OPERATING INSTRUCTIONS

EN

Translation of the Original

QMH 800-X

High-frequency generator for QMG 800 HiQuad® Neo

PFEIFFER VACUUM

Dear Customer,

Thank you for choosing a Pfeiffer Vacuum product. Your new high-frequency generator is designed to support you in your individual application with full performance and without malfunctions. The name Pfeiffer Vacuum represents high-quality vacuum technology, a comprehensive and complete range of top-quality products and first-class service. From this extensive, practical experience we have gained a large volume of information that can contribute to efficient deployment and to your personal safety.

In the knowledge that our product must avoid consuming work output, we trust that our product can offer you a solution that supports you in the effective and trouble-free implementation of your individual application.

Please read these operating instructions before putting your product into operation for the first time. If you have any questions or suggestions, please feel free to contact info@pfeiffer-vacuum.de.

Further operating instructions from Pfeiffer Vacuum can be found in the Download Center on our website.

Disclaimer of liability

These operating instructions describe all models and variants of your product. Note that your product may not be equipped with all features described in this document. Pfeiffer Vacuum constantly adapts its products to the latest state of the art without prior notice. Please take into account that online operating instructions can deviate from the printed operating instructions supplied with your product.

Furthermore, Pfeiffer Vacuum assumes no responsibility or liability for damage resulting from the use of the product that contradicts its proper use or is explicitly defined as foreseeable misuse.

Copyright

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1 About this manual

IMPORTANT
Read carefully before use.
Keep the manual for future consultation.

1.1 Validity

This document describes the function of the products listed in the following and provides the most important information for safe use. The description is written in accordance with the valid directives. The information in this document refers to the current development status of the products. The document retains its validity assuming that the customer does not make any changes to the product.

1.1.1 Applicable documents

Designation	Document
Operating instructions for QMG 800 HiQuad Neo	BG 6013
Operating instructions for EP 822 electrometer pre-amplifier	
Operating instructions for IO 820 input-output module	
Operating instructions for QMA 4x0 analyzer	BG 6018
PV MassSpec Software Documentation	A component of the software
Declaration of conformity	A component of these instructions

Tbl. 1: Applicable documents

You can find these documents in the Pfeiffer Vacuum Download Center.

1.1.2 Variants

This document applies to products with the following article numbers:

Article number	Designation
PT M22 001	QMH 800-3
PT M22 000	QMH 800-5

You can find the part number on the rating plate of the product.

Pfeiffer Vacuum reserves the right to make technical changes without prior notification.

The figures in this document are not to scale.

Dimensions are in mm unless stated otherwise.

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

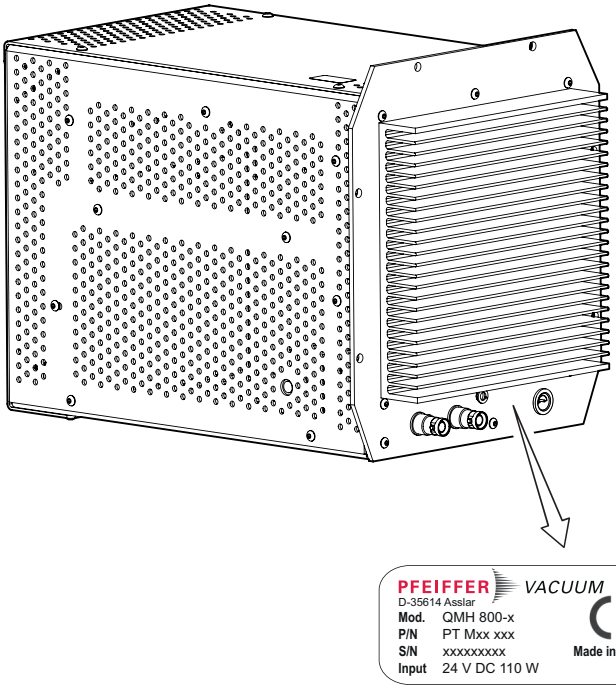
Pictographs used in the document indicate useful information.

Note

Tip

1.3.3 Labels on product

This section describes all the labels on the product along with their meanings.



Rating plate

The rating plate is located on the side of the unit.

1.3.4 Abbreviations

Abbreviation	Explanation
ARM	Advanced RISC machine (main processor)
ESD	Electrostatic discharge

Abbreviation	Explanation
FA	Field axes
FPGA	Field programmable gate array
HF	High frequency
QMA	Quadrupole mass spectrometer analyzer
QMH	Quadrupole mass spectrometer high-frequency generator
RF	Radio frequency (high frequency)
RISC	Reduced instruction set computer
SEM	Secondary electron multiplier
SOM	System-on-module

Tbl. 2: Abbreviations used

1.4 Trademark proof

- HiQuad® is a registered trademark of Pfeiffer Vacuum GmbH.

2 Safety

2.1 General safety information

The following 4 risk levels and 1 information level are taken into account in this document.

⚠ DANGER

Immediately pending danger

Indicates an immediately pending danger that will result in death or serious injury if not observed.

► Instructions to avoid the danger situation

⚠ WARNING

Potential pending danger

Indicates a pending danger that could result in death or serious injury if not observed.

► Instructions to avoid the danger situation

⚠ CAUTION

Potential pending danger

Indicates a pending danger that could result in minor injuries if not observed.

► Instructions to avoid the danger situation

NOTICE

Danger of damage to property

Is used to highlight actions that are not associated with personal injury.

► Instructions to avoid damage to property

Notes, tips or examples indicate important information about the product or about this document.

2.2 Safety instructions

Safety instructions according to product life stages

All safety instructions in this document are based on the results of a risk assessment. Pfeiffer Vacuum has taken into account all the relevant life stages of the product.

Risks during installation

⚠ DANGER

Danger to life from electric shock

Inadequate or incorrect grounding of the unit leads to contact-sensitive voltage on the housing. When making contact, increased leakage currents will cause a life-threatening electric shock.

- ► Before the installation, check that the connection leads are voltage-free.
- ► Conduct the electrical connection in accordance with locally applicable regulations.
- ► Make sure that the local mains voltage and frequency match rating plate specifications.
- ► Make sure that the mains cable and extension cable meet the requirements for double isolation between input voltage and output voltage, in accordance with IEC 61010 and IEC 60950.
- ► Use only a 3-pin mains cable and extension cable with properly connected protective earthing (earthed conductor).
- ► Plug the mains plug into a socket with earthing contact only.
- ► Always connect the mains cable prior to all other cables, to ensure continuous protective earthing.

Risks during operation

⚠ DANGER

Danger to life from electric shock caused by moisture ingress

Water that has entered the unit will result in personal injury through electric shocks.

- ► Only operate the unit in a dry environment.
- ► Operate the unit away from fluids and sources of moisture.
- ► Do not switch on the unit if fluid has entered it. Instead contact Pfeiffer Vacuum Service.
- ► Always disconnect the power supply before cleaning the unit.

Risks during maintenance

⚠ DANGER

Danger to life due to electric voltage

High voltages exist inside the device. When touching parts that are live, there is a risk of death. If there is visible damage, there is a risk of fatal injury when commissioning the device.

- ► Always disconnect the unit before opening the power supply.
- ► Work on the open device must only be carried out by trained specialist personnel.
- ► Before carrying out any installation and maintenance work, switch the device off and disconnect it from the current supply.
  - – After switching off, wait for 60 seconds and then disconnect all cables (power cable last).
- ► Secure the current supply against unauthorized or unintentional reactivation.
- ► Do not insert any objects into the vent openings.
- ► Never open an external power supply pack.
- ► Never operate an open or defective device.
- ► Secure a defective device against accidental operation.
- ► Protect the device against moisture.

⚠ WARNING

Health hazard through poisoning from toxic contaminated components or devices

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ► Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ► Decontaminate affected parts before carrying out maintenance work.
- ► Wear protective equipment.

⚠ WARNING

Health hazards due to cleaning agent

The cleaning agent being used causes health hazards which could include, for example, poisoning, allergies, skin irritations, chemical burns or damage to the airways.

- ► When handling cleaning agents, observe the applicable regulations.
- ► Adhere to safety measures regarding handling and disposal of cleaning agents.
- ► Be aware of potential reactions with product materials.

Risks when shipping

⚠ WARNING

Risk of poisoning from contaminated products

Where products that contain harmful substances are shipped for maintenance or repair purposes, the health and safety of service personnel is at risk.

- ► Comply with the notices for safe shipment.

Risks during disposal

⚠ WARNING

Health hazard through poisoning from toxic contaminated components or devices

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ► Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ► Decontaminate affected parts before carrying out maintenance work.
- ► Wear protective equipment.

2.3 Safety precautions

The product is designed according to the latest technology and recognized safety engineering rules. Nevertheless, improper use can result in danger to operator all third party life and limb, and product damage and additional property damage.

