

# BETRIEBSANLEITUNG OPERATING INSTRUCTIONS

DE

EN

Original

## ETHERCAT

Optionsbaustein für Converter  
Optional module for converter

---

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# 1 Zu dieser Anleitung



## WICHTIG

Vor Gebrauch sorgfältig lesen.  
Aufbewahren für späteres Nachschlagen.

## 1.1 Gültigkeit

Diese Betriebsanleitung ist ein Kundendokument der Firma Pfeiffer Vacuum. Die Betriebsanleitung beschreibt das benannte Produkt in seiner Funktion und vermittelt die wichtigsten Informationen für den sicheren Gebrauch des Geräts. Die Beschreibung erfolgt nach den geltenden Richtlinien. Alle Angaben in dieser Betriebsanleitung beziehen sich auf den aktuellen Entwicklungsstand des Produkts. Die Dokumentation behält ihre Gültigkeit, sofern kundenseitig keine Veränderungen am Produkt vorgenommen werden.

### 1.1.1 Mitgeltende Dokumente

| Betriebsanleitung           | Nummer     |
|-----------------------------|------------|
| Betriebsanleitung Converter | PT 0730 BN |

Sie finden dieses Dokument im [Pfeiffer Vacuum Download Center](#).

## 1.2 Zielgruppe

Diese Betriebsanleitung richtet sich an alle Personen, die das Produkt

- transportieren,
- aufstellen (installieren),
- bedienen und betreiben,
- außerbetriebnehmen,
- warten und reinigen,
- lagern oder entsorgen.

Die in diesem Dokument beschriebenen Arbeiten dürfen nur Personen durchführen, die eine geeignete technische Ausbildung besitzen (Fachpersonal) oder eine entsprechende Schulung durch Pfeiffer Vacuum erhalten haben.

## 1.3 Konventionen

### 1.3.1 Anweisungen im Text

Handlungsanweisungen im Dokument folgen einem generellen und in sich abgeschlossenen Aufbau. Die notwendige Tätigkeit ist durch einen einzelnen oder mehrere Handlungsschritte gekennzeichnet.

#### Einzelner Handlungsschritt

Ein liegendes gefülltes Dreieck kennzeichnet den einzigen Handlungsschritt einer Tätigkeit.

- Dies ist ein einzelner Handlungsschritt.

#### Abfolge von mehreren Handlungsschritten

Die numerische Aufzählung kennzeichnet eine Tätigkeit mit mehreren notwendigen Handlungsschritten.

1. Handlungsschritt 1
2. Handlungsschritt 2
3. ...

### 1.3.2 Piktogramme

Im Dokument verwendete Piktogramme kennzeichnen nützliche Informationen.



Hinweis



Tipp

### 1.3.3 Abkürzungen

| Abkürzung | Bedeutung im Dokument                                               |
|-----------|---------------------------------------------------------------------|
| AI / AO   | Analoger Eingang / Analoger Ausgang                                 |
| DCU       | Display Control Unit                                                |
| DI / DO   | Digitaler Eingang / Digitaler Ausgang                               |
| EC        | EtherCAT®-Schnittstelle                                             |
| f         | Betrag der Drehzahl einer Vakuumpumpe (frequency, in 1/min oder Hz) |
| FE        | Funktionserde (functional earth)                                    |
| HPU       | Handheld Programming Unit                                           |
| LED       | Leuchtdiode                                                         |
| P         | Leistung                                                            |
| [P:xxx]   | Parameter der Antriebselektronik mit Nummer                         |
| PE        | Schutzleiter (protective earth)                                     |
| t         | Zeit                                                                |
| TM        | Antriebs- und Magnetlagerelektronik der Turbopumpe                  |
| TPS       | Spannungsversorgung (turbo power supply)                            |

Tab. 1: Verwendete Abkürzungen im Dokument

### 1.3.4 Markennachweis



- EtherCAT® ist eine eingetragene Marke und patentierte Technologie, lizenziert durch die Beckhoff Automation GmbH, Deutschland.

## 2 Sicherheit

### 2.1 Sicherheitsmaßnahmen

**Informationspflicht zu möglichen Gefahren**

Der Halter oder Betreiber des Produkts ist verpflichtet, jede Bedienperson auf Gefahren, die von diesem Produkt ausgehen, aufmerksam zu machen.

Jede Person, die sich mit der Installation, dem Betrieb oder der Instandhaltung des Produkts befasst, muss die sicherheitsrelevanten Teile dieses Dokuments lesen, verstehen und befolgen.

**Verletzung der Konformität durch Veränderungen am Produkt**

Die Konformitätserklärung des Herstellers erlischt, wenn der Betreiber das Originalprodukt verändert oder Zusatzeinrichtungen installiert.

- Nach Einbau in eine Anlage ist der Betreiber verpflichtet, vor deren Inbetriebnahme die Konformität des Gesamtsystems im Sinne der geltenden europäischen Richtlinien zu überprüfen und entsprechend neu zu bewerten.

**Allgemeine Sicherheitsmaßnahmen im Umgang mit dem Produkt**

- ▶ Verwenden Sie nur Netzteile, die den geltenden Sicherheitsbestimmungen entsprechen.
- ▶ Beachten Sie alle geltenden Sicherheits- und Unfallverhütungsvorschriften.
- ▶ Überprüfen Sie regelmäßig die Einhaltung aller Schutzmaßnahmen.
- ▶ Empfehlung: Stellen Sie eine sichere Verbindung zum Schutzleiter (PE) her; Schutzklasse I bzw. III.
- ▶ Lösen Sie während des Betriebs keine Steckerverbindungen.
- ▶ Halten Sie Leitungen und Kabel von heißen Oberflächen ( $> 70\text{ °C}$ ) fern.
- ▶ Nehmen Sie keine eigenmächtigen Umbauten oder Veränderungen am Gerät vor.
- ▶ Beachten Sie die Schutzart des Geräts vor dem Einbau oder Betrieb in anderen Umgebungen.

### 2.2 Bestimmungsgemäße Verwendung

Die EtherCAT Option dient ausschließlich dem Betrieb von Pfeiffer Vacuum Vakuumpumpen und deren Zubehör in einem EtherCAT System.

### 2.3 Vorhersehbarer Fehlgebrauch

Bei Fehlgebrauch des Produkts erlischt jeglicher Haftungs- und Gewährleistungsanspruch. Als Fehlgebrauch gilt jede, auch unabsichtliche Verwendung, die dem Zweck des Produkts zuwider läuft, insbesondere:

- Eigenmächtiger Einbau, Ausbau, Umbau oder Austausch

## 3 Produktbeschreibung

### 3.1 Bedienelemente

#### 3.1.1 Bedienelemente

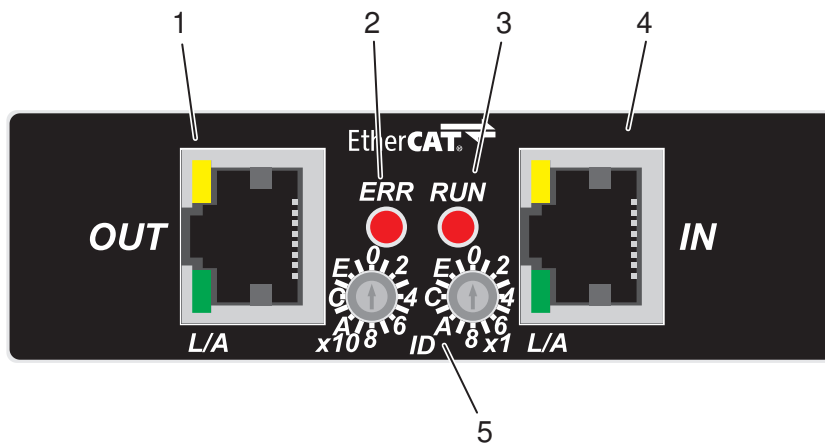


Abb. 2: Option EtherCAT

- |                                |                               |
|--------------------------------|-------------------------------|
| 1 Anschluss OUT mit Status-LED | 4 Anschluss IN mit Status-LED |
| 2 LED Error                    | 5 Drehcodierschalter          |
| 3 LED Run                      |                               |

#### 3.1.2 Anschlüsse

|  | Pin | Belegung |
|--|-----|----------|
|  | 1   | Rx+      |
|  | 2   | Rx-      |
|  | 3   | Tx+      |
|  | 4   | n.c.     |
|  | 5   | n.c.     |
|  | 6   | Tx-      |
|  | 7   | n.c.     |
|  | 8   | n.c.     |

Tab. 2: EtherCAT Schnittstelle, Anschlussbelegung

#### 3.1.3 Betriebsanzeige über LED

| Anzeige         | L/A  (grün)<br>Verbindung | RUN  (grün)<br>EtherCAT Status                                                                                                          | ERR  (rot)<br>EtherCAT Fehler |
|-----------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Aus<br>         | Keine Verbindung          | "INIT":<br>• Initialisierung, keine Prozess- oder Servicedaten                                                                          | kein Fehler                   |
| Blitzend<br>    | –                         | "SAFE OPERATIONAL":<br>• Prozesseingangsdaten (Gerät --> Steuerung) gültig<br>• Ausgangsdaten (Steuerung --> Gerät) im sicheren Zustand | spontaner Zustandswechsel     |
| 2x Blitzend<br> | –                         | –                                                                                                                                       | Ausfall der Verbindung        |

| Anzeige                                                                                         | <i>L/A</i>  (grün)<br>Verbindung | <i>RUN</i>  (grün)<br>EtherCAT Status | <i>ERR</i>  (rot)<br>EtherCAT Fehler |
|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| blinkend<br>   | –                                                                                                                 | "PRE_OPERATIONAL":<br>• nur Servicedaten, keine Prozessdaten                                                           | ungültige Konfiguration                                                                                                 |
| Dauernd an<br> | Verbindung zum nächsten Gerät, keine Aktivität                                                                    | "OPERATIONAL":<br>• Prozessein- und ausgangsdaten gültig                                                               | bootstrap                                                                                                               |
| Flackernd<br>  | Verbindung aktiv                                                                                                  | "BOOTSTRAP"                                                                                                            | booting error                                                                                                           |

**Tab. 3: Verhalten und Bedeutung der LEDs der EtherCAT-Schnittstelle**



## 4 Inbetriebnahme

### 4.1 Geräteidentifikation festlegen

EtherCAT-Geräte sind grundsätzlich durch ihre Position im Bus adressiert. Eine klassische Adresseinstellung ist nicht notwendig.



#### Zusätzliche Identifizierung im Bus

Unter bestimmten Bedingungen kann eine zusätzliche (manuelle) Identifizierung hilfreich sein, z. B. bei Verwechslungsgefahr mehrerer gleichartiger Geräte durch fehlerhafte Verkabelung. Hierfür stehen verschiedene Konfigurationsmöglichkeiten zur Verfügung.



Abb. 3: Kodierschalter hexadezimal

#### Explicit Device Identification

Empfohlene Methode, da keine zusätzlichen Konfigurationsprogramme notwendig sind.

1. Nehmen Sie die Gummistopfen von den Adresswahlschaltern.
2. Wählen Sie diese Identifikation in der Projektierung aus.
3. Stellen Sie die Geräte-ID auf den projektierten Wert ein.
  - hexadezimal 00h bis FFh entspricht dezimal 2 bis 255,
  - neuer Wert wird nach "Spannung Ein/Aus" übernommen.
4. Verwenden Sie nach dem Austauschen eines Gerätes die ID des alten Gerätes.
5. Setzen Sie die Gummistopfen gerade und so tief wie möglich ein, um die angegebene Schutzart zu erreichen.

#### Station Alias

Voraussetzung ist die Verwendung eines geeigneten Konfigurationsprogramms.

1. Wählen Sie diese Identifikation in der Projektierung aus.
2. Weisen Sie dem Gerät online "Station alias" zu.
  - Der neue Wert wird nach "Reset" gültig.
3. Wiederholen Sie diesen Vorgang nach dem Austausch eines Gerätes.

### 4.2 Anschlüsse verbinden

Über die Anschlüsse "OUT" und "IN" ist die Einbindung in ein ETHERCAT Bussystem möglich. Die Schnittstelle ist galvanisch sicher von der maximal auftretenden Versorgungsspannung getrennt.

## 5 Betrieb

### 5.1 Mehrstufige Wälzkolbenpumpe A 200 L über EtherCAT betreiben

#### 5.1.1 Prozessdaten A 200 L

##### Prozessausgangsdaten

Prozessausgangsdaten sind:

- Default RxPDO (Steuerung --> A 200 L, "output"), CoE 1600h.1 – 4 (1 Byte)

| Byte.Bit | CoE <sup>1)</sup>                        | Bedeutung                  |
|----------|------------------------------------------|----------------------------|
| 0.0      | 0x7000.0x01: Roughing Start/Stop         | Pumpstand (0: aus, 1: ein) |
| 0.1      | 0x7000.0x04: Low Speed (Idle/Green Mode) | Keine Funktion             |
| 0.2 – 7. |                                          | reserviert                 |

**Tab. 4: Prozessausgangsdaten**

##### Prozesseingangsdaten

Prozesseingangsdaten sind:

- Default TxPDO (A 200 L --> Steuerung, "input"), CoE 1A00h.1 – 11 (7 Byte)

| Byte.Bit  | CoE <sup>2)</sup>                        | Bedeutung                   |
|-----------|------------------------------------------|-----------------------------|
| 0.0       | 0x6000.0x01: Roughing Run/Stop           | Pumpstand (0: aus, 1: ein)  |
| 0.1       | 0x6000.0x02: Booster Run/Stop            | konstant 0                  |
| 0.2       | 0x6000.0x04: Low Speed (Idle/Green Mode) | konstant 0                  |
| 0.3       | 0x6000.0x05: Remote/Local                | 0: ECAT, 1: lokal           |
| 0.4       | 0x6000.0x09: Warning                     | 0: kein Warnung, 1: Warnung |
| 0.5       | 0x6000.0x0A: Alarm                       | 0: kein Alarm, 1: Alarm     |
| 0.6       | 0x6000.0x0B: Emergency Off               | 0: normal, 1: Stop          |
| 0.7       | 0x6000.0x0C: N2 Flow Low                 | 0: normal, 1: N2 Flow low   |
| 1. – 2.   | 0x6001.0x02: N2 Flow                     | konstant 0                  |
| 3. – 4.   | 0x6001.0x03: Exhaust Pressure            | konstant 0                  |
| 5. – 6.   | 0x6001.0x05: Roughing Case Temperature   | konstant 0                  |
| 7. – 8.   | 0x6001.0x09: Roughing Current            | 0.1 A                       |
| 9. – 10.  | 0x6001.0x0A: Roughing Power              | 0.1 kW                      |
| 11. – 12. | 0x6001.0x0B: Roughing Speed              | 0.1% der Nenndrehzahl       |
| 13. – 14. | 0x6002.0x05: Booster Case Temperature    | konstant 0                  |
| 15. – 16. | 0x6002.0x09: Booster Current             | konstant 0                  |
| 17. – 18. | 0x6002.0x0A: Booster Power               | konstant 0                  |
| 19. – 20. | 0x6002.0x0B: Booster Speed               | konstant 0                  |

**Tab. 5: Prozesseingangsdaten**

##### Prozessdaten alternativ aus CoE-Objekten zusammenstellen

1. Führen Sie immer den Zustand "PRE-OPERATIONAL" herbei.
2. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit 0.
3. Beschreiben Sie das Objekt 1601h.1-n bzw. 1A01h.1-n mit den entsprechenden CoE-Indizes.
4. Verwenden Sie nur mit "P" gekennzeichnete Objekte.
5. Vergeben Sie den Subindex 1-n nur fortlaufend und ohne Lücke.
6. Achten Sie darauf, dass die Daten eine ganze Anzahl Bytes ergeben (ggf. Pad-Bits verwenden) und auf ganzen Bytes beginnen (Ausnahme BOOL).

1) hexadezimal

2) hexadezimal

7. Beschreiben Sie maximal 12 Objekte pro PDO.
8. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit der Anzahl n der verwendeten Objekte.
9. Stellen Sie das Objekt 1C12h.1 auf 1601h bzw. 1C13h.1 auf 1A01h um.
10. Wählen Sie in den Prozessdaten das entsprechende PDO assignment 1601h bzw. 1A01h aus.

**Sync Manager:**

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

**PDO List:**

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

**PDO Assignment (0x1C12):**

☐ 0x1600 (excluded by 0x1601)

☒ 0x1601

**PDO Content (0x1601):**

| Index     | Size | Offs | Name                  | Type |
|-----------|------|------|-----------------------|------|
| 0x7000:01 | 0.1  | 0.0  | Turbo Start Stop      | BOOL |
| 0x7000:03 | 0.1  | 0.1  | Turbo Low Speed       | BOOL |
| 0x3005:11 | 0.1  | 0.2  | Vnt. Enable           | BOOL |
| 0x3005:21 | 0.1  | 0.3  | Sig. Enable           | BOOL |
| ...       | 0.4  | 0.4  | ...                   | ...  |
| 0x8000:03 | 2.0  | 1.0  | Normal Speed Setpoint | UINT |
|           |      | 3.0  |                       |      |

**Download:**

☒ PDO Assignment

☒ PDO Configuration

**Sync Manager:**

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

**PDO List:**

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

**PDO Assignment (0x1C12):**

☐ 0x1A00 (excluded by 0x1A01)

☒ 0x1A01

**PDO Content (0x1A01):**

| Index     | Size | Offs | Name                | Type  |
|-----------|------|------|---------------------|-------|
| 0x6000:09 | 0.1  | 0.0  | Alarm               | BOOL  |
| 0x6000:0A | 0.1  | 0.1  | Warning             | BOOL  |
| 0x2001:88 | 0.1  | 0.2  | Ready for Process   | BOOL  |
| ...       | 0.5  | 0.3  | ...                 | ...   |
| 0x2001:81 | 1.0  | 1.0  | Status              | USINT |
| 0x2001:82 | 1.0  | 2.0  | Actual Speed (rel.) | SINT  |
| 0x2002:13 | 2.0  | 3.0  | Power               | INT   |
| 0x2002:88 | 2.0  | 5.0  | Pmp. Temperature    | INT   |
|           |      | 7.0  |                     |       |

**Download:**

☒ PDO Assignment

☒ PDO Configuration

Ausgangsdaten inklusive 4 Pad-Bits

Eingangsdaten inklusive 5 Pad-Bits

Tab. 6: Beispiele für Prozessdatenkonfiguration

## 5.1.2 Servicedaten A 200 L

| Typ       | Beschreibung                         |
|-----------|--------------------------------------|
| BOOL      | Binärwert (ja/nein)                  |
| BYTE( )   | ein-Byte Zahl                        |
| STRING( ) | Zeichenkette                         |
| USINT     | positive Ganzzahl, 8 Bit             |
| UINT      | positive Ganzzahl, 16 Bit            |
| UDINT     | positive Ganzzahl, 32 Bit            |
| ULINT     | positive Ganzzahl, 64 Bit            |
| SINT      | Ganzzahl, 8 Bit                      |
| INT       | Ganzzahl, 16 Bit                     |
| DINT      | Ganzzahl, 32 Bit                     |
| REAL      | Fließkommazahl, einfache Genauigkeit |

Tab. 7: Datentypen der Servicedaten

Für den Zugriff auf einzelne Datenobjekte (z. B. zur Konfiguration) stehen folgende CoE-Objekte zur Verfügung:

### Verwaltungsdaten (Information über das Gerät, Kommunikation)

| Idx <sup>3)</sup> | sldx | Name                          | Typ       | Zu-griff <sup>4)</sup> | Beschreibung                                                                                                                                                                   |
|-------------------|------|-------------------------------|-----------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000              |      | Device type                   | UDINT     | RO                     | Bit 0-15: Device profile number (5003).<br>NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B)<br>Bit 16-31: 0x0000 sub-profile number is defined in 0xF010 bit 15..0 |
| 1008              |      | Manufacturer device name      | STRING(n) | RO                     | Name of the device as non-zero terminated string.                                                                                                                              |
| 1009              |      | Manufacturer hardware version | STRING(n) | RO                     | Hardware version of the device as non-zero terminated string.                                                                                                                  |

3) Idx = Index, sldx = Subindex, hexadezimal

4) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>3)</sup> | sldx | Name                                                 | Typ       | Zu-<br>griff <sup>4)</sup> | Beschreibung                                                    |
|-------------------|------|------------------------------------------------------|-----------|----------------------------|-----------------------------------------------------------------|
| 100A              |      | Manufacturer software version                        | STRING(n) | RO                         | Software version of the device as non-zero terminated string.   |
| 100B              |      | Manufacturer bootlo-<br>ader version                 | STRING(n) | RO                         | Bootloader version of the device as non-zero terminated string. |
| 1018              |      | Identity object                                      | IDENTITY  | RO                         |                                                                 |
|                   | 01   | Vendor ID                                            | UDINT     | RO                         |                                                                 |
|                   | 02   | Product code                                         | UDINT     | RO                         |                                                                 |
|                   | 03   | Revision number                                      | UDINT     | RO                         |                                                                 |
|                   | 04   | Serial number                                        | UDINT     | RO                         |                                                                 |
| 10F8              |      | Timestamp object                                     | ULINT     | RO                         | Local timestamp of the device in ns.                            |
| 1600              |      | SDP default RxPDO                                    |           |                            |                                                                 |
|                   | 01h  |                                                      |           |                            | 0x7000.0x01: Roughing start/stop                                |
|                   | 02h  |                                                      |           |                            | 0x7000.0x04: Low speed (idle/<br>green mode)                    |
|                   | 03h  |                                                      |           |                            |                                                                 |
| 1601              |      | User RxPDO                                           |           |                            |                                                                 |
| 1A00              |      | SDP default TxPDO                                    |           |                            |                                                                 |
|                   | 01h  |                                                      |           |                            | 0x6000.0x01: Roughing run/stop                                  |
|                   | 02h  |                                                      |           |                            | 0x6000.0x02: Booster run/stop                                   |
|                   | 03h  |                                                      |           |                            | 0x6000.0x04: Low speed (idle/<br>green mode)                    |
|                   | 04h  |                                                      |           |                            | 0x6000.0x05: Remote/local                                       |
|                   | 05h  |                                                      |           |                            | 0x6000.0x09: Warning                                            |
|                   | 06h  |                                                      |           |                            | 0x6000.0x0A: Alarm                                              |
|                   | 07h  |                                                      |           |                            | 0x6000.0x0B: Emergency off                                      |
|                   | 08h  |                                                      |           |                            | 0x6000.0x0C: N2 flow low                                        |
|                   | 09h  |                                                      |           |                            | 0x6001.0x02: N2 flow                                            |
|                   | 0Ah  |                                                      |           |                            | 0x6001.0x03: Exhaust pressure                                   |
|                   | 0Bh  |                                                      |           |                            | 0x6001.0x05: Roughing case tem-<br>perature                     |
|                   | 0Ch  |                                                      |           |                            | 0x6001.0x09: Roughing current                                   |
|                   | 0Dh  |                                                      |           |                            | 0x6001.0x0A: Roughing power                                     |
|                   | 0Eh  |                                                      |           |                            | 0x6001.0x0B: Roughing speed                                     |
|                   | 0Fh  |                                                      |           |                            | 0x6002.0x05: Booster case tempe-<br>rature                      |
|                   | 10h  |                                                      |           |                            | 0x6002.0x09: Booster current                                    |
|                   | 11h  |                                                      |           |                            | 0x6002.0x0A: Booster power                                      |
|                   | 12h  |                                                      |           |                            | 0x6002.0x0B: Booster speed                                      |
| 1A01              |      | User TxPDO                                           |           |                            |                                                                 |
| 1C00              |      | Sync manager type                                    |           |                            |                                                                 |
| 1C10              |      | Sync manager 0 PDO<br>assignment                     |           |                            |                                                                 |
| 1C11              |      | Sync manager 1 PDO<br>assignment                     |           |                            |                                                                 |
| 1C12              |      | RxPDO assign (sync<br>manager 2 PDO as-<br>signment) |           |                            |                                                                 |

3) Idx = Index, sldx = Subindex, hexadezimal

4) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>3)</sup> | sldx    | Name                                              | Typ  | Zu-griff <sup>4)</sup> | Beschreibung |
|-------------------|---------|---------------------------------------------------|------|------------------------|--------------|
| 1C13              |         | TxPDO assign (sync manager 3 PDO as-<br>signment) |      |                        |              |
| 1C32              | Partial | Output sync manager<br>parameter                  |      | RO                     |              |
|                   | 01h     | Synchronization type                              | UINT | RO                     |              |
| 1C33              | Partial | Input sync manager<br>parameter                   |      | RO                     |              |
|                   | 01h     | Synchronization type                              |      | RO                     |              |

**Tab. 8: Communication Area - Verwaltungsdaten (Information über das Gerät, Kommunikation)**

**Eingangsdaten (A 200 L --> Steuerung)**

| Idx <sup>5)</sup> | sldx    | Name                         | Typ       | Zugriff <sup>6)</sup> | Beschreibung                                                                                |
|-------------------|---------|------------------------------|-----------|-----------------------|---------------------------------------------------------------------------------------------|
| 2000              | Partial | In identity/status           |           | RO                    |                                                                                             |
|                   | 01      | Manufacturer (main)          | STRING(n) | RO                    |                                                                                             |
|                   | 02      | Device name (main)           | STRING(n) | RO                    |                                                                                             |
|                   | 03      | Serial number (main)         | STRING(n) | RO                    |                                                                                             |
|                   | 04      | Hardware version (main)      | STRING(n) | RO                    |                                                                                             |
|                   | 05      | Firmware version (main)      | STRING(n) | RO                    |                                                                                             |
|                   | 08      | Status code (main)           | UINT      | RO                    | PV485 error code. Warnun-<br>gen haben einen Offset von<br>1000.<br>Heißt 1001 -> Warnung 1 |
|                   | 22      | Device name (interface)      | STRING(n) | RO                    |                                                                                             |
|                   | 24      | Hardware version (interface) | STRING(n) | RO                    |                                                                                             |
|                   | 25      | Firmware version (interface) | STRING(n) | RO                    |                                                                                             |
| 2001              | Partial | In operation                 |           | RO                    |                                                                                             |
|                   | 01      | Status (main)                | UDINT     | RO                    |                                                                                             |
| 2003              | Partial | In diagnostic                |           | RO                    |                                                                                             |
|                   | 08      | Error details (main)         | UDINT     | RO                    |                                                                                             |
|                   | 09      | Warning details (main)       | UDINT     | RO                    |                                                                                             |

**Tab. 9: Eingangsdaten**

**Eingangsdaten (A 200 L --> Steuerung)**

| Idx <sup>7)</sup> | sldx | Name                                  | Typ  | Zugriff <sup>8)</sup> | Beschreibung                                           |
|-------------------|------|---------------------------------------|------|-----------------------|--------------------------------------------------------|
| 6000              |      | Roughing and booster sta-<br>tus      |      | RO                    |                                                        |
|                   | 01   | Roughing run/stop                     | BOOL | RO                    | 1: Run<br>0: Stop                                      |
|                   | 04   | Low speed (idle/sleep/<br>green mode) | BOOL | RO                    | 1: Low speed (idle /sleep / green<br>mode)<br>0:Normal |

3) Idx = Index, sldx = Subindex, hexadezimal

4) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

5) Idx = Index, sldx = Subindex, hexadezimal

6) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

7) Idx = Index, sldx = Subindex, hexadezimal

8) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>7)</sup> | sldx | Name                      | Typ  | Zugriff <sup>8)</sup> | Beschreibung                                                       |
|-------------------|------|---------------------------|------|-----------------------|--------------------------------------------------------------------|
|                   | 05   | Remote/local              | BOOL | RO                    | 1: Local. Hand control enabled<br>0: Remote. E-cat control enabled |
|                   | 07   | Pump interlock            | BOOL | RO                    | 1: OK Process may proceed<br>0: Process must not run               |
|                   | 09   | Warning                   | BOOL | RO                    | 1: Warning<br>0: Normal                                            |
|                   | 0A   | Alarm                     | BOOL | RO                    | 1: Alarm<br>0: Normal                                              |
|                   | 0B   | Emergency off             | BOOL | RO                    | 1: Stop<br>0: Normal                                               |
|                   | 0C   | N2 flow low               | BOOL | RO                    | 1: N2 flow low<br>0: Normal                                        |
| 6001              |      | Roughing analog inputs    |      |                       |                                                                    |
|                   | 02   | N2 flow                   | INT  | RO                    | 0.1 [slm]                                                          |
|                   | 03   | Exhaust pressure          | INT  | RO                    | Gauge pressure (not absolute) - 1 [kPa]                            |
|                   | 05   | Roughing case temperature | INT  | RO                    | Degrees celsius                                                    |
|                   | 09   | Roughing current          | INT  | RO                    | 0.1 [A]                                                            |
|                   | 0A   | Roughing power            | INT  | RO                    | 0.1 [kW]                                                           |
|                   | 0B   | Roughing speed            | INT  | RO                    | 1000 (100.0 %): Rated speed<br>0 (0.0%) 0 rotation, 0.1[%]         |
| 6002              |      | Booster analog inputs     |      | RO                    |                                                                    |
|                   | 05   | Booster case temperature  | INT  | RO                    | Degrees celsius                                                    |
|                   | 09   | Booster current           | INT  | RO                    | 0.1 [A]                                                            |
|                   | 0A   | Booster power             | INT  | RO                    | 0.1 [kW]                                                           |
|                   | 0B   | Booster speed             | INT  | RO                    | 1000 (100.0 %): Rated speed<br>0 (0.0 %): 0 rotation, 0.1 [%]      |

Tab. 10: Input Area

## Ausgangsdaten (Steuerung --&gt; A 200 L)

| Idx <sup>9)</sup> | sldx | Name                                  | Typ  | Zugriff <sup>10)</sup> | Beschreibung                                          |
|-------------------|------|---------------------------------------|------|------------------------|-------------------------------------------------------|
| 7000              |      | Roughing and booster controll         |      | RO                     |                                                       |
|                   | 01   | Roughing start/stop                   | BOOL | RW                     | 1: Run<br>0: Stop (roughing pump exists)              |
|                   | 04   | Low speed (idle / sleep / green mode) | BOOL | RW                     | 1: Low speed (idle / sleep / green mode)<br>0: Normal |

Tab. 11: Output Area

7) Idx = Index, sldx = Subindex, hexadezimal

8) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

9) Idx = Index, sldx = Subindex, hexadezimal

10) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

**Konfigurationsdaten (Steuerung --> A 200 L)**

| Idx <sup>11)</sup> | sldx | Name                               | Typ  | Zugriff <sup>12)</sup> | Beschreibung                                                                                                                                                                          |
|--------------------|------|------------------------------------|------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8001               |      | Roughing and booster configuration |      | RO                     |                                                                                                                                                                                       |
|                    | 01   | Safe state                         | UINT | RW                     | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - pumps stop<br>2: Maintain state, exit low speed (idle/sleep mode) = 0 (normal speed) |

**Tab. 12: Configuration Area****Informationsdaten (A 200 L --> Steuerung)**

| Idx <sup>13)</sup> | sldx | Name                              | Typ   | Zugriff <sup>14)</sup> | Beschreibung                                          |
|--------------------|------|-----------------------------------|-------|------------------------|-------------------------------------------------------|
| 9000               |      | Roughing and booster information  |       | RO                     |                                                       |
|                    | 01   | Roughing exists                   | BOOL  | RO                     | 0: not available<br>1: available                      |
|                    | 02   | Booster exists                    | BOOL  | RO                     | 0: not available<br>1: available                      |
|                    | 03   | Booster 2 exists                  | BOOL  | RO                     | 0: not available<br>1: available                      |
|                    | 11   | Roughing and booster running time | UDINT | RO                     | Running time since manufacture or service - 1 [hours] |

**Tab. 13: Information Area****Semiconductor device profile area**

| Idx <sup>15)</sup> | sldx | Name                         | Typ   | Zugriff <sup>16)</sup> | Beschreibung |
|--------------------|------|------------------------------|-------|------------------------|--------------|
| F000               |      | Semiconductor device profile |       | RO                     |              |
|                    | 01   | Index distance               | UINT  |                        |              |
|                    | 02   | Maximum number of modules    | UINT  |                        |              |
| F010               |      | Module profile list          |       | RO                     |              |
|                    | 01   |                              | UDINT | RO                     |              |

**Tab. 14: Semiconductor Device Profile Area**

11) Idx = Index, sldx = Subindex, hexadezimal

12) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

13) Idx = Index, sldx = Subindex, hexadezimal

14) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

15) Idx = Index, sldx = Subindex, hexadezimal

16) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

## Exception Handling

| Idx <sup>17)</sup> | sldx | Name                                                | Typ   | Zu-griff <sup>18)</sup> | Beschreibung                                                                                                                    |
|--------------------|------|-----------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380               |      | Active execption status                             | USINT | RO                      | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                    |      | Bit0: Device warning                                |       |                         | Bit0: Device warning                                                                                                            |
|                    |      | Bit1: Manufacturer warning                          |       |                         | Bit1: Manufacturer warning                                                                                                      |
|                    |      | Bit2: Device error                                  |       |                         | Bit2: Device error                                                                                                              |
|                    |      | Bit3: Manufacturer error                            |       |                         | Bit3: Manufacturer error                                                                                                        |
|                    |      | Bit4: Reserved                                      |       |                         | Bit4: Reserved                                                                                                                  |
|                    |      | Bit5: Reserved                                      |       |                         | Bit5: Reserved                                                                                                                  |
|                    |      | Bit6: Reserved                                      |       |                         | Bit6: Reserved                                                                                                                  |
|                    |      | Bit7: Reserved                                      |       |                         | Bit7: Reserved                                                                                                                  |
| F381               |      | Roughing and booster 1 to 255 active warning detail |       | RO                      |                                                                                                                                 |
|                    | 01   |                                                     | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available                         |
|                    |      | Bit0: EMO                                           |       |                         | Bit0: EMO                                                                                                                       |
|                    |      | Bit1: Water leak                                    |       |                         | Bit1: Water leak                                                                                                                |
|                    |      | Bit2: Power fail open phase                         |       |                         | Bit2: Power fail open phase                                                                                                     |
|                    |      | Bit3: Reverse phase                                 |       |                         | Bit3: Reverse phase                                                                                                             |
|                    |      | Bit4: Coolant flow                                  |       |                         | Bit4: Coolant flow                                                                                                              |
|                    |      | Bit5: N2 flow                                       |       |                         | Bit5: N2 flow                                                                                                                   |
|                    |      | Bit6: Exhaust pressure                              |       |                         | Bit6: Exhaust pressure                                                                                                          |
|                    |      | Bit7: Exhaust temp.                                 |       |                         | Bit7: Exhaust temp.                                                                                                             |
|                    |      | Bit8: Main controller err/batt low                  |       |                         | Bit8: Main controller err/batt low                                                                                              |
|                    |      | Bit9: Roughing case temp                            |       |                         | Bit9: Roughing case temp                                                                                                        |
|                    |      | Bit10: Roughing motor temp                          |       |                         | Bit10: Roughing motor temp                                                                                                      |
|                    |      | Bit11: Roughing current                             |       |                         | Bit11: Roughing current                                                                                                         |
|                    |      | Bit12: Roughing speed                               |       |                         | Bit12: Roughing speed                                                                                                           |
|                    |      | Bit13: Roughing lock rotor                          |       |                         | Bit13: Roughing lock rotor                                                                                                      |
|                    |      | Bit14: Roughing motor driver err                    |       |                         | Bit14: Roughing motor driver err                                                                                                |
|                    |      | Bit15: Booster case temp.                           |       |                         | Bit15: Booster case temp.                                                                                                       |
|                    |      | Bit16: Booster motor temp.                          |       |                         | Bit16: Booster motor temp.                                                                                                      |
|                    |      | Bit17: Booster current                              |       |                         | Bit17: Booster current                                                                                                          |
|                    |      | Bit18: Booster speed                                |       |                         | Bit18: Booster speed                                                                                                            |
|                    |      | Bit19: Booster lock rotor                           |       |                         | Bit19: Booster lock rotor                                                                                                       |
|                    |      | Bit20: Booster motor driver err                     |       |                         | Bit20: Booster motor driver err                                                                                                 |
|                    |      | Bit21: Booster2 case temp.                          |       |                         | Bit21: Booster2 case temp.                                                                                                      |
|                    |      | Bit22: Booster2 motor temp.                         |       |                         | Bit22: Booster2 motor temp.                                                                                                     |
|                    |      | Bit23: Booster2 current                             |       |                         | Bit23: Booster2 current                                                                                                         |
|                    |      | Bit24: Booster2 speed                               |       |                         | Bit24: Booster2 speed                                                                                                           |

17) Idx = Index, sldx = Subindex, hexadezimal

18) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet



| Idx <sup>17)</sup> | sldx | Name                                                      | Typ   | Zu-griff <sup>18)</sup> | Beschreibung                                                                                            |
|--------------------|------|-----------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------|
|                    |      | Bit25: Booster2 lock rotor                                |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                          |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                     |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                         |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                         |       |                         | Bit29: Future use                                                                                       |
|                    |      | Bit30: Future use                                         |       |                         | Bit30: Future use                                                                                       |
|                    |      | Bit31: Others                                             |       |                         | Bit31: Others                                                                                           |
| F383               |      | Roughing and booster 1 to 255 active error (alarm) detail |       | RO                      |                                                                                                         |
|                    | 01   |                                                           | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                    |      | Bit0: EMO                                                 |       |                         | Bit0: EMO                                                                                               |
|                    |      | Bit1: Water leak                                          |       |                         | Bit1: Water leak                                                                                        |
|                    |      | Bit2: Power fail open phase                               |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                       |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit 4: Coolant flow                                       |       |                         | Bit 4: Coolant flow                                                                                     |
|                    |      | Bit5: N2 flow                                             |       |                         | Bit5: N2 flow                                                                                           |
|                    |      | Bit6: Exhaust pressure                                    |       |                         | Bit6: Exhaust pressure                                                                                  |
|                    |      | Bit7: Exhaust temp.                                       |       |                         | Bit7: Exhaust temp.                                                                                     |
|                    |      | Bit8: Main controller err/batt low                        |       |                         | Bit8: Main controller err/batt low                                                                      |
|                    |      | Bit9: Roughing case temp                                  |       |                         | Bit9: Roughing case temp                                                                                |
|                    |      | Bit10: Roughing motor temp                                |       |                         | Bit10: Roughing motor temp                                                                              |
|                    |      | Bit11: Roughing current                                   |       |                         | Bit11: Roughing current                                                                                 |
|                    |      | Bit12: Roughing speed                                     |       |                         | Bit12: Roughing speed                                                                                   |
|                    |      | Bit13: Roughing lock rotor                                |       |                         | Bit13: Roughing lock rotor                                                                              |
|                    |      | Bit14: Roughing motor driver err                          |       |                         | Bit14: Roughing motor driver err                                                                        |
|                    |      | Bit15: Booster case temp.                                 |       |                         | Bit15: Booster case temp.                                                                               |
|                    |      | Bit16: Booster motor temp.                                |       |                         | Bit16: Booster motor temp.                                                                              |
|                    |      | Bit17: Booster current                                    |       |                         | Bit17: Booster current                                                                                  |
|                    |      | Bit18: Booster speed                                      |       |                         | Bit18: Booster speed                                                                                    |
|                    |      | Bit19: Booster lock rotor                                 |       |                         | Bit19: Booster lock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                           |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit22: Booster2 motor temp.                               |       |                         | Bit22: Booster2 motor temp.                                                                             |
|                    |      | Bit23: Booster2 current                                   |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                     |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                          |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                     |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                         |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                         |       |                         | Bit29: Future use                                                                                       |

17) Idx = Index, sldx = Subindex, hexadezimal

18) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>17)</sup> | sidx | Name                                                 | Typ   | Zu-griff <sup>18)</sup> | Beschreibung                                                                                                             |
|--------------------|------|------------------------------------------------------|-------|-------------------------|--------------------------------------------------------------------------------------------------------------------------|
|                    |      | Bit30: Future use                                    |       |                         | Bit30: Future use                                                                                                        |
|                    |      | Bit31: Others                                        |       |                         | Bit31: Others                                                                                                            |
| F390               |      | Latched exception status                             | USINT | RO                      | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. |
|                    |      | Bit0: Device warning                                 |       |                         | Bit0: Device warning                                                                                                     |
|                    |      | Bit1: Manufacturer warning                           |       |                         | Bit1: Manufacturer warning                                                                                               |
|                    |      | Bit2: Device error                                   |       |                         | Bit2: Device error                                                                                                       |
|                    |      | Bit3: Manufacturer error                             |       |                         | Bit3: Manufacturer error                                                                                                 |
|                    |      | Bit4: Reserved                                       |       |                         | Bit4: Reserved                                                                                                           |
|                    |      | Bit5: Reserved                                       |       |                         | Bit5: Reserved                                                                                                           |
|                    |      | Bit6: Reserved                                       |       |                         | Bit6: Reserved                                                                                                           |
|                    |      | Bit7: Reserved                                       |       |                         | Bit7: Reserved                                                                                                           |
| F391               |      | Roughing and booster 1 to 255 latched warning detail |       | RO                      |                                                                                                                          |
|                    | 01   |                                                      | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available                  |
|                    |      | Bit0: EMO                                            |       |                         | Bit0: EMO                                                                                                                |
|                    |      | Bit1: Water leak                                     |       |                         | Bit1: Water leak                                                                                                         |
|                    |      | Bit2: Power fail open phase                          |       |                         | Bit2: Power fail open phase                                                                                              |
|                    |      | Bit3: Reverse phase                                  |       |                         | Bit3: Reverse phase                                                                                                      |
|                    |      | Bit4: Coolant flow                                   |       |                         | Bit4: Coolant flow                                                                                                       |
|                    |      | Bit5: N2 flow                                        |       |                         | Bit5: N2 flow                                                                                                            |
|                    |      | Bit6: Exhaust pressure                               |       |                         | Bit6: Exhaust pressure                                                                                                   |
|                    |      | Bit7: Exhaust temp.                                  |       |                         | Bit7: Exhaust temp.                                                                                                      |
|                    |      | Bit8: Main controller err/batt low                   |       |                         | Bit8: Main controller err/batt low                                                                                       |
|                    |      | Bit9: Roughing case temp                             |       |                         | Bit9: Roughing case temp                                                                                                 |
|                    |      | Bit10: Roughing motor temp                           |       |                         | Bit10: Roughing motor temp                                                                                               |
|                    |      | Bit11: Roughing current                              |       |                         | Bit11: Roughing current                                                                                                  |
|                    |      | Bit12: Roughing speed                                |       |                         | Bit12: Roughing speed                                                                                                    |
|                    |      | Bit13: Roughing lock rotor                           |       |                         | Bit13: Roughing lock rotor                                                                                               |
|                    |      | Bit14: Roughing motor driver err                     |       |                         | Bit14: Roughing motor driver err                                                                                         |
|                    |      | Bit15: Booster case temp.                            |       |                         | Bit15: Booster case temp.                                                                                                |
|                    |      | Bit16: Booster motor temp.                           |       |                         | Bit16: Booster motor temp.                                                                                               |
|                    |      | Bit17: Booster current                               |       |                         | Bit17: Booster current                                                                                                   |
|                    |      | Bit18: Booster speed                                 |       |                         | Bit18: Booster speed                                                                                                     |
|                    |      | Bit19: Booster lock rotor                            |       |                         | Bit19: Booster lock rotor                                                                                                |
|                    |      | Bit20: Booster motor driver err                      |       |                         | Bit20: Booster motor driver err                                                                                          |
|                    |      | Bit21: Booster2 case temp.                           |       |                         | Bit21: Booster2 case temp.                                                                                               |
|                    |      | Bit22: Booster2 motor temp.                          |       |                         | Bit22: Booster2 motor temp.                                                                                              |
|                    |      | Bit23: Booster2 current                              |       |                         | Bit23: Booster2 current                                                                                                  |
|                    |      | Bit24: Booster2 speed                                |       |                         | Bit24: Booster2 speed                                                                                                    |
|                    |      | Bit25: Booster2 lock rotor                           |       |                         | Bit25: Booster2 lock rotor                                                                                               |

17) Idx = Index, sidx = Subindex, hexadezimal

18) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>17)</sup> | sldx | Name                                                       | Typ   | Zu-griff <sup>18)</sup> | Beschreibung                                                                                            |
|--------------------|------|------------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------|
|                    |      | Bit26: Booster2 motor driver err                           |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                      |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                          |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                          |       |                         | Bit29: Future use                                                                                       |
|                    |      | Bit30: Future use                                          |       |                         | Bit30: Future use                                                                                       |
|                    |      | Bit31: Others                                              |       |                         | Bit31: Others                                                                                           |
| F393               |      | Roughing and booster 1 to 255 latched error (alarm) detail |       | RO                      |                                                                                                         |
|                    | 01   |                                                            | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available |
|                    |      | Bit0: EMO                                                  |       |                         | Bit0: EMO                                                                                               |
|                    |      | Bit1: Water leak                                           |       |                         | Bit1: Water leak                                                                                        |
|                    |      | Bit2: Power fail open phase                                |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                        |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit4: Coolant flow                                         |       |                         | Bit4: Coolant flow                                                                                      |
|                    |      | Bit5: N2 flow                                              |       |                         | Bit5: N2 flow                                                                                           |
|                    |      | Bit6: Exhaust pressure                                     |       |                         | Bit6: Exhaust pressure                                                                                  |
|                    |      | Bit7: Exhaust temp.                                        |       |                         | Bit7: Exhaust temp.                                                                                     |
|                    |      | Bit8: Main controller err/batt low                         |       |                         | Bit8: Main controller err/batt low                                                                      |
|                    |      | Bit9: Roughing case temp                                   |       |                         | Bit9: Roughing case temp                                                                                |
|                    |      | Bit10: Roughing motor temp                                 |       |                         | Bit10: Roughing motor temp                                                                              |
|                    |      | Bit11: Roughing current                                    |       |                         | Bit11: Roughing current                                                                                 |
|                    |      | Bit12: Roughing speed                                      |       |                         | Bit12: Roughing speed                                                                                   |
|                    |      | Bit13: Roughing lock rotor                                 |       |                         | Bit13: Roughing lock rotor                                                                              |
|                    |      | Bit14: Roughing motor driver err                           |       |                         | Bit14: Roughing motor driver err                                                                        |
|                    |      | Bit15: Booster case temp.                                  |       |                         | Bit15: Booster case temp.                                                                               |
|                    |      | Bit16: Booster motor temp.                                 |       |                         | Bit16: Booster motor temp.                                                                              |
|                    |      | Bit17: Booster current                                     |       |                         | Bit17: Booster current                                                                                  |
|                    |      | Bit18: Booster speed                                       |       |                         | Bit18: Booster speed                                                                                    |
|                    |      | Bit19: Booster lock rotor                                  |       |                         | Bit19: Booster lock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                            |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                 |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit22: Booster2 motor temp.                                |       |                         | Bit22: Booster2 motor temp.                                                                             |
|                    |      | Bit23: Booster2 current                                    |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                      |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                 |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                           |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                      |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                          |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                          |       |                         | Bit29: Future use                                                                                       |
|                    |      | Bit30: Future use                                          |       |                         | Bit30: Future use                                                                                       |

17) Idx = Index, sldx = Subindex, hexadezimal

18) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>17)</sup> | sidx | Name                                             | Typ   | Zu-griff <sup>18)</sup> | Beschreibung                                                                                                                                                                                                                        |
|--------------------|------|--------------------------------------------------|-------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |      | Bit31: Others                                    |       |                         | Bit31: Others                                                                                                                                                                                                                       |
| F3A1               |      | Roughing and booster 1 to 255 warning mask       |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   |                                                  | UDINT | RW                      | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3               |      | Roughing and booster 1 to 255 error (alarm) mask |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   |                                                  | UDINT | RW                      | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |
| F6F0               |      | Input latch local timestamp                      |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   | Input latch local timestamp                      | UDINT | RO                      | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up.                                                                                                                  |

Tab. 15: Exception Handling

## CDP Specific Information Data

| Idx <sup>19)</sup> | sidx | Name                             | Typ       | Zugriff <sup>20)</sup> | Beschreibung                                                                                                        |
|--------------------|------|----------------------------------|-----------|------------------------|---------------------------------------------------------------------------------------------------------------------|
| F9F0               |      | Manufacturer serial number       | STRING(n) | RO                     | String representing the manufacturer's serial number for the device.                                                |
| F9F1               |      | CDP functional generation number |           | RO                     |                                                                                                                     |
|                    | 01   |                                  | UDINT     | RO                     | Common device profile functional generation number                                                                  |
| F9F2               |      | SDP functional generation number |           | RO                     |                                                                                                                     |
|                    | 01   |                                  | UDINT     | RO                     | SDP functional generation number.                                                                                   |
| F9F3               |      | Vendor name                      | STRING(n) | RO                     |                                                                                                                     |
| F9F4               |      | SDP device name                  |           | RO                     |                                                                                                                     |
|                    | 01   |                                  | STRING(n) | RO                     | String identifying the device type.                                                                                 |
| F9F5               |      | Output identifier                |           | RO                     |                                                                                                                     |
|                    | 01   |                                  | USINT     | RW                     | Output identifier. The controller can then read this value back through the TxPDO to ensure the RxPDO was received. |
| F9F6               |      | Time since power on              | UDINT     | RO                     | This is the time the device has been currently powered on, in seconds.                                              |

17) Idx = Index, sidx = Subindex, hexadezimal

18) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

19) Idx = Index, sidx = Subindex, hexadezimal

20) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>19)</sup> | sidx | Name                                         | Typ   | Zugriff <sup>20)</sup> | Beschreibung                                                          |
|--------------------|------|----------------------------------------------|-------|------------------------|-----------------------------------------------------------------------|
| F9F7               |      | Total time powered                           | UDINT | RO                     | Operating hours of pump [s]                                           |
| F9F8               |      | Firmware update functional generation number | UDINT | RO                     | Firmware update functional generation number supported by the device. |

Tab. 16: CDP Specific Information Data

## CDP Command Objects

| Idx <sup>21)</sup> | sidx | Name                    | Typ                  | Zugriff <sup>22)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|------|-------------------------|----------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0               |      | Device reset command    |                      | RO                     | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. There are two versions of this command:<br><br>Device Reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset.<br><br>Factory Reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                    | 01   | Command                 | AR-RAY[0..5] OF BYTE | RW                     | A device reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72<br>Byte 5: Device Standard Reset = 0x00, factory reset = 0x66                                                                                                                                                                                                                                                                                |
|                    | 02   | Status                  | USINT                | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Reserved<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                                                                                                     |
|                    | 03   | Response                | AR-RAY[0..1] OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| FBF1               |      | Exception reset command |                      | RO                     | Execution of this command clears the latched exceptions.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                    | 01   | Command                 | AR-RAY[0..4] OF BYTE | RW                     | A latched exception reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72                                                                                                                                                                                                                                                                                                                                   |

19) Idx = Index, sidx = Subindex, hexadezimal

20) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

21) Idx = Index, sidx = Subindex, hexadezimal

22) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>21)</sup> | sidx | Name                       | Typ                     | Zu-griff <sup>22)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|------|----------------------------|-------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 02   | Status                     | USINT                   | RO                      | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                                         |
|                    | 03   | Response                   | AR-RAY[0..1]<br>OF BYTE | RO                      | Byte 0: See subindex 2<br>Byte 1: Unused.                                                                                                                                                                                                                                                                                                                                                                     |
| FBF2               |      | Store parameters command   |                         | RO                      | Execution of this command will store all parameters to non-volatile memory.                                                                                                                                                                                                                                                                                                                                   |
|                    | 01   | Command                    | AR-RAY[0..3]<br>OF BYTE | RW                      | Read:<br>Bit 0 = 1: Device saves the non-volatile parameters when writing 0xFB2:01 with 0x65766173<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written<br>Bit 2-31: Reserved, shall be 0<br>Write: All writable, non-volatile values will be stored in non-volatile memory when the following is sent:<br>Byte 0: 0x73<br>Byte 1: 0x61<br>Byte 2: 0x76<br>Byte 3: 0x65 |
|                    | 02   | Status                     | USINT                   | RO                      | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value other-wise.<br>1: Last command completed, no error, reply the-re<br>2: Last command completed, error, no response.                                                                                                                                                                                         |
|                    | 03   | Response                   | AR-RAY[0..1]<br>OF BYTE | RO                      | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                                                      |
| FBF3               |      | Calculate checksum command |                         | RO                      | Execution of this command will calculate a checksum for all writable, non-volatile parameters as currently stored in non-volatile memory.                                                                                                                                                                                                                                                                     |

21) Idx = Index, sidx = Subindex, hexadezimal

22) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>21)</sup> | sidx | Name                                 | Typ                         | Zu-<br>griff <sup>22)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|------|--------------------------------------|-----------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 01   | Com-<br>mand                         | AR-<br>RAY[0..3]<br>OF BYTE | RW                          | <p>Read: Returns information about the supported checksum type</p> <p>Bit 0 = 0: No non-volatile parameters supported<br/>           Bit 0 = 1: Non-volatile parameters supported</p> <p>Bit 1 = 1: CRC-32<br/>           Bit 2 = 1: MD5<br/>           Bit 3 = 1: SHA-1<br/>           Bit 4-6: Reserved, shall be 0<br/>           Bit 7 = 1: Other algorithm.</p> <p>Write: Checksum type selection and start calculation<br/>           A write access to this subindex shall only set one bit true in Bit[0...7].</p> <p>Bit 0 = 1: Use default checksum algorithm of the device<br/>           Bit 1 = 1: CRC-32<br/>           Bit 2 = 1: MD5<br/>           Bit 3 = 1: SHA-1<br/>           Bit 4-6: Reserved, shall be 0<br/>           Bit 7 = 1: Other algorithm<br/>           Bit 8...31: Reserved.</p> |
|                    | 02   | Status                               | USINT                       | RO                          | <p>Supported values:</p> <p>0: Default value if the command has not been initiated. Not a supported value otherwise.<br/>           1: Last command completed, no error, reply there<br/>           2: Last command completed, error, no response</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                    | 03   | Respon-<br>se                        | AR-<br>RAY[0..n]<br>OF BYTE | RO                          | <p>Byte 0: See subindex 2<br/>           Byte 1: Unused - shall be zero<br/>           Byte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length is 64 bytes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| FBF4               |      | Load pa-<br>rameters<br>com-<br>mand |                             | RO                          | Execution of this command will load all parameters from non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                    | 01   | Com-<br>mand                         | AR-<br>RAY[0..3]<br>OF BYTE | RW                          | <p>Read:</p> <p>Bit 0 = 1: Device loads the non-volatile parameters when writing 0xFBFB4:01 with 0x64616F6C<br/>           Bit 1 = 1: Device saves the non-volatile parameters automatically when they are.</p> <p>Write:</p> <p>All writable, non-volatile parameters will be loaded from non-volatile memory when the following is sent:</p> <p>Byte 0: 0x6C<br/>           Byte 1: 0x6F<br/>           Byte 2: 0x61<br/>           Byte 3: 0x64.</p>                                                                                                                                                                                                                                                                                                                                                              |

21) Idx = Index, sidx = Subindex, hexadezimal

22) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>21)</sup> | sidx | Name     | Typ                     | Zu-griff <sup>22)</sup> | Beschreibung                                                                                                                          |
|--------------------|------|----------|-------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|                    | 02   | Status   | USINT                   | RO                      | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response |
|                    | 03   | Response | AR-RAY[0..1]<br>OF BYTE | RO                      | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                              |

Tab. 17: CDP Command Objects

## 5.2 Mehrstufige Wälzkolbenpumpen Serie 4 über EtherCAT betreiben

### 5.2.1 Prozessdaten Series 4

#### Prozessausgangsdaten

Prozessausgangsdaten sind:

- Default RxPDO (Steuerung --> Serie 4, "output"), CoE 1600h.1 – 4 (1 Byte)

| Byte.Bit | CoE <sup>23)</sup>                       | Bedeutung                   |
|----------|------------------------------------------|-----------------------------|
| 0.0      | 0x7000.0x01: Roughing Start/Stop         | Pumpstand (0: aus, 1: ein)  |
| 0.1      | 0x7000.0x04: Low Speed (Idle/Green Mode) | 0: normal, 1:low Speed mode |
| 0.2 – 7. |                                          | reserviert                  |

Tab. 18: Prozessausgangsdaten

#### Prozesseingangsdaten

Prozesseingangsdaten sind:

- Default TxPDO (Serie 4 --> Steuerung, "input"), CoE 1A00h.1 – 11 (7 Byte)

| Byte.Bit  | CoE <sup>24)</sup>                       | Bedeutung                               |
|-----------|------------------------------------------|-----------------------------------------|
| 0.0       | 0x6000.0x01: Roughing Run/Stop           | Pumpstand (0: aus, 1: ein)              |
| 0.1       | 0x6000.0x02: Booster Run/Stop            | WKP ein/aus (0: aus, 1: ein)            |
| 0.2       | 0x6000.0x04: Low Speed (Idle/Green Mode) | Idle Mode (0: deaktiviert, 1:aktiviert) |
| 0.3       | 0x6000.0x05: Remote/Local                | 0: ECAT, 1:lokal                        |
| 0.4       | 0x6000.0x09: Warning                     | 0: kein Warnung, 1: Warnung             |
| 0.5       | 0x6000.0x0A: Alarm                       | 0: kein Alarm, 1: Alarm                 |
| 0.6       | 0x6000.0x0B: Emergency Off               | 0: normal, 1:Stop                       |
| 0.7       | 0x6000.0x0C: N2 Flow Low                 | 0: normal, 1:N2 Flow low                |
| 1. – 2.   | 0x6001.0x02: N2 Flow                     | 0.1 l/min                               |
| 3. – 4.   | 0x6001.0x03: Exhaust Pressure            | kPa                                     |
| 5. – 6.   | 0x6001.0x05: Roughing Case Temperature   | °C                                      |
| 7. – 8.   | 0x6001.0x09: Roughing Current            | 0.1 A                                   |
| 9. – 10.  | 0x6001.0x0A: Roughing Power              | 0.1 kW                                  |
| 11. – 12. | 0x6001.0x0B: Roughing Speed              | 0.1% der Nenndrehzahl                   |
| 13. – 14. | 0x6002.0x05: Booster Case Temperature    | °C                                      |
| 15. – 16. | 0x6002.0x09: Booster Current             | 0.1 A                                   |

21) Idx = Index, sidx = Subindex, hexadezimal

22) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

23) hexadezimal

24) hexadezimal



| Byte.Bit  | CoE <sup>24)</sup>         | Bedeutung             |
|-----------|----------------------------|-----------------------|
| 17. – 18. | 0x6002.0x0A: Booster Power | 0.1 kW                |
| 19. – 20. | 0x6002.0x0B: Booster Speed | 0.1% der Nenndrehzahl |

