

## *Electronic Drive Unit*



## *TCP 3000*

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We reserve the right to make alterations.

**Please note:** Up-to-date operating instructions are also available from [www.pfeiffer-vacuum.net](http://www.pfeiffer-vacuum.net), "Infoservice".

# 1. Important Notes for Your Safety

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- ☞ Read and follow up all information given in these instructions.
- ☞ Inform yourself about:
  - Hazards caused by the unit.
  - Hazards caused by your system.
- ☞ Note the safety and accident prevention regulations.
- ☞ Regularly check compliance with all safety measures.
- ☞ Install the TCP 3000 while maintaining the specified ambient conditions.
- ☞ System of protection is IP 20. The unit is protected against being penetrated by foreign objects exceeding a diameter of 12 mm. There is no protection against entering water, for this reason the unit must be installed in a suitable case (see Chapter 3 – Installation).
- ☞ Never convert or modify the unit on your own.
- ☞ During operation or in the event of a fault condition never disconnect any cables connected at the TCP.
- ☞ After a mains power failure and after mains power returns, the pump will start up automatically.
- ☞ Make sure that the insulation of the cables is undamaged.
- ☞ Never remove the cover of the casing while mains power is applied or while the pump is running.
- ☞ Note the voltage specifications when connecting the cables to the various plugs.
- ☞ Make sure that the cables are laid correctly so that the possibility of damaging the cables can be excluded. Never lay cables over sharp edges or across hot surfaces.
- ☞ Always operate the unit within the specified voltage range (see also Chapter 3.4).
- ☞ The unit must not be operated as a bench top unit without the covers in place.
- ☞ Via the mains connection a reliable connection to the ground wire (PE) must be ensured (German Protection Class 1).
- ☞ Protect the unit against being thermally overloaded.
- ☞ Never disconnect any connectors at the unit or at the turbomolecular pump while running or before the pump has stopped completely.
- ☞ When returning the unit, note our shipping information first (Chapter 9).

## Piktogramm-Definition



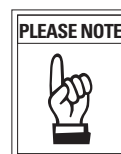
Risk of suffering an electric shock.



Risk of suffering injury.



Risk of damaging the unit or the system.






Important information on the product, its usage or part of the documentation which requires particular attention.

## 2. Getting to Know Your TCP 3000

### 2.1. For Your Assistance

#### Icons used

The following icons are used throughout all the figures of this document:

-  Fore vakuumflange
-  Vent connection
-  Electrical connection

#### Item numbers

The item numbers are the same for all accessory items in all figures.

#### Work instructions in the text

➔ Here you need to do something.

#### Abbreviations used

TMP	Turbomolecular Pump
TPH	Turbomolekular Pump for High Vacuum
TPU	Turbomolekular Pump for Ultra High Vacuum
TCP	Controller Turbomolecular Pump (Electronic Drive Unit)

#### Text explanations (example)

[P:701] = selectable parameter number

«Param. Set» = Parameter designation

### 2.2. Product Description

The TCP 3000 electronic drive unit serves the purpose of driving and monitoring PFEIFFER-VACUUM turbomolecular pumps.

#### Scope of Delivery

The following items are delivered:

- TCP 3000
- Mating plug “Mains”
- Mating plug for the “Remote” socket

The TCP electronic drive unit is composed of the following functional units:

- Electronic drive system monitoring and control
- Illuminated LC display providing information on the operational status of the turbomolecular pump
- Parameter selection and setup
- RS 232/485 serial interface
- Remote control

#### Connection Options

The TCP 3000 electronic drive unit offers the following connection options:

- Remote control (“Remote”)
- Master computer via RS 485/RS 232 serial interface
- Turbomolecular pump (“Pump”)

#### Proper Use

- The TCP 3000 electronic drive unit must be used only in connection with turbomolecular pumps TMH/TMU 2303 from PFEIFFER-VACUUM.
- The operating unit consisting of TCP and turbomolecular pump must be operated in connection with a backing pump.
- Compliance with installation, commissioning, operating and maintenance instructions must be ensured.

#### Improper Use

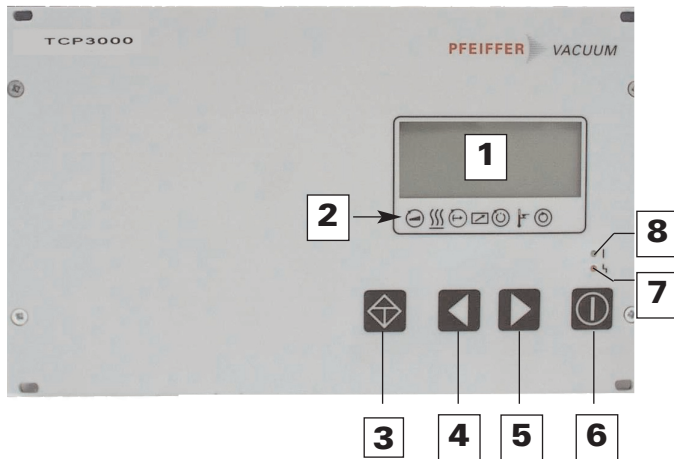
Any of the following is considered as improper usage:

- The use for purposes, other than those detailed above, in particular:
  - connection of the drive unit to pumps and instrumentation not specified for being operated by the drive unit;
  - connection to instrumentation with components carrying voltages which are not touch protected.

Any improper usage will void your liability and warranty rights.

### 2.3. Description of the Front Pane

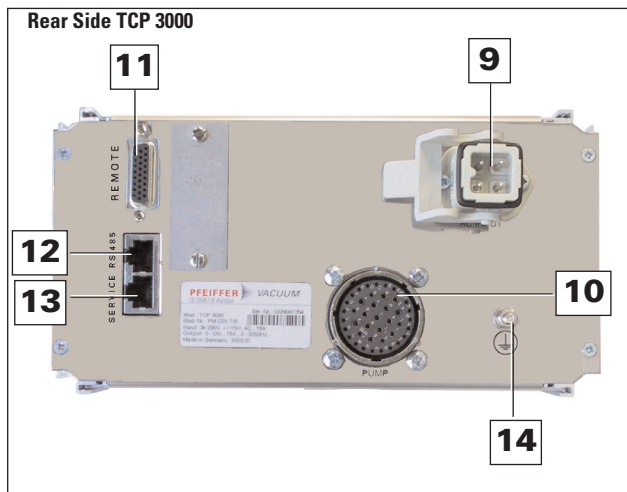
All controls and display components are located on the front panel.



- 1 LC display, illuminated
- 2 Status display
- 3 Key "Acknowledge"
- 4 Parameter selection key "go back"
- 5 Parameter selection key "advance"
- 6 Key "Pump system ON/OFF"
- 7 Red light emitting diode for error status
- 8 Green light emitting diode for operational status

### 2.4. Description of the Rear Side

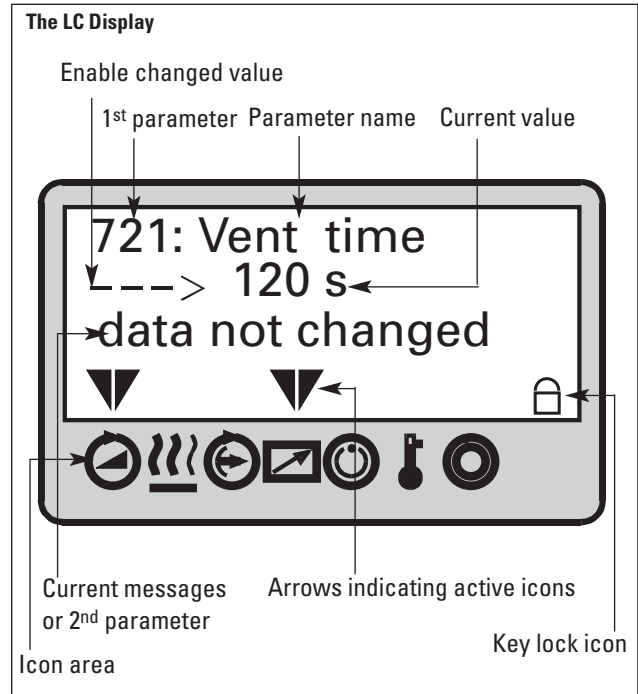
Located on the rear are the connectors for the various connections as well as the mains switch.