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

- ► Observe all applicable safety and accident prevention regulations.
- ► Check that all safety measures are observed at regular intervals.
- ► Pass on safety instructions to all other users.
- ► Do not expose body parts to the vacuum.
- ► Always ensure a secure connection to the earthed conductor (PE).
- ► Never disconnect plug connections during operation.
- ► Observe the above shutdown procedures.
- ► Keep lines and cables away from hot surfaces (> 70 °C).
- ► Do not carry out your own conversions or modifications on the device.
- ► Observe the unit protection degree prior to installation or operation in other environments.
- ► Provide suitable touch protection, if the surface temperature exceeds 70 °C.
- ► Inform yourself about any contamination before starting work.

2.4 Limits of use of product

Parameter	Value
Installation location	Weatherproof (internal space)
Protection degree	IP 20
Protection class	I
Installation altitude	max. 2000 m
Degree of pollution	2
Storage temperature	-20 – +60°C
Operating temperature	+5 – +40°C

Parameter	Value
Cable temperature (HF/FA)	Max. 200°C
Relative humidity	Max. 80% at temperatures of up to +31°C. Decreasing linearly to 50% at +40°C.

Tbl. 3: Permissible ambient conditions

2.5 Proper use

The QMH 800-x high-frequency generator is a component of the Pfeiffer Vacuum QMG 800 HiQuad Neo quadrupole mass spectrometry system and generates the HF and DC voltages required for the rod system of the QMA quadrupole analyzer. The high-frequency generator is intended exclusively for use as a power supply unit for a Pfeiffer Vacuum QMA 4xx quadrupole analyzer.

Use the product according to its intended purpose

- ► Install, operate and maintain the product only in accordance with these operating instructions.
- ► Comply with the limits of use.
- ► Observe the technical data.

2.6 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:

- Use outside the limits of use in accordance with the technical data
- Use for measurements whose results determine the safety of persons or large values
- Use with corrosive or explosive media
- Use outdoors
- Use after technical changes (inside or outside on the product)
- Use with replacement or accessory parts that are not suitable or not approved

2.7 Responsibilities and warranty

Pfeiffer Vacuum shall assume no responsibilities and warranty if the operating company or a third party:

- disregards this document
- does not use the product for its intended purpose
- carries out any modifications to the product (conversions, changes, etc.) that are not listed in the corresponding product documentation
- operates the product with accessories that are not listed in the corresponding product documentation

The operator is responsible for the process media used.

2.8 Operator requirements

Safety-conscious work

1. Only operate the product in a technically flawless state.
2. Operate the product in line with its intended purpose, safety and hazard-conscious as well as when observing the operating instructions.
3. Fulfill the following guidelines and monitor their observation of the following guidelines:
   - Proper use
   - Generally applicable safety instructions and accident prevention regulations
   - International, national and locally applicable standards and guidelines
   - Additional product-related guidelines and regulations
4. Only use original parts or parts approved by Pfeiffer Vacuum.
5. Keep the operating instructions available at the place of installation.
6. Ensure personnel qualification.

2.9 Personnel qualification

The work described in this document may only be carried out by persons who have appropriate professional qualifications and the necessary experience or who have completed the necessary training as provided by Pfeiffer Vacuum.

Training people

1. Train the technical personnel on the product.
2. Only let personnel to be trained work with and on the product when under the supervision of trained personnel.
3. Only allow trained technical personnel to work with the product.
4. Before starting work, make sure that the commissioned personnel have read and understood these operating instructions and all applicable documents, in particular the safety, maintenance and repair information.

2.9.1 Ensuring personnel qualification

Specialist for mechanical work

Only a trained specialist may carry out mechanical work. Within the meaning of this document, specialists are people responsible for construction, mechanical installation, troubleshooting and maintenance of the product, and who have the following qualifications:

- Qualification in the mechanical field in accordance with nationally applicable regulations
- Knowledge of this documentation

Specialist for electrotechnical work

Only a trained electrician may carry out electrical engineering work. Within the meaning of this document, electricians are people responsible for electrical installation, commissioning, troubleshooting, and maintenance of the product, and who have the following qualifications:

- Qualification in the electrical engineering field in accordance with nationally applicable regulations
- Knowledge of this documentation

In addition, these individuals must be familiar with applicable safety regulations and laws, as well as the other standards, guidelines, and laws referred to in this documentation. The above individuals must have an explicitly granted operational authorization to commission, program, configure, mark, and earth devices, systems, and circuits in accordance with safety technology standards.

Trained individuals

Only adequately trained individuals may carry out all works in other transport, storage, operation and disposal fields. Such training must ensure that individuals are capable of carrying out the required activities and work steps safely and properly.

2.9.2 Personnel qualification for maintenance and repair

Advanced training courses

Pfeiffer Vacuum offers advanced training courses to maintenance levels 2 and 3.

Adequately trained individuals are:

- **Maintenance level 1**
  - Customer (trained specialist)
- **Maintenance level 2**
  - Customer with technical education
  - Pfeiffer Vacuum service technician
- **Maintenance level 3**
  - Customer with Pfeiffer Vacuum service training
  - Pfeiffer Vacuum service technician

2.9.3 Advanced training with Pfeiffer Vacuum

For optimal and trouble-free use of this product, Pfeiffer Vacuum offers a comprehensive range of courses and technical trainings.

For more information, please contact Pfeiffer Vacuum technical training.

2.10 Operator requirements

Observing relevant documents and data

1. Read, observe and follow this operating instruction and the work instructions prepared by the operating company, in particular the safety and warning instructions.
2. Install, operate and maintain the product only in accordance with these operating instructions.
3. Carry out all work only on the basis of the complete operating instructions and applicable documents.
4. Comply with the limits of use.
5. Observe the technical data.
6. Please contact the Pfeiffer Vacuum Service Center if your questions on operation or maintenance of the product are not answered in these operating instructions.
   – You can find information in the Pfeiffer Vacuum service area.

3 Product description

3.1 Design, construction

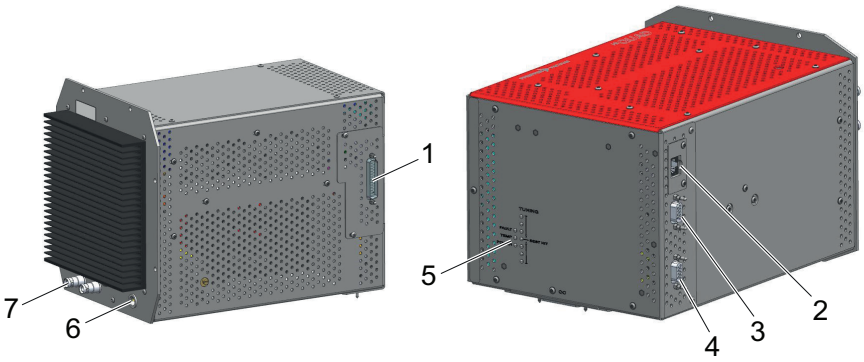


Fig. 1: Design, construction

1 Connection for **QMS** control unit
2 Connection for **LAN 2** control unit
3 Connection for electrometer pre-amplifier "**EP1 (faraday)**"
4 Connection for electrometer pre-amplifier "**EP2 (sem)**"
5 "**TUNING**" LED display
6 Connection for field axis voltage "**FA**"
7 Connections for HF coaxial cables **RF+ and RF-**

3.2 Functional description

System wiring of QMG 800 HiQuad Neo

For details about system wiring, refer to the operating instructions of the QMG 800 HiQuad Neo.

The QMH high-frequency generator generates the voltages required for operating a quadrupole mass filter:

- HF component with quartz-stabilized frequency
- Superimposed DC component

The QMH high-frequency generator has three main components:

- Control board
- HF circuit board
- DC circuit board

The control board (SOM) is an ARM processor combined with a FPGA. The ARM processor operates on Linux and establishes an Ethernet connection to the QMS 800. Mass scans of the QMH 800 are controlled by the 0–10.14 V scanning signal for the QMS 800. The mass calibration is stored in a digital multi-point tuning table which is stored in the QMH 800.

High-quality HF circuits ensure low power consumption. A constant-temperature furnace keeps the temperature influences low. The QMH must be connected to a precision-matched HF load. This is done by connecting the analyzer using the supplied HF cables with accurately defined capacity. Manufacturing tolerances can be compensated. During operation and set-up, the matching condition is monitored and signaled by means of LEDs. The QMH is protected against overheating and destruction resulting from a mismatched HF load, a short circuit or during no-load operation. The field axis potential is supplied externally. Connections EP1 (Faraday) and EP2 (SEM) are used to connect two EP 822 electrometer pre-amplifiers.

The QMS control unit supplies the power and control signals, and contains the electronics for processing the electrometer signals. With the QMS control unit, the following functions of the QMH can be used:

- Mass number M (HF amplitude)
- Peak width ΔM
- Integral spectrum (DC-deactivated)
- RF OFF

- Electrometer range
- Electrometer signal 1 oder 2

The instrument reports operational readiness or error status to the QMS control unit.

