

# OPERATING INSTRUCTIONS

EN

Translation of the original instructions

## HIPACE 10

Turbopump



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# 1 About this manual

## 1.1 Validity

This operating manual is for customers of Pfeiffer Vacuum. It describes the functioning of the designated product and provides the most important information for safe use of the unit. The description follows applicable EU guidelines. All information provided in this operating manual refers to the current state of the product's development. The documentation remains valid as long as the customer does not make any changes to the product.

Up-to-date operating instructions can also be downloaded from [www.pfeiffer-vacuum.com](http://www.pfeiffer-vacuum.com).

### Applicable documents

HiPace 10	Operating instructions
Operating instructions "Electronic drive unit TC 110"	PT 0204 BN*
Declaration of conformity	Part of this document

\*also available via [www.pfeiffer-vacuum.com](http://www.pfeiffer-vacuum.com)

## 1.2 Conventions

### Safety instructions

The safety instructions in Pfeiffer Vacuum operating instructions are the result of risk evaluations and hazard analyses and are oriented on international certification standards as specified by UL, CSA, ANSI Z-535, SEMI S1, ISO 3864 and DIN 4844. In this document, the following hazard levels and information are considered:

<b>DANGER</b>
<b>Imminent danger</b> Indicates an imminent hazardous situation that will result in death or serious injury.
<b>WARNING</b>
<b>Possibly imminent danger</b> Indicates an imminent hazardous situation that can result in death or serious injury.
<b>CAUTION</b>
<b>Possibly imminent danger</b> Indicates an imminent hazardous situation that can result in minor or moderate injury.
<b>NOTICE</b>
<b>Command or note</b> Command to perform an action or information about properties, the disregarding of which may result in damage to the product.

## Pictographs



Prohibition of an action to avoid any risk of accidents, the disregarding of which may result in serious accidents



Warning of a displayed source of danger in connection with operation of the unit or equipment



Command to perform an action or task associated with a source of danger, the disregarding of which may result in serious accidents



Important information about the product or this document

## Instructions in the text

→ Work instruction: here you have to do something.

## Abbreviations

<b>DCU:</b>	Display Control Unit
<b>HPU:</b>	Handheld Programming Unit
<b>TC:</b>	Electronic drive unit for turbopump
<b>TPS:</b>	Mains pack

## Symbols used

The following symbols are used consistently throughout the diagrams:

- ⊕ High vacuum flange
- ∇ Fore-vacuum flange
- ∇ Vacuum flange of the backing pump
- ⊖ Exhaust flange of the backing pump
- ⚡ Electrical connection

## 2 Safety

### 2.1 Safety precautions



#### Duty to inform

Each person involved in the installation, operation or maintenance of the vacuum pump must read and observe the safety-related parts of these operating instructions.

→ The operator is obligated to make operating personnel aware of dangers originating from the vacuum pump, the pumped medium and the entire system.



#### Installation and operation of accessories

Pfeiffer Vacuum pumps can be equipped with a series of adapted accessories. The installation, operation and maintenance of connected devices are described in detail in the operating instructions of the individual components.

→ For information on order numbers of components, see "Accessories".

→ Use original accessory parts only.



#### NOTICE

#### Checking the safety system against excess rotation speed

To provide the functioning of the integrated safety system for avoiding excess rotation speed, the pump must run-up from the standstill at least once a year.

→ Switch off the pump and await the complete standstill (rotation speed = 0 Hz).

→ Run-up the pump according to this operating instructions.



#### WARNING

#### Danger of unsafe electrical installation

Safe operation after installation is the responsibility of the operator.

→ Do not independently modify or change the pump and electrical equipment.

→ Make sure that the system is integrated in an emergency off safety circuit.

→ Consult Pfeiffer Vacuum for special requirements.



#### WARNING

#### Danger due to lack of power disconnection device

Pump and electronic drive unit are not equipped with a power disconnection device. Installation of a user-supplied power disconnection device in accordance with SEMI-S2.

→ Fit a circuit breaker with an interruption rating of min. 10,000 A.



#### WARNING

#### Danger of electric shock

In case of defect, the parts connected to the mains supply are under voltage.

→ Always keep the mains connection freely accessible so you can disconnect it at any time.

- Do not expose any body parts to the vacuum.
- Observe all safety and accident prevention regulations.
- Regularly check the proper observance of all safety measures.
- **Power supply:** The turbopump power supply must apply to the requirements of double insulation between mains input voltage and operating voltage according to the regulations of IEC 61010 and IEC 60950. Therefore Pfeiffer Vacuum recommends to use exclusively original-power packs and -accessories. Only in this case Pfeiffer Vacuum is able to guarantee the compliance of the European and North American guidelines.
- A safe connection to the protective earthing conductor (PE) is recommended (protection class III).

- Do not loosen any plug connection during operations.
- Wait for the rotor to reach standstill before performing work on the high vacuum flange.
- Keep leads and cables well away from hot surfaces ( $> 70\text{ }^{\circ}\text{C}$ ).
- Never fill or operate turbopump with cleaning agent.
- Do not operate the turbopump with open high vacuum flange.
- Do not carry out any unauthorized modifications or conversions to the pump.
- When returning the turbopump observe the shipping instructions.

## 2.2 Protective equipment

Determined situations concerning the handling of vacuum pumps require wearing of personal protective equipment. The owner, respectively the employer are obligated to provide an adequate equipment to any operating persons.



DANGER	
<b>Danger to health by hazardous substances during maintenance or installation</b>	
Depending on the process vacuum pumps, components or operating fluids can be contaminated by toxic, reactive or radioactive substances.	
→ Wear adequate protective equipment during maintenance and repairs or in case of reinstallation.	



WARNING	
<b>Risk of injury through falling objects</b>	
When transporting vacuum pumps by hand, there is a danger through loads slipping and falling down.	
→ Carry small and mid-size vacuum pumps two-handed.	
→ Carry vacuum pumps $> 20\text{ kg}$ by a suitable lifting device.	
→ Wear safety shoes with steel toe cap according to directive EN 347.	



CAUTION	
<b>Risk of injury through hot surfaces</b>	
Vacuum pumps can become hot during operation.	
→ Allow the pump to cool before maintenance and repairs.	
→ If necessary wear protective gloves according to EN 420.	



CAUTION	
<b>Risk of injury through sharp edges</b>	
Rotor and stator disks of turbopumps have very sharp edges.	
→ Before any working wait for the complete standstill of the pump.	
→ Do not reach in the high vacuum flange.	
→ If necessary wear protective gloves according to EN 420.	

## 2.3 Proper use



NOTICE	
<b>EC conformity</b>	
The manufacturer's declaration of conformity becomes invalid if the operator modifies the original product or installs additional components.	
→ Following installation into a plant and before commissioning, the operator must check the entire system for compliance with the valid EU directives and reassess it accordingly.	

- The vacuum pump may only be used to generate a vacuum.
- Only operate the turbopump with an approved backing pump.

## 2.4 Improper use

Improper use will cause all claims for liability and warranties to be forfeited. Improper use is defined as usage for purposes deviating from those mentioned above, especially:

- pumping of corrosive or explosive media
- pumping of condensing vapors
- pumping of liquids
- pumping of dusts
- operation with improper high gas throughput
- operation with improper high fore-vacuum pressures
- operation with improper high levels of insulated heat input
- operation in improper high magnetic fields
- operation with improper gas mode
- venting with improper high venting rates
- use of the vacuum pump to generate pressure
- operation of the devices in areas with ionizing radiation
- operation in potentially explosive areas
- use of the devices in systems in which impact-like stress and vibrations or periodic forces affect the devices
- use of accessories or spare parts, which are not named in this manual

warranty seal

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### Closure seal

The product is sealed at the factory. Damaging or removal of a closure seal leads to the loss of liability and warranty entitlements.

➔ Do not open the product within its warranty period!

➔ For process-related shorter maintenance intervals please contact the Pfeiffer Vacuum Service.