Tab. 19: Prozesseingangsdaten

**Prozessdaten alternativ aus CoE-Objekten zusammenstellen**

1. Führen Sie immer den Zustand "PRE-OPERATIONAL" herbei.
2. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit 0.
3. Beschreiben Sie das Objekt 1601h.1-n bzw. 1A01h.1-n mit den entsprechenden CoE-Indizes.
4. Verwenden Sie nur mit "P" gekennzeichnete Objekte.
5. Vergeben Sie den Subindex 1-n nur fortlaufend und ohne Lücke.
6. Achten Sie darauf, dass die Daten eine ganze Anzahl Bytes ergeben (ggf. Pad-Bits verwenden) und auf ganzen Bytes beginnen (Ausnahme BOOL).
7. Beschreiben Sie maximal 12 Objekte pro PDO.
8. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit der Anzahl n der verwendeten Objekte.
9. Stellen Sie das Objekt 1C12h.1 auf 1601h bzw. 1C13h.1 auf 1A01h um.
10. Wählen Sie in den Prozessdaten das entsprechende PDO assignment 1601h bzw. 1A01h aus.

| Sync Manager: |      |         |       | PDO List: |      |                        |       |    |  |
|---------------|------|---------|-------|-----------|------|------------------------|-------|----|--|
| SM            | Size | Type    | Flags | Index     | Size | Name                   | Flags | SM |  |
| 0             | 128  | MbxOut  |       | 0x1A00    | 7.0  | Default TxPDO (input)  | F     |    |  |
| 1             | 128  | MbxIn   |       | 0x1A01    | 7.0  | User TxPDO (input)     |       | 3  |  |
| 2             | 3    | Outputs |       | 0x1600    | 1.0  | Default RxPDO (output) | F     |    |  |
| 3             | 7    | Inputs  |       | 0x1601    | 3.0  | User RxPDO (output)    |       | 2  |  |

| Sync Manager: |      |         |       | PDO List: |      |                        |       |    |  |
|---------------|------|---------|-------|-----------|------|------------------------|-------|----|--|
| SM            | Size | Type    | Flags | Index     | Size | Name                   | Flags | SM |  |
| 0             | 128  | MbxOut  |       | 0x1A00    | 7.0  | Default TxPDO (input)  | F     |    |  |
| 1             | 128  | MbxIn   |       | 0x1A01    | 7.0  | User TxPDO (input)     |       | 3  |  |
| 2             | 3    | Outputs |       | 0x1600    | 1.0  | Default RxPDO (output) | F     |    |  |
| 3             | 7    | Inputs  |       | 0x1601    | 3.0  | User RxPDO (output)    |       | 2  |  |

| PDO Assignment (0x1C12):                             |  |  |  | PDO Content (0x1601): |      |      |                       |      |  |
|------------------------------------------------------|--|--|--|-----------------------|------|------|-----------------------|------|--|
| <input type="checkbox"/> 0x1600 (excluded by 0x1601) |  |  |  | Index                 | Size | Offs | Name                  | Type |  |
| <input checked="" type="checkbox"/> 0x1601           |  |  |  | 0x7000:01             | 0.1  | 0.0  | Turbo Start Stop      | BOOL |  |
|                                                      |  |  |  | 0x7000:03             | 0.1  | 0.1  | Turbo Low Speed       | BOOL |  |
|                                                      |  |  |  | 0x3005:11             | 0.1  | 0.2  | Vnt. Enable           | BOOL |  |
|                                                      |  |  |  | 0x3005:21             | 0.1  | 0.3  | Sig. Enable           | BOOL |  |
|                                                      |  |  |  | ...                   | 0.4  | 0.4  | ...                   | ...  |  |
|                                                      |  |  |  | 0x8000:03             | 2.0  | 1.0  | Normal Speed Setpoint | UINT |  |
|                                                      |  |  |  |                       |      | 3.0  |                       |      |  |

| Sync Manager: |      |         |       | PDO List: |      |                        |       |    |  |
|---------------|------|---------|-------|-----------|------|------------------------|-------|----|--|
| SM            | Size | Type    | Flags | Index     | Size | Name                   | Flags | SM |  |
| 0             | 128  | MbxOut  |       | 0x1A00    | 7.0  | Default TxPDO (input)  | F     |    |  |
| 1             | 128  | MbxIn   |       | 0x1A01    | 7.0  | User TxPDO (input)     |       | 3  |  |
| 2             | 3    | Outputs |       | 0x1600    | 1.0  | Default RxPDO (output) | F     |    |  |
| 3             | 7    | Inputs  |       | 0x1601    | 3.0  | User RxPDO (output)    |       | 2  |  |

| PDO Assignment (0x1C12):                             |  |  |  | PDO Content (0x1601): |      |      |                     |       |  |
|------------------------------------------------------|--|--|--|-----------------------|------|------|---------------------|-------|--|
| <input type="checkbox"/> 0x1A00 (excluded by 0x1A01) |  |  |  | Index                 | Size | Offs | Name                | Type  |  |
| <input checked="" type="checkbox"/> 0x1A01           |  |  |  | 0x6000:03             | 0.1  | 0.0  | Alarm               | BOOL  |  |
|                                                      |  |  |  | 0x6000:0A             | 0.1  | 0.1  | Warning             | BOOL  |  |
|                                                      |  |  |  | 0x2001:88             | 0.1  | 0.2  | Ready for Process   | BOOL  |  |
|                                                      |  |  |  | ...                   | 0.5  | 0.3  | ...                 | ...   |  |
|                                                      |  |  |  | 0x2001:81             | 1.0  | 1.0  | Status              | USINT |  |
|                                                      |  |  |  | 0x2001:82             | 1.0  | 2.0  | Actual Speed (rel.) | SINT  |  |
|                                                      |  |  |  | 0x2002:13             | 2.0  | 3.0  | Power               | INT   |  |
|                                                      |  |  |  | 0x2002:88             | 2.0  | 5.0  | Pmp. Temperature    | INT   |  |
|                                                      |  |  |  |                       |      | 7.0  |                     |       |  |

Ausgangsdaten inklusive 4 Pad-Bits

Eingangsdaten inklusive 5 Pad-Bits

Tab. 20: Beispiele für Prozessdatenkonfiguration

**5.2.2 Servicedaten Series 4**

| Typ       | Beschreibung                         |
|-----------|--------------------------------------|
| BOOL      | Binärwert (ja/nein)                  |
| BYTE( )   | ein-Byte Zahl                        |
| STRING( ) | Zeichenkette                         |
| USINT     | positive Ganzzahl, 8 Bit             |
| UINT      | positive Ganzzahl, 16 Bit            |
| UDINT     | positive Ganzzahl, 32 Bit            |
| ULINT     | positive Ganzzahl, 64 Bit            |
| SINT      | Ganzzahl, 8 Bit                      |
| INT       | Ganzzahl, 16 Bit                     |
| DINT      | Ganzzahl, 32 Bit                     |
| REAL      | Fließkommazahl, einfache Genauigkeit |

Tab. 21: Datentypen der Servicedaten

Für den Zugriff auf einzelne Datenobjekte (z. B. zur Konfiguration) stehen folgende CoE-Objekte zur Verfügung:

24) hexadezimal

## Verwaltungsdaten (Information über das Gerät, Kommunikation)

| Idx <sup>25)</sup> | sldx | Name                            | Typ       | Zu-griff <sup>26)</sup> | Beschreibung                                                                                                                                                                  |
|--------------------|------|---------------------------------|-----------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000               |      | Device type                     | UDINT     | RO                      | Bit 0-15: Device profile number (5003).<br>NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B)<br>Bit 16-31: 0x0000sub-profile number is defined in 0xF010 bit 15..0 |
| 1008               |      | Manufacturer device name        | STRING(n) | RO                      | Name of the device as non-zero terminated string.                                                                                                                             |
| 1009               |      | Manufacturer hardware version   | STRING(n) | RO                      | Hardware version of the device as non-zero terminated string.                                                                                                                 |
| 100A               |      | Manufacturer software version   | STRING(n) | RO                      | Software version of the device as non-zero terminated string.                                                                                                                 |
| 100B               |      | Manufacturer bootloader version | STRING(n) | RO                      | Bootloader version of the device as non-zero terminated string.                                                                                                               |
| 1018               |      | Identity object                 | IDENTITY  | RO                      |                                                                                                                                                                               |
|                    | 01   | Vendor ID                       | UDINT     | RO                      |                                                                                                                                                                               |
|                    | 02   | Product code                    | UDINT     | RO                      |                                                                                                                                                                               |
|                    | 03   | Revision number                 | UDINT     | RO                      |                                                                                                                                                                               |
|                    | 04   | Serial number                   | UDINT     | RO                      |                                                                                                                                                                               |
| 10F8               |      | Timestamp object                | ULINT     | RO                      | Local timestamp of the device in ns.                                                                                                                                          |
| 1600               |      | SDP default RxPDO               |           |                         |                                                                                                                                                                               |
|                    | 01h  |                                 |           |                         | 0x7000.0x01: Roughing start/stop                                                                                                                                              |
|                    | 02h  |                                 |           |                         | 0x7000.0x04: Low speed (idle/green mode)                                                                                                                                      |
|                    | 03h  |                                 |           |                         |                                                                                                                                                                               |
| 1601               |      | User RxPDO                      |           |                         |                                                                                                                                                                               |
| 1A00               |      | SDP default TxPDO               |           |                         |                                                                                                                                                                               |
|                    | 01h  |                                 |           |                         | 0x6000.0x01: Roughing run/stop                                                                                                                                                |
|                    | 02h  |                                 |           |                         | 0x6000.0x02: Booster run/stop                                                                                                                                                 |
|                    | 03h  |                                 |           |                         | 0x6000.0x04: Low speed (idle/green mode)                                                                                                                                      |
|                    | 04h  |                                 |           |                         | 0x6000.0x05: Remote/local                                                                                                                                                     |
|                    | 05h  |                                 |           |                         | 0x6000.0x09: Warning                                                                                                                                                          |
|                    | 06h  |                                 |           |                         | 0x6000.0x0A: Alarm                                                                                                                                                            |
|                    | 07h  |                                 |           |                         | 0x6000.0x0B: Emergency Off                                                                                                                                                    |
|                    | 08h  |                                 |           |                         | 0x6000.0x0C: N2 flow low                                                                                                                                                      |
|                    | 09h  |                                 |           |                         | 0x6001.0x02: N2 flow                                                                                                                                                          |
|                    | 0Ah  |                                 |           |                         | 0x6001.0x03: Exhaust pressure                                                                                                                                                 |
|                    | 0Bh  |                                 |           |                         | 0x6001.0x05: Roughing case temperature                                                                                                                                        |
|                    | 0Ch  |                                 |           |                         | 0x6001.0x09: Roughing current                                                                                                                                                 |
|                    | 0Dh  |                                 |           |                         | 0x6001.0x0A: Roughing power                                                                                                                                                   |
|                    | 0Eh  |                                 |           |                         | 0x6001.0x0B: Roughing speed                                                                                                                                                   |
|                    | 0Fh  |                                 |           |                         | 0x6002.0x05: Booster case temperature                                                                                                                                         |
|                    | 10h  |                                 |           |                         | 0x6002.0x09: Booster current                                                                                                                                                  |
|                    | 11h  |                                 |           |                         | 0x6002.0x0A: Booster power                                                                                                                                                    |
|                    | 12h  |                                 |           |                         | 0x6002.0x0B: Booster speed                                                                                                                                                    |

25) Idx = Index, sldx = Subindex, hexadezimal

26) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>25)</sup> | sldx | Name                                         | Typ | Zu-griff <sup>26)</sup> | Beschreibung |
|--------------------|------|----------------------------------------------|-----|-------------------------|--------------|
| 1A01               |      | User TxPDO                                   |     |                         |              |
| 1C00               |      | Sync manager type                            |     |                         |              |
| 1C10               |      | Sync manager 0 PDO assignment                |     |                         |              |
| 1C11               |      | Sync manager 1 PDO assignment                |     |                         |              |
| 1C12               |      | RxPDO assign (sync manager 2 PDO assignment) |     |                         |              |
| 1C13               |      | TxPDO assign (sync manager 3 PDO assignment) |     |                         |              |

**Tab. 22: Communication Area - Verwaltungsdaten (Information über das Gerät, Kommunikation)**

**Eingangsdaten (S4 --> Steuerung)**

| Idx <sup>27)</sup> | sldx | Name                                 | Typ  | Zugriff <sup>28)</sup> | Beschreibung                                                       |
|--------------------|------|--------------------------------------|------|------------------------|--------------------------------------------------------------------|
| 6000               |      | Roughing and booster status          |      | RO                     |                                                                    |
|                    | 01   | Roughing run/stop                    | BOOL | RO                     | 1: Run<br>0: Stop                                                  |
|                    | 02   | Booster run/stop                     | BOOL | RO                     | 1: Run<br>0: Stop                                                  |
|                    | 03   | Booster2 run/stop                    |      |                        | 1: Run<br>0: Stop                                                  |
|                    | 04   | Low speed (idle/sleep/green mode)    | BOOL | RO                     | 1: Low speed (idle /sleep / green mode)<br>0: Normal               |
|                    | 05   | Remote/local                         | BOOL | RO                     | 1: Local. Hand control enabled<br>0: Remote, E-cat control enabled |
|                    | 06   | Inlet gate valve                     | BOOL | RO                     | 1: Open<br>0: Closed<br>Mandatory if inlet gate valve fitted       |
|                    | 07   | Pump interlock                       | BOOL | RO                     | 1: OK Process may proceed<br>0: Process must not run               |
|                    | 08   | N2 level ready                       | BOOL | RO                     | 1: OK (high level)<br>0: Not ready (low level)                     |
|                    | 09   | Warning                              | BOOL | RO                     | 1: Warning<br>0: Normal                                            |
|                    | 0A   | Alarm                                | BOOL | RO                     | 1: Alarm<br>0: Normal                                              |
|                    | 0B   | Emergency off                        | BOOL | RO                     | 1: Stop<br>0: Normal                                               |
|                    | 0C   | N2 flow low                          | BOOL | RO                     | 1: N2 flow low<br>0: Normal                                        |
|                    | 11   | Multiple sleep (green) level setting | UINT | RO                     | 0: Idle/sleep level 0 (default)<br>1- 255: Sleep (green) modes     |

25) Idx = Index, sldx = Subindex, hexadezimal

26) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

27) Idx = Index, sldx = Subindex, hexadezimal

28) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>27)</sup> | sIdx | Name                          | Typ | Zugriff <sup>28)</sup> | Beschreibung                                                  |
|--------------------|------|-------------------------------|-----|------------------------|---------------------------------------------------------------|
| 6001               |      | Roughing analog inputs        |     |                        |                                                               |
|                    | 01   | Coolant flow                  | INT | RO                     | 0.1 [l/min]                                                   |
|                    | 02   | N2 flow                       | INT | RO                     | 0.1 [slm]                                                     |
|                    | 03   | Exhaust pressure              | INT | RO                     | Gauge pressure (not absolute) - 1 [kPa]                       |
|                    | 05   | Roughing case temperature     | INT | RO                     | Degrees celsius                                               |
|                    | 06   | Roughing optional temperature | INT | RO                     | Degrees celsius                                               |
|                    | 09   | Roughing current              | INT | RO                     | 0.1 [A]                                                       |
|                    | 0A   | Roughing power                | INT | RO                     | 0.1 [kW]                                                      |
|                    | 0B   | Roughing speed                | INT | RO                     | 1000 (100.0 %): Rated speed<br>0 (0.0 %): 0 Rotation, 0.1 [%] |
| 6002               |      | Booster analog inputs         |     | RO                     |                                                               |
|                    | 05   | Booster case temperature      | INT | RO                     | Degrees celsius                                               |
|                    | 09   | Booster current               | INT | RO                     | 0.1 [A]                                                       |
|                    | 0A   | Booster power                 | INT | RO                     | 0.1 [kW]                                                      |
|                    | 0B   | Booster speed                 | INT | RO                     | 1000 (100.0 %): Rated speed<br>0 (0.0 %): 0 Rotation, 0.1 [%] |
| 6003               |      | Booster2 analog inputs        |     | RO                     |                                                               |
|                    | 05   |                               | INT | RO                     | Degrees celsius                                               |
|                    | 09   | Booster2 current              | INT | RO                     | 0.1 [A]                                                       |
|                    | 0A   | Booster2 power                | INT | RO                     | 0.1 [kW]                                                      |
|                    | 0B   | Booster2 speed                | INT | RO                     | 1000 (100.0 %): Rated speed<br>0 (0.0 %): 0 Rotation, 0.1 [%] |

Tab. 23: Input Area

## Ausgangsdaten (Steuerung --&gt; S4)

| Idx <sup>29)</sup> | sIdx | Name                                  | Typ  | Zugriff <sup>30)</sup> | Beschreibung                                      |
|--------------------|------|---------------------------------------|------|------------------------|---------------------------------------------------|
| 7000               |      | Roughing and booster control          |      | RO                     |                                                   |
|                    | 01   | Roughing start/stop                   | BOOL | RW                     | 1: Run<br>0: Stop                                 |
|                    | 02   | Booster start/stop                    | BOOL | RW                     | 1: Run<br>0: Stop                                 |
|                    | 03   | Booster 2 start/stop                  | BOOL | RW                     | 1: Run<br>0: Stop                                 |
|                    | 04   | Low speed (idle / sleep / green mode) | BOOL | RW                     | 1: Low speed (idle/sleep/green mode)<br>0: Normal |
|                    | 06   | N2 ballast valve                      | BOOL | RW                     | 1: Open ballast valve<br>0: Close ballast valve   |

27) Idx = Index, sIdx = Subindex, hexadezimal

28) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

29) Idx = Index, sIdx = Subindex, hexadezimal

30) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>29)</sup> | sidx | Name                                 | Typ  | Zugriff <sup>30)</sup> | Beschreibung                                                    |
|--------------------|------|--------------------------------------|------|------------------------|-----------------------------------------------------------------|
|                    | 07   | Inlet gate valve                     | BOOL | RW                     | 1: Open gate valve<br>0: Close gate valve                       |
|                    | 11   | Multiple sleep (green) level setting | UINT | RW                     | 0: Idle/sleep level 0 (default)<br>1-255: Sleep (green) levels. |

Tab. 24: Output Area

## Konfigurationsdaten (Steuerung --&gt; S4)

| Idx <sup>31)</sup> | sidx | Name                                      | Typ  | Zugriff <sup>32)</sup> | Beschreibung                                                                                                |
|--------------------|------|-------------------------------------------|------|------------------------|-------------------------------------------------------------------------------------------------------------|
| 8001               |      | Roughing and booster configuration        |      | RO                     |                                                                                                             |
|                    | 01   | Safe state                                | UINT | RW                     | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - pumps stop |
|                    | 02   | Booster and booster2 control mode setting | UINT | RW                     | 0: Co-ordinated mode (default)<br>1: Independent mode                                                       |
|                    | 03   | Gate valve control mode setting           | UINT | RW                     | 0: Co-ordinated mode (default)<br>1: Independent mode                                                       |

Tab. 25: Configuration Area

## Informationsdaten (S4 --&gt; Steuerung)

| Idx <sup>33)</sup> | sidx | Name                              | Typ   | Zugriff <sup>34)</sup> | Beschreibung                                          |
|--------------------|------|-----------------------------------|-------|------------------------|-------------------------------------------------------|
| 9000               |      | Roughing and booster information  |       | RO                     |                                                       |
|                    | 01   | Roughing exists                   | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                    | 02   | Booster exists                    | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                    | 03   | Booster 2 exists                  | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                    | 11   | Roughing and booster running time | UDINT | RO                     | Running time since manufacture or Service - 1 [hours] |
| 9001               |      | Sleep level wake up time          |       | RO                     |                                                       |
|                    | 01   |                                   | UINT  | RO                     | Wake up time.<br>Unit: Seconds                        |

Tab. 26: Information Area

29) Idx = Index, sidx = Subindex, hexadezimal

30) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

31) Idx = Index, sidx = Subindex, hexadezimal

32) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

33) Idx = Index, sidx = Subindex, hexadezimal

34) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

## Semiconductor device profile area

| Idx <sup>35)</sup> | sldx | Name                         | Typ   | Zugriff <sup>36)</sup> | Beschreibung |
|--------------------|------|------------------------------|-------|------------------------|--------------|
| F000               |      | Semiconductor device profile |       | RO                     |              |
|                    | 01   | Index distance               | UINT  |                        |              |
|                    | 02   | Maximum number of modules    | UINT  |                        |              |
| F010               |      | Module profile list          |       | RO                     |              |
|                    | 01   |                              | UDINT | RO                     |              |

Tab. 27: Semiconductor Device Profile Area

## Exception Handling

| Idx <sup>37)</sup> | sldx | Name                                                 | Typ   | Zu-griff <sup>38)</sup> | Beschreibung                                                                                                                    |
|--------------------|------|------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380               |      | Active exeption status                               | USINT | RO                      | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                    |      | Bit0: Device warning                                 |       |                         | Bit0: Device warning                                                                                                            |
|                    |      | Bit1: Manufacturer warning                           |       |                         | Bit1: Manufacturer warning                                                                                                      |
|                    |      | Bit2: Device error                                   |       |                         | Bit2: Device error                                                                                                              |
|                    |      | Bit3: Manufacturer error                             |       |                         | Bit3: Manufacturer error                                                                                                        |
|                    |      | Bit4: Reserved                                       |       |                         | Bit4: Reserved                                                                                                                  |
|                    |      | Bit5: Reserved                                       |       |                         | Bit5: Reserved                                                                                                                  |
|                    |      | Bit6: Reserved                                       |       |                         | Bit6: Reserved                                                                                                                  |
|                    |      | Bit7: Reserved                                       |       |                         | Bit7: Reserved                                                                                                                  |
| F381               |      | Roughing and booster 1 to 255: Active warning detail |       | RO                      |                                                                                                                                 |
|                    | 01   |                                                      | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                         |
|                    |      | Bit2: Power fail open phase                          |       |                         | Bit2: Power fail open phase                                                                                                     |
|                    |      | Bit4: Coolant flow                                   |       |                         | Bit4: Coolant flow                                                                                                              |
|                    |      | Bit5: N2 flow                                        |       |                         | Bit5: N2 flow                                                                                                                   |
|                    |      | Bit6: Exhaust pressure                               |       |                         | Bit6: Exhaust pressure                                                                                                          |
|                    |      | Bit8: Main controller err/batt low                   |       |                         | Bit8: Main controller err/batt low                                                                                              |
|                    |      | Bit9: Roughing case temp                             |       |                         | Bit9: Roughing case temp                                                                                                        |
|                    |      | Bit10: Roughing motor temp                           |       |                         | Bit10: Roughing motor temp                                                                                                      |
|                    |      | Bit11: Roughing current                              |       |                         | Bit11: Roughing current                                                                                                         |
|                    |      | Bit12: Roughing speed                                |       |                         | Bit12: Roughing speed                                                                                                           |
|                    |      | Bit13: Roughing lock rotor                           |       |                         | Bit13: Roughing lock rotor                                                                                                      |
|                    |      | Bit14: Roughing motor driver err                     |       |                         | Bit14: Roughing motor driver err                                                                                                |
|                    |      | Bit15: Booster case temp.                            |       |                         | Bit15: Booster case temp.                                                                                                       |
|                    |      | Bit16: Booster motor temp.                           |       |                         | Bit16: Booster motor temp.                                                                                                      |
|                    |      | Bit17: Booster current                               |       |                         | Bit17: Booster current                                                                                                          |
|                    |      | Bit18: Booster speed                                 |       |                         | Bit18: Booster speed                                                                                                            |

35) Idx = Index, sldx = Subindex, hexadezimal

36) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

37) Idx = Index, sldx = Subindex, hexadezimal

38) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>37)</sup> | sidx | Name                                                       | Typ   | Zu-griff <sup>38)</sup> | Beschreibung                                                                                            |
|--------------------|------|------------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------|
|                    |      | Bit19: Booster lock rotor                                  |       |                         | Bit19: Booster lock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                            |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                 |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit23: Booster2 current                                    |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                      |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                 |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                           |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                      |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit31: Others                                              |       |                         | Bit31: Others                                                                                           |
| F383               |      | Roughing and booster 1 to 255: Active error (alarm) detail |       | RO                      |                                                                                                         |
|                    | 01   |                                                            | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                    |      | Bit0: EMO                                                  |       |                         | Bit0: EMO                                                                                               |
|                    |      | Bit2: Power fail open Phase                                |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                        |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit 4: Coolant flow                                        |       |                         | Bit 4: Coolant flow                                                                                     |
|                    |      | Bit5: N2 flow                                              |       |                         | Bit5: N2 flow                                                                                           |
|                    |      | Bit6: Exhaust pressure                                     |       |                         | Bit6: Exhaust pressure                                                                                  |
|                    |      | Bit8: Main controller err/batt low                         |       |                         | Bit8: Main controller err/batt low                                                                      |
|                    |      | Bit9: Roughing case temp                                   |       |                         | Bit9: Roughing case temp                                                                                |
|                    |      | Bit10: Roughing motor temp                                 |       |                         | Bit10: Roughing motor temp                                                                              |
|                    |      | Bit11: Roughing current                                    |       |                         | Bit11: Roughing current                                                                                 |
|                    |      | Bit12: Roughing speed                                      |       |                         | Bit12: Roughing speed                                                                                   |
|                    |      | Bit13: Roughing lock rotor                                 |       |                         | Bit13: Roughing lock rotor                                                                              |
|                    |      | Bit14: Roughing motor driver err                           |       |                         | Bit14: Roughing motor driver err                                                                        |
|                    |      | Bit15: Booster case temp.                                  |       |                         | Bit15: Booster case temp.                                                                               |
|                    |      | Bit16: Booster motor temp.                                 |       |                         | Bit16: Booster motor temp.                                                                              |
|                    |      | Bit17: Booster current                                     |       |                         | Bit17: Booster current                                                                                  |
|                    |      | Bit18: Booster speed                                       |       |                         | Bit18: Booster speed                                                                                    |
|                    |      | Bit19: Booster lock rotor                                  |       |                         | Bit19: Booster sock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                            |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                 |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit23: Booster2 current                                    |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                      |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                 |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                           |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                      |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit31: Others                                              |       |                         | Bit31: Others                                                                                           |

37) Idx = Index, sidx = Subindex, hexadezimal

38) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>37)</sup> | sidx | Name                                                  | Typ   | Zu-griff <sup>38)</sup> | Beschreibung                                                                                                                                                 |
|--------------------|------|-------------------------------------------------------|-------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| F390               |      | Latched exception status                              | USINT | RO                      | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. See CDP for additional information. |
|                    |      | Bit0: Device warning                                  |       |                         | Bit0: Device warning                                                                                                                                         |
|                    |      | Bit1: Manufacturer warning                            |       |                         | Bit1: Manufacturer warning                                                                                                                                   |
|                    |      | Bit2: Device error                                    |       |                         | Bit2: Device error                                                                                                                                           |
|                    |      | Bit3: Manufacturer error                              |       |                         | Bit3: Manufacturer error                                                                                                                                     |
|                    |      | Bit4: Reserved                                        |       |                         | Bit4: Reserved                                                                                                                                               |
|                    |      | Bit5: Reserved                                        |       |                         | Bit5: Reserved                                                                                                                                               |
|                    |      | Bit6: Reserved                                        |       |                         | Bit6: Reserved                                                                                                                                               |
|                    |      | Bit7: Reserved                                        |       |                         | Bit7: Reserved                                                                                                                                               |
| F391               |      | Roughing and booster 1 to 255: Latched warning detail |       | RO                      |                                                                                                                                                              |
|                    | 01   |                                                       | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                                                      |
|                    |      | Bit0: EMO                                             |       |                         | Bit0: EMO                                                                                                                                                    |
|                    |      | Bit1: Water leak                                      |       |                         | Bit1: Water leak                                                                                                                                             |
|                    |      | Bit2: Power fail open phase                           |       |                         | Bit2: Power fail open phase                                                                                                                                  |
|                    |      | Bit3: Reverse phase                                   |       |                         | Bit3: Reverse phase                                                                                                                                          |
|                    |      | Bit4: Coolant flow                                    |       |                         | Bit4: Coolant flow                                                                                                                                           |
|                    |      | Bit5: N2 flow                                         |       |                         | Bit5: N2 flow                                                                                                                                                |
|                    |      | Bit6: Exhaust pressure                                |       |                         | Bit6: Exhaust pressure                                                                                                                                       |
|                    |      | Bit7: Exhaust temp.                                   |       |                         | Bit7: Exhaust temp.                                                                                                                                          |
|                    |      | Bit8: Main controller err/batt low                    |       |                         | Bit8: Main controller err/batt low                                                                                                                           |
|                    |      | Bit9: Roughing case temp                              |       |                         | Bit9: Roughing case temp                                                                                                                                     |
|                    |      | Bit10: Roughing motor temp                            |       |                         | Bit10: Roughing motor temp                                                                                                                                   |
|                    |      | Bit11: Roughing current                               |       |                         | Bit11: Roughing current                                                                                                                                      |
|                    |      | Bit12: Roughing speed                                 |       |                         | Bit12: Roughing speed                                                                                                                                        |
|                    |      | Bit13: Roughing lock rotor                            |       |                         | Bit13: Roughing lock rotor                                                                                                                                   |
|                    |      | Bit14: Roughing motor driver err                      |       |                         | Bit14: Roughing motor driver err                                                                                                                             |
|                    |      | Bit15: Booster case temp.                             |       |                         | Bit15: Booster case temp.                                                                                                                                    |
|                    |      | Bit16: Booster motor temp.                            |       |                         | Bit16: Booster motor temp.                                                                                                                                   |
|                    |      | Bit17: Booster current                                |       |                         | Bit17: Booster current                                                                                                                                       |
|                    |      | Bit18: Booster speed                                  |       |                         | Bit18: Booster speed                                                                                                                                         |
|                    |      | Bit19: Booster lock rotor                             |       |                         | Bit19: Booster lock rotor                                                                                                                                    |
|                    |      | Bit20: Booster motor driver err                       |       |                         | Bit20: Booster motor driver err                                                                                                                              |
|                    |      | Bit21: Booster2 case temp.                            |       |                         | Bit21: Booster2 case temp.                                                                                                                                   |
|                    |      | Bit22: Booster2 motor temp.                           |       |                         | Bit22: Booster2 motor temp.                                                                                                                                  |
|                    |      | Bit23: Booster2 current                               |       |                         | Bit23: Booster2 current                                                                                                                                      |
|                    |      | Bit24: Booster2 speed                                 |       |                         | Bit24: Booster2 speed                                                                                                                                        |
|                    |      | Bit25: Booster2 lock rotor                            |       |                         | Bit25: Booster2 lock rotor                                                                                                                                   |

37) Idx = Index, sidx = Subindex, hexadezimal

38) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet



| Idx <sup>37)</sup> | sldx | Name                                                        | Typ   | Zu-griff <sup>38)</sup> | Beschreibung                                                                                            |
|--------------------|------|-------------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------|
|                    |      | Bit26: Booster2 motor driver err                            |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                       |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                           |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                           |       |                         | Bit29: Future use                                                                                       |
|                    |      | Bit30: Future use                                           |       |                         | Bit30: Future use                                                                                       |
|                    |      | Bit31: Others                                               |       |                         | Bit31: Others                                                                                           |
| F393               |      | Roughing and booster 1 to 255: Latched error (alarm) detail |       | RO                      |                                                                                                         |
|                    | 01   |                                                             | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                    |      | Bit0: EMO                                                   |       |                         | Bit0: EMO                                                                                               |
|                    |      | Bit1: Water leak                                            |       |                         | Bit1: Water leak                                                                                        |
|                    |      | Bit2: Power fail open phase                                 |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                         |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit4: Coolant flow                                          |       |                         | Bit4: Coolant flow                                                                                      |
|                    |      | Bit5: N2 flow                                               |       |                         | Bit5: N2 flow                                                                                           |
|                    |      | Bit6: Exhaust pressure                                      |       |                         | Bit6: Exhaust pressure                                                                                  |
|                    |      | Bit7: Exhaust temp.                                         |       |                         | Bit7: Exhaust temp.                                                                                     |
|                    |      | Bit8: Main controller err/batt low                          |       |                         | Bit8: Main controller err/batt low                                                                      |
|                    |      | Bit9: Roughing case temp                                    |       |                         | Bit9: Roughing case temp                                                                                |
|                    |      | Bit10: Roughing motor temp                                  |       |                         | Bit10: Roughing motor temp                                                                              |
|                    |      | Bit11: Roughing current                                     |       |                         | Bit11: Roughing current                                                                                 |
|                    |      | Bit12: Roughing speed                                       |       |                         | Bit12: Roughing speed                                                                                   |
|                    |      | Bit13: Roughing lock rotor                                  |       |                         | Bit13: Roughing lock rotor                                                                              |
|                    |      | Bit14: Roughing motor driver err                            |       |                         | Bit14: Roughing motor driver err                                                                        |
|                    |      | Bit15: Booster case temp.                                   |       |                         | Bit15: Booster case temp.                                                                               |
|                    |      | Bit16: Booster motor temp.                                  |       |                         | Bit16: Booster motor temp.                                                                              |
|                    |      | Bit17: Booster current                                      |       |                         | Bit17: Booster current                                                                                  |
|                    |      | Bit18: Booster speed                                        |       |                         | Bit18: Booster speed                                                                                    |
|                    |      | Bit19: Booster lock rotor                                   |       |                         | Bit19: Booster lock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                             |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                  |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit22: Booster2 motor temp.                                 |       |                         | Bit22: Booster2 motor temp.                                                                             |
|                    |      | Bit23: Booster2 current                                     |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                       |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                  |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                            |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                       |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                           |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                           |       |                         | Bit29: Future use                                                                                       |
|                    |      | Bit30: Future use                                           |       |                         | Bit30: Future use                                                                                       |

37) Idx = Index, sldx = Subindex, hexadezimal

38) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>37)</sup> | sidx | Name                                              | Typ   | Zu-griff <sup>38)</sup> | Beschreibung                                                                                                                                                                                                                        |
|--------------------|------|---------------------------------------------------|-------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |      | Bit31: Others                                     |       |                         | Bit31: Others                                                                                                                                                                                                                       |
| F3A1               |      | Roughing and booster 1 to 255: Warning mask       |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   |                                                   | UDINT | RW                      | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3               |      | Roughing and booster 1 to 255: Error (alarm) mask |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   |                                                   | UDINT | RW                      | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |
| F6F0               |      | Input latch local timestamp                       |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   | Input latch local timestamp                       | UDINT | RO                      | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up.                                                                                                                  |

Tab. 28: Exception Handling

## CDP Specific Information Data

| Idx <sup>39)</sup> | sidx | Name                             | Typ       | Zu-griff <sup>40)</sup> | Beschreibung                                                                                                          |
|--------------------|------|----------------------------------|-----------|-------------------------|-----------------------------------------------------------------------------------------------------------------------|
| F9F0               |      | Manufacturer serial number       | STRING(n) | RO                      | String representing the manufacturer's serial number for the device. NOTE: This may have the same value as 0x1018:04. |
| F9F1               |      | CDP functional generation number |           | RO                      |                                                                                                                       |
|                    | 01   |                                  | UDINT     | RO                      | Common device profile functional generation number2                                                                   |
| F9F2               |      | SDP functional generation number |           | RO                      |                                                                                                                       |
|                    | 01   |                                  | UDINT     | RO                      | SDP functional generation number off nn-th moduleIt shall be specified by each SDP.2                                  |
| F9F3               |      | Vendor name                      | STRING(n) | RO                      | This string identifies the supplier of the device.                                                                    |
| F9F4               |      | SDP device name                  |           | RO                      |                                                                                                                       |
|                    | 01   |                                  | STRING(n) | RO                      | String identifying the device type of nn-th module as defined by the SDP.                                             |
| F9F5               |      | Output identifier                |           | RO                      |                                                                                                                       |

37) Idx = Index, sidx = Subindex, hexadezimal

38) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

39) Idx = Index, sidx = Subindex, hexadezimal

40) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>39)</sup> | sldx | Name                                         | Typ   | Zu-griff <sup>40)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                             |
|--------------------|------|----------------------------------------------|-------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 01   |                                              | USINT | RO                      | Output identifier of nn-th module This value can be mapped to both the RxPDO and TxPDO. The required function of the device is to store the value in memory as written by the host. The controller can then read this value back through the TxPDO to ensure the RxPDO was received.                                     |
| F9F6               |      | Time since power on                          | UDINT | RO                      | This is the time the device has been currently powered on, in seconds, regardless of communication presence.                                                                                                                                                                                                             |
| F9F8               |      | Firmware update functional generation number | UDINT | RO                      | Firmware update functional generation number supported by the device. Value shall be specified by the Firmware Update Profile (ETG.5003-2) 0x00000000: FW Update according to ETG.5003-2 not supported. A device cannot return this value and still be compliant with ETG.5003.1, as ETG.5003-2 compliance is mandatory. |

Tab. 29: CDP Specific Information Data

## CDP Command Objects

| Idx <sup>41)</sup> | sldx | Name                 | Typ                  | Zu-griff <sup>42)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|------|----------------------|----------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0               |      | Device reset command |                      | RO                      | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. There are two versions of this command:<br><br>Device Reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset.<br><br>Factory Reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                    | 01   | Command              | AR-RAY[0..5] OF BYTE | RW                      | A device reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72<br>Byte 5: Device Standard Reset = 0x00, factory reset = 0x66                                                                                                                                                                                                                                                                                |
|                    | 02   | Status               | USINT                | RO                      | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Reserved<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                                                                                                     |
|                    | 03   | Response             | AR-RAY[0..1] OF BYTE | RO                      | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                           |

39) Idx = Index, sldx = Subindex, hexadezimal

40) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

41) Idx = Index, sldx = Subindex, hexadezimal

42) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>41)</sup> | sidx | Name                          | Typ                     | Zu-griff <sup>42)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|------|-------------------------------|-------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF1               |      | Excepti-on reset com-mand     |                         | RO                      | Execution of this command clears the latched ex-ceptions.                                                                                                                                                                                                                                                                                                                                                          |
|                    | 01   | Com-mand                      | AR-RAY[0..4]<br>OF BYTE | RW                      | A latched exception reset is initiated when the fol-lowing byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72                                                                                                                                                                                                                                                  |
|                    | 02   | Status                        | USINT                   | RO                      | Supported values:<br>0: Last command completed, no error, no respon-se<br>1: Reserved<br>2: Last command com-pleted, error, no response                                                                                                                                                                                                                                                                            |
|                    | 03   | Respon-se                     | AR-RAY[0..1]<br>OF BYTE | RO                      | Byte 0: See subindex 2<br>Byte 1: Unused.                                                                                                                                                                                                                                                                                                                                                                          |
| FBF2               |      | Store param-e-ters com-mand   |                         | RO                      | Execution of this command will store all param-e-ters to non-volatile memory.                                                                                                                                                                                                                                                                                                                                      |
|                    | 01   | Com-mand                      | AR-RAY[0..3]<br>OF BYTE | RW                      | Read:<br>Bit 0 = 1: Device saves the non-volatile param-e-ters when writing 0xFB2:01 with 0x65766173<br>Bit 1 = 1: Device saves the non-volatile param-e-ters automatically when they are written<br>Bit 2-31: Reserved, shall be 0<br>Write: All writable, non-volatile values will be sto-red in non-volatile memory when the following is sent:<br>Byte 0: 0x73<br>Byte 1: 0x61<br>Byte 2: 0x76<br>Byte 3: 0x65 |
|                    | 02   | Status                        | USINT                   | RO                      | Supported values:<br>0: Default value if the command has not been initi-ated. Not a supported value other-wise.<br>1: Last command completed, no error, reply the-re<br>2: Last command completed, error, no response.                                                                                                                                                                                             |
|                    | 03   | Respon-se                     | AR-RAY[0..1]<br>OF BYTE | RO                      | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                                                           |
| FBF3               |      | Calcula-te check-sum com-mand |                         | RO                      | Execution of this command will calculate a check-sum for all writable, non-volatile parameters as currently stored in non-volatile memory.                                                                                                                                                                                                                                                                         |

41) Idx = Index, sidx = Subindex, hexadezimal

42) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>41)</sup> | sidx | Name                                 | Typ                         | Zu-<br>griff <sup>42)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|------|--------------------------------------|-----------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 01   | Com-<br>mand                         | AR-<br>RAY[0..3]<br>OF BYTE | RW                          | <p>Read: Returns information about the supported checksum type</p> <p>Bit 0 = 0: No non-volatile parameters supported<br/>Bit 0 = 1: Non-volatile parameters supported</p> <p>Bit 1 = 1: CRC-32<br/>Bit 2 = 1: MD5<br/>Bit 3 = 1: SHA-1<br/>Bit 4-6: Reserved, shall be 0<br/>Bit 7 = 1: Other algorithm.</p> <p>Write: Checksum type selection and start calculation<br/>A write access to this subindex shall only set one bit true in Bit[0...7].</p> <p>Bit 0 = 1: Use default checksum algorithm of the device<br/>Bit 1 = 1: CRC-32<br/>Bit 2 = 1: MD5<br/>Bit 3 = 1: SHA-1<br/>Bit 4-6: Reserved, shall be 0<br/>Bit 7 = 1: Other algorithm<br/>Bit 8...31: Reserved.</p> |
|                    | 02   | Status                               | USINT                       | RO                          | <p>Supported values:</p> <p>0: Default value if the command has not been initiated. Not a supported value otherwise.<br/>1: Last command completed, no error, reply there<br/>2: Last command completed, error, no response</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                    | 03   | Respon-<br>se                        | AR-<br>RAY[0..n]<br>OF BYTE | RO                          | <p>Byte 0: See subindex 2<br/>Byte 1: Unused - shall be zero<br/>Byte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length is 64 bytes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FBF4               |      | Load pa-<br>rameters<br>com-<br>mand |                             | RO                          | Execution of this command will load all parameters from non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                    | 01   | Com-<br>mand                         | AR-<br>RAY[0..3]<br>OF BYTE | RW                          | <p>Read:</p> <p>Bit 0 = 1: Device loads the non-volatile parameters when writing 0xFB4F:01 with 0x64616F6C<br/>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are.</p> <p>Write:</p> <p>All writable, non-volatile parameters will be loaded from non-volatile memory when the following is sent:</p> <p>Byte 0: 0x6C<br/>Byte 1: 0x6F<br/>Byte 2: 0x61<br/>Byte 3: 0x64.</p>                                                                                                                                                                                                                                                                       |

41) Idx = Index, sidx = Subindex, hexadezimal

42) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>41)</sup> | sidx | Name     | Typ                     | Zu-griff <sup>42)</sup> | Beschreibung                                                                                                                          |
|--------------------|------|----------|-------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|                    | 02   | Status   | USINT                   | RO                      | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response |
|                    | 03   | Response | AR-RAY[0..1]<br>OF BYTE | RO                      | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                              |

Tab. 30: CDP Command Objects

## 5.3 Mehrstufige Wälzkolbenpumpen UltiDry über EtherCAT betreiben

### 5.3.1 Prozessdaten UltiDry

#### Prozessausgangsdaten

Prozessausgangsdaten sind:

- Default RxPDO (Steuerung --> UltiDry, "output"), CoE 1600h.1 – 4 (1 Byte)

| Byte.Bit | CoE <sup>43)</sup>                       | Bedeutung                   |
|----------|------------------------------------------|-----------------------------|
| 0.0      | 0x7000.0x01: Roughing Start/Stop         | Pumpstand (0: aus, 1: ein)  |
| 0.1      | 0x7000.0x04: Low Speed (Idle/Green Mode) | 0: normal, 1:low Speed mode |
| 0.2 – 7. |                                          | reserviert                  |

Tab. 31: Prozessausgangsdaten

#### Prozesseingangsdaten

Prozesseingangsdaten sind:

- Default TxPDO (UltiDry --> Steuerung, "input"), CoE 1A00h.1 – 11 (7 Byte)

| Byte.Bit  | CoE <sup>44)</sup>                       | Bedeutung                               |
|-----------|------------------------------------------|-----------------------------------------|
| 0.0       | 0x6000.0x01: Roughing Run/Stop           | Pumpstand (0: aus, 1: ein)              |
| 0.1       | 0x6000.0x02: Booster Run/Stop            | WKP ein/aus (0: aus, 1: ein)            |
| 0.2       | 0x6000.0x04: Low Speed (Idle/Green Mode) | Idle Mode (0: deaktiviert, 1:aktiviert) |
| 0.3       | 0x6000.0x05: Remote/Local                | 0: ECAT, 1:lokal                        |
| 0.4       | 0x6000.0x09: Warning                     | 0: kein Warnung, 1: Warnung             |
| 0.5       | 0x6000.0x0A: Alarm                       | 0: kein Alarm, 1: Alarm                 |
| 0.6       | 0x6000.0x0B: Emergency Off               | 0: normal, 1:Stop                       |
| 0.7       | 0x6000.0x0C: N2 Flow Low                 | 0: normal, 1:N2 Flow low                |
| 1. – 2.   | 0x6001.0x02: N2 Flow                     | 0.1 l/min                               |
| 3. – 4.   | 0x6001.0x03: Exhaust Pressure            | kPa                                     |
| 5. – 6.   | 0x6001.0x05: Roughing Case Temperature   | °C                                      |
| 7. – 8.   | 0x6001.0x09: Roughing Current            | 0.1 A                                   |
| 9. – 10.  | 0x6001.0x0A: Roughing Power              | 0.1 kW                                  |
| 11. – 12. | 0x6001.0x0B: Roughing Speed              | 0.1% der Nenndrehzahl                   |
| 13. – 14. | 0x6002.0x05: Booster Case Temperature    | °C                                      |
| 15. – 16. | 0x6002.0x09: Booster Current             | 0.1 A                                   |

41) Idx = Index, sidx = Subindex, hexadezimal

42) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

43) hexadezimal

44) hexadezimal

| Byte.Bit  | CoE <sup>44)</sup>         | Bedeutung             |
|-----------|----------------------------|-----------------------|
| 17. – 18. | 0x6002.0x0A: Booster Power | 0.1 kW                |
| 19. – 20. | 0x6002.0x0B: Booster Speed | 0.1% der Nenndrehzahl |

Tab. 32: Prozesseingangsdaten

#### Prozessdaten alternativ aus CoE-Objekten zusammenstellen

1. Führen Sie immer den Zustand "PRE-OPERATIONAL" herbei.
2. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit 0.
3. Beschreiben Sie das Objekt 1601h.1-n bzw. 1A01h.1-n mit den entsprechenden CoE-Indizes.
4. Verwenden Sie nur mit "P" gekennzeichnete Objekte.
5. Vergeben Sie den Subindex 1-n nur fortlaufend und ohne Lücke.
6. Achten Sie darauf, dass die Daten eine ganze Anzahl Bytes ergeben (ggf. Pad-Bits verwenden) und auf ganzen Bytes beginnen (Ausnahme BOOL).
7. Beschreiben Sie maximal 12 Objekte pro PDO.
8. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit der Anzahl n der verwendeten Objekte.
9. Stellen Sie das Objekt 1C12h.1 auf 1601h bzw. 1C13h.1 auf 1A01h um.
10. Wählen Sie in den Prozessdaten das entsprechende PDO assignment 1601h bzw. 1A01h aus.

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1600 (excluded by 0x1601)
 ☒ 0x1601

PDO Content (0x1601):

| Index     | Size | Offs | Name                  | Type |
|-----------|------|------|-----------------------|------|
| 0x7000:01 | 0.1  | 0.0  | Turbo Start Stop      | BOOL |
| 0x7000:03 | 0.1  | 0.1  | Turbo Low Speed       | BOOL |
| 0x3005:11 | 0.1  | 0.2  | Vnt. Enable           | BOOL |
| 0x3005:21 | 0.1  | 0.3  | Sig. Enable           | BOOL |
| ...       | 0.4  | 0.4  | ...                   |      |
| 0x8000:03 | 2.0  | 1.0  | Normal Speed Setpoint | UINT |
|           |      | 3.0  |                       |      |

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☒ PDO Assignment
 ☒ PDO Configuration

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1A00 (excluded by 0x1A01)
 ☒ 0x1A01

PDO Content (0x1601):

| Index     | Size | Offs | Name                | Type  |
|-----------|------|------|---------------------|-------|
| 0x6000:09 | 0.1  | 0.0  | Alarm               | BOOL  |
| 0x6000:0A | 0.1  | 0.1  | Warning             | BOOL  |
| 0x2001:88 | 0.1  | 0.2  | Ready for Process   | BOOL  |
| ...       | 0.5  | 0.3  | ...                 |       |
| 0x2001:81 | 1.0  | 1.0  | Status              | USINT |
| 0x2001:82 | 1.0  | 2.0  | Actual Speed (rel.) | SINT  |
| 0x2002:13 | 2.0  | 3.0  | Power               | INT   |
| 0x2002:88 | 2.0  | 5.0  | Fmp. Temperature    | INT   |
|           |      | 7.0  |                     |       |

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☒ PDO Assignment
 ☒ PDO Configuration

Ausgangsdaten inklusive 4 Pad-Bits

Eingangsdaten inklusive 5 Pad-Bits

Tab. 33: Beispiele für Prozessdatenkonfiguration

### 5.3.2 Servicedaten UltiDry

| Typ       | Beschreibung                         |
|-----------|--------------------------------------|
| BOOL      | Binärwert (ja/nein)                  |
| BYTE( )   | ein-Byte Zahl                        |
| STRING( ) | Zeichenkette                         |
| USINT     | positive Ganzzahl, 8 Bit             |
| UINT      | positive Ganzzahl, 16 Bit            |
| UDINT     | positive Ganzzahl, 32 Bit            |
| ULINT     | positive Ganzzahl, 64 Bit            |
| SINT      | Ganzzahl, 8 Bit                      |
| INT       | Ganzzahl, 16 Bit                     |
| DINT      | Ganzzahl, 32 Bit                     |
| REAL      | Fließkommazahl, einfache Genauigkeit |

Tab. 34: Datentypen der Servicedaten

Für den Zugriff auf einzelne Datenobjekte (z. B. zur Konfiguration) stehen folgende CoE-Objekte zur Verfügung:

44) hexadezimal

## Verwaltungsdaten (Information über das Gerät, Kommunikation)

| Idx <sup>45)</sup> | sldx | Name                            | Typ       | Zu-griff <sup>46)</sup> | Beschreibung                                                                                                                                                                  |
|--------------------|------|---------------------------------|-----------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000               |      | Device type                     | UDINT     | RO                      | Bit 0-15: Device profile number (5003).<br>NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B)<br>Bit 16-31: 0x0000sub-profile number is defined in 0xF010 bit 15..0 |
| 1008               |      | Manufacturer device name        | STRING(n) | RO                      | Name of the device as non-zero terminated string.                                                                                                                             |
| 1009               |      | Manufacturer hardware version   | STRING(n) | RO                      | Hardware version of the device as non-zero terminated string.                                                                                                                 |
| 100A               |      | Manufacturer software version   | STRING(n) | RO                      | Software version of the device as non-zero terminated string.                                                                                                                 |
| 100B               |      | Manufacturer bootloader version | STRING(n) | RO                      | Bootloader version of the device as non-zero terminated string.                                                                                                               |
| 1018               |      | Identity object                 | IDENTITY  | RO                      |                                                                                                                                                                               |
|                    | 01   | Vendor ID                       | UDINT     | RO                      |                                                                                                                                                                               |
|                    | 02   | Product code                    | UDINT     | RO                      |                                                                                                                                                                               |
|                    | 03   | Revision number                 | UDINT     | RO                      |                                                                                                                                                                               |
|                    | 04   | Serial number                   | UDINT     | RO                      |                                                                                                                                                                               |
| 10F8               |      | Timestamp object                | ULINT     | RO                      | Local timestamp of the device in ns.                                                                                                                                          |
| 1600               |      | SDP default RxPDO               |           |                         |                                                                                                                                                                               |
|                    | 01h  |                                 |           |                         | 0x7000.0x01: Roughing start/stop                                                                                                                                              |
|                    | 02h  |                                 |           |                         | 0x7000.0x04: Low speed (idle/green mode)                                                                                                                                      |
|                    | 03h  |                                 |           |                         |                                                                                                                                                                               |
| 1601               |      | User RxPDO                      |           |                         |                                                                                                                                                                               |
| 1A00               |      | SDP default TxPDO               |           |                         |                                                                                                                                                                               |
|                    | 01h  |                                 |           |                         | 0x6000.0x01: Roughing run/stop                                                                                                                                                |
|                    | 02h  |                                 |           |                         | 0x6000.0x02: Booster run/stop                                                                                                                                                 |
|                    | 03h  |                                 |           |                         | 0x6000.0x04: Low speed (idle/green mode)                                                                                                                                      |
|                    | 04h  |                                 |           |                         | 0x6000.0x05: Remote/local                                                                                                                                                     |
|                    | 05h  |                                 |           |                         | 0x6000.0x09: Warning                                                                                                                                                          |
|                    | 06h  |                                 |           |                         | 0x6000.0x0A: Alarm                                                                                                                                                            |
|                    | 07h  |                                 |           |                         | 0x6000.0x0B: Emergency Off                                                                                                                                                    |
|                    | 08h  |                                 |           |                         | 0x6000.0x0C: N2 flow low                                                                                                                                                      |
|                    | 09h  |                                 |           |                         | 0x6001.0x02: N2 flow                                                                                                                                                          |
|                    | 0Ah  |                                 |           |                         | 0x6001.0x03: Exhaust pressure                                                                                                                                                 |
|                    | 0Bh  |                                 |           |                         | 0x6001.0x05: Roughing case temperature                                                                                                                                        |
|                    | 0Ch  |                                 |           |                         | 0x6001.0x09: Roughing current                                                                                                                                                 |
|                    | 0Dh  |                                 |           |                         | 0x6001.0x0A: Roughing power                                                                                                                                                   |
|                    | 0Eh  |                                 |           |                         | 0x6001.0x0B: Roughing speed                                                                                                                                                   |
|                    | 0Fh  |                                 |           |                         | 0x6002.0x05: Booster case temperature                                                                                                                                         |
|                    | 10h  |                                 |           |                         | 0x6002.0x09: Booster current                                                                                                                                                  |
|                    | 11h  |                                 |           |                         | 0x6002.0x0A: Booster power                                                                                                                                                    |
|                    | 12h  |                                 |           |                         | 0x6002.0x0B: Booster speed                                                                                                                                                    |

45) Idx = Index, sldx = Subindex, hexadezimal

46) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet



| Idx <sup>45)</sup> | sidx | Name                                                 | Typ | Zu-griff <sup>46)</sup> | Beschreibung |
|--------------------|------|------------------------------------------------------|-----|-------------------------|--------------|
| 1A01               |      | User TxPDO                                           |     |                         |              |
| 1C00               |      | Sync manager type                                    |     |                         |              |
| 1C10               |      | Sync manager 0<br>PDO assignment                     |     |                         |              |
| 1C11               |      | Sync manager 1<br>PDO assignment                     |     |                         |              |
| 1C12               |      | RxPDO assign (sync<br>manager 2 PDO as-<br>signment) |     |                         |              |
| 1C13               |      | TxPDO assign (sync<br>manager 3 PDO as-<br>signment) |     |                         |              |

**Tab. 35: Communication Area - Verwaltungsdaten (Information über das Gerät, Kommunikation)**

**Eingangsdaten (UltiDry --> Steuerung)**

| Idx <sup>47)</sup> | sidx | Name                                    | Typ  | Zugriff <sup>48)</sup> | Beschreibung                                                       |
|--------------------|------|-----------------------------------------|------|------------------------|--------------------------------------------------------------------|
| 6000               |      | Roughing and booster status             |      | RO                     |                                                                    |
|                    | 01   | Roughing run/stop                       | BOOL | RO                     | 1: Run<br>0: Stop                                                  |
|                    | 02   | Booster run/stop                        | BOOL | RO                     | 1: Run<br>0: Stop                                                  |
|                    | 03   | Booster2 run/stop                       |      |                        | 1: Run<br>0: Stop                                                  |
|                    | 04   | Low speed (idle/sleep/<br>green mode)   | BOOL | RO                     | 1: Low speed (idle /sleep / green<br>mode)<br>0: Normal            |
|                    | 05   | Remote/local                            | BOOL | RO                     | 1: Local. Hand control enabled<br>0: Remote, E-cat control enabled |
|                    | 06   | Inlet gate valve                        | BOOL | RO                     | 1: Open<br>0: Closed<br>Mandatory if inlet gate valve fitted       |
|                    | 07   | Pump interlock                          | BOOL | RO                     | 1: OK Process may proceed<br>0: Process must not run               |
|                    | 08   | N2 level ready                          | BOOL | RO                     | 1: OK (high level)<br>0: Not ready (low level)                     |
|                    | 09   | Warning                                 | BOOL | RO                     | 1: Warning<br>0: Normal                                            |
|                    | 0A   | Alarm                                   | BOOL | RO                     | 1: Alarm<br>0: Normal                                              |
|                    | 0B   | Emergency off                           | BOOL | RO                     | 1: Stop<br>0: Normal                                               |
|                    | 0C   | N2 flow low                             | BOOL | RO                     | 1: N2 flow low<br>0: Normal                                        |
|                    | 11   | Multiple sleep (green) level<br>setting | UINT | RO                     | 0: Idle/sleep level 0 (default)<br>1- 255: Sleep (green) modes     |

45) Idx = Index, sidx = Subindex, hexadezimal

46) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

47) Idx = Index, sidx = Subindex, hexadezimal

48) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>47)</sup> | sIdx | Name                          | Typ | Zugriff <sup>48)</sup> | Beschreibung                                                  |
|--------------------|------|-------------------------------|-----|------------------------|---------------------------------------------------------------|
| 6001               |      | Roughing analog inputs        |     |                        |                                                               |
|                    | 01   | Coolant flow                  | INT | RO                     | 0.1 [l/min]                                                   |
|                    | 02   | N2 flow                       | INT | RO                     | 0.1 [slm]                                                     |
|                    | 03   | Exhaust pressure              | INT | RO                     | Gauge pressure (not absolute) - 1 [kPa]                       |
|                    | 05   | Roughing case temperature     | INT | RO                     | Degrees celsius                                               |
|                    | 06   | Roughing optional temperature | INT | RO                     | Degrees celsius                                               |
|                    | 09   | Roughing current              | INT | RO                     | 0.1 [A]                                                       |
|                    | 0A   | Roughing power                | INT | RO                     | 0.1 [kW]                                                      |
|                    | 0B   | Roughing speed                | INT | RO                     | 1000 (100.0 %): Rated speed<br>0 (0.0 %): 0 Rotation, 0.1 [%] |
| 6002               |      | Booster analog inputs         |     | RO                     |                                                               |
|                    | 05   | Booster case temperature      | INT | RO                     | Degrees celsius                                               |
|                    | 09   | Booster current               | INT | RO                     | 0.1 [A]                                                       |
|                    | 0A   | Booster power                 | INT | RO                     | 0.1 [kW]                                                      |
|                    | 0B   | Booster speed                 | INT | RO                     | 1000 (100.0 %): Rated speed<br>0 (0.0 %): 0 Rotation, 0.1 [%] |
| 6003               |      | Booster2 analog inputs        |     | RO                     |                                                               |
|                    | 05   |                               | INT | RO                     | Degrees celsius                                               |
|                    | 09   | Booster2 current              | INT | RO                     | 0.1 [A]                                                       |
|                    | 0A   | Booster2 power                | INT | RO                     | 0.1 [kW]                                                      |
|                    | 0B   | Booster2 speed                | INT | RO                     | 1000 (100.0 %): Rated speed<br>0 (0.0 %): 0 Rotation, 0.1 [%] |