3.3 Connections

3.3.1 QC connection to QC 800 control unit

Interfaces on QC 800

For details about the interfaces on the QC 800, refer to the operating instructions of the QMG 800 HiQuad Neo.

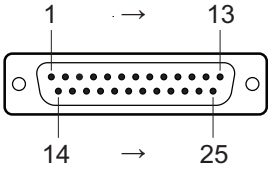


Fig. 2: Pin assignment of QC connection

Pin	Signal word	Signal direction	Level	Impedance
1,2,14	-24 V	IN	See "Technical data"	Feed/supply
3,15,16	+24 V			
4,6,17.19	0 V [1]		GND	10 Ω (see Chassis)
5	SCAN + [2]		0 – +10.24 V	100 kΩ
18	SCAN - [3]		0 V	
7	EP + [4]	OUT	0 V	47 Ω
20	EP - [5]		0 – ±16 V	
8	RESOL + [6]	IN	0 – +10.24 V	100 kΩ
21	RESOL - [7]		0 V	
9	RESERVE 1 H	IN	Digital CMOS [8]	100 kΩ
10	RF OK L	OUT		2.2 kΩ
11	MODE 1 H	IN		100 kΩ pull down
23	MODE 2 H			
12	RANGE 1 H			
24	RANGE 0 H			
13	EP 2 H			
22	SCREEN	---	GND	33 Ω (see Chassis)
25	RESERVE 2 H	IN	Digital CMOS [9]	100 kΩ pull down

Tbl. 4: Pin assignment of QC connection

1) Line 0 V must have max. ±0.5 V_p against chassis GND.
2) Permissible common-mode signal: max. ±0.5 V_p for SCAN±, RESOL± and EP±
3) Permissible common-mode signal: max. ±0.5 V_p for SCAN±, RESOL± and EP±
4) Permissible common-mode signal: max. ±0.5 V_p for SCAN±, RESOL± and EP±
5) Permissible common-mode signal: max. ±0.5 V_p for SCAN±, RESOL± and EP±
6) Permissible common-mode signal: max. ±0.5 V_p for SCAN±, RESOL± and EP±
7) Permissible common-mode signal: max. ±0.5 V_p for SCAN±, RESOL± and EP±
8) Digital CMOS level: L: 0 – +0.75 V DC | H: +11.0 – +12.7 V DC
9) Digital CMOS level: L: 0 – +0.75 V DC | H: +11.0 – +12.7 V DC

Signal directions

- IN = QMH is receiver
- OUT = QMH is transmitter

Signal word	Level	Function of QMH
SCAN±	0 – +10.24 V	MASS = (SCAN/10.24 V) x M_{max}
RESOL±	0 – +10.24 V	$\Delta M = \Delta M_{min}$ + (RESOL/10.24 V) x ΔM_{max}
EP±	0 – ±16 V	Output signal of electrometer pre-amplifier (EP)

Tbl. 5: Functions

Signal word			
RANGE – H	...1...	...0...	Electrometer measuring range:
	L	L	10^{-5} A
	L	H	10^{-7} A
	H	L	10^{-11} A
	H	H	10^{-9} A
EP 2 H	L		EP1, faraday
	H		EP2, sem
MODE – H	...2...	...1...	Operating mode:
	L	L	STANDBY, not used
	L	H	INTEGRAL (DC OFF)
	H	L	SPECTRUM (DC ON)
	H	H	RF OFF
RF OK L	L		QMH is OK
	H		QMH is not OK

Tbl. 6: Coding

3.3.2 Connections FA and RF+ / RF- to the QMA analyzer

Field axis voltage
For details on the field axis voltage, refer to the operating instructions of the QMA analyzer.

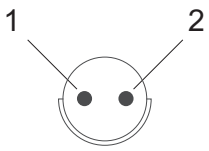


Fig. 3: Pin assignment of FA connection

Pin	Signal word	Signal direction	Level	Impedance
1	FA	IN	Max. ±500 V / 2 mA_{max}	9 MΩ
2	unassigned	---	---	---
Housing	GND	IN	GND, shielding	---

Tbl. 7: Pin assignment of FA connection

Signal word	Signal direction	Level and load
RF+ and RF-	OUT	Adapted load
Housing	OUT	GND, shielding
Plug: coaxial, SHV		

Tbl. 8: Pin assignment of RF+ and RF- connections

Signal directions

- IN = QMH is receiver
- OUT = QMH is transmitter

3.3.3 EP connection to EP 822 electrometer pre-amplifier

Interfaces on EP 822

For details about the interfaces on the EP 822, refer to the operating instructions of the QMG 800 HiQuad Neo.

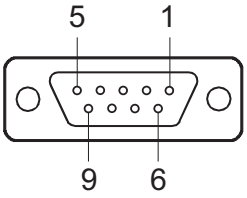


Fig. 4: Pin assignment of EP connection

Pin	Signal word	Signal direction	Level
1	EP GND	IN	0 V
2	+16 V	OUT	+16 V ±0.2 V/27 mA_{max}
3	0 V EP	OUT	EP GND
4	-16 V	OUT	-16 V ±0.2 V/12 mA_{max}
5	EXP 5 L	OUT	Digital [1)]
6	EP OUT	IN	0 – ±16 V
7	SCREEN	---	Chassis GND
8	EXP 7 L	OUT	Digital
9	EXP 9 L	OUT	Digital

Tbl. 9: Pin assignment of EP connection

Signal directions

- IN = QMH is receiver
- OUT = QMH is transmitter

Digital level

- L: 0 – +0.75 V DC
- H: +16.5 – +17.0 V DC with external pull-up >5 kΩ against +16 V
- The levels are relative to 0 V EP.
- With the exception of EP OUT and EP GND, the two plugs are connected in parallel.

3.3.4 LAN connection to QC 800 control unit

Interfaces on QC 800

For details about the interfaces on the QC 800, refer to the operating instructions of the QMG 800 HiQuad Neo.

The connection between QMH 800-x and QC 800 is made via the Ethernet cable from the scope of delivery. The status of the interface is recognized from two LEDs in the RJ-45 socket.

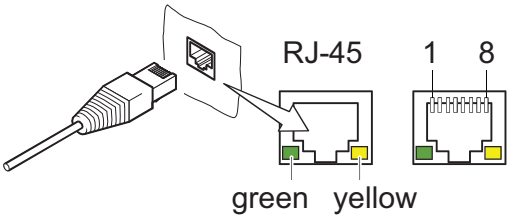


Fig. 5: "Ethernet" (LAN) connector

1	Transmission data (TD+)	6	Reception data (RD-)
2	Transmission data (TD-)	4, 5, 7, 8	Not used
3	Reception data (RD+)		

LED	Status	Meaning
Green (link)	lights up	Hardware connection exists
	dark	No hardware connection
Yellow (activity)	lit up (flickering)	Data transmission runs
	dark	no data transmission / no connection

Tbl. 10: Status of the Ethernet connection

3.4 Identifying the product

You will need all the data from the rating plate to safely identify the product when communicating with Pfeiffer Vacuum.

► To ensure clear identification of the product when communicating with Pfeiffer Vacuum, always keep all of the information on the rating plate to hand.

3.5 Scope of delivery

- QMH high-frequency generator
- Connection cable for QMS 800/QC 800

Unpacking the product and checking completeness of the shipment

1. Unpack the product.
2. Check that the shipment is complete.
3. Ensure that no parts are damaged.

4 Transport and storage

4.1 Transporting product

NOTICE

Damage caused by incorrect transport

Transport in unsuitable packaging or failure to install all transport locks can result in damage to the product.

► Comply with the instructions for safe transport.

Packing

We recommend keeping the transport packaging and original protective cover.

Safe transport of the product

- ► Observe the weight specified on the transport packaging.
- ► Where possible, always transport or ship the product in the original transport packaging.
- ► Always use dense and impact-proof transport packaging for the product.
- ► Remove the existing protective cap and transport protections only immediately prior to installation.
- ► Reattach transport locks and transport protections prior to each transport.

4.2 Storing product

NOTICE

Damage caused by improper storage

Improper storage will lead to damage to the product.

Static charging, moisture, etc. will lead to defects on the electronic components.

► Comply with the instructions for safe storage.

Packing

We recommend storing the product in its original packaging.

Safe storage of the product

- ► Store the product in a cool, dry, dust-free place, where it is protected against impacts and mechanical vibration.
- ► Always use dense and impact-proof packaging for the product.
- ► Where possible, store the product in its original packaging.
- ► Store electronic components in antistatic packaging.
- ► Maintain the permissible storage temperature.
- ► Avoid extreme fluctuations of the ambient temperature.
- ► Avoid high air humidity.
- ► Seal connections with the original protective caps.
- ► Protect the product with the original transport protection (where available).

5 Installation

⚠ DANGER

Danger to life due to electric voltage

High voltages exist inside the device. When touching parts that are live, there is a risk of death. If there is visible damage, there is a risk of fatal injury when commissioning the device.