## 3 Transport and storage

### 3.1 Transport

- Reuse the transport container of the vacuum pump.
  - Transport or ship vacuum pumps in the original packing preferably.
- Only remove the protective covers from the high vacuum and the fore-vacuum side immediately before connection.
- Keep the original protective covers.
- Always transport the turbopump in its upright position.

### 3.2 Storage

- Close the flange openings by using the original protective covers.
- Close further connection ports by using the corresponding protective covers.
- Store the pump only indoors at temperatures between -25 °C and +55 °C.
- In rooms with moist or aggressive atmospheres, the pump must be airproof shrink-wrapped in a plastic bag together with a bag of desiccant.



## 4 Product description

### 4.1 Product identification

#### Pump types

HiPace<sup>(1)</sup> 10<sup>(2)</sup> (3)

The product designation consists of a family designation (1), the size (2), which is oriented on the pumping speed, and if applicable the additional properties (3) of the pump.

1. Family designation	2. Model designation	3. Property designation
HiPace	<b>10</b> = Model designation of the pump related to its pumping speed class	<b>none</b> = Standard version <b>U</b> = Upside-down installation orientation <b>C</b> = Corrosive gas version <b>P</b> = Process <b>M</b> = Active magnetic bearing <b>T</b> = Temperature management system <b>E</b> = High Efficiency <b>H</b> = High Compression <b>I</b> = Ion implantation

#### Pump features



This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or a later version of the same standard incorporating the same level of testing requirements.

For information about other certifications, if applicable, please see the signet on the product or:

- [www.tuvdotcom.com](http://www.tuvdotcom.com)
- TUVdotCOM-ID 0000021320

Characteristics	HiPace 10
HV flange	DN 25
Flange material	Aluminium

To correctly identify the product when communicating with Pfeiffer Vacuum, always have the information from the rating plate available.

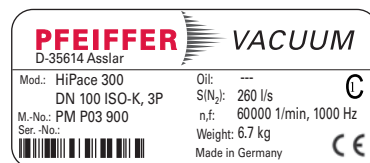


Fig. 1: Example for a rating plate

#### Scope of delivery

- HiPace 10 with TC 110 and 24 V DC  $\pm$  5 %
- Protective cover for the high vacuum flange and the fore-vacuum flange
- Operating instructions

4.2 Function

The turbopump HiPace 10 forms a complete unit together with the electronic drive unit TC 110. For the voltage supply only Pfeiffer Vacuum power supplies may be used (e.g. TPS or DCU).

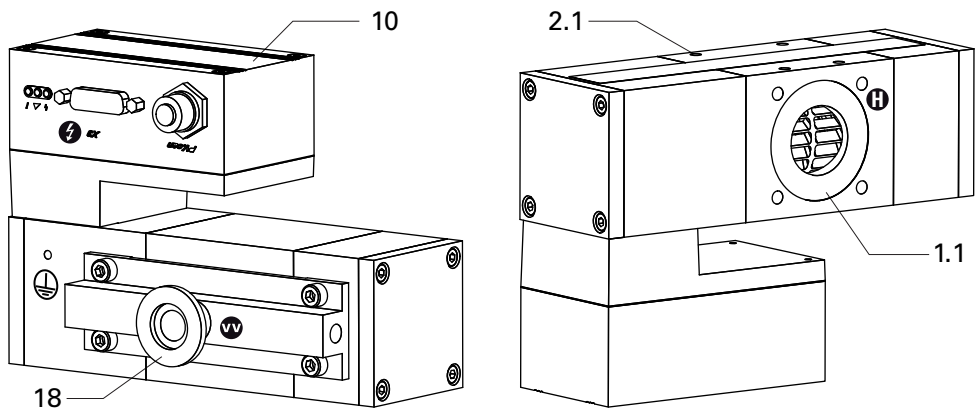


Fig. 2: View of HiPace 10 with TC 110

1.1	High vacuum connection	10	Electronic drive unit
2.1	Fixing hole	18	Connection adapter for fore-vacuum

Cooling

- Convection cooling

In the case of excess temperature the electronic drive unit reduces the drive power automatically.

Rotor bearing

- Ceramic ball bearing

Drive

Electronic drive unit TC 110

4.3 Range of application

The pump HiPace 10 must be installed and operated under the following ambient conditions:

Installation location	weather protected (indoors)
Temperature	+5 °C to +35 °C
Protection category	IP 54
Protection class	III
Relative humidity	max. 80 %, at T ≤ 31 °C, max. 50% at T ≤ 40 °C
Atmospheric pressure:	770 hPa - 1060 hPa
Installation altitude	2000 m max.
Degree of pollution	2
Permissible surrounding magnetic field	≤3 mT
Overvoltage category	II
Connection voltage TC	24 V DC ±5%



Remarks to ambient conditions

The specified permissible ambient temperatures apply to operation of the turbopump at maximum permissible fore-vacuum pressure or at maximum gas throughput depending on the cooling method. The turbopump is intrinsically safe by a redundant temperature monitoring.

- By reducing the fore-vacuum pressure or gas throughput, the turbopump can be operated at higher ambient temperatures.
- If the maximum permissible operating temperature of the turbopump is exceeded, the electronic drive unit reduces drive power first and switches off then, if necessary.

## 5 Installation



### WARNING

#### Danger from the turbopump being ripped off

If the rotor is suddenly blocked, torques of up to 80 Nm could occur, which could cause the turbopump to be ripped off if it is not properly affixed. The energy that this would release could throw the entire pump or pieces from its interior through the room. That would cause severe, possibly fatal, injuries as well as serious property damage.

- Carefully follow the installation instructions in this handbook.
- Only use approved original parts from Pfeiffer Vacuum (Accessories) for the installation.



#### Installation and operation of accessories

Pfeiffer Vacuum pumps can be equipped with a series of adapted accessories. The installation, operation and maintenance of connected devices are described in detail in the operating instructions of the individual components.

- For information on order numbers of components, see "Accessories".
- Use original accessory parts only.

### 5.1 Set-up

When installing the pump, observe the following conditions:

- the ambient conditions specified for the range of application
- It is not allowed to operate the device in systems where impact-like stresses and vibrations or periodically forces occur.

### 5.2 Preparatory work

- Where magnetic fields > 3 mT are involved, a suitable shielding must be used. Check installation location and consult Pfeiffer Vacuum if needed!
- The maximum permissible rotor temperature for the turbopump is 90 °C. If high temperatures arise for process reasons, the radiated heat input must not exceed 0.6 W. Install suitable screening sheets, if necessary (design information on request).

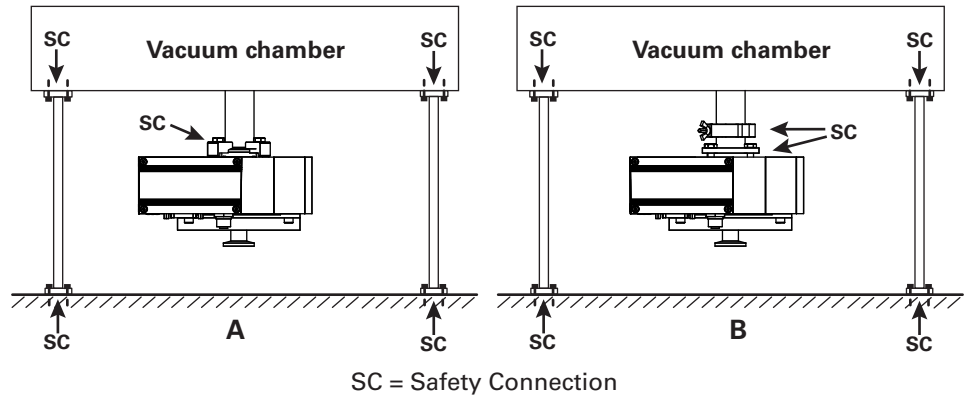
### 5.3 Assembly

- Ensure the greatest possible cleanliness when installing any high vacuum parts. Unclean components prolong the pump-down time.
- All flange components must be grease-free, dust-free and dry at installation.
- The operating fluid reservoir is already installed and filled for the turbopump HiPace 10.

