OPERATING INSTRUCTIONS

EN

Translation of the Original

TCP 350

Electronic drive unit

PFEIFFER VACUUM

Dear Customer,

Thank you for choosing a Pfeiffer Vacuum product. Your new electronic drive unit is designed to support you in your individual applications with maximum performance and without malfunctions. The name Pfeiffer Vacuum stands for high-quality vacuum technology, a comprehensive and complete range of top-quality products and first-class service. With this expertise, we have acquired a multitude of skills contributing to an efficient and secure implementation of our product.

Knowing that our product must not interfere with your actual work, we are convinced that our product offers you the solution that supports you in the effective and trouble-free execution 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.

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1 About this manual

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

1.1 Validity

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

1.1.1 Applicable documents

TCP 350	**Operating instructions**
Declaration of conformity	A component of these instructions

1.1.2 Variants

These instructions apply to electronic drive units with connection cable and the following accessory connections:

- TCP 350 with M8 accessory connection
- TCP 350 with M12 accessory connection
- TCP 350 with RJ45 accessory connection

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.

i Note

Tip

1.3.3 Stickers on the product

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

PFEIFFER VACUUM Mod.: TCP 350 Ser. Nr.: Mod--Nr.: PM C01 740 Input: 115/230 V -20/+15% 50/60 Hz Output: 0 -72 V / 6.5 A 420 VA Mass: 2.8 kg Made in Germany 2021/04 CE	**Rating plate** (example) Rating plates of the devices are affixed to the housing where they can be clearly seen
TÜV Rheinland c US Safety approved USA CAN	**Test seal**: The test seal provides information regarding additional certifications

Tbl. 1:   **Stickers on the product**
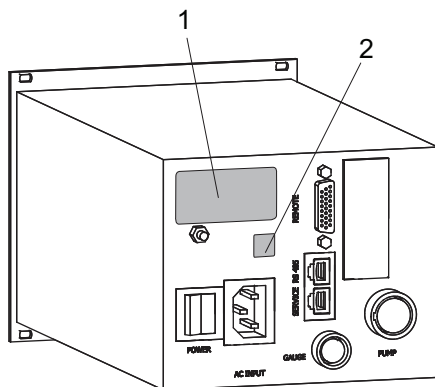
Fig. 1:   **Position of the stickers on the product**

   1   Rating plate   2   Test seal

1.3.4 Abbreviations

Abbreviation	Meaning in this document
AC	Alternating Current voltage
APR	Piezo transmitter
CMR	Capacitive transmitter CMR
DC	Direct Current voltage
DCU	Display Control Unit
f	Rotation speed value of a vacuum pump (frequency, in rpm or Hz)
LC	Liquid crystal
LED	Light emitting diode
MPT	Pirani/Cold cathode transmitter
PCR	Pirani/Capacitive transmitter
PKR	Pirani/Cold cathode transmitter

Abbreviation	Meaning in this document
PPT	Pirani transmitter
[P:xxx]	Electronic drive unit control parameters. Printed in bold as a three-digit number in square brackets. Frequently displayed in conjunction with a short description. Example: **[P:312]** software version
RPT	Piezo/Pirani transmitter RP
RS-485	Standard for a physical interface for asynchronous serial data transmission (Recommended Standard)
S1	Switch on power supply pack
T	Temperature (in °C)
TC	Turbopump electronic drive unit (turbo controller)
TCP	Turbopump electronic drive unit with integrated power supply pack
TMP	Turbomolecular pump
TPR	Pirani transmitter

Tbl. 2:   Abbreviations used in this document

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

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

2.2 Safety instructions

All safety instructions in this document are based on the results of the risk assessment carried out in accordance with Low Voltage Directive 2014/35/EU. Where applicable, all life cycle phases of the product were taken into account.

Risks during installation

> ⚠ **DANGER**
>
> **Danger to life from electric shock**
>
> Touching exposed and voltage-bearing elements causes an electric shock. Improper connection of the mains supply leads to the risk of touchable live housing parts. There is a risk to life.
>
> ► Before the installation, check that the connection leads are voltage-free.
> ► Make sure that electrical installations are only carried out by qualified electricians.
> ► Provide adequate grounding for the device.
> ► After connection work, carry out an earthed conductor check.

> ⚠ **WARNING**
>
> **Risk of danger to life through missing mains disconnection device**
>
> The vacuum pump and electronic drive unit are **not** equipped with a mains disconnection device (mains switch).
>
> ► Install a mains disconnection device according to SEMI-S2.
> ► Install a circuit breaker with an interruption rating of at least 10,000 A.

> ⚠ **WARNING**
>
> **Risk of fatal injury due to electric shock on account of incorrect installation**
>
> The device's power supply uses life-threatening voltages. Unsafe or improper installation can lead to life-threatening situations from electric shocks obtained from working with or on the unit.
>
> ► Ensure safe integration into an emergency off safety circuit.
> ► Do not carry out your own conversions or modifications on the unit.

Risks during operation

> ⚠ **WARNING**
>
> **Danger to life from electric shock in the event of a fault**
>
> In the event of a fault, devices connected to the mains may be live. There is a danger to life from electric shock when making contact with live components.
>
> ► Always keep the mains connection freely accessible so you can disconnect it at any time.

Risks during maintenance

> ⚠ **WARNING**
>
> **Danger to life from electric shock during maintenance and service work**
>
> The device is only completely de-energized when the mains plug has been disconnected and the vacuum pump is at a standstill. There is a danger to life from electric shock when making contact with live components.
>
> ► Before performing all work, switch off the main switch.
> ► Wait until the vacuum pump comes to a standstill (rotation speed =0).
> ► Disconnect all connection cables.
> ► Remove the mains plug from the device.
> ► Secure the device against unintentional restarting.

Risks during troubleshooting

> ⚠ **WARNING**
>
> **Danger to life from electric shock in the event of a fault**
>
> In the event of a fault, devices connected to the mains may be live. There is a danger to life from electric shock when making contact with live components.
>
> ► Always keep the mains connection freely accessible so you can disconnect it at any time.

2.3 Safety precautions

> ℹ **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.

> ℹ **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.

► Recommendation: Establish a secure connection to the earthed conductor (PE); protection class I.
► Never disconnect plug connections during operation.
► Keep lines and cables away from hot surfaces (> 70 °C).
► Do not carry out your own conversions or modifications on the unit.
► Observe the unit protection degree prior to installation or operation in other environments.
► Only disconnect the electronic drive unit when the equipment has reached a complete standstill and the supply voltage from the vacuum pump has been discontinued.

2.4 Limits of use of the product

Installation location	weatherproof (internal space)
Air pressure	750 hPa to 1060 hPa
Installation altitude	max. 2000 m
Rel. air humidity	max. 80%, at T < 31°C, up to max. 50% at T < 40°C
Protection class (according to IEC 61010)	I
Degree of pollution (according to IEC 61010)	2
Overvoltage category	II
Protection degree	IP20
Ambient temperature	+5 ° to +40 °C

Tbl. 3: Permissible ambient conditions

2.5 Proper use

● The electronic drive unit is used exclusively for the operation of Pfeiffer Vacuum turbopumps and their accessories.

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 misuse, in particular:

● Connection to power supplies that do not comply with the provisions of IEC 61010 or IEC 60950
● Operation with excessively high irradiated heat output
● Use in areas with ionizing radiation
● Operation in explosion-hazard areas
● Use of accessories or spare parts that are not listed in these instructions

2.7 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.

3 Product description

3.1 Identifying the product

► To ensure clear identification of the product when communicating with Pfeiffer Vacuum, always keep all of the information on the rating plate to hand.
► Learn about certifications through test seals on the product or at www.certipedia.com with company ID no. 000021320.

3.2 Product features

Feature	TCP 350
Connection panel	Standard
suitable for	Turbopumps from Compact series
	Turbopumps from HiPace series
Mains frequency	50/60 Hz
Mains connection voltage	95 – 265 V AC
Current consumption, max.	4 A
Power consumption, max.	420 VA
Internal fuse	10 A, fast-acting

Tbl. 4: **Product features**

3.3 Function

The electronic drive unit TCP 350 is used for external voltage supply, control and monitoring of turbopumps and connected peripheral devices. It is also possible to connect a pressure gauge.
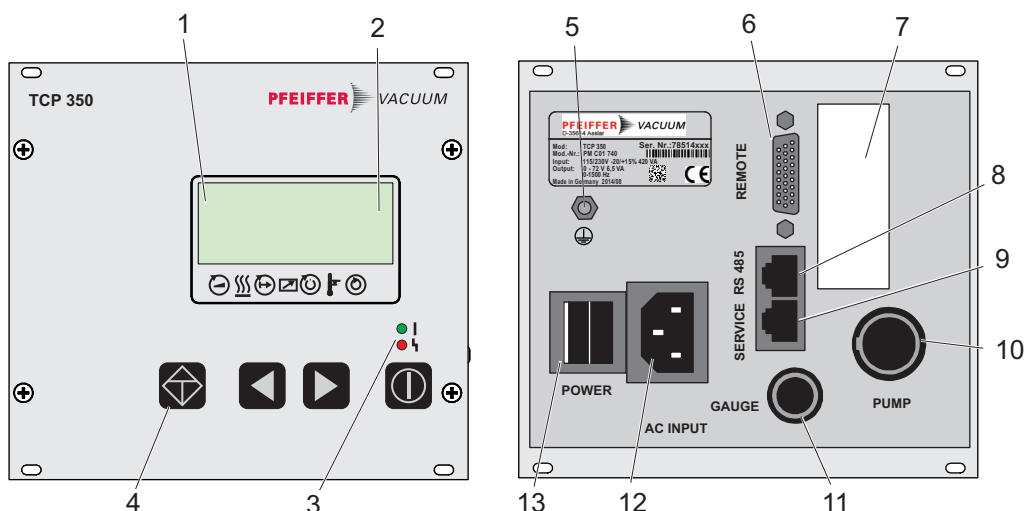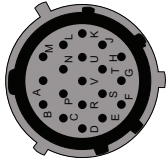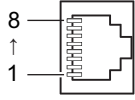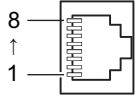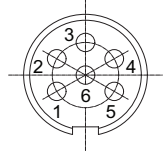
Fig. 2: **TCP 350 connections and manual control elements**

1	LC display, illuminated	8	"RS 485" connection
2	Status symbols	9	"SERVICE" connection
3	LED operating mode display	10	"PUMP" connection
4	Controls	11	"GAUGE" connection
5	Grounding connection PE	12	"AC INPUT" mains connection
6	"REMOTE" connection	13	"POWER" mains switch
7	Module for additional interfaces, optional: Profibus, DeviceNet or Profinet		

3.4 Connections

	POWER / AC INPUT Housing connector C14 for the voltage supply with mains switch
	PUMP Round plug connector, 19-pin bushing with three-point bayonet coupling for connecting a Pfeiffer Vacuum turbopump with connection cables of various lengths (up to max. 110 m in the standard version).
	REMOTE High-density D-sub socket with 26 pins for connection and configuration of a remote control.
	RS485 RJ45 plug contact, 8-pin for connecting Pfeiffer Vacuum control units (e.g. HPU or a PC) with RS485/RS232 or RS485/USB adapter.
	SERVICE RJ45 plug contact, 8-pin for service purposes.
	GAUGE Round plug connector, 6-pin bushing for pressure measure for the connection of a Pfeiffer Vacuum analog gauge from the ActiveLine series.