- 9 Mains connection (185-265 V AC), (AC INPUT)
- 10 Connector Turbopump (PUMP)
- 11 Connector remote control (REMOTE)
- 12 Connector RS 485 interface
- 13 Connector RS 232 service interface (SERVICE)
- 14 Ground terminal PE

### 2.5. General Description of the Unit

The electronics of the TCP 3000 electronic drive unit provides for a number of monitoring and control options for turbomolecular pumps and for the pumping process. The drive unit may be operated either through keyboard, serial interface or remote control unit.



Through the LC display, various operating modes can be displayed. The way in which the vacuum components operate is controlled through parameters, i.e. through certain combinations of numbers to which a function has been assigned. The parameters which may be selected are detailed in the parameter overviews of Chapter 5.2 and 5.3.

#### Parameter Sets

The parameters can be invoked from two different parameter sets (see also the descriptions in Chapter 5.1):

- Basic parameter set
- Expanded parameter set

#### Parameter Types

There are three types of parameters:

- Adjustment commands
- Status queries
- Setpoint presets

The factory default settings may either be retained, or under "Adjustment commands" and "Setpoint presets" the user may enter his own settings. When wanting to enter presets or change operating modes, the information given in Chapter 6 "Operation" must be noted.

Operation via remote control is detailed in Chapter 6.9, Operation involving the interface is detailed in Chapter 6.11.

# 3. Installation

## 3.1. Before Installing the Unit

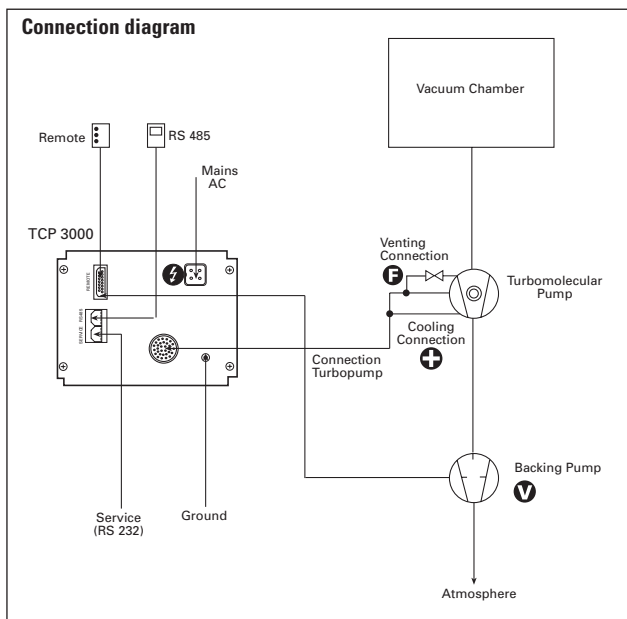


Never convert or modify the unit on your own. The unit must be installed in a suitable case in line with the ambient conditions encountered (see Chapter 10 "Specifications").

Electrical wiring diagram: see Chapter 11.

- ➔ During all installation work make sure that the mains plug has been disconnected and that it is not reconnected inadvertently.

## 3.2. Connection Diagram



- ➔ Install the TCP 350 unit while maintaining the following ambient conditions:

<b>Location:</b>	weather protected (indoor).
<b>Temperature:</b>	+5 °C to +40 °C.
<b>Rel. humidity of the air:</b>	80 % at T ≤ 31 °C up to 50% at T ≤ 40 °C
<b>Atmospheric pressure:</b>	77 kPa to 106 kPa
<b>Installation height:</b>	2000 m max.
<b>Pollution level:</b>	2
<b>Excess voltage class:</b>	II
<b>Connection voltage:</b>	185 ... 253 V/AC (3-Phasen) 207 ... 253 V/AC (1-Phasen)

## 3.3. Rack Mounting

To install the unit in a 19-in. rack enclosure, insert the unit as required into a 19-in. 3 HU mounting frame and then affix the mounting frame.

The ambient temperature within the rack must not exceed +40 °C.

The unit must be installed in an enclosure which complies with the required type of protection in each case.

### Cooling/Air Circulation

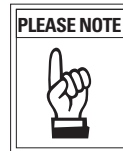
The drive electronics of the TCP 3000 generates heat at an amount equivalent. To dissipate this heat, you must ensure that air can circulate freely around the unit.

## 3.4. Mains Connection



Electrical connections must be carried out in accordance with local regulations. Voltage and frequency values on the PDC 3000 rating plate must concur with mains voltage and mains frequency values.

- Cable socket for power supply connection is included in the delivery.



### Single phase operation:

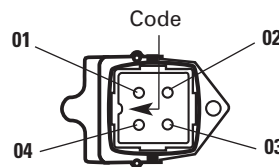
A factory setting protects the mains connector and the internal cable for overloading.

**Three phases operation:** cancel the overload protection with [P:029] (please refer to section 5.2.).

Connection: 4 pole cable plug

Identification: Phases: L1, L2, L3 (black) and protective earth; PE (yellow/green)

Pin configuration mains connection (Power supply)



### 1 phase, 207 ... 253 V/AC

- 01 Neutral line
- 02 Mains connection, phase L1
- 03 not connected
- 04 PE (protective earth)

### 3 phases, 185 ... 253 V/AC

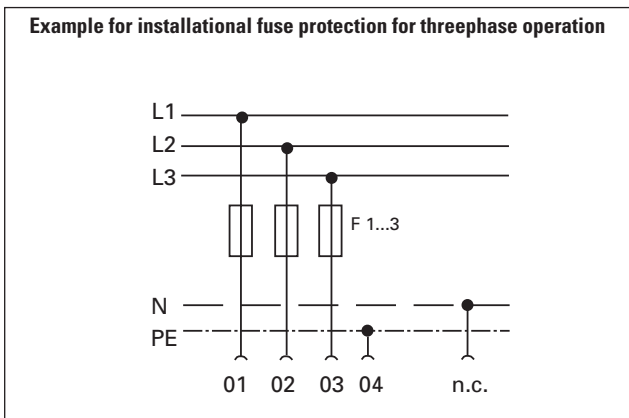
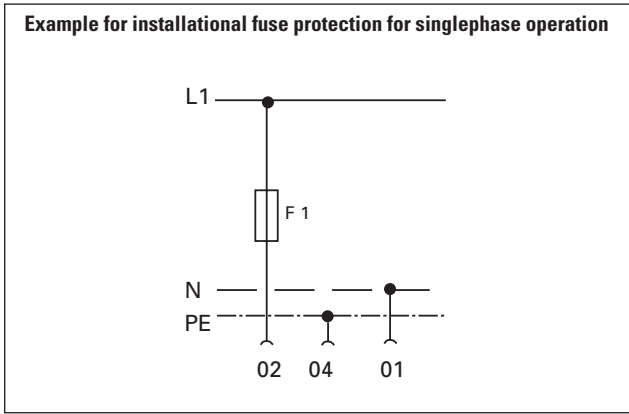
- 1 Mains connection, phase L1
- 2 Mains connection, phase L2
- 3 Mains connection, phase L3
- 4 PE (protective earth)

### 3.5. Installational Fuse Protection



The installational fuse protection must be carried out in accordance with local regulations.  
 ➔ Use a time-lag fuse according to the maximum current consumption of 22 A for the single phase operation, 10 A for 3 phases operation.

➔ Install constructional protection fuse.



### 3.6. Connecting the Turbo Pump

- ➔ Connect the turbopump using the connecting cable (52) to the socket marked PUMP on the TCP 3000.
- ➔ Lock the bayonet catch (51, 53) after plugging in.
- ➔ Connect Cooling water regulating valve to X9 if necessary.



At the open electrical connection you must expect voltages up to 240 V rms while the pump is still running down.  
 Risk of suffering an electric shock when touching the contacts.

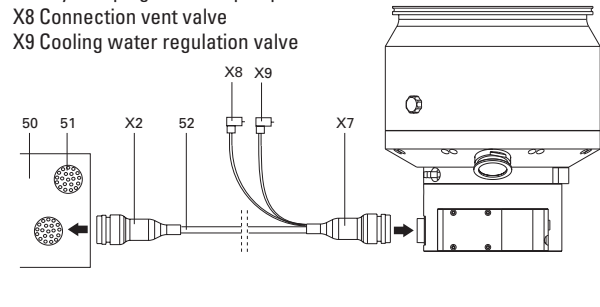
To connect the pump only use connecting cables from PFEIFFER-VACUUM.



Disconnect the connector at the drive electronics only after the pump has stopped completely and after the unit has been disconnected from the mains power.