Tab. 36: Input Area

## Ausgangsdaten (Steuerung --&gt; UltiDry)

| Idx <sup>49)</sup> | sIdx | Name                                  | Typ  | Zugriff <sup>50)</sup> | Beschreibung                                      |
|--------------------|------|---------------------------------------|------|------------------------|---------------------------------------------------|
| 7000               |      | Roughing and booster control          |      | RO                     |                                                   |
|                    | 01   | Roughing start/stop                   | BOOL | RW                     | 1: Run<br>0: Stop                                 |
|                    | 02   | Booster start/stop                    | BOOL | RW                     | 1: Run<br>0: Stop                                 |
|                    | 03   | Booster 2 start/stop                  | BOOL | RW                     | 1: Run<br>0: Stop                                 |
|                    | 04   | Low speed (idle / sleep / green mode) | BOOL | RW                     | 1: Low speed (idle/sleep/green mode)<br>0: Normal |
|                    | 06   | N2 ballast valve                      | BOOL | RW                     | 1: Open ballast valve<br>0: Close ballast valve   |

47) Idx = Index, sIdx = Subindex, hexadezimal

48) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

49) Idx = Index, sIdx = Subindex, hexadezimal

50) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>49)</sup> | sidx | Name                                 | Typ  | Zugriff <sup>50)</sup> | Beschreibung                                                    |
|--------------------|------|--------------------------------------|------|------------------------|-----------------------------------------------------------------|
|                    | 07   | Inlet gate valve                     | BOOL | RW                     | 1: Open gate valve<br>0: Close gate valve                       |
|                    | 11   | Multiple sleep (green) level setting | UINT | RW                     | 0: Idle/sleep level 0 (default)<br>1-255: Sleep (green) levels. |

Tab. 37: Output Area

## Konfigurationsdaten (Steuerung --&gt; UltiDry)

| Idx <sup>51)</sup> | sidx | Name                                      | Typ  | Zugriff <sup>52)</sup> | Beschreibung                                                                                                |
|--------------------|------|-------------------------------------------|------|------------------------|-------------------------------------------------------------------------------------------------------------|
| 8001               |      | Roughing and booster configuration        |      | RO                     |                                                                                                             |
|                    | 01   | Safe state                                | UINT | RW                     | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - pumps stop |
|                    | 02   | Booster and booster2 control mode setting | UINT | RW                     | 0: Co-ordinated mode (default)<br>1: Independent mode                                                       |
|                    | 03   | Gate valve control mode setting           | UINT | RW                     | 0: Co-ordinated mode (default)<br>1: Independent mode                                                       |

Tab. 38: Configuration Area

## Informationsdaten (UltiDry --&gt; Steuerung)

| Idx <sup>53)</sup> | sidx | Name                              | Typ   | Zugriff <sup>54)</sup> | Beschreibung                                          |
|--------------------|------|-----------------------------------|-------|------------------------|-------------------------------------------------------|
| 9000               |      | Roughing and booster information  |       | RO                     |                                                       |
|                    | 01   | Roughing exists                   | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                    | 02   | Booster exists                    | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                    | 03   | Booster 2 exists                  | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                    | 11   | Roughing and booster running time | UDINT | RO                     | Running time since manufacture or Service - 1 [hours] |
| 9001               |      | Sleep level wake up time          |       | RO                     |                                                       |
|                    | 01   |                                   | UINT  | RO                     | Wake up time.<br>Unit: Seconds                        |

Tab. 39: Information Area

49) Idx = Index, sidx = Subindex, hexadezimal

50) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

51) Idx = Index, sidx = Subindex, hexadezimal

52) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

53) Idx = Index, sidx = Subindex, hexadezimal

54) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

**Semiconductor device profile area**

| Idx <sup>55)</sup> | sldx | Name                         | Typ   | Zugriff <sup>56)</sup> | Beschreibung |
|--------------------|------|------------------------------|-------|------------------------|--------------|
| F000               |      | Semiconductor device profile |       | RO                     |              |
|                    | 01   | Index distance               | UINT  |                        |              |
|                    | 02   | Maximum number of modules    | UINT  |                        |              |
| F010               |      | Module profile list          |       | RO                     |              |
|                    | 01   |                              | UDINT | RO                     |              |

**Tab. 40: Semiconductor Device Profile Area****Exception Handling**

| Idx <sup>57)</sup> | sldx | Name                                                 | Typ   | Zu-griff <sup>58)</sup> | Beschreibung                                                                                                                    |
|--------------------|------|------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380               |      | Active exception status                              | USINT | RO                      | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                    |      | Bit0: Device warning                                 |       |                         | Bit0: Device warning                                                                                                            |
|                    |      | Bit1: Manufacturer warning                           |       |                         | Bit1: Manufacturer warning                                                                                                      |
|                    |      | Bit2: Device error                                   |       |                         | Bit2: Device error                                                                                                              |
|                    |      | Bit3: Manufacturer error                             |       |                         | Bit3: Manufacturer error                                                                                                        |
|                    |      | Bit4: Reserved                                       |       |                         | Bit4: Reserved                                                                                                                  |
|                    |      | Bit5: Reserved                                       |       |                         | Bit5: Reserved                                                                                                                  |
|                    |      | Bit6: Reserved                                       |       |                         | Bit6: Reserved                                                                                                                  |
|                    |      | Bit7: Reserved                                       |       |                         | Bit7: Reserved                                                                                                                  |
| F381               |      | Roughing and booster 1 to 255: Active warning detail |       | RO                      |                                                                                                                                 |
|                    | 01   |                                                      | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                         |
|                    |      | Bit2: Power fail open phase                          |       |                         | Bit2: Power fail open phase                                                                                                     |
|                    |      | Bit4: Coolant flow                                   |       |                         | Bit4: Coolant flow                                                                                                              |
|                    |      | Bit5: N2 flow                                        |       |                         | Bit5: N2 flow                                                                                                                   |
|                    |      | Bit6: Exhaust pressure                               |       |                         | Bit6: Exhaust pressure                                                                                                          |
|                    |      | Bit8: Main controller err/batt low                   |       |                         | Bit8: Main controller err/batt low                                                                                              |
|                    |      | Bit9: Roughing case temp                             |       |                         | Bit9: Roughing case temp                                                                                                        |
|                    |      | Bit10: Roughing motor temp                           |       |                         | Bit10: Roughing motor temp                                                                                                      |
|                    |      | Bit11: Roughing current                              |       |                         | Bit11: Roughing current                                                                                                         |
|                    |      | Bit12: Roughing speed                                |       |                         | Bit12: Roughing speed                                                                                                           |
|                    |      | Bit13: Roughing lock rotor                           |       |                         | Bit13: Roughing lock rotor                                                                                                      |
|                    |      | Bit14: Roughing motor driver err                     |       |                         | Bit14: Roughing motor driver err                                                                                                |
|                    |      | Bit15: Booster case temp.                            |       |                         | Bit15: Booster case temp.                                                                                                       |
|                    |      | Bit16: Booster motor temp.                           |       |                         | Bit16: Booster motor temp.                                                                                                      |
|                    |      | Bit17: Booster current                               |       |                         | Bit17: Booster current                                                                                                          |
|                    |      | Bit18: Booster speed                                 |       |                         | Bit18: Booster speed                                                                                                            |

55) Idx = Index, sldx = Subindex, hexadezimal

56) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

57) Idx = Index, sldx = Subindex, hexadezimal

58) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>57)</sup> | sldx | Name                                                       | Typ   | Zu-griff <sup>58)</sup> | Beschreibung                                                                                            |
|--------------------|------|------------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------|
|                    |      | Bit19: Booster lock rotor                                  |       |                         | Bit19: Booster lock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                            |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                 |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit23: Booster2 current                                    |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                      |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                 |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                           |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                      |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit31: Others                                              |       |                         | Bit31: Others                                                                                           |
| F383               |      | Roughing and booster 1 to 255: Active error (alarm) detail |       | RO                      |                                                                                                         |
|                    | 01   |                                                            | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                    |      | Bit0: EMO                                                  |       |                         | Bit0: EMO                                                                                               |
|                    |      | Bit2: Power fail open Phase                                |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                        |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit 4: Coolant flow                                        |       |                         | Bit 4: Coolant flow                                                                                     |
|                    |      | Bit5: N2 flow                                              |       |                         | Bit5: N2 flow                                                                                           |
|                    |      | Bit6: Exhaust pressure                                     |       |                         | Bit6: Exhaust pressure                                                                                  |
|                    |      | Bit8: Main controller err/batt low                         |       |                         | Bit8: Main controller err/batt low                                                                      |
|                    |      | Bit9: Roughing case temp                                   |       |                         | Bit9: Roughing case temp                                                                                |
|                    |      | Bit10: Roughing motor temp                                 |       |                         | Bit10: Roughing motor temp                                                                              |
|                    |      | Bit11: Roughing current                                    |       |                         | Bit11: Roughing current                                                                                 |
|                    |      | Bit12: Roughing speed                                      |       |                         | Bit12: Roughing speed                                                                                   |
|                    |      | Bit13: Roughing lock rotor                                 |       |                         | Bit13: Roughing lock rotor                                                                              |
|                    |      | Bit14: Roughing motor driver err                           |       |                         | Bit14: Roughing motor driver err                                                                        |
|                    |      | Bit15: Booster case temp.                                  |       |                         | Bit15: Booster case temp.                                                                               |
|                    |      | Bit16: Booster motor temp.                                 |       |                         | Bit16: Booster motor temp.                                                                              |
|                    |      | Bit17: Booster current                                     |       |                         | Bit17: Booster current                                                                                  |
|                    |      | Bit18: Booster speed                                       |       |                         | Bit18: Booster speed                                                                                    |
|                    |      | Bit19: Booster lock rotor                                  |       |                         | Bit19: Booster sock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                            |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                 |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit23: Booster2 current                                    |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                      |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                 |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                           |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                      |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit31: Others                                              |       |                         | Bit31: Others                                                                                           |

57) Idx = Index, sldx = Subindex, hexadezimal

58) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>57)</sup> | sldx | Name                                                  | Typ   | Zu-griff <sup>58)</sup> | Beschreibung                                                                                                                                                 |
|--------------------|------|-------------------------------------------------------|-------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| F390               |      | Latched exception status                              | USINT | RO                      | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. See CDP for additional information. |
|                    |      | Bit0: Device warning                                  |       |                         | Bit0: Device warning                                                                                                                                         |
|                    |      | Bit1: Manufacturer warning                            |       |                         | Bit1: Manufacturer warning                                                                                                                                   |
|                    |      | Bit2: Device error                                    |       |                         | Bit2: Device error                                                                                                                                           |
|                    |      | Bit3: Manufacturer error                              |       |                         | Bit3: Manufacturer error                                                                                                                                     |
|                    |      | Bit4: Reserved                                        |       |                         | Bit4: Reserved                                                                                                                                               |
|                    |      | Bit5: Reserved                                        |       |                         | Bit5: Reserved                                                                                                                                               |
|                    |      | Bit6: Reserved                                        |       |                         | Bit6: Reserved                                                                                                                                               |
|                    |      | Bit7: Reserved                                        |       |                         | Bit7: Reserved                                                                                                                                               |
| F391               |      | Roughing and booster 1 to 255: Latched warning detail |       | RO                      |                                                                                                                                                              |
|                    | 01   |                                                       | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                                                      |
|                    |      | Bit0: EMO                                             |       |                         | Bit0: EMO                                                                                                                                                    |
|                    |      | Bit1: Water leak                                      |       |                         | Bit1: Water leak                                                                                                                                             |
|                    |      | Bit2: Power fail open phase                           |       |                         | Bit2: Power fail open phase                                                                                                                                  |
|                    |      | Bit3: Reverse phase                                   |       |                         | Bit3: Reverse phase                                                                                                                                          |
|                    |      | Bit4: Coolant flow                                    |       |                         | Bit4: Coolant flow                                                                                                                                           |
|                    |      | Bit5: N2 flow                                         |       |                         | Bit5: N2 flow                                                                                                                                                |
|                    |      | Bit6: Exhaust pressure                                |       |                         | Bit6: Exhaust pressure                                                                                                                                       |
|                    |      | Bit7: Exhaust temp.                                   |       |                         | Bit7: Exhaust temp.                                                                                                                                          |
|                    |      | Bit8: Main controller err/batt low                    |       |                         | Bit8: Main controller err/batt low                                                                                                                           |
|                    |      | Bit9: Roughing case temp                              |       |                         | Bit9: Roughing case temp                                                                                                                                     |
|                    |      | Bit10: Roughing motor temp                            |       |                         | Bit10: Roughing motor temp                                                                                                                                   |
|                    |      | Bit11: Roughing current                               |       |                         | Bit11: Roughing current                                                                                                                                      |
|                    |      | Bit12: Roughing speed                                 |       |                         | Bit12: Roughing speed                                                                                                                                        |
|                    |      | Bit13: Roughing lock rotor                            |       |                         | Bit13: Roughing lock rotor                                                                                                                                   |
|                    |      | Bit14: Roughing motor driver err                      |       |                         | Bit14: Roughing motor driver err                                                                                                                             |
|                    |      | Bit15: Booster case temp.                             |       |                         | Bit15: Booster case temp.                                                                                                                                    |
|                    |      | Bit16: Booster motor temp.                            |       |                         | Bit16: Booster motor temp.                                                                                                                                   |
|                    |      | Bit17: Booster current                                |       |                         | Bit17: Booster current                                                                                                                                       |
|                    |      | Bit18: Booster speed                                  |       |                         | Bit18: Booster speed                                                                                                                                         |
|                    |      | Bit19: Booster lock rotor                             |       |                         | Bit19: Booster lock rotor                                                                                                                                    |
|                    |      | Bit20: Booster motor driver err                       |       |                         | Bit20: Booster motor driver err                                                                                                                              |
|                    |      | Bit21: Booster2 case temp.                            |       |                         | Bit21: Booster2 case temp.                                                                                                                                   |
|                    |      | Bit22: Booster2 motor temp.                           |       |                         | Bit22: Booster2 motor temp.                                                                                                                                  |
|                    |      | Bit23: Booster2 current                               |       |                         | Bit23: Booster2 current                                                                                                                                      |
|                    |      | Bit24: Booster2 speed                                 |       |                         | Bit24: Booster2 speed                                                                                                                                        |
|                    |      | Bit25: Booster2 lock rotor                            |       |                         | Bit25: Booster2 lock rotor                                                                                                                                   |

57) Idx = Index, sldx = Subindex, hexadezimal

58) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>57)</sup> | sldx | Name                                                        | Typ   | Zu-griff <sup>58)</sup> | Beschreibung                                                                                            |
|--------------------|------|-------------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------|
|                    |      | Bit26: Booster2 motor driver err                            |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                       |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                           |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                           |       |                         | Bit29: Future use                                                                                       |
|                    |      | Bit30: Future use                                           |       |                         | Bit30: Future use                                                                                       |
|                    |      | Bit31: Others                                               |       |                         | Bit31: Others                                                                                           |
| F393               |      | Roughing and booster 1 to 255: Latched error (alarm) detail |       | RO                      |                                                                                                         |
|                    | 01   |                                                             | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                    |      | Bit0: EMO                                                   |       |                         | Bit0: EMO                                                                                               |
|                    |      | Bit1: Water leak                                            |       |                         | Bit1: Water leak                                                                                        |
|                    |      | Bit2: Power fail open phase                                 |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                         |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit4: Coolant flow                                          |       |                         | Bit4: Coolant flow                                                                                      |
|                    |      | Bit5: N2 flow                                               |       |                         | Bit5: N2 flow                                                                                           |
|                    |      | Bit6: Exhaust pressure                                      |       |                         | Bit6: Exhaust pressure                                                                                  |
|                    |      | Bit7: Exhaust temp.                                         |       |                         | Bit7: Exhaust temp.                                                                                     |
|                    |      | Bit8: Main controller err/batt low                          |       |                         | Bit8: Main controller err/batt low                                                                      |
|                    |      | Bit9: Roughing case temp                                    |       |                         | Bit9: Roughing case temp                                                                                |
|                    |      | Bit10: Roughing motor temp                                  |       |                         | Bit10: Roughing motor temp                                                                              |
|                    |      | Bit11: Roughing current                                     |       |                         | Bit11: Roughing current                                                                                 |
|                    |      | Bit12: Roughing speed                                       |       |                         | Bit12: Roughing speed                                                                                   |
|                    |      | Bit13: Roughing lock rotor                                  |       |                         | Bit13: Roughing lock rotor                                                                              |
|                    |      | Bit14: Roughing motor driver err                            |       |                         | Bit14: Roughing motor driver err                                                                        |
|                    |      | Bit15: Booster case temp.                                   |       |                         | Bit15: Booster case temp.                                                                               |
|                    |      | Bit16: Booster motor temp.                                  |       |                         | Bit16: Booster motor temp.                                                                              |
|                    |      | Bit17: Booster current                                      |       |                         | Bit17: Booster current                                                                                  |
|                    |      | Bit18: Booster speed                                        |       |                         | Bit18: Booster speed                                                                                    |
|                    |      | Bit19: Booster lock rotor                                   |       |                         | Bit19: Booster lock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                             |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                  |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit22: Booster2 motor temp.                                 |       |                         | Bit22: Booster2 motor temp.                                                                             |
|                    |      | Bit23: Booster2 current                                     |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                       |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                  |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                            |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                       |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                           |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                           |       |                         | Bit29: Future use                                                                                       |
|                    |      | Bit30: Future use                                           |       |                         | Bit30: Future use                                                                                       |

57) Idx = Index, sldx = Subindex, hexadezimal

58) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>57)</sup> | sidx | Name                                              | Typ   | Zu-griff <sup>58)</sup> | Beschreibung                                                                                                                                                                                                                        |
|--------------------|------|---------------------------------------------------|-------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |      | Bit31: Others                                     |       |                         | Bit31: Others                                                                                                                                                                                                                       |
| F3A1               |      | Roughing and booster 1 to 255: Warning mask       |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   |                                                   | UDINT | RW                      | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3               |      | Roughing and booster 1 to 255: Error (alarm) mask |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   |                                                   | UDINT | RW                      | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |
| F6F0               |      | Input latch local timestamp                       |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   | Input latch local timestamp                       | UDINT | RO                      | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up.                                                                                                                  |

Tab. 41: Exception Handling

## CDP Specific Information Data

| Idx <sup>59)</sup> | sidx | Name                             | Typ       | Zu-griff <sup>60)</sup> | Beschreibung                                                                                                          |
|--------------------|------|----------------------------------|-----------|-------------------------|-----------------------------------------------------------------------------------------------------------------------|
| F9F0               |      | Manufacturer serial number       | STRING(n) | RO                      | String representing the manufacturer's serial number for the device. NOTE: This may have the same value as 0x1018:04. |
| F9F1               |      | CDP functional generation number |           | RO                      |                                                                                                                       |
|                    | 01   |                                  | UDINT     | RO                      | Common device profile functional generation number2                                                                   |
| F9F2               |      | SDP functional generation number |           | RO                      |                                                                                                                       |
|                    | 01   |                                  | UDINT     | RO                      | SDP functional generation number off nn-th moduleIt shall be specified by each SDP.2                                  |
| F9F3               |      | Vendor name                      | STRING(n) | RO                      | This string identifies the supplier of the device.                                                                    |
| F9F4               |      | SDP device name                  |           | RO                      |                                                                                                                       |
|                    | 01   |                                  | STRING(n) | RO                      | String identifying the device type of nn-th module as defined by the SDP.                                             |
| F9F5               |      | Output identifier                |           | RO                      |                                                                                                                       |

57) Idx = Index, sidx = Subindex, hexadezimal

58) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

59) Idx = Index, sidx = Subindex, hexadezimal

60) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet



| Idx <sup>59)</sup> | sldx | Name                                         | Typ   | Zu-griff <sup>60)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                             |
|--------------------|------|----------------------------------------------|-------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 01   |                                              | USINT | RO                      | Output identifier of nn-th module This value can be mapped to both the RxPDO and TxPDO. The required function of the device is to store the value in memory as written by the host. The controller can then read this value back through the TxPDO to ensure the RxPDO was received.                                     |
| F9F6               |      | Time since power on                          | UDINT | RO                      | This is the time the device has been currently powered on, in seconds, regardless of communication presence.                                                                                                                                                                                                             |
| F9F8               |      | Firmware update functional generation number | UDINT | RO                      | Firmware update functional generation number supported by the device. Value shall be specified by the Firmware Update Profile (ETG.5003-2) 0x00000000: FW Update according to ETG.5003-2 not supported. A device cannot return this value and still be compliant with ETG.5003.1, as ETG.5003-2 compliance is mandatory. |

Tab. 42: CDP Specific Information Data

## CDP Command Objects

| Idx <sup>61)</sup> | sldx | Name                 | Typ                  | Zu-griff <sup>62)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|------|----------------------|----------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0               |      | Device reset command |                      | RO                      | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. There are two versions of this command:<br><br>Device Reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset.<br><br>Factory Reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                    | 01   | Command              | AR-RAY[0..5] OF BYTE | RW                      | A device reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72<br>Byte 5: Device Standard Reset = 0x00, factory reset = 0x66                                                                                                                                                                                                                                                                                |
|                    | 02   | Status               | USINT                | RO                      | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Reserved<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                                                                                                     |
|                    | 03   | Response             | AR-RAY[0..1] OF BYTE | RO                      | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                           |

59) Idx = Index, sldx = Subindex, hexadezimal

60) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

61) Idx = Index, sldx = Subindex, hexadezimal

62) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>61)</sup> | sidx | Name                       | Typ                 | Zu-griff <sup>62)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|------|----------------------------|---------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF1               |      | Exception reset command    |                     | RO                      | Execution of this command clears the latched exceptions.                                                                                                                                                                                                                                                                                                                                                      |
|                    | 01   | Command                    | ARRAY[0..4] OF BYTE | RW                      | A latched exception reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72                                                                                                                                                                                                                                              |
|                    | 02   | Status                     | USINT               | RO                      | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                                         |
|                    | 03   | Response                   | ARRAY[0..1] OF BYTE | RO                      | Byte 0: See subindex 2<br>Byte 1: Unused.                                                                                                                                                                                                                                                                                                                                                                     |
| FBF2               |      | Store parameters command   |                     | RO                      | Execution of this command will store all parameters to non-volatile memory.                                                                                                                                                                                                                                                                                                                                   |
|                    | 01   | Command                    | ARRAY[0..3] OF BYTE | RW                      | Read:<br>Bit 0 = 1: Device saves the non-volatile parameters when writing 0xFB2:01 with 0x65766173<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written<br>Bit 2-31: Reserved, shall be 0<br>Write: All writable, non-volatile values will be stored in non-volatile memory when the following is sent:<br>Byte 0: 0x73<br>Byte 1: 0x61<br>Byte 2: 0x76<br>Byte 3: 0x65 |
|                    | 02   | Status                     | USINT               | RO                      | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Last command completed, no error, reply there<br>2: Last command completed, error, no response.                                                                                                                                                                                           |
|                    | 03   | Response                   | ARRAY[0..1] OF BYTE | RO                      | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                                                      |
| FBF3               |      | Calculate checksum command |                     | RO                      | Execution of this command will calculate a checksum for all writable, non-volatile parameters as currently stored in non-volatile memory.                                                                                                                                                                                                                                                                     |

61) Idx = Index, sidx = Subindex, hexadezimal

62) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>61)</sup> | sidx | Name                      | Typ                     | Zu-griff <sup>62)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|------|---------------------------|-------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 01   | Com-mand                  | AR-RAY[0..3]<br>OF BYTE | RW                      | <p>Read: Returns information about the supported checksum type</p> <p>Bit 0 = 0: No non-volatile parameters supported<br/>           Bit 0 = 1: Non-volatile parameters supported</p> <p>Bit 1 = 1: CRC-32<br/>           Bit 2 = 1: MD5<br/>           Bit 3 = 1: SHA-1<br/>           Bit 4-6: Reserved, shall be 0<br/>           Bit 7 = 1: Other algorithm.</p> <p>Write: Checksum type selection and start calculation<br/>           A write access to this subindex shall only set one bit true in Bit[0...7].</p> <p>Bit 0 = 1: Use default checksum algorithm of the device<br/>           Bit 1 = 1: CRC-32<br/>           Bit 2 = 1: MD5<br/>           Bit 3 = 1: SHA-1<br/>           Bit 4-6: Reserved, shall be 0<br/>           Bit 7 = 1: Other algorithm<br/>           Bit 8...31: Reserved.</p> |
|                    | 02   | Status                    | USINT                   | RO                      | <p>Supported values:</p> <p>0: Default value if the command has not been initiated. Not a supported value otherwise.<br/>           1: Last command completed, no error, reply there<br/>           2: Last command completed, error, no response</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                    | 03   | Respon-se                 | AR-RAY[0..n]<br>OF BYTE | RO                      | <p>Byte 0: See subindex 2<br/>           Byte 1: Unused - shall be zero<br/>           Byte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length is 64 bytes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| FBF4               |      | Load pa-rameters com-mand |                         | RO                      | Execution of this command will load all parameters from non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                    | 01   | Com-mand                  | AR-RAY[0..3]<br>OF BYTE | RW                      | <p>Read:</p> <p>Bit 0 = 1: Device loads the non-volatile parameters when writing 0xFB4F:01 with 0x64616F6C<br/>           Bit 1 = 1: Device saves the non-volatile parameters automatically when they are.</p> <p>Write:</p> <p>All writable, non-volatile parameters will be loaded from non-volatile memory when the following is sent:</p> <p>Byte 0: 0x6C<br/>           Byte 1: 0x6F<br/>           Byte 2: 0x61<br/>           Byte 3: 0x64.</p>                                                                                                                                                                                                                                                                                                                                                               |

61) Idx = Index, sidx = Subindex, hexadezimal

62) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>61)</sup> | sidx | Name     | Typ                     | Zu-griff <sup>62)</sup> | Beschreibung                                                                                                                          |
|--------------------|------|----------|-------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|                    | 02   | Status   | USINT                   | RO                      | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response |
|                    | 03   | Response | AR-RAY[0..1]<br>OF BYTE | RO                      | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                              |

Tab. 43: CDP Command Objects

## 5.4 Wälzkolbenpumpe HiLobe über EtherCAT betreiben

### 5.4.1 Prozessdaten HiLobe

#### Prozessausgangsdaten

Prozessausgangsdaten sind:

- Default RxPDO (Steuerung --> HiLobe, "output"), CoE 1600h.1 – 4 (1 Byte)

| Byte.Bit | CoE <sup>63)</sup>                       | Bedeutung                  |
|----------|------------------------------------------|----------------------------|
| 0.0      | 0x7000.0x01: Roughing Start/Stop         | Pumpstand (0: aus, 1: ein) |
| 0.1      | 0x7000.0x04: Low Speed (Idle/Green Mode) | Standby (0: aus, 1: ein)   |
| 0.2 – 7. |                                          | reserviert                 |

Tab. 44: Prozessausgangsdaten

#### Prozesseingangsdaten

Prozesseingangsdaten sind:

- Default TxPDO (HiLobe --> Steuerung, "input"), CoE 1A00h.1 – 11 (7 Byte)

| Byte.Bit  | CoE <sup>64)</sup>                       | Bedeutung                   |
|-----------|------------------------------------------|-----------------------------|
| 0.0       | 0x6000.0x01: Roughing Run/Stop           | Pumpstand (0: aus, 1: ein)  |
| 0.1       | 0x6000.0x02: Booster Run/Stop            | konstant 0                  |
| 0.2       | 0x6000.0x04: Low Speed (Idle/Green Mode) | Standby (0: aus, 1: ein)    |
| 0.3       | 0x6000.0x05: Remote/Local                | 0: lokal, 1: EtherCAT       |
| 0.4       | 0x6000.0x09: Warning                     | 0: kein Warnung, 1: Warnung |
| 0.5       | 0x6000.0x0A: Alarm                       | 0: kein Alarm, 1: Alarm     |
| 0.6       | 0x6000.0x0B: Emergency Off               | konstant 0                  |
| 0.7       | 0x6000.0x0C: N2 Flow Low                 | konstant 0                  |
| 1. – 2.   | 0x6001.0x02: N2 Flow                     | konstant 0                  |
| 3. – 4.   | 0x6001.0x03: Exhaust Pressure            | konstant 0                  |
| 5. – 6.   | 0x6001.0x05: Roughing Case Temperature   | konstant 0                  |
| 7. – 8.   | 0x6001.0x09: Roughing Current            | 0.1 A                       |
| 9. – 10.  | 0x6001.0x0A: Roughing Power              | 0.1 kW                      |
| 11. – 12. | 0x6001.0x0B: Roughing Speed              | 0.1% der Nenndrehzahl       |
| 13. – 14. | 0x6002.0x05: Booster Case Temperature    | konstant 0                  |
| 15. – 16. | 0x6002.0x09: Booster Current             | konstant 0                  |

61) Idx = Index, sidx = Subindex, hexadezimal

62) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

63) hexadezimal

64) hexadezimal

| Byte.Bit  | CoE <sup>64)</sup>         | Bedeutung  |
|-----------|----------------------------|------------|
| 17. – 18. | 0x6002.0x0A: Booster Power | konstant 0 |
| 19. – 20. | 0x6002.0x0B: Booster Speed | konstant 0 |

Tab. 45: Prozesseingangsdaten

#### Prozessdaten alternativ aus CoE-Objekten zusammenstellen

1. Führen Sie immer den Zustand "PRE-OPERATIONAL" herbei.
2. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit 0.
3. Beschreiben Sie das Objekt 1601h.1-n bzw. 1A01h.1-n mit den entsprechenden CoE-Indizes.
4. Verwenden Sie nur mit "P" gekennzeichnete Objekte.
5. Vergeben Sie den Subindex 1-n nur fortlaufend und ohne Lücke.
6. Achten Sie darauf, dass die Daten eine ganze Anzahl Bytes ergeben (ggf. Pad-Bits verwenden) und auf ganzen Bytes beginnen (Ausnahme BOOL).
7. Beschreiben Sie maximal 12 Objekte pro PDO.
8. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit der Anzahl n der verwendeten Objekte.
9. Stellen Sie das Objekt 1C12h.1 auf 1601h bzw. 1C13h.1 auf 1A01h um.
10. Wählen Sie in den Prozessdaten das entsprechende PDO assignment 1601h bzw. 1A01h aus.

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MboxOut |       |
| 1  | 128  | MboxIn  |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1600 (excluded by 0x1601)

☒ 0x1601

Download

☒ PDO Assignment

☒ PDO Configuration

PDO Content (0x1601):

| Index     | Size | Offs | Name                  | Type |
|-----------|------|------|-----------------------|------|
| 0x7000:01 | 0.1  | 0.0  | Turbo Start Stop      | BOOL |
| 0x7000:03 | 0.1  | 0.1  | Turbo Low Speed       | BOOL |
| 0x3005:11 | 0.1  | 0.2  | Vnt. Enable           | BOOL |
| 0x3005:21 | 0.1  | 0.3  | Sig. Enable           | BOOL |
| ...       | 0.4  | 0.4  | ...                   | ...  |
| 0x8000:03 | 2.0  | 1.0  | Normal Speed Setpoint | UINT |
|           |      | 3.0  |                       |      |

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MboxOut |       |
| 1  | 128  | MboxIn  |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1A00 (excluded by 0x1A01)

☒ 0x1A01

Download

☒ PDO Assignment

☒ PDO Configuration

PDO Content (0x1601):

| Index     | Size | Offs | Name                | Type  |
|-----------|------|------|---------------------|-------|
| 0x6000:09 | 0.1  | 0.0  | Alarm               | BOOL  |
| 0x6000:0A | 0.1  | 0.1  | Warning             | BOOL  |
| 0x2001:88 | 0.1  | 0.2  | Ready for Process   | BOOL  |
| ...       | 0.5  | 0.3  | ...                 | ...   |
| 0x2001:81 | 1.0  | 1.0  | Status              | USINT |
| 0x2001:82 | 1.0  | 2.0  | Actual Speed (rel.) | SINT  |
| 0x2002:13 | 2.0  | 3.0  | Power               | INT   |
| 0x2002:88 | 2.0  | 5.0  | Pmp. Temperature    | INT   |
|           |      | 7.0  |                     |       |

Ausgangsdaten inklusive 4 Pad-Bits

Eingangsdaten inklusive 5 Pad-Bits

Tab. 46: Beispiele für Prozessdatenkonfiguration

## 5.4.2 Servicedaten HiLobe

| Typ       | Beschreibung                         |
|-----------|--------------------------------------|
| BOOL      | Binärwert (ja/nein)                  |
| BYTE( )   | ein-Byte Zahl                        |
| STRING( ) | Zeichenkette                         |
| USINT     | positive Ganzzahl, 8 Bit             |
| UINT      | positive Ganzzahl, 16 Bit            |
| UDINT     | positive Ganzzahl, 32 Bit            |
| ULINT     | positive Ganzzahl, 64 Bit            |
| SINT      | Ganzzahl, 8 Bit                      |
| INT       | Ganzzahl, 16 Bit                     |
| DINT      | Ganzzahl, 32 Bit                     |
| REAL      | Fließkommazahl, einfache Genauigkeit |

Tab. 47: Datentypen der Servicedaten

Für den Zugriff auf einzelne Datenobjekte (z. B. zur Konfiguration) stehen folgende CoE-Objekte zur Verfügung:

64) hexadezimal

## Verwaltungsdaten (Information über das Gerät, Kommunikation)

| Idx <sup>65)</sup> | sldx | Name                            | Typ       | Zu-griff <sup>66)</sup> | Beschreibung                                                                                                                                                                  |
|--------------------|------|---------------------------------|-----------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000               |      | Device type                     | UDINT     | RO                      | Bit 0-15: Device profile number (5003).<br>NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B)<br>Bit 16-31: 0x0000sub-profile number is defined in 0xF010 bit 15..0 |
| 1008               |      | Manufacturer device name        | STRING(n) | RO                      | Name of the device as non-zero terminated string.                                                                                                                             |
| 1009               |      | Manufacturer hardware version   | STRING(n) | RO                      | Hardware version of the device as non-zero terminated string.                                                                                                                 |
| 100A               |      | Manufacturer software version   | STRING(n) | RO                      | Software version of the device as non-zero terminated string.                                                                                                                 |
| 100B               |      | Manufacturer bootloader version | STRING(n) | RO                      | Bootloader version of the device as non-zero terminated string.                                                                                                               |
| 1018               |      | Identity object                 | IDENTITY  | RO                      |                                                                                                                                                                               |
|                    | 01   | Vendor ID                       | UDINT     | RO                      |                                                                                                                                                                               |
|                    | 02   | Product code                    | UDINT     | RO                      |                                                                                                                                                                               |
|                    | 03   | Revision number                 | UDINT     | RO                      |                                                                                                                                                                               |
|                    | 04   | Serial number                   | UDINT     | RO                      |                                                                                                                                                                               |
| 10F8               |      | Timestamp object                | ULINT     | RO                      | Local timestamp of the device in ns.                                                                                                                                          |
| 1600               |      | SDP default RxPDO               |           |                         |                                                                                                                                                                               |
|                    | 01h  |                                 |           |                         | 0x7000.0x01: Roughing start/stop                                                                                                                                              |
|                    | 02h  |                                 |           |                         | 0x7000.0x04: Low speed (idle/green mode)                                                                                                                                      |
|                    | 03h  |                                 |           |                         |                                                                                                                                                                               |
| 1601               |      | User RxPDO                      |           |                         |                                                                                                                                                                               |
| 1A00               |      | SDP default TxPDO               |           |                         |                                                                                                                                                                               |
|                    | 01h  |                                 |           |                         | 0x6000.0x01: Roughing run/stop                                                                                                                                                |
|                    | 02h  |                                 |           |                         | 0x6000.0x02: Booster run/stop                                                                                                                                                 |
|                    | 03h  |                                 |           |                         | 0x6000.0x04: Low speed (idle/green mode)                                                                                                                                      |
|                    | 04h  |                                 |           |                         | 0x6000.0x05: Remote/local                                                                                                                                                     |
|                    | 05h  |                                 |           |                         | 0x6000.0x09: Warning                                                                                                                                                          |
|                    | 06h  |                                 |           |                         | 0x6000.0x0A: Alarm                                                                                                                                                            |
|                    | 07h  |                                 |           |                         | 0x6000.0x0B: Emergency Off                                                                                                                                                    |
|                    | 08h  |                                 |           |                         | 0x6000.0x0C: N2 flow low                                                                                                                                                      |
|                    | 09h  |                                 |           |                         | 0x6001.0x02: N2 flow                                                                                                                                                          |
|                    | 0Ah  |                                 |           |                         | 0x6001.0x03: Exhaust pressure                                                                                                                                                 |
|                    | 0Bh  |                                 |           |                         | 0x6001.0x05: Roughing case temperature                                                                                                                                        |
|                    | 0Ch  |                                 |           |                         | 0x6001.0x09: Roughing current                                                                                                                                                 |
|                    | 0Dh  |                                 |           |                         | 0x6001.0x0A: Roughing power                                                                                                                                                   |
|                    | 0Eh  |                                 |           |                         | 0x6001.0x0B: Roughing speed                                                                                                                                                   |
|                    | 0Fh  |                                 |           |                         | 0x6002.0x05: Booster case temperature                                                                                                                                         |
|                    | 10h  |                                 |           |                         | 0x6002.0x09: Booster current                                                                                                                                                  |
|                    | 11h  |                                 |           |                         | 0x6002.0x0A: Booster power                                                                                                                                                    |
|                    | 12h  |                                 |           |                         | 0x6002.0x0B: Booster speed                                                                                                                                                    |

65) Idx = Index, sldx = Subindex, hexadezimal

66) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>65)</sup> | sidx | Name                                                 | Typ | Zu-griff <sup>66)</sup> | Beschreibung |
|--------------------|------|------------------------------------------------------|-----|-------------------------|--------------|
| 1A01               |      | User TxPDO                                           |     |                         |              |
| 1C00               |      | Sync manager type                                    |     |                         |              |
| 1C10               |      | Sync manager 0<br>PDO assignment                     |     |                         |              |
| 1C11               |      | Sync manager 1<br>PDO assignment                     |     |                         |              |
| 1C12               |      | RxPDO assign (sync<br>manager 2 PDO as-<br>signment) |     |                         |              |
| 1C13               |      | TxPDO assign (sync<br>manager 3 PDO as-<br>signment) |     |                         |              |

**Tab. 48: Communication Area - Verwaltungsdaten (Information über das Gerät, Kommunikation)**

**Eingangsdaten (HiLobe --> Steuerung)**

| Idx <sup>67)</sup> | sidx    | Name                           | Typ       | Zugriff <sup>68)</sup> | Beschreibung |
|--------------------|---------|--------------------------------|-----------|------------------------|--------------|
| 2000               | partial | In identity/status             |           | RO                     |              |
|                    | 01      | Manufacturer                   | STRING( ) | RO                     |              |
|                    | 02      | Device name (main)             | STRING( ) | RO                     |              |
|                    | 04      | Hardware version (main)        | STRING( ) | RO                     |              |
|                    | 05      | Firmware version (main)        | STRING( ) | RO                     |              |
|                    | 08      | Status code (main)             | UINT      | RO                     |              |
|                    | 22      | Device name (interface)        | UDINT     | RO P                   |              |
|                    | 24      | Hardware version (interface)   | STRING( ) | RO                     |              |
|                    | 25      | Firmware version (interface)   | STRING(n) | RO                     |              |
| 2001               | Partial | In operation                   |           | RO                     |              |
|                    | 86      | Nominal value abs (pump)       | UDINT     | RO                     | Rpm          |
| 2002               | Partial | Pump power/temperature         |           | RO                     |              |
|                    | 11      | Voltage (power)                | INT       | RO                     | 0.1V         |
|                    | 92      | Current (motor)                | INT       | RO                     | 0.1A         |
|                    | A8      | Temperature (bearing L)        | INT       | RO                     | °C           |
|                    | C8      | Temperature (bearing F)        | INT       | RO                     | °C           |
| 2006               | Partial | In component power/temperature |           |                        | °C           |
|                    | 88      | Temperature (cooling water)    | INT       | RO                     | °C           |

**Tab. 49: Eingangsdaten**

**Ausgangsdaten (Steuerung --> HiLobe)**

| Idx <sup>69)</sup> | sidx    | Name                    | Typ  | Zugriff <sup>70)</sup> | Beschreibung |
|--------------------|---------|-------------------------|------|------------------------|--------------|
| 3001               | Partial |                         |      |                        |              |
|                    | 083     | Setpoint enable (pump)  | BOOL | RW                     |              |
| 3005               | partial | Out component operation |      |                        |              |

65) Idx = Index, sidx = Subindex, hexadezimal

66) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

67) Idx = Index, sidx = Subindex, hexadezimal

68) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

69) Idx = Index, sidx = Subindex, hexadezimal

70) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>69)</sup> | sldx | Name           | Typ  | Zugriff <sup>70)</sup> | Beschreibung |
|--------------------|------|----------------|------|------------------------|--------------|
|                    | 31   | Enable (brake) | BOOL | RW                     |              |
|                    | 71   | Enable (fan)   | BOOL | RW                     |              |

Tab. 50: Manufacturer Specific Outputs

## Manufacturer Specific Configuration data

| Idx <sup>71)</sup> | sldx    | Name                    | Typ   | Zugriff <sup>72)</sup> | Beschreibung |
|--------------------|---------|-------------------------|-------|------------------------|--------------|
| 4001               | Partial | Cfg pump operation      |       |                        |              |
|                    | 8B      | Default setpoint (pump) | USINT | RW                     |              |
| 4009               | Partial | Cfg interface operation |       |                        |              |
|                    | 21      | Configuration (DO1)     | USINT | RW                     |              |
|                    | 31      | Configuration (DO2)     | USINT | RW                     |              |

Tab. 51: Manufacturer Specific Configuration data

## Input area

| Idx <sup>73)</sup> | sldx | Name                                   | Typ  | Zugriff <sup>74)</sup> | Beschreibung                                                                |
|--------------------|------|----------------------------------------|------|------------------------|-----------------------------------------------------------------------------|
| 6000               |      | Roughing and booster status            |      | RO                     |                                                                             |
|                    | 01   | Roughing run/stop                      | BOOL | RO                     | 1: Run<br>0: Stop                                                           |
|                    | 04   | Low speed (idle/sleep/green mode)      | BOOL | RO                     | 1: Low speed (idle /sleep / green mode)<br>0: Normal                        |
|                    | 05   | Remote/local                           | BOOL | RO                     | 1: Local. hand control enabled<br>0: Remote, E-cat control enabled          |
|                    | 09   | Warning                                | BOOL | RO                     | 1: Warning<br>0: Normal                                                     |
|                    | 0A   | Alarm                                  | BOOL | RO                     | 1: Alarm<br>0: Normal                                                       |
|                    | 0B   | Emergency off                          | BOOL | RO                     | 1: Stop<br>0: Normal                                                        |
|                    | 0C   | N2 flow low                            | BOOL | RO                     | 1: N2 flow low<br>0: Normal                                                 |
| 6001               |      | Roughing analog inputs                 |      |                        |                                                                             |
|                    | 04   | Exhaust temperature                    | INT  | RO                     | Degrees celsius, mandatory if exhaust temperature measurement device fitted |
|                    | 08   | Roughing pump motor driver temperature | INT  | RO                     | Degrees celsius                                                             |
|                    | 09   | Roughing current                       | INT  | RO                     | 0.1 [A]                                                                     |

69) Idx = Index, sldx = Subindex, hexadezimal

70) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

71) Idx = Index, sldx = Subindex, hexadezimal

72) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

73) Idx = Index, sldx = Subindex, hexadezimal

74) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet



| Idx <sup>73)</sup> | sidx | Name           | Typ | Zugriff <sup>74)</sup> | Beschreibung                                                |
|--------------------|------|----------------|-----|------------------------|-------------------------------------------------------------|
|                    | 0A   | Roughing power | INT | RO                     | 0.1 [kW]                                                    |
|                    | 0B   | Roughing speed | INT | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%): 0 rotation, 0.1 [%] |

Tab. 52: Input Area

## Output area

| Idx <sup>75)</sup> | sidx | Name                                     | Typ  | Zugriff <sup>76)</sup> | Beschreibung                                                                           |
|--------------------|------|------------------------------------------|------|------------------------|----------------------------------------------------------------------------------------|
| 7000               |      | Roughing and booster control             |      | RO                     |                                                                                        |
|                    | 01   | Roughing start/stop                      | BOOL | RW                     | 1: Run<br>0: Stop                                                                      |
|                    | 04   | Low speed (idle/sleep/green mode)        | BOOL | RW                     | 1: Low speed (idle / sleep / green mode)<br>0: Normal                                  |
|                    | 05   | Reset pump                               | BOOL | RW                     | 1: Reset alarm<br>0: No action                                                         |
| 7001               |      | Roughing analog control                  |      | RO                     |                                                                                        |
|                    | 01   | Roughing real-time normal speed setpoint | UINT | RW                     | 1000 (100.0%): Rated speed<br>0 (0.0%): No rotation, minimum speed restrictions apply. |

Tab. 53: Output Area

## Konfigurationsdaten (Steuerung --&gt; HiLobe)

| Idx <sup>77)</sup> | sidx | Name                                                  | Typ  | Zugriff <sup>78)</sup> | Beschreibung                                                                                                |
|--------------------|------|-------------------------------------------------------|------|------------------------|-------------------------------------------------------------------------------------------------------------|
| 8001               |      | Roughing and booster configuration                    |      | RO                     |                                                                                                             |
|                    | 01   | Safe state                                            | UINT | RW                     | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - pumps stop |
| 8002               |      | Roughing pump configuration                           |      | RO                     |                                                                                                             |
|                    | 01   | Roughing low speed (multiple sleep level = 0) setting |      | RW                     | 1000 (100.0 %): Rated Speed<br>0 (0.0 %): No rotation, minimum speed restrictions apply, 0.1 [%]            |

Tab. 54: Configuration Area

73) Idx = Index, sidx = Subindex, hexadezimal

74) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

75) Idx = Index, sidx = Subindex, hexadezimal

76) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

77) Idx = Index, sidx = Subindex, hexadezimal

78) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

**Informationsdaten (HiLobe --> Steuerung)**

| Idx <sup>79)</sup> | sldx | Name                              | Typ   | Zugriff <sup>80)</sup> | Beschreibung                                          |
|--------------------|------|-----------------------------------|-------|------------------------|-------------------------------------------------------|
| 9000               |      | Roughing and booster information  |       | RO                     |                                                       |
|                    | 01   | Roughing exists                   | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                    | 03   | Booster 2 exists                  | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                    | 11   | Roughing and booster running time | UDINT | RO                     | Running time since manufacture or service - 1 [hours] |

**Tab. 55: Information Area****Semiconductor device profile area**

| Idx <sup>81)</sup> | sldx | Name                         | Typ   | Zugriff <sup>82)</sup> | Beschreibung |
|--------------------|------|------------------------------|-------|------------------------|--------------|
| F000               |      | Semiconductor device profile |       | RO                     |              |
|                    | 01   | Index distance               | UINT  |                        |              |
|                    | 02   | Maximum number of modules    | UINT  |                        |              |
| F010               |      | Module profile list          |       | RO                     |              |
|                    | 01   |                              | UDINT | RO                     |              |

**Tab. 56: Semiconductor Device Profile Area****Exception Handling**

| Idx <sup>83)</sup> | sldx | Name                                                | Typ   | Zugriff <sup>84)</sup> | Beschreibung                                                                                                                    |
|--------------------|------|-----------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380               |      | Active exception status                             | USINT | RO                     | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                    |      | Bit0: Device warning                                |       |                        | Bit0: Device warning                                                                                                            |
|                    |      | Bit1: Manufacturer warning                          |       |                        | Bit1: Manufacturer warning                                                                                                      |
|                    |      | Bit2: Device error                                  |       |                        | Bit2: Device error                                                                                                              |
|                    |      | Bit3: Manufacturer error                            |       |                        | Bit3: Manufacturer error                                                                                                        |
|                    |      | Bit4: Reserved                                      |       |                        | Bit4: Reserved                                                                                                                  |
|                    |      | Bit5: Reserved                                      |       |                        | Bit5: Reserved                                                                                                                  |
|                    |      | Bit6: Reserved                                      |       |                        | Bit6: Reserved                                                                                                                  |
|                    |      | Bit7: Reserved                                      |       |                        | Bit7: Reserved                                                                                                                  |
| F381               |      | Roughing and booster 1 to 255 active warning detail |       | RO                     |                                                                                                                                 |
|                    | 01   |                                                     | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available                         |
|                    |      | Bit0: EMO                                           |       |                        | Bit0: EMO                                                                                                                       |

79) Idx = Index, sldx = Subindex, hexadezimal

80) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

81) Idx = Index, sldx = Subindex, hexadezimal

82) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

83) Idx = Index, sldx = Subindex, hexadezimal

84) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>83)</sup> | sidx | Name                                                      | Typ   | Zu-griff <sup>84)</sup> | Beschreibung                                                                                            |
|--------------------|------|-----------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------|
|                    |      | Bit1: Water leak                                          |       |                         | Bit1: Water leak                                                                                        |
|                    |      | Bit2: Power fail open phase                               |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                       |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit4: Coolant flow                                        |       |                         | Bit4: Coolant flow                                                                                      |
|                    |      | Bit5: N2 flow                                             |       |                         | Bit5: N2 flow                                                                                           |
|                    |      | Bit6: Exhaust pressure                                    |       |                         | Bit6: Exhaust pressure                                                                                  |
|                    |      | Bit7: Exhaust temp.                                       |       |                         | Bit7: Exhaust temp.                                                                                     |
|                    |      | Bit8: Main controller err/batt low                        |       |                         | Bit8: Main controller err/batt low                                                                      |
|                    |      | Bit9: Roughing case temp                                  |       |                         | Bit9: Roughing case temp                                                                                |
|                    |      | Bit10: Roughing motor temp                                |       |                         | Bit10: Roughing motor temp                                                                              |
|                    |      | Bit11: Roughing current                                   |       |                         | Bit11: Roughing current                                                                                 |
|                    |      | Bit12: Roughing speed                                     |       |                         | Bit12: Roughing speed                                                                                   |
|                    |      | Bit13: Roughing lock rotor                                |       |                         | Bit13: Roughing lock rotor                                                                              |
|                    |      | Bit14: Roughing motor driver err                          |       |                         | Bit14: Roughing motor driver err                                                                        |
|                    |      | Bit15: Booster case temp.                                 |       |                         | Bit15: Booster case temp.                                                                               |
|                    |      | Bit16: Booster motor temp.                                |       |                         | Bit16: Booster motor temp.                                                                              |
|                    |      | Bit17: Booster current                                    |       |                         | Bit17: Booster current                                                                                  |
|                    |      | Bit18: Booster speed                                      |       |                         | Bit18: Booster speed                                                                                    |
|                    |      | Bit19: Booster lock rotor                                 |       |                         | Bit19: Booster lock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                           |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit22: Booster2 motor temp.                               |       |                         | Bit22: Booster2 motor temp.                                                                             |
|                    |      | Bit23: Booster2 current                                   |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                     |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                          |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                     |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                         |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                         |       |                         | Bit29: Future use                                                                                       |
|                    |      | Bit30: Future use                                         |       |                         | Bit30: Future use                                                                                       |
|                    |      | Bit31: Others                                             |       |                         | Bit31: Others                                                                                           |
| F383               |      | Roughing and booster 1 to 255 active error (alarm) detail |       | RO                      |                                                                                                         |
|                    | 01   |                                                           | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                    |      | Bit0: EMO                                                 |       |                         | Bit0: EMO                                                                                               |
|                    |      | Bit1: Water leak                                          |       |                         | Bit1: Water leak                                                                                        |
|                    |      | Bit2: Power fail open phase                               |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                       |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit 4: Coolant flow                                       |       |                         | Bit 4: Coolant flow                                                                                     |
|                    |      | Bit5: N2 flow                                             |       |                         | Bit5: N2 flow                                                                                           |

83) Idx = Index, sidx = Subindex, hexadezimal

84) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>83)</sup> | sidx | Name                                                 | Typ   | Zu-griff <sup>84)</sup> | Beschreibung                                                                                                             |
|--------------------|------|------------------------------------------------------|-------|-------------------------|--------------------------------------------------------------------------------------------------------------------------|
|                    |      | Bit6: Exhaust pressure                               |       |                         | Bit6: Exhaust pressure                                                                                                   |
|                    |      | Bit7: Exhaust temp.                                  |       |                         | Bit7: Exhaust temp.                                                                                                      |
|                    |      | Bit8: Main controller err/batt low                   |       |                         | Bit8: Main controller err/batt low                                                                                       |
|                    |      | Bit9: Roughing case temp                             |       |                         | Bit9: Roughing case temp                                                                                                 |
|                    |      | Bit10: Roughing motor temp                           |       |                         | Bit10: Roughing motor temp                                                                                               |
|                    |      | Bit11: Roughing current                              |       |                         | Bit11: Roughing current                                                                                                  |
|                    |      | Bit12: Roughing speed                                |       |                         | Bit12: Roughing speed                                                                                                    |
|                    |      | Bit13: Roughing lock rotor                           |       |                         | Bit13: Roughing lock rotor                                                                                               |
|                    |      | Bit14: Roughing motor driver err                     |       |                         | Bit14: Roughing motor driver err                                                                                         |
|                    |      | Bit15: Booster case temp.                            |       |                         | Bit15: Booster case temp.                                                                                                |
|                    |      | Bit16: Booster motor temp.                           |       |                         | Bit16: Booster motor temp.                                                                                               |
|                    |      | Bit17: Booster current                               |       |                         | Bit17: Booster current                                                                                                   |
|                    |      | Bit18: Booster speed                                 |       |                         | Bit18: Booster speed                                                                                                     |
|                    |      | Bit19: Booster lock rotor                            |       |                         | Bit19: Booster lock rotor                                                                                                |
|                    |      | Bit20: Booster motor driver err                      |       |                         | Bit20: Booster motor driver err                                                                                          |
|                    |      | Bit21: Booster2 case temp.                           |       |                         | Bit21: Booster2 case temp.                                                                                               |
|                    |      | Bit22: Booster2 motor temp.                          |       |                         | Bit22: Booster2 motor temp.                                                                                              |
|                    |      | Bit23: Booster2 current                              |       |                         | Bit23: Booster2 current                                                                                                  |
|                    |      | Bit24: Booster2 speed                                |       |                         | Bit24: Booster2 speed                                                                                                    |
|                    |      | Bit25: Booster2 lock rotor                           |       |                         | Bit25: Booster2 lock rotor                                                                                               |
|                    |      | Bit26: Booster2 motor driver err                     |       |                         | Bit26: Booster2 motor driver err                                                                                         |
|                    |      | Bit27: Gate valve err                                |       |                         | Bit27: Gate valve err                                                                                                    |
|                    |      | Bit28: Future use                                    |       |                         | Bit28: Future use                                                                                                        |
|                    |      | Bit29: Future use                                    |       |                         | Bit29: Future use                                                                                                        |
|                    |      | Bit30: Future use                                    |       |                         | Bit30: Future use                                                                                                        |
|                    |      | Bit31: Others                                        |       |                         | Bit31: Others                                                                                                            |
| F390               |      | Latched exception status                             | USINT | RO                      | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. |
|                    |      | Bit0: Device warning                                 |       |                         | Bit0: Device warning                                                                                                     |
|                    |      | Bit1: Manufacturer warning                           |       |                         | Bit1: Manufacturer warning                                                                                               |
|                    |      | Bit2: Device error                                   |       |                         | Bit2: Device error                                                                                                       |
|                    |      | Bit3: Manufacturer error                             |       |                         | Bit3: Manufacturer error                                                                                                 |
|                    |      | Bit4: Reserved                                       |       |                         | Bit4: Reserved                                                                                                           |
|                    |      | Bit5: Reserved                                       |       |                         | Bit5: Reserved                                                                                                           |
|                    |      | Bit6: Reserved                                       |       |                         | Bit6: Reserved                                                                                                           |
|                    |      | Bit7: Reserved                                       |       |                         | Bit7: Reserved                                                                                                           |
| F391               |      | Roughing and booster 1 to 255 latched warning detail |       | RO                      |                                                                                                                          |
|                    | 01   |                                                      | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available                  |
|                    |      | Bit0: EMO                                            |       |                         | Bit0: EMO                                                                                                                |