#### Earthquake safety

An earthquake can result in contact with the safety bearings. All forces occurring hereby are safely absorbed by the properly installed flange connections.

- Secure the vacuum chamber against shifting and tipping on customers side.



**Fig. 3: Example: How to secure against shifting and tipping by external tremors**

A High vacuum connection with claws

B High vacuum connection with connection adapter (accessories)

## Mounting orientation



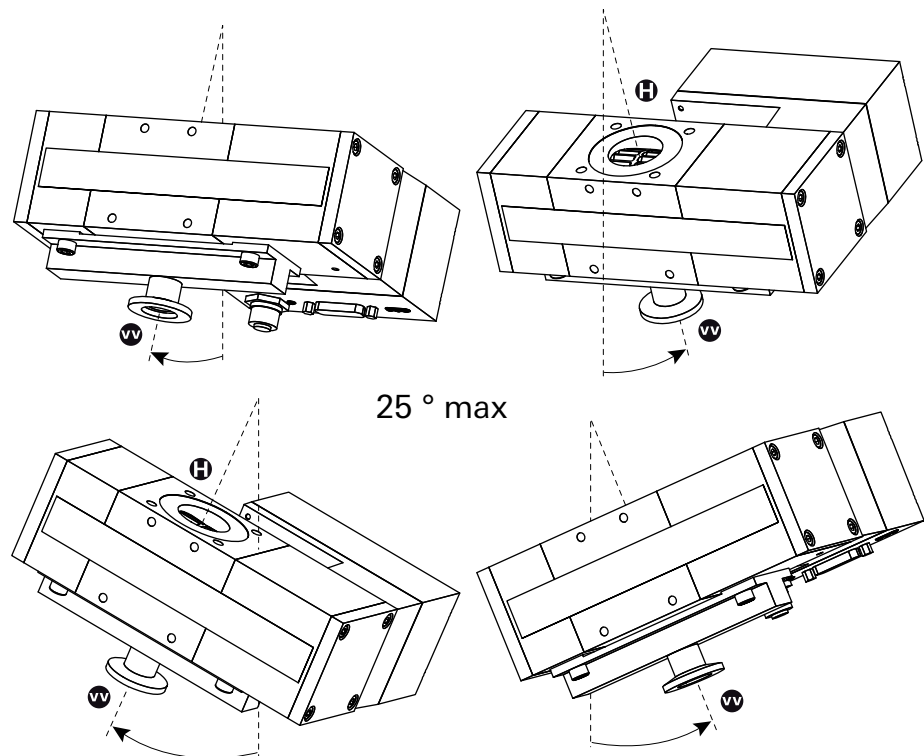
### NOTICE

#### The orientation of the fore-vacuum flange depending on the backing pump

When using a dry compressing backing pump the turbopump can be mounted and operated with the fore-vacuum flange in any orientation.

→ To avoid impurities via the fore-vacuum line when using oil-sealed backing pumps, the fore-vacuum flange should always point vertically downwards ( $\pm 25^\circ$ ).

→ Support pipes in front of the vacuum pump or remove them. No force from the pipe system may be exerted on the fixed pump.



**Fig. 4: Recommended orientation of the fore-vacuum flange**

The maximum axial loading capacity of the high vacuum flange is 200 N (equals 20 kg). A one-sided load on the high vacuum flange is not permitted.

## Use of a mesh screen

The installation of a Pfeiffer Vacuum mesh screen in the high vacuum flange protects the turbopump against foreign bodies coming from the vacuum chamber. The volume flow rate is reduced as followed.

	Reduced volume flow rate in %			
	H <sub>2</sub>	He	N <sub>2</sub>	Ar
Mesh screen DN 25	3	8	27	47

## Installing the high vacuum flange

If the rotor is suddenly blocked, the torques arising from the system and the high vacuum flange must be absorbed. Only the components listed in the following can be used to fasten the turbopumps to the high vacuum flange. The installation elements for turbopumps are special designs by Pfeiffer Vacuum. In all operating conditions, the tensile strength of the flange material must be at least 170 N/mm<sup>2</sup>.



### NOTICE

#### Observe shape tolerances for the counter flange

Unevennesses of the customer supplied counter flange can lead to warping of the pump casing despite proper fastening. Leakiness and negative running characteristics can be the result.

→ Do not exceed an evenness of max. 0.05 mm for the whole surface.



#### Mounting of ISO flanges

If the rotor suddenly blocks the connection of high vacuum flanges of types ISO-KF or ISO-K can lead to twisting despite proper installation.

- The tightness of the high vacuum flange is not at risk thereby.

For the installation the following components are exclusively authorized:

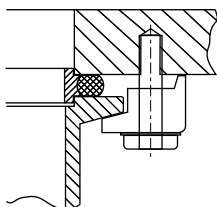
- the valid mounting kit of the Pfeiffer Vacuum accessories programme
- a centering ring with mesh screen is optionally

→ Mind that the sealing surfaces are not damaged.

→ Connect the flanges according to the drawing and with the component parts of the mounting kit.

→ Use the required number of **4** claws.

→ Tighten the claws crosswise in three steps.



## 5.4 Connections to the turbopump

### Electronic drive unit

Turbopumps with integrated electronic drive unit are designed for various applications. Therefore different connection panels are available.

- TC 110 in standard version
- TC 110 PB for Profibus linking
- TC 110 E74 in dependence on specification SEMI E74
- TC 110 DN for DeviceNet linking
- TC 110 RS with interface RS-485

Detailed description for function, configuration and operation with the respective connection panel are given in the specific operating instructions for the electronic drive unit.

### Connecting the power supply

For voltage supply of the electronic drive unit TC 110, only use original power supplies (e.g. TPS 110 or DCU 110). Use of other power supplies only after consultation with Pfeiffer Vacuum. Connecting cables are available from the Pfeiffer Vacuum accessories.

Connecting cable	Function
TC 110 - TPS/DCU 110/180 with bridges, RS-485	<ul style="list-style-type: none"> <li>• Voltage supply via power supply pack</li> <li>• Automatic start by bridges on pins 2, 5, 7</li> <li>• Connection to a display and control unit via RS-485</li> </ul>
TC 110 - TPS/DCU 110/180 with accessory ports, RS-485	<ul style="list-style-type: none"> <li>• Voltage supply via power supply pack</li> <li>• Accessory connection via M8 plugs</li> <li>• Connection to a display and control unit via RS-485</li> </ul>
TC 110 - TPS 110/180 with bridges	<ul style="list-style-type: none"> <li>• Voltage supply via power supply pack</li> <li>• Automatic start by bridges on pins 2, 5, 7</li> </ul>
TC 110 - TPS 110/180 with bridges, with accessory ports	<ul style="list-style-type: none"> <li>• Voltage supply via power supply pack</li> <li>• Automatic start by bridges on pins 2, 5, 7</li> <li>• Accessory connection via M8 plugs</li> </ul>



### WARNING

#### Danger of electric shock

In case of defect, the parts connected to the mains supply are under voltage.

→ Always keep the mains connection freely accessible so you can disconnect it at any time.

→ Make sure that the voltage of the turbopump is valid.

