

Serial Interfaces for TURBOVAC i/iX

RS 232, RS 485, Profibus, USB

Operating Instructions 300450826_002_A0



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Original operating instructions.

Safety Information

Obligation to Provide Information

Before installing and commissioning, carefully read these Operating Instructions and follow the information so as to ensure optimum and safe working right from the start.

The Oerlikon Leybold Vacuum **TURBOVAC i/iX with serial interface** 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 carefully read and strictly observe all safety precautions described in this section and throughout the Operating Instructions. The device must only be operated in the proper condition and under the conditions 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.

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE is used to notify users of installation, operation, programming or maintenance information that is important, but not hazard related.

We reserve the right to alter the design or any data given in these Operating Instructions. The illustrations are not binding.

Retain the Operating Instructions for further use.

NOTICE



DANGER



WARNING



CAUTION



NOTICE



Description RS 232, RS 485



Fig. 1.1 Interface modules for the Anybus plug-in

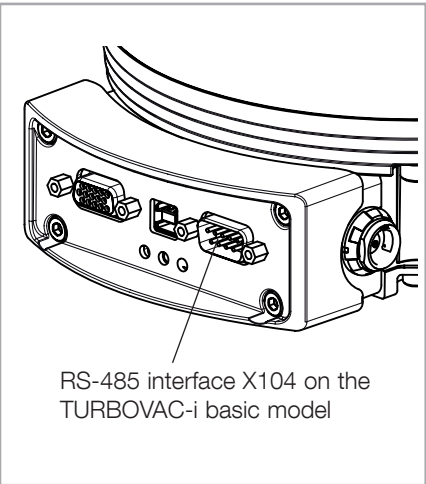


Fig.1.2 TURBOVAC i

1 Description

1.1 Description of the RS 232 and RS 485 Interfaces

The TURBOVAC is a slave unit and thus responds to requests from the master, and supplies data exclusively after having received a request to do so from the master.

In the case of word data (16 or 32 bits long) the high byte is transferred first (Motorola standard).

LED PWR (Power)

State	Indication
Off	no power
Green	power on

Description RS 232, RS 485

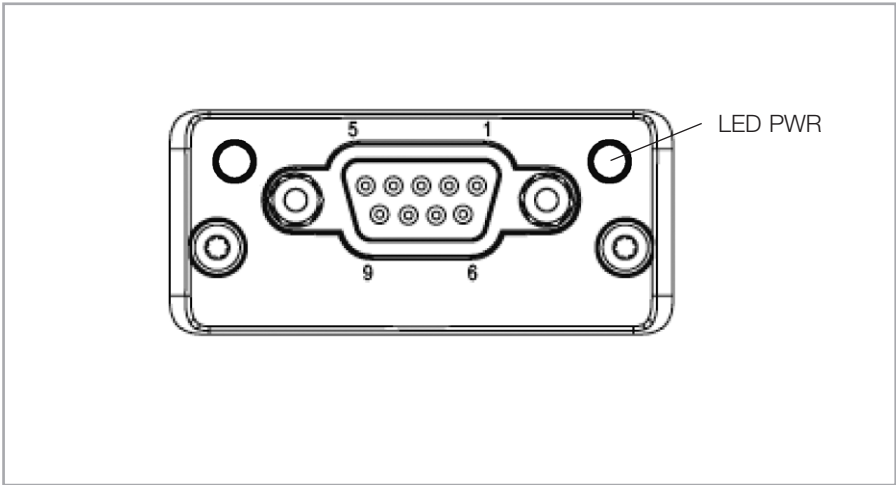
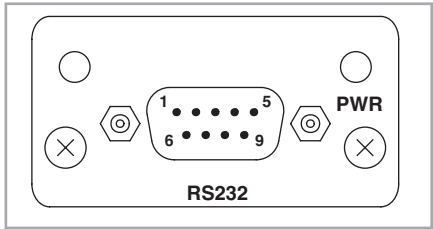


Fig.1.3 Front

Technical Data RS 232

The module is designed as a DTE (Data Terminal Equipment, i.e. in order to connect the module another DTE such as a computer, a crossover cable must be used (0-Modem)

Pin	Signal	Description
1	–	
2	RxD	RS 232 level receive data input
3	TxD	RS 232 level transmit data output
4	–	
5	GND	Signal ground
6	–	
7	RTS	Request to send
8/9	–	
Housing	Shield	Cable shield



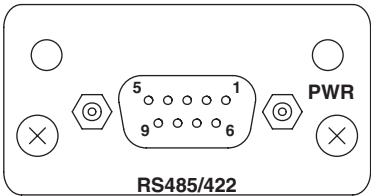
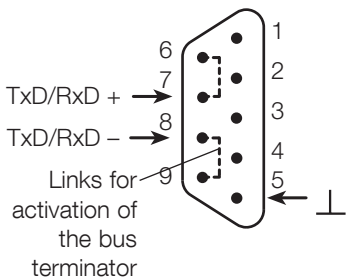
Max. cable length	10 m
Baud rate	19200 Baud
Address range	–
Voltage level	see standards
Interface connection	Sub-D 9-way socket (male)

Description RS 232, RS 485

Two types of RS-485 interface which differ slightly are used on the TURBOVAC i/iX. However, their programming is identical

- Combined RS 485/422 interface for the optional plug-in interface X120 on the TURBOVAC i/iX.
- Standard RS 485 interface on the TURBOVAC-i basic models.

Pin	Standard RS 485 on the TURBOVAC-i basic models	Optional interface RS-422 mode	Optional interface RS-485 mode
-----	--	--------------------------------	--------------------------------



Pin	male	female	female
1	–	+ 5 V termination power (isolated)	+ 5 V termination power (isolated)
2/3	–	–	–
4	–	Mode select: Connect to GND (Pin 5) for RS 422	Mode select: NC for RS 485
5	GND Isolated signal ground	GND Isolated signal ground	GND Isolated signal ground
6	TxD/RxD +	RxD inverted (Internally terminated (100 Ω) Receive data line	–
7	TxD/RxD -	RxD (Internally terminated (100 Ω) Receive data line	–
8	–	TxD inverted Transmit data line	RxD/TxD inverted Bidirectional data line
9	–	TxD Transmit data line	RxD/TxD Bidirectional data line
Housing	Cable shield	Cable shield	Cable shield

Description RS 232, RS 485

Technical Data RS 485

Max. cable length	100 m (in the case of long cable runs observe bus master termination)
Baud rate	19200 Baud fixed
Address range	0 to 31 (Parameter 37)
Default address	0
Voltage level:	see standards transmitter: 1,5 ... 5 V receiver: > 0,3 V logic «1»: transmitter: - 1,5 ... - 5 V receiver: ≤ - 0,3 V
Standards	ISO 8482, EIA 485
Protocol	acc. to VDI/VDE 3689
Response delay	10 ms
Type of cable	2 wire twisted pair

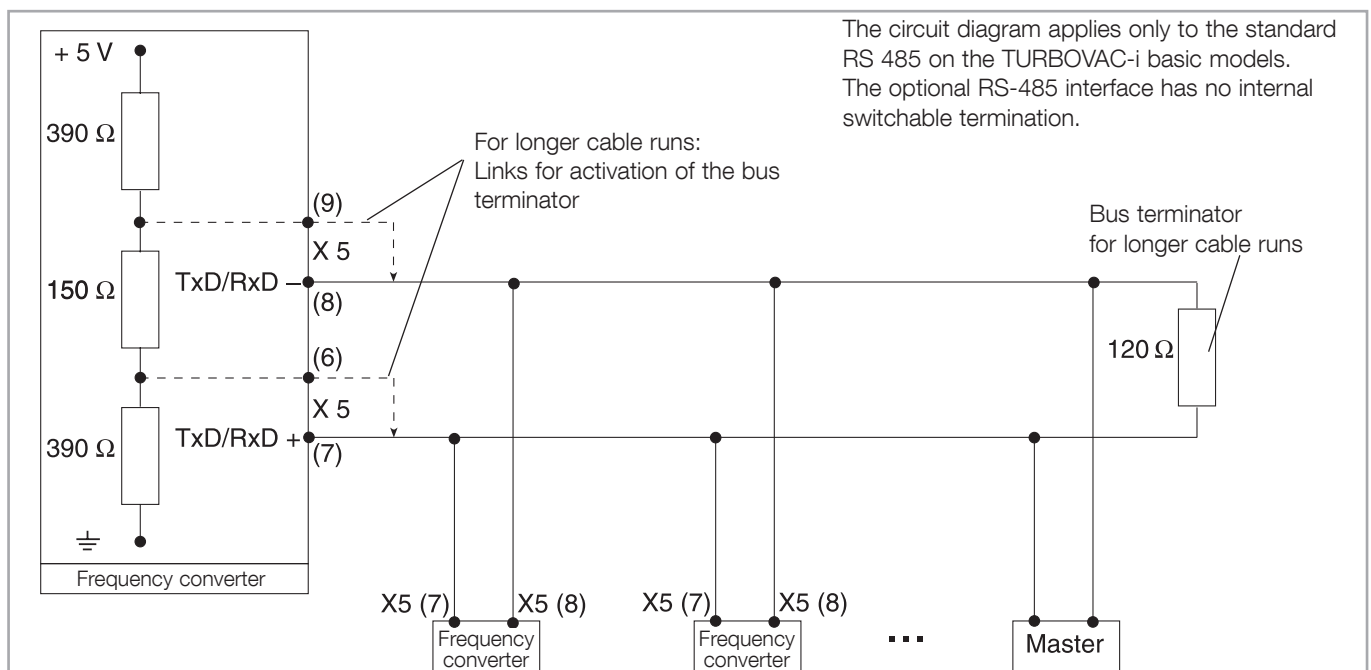


Fig. 1.4 Connection of the RS 485 bus

Description Profibus



Fig. 1.3 Profibus module

1.2 Description of the Profibus Interface

In a Profibus DP system, a difference is made between master and slave units. Here the master units control all traffic. They transmit data to the related slaves and request data from these. It is possible to run one or several masters in a system.

The TURBOVAC is a slave unit and thus responds to requests from the master, and supplies data exclusively after having received a request to do so from the master.

For more information on the Profibus system:
"The New Rapid Way to Profibus DP",
Manfred Popp, Profibus Nutzerorganisation e.V.
Haid-und-Neu-Str. 7
D-76131 Karlsruhe, Germany
P/N 4.072
www.profibus.com

At both ends of the bus a terminating resistor is required. Such a terminator must be incorporated in an external plug. The connections for this plug are provided through the interface connector. For this also see the standards.

Standards

Profibus DP V0 corresponding to IEC 61158-2 and IEC 61784 Type 3

Profibus DP V1 corresponding to IEC61158-8 (not supported)

Protocol

In accordance with Profidrive profile

In the case of word data (16 or 32 bit word length) , the high bit is transmitted first (Motorola standard).