#### Connecting the turbopump

- 50 TCP 3000 electronic drive unit
- 51 Bayonet plug --> TCP 3000
- 52 Connecting cable TMP-TCP
- 53 Bayonet plug --> Turbopump
- X8 Connection vent valve
- X9 Cooling water regulation valve



### 3.7. Connecting the Vent Valve

The vent valve (accessory) is used to vent the pump when shutting the pump down or in the event of a power failure. The vent mode is selectable through the front panel controls or the RS 485 interface.

- ➔ Install the vent valve at the turbopump in accordance with the operating instructions (see "Supplementary Information, Chapter 13").
- ➔ Connect the control cable of the vent valve to the control cable "Vent" X8 of the pump cable.

### 3.8. Connecting the Remote Control

Remote control options are accessible for various functions via the "REMOTE" connection on the TM 3000 using a 26-pin D-Sub (high density). A screened cable should be used. The screen should be placed on the plug housing.

A distinction is made between digital and analog inputs and outputs.

#### Digital Inputs

Inputs adjusted to the level of SPS controls  
 Logic 0 = Function OFF ⇒ level (-33 V to +7 V)  
 Logic 1 = Function ON ⇒ level (+13 V to +33 V)

#### Digital Outputs

Potential-free relay contacts or active outputs (see following "Plug Arrangement REMOTE" table)

#### Analog Inputs and Outputs

(See following "Plug Arrangement REMOTE" table).

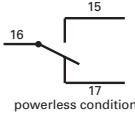
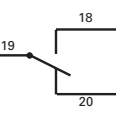
#### Pin Arrangement and Remote Plug Function

(See following "Plug Arrangement REMOTE" table)

The active outputs deliver a signal of between 0 and 24 VDC and can handle current loads ≤ 50 mA.

An external relay can be connected to the active switching outputs 1/2 between Pin 8 ■ Pin 26 and Pin 9 ■ Pin 26. Pin 26 is the complete mass GND\* (see following "Plug Arrangement REMOTE" table).

## Plug Arrangement REMOTE

Pin	Description/Explanation	Function	Type
1	+ 24 VDC	Reference voltage for all remote inputs and outputs (potential free)	-
2	Venting release ON/OFF	Release "vent pump" The pump is vented according to the "Vent mode P030" setting	Digital input (static signal)
3	Motor TMP ON/OFF	Switches the turbo pump drive on (is only switched on if the function "pumping station P010" is also ON)	Digital input (static signal)
4	Pumping station ON/OFF	Switches on pumping station (rotor lifted from its rest position. When [P:023] "Motor TMP" is set to ON, the rotor accelerates.)	Digital input (static signal)
5	Standby rotation speed ON/OFF	Rotor speed is limited to n% as per [P:717] (factory setting 66%)	Digital input (static signal)
6	n.c.		
7	Rotation speed preset 0-10 VDC	Rotation speed preset value in the range of 20-100% of the "nominal rotation speed"[P:315]	Analog voltage input 2-10 VDC; 0-2 V=f <sub>nom</sub>
8	Switching output 1 (Switch point)	Function configurable with «024:Conf. Out1»; factory setting [P:701] "rotation speed switch point" exceeded	Active digital output (I <sub>max</sub> = 50 mA/24 V)
9	Switching output 2 (error)	Function configurable with «019:Conf.Out2»; factory setting "error output 24 V = no error"	Active digital output (I <sub>max</sub> = 50 mA/24 V)
10	n.c.		
11	Backing pump control	24 V = Backing pump on	Active digital output (I <sub>max</sub> = 50 mA/24 V)
12	Uf/Ui/Up voltage output	Output voltage 0-10 VDC proportional; Rotor speed, motor current or drive power configurable with «055: Conf A01»	Analog voltage output 0-10 VDC / R <sub>L</sub> > 10 kΩ
13	Malfunction acknowledgment	Deleting an error message	Digital input (pulse)
14	Remote priority ON/OFF	Remote functions have priority over operation via RS 485. Must be activated with parameter [P:028]	Digital input (static signal)
15	Relay contact switch point	Pin 15 and 16 connected when the rotor speed is above switch point	Relay contact U <sub>max</sub> = 50 VDC
16	Relay contact Switch point		I <sub>max</sub> = 1 A
17	Relay contact Switch point		
18	Relay contact Error	Pin 18 and 19 connected if there is no error	Relay contact U <sub>max</sub> = 50 VDC
19	Relay contact Error		I <sub>max</sub> = 1 A
20	Relay contact Error		
21	n.c.		
22	n.c.		
23	n.c.		
24	n.c.		
25	n.c.		
26	GND*	Ground potential for all remote inputs and outputs	

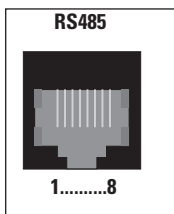
### 3.9. Connecting the RS 485 Interface

Interfacing is provided by means of an RJ45 plug (modular plug) at the socket "RS 485" on the rear of the unit.

#### Physical Link

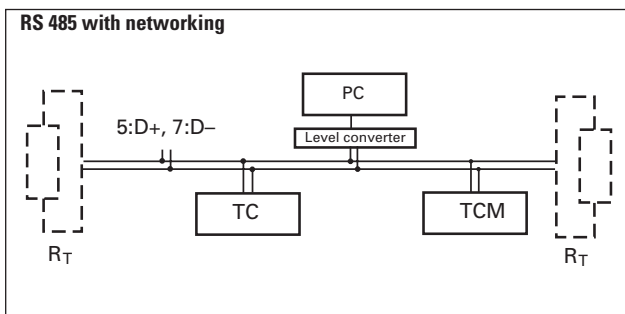
Designation	Value
Type of interface:	RS 485
Baud rate:	9600 baud
Data word length:	8 bit
Parity:	no parity
Start bits:	1
Stop bits:	1..2

#### "RS 485" pinout



PIN	Assignment
1	not connected
2	+24 V* DC (load current < 150 mA)
3	not connected
4	not connected
5	RS 485: D+ (DO / RI)
6	gnd*
7	RS 485: D- (D $\bar{O}$ / R $\bar{I}$ )
8	not connected

A RS 485 bus is arranged as depicted in the figure below, for example. By means of standard modular connectors, cables and branch-offs the signals are looped through from one unit to the next.



#### Connection to a fixed bus system

➔ Connect all units with D+ (pin 5) and D- (pin7) to the bus.

The bus must be terminated at both ends with RT.

#### Networking of several units

➔ Loop the bus through with the aid of a tee piece.

The bus must be terminated at both ends with RT.

All units connected to the bus must be set to a different interface address [P:797].



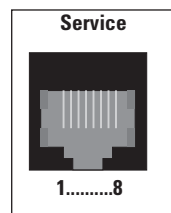
Only extra-low voltages may be connected to the RS 485 interface.

### 3.10. Connecting the RS 232 Interface

Interfacing is provided by means of an RJ45 plug (modular plug) at the socket "SERVICE" on the rear of the unit.

Designation	Value
Type of interface:	RS 232
Baud rate:	9600 baud
Data word length:	8 bit
Parity:	no parity
Start bits:	1
Stop bits:	1..2

#### Physical Link



#### "Service" pinout







Pin	Assignment
1	reserved <sup>1)</sup>
2	reserved <sup>1)</sup>
3	RS 232 RxD
4	RS 232 TxD
5	reserved <sup>1)</sup>
6	Gnd
7	reserved <sup>1)</sup>
8	reserved <sup>1)</sup>

<sup>1)</sup> **Caution!** No connections may be run to these pins. They are only used by PFEIFFER VACUUM Service!

## 4. Operating And Display Elements

### 4.1. Operating Elements

The four push-buttons on the front panel have the following functions:

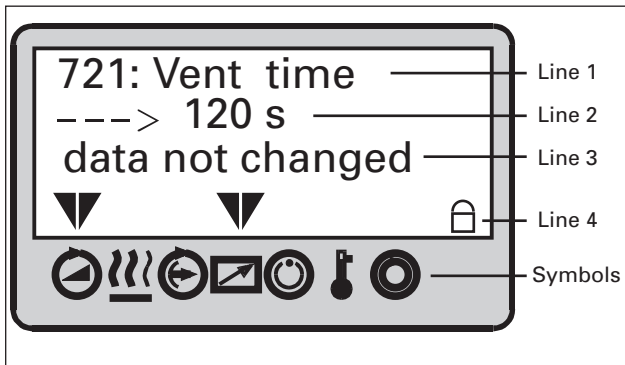
Push-Button	Application/Example	Explanation
		<b>Reset</b> (malfunction acknowledgement) acknowledges malfunctions (red LED illuminates)
	↶309: Act rotspd ↶310: TMP I-Mot	<b>Scroll Parameters Backwards</b> scrolls a parameter backwards
	→	↷50% ↷ 49%
	↷310: TMP I-Mot ↷311: TMP Op hrs	<b>Scroll Parameters Forwards</b> scrolls a parameter forwards
	→	49% ↶ 50% ↶ ...
	001: Heating off	<b>Alters Values</b> (⇒data editing mode) access to a displayed value, if possible (arrow "→" appears)
	simultaneous-ly →	001: Heating off ✓
	010: Pump stat. on ⇔ off	<b>Pumping Station ON/OFF</b> switches the pumping station ON or OFF, corresponding to Parameter 010: "Pump stat."