Tbl. 5:   Connection description of the electronic drive unit

3.5 Scope of delivery

- TCP 350, external electronic drive unit for turbopumps
- Mating plug for the "REMOTE" connection (type-dependent)
- Fixing materials
- Operating instructions

4 Installation

4.1 Preparing for installation

General comments regarding installation

► Choose a site for installation where access to the product and to supply lines is possible at all times.
► Install the device upright.
► Respect the ambient conditions stated for the area of use.
► A minimum distance of 50 mm from the upper cooling vents to adjacent components must be maintained.
► Ensure adequate cooling options, e.g., in the control cabinet.

4.2 Installing the device in a rack

NOTICE
Damage caused by overheating
The ambient temperature must not exceed the permissible operating temperature of the device.
► Make sure there is unobstructed circulation of air when installing the device.
► Periodically check and clean the installed air filter, if necessary.

The device is suitable for installation in a 19" mounting rack 3HE in accordance with DIN 41494.

Installing the device in a rack

1. Install guide rails in the rack as required.
2. Push the device upright into the rack all the way to the front panel.
3. Secure the front panel with 4 collar screws and plastic nipples included in the shipment.

4.3 Connecting turbopump

⚠ WARNING
Danger to life from electric shock during maintenance and service work
The device is only completely de-energized when the mains plug has been disconnected and the turbopump is at a standstill. There is a danger to life from electric shock when making contact with live components.
► Before performing all work, switch off the main switch.
► Wait until the turbopump comes to a standstill (rotation speed =0).
► Remove the mains plug from the device.
► Secure the device against unintentional restarting.

The external connection of a Pfeiffer Vacuum turbopump to the electronic drive unit TCP 350 is possible with screened connection cables in different lengths from the Pfeiffer Vacuum accessories range.

Assignment of plugs and bushings

● Round connector, 19-pin for connecting to the electronic drive unit TCP 350.
● Bushing, 8-pin with 2 control cables for accessories and grounding cable for connecting to the turbopump.
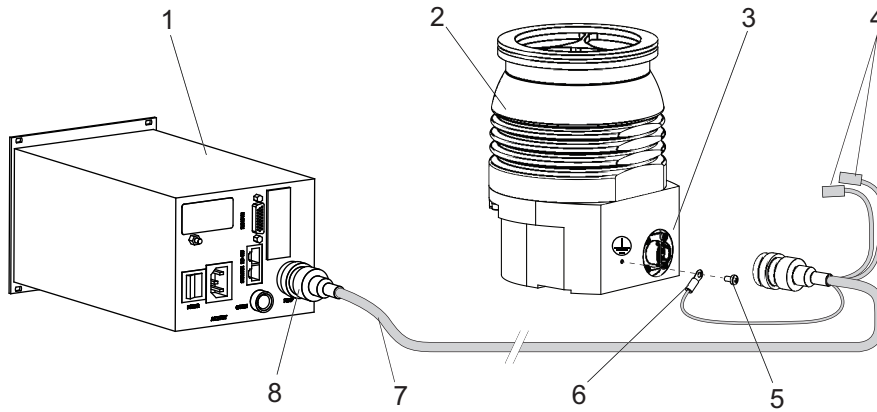
Fig. 3:   Connecting turbopump to electronic drive unit

1	Electronic drive unit TCP 350	5	Fixing materials
2	Turbopump	6	PE grounding cable
3	Connection "vacuum pump"	7	Pump connection cable
4	Accessory connections	8	Connection "PUMP" to TCP

Procedure

1. Use the respective connection cable from the electronic drive unit scope of delivery or from the accessories range.
2. Secure the electrical connection with the bayonet screw connections.
3. Connect the grounding cable to the grounding connection of the turbopump.

4.4   Connection diagram

⚠ **DANGER**

Danger to life from electric shock

When establishing the voltages that exceed the specified safety extra-low voltage (according to IEC 60449 and VDE 0100), the insulating measures will be destroyed. There is a danger to life from electric shock at the communication interfaces.

► Connect only suitable devices to the bus system.

⚠ **WARNING**

Risk of injury due to incorrect installation

Dangerous situations may arise from unsafe or incorrect installation.

► Do not carry out your own conversions or modifications on the unit.
► Ensure the integration into an Emergency Off safety circuit.

ⓘ **Contact load for the accessory connections to "accessory"**

1. Note the maximum contact load of 200 mA per connection.
2. However, do not exceed the total sum of the load of all connections of 450 mA.

ⓘ **Potential-free connections**

● All inputs and outputs of the "REMOTE" and "RS-485" connections are galvanically separate from the mains voltage and from the signals on the pump plug.
● The contacts of relays 1 and 2 are potential-free.

Fig. 4:   Connection diagram for TCP350 with M12 accessory connection
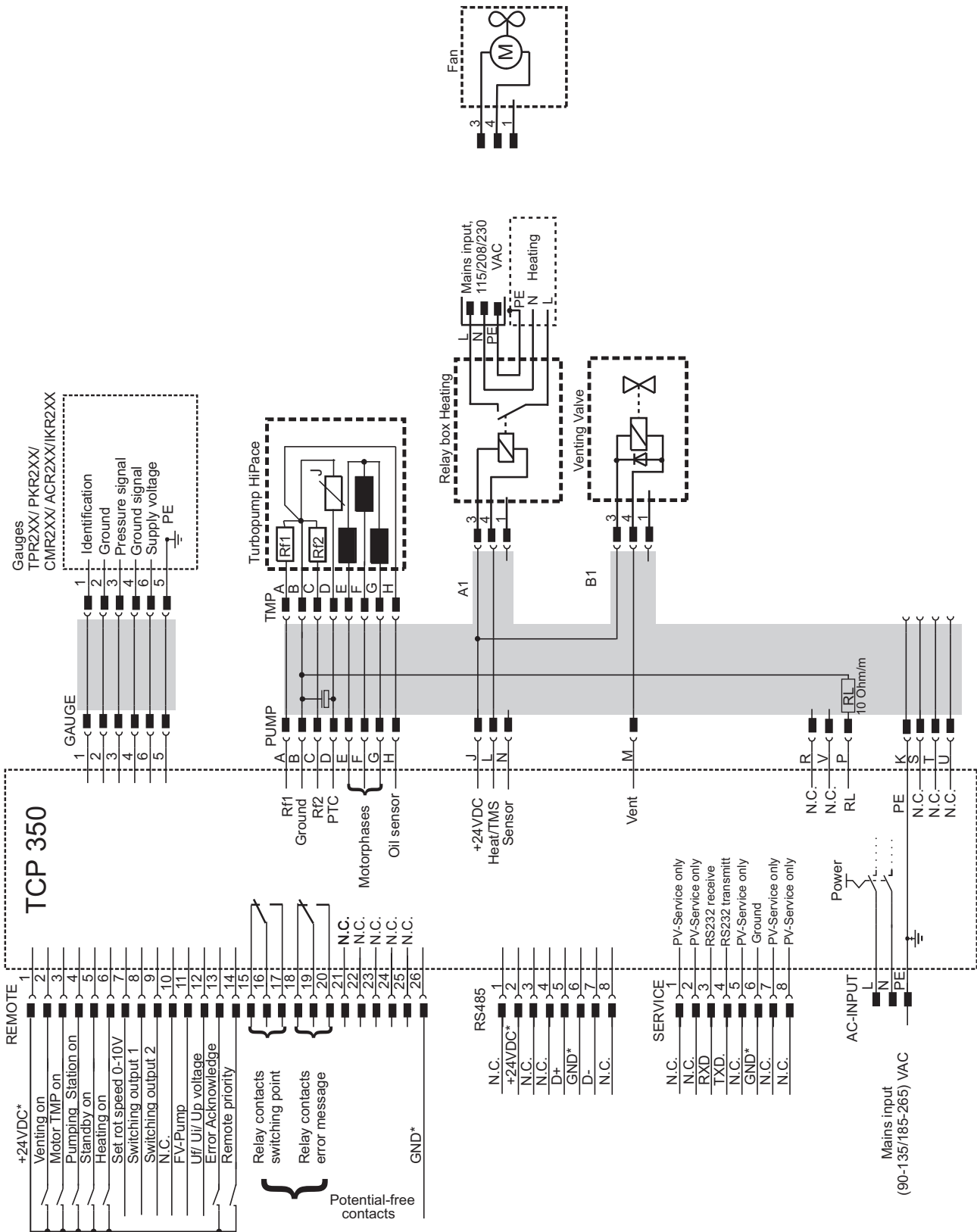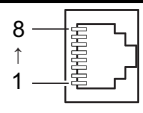
Fig. 5: Connection diagram for TCP350 with M8 accessory connection

Fig. 6: Connection diagram for TCP350 with RJ45 accessory connection

4.5 "SERVICE" connection

The connection with the "SERVICE" designation on the electronic drive unit is used exclusively for service and configuration purposes. The connections are galvanically safe and are isolated from the maxi-