83) Idx = Index, sidx = Subindex, hexadezimal

84) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>83)</sup> | sidx | Name                                                       | Typ   | Zu-griff <sup>84)</sup> | Beschreibung                                                                                            |
|--------------------|------|------------------------------------------------------------|-------|-------------------------|---------------------------------------------------------------------------------------------------------|
|                    |      | Bit1: Water leak                                           |       |                         | Bit1: Water leak                                                                                        |
|                    |      | Bit2: Power fail open phase                                |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                        |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit4: Coolant flow                                         |       |                         | Bit4: Coolant flow                                                                                      |
|                    |      | Bit5: N2 flow                                              |       |                         | Bit5: N2 flow                                                                                           |
|                    |      | Bit6: Exhaust pressure                                     |       |                         | Bit6: Exhaust pressure                                                                                  |
|                    |      | Bit7: Exhaust temp.                                        |       |                         | Bit7: Exhaust temp.                                                                                     |
|                    |      | Bit8: Main controller err/batt low                         |       |                         | Bit8: Main controller err/batt low                                                                      |
|                    |      | Bit9: Roughing case temp                                   |       |                         | Bit9: Roughing case temp                                                                                |
|                    |      | Bit10: Roughing motor temp                                 |       |                         | Bit10: Roughing motor temp                                                                              |
|                    |      | Bit11: Roughing current                                    |       |                         | Bit11: Roughing current                                                                                 |
|                    |      | Bit12: Roughing speed                                      |       |                         | Bit12: Roughing speed                                                                                   |
|                    |      | Bit13: Roughing lock rotor                                 |       |                         | Bit13: Roughing lock rotor                                                                              |
|                    |      | Bit14: Roughing motor driver err                           |       |                         | Bit14: Roughing motor driver err                                                                        |
|                    |      | Bit15: Booster case temp.                                  |       |                         | Bit15: Booster case temp.                                                                               |
|                    |      | Bit16: Booster motor temp.                                 |       |                         | Bit16: Booster motor temp.                                                                              |
|                    |      | Bit17: Booster current                                     |       |                         | Bit17: Booster current                                                                                  |
|                    |      | Bit18: Booster speed                                       |       |                         | Bit18: Booster speed                                                                                    |
|                    |      | Bit19: Booster lock rotor                                  |       |                         | Bit19: Booster lock rotor                                                                               |
|                    |      | Bit20: Booster motor driver err                            |       |                         | Bit20: Booster motor driver err                                                                         |
|                    |      | Bit21: Booster2 case temp.                                 |       |                         | Bit21: Booster2 case temp.                                                                              |
|                    |      | Bit22: Booster2 motor temp.                                |       |                         | Bit22: Booster2 motor temp.                                                                             |
|                    |      | Bit23: Booster2 current                                    |       |                         | Bit23: Booster2 current                                                                                 |
|                    |      | Bit24: Booster2 speed                                      |       |                         | Bit24: Booster2 speed                                                                                   |
|                    |      | Bit25: Booster2 lock rotor                                 |       |                         | Bit25: Booster2 lock rotor                                                                              |
|                    |      | Bit26: Booster2 motor driver err                           |       |                         | Bit26: Booster2 motor driver err                                                                        |
|                    |      | Bit27: Gate valve err                                      |       |                         | Bit27: Gate valve err                                                                                   |
|                    |      | Bit28: Future use                                          |       |                         | Bit28: Future use                                                                                       |
|                    |      | Bit29: Future use                                          |       |                         | Bit29: Future use                                                                                       |
|                    |      | Bit30: Future use                                          |       |                         | Bit30: Future use                                                                                       |
|                    |      | Bit31: Others                                              |       |                         | Bit31: Others                                                                                           |
| F393               |      | Roughing and booster 1 to 255 latched error (alarm) detail |       | RO                      |                                                                                                         |
|                    | 01   |                                                            | UDINT | RO                      | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available |
|                    |      | Bit0: EMO                                                  |       |                         | Bit0: EMO                                                                                               |
|                    |      | Bit1: Water leak                                           |       |                         | Bit1: Water leak                                                                                        |
|                    |      | Bit2: Power fail open phase                                |       |                         | Bit2: Power fail open phase                                                                             |
|                    |      | Bit3: Reverse phase                                        |       |                         | Bit3: Reverse phase                                                                                     |
|                    |      | Bit4: Coolant flow                                         |       |                         | Bit4: Coolant flow                                                                                      |
|                    |      | Bit5: N2 flow                                              |       |                         | Bit5: N2 flow                                                                                           |

83) Idx = Index, sidx = Subindex, hexadezimal

84) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>83)</sup> | sidx | Name                                             | Typ   | Zu-griff <sup>84)</sup> | Beschreibung                                                                                                                                                                                                                        |
|--------------------|------|--------------------------------------------------|-------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |      | Bit6: Exhaust pressure                           |       |                         | Bit6: Exhaust pressure                                                                                                                                                                                                              |
|                    |      | Bit7: Exhaust temp.                              |       |                         | Bit7: Exhaust temp.                                                                                                                                                                                                                 |
|                    |      | Bit8: Main controller err/batt low               |       |                         | Bit8: Main controller err/batt low                                                                                                                                                                                                  |
|                    |      | Bit9: Roughing case temp                         |       |                         | Bit9: Roughing case temp                                                                                                                                                                                                            |
|                    |      | Bit10: Roughing motor temp                       |       |                         | Bit10: Roughing motor temp                                                                                                                                                                                                          |
|                    |      | Bit11: Roughing current                          |       |                         | Bit11: Roughing current                                                                                                                                                                                                             |
|                    |      | Bit12: Roughing speed                            |       |                         | Bit12: Roughing speed                                                                                                                                                                                                               |
|                    |      | Bit13: Roughing lock rotor                       |       |                         | Bit13: Roughing lock rotor                                                                                                                                                                                                          |
|                    |      | Bit14: Roughing motor driver err                 |       |                         | Bit14: Roughing motor driver err                                                                                                                                                                                                    |
|                    |      | Bit15: Booster case temp.                        |       |                         | Bit15: Booster case temp.                                                                                                                                                                                                           |
|                    |      | Bit16: Booster motor temp.                       |       |                         | Bit16: Booster motor temp.                                                                                                                                                                                                          |
|                    |      | Bit17: Booster current                           |       |                         | Bit17: Booster current                                                                                                                                                                                                              |
|                    |      | Bit18: Booster speed                             |       |                         | Bit18: Booster speed                                                                                                                                                                                                                |
|                    |      | Bit19: Booster lock rotor                        |       |                         | Bit19: Booster lock rotor                                                                                                                                                                                                           |
|                    |      | Bit20: Booster motor driver err                  |       |                         | Bit20: Booster motor driver err                                                                                                                                                                                                     |
|                    |      | Bit21: Booster2 case temp.                       |       |                         | Bit21: Booster2 case temp.                                                                                                                                                                                                          |
|                    |      | Bit22: Booster2 motor temp.                      |       |                         | Bit22: Booster2 motor temp.                                                                                                                                                                                                         |
|                    |      | Bit23: Booster2 current                          |       |                         | Bit23: Booster2 current                                                                                                                                                                                                             |
|                    |      | Bit24: Booster2 speed                            |       |                         | Bit24: Booster2 speed                                                                                                                                                                                                               |
|                    |      | Bit25: Booster2 lock rotor                       |       |                         | Bit25: Booster2 lock rotor                                                                                                                                                                                                          |
|                    |      | Bit26: Booster2 motor driver err                 |       |                         | Bit26: Booster2 motor driver err                                                                                                                                                                                                    |
|                    |      | Bit27: Gate valve err                            |       |                         | Bit27: Gate valve err                                                                                                                                                                                                               |
|                    |      | Bit28: Future use                                |       |                         | Bit28: Future use                                                                                                                                                                                                                   |
|                    |      | Bit29: Future use                                |       |                         | Bit29: Future use                                                                                                                                                                                                                   |
|                    |      | Bit30: Future use                                |       |                         | Bit30: Future use                                                                                                                                                                                                                   |
|                    |      | Bit31: Others                                    |       |                         | Bit31: Others                                                                                                                                                                                                                       |
| F3A1               |      | Roughing and booster 1 to 255 warning mask       |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   |                                                  | UDINT | RW                      | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3               |      | Roughing and booster 1 to 255 error (alarm) mask |       | RO                      |                                                                                                                                                                                                                                     |
|                    | 01   |                                                  | UDINT | RW                      | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |

83) Idx = Index, sidx = Subindex, hexadezimal

84) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>83)</sup> | sidx | Name                        | Typ   | Zu-griff <sup>84)</sup> | Beschreibung                                                                                                       |
|--------------------|------|-----------------------------|-------|-------------------------|--------------------------------------------------------------------------------------------------------------------|
| F6F0               |      | Input latch local timestamp |       | RO                      |                                                                                                                    |
|                    | 01   | Input latch local timestamp | UDINT | RO                      | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up. |

Tab. 57: Exception Handling

## CDP Specific Information Data

| Idx <sup>85)</sup> | sidx | Name                                         | Typ       | Zugriff <sup>86)</sup> | Beschreibung                                                                                                        |
|--------------------|------|----------------------------------------------|-----------|------------------------|---------------------------------------------------------------------------------------------------------------------|
| F9F0               |      | Manufacturer serial number                   | STRING(n) | RO                     | String representing the manufacturer's serial number for the device.                                                |
| F9F1               |      | CDP functional generation number             |           | RO                     |                                                                                                                     |
|                    | 01   |                                              | UDINT     | RO                     | Common device profile functional generation number                                                                  |
| F9F2               |      | SDP functional generation number             |           | RO                     |                                                                                                                     |
|                    | 01   |                                              | UDINT     | RO                     | SDP functional generation number.                                                                                   |
| F9F3               |      | Vendor name                                  | STRING(n) | RO                     |                                                                                                                     |
| F9F4               |      | SDP device name                              |           | RO                     |                                                                                                                     |
|                    | 01   |                                              | STRING(n) | RO                     | String identifying the device type.                                                                                 |
| F9F5               |      | Output identifier                            |           | RO                     |                                                                                                                     |
|                    | 01   |                                              | USINT     | RW                     | Output identifier. The controller can then read this value back through the TxPDO to ensure the RxPDO was received. |
| F9F6               |      | Time since power on                          | UDINT     | RO                     | This is the time the device has been currently powered on, in seconds.                                              |
| F9F7               |      | Total time powered                           | UDINT     | RO                     | Operating hours of pump [s]                                                                                         |
| F9F8               |      | Firmware update functional generation number | UDINT     | RO                     | Firmware update functional generation number supported by the device.                                               |

Tab. 58: CDP Specific Information Data

83) Idx = Index, sidx = Subindex, hexadezimal

84) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

85) Idx = Index, sidx = Subindex, hexadezimal

86) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

## CDP Command Objects

| Idx <sup>87)</sup> | sldx | Name                     | Typ                  | Zu-griff <sup>88)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|------|--------------------------|----------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0               |      | Device reset command     |                      | RO                      | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. There are two versions of this command:<br><br>Device Reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset.<br><br>Factory Reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                    | 01   | Command                  | AR-RAY[0..5] OF BYTE | RW                      | A device reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72<br>Byte 5: Device Standard Reset = 0x00, factory reset = 0x66                                                                                                                                                                                                                                                                                |
|                    | 02   | Status                   | USINT                | RO                      | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Reserved<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                                                                                                     |
|                    | 03   | Response                 | AR-RAY[0..1] OF BYTE | RO                      | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| FBF1               |      | Exception reset command  |                      | RO                      | Execution of this command clears the latched exceptions.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                    | 01   | Command                  | AR-RAY[0..4] OF BYTE | RW                      | A latched exception reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72                                                                                                                                                                                                                                                                                                                                   |
|                    | 02   | Status                   | USINT                | RO                      | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                                                                                                                              |
|                    | 03   | Response                 | AR-RAY[0..1] OF BYTE | RO                      | Byte 0: See subindex 2<br>Byte 1: Unused.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| FBF2               |      | Store parameters command |                      | RO                      | Execution of this command will store all parameters to non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                        |

87) Idx = Index, sldx = Subindex, hexadezimal

88) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet



| Idx <sup>87)</sup> | sidx | Name                          | Typ                     | Zu-griff <sup>88)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|------|-------------------------------|-------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 01   | Com-mand                      | AR-RAY[0..3]<br>OF BYTE | RW                      | Read:<br>Bit 0 = 1: Device saves the non-volatile parameters when writing 0xFBFB2:01 with 0x65766173<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written<br>Bit 2-31: Reserved, shall be 0<br>Write: All writable, non-volatile values will be stored in non-volatile memory when the following is sent:<br>Byte 0: 0x73<br>Byte 1: 0x61<br>Byte 2: 0x76<br>Byte 3: 0x65                                                                                                                                                                                                                           |
|                    | 02   | Status                        | USINT                   | RO                      | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value other-wise.<br>1: Last command completed, no error, reply the-re<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                    | 03   | Respon-se                     | AR-RAY[0..1]<br>OF BYTE | RO                      | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| FBF3               |      | Calcula-te check-sum com-mand |                         | RO                      | Execution of this command will calculate a checksum for all writable, non-volatile parameters as currently stored in non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                    | 01   | Com-mand                      | AR-RAY[0..3]<br>OF BYTE | RW                      | Read: Returns information about the supported checksum type<br>Bit 0 = 0: No non-volatile parameters supported<br>Bit 0 = 1: Non-volatile parameters supported<br>Bit 1 = 1: CRC-32<br>Bit 2 = 1: MD5<br>Bit 3 = 1: SHA-1<br>Bit 4-6: Reserved, shall be 0<br>Bit 7 = 1: Other algorithm.<br>Write: Checksum type selection and start calculationA write access to this subindex shall only set one bit true in Bit[0...7].<br>Bit 0 = 1: Use default checksum algorithm of the device<br>Bit 1 = 1: CRC-32<br>Bit 2 = 1: MD5<br>Bit 3 = 1: SHA-1<br>Bit 4-6: Reserved, shall be 0<br>Bit 7 = 1: Other algorithm<br>Bit 8...31: Reserved. |
|                    | 02   | Status                        | USINT                   | RO                      | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Last command completed, no error, reply there<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                                                                                                                                                                                        |

87) Idx = Index, sidx = Subindex, hexadezimal

88) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>87)</sup> | sidx | Name                    | Typ                     | Zu-griff <sup>88)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|------|-------------------------|-------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 03   | Response                | AR-RAY[0..n]<br>OF BYTE | RO                      | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero<br>Byte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length is 64 bytes.                                                                                                                                                                                                      |
| FBF4               |      | Load parameters command |                         | RO                      | Execution of this command will load all parameters from non-volatile memory.                                                                                                                                                                                                                                                                                                   |
|                    | 01   | Command                 | AR-RAY[0..3]<br>OF BYTE | RW                      | Read:<br>Bit 0 = 1: Device loads the non-volatile parameters when writing 0xFB4:01 with 0x64616F6C<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are.<br>Write:<br>All writable, non-volatile parameters will be loaded from non-volatile memory when the following is sent:<br>Byte 0: 0x6C<br>Byte 1: 0x6F<br>Byte 2: 0x61<br>Byte 3: 0x64. |
|                    | 02   | Status                  | USINT                   | RO                      | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                          |
|                    | 03   | Response                | AR-RAY[0..1]<br>OF BYTE | RO                      | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                       |

Tab. 59: CDP Command Objects

## 5.5 Turbopumpe mit TC 80 über EtherCAT betreiben

### 5.5.1 Prozessdaten TC 80

#### Prozessausgangsdaten

Prozessausgangsdaten sind:

- Default RxPDO (Steuerung --> TC 80, "output"), CoE 1600h.1 – 4 (1 Byte)

| Byte.Bit | CoE <sup>89)</sup>        | Bedeutung                    |
|----------|---------------------------|------------------------------|
| 0.0      | 7000.01 Turbo Start Stop  | Pumpstand (0: aus, 1: ein)   |
| 0.1      | 7000.02 Turbo Reset Alarm | 0 --> 1: Störungsquittierung |
| 0.2      | 7000.03 Turbo Low Speed   | Standby (0: aus, 1: ein)     |

Tab. 60: Prozessausgangsdaten

#### Prozesseingangsdaten

Prozesseingangsdaten sind:

- Default TxPDO (TC 80 --> Steuerung, "input"), CoE 1A00h.1 – 11 (7 Byte)

87) Idx = Index, sidx = Subindex, hexadezimal

88) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

89) hexadezimal

| Byte.Bit | CoE <sup>90)</sup>                      | Bedeutung                                           |
|----------|-----------------------------------------|-----------------------------------------------------|
| 0.0      | 6000.01 Rotation                        | Pumpe dreht > 60 min <sup>-1</sup> (0: nein, 1: ja) |
| 0.1      | 6000.02 Normal                          | Normalbetrieb (0: nein, 1: ja)                      |
| 0.2      | 6000.03 Acceleration                    | Pumpe beschleunigt (0: nein, 1: ja)                 |
| 0.3      | 6000.04 Deceleration (includes Braking) | Pumpe verzögert (0: nein, 1: ja)                    |
| 0.4      | 6000.05 Remote / Local                  | Steuerung über EtherCAT (0: ja, 1: nein)            |
| 0.5      | 6000.07 Turbo Low Speed                 | Standby (0: aus, 1: ein)                            |
| 0.6      | 6000.09 Alarm                           | 0: nein<br>1: ja                                    |
| 0.7      | 6000.0A Warning                         | 0: nein<br>1: ja                                    |
| 1. – 2.  | 6000.11 Turbo Speed                     | 0,1 % der Nenndrehzahl                              |
| 3. – 4.  | 6000.12 Turbo Current                   | 0,1 A                                               |
| 5. – 6.  | 6000.13 Turbo Pump Temperature          | °C                                                  |

Tab. 61: Prozesseingangsdaten

**Prozessdaten alternativ aus CoE-Objekten zusammenstellen**

1. Führen Sie immer den Zustand "PRE-OPERATIONAL" herbei.
2. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit 0.
3. Beschreiben Sie das Objekt 1601h.1-n bzw. 1A01h.1-n mit den entsprechenden CoE-Indizes.
4. Verwenden Sie nur mit "P" gekennzeichnete Objekte.
5. Vergeben Sie den Subindex 1-n nur fortlaufend und ohne Lücke.
6. Achten Sie darauf, dass die Daten eine ganze Anzahl Bytes ergeben (ggf. Pad-Bits verwenden) und auf ganzen Bytes beginnen (Ausnahme BOOL).
7. Beschreiben Sie maximal 12 Objekte pro PDO.
8. Beschreiben Sie das Objekt 1601h.0 bzw. 1A01h.0 mit der Anzahl n der verwendeten Objekte.
9. Stellen Sie das Objekt 1C12h.1 auf 1601h bzw. 1C13h.1 auf 1A01h um.
10. Wählen Sie in den Prozessdaten das entsprechende PDO assignment 1601h bzw. 1A01h aus.

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1600 (excluded by 0x1601)  
☒ 0x1601

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☒ PDO Assignment  
☒ PDO Configuration

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1A00 (excluded by 0x1A01)  
☒ 0x1A01

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☒ PDO Assignment  
☒ PDO Configuration

PDO Content (0x1601):

| Index     | Size | Offs | Name                  | Type |
|-----------|------|------|-----------------------|------|
| 0x7000:01 | 0.1  | 0.0  | Turbo Start Stop      | BOOL |
| 0x7000:03 | 0.1  | 0.1  | Turbo Low Speed       | BOOL |
| 0x3005:11 | 0.1  | 0.2  | Vnt. Enable           | BOOL |
| 0x3005:21 | 0.1  | 0.3  | Sig. Enable           | BOOL |
| ...       | 0.4  | 0.4  | ...                   |      |
| 0x8000:03 | 2.0  | 1.0  | Normal Speed Setpoint | UINT |
|           |      | 3.0  |                       |      |

PDO Content (0x1601):

| Index     | Size | Offs | Name                | Type  |
|-----------|------|------|---------------------|-------|
| 0x6000:09 | 0.1  | 0.0  | Alarm               | BOOL  |
| 0x6000:04 | 0.1  | 0.1  | Warning             | BOOL  |
| 0x2001:88 | 0.1  | 0.2  | Ready for Process   | BOOL  |
| ...       | 0.5  | 0.3  | ...                 |       |
| 0x2001:81 | 1.0  | 1.0  | Status              | USINT |
| 0x2001:82 | 1.0  | 2.0  | Actual Speed (rel.) | SINT  |
| 0x2002:13 | 2.0  | 3.0  | Power               | INT   |
| 0x2002:88 | 2.0  | 5.0  | Fmp. Temperature    | INT   |
|           |      | 7.0  |                     |       |

Ausgangsdaten inklusive 4 Pad-Bits

Eingangsdaten inklusive 5 Pad-Bits

Tab. 62: Beispiele für Prozessdatenkonfiguration

**5.5.2 Servicedaten TC 80**

| Typ       | Beschreibung              |
|-----------|---------------------------|
| BOOL      | Binärwert (ja/nein)       |
| BYTE( )   | ein-Byte Zahl             |
| STRING( ) | Zeichenkette              |
| USINT     | positive Ganzzahl, 8 Bit  |
| UINT      | positive Ganzzahl, 16 Bit |
| UDINT     | positive Ganzzahl, 32 Bit |

90) hexadezimal

| Typ   | Beschreibung                         |
|-------|--------------------------------------|
| ULINT | positive Ganzzahl, 64 Bit            |
| SINT  | Ganzzahl, 8 Bit                      |
| INT   | Ganzzahl, 16 Bit                     |
| DINT  | Ganzzahl, 32 Bit                     |
| REAL  | Fließkommazahl, einfache Genauigkeit |

**Tab. 63: Datentypen der Servicedaten**

Für den Zugriff auf einzelne Datenobjekte (z. B. zur Konfiguration) stehen folgende CoE-Objekte zur Verfügung:

**Verwaltungsdaten (Information über das Gerät, Kommunikation)**

| Idx <sup>91)</sup> | sldx | Name                            | Typ       | Zu-griff <sup>92)</sup> | Beschreibung                                                                                                                                                                 |
|--------------------|------|---------------------------------|-----------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000               |      | Device type                     | UDINT     | RO                      | Bit 0-15: device profile number (5003). NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B)<br>Bit 16-31: 0x0000, sub-profile number is defined in 0xF010 bit 15..0 |
| 1008               |      | Manufacturer device name        | STRING(n) | RO                      | Name of the device as non-zero terminated string.                                                                                                                            |
| 1009               |      | Manufacturer hardware version   | STRING(n) | RO                      | Hardware version of the device as non-zero terminated string.                                                                                                                |
| 100A               |      | Manufacturer software version   | STRING(n) | RO                      | Software version of the device as non-zero terminated string.                                                                                                                |
| 100B               |      | Manufacturer bootloader version | STRING(n) | RO                      | Bootloader version of the device as non-zero terminated string.                                                                                                              |
| 1018               |      | Identity object                 | IDENTITY  | RO                      |                                                                                                                                                                              |
|                    | 01   | Vendor ID                       | UDINT     | RO                      |                                                                                                                                                                              |
|                    | 02   | Product code                    | UDINT     | RO                      |                                                                                                                                                                              |
|                    | 03   | Revision number                 | UDINT     | RO                      |                                                                                                                                                                              |
|                    | 04   | Serial number                   | UDINT     | RO                      |                                                                                                                                                                              |
| 10F8               |      | Timestamp object                | ULINT     | RO                      | Local timestamp of the device in ns.                                                                                                                                         |
| 1600               |      | SDP default RxPDO               |           |                         |                                                                                                                                                                              |
|                    | 01h  |                                 |           |                         | 0x7000.0x01: Turbo start/stop                                                                                                                                                |
|                    | 02h  |                                 |           |                         | 0x7000.0x02: Turbo reset alarm                                                                                                                                               |
|                    | 03h  |                                 |           |                         | 0x7000.0x03: Turbo low speed                                                                                                                                                 |
|                    | 04h  |                                 |           |                         | 0x0000.0x00:5                                                                                                                                                                |
| 1601               |      | User RxPDO                      |           |                         |                                                                                                                                                                              |
| 1A00               |      | SDP default TxPDO               |           |                         |                                                                                                                                                                              |
|                    | 01h  |                                 |           |                         | 0x6000.0x01: Rotation                                                                                                                                                        |
|                    | 02h  |                                 |           |                         | 0x6000.0x02: Normal                                                                                                                                                          |
|                    | 03h  |                                 |           |                         | 0x6000.0x03: Acceleration                                                                                                                                                    |
|                    | 04h  |                                 |           |                         | 0x6000.0x04: Deceleration (includes braking)                                                                                                                                 |
|                    | 05h  |                                 |           |                         | 0x6000.0x05: Remote/local                                                                                                                                                    |
|                    | 06h  |                                 |           |                         | 0x6000.0x07: Turbo low speed                                                                                                                                                 |
|                    | 07h  |                                 |           |                         | 0x6000.0x09: Alarm                                                                                                                                                           |
|                    | 08h  |                                 |           |                         | 0x6000.0x0A: Warning                                                                                                                                                         |
|                    | 09h  |                                 |           |                         | 0x6000.0x11: Turbo speed                                                                                                                                                     |
|                    | 0Ah  |                                 |           |                         | 0x6000.0x12: Turbo current                                                                                                                                                   |

91) Idx = Index, sldx = Subindex, hexadezimal

92) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>91)</sup> | sidx | Name                                               | Typ | Zu-griff <sup>92)</sup> | Beschreibung                        |
|--------------------|------|----------------------------------------------------|-----|-------------------------|-------------------------------------|
|                    | 0Bh  |                                                    |     |                         | 0x6000.0x13: Turbo pump temperature |
| 1A01               |      | User TxPDO                                         |     |                         |                                     |
| 1C00               |      | Sync manager type                                  |     |                         |                                     |
| 1C12               |      | RxPDO assign<br>(sync manager 2<br>PDO assignment) |     |                         |                                     |
| 1C13               |      | TxPDO assign<br>(sync manager 3<br>PDO assignment) |     |                         |                                     |

**Tab. 64: Communication Area - Verwaltungsdaten (Information über das Gerät, Kommunikation)**

**Eingangsdaten (TC 80 --> Steuerung)**

| Idx <sup>93)</sup> | sidx    | Name                            | Typ       | Zugriff <sup>94)</sup> | Beschreibung                                    |
|--------------------|---------|---------------------------------|-----------|------------------------|-------------------------------------------------|
| 2000               | Partial | In identity/status              |           | RO                     |                                                 |
|                    | 08      | Status code (main)              | UINT      | RO                     | "000000"->0, "ErrXXX"->XXX, "WrnXXX"->XXX +1000 |
|                    | 0A      | Operating hours (main)          | UDINT     | RO                     |                                                 |
|                    | 24      | Hardware version (interface)    | STRING(n) | RO                     |                                                 |
|                    | 25      | Firmware version (interface)    | STRING(n) | RO                     |                                                 |
|                    | 86      | ID (pump)                       | UINT      | RO                     |                                                 |
|                    | 8A      | Operating hours (pump)          | UDINT     | RO                     |                                                 |
|                    | 8D      | Cycles (pump)                   | UDINT     | RO                     |                                                 |
| 2001               | Partial | In operation                    |           | RO                     |                                                 |
|                    | 83      | Actual value (abs) (pump)       | UDINT     | RO                     |                                                 |
|                    | 86      | Nominal value abs (pump)        | UDINT     | RO                     | rpm                                             |
|                    | 88      | Ready for process (pump)        | BOOL      | RO                     | Speed switchpoint attained                      |
| 2002               | Partial | In pump power/temperature       |           | RO                     |                                                 |
|                    | 08      | Temperature (main)              | INT       | RO                     | °C                                              |
|                    | 11      | Voltage (power)                 | INT       | RO                     | 0.1 V                                           |
|                    | 13      | Power (power)                   | INT       | RO                     | W                                               |
|                    | 18      | Temperature (power)             | INT       | RO                     | °C                                              |
|                    | 98      | Temperature (motor)             | INT       | RO                     | °C                                              |
|                    | B8      | Temperature (rotor)             | INT       | RO                     |                                                 |
| 2004               | Partial | In component identity/status    |           | RO                     |                                                 |
|                    | 52      | Device name (pressure 1)        | STRING(n) | RO                     |                                                 |
|                    | 62      | Device name (pressure 2)        | STRING(n) | RO                     |                                                 |
| 2005               | Partial | In component operation          |           | RO                     |                                                 |
|                    | 53      | Actual value (abs) (pressure 1) |           | RO                     | hPa                                             |
|                    | 63      | Actual value (abs) (pressure 2) |           | RO                     | hPa                                             |

**Tab. 65: Eingangsdaten**

91) Idx = Index, sidx = Subindex, hexadezimal

92) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

93) Idx = Index, sidx = Subindex, hexadezimal

94) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

**Ausgangsdaten (Steuerung --> TC 80)**

| Idx <sup>95)</sup> | sldx    | Name                    | Typ  | Zugriff <sup>96)</sup> | Beschreibung |
|--------------------|---------|-------------------------|------|------------------------|--------------|
| 3005               | Partial | Out component operation |      | RO                     |              |
|                    | 01      | Enable (heating)        | BOOL | RW                     |              |
|                    | 11      | Enable (venting)        | BOOL | RW                     |              |
|                    | 21      | Enable (sealing gas)    | BOOL | RW                     |              |
|                    | 51      | Enable (pressure)       | BOOL | RW                     |              |

**Tab. 66: Manufacturer Specific Outputs****Manufacturer Specific Configuration data**

| Idx <sup>97)</sup> | sldx    | Name                               | Typ   | Zugriff <sup>98)</sup> | Beschreibung                  |
|--------------------|---------|------------------------------------|-------|------------------------|-------------------------------|
| 4001               | Partial | Cfg pump operation                 |       | RO                     |                               |
|                    | 12      | Setpoint 1/on (power)              | UINT  | RW                     | mV, power out voltage (V)     |
|                    | 13      | Setpoint 2/off (power)             | UINT  | RW                     | W, power out threshold (W)    |
|                    | 84      | Nominal value (abs) (pump)         | UDINT | RW                     | rpm                           |
|                    | 85      | Process configuration (pump)       | USINT | RW                     | Gas mode                      |
|                    | 86      | Cfg. ready for process (pump)      | USINT | RW                     | cfg. speed switchpoint        |
|                    | 87      | Switchpoint 1/on (pump)            | USINT | RW                     | %, speed switchpoint 1 (% fN) |
|                    | 88      | Switchpoint 2/off (pump)           | USINT | RW                     | %, speed switchpoint 2 (% fN) |
|                    | 89      | Cfg. run-up timer (pump)           | BOOL  | RW                     |                               |
|                    | 8A      | Run-up time (pump)                 | USINT | RW                     | Min                           |
|                    | 8B      | Temperature mode                   | USINT | RW                     |                               |
| 4002               | Partial | Cfg power                          |       | RO                     |                               |
|                    | 11      | Max. power (power)                 | USINT | RW                     | %                             |
| 4005               | Partial | Cfg component operation            |       | RO                     |                               |
|                    | 11      | Configuration (venting)            | USINT | RW                     |                               |
|                    | 12      | Setpoint 1/on (venting)            | USINT | RW                     | %, venting speed (% fN)       |
|                    | 13      | Setpoint 2/off (venting)           | UINT  | RW                     | s, venting time               |
|                    | 41      | Configuration (backing pump)       | USINT | RW                     |                               |
|                    | 42      | Setpoint 1/on (backing pump)       | UINT  | RW                     | W                             |
|                    | 43      | Setpoint 2/off (backing pump)      | UINT  | RW                     | W                             |
|                    | 55      | Process configuration (pressure 1) | REAL  | RW                     | Correction factor 1           |
|                    | 57      | Switchpoint 1/on (pressure 1)      | REAL  | RW                     | hPa                           |
|                    | 65      | Process configuration (pressure 2) | REAL  | RW                     | Correction factor 2           |
|                    | 67      | Switchpoint 1/on (pressure 2)      | REAL  | RW                     | hPa                           |
|                    | 72      | Setpoint 1/on (fan)                | USINT | RW                     | °C                            |
|                    | 81      | Configuration (accessory A1)       | USINT | RW                     |                               |
|                    | 91      | Configuration (accessory B1)       | USINT | RW                     |                               |
|                    | C1      | Configuration (accessory C1)       |       |                        |                               |
|                    | D1      | Configuration (accessory D1)       |       |                        |                               |
| 4009               | Partial | Cfg interface operation            |       | RO                     |                               |

95) Idx = Index, sldx = Subindex, hexadezimal

96) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

97) Idx = Index, sldx = Subindex, hexadezimal

98) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>97)</sup> | sidx | Name                | Typ   | Zugriff <sup>98)</sup> | Beschreibung |
|--------------------|------|---------------------|-------|------------------------|--------------|
|                    | 01   | Configuration (DI1) | USINT | RW                     |              |
|                    | 11   | Configuration (DI2) | USINT | RW                     |              |
|                    | 41   | Configuration (DO1) | USINT | RW                     |              |
|                    | 51   | Configuration (DO2) | USINT | RW                     |              |
|                    | A1   | Configuration (AO1) | USINT | RW                     |              |

Tab. 67: Manufacturer Specific Configuration data

## Input area

| Idx <sup>99)</sup> | sidx | Name                            | Typ  | Zugriff <sup>100)</sup> | Beschreibung                                                                      |
|--------------------|------|---------------------------------|------|-------------------------|-----------------------------------------------------------------------------------|
| 6000               |      | Turbo status and sensor value   |      | RO                      |                                                                                   |
|                    | 01   | Rotation                        | BOOL | RO                      | 1: Under normal operation<br>0: Not normal                                        |
|                    | 02   | Normal                          | BOOL | RO                      | 1: Under normal operation<br>0: Not normal                                        |
|                    | 03   | Acceleration                    | BOOL | RO                      | 1: Accelerating<br>0: Not accelerating                                            |
|                    | 04   | Deceleration (includes braking) | BOOL | RO                      | 1: Decelerating<br>0: Not decelerating                                            |
|                    | 05   | Remote/local                    | BOOL | RO                      | 1: Local hand control enabled<br>0: Remote E-cat control enabled                  |
|                    | 06   | Coast (motor off)               | BOOL | RO                      | Conditional where supported by the turbo controller<br>1: Coast mode ON<br>0: OFF |
|                    | 07   | Turbo low speed                 | BOOL | RO                      | 1: Low speed mode ON<br>0: OFF                                                    |
|                    | 09   | Alarm                           | BOOL | RO                      | 1: Alarm<br>0: Not alarm                                                          |
|                    | 0A   | Warning                         | BOOL | RO                      | 1: Warning<br>0: Not warning                                                      |
|                    | 11   | Turbo speed                     | INT  | RO                      | 1000 (100.0 %): Rated speed - 0.1 [%]<br>0 (0.0 %): No rotation                   |
|                    | 12   | Turbo current                   | INT  | RO                      | 0.1 [A]                                                                           |
|                    | 13   | Turbo pump temperature          | INT  | RO                      | Celsius - 1 [°C]                                                                  |

Tab. 68: Input Area

## Output area

| Idx <sup>101)</sup> | sidx | Name             | Typ  | Zugriff <sup>102)</sup> | Beschreibung      |
|---------------------|------|------------------|------|-------------------------|-------------------|
| 7000                |      | Turbo control    |      | RO                      |                   |
|                     | 01   | Turbo start/stop | BOOL | RW                      | 1: Run<br>0: Stop |

97) Idx = Index, sidx = Subindex, hexadezimal

98) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

99) Idx = Index, sidx = Subindex, hexadezimal

100) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

101) Idx = Index, sidx = Subindex, hexadezimal

102) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>101)</sup> | sldx | Name              | Typ  | Zugriff <sup>102)</sup> | Beschreibung                                                                       |
|---------------------|------|-------------------|------|-------------------------|------------------------------------------------------------------------------------|
|                     | 02   | Turbo reset alarm | BOOL | RW                      | 1: Reset alarm<br>0: No action                                                     |
|                     | 03   | Turbo low speed   | BOOL | RW                      | 1: Low speed mode ON<br>0: OFF                                                     |
|                     | 04   | Coast (motor off) | BOOL | RW                      | Conditional where supported by the turbo controller,<br>1: Coast mode ON<br>0: OFF |

Tab. 69: Output Area

## Konfigurationsdaten (Steuerung --&gt; TC 80)

| Idx <sup>103)</sup> | sldx | Name                        | Typ  | Zugriff <sup>104)</sup> | Beschreibung                                                                                                                                                                |
|---------------------|------|-----------------------------|------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8001                |      | Turbo parameter setting     |      | RO                      |                                                                                                                                                                             |
|                     | 01   | Turbo safe state            | UINT | RW                      | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - turbo stops<br>2: Maintain state exit low speed/coast (go to normal speed) |
|                     | 02   | Turbo low speed setpoint    | UINT | RW                      | 1000 (100.0 %): Rated speed<br>0 (0.0 %): No rotation, minimum speed restrictions apply, 0.1 [%]                                                                            |
|                     | 03   | Turbo normal speed setpoint | UINT | RW                      | 1000 (100.0 %): Rated speed<br>0 (0.0 %): No rotation, minimum speed restrictions apply, 0.1 [%]                                                                            |

Tab. 70: Configuration Area

## Semiconductor device profile area

| Idx <sup>105)</sup> | sldx | Name                         | Typ   | Zugriff <sup>106)</sup> | Beschreibung |
|---------------------|------|------------------------------|-------|-------------------------|--------------|
| F000                |      | Semiconductor device profile |       | RO                      |              |
|                     | 01   | Index distance               | UINT  | RO                      |              |
|                     | 02   | Maximum number of modules    | UINT  | RO                      |              |
| F010                |      | Module profile list          |       | RO                      |              |
|                     | 01   |                              | UDINT | RO                      |              |

Tab. 71: Semiconductor Device Profile Area

101) Idx = Index, sldx = Subindex, hexadezimal

102) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

103) Idx = Index, sldx = Subindex, hexadezimal

104) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

105) Idx = Index, sldx = Subindex, hexadezimal

106) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet



## Exception handling

| Idx <sup>107)</sup> | sldx | Name                            | Typ   | Zu-griff <sup>108)</sup> | Beschreibung                                                                                                                    |
|---------------------|------|---------------------------------|-------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380                |      | Active exception status         | USINT | RO                       | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning            |       |                          | Bit0: Device warning                                                                                                            |
|                     |      | Bit1: Manufacturer warning      |       |                          | Bit1: Manufacturer warning                                                                                                      |
|                     |      | Bit2: Device error              |       |                          | Bit2: Device error                                                                                                              |
|                     |      | Bit3: Manufacturer error        |       |                          | Bit3: Manufacturer error                                                                                                        |
|                     |      | Bit4: Reserved                  |       |                          | Bit4: Reserved                                                                                                                  |
|                     |      | Bit5: Reserved                  |       |                          | Bit5: Reserved                                                                                                                  |
|                     |      | Bit6: Reserved                  |       |                          | Bit6: Reserved                                                                                                                  |
|                     |      | Bit7: Reserved                  |       |                          | Bit7: Reserved                                                                                                                  |
| F381                |      | Active device warning details   |       | RO                       |                                                                                                                                 |
|                     | 01   |                                 | UDINT | RO                       | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                         |
|                     |      | Bit0: Power fail                |       |                          | Bit0: Power fail                                                                                                                |
|                     |      | Bit1: Pump over temperature     |       |                          | Bit1: Pump over temperature                                                                                                     |
|                     |      | Bit2: Over speed                |       |                          | Bit2: Over speed                                                                                                                |
|                     |      | Bit3: Motor over current        |       |                          | Bit3: Motor over current                                                                                                        |
|                     |      | Bit4: Driver over temperature   |       |                          | Bit4: Driver over temperature                                                                                                   |
|                     |      | Bit5: Driver over current       |       |                          | Bit5: Driver over current                                                                                                       |
|                     |      | Bit6: Driver over voltage       |       |                          | Bit6: Driver over voltage                                                                                                       |
|                     |      | Bit7: Driver fail               |       |                          | Bit7: Driver fail                                                                                                               |
|                     |      | Bit8: Controller fail           |       |                          | Bit8: Controller fail                                                                                                           |
|                     |      | Bit9: Can not start             |       |                          | Bit9: Can not start                                                                                                             |
|                     |      | Bit10: Accel. Overtime          |       |                          | Bit10: Accel. Overtime                                                                                                          |
|                     |      | Bit11: Brake overtime           |       |                          | Bit11: Brake overtime                                                                                                           |
|                     |      | Bit12: Bearing err              |       |                          | Bit12: Bearing err                                                                                                              |
|                     |      | Bit13: Bearing sensor err       |       |                          | Bit13: Bearing sensor err                                                                                                       |
|                     |      | Bit14: TC over temperature      |       |                          | Bit14: TC over temperature                                                                                                      |
|                     |      | Bit15: TC sensor error          |       |                          | Bit15: TC sensor error                                                                                                          |
|                     |      | Bit16: TC heater err            |       |                          | Bit16: TC heater err                                                                                                            |
|                     |      | Bit17: TC valve err             |       |                          | Bit17: TC valve err                                                                                                             |
|                     |      | Bit18: Other (not in the above) |       |                          | Bit18: Other (not in the above)                                                                                                 |
|                     |      | Bit19: Reserved                 |       |                          | Bit19: Reserved                                                                                                                 |
|                     |      | Bit20: Reserved                 |       |                          | Bit20: Reserved                                                                                                                 |
|                     |      | Bit21: Reserved                 |       |                          | Bit21: Reserved                                                                                                                 |
|                     |      | Bit22: Reserved                 |       |                          | Bit22: Reserved                                                                                                                 |
|                     |      | Bit23: Reserved                 |       |                          | Bit23: Reserved                                                                                                                 |
|                     |      | Bit24: Reserved                 |       |                          | Bit24: Reserved                                                                                                                 |

107) Idx = Index, sldx = Subindex, hexadezimal

108) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>107)</sup> | sldx | Name                            | Typ   | Zu-griff <sup>108)</sup> | Beschreibung                                                                                            |
|---------------------|------|---------------------------------|-------|--------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit25: Reserved                 |       |                          | Bit25: Reserved                                                                                         |
|                     |      | Bit26: Reserved                 |       |                          | Bit26: Reserved                                                                                         |
|                     |      | Bit27: Reserved                 |       |                          | Bit27: Reserved                                                                                         |
|                     |      | Bit28: Reserved                 |       |                          | Bit28: Reserved                                                                                         |
|                     |      | Bit29: Reserved                 |       |                          | Bit29: Reserved                                                                                         |
|                     |      | Bit30: Reserved                 |       |                          | Bit30: Reserved                                                                                         |
|                     |      | Bit31: Reserved                 |       |                          | Bit31: Reserved                                                                                         |
| F383                |      | Active device error details     |       | RO                       |                                                                                                         |
|                     | 01   |                                 | UDINT | RO                       | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: Power fail                |       |                          | Bit0: Power fail                                                                                        |
|                     |      | Bit1: Pump over temperature     |       |                          | Bit1: Pump over temperature                                                                             |
|                     |      | Bit2: Over speed                |       |                          | Bit2: Over speed                                                                                        |
|                     |      | Bit3: Motor over current        |       |                          | Bit3: Motor over current                                                                                |
|                     |      | Bit4: Driver over temperature   |       |                          | Bit4: Driver over temperature                                                                           |
|                     |      | Bit5: Driver over current       |       |                          | Bit5: Driver over current                                                                               |
|                     |      | Bit6: Driver over voltage       |       |                          | Bit6: Driver over voltage                                                                               |
|                     |      | Bit7: Driver fail               |       |                          | Bit7: Driver fail                                                                                       |
|                     |      | Bit8: Controller fail           |       |                          | Bit8: Controller fail                                                                                   |
|                     |      | Bit9: Can not start             |       |                          | Bit9: Can not start                                                                                     |
|                     |      | Bit10: Accel. Overtime          |       |                          | Bit10: Accel. Overtime                                                                                  |
|                     |      | Bit11: Brake overtime           |       |                          | Bit11: Brake overtime                                                                                   |
|                     |      | Bit12: Bearing err              |       |                          | Bit12: Bearing err                                                                                      |
|                     |      | Bit13: Bearing sensor err       |       |                          | Bit13: Bearing sensor err                                                                               |
|                     |      | Bit14: TC over temperature      |       |                          | Bit14: TC over temperature                                                                              |
|                     |      | Bit15: TC sensor error          |       |                          | Bit15: TC sensor error                                                                                  |
|                     |      | Bit16: TC heater err            |       |                          | Bit16: TC heater err                                                                                    |
|                     |      | Bit17: TC valve err             |       |                          | Bit17: TC valve err                                                                                     |
|                     |      | Bit18: Other (not in the above) |       |                          | Bit18: Other (not in the above)                                                                         |
|                     |      | Bit19: Reserved                 |       |                          | Bit19: Reserved                                                                                         |
|                     |      | Bit20: Reserved                 |       |                          | Bit20: Reserved                                                                                         |
|                     |      | Bit21: Reserved                 |       |                          | Bit21: Reserved                                                                                         |
|                     |      | Bit22: Reserved                 |       |                          | Bit22: Reserved                                                                                         |
|                     |      | Bit23: Reserved                 |       |                          | Bit23: Reserved                                                                                         |
|                     |      | Bit24: Reserved                 |       |                          | Bit24: Reserved                                                                                         |
|                     |      | Bit25: Reserved                 |       |                          | Bit25: Reserved                                                                                         |
|                     |      | Bit26: Reserved                 |       |                          | Bit26: Reserved                                                                                         |
|                     |      | Bit27: Reserved                 |       |                          | Bit27: Reserved                                                                                         |
|                     |      | Bit28: Reserved                 |       |                          | Bit28: Reserved                                                                                         |
|                     |      | Bit29: Reserved                 |       |                          | Bit29: Reserved                                                                                         |
|                     |      | Bit30: Reserved                 |       |                          | Bit30: Reserved                                                                                         |
|                     |      | Bit31: Reserved                 |       |                          | Bit31: Reserved                                                                                         |

107) Idx = Index, sldx = Subindex, hexadezimal

108) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>107)</sup> | sldx | Name                            | Typ   | Zu-griff <sup>108)</sup> | Beschreibung                                                                                                             |
|---------------------|------|---------------------------------|-------|--------------------------|--------------------------------------------------------------------------------------------------------------------------|
| F390                |      | Latched exception status        | USINT | RO                       | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning            |       |                          | Bit0: Device warning                                                                                                     |
|                     |      | Bit1: Manufacturer warning      |       |                          | Bit1: Manufacturer warning                                                                                               |
|                     |      | Bit2: Device error              |       |                          | Bit2: Device error                                                                                                       |
|                     |      | Bit3: Manufacturer error        |       |                          | Bit3: Manufacturer error                                                                                                 |
|                     |      | Bit4: Reserved                  |       |                          | Bit4: Reserved                                                                                                           |
|                     |      | Bit5: Reserved                  |       |                          | Bit5: Reserved                                                                                                           |
|                     |      | Bit6: Reserved                  |       |                          | Bit6: Reserved                                                                                                           |
|                     |      | Bit7: Reserved                  |       |                          | Bit7: Reserved                                                                                                           |
| F391                |      | Latched device warning details  |       | RO                       |                                                                                                                          |
|                     | 01   |                                 | UDINT | RO                       | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                  |
|                     |      | Bit0: Power fail                |       |                          | Bit0: Power fail                                                                                                         |
|                     |      | Bit1: Pump over temperature     |       |                          | Bit1: Pump over temperature                                                                                              |
|                     |      | Bit2: Over speed                |       |                          | Bit2: Over speed                                                                                                         |
|                     |      | Bit3: Motor over current        |       |                          | Bit3: Motor over current                                                                                                 |
|                     |      | Bit4: Driver over temperature   |       |                          | Bit4: Driver over temperature                                                                                            |
|                     |      | Bit5: Driver over current       |       |                          | Bit5: Driver over current                                                                                                |
|                     |      | Bit6: Driver over voltage       |       |                          | Bit6: Driver over voltage                                                                                                |
|                     |      | Bit7: Driver fail               |       |                          | Bit7: Driver fail                                                                                                        |
|                     |      | Bit8: Controller fail           |       |                          | Bit8: Controller fail                                                                                                    |
|                     |      | Bit9: Can not start             |       |                          | Bit9: Can not start                                                                                                      |
|                     |      | Bit10: Accel. Overtime          |       |                          | Bit10: Accel. Overtime                                                                                                   |
|                     |      | Bit11: Brake overtime           |       |                          | Bit11: Brake overtime                                                                                                    |
|                     |      | Bit12: Bearing err              |       |                          | Bit12: Bearing err                                                                                                       |
|                     |      | Bit13: Bearing sensor err       |       |                          | Bit13: Bearing sensor err                                                                                                |
|                     |      | Bit14: TC over temperature      |       |                          | Bit14: TC over temperature                                                                                               |
|                     |      | Bit15: TC sensor error          |       |                          | Bit15: TC sensor error                                                                                                   |
|                     |      | Bit16: TC heater err            |       |                          | Bit16: TC heater err                                                                                                     |
|                     |      | Bit17: TC valve err             |       |                          | Bit17: TC valve err                                                                                                      |
|                     |      | Bit18: Other (not in the above) |       |                          | Bit18: Other (not in the above)                                                                                          |
|                     |      | Bit19: Reserved                 |       |                          | Bit19: Reserved                                                                                                          |
|                     |      | Bit20: Reserved                 |       |                          | Bit20: Reserved                                                                                                          |
|                     |      | Bit21: Reserved                 |       |                          | Bit21: Reserved                                                                                                          |
|                     |      | Bit22: Reserved                 |       |                          | Bit22: Reserved                                                                                                          |
|                     |      | Bit23: Reserved                 |       |                          | Bit23: Reserved                                                                                                          |
|                     |      | Bit24: Reserved                 |       |                          | Bit24: Reserved                                                                                                          |
|                     |      | Bit25: Reserved                 |       |                          | Bit25: Reserved                                                                                                          |
|                     |      | Bit26: Reserved                 |       |                          | Bit26: Reserved                                                                                                          |
|                     |      | Bit27: Reserved                 |       |                          | Bit27: Reserved                                                                                                          |

107) Idx = Index, sldx = Subindex, hexadezimal

108) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>107)</sup> | sldx | Name                               | Typ   | Zu-griff <sup>108)</sup> | Beschreibung                                                                                               |
|---------------------|------|------------------------------------|-------|--------------------------|------------------------------------------------------------------------------------------------------------|
|                     |      | Bit28: Reserved                    |       |                          | Bit28: Reserved                                                                                            |
|                     |      | Bit29: Reserved                    |       |                          | Bit29: Reserved                                                                                            |
|                     |      | Bit30: Reserved                    |       |                          | Bit30: Reserved                                                                                            |
|                     |      | Bit31: Reserved                    |       |                          | Bit31: Reserved                                                                                            |
| F393                |      | Latched device error de-<br>tails  |       | RO                       |                                                                                                            |
|                     | 01   |                                    | UDINT | RO                       | Expanded details of the device<br>warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: Power fail                   |       |                          | Bit0: Power fail                                                                                           |
|                     |      | Bit1: Pump over tempera-<br>ture   |       |                          | Bit1: Pump over temperature                                                                                |
|                     |      | Bit2: Over speed                   |       |                          | Bit2: Over speed                                                                                           |
|                     |      | Bit3: Motor over current           |       |                          | Bit3: Motor over current                                                                                   |
|                     |      | Bit4: Driver over tempera-<br>ture |       |                          | Bit4: Driver over temperature                                                                              |
|                     |      | Bit5: Driver over current          |       |                          | Bit5: Driver over current                                                                                  |
|                     |      | Bit6: Driver over voltage          |       |                          | Bit6: Driver over voltage                                                                                  |
|                     |      | Bit7: Driver fail                  |       |                          | Bit7: Driver fail                                                                                          |
|                     |      | Bit8: Controller fail              |       |                          | Bit8: Controller fail                                                                                      |
|                     |      | Bit9: Can not start                |       |                          | Bit9: Can not start                                                                                        |
|                     |      | Bit10: Accel. Overtime             |       |                          | Bit10: Accel. Overtime                                                                                     |
|                     |      | Bit11: Brake overtime              |       |                          | Bit11: Brake overtime                                                                                      |
|                     |      | Bit12: Bearing err                 |       |                          | Bit12: Bearing err                                                                                         |
|                     |      | Bit13: Bearing sensor err          |       |                          | Bit13: Bearing sensor err                                                                                  |
|                     |      | Bit14: TC over temperature         |       |                          | Bit14: TC over temperature                                                                                 |
|                     |      | Bit15: TC sensor error             |       |                          | Bit15: TC sensor error                                                                                     |
|                     |      | Bit16: TC heater err               |       |                          | Bit16: TC heater err                                                                                       |
|                     |      | Bit17: TC valve err                |       |                          | Bit17: TC valve err                                                                                        |
|                     |      | Bit18: Other (not in the<br>above) |       |                          | Bit18: Other (not in the above)                                                                            |
|                     |      | Bit19: Reserved                    |       |                          | Bit19: Reserved                                                                                            |
|                     |      | Bit20: Reserved                    |       |                          | Bit20: Reserved                                                                                            |
|                     |      | Bit21: Reserved                    |       |                          | Bit21: Reserved                                                                                            |
|                     |      | Bit22: Reserved                    |       |                          | Bit22: Reserved                                                                                            |
|                     |      | Bit23: Reserved                    |       |                          | Bit23: Reserved                                                                                            |
|                     |      | Bit24: Reserved                    |       |                          | Bit24: Reserved                                                                                            |
|                     |      | Bit25: Reserved                    |       |                          | Bit25: Reserved                                                                                            |
|                     |      | Bit26: Reserved                    |       |                          | Bit26: Reserved                                                                                            |
|                     |      | Bit27: Reserved                    |       |                          | Bit27: Reserved                                                                                            |
|                     |      | Bit28: Reserved                    |       |                          | Bit28: Reserved                                                                                            |
|                     |      | Bit29: Reserved                    |       |                          | Bit29: Reserved                                                                                            |
|                     |      | Bit30: Reserved                    |       |                          | Bit30: Reserved                                                                                            |
|                     |      | Bit31: Reserved                    |       |                          | Bit31: Reserved                                                                                            |
| F3A1                |      | Device warning mask                |       | RO                       |                                                                                                            |

107) Idx = Index, sldx = Subindex, hexadezimal

108) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>107)</sup> | sldx | Name              | Typ   | Zu-griff <sup>108)</sup> | Beschreibung                                                                                                                                                                                                                        |
|---------------------|------|-------------------|-------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 01   |                   | UDINT | RW                       | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3                |      | Device error mask |       | RO                       |                                                                                                                                                                                                                                     |
|                     | 01   |                   | UDINT | RO                       | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |

Tab. 72: Exception handling

## CDP Device Specific inputs

| Idx <sup>109)</sup> | sldx | Name                        | Typ   | Zugriff <sup>110)</sup> | Beschreibung                                                                                                       |
|---------------------|------|-----------------------------|-------|-------------------------|--------------------------------------------------------------------------------------------------------------------|
| F6F0                |      | Input latch local timestamp |       | RO                      |                                                                                                                    |
|                     | 01   | Input latch local timestamp | UDINT | RO                      | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up. |

Tab. 73: Device specific inputs

## CDP Specific Information Data

| Idx <sup>111)</sup> | sldx | Name                             | Typ       | Zu-griff <sup>112)</sup> | Beschreibung                                                                                                          |
|---------------------|------|----------------------------------|-----------|--------------------------|-----------------------------------------------------------------------------------------------------------------------|
| F9F0                |      | Manufacturer serial number       | STRING(n) | RO                       | String representing the manufacturer's serial number for the device. NOTE: This may have the same value as 0x1018:04. |
| F9F1                |      | CDP Functional generation number |           | RO                       |                                                                                                                       |
|                     | 01   |                                  | UDINT     | RO                       | Common Device Profile Functional Generation Number2, see ETG.5003.2050                                                |
| F9F2                |      | SDP Functional generation number |           | RO                       |                                                                                                                       |
|                     | 01   |                                  | UDINT     | RO                       | SDP functional generation number off nn-th moduleIt shall be specified by each SDP.2, see ETG.5003.2050               |
| F9F3                |      | Vendor name                      | STRING(n) | RO                       | This string identifies the supplier of the device.                                                                    |
| F9F4                |      | SDP Device Name                  |           | RO                       |                                                                                                                       |

107) Idx = Index, sldx = Subindex, hexadezimal

108) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

109) Idx = Index, sldx = Subindex, hexadezimal

110) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

111) Idx = Index, sldx = Subindex, hexadezimal

112) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>111)</sup> | sldx | Name                                         | Typ       | Zu-griff <sup>112)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                             |
|---------------------|------|----------------------------------------------|-----------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 01   |                                              | STRING(n) | RO                       | String identifying the device type of nn-th module as defined by the SDP, see ETG.5003.2050                                                                                                                                                                                                                              |
| F9F5                |      | Output identifier                            |           | RO                       |                                                                                                                                                                                                                                                                                                                          |
|                     | 01   |                                              | USINT     | RW                       | Output identifier of nn-th module This value can be mapped to both the RxPDO and TxPDO. The required function of the device is to store the value in memory as written by the host. The controller can then read this value back through the TxPDO to ensure the RxPDO was received.                                     |
| F9F6                |      | Time since power on                          | UDINT     | RO                       | This is the time the device has been currently powered on, in seconds, regardless of communication presence.                                                                                                                                                                                                             |
| F9F7                |      | Total time powered                           | UDINT     | RO                       | This is the cumulative amount of time the device has been powered on, in seconds. It shall be stored automatically as non-volatile. Accuracy shall be equal or better to one hour.                                                                                                                                       |
| F9F8                |      | Firmware update functional generation number | UDINT     | RO                       | Firmware update functional generation number supported by the device. Value shall be specified by the Firmware Update Profile (ETG.5003-2) 0x00000000: FW Update according to ETG.5003-2 not supported. A device cannot return this value and still be compliant with ETG.5003.1, as ETG.5003-2 compliance is mandatory. |

Tab. 74: CDP Specific Information Data

## CDP Command Objects

| Idx <sup>113)</sup> | sldx | Name                 | Typ                 | Zu-griff <sup>114)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------|------|----------------------|---------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0                |      | Device reset command |                     | RO                       | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. Some devices may require this reset to maintain a specific state not matching power cycle behavior for proper operation, per the SDP. NOTE: As a consequence of an ESC reset all of the subsequent devices are disconnected from the network. There are two versions of this command: Device Reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset. Factory Reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                     | 01   | Command              | ARRAY[0..5] OF BYTE | RW                       | A device reset is initiated when the following byte sequence is sent: Byte 0: 0x74 Byte 1: 0x65 Byte 2: 0x73 Byte 3: 0x65 Byte 4: 0x72 Byte 5: Device Standard Reset = 0x00, Factory Reset = 0x66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

111) Idx = Index, sldx = Subindex, hexadezimal

112) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

113) Idx = Index, sldx = Subindex, hexadezimal

114) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>113)</sup> | sldx | Name                     | Typ                  | Zu-griff <sup>114)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------|------|--------------------------|----------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 02   | Status                   | USINT                | RO                       | Supported values:0: Default value if the command has not been initiated. Not a supported value otherwise.1: Reserved2: last command completed, error, no response3: Reserved3-99: Reserved,100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%)201-254: Reserved,255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                                       |
|                     | 03   | Response                 | AR-RAY[0..1] OF BYTE | RO                       | Byte 0: see Subindex 2Byte 1: Unused - Shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FBF1                |      | Exception reset command  |                      | RO                       | Execution of this command clears the latched exceptions. Execution of this command may also optionally acknowledge device or SDP-specific exceptions (if specified) that would otherwise require a separate acknowledgement action to resume normal operation. If this is required, it shall be noted in the SDP or device documentation.                                                                                                                                                                                                                                                                                                                                                                                                          |
|                     | 01   | Command                  | AR-RAY[0..4] OF BYTE | RW                       | A Latched Exception Reset is initiated when the following byte sequence is sent:Byte 0: 0x74Byte 1: 0x65Byte 2: 0x73Byte 3: 0x65Byte 4: 0x72                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                     | 02   | Status                   | USINT                | RO                       | Supported values:0: last command completed, no error, no response1: Reserved2: last command completed, error, no response3: Reserved3-99: Reserved,100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%)201-254: Reserved,255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                                                                               |
|                     | 03   | Response                 | AR-RAY[0..1] OF BYTE | RO                       | Byte 0: see Subindex 2Byte 1: Unused- Shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| FBF2                |      | Store parameters command |                      | RO                       | Execution of this command will store all parameters to non-volatile memory. If a device automatically saves all non-volatile parameters at the time they are written, this command will not take any action. In the event that this command may interfere with the safe or expected functional operation of a device, it may be optionally restricted to functioning only in certain functional conditions while in OPERATIONAL state. If the command cannot be performed due to this operating condition, the Abort Code "0x08 00 00 21" shall be returned. In this case, documentation shall be supplied detailing the proper condition to execute this command. All devices shall be able to execute this command in PREOP without restriction. |
|                     | 01   | Command                  | AR-RAY[0..3] OF BYTE | RW                       | Read: Bit 0 = 1: device saves the non-volatile parameters when writing 0xFB2:01 with 0x65766173Bit 1 = 1: device saves the non-volatile parameters automatically when they are writtenBit 2-31: reserved, shall be 0 Write:All writable, non-volatile values will be stored in non-volatile memory when the following is sent:Byte 0: 0x73Byte 1: 0x61Byte 2: 0x76Byte 3: 0x65If other values are written the Abort Code "0x06040043 General parameter incompatibility reason" shall be returned.                                                                                                                                                                                                                                                  |

113) Idx = Index, sldx = Subindex, hexadezimal

114) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet

| Idx <sup>113)</sup> | sIdx | Name                       | Typ                     | Zu-griff <sup>114)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------|------|----------------------------|-------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 02   | Status                     | USINT                   | RO                       | Supported values:0: last command completed, no error, no response1: Reserved2: last command completed, error, no response3-99: Reserved,100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%)201-254: Reserved,255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                     | 03   | Response                   | AR-RAY[0..1]<br>OF BYTE | RO                       | Byte 0: see Subindex 2Byte 1: Unused - Shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| FBF3                |      | Calculate checksum command |                         | RO                       | Execution of this command will calculate a checksum for all writable, non-volatile parameters as currently stored in non-volatile memory. In the event that this calculation may interfere with the safe or expected functional operation of a device, it may be optionally restricted to functioning only in certain functional conditions while in OPERATIONAL state. If the Checksum cannot be calculated the Abort Code "0x08 00 00 21" shall be returned. In this case, documentation shall be supplied detailing the proper condition to execute this command. All devices shall be able to calculate the checksum in PREOP without restriction. Even if the manufacturer chooses to store the checksum itself in non-volatile or volatile memory, the device shall perform the calculation at the time of executing this command and return this calculated value. This command shall therefore not return a value calculated prior to executing this command. |
|                     | 01   | Command                    | AR-RAY[0..3]<br>OF BYTE | RW                       | Read: Returns information about the supported checksum typeBit 0 = 0: no non-volatile parameters supportedBit 0 = 1: non-volatile parameters supported, at least 1 of the defined bits 1-7 shall be setBit 1 = 1: CRC-32Bit 2 = 1: MD5Bit 3 = 1: SHA-1Bit 4-6: Reserved, shall be 0Bit 7 = 1: other algorithmBit 8...31: Reserved, shall be 0Write: Checksum Type Selection and Start CalculationA write access to this subindex shall only set one bit true in Bit[0...7]. If other values are written the Abort Code "0x06040043 Parameter is incompatible" shall be returned.Bit 0 = 1: Use default checksum algorithm of the device Bit 1 = 1: CRC-32Bit 2 = 1: MD5Bit 3 = 1: SHA-1Bit 4-6: Reserved, shall be 0Bit 7 = 1: other algorithmBit 8...31: Reserved, shall be 0                                                                                                                                                                                        |
|                     | 02   | Status                     | USINT                   | RO                       | Supported values:0: Default value if the command has not been initiated. Not a supported value otherwise.1: last command completed, no error, reply there2: last command completed, error, no response3: Reserved3-99: Reserved,100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%)201-254: Reserved,255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                     | 03   | Response                   | AR-RAY[0..n]<br>OF BYTE | RO                       | Byte 0: see Subindex 2Byte 1: Unused - Shall be zeroByte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length shall be 64 bytes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

113) Idx = Index, sIdx = Subindex, hexadecimal

114) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet



| Idx <sup>113)</sup> | sidx | Name                    | Typ                 | Zu-griff <sup>114)</sup> | Beschreibung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------|------|-------------------------|---------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF4                |      | Load parameters command |                     | RO                       | Execution of this command will load all parameters from non-volatile memory. If a device automatically saves all non-volatile parameters at the time they are written, this command will not take any action. In the event that this command may interfere with the safe or expected functional operation of a device, it may be optionally restricted to functioning only in certain functional conditions while in OPERATIONAL state. If the command cannot be performed due to this operating condition, the Abort Code "0x08 00 00 21" shall be returned. In this case, documentation shall be supplied detailing the proper condition to execute this command. All devices shall be able to execute this command in PREOP without restriction. |
|                     | 01   | Command                 | ARRAY[0..3] OF BYTE | RW                       | Read: Bit 0 = 1: device loads the non-volatile parameters when writing 0xFB4:01 with 0x64616F6C<br>Bit 1 = 1: device saves the non-volatile parameters automatically when they are written<br>Bit 2-31: reserved, shall be 0<br>Write: All writable, non-volatile parameters will loaded from non-volatile memory when the following is sent:<br>Byte 0: 0x6C<br>Byte 1: 0x6F<br>Byte 2: 0x61<br>Byte 3: 0x64<br>If other values are written the Abort Code "0x06040043 General parameter incompatibility reason" shall be returned.                                                                                                                                                                                                                |
|                     | 02   | Status                  | USINT               | RO                       | Supported values:<br>0: last command completed, no error, no response<br>1: Reserved<br>2: last command completed, error, no response<br>3-99: Reserved<br>100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%)<br>201-254: Reserved<br>255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                                                                 |
|                     | 03   | Response                | ARRAY[0..1] OF BYTE | RO                       | Byte 0: see Subindex 2<br>Byte 1: Unused - Shall be zero ETG5003_                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

Tab. 75: CDP Command Objects

113) Idx = Index, sidx = Subindex, hexadezimal

114) RO = nur lesbar, RW = lesbar/schreibbar, P = für Prozessdaten geeignet



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# 1 About this manual

**IMPORTANT**

Read carefully before use.