Device-ID: 0x0E96
GSD file: LEY_0E96.GSD

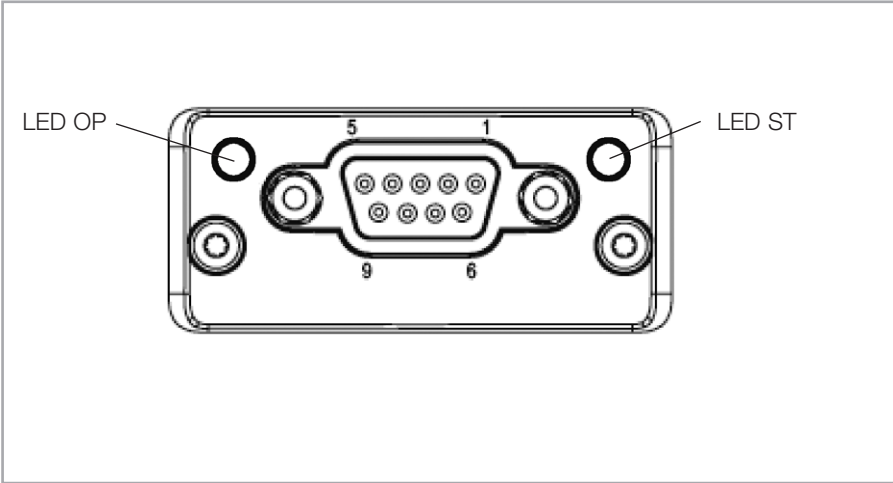


Fig.1.6 Front

LED OP (Operation Mode)

State	Indication
Off	Not online, no power
Green	online, data exchange
Flashing green	online, clear
Flashing red (1 flash)	Parametrization error
Flashing red (2 flashes)	Profibus configuration error

LED ST (Status)

State	Indication	Comment
Off	no power or not initialised	Anybus state = SETUP or NW_INIT
Green	Initialised	Anybus module has left the NW_INIT state
Flashing green	Initialised, diagnostic event(s) present	Extended diagnostic bit is set
Red	Exception error	Anybus state = EXCEPTION

Description Profibus

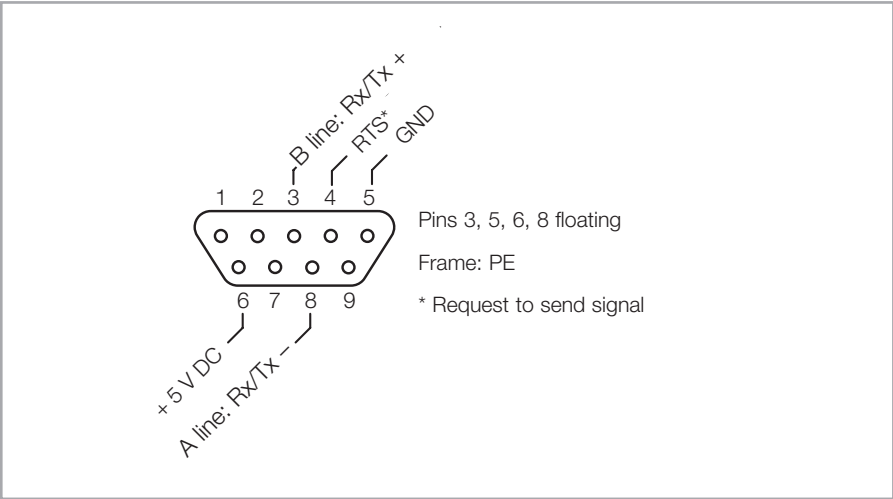


Fig. 1.7 Pin assignment for the socket

Transmission rates and cable lengths

(see also the standards)

Transmission rate (kBit/s)	max. segment length (m)
9.6 –93.75	1200
187.5	1000
500	400
1500	200
3000 - 12000	100

The baud rate is set automatically. The following baud rates are supported:

9.6 k Baud	19.2 k Baud	4.45 k Baud	
93.75 k Baud	187.5 k Baud	500 k Baud	
1.5 M Baud	3 M Baud	6 M Baud	12 M Baud

Address range	0 to 125
Voltage level	see standards
Interface connection	Sub-D 9-way socket (female))

1.3 Description of the USB Interface

USB device class	0A _n CDC-Data (COM port emulation)
Serial protocol via the COM port	acc. to VDI/VDE 3689
Transmission rate	19200 baud fixed
Address range	0 (fixed)
Max. cable length	5 m
Interface connection	USB B

Visit www.oerlikon.com/leyboldvacuum → Documents → Download Software, to download drivers for Windows.

Pin	Name	Color	Description
1	VCC	red	+ 5 V
2	D-	white	Data -
3	D+	green	Data +
4	GND	black	Ground

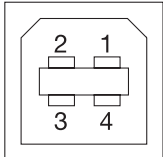


Fig. 1.8 Pin assignment for the socket at the frequency converter for USB interface

2 Start-up

Connection

NOTICE

Before making any connections, switch the pump off and wait until it turns no longer (LEDs are off). Interfaces and connections may only be plugged in and removed in the deenergised state.

RS 232, RS 485

Connect the interface connector.

Address Setup RS 485

The saving process takes approx. 30 secs.

NOTICE

During the saving process the power supply must not be interrupted.

Parameterisation through the serial service interface (typically USB).

For this, set parameter 37 to the desired address.

Permanently save the setting, by setting parameter 8 to 1.

Then switch the pump off (Caution: shut down the pump; wait for it to stop), switch off the supply voltage and switch on again.

While saving is in progress, no parameters can be read or written. However, PZDs are still transferred.

Profibus

Connect the Profibus to the Profibus interface connector (Control). Both bus ends must be terminated. This must be done externally using a special plug. The connections required for this are provided in the interface connector.

Line type	Profibus standard line
P/N (Siemens)	6XV1830-0EH10
Default Bus address:	126

Address Setup for Profibus

Profibus DP provides for a maximum of 126 possible addresses whereby the addresses 1 to 125 are defined.

Address 126 is typically used for configuration settings and does not represent a valid address for cyclic data traffic. Addresses 01 and 02 are reserved for the Profibus master.

The address for the TURBOVAC can be set up in two different ways. Here the address for the turbomolecular pump should be in the range of 03hex to 7Ehex (7Ehex = 126dec).

- Setting through the Profibus service
- Setting through USS parameters

1. Address setting through the Profibus bus service:

When the slave has the bus address 126 (this being the default for parameter 918) then the bus address can be changed through the standard Profibus bus service SAP 0x37 (Set_Slave_Add). The changed address setting is saved without further measures in the interface module. A saving process as detailed in Section 2 below is not necessary. The value of parameter 924 is not relevant. Decisive here is the value 126 for the parameter 918.

2. Address setting through the parameter 918 via the service interface (USB):

Here the address setting is saved to the pump's memory and not to the interface module. The value for the bus address is defined through parameter 918. The default upon delivery for this parameter is 126.

If the address setting shall be defined through the value of parameter 918, then first the value for parameter 924 must be set to 1, and thereafter the desired value for the bus address must be written to parameter 918. Finally this setting needs to be saved permanently in the pump's memory.

This should only be done with the pump at standstill. By setting parameter 8 to 1, save the setting permanently. The saving process takes approx. 30 seconds. During the saving process, the power supply must not be interrupted.

With the pump at standstill disconnect the system from the mains power side and then switch it on again. After a reinitialisation, the changed bus address will then be available.

The change to parameter 918 is effected only in connection with the reinitialisation after switching on the mains power once more.

Telegram RS 232, RS 485

3 Description of the Telegram

3.1 Telegram for RS 232 and RS 485

Structure of the complete data string in accordance with USS protocol specification

Byte NO.	Abbreviation	Description	Read access to frequency converter	Write access to frequency converter	Response from the frequency converter
0	STX	Start byte	2		
1	LGE	Length of the payload data block in bytes (bytes 3 to 22) + 2: 22	22		
2	ADR	Frequency converter address	RS232: 0 RS485: 0...31		
3-4	PKE	Parameter number and type of access	Value (s. 4.1)		
5	–	Reserved	0		
6	IND	Parameter index	Value (s. 4.1)		
7-10	PWE	Parameter value	0	Value	Value
11-12	PZD1 STW, ZSW	Status and control bits	Value (see 4.3 / 4.4)		
13-14	PZD2, HSW HIW, (MSW)	Current stator frequency (= P3)	0	0	Value (Hz)
15-16	PZD3, HSW HIW, (LSW)	Current frequency converter temperature (= P11)	0	0	Value (°C)
17-18	PZD4	Current motor current (= P5)	0	0	Value (0.1 A)
19-20	-	Reserved	0	0	0
21-22	PZD6	Current intermediate circuit voltage (=P4)	0	0	Value (0.1 V)
23	BCC	Recursive calculation: Checksum (i = 0) = byte (i = 0) Checksum (i) = checksum (i-1) XOR byte (i); i from 1 to 22, i = byte No.	Checksum (i=22)		

Payload data block for
RS 232 and RS 485

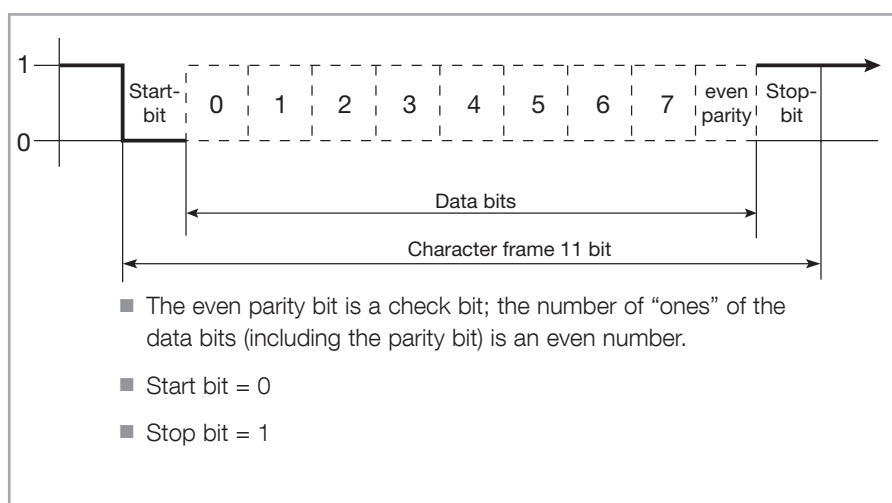


Fig. 3.1 Structure of a data frame for transferring a string byte

3.2 Telegram for Profibus

Two types of protocol (PPO types) have been implemented. In the following only the payload data are described. Data which serve communication purposes (data link layer, layer 2 acc. to OSI, for example, start byte and addressing etc.) are processed automatically in the background by the Profibus.