- ► Always disconnect the unit before opening the power supply.
- ► Work on the open device must only be carried out by trained specialist personnel.
- ► Before carrying out any installation and maintenance work, switch the device off and disconnect it from the current supply.
  - – After switching off, wait for 60 seconds and then disconnect all cables (power cable last).
- ► Secure the current supply against unauthorized or unintentional reactivation.
- ► Do not insert any objects into the vent openings.
- ► Never open an external power supply pack.
- ► Never operate an open or defective device.
- ► Secure a defective device against accidental operation.
- ► Protect the device against moisture.

⚠ DANGER

Danger to life from electric shock

Inadequate or incorrect grounding of the unit leads to contact-sensitive voltage on the housing. When making contact, increased leakage currents will cause a life-threatening electric shock.

- ► Before the installation, check that the connection leads are voltage-free.
- ► Conduct the electrical connection in accordance with locally applicable regulations.
- ► Make sure that the local mains voltage and frequency match rating plate specifications.
- ► Make sure that the mains cable and extension cable meet the requirements for double isolation between input voltage and output voltage, in accordance with IEC 61010 and IEC 60950.
- ► Use only a 3-pin mains cable and extension cable with properly connected protective earthing (earthed conductor).
- ► Plug the mains plug into a socket with earthing contact only.
- ► Always connect the mains cable prior to all other cables, to ensure continuous protective earthing.

5.1 Installing the HF generator

System components

This document only describes the installation of the high-frequency generator. Also pay attention to the documents of the QMS control unit and other system components.

5.1.1 Observing ambient conditions

Recommendations

- ► Avoid operation if exposed to high humidity, a dusty atmosphere, mechanical vibrations, and extreme fluctuations in ambient temperature.
- ► Make sure that the ambient air of the device warms up to max. 50 °C during operation (measured at a distance of 30 cm).
- ► To achieve the best accuracy of measurement, avoid temperature fluctuations.
- ► Ensure adequate air circulation.
- ► Take the appropriate measures to safeguard air circulation if you install the device in an additional housing.
- ► If water or coolant hoses are routed in close proximity to the device, protect the device against drip and splash.

5.1.2 Observing mounting orientation

Permissible distance to QMA

A distance of approx. 0.5 m is possible (cable lengths 0.7 m).

Recommendations

- ► When selecting the installation position, make sure that the LED tuning and status displays are clearly visible on the front side.
  - – It is possible to install the device on the flange by using the support included with the QMA.
- ► Mount the QMH horizontally or with an inclination of 30° at a location where there are as few vibrations as possible.

5.1.3 Installing high-frequency generator with support on QMA

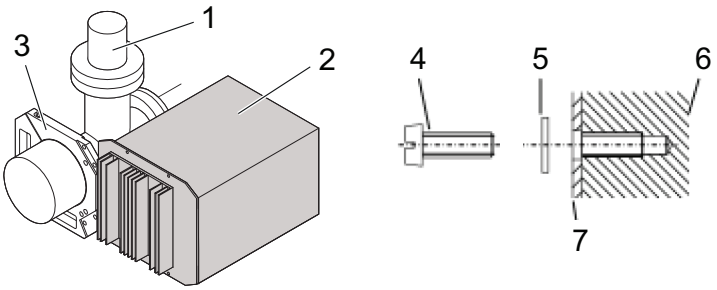


Fig. 6: Installing high-frequency generator with support on QMA

1 QMA analyzer
2 QMH high-frequency generator
3 Support
4 Screw M4
5 Washer
6 Support
7 QMH front panel
8 Circlip

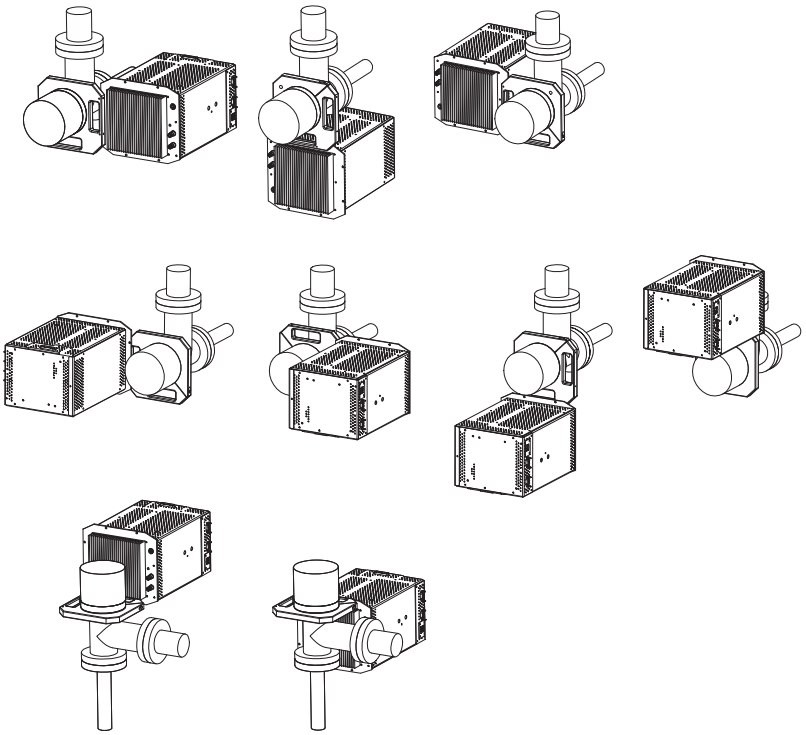


Fig. 7: Possible installation positions

Procedure

1. Place the device on an appropriate surface that is convenient for working on it.
2. Fasten the device to the support.
3. Fasten the device with the support on the QMA.

5.2 Establishing an electrical connection

5.2.1 Establishing grounding connection

NOTICE

Impairment of electrical connections caused by external disruptive influences

For reasons of electromagnetic compatibility (EMC) (external disruptive influences), we strongly recommend a central grounding point for all devices coupled together (for example, pumping station, control unit, PC, recorder, etc.). A multiple socket, or even better, a common power distributor with mains switch fulfills this in a simple manner.

Exception: For computers that are installed far away from each other or a heavily disturbed environment.

- ► Use a multiple socket or a common mains distributor with mains switch.
- ► Route the control cable separately from the interference source.

Max. permissible voltage

The max. permissible voltage between the QMH and control unit housing (SC) is 0.5 V_{peak}.

When the HF generator is installed on a properly grounded QMA flange by means of the support, the housing of the HF generator is safely grounded.

5.2.2 Connecting control cable

Procedure

- ► Always make sure that the control unit has been switched off before connecting or disconnecting the QC control cable.
- ► Use a cable with the corresponding required length.

5.2.3 Connecting HF coaxial cables

NOTICE

Damage to the analyzer caused by external voltages and magnetic fields

Never expose the analyzer electrode system to external voltages that are hazardous in the event of contact, as a result of galvanic connections, contact, flashover, plasma, ion or electron beams, etc. If such danger sources exist in the vacuum chamber, you must provide protective measures that safely rule out such influences. Even smaller external voltages acting on the analyzer will lead to damage to the electronics and unreliable measuring results.

- ► Meet appropriate protective measures against external voltages (for example, better arrangement, shielding, earthing, etc.).
- ► Do not mount the analyzer near to magnetic fields with > 0.2 mT.
- ► Ensure mechanical protection against contact of the analyzer and the parts installed.
- ► Ensure compulsory separation of the current supply when opening the system (using a door contact, for example).
- ► Observe the standards applicable for the vacuum system.

Procedure

- ► Using the two supplied 0.7 M HF coaxial cables, connect the **RF+** and **RF-** bushings of the QMH with the **RF A** and **RF B** bushings of the QMA.
- ► If necessary, refer to the test log for the polarity.
  - – The factory tests take place with normal polarity to optimize the peak shape. Reversal of the polarity is permitted, although this may require returning of the HF (not recommended).
- ► Only use the cables supplied by Pfeiffer Vacuum, with the specified length and capacity.
- ► Connect the plug that is fit to a Teflon hose to the QMA, to ensure that bakeout is possible there.
- ► Never kink the cables.
- ► If the cables are too short, use a different mounting method.

5.2.4 Connecting field axis cable

The following applies for connecting an external field axis supply:

- The permissible voltage against chassis potential is max. ±500 V DC.
- The effective field axis potential amounts to 99.9% of the supplied voltage.
- The external FA supply has to be current-limited to 2 mA, for safety reasons.

Procedure

► Connect the **FA** bushings on QMH and QMA with the supplied cables.
  – By doing so, you supply the field axis voltage from the control unit via the ion source cable. The setting for the FA voltage can be found in the test log for the overall system.
► If you are **not** using the supplied cable: Use a shielded cable with its shield placed on the housing.

5.2.5 Connecting electrometer pre-amplifiers

Both electrometer pre-amplifiers can be connected simultaneously.