Keep the manual for future consultation.

## 1.1 Validity

These operating instructions are a customer document of Pfeiffer Vacuum. The operating instructions describe the functions of the named product and provide the most important information for the safe use of the device. The description is written in accordance with the valid directives. The information in these operating instructions refers to the product's current development status. The document shall remain valid provided that the customer does not make any changes to the product.

### 1.1.1 Applicable documents

| Operating instructions           | Number     |
|----------------------------------|------------|
| Converter operating instructions | PT 0730 BN |

You can find this document in the [Pfeiffer Vacuum Download Center](#).

## 1.2 Target group

These operating instructions are aimed at all persons performing the following activities on the product:

- Transportation
- Setup (Installation)
- Usage and operation
- Decommissioning
- Maintenance and cleaning
- Storage or disposal

The work described in this document is only permitted to be performed by persons with the appropriate technical qualifications (expert personnel) or who have received the relevant training from Pfeiffer Vacuum.

## 1.3 Conventions

### 1.3.1 Instructions in the text

Usage instructions in the document follow a general structure that is complete in itself. The required action is indicated by an individual step or multi-part action steps.

**Individual action step**

A horizontal, solid triangle indicates the only step in an action.

- This is an individual action step.

**Sequence of multi-part action steps**

The numerical list indicates an action with multiple necessary steps.

1. Step 1
2. Step 2
3. ...

### 1.3.2 Pictographs

Pictographs used in the document indicate useful information.



Note



Tip

### 1.3.3 Abbreviations

| Abbreviation | Meaning in this document                                                           |
|--------------|------------------------------------------------------------------------------------|
| AI / AO      | Analog Input / Analog Output                                                       |
| DCU          | Display Control Unit                                                               |
| DI / DO      | Digital Input / Digital Output                                                     |
| EC           | EtherCAT® interface                                                                |
| f            | Rotation speed value of a vacuum pump (frequency, in rpm or Hz)                    |
| FE           | Functional earth                                                                   |
| HPU          | Handheld Programming Unit                                                          |
| LED          | Light emitting diode                                                               |
| P            | Power                                                                              |
| [P:xxx]      | Electronic drive unit parameter with number                                        |
| PE           | Protective earth (earthed conductor)                                               |
| t            | Time                                                                               |
| TM           | Turbopump electronic drive unit (turbo controller) and magnetic bearing controller |
| TPS          | Voltage supply (turbo power supply)                                                |

Tbl. 1: Abbreviations used in this document

### 1.3.4 Trademark proof



- EtherCAT® is a trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

## 2 Safety

### 2.1 Safety precautions

**Duty to provide information on potential dangers**

The product holder or user is obliged to make all operating personnel aware of dangers posed by this product.

Every person who is involved in the installation, operation or maintenance of the product must read, understand and adhere to the safety-related parts of this document.

**Infringement of conformity due to modifications to the product**

The Declaration of Conformity from the manufacturer is no longer valid if the operator changes the original product or installs additional equipment.

- Following the installation into a system, the operator is required to check and re-evaluate the conformity of the overall system in the context of the relevant European Directives, before commissioning that system.

**General safety precautions when handling the product**

- ▶ Use only power supply packs that comply with the applicable safety regulations.
- ▶ Observe all applicable safety and accident prevention regulations.
- ▶ Check that all safety measures are observed at regular intervals.
- ▶ Recommendation: Establish a secure connection to the grounded conductor (PE); protection class I or III.
- ▶ Never disconnect plug connections during operation.
- ▶ Keep lines and cables away from hot surfaces ( $> 70\text{ °C}$ ).
- ▶ Do not carry out your own conversions or modifications on the unit.
- ▶ Observe the unit protection degree prior to installation or operation in other environments.

### 2.2 Proper use

The EtherCAT option is used exclusively for the operation of Pfeiffer Vacuum vacuum pumps and their accessories in an EtherCAT system.

### 2.3 Foreseeable improper use

Improper use of the product invalidates all warranty and liability claims. Any use that is counter to the purpose of the product, whether intentional or unintentional, is regarded as improper use; in particular:

- Unauthorized installation, removal, conversion, or replacement

### 3 Product description

#### 3.1 Manual control elements

##### 3.1.1 Manual control elements

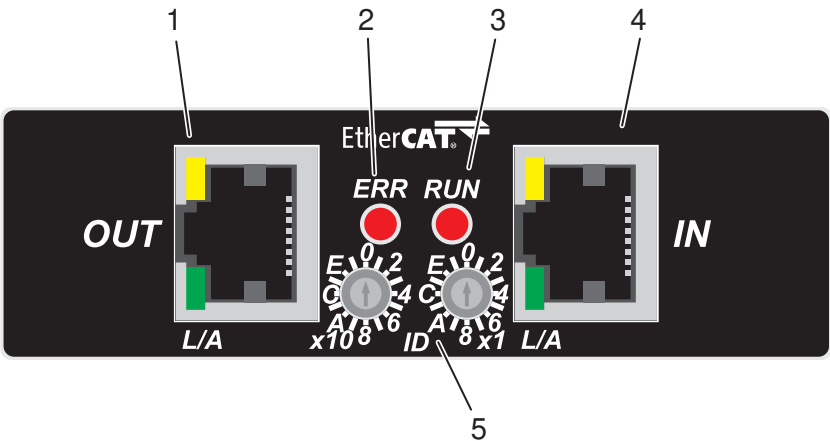


Fig. 2: EtherCAT option

- 1

OUT connection with status LED
- 2

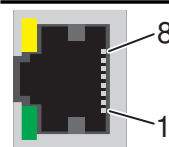
LED Error
- 3

LED Run
- 4

IN connection with status LED
- 5

Rotary coding switch

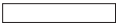
##### 3.1.2 Connections

|                                                                                     | Pin | Assignment |
|-------------------------------------------------------------------------------------|-----|------------|
|  | 1   | Rx+        |
|                                                                                     | 2   | Rx-        |
|                                                                                     | 3   | Tx+        |
|                                                                                     | 4   | n.c.       |
|                                                                                     | 5   | n.c.       |
|                                                                                     | 6   | Tx-        |
|                                                                                     | 7   | n.c.       |
|                                                                                     | 8   | n.c.       |

Tbl. 2: EtherCAT interface, connection assignment

##### 3.1.3 Operating mode display via LED

| Display                                                                                               | L/A  (green)<br>Connection | RUN  (green)<br>EtherCAT status                                                              | ERR  (red)<br>EtherCAT error |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Off<br>            | No connection                                                                                                 | "INIT": <ul style="list-style-type: none"><li>Initialization, no process or service data</li></ul>                                                                              | No error                                                                                                          |
| Rapid flashing<br> | –                                                                                                             | "SAFE OPERATIONAL": <ul style="list-style-type: none"><li>Process input data (unit --&gt; control) is valid</li><li>Output data (control --&gt; unit) in a safe state</li></ul> | Spontaneous status change                                                                                         |
| Flashing 2x<br>    | –                                                                                                             | –                                                                                                                                                                               | Connection lost                                                                                                   |

| Display                                                                                             | <b>L/A</b>  (green)<br>Connection | <b>RUN</b>  (green)<br>EtherCAT status | <b>ERR</b>  (red)<br>EtherCAT error |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Flashing<br>       | –                                                                                                                  | "PRE_OPERATIONAL":<br>• Service data only, no process data                                                              | Invalid configuration                                                                                                  |
| Permanently on<br> | Connection to next device, no activity                                                                             | "OPERATIONAL":<br>• Process input and output data is valid                                                              | Bootstrap                                                                                                              |
| Flickering<br>     | Connection active                                                                                                  | "BOOTSTRAP"                                                                                                             | Booting error                                                                                                          |

**Tbl. 3: Behavior and meaning of the LEDS of the EtherCAT interface**



## 4 Commissioning

### 4.1 Defining device ID

EtherCAT devices are always addressed using their position in the bus. There is no need to make conventional address settings.



#### Additional identification in the bus

Under certain conditions, it may be beneficial to perform additional (manual) identification, e.g., if there is a risk of mixing up multiple similar devices through incorrect cabling. Various configuration options exist for this.



Fig. 3: Hexadecimal coding switch

#### Explicit device identification

Recommended method as no additional configuration programs are required.

1. Take the rubber plug off the address selector switches.
2. Select this identification in the projection.
3. Set the device ID to the projected value.
  - Hexadecimal 00h to FFh corresponds to decimal 2 to 255.
  - The new value is transferred from "Voltage on/off".
4. After replacing a device, use the ID of the older device.
5. Position the rubber plugs straight and as deep as possible to achieve the stated protection degree.

#### Station alias

A suitable configuration program must be used as a prerequisite.

1. Select this identification in the projection.
2. Allocate the device online "Station alias".
  - This new value applies after a "Reset".
3. Repeat this procedure after replacing a device.

### 4.2 Making connections

Integration into an EtherCAT bus system is possible with the "OUT" and "IN" connections. The interface is galvanically safe and is isolated from the maximum supply voltage.

## 5 Operation

### 5.1 Operating multi-stage roots pump A 200 L via EtherCAT

#### 5.1.1 Process data: A 200 L

##### Process output data

Process output data are:

- Default RxPDO (control --> A 200 L, "output"), CoE 1600h.1 – 4 (1 Byte)

| Byte.Bit | CoE <sup>115)</sup>                      | Meaning                         |
|----------|------------------------------------------|---------------------------------|
| 0.0      | 0x7000.0x01: Roughing start/stop         | Pumping station (0: off, 1: on) |
| 0.1      | 0x7000.0x04: Low speed (idle/green mode) | No function                     |
| 0.2 – 7. |                                          | Reserved                        |

**Tbl. 4: Process output data**

##### Process input data

Process input data are:

- Default TxPDO (A 200 L --> control, "input"), CoE 1A00h.1 – 11 (7 Byte)

| Byte.Bit  | CoE <sup>116)</sup>                      | Meaning                         |
|-----------|------------------------------------------|---------------------------------|
| 0.0       | 0x6000.0x01: Roughing run/stop           | Pumping station (0: off, 1: on) |
| 0.1       | 0x6000.0x02: Booster run/stop            | Constant 0                      |
| 0.2       | 0x6000.0x04: Low speed (idle/green mode) | Constant 0                      |
| 0.3       | 0x6000.0x05: Remote/Local                | 0: ECAT, 1: Local               |
| 0.4       | 0x6000.0x09: Warning                     | 0: No warning, 1: Warning       |
| 0.5       | 0x6000.0x0A: Alarm                       | 0: No alarm, 1: Alarm           |
| 0.6       | 0x6000.0x0B: Emergency Off               | 0: Normal, 1: Stop              |
| 0.7       | 0x6000.0x0C: N2 flow low                 | 0: Normal, 1: N2 flow low       |
| 1st – 2.  | 0x6001.0x02: N2 flow                     | Constant 0                      |
| 3. – 4.   | 0x6001.0x03: Exhaust pressure            | Constant 0                      |
| 5. – 6.   | 0x6001.0x05: Roughing case temperature   | Constant 0                      |
| 7. – 8.   | 0x6001.0x09: Roughing current            | 0.1 A                           |
| 9. – 10.  | 0x6001.0x0A: Roughing power              | 0.1 kW                          |
| 11. – 12. | 0x6001.0x0B: Roughing speed              | 0.1% of rated speed             |
| 13. – 14. | 0x6002.0x05: Booster case temperature    | Constant 0                      |
| 15. – 16. | 0x6002.0x09: Booster current             | Constant 0                      |
| 17. – 18. | 0x6002.0x0A: Booster power               | Constant 0                      |
| 19. – 20. | 0x6002.0x0B: Booster speed               | Constant 0                      |

**Tbl. 5: Process input data**

##### Compile process data alternative from CoE objects

1. Always conduct the state "PRE-OPERATIONAL".
2. Describe the object 1601h.0 or 1A01h.0 with 0.
3. Describe the object 1601h.1-n or 1A01h.1-n with corresponding CoE indices.
4. Use only objects marked with "P".
5. Assign the sub-index 1-n on a sequential basis only and without gaps.
6. Make sure that the data yields a total number of bytes (use pad bits if needed) and start with whole bytes (exception BOOL).

<sup>115)</sup> Hexadecimal

<sup>116)</sup> Hexadecimal

7. Describe maximum 12 objects per PDO.
8. Describe the object 1601h.0 or 1A01h.0 with the number n of objects to be used.
9. Change object 1C12h.1 to 1601h or 1C13h.1 to 1A01h.
10. In the process data, select the corresponding PDO assignment 1601h or 1A01h.

**Sync Manager:**

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

**PDO List:**

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

**PDO Assignment (0x1C12):**

☐ 0x1600 (excluded by 0x1601)

☒ 0x1601

**PDO Content (0x1601):**

| Index     | Size | Offs | Name                  | Type |
|-----------|------|------|-----------------------|------|
| 0x7000:01 | 0.1  | 0.0  | Turbo Start Stop      | BOOL |
| 0x7000:03 | 0.1  | 0.1  | Turbo Low Speed       | BOOL |
| 0x3005:11 | 0.1  | 0.2  | Vnt. Enable           | BOOL |
| 0x3005:21 | 0.1  | 0.3  | Sig. Enable           | BOOL |
| ...       | 0.4  | 0.4  | ...                   | ...  |
| 0x8000:03 | 2.0  | 1.0  | Normal Speed Setpoint | UINT |
|           |      | 3.0  |                       |      |

**Download:**

☒ PDO Assignment

☒ PDO Configuration

**Sync Manager:**

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

**PDO List:**

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

**PDO Assignment (0x1C12):**

☐ 0x1A00 (excluded by 0x1A01)

☒ 0x1A01

**PDO Content (0x1601):**

| Index     | Size | Offs | Name                | Type  |
|-----------|------|------|---------------------|-------|
| 0x6000:09 | 0.1  | 0.0  | Alarm               | BOOL  |
| 0x6000:0A | 0.1  | 0.1  | Warning             | BOOL  |
| 0x2001:88 | 0.1  | 0.2  | Ready for Process   | BOOL  |
| ...       | 0.5  | 0.3  | ...                 | ...   |
| 0x2001:81 | 1.0  | 1.0  | Status              | USINT |
| 0x2001:82 | 1.0  | 2.0  | Actual Speed (rel.) | SINT  |
| 0x2002:13 | 2.0  | 3.0  | Power               | INT   |
| 0x2002:88 | 2.0  | 5.0  | Pmp. Temperature    | INT   |
|           |      | 7.0  |                     |       |

**Download:**

☒ PDO Assignment

☒ PDO Configuration

Output data including 4 pad bits

Input data including 5 pad bits

Tbl. 6: Example for a process data configuration

## 5.1.2 Service data: A 200 L

| Type      | Description                            |
|-----------|----------------------------------------|
| BOOL      | Binary value (yes/no)                  |
| BYTE( )   | Single byte number                     |
| STRING( ) | Character string                       |
| USINT     | Positive integer, 8 bit                |
| UINT      | Positive integer, 16 bit               |
| UDINT     | Positive integer, 32 bit               |
| ULINT     | Positive integer, 64 bit               |
| SINT      | Integer, 8 bit                         |
| INT       | Integer, 16 bit                        |
| DINT      | Integer, 32 bit                        |
| REAL      | Floating point value, single precision |

Tbl. 7: Data types of the service data

The following CoE objects are available for access to individual data objects (e.g., for configuration):

### Administrative data (information about the device, communication)

| Idx <sup>117)</sup> | sldx | Name                          | Type      | Access <sup>118)</sup> | Description                                                                                                                                                                    |
|---------------------|------|-------------------------------|-----------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000                |      | Device type                   | UDINT     | RO                     | Bit 0-15: Device profile number (5003).<br>NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B)<br>Bit 16-31: 0x0000 sub-profile number is defined in 0xF010 bit 15..0 |
| 1008                |      | Manufacturer device name      | STRING(n) | RO                     | Name of the device as non-zero terminated string.                                                                                                                              |
| 1009                |      | Manufacturer hardware version | STRING(n) | RO                     | Hardware version of the device as non-zero terminated string.                                                                                                                  |

<sup>117)</sup> Idx = Index, sldx = Sub-index, Hexadecimal

<sup>118)</sup> RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>117)</sup> | sIdx | Name                                         | Type      | Access <sup>118)</sup> | Description                                                     |
|---------------------|------|----------------------------------------------|-----------|------------------------|-----------------------------------------------------------------|
| 100 A               |      | Manufacturer software version                | STRING(n) | RO                     | Software version of the device as non-zero terminated string.   |
| 100B                |      | Manufacturer bootloader version              | STRING(n) | RO                     | Bootloader version of the device as non-zero terminated string. |
| 1018                |      | Identity object                              | IDENTITY  | RO                     |                                                                 |
|                     | 01   | Vendor ID                                    | UDINT     | RO                     |                                                                 |
|                     | 02   | Product code                                 | UDINT     | RO                     |                                                                 |
|                     | 03   | Revision number                              | UDINT     | RO                     |                                                                 |
|                     | 04   | Serial number                                | UDINT     | RO                     |                                                                 |
| 10F8                |      | Timestamp object                             | ULINT     | RO                     | Local timestamp of the device in ns.                            |
| 1600                |      | SDP default RxPDO                            |           |                        |                                                                 |
|                     | 01h  |                                              |           |                        | 0x7000.0x01: Roughing start/stop                                |
|                     | 02h  |                                              |           |                        | 0x7000.0x04: Low speed (idle/green mode)                        |
|                     | 03h  |                                              |           |                        |                                                                 |
| 1601                |      | User RxPDO                                   |           |                        |                                                                 |
| 1A00                |      | SDP default TxPDO                            |           |                        |                                                                 |
|                     | 01h  |                                              |           |                        | 0x6000.0x01: Roughing run/stop                                  |
|                     | 02h  |                                              |           |                        | 0x6000.0x02: Booster run/stop                                   |
|                     | 03h  |                                              |           |                        | 0x6000.0x04: Low speed (idle/green mode)                        |
|                     | 04h  |                                              |           |                        | 0x6000.0x05: Remote/local                                       |
|                     | 05h  |                                              |           |                        | 0x6000.0x09: Warning                                            |
|                     | 06h  |                                              |           |                        | 0x6000.0x0A: Alarm                                              |
|                     | 07h  |                                              |           |                        | 0x6000.0x0B: Emergency off                                      |
|                     | 08h  |                                              |           |                        | 0x6000.0x0C: N2 flow low                                        |
|                     | 09h  |                                              |           |                        | 0x6001.0x02: N2 flow                                            |
|                     | 0Ah  |                                              |           |                        | 0x6001.0x03: Exhaust pressure                                   |
|                     | 0Bh  |                                              |           |                        | 0x6001.0x05: Roughing case temperature                          |
|                     | 0Ch  |                                              |           |                        | 0x6001.0x09: Roughing current                                   |
|                     | 0Dh  |                                              |           |                        | 0x6001.0x0A: Roughing power                                     |
|                     | 0Eh  |                                              |           |                        | 0x6001.0x0B: Roughing speed                                     |
|                     | 0Fh  |                                              |           |                        | 0x6002.0x05: Booster case temperature                           |
|                     | 10h  |                                              |           |                        | 0x6002.0x09: Booster current                                    |
|                     | 11h  |                                              |           |                        | 0x6002.0x0A: Booster power                                      |
|                     | 12h  |                                              |           |                        | 0x6002.0x0B: Booster speed                                      |
| 1A01                |      | User TxPDO                                   |           |                        |                                                                 |
| 1C00                |      | Sync manager type                            |           |                        |                                                                 |
| 1C10                |      | Sync manager 0 PDO assignment                |           |                        |                                                                 |
| 1C11                |      | Sync manager 1 PDO assignment                |           |                        |                                                                 |
| 1C12                |      | RxPDO assign (sync manager 2 PDO assignment) |           |                        |                                                                 |

117) Idx = Index, sIdx = Sub-index, Hexadecimal

118) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>117)</sup> | sIdx    | Name                                         | Type | Access <sup>118)</sup> | Description |
|---------------------|---------|----------------------------------------------|------|------------------------|-------------|
| 1C13                |         | TxPDO assign (sync manager 3 PDO assignment) |      |                        |             |
| 1C32                | Partial | Output sync manager parameter                |      | RO                     |             |
|                     | 01h     | Synchronization type                         | UINT | RO                     |             |
| 1C33                | Partial | Input sync manager parameter                 |      | RO                     |             |
|                     | 01h     | Synchronization type                         |      | RO                     |             |

**Tbl. 8: Communication area – administrative data (information about the device, communication)**

**Input data (A 200 L --> control)**

| Idx <sup>119)</sup> | sIdx    | Name                         | Type      | Access <sup>120)</sup> | Description                                                                |
|---------------------|---------|------------------------------|-----------|------------------------|----------------------------------------------------------------------------|
| 2000                | Partial | In identity/status           |           | RO                     |                                                                            |
|                     | 01      | Manufacturer (main)          | STRING(n) | RO                     |                                                                            |
|                     | 02      | Device name (main)           | STRING(n) | RO                     |                                                                            |
|                     | 03      | Serial number (main)         | STRING(n) | RO                     |                                                                            |
|                     | 04      | Hardware version (main)      | STRING(n) | RO                     |                                                                            |
|                     | 05      | Firmware version (main)      | STRING(n) | RO                     |                                                                            |
|                     | 08      | Status code (main)           | UINT      | RO                     | PV485 error code. Warnings have an offset of 1000; i.e.: 1001 -> Warning 1 |
|                     | 22      | Device name (interface)      | STRING(n) | RO                     |                                                                            |
|                     | 24      | Hardware version (interface) | STRING(n) | RO                     |                                                                            |
|                     | 25      | Firmware version (interface) | STRING(n) | RO                     |                                                                            |
| 2001                | Partial | In operation                 |           | RO                     |                                                                            |
|                     | 01      | Status (main)                | UDINT     | RO                     |                                                                            |
| 2003                | Partial | In diagnostic                |           | RO                     |                                                                            |
|                     | 08      | Error details (main)         | UDINT     | RO                     |                                                                            |
|                     | 09      | Warning details (main)       | UDINT     | RO                     |                                                                            |

**Tbl. 9: Input data**

**Input data (A 200 L --> control)**

| Idx <sup>121)</sup> | sIdx | Name                        | Type | Access <sup>122)</sup> | Description       |
|---------------------|------|-----------------------------|------|------------------------|-------------------|
| 6000                |      | Roughing and booster status |      | RO                     |                   |
|                     | 01   | Roughing run/stop           | BOOL | RO                     | 1: Run<br>0: Stop |

117) Idx = Index, sIdx = Sub-index, Hexadecimal

118) RO = read only, RW = read/write, P = suitable for process data

119) Idx = Index, sIdx = Sub-index, Hexadecimal

120) RO = read only, RW = read/write, P = suitable for process data

121) Idx = Index, sIdx = Sub-index, Hexadecimal

122) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>121)</sup> | sidx | Name                              | Type | Access <sup>122)</sup> | Description                                                        |
|---------------------|------|-----------------------------------|------|------------------------|--------------------------------------------------------------------|
|                     | 04   | Low speed (idle/sleep/green mode) | BOOL | RO                     | 1: Low speed (idle /sleep / green mode)<br>0: Normal               |
|                     | 05   | Remote/local                      | BOOL | RO                     | 1: Local. Hand control enabled<br>0: Remote. E-cat control enabled |
|                     | 07   | Pump interlock                    | BOOL | RO                     | 1: OK, process may proceed<br>0: Process must not run              |
|                     | 09   | Warning                           | BOOL | RO                     | 1: Warning<br>0: Normal                                            |
|                     | 0 A  | Alarm                             | BOOL | RO                     | 1: Alarm<br>0: Normal                                              |
|                     | 0B   | Emergency off                     | BOOL | RO                     | 1: Stop<br>0: Normal                                               |
|                     | 0C   | N2 flow low                       | BOOL | RO                     | 1: N2 flow low<br>0: Normal                                        |
| 6001                |      | Roughing analog inputs            |      |                        |                                                                    |
|                     | 02   | N2 flow                           | INT  | RO                     | 0.1 [slm]                                                          |
|                     | 03   | Exhaust pressure                  | INT  | RO                     | Gauge pressure (not absolute) - 1 [kPa]                            |
|                     | 05   | Roughing case temperature         | INT  | RO                     | Degrees Celsius                                                    |
|                     | 09   | Roughing current                  | INT  | RO                     | 0.1 [A]                                                            |
|                     | 0 A  | Roughing power                    | INT  | RO                     | 0.1 [kW]                                                           |
|                     | 0B   | Roughing speed                    | INT  | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%) 0 rotation, 0.1 [%]         |
| 6002                |      | Booster analog inputs             |      | RO                     |                                                                    |
|                     | 05   | Booster case temperature          | INT  | RO                     | Degrees Celsius                                                    |
|                     | 09   | Booster current                   | INT  | RO                     | 0.1 [A]                                                            |
|                     | 0 A  | Booster power                     | INT  | RO                     | 0.1 [kW]                                                           |
|                     | 0B   | Booster speed                     | INT  | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%): 0 rotation, 0.1 [%]        |

Tbl. 10: Input area

## Output data (control --&gt; A 200 L)

| Idx <sup>123)</sup> | sidx | Name                                  | Type | Access <sup>124)</sup> | Description                                           |
|---------------------|------|---------------------------------------|------|------------------------|-------------------------------------------------------|
| 7000                |      | Roughing and booster control          |      | RO                     |                                                       |
|                     | 01   | Roughing start/stop                   | BOOL | RW                     | 1: Run<br>0: Stop (roughing pump exists)              |
|                     | 04   | Low speed (idle / sleep / green mode) | BOOL | RW                     | 1: Low speed (idle / sleep / green mode)<br>0: Normal |

Tbl. 11: Output area

121) Idx = Index, sidx = Sub-index, Hexadecimal

122) RO = read only, RW = read/write, P = suitable for process data

123) Idx = Index, sidx = Sub-index, Hexadecimal

124) RO = read only, RW = read/write, P = suitable for process data

**Configuration data (control --> A 200 L)**

| Idx <sup>125)</sup> | sIdx | Name                               | Type | Access <sup>126)</sup> | Description                                                                                                                                                                           |
|---------------------|------|------------------------------------|------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8001                |      | Roughing and booster configuration |      | RO                     |                                                                                                                                                                                       |
|                     | 01   | Safe state                         | UINT | RW                     | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - pumps stop<br>2: Maintain state, exit low speed (idle/sleep mode) = 0 (normal speed) |

**Tbl. 12: Configuration area****Information data (A 200 L --> control)**

| Idx <sup>127)</sup> | sIdx | Name                              | Type  | Access <sup>128)</sup> | Description                                           |
|---------------------|------|-----------------------------------|-------|------------------------|-------------------------------------------------------|
| 9000                |      | Roughing and booster information  |       | RO                     |                                                       |
|                     | 01   | Roughing exists                   | BOOL  | RO                     | 0: not available<br>1: available                      |
|                     | 02   | Booster exists                    | BOOL  | RO                     | 0: not available<br>1: available                      |
|                     | 03   | Booster 2 exists                  | BOOL  | RO                     | 0: not available<br>1: available                      |
|                     | 11   | Roughing and booster running time | UDINT | RO                     | Running time since manufacture or service - 1 [hours] |

**Tbl. 13: Information area****Semiconductor device profile area**

| Idx <sup>129)</sup> | sIdx | Name                         | Type  | Access <sup>130)</sup> | Description |
|---------------------|------|------------------------------|-------|------------------------|-------------|
| F000                |      | Semiconductor device profile |       | RO                     |             |
|                     | 01   | Index distance               | UINT  |                        |             |
|                     | 02   | Maximum number of modules    | UINT  |                        |             |
| F010                |      | Module profile list          |       | RO                     |             |
|                     | 01   |                              | UDINT | RO                     |             |

**Tbl. 14: Semiconductor device profile area**

125) Idx = Index, sIdx = Sub-index, Hexadecimal

126) RO = read only, RW = read/write, P = suitable for process data

127) Idx = Index, sIdx = Sub-index, Hexadecimal

128) RO = read only, RW = read/write, P = suitable for process data

129) Idx = Index, sIdx = Sub-index, Hexadecimal

130) RO = read only, RW = read/write, P = suitable for process data

## Exception handling

| Idx <sup>131)</sup> | sldx | Name                                                 | Type  | Access <sup>132)</sup> | Description                                                                                                                     |
|---------------------|------|------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380                |      | Active exception status                              | USINT | RO                     | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning                                 |       |                        | Bit0: Device warning                                                                                                            |
|                     |      | Bit1: Manufacturer warning                           |       |                        | Bit1: Manufacturer warning                                                                                                      |
|                     |      | Bit2: Device error                                   |       |                        | Bit2: Device error                                                                                                              |
|                     |      | Bit3: Manufacturer error                             |       |                        | Bit3: Manufacturer error                                                                                                        |
|                     |      | Bit4: Reserved                                       |       |                        | Bit4: Reserved                                                                                                                  |
|                     |      | Bit5: Reserved                                       |       |                        | Bit5: Reserved                                                                                                                  |
|                     |      | Bit6: Reserved                                       |       |                        | Bit6: Reserved                                                                                                                  |
|                     |      | Bit7: Reserved                                       |       |                        | Bit7: Reserved                                                                                                                  |
| F381                |      | Roughing and booster 1 to 255: Active warning detail |       | RO                     |                                                                                                                                 |
|                     | 01   |                                                      | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available                         |
|                     |      | Bit0: EMO                                            |       |                        | Bit0: EMO                                                                                                                       |
|                     |      | Bit1: Water leak                                     |       |                        | Bit1: Water leak                                                                                                                |
|                     |      | Bit2: Power fail open phase                          |       |                        | Bit2: Power fail open phase                                                                                                     |
|                     |      | Bit3: Reverse phase                                  |       |                        | Bit3: Reverse phase                                                                                                             |
|                     |      | Bit4: Coolant flow                                   |       |                        | Bit4: Coolant flow                                                                                                              |
|                     |      | Bit5: N2 flow                                        |       |                        | Bit5: N2 flow                                                                                                                   |
|                     |      | Bit6: Exhaust pressure                               |       |                        | Bit6: Exhaust pressure                                                                                                          |
|                     |      | Bit7: Exhaust temp.                                  |       |                        | Bit7: Exhaust temp.                                                                                                             |
|                     |      | Bit8: Main controller err/batt low                   |       |                        | Bit8: Main controller err/batt low                                                                                              |
|                     |      | Bit9: Roughing case temp                             |       |                        | Bit9: Roughing case temp                                                                                                        |
|                     |      | Bit10: Roughing motor temp                           |       |                        | Bit10: Roughing motor temp                                                                                                      |
|                     |      | Bit11: Roughing current                              |       |                        | Bit11: Roughing current                                                                                                         |
|                     |      | Bit12: Roughing speed                                |       |                        | Bit12: Roughing speed                                                                                                           |
|                     |      | Bit13: Roughing lock rotor                           |       |                        | Bit13: Roughing lock rotor                                                                                                      |
|                     |      | Bit14: Roughing motor driver err                     |       |                        | Bit14: Roughing motor driver err                                                                                                |
|                     |      | Bit15: Booster case temp.                            |       |                        | Bit15: Booster case temp                                                                                                        |
|                     |      | Bit16: Booster motor temp.                           |       |                        | Bit16: Booster motor temp                                                                                                       |
|                     |      | Bit17: Booster current                               |       |                        | Bit17: Booster current                                                                                                          |
|                     |      | Bit18: Booster speed                                 |       |                        | Bit18: Booster speed                                                                                                            |
|                     |      | Bit19: Booster lock rotor                            |       |                        | Bit19: Booster lock rotor                                                                                                       |
|                     |      | Bit20: Booster motor driver err                      |       |                        | Bit20: Booster motor driver err                                                                                                 |
|                     |      | Bit21: Booster 2 case temp.                          |       |                        | Bit21: Booster 2 case temp.                                                                                                     |
|                     |      | Bit22: Booster 2 motor temp.                         |       |                        | Bit22: Booster 2 motor temp.                                                                                                    |
|                     |      | Bit23: Booster 2 current                             |       |                        | Bit23: Booster 2 current                                                                                                        |
|                     |      | Bit24: Booster 2 speed                               |       |                        | Bit24: Booster 2 speed                                                                                                          |

131) Idx = Index, sldx = Sub-index, Hexadecimal

132) RO = read only, RW = read/write, P = suitable for process data



| Idx <sup>131)</sup> | sldx | Name                                                       | Type  | Access <sup>132)</sup> | Description                                                                                             |
|---------------------|------|------------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit25: Booster 2 lock rotor                                |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                          |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                      |       |                        | Bit27: Gate valve err                                                                                   |
|                     |      | Bit28: Future use                                          |       |                        | Bit28: Future use                                                                                       |
|                     |      | Bit29: Future use                                          |       |                        | Bit29: Future use                                                                                       |
|                     |      | Bit30: Future use                                          |       |                        | Bit30: Future use                                                                                       |
|                     |      | Bit31: Others                                              |       |                        | Bit31: Others                                                                                           |
| F383                |      | Roughing and booster 1 to 255: Active error (alarm) detail |       | RO                     |                                                                                                         |
|                     | 01   |                                                            | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: EMO                                                  |       |                        | Bit0: EMO                                                                                               |
|                     |      | Bit1: Water leak                                           |       |                        | Bit1: Water leak                                                                                        |
|                     |      | Bit2: Power fail open phase                                |       |                        | Bit2: Power fail open phase                                                                             |
|                     |      | Bit3: Reverse phase                                        |       |                        | Bit3: Reverse phase                                                                                     |
|                     |      | Bit 4: Coolant flow                                        |       |                        | Bit 4: Coolant flow                                                                                     |
|                     |      | Bit5: N2 flow                                              |       |                        | Bit5: N2 flow                                                                                           |
|                     |      | Bit6: Exhaust pressure                                     |       |                        | Bit6: Exhaust pressure                                                                                  |
|                     |      | Bit7: Exhaust temp.                                        |       |                        | Bit7: Exhaust temp.                                                                                     |
|                     |      | Bit8: Main controller err/batt low                         |       |                        | Bit8: Main controller err/batt low                                                                      |
|                     |      | Bit9: Roughing case temp                                   |       |                        | Bit9: Roughing case temp                                                                                |
|                     |      | Bit10: Roughing motor temp                                 |       |                        | Bit10: Roughing motor temp                                                                              |
|                     |      | Bit11: Roughing current                                    |       |                        | Bit11: Roughing current                                                                                 |
|                     |      | Bit12: Roughing speed                                      |       |                        | Bit12: Roughing speed                                                                                   |
|                     |      | Bit13: Roughing lock rotor                                 |       |                        | Bit13: Roughing lock rotor                                                                              |
|                     |      | Bit14: Roughing motor driver err                           |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                  |       |                        | Bit15: Booster case temp.                                                                               |
|                     |      | Bit16: Booster motor temp.                                 |       |                        | Bit16: Booster motor temp.                                                                              |
|                     |      | Bit17: Booster current                                     |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                       |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                  |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                            |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                |       |                        | Bit21: Booster 2 case temp.                                                                             |
|                     |      | Bit22: Booster 2 motor temp.                               |       |                        | Bit22: Booster 2 motor temp.                                                                            |
|                     |      | Bit23: Booster 2 current                                   |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                     |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                          |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                      |       |                        | Bit27: Gate valve err                                                                                   |
|                     |      | Bit28: Future use                                          |       |                        | Bit28: Future use                                                                                       |

131) Idx = Index, sldx = Sub-index, Hexadecimal

132) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>131)</sup> | sldx | Name                                                  | Type  | Access <sup>132)</sup> | Description                                                                                                              |
|---------------------|------|-------------------------------------------------------|-------|------------------------|--------------------------------------------------------------------------------------------------------------------------|
|                     |      | Bit29: Future use                                     |       |                        | Bit29: Future use                                                                                                        |
|                     |      | Bit30: Future use                                     |       |                        | Bit30: Future use                                                                                                        |
|                     |      | Bit31: Others                                         |       |                        | Bit31: Others                                                                                                            |
| F390                |      | Latched exception status                              | USINT | RO                     | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning                                  |       |                        | Bit0: Device warning                                                                                                     |
|                     |      | Bit1: Manufacturer warning                            |       |                        | Bit1: Manufacturer warning                                                                                               |
|                     |      | Bit2: Device error                                    |       |                        | Bit2: Device error                                                                                                       |
|                     |      | Bit3: Manufacturer error                              |       |                        | Bit3: Manufacturer error                                                                                                 |
|                     |      | Bit4: Reserved                                        |       |                        | Bit4: Reserved                                                                                                           |
|                     |      | Bit5: Reserved                                        |       |                        | Bit5: Reserved                                                                                                           |
|                     |      | Bit6: Reserved                                        |       |                        | Bit6: Reserved                                                                                                           |
|                     |      | Bit7: Reserved                                        |       |                        | Bit7: Reserved                                                                                                           |
| F391                |      | Roughing and booster 1 to 255: Latched warning detail |       | RO                     |                                                                                                                          |
|                     | 01   |                                                       | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available                  |
|                     |      | Bit0: EMO                                             |       |                        | Bit0: EMO                                                                                                                |
|                     |      | Bit1: Water leak                                      |       |                        | Bit1: Water leak                                                                                                         |
|                     |      | Bit2: Power fail open phase                           |       |                        | Bit2: Power fail open phase                                                                                              |
|                     |      | Bit3: Reverse phase                                   |       |                        | Bit3: Reverse phase                                                                                                      |
|                     |      | Bit4: Coolant flow                                    |       |                        | Bit4: Coolant flow                                                                                                       |
|                     |      | Bit5: N2 flow                                         |       |                        | Bit5: N2 flow                                                                                                            |
|                     |      | Bit6: Exhaust pressure                                |       |                        | Bit6: Exhaust pressure                                                                                                   |
|                     |      | Bit7: Exhaust temp.                                   |       |                        | Bit7: Exhaust temp.                                                                                                      |
|                     |      | Bit8: Main controller err/batt low                    |       |                        | Bit8: Main controller err/batt low                                                                                       |
|                     |      | Bit9: Roughing case temp                              |       |                        | Bit9: Roughing case temp                                                                                                 |
|                     |      | Bit10: Roughing motor temp                            |       |                        | Bit10: Roughing motor temp                                                                                               |
|                     |      | Bit11: Roughing current                               |       |                        | Bit11: Roughing current                                                                                                  |
|                     |      | Bit12: Roughing speed                                 |       |                        | Bit12: Roughing speed                                                                                                    |
|                     |      | Bit13: Roughing lock rotor                            |       |                        | Bit13: Roughing lock rotor                                                                                               |
|                     |      | Bit14: Roughing motor driver err                      |       |                        | Bit14: Roughing motor driver err                                                                                         |
|                     |      | Bit15: Booster case temp.                             |       |                        | Bit15: Booster case temp.                                                                                                |
|                     |      | Bit16: Booster motor temp.                            |       |                        | Bit16: Booster motor temp.                                                                                               |
|                     |      | Bit17: Booster current                                |       |                        | Bit17: Booster current                                                                                                   |
|                     |      | Bit18: Booster speed                                  |       |                        | Bit18: Booster speed                                                                                                     |
|                     |      | Bit19: Booster lock rotor                             |       |                        | Bit19: Booster lock rotor                                                                                                |
|                     |      | Bit20: Booster motor driver err                       |       |                        | Bit20: Booster motor driver err                                                                                          |
|                     |      | Bit21: Booster 2 case temp.                           |       |                        | Bit21: Booster 2 case temp.                                                                                              |
|                     |      | Bit22: Booster 2 motor temp.                          |       |                        | Bit22: Booster 2 motor temp.                                                                                             |
|                     |      | Bit23: Booster 2 current                              |       |                        | Bit23: Booster 2 current                                                                                                 |

131) Idx = Index, sldx = Sub-index, Hexadecimal

132) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>131)</sup> | sldx | Name                                                        | Type  | Access <sup>132)</sup> | Description                                                                                             |
|---------------------|------|-------------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit24: Booster 2 speed                                      |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                 |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                           |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                       |       |                        | Bit27: Gate valve err                                                                                   |
|                     |      | Bit28: Future use                                           |       |                        | Bit28: Future use                                                                                       |
|                     |      | Bit29: Future use                                           |       |                        | Bit29: Future use                                                                                       |
|                     |      | Bit30: Future use                                           |       |                        | Bit30: Future use                                                                                       |
|                     |      | Bit31: Others                                               |       |                        | Bit31: Others                                                                                           |
| F393                |      | Roughing and booster 1 to 255: Latched error (alarm) detail |       | RO                     |                                                                                                         |
|                     | 01   |                                                             | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available |
|                     |      | Bit0: EMO                                                   |       |                        | Bit0: EMO                                                                                               |
|                     |      | Bit1: Water leak                                            |       |                        | Bit1: Water leak                                                                                        |
|                     |      | Bit2: Power fail open phase                                 |       |                        | Bit2: Power fail open phase                                                                             |
|                     |      | Bit3: Reverse phase                                         |       |                        | Bit3: Reverse phase                                                                                     |
|                     |      | Bit4: Coolant flow                                          |       |                        | Bit4: Coolant flow                                                                                      |
|                     |      | Bit5: N2 flow                                               |       |                        | Bit5: N2 flow                                                                                           |
|                     |      | Bit6: Exhaust pressure                                      |       |                        | Bit6: Exhaust pressure                                                                                  |
|                     |      | Bit7: Exhaust temp.                                         |       |                        | Bit7: Exhaust temp.                                                                                     |
|                     |      | Bit8: Main controller err/batt low                          |       |                        | Bit8: Main controller err/batt low                                                                      |
|                     |      | Bit9: Roughing case temp                                    |       |                        | Bit9: Roughing case temp                                                                                |
|                     |      | Bit10: Roughing motor temp                                  |       |                        | Bit10: Roughing motor temp                                                                              |
|                     |      | Bit11: Roughing current                                     |       |                        | Bit11: Roughing current                                                                                 |
|                     |      | Bit12: Roughing speed                                       |       |                        | Bit12: Roughing speed                                                                                   |
|                     |      | Bit13: Roughing lock rotor                                  |       |                        | Bit13: Roughing lock rotor                                                                              |
|                     |      | Bit14: Roughing motor driver err                            |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                   |       |                        | Bit15: Booster case temp.                                                                               |
|                     |      | Bit16: Booster motor temp.                                  |       |                        | Bit16: Booster motor temp.                                                                              |
|                     |      | Bit17: Booster current                                      |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                        |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                   |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                             |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                 |       |                        | Bit21: Booster 2 case temp.                                                                             |
|                     |      | Bit22: Booster 2 motor temp.                                |       |                        | Bit22: Booster 2 motor temp.                                                                            |
|                     |      | Bit23: Booster 2 current                                    |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                      |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                 |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                           |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                       |       |                        | Bit27: Gate valve err                                                                                   |

131) Idx = Index, sldx = Sub-index, Hexadecimal

132) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>131)</sup> | sldx | Name                                              | Type  | Access <sup>132)</sup> | Description                                                                                                                                                                                                                         |
|---------------------|------|---------------------------------------------------|-------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |      | Bit28: Future use                                 |       |                        | Bit28: Future use                                                                                                                                                                                                                   |
|                     |      | Bit29: Future use                                 |       |                        | Bit29: Future use                                                                                                                                                                                                                   |
|                     |      | Bit30: Future use                                 |       |                        | Bit30: Future use                                                                                                                                                                                                                   |
|                     |      | Bit31: Others                                     |       |                        | Bit31: Others                                                                                                                                                                                                                       |
| F3A1                |      | Roughing and booster 1 to 255: Warning mask       |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   |                                                   | UDINT | RW                     | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3                |      | Roughing and booster 1 to 255: Error (alarm) mask |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   |                                                   | UDINT | RW                     | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |
| F6F0                |      | Input latch local timestamp                       |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   | Input latch local timestamp                       | UDINT | RO                     | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up.                                                                                                                  |

Tbl. 15: Exception handling

## CDP-specific information data

| Idx <sup>133)</sup> | sldx | Name                             | Type      | Access <sup>134)</sup> | Description                                                                                                         |
|---------------------|------|----------------------------------|-----------|------------------------|---------------------------------------------------------------------------------------------------------------------|
| F9F0                |      | Manufacturer serial number       | STRING(n) | RO                     | String representing the manufacturer's serial number for the device.                                                |
| F9F1                |      | CDP functional generation number |           | RO                     |                                                                                                                     |
|                     | 01   |                                  | UDINT     | RO                     | Common device profile functional generation number                                                                  |
| F9F2                |      | SDP functional generation number |           | RO                     |                                                                                                                     |
|                     | 01   |                                  | UDINT     | RO                     | SDP functional generation number.                                                                                   |
| F9F3                |      | Vendor name                      | STRING(n) | RO                     |                                                                                                                     |
| F9F4                |      | SDP device name                  |           | RO                     |                                                                                                                     |
|                     | 01   |                                  | STRING(n) | RO                     | String identifying the device type.                                                                                 |
| F9F5                |      | Output identifier                |           | RO                     |                                                                                                                     |
|                     | 01   |                                  | USINT     | RW                     | Output identifier. The controller can then read this value back through the TxPDO to ensure the RxPDO was received. |

131) Idx = Index, sldx = Sub-index, Hexadecimal

132) RO = read only, RW = read/write, P = suitable for process data

133) Idx = Index, sldx = Sub-index, Hexadecimal

134) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>133)</sup> | sldx | Name                                          | Type  | Access <sup>134)</sup> | Description                                                              |
|---------------------|------|-----------------------------------------------|-------|------------------------|--------------------------------------------------------------------------|
| F9F6                |      | Time since power on                           | UDINT | RO                     | This is the time the device has currently been powered on, in seconds.   |
| F9F7                |      | Total time powered                            | UDINT | RO                     | Operating hours of pump [s]                                              |
| F9F8                |      | Firmware update: functional generation number | UDINT | RO                     | Firmware update of functional generation number supported by the device. |

**Tbl. 16: CDP-specific information data**

#### CDP command objects

| Idx <sup>135)</sup> | sldx | Name                    | Type                 | Access <sup>136)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------|------|-------------------------|----------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0                |      | Device reset command    |                      | RO                     | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. There are two versions of this command:<br><br>Device reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset.<br><br>Factory reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                     | 01   | Command                 | AR-RAY[0..5] OF BYTE | RW                     | A device reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72<br>Byte 5: Device standard reset = 0x00, factory reset = 0x66                                                                                                                                                                                                                                                                                |
|                     | 02   | Status                  | USINT                | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Reserved<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                                                                                                     |
|                     | 03   | Response                | AR-RAY[0..1] OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| FBF1                |      | Exception reset command |                      | RO                     | Execution of this command clears the latched exceptions.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                     | 01   | Command                 | AR-RAY[0..4] OF BYTE | RW                     | A latched exception reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72                                                                                                                                                                                                                                                                                                                                   |

133) Idx = Index, sldx = Sub-index, Hexadecimal

134) RO = read only, RW = read/write, P = suitable for process data

135) Idx = Index, sldx = Sub-index, Hexadecimal

136) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>135)</sup> | sidx | Name                       | Type                    | Access <sup>136)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------|------|----------------------------|-------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 02   | Status                     | USINT                   | RO                     | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                                         |
|                     | 03   | Re-sponse                  | AR-RAY[0..1]<br>OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused.                                                                                                                                                                                                                                                                                                                                                                     |
| FBF2                |      | Store parameters command   |                         | RO                     | Execution of this command will store all parameters to non-volatile memory.                                                                                                                                                                                                                                                                                                                                   |
|                     | 01   | Command                    | AR-RAY[0..3]<br>OF BYTE | RW                     | Read:<br>Bit 0 = 1: Device saves the non-volatile parameters when writing 0xFB2:01 with 0x65766173<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written<br>Bit 2-31: Reserved, shall be 0<br>Write: All writable, non-volatile values will be stored in non-volatile memory when the following is sent:<br>Byte 0: 0x73<br>Byte 1: 0x61<br>Byte 2: 0x76<br>Byte 3: 0x65 |
|                     | 02   | Status                     | USINT                   | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Last command completed, no error, reply there<br>2: Last command completed, error, no response.                                                                                                                                                                                           |
|                     | 03   | Re-sponse                  | AR-RAY[0..1]<br>OF BYTE | RO                     | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                                                      |
| FBF3                |      | Calculate checksum command |                         | RO                     | Execution of this command will calculate a checksum for all writable, non-volatile parameters as currently stored in non-volatile memory.                                                                                                                                                                                                                                                                     |

135) Idx = Index, sidx = Sub-index, Hexadecimal

136) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>135)</sup> | sIdx | Name                    | Type                   | Access <sup>136)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------|------|-------------------------|------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 01   | Command                 | ARRAY[0..3]<br>OF BYTE | RW                     | <p>Read: Returns information about the supported checksum type</p> <p>Bit 0 = 0: No non-volatile parameters supported<br/>           Bit 0 = 1: Non-volatile parameters supported</p> <p>Bit 1 = 1: CRC-32<br/>           Bit 2 = 1: MD5<br/>           Bit 3 = 1: SHA-1<br/>           Bit 4-6: Reserved, shall be 0<br/>           Bit 7 = 1: Other algorithm.</p> <p>Write: Checksum type selection and start calculation. A write access to this subindex shall only set one bit true in Bit[0...7].</p> <p>Bit 0 = 1: Use default checksum algorithm of the device<br/>           Bit 1 = 1: CRC-32<br/>           Bit 2 = 1: MD5<br/>           Bit 3 = 1: SHA-1<br/>           Bit 4-6: Reserved, shall be 0<br/>           Bit 7 = 1: Other algorithm<br/>           Bit 8...31: Reserved.</p> |
|                     | 02   | Status                  | USINT                  | RO                     | <p>Supported values:</p> <p>0: Default value if the command has not been initiated. Not a supported value otherwise.<br/>           1: Last command completed, no error, reply there<br/>           2: Last command completed, error, no response</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                     | 03   | Response                | ARRAY[0..n]<br>OF BYTE | RO                     | <p>Byte 0: See subindex 2<br/>           Byte 1: Unused - shall be zero<br/>           Byte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length is 64 bytes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FBF4                |      | Load parameters command |                        | RO                     | Execution of this command will load all parameters from non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                     | 01   | Command                 | ARRAY[0..3]<br>OF BYTE | RW                     | <p>Read:</p> <p>Bit 0 = 1: Device loads the non-volatile parameters when writing 0xFB4:01 with 0x64616F6C<br/>           Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written.</p> <p>Write:</p> <p>All writable, non-volatile parameters will be loaded from non-volatile memory when the following is sent:</p> <p>Byte 0: 0x6C<br/>           Byte 1: 0x6F<br/>           Byte 2: 0x61<br/>           Byte 3: 0x64.</p>                                                                                                                                                                                                                                                                                                                                          |

135) Idx = Index, sIdx = Sub-index, Hexadecimal

136) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>135)</sup> | sidx | Name      | Type                    | Access <sup>136)</sup> | Description                                                                                                                           |
|---------------------|------|-----------|-------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|                     | 02   | Status    | USINT                   | RO                     | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response |
|                     | 03   | Re-sponse | AR-RAY[0..1]<br>OF BYTE | RO                     | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                              |

Tbl. 17: CDP command objects

## 5.2 Operating Series 4 multi-stage roots pumps via EtherCAT

### 5.2.1 Process data: Series 4

#### Process output data

Process output data are:

- Default RxPDO (control --> Series 4, "output"), CoE 1600h.1 – 4 (1 Byte)

| Byte.Bit | CoE <sup>137)</sup>                      | Meaning                         |
|----------|------------------------------------------|---------------------------------|
| 0.0      | 0x7000.0x01: Roughing start/stop         | Pumping station (0: off, 1: on) |
| 0.1      | 0x7000.0x04: Low speed (idle/green mode) | 0: Normal, 1: Low speed mode    |
| 0.2 – 7. |                                          | Reserved                        |

Tbl. 18: Process output data

#### Process input data

Process input data are:

- Default TxPDO (Series 4 --> control, "input"), CoE 1A00h.1 – 11 (7 Byte)

| Byte.Bit  | CoE <sup>138)</sup>                      | Meaning                                  |
|-----------|------------------------------------------|------------------------------------------|
| 0.0       | 0x6000.0x01: Roughing run/stop           | Pumping station (0: off, 1: on)          |
| 0.1       | 0x6000.0x02: Booster run/stop            | Roots pump on/off (0: on, 1: off)        |
| 0.2       | 0x6000.0x04: Low speed (idle/green mode) | Idle mode (0: deactivated, 1: activated) |
| 0.3       | 0x6000.0x05: Remote/Local                | 0: ECAT, 1: Local                        |
| 0.4       | 0x6000.0x09: Warning                     | 0: No warning, 1: Warning                |
| 0.5       | 0x6000.0x0A: Alarm                       | 0: No alarm, 1: Alarm                    |
| 0.6       | 0x6000.0x0B: Emergency Off               | 0: Normal, 1: Stop                       |
| 0.7       | 0x6000.0x0C: N2 flow low                 | 0: Normal, 1: N2 flow low                |
| 1st – 2.  | 0x6001.0x02: N2 flow                     | 0.1 l/min                                |
| 3. – 4.   | 0x6001.0x03: Exhaust pressure            | kPa                                      |
| 5. – 6.   | 0x6001.0x05: Roughing case temperature   | °C                                       |
| 7. – 8.   | 0x6001.0x09: Roughing current            | 0.1 A                                    |
| 9. – 10.  | 0x6001.0x0A: Roughing power              | 0.1 kW                                   |
| 11. – 12. | 0x6001.0x0B: Roughing speed              | 0.1% of rated speed                      |
| 13. – 14. | 0x6002.0x05: Booster case temperature    | °C                                       |

135) Idx = Index, sidx = Sub-index, Hexadecimal

136) RO = read only, RW = read/write, P = suitable for process data

137) Hexadecimal

138) Hexadecimal



| Byte.Bit  | CoE <sup>138)</sup>          | Meaning             |
|-----------|------------------------------|---------------------|
| 15. – 16. | 0x6002.0x09: Booster current | 0.1 A               |
| 17. – 18. | 0x6002.0x0A: Booster power   | 0.1 kW              |
| 19. – 20. | 0x6002.0x0B: Booster speed   | 0.1% of rated speed |

**Tbl. 19: Process input data**

#### Compile process data alternative from CoE objects

1. Always conduct the state "PRE-OPERATIONAL".
2. Describe the object 1601h.0 or 1A01h.0 with 0.
3. Describe the object 1601h.1-n or 1A01h.1-n with corresponding CoE indices.
4. Use only objects marked with "P".
5. Assign the sub-index 1-n on a sequential basis only and without gaps.
6. Make sure that the data yields a total number of bytes (use pad bits if needed) and start with whole bytes (exception BOOL).
7. Describe maximum 12 objects per PDO.
8. Describe the object 1601h.0 or 1A01h.0 with the number n of objects to be used.
9. Change object 1C12h.1 to 1601h or 1C13h.1 to 1A01h.
10. In the process data, select the corresponding PDO assignment 1601h or 1A01h.

