œrlikon
leybold vacuum

TURBO.DRIVE 300

Frequency Converter for Turbomolecular Pumps

Operating Instructions 17200432_002_00
Valid from Firmware 1.13

Part Numbers

800072Vxxxx

Contents

Safety Information

Important Safety Information

Indicates procedures that must be strictly observed to pre-vent hazards to persons.

Warning

Indicates procedures that must be strictly observed to pre-vent damage to, or destruction of the product.

Caution

The Oerlikon Leybold Vacuum **TURBO.DRIVE 300** have been designed for safe and efficient operation when used properly and in accordance with these Operating Instructions. It is the responsibility of the user to careful-ly read and strictly observe all safety precautions de-scribed in this section and throughout the Operating Instructions. The TURBO.DRIVE **must only be oper-ated in the proper condition and under the conditi-ons described in the Operating Instructions**. It must be operated and maintained by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to our nearest office.

Safety Information

Failure to observe the following precautions could result in serious personal injury!

Warning

The frequency converter must only be connected to power supplies which meet the requirements for functional extra low voltage with positive isolation in accordance with IEC 364 (VDE 0100, Part 410, or local regulations) (SELV).

During operation the frequency converter may attain temperatures up to 75 °C. We recommend that the unit be installed so that it can not be touched inadvertently.

Inside the unit there is the risk of suffering burns from hot components.

After a mains power failure the pump can run up automatically once more.

Caution **Failure to observe the following precautions could result in damage to the equipment!**

The pump may be operated only with a suitable frequency converter and suitable connecting cables.

Ensure correct polarity.

Route all cables so as to protect them from damage.

Disconnect and connect the cable connections only while the pump is turning no longer (green status LED off) and with the mains power switched off (yellow power LED off). Otherwise there is the risk of damaging the TURBO.DRIVE 300.

We reserve the right to alter the design or any data given in these Operating Instructions. The illustrations are approximate.

Description

Green LED STS
off: Pump at standstill (< 3 Hz)
flashes slowly 1/s: Start command is present (about 10 s after start)
flashes fast 3/s: Running up or running down
on: Normal operation

Yellow LED PWR
off: No supply voltage
flashes: Supply voltage too low or too high
on: Supply voltage is present

Red LED ERR
off: No error, no warning
flashes: Warning is present, pump can be operated
            possibly with some restrictions
on: Fault is present, pump stopped or can not
            be operated

Fig. 1 TURBO.DRIVE 300, front and rear side

Description

Profibus LEDs

9-way Profibus connection

Selector switches for setting the Profibus address in the hexadecimal format

PROFIBUS

HEAT SINK

BUS STS
BUS ERR

STS
PWR
ERR

HIGH LOW

TurboDrive 300

SERVICE (X5)   REMOTE (X1)

HEAT SINK

Green LED BUS STS

off:	Profibus not active
flashing:	Profibus is waiting for initialisation and parameters
on:	Profibus data is being transmitted

Red LED BUS ERR

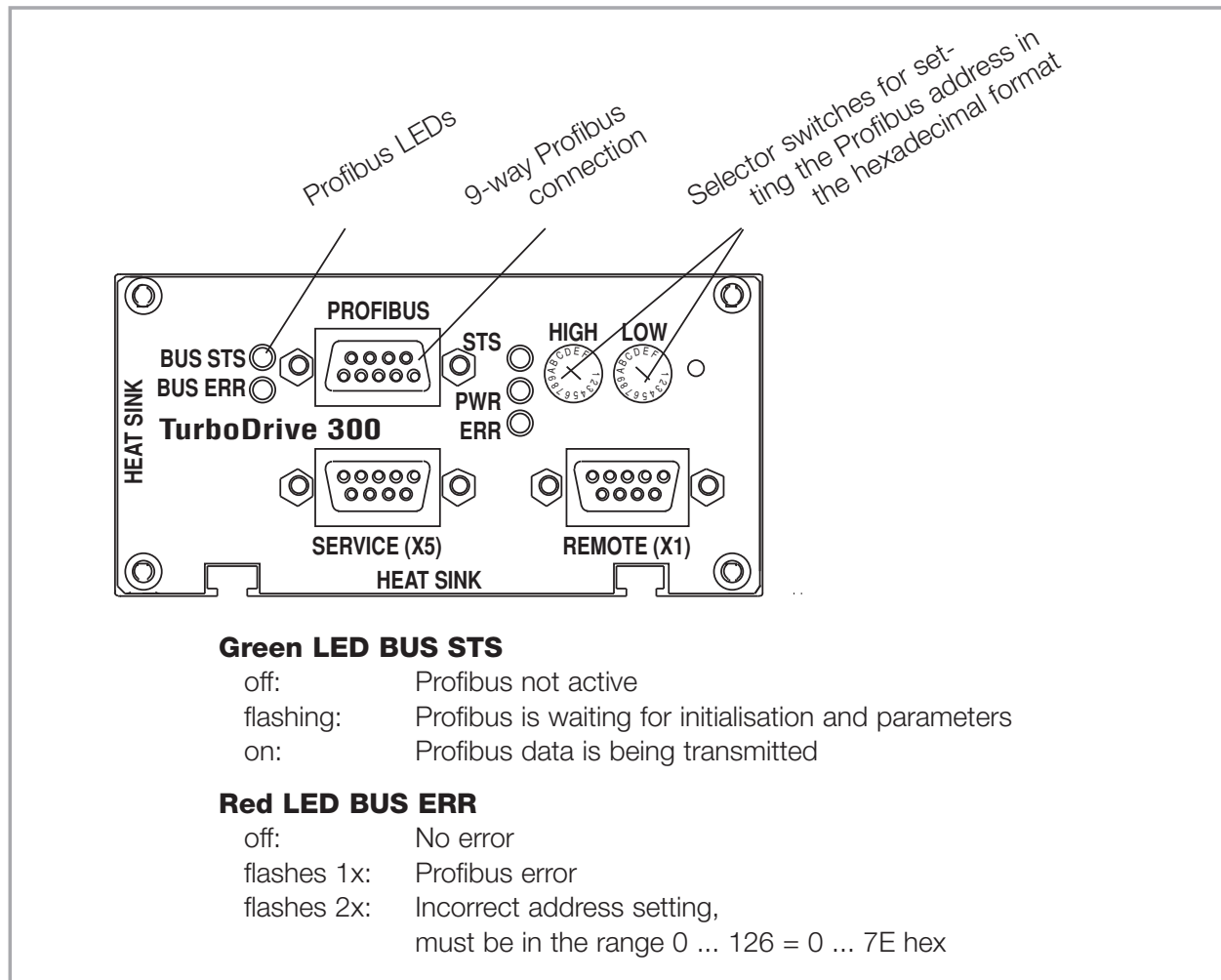|	
off:	No error
flashes 1x:	Profibus error
flashes 2x:	Incorrect address setting, must be in the range 0 ... 126 = 0 ... 7E hex

Fig. 2 Front side of TURBO.DRIVE 300 with additional Profibus interface

1   Description

1.1   Design and function

The TURBO.DRIVE 300 supplies power to the TW series turbomolecular pumps and is used to control their operation.

The TURBO.DRIVE 300 is either integrated in the pump or it is separate and linked to the pump by means of a connecting cable.

The TURBO.DRIVE 300 requires a supply voltage of 24 V DC. It is equipped with interfaces for programmable controls (REMOTE) and an optional interface for serial communication.

1.2   Standard equipment

Included with the delivery are the DC connector Hirose HS16P-3, four moving nuts M4 for affixing the frequency converter and the Operating Instructions.

Description

1.3 Technical data

|	
Supply voltage	24 V $=$ (21 ... 29 V)
Residual ripple	< 3 %
Output	
Voltage	0 - 24 V 3~
Power	160 W
Frequency	0 - 1500 Hz
When operating a TW 300, TW 300 H, TW 220/150(/15) S	
Nominal voltage	24 V $=$
Max. power consumption	190 W
Max. peak current, input side	8 A DC
Required power output from the power supply	≥ 200 W
When operating a TW 70 H, TW 250 S	
Nominal voltage	24 V $=$
Max. power consumption	140 W
Max. peak current, input side	6 A DC
Required power output from the power supply	≥ 150 W
Max. length of the DC cable (shielded)	
at 3 x 1.5 mm^2	5 m
at 3 x 2.5 mm^2	20 m
Relay output rating	42 V, 0.5 A
Ambient temperature	
during operation	5 - 45 °C
storage	- 15 - + 70 °C
Relative air humidity	5 to 85 % non condensing
Overvoltage category	II
Contamination grade	2
Temp. of the cooling surface	5 - 55 °C
Only Part No. 800072V0004	5 - 50 °C
Power consumption	≤ 20 W
Type of protection	IP 20
Weight, approx.	0.7 kg
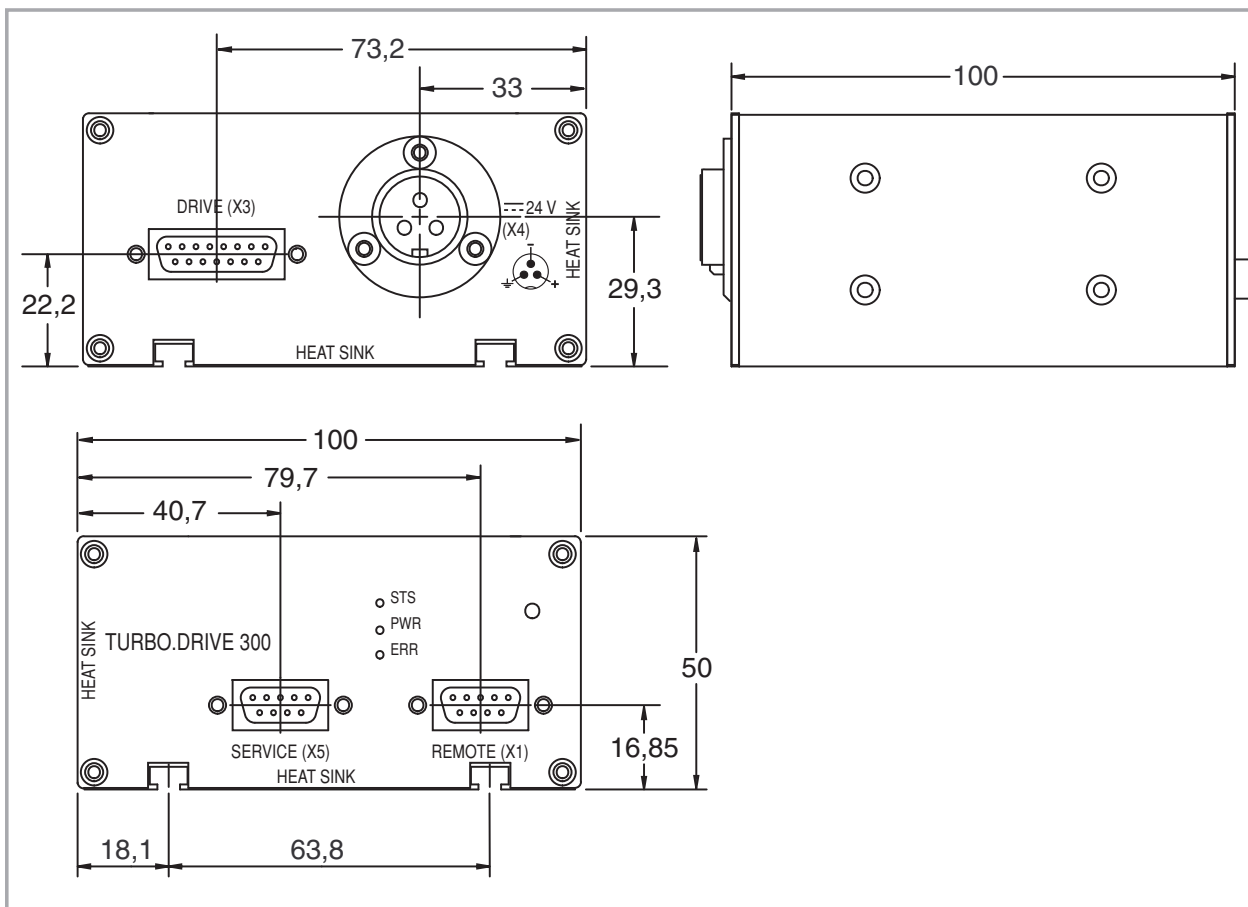
Fig. 3   Dimensional drawing for the frequency converter and the power supply; dimensions in mm