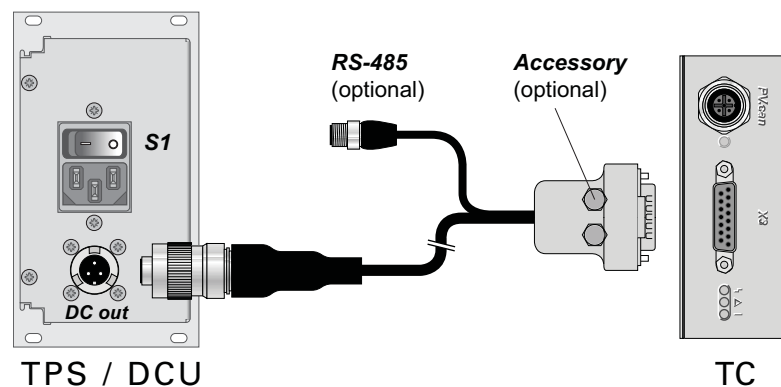


Fig. 5: Connecting the TC 110 to a power supply using a Pfeiffer Vacuum connecting cable

- Switch off switch **S1** on the power pack (position "0").
- Place and fix the connecting cable with the 15-pole mating plug into the connection "X3" on the electronic drive unit.
- Insert the connection cable with the plug in the connection "DC out" on the power supply and close the bayonet lock.

When using a Pfeiffer Vacuum display and control unit:

- Connect the display and control unit to the plug "RS485" of the adapter or the connecting cable.

## Accessory connection

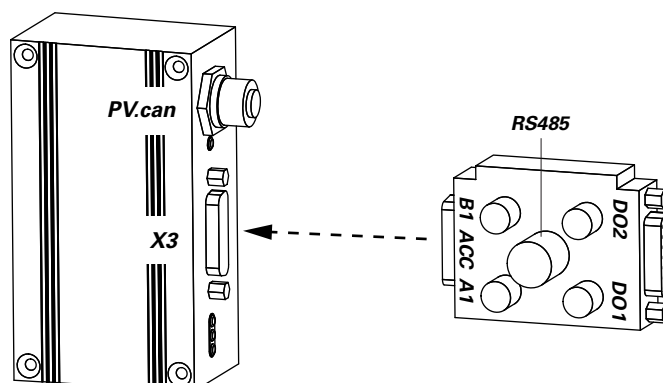


Fig. 6: Example: Connections on the electronic drive unit TC 110 with adapter TCS 12



### Accessory connection on the TC 110

The connection of Pfeiffer Vacuum accessory units to the electronic drive unit TC 110 is only possible by using respective connecting cables or adapters.

- Configure the preferred accessory output via RS-485 using a Pfeiffer Vacuum display and control unit or a PC.
- Consider the operating instructions "Electronic Drive Unit TC 110".



### Accessory connection to an electronic drive unit in special design

Differing to the standard model, drive units in special design (e.g. Profibus panel) can be equipped with accessory connections.

- Refer to the operating instructions of the respective electronic drive unit.
- Connect the control lead of the accessory directly to the electronic drive unit.
- Configure the preferred accessory output via RS-485 using a Pfeiffer Vacuum display and control unit or a PC.

## Connecting the fore-vacuum side

**Recommendation:** As backing pump, use a suitable vacuum pump from the Pfeiffer Vacuum programme.

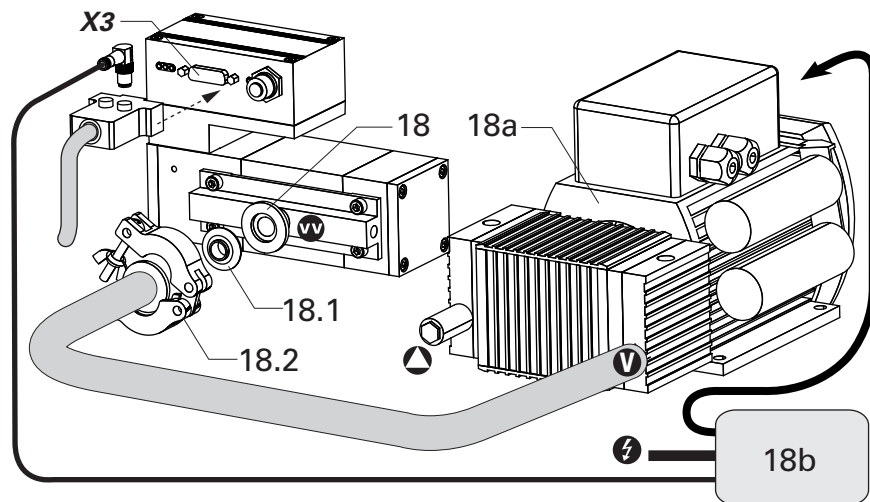


### WARNING

#### Damage to health due to poisonous gases

Process gases can damage health and contaminate the environment.

- Safely lead away the gas emission from the backing pump!
- Observe all safety recommendations of the gas producer.



**Fig. 7: Connecting a backing pump**

- |                           |                                |
|---------------------------|--------------------------------|
| 18 Fore-vacuum connection | 18a Backing pump               |
| 18.1 Centering ring       | 18b Backing pump relay box     |
| 18.2 Clamping ring        | X3 Multi-functional connection |

- With rigid pipe connections: Install bellows for attenuation of vibrations in the connection line.
- Connect the fore-vacuum line with small-flange components or threaded hose couplings. Do not narrow the free cross section of the fore-vacuum flange!
- The backing pump is connected electrically via a relay box.
- Plug in and fix the accessory's control lead to a free connection port on the connecting cable or adapter of the electronic drive unit.
- Establish the mains supply for the relay box according to the accessory operating instructions.
  - Make sure the supply voltage for the backing pump is valid.
- Make the settings and control via the interfaces of the electronic drive unit.



## 6 Operation

### 6.1 Commissioning

The following important settings are programmed in the electronic drive unit ex factory.

- Parameter **[P:027]** Gas mode: 0 = heavy gases
- Parameter **[P:700]** Set value max. run-up time monitoring: 8 min
- Parameter **[P:701]** Rotation speed switchpoint: 80% of the nominal rotation speed
- Parameter **[P:707]** Set value in rotation speed setting mode: 65 % of the nominal rotation speed
- Parameter **[P:708]** Set value power consumption: 100 %
- Parameter **[P:720]** Venting rotation speed at delayed venting: 50 % of the nominal rotation speed
- Parameter **[P:721]** Venting time: 3600 s

→ Establish the mains for the power supply.



#### NOTICE

##### **Risk of destroying the pump by inputting too much energy**

Simultaneous loading by means of high drive power (gas flow rate, fore-vacuum pressure), high heat radiation, or strong magnetic fields results in uncontrolled heating of the rotor and may destroy the pump.

→ Reduced limit values apply when combining these loads.

→ If necessary consult with Pfeiffer Vacuum.



#### NOTICE

##### **Danger of the pump being destroyed**

Pumping of gases with a higher molecular mass in the wrong gas mode can lead to destruction of the pump.

→ Ensure the gas mode is correctly set.

→ Contact Pfeiffer Vacuum before using gases with a greater molecular mass (> 80).

### 6.2 Operation modes

The following operation modes are available:

- Operation without operating unit
- Operation via "X3" connection
- Operation via RS-485 and Pfeiffer Vacuum display and control units or PC
- Operation via field bus

### 6.3 Function description



#### WARNING

##### **Danger due to open high vacuum flange**

The rotor of the turbopump turns at high speed. If the high vacuum flange is open, there is a danger of cut injuries and that the pump can be destroyed by objects falling into it.

→ Never operate the pump with an open high vacuum flange.

## Operation without operating unit



### CAUTION

#### Automatic start

After bridging the contacts Pin 2, 5, 7 on the connection "X3" or using a connecting cable "with bridges" **and** setting up the supply voltage, the turbopump will run up immediately.

→ Switch on the mains supply on the turbopump immediately before operation.

→ For operation without the control unit, the respective connecting cable "with bridges" must be in the "X3" connection on the TC 110.

→ Switch on the supply voltage with switch S1 on the power supply.

After operating voltage is applied, the TC 110 performs a self-test to check the supply voltage. Once the self-test has been successfully completed on the TC 110, the turbopump and the backing pump - if connected - begin to operate.

## Operation via "X3" connection

Remote control is possible via the 15-pin D-sub connector labelled "X3" on the electronic drive unit. The accessible individual functions are mapped to "PLC levels".