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1600 (excluded by 0x1601)

☒ 0x1601

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☒ PDO Assignment

☒ PDO Configuration

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1A00 (excluded by 0x1A01)

☒ 0x1A01

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☒ PDO Assignment

☒ PDO Configuration

PDO Content (0x1601):

| Index     | Size | Offs | Name                  | Type |
|-----------|------|------|-----------------------|------|
| 0x7000:01 | 0.1  | 0.0  | Turbo Start Stop      | BOOL |
| 0x7000:03 | 0.1  | 0.1  | Turbo Low Speed       | BOOL |
| 0x3005:11 | 0.1  | 0.2  | Vnt. Enable           | BOOL |
| 0x3005:21 | 0.1  | 0.3  | Sig. Enable           | BOOL |
| ---       | 0.4  | 0.4  | ---                   |      |
| 0x8000:03 | 2.0  | 1.0  | Normal Speed Setpoint | UINT |
|           |      | 3.0  |                       |      |

PDO Content (0x1601):

| Index     | Size | Offs | Name                | Type  |
|-----------|------|------|---------------------|-------|
| 0x6000:09 | 0.1  | 0.0  | Alarm               | BOOL  |
| 0x6000:0A | 0.1  | 0.1  | Warning             | BOOL  |
| 0x2001:88 | 0.1  | 0.2  | Ready for Process   | BOOL  |
| ---       | 0.5  | 0.3  | ---                 |       |
| 0x2001:81 | 1.0  | 1.0  | Status              | USINT |
| 0x2001:82 | 1.0  | 2.0  | Actual Speed (rel.) | SINT  |
| 0x2002:13 | 2.0  | 3.0  | Power               | INT   |
| 0x2002:88 | 2.0  | 5.0  | Fmp. Temperature    | INT   |
|           |      | 7.0  |                     |       |

**Administrative data (information about the device, communication)**

| Idx <sup>139)</sup> | sldx | Name                            | Type      | Access <sup>140)</sup> | Description                                                                                                                                                                     |
|---------------------|------|---------------------------------|-----------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000                |      | Device type                     | UDINT     | RO                     | Bit 0-15: Device profile number (5003).<br>NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B)<br>Bit 16-31: 0x0000, sub-profile number is defined in 0xF010 bit 15..0 |
| 1008                |      | Manufacturer device name        | STRING(n) | RO                     | Name of the device as non-zero terminated string.                                                                                                                               |
| 1009                |      | Manufacturer hardware version   | STRING(n) | RO                     | Hardware version of the device as non-zero terminated string.                                                                                                                   |
| 100 A               |      | Manufacturer software version   | STRING(n) | RO                     | Software version of the device as non-zero terminated string.                                                                                                                   |
| 100B                |      | Manufacturer bootloader version | STRING(n) | RO                     | Bootloader version of the device as non-zero terminated string.                                                                                                                 |
| 1018                |      | Identity object                 | IDENTITY  | RO                     |                                                                                                                                                                                 |
|                     | 01   | Vendor ID                       | UDINT     | RO                     |                                                                                                                                                                                 |
|                     | 02   | Product code                    | UDINT     | RO                     |                                                                                                                                                                                 |
|                     | 03   | Revision number                 | UDINT     | RO                     |                                                                                                                                                                                 |
|                     | 04   | Serial number                   | UDINT     | RO                     |                                                                                                                                                                                 |
| 10F8                |      | Timestamp object                | ULINT     | RO                     | Local timestamp of the device in ns.                                                                                                                                            |
| 1600                |      | SDP default RxPDO               |           |                        |                                                                                                                                                                                 |
|                     | 01h  |                                 |           |                        | 0x7000.0x01: Roughing start/stop                                                                                                                                                |
|                     | 02h  |                                 |           |                        | 0x7000.0x04: Low speed (idle/green mode)                                                                                                                                        |
|                     | 03h  |                                 |           |                        |                                                                                                                                                                                 |
| 1601                |      | User RxPDO                      |           |                        |                                                                                                                                                                                 |
| 1A00                |      | SDP default TxPDO               |           |                        |                                                                                                                                                                                 |
|                     | 01h  |                                 |           |                        | 0x6000.0x01: Roughing run/stop                                                                                                                                                  |
|                     | 02h  |                                 |           |                        | 0x6000.0x02: Booster run/stop                                                                                                                                                   |
|                     | 03h  |                                 |           |                        | 0x6000.0x04: Low speed (idle/green mode)                                                                                                                                        |
|                     | 04h  |                                 |           |                        | 0x6000.0x05: Remote/local                                                                                                                                                       |
|                     | 05h  |                                 |           |                        | 0x6000.0x09: Warning                                                                                                                                                            |
|                     | 06h  |                                 |           |                        | 0x6000.0x0A: Alarm                                                                                                                                                              |
|                     | 07h  |                                 |           |                        | 0x6000.0x0B: Emergency Off                                                                                                                                                      |
|                     | 08h  |                                 |           |                        | 0x6000.0x0C: N2 flow low                                                                                                                                                        |
|                     | 09h  |                                 |           |                        | 0x6001.0x02: N2 flow                                                                                                                                                            |
|                     | 0Ah  |                                 |           |                        | 0x6001.0x03: Exhaust pressure                                                                                                                                                   |
|                     | 0Bh  |                                 |           |                        | 0x6001.0x05: Roughing case temperature                                                                                                                                          |
|                     | 0Ch  |                                 |           |                        | 0x6001.0x09: Roughing current                                                                                                                                                   |
|                     | 0Dh  |                                 |           |                        | 0x6001.0x0A: Roughing power                                                                                                                                                     |
|                     | 0Eh  |                                 |           |                        | 0x6001.0x0B: Roughing speed                                                                                                                                                     |
|                     | 0Fh  |                                 |           |                        | 0x6002.0x05: Booster case temperature                                                                                                                                           |
|                     | 10h  |                                 |           |                        | 0x6002.0x09: Booster current                                                                                                                                                    |
|                     | 11h  |                                 |           |                        | 0x6002.0x0A: Booster power                                                                                                                                                      |

139) Idx = Index, sldx = Sub-index, Hexadecimal

140) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>139)</sup> | sldx | Name                                         | Type | Access <sup>140)</sup> | Description                |
|---------------------|------|----------------------------------------------|------|------------------------|----------------------------|
|                     | 12h  |                                              |      |                        | 0x6002.0x0B: Booster speed |
| 1A01                |      | User TxPDO                                   |      |                        |                            |
| 1C00                |      | Sync manager type                            |      |                        |                            |
| 1C10                |      | Sync manager 0 PDO assignment                |      |                        |                            |
| 1C11                |      | Sync manager 1 PDO assignment                |      |                        |                            |
| 1C12                |      | RxPDO assign (sync manager 2 PDO assignment) |      |                        |                            |
| 1C13                |      | TxPDO assign (sync manager 3 PDO assignment) |      |                        |                            |

**Tbl. 22: Communication area – administrative data (information about the device, communication)**

**Input data (S4 --> control)**

| Idx <sup>141)</sup> | sldx | Name                              | Type | Access <sup>142)</sup> | Description                                                        |
|---------------------|------|-----------------------------------|------|------------------------|--------------------------------------------------------------------|
| 6000                |      | Roughing and booster status       |      | RO                     |                                                                    |
|                     | 01   | Roughing run/stop                 | BOOL | RO                     | 1: Run<br>0: Stop                                                  |
|                     | 02   | Booster run/stop                  | BOOL | RO                     | 1: Run<br>0: Stop                                                  |
|                     | 03   | Booster 2 run/stop                |      |                        | 1: Run<br>0: Stop                                                  |
|                     | 04   | Low speed (idle/sleep/green mode) | BOOL | RO                     | 1: Low speed (idle /sleep / green mode)<br>0: Normal               |
|                     | 05   | Remote/local                      | BOOL | RO                     | 1: Local. Hand control enabled<br>0: Remote, E-cat control enabled |
|                     | 06   | Inlet gate valve                  | BOOL | RO                     | 1: Open<br>0: Closed<br>Mandatory if inlet gate valve fitted       |
|                     | 07   | Pump interlock                    | BOOL | RO                     | 1: OK, process may proceed<br>0: Process must not run              |
|                     | 08   | N2 level ready                    | BOOL | RO                     | 1: OK (high level)<br>0: Not ready (low level)                     |
|                     | 09   | Warning                           | BOOL | RO                     | 1: Warning<br>0: Normal                                            |
|                     | 0 A  | Alarm                             | BOOL | RO                     | 1: Alarm<br>0: Normal                                              |
|                     | 0B   | Emergency off                     | BOOL | RO                     | 1: Stop<br>0: Normal                                               |
|                     | 0C   | N2 flow low                       | BOOL | RO                     | 1: N2 flow low<br>0: Normal                                        |

139) Idx = Index, sldx = Sub-index, Hexadecimal

140) RO = read only, RW = read/write, P = suitable for process data

141) Idx = Index, sldx = Sub-index, Hexadecimal

142) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>141)</sup> | sIdx | Name                                 | Type | Access <sup>142)</sup> | Description                                                    |
|---------------------|------|--------------------------------------|------|------------------------|----------------------------------------------------------------|
|                     | 11   | Multiple sleep (green) level setting | UINT | RO                     | 0: Idle/sleep level 0 (default)<br>1- 255: Sleep (green) modes |
| 6001                |      | Roughing analog inputs               |      |                        |                                                                |
|                     | 01   | Coolant flow                         | INT  | RO                     | 0.1 [l/min]                                                    |
|                     | 02   | N2 flow                              | INT  | RO                     | 0.1 [slm]                                                      |
|                     | 03   | Exhaust pressure                     | INT  | RO                     | Gauge pressure (not absolute) - 1 [kPa]                        |
|                     | 05   | Roughing case temperature            | INT  | RO                     | Degrees Celsius                                                |
|                     | 06   | Roughing optional temperature        | INT  | RO                     | Degrees Celsius                                                |
|                     | 09   | Roughing current                     | INT  | RO                     | 0.1 [A]                                                        |
|                     | 0 A  | Roughing power                       | INT  | RO                     | 0.1 [kW]                                                       |
|                     | 0B   | Roughing speed                       | INT  | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%): 0 Rotation, 0.1 [%]    |
| 6002                |      | Booster analog inputs                |      | RO                     |                                                                |
|                     | 05   | Booster case temperature             | INT  | RO                     | Degrees Celsius                                                |
|                     | 09   | Booster current                      | INT  | RO                     | 0.1 [A]                                                        |
|                     | 0 A  | Booster power                        | INT  | RO                     | 0.1 [kW]                                                       |
|                     | 0B   | Booster speed                        | INT  | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%): 0 Rotation, 0.1 [%]    |
| 6003                |      | Booster 2 analog inputs              |      | RO                     |                                                                |
|                     | 05   |                                      | INT  | RO                     | Degrees Celsius                                                |
|                     | 09   | Booster 2 current                    | INT  | RO                     | 0.1 [A]                                                        |
|                     | 0 A  | Booster 2 power                      | INT  | RO                     | 0.1 [kW]                                                       |
|                     | 0B   | Booster 2 speed                      | INT  | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%): 0 Rotation, 0.1 [%]    |

Tbl. 23: Input area

## Output data (control --&gt; S4)

| Idx <sup>143)</sup> | sIdx | Name                              | Type | Access <sup>144)</sup> | Description                                       |
|---------------------|------|-----------------------------------|------|------------------------|---------------------------------------------------|
| 7000                |      | Roughing and booster control      |      | RO                     |                                                   |
|                     | 01   | Roughing start/stop               | BOOL | RW                     | 1: Run<br>0: Stop                                 |
|                     | 02   | Booster start/stop                | BOOL | RW                     | 1: Run<br>0: Stop                                 |
|                     | 03   | Booster 2 start/stop              | BOOL | RW                     | 1: Run<br>0: Stop                                 |
|                     | 04   | Low speed (idle/sleep/green mode) | BOOL | RW                     | 1: Low speed (idle/sleep/green mode)<br>0: Normal |
|                     | 06   | N2 ballast valve                  | BOOL | RW                     | 1: Open ballast valve<br>0: Close ballast valve   |

141) Idx = Index, sIdx = Sub-index, Hexadecimal

142) RO = read only, RW = read/write, P = suitable for process data

143) Idx = Index, sIdx = Sub-index, Hexadecimal

144) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>143)</sup> | sIdx | Name                                 | Type | Access <sup>144)</sup> | Description                                                     |
|---------------------|------|--------------------------------------|------|------------------------|-----------------------------------------------------------------|
|                     | 07   | Inlet gate valve                     | BOOL | RW                     | 1: Open gate valve<br>0: Close gate valve                       |
|                     | 11   | Multiple sleep (green) level setting | UINT | RW                     | 0: Idle/sleep level 0 (default)<br>1-255: Sleep (green) levels. |

Tbl. 24: Output area

## Configuration data (control --&gt; S4)

| Idx <sup>145)</sup> | sIdx | Name                                       | Type | Access <sup>146)</sup> | Description                                                                                                 |
|---------------------|------|--------------------------------------------|------|------------------------|-------------------------------------------------------------------------------------------------------------|
| 8001                |      | Roughing and booster configuration         |      | RO                     |                                                                                                             |
|                     | 01   | Safe state                                 | UINT | RW                     | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - pumps stop |
|                     | 02   | Booster and booster 2 control mode setting | UINT | RW                     | 0: Co-ordinated mode (default)<br>1: Independent mode                                                       |
|                     | 03   | Gate valve control mode setting            | UINT | RW                     | 0: Co-ordinated mode (default)<br>1: Independent mode                                                       |

Tbl. 25: Configuration area

## Information data (S4 --&gt; control)

| Idx <sup>147)</sup> | sIdx | Name                              | Type  | Access <sup>148)</sup> | Description                                           |
|---------------------|------|-----------------------------------|-------|------------------------|-------------------------------------------------------|
| 9000                |      | Roughing and booster information  |       | RO                     |                                                       |
|                     | 01   | Roughing exists                   | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                     | 02   | Booster exists                    | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                     | 03   | Booster 2 exists                  | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                     | 11   | Roughing and booster running time | UDINT | RO                     | Running time since manufacture or service - 1 [hours] |
| 9001                |      | Sleep level wake-up time          |       | RO                     |                                                       |
|                     | 01   |                                   | UINT  | RO                     | Wake-up time.<br>Unit: Seconds                        |

Tbl. 26: Information area

143) Idx = Index, sIdx = Sub-index, Hexadecimal

144) RO = read only, RW = read/write, P = suitable for process data

145) Idx = Index, sIdx = Sub-index, Hexadecimal

146) RO = read only, RW = read/write, P = suitable for process data

147) Idx = Index, sIdx = Sub-index, Hexadecimal

148) RO = read only, RW = read/write, P = suitable for process data

**Semiconductor device profile area**

| Idx <sup>149)</sup> | sIdx | Name                         | Type  | Access <sup>150)</sup> | Description |
|---------------------|------|------------------------------|-------|------------------------|-------------|
| F000                |      | Semiconductor device profile |       | RO                     |             |
|                     | 01   | Index distance               | UINT  |                        |             |
|                     | 02   | Maximum number of modules    | UINT  |                        |             |
| F010                |      | Module profile list          |       | RO                     |             |
|                     | 01   |                              | UDINT | RO                     |             |

**Tbl. 27: Semiconductor device profile area****Exception handling**

| Idx <sup>151)</sup> | sIdx | Name                                                 | Type  | Access <sup>152)</sup> | Description                                                                                                                     |
|---------------------|------|------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380                |      | Active exception status                              | USINT | RO                     | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning                                 |       |                        | Bit0: Device warning                                                                                                            |
|                     |      | Bit1: Manufacturer warning                           |       |                        | Bit1: Manufacturer warning                                                                                                      |
|                     |      | Bit2: Device error                                   |       |                        | Bit2: Device error                                                                                                              |
|                     |      | Bit3: Manufacturer error                             |       |                        | Bit3: Manufacturer error                                                                                                        |
|                     |      | Bit4: Reserved                                       |       |                        | Bit4: Reserved                                                                                                                  |
|                     |      | Bit5: Reserved                                       |       |                        | Bit5: Reserved                                                                                                                  |
|                     |      | Bit6: Reserved                                       |       |                        | Bit6: Reserved                                                                                                                  |
|                     |      | Bit7: Reserved                                       |       |                        | Bit7: Reserved                                                                                                                  |
| F381                |      | Roughing and booster 1 to 255: Active warning detail |       | RO                     |                                                                                                                                 |
|                     | 01   |                                                      | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                         |
|                     |      | Bit2: Power fail open phase                          |       |                        | Bit2: Power fail open phase                                                                                                     |
|                     |      | Bit4: Coolant flow                                   |       |                        | Bit4: Coolant flow                                                                                                              |
|                     |      | Bit5: N2 flow                                        |       |                        | Bit5: N2 flow                                                                                                                   |
|                     |      | Bit6: Exhaust pressure                               |       |                        | Bit6: Exhaust pressure                                                                                                          |
|                     |      | Bit8: Main controller err/batt low                   |       |                        | Bit8: Main controller err/batt low                                                                                              |
|                     |      | Bit9: Roughing case temp                             |       |                        | Bit9: Roughing case temp                                                                                                        |
|                     |      | Bit10: Roughing motor temp                           |       |                        | Bit10: Roughing motor temp                                                                                                      |
|                     |      | Bit11: Roughing current                              |       |                        | Bit11: Roughing current                                                                                                         |
|                     |      | Bit12: Roughing speed                                |       |                        | Bit12: Roughing speed                                                                                                           |
|                     |      | Bit13: Roughing lock rotor                           |       |                        | Bit13: Roughing lock rotor                                                                                                      |
|                     |      | Bit14: Roughing motor driver err                     |       |                        | Bit14: Roughing motor driver err                                                                                                |
|                     |      | Bit15: Booster case temp.                            |       |                        | Bit15: Booster case temp.                                                                                                       |
|                     |      | Bit16: Booster motor temp.                           |       |                        | Bit16: Booster motor temp.                                                                                                      |

149) Idx = Index, sIdx = Sub-index, Hexadecimal

150) RO = read only, RW = read/write, P = suitable for process data

151) Idx = Index, sIdx = Sub-index, Hexadecimal

152) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>151)</sup> | sldx | Name                                                       | Type  | Access <sup>152)</sup> | Description                                                                                             |
|---------------------|------|------------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit17: Booster current                                     |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                       |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                  |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                            |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                |       |                        | Bit21: Booster 2 case temp.                                                                             |
|                     |      | Bit23: Booster 2 current                                   |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                     |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                          |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                      |       |                        | Bit27: Gate valve err                                                                                   |
|                     |      | Bit31: Others                                              |       |                        | Bit31: Others                                                                                           |
| F383                |      | Roughing and booster 1 to 255: Active error (alarm) detail |       | RO                     |                                                                                                         |
|                     | 01   |                                                            | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: EMO                                                  |       |                        | Bit0: EMO                                                                                               |
|                     |      | Bit2: Power fail open phase                                |       |                        | Bit2: Power fail open phase                                                                             |
|                     |      | Bit3: Reverse phase                                        |       |                        | Bit3: Reverse phase                                                                                     |
|                     |      | Bit 4: Coolant flow                                        |       |                        | Bit 4: Coolant flow                                                                                     |
|                     |      | Bit5: N2 flow                                              |       |                        | Bit5: N2 flow                                                                                           |
|                     |      | Bit6: Exhaust pressure                                     |       |                        | Bit6: Exhaust pressure                                                                                  |
|                     |      | Bit8: Main controller err/batt low                         |       |                        | Bit8: Main controller err/batt low                                                                      |
|                     |      | Bit9: Roughing case temp                                   |       |                        | Bit9: Roughing case temp                                                                                |
|                     |      | Bit10: Roughing motor temp                                 |       |                        | Bit10: Roughing motor temp                                                                              |
|                     |      | Bit11: Roughing current                                    |       |                        | Bit11: Roughing current                                                                                 |
|                     |      | Bit12: Roughing speed                                      |       |                        | Bit12: Roughing speed                                                                                   |
|                     |      | Bit13: Roughing lock rotor                                 |       |                        | Bit13: Roughing lock rotor                                                                              |
|                     |      | Bit14: Roughing motor driver err                           |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                  |       |                        | Bit15: Booster case temp.                                                                               |
|                     |      | Bit16: Booster motor temp.                                 |       |                        | Bit16: Booster motor temp.                                                                              |
|                     |      | Bit17: Booster current                                     |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                       |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                  |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                            |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                |       |                        | Bit21: Booster 2 case temp.                                                                             |
|                     |      | Bit23: Booster 2 current                                   |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                     |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                          |       |                        | Bit26: Booster 2 motor driver err                                                                       |

151) Idx = Index, sldx = Sub-index, Hexadecimal

152) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>151)</sup> | sldx | Name                                                  | Type  | Access <sup>152)</sup> | Description                                                                                                                                                  |
|---------------------|------|-------------------------------------------------------|-------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |      | Bit27: Gate valve err                                 |       |                        | Bit27: Gate valve err                                                                                                                                        |
|                     |      | Bit31: Others                                         |       |                        | Bit31: Others                                                                                                                                                |
| F390                |      | Latched exception status                              | USINT | RO                     | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. See CDP for additional information. |
|                     |      | Bit0: Device warning                                  |       |                        | Bit0: Device warning                                                                                                                                         |
|                     |      | Bit1: Manufacturer warning                            |       |                        | Bit1: Manufacturer warning                                                                                                                                   |
|                     |      | Bit2: Device error                                    |       |                        | Bit2: Device error                                                                                                                                           |
|                     |      | Bit3: Manufacturer error                              |       |                        | Bit3: Manufacturer error                                                                                                                                     |
|                     |      | Bit4: Reserved                                        |       |                        | Bit4: Reserved                                                                                                                                               |
|                     |      | Bit5: Reserved                                        |       |                        | Bit5: Reserved                                                                                                                                               |
|                     |      | Bit6: Reserved                                        |       |                        | Bit6: Reserved                                                                                                                                               |
|                     |      | Bit7: Reserved                                        |       |                        | Bit7: Reserved                                                                                                                                               |
| F391                |      | Roughing and booster 1 to 255: Latched warning detail |       | RO                     |                                                                                                                                                              |
|                     | 01   |                                                       | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                                                      |
|                     |      | Bit0: EMO                                             |       |                        | Bit0: EMO                                                                                                                                                    |
|                     |      | Bit1: Water leak                                      |       |                        | Bit1: Water leak                                                                                                                                             |
|                     |      | Bit2: Power fail open phase                           |       |                        | Bit2: Power fail open phase                                                                                                                                  |
|                     |      | Bit3: Reverse phase                                   |       |                        | Bit3: Reverse phase                                                                                                                                          |
|                     |      | Bit4: Coolant flow                                    |       |                        | Bit4: Coolant flow                                                                                                                                           |
|                     |      | Bit5: N2 flow                                         |       |                        | Bit5: N2 flow                                                                                                                                                |
|                     |      | Bit6: Exhaust pressure                                |       |                        | Bit6: Exhaust pressure                                                                                                                                       |
|                     |      | Bit7: Exhaust temp.                                   |       |                        | Bit7: Exhaust temp.                                                                                                                                          |
|                     |      | Bit8: Main controller err/batt low                    |       |                        | Bit8: Main controller err/batt low                                                                                                                           |
|                     |      | Bit9: Roughing case temp                              |       |                        | Bit9: Roughing case temp                                                                                                                                     |
|                     |      | Bit10: Roughing motor temp                            |       |                        | Bit10: Roughing motor temp                                                                                                                                   |
|                     |      | Bit11: Roughing current                               |       |                        | Bit11: Roughing current                                                                                                                                      |
|                     |      | Bit12: Roughing speed                                 |       |                        | Bit12: Roughing speed                                                                                                                                        |
|                     |      | Bit13: Roughing lock rotor                            |       |                        | Bit13: Roughing lock rotor                                                                                                                                   |
|                     |      | Bit14: Roughing motor driver err                      |       |                        | Bit14: Roughing motor driver err                                                                                                                             |
|                     |      | Bit15: Booster case temp.                             |       |                        | Bit15: Booster case temp.                                                                                                                                    |
|                     |      | Bit16: Booster motor temp.                            |       |                        | Bit16: Booster motor temp.                                                                                                                                   |
|                     |      | Bit17: Booster current                                |       |                        | Bit17: Booster current                                                                                                                                       |
|                     |      | Bit18: Booster speed                                  |       |                        | Bit18: Booster speed                                                                                                                                         |
|                     |      | Bit19: Booster lock rotor                             |       |                        | Bit19: Booster lock rotor                                                                                                                                    |
|                     |      | Bit20: Booster motor driver err                       |       |                        | Bit20: Booster motor driver err                                                                                                                              |
|                     |      | Bit21: Booster 2 case temp.                           |       |                        | Bit21: Booster 2 case temp.                                                                                                                                  |
|                     |      | Bit22: Booster 2 motor temp.                          |       |                        | Bit22: Booster 2 motor temp.                                                                                                                                 |

151) Idx = Index, sldx = Sub-index, Hexadecimal

152) RO = read only, RW = read/write, P = suitable for process data



| Idx <sup>151)</sup> | sldx | Name                                                        | Type  | Access <sup>152)</sup> | Description                                                                                             |
|---------------------|------|-------------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit23: Booster 2 current                                    |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                      |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                 |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                           |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                       |       |                        | Bit27: Gate valve err                                                                                   |
|                     |      | Bit28: Future use                                           |       |                        | Bit28: Future use                                                                                       |
|                     |      | Bit29: Future use                                           |       |                        | Bit29: Future use                                                                                       |
|                     |      | Bit30: Future use                                           |       |                        | Bit30: Future use                                                                                       |
|                     |      | Bit31: Others                                               |       |                        | Bit31: Others                                                                                           |
| F393                |      | Roughing and booster 1 to 255: Latched error (alarm) detail |       | RO                     |                                                                                                         |
|                     | 01   |                                                             | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: EMO                                                   |       |                        | Bit0: EMO                                                                                               |
|                     |      | Bit1: Water leak                                            |       |                        | Bit1: Water leak                                                                                        |
|                     |      | Bit2: Power fail open phase                                 |       |                        | Bit2: Power fail open phase                                                                             |
|                     |      | Bit3: Reverse phase                                         |       |                        | Bit3: Reverse phase                                                                                     |
|                     |      | Bit4: Coolant flow                                          |       |                        | Bit4: Coolant flow                                                                                      |
|                     |      | Bit5: N2 flow                                               |       |                        | Bit5: N2 flow                                                                                           |
|                     |      | Bit6: Exhaust pressure                                      |       |                        | Bit6: Exhaust pressure                                                                                  |
|                     |      | Bit7: Exhaust temp.                                         |       |                        | Bit7: Exhaust temp.                                                                                     |
|                     |      | Bit8: Main controller err/batt low                          |       |                        | Bit8: Main controller err/batt low                                                                      |
|                     |      | Bit9: Roughing case temp                                    |       |                        | Bit9: Roughing case temp                                                                                |
|                     |      | Bit10: Roughing motor temp                                  |       |                        | Bit10: Roughing motor temp                                                                              |
|                     |      | Bit11: Roughing current                                     |       |                        | Bit11: Roughing current                                                                                 |
|                     |      | Bit12: Roughing speed                                       |       |                        | Bit12: Roughing speed                                                                                   |
|                     |      | Bit13: Roughing lock rotor                                  |       |                        | Bit13: Roughing lock rotor                                                                              |
|                     |      | Bit14: Roughing motor driver err                            |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                   |       |                        | Bit15: Booster case temp.                                                                               |
|                     |      | Bit16: Booster motor temp.                                  |       |                        | Bit16: Booster motor temp.                                                                              |
|                     |      | Bit17: Booster current                                      |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                        |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                   |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                             |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                 |       |                        | Bit21: Booster 2 case temp.                                                                             |
|                     |      | Bit22: Booster 2 motor temp.                                |       |                        | Bit22: Booster 2 motor temp.                                                                            |
|                     |      | Bit23: Booster 2 current                                    |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                      |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                 |       |                        | Bit25: Booster 2 lock rotor                                                                             |

151) Idx = Index, sldx = Sub-index, Hexadecimal

152) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>151)</sup> | sldx | Name                                              | Type  | Access <sup>152)</sup> | Description                                                                                                                                                                                                                         |
|---------------------|------|---------------------------------------------------|-------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |      | Bit26: Booster 2 motor driver err                 |       |                        | Bit26: Booster 2 motor driver err                                                                                                                                                                                                   |
|                     |      | Bit27: Gate valve err                             |       |                        | Bit27: Gate valve err                                                                                                                                                                                                               |
|                     |      | Bit28: Future use                                 |       |                        | Bit28: Future use                                                                                                                                                                                                                   |
|                     |      | Bit29: Future use                                 |       |                        | Bit29: Future use                                                                                                                                                                                                                   |
|                     |      | Bit30: Future use                                 |       |                        | Bit30: Future use                                                                                                                                                                                                                   |
|                     |      | Bit31: Others                                     |       |                        | Bit31: Others                                                                                                                                                                                                                       |
| F3A1                |      | Roughing and booster 1 to 255: Warning mask       |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   |                                                   | UDINT | RW                     | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3                |      | Roughing and booster 1 to 255: Error (alarm) mask |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   |                                                   | UDINT | RW                     | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |
| F6F0                |      | Input latch local timestamp                       |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   | Input latch local timestamp                       | UDINT | RO                     | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up.                                                                                                                  |

Tbl. 28: Exception handling

## CDP-specific information data

| Idx <sup>153)</sup> | sldx | Name                             | Type      | Access <sup>154)</sup> | Description                                                                                                           |
|---------------------|------|----------------------------------|-----------|------------------------|-----------------------------------------------------------------------------------------------------------------------|
| F9F0                |      | Manufacturer serial number       | STRING(n) | RO                     | String representing the manufacturer's serial number for the device. NOTE: This may have the same value as 0x1018:04. |
| F9F1                |      | CDP functional generation number |           | RO                     |                                                                                                                       |
|                     | 01   |                                  | UDINT     | RO                     | Common device profile functional generation number 2                                                                  |
| F9F2                |      | SDP functional generation number |           | RO                     |                                                                                                                       |
|                     | 01   |                                  | UDINT     | RO                     | SDP functional generation number of nn-th module shall be specified by each SDP.2                                     |
| F9F3                |      | Vendor name                      | STRING(n) | RO                     | This string identifies the supplier of the device.                                                                    |

151) Idx = Index, sldx = Sub-index, Hexadecimal

152) RO = read only, RW = read/write, P = suitable for process data

153) Idx = Index, sldx = Sub-index, Hexadecimal

154) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>153)</sup> | sIdx | Name                                          | Type      | Access <sup>154)</sup> | Description                                                                                                                                                                                                                                                                                                                 |
|---------------------|------|-----------------------------------------------|-----------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| F9F4                |      | SDP device name                               |           | RO                     |                                                                                                                                                                                                                                                                                                                             |
|                     | 01   |                                               | STRING(n) | RO                     | String identifying the device type of nn-th module as defined by the SDP.                                                                                                                                                                                                                                                   |
| F9F5                |      | Output identifier                             |           | RO                     |                                                                                                                                                                                                                                                                                                                             |
|                     | 01   |                                               | USINT     | RO                     | Output identifier of nn-th module. This value can be mapped to both the RxPDO and TxPDO. The required function of the device is to store the value in memory as written by the host. The controller can then read this value back through the TxPDO to ensure the RxPDO was received.                                       |
| F9F6                |      | Time since power on                           | UDINT     | RO                     | This is the time the device has currently been powered on, in seconds, regardless of communication presence.                                                                                                                                                                                                                |
| F9F8                |      | Firmware update: functional generation number | UDINT     | RO                     | Firmware update of functional generation number supported by the device. Value shall be specified by the Firmware Update Profile (ETG.5003-2) 0x00000000: FW update according to ETG.5003-2 not supported. A device cannot return this value and still be compliant with ETG.5003.1, as ETG.5003-2 compliance is mandatory. |

Tb1. 29: CDP-specific information data

## CDP command objects

| Idx <sup>155)</sup> | sIdx | Name                 | Type                    | Access <sup>156)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------|------|----------------------|-------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0                |      | Device reset command |                         | RO                     | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. There are two versions of this command:<br><br>Device reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset.<br><br>Factory reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                     | 01   | Command              | AR-RAY[0..5]<br>OF BYTE | RW                     | A device reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72<br>Byte 5: Device standard reset = 0x00, factory reset = 0x66                                                                                                                                                                                                                                                                                |

153) Idx = Index, sIdx = Sub-index, Hexadecimal

154) RO = read only, RW = read/write, P = suitable for process data

155) Idx = Index, sIdx = Sub-index, Hexadecimal

156) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>155)</sup> | sIdx | Name                     | Type                   | Access <sup>156)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------|------|--------------------------|------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 02   | Status                   | USINT                  | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Reserved<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                |
|                     | 03   | Response                 | ARRAY[0..1]<br>OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero                                                                                                                                                                                                                                                                                                                                                      |
| FBF1                |      | Exception reset command  |                        | RO                     | Execution of this command clears the latched exceptions.                                                                                                                                                                                                                                                                                                                                                      |
|                     | 01   | Command                  | ARRAY[0..4]<br>OF BYTE | RW                     | A latched exception reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72                                                                                                                                                                                                                                              |
|                     | 02   | Status                   | USINT                  | RO                     | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                                         |
|                     | 03   | Response                 | ARRAY[0..1]<br>OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused.                                                                                                                                                                                                                                                                                                                                                                     |
| FBF2                |      | Store parameters command |                        | RO                     | Execution of this command will store all parameters to non-volatile memory.                                                                                                                                                                                                                                                                                                                                   |
|                     | 01   | Command                  | ARRAY[0..3]<br>OF BYTE | RW                     | Read:<br>Bit 0 = 1: Device saves the non-volatile parameters when writing 0xFB2:01 with 0x65766173<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written<br>Bit 2-31: Reserved, shall be 0<br>Write: All writable, non-volatile values will be stored in non-volatile memory when the following is sent:<br>Byte 0: 0x73<br>Byte 1: 0x61<br>Byte 2: 0x76<br>Byte 3: 0x65 |
|                     | 02   | Status                   | USINT                  | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Last command completed, no error, reply there<br>2: Last command completed, error, no response.                                                                                                                                                                                           |

155) Idx = Index, sIdx = Sub-index, Hexadecimal

156) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>155)</sup> | sidx | Name                        | Type                    | Access <sup>156)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------|------|-----------------------------|-------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 03   | Re-sponse                   | AR-RAY[0..1]<br>OF BYTE | RO                     | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| FBF3                |      | Calculate check-sum command |                         | RO                     | Execution of this command will calculate a checksum for all writable, non-volatile parameters as currently stored in non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                     | 01   | Command                     | AR-RAY[0..3]<br>OF BYTE | RW                     | Read: Returns information about the supported checksum type<br>Bit 0 = 0: No non-volatile parameters supported<br>Bit 0 = 1: Non-volatile parameters supported<br>Bit 1 = 1: CRC-32<br>Bit 2 = 1: MD5<br>Bit 3 = 1: SHA-1<br>Bit 4-6: Reserved, shall be 0<br>Bit 7 = 1: Other algorithm.<br>Write: Checksum type selection and start calculation. A write access to this subindex shall only set one bit true in Bit[0...7].<br>Bit 0 = 1: Use default checksum algorithm of the device<br>Bit 1 = 1: CRC-32<br>Bit 2 = 1: MD5<br>Bit 3 = 1: SHA-1<br>Bit 4-6: Reserved, shall be 0<br>Bit 7 = 1: Other algorithm<br>Bit 8...31: Reserved. |
|                     | 02   | Status                      | USINT                   | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Last command completed, no error, reply there<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                     | 03   | Re-sponse                   | AR-RAY[0..n]<br>OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero<br>Byte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length is 64 bytes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| FBF4                |      | Load parameters command     |                         | RO                     | Execution of this command will load all parameters from non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

155) Idx = Index, sidx = Sub-index, Hexadecimal

156) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>155)</sup> | sIdx | Name     | Type                   | Access <sup>156)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------|------|----------|------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 01   | Command  | ARRAY[0..3]<br>OF BYTE | RW                     | Read:<br>Bit 0 = 1: Device loads the non-volatile parameters when writing 0xFBF4:01 with 0x64616F6C<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written.<br>Write:<br>All writable, non-volatile parameters will be loaded from non-volatile memory when the following is sent:<br>Byte 0: 0x6C<br>Byte 1: 0x6F<br>Byte 2: 0x61<br>Byte 3: 0x64. |
|                     | 02   | Status   | USINT                  | RO                     | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                   |
|                     | 03   | Response | ARRAY[0..1]<br>OF BYTE | RO                     | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                                |

Tbl. 30: CDP command objects

## 5.3 Operating Ultidry multi-stage roots pumps via EtherCAT

### 5.3.1 Process data: UltiDry

#### Process output data

Process output data are:

- Default RxPDO (control --> UltiDry, "output"), CoE 1600h.1 – 4 (1 Byte)

| Byte.Bit | CoE <sup>157)</sup>                      | Meaning                         |
|----------|------------------------------------------|---------------------------------|
| 0.0      | 0x7000.0x01: Roughing start/stop         | Pumping station (0: off, 1: on) |
| 0.1      | 0x7000.0x04: Low speed (idle/green mode) | 0: Normal, 1: Low speed mode    |
| 0.2 – 7. |                                          | Reserved                        |

Tbl. 31: Process output data

#### Process input data

Process input data are:

- Default TxPDO (UltiDry --> control, "input"), CoE 1A00h.1 – 11 (7 Byte)

| Byte.Bit | CoE <sup>158)</sup>                      | Meaning                                  |
|----------|------------------------------------------|------------------------------------------|
| 0.0      | 0x6000.0x01: Roughing run/stop           | Pumping station (0: off, 1: on)          |
| 0.1      | 0x6000.0x02: Booster run/stop            | Roots pump on/off (0: on, 1: off)        |
| 0.2      | 0x6000.0x04: Low speed (idle/green mode) | Idle mode (0: deactivated, 1: activated) |

155) Idx = Index, sIdx = Sub-index, Hexadecimal

156) RO = read only, RW = read/write, P = suitable for process data

157) Hexadecimal

158) Hexadecimal

| Byte.Bit  | CoE <sup>158)</sup>                    | Meaning                   |
|-----------|----------------------------------------|---------------------------|
| 0.3       | 0x6000.0x05: Remote/Local              | 0: ECAT, 1: Local         |
| 0.4       | 0x6000.0x09: Warning                   | 0: No warning, 1: Warning |
| 0.5       | 0x6000.0x0A: Alarm                     | 0: No alarm, 1: Alarm     |
| 0.6       | 0x6000.0x0B: Emergency Off             | 0: Normal, 1: Stop        |
| 0.7       | 0x6000.0x0C: N2 flow low               | 0: Normal, 1: N2 flow low |
| 1st – 2.  | 0x6001.0x02: N2 flow                   | 0.1 l/min                 |
| 3. – 4.   | 0x6001.0x03: Exhaust pressure          | kPa                       |
| 5. – 6.   | 0x6001.0x05: Roughing case temperature | °C                        |
| 7. – 8.   | 0x6001.0x09: Roughing current          | 0.1 A                     |
| 9. – 10.  | 0x6001.0x0A: Roughing power            | 0.1 kW                    |
| 11. – 12. | 0x6001.0x0B: Roughing speed            | 0.1% of rated speed       |
| 13. – 14. | 0x6002.0x05: Booster case temperature  | °C                        |
| 15. – 16. | 0x6002.0x09: Booster current           | 0.1 A                     |
| 17. – 18. | 0x6002.0x0A: Booster power             | 0.1 kW                    |
| 19. – 20. | 0x6002.0x0B: Booster speed             | 0.1% of rated speed       |

Tbl. 32: Process input data

#### Compile process data alternative from CoE objects

1. Always conduct the state "PRE-OPERATIONAL".
2. Describe the object 1601h.0 or 1A01h.0 with 0.
3. Describe the object 1601h.1-n or 1A01h.1-n with corresponding CoE indices.
4. Use only objects marked with "P".
5. Assign the sub-index 1-n on a sequential basis only and without gaps.
6. Make sure that the data yields a total number of bytes (use pad bits if needed) and start with whole bytes (exception BOOL).
7. Describe maximum 12 objects per PDO.
8. Describe the object 1601h.0 or 1A01h.0 with the number n of objects to be used.
9. Change object 1C12h.1 to 1601h or 1C13h.1 to 1A01h.
10. In the process data, select the corresponding PDO assignment 1601h or 1A01h.

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1600 (excluded by 0x1601)

☒ 0x1601

Download:

☒ PDO Assignment

☒ PDO Configuration

PDO Content (0x1601):

| Index     | Size | Offs | Name                  | Type |
|-----------|------|------|-----------------------|------|
| 0x7000:01 | 0.1  | 0.0  | Turbo Start Stop      | BOOL |
| 0x7000:03 | 0.1  | 0.1  | Turbo Low Speed       | BOOL |
| 0x3005:11 | 0.1  | 0.2  | Vnt. Enable           | BOOL |
| 0x3005:21 | 0.1  | 0.3  | Slg. Enable           | BOOL |
| ...       | 0.4  | 0.4  | ...                   | ...  |
| 0x8000:03 | 2.0  | 1.0  | Normal Speed Setpoint | UINT |
|           |      | 3.0  |                       |      |

Output data including 4 pad bits

Sync Manager:

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

PDO List:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

PDO Assignment (0x1C12):

☐ 0x1A00 (excluded by 0x1A01)

☒ 0x1A01

Download:

☒ PDO Assignment

☒ PDO Configuration

PDO Content (0x1601):

| Index     | Size | Offs | Name                | Type  |
|-----------|------|------|---------------------|-------|
| 0x6000:09 | 0.1  | 0.0  | Alarm               | BOOL  |
| 0x6000:0A | 0.1  | 0.1  | Warning             | BOOL  |
| 0x2001:88 | 0.1  | 0.2  | Ready for Process   | BOOL  |
| ...       | 0.5  | 0.3  | ...                 | ...   |
| 0x2001:81 | 1.0  | 1.0  | Status              | USINT |
| 0x2001:82 | 1.0  | 2.0  | Actual Speed (rel.) | SINT  |
| 0x2002:13 | 2.0  | 3.0  | Power               | INT   |
| 0x2002:88 | 2.0  | 5.0  | Pmp. Temperature    | INT   |
|           |      | 7.0  |                     |       |

Input data including 5 pad bits

Tbl. 33: Example for a process data configuration

### 5.3.2 Service data: UltiDry

| Type    | Description           |
|---------|-----------------------|
| BOOL    | Binary value (yes/no) |
| BYTE( ) | Single byte number    |

158) Hexadecimal

| Type      | Description                            |
|-----------|----------------------------------------|
| STRING( ) | Character string                       |
| USINT     | Positive integer, 8 bit                |
| UINT      | Positive integer, 16 bit               |
| UDINT     | Positive integer, 32 bit               |
| ULINT     | Positive integer, 64 bit               |
| SINT      | Integer, 8 bit                         |
| INT       | Integer, 16 bit                        |
| DINT      | Integer, 32 bit                        |
| REAL      | Floating point value, single precision |

**Tbl. 34: Data types of the service data**

The following CoE objects are available for access to individual data objects (e.g., for configuration):

**Administrative data (information about the device, communication)**

| Idx <sup>159)</sup> | sldx | Name                            | Type      | Access <sup>160)</sup> | Description                                                                                                                                                                     |
|---------------------|------|---------------------------------|-----------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000                |      | Device type                     | UDINT     | RO                     | Bit 0-15: Device profile number (5003).<br>NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B)<br>Bit 16-31: 0x0000, sub-profile number is defined in 0xF010 bit 15..0 |
| 1008                |      | Manufacturer device name        | STRING(n) | RO                     | Name of the device as non-zero terminated string.                                                                                                                               |
| 1009                |      | Manufacturer hardware version   | STRING(n) | RO                     | Hardware version of the device as non-zero terminated string.                                                                                                                   |
| 100 A               |      | Manufacturer software version   | STRING(n) | RO                     | Software version of the device as non-zero terminated string.                                                                                                                   |
| 100B                |      | Manufacturer bootloader version | STRING(n) | RO                     | Bootloader version of the device as non-zero terminated string.                                                                                                                 |
| 1018                |      | Identity object                 | IDENTITY  | RO                     |                                                                                                                                                                                 |
|                     | 01   | Vendor ID                       | UDINT     | RO                     |                                                                                                                                                                                 |
|                     | 02   | Product code                    | UDINT     | RO                     |                                                                                                                                                                                 |
|                     | 03   | Revision number                 | UDINT     | RO                     |                                                                                                                                                                                 |
|                     | 04   | Serial number                   | UDINT     | RO                     |                                                                                                                                                                                 |
| 10F8                |      | Timestamp object                | ULINT     | RO                     | Local timestamp of the device in ns.                                                                                                                                            |
| 1600                |      | SDP default RxPDO               |           |                        |                                                                                                                                                                                 |
|                     | 01h  |                                 |           |                        | 0x7000.0x01: Roughing start/stop                                                                                                                                                |
|                     | 02h  |                                 |           |                        | 0x7000.0x04: Low speed (idle/green mode)                                                                                                                                        |
|                     | 03h  |                                 |           |                        |                                                                                                                                                                                 |
| 1601                |      | User RxPDO                      |           |                        |                                                                                                                                                                                 |
| 1A00                |      | SDP default TxPDO               |           |                        |                                                                                                                                                                                 |
|                     | 01h  |                                 |           |                        | 0x6000.0x01: Roughing run/stop                                                                                                                                                  |
|                     | 02h  |                                 |           |                        | 0x6000.0x02: Booster run/stop                                                                                                                                                   |
|                     | 03h  |                                 |           |                        | 0x6000.0x04: Low speed (idle/green mode)                                                                                                                                        |
|                     | 04h  |                                 |           |                        | 0x6000.0x05: Remote/local                                                                                                                                                       |

159) Idx = Index, sldx = Sub-index, Hexadecimal

160) RO = read only, RW = read/write, P = suitable for process data



| Idx <sup>159)</sup> | sldx | Name                                         | Type | Access <sup>160)</sup> | Description                            |
|---------------------|------|----------------------------------------------|------|------------------------|----------------------------------------|
|                     | 05h  |                                              |      |                        | 0x6000.0x09: Warning                   |
|                     | 06h  |                                              |      |                        | 0x6000.0x0A: Alarm                     |
|                     | 07h  |                                              |      |                        | 0x6000.0x0B: Emergency Off             |
|                     | 08h  |                                              |      |                        | 0x6000.0x0C: N2 flow low               |
|                     | 09h  |                                              |      |                        | 0x6001.0x02: N2 flow                   |
|                     | 0Ah  |                                              |      |                        | 0x6001.0x03: Exhaust pressure          |
|                     | 0Bh  |                                              |      |                        | 0x6001.0x05: Roughing case temperature |
|                     | 0Ch  |                                              |      |                        | 0x6001.0x09: Roughing current          |
|                     | 0Dh  |                                              |      |                        | 0x6001.0x0A: Roughing power            |
|                     | 0Eh  |                                              |      |                        | 0x6001.0x0B: Roughing speed            |
|                     | 0Fh  |                                              |      |                        | 0x6002.0x05: Booster case temperature  |
|                     | 10h  |                                              |      |                        | 0x6002.0x09: Booster current           |
|                     | 11h  |                                              |      |                        | 0x6002.0x0A: Booster power             |
|                     | 12h  |                                              |      |                        | 0x6002.0x0B: Booster speed             |
| 1A01                |      | User TxPDO                                   |      |                        |                                        |
| 1C00                |      | Sync manager type                            |      |                        |                                        |
| 1C10                |      | Sync manager 0 PDO assignment                |      |                        |                                        |
| 1C11                |      | Sync manager 1 PDO assignment                |      |                        |                                        |
| 1C12                |      | RxPDO assign (sync manager 2 PDO assignment) |      |                        |                                        |
| 1C13                |      | TxPDO assign (sync manager 3 PDO assignment) |      |                        |                                        |

**Tbl. 35: Communication area – administrative data (information about the device, communication)**

**Input data (UltiDry --> control)**

| Idx <sup>161)</sup> | sldx | Name                              | Type | Access <sup>162)</sup> | Description                                                        |
|---------------------|------|-----------------------------------|------|------------------------|--------------------------------------------------------------------|
| 6000                |      | Roughing and booster status       |      | RO                     |                                                                    |
|                     | 01   | Roughing run/stop                 | BOOL | RO                     | 1: Run<br>0: Stop                                                  |
|                     | 02   | Booster run/stop                  | BOOL | RO                     | 1: Run<br>0: Stop                                                  |
|                     | 03   | Booster 2 run/stop                |      |                        | 1: Run<br>0: Stop                                                  |
|                     | 04   | Low speed (idle/sleep/green mode) | BOOL | RO                     | 1: Low speed (idle /sleep / green mode)<br>0: Normal               |
|                     | 05   | Remote/local                      | BOOL | RO                     | 1: Local. Hand control enabled<br>0: Remote, E-cat control enabled |

159) Idx = Index, sldx = Sub-index, Hexadecimal

160) RO = read only, RW = read/write, P = suitable for process data

161) Idx = Index, sldx = Sub-index, Hexadecimal

162) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>161)</sup> | sIdx | Name                                 | Type | Access <sup>162)</sup> | Description                                                    |
|---------------------|------|--------------------------------------|------|------------------------|----------------------------------------------------------------|
|                     | 06   | Inlet gate valve                     | BOOL | RO                     | 1: Open<br>0: Closed<br>Mandatory if inlet gate valve fitted   |
|                     | 07   | Pump interlock                       | BOOL | RO                     | 1: OK, process may proceed<br>0: Process must not run          |
|                     | 08   | N2 level ready                       | BOOL | RO                     | 1: OK (high level)<br>0: Not ready (low level)                 |
|                     | 09   | Warning                              | BOOL | RO                     | 1: Warning<br>0: Normal                                        |
|                     | 0 A  | Alarm                                | BOOL | RO                     | 1: Alarm<br>0: Normal                                          |
|                     | 0B   | Emergency off                        | BOOL | RO                     | 1: Stop<br>0: Normal                                           |
|                     | 0C   | N2 flow low                          | BOOL | RO                     | 1: N2 flow low<br>0: Normal                                    |
|                     | 11   | Multiple sleep (green) level setting | UINT | RO                     | 0: Idle/sleep level 0 (default)<br>1- 255: Sleep (green) modes |
| 6001                |      | Roughing analog inputs               |      |                        |                                                                |
|                     | 01   | Coolant flow                         | INT  | RO                     | 0.1 [l/min]                                                    |
|                     | 02   | N2 flow                              | INT  | RO                     | 0.1 [slm]                                                      |
|                     | 03   | Exhaust pressure                     | INT  | RO                     | Gauge pressure (not absolute) - 1 [kPa]                        |
|                     | 05   | Roughing case temperature            | INT  | RO                     | Degrees Celsius                                                |
|                     | 06   | Roughing optional temperature        | INT  | RO                     | Degrees Celsius                                                |
|                     | 09   | Roughing current                     | INT  | RO                     | 0.1 [A]                                                        |
|                     | 0 A  | Roughing power                       | INT  | RO                     | 0.1 [kW]                                                       |
|                     | 0B   | Roughing speed                       | INT  | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%): 0 Rotation, 0.1 [%]    |
| 6002                |      | Booster analog inputs                |      | RO                     |                                                                |
|                     | 05   | Booster case temperature             | INT  | RO                     | Degrees Celsius                                                |
|                     | 09   | Booster current                      | INT  | RO                     | 0.1 [A]                                                        |
|                     | 0 A  | Booster power                        | INT  | RO                     | 0.1 [kW]                                                       |
|                     | 0B   | Booster speed                        | INT  | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%): 0 Rotation, 0.1 [%]    |
| 6003                |      | Booster 2 analog inputs              |      | RO                     |                                                                |
|                     | 05   |                                      | INT  | RO                     | Degrees Celsius                                                |
|                     | 09   | Booster 2 current                    | INT  | RO                     | 0.1 [A]                                                        |
|                     | 0 A  | Booster 2 power                      | INT  | RO                     | 0.1 [kW]                                                       |
|                     | 0B   | Booster 2 speed                      | INT  | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%): 0 Rotation, 0.1 [%]    |

**Tbl. 36: Input area**

161) Idx = Index, sIdx = Sub-index, Hexadecimal

162) RO = read only, RW = read/write, P = suitable for process data

**Output data (control --> UltiDry)**

| Idx <sup>163)</sup> | sIdx | Name                                 | Type | Access <sup>164)</sup> | Description                                                     |
|---------------------|------|--------------------------------------|------|------------------------|-----------------------------------------------------------------|
| 7000                |      | Roughing and booster control         |      | RO                     |                                                                 |
|                     | 01   | Roughing start/stop                  | BOOL | RW                     | 1: Run<br>0: Stop                                               |
|                     | 02   | Booster start/stop                   | BOOL | RW                     | 1: Run<br>0: Stop                                               |
|                     | 03   | Booster 2 start/stop                 | BOOL | RW                     | 1: Run<br>0: Stop                                               |
|                     | 04   | Low speed (idle/sleep/green mode)    | BOOL | RW                     | 1: Low speed (idle/sleep/green mode)<br>0: Normal               |
|                     | 06   | N2 ballast valve                     | BOOL | RW                     | 1: Open ballast valve<br>0: Close ballast valve                 |
|                     | 07   | Inlet gate valve                     | BOOL | RW                     | 1: Open gate valve<br>0: Close gate valve                       |
|                     | 11   | Multiple sleep (green) level setting | UINT | RW                     | 0: Idle/sleep level 0 (default)<br>1-255: Sleep (green) levels. |

**Tbl. 37: Output area****Configuration data (control --> UltiDry)**

| Idx <sup>165)</sup> | sIdx | Name                                       | Type | Access <sup>166)</sup> | Description                                                                                                 |
|---------------------|------|--------------------------------------------|------|------------------------|-------------------------------------------------------------------------------------------------------------|
| 8001                |      | Roughing and booster configuration         |      | RO                     |                                                                                                             |
|                     | 01   | Safe state                                 | UINT | RW                     | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - pumps stop |
|                     | 02   | Booster and booster 2 control mode setting | UINT | RW                     | 0: Co-ordinated mode (default)<br>1: Independent mode                                                       |
|                     | 03   | Gate valve control mode setting            | UINT | RW                     | 0: Co-ordinated mode (default)<br>1: Independent mode                                                       |

**Tbl. 38: Configuration area****Information data (UltiDry --> control)**

| Idx <sup>167)</sup> | sIdx | Name                             | Type | Access <sup>168)</sup> | Description                      |
|---------------------|------|----------------------------------|------|------------------------|----------------------------------|
| 9000                |      | Roughing and booster information |      | RO                     |                                  |
|                     | 01   | Roughing exists                  | BOOL | RO                     | 0: Not available<br>1: Available |
|                     | 02   | Booster exists                   | BOOL | RO                     | 0: Not available<br>1: Available |

163) Idx = Index, sIdx = Sub-index, Hexadecimal

164) RO = read only, RW = read/write, P = suitable for process data

165) Idx = Index, sIdx = Sub-index, Hexadecimal

166) RO = read only, RW = read/write, P = suitable for process data

167) Idx = Index, sIdx = Sub-index, Hexadecimal

168) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>167)</sup> | sldx | Name                              | Type  | Access <sup>168)</sup> | Description                                           |
|---------------------|------|-----------------------------------|-------|------------------------|-------------------------------------------------------|
|                     | 03   | Booster 2 exists                  | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                     | 11   | Roughing and booster running time | UDINT | RO                     | Running time since manufacture or service - 1 [hours] |
| 9001                |      | Sleep level wake-up time          |       | RO                     |                                                       |
|                     | 01   |                                   | UINT  | RO                     | Wake-up time.<br>Unit: Seconds                        |

Tbl. 39: Information area

## Semiconductor device profile area

| Idx <sup>169)</sup> | sldx | Name                         | Type  | Access <sup>170)</sup> | Description |
|---------------------|------|------------------------------|-------|------------------------|-------------|
| F000                |      | Semiconductor device profile |       | RO                     |             |
|                     | 01   | Index distance               | UINT  |                        |             |
|                     | 02   | Maximum number of modules    | UINT  |                        |             |
| F010                |      | Module profile list          |       | RO                     |             |
|                     | 01   |                              | UDINT | RO                     |             |

Tbl. 40: Semiconductor device profile area

## Exception handling

| Idx <sup>171)</sup> | sldx | Name                                                 | Type  | Access <sup>172)</sup> | Description                                                                                                                     |
|---------------------|------|------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380                |      | Active exception status                              | USINT | RO                     | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning                                 |       |                        | Bit0: Device warning                                                                                                            |
|                     |      | Bit1: Manufacturer warning                           |       |                        | Bit1: Manufacturer warning                                                                                                      |
|                     |      | Bit2: Device error                                   |       |                        | Bit2: Device error                                                                                                              |
|                     |      | Bit3: Manufacturer error                             |       |                        | Bit3: Manufacturer error                                                                                                        |
|                     |      | Bit4: Reserved                                       |       |                        | Bit4: Reserved                                                                                                                  |
|                     |      | Bit5: Reserved                                       |       |                        | Bit5: Reserved                                                                                                                  |
|                     |      | Bit6: Reserved                                       |       |                        | Bit6: Reserved                                                                                                                  |
|                     |      | Bit7: Reserved                                       |       |                        | Bit7: Reserved                                                                                                                  |
| F381                |      | Roughing and booster 1 to 255: Active warning detail |       | RO                     |                                                                                                                                 |
|                     | 01   |                                                      | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                         |
|                     |      | Bit2: Power fail open phase                          |       |                        | Bit2: Power fail open phase                                                                                                     |
|                     |      | Bit4: Coolant flow                                   |       |                        | Bit4: Coolant flow                                                                                                              |
|                     |      | Bit5: N2 flow                                        |       |                        | Bit5: N2 flow                                                                                                                   |