PPO Type 1

Length of the payload data block: 6 words = 12 bytes

Designator = 0xF3, 0xF1

Byte No.	Abbreviation	Description	Read access to frequency converter	Write access to frequency converter	Response from the frequency converter
0-1	PKE	Parameter number and type of access	Value (s. 4.1)		
2	IND	Parameter index	Value (s. 4.1)		
3	–	reserved	0		
4-7	PWE	Parameter value	0	Value	Value
8-9	PZD1: ZSW STW	Status and control bits	Value (s. 4.3/4.4)		
10-11	PZD2: HIW HSW	Current rotor frequency (= P3)	0	0	Value (Hz)

PPO Type 6

Length of the payload data block: 1 word = 2 byte identifier = 0x00, 0xF0

Byte No.	Abbreviation	Description	Read access to frequency converter	Write access to frequency converter	Response from the frequency converter
0-1	PZD1: ZSW STW	Status and control bits	Value (s. 4.3/4.4)		

GSD File

Documented in the GSD file are the parameters of the Profibus DP interface. The file format has been defined in the standard so that project tools from different manufacturers can be used. The current GSD file can be downloaded from the Oerlikon Leybold homepage or is available upon request.

PKE, IND, Bits

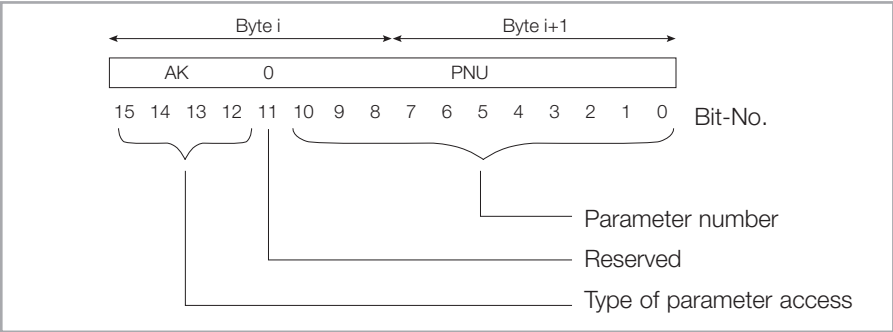


Fig. 4.1 Structure of the parameter section

4 Description of PKE, IND, Control and Status Bits

4.1 PKE: Parameter Number and Type of Access

The parameter number is sent when accessing the frequency converter and also in the response of the frequency converter.

The receiver is provided with information on the parameter value PWE: size, field value or individual value, read or write.

The parameters and error messages are listed in Sections 5 and 6.

Type of Parameter Access to the Frequency Converter (Query Designator)					Type of Parameter Response from the Frequency Converter (Reply Designator)				
Bit number					Bit number				
15	14	13	12		15	14	13	12	
0	0	0	0	No access	0	0	0	0	No response
0	0	0	1	Parameter value requested	0	0	0	1	16 bit value is sent
					0	0	1	0	32 bit value is sent
0	0	1	0	Write a 16 bit value	0	0	0	1	16 bit value is sent
0	0	1	1	Write a 32 bit value	0	0	1	0	32 bit value is sent
0	1	1	0	Field value requested*	0	1	0	0	16 bit field value is sent
					0	1	0	1	32 bit field value is sent
0	1	1	1	Write a 16 bit field value*	0	1	0	0	16 bit field value is sent
1	0	0	0	Write a 32 bit field value*	0	1	0	1	32 bit field value is sent
					Further responses				
					0	1	1	1	The frequency converter can not run the command
					1	0	0	0	During a write access: no permission to write

Depending on the query designator, only certain reply designators are possible. If the reply designator has the value 7 (query cannot be run) then in parameter value (PWE) an error number is provided.

Parameter Index IND

* The desired element of the index parameter is provided in IND.

Fault detection	Description
0	impermissible parameter number
1	parameter cannot be changed
2	min./max. restriction
18	all other errors

4.2 Status and Control Bits (Status and Control Word)

The status and control bits are only temporarily available, i.e. after interrupting the power supply the bits revert to the default status.

See also the example telegrams given in the Annex.

4.3 USS Control Word

Bit	Description
0	Start/Stop
1	Not assigned
2	Not assigned
3	Not assigned
4	Not assigned
5	24 VDC output X201
6	Enable main setpoint PZD2 PZD2 = speed setpoint
7	Reset error (all components) Resetting impossible when Bit 0 = 1; Start is active
8	Enable standby function
9	Not assigned
10	Enable process data (Bit 0, 5, 6, 7, 8, 13, 14, 15)
11	Error operation relay X1
12	Normal operation relay X1
13	Warning relay X1
14	24 VDC output X202 (function present on the TURBOVAC iX only)
15	24 VDC output X203 (function present on the TURBOVAC iX only)

4.4 USS Status Word

Bit	Description
0	Ready for operation
1	No function
2	Operation enabled
3	Error condition (all components)
4	Accelerating
5	Decelerating
6	Switch-on lock
7	Temperature warning
8	No function
9	Parameter channel enabled
10	Normal operation detained
11	Pump is turning
12	No function
13	Overload warning
14	Collective warning
15	Process channel enabled

Parameter List

5 Parameter List

It is possible to change certain parameters depending on the specific requirements and save these permanently.

r = readable, w = writable

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
1	Device type	0	65535	180		r/w	u16	180 = TURBOVAC 350/450 i 181 = TURBOVAC 350/450 i with optional interface 182 = TURBOVAC 350/450 iX 190 = TURBOVAC 80/200 i 191 = TURBOVAC 80/200 with optional interface 192 = TURBOVAC 80/200 iX
2	Software version communication electronics x.yy.zz	0	65535	10000		r	u16	x.yy: version, zz: correction index
3	Actual frequency	0	65535	0	Hz	r	u16	Actual rotor frequency
4	Actual intermediate circuit voltage	0	1500	30	0.1 V	r	u16	
5	Actual motor current	0	150	0	0.1 A	r	u16	
6	Actual drive input power	0	65535	0	0.1 W	r	u16	
7	Actual motor temperature	-10	150	0	°C	r	s16	
8	Save data command	0	65535	0		r/w	s16	A write command with any value saves temporary data into nonvolatile memory.
11	Actual converter temperature	-10	100	0	°C	r	s16	
16	Motor temperature warning threshold	0	150	80	°C	r/w	s16	Exceeding the motor temperature warning threshold results in a warning.
17	Nominal motor current	3	120	50	0.1 A	r/w	u16	Maximum permissible motor current
18	Nominal frequency	500	2000	1000	Hz	r/w	u16	Highest permissible frequency
19	Minimum nominal frequency	P20	2000	2000	Hz	r/w	u16	Lowest permissible nominal frequency
20	Minimum frequency level	0	2000	2000	Hz	r/w	u16	When the pump is accelerating this frequency must be reached within the maximum passing time (P183). At the end of run-up: Switch-off threshold at overload.
21	Motor current threshold	1	100	100	%	r/w	u16	After attaining normal operation and when this threshold is exceeded a „high load error“ will occur after a certain period of time has elapsed.
23	Pump type/Rotor type	-32768	32767	10	0.1	r/w	s16	0 = TURBOVAC i/iX CL (classic) 1 = TURBOVAC i/iX WR (wide-range) 2 = TURBOVAC i/iX MI (multi-inlet)
24	Setpoint frequency	P19	P18	1000	Hz	r/w	u16	Setpoint of the rotor frequency
25	Frequency dependent normal operation threshold	35	99	90	%	r/w	u16	Setpoint of the frequency dependent normal operation level

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
26	Lower temperature switching threshold (for TURBOVAC iX only)	0	65535	25	°C	r/w	u16	Defines the lower temperature switching threshold for the function output. X201: Index 0 / X202: Index 1 / X203: Index 2
27	Upper current switching threshold (for TURBOVAC iX only)	0	65535	40	0.1 A	r/w	u16	Defines the upper current switching threshold for the function output. X201: Index 0 / X202: Index 1 / X203: Index 2
28	Upper frequency switching threshold (for TURBOVAC iX only)	0	65535	999	Hz	r/w	u16	Defines the upper frequency switching threshold for the function output X201: Index 0 / X202: Index 1 / X203: Index 2
29	Relay function selection on X1	0	8	0		r/w	u16	If required, special functions can be assigned to the normal operation and the error relay. Field 0 specifies the function for normal operation: 0 = Frequency dependent (=ZSW Bit 10) 1 = Motor current dependent (not applied) 2 = Fieldbus controlled (=STW Bit 12) 3 = Trigger current bearing temperature (P122) 4 = Venting function (P247/P248) 5 = Pump at standstill (=ZSW Bit 11)) 6 = Start command is present 7 = Ready for switch on (=ZSW Bit0) 8 = not applied Field 1 specifies the function for the error relay: 0 = Energised when an error is present 1 = Deenergised when an error is present 2 = Fieldbus controlled Field 2 specifies the function for the warning relay: 0 = Energised when an warning is present 1 = Deenergised when an warning is present 2 = Fieldbus controlled
30	Analog output function	0	3	0		r/w	u16	0 = no function 1 = Pump temperature P127 2 = Motor current P5 3 = Frequency P3 4 = Input voltage P4 5 = Measured value of the pressure sensor (available for iX only)
31	Index 1: Upper limit for analog output	-32768	32767	1000	0.1	r/w	s16	
31	Index 2: Lower limit for analog output	-32768	32767	0	0.1	r/w	s16	
32	Max. run-up time	30	2000	2000	s	r/w	u16	Max. permissible time during which the pump must attain the normal operation threshold (P24*P25) with the start signal present.
36	Start delay time	0	255	0	0.1 min	r/w	u16	Delays the start of the pump to allow lead-time for the fore vacuum pump for example. Only active when the pump is under x Hz.
37	RS485 address	0	31	0		r/w	u16	Parameterizable RS485 address A change of this parameter setting will only be effective after the power supply has been switched off and on. Bus address does not apply to the USB interface

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
38	Number of start commands	0	65535	0		r/w	u16	counts pump run-ups
40	Error counter total	0	65535	0		r	u16	counts error messages
41	Error counter over-load	0	65535	0		r	u16	counts overload error messages
43	Error counter supply	0	65535	0		r	u16	counts the number of power failures
119	Index 0: Bearing break-in function	0	8	0		r/w	u16	0 = converter starts pump normally 1 = converter starts with phase 1 2 = converter starts with phase 2 4 = converter starts with phase 3
119	Index 1: Status bearing break-in function	0	8	0		r/w	u16	1 = 1st phase active 2 = 2nd phase active 4 = 3rd phase active 8 = 4th phase active
122	Switching threshold for bearing temperature relay output (for TURBOVAC i only)	0	65535	40	°C	r/w	u16	Temperature at which the relay contact shall be switched on when P29[0]=3. For P125 > P122.
122	Switching threshold for bearing temperature relay output (for TURBOVAC iX only)	0	65535	40	°C	r/w	u16	Temperature at which the relay contact shall be switched on when P29[0]=3. For P125 > P122. X201: Index 0 / X202: Index 1 / X203: Index 2
125	Actual bearing temperature	-10	150	0	°C	r	s16	Calculated temperature of the bearing.
126	Bearing temperature warning threshold	-10	150	60	°C	r/w	s16	Exceeding the bearing temperature warning threshold results in a warning.
128	Motor temperature lower warning threshold	-10	150	5	°C	r/w	s16	Falling below the motor temperature lower warning threshold results in a warning.
131	Motor temperature lower error threshold	-10	150	0	°C	r/w	s16	Falling below the motor temperature lower error threshold results in an error message.
132	Bearing temperature error threshold	-10	150	65	°C	r/w	s16	Exceeding the bearing temperature error threshold results in an error message.
133	Motor temperature error threshold	-10	150	100	°C	r/w	s16	Exceeding the motor temperature error threshold results in an error message.