Description
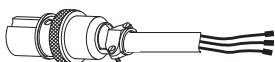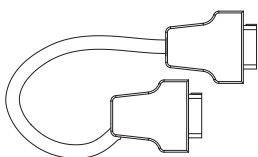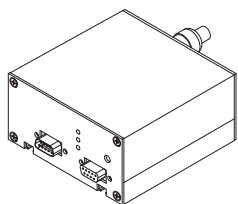
1.4   Ordering data

Frequency converter TURBO.DRIVE 300

with RS 232/422 C interface	800072V0001
with RS 485 C interface	800072V0003
with Profibus interface	800072V0004

Connecting cable pump - frequency converter

1.0 m long	152 47
2.5 m long	864 49
3.0 m long	864 40
5.0 m long	864 50

1.5   Accessories

OEM power supply (with screw terminals)

SITOP 24 V / 10 A (120/230 VAC / 50/60 Hz)	152 50

■ supplies the TURBO.DRIVE 300 with 24 V DC
■ other power supplies on request

24 V DC cable
(TURBO.DRIVE 300 – OEM power supply)

3 m	200 12 732
5 m	200 12 733
10 m	200 12 734
20 m	200 12 735

Mains cable for power supply, 2 m long

with EURO plug	800102V0001
with US plug 5-15P	800102V1001

Power supply unit - plug and play
TURBO.POWER 300   800100V0002
- ■ supplies the TURBO.DRIVE 300 with 24 V DC
- ■ plug & play cables
- ■ desktop unit or rack mountable
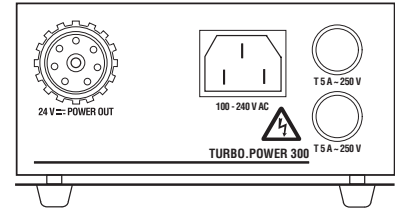
24V DC Power cable TURBO.DRIVE 300 – TURBO.POWER 300)

1 m	800094V0100
3 m	800094V0300
5 m	800094V0500
10 m	800094V1000
20 m	800094V2000

Mains cable for TURBO.POWER 300, 3 m long

with EURO plug	800102V0002
with US plug 6-15P	800102V1002

Power supply and control unit
TURBO.CONTROL 300   800100V0001
- ■ supplies the TURBO.DRIVE 300 with 24 V DC
- ■ plug & play cables
- ■ desktop unit or rack mountable
- ■ with power switch
- ■ with start/stop switch for the turbomolecular pump
- ■ remote control
- ■ status LEDs and status relays
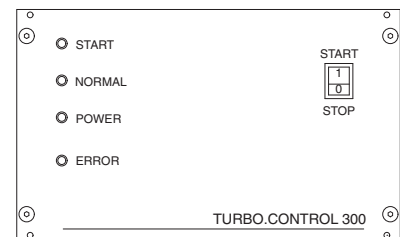
24V DC Control cable
(TURBO.DRIVE 300 – TURBO.CONTROL 300)

1 m	800091V0100
3 m	800091V0300
5 m	800091V0500
10 m	800091V1000
20 m	800091V2000

Mains cable for TURBO.CONTROL 300,
3 m long

with EURO plug	800102V0002
with US plug 6-15P	800102V1002
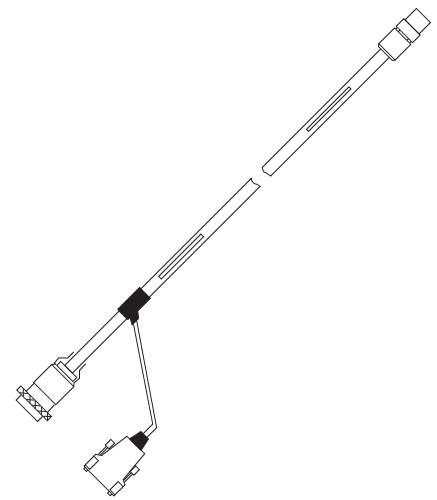
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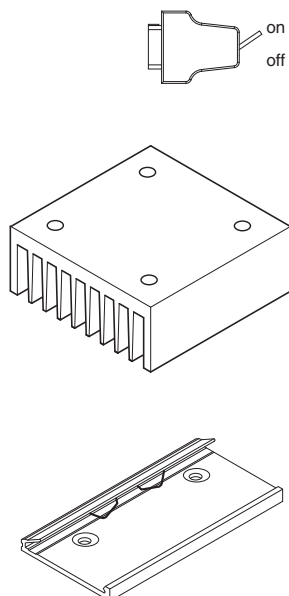
Mechanical accessories

Plug for connector REMOTE with integrated
ON/OFF switch for the pump
(Sub-D plug, 9 way)   152 48

Heat sink for frequency converter   800110V0001

Top hat rail adaptor (mounting aid for
TURBO.DRIVE 300 and TURBO.POWER 300)
800110V0003

Accessories for serial interfaces

PC software "Turbo.Drive Server" for Windows 95
and higher, CD-ROM
■ Display, change, save and compare parameter lists
■ Integration of customer's software
■ Record parameter data   800110V0102
(new parameter library for TURBO.DRIVE 300
is required, please ask us for a quotation)
The software can also be downloaded from
www.oerlikon.com in the menu Oerlikon Leybold Vacuum
Systems → Documentation → Download Software

Adaptor RS232/RS485 100-240 VAC
with mains plug adaptor   800110V0101

GSD file for Profibus DP   upon request
The software can also be downloaded from
www.oerlikon.com in the menu Oerlikon Leybold Vacuum
Systems → Documentation → Download Software

2 Installation

2.1 Conforming Utilization

The TURBO.DRIVE 300 supplies power to the TW series turbomolecular pumps and is used to control their operation.

The TURBO.DRIVE 300 is suited for operation of the following pumps:

- TURBOVAC TW 70 H
- TURBOVAC TW 220/150 S, TW 220/150/15 S
- TURBOVAC TW 250 S
- TURBOVAC TW 290 H
- TURBOVAC TW 300, TW 300 H

Other pumps may only be operated after approval from Oerlikon Leybold Vacuum or if the operation of such pumps is expressly permitted in the Operating Instructions for the specific pump.

The TURBO.DRIVE may only be operated with power supply units which meet SELV (Safety Extra Low Voltage) requirements.

The TURBO.DRIVE must only be opened by certified Oerlikon Leybold Vacuum Service Centres. Opening by unauthorised personnel voids warranty.

Installation

2.2 Operating environment

See also Chapter 1.3 Technical Data.

Places of installation up to 1000 m above sea level (3300 ft) are possible without restrictions. At altitudes over 1000 m heat dissipation by the ambient air is impaired. Please consult us.

If the TURBO.DRIVE 300 has been integrated in the pump, it is cooled by the pump.

As to the cooling requirements for the separately fitted TURBO. DRIVE see Fig. 4. The bottom side of the frequency converter must not be allowed to attain temperatures in excess of 55 °C, in the case of frequency converters equipped with a Profibus interface the temperature at the bottom must not exceed 50 °C.

Max. magnetic induction levels are 15 mT, max. radioactive radiation spec. is 10^5 rad (10^3 Gy).

The frequency converter must only be used in rooms within buildings. It must not be operated in explosive gas atmospheres.

The frequency converter and the connecting lines must be protected against exposure to sprayed and condensing water.

Warning

During operation the frequency converter may attain temperatures up to 75 °C. We recommend that the unit be installed so that it can not be touched inadvertently.

Owing to the small quantity of combustible material and the proven safety of the instrument by testing in accordance with EN 61010, the risk through fire and burning can almost completely be excluded.
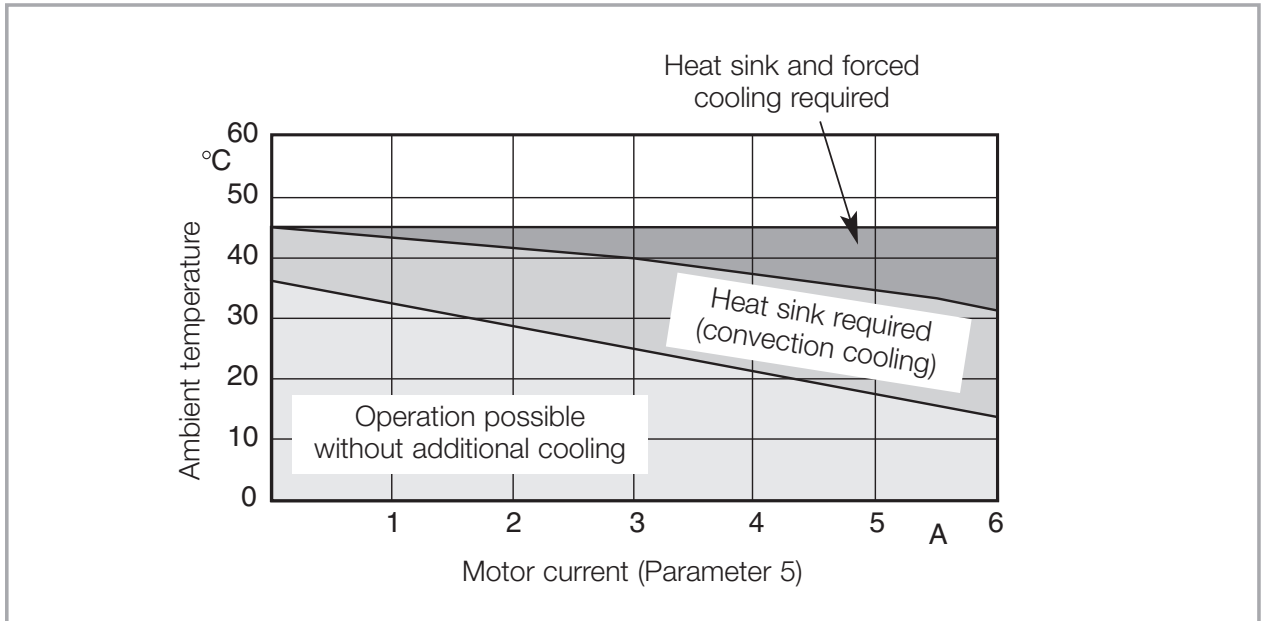
Fig. 4 Cooling requirements for the TURBO.DRIVE 300 when fitted separately

2.3   Mounting the frequency converter

The frequency converter may be affixed with the aid of the enclosed M4 sliding nuts. The bottom side of the frequency converter must be cooled sufficiently.