Procedure

► For measuring with Faraday cup (positive ions): Connect the electrometer pre-amplifier that matches the QMS control unit to **EP1 (Faraday)**.
► For measuring an SEM signal (electrons): Connect the electrometer pre-amplifier that matches the QMS control unit to **EP2 (SEM)**.

6 Commissioning

Prerequisites

- All electrical connections established
- All conditions of the overall system fulfilled (e.g. adequate vacuum)

6.1 Waiting time

No operation with higher masses during the waiting time

During the waiting time, do not operate the QMH with higher masses (FIRST MASS + SCAN WIDTH ≤0.5 M_{max}), as this could impair the control unit function due to the high load on the power supply.

After a **waiting time of approx. 10 minutes,** the green "TEMP" LED lights up on the front side of the QMH. When the "FAULT" LED is not flashing, the instrument resets the error signal forwarded to the control unit.

6.2 Checking tuning

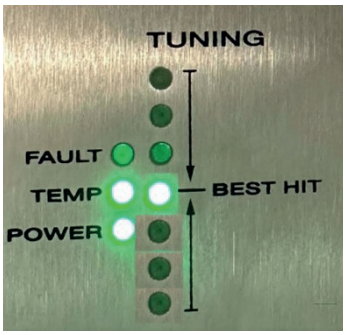


Fig. 8: "TUNING" LED display

LED	Meaning
BEST HIT	The LED is lit to show that the generator has been accurately tuned.
FAULT	The LED flashes when the detuning exceeds the permissible value or there is an error (e.g., HF cable not connected). The device sends this status to the control unit as error signal. The LED is lit continuously if the HF has been switched off via the control unit (RF OFF).
TEMP	RF furnace heated to the operating setpoint (READY)
POWER	Current power level (intensity increases with increasing mass scan range)
TUNING	Deviation in the resonance on the right and left from the ideal resonance

Tbl. 11: Displays on the LED display

As the system scans the mass range above and below 250 u, it is normal that the "TUNING" LEDS light up above and below the BEST HIT.

The available status is available via the OPC UA end points.

Fig. 9: OPC UA end points

Checking tuning

1. During the first commissioning, check the tuning.
   – The quality of the tuning is shown on the "**TUNING**" LEDs.
2. Set a fixed mass number (no scan) of approx. ≤ ½ M_{max}.
3. **If "BEST HIT" is not lit:** Contact Pfeiffer Vacuum Service.

7 Operation

7.1 Measuring spectra

Information about PV MassSpec
You can find detailed information in the "**Help**" section of the software.

7.2 Calibrating mass scale (MASS CALIBRATION LOW/HIGH)

Recalibration may become necessary due to aging or after the QMA has been replaced.

Information about PV MassSpec
You can find detailed information in the "**Help**" section of the software.

7.3 Waiting times

After a warm-up time of approx. 20 minutes from the startup of the cold QMH and the warm-up time of the QMA (EMISSION ON) has passed, the measurement results conform to the calibrated values (M and DM). Depending on the requirements on precision, the warm-up time amounts to 0.5 to 5 hours.

If there are step changes in the mass number, it takes several ms (depending on the size and direction of the step and the type of QMH) until the HF and DC values stabilize in the new state. Pfeiffer Vacuum control units take this into account in the integrated software.

Recommendations

► If necessary, optimize the waiting time manually by means of the "**PAUSE**" parameter.

8 Maintenance

Warranty claim

Opening the device during the warranty period or damaging/removing the warranty seal will void the warranty.

Contact the Pfeiffer Vacuum Service Center in the event of process-related shorter maintenance intervals.

Warranty

Malfunctioning of the equipment as a direct result of contamination or wear, as well as wear parts, is not covered by the warranty.

First read through the sections completely

Read the section with the work instructions through completely first before you commence with work.

Maintenance in the Pfeiffer Vacuum Service Center

Pfeiffer Vacuum offers a complete maintenance service for all products.

Pfeiffer Vacuum recommends: Contact your Pfeiffer Vacuum Service Center to arrange the maintenance of defective products and components.

Cleaning in the Pfeiffer Vacuum Service Center

Pfeiffer Vacuum recommends: Contact your nearest Pfeiffer Vacuum Service Center to arrange the cleaning of heavily-soiled products and components.

8.1 Maintaining product

NOTICE

Damage to unit from electrostatic discharge

Electrostatic discharge damages electronic components. Defects resulting from failure to comply with this warning shall result in loss of any warranty claim entitlement.

- ► Carry out all work on ESD-protected workstations only, in compliance with the appropriate working methods.
- ► When the unit is open, take suitable precautions against electrostatic charges.
- ► Always store electronic units and components in anti-static packaging.
- ► Observe EN 61340, Parts 5-1 and 5-2 – Protection of electronic devices from electrostatic phenomena.

NOTICE

Damage to electronics as result of improper repairs

Pfeiffer Vacuum has very accurately harmonized the circuit boards of the device to the other assembly groups. Correct calibration can only be performed in the factory.

- ► Never replace circuit boards or other components in the course of device repairs.

Under normal operating conditions, the HF generator does not require maintenance. The mass scale and resolution might have to be recalibrated at times, if the analysis of the measuring values indicates that this is necessary. The LEDs "**fault**" or "**best hit**" indicates when it is necessary to reconfigure "**tune**".

Remedying high HF losses through drying

- ► High HF losses (symptom F4) caused by storage in high humidity can be remedied by drying at max. 70 °C or by means of operation for an extended period at the maximum possible saturation.

8.2 Cleaning device

⚠ DANGER

Danger to life from electric shock caused by moisture ingress

Water that has entered the unit will result in personal injury through electric shocks.

- ► Only operate the unit in a dry environment.
- ► Operate the unit away from fluids and sources of moisture.
- ► Do not switch on the unit if fluid has entered it. Instead contact Pfeiffer Vacuum Service.
- ► Always disconnect the power supply before cleaning the unit.

⚠ WARNING

Health hazards due to cleaning agent

The cleaning agent being used causes health hazards which could include, for example, poisoning, allergies, skin irritations, chemical burns or damage to the airways.

- ► When handling cleaning agents, observe the applicable regulations.
- ► Adhere to safety measures regarding handling and disposal of cleaning agents.
- ► Be aware of potential reactions with product materials.

NOTICE

Damage caused by penetrating moisture

Penetrating moisture, e.g. through condensation or dripping water, damages the unit.

- ► Protect the unit against penetration of moisture.
- ► Only operate the unit in a clean and dry environment.
- ► Operate the unit away from fluids and sources of moisture.
- ► Take special precautions if there is a risk of dripping water.
- ► Do not switch on the unit if fluid has penetrated into it, instead contact the Pfeiffer Vacuum Service Center.

NOTICE

Danger of misadjustment or other damage

If improper procedures are followed when opening the device and cleaning its interior, damage can result.

- ► Do not bend or move small wires, components etc.
- ► Check the requirements for compressed air.

NOTICE

Damage caused by unsuitable cleaning agents

Unsuitable cleaning agents damage the product.

- ► Do not use solvents as they attack the surface.
- ► Do not use any aggressive or abrasive cleaning agents.

Prerequisites

- Device is switched off
- Mains plug is removed

Required consumables

- Common cleaning agent (e.g. mild household detergent).
- Clean, soft cloth
- Dry, oil-free, and particle-free compressed air (<2 bar overpressure)

Cleaning housing parts

1. Use a soft, damp cloth to clean the outside of the housing.
2. Allow the surfaces to dry thoroughly after cleaning.
3. Remove dust layers inside the unit by blowing them out carefully with compressed air.

9 Malfunctions

⚠ DANGER

Danger to life due to electric voltage

High voltages exist inside the device. When touching parts that are live, there is a risk of death. If there is visible damage, there is a risk of fatal injury when commissioning the device.

- ► Always disconnect the unit before opening the power supply.
- ► Work on the open device must only be carried out by trained specialist personnel.
- ► Before carrying out any installation and maintenance work, switch the device off and disconnect it from the current supply.
  - – After switching off, wait for 60 seconds and then disconnect all cables (power cable last).
- ► Secure the current supply against unauthorized or unintentional reactivation.
- ► Do not insert any objects into the vent openings.
- ► Never open an external power supply pack.
- ► Never operate an open or defective device.
- ► Secure a defective device against accidental operation.
- ► Protect the device against moisture.

In the following, you can find typical malfunctions that can occur due to operator errors, during first commissioning or after an extended period of operation, as well as their possible causes and remedies.