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
134	Function of the accessory connection X201 (for TURBOVAC i only)	0	65535	7		r/w	s16	Selection of the function for the 24V DC output X201 0 = Always off 1 = Error 2 = No error 3 = Warning 4 = No warning 5 = Pump in normal operation 6 = Pump not in normal operation 7 = Pump is turning 8 = Pump at standstill 18 = Fieldbus controlled (must be enabled to switch via the digital input at X1 the 24V DC output when the control rights have not been assigned to a serial interface) 19 = Always on 24 = Trigger current bearing temperature 25 = Power failure venting 26 = Pump has start command 27 = Pump is ready for switching on
134	Function of the accessory connections X201 (Index 0) / X202 (Index 1) / X203 (Index 2) (for TURBOVAC iX only)	0	65535	see list		r/w	s16	Selection of the function for the 24 V DC outputs X201 (Index 0) / X202 (Index 1) / X203 (Index 2) 0 = Always off 1 = Error 2 = No error 3 = Warning 4 = No warning 5 = Pump in normal operation 6 = Pump not in normal operation 7 = Pump is turning 8 = Pump at standstill 18 = Fieldbus controlled (must be enabled to switch via the digital input at X1 the 24V DC output when the control rights have not been assigned to a serial interface) 19 = Always on 23 = Motor current dependent 24 = Trigger current bearing temperature 25 = Power failure venting 26 = Pump has start command 27 = Pump is ready for switching on 28 = Fan 1 ("pump is turning") (default for X201) 29 = Fan 2 ("frequency dependent") 30 = Fan 3 ("bearing temperature dependent") 31 = Purge gas valve 1 ("normally open") 32 = Purge gas valve 2 ("normally closed") 33 = Purge gas valve 3 ("start command") 34 = Relay box for backing pump ("start command") (default for X202) 35 = Relay box for backing pump 2 ("current dependent") 36 = Venting valves ("frequency dependent") (default for X203) 37 = Acceleration of the pump 38 = Delay of the pump 39 = Pressure dependent

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
140	Intermediate circuit current	0	150	0	0.1 A	r	s16	Mean value measurement of the intermediate circuit current. Corresponds to the current consumption of the frequency converter.
150	Standby frequency	0	1000	800	Hz	r/w	u16	Standby operation frequency setpoint
171	Error code memory	0	65535	0		r	u16	Indexed parameter for storing the most recent 254 error codes. The individual error memory entries are accessed via this parameter with additional index number. The last error code is accessed with index 0 and the oldest with index 253.
174	Rotational frequency at time of the error	0	65535	0	Hz	r	u16	Access analogously as for parameter 171
176	Operat. hours count at time of error	0	21474 83647	0	0.01 h	r	s32	Access analogously as for parameter 171
179	Response when cancelling the control rights or in the case of a communication interruption of the bus adapter	0	65535	0		r/w	u16	<p>Behaviour in case bit 10 in the control word of the bus adapter is cancelled or when interrupting the communication between converter and bus adapter (see also P182). Here it is assumed that the respective bus adapters perform a cyclic communication on the USS side, so that the respective converter electronics is capable of detecting a communication interruption</p> <p>The bits in parameter 179 represent an equivalent to the control word in the USS protocol.</p> <p>The actions linked to these bits are run provided bit 10 in the control word (USS protocol for bus adapter) is cancelled or if there are interruptions in the communication between converter and bus adapter.</p> <p>Here bit 10 is of special significance: Bit 10 = 0 The control rights are returned to the next lower priority level. All other bits are not relevant. Bit 10 = 1 The control rights remain unchanged. The actions linked to the other bits are run.</p>
180	USS Response delay time	0	20	10	ms	r/w	u16	Pause time between received and transmitted telegram (Minimum transmit pause). We recommend not to change the default setting (10ms).
182	Delay when cancelling the control rights of the bus adapter and time-out in the case of a communication interruption	0	65535	100	0.1 s	r/w	u16	<p>Defines the time characteristic when cancelling bit 10 in the control word of the USS protocol or when an interruption in the communication between bus adapter and converter and electronics is detected. Handling when cancelling bit 10 or when there is an interruption on the communication side of the USS bus adapter, is the same.</p> <p>Value 0.0: Indefinite time delay. In this way a change of the control right is inhibited.</p> <p>Values 0.1 ..6553.5: A change in the control right corresponding to the setting of parameter 179 is only effected after the time span defined through parameter 182 has elapsed.</p>
183	Max. passing time	0	1800	500	s	r/w	u16	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.

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
184	Converter operating hours	0	21474 83647	0	0.01 h	r	s32	Counts the operating hours of the converter during active pump operation.
185	Max. converter DC input current	0	100	90	0.1	r/w	u16	
227	Active warnings described bit per bit.	0	65535	0		r/w	u16	See Section 7.
247	Vent on frequency	0	P18	999	Hz	r/w	u16	Frequency at which the venting valve shall be switched on in the event of a mains power failure. Power failure venting can be enabled through P134.
248	Vent off frequency	0	P18	5	Hz	r/w	u16	Frequency at which the venting valve shall be switched off in the event of a mains power failure. Power failure venting can be enabled through P134.
249	Generator mode	0	1	1		r/w	u16	P249 = 0 : no return feeding in to the DC supply P249 = 1 : return feeding in to the DC supply Notice: take note of the maximum generator power of 160 W as otherwise the electronics may suffer damage.
312	Converter part number (Index 0 ... 17)	0	127	0	0	r/w	u16	Converter part number. One ASCII character per index.
313	Product name (Index 0 ... 17)	0	127	0	0	r/w	u16	
314	Configuration text (Index 0 ... 26)	0	127	0	0	r/w	u16	
315	Converter serial number (Index 0...10 usable)	0	127	0	0	r/w	u16	Converter serial number. One ASCII character per index.
316	Converter hardware version (Index 0 ... 17)	0	127	0	0	r/w	u16	
349	Pump parameter set (Index 0 ... 17)	0	127	0	0	r/w	u16	Document number of the pump specific parameters set
350	Pump part number (Index 0 ... 17)	0	127	0	0	r/w	u16	
355	Pump serial number (Index 0 ... 17)	0	127	0	0	r/w	u16	
394	Communication electronics part number (Index 0 ... 17)	0	127	0	0	r/w	u16	
395	Communication electronics serial number (Index 0 ... 17)	0	127	0	0	r/w	u16	
396	Communication electronics hardware version (Index 0 ... 17)	0	127	0	0	r/w	u16	

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
Parameters 601 to 686 are available for the TURBOVAC iX only.								
601	Gauge head equipment type	0	65535	0		r	u16	0 = None 1 = CTR 2 = TTR 9x 3 = TTR 100 4 = PTR 90 5 = PTR 2xx 6 = ITR 7 = DI 200 8 = DI 2000 9 = Measuring instrument 11 = DU 200 12 = DU 2000
602	Gauge head subtype	0	65535	0		r/w	u16	CTR: 0 = No subtype information 1 = 0.1 Torr 2 = 1 Torr 3 = 10 Torr 4 = 100 Torr 5 = 1000 Torr 6 = 20 Torr
604	Gauge head status word	0	42949 67295	0		r	u32	Bit00 = Power supply okay Bit01 = Status Bit02 = Degassing active Bit03 = Error Bit04 = Above upper measurement range Bit05 = Below lower measurement range Bit12 = Maintenance required Bit14 = Warning
606	Gauge head control word	0	42949 67295	0		r/w	u32	Bit01 = Degassing
609	Gas type correction factor available	0	65535	0		r	u16	Bit encoded information which type of gas can be selected Bit00 = Air_N2_CO_O2 Bit01 = CO2 Bit02 = He Bit03 = Ne Bit04 = Ar Bit05 = Kr Bit06 = Xe Bit07 = H2 Bit10 = Customer specific
610	Gas type correction factor	1.401 E-42	3.403 E+41	0		r	real 32	Indicates the currently active gas type correction factor
611	Customer specific gas type correction factor	1.401 E-42	3.403 E+41	1		r/w	real 32	Value for customer specific gas type correction factor, active at P620=10
615	Filtering time	0	3	3		r/w	u16	Size of the ring memory for averaging the pressure value 0 = 1 1 = 50 2 = 100 3 = 200

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
616	Gauge head pressure value in mbar	1.401 E-42	3.403 E+41	0	mbar	r	real 32	Current pressure value of the gauge head in mbar
617	Pressure value of the gauge head in torr	1.401 E-42	3.403 E+41	0	Torr	r	real 32	Current pressure value of the gauge head in torr
618	Pressure value of the gauge head in Pa	1.401 E-42	3.403 E+41	0	Pa	r	real 32	Current pressure value of the gauge head in pa
619	Gauge head measurement voltage	1.401 E-42	3.403 E+41	0	V	r	real 32	Current voltage value of the gauge head measurement signal
620	Gas type	0	65535	0		r/w	u16	indicates the setup gas type correction factor 0 = Air_N2_CO_O2 1 = CO2 2 = He 3 = Ne 4 = Ar 5 = Kr 6 = Xe 7 = H2 10 = customer specific
623	System warning bits	0	65535	0		r/w	u16	Bit00 = inside volume temperature Bit01 = intermediate circuit voltage not within the nominal range
624	Gauge head warning bits	0	65535	0		r/w	u16	Bit00 = second stage not started
625	Pump start function	0	65535	0		r/w	u16	0 = pump starts with start signal 1 = pump starts pressure dependent
634	Status word accessory output X201 (Index 0) / X202 (Index 1) / X203 (Index 2)	0	42949 67295	0		r	u32	Pump: Bit03 = Error Bit10 = Normal operation : = 10 Bit14 = Warning : = 14 Special: Bit03 = Error Bit10 = Setpoint reached Bit14 = Warning Valve Bit03 = Error Bit10 = Valve in position Bit14 = Warning
636	Control word accessory output X201 (Index 0) / X202 (Index 1) / X203 (Index 2)	0	42949 67295	0		r/w	u32	Pump: Bit00 = Start Bit07 = Reset Bit10 = Control right Special: Bit00 = Operate Bit07 = Reset Bit10 = Control right Valve: Bit00 = Open Bit07 = Reset Bit10 = Control right
643	Accessory output switch-on delay	1.401 E-42	3.403 E+41	0	s	r/w	real 32	X201: Index 0 / X202: Index 1 / X203: Index 2