Ensure an adequate supply and discharge of cooling air.

For special requirements please contact us.

Installation

2.4 Connecting the pump

In the case of a separately fitted TURBO.DRIVE 300 connect the pump using the connecting cable.

The pump may be operated only with a suitable frequency converter and suitable connecting cables.

Route all cables so as to protect them from damage.

Disconnect and connect the cable connections only while the pump is turning no longer (green status LED off) and with the mains power switched off (yellow power LED off). Otherwise there is the risk of damaging the TURBO.DRIVE 300.

2.5 Connecting the power supply

The frequency converter must only be connected to power supplies which meet the requirements for functional extra low voltage with positive isolation in accordance with IEC 364 (VDE 0100, Part 410, or local regulations) (SELV).

The power supply must meet the requirements given in Section 1.3. Peak currents in the kHz range may be present on the DC side. The power supply should have a current limiter of the current regulated type.

Connect the frequency converter to the 24 V DC power supply or to the TURBO.CONTROL 300 or to the TURBO.POWER 300 via the 24 V DC cable.

Ensure correct polarity.
Pin 1   + 24 VDC
Pin 2   0 V
Pin 3   GND

The frequency converter is equipped with an internal 8 AT (slow blow) fuse. It can only be replaced by Oerlikon Leybold Vacuum staff.

Connect the power supply to the mains.

Pin 3 GND

Shielding

Pin 1 24 V

Pin 2 0 V

1

3

2
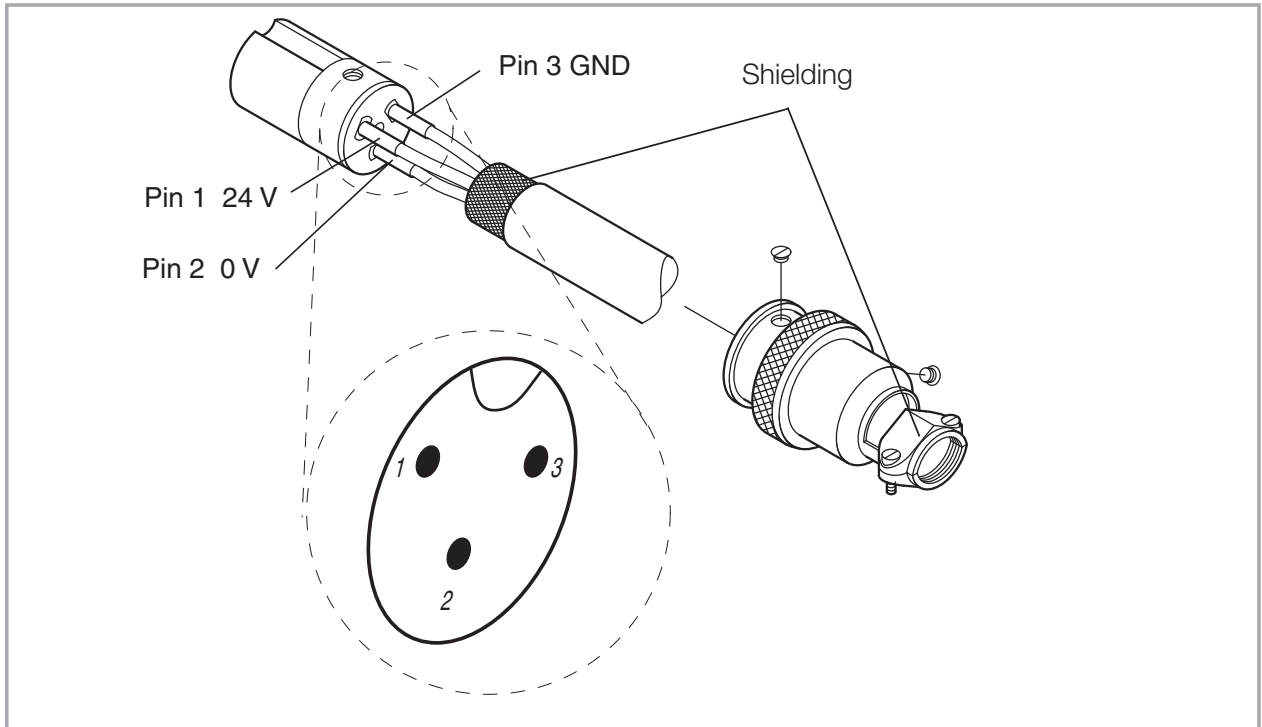
Fig. 5   Pin assignment of the DC connector (X4) Model Hirose HS16P-3

Installation

93 - 132 /
187 - 264
V AC,
50/60 Hz

24 V DC

REMOTE

In the case of an integrated
TURBO.DRIVE 300 the
connecting cable is omitted.

Recommended for pumps
and frequency converters
not connected to ground

Optional jumper for operating
voltage range 93 - 132 V

L1
N
PE
120 V
AC
L+
M
M
+ 24 V DC
0 V DC
GND
LED POWER

Note the Operating Instructions
for the power supply.
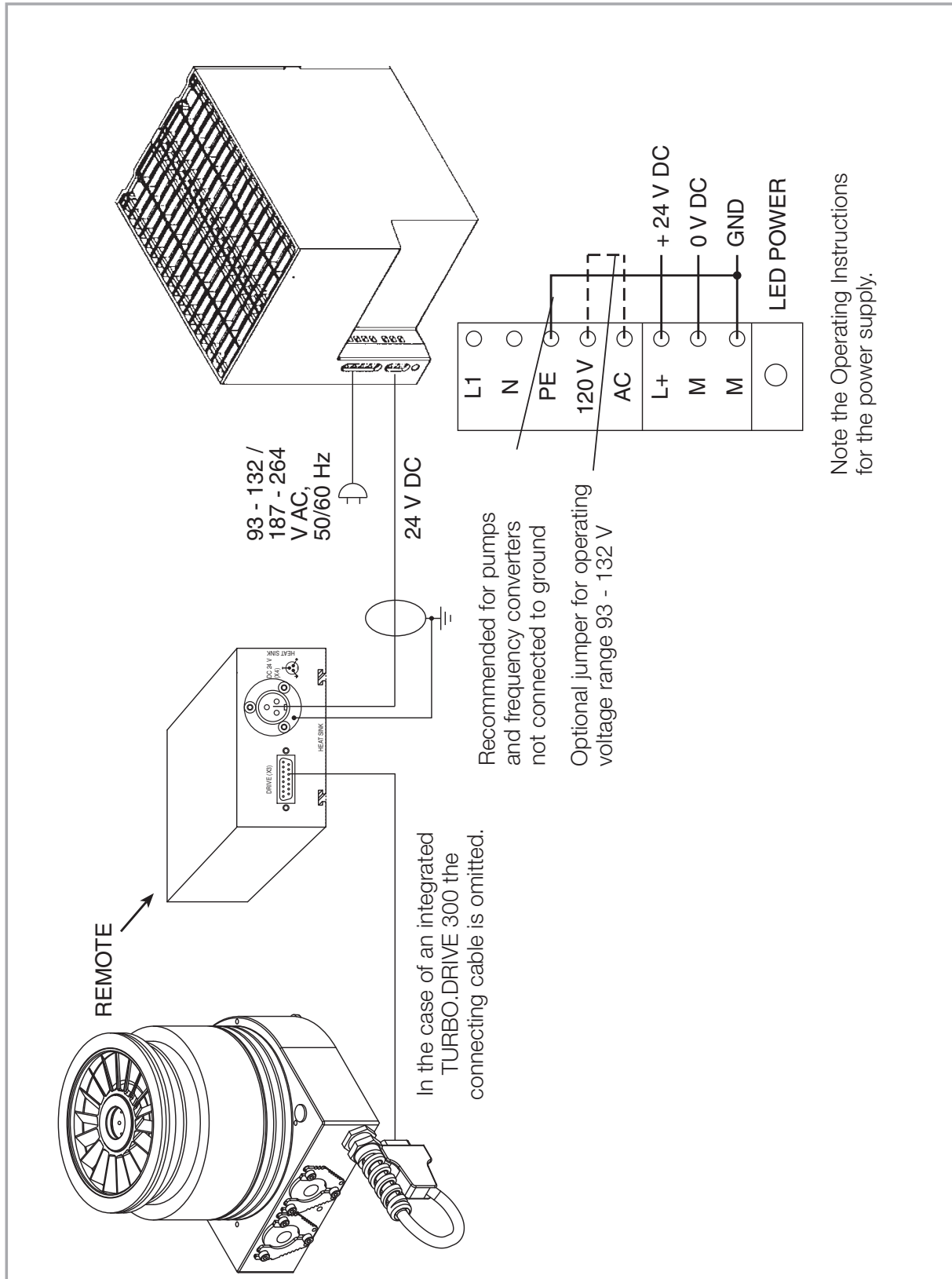
Fig. 6   Connecting the pump and the power supply

Programmable logic control (PLC)