167) Idx = Index, sldx = Sub-index, Hexadecimal

168) RO = read only, RW = read/write, P = suitable for process data

169) Idx = Index, sldx = Sub-index, Hexadecimal

170) RO = read only, RW = read/write, P = suitable for process data

171) Idx = Index, sldx = Sub-index, Hexadecimal

172) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>171)</sup> | sldx | Name                                                       | Type  | Access <sup>172)</sup> | Description                                                                                             |
|---------------------|------|------------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit6: Exhaust pressure                                     |       |                        | Bit6: Exhaust pressure                                                                                  |
|                     |      | Bit8: Main controller err/batt low                         |       |                        | Bit8: Main controller err/batt low                                                                      |
|                     |      | Bit9: Roughing case temp                                   |       |                        | Bit9: Roughing case temp                                                                                |
|                     |      | Bit10: Roughing motor temp                                 |       |                        | Bit10: Roughing motor temp                                                                              |
|                     |      | Bit11: Roughing current                                    |       |                        | Bit11: Roughing current                                                                                 |
|                     |      | Bit12: Roughing speed                                      |       |                        | Bit12: Roughing speed                                                                                   |
|                     |      | Bit13: Roughing lock rotor                                 |       |                        | Bit13: Roughing lock rotor                                                                              |
|                     |      | Bit14: Roughing motor driver err                           |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                  |       |                        | Bit15: Booster case temp.                                                                               |
|                     |      | Bit16: Booster motor temp.                                 |       |                        | Bit16: Booster motor temp.                                                                              |
|                     |      | Bit17: Booster current                                     |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                       |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                  |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                            |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                |       |                        | Bit21: Booster 2 case temp.                                                                             |
|                     |      | Bit23: Booster 2 current                                   |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                     |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                          |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                      |       |                        | Bit27: Gate valve err                                                                                   |
|                     |      | Bit31: Others                                              |       |                        | Bit31: Others                                                                                           |
| F383                |      | Roughing and booster 1 to 255: Active error (alarm) detail |       | RO                     |                                                                                                         |
|                     | 01   |                                                            | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: EMO                                                  |       |                        | Bit0: EMO                                                                                               |
|                     |      | Bit2: Power fail open phase                                |       |                        | Bit2: Power fail open phase                                                                             |
|                     |      | Bit3: Reverse phase                                        |       |                        | Bit3: Reverse phase                                                                                     |
|                     |      | Bit 4: Coolant flow                                        |       |                        | Bit 4: Coolant flow                                                                                     |
|                     |      | Bit5: N2 flow                                              |       |                        | Bit5: N2 flow                                                                                           |
|                     |      | Bit6: Exhaust pressure                                     |       |                        | Bit6: Exhaust pressure                                                                                  |
|                     |      | Bit8: Main controller err/batt low                         |       |                        | Bit8: Main controller err/batt low                                                                      |
|                     |      | Bit9: Roughing case temp                                   |       |                        | Bit9: Roughing case temp                                                                                |
|                     |      | Bit10: Roughing motor temp                                 |       |                        | Bit10: Roughing motor temp                                                                              |
|                     |      | Bit11: Roughing current                                    |       |                        | Bit11: Roughing current                                                                                 |
|                     |      | Bit12: Roughing speed                                      |       |                        | Bit12: Roughing speed                                                                                   |
|                     |      | Bit13: Roughing lock rotor                                 |       |                        | Bit13: Roughing lock rotor                                                                              |
|                     |      | Bit14: Roughing motor driver err                           |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                  |       |                        | Bit15: Booster case temp.                                                                               |

171) Idx = Index, sldx = Sub-index, Hexadecimal

172) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>171)</sup> | sldx | Name                                                  | Type  | Access <sup>172)</sup> | Description                                                                                                                                                  |
|---------------------|------|-------------------------------------------------------|-------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |      | Bit16: Booster motor temp.                            |       |                        | Bit16: Booster motor temp.                                                                                                                                   |
|                     |      | Bit17: Booster current                                |       |                        | Bit17: Booster current                                                                                                                                       |
|                     |      | Bit18: Booster speed                                  |       |                        | Bit18: Booster speed                                                                                                                                         |
|                     |      | Bit19: Booster lock rotor                             |       |                        | Bit19: Booster lock rotor                                                                                                                                    |
|                     |      | Bit20: Booster motor driver err                       |       |                        | Bit20: Booster motor driver err                                                                                                                              |
|                     |      | Bit21: Booster 2 case temp.                           |       |                        | Bit21: Booster 2 case temp.                                                                                                                                  |
|                     |      | Bit23: Booster 2 current                              |       |                        | Bit23: Booster 2 current                                                                                                                                     |
|                     |      | Bit24: Booster 2 speed                                |       |                        | Bit24: Booster 2 speed                                                                                                                                       |
|                     |      | Bit25: Booster 2 lock rotor                           |       |                        | Bit25: Booster 2 lock rotor                                                                                                                                  |
|                     |      | Bit26: Booster 2 motor driver err                     |       |                        | Bit26: Booster 2 motor driver err                                                                                                                            |
|                     |      | Bit27: Gate valve err                                 |       |                        | Bit27: Gate valve err                                                                                                                                        |
|                     |      | Bit31: Others                                         |       |                        | Bit31: Others                                                                                                                                                |
| F390                |      | Latched exception status                              | USINT | RO                     | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. See CDP for additional information. |
|                     |      | Bit0: Device warning                                  |       |                        | Bit0: Device warning                                                                                                                                         |
|                     |      | Bit1: Manufacturer warning                            |       |                        | Bit1: Manufacturer warning                                                                                                                                   |
|                     |      | Bit2: Device error                                    |       |                        | Bit2: Device error                                                                                                                                           |
|                     |      | Bit3: Manufacturer error                              |       |                        | Bit3: Manufacturer error                                                                                                                                     |
|                     |      | Bit4: Reserved                                        |       |                        | Bit4: Reserved                                                                                                                                               |
|                     |      | Bit5: Reserved                                        |       |                        | Bit5: Reserved                                                                                                                                               |
|                     |      | Bit6: Reserved                                        |       |                        | Bit6: Reserved                                                                                                                                               |
|                     |      | Bit7: Reserved                                        |       |                        | Bit7: Reserved                                                                                                                                               |
| F391                |      | Roughing and booster 1 to 255: Latched warning detail |       | RO                     |                                                                                                                                                              |
|                     | 01   |                                                       | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                                                      |
|                     |      | Bit0: EMO                                             |       |                        | Bit0: EMO                                                                                                                                                    |
|                     |      | Bit1: Water leak                                      |       |                        | Bit1: Water leak                                                                                                                                             |
|                     |      | Bit2: Power fail open phase                           |       |                        | Bit2: Power fail open phase                                                                                                                                  |
|                     |      | Bit3: Reverse phase                                   |       |                        | Bit3: Reverse phase                                                                                                                                          |
|                     |      | Bit4: Coolant flow                                    |       |                        | Bit4: Coolant flow                                                                                                                                           |
|                     |      | Bit5: N2 flow                                         |       |                        | Bit5: N2 flow                                                                                                                                                |
|                     |      | Bit6: Exhaust pressure                                |       |                        | Bit6: Exhaust pressure                                                                                                                                       |
|                     |      | Bit7: Exhaust temp.                                   |       |                        | Bit7: Exhaust temp.                                                                                                                                          |
|                     |      | Bit8: Main controller err/batt low                    |       |                        | Bit8: Main controller err/batt low                                                                                                                           |
|                     |      | Bit9: Roughing case temp                              |       |                        | Bit9: Roughing case temp                                                                                                                                     |
|                     |      | Bit10: Roughing motor temp                            |       |                        | Bit10: Roughing motor temp                                                                                                                                   |
|                     |      | Bit11: Roughing current                               |       |                        | Bit11: Roughing current                                                                                                                                      |
|                     |      | Bit12: Roughing speed                                 |       |                        | Bit12: Roughing speed                                                                                                                                        |
|                     |      | Bit13: Roughing lock rotor                            |       |                        | Bit13: Roughing lock rotor                                                                                                                                   |

171) Idx = Index, sldx = Sub-index, Hexadecimal

172) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>171)</sup> | sldx | Name                                                        | Type  | Access <sup>172)</sup> | Description                                                                                             |
|---------------------|------|-------------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit14: Roughing motor driver err                            |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                   |       |                        | Bit15: Booster case temp.                                                                               |
|                     |      | Bit16: Booster motor temp.                                  |       |                        | Bit16: Booster motor temp.                                                                              |
|                     |      | Bit17: Booster current                                      |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                        |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                   |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                             |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                 |       |                        | Bit21: Booster 2 case temp.                                                                             |
|                     |      | Bit22: Booster 2 motor temp.                                |       |                        | Bit22: Booster 2 motor temp.                                                                            |
|                     |      | Bit23: Booster 2 current                                    |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                      |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                 |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                           |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                       |       |                        | Bit27: Gate valve err                                                                                   |
|                     |      | Bit28: Future use                                           |       |                        | Bit28: Future use                                                                                       |
|                     |      | Bit29: Future use                                           |       |                        | Bit29: Future use                                                                                       |
|                     |      | Bit30: Future use                                           |       |                        | Bit30: Future use                                                                                       |
|                     |      | Bit31: Others                                               |       |                        | Bit31: Others                                                                                           |
| F393                |      | Roughing and booster 1 to 255: Latched error (alarm) detail |       | RO                     |                                                                                                         |
|                     | 01   |                                                             | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: EMO                                                   |       |                        | Bit0: EMO                                                                                               |
|                     |      | Bit1: Water leak                                            |       |                        | Bit1: Water leak                                                                                        |
|                     |      | Bit2: Power fail open phase                                 |       |                        | Bit2: Power fail open phase                                                                             |
|                     |      | Bit3: Reverse phase                                         |       |                        | Bit3: Reverse phase                                                                                     |
|                     |      | Bit4: Coolant flow                                          |       |                        | Bit4: Coolant flow                                                                                      |
|                     |      | Bit5: N2 flow                                               |       |                        | Bit5: N2 flow                                                                                           |
|                     |      | Bit6: Exhaust pressure                                      |       |                        | Bit6: Exhaust pressure                                                                                  |
|                     |      | Bit7: Exhaust temp.                                         |       |                        | Bit7: Exhaust temp.                                                                                     |
|                     |      | Bit8: Main controller err/batt low                          |       |                        | Bit8: Main controller err/batt low                                                                      |
|                     |      | Bit9: Roughing case temp                                    |       |                        | Bit9: Roughing case temp                                                                                |
|                     |      | Bit10: Roughing motor temp                                  |       |                        | Bit10: Roughing motor temp                                                                              |
|                     |      | Bit11: Roughing current                                     |       |                        | Bit11: Roughing current                                                                                 |
|                     |      | Bit12: Roughing speed                                       |       |                        | Bit12: Roughing speed                                                                                   |
|                     |      | Bit13: Roughing lock rotor                                  |       |                        | Bit13: Roughing lock rotor                                                                              |
|                     |      | Bit14: Roughing motor driver err                            |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                   |       |                        | Bit15: Booster case temp.                                                                               |
|                     |      | Bit16: Booster motor temp.                                  |       |                        | Bit16: Booster motor temp.                                                                              |

171) Idx = Index, sldx = Sub-index, Hexadecimal

172) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>171)</sup> | sldx | Name                                              | Type  | Access <sup>172)</sup> | Description                                                                                                                                                                                                                         |
|---------------------|------|---------------------------------------------------|-------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |      | Bit17: Booster current                            |       |                        | Bit17: Booster current                                                                                                                                                                                                              |
|                     |      | Bit18: Booster speed                              |       |                        | Bit18: Booster speed                                                                                                                                                                                                                |
|                     |      | Bit19: Booster lock rotor                         |       |                        | Bit19: Booster lock rotor                                                                                                                                                                                                           |
|                     |      | Bit20: Booster motor driver err                   |       |                        | Bit20: Booster motor driver err                                                                                                                                                                                                     |
|                     |      | Bit21: Booster 2 case temp.                       |       |                        | Bit21: Booster 2 case temp.                                                                                                                                                                                                         |
|                     |      | Bit22: Booster 2 motor temp.                      |       |                        | Bit22: Booster 2 motor temp.                                                                                                                                                                                                        |
|                     |      | Bit23: Booster 2 current                          |       |                        | Bit23: Booster 2 current                                                                                                                                                                                                            |
|                     |      | Bit24: Booster 2 speed                            |       |                        | Bit24: Booster 2 speed                                                                                                                                                                                                              |
|                     |      | Bit25: Booster 2 lock rotor                       |       |                        | Bit25: Booster 2 lock rotor                                                                                                                                                                                                         |
|                     |      | Bit26: Booster 2 motor driver err                 |       |                        | Bit26: Booster 2 motor driver err                                                                                                                                                                                                   |
|                     |      | Bit27: Gate valve err                             |       |                        | Bit27: Gate valve err                                                                                                                                                                                                               |
|                     |      | Bit28: Future use                                 |       |                        | Bit28: Future use                                                                                                                                                                                                                   |
|                     |      | Bit29: Future use                                 |       |                        | Bit29: Future use                                                                                                                                                                                                                   |
|                     |      | Bit30: Future use                                 |       |                        | Bit30: Future use                                                                                                                                                                                                                   |
|                     |      | Bit31: Others                                     |       |                        | Bit31: Others                                                                                                                                                                                                                       |
| F3A1                |      | Roughing and booster 1 to 255: Warning mask       |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   |                                                   | UDINT | RW                     | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3                |      | Roughing and booster 1 to 255: Error (alarm) mask |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   |                                                   | UDINT | RW                     | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |
| F6F0                |      | Input latch local timestamp                       |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   | Input latch local timestamp                       | UDINT | RO                     | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up.                                                                                                                  |

Tbl. 41: Exception handling

171) Idx = Index, sldx = Sub-index, Hexadecimal

172) RO = read only, RW = read/write, P = suitable for process data



CDP-specific information data

| Idx <sup>173)</sup> | sIdx | Name                                          | Type      | Access <sup>174)</sup> | Description                                                                                                                                                                                                                                                                                                                |
|---------------------|------|-----------------------------------------------|-----------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| F9F0                |      | Manufacturer serial number                    | STRING(n) | RO                     | String representing the manufacturer's serial number for the device. NOTE: This may have the same value as 0x1018:04.                                                                                                                                                                                                      |
| F9F1                |      | CDP functional generation number              |           | RO                     |                                                                                                                                                                                                                                                                                                                            |
|                     | 01   |                                               | UDINT     | RO                     | Common device profile functional generation number 2                                                                                                                                                                                                                                                                       |
| F9F2                |      | SDP functional generation number              |           | RO                     |                                                                                                                                                                                                                                                                                                                            |
|                     | 01   |                                               | UDINT     | RO                     | SDP functional generation number of nn-th module shall be specified by each SDP.2                                                                                                                                                                                                                                          |
| F9F3                |      | Vendor name                                   | STRING(n) | RO                     | This string identifies the supplier of the device.                                                                                                                                                                                                                                                                         |
| F9F4                |      | SDP device name                               |           | RO                     |                                                                                                                                                                                                                                                                                                                            |
|                     | 01   |                                               | STRING(n) | RO                     | String identifying the device type of nn-th module as defined by the SDP.                                                                                                                                                                                                                                                  |
| F9F5                |      | Output identifier                             |           | RO                     |                                                                                                                                                                                                                                                                                                                            |
|                     | 01   |                                               | USINT     | RO                     | Output identifier of nn-th module. This value can be mapped to both the RxPDO and TxPDO. The required function of the device is to store the value in memory as written by the host. The controller can then read this value back through the TxPDO to ensure the RxPDO was received.                                      |
| F9F6                |      | Time since power on                           | UDINT     | RO                     | This is the time the device has currently been powered on, in seconds, regardless of communication presence.                                                                                                                                                                                                               |
| F9F8                |      | Firmware update: functional generation number | UDINT     | RO                     | Firmware update of functional generation number supported by the device. Value shall be specified by the Firmware Update Profile (ETG.5003-2)0x00000000: FW update according to ETG.5003-2 not supported. A device cannot return this value and still be compliant with ETG.5003.1, as ETG.5003-2 compliance is mandatory. |

Tbl. 42: CDP-specific information data

173) Idx = Index, sIdx = Sub-index, Hexadecimal

174) RO = read only, RW = read/write, P = suitable for process data

## CDP command objects

| Idx <sup>175)</sup> | sIdx | Name                     | Type                   | Access <sup>176)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------|------|--------------------------|------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0                |      | Device reset command     |                        | RO                     | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. There are two versions of this command:<br><br>Device reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset.<br><br>Factory reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                     | 01   | Command                  | ARRAY[0..5]<br>OF BYTE | RW                     | A device reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72<br>Byte 5: Device standard reset = 0x00, factory reset = 0x66                                                                                                                                                                                                                                                                                |
|                     | 02   | Status                   | USINT                  | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Reserved<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                                                                                                     |
|                     | 03   | Response                 | ARRAY[0..1]<br>OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| FBF1                |      | Exception reset command  |                        | RO                     | Execution of this command clears the latched exceptions.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                     | 01   | Command                  | ARRAY[0..4]<br>OF BYTE | RW                     | A latched exception reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72                                                                                                                                                                                                                                                                                                                                   |
|                     | 02   | Status                   | USINT                  | RO                     | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                                                                                                                              |
|                     | 03   | Response                 | ARRAY[0..1]<br>OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| FBF2                |      | Store parameters command |                        | RO                     | Execution of this command will store all parameters to non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                        |

175) Idx = Index, sIdx = Sub-index, Hexadecimal

176) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>175)</sup> | sIdx | Name                       | Type                    | Access <sup>176)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------|------|----------------------------|-------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 01   | Command                    | AR-RAY[0..3]<br>OF BYTE | RW                     | Read:<br>Bit 0 = 1: Device saves the non-volatile parameters when writing 0xFB2:01 with 0x65766173<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written<br>Bit 2-31: Reserved, shall be 0<br>Write: All writable, non-volatile values will be stored in non-volatile memory when the following is sent:<br>Byte 0: 0x73<br>Byte 1: 0x61<br>Byte 2: 0x76<br>Byte 3: 0x65                                                                                                                                                                                                                               |
|                     | 02   | Status                     | USINT                   | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Last command completed, no error, reply there<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                     | 03   | Response                   | AR-RAY[0..1]<br>OF BYTE | RO                     | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| FBF3                |      | Calculate checksum command |                         | RO                     | Execution of this command will calculate a checksum for all writable, non-volatile parameters as currently stored in non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                     | 01   | Command                    | AR-RAY[0..3]<br>OF BYTE | RW                     | Read: Returns information about the supported checksum type<br>Bit 0 = 0: No non-volatile parameters supported<br>Bit 0 = 1: Non-volatile parameters supported<br>Bit 1 = 1: CRC-32<br>Bit 2 = 1: MD5<br>Bit 3 = 1: SHA-1<br>Bit 4-6: Reserved, shall be 0<br>Bit 7 = 1: Other algorithm.<br>Write: Checksum type selection and start calculation. A write access to this subindex shall only set one bit true in Bit[0...7].<br>Bit 0 = 1: Use default checksum algorithm of the device<br>Bit 1 = 1: CRC-32<br>Bit 2 = 1: MD5<br>Bit 3 = 1: SHA-1<br>Bit 4-6: Reserved, shall be 0<br>Bit 7 = 1: Other algorithm<br>Bit 8...31: Reserved. |

175) Idx = Index, sIdx = Sub-index, Hexadecimal

176) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>175)</sup> | sidx | Name                    | Type                    | Access <sup>176)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------|------|-------------------------|-------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 02   | Status                  | USINT                   | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Last command completed, no error, reply there<br>2: Last command completed, error, no response                                                                                                                                                                     |
|                     | 03   | Re-sponse               | AR-RAY[0..n]<br>OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero<br>Byte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length is 64 bytes.                                                                                                                                                                                                              |
| FBF4                |      | Load parameters command |                         | RO                     | Execution of this command will load all parameters from non-volatile memory.                                                                                                                                                                                                                                                                                                           |
|                     | 01   | Command                 | AR-RAY[0..3]<br>OF BYTE | RW                     | Read:<br>Bit 0 = 1: Device loads the non-volatile parameters when writing 0xFB4:01 with 0x64616F6C<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written.<br>Write:<br>All writable, non-volatile parameters will be loaded from non-volatile memory when the following is sent:<br>Byte 0: 0x6C<br>Byte 1: 0x6F<br>Byte 2: 0x61<br>Byte 3: 0x64. |
|                     | 02   | Status                  | USINT                   | RO                     | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                  |
|                     | 03   | Re-sponse               | AR-RAY[0..1]<br>OF BYTE | RO                     | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                               |

Tbl. 43: CDP command objects

## 5.4 Operating HiLobe roots pump via EtherCAT

### 5.4.1 Process data: HiLobe

#### Process output data

Process output data are:

- Default RxPDO (control --> HiLobe, "output"), CoE 1600h.1 – 4 (1 Byte)

175) Idx = Index, sidx = Sub-index, Hexadecimal

176) RO = read only, RW = read/write, P = suitable for process data

| Byte.Bit | CoE <sup>177)</sup>                      | Meaning                         |
|----------|------------------------------------------|---------------------------------|
| 0.0      | 0x7000.0x01: Roughing start/stop         | Pumping station (0: off, 1: on) |
| 0.1      | 0x7000.0x04: Low speed (idle/green mode) | Standby (0: off, 1: on)         |
| 0.2 – 7. |                                          | Reserved                        |

**Tbl. 44: Process output data**

#### Process input data

Process input data are:

- Default TxPDO (HiLobe --> control, "input"), CoE 1A00h.1 – 11 (7 Byte)

| Byte.Bit  | CoE <sup>178)</sup>                      | Meaning                         |
|-----------|------------------------------------------|---------------------------------|
| 0.0       | 0x6000.0x01: Roughing run/stop           | Pumping station (0: off, 1: on) |
| 0.1       | 0x6000.0x02: Booster run/stop            | Constant 0                      |
| 0.2       | 0x6000.0x04: Low speed (idle/green mode) | Standby (0: off, 1: on)         |
| 0.3       | 0x6000.0x05: Remote/Local                | 0: Local, 1: EtherCAT           |
| 0.4       | 0x6000.0x09: Warning                     | 0: No warning, 1: Warning       |
| 0.5       | 0x6000.0x0A: Alarm                       | 0: No alarm, 1: Alarm           |
| 0.6       | 0x6000.0x0B: Emergency Off               | Constant 0                      |
| 0.7       | 0x6000.0x0C: N2 flow low                 | Constant 0                      |
| 1st – 2.  | 0x6001.0x02: N2 flow                     | Constant 0                      |
| 3. – 4.   | 0x6001.0x03: Exhaust pressure            | Constant 0                      |
| 5. – 6.   | 0x6001.0x05: Roughing case temperature   | Constant 0                      |
| 7. – 8.   | 0x6001.0x09: Roughing current            | 0.1 A                           |
| 9. – 10.  | 0x6001.0x0A: Roughing power              | 0.1 kW                          |
| 11. – 12. | 0x6001.0x0B: Roughing speed              | 0.1% of rated speed             |
| 13. – 14. | 0x6002.0x05: Booster case temperature    | Constant 0                      |
| 15. – 16. | 0x6002.0x09: Booster current             | Constant 0                      |
| 17. – 18. | 0x6002.0x0A: Booster power               | Constant 0                      |
| 19. – 20. | 0x6002.0x0B: Booster speed               | Constant 0                      |

**Tbl. 45: Process input data**

#### Compile process data alternative from CoE objects

1. Always conduct the state "PRE-OPERATIONAL".
2. Describe the object 1601h.0 or 1A01h.0 with 0.
3. Describe the object 1601h.1-n or 1A01h.1-n with corresponding CoE indices.
4. Use only objects marked with "P".
5. Assign the sub-index 1-n on a sequential basis only and without gaps.
6. Make sure that the data yields a total number of bytes (use pad bits if needed) and start with whole bytes (exception BOOL).
7. Describe maximum 12 objects per PDO.
8. Describe the object 1601h.0 or 1A01h.0 with the number n of objects to be used.
9. Change object 1C12h.1 to 1601h or 1C13h.1 to 1A01h.
10. In the process data, select the corresponding PDO assignment 1601h or 1A01h.

177) Hexadecimal

178) Hexadecimal

The left screenshot shows the 'PDO List' with the following entries:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     | 3  |
| 0x1A01 | 7.0  | User TxPDO (input)     | F     | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     | 2  |
| 0x1601 | 3.0  | User RxPDO (output)    | F     | 2  |

The right screenshot shows the 'PDO List' with the following entries:

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     | 3  |
| 0x1A01 | 7.0  | User TxPDO (input)     | F     | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     | 2  |
| 0x1601 | 3.0  | User RxPDO (output)    | F     | 2  |

Output data including 4 pad bits

Input data including 5 pad bits

Tbl. 46: Example for a process data configuration

## 5.4.2 Service data: HiLobe

| Type      | Description                            |
|-----------|----------------------------------------|
| BOOL      | Binary value (yes/no)                  |
| BYTE( )   | Single byte number                     |
| STRING( ) | Character string                       |
| USINT     | Positive integer, 8 bit                |
| UINT      | Positive integer, 16 bit               |
| UDINT     | Positive integer, 32 bit               |
| ULINT     | Positive integer, 64 bit               |
| SINT      | Integer, 8 bit                         |
| INT       | Integer, 16 bit                        |
| DINT      | Integer, 32 bit                        |
| REAL      | Floating point value, single precision |

Tbl. 47: Data types of the service data

The following CoE objects are available for access to individual data objects (e.g., for configuration):

### Administrative data (information about the device, communication)

| Idx <sup>179)</sup> | sldx | Name                            | Type      | Access <sup>180)</sup> | Description                                                                                                                                                                     |
|---------------------|------|---------------------------------|-----------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000                |      | Device type                     | UDINT     | RO                     | Bit 0-15: Device profile number (5003).<br>NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B)<br>Bit 16-31: 0x0000, sub-profile number is defined in 0xF010 bit 15..0 |
| 1008                |      | Manufacturer device name        | STRING(n) | RO                     | Name of the device as non-zero terminated string.                                                                                                                               |
| 1009                |      | Manufacturer hardware version   | STRING(n) | RO                     | Hardware version of the device as non-zero terminated string.                                                                                                                   |
| 100 A               |      | Manufacturer software version   | STRING(n) | RO                     | Software version of the device as non-zero terminated string.                                                                                                                   |
| 100B                |      | Manufacturer bootloader version | STRING(n) | RO                     | Bootloader version of the device as non-zero terminated string.                                                                                                                 |
| 1018                |      | Identity object                 | IDENTITY  | RO                     |                                                                                                                                                                                 |
|                     | 01   | Vendor ID                       | UDINT     | RO                     |                                                                                                                                                                                 |

179) Idx = Index, sldx = Sub-index, Hexadecimal

180) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>179)</sup> | sldx | Name                                         | Type  | Access <sup>180)</sup> | Description                              |
|---------------------|------|----------------------------------------------|-------|------------------------|------------------------------------------|
|                     | 02   | Product code                                 | UDINT | RO                     |                                          |
|                     | 03   | Revision number                              | UDINT | RO                     |                                          |
|                     | 04   | Serial number                                | UDINT | RO                     |                                          |
| 10F8                |      | Timestamp object                             | ULINT | RO                     | Local timestamp of the device in ns.     |
| 1600                |      | SDP default RxPDO                            |       |                        |                                          |
|                     | 01h  |                                              |       |                        | 0x7000.0x01: Roughing start/stop         |
|                     | 02h  |                                              |       |                        | 0x7000.0x04: Low speed (idle/green mode) |
|                     | 03h  |                                              |       |                        |                                          |
| 1601                |      | User RxPDO                                   |       |                        |                                          |
| 1A00                |      | SDP default TxPDO                            |       |                        |                                          |
|                     | 01h  |                                              |       |                        | 0x6000.0x01: Roughing run/stop           |
|                     | 02h  |                                              |       |                        | 0x6000.0x02: Booster run/stop            |
|                     | 03h  |                                              |       |                        | 0x6000.0x04: Low speed (idle/green mode) |
|                     | 04h  |                                              |       |                        | 0x6000.0x05: Remote/local                |
|                     | 05h  |                                              |       |                        | 0x6000.0x09: Warning                     |
|                     | 06h  |                                              |       |                        | 0x6000.0x0A: Alarm                       |
|                     | 07h  |                                              |       |                        | 0x6000.0x0B: Emergency Off               |
|                     | 08h  |                                              |       |                        | 0x6000.0x0C: N2 flow low                 |
|                     | 09h  |                                              |       |                        | 0x6001.0x02: N2 flow                     |
|                     | 0Ah  |                                              |       |                        | 0x6001.0x03: Exhaust pressure            |
|                     | 0Bh  |                                              |       |                        | 0x6001.0x05: Roughing case temperature   |
|                     | 0Ch  |                                              |       |                        | 0x6001.0x09: Roughing current            |
|                     | 0Dh  |                                              |       |                        | 0x6001.0x0A: Roughing power              |
|                     | 0Eh  |                                              |       |                        | 0x6001.0x0B: Roughing speed              |
|                     | 0Fh  |                                              |       |                        | 0x6002.0x05: Booster case temperature    |
|                     | 10h  |                                              |       |                        | 0x6002.0x09: Booster current             |
|                     | 11h  |                                              |       |                        | 0x6002.0x0A: Booster power               |
|                     | 12h  |                                              |       |                        | 0x6002.0x0B: Booster speed               |
| 1A01                |      | User TxPDO                                   |       |                        |                                          |
| 1C00                |      | Sync manager type                            |       |                        |                                          |
| 1C10                |      | Sync manager 0 PDO assignment                |       |                        |                                          |
| 1C11                |      | Sync manager 1 PDO assignment                |       |                        |                                          |
| 1C12                |      | RxPDO assign (sync manager 2 PDO assignment) |       |                        |                                          |
| 1C13                |      | TxPDO assign (sync manager 3 PDO assignment) |       |                        |                                          |

**Tbl. 48: Communication area – administrative data (information about the device, communication)**

179) Idx = Index, sldx = Sub-index, Hexadecimal

180) RO = read only, RW = read/write, P = suitable for process data

**Input data (HiLobe --> control)**

| Idx <sup>181)</sup> | sldx    | Name                           | Type      | Access <sup>182)</sup> | Description |
|---------------------|---------|--------------------------------|-----------|------------------------|-------------|
| 2000                | Partial | In identity/status             |           | RO                     |             |
|                     | 01      | Manufacturer                   | STRING( ) | RO                     |             |
|                     | 02      | Device name (main)             | STRING( ) | RO                     |             |
|                     | 04      | Hardware version (main)        | STRING( ) | RO                     |             |
|                     | 05      | Firmware version (main)        | STRING( ) | RO                     |             |
|                     | 08      | Status code (main)             | UINT      | RO                     |             |
|                     | 22      | Device name (interface)        | UDINT     | RO P                   |             |
|                     | 24      | Hardware version (interface)   | STRING( ) | RO                     |             |
|                     | 25      | Firmware version (interface)   | STRING(n) | RO                     |             |
| 2001                | Partial | In operation                   |           | RO                     |             |
|                     | 86      | Nominal value abs (pump)       | UDINT     | RO                     | Rpm         |
| 2002                | Partial | Pump power/temperature         |           | RO                     |             |
|                     | 11      | Voltage (power)                | INT       | RO                     | 0.1 V       |
|                     | 92      | Current (motor)                | INT       | RO                     | 0.1 A       |
|                     | A8      | Temperature (bearing L)        | INT       | RO                     | °C          |
|                     | C8      | Temperature (bearing F)        | INT       | RO                     | °C          |
| 2006                | Partial | In component power/temperature |           |                        | °C          |
|                     | 88      | Temperature (cooling water)    | INT       | RO                     | °C          |

**Tbl. 49: Input data****Output data (control --> HiLobe)**

| Idx <sup>183)</sup> | sldx    | Name                    | Type | Access <sup>184)</sup> | Description |
|---------------------|---------|-------------------------|------|------------------------|-------------|
| 3001                | Partial |                         |      |                        |             |
|                     | 083     | Setpoint enable (pump)  | BOOL | RW                     |             |
| 3005                | Partial | Out component operation |      |                        |             |
|                     | 31      | Enable (brake)          | BOOL | RW                     |             |
|                     | 71      | Enable (fan)            | BOOL | RW                     |             |

**Tbl. 50: Manufacturer-specific outputs****Manufacturer-specific configuration data**

| Idx <sup>185)</sup> | sldx    | Name                    | Type  | Access <sup>186)</sup> | Description |
|---------------------|---------|-------------------------|-------|------------------------|-------------|
| 4001                | Partial | Cfg pump operation      |       |                        |             |
|                     | 8B      | Default setpoint (pump) | USINT | RW                     |             |
| 4009                | Partial | Cfg interface operation |       |                        |             |
|                     | 21      | Configuration (DO1)     | USINT | RW                     |             |
|                     | 31      | Configuration (DO2)     | USINT | RW                     |             |

**Tbl. 51: Manufacturer-specific configuration data**

181) Idx = Index, sldx = Sub-index, Hexadecimal

182) RO = read only, RW = read/write, P = suitable for process data

183) Idx = Index, sldx = Sub-index, Hexadecimal

184) RO = read only, RW = read/write, P = suitable for process data

185) Idx = Index, sldx = Sub-index, Hexadecimal

186) RO = read only, RW = read/write, P = suitable for process data



## Input area

| Idx <sup>187)</sup> | sIdx | Name                                   | Type | Access <sup>188)</sup> | Description                                                                 |
|---------------------|------|----------------------------------------|------|------------------------|-----------------------------------------------------------------------------|
| 6000                |      | Roughing and booster status            |      | RO                     |                                                                             |
|                     | 01   | Roughing run/stop                      | BOOL | RO                     | 1: Run<br>0: Stop                                                           |
|                     | 04   | Low speed (idle/sleep/green mode)      | BOOL | RO                     | 1: Low speed (idle /sleep / green mode)<br>0: Normal                        |
|                     | 05   | Remote/local                           | BOOL | RO                     | 1: Local, hand control enabled<br>0: Remote, E-cat control enabled          |
|                     | 09   | Warning                                | BOOL | RO                     | 1: Warning<br>0: Normal                                                     |
|                     | 0 A  | Alarm                                  | BOOL | RO                     | 1: Alarm<br>0: Normal                                                       |
|                     | 0B   | Emergency off                          | BOOL | RO                     | 1: Stop<br>0: Normal                                                        |
|                     | 0C   | N2 flow low                            | BOOL | RO                     | 1: N2 flow low<br>0: Normal                                                 |
| 6001                |      | Roughing analog inputs                 |      |                        |                                                                             |
|                     | 04   | Exhaust temperature                    | INT  | RO                     | Degrees Celsius, mandatory if exhaust temperature measurement device fitted |
|                     | 08   | Roughing pump motor driver temperature | INT  | RO                     | Degrees Celsius                                                             |
|                     | 09   | Roughing current                       | INT  | RO                     | 0.1 [A]                                                                     |
|                     | 0 A  | Roughing power                         | INT  | RO                     | 0.1 [kW]                                                                    |
|                     | 0B   | Roughing speed                         | INT  | RO                     | 1000 (100.0%): Rated speed<br>0 (0.0%): 0 rotation, 0.1 [%]                 |

Tbl. 52: Input area

## Output area

| Idx <sup>189)</sup> | sIdx | Name                              | Type | Access <sup>190)</sup> | Description                                           |
|---------------------|------|-----------------------------------|------|------------------------|-------------------------------------------------------|
| 7000                |      | Roughing and booster control      |      | RO                     |                                                       |
|                     | 01   | Roughing start/stop               | BOOL | RW                     | 1: Run<br>0: Stop                                     |
|                     | 04   | Low speed (idle/sleep/green mode) | BOOL | RW                     | 1: Low speed (idle / sleep / green mode)<br>0: Normal |
|                     | 05   | Reset pump                        | BOOL | RW                     | 1: Reset alarm<br>0: No action                        |

187) Idx = Index, sIdx = Sub-index, Hexadecimal

188) RO = read only, RW = read/write, P = suitable for process data

189) Idx = Index, sIdx = Sub-index, Hexadecimal

190) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>189)</sup> | sldx | Name                                     | Type | Access <sup>190)</sup> | Description                                                                            |
|---------------------|------|------------------------------------------|------|------------------------|----------------------------------------------------------------------------------------|
| 7001                |      | Roughing analog control                  |      | RO                     |                                                                                        |
|                     | 01   | Roughing real-time normal speed setpoint | UINT | RW                     | 1000 (100.0%): Rated speed<br>0 (0.0%): No rotation, minimum speed restrictions apply. |

**Tbl. 53: Output area****Configuration data (control --> HiLobe)**

| Idx <sup>191)</sup> | sldx | Name                                                  | Type | Access <sup>192)</sup> | Description                                                                                                 |
|---------------------|------|-------------------------------------------------------|------|------------------------|-------------------------------------------------------------------------------------------------------------|
| 8001                |      | Roughing and booster configuration                    |      | RO                     |                                                                                                             |
|                     | 01   | Safe state                                            | UINT | RW                     | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - pumps stop |
| 8002                |      | Roughing pump configuration                           |      | RO                     |                                                                                                             |
|                     | 01   | Roughing low speed (multiple sleep level = 0) setting |      | RW                     | 1000 (100.0%): Rated speed<br>0 (0.0%): No rotation, minimum speed restrictions apply, 0.1 [%]              |

**Tbl. 54: Configuration area****Information data (HiLobe --> control)**

| Idx <sup>193)</sup> | sldx | Name                              | Type  | Access <sup>194)</sup> | Description                                           |
|---------------------|------|-----------------------------------|-------|------------------------|-------------------------------------------------------|
| 9000                |      | Roughing and booster information  |       | RO                     |                                                       |
|                     | 01   | Roughing exists                   | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                     | 03   | Booster 2 exists                  | BOOL  | RO                     | 0: Not available<br>1: Available                      |
|                     | 11   | Roughing and booster running time | UDINT | RO                     | Running time since manufacture or service - 1 [hours] |

**Tbl. 55: Information area****Semiconductor device profile area**

| Idx <sup>195)</sup> | sldx | Name                         | Type | Access <sup>196)</sup> | Description |
|---------------------|------|------------------------------|------|------------------------|-------------|
| F000                |      | Semiconductor device profile |      | RO                     |             |
|                     | 01   | Index distance               | UINT |                        |             |
|                     | 02   | Maximum number of modules    | UINT |                        |             |

189) Idx = Index, sldx = Sub-index, Hexadecimal

190) RO = read only, RW = read/write, P = suitable for process data

191) Idx = Index, sldx = Sub-index, Hexadecimal

192) RO = read only, RW = read/write, P = suitable for process data

193) Idx = Index, sldx = Sub-index, Hexadecimal

194) RO = read only, RW = read/write, P = suitable for process data

195) Idx = Index, sldx = Sub-index, Hexadecimal

196) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>195)</sup> | sIdx | Name                | Type  | Access <sup>196)</sup> | Description |
|---------------------|------|---------------------|-------|------------------------|-------------|
| F010                |      | Module profile list |       | RO                     |             |
|                     | 01   |                     | UDINT | RO                     |             |

**Tbl. 56: Semiconductor device profile area**

#### Exception handling

| Idx <sup>197)</sup> | sIdx | Name                                                 | Type  | Access <sup>198)</sup> | Description                                                                                                                     |
|---------------------|------|------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380                |      | Active exception status                              | USINT | RO                     | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning                                 |       |                        | Bit0: Device warning                                                                                                            |
|                     |      | Bit1: Manufacturer warning                           |       |                        | Bit1: Manufacturer warning                                                                                                      |
|                     |      | Bit2: Device error                                   |       |                        | Bit2: Device error                                                                                                              |
|                     |      | Bit3: Manufacturer error                             |       |                        | Bit3: Manufacturer error                                                                                                        |
|                     |      | Bit4: Reserved                                       |       |                        | Bit4: Reserved                                                                                                                  |
|                     |      | Bit5: Reserved                                       |       |                        | Bit5: Reserved                                                                                                                  |
|                     |      | Bit6: Reserved                                       |       |                        | Bit6: Reserved                                                                                                                  |
|                     |      | Bit7: Reserved                                       |       |                        | Bit7: Reserved                                                                                                                  |
| F381                |      | Roughing and booster 1 to 255: Active warning detail |       | RO                     |                                                                                                                                 |
|                     | 01   |                                                      | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available                         |
|                     |      | Bit0: EMO                                            |       |                        | Bit0: EMO                                                                                                                       |
|                     |      | Bit1: Water leak                                     |       |                        | Bit1: Water leak                                                                                                                |
|                     |      | Bit2: Power fail open phase                          |       |                        | Bit2: Power fail open phase                                                                                                     |
|                     |      | Bit3: Reverse phase                                  |       |                        | Bit3: Reverse phase                                                                                                             |
|                     |      | Bit4: Coolant flow                                   |       |                        | Bit4: Coolant flow                                                                                                              |
|                     |      | Bit5: N2 flow                                        |       |                        | Bit5: N2 flow                                                                                                                   |
|                     |      | Bit6: Exhaust pressure                               |       |                        | Bit6: Exhaust pressure                                                                                                          |
|                     |      | Bit7: Exhaust temp.                                  |       |                        | Bit7: Exhaust temp.                                                                                                             |
|                     |      | Bit8: Main controller err/batt low                   |       |                        | Bit8: Main controller err/batt low                                                                                              |
|                     |      | Bit9: Roughing case temp                             |       |                        | Bit9: Roughing case temp                                                                                                        |
|                     |      | Bit10: Roughing motor temp                           |       |                        | Bit10: Roughing motor temp                                                                                                      |
|                     |      | Bit11: Roughing current                              |       |                        | Bit11: Roughing current                                                                                                         |
|                     |      | Bit12: Roughing speed                                |       |                        | Bit12: Roughing speed                                                                                                           |
|                     |      | Bit13: Roughing lock rotor                           |       |                        | Bit13: Roughing lock rotor                                                                                                      |
|                     |      | Bit14: Roughing motor driver err                     |       |                        | Bit14: Roughing motor driver err                                                                                                |
|                     |      | Bit15: Booster case temp.                            |       |                        | Bit15: Booster case temp                                                                                                        |
|                     |      | Bit16: Booster motor temp.                           |       |                        | Bit16: Booster motor temp                                                                                                       |
|                     |      | Bit17: Booster current                               |       |                        | Bit17: Booster current                                                                                                          |
|                     |      | Bit18: Booster speed                                 |       |                        | Bit18: Booster speed                                                                                                            |

195) Idx = Index, sIdx = Sub-index, Hexadecimal

196) RO = read only, RW = read/write, P = suitable for process data

197) Idx = Index, sIdx = Sub-index, Hexadecimal

198) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>197)</sup> | sldx | Name                                                       | Type  | Access <sup>198)</sup> | Description                                                                                             |
|---------------------|------|------------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit19: Booster lock rotor                                  |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                            |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                |       |                        | Bit21: Booster 2 case temp.                                                                             |
|                     |      | Bit22: Booster 2 motor temp.                               |       |                        | Bit22: Booster 2 motor temp.                                                                            |
|                     |      | Bit23: Booster 2 current                                   |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                     |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                          |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                      |       |                        | Bit27: Gate valve err                                                                                   |
|                     |      | Bit28: Future use                                          |       |                        | Bit28: Future use                                                                                       |
|                     |      | Bit29: Future use                                          |       |                        | Bit29: Future use                                                                                       |
|                     |      | Bit30: Future use                                          |       |                        | Bit30: Future use                                                                                       |
|                     |      | Bit31: Others                                              |       |                        | Bit31: Others                                                                                           |
| F383                |      | Roughing and booster 1 to 255: Active error (alarm) detail |       | RO                     |                                                                                                         |
|                     | 01   |                                                            | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: EMO                                                  |       |                        | Bit0: EMO                                                                                               |
|                     |      | Bit1: Water leak                                           |       |                        | Bit1: Water leak                                                                                        |
|                     |      | Bit2: Power fail open phase                                |       |                        | Bit2: Power fail open phase                                                                             |
|                     |      | Bit3: Reverse phase                                        |       |                        | Bit3: Reverse phase                                                                                     |
|                     |      | Bit 4: Coolant flow                                        |       |                        | Bit 4: Coolant flow                                                                                     |
|                     |      | Bit5: N2 flow                                              |       |                        | Bit5: N2 flow                                                                                           |
|                     |      | Bit6: Exhaust pressure                                     |       |                        | Bit6: Exhaust pressure                                                                                  |
|                     |      | Bit7: Exhaust temp.                                        |       |                        | Bit7: Exhaust temp.                                                                                     |
|                     |      | Bit8: Main controller err/batt low                         |       |                        | Bit8: Main controller err/batt low                                                                      |
|                     |      | Bit9: Roughing case temp                                   |       |                        | Bit9: Roughing case temp                                                                                |
|                     |      | Bit10: Roughing motor temp                                 |       |                        | Bit10: Roughing motor temp                                                                              |
|                     |      | Bit11: Roughing current                                    |       |                        | Bit11: Roughing current                                                                                 |
|                     |      | Bit12: Roughing speed                                      |       |                        | Bit12: Roughing speed                                                                                   |
|                     |      | Bit13: Roughing lock rotor                                 |       |                        | Bit13: Roughing lock rotor                                                                              |
|                     |      | Bit14: Roughing motor driver err                           |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                  |       |                        | Bit15: Booster case temp.                                                                               |
|                     |      | Bit16: Booster motor temp.                                 |       |                        | Bit16: Booster motor temp.                                                                              |
|                     |      | Bit17: Booster current                                     |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                       |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                  |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                            |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                |       |                        | Bit21: Booster 2 case temp.                                                                             |

197) Idx = Index, sldx = Sub-index, Hexadecimal

198) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>197)</sup> | sldx | Name                                                  | Type  | Access <sup>198)</sup> | Description                                                                                                              |
|---------------------|------|-------------------------------------------------------|-------|------------------------|--------------------------------------------------------------------------------------------------------------------------|
|                     |      | Bit22: Booster 2 motor temp.                          |       |                        | Bit22: Booster 2 motor temp.                                                                                             |
|                     |      | Bit23: Booster 2 current                              |       |                        | Bit23: Booster 2 current                                                                                                 |
|                     |      | Bit24: Booster 2 speed                                |       |                        | Bit24: Booster 2 speed                                                                                                   |
|                     |      | Bit25: Booster 2 lock rotor                           |       |                        | Bit25: Booster 2 lock rotor                                                                                              |
|                     |      | Bit26: Booster 2 motor driver err                     |       |                        | Bit26: Booster 2 motor driver err                                                                                        |
|                     |      | Bit27: Gate valve err                                 |       |                        | Bit27: Gate valve err                                                                                                    |
|                     |      | Bit28: Future use                                     |       |                        | Bit28: Future use                                                                                                        |
|                     |      | Bit29: Future use                                     |       |                        | Bit29: Future use                                                                                                        |
|                     |      | Bit30: Future use                                     |       |                        | Bit30: Future use                                                                                                        |
|                     |      | Bit31: Others                                         |       |                        | Bit31: Others                                                                                                            |
| F390                |      | Latched exception status                              | USINT | RO                     | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning                                  |       |                        | Bit0: Device warning                                                                                                     |
|                     |      | Bit1: Manufacturer warning                            |       |                        | Bit1: Manufacturer warning                                                                                               |
|                     |      | Bit2: Device error                                    |       |                        | Bit2: Device error                                                                                                       |
|                     |      | Bit3: Manufacturer error                              |       |                        | Bit3: Manufacturer error                                                                                                 |
|                     |      | Bit4: Reserved                                        |       |                        | Bit4: Reserved                                                                                                           |
|                     |      | Bit5: Reserved                                        |       |                        | Bit5: Reserved                                                                                                           |
|                     |      | Bit6: Reserved                                        |       |                        | Bit6: Reserved                                                                                                           |
|                     |      | Bit7: Reserved                                        |       |                        | Bit7: Reserved                                                                                                           |
| F391                |      | Roughing and booster 1 to 255: Latched warning detail |       | RO                     |                                                                                                                          |
|                     | 01   |                                                       | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available                  |
|                     |      | Bit0: EMO                                             |       |                        | Bit0: EMO                                                                                                                |
|                     |      | Bit1: Water leak                                      |       |                        | Bit1: Water leak                                                                                                         |
|                     |      | Bit2: Power fail open phase                           |       |                        | Bit2: Power fail open phase                                                                                              |
|                     |      | Bit3: Reverse phase                                   |       |                        | Bit3: Reverse phase                                                                                                      |
|                     |      | Bit4: Coolant flow                                    |       |                        | Bit4: Coolant flow                                                                                                       |
|                     |      | Bit5: N2 flow                                         |       |                        | Bit5: N2 flow                                                                                                            |
|                     |      | Bit6: Exhaust pressure                                |       |                        | Bit6: Exhaust pressure                                                                                                   |
|                     |      | Bit7: Exhaust temp.                                   |       |                        | Bit7: Exhaust temp.                                                                                                      |
|                     |      | Bit8: Main controller err/batt low                    |       |                        | Bit8: Main controller err/batt low                                                                                       |
|                     |      | Bit9: Roughing case temp                              |       |                        | Bit9: Roughing case temp                                                                                                 |
|                     |      | Bit10: Roughing motor temp                            |       |                        | Bit10: Roughing motor temp                                                                                               |
|                     |      | Bit11: Roughing current                               |       |                        | Bit11: Roughing current                                                                                                  |
|                     |      | Bit12: Roughing speed                                 |       |                        | Bit12: Roughing speed                                                                                                    |
|                     |      | Bit13: Roughing lock rotor                            |       |                        | Bit13: Roughing lock rotor                                                                                               |
|                     |      | Bit14: Roughing motor driver err                      |       |                        | Bit14: Roughing motor driver err                                                                                         |
|                     |      | Bit15: Booster case temp.                             |       |                        | Bit15: Booster case temp.                                                                                                |
|                     |      | Bit16: Booster motor temp.                            |       |                        | Bit16: Booster motor temp.                                                                                               |

197) Idx = Index, sldx = Sub-index, Hexadecimal

198) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>197)</sup> | sldx | Name                                                        | Type  | Access <sup>198)</sup> | Description                                                                                             |
|---------------------|------|-------------------------------------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit17: Booster current                                      |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                        |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                   |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                             |       |                        | Bit20: Booster motor driver err                                                                         |
|                     |      | Bit21: Booster 2 case temp.                                 |       |                        | Bit21: Booster 2 case temp.                                                                             |
|                     |      | Bit22: Booster 2 motor temp.                                |       |                        | Bit22: Booster 2 motor temp.                                                                            |
|                     |      | Bit23: Booster 2 current                                    |       |                        | Bit23: Booster 2 current                                                                                |
|                     |      | Bit24: Booster 2 speed                                      |       |                        | Bit24: Booster 2 speed                                                                                  |
|                     |      | Bit25: Booster 2 lock rotor                                 |       |                        | Bit25: Booster 2 lock rotor                                                                             |
|                     |      | Bit26: Booster 2 motor driver err                           |       |                        | Bit26: Booster 2 motor driver err                                                                       |
|                     |      | Bit27: Gate valve err                                       |       |                        | Bit27: Gate valve err                                                                                   |
|                     |      | Bit28: Future use                                           |       |                        | Bit28: Future use                                                                                       |
|                     |      | Bit29: Future use                                           |       |                        | Bit29: Future use                                                                                       |
|                     |      | Bit30: Future use                                           |       |                        | Bit30: Future use                                                                                       |
|                     |      | Bit31: Others                                               |       |                        | Bit31: Others                                                                                           |
| F393                |      | Roughing and booster 1 to 255: Latched error (alarm) detail |       | RO                     |                                                                                                         |
|                     | 01   |                                                             | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/Not available |
|                     |      | Bit0: EMO                                                   |       |                        | Bit0: EMO                                                                                               |
|                     |      | Bit1: Water leak                                            |       |                        | Bit1: Water leak                                                                                        |
|                     |      | Bit2: Power fail open phase                                 |       |                        | Bit2: Power fail open phase                                                                             |
|                     |      | Bit3: Reverse phase                                         |       |                        | Bit3: Reverse phase                                                                                     |
|                     |      | Bit4: Coolant flow                                          |       |                        | Bit4: Coolant flow                                                                                      |
|                     |      | Bit5: N2 flow                                               |       |                        | Bit5: N2 flow                                                                                           |
|                     |      | Bit6: Exhaust pressure                                      |       |                        | Bit6: Exhaust pressure                                                                                  |
|                     |      | Bit7: Exhaust temp.                                         |       |                        | Bit7: Exhaust temp.                                                                                     |
|                     |      | Bit8: Main controller err/batt low                          |       |                        | Bit8: Main controller err/batt low                                                                      |
|                     |      | Bit9: Roughing case temp                                    |       |                        | Bit9: Roughing case temp                                                                                |
|                     |      | Bit10: Roughing motor temp                                  |       |                        | Bit10: Roughing motor temp                                                                              |
|                     |      | Bit11: Roughing current                                     |       |                        | Bit11: Roughing current                                                                                 |
|                     |      | Bit12: Roughing speed                                       |       |                        | Bit12: Roughing speed                                                                                   |
|                     |      | Bit13: Roughing lock rotor                                  |       |                        | Bit13: Roughing lock rotor                                                                              |
|                     |      | Bit14: Roughing motor driver err                            |       |                        | Bit14: Roughing motor driver err                                                                        |
|                     |      | Bit15: Booster case temp.                                   |       |                        | Bit15: Booster case temp.                                                                               |
|                     |      | Bit16: Booster motor temp.                                  |       |                        | Bit16: Booster motor temp.                                                                              |
|                     |      | Bit17: Booster current                                      |       |                        | Bit17: Booster current                                                                                  |
|                     |      | Bit18: Booster speed                                        |       |                        | Bit18: Booster speed                                                                                    |
|                     |      | Bit19: Booster lock rotor                                   |       |                        | Bit19: Booster lock rotor                                                                               |
|                     |      | Bit20: Booster motor driver err                             |       |                        | Bit20: Booster motor driver err                                                                         |

197) Idx = Index, sldx = Sub-index, Hexadecimal

198) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>197)</sup> | sldx | Name                                              | Type  | Access <sup>198)</sup> | Description                                                                                                                                                                                                                         |
|---------------------|------|---------------------------------------------------|-------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |      | Bit21: Booster 2 case temp.                       |       |                        | Bit21: Booster 2 case temp.                                                                                                                                                                                                         |
|                     |      | Bit22: Booster 2 motor temp.                      |       |                        | Bit22: Booster 2 motor temp.                                                                                                                                                                                                        |
|                     |      | Bit23: Booster 2 current                          |       |                        | Bit23: Booster 2 current                                                                                                                                                                                                            |
|                     |      | Bit24: Booster 2 speed                            |       |                        | Bit24: Booster 2 speed                                                                                                                                                                                                              |
|                     |      | Bit25: Booster 2 lock rotor                       |       |                        | Bit25: Booster 2 lock rotor                                                                                                                                                                                                         |
|                     |      | Bit26: Booster 2 motor driver err                 |       |                        | Bit26: Booster 2 motor driver err                                                                                                                                                                                                   |
|                     |      | Bit27: Gate valve err                             |       |                        | Bit27: Gate valve err                                                                                                                                                                                                               |
|                     |      | Bit28: Future use                                 |       |                        | Bit28: Future use                                                                                                                                                                                                                   |
|                     |      | Bit29: Future use                                 |       |                        | Bit29: Future use                                                                                                                                                                                                                   |
|                     |      | Bit30: Future use                                 |       |                        | Bit30: Future use                                                                                                                                                                                                                   |
|                     |      | Bit31: Others                                     |       |                        | Bit31: Others                                                                                                                                                                                                                       |
| F3A1                |      | Roughing and booster 1 to 255: Warning mask       |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   |                                                   | UDINT | RW                     | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3                |      | Roughing and booster 1 to 255: Error (alarm) mask |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   |                                                   | UDINT | RW                     | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |
| F6F0                |      | Input latch local timestamp                       |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   | Input latch local timestamp                       | UDINT | RO                     | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up.                                                                                                                  |

Tbl. 57: Exception handling

## CDP-specific information data

| Idx <sup>199)</sup> | sldx | Name                             | Type      | Access <sup>200)</sup> | Description                                                          |
|---------------------|------|----------------------------------|-----------|------------------------|----------------------------------------------------------------------|
| F9F0                |      | Manufacturer serial number       | STRING(n) | RO                     | String representing the manufacturer's serial number for the device. |
| F9F1                |      | CDP functional generation number |           | RO                     |                                                                      |
|                     | 01   |                                  | UDINT     | RO                     | Common device profile functional generation number                   |
| F9F2                |      | SDP functional generation number |           | RO                     |                                                                      |
|                     | 01   |                                  | UDINT     | RO                     | SDP functional generation number.                                    |

197) Idx = Index, sldx = Sub-index, Hexadecimal

198) RO = read only, RW = read/write, P = suitable for process data

199) Idx = Index, sldx = Sub-index, Hexadecimal

200) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>199)</sup> | sIdx | Name                                          | Type      | Access <sup>200)</sup> | Description                                                                                                         |
|---------------------|------|-----------------------------------------------|-----------|------------------------|---------------------------------------------------------------------------------------------------------------------|
| F9F3                |      | Vendor name                                   | STRING(n) | RO                     |                                                                                                                     |
| F9F4                |      | SDP device name                               |           | RO                     |                                                                                                                     |
|                     | 01   |                                               | STRING(n) | RO                     | String identifying the device type.                                                                                 |
| F9F5                |      | Output identifier                             |           | RO                     |                                                                                                                     |
|                     | 01   |                                               | USINT     | RW                     | Output identifier. The controller can then read this value back through the TxPDO to ensure the RxPDO was received. |
| F9F6                |      | Time since power on                           | UDINT     | RO                     | This is the time the device has currently been powered on, in seconds.                                              |
| F9F7                |      | Total time powered                            | UDINT     | RO                     | Operating hours of pump [s]                                                                                         |
| F9F8                |      | Firmware update: functional generation number | UDINT     | RO                     | Firmware update of functional generation number supported by the device.                                            |