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
644	Accessory output switch-off delay	1.401 E-42	3.403 E+41	0	s	r/w	real 32	X201: Index 0 / X202: Index 1 / X203: Index 2
647	Lower frequency switching threshold	0	65535	5	Hz	r/w	u16	X201: Index 0 / X202: Index 1 / X203: Index 2
648	Upper pressure switching threshold	1.401 E-42	3.403 E+41	0	mbar	r/w	real 32	X201: Index 0 / X202: Index 1 / X203: Index 2
649	Lower pressure switching threshold	1.401 E-42	3.403 E+41	0	mbar	r/w	real 32	X201: Index 0 / X202: Index 1 / X203: Index 2
652	Lower current switching threshold	0	65535	15	0.1 A	r/w	u16	X201: Index 0 / X202: Index 1 / X203: Index 2
670	Communication electronics temperature	0	65535	0	°C	r/w	u16	Current temperature of the communication electronics
671	Communication electronics temperature warning threshold	0	65535	75	°C	r/w	u16	When the communication electronics warning temperature threshold is exceeded, a warning message is output.
672	Communication electronics temperature error threshold	0	65535	80	°C	r/w	u16	When the communication electronics temperature shutdown switching threshold is exceeded, an error message is output
673	Communication electronics software version	0	65535	0		r	u16	x.yy: Version, zz: Correction index
678	Equipment error code	0	65535	0		r	u16	Equipment error: number code indicates the error source 101 Pump 201 Gauge head 1 System (Index 0 to 253)
679	Electronics operating time upon error occurrence	0	42949 67295	0	0.01h	r	u32	(Index 0 to 253)
682	Electronics operating hours	0	42949 67295	0	0.01h	r/w	u32	
686	Pressure switching threshold for the function of pressure dependent starting of the pump	1.401 E-42	3.403 E+41	0	mbar		real 32	

Parameters 601 to 686 are available for the TURBOVAC **iX** only.

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
690	Index 1: Upper limit for analogue output	1.401 E-42	3.403 E+41	0			real 32	
690	Index 2: Lower limit for analogue output	1.401 E-42	3.403 E+41	0			real 32	
918	Set bus address parameter	0	126	126		r/w	u16	
923	Active bus address	0	126	126		r	u16	
924	Type of bus address	0	1	1		r/w	u16	
1025	Reset to factory default	0	65535	0	0	r/w	u16	Initialisation of the parameters to their default values
1035	Pump serial number	0	127	0		r/w	u16	Used for parts identification (index 0 to 17)
1100	Drive electronics software version x.yy.zz	0	65535	10000		r	u16	x.yy: Version, zz: Correction index
1101	Frequency converter temperature warning threshold	0	90	75	°C	r/w	s16	Temperature above which an overtemperature warning is output.
1102	Frequency converter temperature error threshold	0	90	80	°C	r/w	s16	Temperature above which an overtemperature error is output.

6 Error Memory

Parameter 171 contains in the case of an error the corresponding error code. For the respective error, the corresponding rotor frequency and the corresponding number of operating hours at that point of time the error has occurred is saved under the parameters 174 and 176 at the same index number.

Only for TURBOVAC **iX**: also under the same index number under parameter 678 the error source and under parameter 679 the corresponding number of operating hours of the electronics is saved.

Listed in the following are the possible error codes and their causes.

Error code	Designation	Possible cause	Remedy
1	Overspeed warning. The actual frequency exceeds the setpoint by over 10 Hz.	Frequency converter defective	Contact Oerlikon Leybold Vacuum Service.
2	Pass through time error The pump has not reached the minimum speed after the maximum run-up time has elapsed.	Forevacuum pressure too high. Gas flow too high Rotor blocked	Check the ultimate pressure of the backing pump and install a bigger backing pump if req. Seal leak, check process Check if the rotor turns freely. Contact Oerlikon Leybold Vacuum Service if the rotor is damaged or blocked.
3	Error threshold pump temperature 3 exceeded. The maximum permissible bearing temperature was exceeded.	Forevacuum pressure too high. Gas flow too high Fan defective Water cooling switched off	Check the ultimate pressure of the backing pump and install a bigger backing pump if req. Seal leak, check process Replace fan Switch on water cooling
4	Short circuit error		
5	Converter temperature error Overtemperature at the power output stage or within the frequency converter	Ambient temperature too high Poor cooling	Ensure max. ambient temperature of 45°C Improve cooling
6	Run-up time error The pump has not reached the normal operating frequency after the maximum run-up time.	Forevacuum pressure too high. Gas flow too high	Check the ultimate pressure of the backing pump and install a bigger backing pump if req. Seal leak, check process
7	Motor temperature error The motor temperature has exceeded the shutdown threshold.	Forevacuum pressure too high. Gas flow too high Fan defective Water cooling switched off	Check the ultimate pressure of the backing pump and install a bigger backing pump if req. Seal leak, check process Replace fan Switch on water cooling
8	The pump could not be identified or no pump has been connected.	Pump not correctly connected to the frequency converter. Defective hardware	Check the connection between pump and frequency converter. Contact Oerlikon Leybold Vacuum Service.

Error Memory

Error code	Designation	Possible cause	Remedy
61	Low motor temperature warning		
82	Fan voltage has failed		
83	Motor temperature low warning		
84	Motor overtemperature warning		
85 to 96	Frequency converter collective error		
97	Frequency converter internal volume temperature error		
101	Overload warning The pump speed has dropped under the normal operation threshold	Forevacuum pressure too high. Gas flow too high	Check the ultimate pressure of the backing pump and install a bigger backing pump if req. Seal leak, check process
103	Supply voltage warning Intermediate circuit voltage too low or maximum time for generator operation was exceeded.	DC supply voltage below 24V Mains voltage has failed	Check the voltage at the power supply and if required set up correctly Remedy the cause for the mains power failure
106	Overload error The pump speed has dropped under the minimum speed	Forevacuum pressure too high. Gas flow too high	Check the ultimate pressure of the backing pump and install a bigger backing pump if req. Seal leak, check process
111	The minimum permissible motor temperature is not attained.	Ambient temperature too low Pump cooling too high	Ensure min. ambient temperature of 0°C Reduce water cooling
116	The speed of the pump has dropped below the normal operation threshold and has stayed there for a longer period of time.	Forevacuum pressure too high. Gas flow too high	Check the ultimate pressure of the backing pump and install a bigger backing pump if req. Seal leak, check process
117	Motor current error (start-up error), Motor current below nominal current, switchover from open loop controlled to closed loop controlled operation was not successful	Cable fault Faulty connector	Contact Oerlikon Leybold Vacuum Service
126	Defective bearing temperature sensor.	Defective component, short-circuit or broken cable	Contact Oerlikon Leybold Vacuum Service
128	Defective motor temperature sensor.	Defective component, short-circuit or broken cable	Contact Oerlikon Leybold Vacuum Service
143	Overspeed error		
144	Bearing break-in function active		Disable bearing break-in function and restart the pump

Error Memory

Error code	Designation	Possible cause	Remedy
225	Temperature derating active. One of the temperature warning values was exceeded and the maximum permissible motor current was reduced		
226 to 236	Frequency converter collective error		Reset error, try to restart. If this is not possible inform Oerlikon Leybold Vacuum Service or send in the pump.
237	Communication in error: is initiated when a communication error on CAN level was determined.		Reset error, try to restart. If this is not possible inform Oerlikon Leybold Vacuum Service or send in the pump.
238	Frequency converter collective error		Reset error, try to restart. If this is not possible inform Oerlikon Leybold Vacuum Service or send in the pump.
240	EEPROM error (CRC) inconsistent data in the EEPROM		
252	Hardware plausibility error. Frequency converter and communication electronics are not from the same pump	Front end and frequency converter were interchanged	Establish the correct hardware configuration or run a software update
600	Second gauge head stage was not started		Check gauge head and connection, if required replace the gauge head.
601	Gauge head lost		
602	No power supply at the gauge head		
608	Broken filament		
609	Pirani error		
603	No power from the supply. Return signal from the gauge head output voltage is missing.		
610	Inside volume temperature warning		Improve cooling.
611	Inside volume temperature error		Improve cooling.
612	Intermediate circuit voltage warning		

Warnings

7 Warning Codes for Parameter 227

P227 Bit	Designation	Possible cause	Remedy
0	Pump temperature 1 has passed the warning threshold	Forevacuum pressure too high.	Check the ultimate pressure of the backing pump and install a bigger backing pump if req.
1	Pump temperature 2 has passed the warning threshold	Gas flow too high	Seal leak, check process.
2	Pump temperature 3 has passed the warning threshold	Fan defective	Replace fan.
		Water cooling switched off	Switch on water cooling.
3	The minimum permissible ambient temperature is not reached.	Ambient temperature too low	Ensure min. ambient temperature of 5 °C.
		Pump cooling too high	Reduce water cooling.
4, 5	not used		
6	Overspeed warning: The actual value exceeds the setpoint by more than 10 Hz		Consult OLV service.
7	Pump temperature 4 has passed the warning threshold	Forevacuum pressure too high.	Check the ultimate pressure of the backing pump and install a bigger backing pump if req.
		Gas flow too high	Seal leak, check process.
		Fan defective	Replace fan.
		Water cooling switched off	Switch on water cooling.
8 - 10	not used		
11	Overload warning: The pump speed has dropped under the normal operation threshold	Forevacuum pressure too high.	Check the ultimate pressure of the backing pump and install a bigger backing pump if req.
		Gas flow too high	Seal leak, check process
12	Pump temperature 5 has passed the warning threshold	Forevacuum pressure too high.	Check the ultimate pressure of the backing pump and install a bigger backing pump if req.
13	Pump temperature 6 has passed the warning threshold	Gas flow too high	Seal leak, check process.
		Fan defective	Replace fan.
		Water cooling switched off	Switch on water cooling.
14	Power supply voltage warning: Supply voltage failure during active operation of the pump P4 > Umax or P4 < Umin	Intermediate circuit voltage too low	
		DC power supply voltage below 24V or 48 V	
		Mains voltage failure	

8 Operation of the Accessory Connections

Through the accessory connections (M8 plug) accessories can be electrically powered and driven. The switching behaviour (operation) of the accessory connections can be set up through parameters.

The functions for the accessory connections and the parameters must only be changed while the pump is at standstill as otherwise the connected accessories may only function incorrectly.

8.1 Configurations upon Delivery

The accessory connections have been preconfigured in the factory and are therefore immediately ready for operation upon connecting the accessory equipment.

Accessory Connection X201: Air Cooling Function

The output switches as soon as the pump is turning. Status word Bit 11 is set ("pump is turning").

Accessory Connection X202 (for TURBOVAC iX only):

Function: Relay Box for Backing Pump

The output switches as soon as the pump is started.

Control word Bit 00 is set ("start command").