Error symptom		Possible causes and localization	Remedy
F1	"**FAULT**" flashes continuously. "**RF ERROR**" appears from approx. 5% of M_{max}	No or incorrect HF load at the RF+ and RF- bushings	• Connect the QMA analyzer with the supplied HF coaxial cables (RF+ and RF-). • Tune the QMH HF generator.
		HF load higher or lower than data	• Check the combination of QMH HF generator and QMA analyzer used (in operating instructions of QMG 800)
		Defect in HF load	• Check the HF coaxial cable and HF lines in the QMA analyzer for interruptions or short-circuits. • Measure the capacitance values (inner conductor **RF A**, **RF B**).
		Defect in HF circuit of the HF generator	• Contact Pfeiffer Vacuum Service.
F2	"**FAULT**" flashes continuously. "**IS ERR #1**" appears.	Short-circuit in the HF load circuit	• Disconnect the HF coaxial cable at the RF+ and RF-bushings, and check the cables for short circuit. • Check the HF connections at the QMA analyzer. • Disconnect all cables and check the isolation from the chassis at the RF+ and RF-bushings. If < 9 MΩ: Contact Pfeiffer Vacuum Service. (see symptom F11)
F3	"**FAULT**" only flashes for higher masses. "**RF ERROR**" appears.	QMH HF generator not tuned.	• Tune the QMH HF generator.
		Corona discharges due to too high pressure in the QMA analyzer	• Evacuate the vacuum chamber. • Reduce the pressure in the vacuum chamber.
		Corona discharges due to defective HF coaxial cable or HF line in QMA analyzer	• Perform a visual inspection.
		Corona discharges due to dust in QMH HF generator	• Carefully blow out the QMH HF generator with compressed air.
		Defect in QMH HF generator	• Contact Pfeiffer Vacuum Service.

Error symptom		Possible causes and localization	Remedy
F4	"**FAULT**" flashes for the highest masses, although "**TUNE**" is OK for smaller masses, i.e., "**BEST HIT**" is lit.	Current consumption too high due to excessive HF losses in the HF load circuit	• Check the HF coaxial cable. • Check the combination of QMH HF generator and QMA analyzer used (in operating instructions of QMG 800) • Operate the QMH HF generator in a dry environment. • Operate the QMH HF generator for a long period with small masses, so that heat of the device evaporates the moisture.
		Defect in QMH HF generator	• Contact Pfeiffer Vacuum Service.
F5	"**FAULT**" occasionally flashes with a high mass.	Individual flashovers in the HF load circuit (see symptom F3).	• (Like error symptom F3)
		Current consumption close to the permissible threshold (see symptom F3).	• (Like error symptom F3)
F6	"**FAULT**" is lit continuously.	No error	HF generator is off. Control unit transmits **RF OFF**, e.g. for **DEGAS**.
F7	"**BEST HIT**" has gone out. "**FAULT**" is not flashing.	No error	Tuning condition can change slightly.
F8	All indicators on the QMH HF generator are dark.	Cable **QC** not connected or QMS control unit switched off.	• Connect the QC cable. • Switch on the QMS control unit.
		Fuse **F1** in QMH HF generator defective.	1. Switch the QMS control unit off and disconnect all cables. 2. Unscrew and remove the left hood (with display window). 3. On the connecting circuit board, check the fuses **F1** and **F2**. 4. If fuses are defective, it is possible that there additional defects in the QMH HF generator. Contact Pfeiffer Vacuum Service.
F9	"**READY**" is not lit. "**FAULT**" is not flashing. "**RF ERROR**" appears.	The QMH HF generator has been switched only recently.	• Wait until "**ready**" lights up.
F10	"**READY**" is not lit, although the waiting period has passed. "**FAULT**" flashes continuously, even when you are tuning. "**BEST HIT**" is lit. The peaks do not meet the expectations.	Fuse F2 is defective (see error symptom F8).	• Check the mains voltage of the QMS control unit. • Check the supply voltages at the **QC** cable. — Pin assignment — Values: +24 V/-24 V (±0.5 V)
F11	"**FAULT**" is not flashing. "**ION SOURCE ERROR**" appears.	Ion sources and/or field axis voltages do not match setpoint	When there is an error message, it can be resetted as follows: • Unplug the FA cable and check it for short circuit. • Unplug the IS cable and check it for short circuit.
F12	Peaks for higher masses too wide or too narrow, although "**RESOLUTION**" ΔM = 1 u on the control unit.	The control for "**resolution coarse**" has been adjusted.	• Set the resolution.
F13	Peaks for the smallest masses too narrow or not visible, although "**RESOLUTION**" ΔM = 1 u on the control unit.	The control for "**resolution low**" is not at the setting for ΔM = 1 u.	• Set the resolution for small masses.

Error symptom		Possible causes and localization	Remedy
F14	Irregular peaks, ragged shape	Field axis voltage not connected at plug **FA** .	• Connect the field axis cable at the QMH HF generator and at the QMA analyzer.
		Field axis voltage value too high.	• Check and correct the settings.
		Polarity of HF coaxial cable at the **RF+** and **RF-** bushings is not correct.	• Check and correct the polarity of the HF coaxial cable.
		Interrupted FA cable.	• Check the FA cable for continuity (pin assignment). • Disconnect the **FA** and **QC** cables. a. R_{isol} at Pin 1 of bushing FA > 9 MΩ against chassis. b. In the event of a short circuit: see F2 and F11.
F15	Measuring signal present, but no resolved peaks	Control unit set to **INTEGRAL** operating mode.	• Set the operating modes. Observe the operating instructions for the HiQuad Neo QMG 800.
F16	Measuring value missing, although all parameters have been configured correctly.	EP electrometer pre-amplifier not connected or connected to wrong plug (EP1, EP2).	• Check the connection of the EP electrometer pre-amplifier.
		Error in the cabling of the QMA analyzer.	• Check the connection of the QMA analyzer. Observe the operating instructions for the HiQuad Neo QMG 800.

Tbl. 12: Malfunctions

10 Shipping

⚠ WARNING

Risk of poisoning from contaminated products

Where products that contain harmful substances are shipped for maintenance or repair purposes, the health and safety of service personnel is at risk.

► Comply with the notices for safe shipment.

Decontamination subject to charge

Pfeiffer Vacuum decontaminates products not clearly declared "Free of contamination" at your expense.

Safe shipping of the product

► Do not ship microbiological, explosive or radioactively contaminated products.
► Observe the shipping guidelines for the participating countries and transport companies.
► Highlight any potential dangers on the outside of the packaging.
► Download the explanation for contamination at Pfeiffer Vacuum Service.
► Always enclose a completed declaration of contamination.

11 Recycling and disposal

⚠ WARNING

Health hazard through poisoning from toxic contaminated components or devices

Toxic process media result in contamination of devices or parts of them. During maintenance work, there is a risk to health from contact with these poisonous substances. Illegal disposal of toxic substances causes environmental damage.

- ► Take suitable safety precautions and prevent health hazards or environmental pollution by toxic process media.
- ► Decontaminate affected parts before carrying out maintenance work.
- ► Wear protective equipment.

Environmental protection

You **must** dispose of the product and its components in accordance with all applicable regulations for protecting people, the environment and nature.

- Help to reduce the wastage of natural resources.
- Prevent contamination.

11.1 General disposal information

Pfeiffer Vacuum products contain materials that you must recycle.

- ► Dispose of our products according to the following:
  - – Iron
  - – Aluminium
  - – Copper
  - – Synthetic
  - – Electronic components
  - – Oil and fat, solvent-free
- ► Observe the special precautionary measures when disposing of:
  - – Fluoroelastomers (FKM)
  - – Potentially contaminated components that come into contact with media

11.2 Dispose of a mass spectrometer system

Pfeiffer Vacuum mass spectrometer systems contain materials that you must recycle.

1. Dismantle the housing parts.
2. Dismantle all individual components.
3. Dismantle the electronic components.
4. Decontaminate the components that come into contact with process gases.
5. Separate the components into recyclable materials.
6. Recycle the non-contaminated components.
7. Dispose of the product or components in a safe manner according to locally applicable regulations.

12 Service solutions by Pfeiffer Vacuum

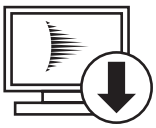
We offer first-class service
High vacuum component service life, in combination with low downtime, are clear expectations that you place on us. We meet your needs with efficient products and outstanding service.

We are always focused on perfecting our core competence – servicing of vacuum components. Once you have purchased a product from Pfeiffer Vacuum, our service is far from over. This is often exactly where service begins. Obviously, in proven Pfeiffer Vacuum quality.

Our professional sales and service employees are available to provide you with reliable assistance, worldwide. Pfeiffer Vacuum offers an entire range of services, from original replacement parts to service contracts.

Make use of Pfeiffer Vacuum service
Whether preventive, on-site service carried out by our field service, fast replacement with mint condition replacement products, or repair carried out in a Service Center near you – you have various options for maintaining your equipment availability. You can find more detailed information and addresses on our homepage, in the section.

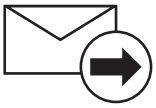
You can obtain advice on the optimal solution for you, from your Pfeiffer Vacuum representative.
For fast and smooth service process handling, we recommend the following:



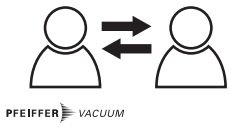
1. Download the up-to-date form templates.
   - Explanations of service requests
   - Service requests
   - Contamination declaration

a) Remove and store all accessories (all external parts, such as valves, protective screens, etc.).
b) If necessary, drain operating fluid/lubricant.
c) If necessary, drain coolant.