**Tbl. 58: CDP-specific information data**

#### CDP command objects

| Idx <sup>201)</sup> | sIdx | Name                 | Type                 | Access <sup>202)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------|------|----------------------|----------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0                |      | Device reset command |                      | RO                     | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. There are two versions of this command:<br><br>Device reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset.<br><br>Factory reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                     | 01   | Command              | AR-RAY[0..5] OF BYTE | RW                     | A device reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72<br>Byte 5: Device standard reset = 0x00, factory reset = 0x66                                                                                                                                                                                                                                                                                |
|                     | 02   | Status               | USINT                | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Reserved<br>2: Last command completed, error, no response.                                                                                                                                                                                                                                                                                                                     |
|                     | 03   | Response             | AR-RAY[0..1] OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused - shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                           |

199) Idx = Index, sIdx = Sub-index, Hexadecimal

200) RO = read only, RW = read/write, P = suitable for process data

201) Idx = Index, sIdx = Sub-index, Hexadecimal

202) RO = read only, RW = read/write, P = suitable for process data



| Idx <sup>201)</sup> | sidx | Name                       | Type                   | Access <sup>202)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------|------|----------------------------|------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF1                |      | Exception reset command    |                        | RO                     | Execution of this command clears the latched exceptions.                                                                                                                                                                                                                                                                                                                                                      |
|                     | 01   | Command                    | ARRAY[0..4]<br>OF BYTE | RW                     | A latched exception reset is initiated when the following byte sequence is sent:<br>Byte 0: 0x74<br>Byte 1: 0x65<br>Byte 2: 0x73<br>Byte 3: 0x65<br>Byte 4: 0x72                                                                                                                                                                                                                                              |
|                     | 02   | Status                     | USINT                  | RO                     | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response                                                                                                                                                                                                                                                                         |
|                     | 03   | Response                   | ARRAY[0..1]<br>OF BYTE | RO                     | Byte 0: See subindex 2<br>Byte 1: Unused.                                                                                                                                                                                                                                                                                                                                                                     |
| FBF2                |      | Store parameters command   |                        | RO                     | Execution of this command will store all parameters to non-volatile memory.                                                                                                                                                                                                                                                                                                                                   |
|                     | 01   | Command                    | ARRAY[0..3]<br>OF BYTE | RW                     | Read:<br>Bit 0 = 1: Device saves the non-volatile parameters when writing 0xFB2:01 with 0x65766173<br>Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written<br>Bit 2-31: Reserved, shall be 0<br>Write: All writable, non-volatile values will be stored in non-volatile memory when the following is sent:<br>Byte 0: 0x73<br>Byte 1: 0x61<br>Byte 2: 0x76<br>Byte 3: 0x65 |
|                     | 02   | Status                     | USINT                  | RO                     | Supported values:<br>0: Default value if the command has not been initiated. Not a supported value otherwise.<br>1: Last command completed, no error, reply there<br>2: Last command completed, error, no response.                                                                                                                                                                                           |
|                     | 03   | Response                   | ARRAY[0..1]<br>OF BYTE | RO                     | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                                                                                                                                                                                                                                                                                                      |
| FBF3                |      | Calculate checksum command |                        | RO                     | Execution of this command will calculate a checksum for all writable, non-volatile parameters as currently stored in non-volatile memory.                                                                                                                                                                                                                                                                     |

201) Idx = Index, sidx = Sub-index, Hexadecimal

202) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>201)</sup> | sIdx | Name                    | Type                   | Access <sup>202)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------|------|-------------------------|------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 01   | Command                 | ARRAY[0..3]<br>OF BYTE | RW                     | <p>Read: Returns information about the supported checksum type</p> <p>Bit 0 = 0: No non-volatile parameters supported<br/>           Bit 0 = 1: Non-volatile parameters supported</p> <p>Bit 1 = 1: CRC-32<br/>           Bit 2 = 1: MD5<br/>           Bit 3 = 1: SHA-1<br/>           Bit 4-6: Reserved, shall be 0<br/>           Bit 7 = 1: Other algorithm.</p> <p>Write: Checksum type selection and start calculation. A write access to this subindex shall only set one bit true in Bit[0...7].</p> <p>Bit 0 = 1: Use default checksum algorithm of the device<br/>           Bit 1 = 1: CRC-32<br/>           Bit 2 = 1: MD5<br/>           Bit 3 = 1: SHA-1<br/>           Bit 4-6: Reserved, shall be 0<br/>           Bit 7 = 1: Other algorithm<br/>           Bit 8...31: Reserved.</p> |
|                     | 02   | Status                  | USINT                  | RO                     | <p>Supported values:</p> <p>0: Default value if the command has not been initiated. Not a supported value otherwise.<br/>           1: Last command completed, no error, reply there<br/>           2: Last command completed, error, no response</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                     | 03   | Response                | ARRAY[0..n]<br>OF BYTE | RO                     | <p>Byte 0: See subindex 2<br/>           Byte 1: Unused - shall be zero<br/>           Byte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length is 64 bytes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FBF4                |      | Load parameters command |                        | RO                     | Execution of this command will load all parameters from non-volatile memory.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                     | 01   | Command                 | ARRAY[0..3]<br>OF BYTE | RW                     | <p>Read:</p> <p>Bit 0 = 1: Device loads the non-volatile parameters when writing 0xFB4:01 with 0x64616F6C<br/>           Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written.</p> <p>Write:</p> <p>All writable, non-volatile parameters will be loaded from non-volatile memory when the following is sent:</p> <p>Byte 0: 0x6C<br/>           Byte 1: 0x6F<br/>           Byte 2: 0x61<br/>           Byte 3: 0x64.</p>                                                                                                                                                                                                                                                                                                                                          |

201) Idx = Index, sIdx = Sub-index, Hexadecimal

202) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>201)</sup> | sldx | Name      | Type                    | Access <sup>202)</sup> | Description                                                                                                                           |
|---------------------|------|-----------|-------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|                     | 02   | Status    | USINT                   | RO                     | Supported values:<br>0: Last command completed, no error, no response<br>1: Reserved<br>2: Last command completed, error, no response |
|                     | 03   | Re-sponse | AR-RAY[0..1]<br>OF BYTE | RO                     | Byte 0: See Subindex 2<br>Byte 1: Unused                                                                                              |

Tbl. 59: CDP command objects

## 5.5 Operating turbopump with TC 80 via EtherCAT

### 5.5.1 Process data: TC 80

#### Process output data

Process output data are:

- Default RxPDO (control --> TC 80, "output"), CoE 1600h.1 – 4 (1 Byte)

| Byte.Bit | CoE <sup>203)</sup>       | Meaning                              |
|----------|---------------------------|--------------------------------------|
| 0.0      | 7000.01 Turbo Start Stop  | Pumping station (0: off, 1: on)      |
| 0.1      | 7000.02 Turbo Reset Alarm | 0 --> 1: Malfunction acknowledgement |
| 0.2      | 7000.03 Turbo Low Speed   | Stand-by (0: off, 1: on)             |

Tbl. 60: Process output data

#### Process input data

Process input data are:

- Default TxPDO (TC 80 --> control, "input"), CoE 1A00h.1 – 11 (7 Byte)

| Byte.Bit | CoE <sup>204)</sup>                     | Meaning                              |
|----------|-----------------------------------------|--------------------------------------|
| 0.0      | 6000.01 Rotation                        | Pump rotates > 60 rpm(0: no, 1: yes) |
| 0.1      | 6000.02 Normal                          | Normal operation (0: no, 1: yes)     |
| 0.2      | 6000.03 Acceleration                    | Pump accelerates (0: no, 1: yes)     |
| 0.3      | 6000.04 Deceleration (includes braking) | Pump decelerates (0: no, 1: yes)     |
| 0.4      | 6000.05 Remote / Local                  | Control via EtherCAT (0: yes, 1: no) |
| 0.5      | 6000.07 Turbo Low Speed                 | Stand-by (0: off, 1: on)             |
| 0.6      | 6000.09 Alarm                           | 0: no<br>1: yes                      |
| 0.7      | 6000.0A Warning                         | 0: no<br>1: yes                      |
| 1st – 2. | 6000.11 Turbo Speed                     | 0.1% of rated speed                  |
| 3. – 4.  | 6000.12 Turbo Current                   | 0.1 A                                |
| 5. – 6.  | 6000.13 Turbo Pump Temperature          | °C                                   |

Tbl. 61: Process input data

201) Idx = Index, sldx = Sub-index, Hexadecimal

202) RO = read only, RW = read/write, P = suitable for process data

203) Hexadecimal

204) Hexadecimal

### Compile process data alternative from CoE objects

1. Always conduct the state "PRE-OPERATIONAL".
2. Describe the object 1601h.0 or 1A01h.0 with 0.
3. Describe the object 1601h.1-n or 1A01h.1-n with corresponding CoE indices.
4. Use only objects marked with "P".
5. Assign the sub-index 1-n on a sequential basis only and without gaps.
6. Make sure that the data yields a total number of bytes (use pad bits if needed) and start with whole bytes (exception BOOL).
7. Describe maximum 12 objects per PDO.
8. Describe the object 1601h.0 or 1A01h.0 with the number n of objects to be used.
9. Change object 1C12h.1 to 1601h or 1C13h.1 to 1A01h.
10. In the process data, select the corresponding PDO assignment 1601h or 1A01h.

**Sync Manager:**

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

**PDO List:**

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

**PDO Assignment (0x1C12):**

☐ 0x1600 (excluded by 0x1601)

☒ 0x1601

**Download:**

☒ PDO Assignment

☒ PDO Configuration

**PDO Content (0x1601):**

| Index     | Size | Offs | Name                  | Type |
|-----------|------|------|-----------------------|------|
| 0x7000:01 | 0.1  | 0.0  | Turbo Start Stop      | BOOL |
| 0x7000:03 | 0.1  | 0.1  | Turbo Low Speed       | BOOL |
| 0x3005:11 | 0.1  | 0.2  | Vnt. Enable           | BOOL |
| 0x3005:21 | 0.1  | 0.3  | Sig. Enable           | BOOL |
| ...       | 0.4  | 0.4  | ...                   | ...  |
| 0x8000:03 | 2.0  | 1.0  | Normal Speed Setpoint | UINT |
|           |      | 3.0  |                       |      |

**Sync Manager:**

| SM | Size | Type    | Flags |
|----|------|---------|-------|
| 0  | 128  | MbxOut  |       |
| 1  | 128  | MbxIn   |       |
| 2  | 3    | Outputs |       |
| 3  | 7    | Inputs  |       |

**PDO List:**

| Index  | Size | Name                   | Flags | SM |
|--------|------|------------------------|-------|----|
| 0x1A00 | 7.0  | Default TxPDO (input)  | F     |    |
| 0x1A01 | 7.0  | User TxPDO (input)     |       | 3  |
| 0x1600 | 1.0  | Default RxPDO (output) | F     |    |
| 0x1601 | 3.0  | User RxPDO (output)    |       | 2  |

**PDO Assignment (0x1C12):**

☐ 0x1A00 (excluded by 0x1A01)

☒ 0x1A01

**Download:**

☒ PDO Assignment

☒ PDO Configuration

**PDO Content (0x1601):**

| Index     | Size | Offs | Name                | Type  |
|-----------|------|------|---------------------|-------|
| 0x6000:03 | 0.1  | 0.0  | Alarm               | BOOL  |
| 0x6000:0A | 0.1  | 0.1  | Warning             | BOOL  |
| 0x2001:88 | 0.1  | 0.2  | Ready for Process   | BOOL  |
| ...       | 0.5  | 0.3  | ...                 | ...   |
| 0x2001:81 | 1.0  | 1.0  | Status              | USINT |
| 0x2001:82 | 1.0  | 2.0  | Actual Speed (rel.) | SINT  |
| 0x2002:13 | 2.0  | 3.0  | Power               | INT   |
| 0x2002:88 | 2.0  | 5.0  | Pmp. Temperature    | INT   |
|           |      | 7.0  |                     |       |

Output data including 4 pad bits

Input data including 5 pad bits

Tbl. 62: Example for a process data configuration

## 5.5.2 Service data: TC 80

| Type      | Description                            |
|-----------|----------------------------------------|
| BOOL      | Binary value (yes/no)                  |
| BYTE( )   | Single byte number                     |
| STRING( ) | Character string                       |
| USINT     | Positive integer, 8 bit                |
| UINT      | Positive integer, 16 bit               |
| UDINT     | Positive integer, 32 bit               |
| ULINT     | Positive integer, 64 bit               |
| SINT      | Integer, 8 bit                         |
| INT       | Integer, 16 bit                        |
| DINT      | Integer, 32 bit                        |
| REAL      | Floating point value, single precision |

Tbl. 63: Data types of the service data

The following CoE objects are available for access to individual data objects (e.g., for configuration):

**Administrative data (information about the device, communication)**

| Idx <sup>205)</sup> | sIdx | Name                            | Type      | Access <sup>206)</sup> | Description                                                                                                                                                               |
|---------------------|------|---------------------------------|-----------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000                |      | Device type                     | UDINT     | RO                     | Bit 0-15: device profile number (5003). NOTE: Representation is hexadecimal (i.e. 5003dec -> 0x138B) Bit 16-31: 0x0000, sub-profile number is defined in 0xF010 bit 15..0 |
| 1008                |      | Manufacturer device name        | STRING(n) | RO                     | Name of the device as non-zero terminated string.                                                                                                                         |
| 1009                |      | Manufacturer hardware version   | STRING(n) | RO                     | Hardware version of the device as non-zero terminated string.                                                                                                             |
| 100 A               |      | Manufacturer software version   | STRING(n) | RO                     | Software version of the device as non-zero terminated string.                                                                                                             |
| 100B                |      | Manufacturer bootloader version | STRING(n) | RO                     | Bootloader version of the device as non-zero terminated string.                                                                                                           |
| 1018                |      | Identity object                 | IDENTITY  | RO                     |                                                                                                                                                                           |
|                     | 01   | Vendor ID                       | UDINT     | RO                     |                                                                                                                                                                           |
|                     | 02   | Product code                    | UDINT     | RO                     |                                                                                                                                                                           |
|                     | 03   | Revision number                 | UDINT     | RO                     |                                                                                                                                                                           |
|                     | 04   | Serial number                   | UDINT     | RO                     |                                                                                                                                                                           |
| 10F8                |      | Timestamp object                | ULINT     | RO                     | Local timestamp of the device in ns.                                                                                                                                      |
| 1600                |      | SDP default RxPDO               |           |                        |                                                                                                                                                                           |
|                     | 01h  |                                 |           |                        | 0x7000.0x01: Turbo start/stop                                                                                                                                             |
|                     | 02h  |                                 |           |                        | 0x7000.0x02: Turbo reset alarm                                                                                                                                            |
|                     | 03h  |                                 |           |                        | 0x7000.0x03: Turbo low speed                                                                                                                                              |
|                     | 04h  |                                 |           |                        | 0x0000.0x00:5                                                                                                                                                             |
| 1601                |      | User RxPDO                      |           |                        |                                                                                                                                                                           |
| 1A00                |      | SDP default TxPDO               |           |                        |                                                                                                                                                                           |
|                     | 01h  |                                 |           |                        | 0x6000.0x01: Rotation                                                                                                                                                     |
|                     | 02h  |                                 |           |                        | 0x6000.0x02: Normal                                                                                                                                                       |
|                     | 03h  |                                 |           |                        | 0x6000.0x03: Acceleration                                                                                                                                                 |
|                     | 04h  |                                 |           |                        | 0x6000.0x04: Deceleration (includes braking)                                                                                                                              |
|                     | 05h  |                                 |           |                        | 0x6000.0x05: Remote/local                                                                                                                                                 |
|                     | 06h  |                                 |           |                        | 0x6000.0x07: Turbo low speed                                                                                                                                              |
|                     | 07h  |                                 |           |                        | 0x6000.0x09: Alarm                                                                                                                                                        |
|                     | 08h  |                                 |           |                        | 0x6000.0x0A: Warning                                                                                                                                                      |
|                     | 09h  |                                 |           |                        | 0x6000.0x11: Turbo speed                                                                                                                                                  |
|                     | 0Ah  |                                 |           |                        | 0x6000.0x12: Turbo current                                                                                                                                                |
|                     | 0Bh  |                                 |           |                        | 0x6000.0x13: Turbo pump temperature                                                                                                                                       |
| 1A01                |      | User TxPDO                      |           |                        |                                                                                                                                                                           |
| 1C00                |      | Sync manager type               |           |                        |                                                                                                                                                                           |

205) Idx = Index, sIdx = Sub-index, Hexadecimal

206) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>205)</sup> | sldx | Name                                               | Type | Access <sup>206)</sup> | Description |
|---------------------|------|----------------------------------------------------|------|------------------------|-------------|
| 1C12                |      | RxPDO assign<br>(sync manager 2<br>PDO assignment) |      |                        |             |
| 1C13                |      | TxPDO assign<br>(sync manager 3<br>PDO assignment) |      |                        |             |

**Tbl. 64: Communication area – administrative data (information about the device, communication)**

**Input data (TC 80 --> control)**

| Idx <sup>207)</sup> | sldx    | Name                            | Type      | Access <sup>208)</sup> | Description                                              |
|---------------------|---------|---------------------------------|-----------|------------------------|----------------------------------------------------------|
| 2000                | Partial | In identity/status              |           | RO                     |                                                          |
|                     | 08      | Status code (main)              | UINT      | RO                     | "000000"->0,<br>"ErrXXX"->XXX,<br>"WrnXXX"->XXX<br>+1000 |
|                     | 0 A     | Operating hours (main)          | UDINT     | RO                     |                                                          |
|                     | 24      | Hardware version (interface)    | STRING(n) | RO                     |                                                          |
|                     | 25      | Firmware version (interface)    | STRING(n) | RO                     |                                                          |
|                     | 86      | ID (pump)                       | UINT      | RO                     |                                                          |
|                     | 8 A     | Operating hours (pump)          | UDINT     | RO                     |                                                          |
|                     | 8D      | Cycles (pump)                   | UDINT     | RO                     |                                                          |
| 2001                | Partial | In operation                    |           | RO                     |                                                          |
|                     | 83      | Actual value (abs) (pump)       | UDINT     | RO                     |                                                          |
|                     | 86      | Nominal value abs (pump)        | UDINT     | RO                     | rpm                                                      |
|                     | 88      | Ready for process (pump)        | BOOL      | RO                     | Speed switchpoint attained                               |
| 2002                | Partial | In pump power/temperature       |           | RO                     |                                                          |
|                     | 08      | Temperature (main)              | INT       | RO                     | °C                                                       |
|                     | 11      | Voltage (power)                 | INT       | RO                     | 0.1 V                                                    |
|                     | 13      | Power (power)                   | INT       | RO                     | W                                                        |
|                     | 18      | Temperature (power)             | INT       | RO                     | °C                                                       |
|                     | 98      | Temperature (motor)             | INT       | RO                     | °C                                                       |
|                     | B8      | Temperature (rotor)             | INT       | RO                     |                                                          |
| 2004                | Partial | In component identity/status    |           | RO                     |                                                          |
|                     | 52      | Device name (pressure 1)        | STRING(n) | RO                     |                                                          |
|                     | 62      | Device name (pressure 2)        | STRING(n) | RO                     |                                                          |
| 2005                | Partial | In component operation          |           | RO                     |                                                          |
|                     | 53      | Actual value (abs) (pressure 1) |           | RO                     | hPa                                                      |
|                     | 63      | Actual value (abs) (pressure 2) |           | RO                     | hPa                                                      |

**Tbl. 65: Input data**

205) Idx = Index, sldx = Sub-index, Hexadecimal

206) RO = read only, RW = read/write, P = suitable for process data

207) Idx = Index, sldx = Sub-index, Hexadecimal

208) RO = read only, RW = read/write, P = suitable for process data

## Output data (control --&gt; TC 80)

| Idx <sup>209)</sup> | sldx    | Name                    | Type | Access <sup>210)</sup> | Description |
|---------------------|---------|-------------------------|------|------------------------|-------------|
| 3005                | Partial | Out component operation |      | RO                     |             |
|                     | 01      | Enable (heating)        | BOOL | RW                     |             |
|                     | 11      | Enable (venting)        | BOOL | RW                     |             |
|                     | 21      | Enable (sealing gas)    | BOOL | RW                     |             |
|                     | 51      | Enable (pressure)       | BOOL | RW                     |             |

Tbl. 66: Manufacturer-specific outputs

## Manufacturer-specific configuration data

| Idx <sup>211)</sup> | sldx    | Name                               | Type  | Access <sup>212)</sup> | Description                   |
|---------------------|---------|------------------------------------|-------|------------------------|-------------------------------|
| 4001                | Partial | Cfg pump operation                 |       | RO                     |                               |
|                     | 12      | Setpoint 1/on (power)              | UINT  | RW                     | mV, power out voltage (V)     |
|                     | 13      | Setpoint 2/off (power)             | UINT  | RW                     | W, power out threshold (W)    |
|                     | 84      | Nominal value (abs) (pump)         | UDINT | RW                     | rpm                           |
|                     | 85      | Process configuration (pump)       | USINT | RW                     | Gas mode                      |
|                     | 86      | Cfg. ready for process (pump)      | USINT | RW                     | Cfg. speed switchpoint        |
|                     | 87      | Switchpoint 1/on (pump)            | USINT | RW                     | %, speed switchpoint 1 (% fN) |
|                     | 88      | Switchpoint 2/off (pump)           | USINT | RW                     | %, speed switchpoint 2 (% fN) |
|                     | 89      | Cfg. run-up timer (pump)           | BOOL  | RW                     |                               |
|                     | 8 A     | Run-up time (pump)                 | USINT | RW                     | Min                           |
|                     | 8B      | Temperature mode                   | USINT | RW                     |                               |
| 4002                | Partial | Cfg power                          |       | RO                     |                               |
|                     | 11      | Max. power (power)                 | USINT | RW                     | %                             |
| 4005                | Partial | Cfg component operation            |       | RO                     |                               |
|                     | 11      | Configuration (venting)            | USINT | RW                     |                               |
|                     | 12      | Setpoint 1/on (venting)            | USINT | RW                     | %, venting speed (% fN)       |
|                     | 13      | Setpoint 2/off (venting)           | UINT  | RW                     | s, venting time               |
|                     | 41      | Configuration (backing pump)       | USINT | RW                     |                               |
|                     | 42      | Setpoint 1/on (backing pump)       | UINT  | RW                     | W                             |
|                     | 43      | Setpoint 2/off (backing pump)      | UINT  | RW                     | W                             |
|                     | 55      | Process configuration (pressure 1) | REAL  | RW                     | Correction factor 1           |
|                     | 57      | Switchpoint 1/on (pressure 1)      | REAL  | RW                     | hPa                           |
|                     | 65      | Process configuration (pressure 2) | REAL  | RW                     | Correction factor 2           |
|                     | 67      | Switchpoint 1/on (pressure 2)      | REAL  | RW                     | hPa                           |
|                     | 72      | Setpoint 1/on (fan)                | USINT | RW                     | °C                            |
|                     | 81      | Configuration (accessory A1)       | USINT | RW                     |                               |
|                     | 91      | Configuration (accessory B1)       | USINT | RW                     |                               |
|                     | C1      | Configuration (accessory C1)       |       |                        |                               |
|                     | D1      | Configuration (accessory D1)       |       |                        |                               |
| 4009                | Partial | Cfg interface operation            |       | RO                     |                               |

209) Idx = Index, sldx = Sub-index, Hexadecimal

210) RO = read only, RW = read/write, P = suitable for process data

211) Idx = Index, sldx = Sub-index, Hexadecimal

212) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>211)</sup> | sldx | Name                | Type  | Access <sup>212)</sup> | Description |
|---------------------|------|---------------------|-------|------------------------|-------------|
|                     | 01   | Configuration (DI1) | USINT | RW                     |             |
|                     | 11   | Configuration (DI2) | USINT | RW                     |             |
|                     | 41   | Configuration (DO1) | USINT | RW                     |             |
|                     | 51   | Configuration (DO2) | USINT | RW                     |             |
|                     | A1   | Configuration (AO1) | USINT | RW                     |             |

**Tbl. 67: Manufacturer-specific configuration data**

#### Input area

| Idx <sup>213)</sup> | sldx | Name                            | Type | Access <sup>214)</sup> | Description                                                                       |
|---------------------|------|---------------------------------|------|------------------------|-----------------------------------------------------------------------------------|
| 6000                |      | Turbo status and sensor value   |      | RO                     |                                                                                   |
|                     | 01   | Rotation                        | BOOL | RO                     | 1: Under normal operation<br>0: Not normal                                        |
|                     | 02   | Normal                          | BOOL | RO                     | 1: Under normal operation<br>0: Not normal                                        |
|                     | 03   | Acceleration                    | BOOL | RO                     | 1: Accelerating<br>0: Not accelerating                                            |
|                     | 04   | Deceleration (includes braking) | BOOL | RO                     | 1: Decelerating<br>0: Not decelerating                                            |
|                     | 05   | Remote/local                    | BOOL | RO                     | 1: Local. Hand control enabled<br>0: Remote. E-cat control enabled                |
|                     | 06   | Coast (motor off)               | BOOL | RO                     | Conditional where supported by the turbo controller<br>1: Coast mode ON<br>0: OFF |
|                     | 07   | Turbo low speed                 | BOOL | RO                     | 1: Low speed mode ON<br>0: OFF                                                    |
|                     | 09   | Alarm                           | BOOL | RO                     | 1: Alarm<br>0: Not alarm                                                          |
|                     | 0 A  | Warning                         | BOOL | RO                     | 1: Warning<br>0: Not warning                                                      |
|                     | 11   | Turbo speed                     | INT  | RO                     | 1000 (100.0%): Rated speed - 0.1 [%]<br>0 (0.0%): No rotation                     |
|                     | 12   | Turbo current                   | INT  | RO                     | 0.1 [A]                                                                           |
|                     | 13   | Turbo pump temperature          | INT  | RO                     | Celsius - 1 [°C]                                                                  |

**Tbl. 68: Input area**

#### Output area

| Idx <sup>215)</sup> | sldx | Name             | Type | Access <sup>216)</sup> | Description       |
|---------------------|------|------------------|------|------------------------|-------------------|
| 7000                |      | Turbo control    |      | RO                     |                   |
|                     | 01   | Turbo start/stop | BOOL | RW                     | 1: Run<br>0: Stop |

211) Idx = Index, sldx = Sub-index, Hexadecimal

212) RO = read only, RW = read/write, P = suitable for process data

213) Idx = Index, sldx = Sub-index, Hexadecimal

214) RO = read only, RW = read/write, P = suitable for process data

215) Idx = Index, sldx = Sub-index, Hexadecimal

216) RO = read only, RW = read/write, P = suitable for process data



| Idx <sup>215)</sup> | sldx | Name              | Type | Access <sup>216)</sup> | Description                                                                        |
|---------------------|------|-------------------|------|------------------------|------------------------------------------------------------------------------------|
|                     | 02   | Turbo reset alarm | BOOL | RW                     | 1: Reset alarm<br>0: No action                                                     |
|                     | 03   | Turbo low speed   | BOOL | RW                     | 1: Low speed mode ON<br>0: OFF                                                     |
|                     | 04   | Coast (motor off) | BOOL | RW                     | Conditional where supported by the turbo controller,<br>1: Coast mode ON<br>0: OFF |

Tbl. 69: Output area

## Configuration data (control --&gt; TC 80)

| Idx <sup>217)</sup> | sldx | Name                        | Type | Access <sup>218)</sup> | Description                                                                                                                                                                 |
|---------------------|------|-----------------------------|------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8001                |      | Turbo parameter setting     |      | RO                     |                                                                                                                                                                             |
|                     | 01   | Turbo safe state            | UINT | RW                     | 0: Maintain state (hold last state) (default)<br>1: Go to default state (power up/reset state) - turbo stops<br>2: Maintain state exit low speed/coast (go to normal speed) |
|                     | 02   | Turbo low speed setpoint    | UINT | RW                     | 1000 (100.0%): Rated speed<br>0 (0.0%): No rotation, minimum speed restrictions apply, 0.1 [%]                                                                              |
|                     | 03   | Turbo normal speed setpoint | UINT | RW                     | 1000 (100.0%): Rated speed<br>0 (0.0%): No rotation, minimum speed restrictions apply, 0.1 [%]                                                                              |

Tbl. 70: Configuration area

## Semiconductor device profile area

| Idx <sup>219)</sup> | sldx | Name                         | Type  | Access <sup>220)</sup> | Description |
|---------------------|------|------------------------------|-------|------------------------|-------------|
| F000                |      | Semiconductor device profile |       | RO                     |             |
|                     | 01   | Index distance               | UINT  | RO                     |             |
|                     | 02   | Maximum number of modules    | UINT  | RO                     |             |
| F010                |      | Module profile list          |       | RO                     |             |
|                     | 01   |                              | UDINT | RO                     |             |

Tbl. 71: Semiconductor device profile area

215) Idx = Index, sldx = Sub-index, Hexadecimal

216) RO = read only, RW = read/write, P = suitable for process data

217) Idx = Index, sldx = Sub-index, Hexadecimal

218) RO = read only, RW = read/write, P = suitable for process data

219) Idx = Index, sldx = Sub-index, Hexadecimal

220) RO = read only, RW = read/write, P = suitable for process data

## Exception handling

| Idx <sup>221)</sup> | sldx | Name                            | Type  | Access <sup>222)</sup> | Description                                                                                                                     |
|---------------------|------|---------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| F380                |      | Active exception status         | USINT | RO                     | A condensed summary byte describing the collection of active device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning            |       |                        | Bit0: Device warning                                                                                                            |
|                     |      | Bit1: Manufacturer warning      |       |                        | Bit1: Manufacturer warning                                                                                                      |
|                     |      | Bit2: Device error              |       |                        | Bit2: Device error                                                                                                              |
|                     |      | Bit3: Manufacturer error        |       |                        | Bit3: Manufacturer error                                                                                                        |
|                     |      | Bit4: Reserved                  |       |                        | Bit4: Reserved                                                                                                                  |
|                     |      | Bit5: Reserved                  |       |                        | Bit5: Reserved                                                                                                                  |
|                     |      | Bit6: Reserved                  |       |                        | Bit6: Reserved                                                                                                                  |
|                     |      | Bit7: Reserved                  |       |                        | Bit7: Reserved                                                                                                                  |
| F381                |      | Active device warning details   |       | RO                     |                                                                                                                                 |
|                     | 01   |                                 | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                         |
|                     |      | Bit0: Power fail                |       |                        | Bit0: Power fail                                                                                                                |
|                     |      | Bit1: Pump overtemperature      |       |                        | Bit1: Pump overtemperature                                                                                                      |
|                     |      | Bit2: Overspeed                 |       |                        | Bit2: Overspeed                                                                                                                 |
|                     |      | Bit3: Motor overcurrent         |       |                        | Bit3: Motor overcurrent                                                                                                         |
|                     |      | Bit4: Driver overtemperature    |       |                        | Bit4: Driver overtemperature                                                                                                    |
|                     |      | Bit5: Driver overcurrent        |       |                        | Bit5: Driver overcurrent                                                                                                        |
|                     |      | Bit6: Driver overvoltage        |       |                        | Bit6: Driver overvoltage                                                                                                        |
|                     |      | Bit7: Driver fail               |       |                        | Bit7: Driver fail                                                                                                               |
|                     |      | Bit8: Controller fail           |       |                        | Bit8: Controller fail                                                                                                           |
|                     |      | Bit9: Cannot start              |       |                        | Bit9: Cannot start                                                                                                              |
|                     |      | Bit10: Accel. overtime          |       |                        | Bit10: Accel. overtime                                                                                                          |
|                     |      | Bit11: Brake overtime           |       |                        | Bit11: Brake overtime                                                                                                           |
|                     |      | Bit12: Bearing err              |       |                        | Bit12: Bearing err                                                                                                              |
|                     |      | Bit13: Bearing sensor err       |       |                        | Bit13: Bearing sensor err                                                                                                       |
|                     |      | Bit14: TC over temperature      |       |                        | Bit14: TC over temperature                                                                                                      |
|                     |      | Bit15: TC sensor error          |       |                        | Bit15: TC sensor error                                                                                                          |
|                     |      | Bit16: TC heater err            |       |                        | Bit16: TC heater err                                                                                                            |
|                     |      | Bit17: TC valve err             |       |                        | Bit17: TC valve err                                                                                                             |
|                     |      | Bit18: Other (not in the above) |       |                        | Bit18: Other (not in the above)                                                                                                 |
|                     |      | Bit19: Reserved                 |       |                        | Bit19: Reserved                                                                                                                 |
|                     |      | Bit20: Reserved                 |       |                        | Bit20: Reserved                                                                                                                 |
|                     |      | Bit21: Reserved                 |       |                        | Bit21: Reserved                                                                                                                 |
|                     |      | Bit22: Reserved                 |       |                        | Bit22: Reserved                                                                                                                 |
|                     |      | Bit23: Reserved                 |       |                        | Bit23: Reserved                                                                                                                 |
|                     |      | Bit24: Reserved                 |       |                        | Bit24: Reserved                                                                                                                 |

221) Idx = Index, sldx = Sub-index, Hexadecimal

222) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>221)</sup> | sidx | Name                            | Type  | Access <sup>222)</sup> | Description                                                                                             |
|---------------------|------|---------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit25: Reserved                 |       |                        | Bit25: Reserved                                                                                         |
|                     |      | Bit26: Reserved                 |       |                        | Bit26: Reserved                                                                                         |
|                     |      | Bit27: Reserved                 |       |                        | Bit27: Reserved                                                                                         |
|                     |      | Bit28: Reserved                 |       |                        | Bit28: Reserved                                                                                         |
|                     |      | Bit29: Reserved                 |       |                        | Bit29: Reserved                                                                                         |
|                     |      | Bit30: Reserved                 |       |                        | Bit30: Reserved                                                                                         |
|                     |      | Bit31: Reserved                 |       |                        | Bit31: Reserved                                                                                         |
| F383                |      | Active device error details     |       | RO                     |                                                                                                         |
|                     | 01   |                                 | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: Power fail                |       |                        | Bit0: Power fail                                                                                        |
|                     |      | Bit1: Pump overtemperature      |       |                        | Bit1: Pump overtemperature                                                                              |
|                     |      | Bit2: Overspeed                 |       |                        | Bit2: Overspeed                                                                                         |
|                     |      | Bit3: Motor overcurrent         |       |                        | Bit3: Motor overcurrent                                                                                 |
|                     |      | Bit4: Driver overtemperature    |       |                        | Bit4: Driver overtemperature                                                                            |
|                     |      | Bit5: Driver overcurrent        |       |                        | Bit5: Driver overcurrent                                                                                |
|                     |      | Bit6: Driver overvoltage        |       |                        | Bit6: Driver overvoltage                                                                                |
|                     |      | Bit7: Driver fail               |       |                        | Bit7: Driver fail                                                                                       |
|                     |      | Bit8: Controller fail           |       |                        | Bit8: Controller fail                                                                                   |
|                     |      | Bit9: Cannot start              |       |                        | Bit9: Cannot start                                                                                      |
|                     |      | Bit10: Accel. overtime          |       |                        | Bit10: Accel. overtime                                                                                  |
|                     |      | Bit11: Brake overtime           |       |                        | Bit11: Brake overtime                                                                                   |
|                     |      | Bit12: Bearing err              |       |                        | Bit12: Bearing err                                                                                      |
|                     |      | Bit13: Bearing sensor err       |       |                        | Bit13: Bearing sensor err                                                                               |
|                     |      | Bit14: TC over temperature      |       |                        | Bit14: TC over temperature                                                                              |
|                     |      | Bit15: TC sensor error          |       |                        | Bit15: TC sensor error                                                                                  |
|                     |      | Bit16: TC heater err            |       |                        | Bit16: TC heater err                                                                                    |
|                     |      | Bit17: TC valve err             |       |                        | Bit17: TC valve err                                                                                     |
|                     |      | Bit18: Other (not in the above) |       |                        | Bit18: Other (not in the above)                                                                         |
|                     |      | Bit19: Reserved                 |       |                        | Bit19: Reserved                                                                                         |
|                     |      | Bit20: Reserved                 |       |                        | Bit20: Reserved                                                                                         |
|                     |      | Bit21: Reserved                 |       |                        | Bit21: Reserved                                                                                         |
|                     |      | Bit22: Reserved                 |       |                        | Bit22: Reserved                                                                                         |
|                     |      | Bit23: Reserved                 |       |                        | Bit23: Reserved                                                                                         |
|                     |      | Bit24: Reserved                 |       |                        | Bit24: Reserved                                                                                         |
|                     |      | Bit25: Reserved                 |       |                        | Bit25: Reserved                                                                                         |
|                     |      | Bit26: Reserved                 |       |                        | Bit26: Reserved                                                                                         |
|                     |      | Bit27: Reserved                 |       |                        | Bit27: Reserved                                                                                         |
|                     |      | Bit28: Reserved                 |       |                        | Bit28: Reserved                                                                                         |
|                     |      | Bit29: Reserved                 |       |                        | Bit29: Reserved                                                                                         |
|                     |      | Bit30: Reserved                 |       |                        | Bit30: Reserved                                                                                         |
|                     |      | Bit31: Reserved                 |       |                        | Bit31: Reserved                                                                                         |

221) Idx = Index, sidx = Sub-index, Hexadecimal

222) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>221)</sup> | sldx | Name                            | Type  | Access <sup>222)</sup> | Description                                                                                                              |
|---------------------|------|---------------------------------|-------|------------------------|--------------------------------------------------------------------------------------------------------------------------|
| F390                |      | Latched exception status        | USINT | RO                     | A condensed summary byte describing the collection of device exceptions after corresponding masks (0xF3Ax) were applied. |
|                     |      | Bit0: Device warning            |       |                        | Bit0: Device warning                                                                                                     |
|                     |      | Bit1: Manufacturer warning      |       |                        | Bit1: Manufacturer warning                                                                                               |
|                     |      | Bit2: Device error              |       |                        | Bit2: Device error                                                                                                       |
|                     |      | Bit3: Manufacturer error        |       |                        | Bit3: Manufacturer error                                                                                                 |
|                     |      | Bit4: Reserved                  |       |                        | Bit4: Reserved                                                                                                           |
|                     |      | Bit5: Reserved                  |       |                        | Bit5: Reserved                                                                                                           |
|                     |      | Bit6: Reserved                  |       |                        | Bit6: Reserved                                                                                                           |
|                     |      | Bit7: Reserved                  |       |                        | Bit7: Reserved                                                                                                           |
| F391                |      | Latched device warning details  |       | RO                     |                                                                                                                          |
|                     | 01   |                                 | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available                  |
|                     |      | Bit0: Power fail                |       |                        | Bit0: Power fail                                                                                                         |
|                     |      | Bit1: Pump overtemperature      |       |                        | Bit1: Pump overtemperature                                                                                               |
|                     |      | Bit2: Overspeed                 |       |                        | Bit2: Overspeed                                                                                                          |
|                     |      | Bit3: Motor overcurrent         |       |                        | Bit3: Motor overcurrent                                                                                                  |
|                     |      | Bit4: Driver overtemperature    |       |                        | Bit4: Driver overtemperature                                                                                             |
|                     |      | Bit5: Driver overcurrent        |       |                        | Bit5: Driver overcurrent                                                                                                 |
|                     |      | Bit6: Driver overvoltage        |       |                        | Bit6: Driver overvoltage                                                                                                 |
|                     |      | Bit7: Driver fail               |       |                        | Bit7: Driver fail                                                                                                        |
|                     |      | Bit8: Controller fail           |       |                        | Bit8: Controller fail                                                                                                    |
|                     |      | Bit9: Cannot start              |       |                        | Bit9: Cannot start                                                                                                       |
|                     |      | Bit10: Accel. overtime          |       |                        | Bit10: Accel. overtime                                                                                                   |
|                     |      | Bit11: Brake overtime           |       |                        | Bit11: Brake overtime                                                                                                    |
|                     |      | Bit12: Bearing err              |       |                        | Bit12: Bearing err                                                                                                       |
|                     |      | Bit13: Bearing sensor err       |       |                        | Bit13: Bearing sensor err                                                                                                |
|                     |      | Bit14: TC over temperature      |       |                        | Bit14: TC over temperature                                                                                               |
|                     |      | Bit15: TC sensor error          |       |                        | Bit15: TC sensor error                                                                                                   |
|                     |      | Bit16: TC heater err            |       |                        | Bit16: TC heater err                                                                                                     |
|                     |      | Bit17: TC valve err             |       |                        | Bit17: TC valve err                                                                                                      |
|                     |      | Bit18: Other (not in the above) |       |                        | Bit18: Other (not in the above)                                                                                          |
|                     |      | Bit19: Reserved                 |       |                        | Bit19: Reserved                                                                                                          |
|                     |      | Bit20: Reserved                 |       |                        | Bit20: Reserved                                                                                                          |
|                     |      | Bit21: Reserved                 |       |                        | Bit21: Reserved                                                                                                          |
|                     |      | Bit22: Reserved                 |       |                        | Bit22: Reserved                                                                                                          |
|                     |      | Bit23: Reserved                 |       |                        | Bit23: Reserved                                                                                                          |
|                     |      | Bit24: Reserved                 |       |                        | Bit24: Reserved                                                                                                          |
|                     |      | Bit25: Reserved                 |       |                        | Bit25: Reserved                                                                                                          |
|                     |      | Bit26: Reserved                 |       |                        | Bit26: Reserved                                                                                                          |
|                     |      | Bit27: Reserved                 |       |                        | Bit27: Reserved                                                                                                          |

221) Idx = Index, sldx = Sub-index, Hexadecimal

222) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>221)</sup> | sldx | Name                            | Type  | Access <sup>222)</sup> | Description                                                                                             |
|---------------------|------|---------------------------------|-------|------------------------|---------------------------------------------------------------------------------------------------------|
|                     |      | Bit28: Reserved                 |       |                        | Bit28: Reserved                                                                                         |
|                     |      | Bit29: Reserved                 |       |                        | Bit29: Reserved                                                                                         |
|                     |      | Bit30: Reserved                 |       |                        | Bit30: Reserved                                                                                         |
|                     |      | Bit31: Reserved                 |       |                        | Bit31: Reserved                                                                                         |
| F393                |      | Latched device error details    |       | RO                     |                                                                                                         |
|                     | 01   |                                 | UDINT | RO                     | Expanded details of the device warning exceptions. For each bit:<br>1: Occur<br>0: Normal/not available |
|                     |      | Bit0: Power fail                |       |                        | Bit0: Power fail                                                                                        |
|                     |      | Bit1: Pump overtemperature      |       |                        | Bit1: Pump overtemperature                                                                              |
|                     |      | Bit2: Overspeed                 |       |                        | Bit2: Overspeed                                                                                         |
|                     |      | Bit3: Motor overcurrent         |       |                        | Bit3: Motor overcurrent                                                                                 |
|                     |      | Bit4: Driver overtemperature    |       |                        | Bit4: Driver overtemperature                                                                            |
|                     |      | Bit5: Driver overcurrent        |       |                        | Bit5: Driver overcurrent                                                                                |
|                     |      | Bit6: Driver overvoltage        |       |                        | Bit6: Driver overvoltage                                                                                |
|                     |      | Bit7: Driver fail               |       |                        | Bit7: Driver fail                                                                                       |
|                     |      | Bit8: Controller fail           |       |                        | Bit8: Controller fail                                                                                   |
|                     |      | Bit9: Cannot start              |       |                        | Bit9: Cannot start                                                                                      |
|                     |      | Bit10: Accel. overtime          |       |                        | Bit10: Accel. overtime                                                                                  |
|                     |      | Bit11: Brake overtime           |       |                        | Bit11: Brake overtime                                                                                   |
|                     |      | Bit12: Bearing err              |       |                        | Bit12: Bearing err                                                                                      |
|                     |      | Bit13: Bearing sensor err       |       |                        | Bit13: Bearing sensor err                                                                               |
|                     |      | Bit14: TC over temperature      |       |                        | Bit14: TC over temperature                                                                              |
|                     |      | Bit15: TC sensor error          |       |                        | Bit15: TC sensor error                                                                                  |
|                     |      | Bit16: TC heater err            |       |                        | Bit16: TC heater err                                                                                    |
|                     |      | Bit17: TC valve err             |       |                        | Bit17: TC valve err                                                                                     |
|                     |      | Bit18: Other (not in the above) |       |                        | Bit18: Other (not in the above)                                                                         |
|                     |      | Bit19: Reserved                 |       |                        | Bit19: Reserved                                                                                         |
|                     |      | Bit20: Reserved                 |       |                        | Bit20: Reserved                                                                                         |
|                     |      | Bit21: Reserved                 |       |                        | Bit21: Reserved                                                                                         |
|                     |      | Bit22: Reserved                 |       |                        | Bit22: Reserved                                                                                         |
|                     |      | Bit23: Reserved                 |       |                        | Bit23: Reserved                                                                                         |
|                     |      | Bit24: Reserved                 |       |                        | Bit24: Reserved                                                                                         |
|                     |      | Bit25: Reserved                 |       |                        | Bit25: Reserved                                                                                         |
|                     |      | Bit26: Reserved                 |       |                        | Bit26: Reserved                                                                                         |
|                     |      | Bit27: Reserved                 |       |                        | Bit27: Reserved                                                                                         |
|                     |      | Bit28: Reserved                 |       |                        | Bit28: Reserved                                                                                         |
|                     |      | Bit29: Reserved                 |       |                        | Bit29: Reserved                                                                                         |
|                     |      | Bit30: Reserved                 |       |                        | Bit30: Reserved                                                                                         |
|                     |      | Bit31: Reserved                 |       |                        | Bit31: Reserved                                                                                         |
| F3A1                |      | Device warning mask             |       | RO                     |                                                                                                         |

221) Idx = Index, sldx = Sub-index, Hexadecimal

222) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>221)</sup> | sidx | Name              | Type  | Access <sup>222)</sup> | Description                                                                                                                                                                                                                         |
|---------------------|------|-------------------|-------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 01   |                   | UDINT | RW                     | Bitmask to include the corresponding device warning exception bits (as defined in the device warning details) in the active and latched exception status objects (0xF380 bit 0 and 0xF390 bit 0), if the corresponding bit is TRUE. |
| F3A3                |      | Device error mask |       | RO                     |                                                                                                                                                                                                                                     |
|                     | 01   |                   | UDINT | RO                     | Bitmask to include the corresponding device error exception bits (as defined in the device error details) in the active and latched exception status objects (0xF380 bit 2 and 0xF390 bit 2), if the corresponding bit is TRUE.     |

Tbl. 72: Exception handling

## CDP device-specific inputs

| Idx <sup>223)</sup> | sidx | Name                        | Type  | Access <sup>224)</sup> | Description                                                                                                        |
|---------------------|------|-----------------------------|-------|------------------------|--------------------------------------------------------------------------------------------------------------------|
| F6F0                |      | Input latch local timestamp |       | RO                     |                                                                                                                    |
|                     | 01   | Input latch local timestamp | UDINT | RO                     | Local controller time corresponding to the input latch time in microseconds. It starts at zero on device power-up. |

Tbl. 73: Device-specific inputs

## CDP-specific information data

| Idx <sup>225)</sup> | sidx | Name                             | Type      | Access <sup>226)</sup> | Description                                                                                                           |
|---------------------|------|----------------------------------|-----------|------------------------|-----------------------------------------------------------------------------------------------------------------------|
| F9F0                |      | Manufacturer serial number       | STRING(n) | RO                     | String representing the manufacturer's serial number for the device. NOTE: This may have the same value as 0x1018:04. |
| F9F1                |      | CDP functional generation number |           | RO                     |                                                                                                                       |
|                     | 01   |                                  | UDINT     | RO                     | Common device profile functional generation number 2, see ETG.5003.2050                                               |
| F9F2                |      | SDP functional generation number |           | RO                     |                                                                                                                       |
|                     | 01   |                                  | UDINT     | RO                     | SDP functional generation number of nn-th module shall be specified by each SDP.2, see ETG.5003.2050                  |
| F9F3                |      | Vendor name                      | STRING(n) | RO                     | This string identifies the supplier of the device.                                                                    |
| F9F4                |      | SDP device name                  |           | RO                     |                                                                                                                       |

221) Idx = Index, sidx = Sub-index, Hexadecimal

222) RO = read only, RW = read/write, P = suitable for process data

223) Idx = Index, sidx = Sub-index, Hexadecimal

224) RO = read only, RW = read/write, P = suitable for process data

225) Idx = Index, sidx = Sub-index, Hexadecimal

226) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>225)</sup> | sldx | Name                                          | Type      | Access <sup>226)</sup> | Description                                                                                                                                                                                                                                                                                                                |
|---------------------|------|-----------------------------------------------|-----------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 01   |                                               | STRING(n) | RO                     | String identifying the device type of nn-th module as defined by the SDP, see ETG.5003.2050                                                                                                                                                                                                                                |
| F9F5                |      | Output identifier                             |           | RO                     |                                                                                                                                                                                                                                                                                                                            |
|                     | 01   |                                               | USINT     | RW                     | Output identifier of nn-th module. This value can be mapped to both the RxPDO and TxPDO. The required function of the device is to store the value in memory as written by the host. The controller can then read this value back through the TxPDO to ensure the RxPDO was received.                                      |
| F9F6                |      | Time since power on                           | UDINT     | RO                     | This is the time the device has currently been powered on, in seconds, regardless of communication presence.                                                                                                                                                                                                               |
| F9F7                |      | Total time powered                            | UDINT     | RO                     | This is the cumulative amount of time the device has been powered on, in seconds. It shall be stored automatically as non-volatile. Accuracy shall be equal or better to one hour.                                                                                                                                         |
| F9F8                |      | Firmware update: functional generation number | UDINT     | RO                     | Firmware update of functional generation number supported by the device. Value shall be specified by the Firmware Update Profile (ETG.5003-2)0x00000000: FW update according to ETG.5003-2 not supported. A device cannot return this value and still be compliant with ETG.5003.1, as ETG.5003-2 compliance is mandatory. |

Tbl. 74: CDP-specific information data

## CDP command objects

| Idx <sup>227)</sup> | sldx | Name                 | Type                | Access <sup>228)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------|------|----------------------|---------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF0                |      | Device reset command |                     | RO                     | Execution of this command causes the device to emulate a complete power cycle. This includes an ESC reset. Some devices may require this reset to maintain a specific state not matching power cycle behavior for proper operation, per the SDP. NOTE: As a consequence of an ESC reset, all of the subsequent devices are disconnected from the network. There are two versions of this command: Device reset: Backup parameters will not change as a result of this reset. All setting parameters will revert to power-on defaults as a result of the reset. Factory reset: All backup parameters will be changed to their as-shipped defaults. All setting parameters will revert to power-on defaults as a result of the reset. |
|                     | 01   | Command              | ARRAY[0..5] OF BYTE | RW                     | A device reset is initiated when the following byte sequence is sent: Byte 0: 0x74Byte 1: 0x65Byte 2: 0x73 Byte 3: 0x65Byte 4: 0x72Byte 5: Device standard reset = 0x00, factory reset = 0x66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

225) Idx = Index, sldx = Sub-index, Hexadecimal

226) RO = read only, RW = read/write, P = suitable for process data

227) Idx = Index, sldx = Sub-index, Hexadecimal

228) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>227)</sup> | sIdx | Name                     | Type                | Access <sup>228)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------|------|--------------------------|---------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 02   | Status                   | USINT               | RO                     | Supported values: 0: Default value if the command has not been initiated. Not a supported value otherwise. 1: Reserved 2: Last command completed, error, no response 3: Reserved 3-99: Reserved, 100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%) 201-254: Reserved, 255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                               |
|                     | 03   | Response                 | ARRAY[0..1] OF BYTE | RO                     | Byte 0: see Subindex 2 Byte 1: Unused - Shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| FBF1                |      | Exception reset command  |                     | RO                     | Execution of this command clears the latched exceptions. Execution of this command may also optionally acknowledge device or SDP-specific exceptions (if specified) that would otherwise require a separate acknowledgment action to resume normal operation. If this is required, it shall be noted in the SDP or device documentation.                                                                                                                                                                                                                                                                                                                                                                                                           |
|                     | 01   | Command                  | ARRAY[0..4] OF BYTE | RW                     | A Latched Exception Reset is initiated when the following byte sequence is sent: Byte 0: 0x74 Byte 1: 0x65 Byte 2: 0x73 Byte 3: 0x65 Byte 4: 0x72                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                     | 02   | Status                   | USINT               | RO                     | Supported values: 0: Last command completed, no error, no response 1: Reserved 2: Last command completed, error, no response 3: Reserved 3-99: Reserved, 100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%) 201-254: Reserved, 255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                                                                       |
|                     | 03   | Response                 | ARRAY[0..1] OF BYTE | RO                     | Byte 0: see Subindex 2 Byte 1: Unused - Shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| FBF2                |      | Store parameters command |                     | RO                     | Execution of this command will store all parameters to non-volatile memory. If a device automatically saves all non-volatile parameters at the time they are written, this command will not take any action. In the event that this command may interfere with the safe or expected functional operation of a device, it may be optionally restricted to functioning only in certain functional conditions while in OPERATIONAL state. If the command cannot be performed due to this operating condition, the Abort Code "0x08 00 00 21" shall be returned. In this case, documentation shall be supplied detailing the proper condition to execute this command. All devices shall be able to execute this command in PREOP without restriction. |
|                     | 01   | Command                  | ARRAY[0..3] OF BYTE | RW                     | Read: Bit 0 = 1: Device saves the non-volatile parameters when writing 0xFB2:01 with 0x65766173 Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written Bit 2-31: Reserved, shall be 0 Write: All writable, non-volatile values will be stored in non-volatile memory when the following is sent: Byte 0: 0x73 Byte 1: 0x61 Byte 2: 0x76 Byte 3: 0x65 If other values are written, the Abort Code "0x06040043 General parameter incompatibility reason" shall be returned.                                                                                                                                                                                                                                         |

227) Idx = Index, sIdx = Sub-index, Hexadecimal

228) RO = read only, RW = read/write, P = suitable for process data



| Idx <sup>227)</sup> | sIdx | Name                       | Type                | Access <sup>228)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------|------|----------------------------|---------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | 02   | Status                     | USINT               | RO                     | Supported values: 0: Last command completed, no error, no response 1: Reserved 2: Last command completed, error, no response 3-99: Reserved, 100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%) 201-254: Reserved, 255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                     | 03   | Response                   | ARRAY[0..1] OF BYTE | RO                     | Byte 0: see Subindex 2 Byte 1: Unused - Shall be zero                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| FBF3                |      | Calculate checksum command |                     | RO                     | Execution of this command will calculate a checksum for all writable, non-volatile parameters as currently stored in non-volatile memory. In the event that this calculation may interfere with the safe or expected functional operation of a device, it may be optionally restricted to functioning only in certain functional conditions while in OPERATIONAL state. If the checksum cannot be calculated, the Abort Code "0x08 00 00 21" shall be returned. In this case, documentation shall be supplied detailing the proper condition to execute this command. All devices shall be able to calculate the checksum in PREOP without restriction. Even if the manufacturer chooses to store the checksum itself in non-volatile or volatile memory, the device shall perform the calculation at the time of executing this command and return this calculated value. This command shall therefore not return a value calculated prior to executing this command. |
|                     | 01   | Command                    | ARRAY[0..3] OF BYTE | RW                     | Read: Returns information about the supported checksum type Bit 0 = 0: no non-volatile parameters supported. Bit 0 = 1: non-volatile parameters supported, at least 1 of the defined bits 1-7 shall be set. Bit 1 = 1: CRC-32 Bit 2 = 1: MD5 Bit 3 = 1: SHA-1 Bit 4-6: Reserved, shall be 0. Bit 7 = 1: other algorithm. Bit 8...31: Reserved, shall be 0. Write: Checksum type selection and start calculation. A write access to this subindex shall only set one bit true in Bit[0...7]. If other values are written, the Abort Code "0x06040043 Parameter is incompatible" shall be returned. Bit 0 = 1: Use default checksum algorithm of the device. Bit 1 = 1: CRC-32 Bit 2 = 1: MD5 Bit 3 = 1: SHA-1 Bit 4-6: Reserved, shall be 0. Bit 7 = 1: other algorithm. Bit 8...31: Reserved, shall be 0                                                                                                                                                               |
|                     | 02   | Status                     | USINT               | RO                     | Supported values: 0: Default value if the command has not been initiated. Not a supported value otherwise. 1: Last command completed, no error, reply there. 2: Last command completed, error, no response. 3: Reserved 3-99: Reserved, 100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%) 201-254: Reserved, 255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                     | 03   | Response                   | ARRAY[0..n] OF BYTE | RO                     | Byte 0: see Subindex 2 Byte 1: Unused - Shall be zero. Byte 2-n: Checksum return value. Size varies depending on checksum type used. The maximum length shall be 64 bytes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

227) Idx = Index, sIdx = Sub-index, Hexadecimal

228) RO = read only, RW = read/write, P = suitable for process data

| Idx <sup>227)</sup> | sidx | Name                    | Type                | Access <sup>228)</sup> | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------|------|-------------------------|---------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FBF4                |      | Load parameters command |                     | RO                     | Execution of this command will load all parameters from non-volatile memory. If a device automatically saves all non-volatile parameters at the time they are written, this command will not take any action. In the event that this command may interfere with the safe or expected functional operation of a device, it may be optionally restricted to functioning only in certain functional conditions while in OPERATIONAL state. If the command cannot be performed due to this operating condition, the Abort Code "0x08 00 00 21" shall be returned. In this case, documentation shall be supplied detailing the proper condition to execute this command. All devices shall be able to execute this command in PREOP without restriction. |
|                     | 01   | Command                 | ARRAY[0..3] OF BYTE | RW                     | Read: Bit 0 = 1: Device loads the non-volatile parameters when writing 0xFB4:01 with 0x64616F6C Bit 1 = 1: Device saves the non-volatile parameters automatically when they are written Bit 2-31: reserved, shall be 0 Write: All writable, non-volatile parameters will loaded from non-volatile memory when the following is sent: Byte 0: 0x6CByte 1: 0x6FByte 2: 0x61 Byte 3: 0x64 If other values are written, the Abort Code "0x06040043 General parameter incompatibility reason" shall be returned.                                                                                                                                                                                                                                         |
|                     | 02   | Status                  | USINT               | RO                     | Supported values: 0: Last command completed, no error, no response 1: Reserved 2: Last command completed, error, no response 3-99: Reserved, 100-200: indicates how much of the command has been executed (in %, 100 = 0%, 200 = 100%) 201-254: Reserved, 255: command is executing (if the percentage display is not supported)                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                     | 03   | Response                | ARRAY[0..1] OF BYTE | RO                     | Byte 0: see Subindex 2 Byte 1: Unused - Shall be zero ETG5003_                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

**Tbl. 75: CDP command objects**

227) Idx = Index, sidx = Sub-index, Hexadecimal

228) RO = read only, RW = read/write, P = suitable for process data



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