The following should also be noted:

- The data editing mode (arrow "→" is displayed) is automatically exited under the following conditions, without taking over the possible altered value:
  - if no push-button is depressed for approximately 10 seconds.
  - an error occurs.

## 4.2. Display Elements

### LC Display



The display of the functions is shown via a four line LC display. In normal operations a specific function is assigned to each line:

- **Line 1:** Number and name of the selected parameter (e.g. «721: Vent time»).
- **Line 2:** relevant value. In the data editing mode [P:795] an arrow (--->) is displayed left. The value can now be altered.
- **Line 3:** With two functions,  
**Function 1:** Actual messages which refer to operation and control appear (see table "Operating Messages (line 3)" on the next page.  
**Function 2:** An optional second parameter in the form «Parameter number»: «Value» is displayed. The function of this line is set via «725: Servicelin»: The value «795» allows actual messages to appear.

Error messages/ warning messages overwrite the selected value of the parameter.

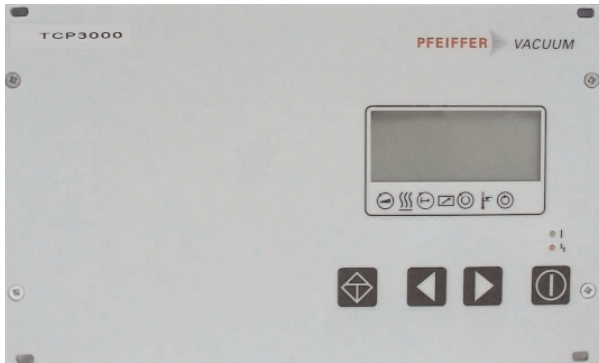
- **Line 4:** Arrows which point to the underlying symbols. These restore the unit status.

Symbols "keyboard lock" and "battery box connected".



### Symbol Definitions

Symbol	Meaning	Display	Explanation
	Pump	–	No
	accelerates	▼	YES
	no function	–	
		–	
		–	
	Standby	–	OFF
		▼	ON
	Unit	–	NO
	remote controlled	▼	YES
	Rotation switchpoint attained	–	NO
		▼	YES
	Excess temperature	–	NO
		▼	Excess temperature TMP
		▼	Excess temperature Magnetic Bearing Elektronik
	Excess temperature TMP and Magnetic Bearing Elektronik	–	NO
		▼	YES
		–	
	Final rotation speed attained	–	NO
		▼	YES
	Keypad lock		ON, operation locked via keys
	Battery box		Battery box connected. No statement with regard to the charge level of the battery.







### 4.3. Abbreviated Overview, Operating




#### Selecting Parameters

- ➔ Selecting parameters with push-button  (backwards) or  (forwards). Keeping the key depressed enables rapid scrolling.


#### Setting Parameters

- ➔ Select Parameter.
- ➔ Depress key-button  and  simultaneously till an arrow (--->) will appear in the second line from the top.
- ➔ With key-button  reduce the value and with key-button  increase the value.
- ➔ Depress key-button  and  simultaneously till the arrow (--->) disappears. The set values are now taken over.

#### Error acknowledgement

- Depress key-button .

#### Switching ON and OFF the pumping Station


- Depress key-button .

### 4.4. Operating Examples

#### Switching on the electronic drive unit

- ➔ Make connection to the mains.

#### Switching on the pumping station

- ➔ Select «794 : Param. Set».
- ➔ Select «1».
- ➔ Check set values [P:7xx] and setting commands [P:0xx], change if necessary.
- ➔ Switch on the pumping station with key .

#### Switching off the Turbo pump

- ➔ Bridge "REMOTE", remove Pin 1/3.
- ➔ Select «023 : Motor TMP».
- ➔ Select «OFF», or «ON».
- ➔ Save adjustment.

#### Switching off the pumping station

- ➔ Depress key-button  on the front panel.

Details see chapter 6 "Operation".

## Illuminated Displays

The red LEDs (error status) and green LEDs (operations status) on the front panel can assume the following conditions:

	Red LED	Green LED
<b>Illuminates:</b>	Collective error message	Mains ON, pumping station ON [P:010]
<b>Flashes short:</b> (1/12s active)	Warning	Mains pack ON, pumping station OFF [P:010]
<b>Blinks:</b> (1/2s active)	Turbopump vibration	Mains power failure

## Operations Messages (Line 3)

Independent to the adjustments at «**795: Servicelin**»:

Meldung	Bedeutung
** Error Exxx **	Error xxx has occurred
* Warning Fxxx *	Warning xxx has occurred

# 5. Parameters

## 5.1. General

All function relevant sizes of the magnetic bearing controller are structured in the form of parameters. Each parameter has a number and a clear text designation

(e.g. «**026: OpMode TMP**»). There are three different parameter types:

Type of Parameter	Function
Setting commands	Activating/de-activating a controlling function
Status requests	Parameter status/value request (readable only)
Set values	Numerical modifying of a value

To adapt this parameter to the individual requirements of the user the TCP 3000 provides three parameter sets which differ from each other in the number of parameters and their sorting. The respective parameter set can be selected via the parameter «**794: Param. set**».

Parameter set	Notice	Setting «794: Param. set»
Basic parameter set	Only basic function parameters sorted by number	0
Extended parameter set	Complete parameter set sorted by number	1

## 5.2. Parameter Overview TCP 3000, numerical

Setting Commands (readable and writable)							
#	Anzeige	Name, Beschreibung	min	max	fact. set.	RS 485 <sup>1)</sup>	Data typ <sup>2)</sup>
<b>002</b>	Standby	Stand-by ON/OFF	OFF	ON	OFF <sup>3)</sup>	R/W	0
004	RUTime ctr	Run-up time monitoring ON/OFF	OFF	ON	ON	R/W	0
008	Keys lockd	Keyboard interlock			–	R/W	0
009*		Error acknowledgement			–	W	0
010	Pump stat	Pumping station ON/OFF	OFF	ON	OFF <sup>3)</sup>	R/W	0
012	Vent enab	Venting enable Turbopump ON/OFF	OFF	ON	OFF <sup>3)</sup>	R/W	0
019	Conf. OUT2	Config. K2 0= open if mains OFF or failure, 1=dto. or warnings 2=open if mains OFF, turbo drive OFF or failure	OFF	ON	OFF	R/W	7
023	Motor TMP	Motor Turbopump ON/OFF	OFF	ON	ON <sup>3)</sup>	R/W	0
025	OpMode BkP	Operation mode backing pump 0=cont. operations; 1=interval oper.	0	1	0	R/W	7
026	OpMode TMP	Operations mode TMP 0=final rotation speed operations; 1=rotation speed setting mode	0	1	0 <sup>3)</sup>	R/W	7
027	Gas mode	Gas mode 0=heavy inert gases; 1=other gases	0	1	0	R/W	7
028	Opmode rem	Remote operations mode 0=standard operations, 1=remote priority	0	1	0	R/W	7
029	OpMode drv	Selection of the voltage supply; 0=single phase; 1=threephase supp.	0	1	0	R/W	7
030	Vent mode	Venting mode 0=automatic venting ; 1=do not vent; 2=venting "ON"	0	2	0	R/W	7
055	Conf A01	Configuration analog output 1; 0=rot.speed, 1=power, 2=Current	0	2	0	R/W	7
095	RstCstVals	Zurücksetzen auf Werkseinstellung (für Parameter 0.....99; 700....799) <sup>4)</sup>	0	1	0	R/W	0