→ Consider the following manuals for the operation via remote control:

- Operating instructions "Electronic drive unit TC 110"

## Operation with DCU or HPU

→ Consider the following manuals for the operation via Pfeiffer Vacuum display and control units:

- Operating instructions "DCU"
- Operating instructions "HPU"
- Operating instructions "Electronic drive unit TC 110"

→ Connect the display and control unit to the plug "RS485" of the adapter or the connecting cable.

→ Switch on the supply voltage with switch S1 on the power supply or on the DCU 110.

→ Settings are possible via interface RS-485 by using DCU, HPU or PC.

## Operation via field-bus

Integrating and operating Pfeiffer Vacuum turbopumps in the customer's field bus system is possible for electronic drive units with a corresponding field bus panel.

→ Consider the following manuals for the operation via field bus:

- Operating instructions for the electronic drive unit with the respective connection panel

## 6.4 Monitoring of the operation conditions

### Operation display via LED

LEDs in the front panel of the electronic drive unit show basic operating conditions of the turbopump. A differentiated malfunction and warning display is possible only for operation with DCU or HPU.





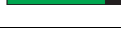




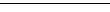



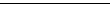

LED	Symbol	LED status	Display	Meaning
Green 		Off		currentless
		On, flashing		"Pumping Station OFF", rotation speed $\leq 60 \text{ min}^{-1}$
		On, invers flashing		"Pumping Station ON", set rotation speed not attained
		On, constantly		"Pumping Station ON", set rotation speed attained
		On, blinking		"Pumping Station OFF", rotation speed $> 60 \text{ min}^{-1}$
Yellow 		Off		no warning
		On, constantly		Warning
Red 		Off		no malfunction
		On, constantly		Malfunction

Fig. 8: Behaviour and meaning of LEDs on the electronic drive unit

### Temperature monitoring

The drive power is reduced in case of impermissible motor temperature or impermissibly high housing temperature. This can cause falling below the rotation speed switchpoint and so result in turning off the turbopump.

## 6.5 Switching off and venting

### Switching off

After the turbopump is switched off, it must be vented to avoid contamination due to particles streaming back from the fore-vacuum area.

- Close the fore-vacuum: Switch off the backing pump or close a fore-vacuum valve.
- Switch off the turbopump on the control unit or via remote control.
- Vent the pump on the high vacuum side for at least 5 s to atmospheric pressure.



#### NOTICE

##### Danger of excessive inlet pressure

The gas flow of the venting gas supply increases according to the inlet pressure. Unacceptably high rates of pressure rise while venting can damage the pump.

- When using venting gas at excess pressure, the permissible rate of pressure rise must be observed.

## 7 Maintenance / replacement



### WARNING

#### **Contamination of parts and operating fluid by pumped media is possible.**

Poisoning hazard through contact with materials that damage health.

- In the case of contamination, carry out appropriate safety precautions in order to prevent danger to health through dangerous substances.
- Decontaminate affected parts before carrying out maintenance work.



### NOTICE

#### **Disclaimer of liability**

Pfeiffer Vacuum accepts no liability for personal injury or material damage, losses or operating malfunctions due to improperly performed maintenance. The liability and warranty entitlement expires.

### 7.1 Maintenance intervals and responsibilities

- Clean the turbopump externally with a lint-free cloth and little industrial alcohol.
- Replace the operating fluid reservoir and electronic drive unit yourself.
- Change the operating fluid reservoir at least every 3 years.
- Change the turbopump bearing at least every 3 years.
  - Contact Pfeiffer Vacuum Service.
- Clarify shorter maintenance intervals for extreme loads or impure processes with Pfeiffer Vacuum Service.
- For all other cleaning, maintenance or repair work, please contact your Pfeiffer Vacuum service location.

### 7.2 Replacing the operating fluid reservoir



### WARNING

#### **Poisoning hazard through contact with materials that damage health.**

The operating fluid reservoir and parts of the pump may contain toxic substances from the pumped media.

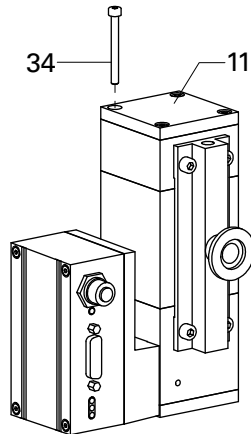
- Dispose of operating fluid reservoir in accordance with the applicable regulations. Safety data sheet on request or under [www.pfeiffer-vacuum.com](http://www.pfeiffer-vacuum.com)
- Prevent health hazards or environmental damage due to contamination by means of appropriate safety precautions.
- Decontaminate affected parts before carrying out maintenance work.



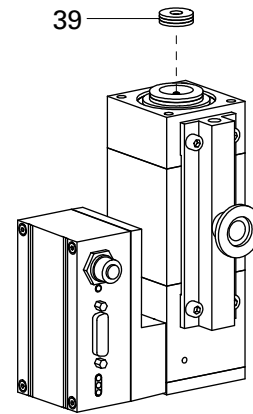
#### **Operating fluid filling**

The operating fluid reservoir is sufficiently filled with operating fluid.

- Do not add additional operating fluid.
- Turn off the vacuum pump, vent to atmospheric pressure and allow to cool.
- Remove the vacuum pump from the system, if necessary.
- Close the flange openings by using the original protective covers.
- Place the turbopump upright.



11 End cover  
34 Allen head screw



39 Operating fluid reservoir

- Screw out the end cover on the respective bearing side of the turbopump with an Allen key. Pay attention to the bearing mounting **and** the O-ring!
- Using tweezers, lift out the lubricant reservoir.
- Remove impurities from the turbopump and the end cover with a clean, lint-free cloth.  
**Do not use any cleaning fluids!**
- Insert the new operating fluid reservoir into the turbopump. The felt disc with the two noses must point towards the middle of the pump.
- For the HiPace turbopumps the operating fluid reservoir can be inserted completely into the bearing cartridge.
- Screw in the end cover with the new O-ring.
  - Tightening torque: **2.5 Nm**.
- Replace the operating fluid reservoir of the opposite bearing side as well.

### 7.3 Replacing the electronic drive unit



#### NOTICE

##### Damages to the pump and drive

Even after the mains power is switched off, the subsequently running pump delivers electric power to the electronic drive unit. There is a danger of electric body contact by premature separating the pump from the electronic drive unit.

- Never separate the electronic drive unit from the pump when the mains power is connected or the rotor is running.



##### Operating parameters of the electronic drive unit

The factory operating parameters are always preset with replacement shipments.

- The use of a HPU enables the storing and the reuse of an existing parameter record.
- Reset any individually changed application parameters.
- Refer to the manual "Electronic drive unit".

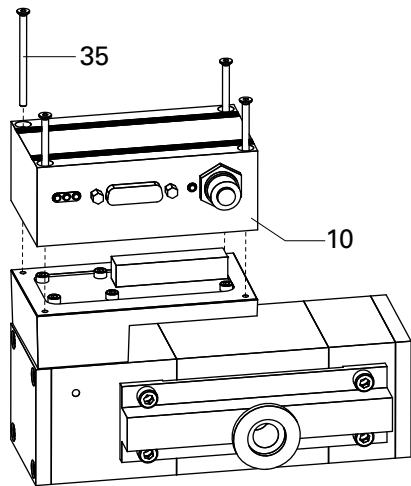


Fig. 9: Assembly / disassembly of the TC 110

10 Electronic drive unit                      35 Allen head screw

- Do not exercise any mechanical load on the electronic drive unit.
- Turn off the vacuum pump, vent to atmospheric pressure and allow to cool.
- Only separate the pump and the electronic drive unit from each other after disconnecting the supply voltage and the complete standstill of the pump.
- Remove the vacuum pump from the system, if necessary.
- Unscrew Allen head screws (4x) from the electronic drive unit.
- Pull the electronic drive unit off the pump.
- Screw on and connect new electronic drive unit to the turbopump.
  - Tightening torque: **0.6 - 0.8 Nm**.