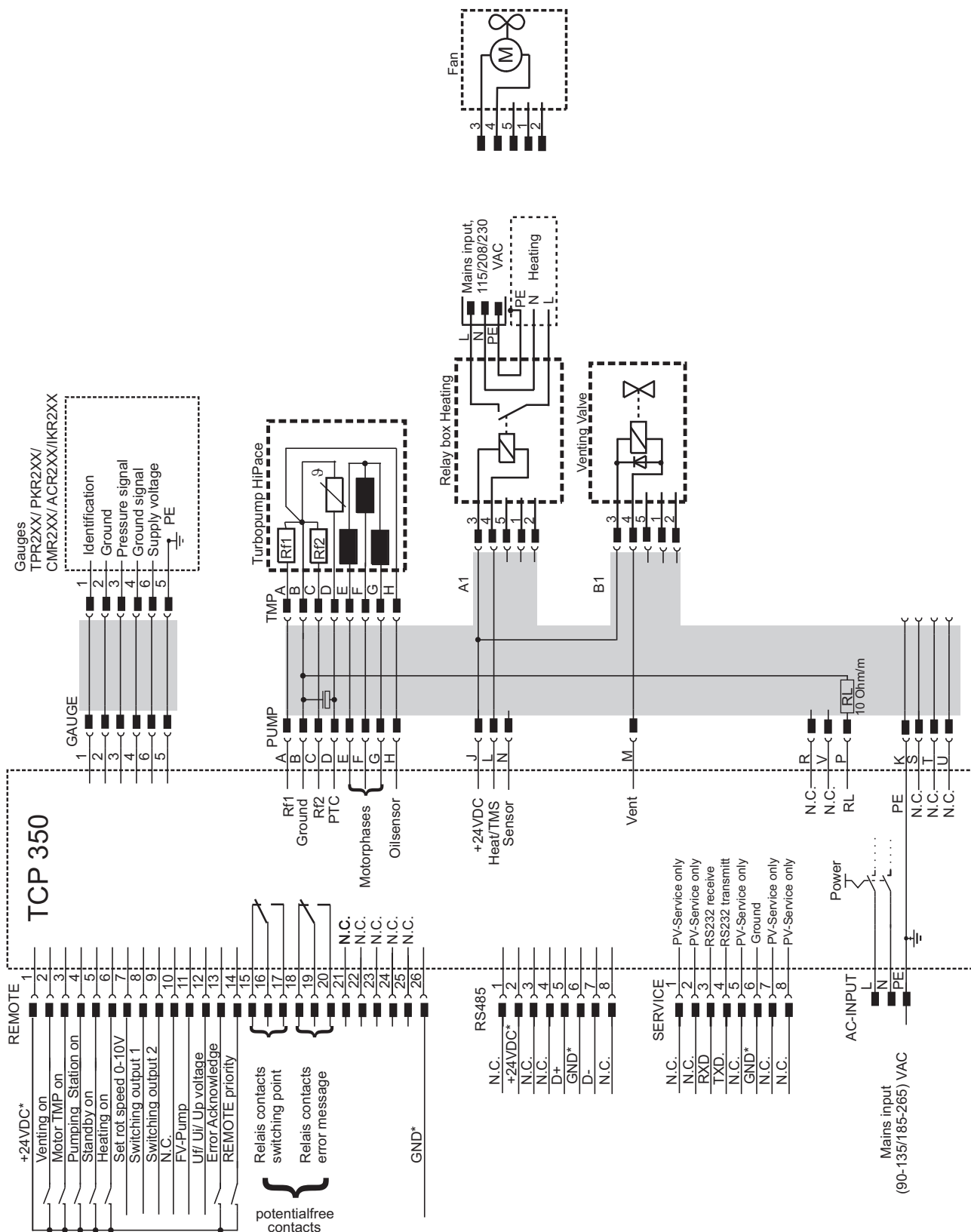mum supply voltage for the electronic drive unit. The electrical connections are optically decoupled internally.

Designation	Value
Serial interface	RS-232
Baud rate	9600 Baud
Data word length	8 bit
Parity	none (no parity)
Start bits	1
Stop bits	1 ... 2

Tbl. 6:   Characteristics of the RS232 service interface

Pin	Assignment
1	Service only
2	Service only
3	RS-232 RxD
4	RS-232 TxD
5	Service only
6	GND
7	Service only
8	Service only

Tbl. 7:   Assignment of RJ-45 connecting socket of service interface

4.6   "REMOTE" connection

The 26-pin D-sub connection with the "REMOTE" designation offers the possibility to operate the electronic drive unit via remote control. The accessible individual functions are mapped to "PLC levels". The following specifications are the factory settings for the electronic drive unit. They can be configured with the Pfeiffer Vacuum parameter set.

Required tools

- Calibrated torque wrench
- Hexagon socket wrench, **SW 4,5**

Input signals	Output signals
● High level: +13 to +33 VDC ● PLC Low level: -33 to +7 VDC	● High level: +20 to +28 VDC ● PLC Low level: 0 to +3 VDC

Tbl. 8:   Logic levels of digital inputs and outputs

Connecting remote control to "REMOTE"

► Remove the remote plug from the electronic drive unit and connect a remote control.
► Utilize the screened plug and cable.
► Secure the remote control to the "REMOTE" connection.
  – Tightening torque of the spacer bolt of the D-sub socket: **0.25 - 0.3 Nm**

Pin	Assignment	Description, factory setting
1	+24 V DC* output (V+)	Reference voltage for all digital inputs and outputs
2	DI1	Enable venting (Low: off, High: on)
3	DI motor vacuum pump	Drive motor (Low: off, High: on)
4	DI Pumping station	Low: off, High: on
5	DI stand-by	Stand-by rotation speed (Low: off, High: on)
6	DI2	Heating (Low: off, High: on)
7	AI+ rotation speed setting mode	Set value in rotation speed setting mode; 2 - 10 V DC corresponds to 20 - 100% of the nominal rotation speed
8	DO1	Speed-control switchpoint reached; Low: no, High: yes (I_{max} = 50 mA/24 V)
9	DO2	Low: fault, High: no fault (I_{max} = 50 mA/24 V)
10		not assigned
11	DO control backing pump	backing pump on (Low: no, High: yes (I_{max} = 50 mA/24 V)
12	AO voltage Vf, Vp, Vi	0 - 10 V DC corresponds to 0 - 100 %; R_L > 10 kΩ
13	DI malfunction acknowledgement	Malfunction acknowledgment, High: V+ pulse (min. 500 ms)
14	DI REMOTE priority	Operation via "REMOTE" interface (Low: off, High: set and takes priority over keyboard or RS-485)
15	Relay 1	Connection with pin 16, if relay 1 active = switching point reached
16		Relay contact 1 (rpm_{max} = 50 V DC; I_{max} = 1 A)
17		Connection with pin 16, if relay 1 inactive = switching point not reached
18	Relay 2	Connection with pin 19, if relay 2 active = no fault
19		Relay contact 2 (rpm_{max} = 50 V DC; I_{max} = 1 A)
20		Connection with pin 19, if relay 2 inactive= fault
21		not assigned
22		not assigned
23		not assigned
24		not assigned
25		not assigned
26	Earth (GND*)	Reference earth for all digital inputs and outputs
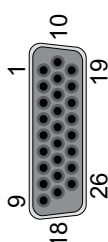
Tbl. 9: **Connection assignment of 26-pin "REMOTE" connection**

4.6.1 Voltage supply

+24 V DC* output/pin 1
A connection with +24 V DC to pin 1 (active high) activates inputs 2 to 6, as well as the connections to pins 13 and 14. Alternatively, they can be activated via an external PLC. "PLC High level" activates and "PLC Low level" deactivates the functions.

4.6.2 Inputs

The digital inputs at the "REMOTE" connection are used to switch various electronic drive unit functions. Inputs DI1 to DI2 are assigned functions in the factory. You can configure them via the RS-485 interface and the Pfeiffer Vacuum parameter set.

DI1 (release venting)/pin 2

V+:   Enable venting (venting as per venting mode)

open: Venting blocked (no venting occurs)

DI motor vacuum pump/pin 3

The turbopump starts up with activation of pin 4 (pumping station) and successful self-testing of the electronic drive unit. The turbopump can be switched off and switched on again during operation with the pumping station still activated. This will not initiate a venting action.

V+:   Turbopump motor on

open: Turbopump motor off

DI pumping station/pin 4

Control of connected pumping station components (e.g. backing pump valve, air cooling) and start-up of the turbopump with simultaneously activated pin 3 (motor). Any pending error messages are reset by eliminating the cause.

V+:   Pumping station on

open: Pumping station off

DI stand-by/pin 5

In stand-by mode, the turbopump operates at a specified rotor speed < nominal rotation speed. The factory setting and recommended operation is 66.7 % of the nominal rotation speed.

V+:   Stand-by activated

open: Stand-by off, operation at nominal rotation speed

DI2 (heating)/pin 6

V+:   Heating on

open: Heating off

DI malfunction acknowledgment/pin 13

V+:   Resetting of pending error messages when cause has been eliminated with a pulse of min. 500 ms duration

open: Inactive

DI remote priority/pin 14

V+:   "REMOTE" connection has control priority over all other digital inputs.
- Change activated individual functions exclusively via "REMOTE"
- Deactivate individual functions via the keyboard or interface

open: "REMOTE" priority inactive

AI rotation speed control mode/pin 7 and pin 26

The analog input serves as a rotation speed setpoint for the turbopump. An input signal of 2 to 10 V between AI+ (pin 7) and GND (pin 26) corresponds to a rotation speed within the range of 20 to 100 % of the nominal rotation speed. If the input is open or signals are below 2 V, the turbopump accelerates to the nominal rotation speed.
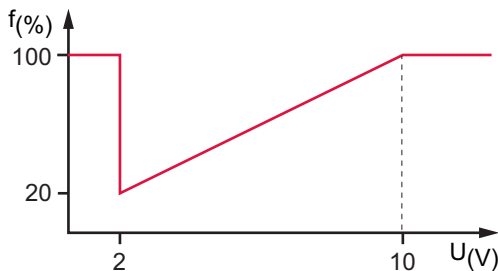

Fig. 7:   Rotation speed control mode pin 7 and pin 26

4.6.3 Outputs

The digital outputs at the "REMOTE" connection have a maximum load limit of 24 V/50 mA per output. All outputs listed below are configurable with the Pfeiffer Vacuum parameter set via the RS-485 interface (description relates to factory settings).

DO1 (rotation speed switch point reached)/pin 8
Active high: After reaching the rotation speed switchpoint. Rotation speed switch point 1 has a factory setting of 80% of the nominal rotation speed. This can be used for a "Ready for operation" message, for example.

DO2 (no error)/pin 9
When the supply voltage has been connected, digital output DO2 permanently outputs 24 V DC, which means "no error". Active low: in case of error (group error message).

AO analog output 0 to 10 V DC/pin 12
You can reduce a speed-proportional voltage (0 to 10 V DC equals 0 to 100% × $f_{nominal}$) at the analog output (load R ≥ 10 kΩ). You can assign either current or power to the analog output via the keyboard or interface.

4.6.4 Relay contacts

Relay 1	Digital output pin 8	Status
Pins 16/15 Contact closed	● High	Rotation speed switchpoint reached
Pins 16/17 Contact closed	● Low	Rotation speed switchpoint not reached or fallen below

Relay 2	Digital output pin 9	Status
Pins 19/18 Contact closed	● High	No error (trouble-free operation)
Pins 19/20 Contact closed	● Low	Error

4.7 Connecting accessories

Installation and operation of accessories

Pfeiffer Vacuum offers a series of special, compatible accessories for its products.

- Information and ordering options for approved accessories for hybrid bearing turbopumps can be found online.

Electronic drive unit TCP 350 accessory connection

The electronic drive unit of the turbopump offers space for the connection of maximum 2 accessory devices. M8, M12 or RJ45 connector sockets with the corresponding designation are available for this purpose.

- The accessory connections have been preconfigured at the factory.
- After connecting pre-configured accessory devices, these are immediately ready for operation according to the factory settings.
- Additional turbopump accessories can be used once the electronic drive unit has been configured.
- The required accessory output is configured via operator keys on the front side, RS-485 interface or a PC.

Connection cable	Accessory connection	Accessories	Current load, max.
	A1 or FAN/HEAT	Air cooling or Heating	$I_{max} \leq 200$ mA
	B1 or VENT	only Venting valve	

Tbl. 10: Connection cable TCP350 – turbopump with variants of the accessory connection

Connecting accessory devices

1. Observe the installation instructions in the operating instructions for the relevant accessory.
2. Use parameter **[P:035]** to configure the existing connections and control cables for the required accessory.
   – Only FAN/HEAT is valid for A1.
3. When connecting a backing pump, use an adapter cable to connect the relay box to the "Remote" output on the electronic drive unit.
4. If sealing gas is required, use a sealing gas throttle instead of a valve.