100 - 240 V ~
50 - 60 Hz

24 V DC Control cable

REMOTE

In the case of an integrated TURBO.DRIVE 300 the connecting cable is omitted.
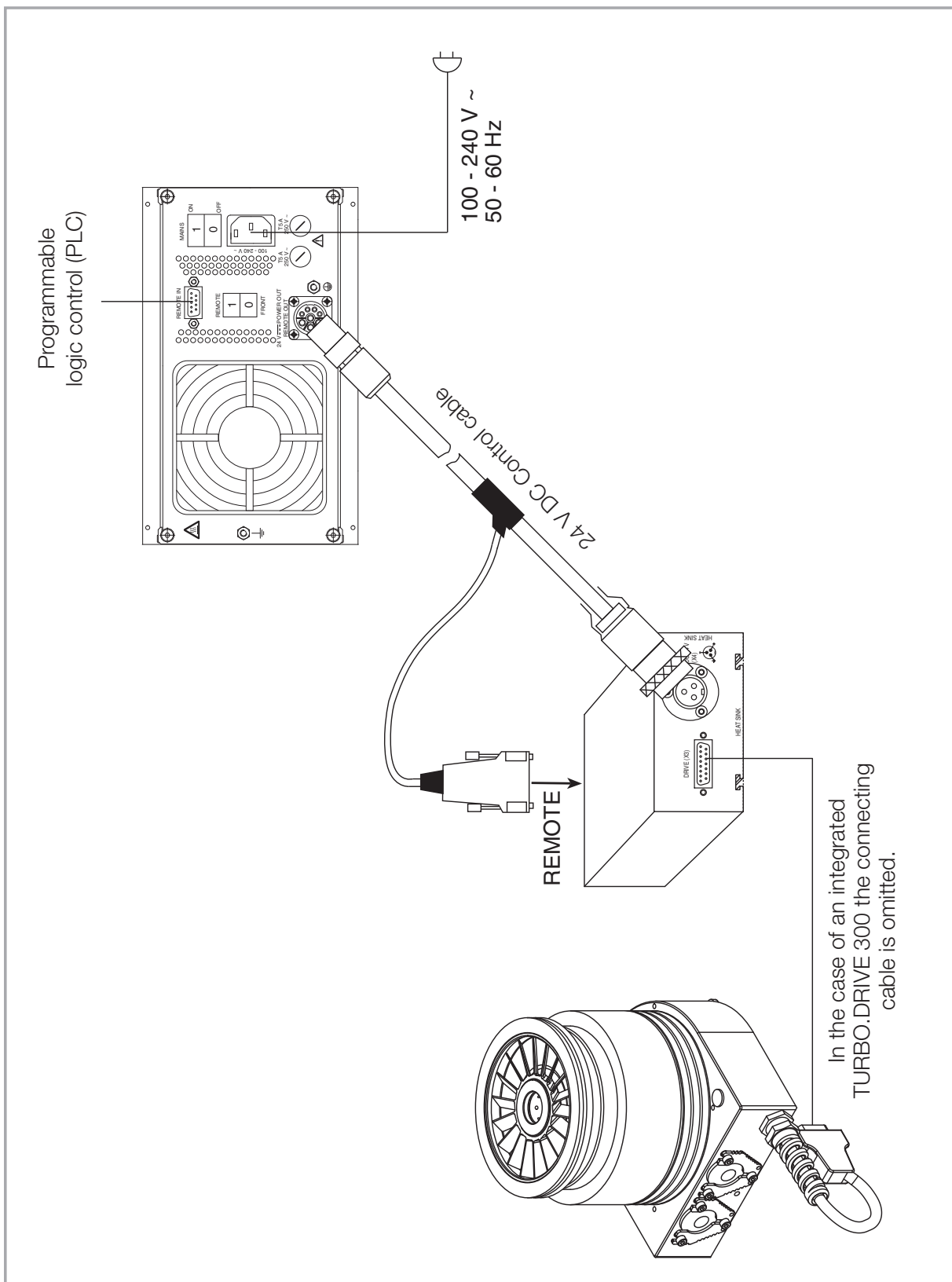
Fig. 7 Connecting the pump and the TURBO.CONTROL 300

Installation

100 - 240 V AC
50/60 Hz

24 V DC Power cable

In the case of an integrated
TURBO.DRIVE 300 the connecting
cable is omitted.
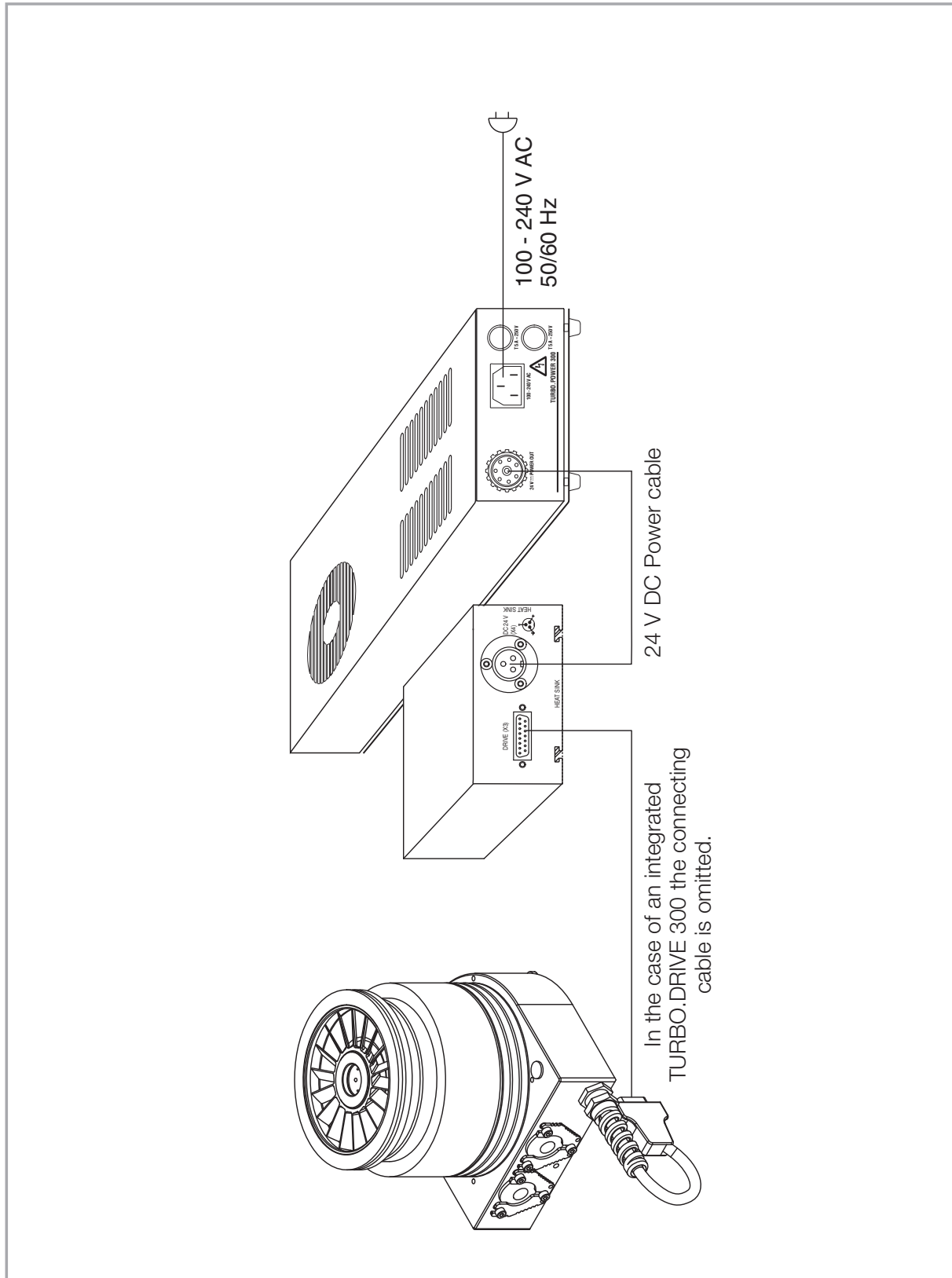
Fig. 8 Connecting the pump and the TURBO.POWER 300

Relay functions

Pin assignment of the connector

5 4 3 2 1
9 8 7 6

Relay – Normal operation

■ While deceleration, acceleration, Stop:
  4 connected to 5 (as shown; passive)
■ During normal operation (f > 0,9·$f_{nom.}$):
  4 connected to 3 (active)

Relay – Error

■ No error: 1 connected to 2 (as shown; passive)
■ Error is present: 1 connected to 9 (active)

Relay output rating: 42 V, 0.5 A

n.c. 5
n.o. 3
com. 4

n.c. 2
n.o. 9
com. 1

TURBO.DRIVE 300

Pin assignment for the Start/Stop input

Switching threshold for the Start/Stop control input:
Low level: < 5 V
High level: > 15 V

24 V
5 V
1 kΩ
1 kΩ

TURBO.DRIVE 300

Caution: No power feed is allowed at pin 7

7
8
6

Start/Stop operation
Example 1: Operation via a PLC

0 V = STOP
24 V = START

7
24 V
8
6

TURBO.DRIVE 300

Example 2: Operation via contacts

Contact open = STOP
Contact closed = START

7
24 V
8
6

TURBO.DRIVE 300

Fig. 9   Pin assignment of the REMOTE (X1) connector

Installation

2.6 Relay status

Input data / status				Output data					Operating mode
Start/ stop signal	Pump rotating	Normal frequency ≥ 90% of setpoint frequency	Error is present	Motor drive	Relay NORMAL OPERATION	Relay ERROR	LED STATUS (green)	LED ERROR (red)	
Stop	no	no	no	off	passive	passive	off	off	Pump not operating
Stop	yes	no	no	off	passive	passive	flashes	off	Pump is decelerating
Stop	yes	yes	no	off	passive	passive	flashes	off	Just after stop; pump was in the normal operating mode before that
Start	no	no	no	on	passive	passive	off	off	Just after start
Start	yes	no	no	on	passive	passive	flashes	off	Pump is accelerating
Start	yes	yes	no	on	active	passive	green	off	Pump is in the normal operating mode
Stop	no	no	yes	off	passive	active	off	red	Error is present; pump is at standstill
Stop	yes	no	yes	off	passive	active	flashes	red	Error is present; pump is decelerating
Stop	yes	yes	yes	off	passive	active	flashes	red	Error has just occurred
Start	no	no	yes	off	passive	active	off	red	Error is present; pump is at standstill
Start	yes	no	yes	off	passive	active	flashes	red	Error is present; pump is decelerating
Start	yes	yes	yes	off	passive	active	flashes	red	Error has just occurred

Other modes are not possible; they indicate a failure affecting the TURBO.DRIVE 300.

3   Operation

3.1   Interface description

The frequency converter is optionally equipped with serial interfaces:

- RS 232/422 C

- RS 485 C

- Profibus DP

The TURBO.DRIVE 300 is configured through the parameters according to the parameter list. Pxxx denotes parameter value xxx.

The PC software "TURBO.DRIVE Server" allows convenient access by the user to the parameters of the frequency converter.