2. Complete the service request and contamination declaration.

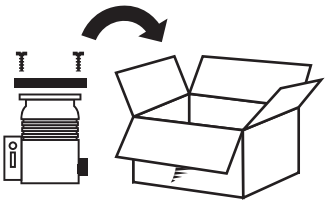


3. Send the forms by email, fax, or post to your local Service Center.

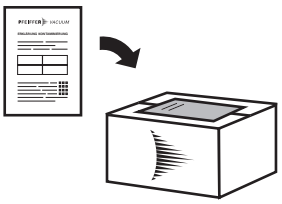


4. You will receive an acknowledgment from Pfeiffer Vacuum.

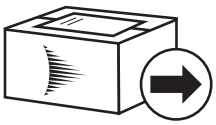
Submission of contaminated products
No microbiological, explosive, or radiologically contaminated products will be accepted. Where products are contaminated, or the contamination declaration is missing, Pfeiffer Vacuum will contact you before starting service work. Depending on the product and degree of pollution, **additional decontamination costs** may be incurred.



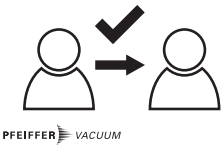
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
a) Neutralize the product with nitrogen or dry air.
b) Seal all openings with blind flanges, so that they are airtight.
c) Shrink-wrap the product in suitable protective foil.
d) Package the product in suitable, stable transport containers only.
e) Maintain applicable transport conditions.



6. Attach the contamination declaration to the **outside** of the packaging.



7. Now send your product to your local Service Center.



8. You will receive an acknowledgment/quotation, from Pfeiffer Vacuum.

Our sales and delivery conditions and repair and maintenance conditions for vacuum devices and components apply to all service orders.

13 Ordering information

13.1 Ordering parts

Ordering spare parts, accessories or optional components

► Always specify the following details when ordering spare parts, accessories or optional components:
- all details according to the rating plate
- description and order number according to the parts list

13.2 Ordering spare parts and accessories

Description	Order number	Remark
HF coaxial cable	PT 168 560 -T	0.7 m, 3.5 kV
Field axis cable	PT 168 550 -T	0.7 m, 500 V

Tbl. 13: Spare parts

Description	Order number	Remark
Cable QMH-QC (24 V)	PT 168 531 -T	1.5 m long
	PT 168 532 -T	3 m long
	PT 168 533 -T	10 m long
	PT 168 534 -T	15 m long
Cable QMH-QC (Ethernet)	PT 168 541 -T	1.5 m long
	PT 168 542 -T	3 m long
	PT 168 543 -T	10 m long
	PT 168 544 -T	15 m long

Tbl. 14: Accessories

14 Technical data and dimensions

14.1 Technical data

Parameter	Value
Dimensions	
Housing [10] (W × H × D) (approx.)	235 × 193 × 340 mm
Cable lengths	
Control cable (QC)	1, 5 m, 3 m, or 10 m
Control cable extension	Length as required (see chapter “Ordering spare parts and accessories”, page 38)
HF coaxial cable	0.7 m
Field axis cable	
Weight (incl. cable)	
Without packaging	4.5 kg
With packaging	6.8 kg
Mounting orientation	Horizontal ±30° max. inclination

Tbl. 15: Technical data

Parameter	Value
Installation location	Weatherproof (internal space)
Protection degree	IP 20
Protection class	I
Installation altitude	max. 2000 m
Degree of pollution	2
Storage temperature	-20 – +60°C
Operating temperature	+5 – +40°C ±0.01 u/°C at 10 – 40°C
Cable temperature (HF/FA)	Max. 200°C
Relative humidity	Max. 80% at temperatures of up to +31°C. Decreasing linearly to 50% at +40°C.

Tbl. 16: Ambient conditions

14.2 Electrical data

Parameter	Value
Frequency	2.25 MHz
HF amplitudes (RF+, RF-)	1.5–2350 Vp
DC voltage (spectrum)	0.5–394 ± V DC
Supply voltage	+24 ±0.5 V DC / -24 ±0.5 V DC
Current consumption (max. permissible detuning)	
• Furnace cold	≤ 2.5 A
• Furnace warm	≤2.3 A
• When RF OFF	≤0.9 A
Internal power loss	
• Furnace warm, max. permissible detuning	≤100 W

10) For the cables, additional space is needed.

Parameter	Value
Temperatures	
• Excess temperature of the housing surface [11)]	Typical 30°C, max. 35°C
Self-heating time	
• Switch-point of the overload protection thermostat	Approx. 100°C Approx. 15 minutes (heat sinks) Approx. 60 minutes (housing)
Field axis voltage (FA)	Max. permissible ±500 V; has to be current-limited to max. ±2 mA
Electrometer pre-amplifier connections	Supply integrated, range selection and signal selection remote-controlled
Protection of HF outputs	Against impermissible detuning, as well as no-load operation and short circuit
Output voltage during no-load operation	Field axis potential + HF 50 Vp max.
Fuses	(see chapter “Ordering spare parts and accessories”, page 38)
Pin assignment and signals	(see chapter “Connections”, page 17)

Tbl. 17: Electrical data

14.3 Working data with quadrupole analyzer

QMH type	Mass range [u]	QMA type	Rod diameter [mm]
QMH 800-3	300	QMA 430	8
QMH 800-5	512	QMA 400	8

Tbl. 18: QMH and QMA types

The error sizes refer to the voltage values of the HF and DC components; they have been converted to mass units for better comprehensibility. The start-up drift of the analyzers (EMISSION set to "ON" for cold analyzer) of dM = approx. -0.02%/h over 4–5 h, as well as other influences of the analyzer, have not been taken into account in the specified error values dM and dΔM. The applied HF power heats up the QMA – this effect is the square ratio of the mass number and therefore only plays a role in the upper third of the mass scale. It has approx. the same effect as heating up by means of the ion source.

Parameter	QMH 800-x
QMA analyzer type	(see table “QMH and QMA types”, page 40)[12)]
Rod system	(see table “QMH and QMA types”, page 40)
Mass range M_{min} – M_{max} [13)]	0.5–512 u
Resolution setting range	
• Constant peak width ΔM_{10}, remote-controlled with **RESOLUTION** signal	0.3–7 u
• Constant ΔM/M resolution can be set: **resolution coarse**	0–2% (ΔM > 0.3 u)
Waiting period after step jump in setpoint	(see chapter “Step response”, page 42)
Error sizes dM and dΔM at M_{max} [14)]	
• Step drift, M_{min} -> M_{max}	approx. 0.05 u
• Long-term drift, per 100 h	approx. 0.03 u
• Short-term drift, per 1 h	approx. 0.01 u

11) Excess temperature = increase compared to ambient temperature

12) With QMA 800-3, the information only applies up to a mass of 300 u.

13) This makes it possible to display full peaks up to M_{max} - 1.

14) Without calibration errors, stability errors, non-linearity of the control signal, measured with QMA 400 or QMA 410 (measuring method: (see chapter “Appendix”, page 42)).

Parameter	QMH 800-x
• Temperature drift (environment, 10–40°C) per °C	approx. 0.01 u
• Mechanical impact, drift per 10 G	approx. 0.02 u