4.8 Connecting gauges

Measuring tubes	Display [P:738]
APR 250/260	CMRx61
CMR 261/361	CMRx61, following manual selection
CMR 262/362	CMRx62, following manual selection
CMR 263/363	CMRx63, following manual selection
CMR 264/364	CMRx64, following manual selection
CMR 365	CMRx65, following manual selection
PCR 280	TP/PCR
PKR 251/261/360/361	PKR2xx
TPR 270/280/281	TP/PCR

Tbl. 11: Available types of gauges

Procedure

1. As required, connect a gauge to the "**GAUGE**" connection.
2. The corresponding connection cable is available as a Pfeiffer Vacuum accessory.
3. If needed, set parameter [P:738] to change display name of gauge.

4.9 Connecting the electrical supply

> **⚠ DANGER**
>
> **Danger to life from electric shock**
>
> Touching exposed and voltage-bearing elements causes an electric shock. Improper connection of the mains supply leads to the risk of touchable live housing parts. There is a risk to life.
>
> ► Before the installation, check that the connection leads are voltage-free.
> ► Make sure that electrical installations are only carried out by qualified electricians.
> ► Provide adequate grounding for the device.
> ► After connection work, carry out an earthed conductor check.

> **⚠ WARNING**
>
> **Risk of injury due to incorrect installation**
>
> Dangerous situations may arise from unsafe or incorrect installation.
>
> ► Do not carry out your own conversions or modifications on the unit.
> ► Ensure the integration into an Emergency Off safety circuit.

> **⚠ WARNING**
>
> **Risk of danger to life through missing mains disconnection device**
>
> The vacuum pump and electronic drive unit are **not** equipped with a mains disconnection device (mains switch).
>
> ► Install a mains disconnection device according to SEMI-S2.
> ► Install a circuit breaker with an interruption rating of at least 10,000 A.

4.9.1 Grounding unit

Required aids

- Screw M4 × 8
- Shake proof washer M4, if required
- Suitable grounding cable with cable lug size M4
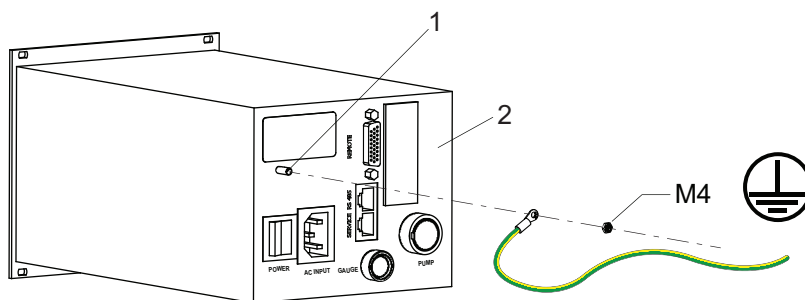

Fig. 8:   Connection of the grounding cable to the TCP 350

1 Ground terminal   2   Rear of housing

- The grounding connection is mandatory for the TCP 350 in order to discharge applicative interferences.
- Alternatively, the TCP 350 is grounded following installation in a rack.

Procedure

1. Use the grounding connection at the rear of the device (M4 stud bolt).
2. Route the connection in accordance with locally applicable provisions.

4.9.2 Connecting to mains power supply

Establishing mains supply

1. Make sure that the "POWER" main switch of the power supply pack is switched off prior to connection.
2. Always ensure a secure connection to the earthed conductor (PE), protection class I.

3. Insert the mains connector cable (not included in the shipment) in the "AC in" power supply plug at the rear side of the device.
4. Secure the connection with the mounting bracket.
5. Connect the mains cable to the mains power supply on the customer-side.

5 Interfaces

5.1 Interface RS-485

> ⚠ **DANGER**
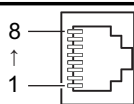>
> **Danger to life from electric shock**
>
> When establishing the voltages that exceed the specified safety extra-low voltage (according to IEC 60449 and VDE 0100), the insulating measures will be destroyed. There is a danger to life from electric shock at the communication interfaces.
>
> ► Connect only suitable devices to the bus system.

The interface with the designation "RS-485" on the electronic drive unit is intended for connecting an external PC. The connections are galvanically safe and are isolated from the maximum supply voltage for the electronic drive unit. The electrical connections are optically decoupled internally.

Designation	Value
Serial interface	RS-485
Baud rate	9600 Baud
Data word length	8 bit
Parity	none (no parity)
Start bits	1
Stop bits	1

Tbl. 12:   Features of the RS-485 interface

	Pin	Assignment
8 —⬚⬚⬚⬚ ↑ 1 —⬚⬚⬚⬚	1	not connected
	2	+24 V output, ≤ 150 mA loading capacity
	3	not connected
	4	not connected
	5	RS-485: D+
	6	GND
	7	RS-485: D-
	8	not connected

Tbl. 13:   Connection assignment of the RS-485 connecting socket RJ-45

Connecting Pfeiffer Vacuum display and control units or a PC

1. Use the respective connection cable from the control unit shipment or from the accessories program.
2. Use the option to connect a PC via the USB/RS-485 converter.

5.2 Cross-linked via the RS-485 connection

> ⚠ **DANGER**
>
> **Danger to life from electric shock**
>
> When establishing the voltages that exceed the specified safety extra-low voltage (according to IEC 60449 and VDE 0100), the insulating measures will be destroyed. There is a danger to life from electric shock at the communication interfaces.
>
> ► Connect only suitable devices to the bus system.

> **ℹ** **Connecting to external bus system**
>
> To connect to an external bus system, the Profibus DP, DeviceNet or Profinet interfaces are possible as an option.
>
> - The field bus option cannot be retrofitted on the standard device.
> - For installed, alternative bus systems, the functionality of the RS-485 interface is limited.
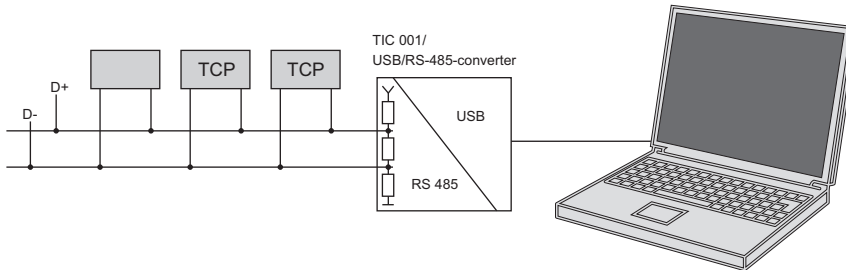

Fig. 9:   **Cross-linking of turbopumps via RS-485 interface**

Connect the peripheral devices

The group address of the electronic drive unit is 988.

1. Install the devices according to the specification for RS-485 interfaces.
2. Connect all devices with RS-485 D+ and RS-485 D- to the bus.
3. Make sure that all devices connected to the bus have different RS-485 device addresses **[P:797]**.

5.3 Pfeiffer Vacuum protocol for RS-485 interface

5.3.1 Telegram frame

The telegram frame of the Pfeiffer Vacuum protocol contains only ASCII code characters [32; 127], the exception being the end character of the telegram C_R. Basically, a master 🖳 (e.g. a PC) sends a telegram, which a slave ◯ (e.g. electronic drive unit or gauge) responds to.

a2	a1	a0	*	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	C_R

a2 – a0	Unit address for slave ◯ • Individual address of the unit ["001";"255"] • Group address "9xx" for all identical units (no response) • Global address "000" for all units on the bus (no response)
*	Action according to telegram description
n2 – n0	Pfeiffer Vacuum parameter numbers
l1 – l0	Data length dn to d0
dn – d0	Data in the respective data type (see chapter "Data types", page 29).
c2 – c0	Checksum (sum of ASCII values of cells a2 to d0) modulo 256
C_R	carriage return (ASCII 13)

5.3.2 Telegram description

Data query 🖳 --> ◯ ?

a2	a1	a0	0	0	n2	n1	n0	0	2	=	?	c2	c1	c0	c_R

Control command 🖳 --> ◯ !

a2	a1	a0	1	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	c_R

Data response / Control command understood ◯ --> 🖳

a2	a1	a0	1	0	n2	n1	n0	l1	l0	dn	...	d0	c2	c1	c0	c_R

Error message ○ --> 🖥

a2	a1	a0	1	0	n2	n1	n0	0	6	N	O	_	D	E	F	c2	c1	c0	c_R
										_	R	A	N	G	E				
										_	L	O	G	I	C				

NO_DEF   Parameter number n2–n0 no longer exists
_RANGE   Data dn–d0 outside the permissible range
_LOGIC   Logical access error

5.3.3 Telegram example 1

Data query
Current rotation speed (parameter **[P:309]**, device address slave: "123")

🖥 --> ○ ?	1	2	3	0	0	3	0	9	0	2	=	?	1	1	2	c_R
ASCII	49	50	51	48	48	51	48	57	48	50	61	63	49	49	50	13

Data response: 633 Hz
Current rotation speed (parameter **[P:309]**, device address Slave: "123")

○ --> 🖥	1	2	3	1	0	3	0	9	0	6	0	0	0	6	3	3	0	3	7	c_R
ASCII	49	50	51	49	48	51	48	57	48	54	48	48	48	54	51	51	48	51	55	13

5.3.4 Telegram example 2

Control command
Switch on the pumping station (parameter **[P:010]**, device address Slave: "042")

🖥 --> ○ !	0	4	2	1	0	0	1	0	0	6	1	1	1	1	1	1	0	2	0	c_R
ASCII	48	52	50	49	48	48	49	48	48	54	49	49	49	49	49	49	48	50	48	13

Control command understood
Switch on the pumping station (parameter **[P:010]**, device address Slave: "042")

○ --> 🖥	0	4	2	1	0	0	1	0	0	6	1	1	1	1	1	1	0	2	0	c_R
ASCII	48	52	50	49	48	48	49	48	48	54	49	49	49	49	49	49	48	50	48	13

5.3.5 Data types

No.	Data type	Description	Length l1 – l0	Example
0	boolean_old	Logical value (false/true)	06	000000 is equivalent to false 111111 is equivalent to true
1	u_integer	Positive whole number	06	000000 to 999999
2	u_real	Positive fixed point number	06	001571 corresponds with 15.71
3	u_expo	Positive exponential number	06	1.2E-2 is equivalent to $1,2 \cdot 10^{-2}$ 005E8 is equivalent to $5 \cdot 10^{8}$
4	string	Any character string with 6 characters. ASCII codes between 32 and 127	06	TC_110, TM_700
6	boolean_new	Logical value (false/true)	01	0 is equivalent to false 1 is equivalent to true
7	u_short_int	Positive whole number	03	000 to 999

No.	Data type	Description	Length I1 – I0	Example
10	u_expo_new	Positive exponential number. The last of both digits are the exponent with a deduction of 20.	06	100023 is equivalent to $1{,}0 \cdot 10^{3}$ 100000 is equivalent to $1{,}0 \cdot 10^{-20}$
11	string16	Any character string with 16 characters. ASCII codes between 32 and 127	16	this-is-an-example
12	string8	Any character string with 8 characters. ASCII codes between 32 and 127	08	Example

6 Parameter set

6.1 General

Important settings and function-related characteristics are factory-programmed into the electronic drive unit as parameters. Each parameter has a three-digit number that can be selected via the keyboard or via the RS-485, externally via the Pfeiffer Vacuum protocol.