Rotation speed set value

The typical nominal rotation speed of a turbopump is factory-set in the electronic drive unit. If the electronic drive unit is replaced or a different pump type is used, the reference set value of the nominal rotation speed must be confirmed. This procedure is part of a redundant safety system for avoiding excess rotation speeds.

HiPace	Nominal rotation speed confirmation [P:777]
10 / 30 / 60 / 80	1500 Hz
300	1000 Hz

- Adjust the parameter **[P:777]** according to the pump type.
- **Alternatively:** If no display and control unit is available, please use the "SpeedConfigurator" of the spare parts delivery.

## 8 Decommissioning

### 8.1 Shutting down for longer periods



#### WARNING

**Contamination of parts and operating fluid by pumped media is possible.**

Poisoning hazard through contact with materials that damage health.

- In the case of contamination, carry out appropriate safety precautions in order to prevent danger to health through dangerous substances.
- Decontaminate affected parts before carrying out maintenance work.

If the turbopump should be shut down for longer than a year:

- Remove the vacuum pump from the system, if necessary.
- Change the operating fluid reservoir.
- Close the high vacuum flange of the turbopump.
- Evacuate turbopump via the fore-vacuum flange.
- Vent turbopump via the venting connection with oil-free, dry air or inert gas.
- Close the flange openings by using the original protective covers.
- Close further connection ports by using the corresponding protective covers.
- Place pump upright on rubber feet.
- Store the pump only indoors at temperatures between -25 °C and +55 °C.
- In rooms with moist or aggressive atmospheres, the pump must be airtight shrink-wrapped in a plastic bag together with a bag of desiccant.

### 8.2 Re-starting



#### NOTICE

##### Wiederinbetriebnahme

Die Gebrauchsfähigkeit des Betriebsmittels der Turbopumpe beträgt ohne Betrieb max. 3 Jahre. Vor der Inbetriebnahme nach Stillsetzen für **3 Jahre oder länger** folgende Arbeiten durchführen:

- Betriebsmittelspeicher austauschen
- Lagerwechsel vornehmen lassen
- Wartungshinweise beachten und Pfeiffer Vacuum Service verständigen

- Check turbopump for contamination and moisture.
- Clean the turbopump externally with a lint-free cloth and little industrial alcohol.
- If necessary, have Pfeiffer Vacuum Service clean the turbopump completely.
- If necessary, have the bearings replaced. Take into account the total running time.
- Change the operating fluid reservoir.
- Installation and commissioning in accordance with the operating instructions.

### 8.3 Disposal

Products or parts thereof (mechanical and electrical components, operating fluids, etc.) may cause environmental burden.

- Safely dispose of the materials according to the locally applicable regulations.

## 9 Malfunctions

If malfunctions on the pump occur, you will find possible causes and instructions for repair in the following table.

### 9.1 Rectifying malfunctions

Problem	Possible causes	Remedy
Pump will not start; none of the built-in LEDs on the TC 110 lights up	• Electrical supply interrupted	⇒ Check plug contacts on the power supply ⇒ Check supply lines on the power supply ⇒ Check the output voltage (24 V DC) on the connection "DC out" of the power supply ⇒ Check the plug contacts on the TC
	• Operating voltage incorrect	⇒ Apply correct operating voltage ⇒ Observe the rating plate
	• No operating voltage applied	⇒ Apply operating voltage
	• TC 110 defective	⇒ Exchange the TC 110 ⇒ Contact the Pfeiffer Vacuum Service
Pump will not start; green LED on the TC 110 is flashing	• At operation without control panel: Pins 2-7 and 5-7 are not connected on the "X3" connection	⇒ Connect the pins 2-7 and 5-7 on the "X3" connection
	• At operation via RS-485: Bridge at Pin 2-7 prevents control commands	⇒ Remove the bridge at the "X3" connection.
	• At operation via RS-485: Parameters of the electronic drive unit not set	⇒ Set parameters <b>[P: 010]</b> and <b>[P: 023]</b> "ON" via interface RS-485. ⇒ Please refer to operating instructions of the electronic drive unit.
	• Voltage drop in the cable too high	⇒ Use a suitable cable
Pump does not attain the final rotational speed within the specified run-up time	• Fore-vacuum pressure too high	⇒ Ensure function and suitability of the backing pump
	• Leak	⇒ Perform leak detection ⇒ Check sealings and flange fastenings ⇒ Eliminate leaks
	• Gas throughput too high	⇒ Reduce process gas supply
	• Rotor is rough-running, bearing defective	⇒ Check the bearing for noises ⇒ Contact the Pfeiffer Vacuum Service
	• Setpoint for run-up time to low	⇒ Extend the run-up time via DCU, HPU or PC
	• Thermal overload: – Lack of air ventilation – Water flow too low – Fore-vacuum pressure too high – Ambient temperature too high	⇒ Reduce thermal loads – Ensure adequate cooling – Ensure the cooling water flow – Lower the fore-vacuum pressure – Adjust ambient conditions
	• Pump is dirty	⇒ Bake out the pump ⇒ Cleaning in case of heavy contamination – Contact the Pfeiffer Vacuum Service
Pump does not attain the ultimate pressure	• Vacuum chamber, pipes or pump are leaky	⇒ Leak detection starting from the vacuum chamber ⇒ Eliminate leaks
	• Bearing damage • Rotor damage • Splinter shield or protective screen are loose	⇒ Contact the Pfeiffer Vacuum Service ⇒ Contact the Pfeiffer Vacuum Service ⇒ Correct the seat of the splinter shield or the protective screen ⇒ Observe the installation notes
Unusual noises during operation	• Bearing damage • Rotor damage • Splinter shield or protective screen are loose	⇒ Contact the Pfeiffer Vacuum Service ⇒ Contact the Pfeiffer Vacuum Service ⇒ Correct the seat of the splinter shield or the protective screen ⇒ Observe the installation notes
Red LED on the TC 110 is on	• Collective fault	⇒ Reset by switching the mains OFF/ON ⇒ Reset via pin 6 on the "X3" connection ⇒ Differentiated malfunction display is possible via DCU or HPU <sup>1)</sup> ⇒ Contact the Pfeiffer Vacuum Service

<sup>1)</sup> If no display and control unit is available, please contact the Pfeiffer Vacuum Service.



## 10 Service

### **Pfeiffer Vacuum offers first-class service!**

- Operating fluid and bearing change on the spot by Pfeiffer Vacuum FieldService
- Maintenance / repair in the nearby ServiceCenter or ServicePoint
- Fast replacement with exchange products in mint condition
- Advice on the most cost-efficient and quickest solution

Detailed information, addresses and forms at: **[www.pfeiffer-vacuum.com](http://www.pfeiffer-vacuum.com) (Service)**.

### **Maintenance and repair in the Pfeiffer Vacuum ServiceCenter**

The following steps are necessary to ensure a fast, smooth servicing process:

- ➔ Download the forms "Service Request" and "Declaration on Contamination".<sup>1)</sup>
- ➔ Fill out the "Service Request" form and send it by fax or e-mail to your Pfeiffer Vacuum service address.
- ➔ Include the confirmation on the service request from Pfeiffer Vacuum with your shipment.
- ➔ Fill out the declaration on contamination and include it in the shipment (required!).
- ➔ Dismantle all accessories.
- ➔ Drain the operating fluid (applies for turbopumps with pumping speed > 800 l/s).
- ➔ Leave electronic drive on the pump.
- ➔ Close the flange openings by using the original protective covers.
- ➔ If possible, send pump or unit in the original packaging.

### **Sending of contaminated pumps or devices**

No units will be accepted if they are contaminated with micro-biological, explosive or radioactive substances. "Hazardous substances" are substances and compounds in accordance with the hazardous goods directive (current version). If pumps are contaminated or the declaration on contamination is missing, Pfeiffer Vacuum performs decontamination at the shipper's expense.

- ➔ Neutralise the pump by flushing it with nitrogen or dry air.
- ➔ Close all openings airtight.
- ➔ Seal the pump or unit in suitable protective film.
- ➔ Return the pump/unit only in a suitable and sturdy transport container and send it in while following applicable transport conditions.