Tbl. 19: Working data with quadrupole analyzer

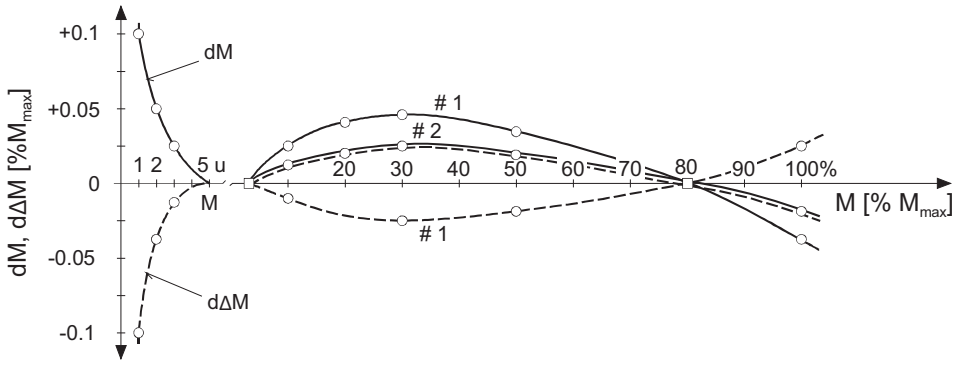


Fig. 10: Non-linearity of M and ΔM_{10}

14.4 Dimensions

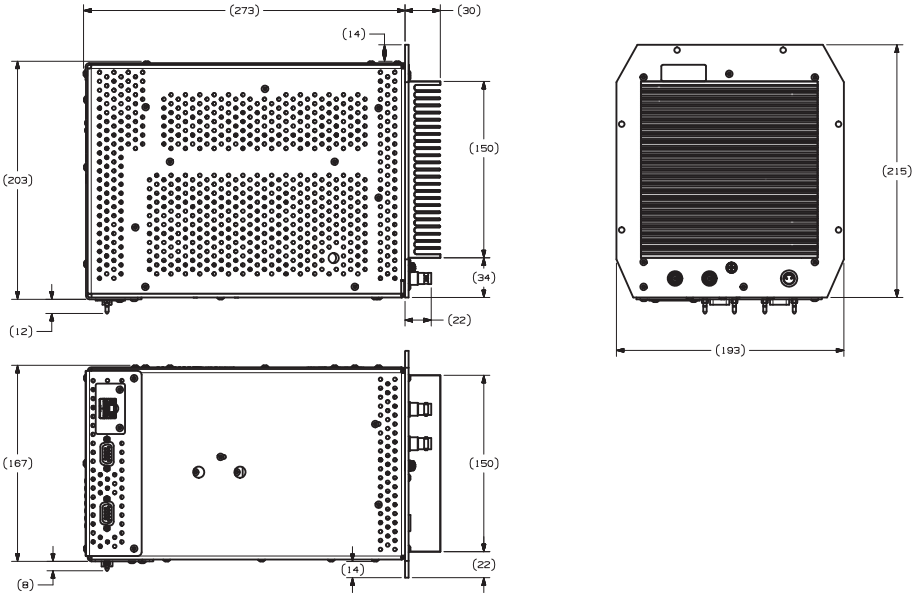


Fig. 11: Dimensions

Dimensions in mm

15 Appendix

15.1 Behavior as a function of time

15.1.1 Step response

If the mass number jumps from M_1 to M_2, you have to wait until the new status is stable. You have to mask the measuring signal in the transition area, since it has no relevance to the measuring value of the new mass number. The necessary waiting period depends on M_1 and M_2, the direction of the step response, the QMH type and the required accuracy of measurement. Pfeiffer Vacuum recommends experimenting to optimize the waiting periods, in particular for fast measuring speeds. This is the only way to find the best compromise between speed and accuracy of measurement. The following reference values apply for the unit resolution (ΔM_{10} = 1 u), until the detector signal has reached 98% of the final value. They only concern the behavior of the QMH. Delays of the ion detection systems have not been taken into account.

The waiting time t_w for the QMH to engage is calculated as follows:

$t_w = t_1 + t_2 \times |M_2 - M_1|$ [ms]

For small mass steps (M_2 - M_1 < 0.5 u), the formula above no longer applies – there is a delay t_d as a result of the finite rate of change of HF and DC signals. Continuous small steps (M_2 - M_1 < 0.1 u) has the same effect as a linear ramp for a scan signal.

HF generator		**QMH 800**	
M_L		5 u	
Type of step		$M_1 > M_2$	$M_2 > M_1$
M_1 and/or $M_2 \geq M_L$	t_1	2 ms	2 ms
	t_2	0.01 ms	0.02 ms
M_1 and $M_2 < M_L$	t_1	4 ms	4 ms
	t_2	0.5 ms	1 ms
M_2 - M_1 < 0.5 u [ms/u]	t_d	0.15 ms	

Tbl. 20: Waiting periods for QMH engagement

15.1.2 Fast mass scans

During fast mass scans with a linear ramp function, the mass scale lags behind the input signal (dM) and a peak width deviation (dΔM) occurs.

For the fastest scan speed of 0.5 ms/u and upward scan ($M_1 < M_2$), the following applies:

HF generator	**QMH 800**
$dM_{0.5}$ [u]	0.2
$d\Delta M_{0.5}$ [u]	0.15

Tbl. 21: Mass scale lag

On downward scan, both signs are negative.

For a slow scan, the following applies:

- $dM = dM_{0.5} \times 0.5$ / SPEED [ms/u], and
- $d\Delta M = d\Delta M_{0.5} \times 0.5$ / SPEED [ms/u]

15.2 Calibration method for mass number M and line width ΔM

The position of the peak maximum on the mass scale is often used for determining the mass number of a peak. However, this method is subject to error. For more accurate information concerning the mass scale and peak width, a definition of the corresponding measurement method is needed.

15.2.1 Apparent peak position and line width

The apparent mass position depends on the line width ΔM (that is, on the resolution). This shift of the peak maxima with the line width is a natural phenomenon of the quadrupole mass spectrometer. For this reason, the position of the peak top on the mass scale is not an accurate indicator of the mass number.

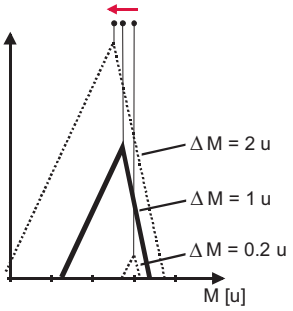


Fig. 12: The peak top moves with ΔM

15.2.2 Apparent peak position and peak shape

The apparent position of the peak maximum varies, depending on the peak shape. Different peak shapes can occur at different positions of the mass scale even if all other parameters remain constant. The peak shape also varies as a function of the mass range, the individual mass filter, or the ion source.

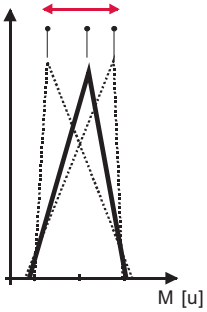


Fig. 13: The peak top moves with the peak shape

15.2.3 Definition of mass number and line width

Calibration method for mass number M and line width ΔM:

- The line width ΔM_{10} = 1 u is measured at 10 % of the peak height.
- The mass number is in the middle of the ΔM_{10} line.
- The **middle** of this 10 % line is used as the reference value for the mass number M.

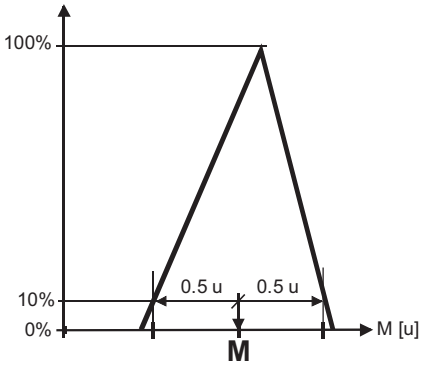


Fig. 14: Calibration method for mass number M and line width ΔM

15.2.4 Deviations from M and ΔM

The diagrams show how the deviations from the reference values can be determined. Here dM is the deviation from the setpoint of the mass position M and dΔM is the deviation from the setpoint of the line width ΔM.

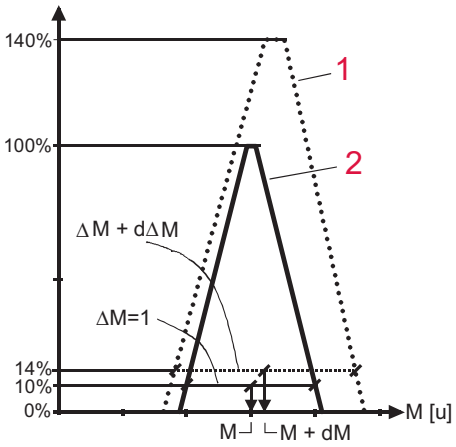


Fig. 15: 1 = Measured peak | 2 = Reference peak ΔM_{10} = 1 u

EU Declaration of conformity

This declaration of conformity has been issued under the sole responsibility of the manufacturer.

Declaration for product(s) of the type:

High-frequency generator

QMH 800-3

QMH 800-5

We hereby declare that the listed product satisfies all relevant provisions of the following **European Directives**.

Low voltage 2014/35/EU

Electromagnetic compatibility 2014/30/EU

Restriction of the use of certain hazardous substances, 2011/65/EU (Article 2, number 4 d, e, and j)

Harmonized standards and applied national standards and specifications:

DIN EN 61010-1:2011-07

DIN EN 61326-1:2013-07

DIN EN 55011:2009 + A1:2010 (Class A)

Signature:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(Daniel Sälzer)
Managing Director

Asslar, 2024-04-24

CE

PFEIFFER VACUUM

UK Declaration of Conformity

This declaration of conformity has been issued under the sole responsibility of the manufacturer.

Declaration for product(s) of the type:

High-frequency generator

QMH 800-3

QMH 800-5

We hereby declare that the listed product satisfies all relevant provisions of the following **British Directives**.

Electrical Equipment (Safety) Regulations 2016

Electromagnetic Compatibility Regulations 2016

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Applied standards and specifications:

EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019

EN IEC 61326-1:2021

EN 55011:2016 + A1:2017 + A11:2020 + A2:2021

The manufacturer's authorized representative in the United Kingdom and the authorized agent for compiling the technical documentation is Pfeiffer Vacuum Ltd, 16 Plover Close, Interchange Park, MK169PS Newport Pagnell.

Signature:

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

(Daniel Sälzer)
Managing Director

Asslar, 2024-04-24

UK CA

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