The vacuum pump starts in standard mode with factory default pre-set parameters.

> **i** **Non-volatile data storage**
>
> When switching off or in the event of unintentional voltage drop, the **parameters** and the operating hours stay saved in the electronics.

#	Three digit number of the parameter
Display	Display of parameter description
Description	Brief description of the parameters
Functions	Function description of the parameters
Data type	Type of formatting of the parameter for the use with the Pfeiffer Vacuum protocol
Access type	R (read): Read access; W (write): Write access
Unit	Physical unit of the described variable
min. / max.	Permissible limit values for the entry of a value
default	Factory default pre-setting (partially pump-specific)
💾	The parameter can be saved persistently in the electronic drive unit

Tbl. 14: **Explanation and meaning of the parameters**

6.2 Control commands

#	Display	Description	Functions	Data type	Access type	Unit	min.	max.	default	💾
001	Heating	Heating	0 = off 1 = on	0	RW		0	1	0	✔
002	Stand-by	Stand-by	0 = off 1 = on	0	RW		0	1	0	✔
004	RUTimeCtr	Run-up time monitoring	0 = off 1 = on	0	RW		0	1	1	✔
008	Keys lockd	Key lock	0 = off 1 = keys locked	0	RW		0	1	0	
009[1]	ErrorAckn	Malfunction acknowledgement	1 = Malfunction acknowledgement	0	W		1	1		
010	Pump stat.	Pumping station	0 = off 1 = on	0	RW		0	1	0	✔
012	Vent enab	Enable venting	0 = no 1 = yes	0	RW		0	1	0	✔
019	Conf. Out2	Output DO2 configuration	0 = mains "OFF" or fault 1 = mains "OFF" or fault or warning 2 = mains "OFF" or fault or turbopump drive "OFF"	7	RW		0	2	1	✔

---

[1] No text display of the parameter, instead symbol or key operated

#	Display	Description	Functions	Data type	Access type	Unit	min.	max.	de-fault	💾
023	Motor TMP	Motor vacuum pump	0 = off 1 = on	0	RW		0	1	0	✓
025	OpMode BKP	Backup pump operating mode	0 = continuous operation 1 = intermittent operation	7	RW		0	1	0	✓
026	OPMode TMP	Rotation speed setting mode	0 = off, final speed operation 1 = on, rotation speed setting mode	7	RW		0	1	0	✓
027	GasMode	Gas mode	0 = heavy gases 1 = light gases	7	RW		0	1	0	✓
028	Opmode Rem	Operating mode interfaces	0 = no priorities 1 = remote priority, with pin 14 active high	7	RW		0	1	0	✓
030	VentMode	Venting mode	0 = delayed venting 1 = no venting 2 = direct venting	7	RW		0	2	0	✓
035	Conf IO	Accessory output configuration	0 = Heating 2 = Fan	7	RW		0	2	0	✓
055	Conf AO1	Output AO1 configuration	0 = actual rotational speed 1 = output 2 = current	7	RW		0	2	0	✓
095[2]	RstCstVals	Reset to factory settings (relates to actuating instructions and setpoints)	no yes	0	W		-	-	no	✓

Tbl. 15:   Control commands

6.3 Status requests

#	Display	Description	Functions	Data type	Access type	Unit	min.	max.	de-fault	💾
300[3]	↗	Remote priority	0 = no 1 = yes	0	R		0	1		
301	Oil defic	Operating fluid low								
302[4]	↻	Rotation speed switchpoint reached	0 = no 1 = yes	0	R		0	1		
303	Error code	Error code		4	R					
304[5]	🌡	Excess temperature, electronic drive unit	0 = no 1 = yes	0	R		0	1		

---

2)   Reset is only possible via the operator key on the unit

3)   No text display of the parameter, instead symbol or key operated

4)   No text display of the parameter, instead symbol or key operated

5)   No text display of the parameter, instead symbol or key operated, detailed error description via parameter 303

#	Display	Description	Func-tions	Data type	Ac-cess type	Unit	min.	max.	de-fault	💾
305[6]		Vacuum pump excess temperature	0 = no 1 = yes	0	R		0	1		
306[7]		Set rotation speed reached	0 = no 1 = yes	0	R		0	1		
307[8]		Vacuum pump accelerates	0 = no 1 = yes	0	R		0	1		
308	Set rotspd	Set rotation speed (Hz)		1	R	Hz	0	999999		
309	Act rotspd	Actual rotation speed (Hz)		1	R	Hz	0	999999		
310	TMP I-mot	Drive motor current		2	R	A	0	9999.99		
311	TMP Op hrs	Vacuum pump operating hours		1	R	h	0	65535		✓
312	PCS Softw.	Electronic drive unit soft-ware version		4	R					
313	TMP DClink	Drive motor voltage		2	R	V	0	9999.99		
314	Drv Op hrs	Electronic drive unit oper-ating hours		1	R	h	0	65535		✓
315	TMP finspd	Nominal rotation speed (Hz)		1	R	Hz	0	999999		
316	TMP Power	Drive motor output		1	R	W	0	999999		
319	Cycl count	Pump cycles		1	R		0	65535		✓
335	HeatType	Accessory connection as-signment	0 = heat-ing 2 = air cooling	7	R		0	255		✓
340	Pressure	Actual pressure value (Ac-tiveLine)		7	R	hPa	1E-12	1.0E3		
349	Drv Name	Drive type, electronic drive unit		4	R			TCP 350		
352	Drv Softw.	Software version motor control		4	R			999999		
354	HW Version	Hardware version, elec-tronic drive unit		4	R					
360	ErrHist1	Error code history, item 1	last error message	4	R					✓
361	ErrHist2	Error code history, item 2		4	R					✓
362	ErrHist3	Error code history, item 3		4	R					✓
363	ErrHist4	Error code history, item 4		4	R					✓
364	ErrHist5	Error code history, item 5		4	R					✓
365	ErrHist6	Error code history, item 6		4	R					✓
366	ErrHist7	Error code history, item 7		4	R					✓
367	ErrHist8	Error code history, item 8		4	R					✓
368	ErrHist9	Error code history, item 9		4	R					✓
369	ErrHist10	Error code history, item 10		4	R					✓

Tbl. 16:   Status requests

6)   No text display of the parameter, instead symbol or key operated, detailed error description via parameter 303

7)   No text display of the parameter, instead symbol or key operated

8)   No text display of the parameter, instead symbol or key operated

6.4 Reference value inputs

#	Display	Description	Functions	Data type	Ac-cess type	Unit	min.	max.	default	💾
700	RUTimeSVal	Set value run-up time		1	RW	min	1	120	8	✓
701	SpdSwPt1	Rotation speed switch point 1		1	RW	%	50	97	80	✓
707	SpdSVal	Set value in rotation speed setting mode		2	RW	%	20	100	65	✓
710	Swoff BKP	Backup pump switch-off threshold for intermittent operation		1	RW	W	0	1000	0	✓
711	SwOn BKP	Backup pump switch-on threshold for intermittent operation		1	RW	W	0	1000	0	✓
717	StdbySVal	Rotational speed set value in stand-by operation		2	RW	%	20	100	66.7	✓
720	VentSpd	Venting at rotation speed, delayed venting		7	RW	%	40	98	50	✓
721	VentTime	Venting time, delayed venting		1	RW	s	6	3600	3600	✓
738	Gauge type	Type of pressure gauge	noGaug TPR2xx IKR2xx PKR2xx CMRx61 CMRx62 CMRx63	1	RW		0	6	0	✓
777	PumpRotMax	Confirmation of nominal rotational speed		1	RW	Hz	0	2000	777	✓
794	Param. set	Parameter set	0 = Basic pa-rameter set 1 = Extended parameter set	7	RW		0	1	0	
795	Servicelin	Insert service line		7	RW				309	
797	Address	Device address		1	RW		1	255	1	✓

Tbl. 17: Reference value inputs

7 Operation

7.1 Switching on unit

> ⚠ **WARNING**
>
> **Danger to life from electric shock in the event of a fault**
>
> In the event of a fault, devices connected to the mains may be live. There is a danger to life from electric shock when making contact with live components.
>
> ► Always keep the mains connection freely accessible so you can disconnect it at any time.

Switching on power supply

► Switch on the power supply with the mains switch on the rear of the unit.

After switching on, the TCP carries out self-testing for approx. 5 seconds and checks the connected units.

Test	Function
LC-display	All characters in the LC-display are controlled for a short time.
LED	The LEDs have the status of the last switched-on status and do not necessarily light up after switching on.
Identification of the connected devices	• The connected gauge is not detected automatically. The respective selection takes place via parameter **P [738]**.

Tbl. 18: Self-test, internal requests after switching on

What to do in the event error messages appearing after switching on

For initial operation of the electronic drive unit or after changing the connected turbopump, the error message **E777** appears on the display.

1. Remove the cause of the malfunction .
2. Reset error messages where applicable by pressing the ⊕ key.
3. Remove the cause where applicable by selecting the valid nominal rotation speed of the turbopump concerned .
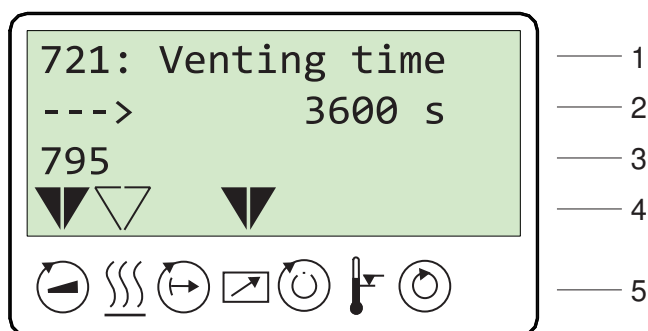
7.2 LC-display

Fig. 10: LC-display, overview

The 4-line LC-display visualizes all functions.

Line number	Function
Line 1	Number and name of the selected parameter (e.g. 721: Vent time).
Line 2	Relevant value for the selected parameter. The arrow ——► indicates Edit mode.