Through parameter 643[1] and parameter 644[1] a switch-on and a switch-off delay time in ms can be set up for each. The default for the switch-on and switch-off delay time is 0 ms.

Accessory Connection X203 (for TURBOVAC iX only):

Function: Venting Valves

The output switches when the start signal control word Bit 00 is not set and the frequency drops below the upper limit.

When the frequency drops below the lower limit, the output is reset.

Switching of the output can be prevented by setting Bit 14 in the control word.

The limits can be changed through parameter 28 [2] (upper limit) and parameter 647 [2] (lower limit). The default settings are 999 Hz (upper limit) and 5 Hz (lower limit).

Accessory Connections

8.2 Function Codes of the Accessory Connections

The function of the accessory connections can be changed through

- parameter 134 for accessory connection X201 on the TURBOVAC i
- parameter 134 [0] for the accessory connection X201 on the TURBOVAC iX
- parameter 134 [1] for the accessory connection X202 on the TURBOVAC iX
- parameter 134 [2] for the accessory connection X203 on the TURBOVAC iX

by writing a certain value (called function code in the following) in to the respective parameter.

Through further parameters the limit values of the respective function can be changed.

When in a function code the output is enabled or disabled through a bit in the control word, the following bit is assigned to the respective output. Bit 10 must be enabled additionally.

Control word Bit 5: Accessory connection X201

Control word Bit 14: Accessory connection X202 (available on the TURBOVAC iX only)

Control word Bit 15: Accessory connection X203 (available on the TURBOVAC iX only)

Accessory Connections

Function code	Function	Bit controlled function	Bit controlled function with switch-on and switch-off delay	Function with limit values
0	Always off			
1	Error	■		
2	No error	■		
3	Warning	■		
4	No warning	■		
5	Pump in normal operation	■		
6	Pump not in normal operation	■		
7	Pump is turning	■		
8	Pump at standstill		■	
18	Fieldbus controlled		■	
19	Always on			
23	Motor current dependent			■
24	Trigger current bearing temperature			■
25	Power failure venting			■
26	Pump has start command	■		
27	Pump is ready for switching on		■	
28	Fan 1 ("pump is turning") (default X201)	■		
29	Fan 2 ("frequency dependent")			■
30	Fan 3 ("bearing temperature dependent")			■
31	Purge gas valve 1 ("normally open")		■	
32	Purge gas valve 2 "normally closed")		■	
33	Purge gas valve 3 ("start command")		■	
34	Relay box for backing pump ("start command") (default X202)		■	
35	Relay box for backing pump 2 ("current dependent")			■
36	Venting valve ("frequency dependent") (default X203)			■
37	Acceleration of the pump	■		
38	Delay of the pump	■		
39	Pressure dependent			■

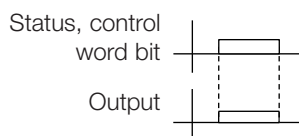
Accessory Connections

8.2.1 Bit Controlled Functions

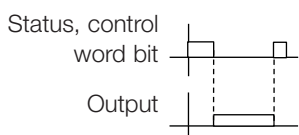
The output is set when a corresponding bit in the USS status or control word has been set.

Function code	Function	
0	Always off	The output is always disabled
1	Error	The output is set when Bit 3 in the USS status word is set (active error)
2	No error	The output is set when Bit 3 in the USS status word is not set (no active error)
3	Warning	The output is set when Bit 14 in the USS status word is set (collective warning)
4	No warning	The output is set when Bit 14 in the USS status word is not set (no collective warning)
5	Pump in normal operation	The output is set when Bit 10 in the USS status word is set (normal operation reached)
6	Pump not in normal operation	The output is set when Bit 10 in the USS status word is not set (no normal operation reached)
7	Pump is turning	The output is set when Bit 11 in the USS status word is set (pump is turning).
19	Always on	The output is always enabled
26	Pump has start command	The output is set when Bit 0 in the USS status word is set (start command)
28	Fan 1 ("pump is turning") (default X201)	The output is set when Bit 11 in the USS status word is set (pump is turning)
37	Acceleration of the pump	The output is set when Bit 4 in the USS status word is set (acceleration)
38	Delay of the pump	The output is set when Bit 5 in the USS status word is set (deceleration/delay)

**State diagram for function code
0, 1, 3, 5, 6, 19, 26, 28, 37, 38**



State diagram for function code 2, 4



8.2.2 Functions with Switch-on and Switch-off Delay

The output is set when a corresponding bit in the USS status or control word has been set.

Additionally a switch-on and switch-off delay time in milliseconds can be set up by writing a value into a parameter.

The parameter relates to the output and is the same parameter for every function which offers a switch-on and switch-off delay!

Parameter	643 [0]	644 [0]	643 [1]	644 [1]	643 [2]	644 [2]
Switch-on delay time for the accessory connection	X201		X202		X203	
Switch-off delay time for the accessory connection		X201		X202		X203

Unit ms

The default setting for the delay times is 0 ms.

When changing the function code for an accessory connection, the value in the parameter remains unchanged!

The parameter must (if necessary) is set by the user to 0! This does not happen automatically when changing a function code!

In the case of functions which do not take into account any delay times this does not matter since the value is not effective.

We urgently recommend that you consult Oerlikon Leybold Vacuum when making changes to the pump settings. Unsuitable settings or incorrect combinations of settings may damage the pump or reduce its service life and will void any warranty claims.

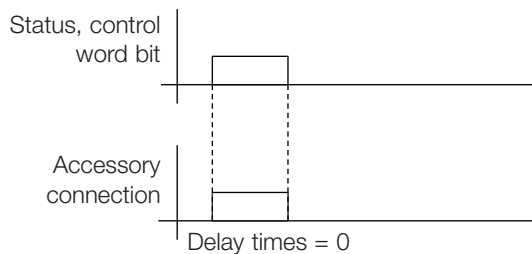
NOTICE



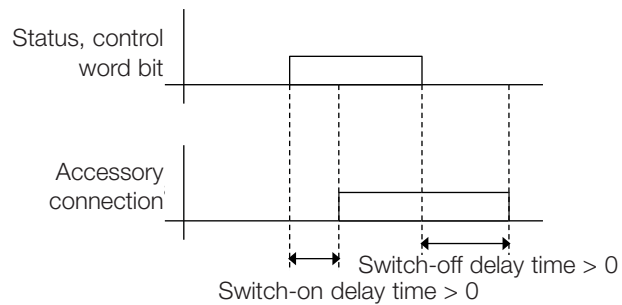
Accessory Connections

Function code	Function	The output is set when ...
18	Fieldbus controlled	the corresponding bit in the USS control word has been set.
27	Pump is ready for switching on	Bit 0 in the USS status word is set (pump ready for operation)
31	Purge gas valve 1 ("normally open")	the corresponding bit for the accessory output has been set in the USS control word (Bit 5: X201, Bit 14: X202, Bit 15: X203)
33	Purge gas valve 3 ("start command")	Bit 0 has been set in the USS control word (start command)
34	Relay box for backing pump ("start command") (default X202)	Bit 0 has been set in the USS control word (start command)

State diagram for function code 18, 27, 31, 33, 34

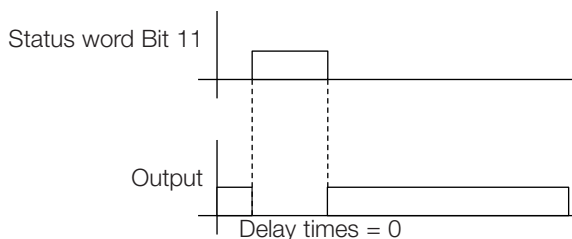


Additionally, a switch-on/switch-off delay time can be set up. The delay time is entered in milliseconds.

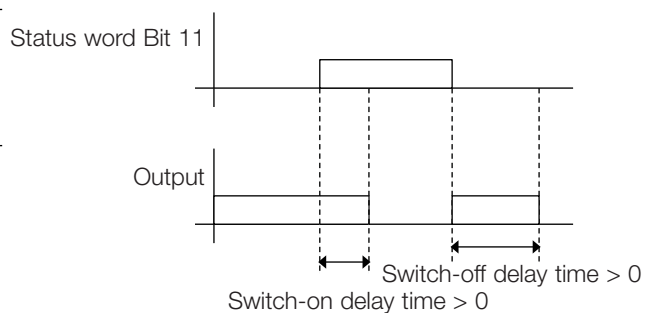


Function code	Function	The output is set when when Bit 11 in the USS status word is not set (pump is turning).
8	Pump at standstill	

State diagram for function code 8



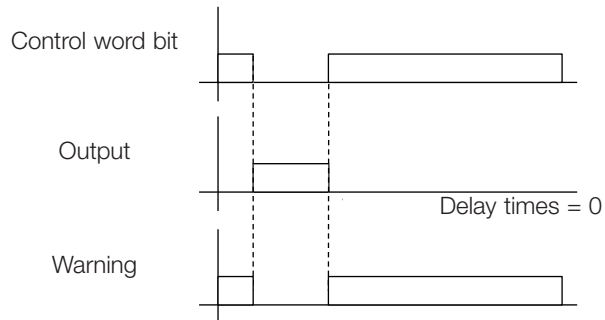
Additionally, a switch-on/switch-off delay time can be set up. The delay time is entered in milliseconds.



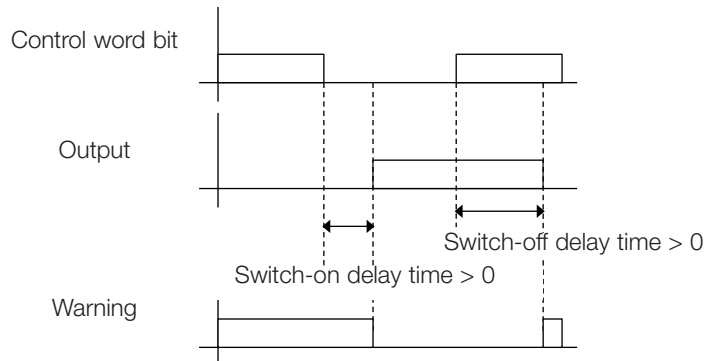
Accessory Connections

Function code	Function	
32	Purge gas valve 2 “normally closed”)	<p>The output is set when the corresponding bit for the accessory output has not been set in the USS control word. (Bit 5: X201, Bit 14: X202, Bit 15: X203)</p> <p>If the bit has been set, then a warning is produced.</p>

State diagram for function code 32



Additionally, a switch-on/switch-off delay time can be set up.
The delay time is entered in milliseconds.