### Status requests (only readable)

#	Display	Name, Description	min	max	fact. set.	RS 485 <sup>1)</sup>	Data typ <sup>2)</sup>
300*		Unit remote controlled			–	R	0
301		Oil deficiency turbopump	–	–	–	R	0
302*		Rotation switch point attained			–	R	0
<b>303</b>	<b>Error code</b>	Actual error code „no Err“, „Errxxx“ oder „Wrnxxx“			–	R	4
304*		Over temperature electronic drive unit			–	R	0
305*		Over temperature turbopump			–	R	0
306*		Set rotation speed attained			–	R	0
307*		Turbopump accelerates			–	R	0
<b>308</b>	<b>Set rotspd</b>	Set rotation speed TMP in Hz	0	2000	–	R	1
<b>309</b>	<b>Act rotspd</b>	Actual rotation speed TMP in Hz	0	2000	–	R	1
<b>310</b>	<b>TMP I-Mot</b>	Motor current TMP in A	0.00	25.00	–	R	2
<b>311</b>	<b>TMP Op hrs</b>	Operating hours TMP in h	0	99999	–	R	1
312	PCS Softw	Software version electronic drive unit	V 0.0	V 25.4	–	R	4
313	TMP DClink	Motor voltage TMP in V	0.0	327.67	–	R	2
314	Drv Op hrs	Operating hours electronic drive unit	0	99999	–	R	1
<b>315</b>	<b>TMP finspd</b>	Final rotation speed TMP in Hz	0	2000	–	R	1
316	TMP power	Motor power TMP in W	0.0	5000.0	–	R	1
319	Cycl count	Cycle counter	0	99999	–	R	1
346	Temp Motor	Motor temperature pump	0	255	–	R	7
349	Drv Name	Unit type electronic drive unit			TCP3kA	R	4
352	Drv Softw.	Software motor control					
360	Past Err1	Error storage, Position 1 (last error occuring)			–	R	4
361	Past Err2	Error storage, Position 2			–	R	4
362	Past Err3	Error storage, Position 3			–	R	4
363	Past Err4	Error storage, Position 4			–	R	4
364	Past Err5	Error storage, Position 5			–	R	4
365	Past Err6	Error storage, Position 6			–	R	4
366	Past Err7	Error storage, Position 7			–	R	4
367	Past Err8	Error storage, Position 8			–	R	4
368	Past Err9	Error storage, Position 9			–	R	4
369	Past Err10	Error storage, Position 10			–	R	4

### Set values (readable and writable)

#	Display	Name, description	min	max	fact. set.	RS 485	Data typ <sup>2)</sup>
<b>700</b>	<b>TMP RUTime</b>	maximum run-up time in mins	1	120	8	R/W	1
<b>701</b>	<b>Switch pnt</b>	Rotation speed switchpoint in %	50	97	80	R/W	1
707	TMPProt set	Rotation speed set value in rotation speed setting operations in %	20.0	100.0	50.0 <sup>3)</sup>	R/W	2
710	BkP off	P <sub>min</sub> for interval operations backing pump [W]	0	1000	0	R/W	1
711	BkP on	P <sub>max</sub> for interval operations backing pump [W]	0	1000	0	R/W	1
717	Stbyrotset	Drehzahlvorgabe im Standbybetrieb in %	20	100	66,7	R/W	2
720	Vent frequ	Venting frequency as a % of the final rotation speed of the TMP	40	98	50	R/W	7
721	Vent time	Venting time in s	6	3600	3600	R/W	1
<b>777</b>	<b>PumpRotMax</b>	Max. rotation speed	0	2000	777	R/W	1
<b>794</b>	<b>Param. set</b>	Parameter set 0 = basic parameter set; 1 = extended parameter set	0	1	0	R/W	7
795	ServiceLin	Contains the service line 795=messages; #795 = # of the 2. param. set			309	R/W	7
797	Address	Unit address	1	255	1	R/W	1

A number in bold type is a basic parameter set, e.g. "700 TMP RUTime".

= Parameter setting is saved internal and preserves the value if mains is switched off.

<sup>1)</sup> R = Parameter readable via interface /W = parameter writeable via interface.

<sup>2)</sup> See Interface instruction "Pfeiffer vacuum Protocol to RS 232 and 485" / PM 800 488 BN

<sup>3)</sup> Function can only be affected via remote plug

### 5.3. Parameter overview TCP 3000, operation oriented

#	Display	Name, Description	min	max	fact. set.	RS 485	Sect.
<b>Run up time and switch point</b>							
004	RUTime ctr	Run-up time monitoring ON/OFF	OFF	ON	ON	●	-
700	TMP RUTime	Maximum run-up time in mins	1	120	8	●	6.
701	Switch pnt	Switchpoint in % of nominal rotation speed	50	97	80	●	6.
<b>General operating information</b>							
301	Oil defic	Oil deficiency Turbopumpe	-	-	-	●	-
315	TMP finspd	Final rotation speed TMP in Hz	0	2000	-	●	6.
310	TMP I-Mot	TMP motor current in A	0.0	25.00	-	●	6.
313	TMP DClink	TMP motor voltage in V	0	500	-	●	-
316	TMP power	TMP motor power in W	0	5000	-	●	-
311	TMP Op hrs	Operating hours TMP in h	-	-	-	●	-
319	Cycl count	Cycle counter	-	-	-	●	-
346	Temp Motor	Motor temperature pump	0	255	-	●	-
349	Drv Name	Unit type electronic drive unit	-	-	TCP3kA	●	-
352	DrvSoftware	Software motor control	-	-	-	●	-
<b>Operating adjustment turbopump</b>							
002	Standby	Stand-by ON/OFF	OFF	ON	OFF <sup>3)</sup>	●	6.
010	Pump stat	Pumping station ON/OFF	OFF	ON	OFF <sup>3)</sup>	●	-
023	Motor TMP	Motor turbopump ON/OFF	OFF	ON	ON <sup>3)</sup>	●	6.
026	OpMode TMP	Operations mode TMP 0 = final rotation speed; 1=rotation speed setting mode	0	1	0	●	6.
027	gas mode	Operations mode 0=heavy inert gases; 1=other gases	0	1	0	●	6.
029	OpMode drv	Selection of the voltage supply; 0=single phase; 1=threephase supp.	0	1	0	●	6.
055	ConfA01	Configuration analog output 0=rot. speed, 1=current, 2=power	0	2	0	●	-
095	RstCstVals	Reset to factory setting (for parameter 0....99; 700....799)	0	1	0	●	-
308	Set rotspd	Set rotation speed TMP in Hz	0	1000	-	●	-
309	Act rotspd	Actual rotation speed TMP in Hz	0	1000	-	●	-
707	TMPProt set	Preset rot. speed in rotation speed setting mode in %	20.0	100.0	50.0 <sup>3)</sup>	●	6.
717	Stbyrotset	Preset rot. speed in stand-by mode in %	20	100	66	●	6.
777	PumpRotMax	Max. rotation speed	0	2000	0	●	6.
<b>Vent valve controlling turbopump</b>							
012	Vent enab	Venting release turbopump ON/OFF	OFF	ON	ON	●	6.
030	Vent mode	Venting mode 0=automatic venting ; 1=do not vent; 2=venting "On"	0	2	0(*)	●	6.
720	Vent frequ	Venting frequency as a % of the final rotation speed of the TMP	40	98	50	●	6.
721	Vent time	Venting time in seconds	6	3600	3600	●	6.
<b>Pumping unit control</b>							
025	Vent enab	Venting release turbopump ON/OFF	OFF	ON	ON	●	6.
710	BkP off	P <sub>min</sub> for interval operations backing pump [W]	0	1000	0	●	6.
711	BkP on	P <sub>max</sub> for interval operations backing pump [W]	0	1000	0	●	6.
<b>Others</b>							
019	Conf. OUT2	Config. K2 0= open if mains OFF or failure, 1=dto. or warnings 2=open if mains OFF, turbo drive OFF or failure	0	2	0	●	3.
028	OpMode Rem	Remote Operations mode 0=Standard operations, 1=Latch (Pin 14 "Remote" set to 1)	0	1	0	●	6.
303	Error code	Actual error code „no Err“, „Errxxx“ oder „Wrnxxx“	-	-	-	●	4.
312	Drv Softw	Software version electronic drive unit	-	-	-	●	8.
794	Param. set	Parameter set 0=basic parameter set; 1=expanded parameter set;	-	-	-	●	-
795	ServiceLin	Contains service line =# of the second parameter set	-	-	309	●	4.
797	Address	Unit address	1	255	1	●	6.
<b>Table of failures</b>							
360	Past Err1	Error storage, Position 1 (last visible failure)	-	-	-	●	7.
361	Past Err2	Error storage, Position 2	-	-	-	●	7.
362	Past Err3	Error storage, Position 3	-	-	-	●	7.
363	Past Err4	Error storage, Position 4	-	-	-	●	7.
364	Past Err5	Error storage, Position 5	-	-	-	●	7.
365	Past Err6	Error storage, Position 6	-	-	-	●	7.
366	Past Err7	Error storage, Position 7	-	-	-	●	7.
367	Past Err8	Error storage, Position 8	-	-	-	●	7.
368	Past Err9	Error storage, Position 9	-	-	-	●	7.
369	Past Err10	Error storage, Position 10	-	-	-	●	7.