For further information on the interfaces refer to Operating Instructions GA 05.281 "Serial Interfaces".
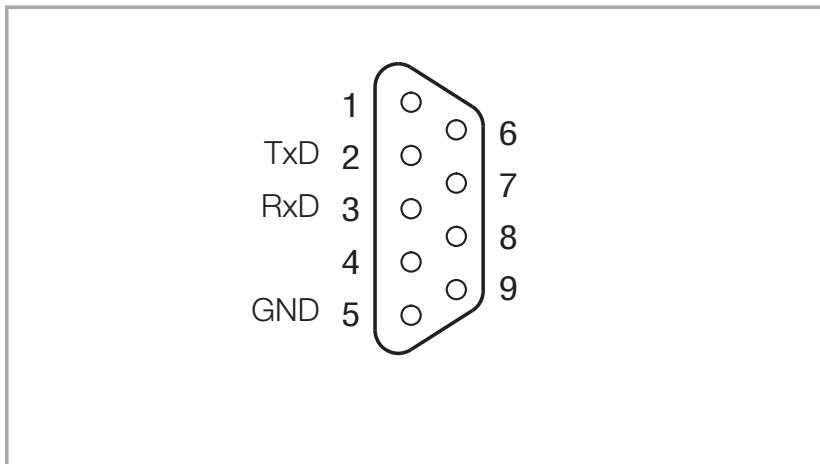

Fig. 10   Pin assignment for the socket at the frequency converter
(female) SERVICE X5

Operation

Applications which can be implemented with the aid of the serial interface:

Application	Benefits to the customer	How to do it
Networking of several pumps and other equipment	Savings relating to the costs for signalling cables	With Field Bus systems like Profibus
Automation	Savings related to repetitive manual work	For example by a control computer
Avoidance of warnings and warnings before overload operation and early detection of a failing pump	■ Precise planning for maintenance ■ Improved reliability of sensitive production processes in a vacuum	Monitoring of: ■ Motor current P5 ■ Ball bearing temperature P125 or P127 ■ Motor temperature P7 ■ Frequency converter temperature P11
Standby operation	■ Extending the service life for the ball bearings ■ Cutting energy consumption	Reducing the rotor's frequency through P24
Troubleshooting	Quick analysis of problems	Reading of error memories P171, P174 and P176: error code, speed, operating hours for error
Slow pressure control by changing the pumping speed	Dispensing with a flow controller	Changing the rotor frequency through parameter 24
Reducing the maximum motor current	Cost savings through smaller power supply units if peak loads can be reduced	With P139, motor current reduction factor
Starting the pump with a delay if several consumers are connected to the same PSU	Cost savings through smaller power supply units if peak loads can be reduced	With P36, delay
Frequency converter as a simple pressure gauge, since motor current is dependent on the vacuum conditions	Dispensing with pressure gauges	Monitor motor current P5; second function for "Normal Operation" relay: relay switches as soon as the motor current threshold is tripped. Adjust second function: P29 Set motor current thresh.: P27
Lowering the normal operation threshold	Normal operating mode is attained faster, processes can be started faster	Reduce frequency threshold through P25

Operation
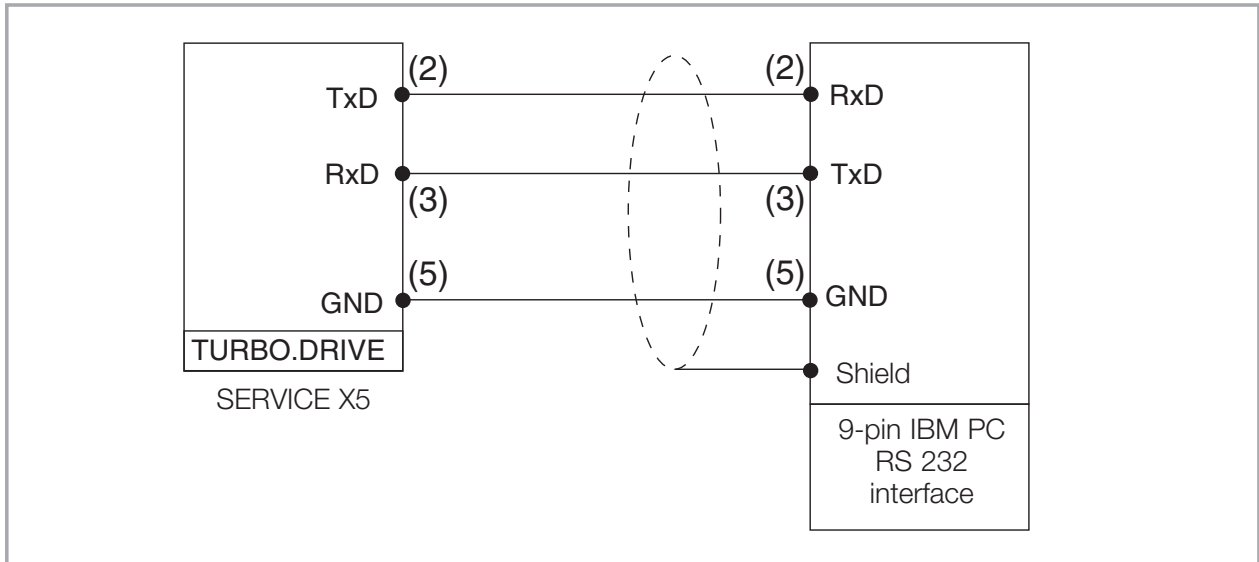
Fig. 11 Providing a RS 232 connection

3.1.1 RS 232/422 C interface (SERVICE X5)

Standards   DIN 66020

Protocol   acc. to VDI/VDE 3689

Transmission rate   19200 baud

Response delay   default setting 10 ms
                                         (parameter 180)

Address range   non-addressable

Max. cable length   5 m

Interface connector   9 way Sub-D type,
                          socket on the instrument (female)
                                         thread UNC4-40

Note: If on the controlling side an RS 232 interface in accordance with the PC standard with a 9-pin Sub-D male connector is present, then a straight through cable as shown in Fig. 11 may be used.

Refer also to Operating Instructions GA 05.281

Operation
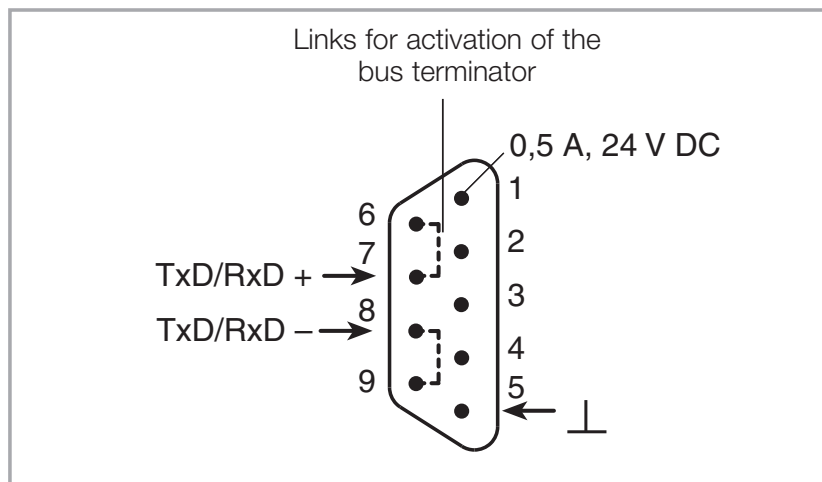
Fig. 12 Pin assignment for the socket at the frequency converter for RS 485 interface (male)

3.1.2 RS 485 interface

Standards	ISO/IEC 8482, EIA 485
Protocol	acc. to VDI/VDE 3689
Transmission rate	19200 baud fixed
Response delay	default setting 10 ms (parameter 180)
Address range	0 ... 15
Max. cable length	50 m (with bus termination)
Type of cable	2 wire twisted pair (twisted pair cable)
Differential voltage levels (see also "Standards")	logic "0": transmitter: 1.5 ... 5 V receiver: > 0.3 V
	logic "1": transmitter: - 1,5 ... - 5 V receiver: $\leq$ - 0,3 V
Interface connector	9 way Sub-D type, socket on the instrument (male) thread UNC4-40
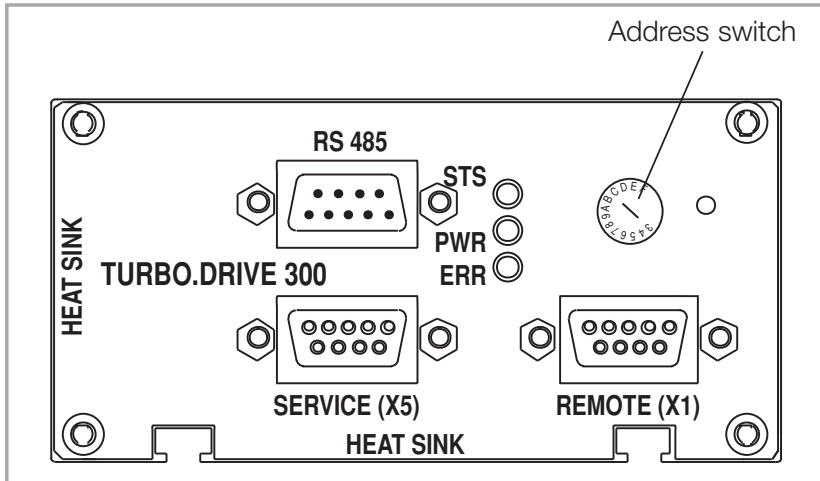
Fig. 13 TURBO.DRIVE 300 with RS 485 interface

Note: After having changed the bus address through the rotary switch, the frequency converter must be switched off (yellow power LED off) and then on again so as to enable the new address setting.

3.1.3 Profibus DP

The Profibus DP used has been defined in the standards EN 50170 and VDI/VDE 3689.

For more information on the Profibus system:

"The Rapid Way to Profibus",
Manfred Popp, Profibus Nutzerorganisation e.V., Germany
P/N 4.072

Upon request we shall be pleased to provide detailed information on the hardware and the protocol used for the data.

Refer also to Operating Instructions GA 05.281

Operation
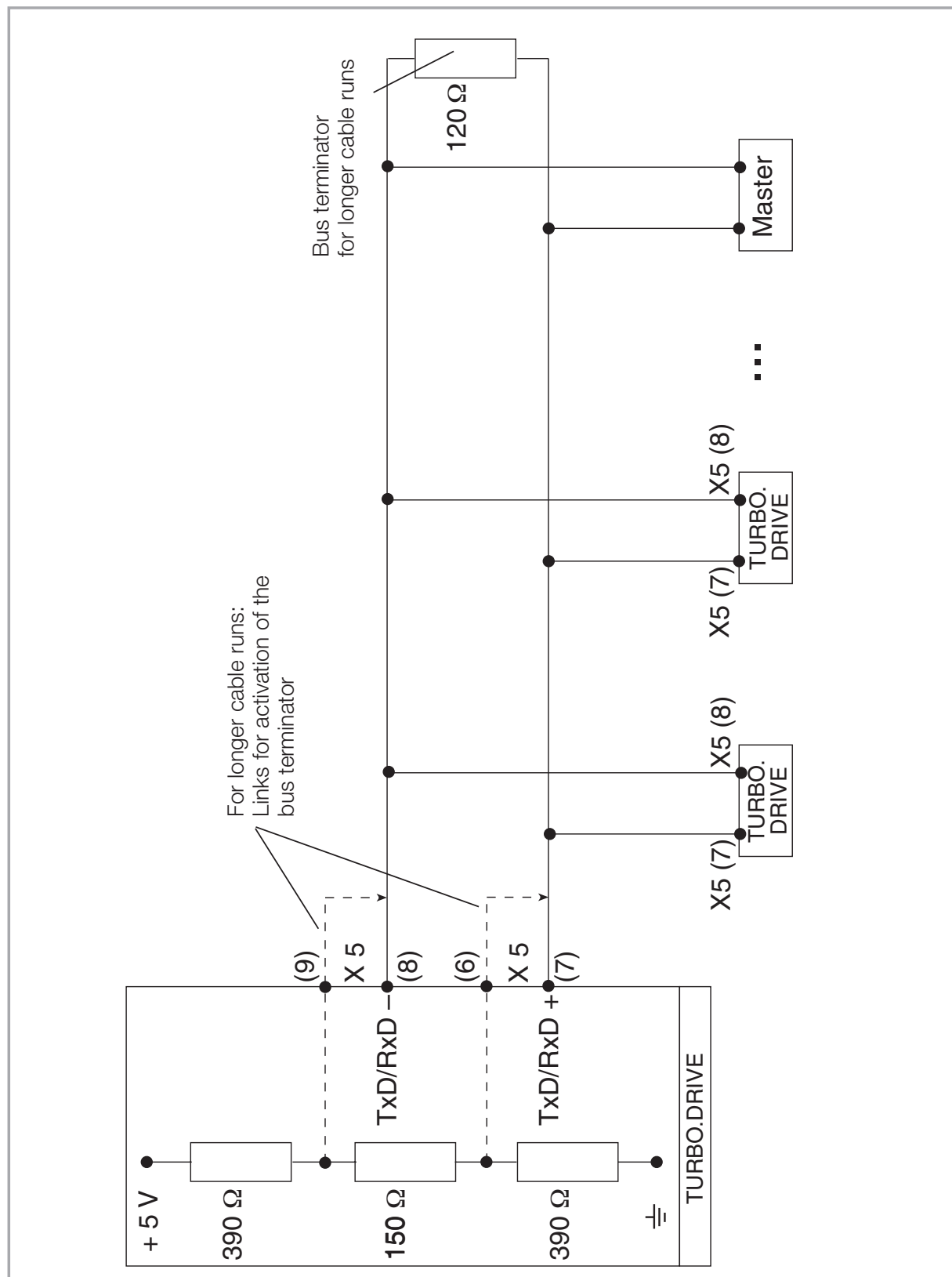
Fig. 14   Connection of the RS 485 bus