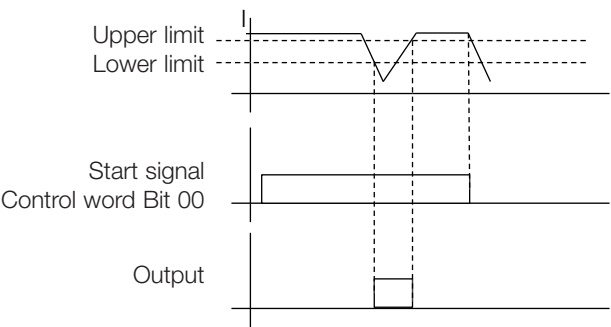


Accessory Connections

8.2.3 Functions with Limit Values

Function code	Function	
23	Motor current dependent	<p>The output is set when the current drops below the lower limit and in the USS status word Bit 00 has been set (start command).</p> <p>When the current exceeds the upper limit, the output is reset again.</p> <p>Parameter 27 [0 ... 2]: upper limit for accessory connection (unit 0.1 A)</p> <p>Parameter 652 [0 ... 2]: lower limit for accessory connection (unit 0.1 A)</p>

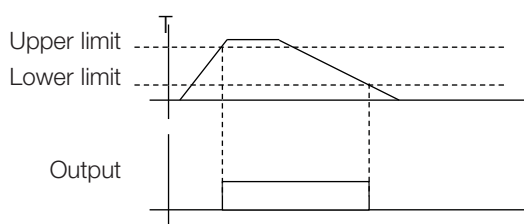
State diagram for function code 23



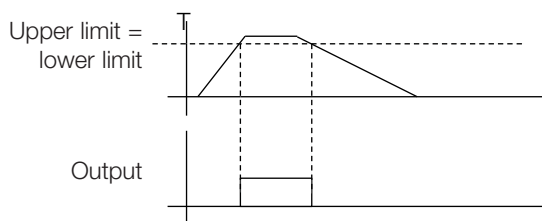
Accessory Connections

Function code	Function	
24	Current bearing temperature trigger	<p>The output is set when the bearing temperature exceeds the upper limit.</p> <p>When the bearing temperature drops below the lower limit, the output is reset again.</p> <p>Parameter 122 [0 ... 2]: upper limit for accessory connection (unit °C).</p> <p>Parameter 26 [0 ... 2]: lower limit for accessory connection (unit °C).</p> <p>The default settings are listed in the parameter list.</p>
29	Fan 2 ("frequency dependent")	<p>The output is set when the frequency exceeds the upper limit.</p> <p>When the frequency drops below the lower limit, the output is reset again.</p> <p>Parameter 28 [0 ... 2]: upper limit for accessory connection (unit Hz).</p> <p>Parameter 647 [0 ... 2]: lower limit for accessory connection (unit Hz).</p> <p>The default settings are listed in the parameter list.</p>
30	Fan 3 ("bearing temperature dependent")	<p>The output is set when when the bearing temperature exceeds the upper limit.</p> <p>When the bearing temperature drops below the lower limit, the output is reset again.</p> <p>Parameter 122 [0 ... 2]: upper limit for accessory connection (unit °C).</p> <p>Parameter 26 [0 ... 2]: lower limit for accessory connection (unit °C).</p> <p>The default settings are listed in the parameter list.</p>
39	Pressure dependent	<p>The output is set when the pressure exceeds the upper limit.</p> <p>When the pressure drops below the lower limit, the output is reset again.</p> <p>Parameter 648 [0 ... 2]: upper limit for accessory connection (unit mbar).</p> <p>Parameter 649 [0 ... 2]: lower limit for accessory connection (unit mbar).</p> <p>The default settings are listed in the parameter list.</p>

State diagram for function code 24, 29, 30, 39



When upper limit = lower limit is set up then the output switches as soon as the limit is exceeded and it switches off again when the value drops below the limit.



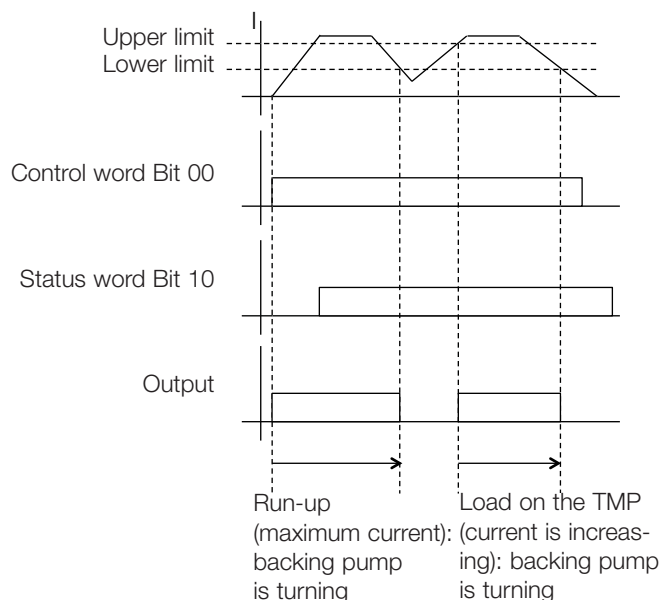
Accessory Connections

Function code

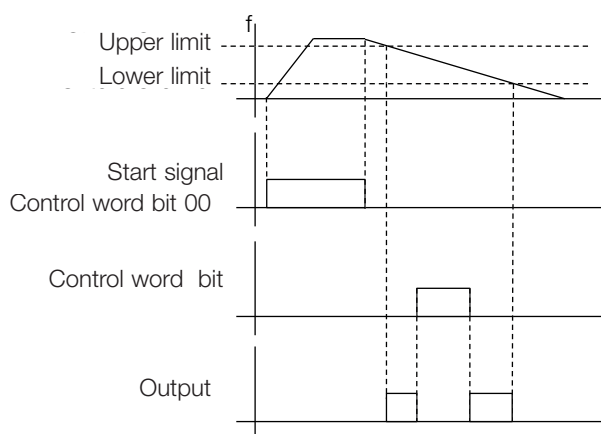
Function

35	Relay box for backing pump 2 ("current dependent")	<p>1. When the pump runs up to nominal speed, the output is set until the current drops below the lower limit.</p> <p>2. The output is set when control word Bit 00 is set (start command), status word Bit 10 is set (pump in normal operation) the current exceeds the upper limit</p> <p>When the current drops below the lower limit, the output is reset again.</p> <p>3. When the start signal is revoked, the output is reset..</p> <p>Parameter 27 [0 ... 2]: upper limit for accessory connection (unit 0.1 A).</p> <p>Parameter 652 [0 ... 2]: lower limit for accessory connection (unit 0.1 A).</p> <p>The default settings are listed in the parameter list.</p>
36	Venting valve ("frequency dependent") (default X203)	<p>The output is set when the control word Bit 00 (start command) is not set and the frequency drops below the upper limit.</p> <p>When the frequency drops below the lower limit, the output is reset again.</p> <p>Switching of the output can be prevented by setting the corresponding bit in the USS control word for the accessory output. (Bit 5: X201, Bit 14: X202, Bit 15: X203)</p> <p>Parameter 28 [0 ... 2]: upper limit for accessory connection (unit Hz).</p> <p>Parameter 647 [0 ... 2]: lower limit for accessory connection (unit Hz).</p> <p>The default settings are listed in the parameter list.</p>

State diagram for function code 35



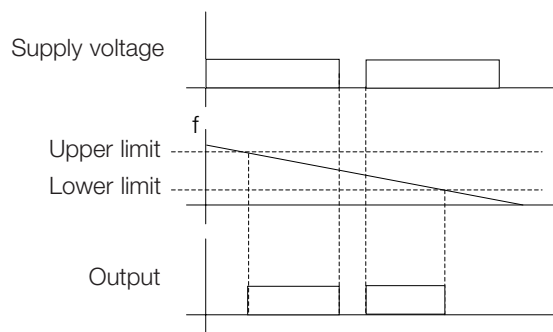
State diagram for function code 36



Accessory Connections

Function code	Function	
25	Power failure venting	<p>The output is reset when the supply power fails and the frequency drops below the upper limit.</p> <p>When the frequency drops below the lower limit, the output is reset.</p> <p>Parameter 247 [0 ... 2]: upper limit for accessory connection (unit Hz).</p> <p>Parameter 248 [0 ... 2]: lower limit for accessory connection (unit Hz).</p> <p>The default settings are listed in the parameter list.</p>

State diagram for function code 25

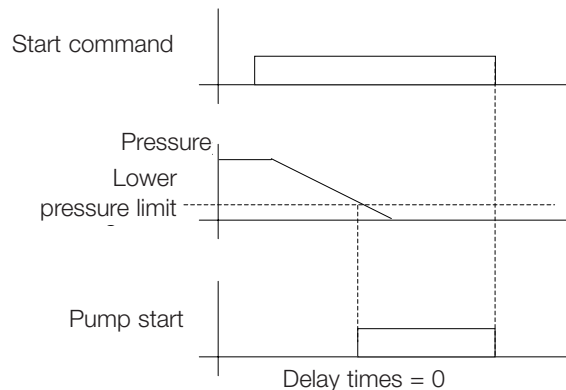


8.2.4 Function for Pressure Dependent Switching on of the Pump

Through parameter 625 the function can be enabled. P625 = 0 – disabled. P625 = 1 – enabled. The pressure limits can be set up through parameter 686.

When the function has been enabled, the pump will respond as shown in the diagram: the pump starts when a start command is present and the pressure has dropped below the limit.

Function pressure dependent switch-on



Example for Telegrams

Annex: Profibus strings

Detailed in the following table is the complete structure of the USS payload data block as described in detail on the preceding pages.

For the TURBOVAC i
Bit 14 (24 VDC output X202) and
Bit 15 (24 VDC output X203) have
no function in the control word.