### **Exchange unit**

The factory operating parameters are always preset with exchange units. If you use changed parameters for your application, you have to set these again.

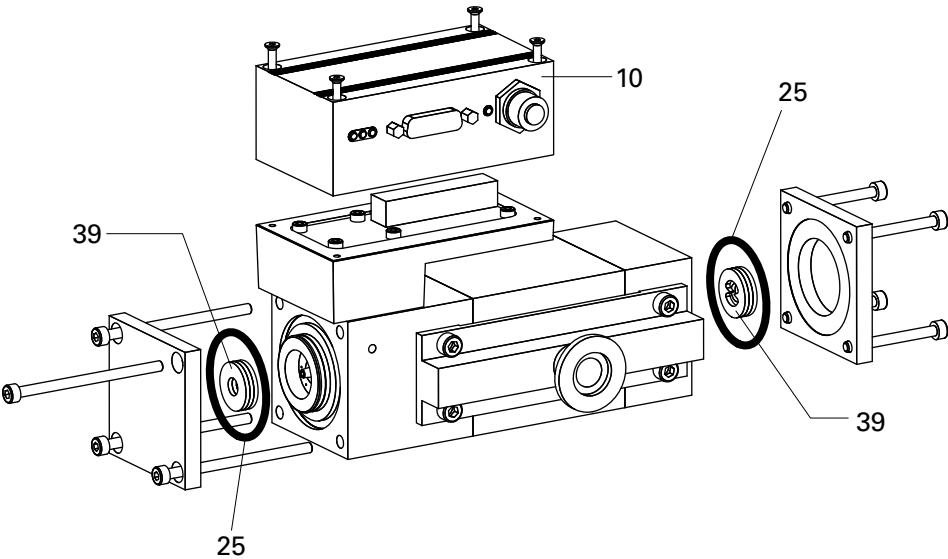
### **Service orders**

All service orders are carried out exclusively according to our repair conditions for vacuum units and components.

<sup>1)</sup> Forms under [www.pfeiffer-vacuum.com](http://www.pfeiffer-vacuum.com)

# 11 Spare parts HiPace 10

Pos.	Designation	Size	Order number	Notes	Pieces	Order quantity
10	Electronic drive unit TC 110		PM C01790		1	
39	Operating fluid reservoir		PM 083 373 -T	2 x incl. O-ring (25)	1	



Please also specify model number of the the rating plate when ordering accessories or spare parts.

## 12 Accessories

Designation	HiPace® 10 with TC 110, DN 25
TPS 110, mains pack for wall/standard rail fitting	PM 061 340 -T
TPS 111, mains pack 19" rack module 3HU	PM 061 344 -T
Front panel kit for TPS 111	PM 061 393 -T
DCU 110, Display control unit incl. power supply	PM C01 820
DCU 002, Display Control Unit	PM 061 348 -T
HPU 001, Handheld Programming Unit	PM 051 510 -T
Accessories package for HPU 001/PC	PM 061 005 -T
Mains cable 230 V AC, CEE 7/7 to C13, 3 m	P 4564 309 ZA
Mains cable 115 V AC, NEMA 5-15 to C13, 3 m	P 4564 309 ZE
Mains cable 208 V AC, NEMA 6-15 to C13, 3 m	P 4564 309 ZF
TCS 11, adapter for TC 110/120 with RS-485 interface	PM 061 636 -U
TCS 12, adapter for TC 110/120 with interface RS-485, 4 accessory ports and coupling set	PM 061 638 -U
HiPace - ACP connection cable	PM 071 142 -X
TCS 15 for controlling backing pumps	PM 061 685 -X
Connection cable with RS-485 interface for TC 110/120 to power supply	PM 061 350 -T
Connection cable with RS-485 interface and 2 accessory ports for TC110/120 to power supply	PM 061 351 -T
Relay box, shielded, for backing pumps, 1-phase 7A for TC 110/120 and TCP 350, plug M8	PM 071 282 -X
Relay box for backing pump, single phase 20 A for TC 110/120 and TCP 350, M8 plug	PM 061 373 -T
TVV 001 fore-vacuum safety valve, 230 V AC	PM Z01 205
TVV 001 fore-vacuum safety valve, 115 V AC	PM Z01 206
Y-Connector M12 to RS-485	P 4723 010
Connection adapter DN 25 ISO-KF	PM 093 315 -T
USB converter to RS-485 interface	PM 061 207 -T
Interface cable, M12 m straight/M12 m straight, 3 m	PM 061 283 -T
Connection cable for HiPace with TC 110/120	PM 061 543 -T
Connection cable incl. 2 accessory ports for TC 110/120 to power supply	PM 061 552 -T
Connection cable TPS 180 - MVP 006-4 with HiPace 80/HiPace 10, 2 x 0.5 m	PM 061 399 -T
Connection adapter for backing pump	PM 016 525 -T
Connector M12 to RS-485	PM 061 270 -X
Extension cable M8 on M8	PM 061 783 -T
TCS 13, adapter for TC 110/120 with interface RS-485, 2 accessory ports and coupling set	PM 061 856 -U
Enclosure for plug, spraywater-protected, 15-pole, D-sub	P 0998 016
Mains power plug for TC 110/120 and mating plug for E74 interface, straight	P 4723 110
Mains power plug angled for TC 110/120 and mating plug for interface E74	P 4723 111
RJ 45 interface cable on M12 for HiPace	PM 051 726 -T
Interface cable, M12 m straight/ M12 m angled 0.7 m	PM 061 791 -T
TIC 001, Interface converter RS-232/RS-485	PM 051 054 -T
Wall rail fitting for TPS 110/180/310/400	PM 061 392 -T
Round plug M12, straight	P 4722 605
Mains power plug straight "coded" for TC 110/120	P 4723 112
Mains power plug angled "coded" for TC 110/120	P 4723 113
D-sub adapter, 15-pole, 90°	PM 071 165 -U
Remote mating plug 26-pol, IP 54 protection	PM 061 880 -T
Connecting plug TPS 110/180/310/400 DC out	P 4723 102
Tele TC cable 110, 3 m	PM 061 773 -T
Round plug M8	P 4722 603
Centering ring, FPM/Aluminum, DN 25 ISO-KF	PF 110 125 -T
Centering ring with integrated mesh screen, DN 25 ISO-KF	PF 113 225 -T
Mounting kit for HiPace 10, DN 25 ISO-K and claws	PF 104 000 -T
Mounting kit for HiPace 10, DN 25 ISO-KF, including centering ring with claws	PM 016 627 -T

## 13 Technical data and dimensions

### 13.1 General

Basic principles for the Technical Data of Pfeiffer Vacuum Turbopumps:

**Maximum values refer exclusively to the input as a single load.**

- Recommendations of PNEUROP committee PN5
- ISO 21360; 2007: "Vacuum technology - Standard methods for measuring vacuum-pump performance - General description"
- ISO 5302; 2003: "Vacuum technology - Turbomolecular pumps - Measurement of performance characteristics"
- Ultimate pressure: using a test dome and a 48 hrs. period of baking out
- Gas throughput: water cooling; backing pump = rotary vane pump (10 m<sup>3</sup>/h)
- Cooling water consumption: at max. gas throughput, cooling water temp. 25 °C
- Integral leak rate: using a Helium concentration of 100 %, period 10 s
- Sound pressure level: Distance 1 m to the pump

**Conversion table: pressure units**

	mbar	bar	Pa	hPa	kPa	Torr mm Hg
mbar	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
bar	1000	1	$1 \cdot 10^5$	1000	100	750
Pa	0.01	$1 \cdot 10^{-5}$	1	0.01	$1 \cdot 10^{-3}$	$7.5 \cdot 10^{-3}$
hPa	1	$1 \cdot 10^{-3}$	100	1	0.1	0.75
kPa	10	0.01	1000	10	1	7.5
Torr mm Hg	1.33	$1.33 \cdot 10^{-3}$	133.32	1.33	0.133	1