3.1.4 Parameter list

No.	Designation	Range	Unit	Default	Format	r/w	Description
0	Dummy parameter	-	-	-	U16		No function
1	Type of frequency converter	132/134	-	-	U16	r	TURBO.DRIVE 300 = 132
2	Software version	xx.yy.zz	-	1.13.00	U16	r	xx.yy: version, zz: correction index
3	Actual rotor frequency	0...1300	Hz	-	U16	r	The max. frequency depends on the pump type.
4	Actual converter supply voltage	18...32	V	-	U16	r	Nominal value for TURBO.DRIVE 300: 24V
5	Setpoint for the motor current	0... 60	0.1A	-	U16	r	
7	Actual motor-temperature	-20...150	°C	-	S16	r	Measured coil temperature for the motor
8	Permanently save the changed parameter data in the EEPROM	-	-	-	U16	w	A write command will cause the data to be saved. The parameter value itself is not processed and saved. After a reset or switching on the supply voltage with a different pump connected or without a pump, all parameters will be reset to their defaults.

Operation

No.	Designation	Range	Unit	Default	Format	r/w	Description
11	Actual converter temperature	-20...150	°C	-	S16	r	Measured internal converter temperature
12	Operating mode for START/STOP	0...2	-	0	U16	r/w	P12 = 0 (default): via REMOTE (X1); P12 = 1: via serial interface P12 = 2: Start: REMOTE (X1) at Start **and** serial interface sends Start signal Stop: REMOTE (X1) at Stop **or** serial interface sends Stop signal
16	Motor temperature warning threshold	30...150	°C	*	U16	r	Exceeding the motor temperature warning threshold results in a warning
17	Max. value setting for motor current	5 ... 75	0,1 A	*	U16	r/w	Maximum permissible motor current
18	Nominal pump frequency	750...1200	Hz	*	U16	r	Highest permissible frequency
19	Minimum setpoint frequency for the pump	P20 ... P18	Hz	*	U16	r/w	Lowest permissible frequency
20	Minimum frequency level	0 ... P19	Hz	*	U16	r	When the pump is accelerating this frequency must be reached within the maximum passing time (P183). After the end of acceleration: Switch-off threshold because of overload; see error 106

No.	Designation	Range	Unit	Default	Format	r/w	Description
23	Pump type	0...4	-	*	U16	r	0 = TW 220/150, TW 220/150/15 1 = TW 400/300/25S 2 = TW 250S 3 = TW 70 H 4 = TW 290 H TW 300 / TW 300 H
24	Setpoint frequency	P19 ... P18	Hz	*	U16	r/w	Adjustable between P19 to P18
25	Frequency dependent normal operation level	35..99	%	90	U16	r/w	If P29 = 0: Defines the normal operation level. Normal operation if $P3 \geq P24 \times P25$
27	Motor current dependent normal operation level	5...75	0,1 A	20	U16	r/w	If P29 = 1: Defines the normal operation level. Normal operation if $P5 \leq P27$

Operation

No.	Designation	Range	Unit	Default	Format	r/w	Description
29	Selection of the relay functions	0 ... 4	-	0	U16	r/w	The normal operation and error relays can be set to special functions if required.

P29 = 0 means: the **normal operation relay** is active when the normal operation frequency is exceeded (P3 ≥ P24 * P25)
the **error relay** is active in case of an error {TDS/L compatible}

P29 = 1 means: the **normal operation relay** is active when the current falls below the normal operation threshold (P5 ≤ P27)
the **error relay** is active in case of an error {TDS/L compatible}

P29 = 2 means: the **normal operation relay** controls e.g. a venting valve, activated via the field bus interface
(Bit 12 in the control word of the data transfer protocol)
the **error relay** controls e.g. a purge gas valve, activated via the field bus interface
(Bit 11 in the control word of the data transfer protocol) (makes only sense at interface operation}

P29 = 3 means: the **normal operation relay** is active when the normal operation frequency is exceeded (P3 ≥ P24 * P25)
the **error relay** is active when **no** error exists {T1600 compatible}

P29 = 4 means: the **normal operation relay** is active when the current drops below the normal operation threshold (P5 ≤ P27)
the **error relay** is active when **no** error exists

No.	Designation	Range	Unit	Default	Format	r/w	Description
32	Maximum run up time	P183...2000	s	720	U16	r/w	Max. permissible time during which the pump must attain the normal operation threshold (P24 x P25) with the start signal present

No.	Designation	Range	Unit	Default	Format	r/w	Description
36	Start delay time	0...255	0.1 min.	0	U16	r/w	Pause time after the Start command until the pump's drive is started
37	RS485 address	0 ... 31	-	0	U16	r/w	Parameterizable RS485 address;

a change of this parameter setting will only be effective
■ after the power supply has been switched off and on and
■ if the addresses 1, 2 and 3 are **not connection coded** via SERVICE (X5)

No.	Designation	Range	Unit	Default	Format	r/w	Description
38	Start counter	0 ... 65535	-	-	U16	r	Counts the total number of pump starts
40	Error counter	0 ... 65535	-	-	U16	r	Counts the total number of errors
90	Error mode	1/2	-	2	U16	r/w	Selection of the error code table which is saved in P171 2 = standard setting 1 = compatible to T1600
125	Current bearing temperature	-20...150	°C	-	S16	r	Measured bearing temperature (identical to P127)
126	Bearing temperature warning threshold	30...150	°C	*	U16	r	Exceeding the bearing temperature warning threshold results in a warning
127	Current bearing temperature	-20...150	°C	-	S16	r	Measured bearing temperature (identical to P125)
128	Bearing temperature warning threshold	30...150	°C	*	U16	r	Exceeding the bearing temperature warning threshold results in a warning

Operation

No.	Designation	Range	Unit	Default	Format	r/w	Description
131	Bearing temperature shutdown level	30...150	°C	*	U16	r	Max. permissible bearing temperature; P125 > P131 causes the pump to be switched off
132	Bearing temperature shutdown level	30...150	°C	*	U16	r	Max. permissible bearing temperature; P125 > P132 causes the pump to be switched off
133	Motor temperature shutdown level	30...150	°C	*	U16	r	Max. permissible motor temperature; P7 > P133 causes the pump to be switched off
139	Current reduction factor	30...100	%	100	U16	r/w	Is used for the reduction of the maximum current drawn by the frequency

converter, e.g. for adaption of low performance power supplies (Note: values < 100 reduce the pump performance and increase the run-up time)
A change in the current reduction factor will only become effective after writing any value to parameter 8 and when switching after this the supply voltage off and on.

No.	Designation	Range	Unit	Default	Format	r/w	Description
171	Error code memory for the last 40 error events	0...39	-	0	Array 0..39 U16	r	Sequential permanent memory; the individual error codes are accessed via parameter

171 with additional index no. in the parameter order identifier of the interface protocol. The last error code which has occurred is saved at the memory location with the index 0, the oldest is at index 39. See Section 3.1.7 for the error codes.

No.	Designation	Range	Unit	Default	Format	r/w	Description
174	Rotor frequency at the time of error	0...1300	Hz	-	U16	r	Sequential permanent memory of the last 40 rotor frequency values, which have been
	saved at the time of an error. The individual error codes are accessed via parameter 174 with additional index no. in the parameter order identifier of the interface protocol. The last error code which has occurred is saved at the memory location with the index 0, the oldest is at index 39.						
176	Error operating hours memory for the last 40 error events	0...19 years	0.01 h	-	Array 0..39 U32	r	Analogous to P171 (error code memory)
180	Response delay time	2...19	msec	10	U16	r/w	Pause time between received and transmitted interface protocol
	string of the frequency converter's serial interface RS 232 and RS 485. We recommend not to change the default setting (10 ms)						
183	Max. passing time	10...2000	s	500	U16	r	Max. permissible time during which the
	pump must - with the start signal present - have passed through the critical speed range between 60 Hz and P20						
184	Converter operating hours counter	0...19 Years	0,01h	-	U32	r	Totals the operating hours for the converter when the pump's drive is active
199	Converter date of manufacture	01.01.00 ... 31.12.99	-	-	U32	r	

Operation

No.	Designation	Range	Unit	Default	Format	r/w	Description
227	Warnings bits 10	... 65535	-	-	U16	r	Active warnings described bit per bit; for the meaning see Section 3.1.6
303	Pump status word	-	-	-	U16	r	Meaning of the bits: Bit 0 = 1 Normal operation Bit 1 = 1 Ready for switch on Bit 2 = 1 Speed is increasing Bit 3 = 1 Speed is dropping Bit 4 = 1 Generator operation Bit 5 = 1 Stand-by In case of an error P303 has the value of 0 (not ready to be switched on)
312	Cat. No. code	0 ... 2^{31}-1	-	-	U32	r	Abbreviated description of the Cat. No. of the pump or of the converter Examples: 800072V1003 = 721003 830070V0101 = 300700101
315	Serial No. code	1 ... 2^{31}-1	-	-	U32	r	The 9 least significant bits of the original serial No.
316	Hardware identifier	0...100	-	-	U16	r	Hardware version index of the converter

3.1.5 Specific parameter data for the pumps

Type of pump	Pump designation	Nominal and setpoint frequency	Minimum setpoint frequency	Minimum frequency level	Max. motor current	Max. bearing temp.	Max. motor temp.	Bearing temp. warning threshold	Motor temp. warning threshold
P23		P18 / P24	P19	P20	P17	P132	P133	P126	P16
0	TW 220/150 TW 220/150/15	750	400	375	60	80	100	70	95
1	TW 400/300/25S	800	400	375	60	80	100	70	95
2	TW 250S	860	475	450	50	67	100	60	95
3	TW 70 H	1200	625	600	50	67	90	60	85
4	TW 290 H / TW 300 TW 300 H	1000	525	500	50	80	63	70	58