Abr.		Description	Dez	Value Hex	Bin	Bit	Byte	Word	Bit	Bin	Value Hex	Dez	Description		Abr.				
PKE	Query designator					7	0		15					Reply designator	PKE				
					6	14													
					5	13													
					4	12													
	Res.					3	1		11					Res.					
						2			10										
						1			9										
						0			8										
						7			7										
						6			6										
						5			5										
						4			4										
						3			3										
						2			2										
						1			1										
						0			0										
IND	Parameter Index					7	2		15					Parameter Index	IND				
					6	14													
					5	13													
					4	12													
					3	11													
					2	10													
					1	9													
					0	8													
					7	1			7										
					6				6										
-	Reserved				5				5					Reserved	-				
					4				4										
					3				3										
					2				2										
					1				1										
					0				0										
		PWE	Parameter value					7	4		15							Parameter value	PWE
								6			14								
						5	13												
						4	12												
						3	11												
						2	10												
						1	9												
						0	8												
						7	2		7										
						6			6										
						5			5										
						4			4										
						3			3										
						2			2										
						1			1										
						0			0										
						7	5		7										
						6			6										
						5			5										
						4			4										
						3			3										
						2			2										
						1			1										
						0			0										
						7	6		7										
						6			6										
						5			5										
						4			4										
						3			3										
						2			2										
						1			1										
						0			0										
						7	3		7										
						6			6										
						5			5										
						4			4										
						3			3										
						2			2										
						1			1										
						0			0										
PZD1	Control word	24 VDC Output X203				7	8		15				Remote active	Status word	PZD1				
		24 VDC Output X202				6			14				Collective warning						
		Warning relay				5			13				Warning overload						
		Normal operation relay				4			12				Failure counter						
		Error relay				3			11				Pump is rotating						
		Activate remote				2			10				Normal operation						
		-				1			9				Parameter accepted						
		Standby speed				0			8				-						
		Error reset				7	4		7				Warning temperature						
		Enable setpoint				6			6				Switch-on lock						
		24 VDC Output X201				5			5				Deceleration						
		-				4			4				Acceleration						
		-				3			3				Error active						
		-				2			2				Operation enabled						
		-				1			1				-						
		Start/Stop				0			0				Ready to start						
PZD2	Setpoint rotor speed					7	10		15					Actual rotor speed	PZD2				
						6			14										
						5			13										
						4			12										
						3			11										
						2			10										
						1			9										
						0			8										
						7	5		7										
						6			6										
						5			5										
						4			4										
						3			3										
						2			2										
						1			1										
						0			0										

Example for Telegrams

Abr.		Description	Value Dez Hex	Bin	Bit	Byte	Word	Bit	Value Bin Hex	Dez	Description		Abr.
①	PZD1	Control word	4	4	8	4	15	1	8E	142	Remote active	③	PZD1
											Collective warning		
											Warning overload		
											Failure counter		
											Pump is rotating		
											Normal operation		
											Parameter accepted		
											-		
											Warning temperature		
											Switch-on lock		
											Deceleration		
											Acceleration		
											Error active		
											Operation enabled		
											-		
											Ready to start		
②	PZD2	Setpoint rotor speed	0	0	10	5	15	0	8B	1000		②	PZD2

It is possible to simultaneously drive the pump and perform parameter operations but we consider these operations separately in the following for the sake of clarity.

Example 1: Starting the pump

The pump was started (PZD1 Bit 0, 10) (1) and runs at 1000 Hz (2) during normal operation (3).

Abr.		Description	Value Dez Hex	Bin	Bit	Byte	Word	Bit	Value Bin Hex	Dez	Description		Abr.
①	PZD1	Control word	4	4	8	4	15	1	8E	142	Remote active	④	PZD1
											Collective warning		
											Warning overload		
											Failure counter		
											Pump is rotating		
											Normal operation		
											Parameter accepted		
											-		
											Warning temperature		
											Switch-on lock		
											Deceleration		
											Acceleration		
											Error active		
											Operation enabled		
											-		
											Ready to start		
②	PZD2	Setpoint rotor speed	700	2	10	5	15	0	8B	700		③	PZD2

Example 2: Setpoint active

The pump is operated with the setpoint active (PZD1 Bit 10,6,0) (1). The frequency is defined in PZD 2 rotor frequency setpoint (2). The pump runs at 700 Hz (3) during normal operation (4).

Example for Telegrams

Example 3:
Read parameter 150

The parameter 150 (1), standby frequency, is read (2).

The requested parameter (3) is sent (4). The standby frequency is 250 Hz (5).

Abr.		Description	Value				Byte	Word	Value				Description	Abr.	
			Dez	Hex	Bin	Bit			Dez	Hex	Bin	Bit			
②	Query designator		1		0	7	0				15	0	Reply designator	④	
	Res.		0	10	0	6					14	0			Res.
①	PKE	Parameter number	150	96	0	5	1	0	150	96	0	1	Parameter number	PKE	③
					1	4					12	1			
					0	3					11	0			
					0	2					10	0			
					0	1					9	0			
					0	0					8	0			
					1	7					7	1			
					0	6					6	0			
					0	5					5	0			
					1	4					4	1			
	IND	Parameter Index	0	0	0	7	2	1	0	0	15	0	Parameter Index	IND	
					0	6					14	0			
					0	5					13	0			
					0	4					12	0			
					0	3					11	0			
					0	2					10	0			
					0	1					9	0			
					0	0					8	0			
					0	7					7	0			
					0	6					6	0			
	Reserved	Reserved	0	0	0	5	3	0	0	0	15	0	Reserved	Reserved	⑤
					0	4					14	0			
					0	3					13	0			
					0	2					12	0			
					0	1					11	0			
					0	0					10	0			
					0	7					9	0			
					0	6					8	0			
					0	5					7	0			
					0	4					6	0			
PWE	Parameter value	Parameter value	0	0	0	3	4	2	0	0	15	0	Parameter value	PWE	⑤
					0	2					14	0			
					0	1					13	0			
					0	0					12	0			
					0	7					11	0			
					0	6					10	0			
					0	5					9	0			
					0	4					8	0			
					0	3					7	0			
					0	2					6	0			
					0	1					5	0			
					0	0					4	0			
					0	7					3	0			
					0	6					2	0			
					0	5					1	0			
					0	4					0	0			
					0	3					15	0			
					0	2					14	0			
					0	1					13	0			
					0	0					12	0			
					0	7					11	0			
					0	6					10	0			
					0	5					9	0			
					0	4					8	0			
					0	3					7	1			
					0	2					6	1			
					0	1					5	1			
					0	0					4	1			
					0	7					3	1			
					0	6					2	0			
					0	5					1	1			
					0	4					0	0			
					0	3					15	0			
					0	2					14	0			
					0	1					13	0			
					0	0					12	0			
					0	7					11	0			
					0	6					10	0			
					0	5					9	0			
					0	4					8	0			
					0	3					7	1			
					0	2					6	1			
					0	1					5	1			
					0	0					4	1			
					0	7					3	1			
					0	6					2	0			
					0	5					1	1			
					0	4					0	0			
					0	3					15	0			
					0	2					14	0			
					0	1					13	0			
					0	0					12	0			
					0	7					11	0			
					0	6					10	0			
					0	5					9	0			
					0	4					8	0			
					0	3					7	1			
					0	2					6	1			
					0	1					5	1			
					0	0			4	1					
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
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0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												
0	1	5	1												
0	0	4	1												
0	7	3	1												
0	6	2	0												
0	5	1	1												
0	4	0	0												
0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
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0	4	0	0												
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0	6	2	0												
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0	4	0	0												
0	3	15	0												
0	2	14	0												
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0	3	7	1												
0	2	6	1												
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0	0	4	1												
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0	6	2	0												
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0	1	13	0												
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0	5	1	1												
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0	3	15	0												
0	2	14	0												
0	1	13	0												
0	0	12	0												
0	7	11	0												
0	6	10	0												
0	5	9	0												
0	4	8	0												
0	3	7	1												
0	2	6	1												

Example for Telegrams

Abr.		Description	Value				Byte	Word	Value				Description		Abr.
			Dez	Hex	Bin	Bit			Bit	Bin	Hex	Dez			
③	Query designator		2		0 7		0		15 0				Reply designator	⑤	
				0 6				14 0							
①	PKE	Res.	0	20	1 5				13 1		20		Res.	PKE	
		Parameter number	150	96	0 4				12 0				Parameter number		④
					0 3				11 0						
					0 2				10 0						
					0 1				9 0						
					0 0				8 0						
					1 7				7 1						
					0 6				6 0						
					0 5				5 0						
					1 4				4 1						
					0 3				3 0						
					1 2				2 1						
					1 1				1 1						
					0 0				0 0						
IND	Parameter Index		0	0	0 7		2		15 0				Parameter Index	IND	
				0 6				14 0							
					0 5				13 0						
					0 4				12 0						
					0 3				11 0						
					0 2				10 0						
					0 1				9 0						
					0 0				8 0						
.	Reserved		0	0	0 7		3		7 0				Reserved	.	
				0 6				6 0							
					0 5				5 0						
					0 4				4 0						
					0 3				3 0						
					0 2				2 0						
					0 1				1 0						
					0 0				0 0						
PWE	Parameter value		500	0	0 7		4		15 0				Parameter value	PWE	
				0 6				14 0							
					0 5				13 0						
					0 4				12 0						
					0 3				11 0						
					0 2				10 0						
					0 1				9 0						
					0 0				8 0						
					0 7				7 0						
					0 6				6 0						
					0 5				5 0						
					0 4				4 0						
					0 3				3 0						
					0 2				2 0						
					0 1				1 0						
					0 0				0 0						
②	PWE		500	1	0 7		6		15 0				PWE	⑥	
				0 6				14 0							
					0 5				13 0						
					0 4				12 0						
					0 3				11 0						
					0 2				10 0						
					0 1				9 0						
					1 0				8 1						
					1 7				7 1						
					1 6				6 1						
					1 5				5 1						
					1 4				4 1						
					0 3				3 0						
					1 2				2 1						
					0 1				1 0						
					0 0				0 0						

Example 4: Write parameter 150

The parameter 150 (1) is set (2) to 500 Hz (3).

Writing of the parameter (4) is confirmed by sending (5) the new value (6).

Caution

The saving process takes a few seconds. It is indicated by a running light on the front LEDs. During the saving process the power supply must not be interrupted.

So that this value is maintained even after having switched off the power, it will have to be saved permanently by writing the parameter 8 to 1.

Example for Telegrams

Example 5:
Reading the error code

The next to last (index number 1)
(1) error code (parameter 171) (2)
is read (3).

The requested error code (4) is
sent (5). It contains the error mes-
sage 39, general magnetic bea-
ring fault (6).

Abr.		Description	Value					Value				Description	Abr.
			Dez	Hex	Bin	Bit	Byte	Word	Bit	Bin	Hex	Dez	
③	Query designator								15	0			Reply designator
									14	0			
②	PKE	Res.							13	0			Res.
									12	0			
①	IND	Parameter number							11	0			Parameter number
									10	0			
	Reserved								9	0			Reserved
									8	0			
PWE	Parameter value								7	1			Parameter value
									6	0			
									5	1			
									4	0			
									3	1			
									2	0			
									1	1			
									0	1			
									15	0			
									14	0			
									13	0			
									12	0			
									11	0			
									10	0			
									9	0			
									8	0			
									7	1			
									6	0			
									5	1			
									4	0			
									3	1			
									2	0			
									1	1			
									0	1			
									15	0			
									14	0			
									13	0			
									12	0			
									11	0			
									10	0			
									9	0			
									8	0			
									7	1			
									6	0			
									5	1			
									4	0			
									3	1			
									2	0			
									1	1			
									0	1			
									15	0			
									14	0			
									13	0			
									12	0			
									11	0			
									10	0			
									9	0			
									8	0			
									7	1			
									6	0			
									5	1			
									4	0			
									3	1			
									2	0			
									1	1			
									0	1			
									15	0			
									14	0			
									13	0			
									12	0			
									11	0			
									10	0			
									9	0			
									8	0			
									7	1			
									6	0			
									5	1			
									4	0			
									3	1			
									2	0			
									1	1			
									0	1			

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Example 6:
Reading out the number of pump operating hours in the event of a malfunction

The number of pump operating hours related to the preceding example (parameter 176) (1) is read (2).

The requested parameter (3) is sent (4). It contains the number of pump operating hours at the point of time the error 27,92 h (5) has occurred.

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