3) Function can only be affected via remote plug

- Function can be called by RS 485

## 6. Operations

### 6.1. Switching On The Unit

- ➔ The unit contains no mains switch. After connecting with mains voltage the Electronic Drive Unit is ready for operation.

#### Self test

The TCP 3000 performs a self-test. Once the self-test is complete, the unit is ready for operation.

### 6.2. Setting the max. Pumping Rotation Speed


Before putting the turbo pump into operation, you must set the maximum pumping rotation speed [P:777]. The turbo pump will not start unless this value is pre-set. The error message E777 is displayed. Please refer to the relevant turbo pump operating instructions to ascertain the maximum pumping rotation speed.

- ➔ Select «777 : PumpRotMax» and enter the maximum pumping rotation speed.


### 6.3. Switching On the Pumping Station



Before the pumping station is switched on, the reference value inputs and control commands (see Chapter 5) must be checked to ensure their suitability for the selected pump and application in question, and changed if necessary.

- ➔ Select «794 : Param. Set» and set to «1».
- ➔ Check [P:7xx] reference value inputs and [P:0xx] control commands.
- ➔ Switch on the pumping station using the  key on the TCP. Alternatively, switch on using the remote control or the serial interface.

The turbo pump begins to rotate. The rotation speed switch point [P:701] must be reached within the pre-set run-up time [P:700]. If an error code is displayed, see the error code table in Chapter 7.

Acknowledge the error with the  key to reset the run-up time to the starting value.

#### Turbo Pump Normal Operation

Once the final rotation speed [P:315] has been reached, the motor current [P:310] sets itself to a particular value, depending on the gas throughput and fore-vacuum pressure.

### 6.4. Stand-by On/Off

- ➔ Select «[P:002] Standby».
- ➔ Select «OFF» or «On».

The factory setting for "Standby mode" is the turbo pump operating at 66.7% of its final rotation speed. This value can be changed.

- ➔ Select [P:717] «Stbyrotset».
- ➔ Set the standby speed within the range 20-100%.

Standby is recommended during stoppages. This function may also be activated via remote control or using the serial interface.

Standby mode is not possible in rotation speed setting mode (see item 6.8.).

Pumps with integral lubricant pump are initially accelerated to 60% of their nominal rotation speed in standby mode, even if the set standby speed is  $<60\% \times f_{nom}$ .



At operations below  $50\% \times f_{nom}$  pump shut-down due to lubricant deficiency is possible.

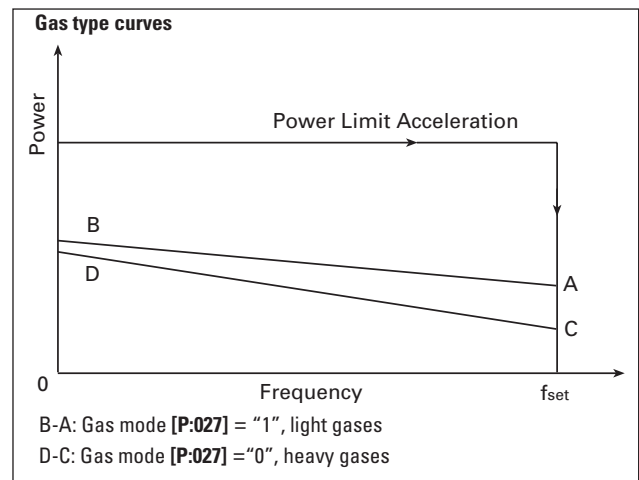
### 6.5. Operation Dependent On Gas Type

#### Gas mode adjustment

- ➔ select «794 : Param. Set» and set to «1».
- ➔ select «027 : gas mode».
- ➔ select «0» for heavy inert gases (e.g. Argon), «1» for other gases.

#### Rotor overheating protection

The TCP 3000 includes a rotor overheating protection to avoid overheating of the rotor by high gas load and high rotation speed. This is guaranteed by the gas type curves [P:027] (see below).



In accordance to the adjustment of [P:027] the protection area is defined between the power limit acceleration and the curve B-A or D-C.

If the rotor overheat protection is active the warning message "F035" is shown and the red LED illuminates.

In accordance to the adjustment of [P:027] the drive power decreases to the selected power rotation curve.

The full drive power is available as soon as the overheat risk is eliminated.

## 6.6. Turbopump ON/OFF

The turbo pump can be switched on and off separately whilst the pumping station is in operation.

- ➔ Select «023 : Motor TMP».
- ➔ Select «OFF», or «ON».

## 6.7. Rotation Speed Setting Mode

Select rotation speed setting mode when you wish to reduce the volume flow rate of the turbo pump. The pressure ratio of the pump falls exponentially with the rotation speed.

### Speed preset in rotation speed setting mode

- ➔ Call [P:794] «Param set», select «1».
- ➔ Select [P:707] «TMProt set».
- ➔ Adjust the speed within the range 20-100%.

### Operating mode of turbo pump

- ➔ Call [P:026] «OpMode TMP».
- ➔ Select <1> for rotation speed setting mode.




Standby mode is ineffective in rotation speed setting mode. Rotation speed setting mode can also be set by means of the remote control or the serial interface.

At operations below  $50\% \times f_{nom}$  pump shut-down due to lubricant deficiency is possible.

Turbo pumps with integral lubricant pump are initially accelerated to 60% of their nominal rotation speed in standby mode, even if the set standby speed is  $<60\% \times f_{nom}$ .

## 6.8. Switching Off the Pumping Station

- ➔ Press the  key on the front panel. Alternatively, switch off the pumping station using the remote control or the interface.

After the pumping station has been switched off, the rotation speed sinks to 0 Hz.

## 6.9. Remote control



If power failure occurs during operation, the turbo pump automatically restarts once power returns.

The following functions can be controlled using remote control (see also "Plug Arrangement REMOTE" table):

- Standby rotation speed ON/OFF
- Pumping station ON/OFF
- Motor TMP ON/OFF
- Vent release ON/OFF
- Sealing gas ON/OFF
- Remote priority ON/OFF
- Rotation speed input (20-100% of the nominal rotation speed [P:315] corresponds to 2-10 VDC voltage)
- Malfunction acknowledgment



If a voltage signal in a range of 2-10 VDC is connected, remote Pin 7 "Rotation speed input" has always priority.

## Operating Modes With Remote Control

There are three different options for remote control with different priorities for the functions:

### Standard remote control

- ➔ Set «028: Opmode Rem» to «0».

The digital switching functions are activated through "SPS High level" <sup>1)</sup>. Activated individual functions cannot be changed via the interface. Individual functions deactivated with remote control can be operated using the interface.

→ The settings are saved.

- 1) SPS-High level: +13 V bis +33 V
- SPS-Low level: -33 V bis +7 V
- Ri: 7 kΩ

### Remote Control Priority "ON"

For certain applications, such as SPS control, the remote control functions can be set to have priority.

- ➔ Set «028: Opmode Rem» to «1», prepare priority function
  - ➔ Set connection between Pin 1 and Pin 14 to "remote" or "SPS high".  
The priority for remote control is now active.  
The unit can now only be controlled via "Remote".  
Equivalent functions can no longer be operated via the RS 485 interface.
- The settings are saved.

The following functions are activated with "SPS high level" and deactivated with "SPS low level":

– Motor TMP	ON/OFF
– Heating	ON/OFF
– Standby rotation speed	ON/OFF
– Pumping station	ON/OFF
– Vent release	ON/OFF
– Sealing gas	ON/OFF
– Malfunction acknowledgment	

### Remote Control Priority "OFF"

- ➔«028: Opmode Rem» remains set to «1».
  - ➔ Set pin 14 to "SPS low" on remote or connect to pin 26.
- Operation only possible via interface (remote control inactive).
- Set values are saved.

## 6.10. Venting the Turbo Pump

Venting can only take place after the pumping station has been switched off.

The venting valve is closed when de-energized. In the event of a malfunction, venting may take place, depending on which venting mode was selected.

The extended parameter set is used to choose between three venting modes:

- ➔ Call [P:794] «Param set»; select «1».
- ➔ Call [P:012] «Vent enab»; select «ON».
- ➔ Call [P:030] «Vent mode»; select «0», «1» oder «2».