Line number	Function
Line 3	has 2 functions: • Function 1: displays current messages, as well as messages pertaining to operation and control. • Function 2: presentation of a required second parameter in the format [Parameter number: value]. The function for this line can be set via parameter **[P:795] Service-lin** in Line 1. All parameters can be accessed with "Servicelin". Error messages will be displayed independently of the selected function.
Line 4	Presentation of the current equipment status with arrows which indicate the associated symbols.
Line 5	Symbols (see below)

Tbl. 19:   Meaning of functions and layout of the LC-display

7.3   Status symbols

Status symbols under the LC-display visualize the current operating condition of the connected devices relative to essential parameters. Arrow representations in the lower display line provide visual information regarding status of the device.

Symbol	Parameter	Arrow representation	Explanation
	Vacuum pump accelerates = [P:307]	–	NO
		▼	YES
	Preselection Heating = [P:001]	–	No preselection
		▽	Preselection heating, switching point not reached
		▼	Heating On, switching point reached
	Stand-by = [P:002]	–	OFF
		▼	ON
	Equipment remote controlled = [P:300]	–	NO
		▼	YES
	Switching point reached = [P:302]	–	NO
		▼	YES
	Overtemperature	–	No overtemperatures
		▽	Overtemperature vacuum pump = [P:305]
		▼	Overtemperature electronic drive unit = [P:304]
		▼	Overtemperature vacuum pump and electronic drive unit
	Final speed reached = [P:306]	–	NO
		▼	YES

Tbl. 20:   Status symbols and display

7.4   Key functions

Four short-stroke keys (softkeys) make up the user interface.

Key	Parameter | Application	Explanation
⊙	Equivalent to **[010]** = 0 or 1	**Pumping station on/off:** Starts/shuts down all components according to their configuration
◈	⊣⊢ (malfunction symbol)	**Malfunction acknowledgment (reset):** Resets active error messages, provided that the cause has been rectified.
▶	**[308]** --> **[309]**	Scroll forward in parameter set
◀	**[309]** --> **[308]**	Scroll back in parameter set
◀ ▶	Press simultaneously	**Editing mode:** Allows the setting of parameter options The arrow **- - - >** on the display indicates the option selection
	Press again simultaneously	**Selection mode:** Confirms the selection ("change confirmed")

Tbl. 21: Description of key functions on control panel

7.5 Displaying and configuring parameters

Each parameter has a three-digit number and a description. The value of each parameter is always readable. You can select and edit control commands and set value settings.

Function	Actuation	Effect
Select parameter	Select parameter number with key ◀ or ▶	The selected parameter is displayed in line 1, and the associated value in line 2
	Holding the key pressed will allow rapid scrolling	
Set parameters	Press keys ◀ ▶ simultaneously	• Edit mode for the selected parameter is active • An arrow (—▶) is displayed at the beginning of the second line in the LCD
Modify parameter value	Reduce or increase value with key ◀ or ▶, or change option.	
Acknowledge parameter	Press keys ◀ ▶ simultaneously	• Parameter for Line 1 is selected • Line 3 displays: "change confirmed", if no 2nd display value was selected (see [P:795] • Editing mode for the selected parameter is complete; the arrow (—▶) disappears

Tbl. 22: Selecting and editing parameters

Conditions for automatic termination of the Edit mode

- Input disruption or no key operation for more than 10 sec.
- Occurrence of an error
- Press the "ON/OFF" key
- If Line 3 = empty , "data not changed" will be displayed.

7.6 Configuring the connections with the Pfeiffer Vacuum parameter set

The electronic drive unit is pre-configured with the factory default basic functions and is ready for operation. For individual requirements, you can configure most connections for the electronic drive unit with the parameter set.

7.6.1 General

Restoring factory settings

The electronic drive unit is pre-programmed ex factory for operating the turbopump without additional configuration.

► If necessary, restore the factory settings via parameter **[P:095]**.

Checking settings

1. Before operating with parameters, check the set value settings and control commands for their suitability for the process.
2. Remove the remote plug from the electronic drive unit.

Locking and unlocking keyboard

1. Lock the keyboard via parameter **[P:008]** to prevent unwanted operation.
   – All of the keypad input functions are disabled.
   – It is still possible to scroll through the parameter list.
2. Switch off the pump to unlock the keyboard.
   – Wait until the pump has come to a complete standstill.
3. Unlock the keyboard only via the RS-485 interface with parameter **[P:008]**.

7.6.2 Configuring digital output and relay

Meaning of "active" (fault-free):

- For DO2: V+ active high (fault-free)
- For relay 2: Active contact change

Meaning of malfunctions:

- For DO2: low
- For relay 2: inactive

Option	Description
0 = mains off and/or fault	DO2 "low" and relay 2 inactive
1 = mains off and/or fault and/or warning	
2 = mains and/or fault and/or drive off	

Tbl. 23:   Configure parameter [P:019]

7.6.3 Configuring analog output

Option	Description
0 = Rotational speed	Rotation speed signal; 0 - 10 V DC = 0 - 100 % × $f_{Nominal}$
1 = power	Output signal; 0 - 10 V DC = 0 - 100 % × P_{max}
2 = current	Current signal; 0 - 10 V DC = 0 - 100 % × I_{max}

Tbl. 24:   Configure parameter [P:055]

7.6.4 Configuring accessory connection

Option	Description
0 = Heating	Control via heating and speed switch point reached parameters
1 = TMS Heating[9]	Control via TMS switchbox
2 = fan (continuous operation)	Control via pumping station parameters

Tbl. 25:   Configure parameter [P:035]

---

9)   Only when using pumps with a temperature management system (TMS)

7.7 Operating modes

7.7.1 Remote control

Possibilities

- Operation via the TCP 350 keyboard without explicit prioritization of the operating interfaces (standard)
- Remote control via the RS-485 interface
- Control via the switching functions of the "REMOTE" connection
  - Possible to connect several TCPs

Setting standard operation

► Set the parameter **[P:028]** to the value "0".
  - Exception: Pin 14 of "REMOTE" connected with +24 V DC (active high)

Activating "REMOTE" priority

The "REMOTE" connection has priority over all functions of the remaining interfaces.

1. Set the parameter **[P:028]** to the value "1".
2. Pin 14 of "REMOTE" = active high
   - Exception: Error acknowledgment is still possible via the corresponding key

Deactivating "REMOTE" priority

The "REMOTE" connection has no priority over all functions of the remaining interfaces.

1. Set the parameter **[P:028]** to the value "1".
2. Pin 14 of "REMOTE" = active low
   - Exception: Error acknowledgment is not possible via pin 13 as long as pin 14 is set to "active high" again.

7.7.2 Gas type-dependent operation

NOTICE
Turbopump destruction due to gases with too high molecular masses
The pumping of gases with impermissible high molecular masses leads to the destruction of the turbopump. ► Make sure that the gas mode is set correctly by **[P:027]** in the electronic drive unit. ► Consult Pfeiffer Vacuum before you use gases with higher molecular masses (> 80).

High gas throughput and high rotation speed lead to strong friction heating of the rotor. To avoid overheating, power-rotation speed-characteristics are implemented in the electronic drive unit. The power characteristic permits the operation of the turbopump at any rotation speed with the maximum permissible gas throughput without thermally overloading the turbopump. The maximum power consumption depends on the gas type. Two characteristics are available for the parameterization in order to completely exhaust the pump's capacity for each gas type.
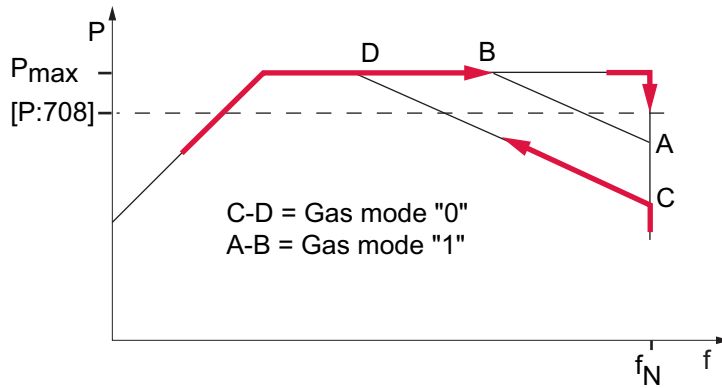
Fig. 11: **Schematic diagram of power characteristics, example of heavy gases [P:027] = 0**

P	Power consumption	f_N	Nominal rotation speed
f	Rotation speed	C-D	Power characteristic in gas mode "0" (gases with molecular mass > 39, e.g. Argon)
P_{max}	Maximum power consumption	A-B	Power characteristic in gas mode "1" (gases with molecular mass ≤ 39)

Setting gas mode

1. Check the current gas mode set with parameter **[P:027]**.
2. Set the parameter **[P:027]** to the required value.
3. If necessary, set a lower frequency in rotation speed setting mode in order to avoid rotation speed fluctuations.

The turbopump runs up with maximum power consumption. When the nominal and/or set rotation speed is reached, the electronic drive unit automatically switches over to the chosen power characteristic of the selected gas mode. The increase in the power consumption initially compensates an increasing gas throughput to keep the rotation speed of the turbopump constant. The turbopump heats up higher due to the increasing gas friction. When the gas-type-dependent maximum power is exceeded, the rotation speed of the turbopump is reduced by the electronic drive unit until a permissible balance between power and gas friction is achieved.

7.7.3 Run-up time

Turbopump run-up is time-monitored in the factory. There are various causes of prolonged run-up times, for example:

- Excessive gas throughput
- Leak in system
- Setpoint of the run-up time too low

Parameterizing run-up time

1. Activate the run-up time monitoring with parameter **[P:004]**.
2. Adjust the run-up time with parameter **[P:700]**.
3. Where applicable, eliminate any external and application-related causes, if there are extended run-up times.

7.7.4 Setting rotation speed switchpoint

You can use the rotation speed switch point for the "Turbopump operational for the process" message. Exceeding or falling below the active rotation speed switch point activates and/or deactivates the status parameter **[P:302]** and the associated remote output:

Signal output at"REMOTE" connection pin 8:

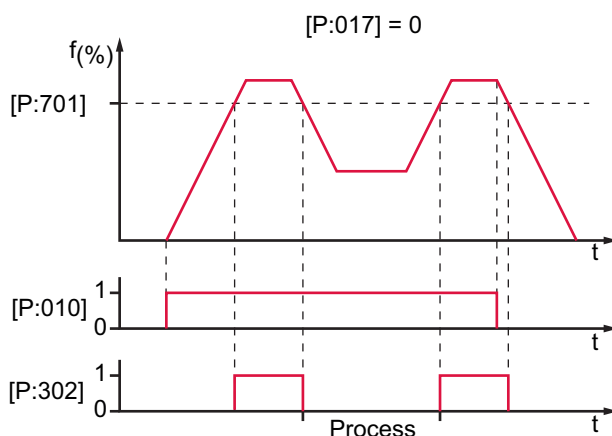- DO1: high
- Relay 1: active (pins 15, 16, 17)

Fig. 12: **Rotation speed switch point active**

Setting rotation speed switchpoint

Signal output and status parameters are based on the set value for rotation speed switchpoint **[P:701]**.

► Set the parameter **[P:701]** to the required value as %.