$1 \text{ Pa} = 1 \text{ N/m}^2$

**Conversion table: gas throughput units**

	mbar·l/s	Pa·m <sup>3</sup> /s	sccm	Torr·l/s	atm·cm <sup>3</sup> /s
mbar·l/s	1	0.1	59.2	0.75	0.987
Pa·m <sup>3</sup> /s	10	1	592	7.5	9.87
sccm	$1.69 \cdot 10^{-2}$	$1.69 \cdot 10^{-3}$	1	$1.27 \cdot 10^{-2}$	$1.67 \cdot 10^{-2}$
Torr·l/s	1.33	0.133	78.9	1	1.32
atm·cm <sup>3</sup> /s	1.01	0.101	59.8	0.76	1

### 13.2 Technical data

Parameter	HiPace® 10
Flange (in)	DN 25
Flange (out)	DN 16 ISO-KF / G 1/8"
Pumping speed for Ar	11.5 l/s
Pumping speed for H <sub>2</sub>	3.7 l/s
Pumping speed for He	6 l/s
Pumping speed for N <sub>2</sub>	10 l/s
Compression ratio for Ar	$2.5 \cdot 10^7$
Compression ratio for H <sub>2</sub>	$3 \cdot 10^2$
Compression ratio for He	$3 \cdot 10^3$
Compression ratio for N <sub>2</sub>	$3 \cdot 10^6$
Gas throughput at full rotational speed for Ar	0.37 hPa l/s
Gas throughput at full rotational speed for He	0.48 hPa l/s
Gas throughput at full rotational speed for H <sub>2</sub>	2.78 hPa l/s
Gas throughput at full rotational speed for N <sub>2</sub>	0.37 hPa l/s
Fore-vacuum max. for Ar	25 hPa
Fore-vacuum max. for H <sub>2</sub>	15 hPa

Parameter	HiPace <sup>®</sup> 10
Fore-vacuum max. for He	22 hPa
Fore-vacuum max. for N <sub>2</sub>	25 hPa
Run-up time	0.9 min
Ultimate pressure according to PNEUROP	$< 5 \cdot 10^{-5}$ hPa
Rotation speed $\pm 2\%$	90000 min <sup>-1</sup>
Rotation speed variable	50-100 %
Power characteristic line in gas mode 1, vertex A	24/90000 W/min <sup>-1</sup>
Power characteristic line in gas mode 1, vertex B	24/90000 W/min <sup>-1</sup>
Power characteristic line in gas mode 0, vertex C	24/90000 W/min <sup>-1</sup>
Power characteristic line in gas mode 0, vertex D	24/90000 W/min <sup>-1</sup>
Power characteristic line in gas mode 2, vertex E	24/90000 W/min <sup>-1</sup>
Power characteristic line in gas mode 2, vertex F	24/90000 W/min <sup>-1</sup>
Sound pressure level	$< 50$ dB (A)
Relative humidity of air	5-85, non-condensing %
Protection category	IP54
Operating voltage	24 ( $\pm 5\%$ ) V DC
Operating voltage power supply	90-265 V AC
Integral leak rate	$< 2 \cdot 10^{-8}$ Pa m <sup>3</sup> /s
Power consumption max.	28.8 W
Current consumption max.	1.2 A
Shipping and storage temperature	-25-+55 °C
Mounting orientation	in any orientation
Weight	1.8 kg
Cooling method, standard	Convection
Permissible irradiated thermal power max.	0.60 W
Permissible magnetic field max.	3 mT
Interfaces	RS-485, Remote

### 13.3 Dimensions

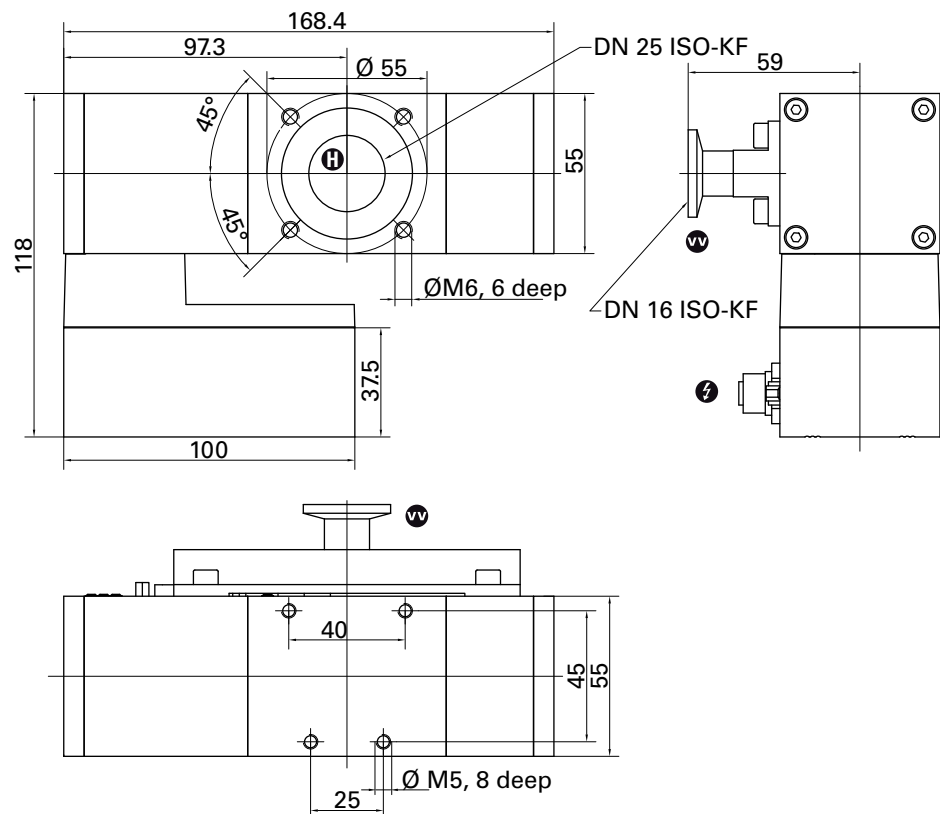


Fig. 10: HiPace 10



# Declaration of conformity

We hereby declare that the product cited below satisfies all relevant provisions according to the following **EC directives**:

- **Machinery 2006/42/EC (Annex II, no. 1 A)**
- **Electromagnetic Compatibility 2014/30/EU**

The agent responsible for compiling the technical documentation is Mr. Helmut Bernhardt, Pfeiffer Vacuum GmbH, Berliner Straße 43, 35614 Asslar.

## HiPace 10

Harmonised standards and national standards and specifications which have been applied:

DIN EN ISO 12100 : 2011-03  
DIN EN 1012-2 : 1996  
DIN EN 61000-3-2 : 2010  
DIN EN 61000-3-3 : 2009  
DIN EN 61010-1 : 2010  
DIN EN 61326-1 : 2013  
DIN EN 62061 : 2013

Signature:

Pfeiffer Vacuum GmbH  
Berliner Straße 43  
35614 Asslar  
Germany

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(Dr. Ulrich von Hülsen)  
Managing Director

2016-3-21

## **VACUUM SOLUTIONS FROM A SINGLE SOURCE**

Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide, technological perfection, competent advice and reliable service.

## **COMPLETE RANGE OF PRODUCTS**

From a single component to complex systems:

We are the only supplier of vacuum technology that provides a complete product portfolio.

## **COMPETENCE IN THEORY AND PRACTICE**

Benefit from our know-how and our portfolio of training opportunities!

We support you with your plant layout and provide first-class on-site service worldwide.

Are you looking for a  
perfect vacuum solution?  
Please contact us:

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Headquarters • Germany  
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[info@pfeiffer-vacuum.de](mailto:info@pfeiffer-vacuum.de)

[www.pfeiffer-vacuum.com](http://www.pfeiffer-vacuum.com)