### Venting mode «0»: Automatic venting

Automatic venting means that venting commences at a set frequency [P:720] for a set time [P:721] after the pumping station has been switched "OFF" or after power failure. The set time cannot be guaranteed in the event of power failure.

- ➔ Select [P:720] «Vent frequ».
  - ➔ Set the venting frequency within the range «40-98%».
  - ➔ Select [P:721] «Vent time».
  - ➔ Set the venting time in seconds within the range «0» and «3600».
- The venting valve is closed after "Power ON".

### Venting mode «1»: Venting OFF

→ The pump is not vented.

### Venting mode «2»: Venting ON

→ Venting takes place after a delay of 6 s when "Pumping station OFF", if a malfunction occurs or on power failure. During this delay time, any high vacuum valve present can be closed. In the event of power failure, venting will only last for as long as the pump energy can continue to feed the venting valve. The venting valve remains open after power "ON". It closes when the pumping station is switched on.

## 6.11. Operation Using Interface RS 485

The group address of the TCP 3000 is 992. Different interface addresses must be selected [P:797] for all the units connected to the bus.

Data communication is described in Operating Instructions PM 800 488 BN.

## 6.12. Emergency Generator Operation

If the power supply fails (Warning F007) whilst the turbo pump is in operation, the pump rotor acts as a generator and supplies power to the electronics. Power failure is also indicated by flashing green and red LED's on the front panel (50% ON; 50% OFF). At a particular rotation speed (depending on the pump), the pump energy will no longer suffice, at which point the TCP 3000 will be shut down completely.

## 6.13. Configuring the Analog Output

An analog signal (0-10 VDC) can be tapped at the TCP 3000, with the following information:

- Rotation speed of turbo pump
- Capacity
- Power input.

To this aim, the analog output must be configured in accordance with its function:

- ➔ Call [P:055] «Conf. AO1».
- ➔ Select function 0, 1 oder 2:
  - 0 = Rotation speed signal, 0-10 VDC = 0-100% x  $f_{end}$
  - 1 = Capacity signal, 0-10 VDC = 0-100% x  $p_{max}$
  - 2 = Current signal, 0-10 VDC = 0-100% x  $I_{max}$


For information about the values  $f_{final}$ ,  $p_{max}$  and  $I_{max}$ , please refer to the operating instructions of the turbo pump you are using.

# 7. Error Messages and Warnings

## 7.1. General information



Error ("Errxxx" or "Error Exxx") always cause the turbo pump, fan, heater and backing pump to switch off.

- ➔ Once the error has been eliminated, press the  key.
- ➔ The unit is once more ready for operation.

## 7.2. Errors During Operation

Errors and warnings occurring during operation are always indicated on the LCD - regardless of the function of the service line - and can additionally be polled by means of the parameter [P:303] «Error code». Further, the parameters 360 to 369 contain ten past errors.

Error	Meaning	Troubleshooting
E001	Excess rotation speed of TMP	- Inform PFEIFFER-VACUUM-Service
E002	Netzteilfehler; interne Versorgungsspannung zu hoch	- Inform PFEIFFER-VACUUM-Service
E006	Run-up time error Pump rotation speed drops below switch point after run-up time.	- Set run-up time correctly - Open fore-vacuum valve - Lower fore-vacuum pressure - Eliminate leak
E007 <sup>2)</sup>	Insufficient lubricant	- Check lubricant level - Ascertain status of lubricant sensor via [P:301] - Inform PFEIFFER-VACUUM-Service
E015	Composite error in TCP controller	- Reset controller by power On/Off with pump stationary (f=0Hz) - Inform PFEIFFER-VACUUM Service if necessary
E021 E621	Incorrect pump characteristic impedance	- Inform PFEIFFER-VACUUM Service
E037	Error in motor end stage or drive circuit	- Inform PFEIFFER-VACUUM Service
E098	Error in internal communication	- Inform PFEIFFER-VACUUM Service
E037	Error in Motor endstage or controller	- Inform PFEIFFER-VACUUM Service if necessary
E040	Error expansion memory (RAM)	- Inform PFEIFFER-VACUUM-Service
E043	Incorrect saving of parameter values	- Inform PFEIFFER-VACUUM-Service
E044	Over temperature TCP	- Ambient temperature too high
E045	Overtemperature motor	- Check cooling water supply
E058	Cooling water too low	- Check cooling water supply
E699	Drive error TCP	- Inform PFEIFFER-VACUUM-Service
E777	Parameter 777 not set to the final rotation speed of the connected turbopump	- Set parameter 777 (see operating instructions of the turbopump)
E913 <sup>1)</sup>	Error during self-test or turbo pump run-up	- Error resets itself - Check pump idle running. <b>Caution!</b> Pump will start automatically. - Inform PFEIFFER-VACUUM Service if necessary

1) Error message is not indicated via switching output 2 (collective error message).

2) An error can be acknowledged max. 5 times.

S: Self-test B: Operation

## 7.3. Warnings

Warnings ("Wrnxxx" or "Warning Fxxx") are only displayed. Unlike errors, components are not disabled.



Warning «039» must be remedied immediately, as otherwise there is a risk of electric shock.

Number	Meaning	Explanation
F007	Power failure	Operating voltage has failed
F035	Rotor overheat protection active	Max. drive power regarding gas mode adjustment [P:027]
F046	Data channel interfered	Incorrect communication to the memory of the parameter values

## 8. What To Do In Case Of Breakdowns?

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### Identifying error messages

Error messages shown on the LCD can be identified and, in part, remedied with the aid of the error code table (Chapter 7).

The last 10 errors and warnings are stored in the fault memory [P:360-369] during operation..

If the malfunction cannot be remedied:

- ➔ Inform PFEIFFER-VACUUM Service.
- ➔ Describe the malfunction and state the associated error messages.
- ➔ Describe the software version from [P:312] and [P:352].

## 9. Maintenance, Service

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The unit is maintenance-free. Dirt on the front panel can simply be cleaned with a damp cloth. The unit must be disconnected from the power supply beforehand.

Please make use of our After-sales Service!

In the unlikely event of problems with your electronic drive unit, there are various ways in which you can maintain your system's availability:

- Get your unit repaired on site by PFEIFFER-VACUUM Service;
- Send your unit to the parent factory for repair;
- Replace the unit by an as-new replacement model.

Please contact your PFEIFFER-VACUUM agent for more detailed information.

The wiring diagram in Chapter 11 shows current carrying circuits and the respective operating voltages.

If you decide to undertake repairs yourself, please bear in mind that the unit may carry dangerous contact voltages. If carrying out repairs or maintenance work yourself to units which have been in contact with substances that are hazardous to health, please observe the relevant regulations.



Please note that repair jobs on units sent in to us for repair or maintenance can only be performed in accordance with our general terms of delivery.

### Contact addresses and telephone hotline:

You can find contact addresses and your telephone hotline on the back of this manual.