7.7.5 Rotation speed setting mode

Rotation speed setting mode reduces the speed and hence the throughput of the turbopump. The pumping speed of the turbopump changes proportional to speed. Stand-by mode is ineffective during rotation speed setting mode. The set value in rotation speed setting mode **[P:707]** sets the set rotation speed. The rotation speed switch point varies with the set rotation speed. Falling below or exceeding the set value in rotation speed setting mode activates or deactivates the status signal respectively **[P:306] SetSpdAtt.**

Setting rotation speed setting mode

1. Set the parameter **[P:707]** to the required value in %.
2. Set the parameter **[P:026]** to "1".
3. Check the set rotation speed (parameter **[P:308]**).

7.7.6 Confirming speed specification

The typical nominal rotation speed of a turbopump is preset ex factory in the electronic drive unit. If the electronic drive unit is replaced or a different pump type is used, the set value settings of the nominal rotation speed is cleared. The manual confirmation of the nominal rotation speed is part of a redundant safety system as a measure for preventing excess rotation speed.

Pump type	Confirmation of nominal rotation speed [P:777]
CompactTurbo 071 | 071 P	1500 Hz
CompactTurbo 261/262 P	1000 Hz
CompactTurbo 261 P C	833 Hz
CompactTurbo 521 P	833 Hz
CompactTurbo 521 P C	715 Hz
HiPace 60 P	1500 Hz
HiPace 80	1500 Hz
HiPace 350 | 450	1100 Hz
HiPace 300	1000 Hz
HiPace 400 | 700 | 800	820 Hz

Tbl. 26: **Characteristic nominal rotation speeds of the turbopumps**

Prerequisite

● Knowledge of the configuration and setting of electronic drive unit operating parameters.

Set parameter [P:777]

► Set the parameter **[P:777]** according to the pump type.

Once the nominal rotation speed is reached, the turbopump will run at idle without additional gas throughput. Depending on process or application requirements, the nominal rotation speed can be reduced in rotation speed setting mode or stand-by mode.

7.7.7 Stand-by

Pfeiffer Vacuum recommends stand-by mode for the turbopump during process and production stops. When stand-by mode is active, the electronic drive unit reduces the rotation speed of the turbopump. Stand-by mode is ineffective during rotation speed setting mode. The factory setting for stand-by mode is 66.7% of the nominal rotation speed. Falling below or exceeding the specification in stand-by mode activates or deactivates the status signal respectively **[P:306] SetSpdAtt**.

Setting the related parameters

1. Set the parameter **[P:717]** to the required value in %.
2. Set the parameter **[P:026]** to "0".
3. Set the parameter **[P:002]** to "1".
4. Check the set rotation speed (parameter **[P:308]** or **[P:397]**).

7.7.8 Backing pump operating modes

Operation of a connected backing pump via the electronic drive unit depends on the backing pump type.

Operating mode [P:025]	Recommended backing pump
"0" Continuous operation	All backing pumps
"1" Interval mode	Diaphragm pumps only

Tbl. 27:   Backing pump operating modes

Setting continuous operation

With "pumping station on", the electronic drive unit sends a signal to digital output pin 11 of the accessory connection to switch on the backing pump.

1. Use an adapter cable to connect the relay box control cable to the "REMOTE" connection on the electronic drive unit.
2. Set the parameter **[P:025]** to "0".
3. Use this signal for the control of a fore-vacuum safety valve.

Set interval operation and determine the switching threshold

Interval operation extends the service life of the diaphragm of a connected diaphragm pump. Either a diaphragm pump with a built-in semiconductor relay or an interconnected relay box with a semiconductor relay is required for interval operation. The electronic drive unit switches the backing pump on or off depending on the power consumption of the turbopump. A relationship to the fore-vacuum pressure results from the power consumption. The backing pump operating mode offers adjustable switch-on and switch-off thresholds. Fluctuations in the power consumption of idling turbopumps and varying fore-vacuum pressures of the backing pumps require individual settings of the interval operation.

Pfeiffer Vacuum recommends interval operation between 5 and 10 hPa. A pressure gauge and a dosing valve are required to set the switching thresholds.

1. Set the parameter **[P:025]** to "1".
2. Switch on the vacuum system with the parameter **[P:010]** ("pumping station").
3. Wait for the run-up.
4. Allow the gas to run via the dosing valve and set the fore-vacuum pressure to 10 hPa.
5. Read the drive power at parameter **[P:316]** and note the value.
6. Set the switch-on threshold of the backing pump with parameter **[P:711]** to the determined drive power for a 10 hPa fore-vacuum pressure.
7. Reduce the fore-vacuum pressure to 5 hPa.
8. Read the drive power at parameter **[P:316]** and note the value.
9. Set the switch-off threshold of the backing pump with parameter **[P:710]** to the determined drive power for a 5 hPa fore-vacuum pressure.

7.7.9 Operation with accessories

> **Installation and operation of accessories**
>
> Pfeiffer Vacuum offers a series of special, compatible accessories for its products.
> - Information and ordering options for approved accessories you can find online.
> - The following accessories are not included in the scope of delivery.

Procedure

► Carry out the configuration of the connections via parameter **[P:035]**.
► Query the status via parameter **[P:335]**.

Configuring heating

Activation of the connected housing heater depends on the rotation speed switchpoint via parameter **[P:701]** (factory setting 80% × $f_{nominal}$).

► Switch the heating on or off with parameter **[P:001]**.

Exceeding or dropping below the speed-control switching point controls the operation of the housing heater. The symbol on the LC-display indicates the respective operating status.

Configuring fan

- If air cooling is connected, it is automatically activated by switching on the pumping station via parameter **[P:010]**.

7.7.10 Venting modes

After switching off, the turbopump can be vented with the function "Pumping station". The signal output at the configurable accessory connections "B1" or "VENT" carried out with a fixed set delay time of 6 sec.

Selecting the venting mode

1. Set parameter **[P:012]** to "1".
2. Select the venting mode with parameter **[P:030]** (3 possible modes).

Operating modes

- The operator can choose from three different operating modes.

Delayed venting

1. Configure the beginning and the time for the venting after "pumping station off" depending on the rotation speed of the turbopump.
2. Set parameter **[P:030]** to "0".
3. With parameter **[P:720]**, set the venting speed to the nominal rotation speed in %.
4. With parameter **[P:721]**, set the venting speed in s.

The venting valve opens for the set venting time. In case of a power failure, the venting starts when underrunning the set venting speed. The venting period depends on the residual energy delivered by the turning rotor. The venting process stops, when power is restored.

No venting

In this operating mode, the venting is deactivated.

► Set parameter **[P:030]** to "1".

Direct venting

Venting starts with a delay of 6 sec. after "pumping station off". When the pumping station function is switched back on, the venting valve closes automatically. After a power failure, the venting starts after falling below a fixed specified type-specific rotation speed. When power is restored, the venting process is continued.

► Set parameter **[P:030]** to "2".

7.7.11 Transmitter operation

> **Pressure measurement**
>
> The electronic drive unit offers an approximate accuracy of measurement. For the precise pressure measurement, and in particular for linear transmitters in the lower pressure range, Pfeiffer Vacuum measuring instruments are ideal.

Displaying active transmitters

The unit detects gauge from the same image impedance group.

1. Set the parameter **[P:794]** to "1" (display of extended parameter set).
2. Select the transmitter with parameter **[P:738]**.
3. Specify the exact designation of the transmitter with parameter **[P:738]** as required.

Display example	Meaning
TPR 2xx	Pirani transmitter TPR 280 connected
CMR ?	Transmitter of CMR group connected, exact type not yet specified
noGaug	No pressure gauge connected

Tbl. 28: Examples of displays for the transmitter

Display of actual pressure value

1. Set the parameter **[P:794]** to "1" (display of extended parameter set).
2. Display the current pressure measurement with parameter **[P:340]** (pressure).

Display example	Meaning
——— hPa	No pressure gauge connected
< 5E-4 hPa	Values below measuring range (depending on the device used)
> 1E3 hPa	Measuring range exceeded (depending on the device used)
6.3E-9 hPa	Valid pressure measurement
id fam hPa	Model not yet identified; see [P:340]
Error	Error in the transmitter

Tbl. 29: Examples of displays for the actual pressure value

7.8 Switching on connected vacuum pump

The "pumping station" parameter **[P:010]** comprises operation of the vacuum pump with control of all connected accessory devices (e.g. backing pump).

Procedure

► Set the parameter **[P:023]** to "1".
 – The parameter **[P:023]** switches the motor of the turbopump on.
► Set parameter **[P:010]** to "1" or press the ⏻ key on the front panel.

After successfully completing self-testing, the turbopump starts and all connected accessories start operation according to their configuration.

7.9 Switching off vacuum pump

Procedure

► Set parameter **[P:010]** to "0" or press the ⏻ key to switch off the vacuum pump.

7.10 Operation monitoring

7.10.1 Operating mode display via LED

LEDs on the front panel indicate basic operating statuses.

LED	Symbol	LED status	Display	Meaning
Green		Off	————	without current
		On, flashing		"Pumping station OFF", rotation speed ≤ 60 rpm
		On, inverse flashing		"Pumping station ON", set rotation speed not reached
		On, constant		"Pumping station ON", set rotation speed reached
		On, flashing		"Pumping station OFF", rotation speed > 60 rpm
Red	⌐	Off	————	no error, no warning
		On, flashing		Warning
		On, constant		Error

Tbl. 30:   Behavior and meaning of the LED display

7.10.2 Temperature monitoring

If threshold values are exceeded, output signals from temperature sensors bring the turbopump to a safe condition. Depending on the type, temperature thresholds for warning and error messages are immutably stored in the electronic drive unit. For information purposes, various status requests are set up in the parameter set.

- In order to avoid switching off the turbopump, the electronic drive unit already reduces the power consumption in case of exceeding the warning threshold for excess temperature.
  - Examples are an impermissible motor temperature, or impermissibly high housing temperature.
- Further reduction of drive power and thus decreasing speed can potentially lead to underrun the rotation speed switchpoint. The turbopump switches off.
- Exceeding the temperature threshold for error messages switches off the turbopump immediately.

7.11 Switching off unit

Procedure

1. Switch off the power supply with the "POWER" mains switch on the rear of the unit.
2. Disconnect the power supply pack from the mains to disconnect the current supply completely.

8 Maintenance

> **⚠ WARNING**
>
> **Danger to life from electric shock during maintenance and service work**
>
> The device is only completely de-energized when the mains plug has been disconnected and the vacuum pump is at a standstill. There is a danger to life from electric shock when making contact with live components.
>
> - ► Before performing all work, switch off the main switch.
> - ► Wait until the vacuum pump comes to a standstill (rotation speed =0).
> - ► Disconnect all connection cables.
> - ► Remove the mains plug from the device.
> - ► Secure the device against unintentional restarting.

The display and control unit cannot be repaired. In the event of a defect, replace the entire device with a replacement part.

9 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.

> ℹ️ **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.