Operation

3.1.6 Warning codes for parameter 227

Bit	Bit 15 binary value Bit 0 ← MSB … LSB →	Hexa-decimal value	Decimal value	Designation	Condition / description of the warning
0	0000 0000 0000 0001	0001	1	Motor tempera-ture warning	P7 > P16
1	0000 0000 0000 0010	0002	2	Converter tempe-rature warning	P11 > 70 °C
2	0000 0000 0000 0100	0004	4	Bearing tempe-rature warning	P125 > P126 or P127 > P128
3	0000 0000 0000 1000	0008	8	Bearing tempe-rature warning	P127 > P128 or P125 > P126
4	0000 0000 0001 0000	0010	16	not used	-
5	0000 0000 0010 0000	0020	32	not used	-
6	0000 0000 0100 0000	0040	64	Overspeed warning	P3 > (P24 + 10 Hz)
7	0000 0000 1000 0000	0080	128	not used	-
8	0000 0001 0000 0000	0100	256	High load warning	P5 > (P17 * P21) effec-tive P32 seconds after the start and if P21 < 100%
9	0000 0010 0000 0000	0200	512	not used	-
10	0000 0100 0000 0000	0400	1024	Switch-off thresh-old exceeded; can only be reset by the Oerlikon Leybold Vacuum Service	P125 > P131 or P127 > P132
11	0000 1000 0000 0000	0800	2048	Overload warning	P3 < P25 * P24
12	0001 0000 0000 0000	1000	4096	not used	-
13	0010 0000 0000 0000	2000	8192	not used	-
14	0100 0000 0000 0000	4000	16384	Power supply warning	P4 > P805 or P4 < P806
15	1000 0000 0000 0000	8000	32768	not used	-

3.1.7 Error codes for parameter P171

Code	Type of error	Condition / Description of the error	Pump switched off
0	No error	–	no
1	Overspeed error	Nominal speed of the pump (P 18) has been exceeded by over 10%	no
2	Pass through time error	Max. time for passing through the critical frequencies of 60 Hz to P20 has been exceeded: 60 Hz < P3 < P20 after P183 has elapsed with the start signal present	yes
3	Bearing temperature error	Maximum bearing temperature has been exceeded: P125 > P132 or P127 > P132	yes
4	Short circuit error	Short circuit in the pump's motor or the connecting cable	yes
5	Converter temp. error	Maximum temperature for the converter has been exceeded: P11 > 85°C	yes
6	Run up time error	Max. time after which the pump must enter its normal operation mode has been exceeded: P3 < P24 x P25 after P32 has elapsed with the start signal present	yes
7	Motor temperature error	Maximum motor temperature has been exceeded: P7 > P133	yes
8	Pump error	Pump could not be identified or no pump is connected.	yes
60	Short circuit error	Short circuit in the pump's motor	yes
61	Bearing temp. warning	Bearing temperature warning threshold has been exceeded: P125 > P126 or P127 > P128	no
62	Bearing temp. warning	Bearing temperature warning threshold has been exceeded: P127 > P126 or P125 > P128	no

Operation

Code	Type of error	Condition / Description of the error	Pump switched off
101	Overload warning	The frequency has dropped below the normal operation frequency by high load: P3 < P25 * 24 (after normal operation has been reached)	no
103	Power supply error	No power supply during active operation of the pump	no
106	Overload error	Upper critical limit frequency has been exceeded by overload (P3 < P20 after P32 from start after run-up)	yes
116	Permanent overload error	Max. overload time has been exceeded: P3 < P25* P24 for longer than P32	yes
117	Motor current error	No motor current or motor current too low (I_{set} > 1 A and P5 < 0,2 A)	yes
118	Motor connection error	Error in the motor connection cable	yes
125	High load warning	Max. permissible permanent current has been exceeded: P5 > P17 * P21 for longer than P32 from start after run-up	no
126	Bearing temperature sensor error	Error at the bearing temperature sensor (Resistance not in the plausible range; –20 °C < T < 150 °C)	yes
127	Bearing temperature sensor error	Error at the bearing temperature sensor (Resistance not in the plausible range; –20 °C < T < 150 °C)	yes
128	Motor temperature sensor error	Error at the motor temperature sensor (Resistance not in the plausible range; –20 °C < T < 150 °C)	yes
131	Permanent high load error	Max. high load time has been exceeded: P5 > P17 * P21 for longer than 2 * P32	yes
143	Overspeed error	Pumping speed has been exceeded by more than 15 % (P3 > P18 x 1,15)	yes
144	Profibus address error	Wrong Profibus address set (must be 0 ... 126)	yes
145	Profibus error	Error during cyclic exchange of data over the Profibus, the watchdog timer has responded	yes

Code	Type of error	Condition / Description of the error	Pump switched off
201	CPU error	Error in the micro computer	yes
202	PLL-synchronisation warning	Error in the pump's speed synchronisation wiring	no
203	Parameter value error	Parameter value internally not valid; data error	yes
205	Data plausibility error	Internal data error (open loop)	yes
207	Motor blocked error	Rotor blocked	yes
208	PLL error	PLL synchronisation error	yes
212	Shut down	Emergency off	
213	Overvoltage error	Power supply voltage too high (UZK > 80 V)	yes
214	Undervoltage error	Power supply voltage too low (level depends on pump)	yes
216	Memory test error	Error in external memory	yes
217	Pump identification resistor error	Wrong or missing pump identification resistor	yes
222	Hardware test error		yes
223 - 226	Logical unit error	Error in the programmed logigal unit	yes
227	Pump model can not be operated	No set of parameters defined for the recognized pump model	yes

Operation

3.2 Switching on

Switch on the DC power supply. The yellow LED at the frequency converter lights up.

Switch on the turbomolecular pump at the frequency converter

■ via pins 7 and 8 of the socket REMOTE (X1) (For example via a remote control or with the aid of the plug with integrated ON/OFF switch: see Section 1.5 Accessories).

■ by a start command via the interface; see Section 3.1.

■ For the power supply units offered or recommended by Oerlikon Leybold Vacuum: If the contacts 7 and 8 at the REMOTE (X1) connector are closed the pump starts automatically when the DC voltage is switched on (provided parameter 12 is set to 0).

The turbomolecular pump accelerates. The green LED flashes. When the pump reaches normal operation the green LED lights up permanently.

Warning

After a mains power failure the pump can run up automatically once more.

3.3   Shutting down

Switch off the pump at the frequency converter.

■ via contacts 7 and 8 of the socket REMOTE (X1), if parameter 12 = 0.

■ apply a stop command via the interface, if parameter 12 = 1 or 2.

■ for the power supply units offered or recommended by Oerlikon Leybold Vacuum switch off the DC voltage.

After switching off, the green status LED will flash until the rotor of the turbomolecular pump is at standstill. This may take several minutes. With the DC power supply off, the turbomolecular pump will act as a generator supplying the frequency converter with energy as indicated by the yellow power LED.

If a failure occurs the turbomolecular pump will be shut down automatically. The red LED at the frequency converter lights up.

To shut down the frequency converter, switch the pump off and wait until the rotor of the turbomolecular pump has arrived at standstill (green status LED off).

Then switch the mains power off and wait until the yellow power LED is off. Then only disconnect any cable connections.

3.4   Emergency shut down

The emergency shutdown facility of a system controller must be capable of shutting the pump down as detailed in Chapter 3.3. The rotor of the turbomolecular pump may be stopped faster by venting the pump; for this refer to the Operating Instructions for the pump.

Operation

3.5   Setting pumping speed and rotational speed

For the purpose of reducing the pumping speed of the pump because of application requirements or for other reasons it can make sense to reduce the rotational speed.

In order to permanently reduce the speed we recommend the following procedure:

With the aid of a Windows PC and the PC software "TURBO. DRIVE Server" change the setting for the parameter 24 "Setpoint frequency". The possible values for parameter 24 will depend on the type of pump connected. Parameter 18 "Nominal pump frequency" defines the maximum value and parameter 19 "Minimum setpoint frequency for the pump" defines the minimum value.

So as to retain the value saved for parameter 24 when switching the pump off, the parameter value needs to be saved permanently. For this enter any value (for example 1) for parameter 8. Thereafter changed parameters will be saved permanently.

After replacing the pump or when switching on the supply voltage without a connected pump, all changed parameter values will be reset to factory defaults.

The rotational speed of the pump may be changed during operation also with the aid of a Windows PC and the PC software "TURBO.DRIVE Server".

However, we here recommend a PLC compliant solution with the aid of the Profibus. The speed can be set over the Profibus in two ways:

■ by changing parameter 24 within the limits defined by parameters 19 and 18 or

■ by transfer as the main setpoint (for this also refer to VDI/VDE 3689).

3.6 Operation at reduced current

Not all applications require that the TURBO.DRIVE 300 be operated at its maximum current. Operation at reduced current will allow operation off a smaller power supply unit or to operate two or more turbomolecular pumps off a power supply unit which in practice is just not strong enough to supply the maximum current for several connected pumps. However, this will increase the run up time, and the maximum gas throughput and backing pressure specifications are reduced.

For this proceed as follows:

With the aid of a Windows PC and the PC software "TURBO. DRIVE Server" change the setting for the parameter 139 "Current reduction factor". The possible values for parameter 139 can be varied within the limits of 30 to 100 % of parameter 17 (current dependents on the type of connected pump. The newly entered current reduction factor will only be active after switching off and on again.

So as to retain the value saved for parameter 139 when switching the pump off, the parameter value needs to be saved permanently. For this enter any value (for example 1) for parameter 8. Thereafter changed parameters will be saved permanently.

After replacing the pump or when switching on the supply voltage without a connected pump, all changed parameter values will be reset to factory defaults.

Operation

3.7   Changing the frequency dependent normal operation level

Depending on the quality of the vacuum which needs to be provided by the turbomolecular pump it may make sense to reduce the frequency dependent normal operation threshold, so that the ready status can be attained faster by the vacuum system. The factory default of 90 % represents a good compromise so that a change will hardly ever be required.

For this proceed as follows:

With the aid of a Windows PC and the PC software "TURBO. DRIVE Server" change the setting for the parameter 25 "Frequency dependent normal operation level". The possible values for parameter 25 can be varied within the limits of 35 to 99 % of parameter 24 (nominal speed depends on the type of connected pump).

So as to retain the value saved for parameter 25 when switching the pump off, the parameter value needs to be saved permanently. For this enter any value (for example 1) for parameter 8. Thereafter changed parameters will be saved permanently.

After replacing the pump or when switching on the supply voltage without a connected pump, all changed parameter values will be reset to factory defaults.

3.8 Changing the maximum permissible run up time

In vacuum systems at a high backing pressure or with increased quantities of gas during the run up phase, the run up time for the turbomolecular pump may be longer. This will then cause the frequency converter to output an error message,

The maximum permissible run up time is changed as follows:

With the aid of a Windows PC and the PC software "TURBO. DRIVE Server" change the setting for the parameter 32 "Maximum run up time". The possible values for parameter 32 can be varied within the limits of P183 to 2000 seconds. The default setting is 720 seconds. As a rule, no value below 720 seconds should be entered as this would give rise to unnecessary error messages. If a significantly higher value than 720 seconds is required, this may indicate that the turbomolecular pump is being overloaded. For this reason in such a case the temperature data from the frequency converter and the turbomolecular pump (parameter 7 = motor temperature, 11 = frequency converter temperature, 125/127 bearing temperature) should be specially monitored during application trials.