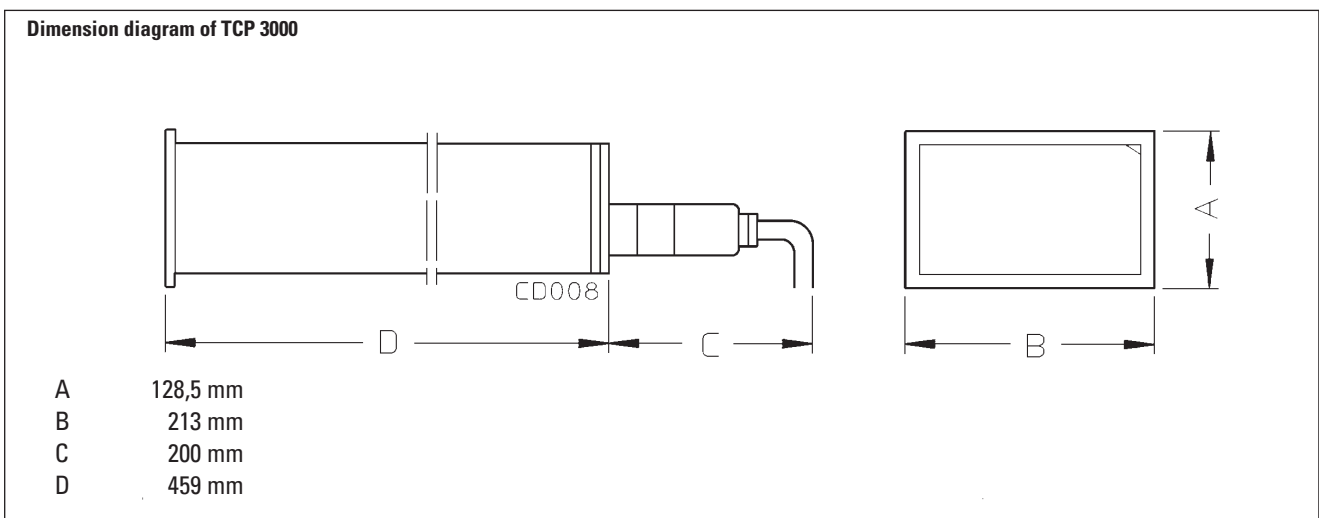
## 10. Technical Data

### 10.1. Data List For TCP 3000 Electronic Drive unit

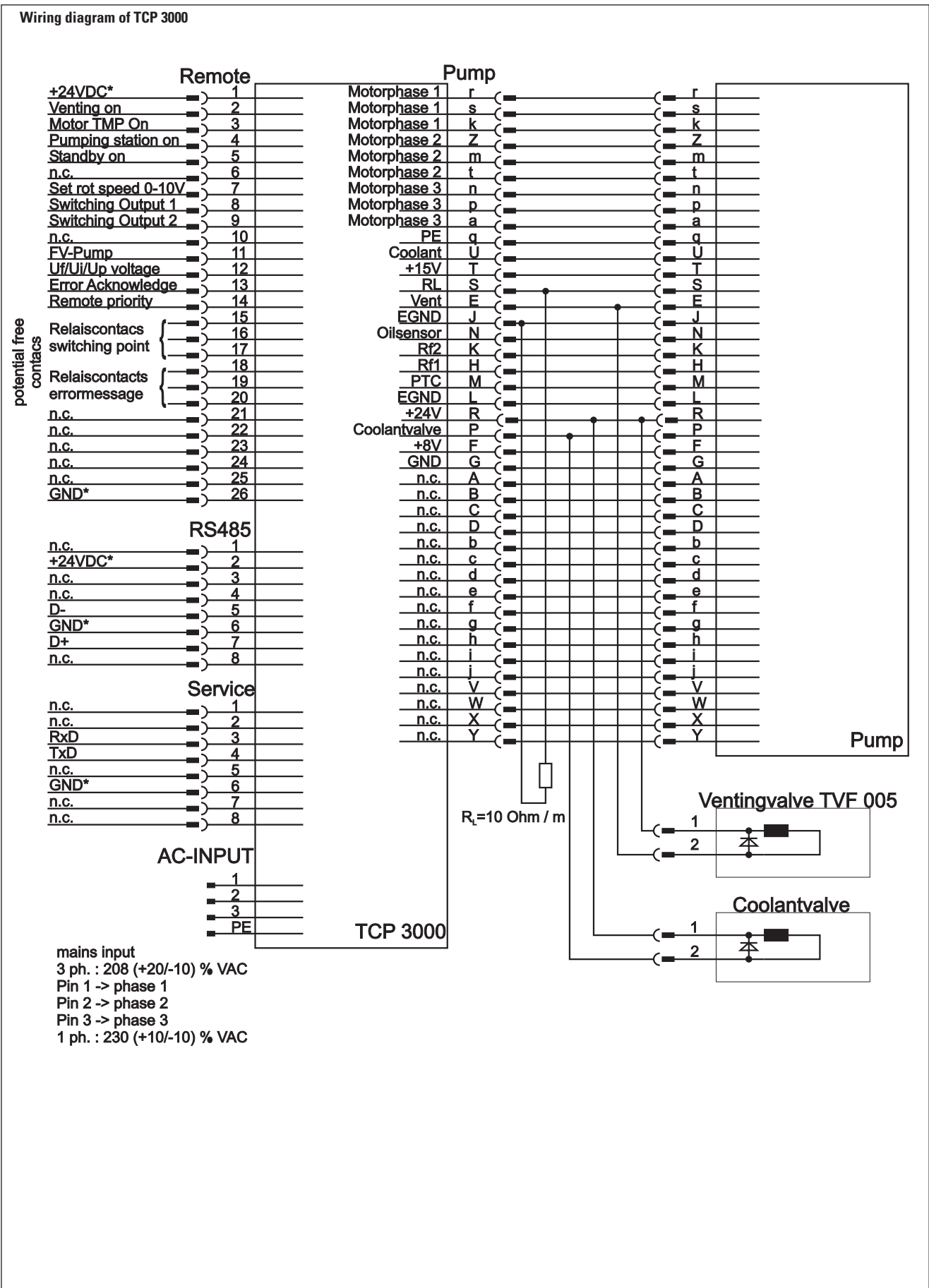
Variable	Unit	TCP 3000
Connection voltage (1-phase/L1-N)	V AC	230 ( $\pm 10\%$ )
Connection voltage (3-phase/Lx-Lx)	V AC	208 (+20/-10%)
Current (single phase), max.	A	22
Current (threephase), max.	A	10,5
Rated input (single phase)	kVA	4,65
Rated input (threephase)	kVA	3,45
Frequency	Hz	50-60
Motor connection output voltage	V DC	< 342
Motor connection output current	A DC	14,7
Permitted ambient temperature	$^{\circ}\text{C}$	5 - 40
Relative humidity, max., without condensation:	%	80/50 <sup>1)</sup>
Air pressure	kPa	86-106
Installation height, max.	m	2000
Protection category		IP 20
Safety class		I
Pollution level		2
Excess voltage class		II
Run-up time, adjustable	min	1-120
Rotation speed switch point	%	50-97
Cable length, max.	m	50
Interface		RS 485 RS 232 Remote
Rotation speed setting mode, adjustable	%	20-100
Weight	kg	7,1

1) 80% at  $T \leq 31^{\circ}\text{C}$ ; up to 50% at  $T \leq 40^{\circ}\text{C}$

### 10.2. Dimension Diagram



# 11. Wiring diagram



## 12. Accessories

Designation	Quantity	Number-	Remarks
Pump cable	3m	PM 051 863 -T	Other lengths available on request
Mains cable, Schuko, single-phase		P 4564 309 HA	
Mains cable, american plug, three-phase		P 4564 309 HB	
Level converter RS 485/RS 232		PM 051 054 -X	

## 13. Additional Information

These Operating Instructions describe the operation of PFEIFFER-VACUUM turbomolecular pumps. This manual forms part of the complete operating instructions for your modular turbo pump system. You will find further instruction manuals in the scope of delivery (see table), to suit your particular combination of components.

If, despite meticulous checks by ourselves, you should be lacking information about our products, please contact your PFEIFFER dealer, or phone the hotline on the back of this manual.

All documentation is also available in PDF format.

The following operating instructions are available for our turbo pump range:

Produkt	Definition	Manual No
Turbomolecular pump	Turbomolecular pump	depends on pump type*
Turbo pump water cooling	Description of water cooling	PM 800 546 BE
Pfeiffer Vacuum Protocol RS 232/RS 485	Description of interface protocol	PM 800 488 BE
Venting valve TVF 005	Description of venting valve	PM 800 507 BE
Level Converter TIC 002	Description of pumping control via RS 232/RS 485	PM 800 549 BE

\*Numbers and instructions can also be obtained from PFEIFFER-VACUUM Service or via our Homepage at [www.pfeiffer-vacuum.de](http://www.pfeiffer-vacuum.de).



**Konformitätserklärung**  
***Declaration of Conformity***



im Sinne folgender EU-Richtlinien:  
*pursuant to the following EU directives:*

- **Elektromagnetische Verträglichkeit/*Electromagnetic Compatibility***  
**89/336/EWG**
- **Niederspannung/*Low Voltage* 73/23/EWG**

Hiermit erklären wir, daß das unten aufgeführte Produkt den Bestimmungen der EU-Richtlinie über elektromagnetische Verträglichkeit 89/336/EWG und der EU-Niederspannungsrichtlinie 73/23/EWG entspricht.

*We hereby certify, that the product specified below is in accordance with the provision of EU Electromagnetic Compatibility Directive 89/336/EEC and EU Low Voltage Directive 73/23/EEC.*

**Produkt/*Product:***

Angewendete Richtlinien, harmonisierte Normen und angewendete nationale Normen:  
*Guidelines, harmonised standards, national standards which have been applied:*

**EN 61010, EN 55011, EN 50081-1, EN 61000-6-2**

Unterschrift/*Signature:*



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(W. Dondorf)  
Geschäftsführer  
*Managing Director*



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