> ℹ️ **Environmental protection**
>
> The product and its components **must be disposed of in accordance with the applicable regulations relating to environmental protection and human health**, with a view to reducing natural resource wastage and preventing pollution.

9.1 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

9.2 Dispose of electronic drive unit

Electronic components and their housings contain material that must be recycled.

► Dispose of electronic components in a safe manner according to locally applicable regulations.

10 Malfunctions

10.1 General

> **⚠ WARNING**
>
> **Risk of injury from parts moving after a power failure or troubleshooting**
>
> The "pumping station" function of the electronic drive unit will remain active after a power failure or if errors occur that shut down the vacuum pump or the system. When power is restored or after acknowledging a fault, the vacuum pump runs up automatically. There is a risk of injury to fingers and hands if they enter the operating range of rotating parts.
>
> ► Always keep the mains connection freely accessible so you can disconnect it at any time.
> ► Remove present mating plugs or bridges from the electronic drive unit possibly before the mains power returns, as these can cause an automatic run-up.
> ► Switch the pump off using the "Pumping station" function (parameter **[P:010]**).

Malfunctions of turbopump and electronic drive unit always result in a warning or error messages. In both cases, you receive an error code that you can read out via the interfaces of the electronic drive unit. Generally, the LEDs on the electronic drive unit show the operating messages. If an error occurs, the turbo pump and connected devices switch off. The selected venting mode starts after a preset delay.

10.2 Error codes

Errors (** Error E—— **) always cause the connected peripheral devices to be switched off.

Warnings (* Warning F —— *) do not cause components to be switched off.

Handling malfunction messages

1. Read out error codes via Pfeiffer display and control units or a PC.
2. Remove the cause of the malfunction.
3. Reset the malfunction message with parameter **[P:009]**.
   − Use preconfigured quick keys with the symbol ⬧ or display tiles on Pfeiffer Vacuum display and control units.

Error code	Problem	Possible causes	Remedy
Err001	Excess rotation speed	● Device defective	● Contact <u>Pfeiffer Vacuum Service</u> ● Only acknowledge for rotational speed f = 0
Err002	Excess voltage	● Incorrect mains input voltage	● Check the mains input voltage ● Only acknowledge for rotational speed f = 0 ● Contact Pfeiffer Vacuum Service
Err006	Run-up error	● Run-up time threshold set too low ● Gas flow in recipients through leaks or open valves ● Still below speed-control switch point run-up time expires	● Adjust run-up time to process conditions ● Check vacuum chambers for leaks and closed valves ● Check the fore-vacuum connection ● Adjust rotation speed switch point
Err007	Operating fluid low	● Operating fluid low	● Check operating fluid ● Acknowledge only at rotation speed f = 0, and max. five times ● Contact Pfeiffer Vacuum Service
Err015	Group error	● Device defective	● Switch the electronic drive unit on/off ● Contact Pfeiffer Vacuum Service
Err021	Electronic drive unit does not detect turbopump	● Incorrect image impedance ● Device defective	● Check the connections ● Contact Pfeiffer Vacuum Service ● Only acknowledge for rotational speed f = 0
Err037	Defective motor end stage or control		● Contact Pfeiffer Vacuum Service

Error code	Problem	Possible causes	Remedy
Err040	Defective storage expansion		● Contact Pfeiffer Vacuum Service
Err043	Storage of parameter values defective	● Internal configuration error	● Contact Pfeiffer Vacuum Service
Err044	Excess temperature, electronics	● Insufficient cooling	● Improve the cooling ● Check the operating conditions
Err045	Excess temperature, motor	● Temperature fuse, motor, as insufficient cooling ● Starting time in lower rotation speed range (up to 90 Hz) >6 min	● Improve the cooling ● Check the operating conditions ● Check the fore-vacuum connection 　— Carry out leak detection 　— Reduce the fore-vacuum pressure where applicable
Err098	Internal communication error	● External faults ● Device defective	● Contact Pfeiffer Vacuum Service
Err621	Electronic drive unit does not detect the turbopump	● Turbopump is not connected correctly ● Incorrect image impedance	● Check the connections ● Contact Pfeiffer Vacuum Service ● Only acknowledge for rotational speed f = 0
Err699	Error in the drive of the TCP		● Contact Pfeiffer Vacuum Service
Err777	Nominal rotation speed not confirmed	● Nominal rotation speed not confirmed after replacing the electronic drive unit	● Confirm the nominal rotation speed with [P:777] ● Only acknowledge for rotational speed f = 0

Tbl. 31:   Error messages of the electronic drive unit

Error code	Problem	Possible causes	Remedy
Wrn007	Undervoltage or power failure	● Mains failure	● Check the mains input voltage
Wrn046	Data channel disrupted	● Communication to parameter value storage disrupted	● Contact Pfeiffer Vacuum Service
Wrn110	Gauge warning	● Gauge is defective ● Supply cable has no contact	● Restart the electronic drive unit – with intact electrical connection ● Replace the gauge if necessary ● Check the parameterization of the gauge

Tbl. 32:   Warning messages of the electronic drive unit

11 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 Pfeiffer Vacuum Service 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:**
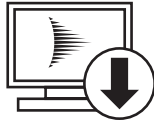
1. Download the up-to-date form templates.
   – Explanations of service requests
   – Service requests
   – Contamination declaration

   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.
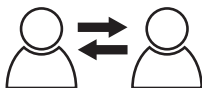
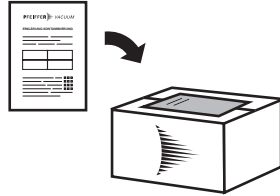4. You will receive an acknowledgment from Pfeiffer Vacuum.

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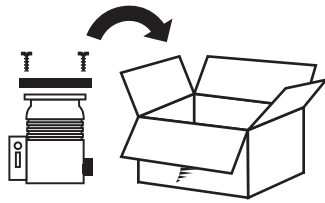
5. Prepare the product for transport in accordance with the provisions in the contamination declaration.
a) Neutralize the product with nitrogen or dry air.
b) Seal all openings with blind flanges, so that they are airtight.
c) Shrink-wrap the product in suitable protective foil.
d) Package the product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

6. Attach the contamination declaration to the **outside** of the packaging.
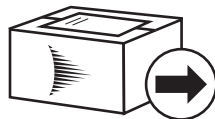
7. Now send your product to your local Service Center.
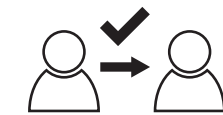
8. You will receive an acknowledgment/quotation, from Pfeiffer Vacuum.

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

12 Accessories

ℹ️ Please refer to the accessories list for the individual components in their respective operating manual or online at pfeiffer-vacuum.de.

12.1 Ordering accessories

Description	Order number
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	P 4564 309 ZE
Mains cable 208 V AC, NEMA 6-15 to C13, 3 m	P 4564 309 ZF
Connection cable from TCP 350 to HiPace with 2 accessory ports M8, 3 m	PM 061 353 -T
Connection cable from TCP 350 to HiPace with 2 accessory ports M12, 3 m	PM 061 356 -T
Adapter cable, TCP 350 - backing pump relay box, M8	PM 061 376 -T
Adapter cable, TCP 350 - backing pump relay box, M12	PM 061 377 -T

Tbl. 33: **Accessories**

13 Technical data and dimensions

13.1 Technical data

Selection field	TCP 350, drive electronics
Part number	PM C01 740
Input voltage(s)	115 / 230 V AC (-20/+15 %), 50/60 Hz
Input voltage 50 Hz	115 / 230 V
Input voltage 60 Hz	115 / 230 V
Input voltage: tolerance	-20/+15 %
Input voltage: frequencies	50/60 Hz
Power consumption max.	420 VA
Overvoltage category	Category II
Output voltage	0 – 72 V
Output current	6.5 A
I/O interfaces	RS-485
Cable length Turbo-TCP max.	110 m
Protection degree	IP20
Ambient temperature	5 – 40 °C
Weight	2.8 kg

Tbl. 34:   TCP 350

13.2 Dimension drawings
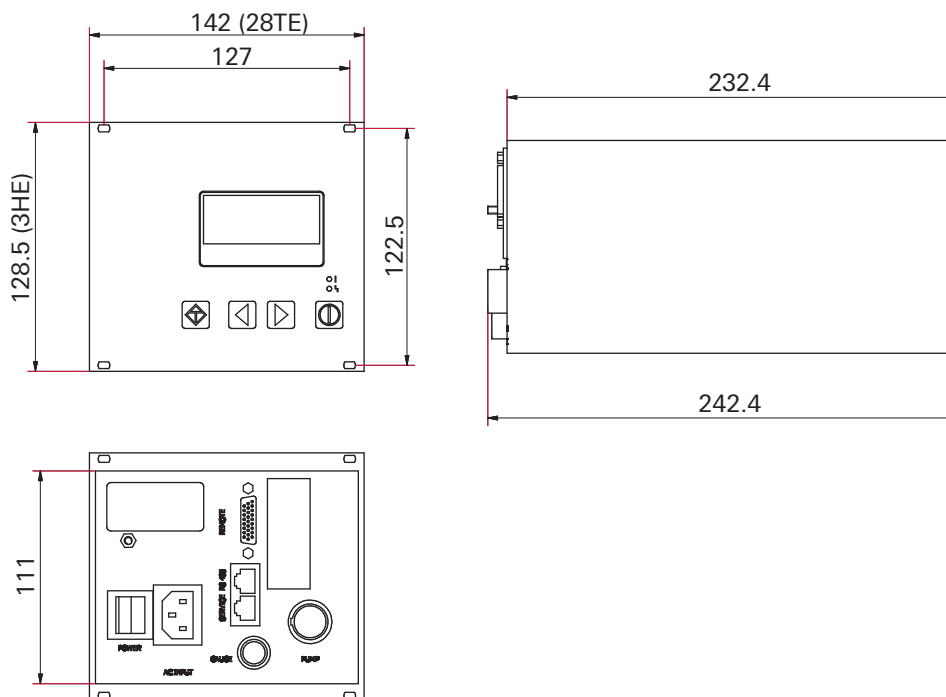
All dimensions in mm

Fig. 13:   Dimensions TCP 350

Declaration of conformity

Declaration for product(s) of the type:

Display Control Unit
TCP 350

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

Electromagnetic compatibility 2014/30/EU
Low voltage 2014/35/EC
Restriction of the use of certain hazardous substances 2011/65/EU
Restriction of the use of certain hazardous substances, delegated directive 2015/863/EU

Harmonized standards and applied national standards and specifications:
DIN EN 61000-3-2: 2014
DIN EN 61000-3-3: 2013
DIN EN 61010-1: 2011
DIN EN 61326-1: 2013
DIN EN 62061: 2013
DIN EN IEC 63000: 2019
Semi F47-0200
Semi S2-0706

Signature:

(Daniel Sälzer)
Managing Director

Pfeiffer Vacuum GmbH
Berliner Straße 43
35614 Asslar
Germany

Asslar, 2020-11-19

CE

PFEIFFER *VACUUM*

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

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Pfeiffer Vacuum GmbH
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