So as to retain the value saved for parameter 32 when switching the pump off, the parameter value needs to be saved permanently. For this enter any value (for example 1) for parameter 8. Thereafter changed parameters will be saved permanently.

After replacing the pump or when switching on the supply voltage without a connected pump, all changed parameter values will be reset to factory defaults.

Operation

3.9   Changing the start delay time

Generally it will make sense to let the turbomolecular pump run up immediately after applying the start command. However when operating two or more turbomolecular pumps off a single power supply unit, it may make sense to start the pumps one after the other. One way of achieving this is to enter a start delay time differing from 0.

To set up the start delay time proceed as follows:

With the aid of a Windows PC and the PC software "TURBO. DRIVE Server" change the setting for the parameter 36 "Start delay time". The possible values for parameter 36 can be varied within the limits of 0 to 25.5 minutes (0 to 255).

So as to retain the value saved for parameter 36 when switching the pump off, the parameter value needs to be saved permanently. For this enter any value (for example 1) for parameter 8. Thereafter changed parameters will be saved permanently.

After replacing the pump or when switching on the supply voltage without a connected pump, all changed parameter values will be reset to factory defaults.

3.10 Selecting relay functions
See parameter 29.

3.11 Reading the error memory
The TURBO.DRIVE 300 is capable of permanently saving up to 40 error events. The error codes are saved under parameter number 171. In addition to each error code the following is also saved:

■ Rotor frequency at the point of time when the error event in parameter 174 occurred.

■ The corresponding number of operating hours in parameter 176.

Access to each of the 40 groups of values is accomplished with the aid of an index value which needs to be stated besides the parameter number when accessing via the protocol in accordance with VDI / VDE 3689. The range of index numbers ranges from 0 to 39.

Maintenance

4   Maintenance

The frequency converter is maintenance free. Repairs must only be done by Oerlikon Leybold Vacuum.

If required clean the frequency converter of dust with a dry cloth.

When removing a defective frequency converter from an installation, please note the information given in Chapter 3.3.

During all work on the pump which is being driven by the frequency converter, the system must be protected against being switched on. For this disconnect the DC power supply.

5 Troubleshooting

Before you start searching for the source of the problem, you should carry out a few simple checks:

Are the connections in good working order?

■ Mains connection,

■ DC power supply to the frequency converter,

■ Connector cable between the frequency converter and the pump

Is the forevacuum pressure sufficient?

After having removed the cause for the error reset the error message at the TURBO.DRIVE:

■ In case of errors with error codes 1 to 7 by applying a STOP signal via the socket REMOTE (X1) or a reset sequence via the serial interface or by switching the mains power off.

■ In case of error code 8 by switching the mains power off.

The error codes can only be read if a serial interface is present (RS 232, RS 485, Profibus).

The following table has been provided as a guide when determining the causes of errors.

To remove possible faults, staff having different qualifications is required:

■ **Operator** of the system

■ Qualified **maintenance staff** of the system operator or qualified staff from the vendor erecting the system

■ Staff from **Oerlikon Leybold Vacuum Service (OLV Service)**

In some cases also a combination of the above will be needed, for example, check by the operator, rectification of the fault by maintenance staff.

Troubleshooting

Malfunction	Possible cause	Corrective action	Responsible
Red ERROR LED is on: Error code1: Overspeed error	EMC influence	Check connecting cable, insert it properly. Switch the power supply voltage off and then on again	Operator/ maint. staff Operator
	TURBO.DRIVE 300 faulty	Replace frequency converter.	Maint. staff/ OLV service
Red ERROR LED is on: Error code 2 + 6: pass through timer error and run up time error ■ Pump runs up too slowly ■ Pump looses its speed	Forevacuum or high-vacuum pressure too high.	Check the forevacuum pump and use a different forevacuum pump if necessary.	Operator/ maint. staff
	Gas volume too great.	Seal leak; install a higher-capacity vacuum pump if necessary.	Maint. staff
	Power supply overloaded	Reduce the number of consumers or use a stronger power supply or switch on the consumers one after the other.	Operator/ maint. staff
	Bearing defective.	Repair the pump.	OLV service
Red ERROR LED is on: Error code 3 + 7: bearing temperature error and motor temperature error	Forevacuum pressure too high.	Check the forevacuum pump and use a different forevacuum pump if necessary.	Operator/ maint. staff
	Gas volume too great or leak in the system.	Seal leak; install a higher-capacity vacuum pump if necessary.	Maint. staff
	Fan defective.	Replace the fan.	OLV service
	Ambient temperature too high.	Feed cooler air to the pump or install water cooling.	Maint. staff
	Bearing defective.	Repair the pump.	OLV service

Malfunction	Possible cause	Corrective action	Responsible
Red ERROR LED is on: Error code 4: Short circuit error	Short circuit in the pump's motor	Repair the pump.	OLV service
	Short circuit in the connecting cable	Check to see if the connecting cable is undamaged, exchange it if required.	Operator/ maint. staff
Red ERROR LED is on: Error code 5: converter temperature error	TURBO.DRIVE integrated in the pump: Inadequate cooling of the pump; operation at too high loads	See error code 3 + 7.	–
	Separate TURBO. DRIVE: Ambient temperatures too high	Improve the cooling situation: Install a fan	Maint. staff Maint. staff
	Inadequate cooling of the TURBO.DRIVE	Ensure better thermal linking to the cooling surface and ensure a lower temperature at the cooling surfaces Avoid exposure to the heat generated by other equipment.	Maint. staff
	Operation at too high loads	See error code 3 + 7.	–
Red ERROR LED is on: Error code 8: pump error TURBO.DRIVE 300 can not detect the type of connected pump.	Pump not connected to TURBO.DRIVE	Check connecting cable	Operator
	Wrong connector cable pump - frequency converter.	Use standard cable; see Section 1.4	Maint. staff
	Power supply builds up the DC too slowly	Use power supply recommended by Oerlikon Leybold Vacuum	Maint. staff
	Power supply overloaded	Reduce the number of consumers when switching on or use a stronger power supply.	Operator/ maint. staff

Troubleshooting

Malfunction	Possible cause	Corrective action	Responsible
Yellow power LED is not on.	No DC power	Check cables and power supply.	Operator/ maint. staff
	DC power miswired.	Ensure correct polarity of the DC cable.	Maint. staff
	Frequency converter defective.	Replace frequency converter. The following may damage the freq. converter: ■ Disconnection of the DC cable while the pump was still rotating ■ Non-compliance with the note related to connecting several pump to a single power supply.	Maint. staff/ OLV service
Red LED flashes.*	Warning message. See Section "3.1.6 Warning codes" for the possible reasons of the warning.	The pump can continue to run, as long as operation limits are only exceeded for a short time. In case of longer exceeding send pump and frequency converter to the OLV service.	Operator/ OLV service

*The flashing can be reset:

■ Stop the turbomoleular pump (by interface, PLC (X1) or plug for connector X1 with integrated ON/OFF switch)

■ Wait until pump stopped spinning (green LED does not light)

■ Disconnect the TD 300 from the power supply

■ Disconnect turbomolecular pump from TD300

■ Reconnect TD 300 to the power supply (error LED lights as no pump is connected)

■ Disconnect again the TD 300 from the power supply. TD 300 is now reset to the default value for the actually used turbomolecular pump.

■ Connect the turbomolecular pump to the TD 300

■ Connect the TD300 to the power supply

■ Restart the turbomolecular pump (by interface, PLC (X1) or plug for connector X1 with integrated ON/OFF switch)

Troubleshooting

Malfunction	Possible cause	Corrective action	Responsible
Yellow LED flashes.	Warning message: Supply voltage too low or too high.	The pump can continue to run. Check the reason for wrong voltage and eliminate the fault.	Operator/ maint. staff
Turbomolecular pump does not start, ERROR LED does not light.	Operation mode set wrongly, e. g. with TURBO.DRIVE Server.	Change parameter 12.	Operator/ Maint. staff
	Interface protocol error	Use USS protocol.	Operator/ Maint. staff
	No communication via the serial interface.	Connect bus as shown in Section 3.1.	Maint. staff
	REMOTE connector (X1) connected wrongly.	Connect as shown in Fig. 9.	Maint. staff
	REMOTE and SER-VICE connectors mixed up.	Connect correctly.	Maint. staff
	Wrong Profibus address set.	Set address between 0 and 126.	Operator/ Maint. staff
Turbomolecular pump produces loud running noises and vibrations.	Rotor out of balance.	Balance the rotor.	OLV service
	Bearing defective.	Replace the bearing.	OLV service

Troubleshooting

Malfunction	Possible cause	Corrective action	Responsible
Turbomolecular pump does not reach ultimate pressure.	Measurement instrument defective.	Inspect the measurement sensor.	Operator/ Maint. staff
	Measurement sensors soiled.	Clean or replace the sensors.	Maint. staff
	Leaks at the equipment, lines or the pump.	Check for leaks.	Maint. staff
	Pump soiled.	Clean the pump.	OLV service
	Forevacuum pump provides insufficient pumping speed or ultimate pressure necessary.	Check the ultimate pressure of the forevacuum pump and install a higher-capacity vacuum pump if which is too high.	Operator/ maint. staff
	Frequency parameters programmed wrongly.	Check parameters.	Operator/ Maint. staff
Green LED blinks, yellow LED lights up weakly.	Frequency converter defective.	Wait for pump standstill (several minutes), then switch off the power supply for 5 seconds and switch it on again.	Operator
Running pump can not be stopped via X1.	Pump has been started via the serial interface, the interface controls the pump.	Disconnect the DC supply or connect serial interface and stop via bus. Check parameter 12.	Operator/ Maint. staff

C E

EG-Manufacturer´s and Conformance Declaration

We, the Oerlikon Leybold Vacuum GmbH. Declare herewith that the products listed below, in the embodiment which we have placed on the market, comply with the applicable EC guidelines.

This declaration becomes invalid if modifications are made to the product without consultation with us.

Designation of the product: Frequency converter for turbo molecular pumps

Model: TurboDrive 300

Part. No.:   800072Vxxxx

The products comply to the following guidelines:

- EC-Directive on Machinery (98/37/EG)
- EC-Low-Voltage Equipment Guideline (2006/95/EG)
- EC-Directive on Electromagnetic Capability (89/336/EWG), (91/263/EWG), (92/31/EWG) and (93/68/EWG)

Related, harmonized standards:

- EN 1012 – 2: 1996
  Safety requirements for compressors and vacuum pumps – Part 2: vacuum pumps

- EN 61010 -1: 2001
  Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements

- EN 61326: 2004
  Electrical equipment for measurement, control and laboratory use – EMC requirements

Cologne,

Dr. Ulrich Jung
Vice President
Head of Product Development

Cologne,

Alois Greven

Head of Electronics Development

NRTL

The frequency converter TURBO.DRIVE 300 has been tested by the TÜV Rheinland of North America according to the requirements of

■ NRTL
   (applied standards UL 61010A-1: 2002)

It complies with the standards stated.

Certificate No. US 72030360 01

Notes

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