

Serial Interfaces for MAG.DRIVE S/iS

RS 232, RS 485, Profibus

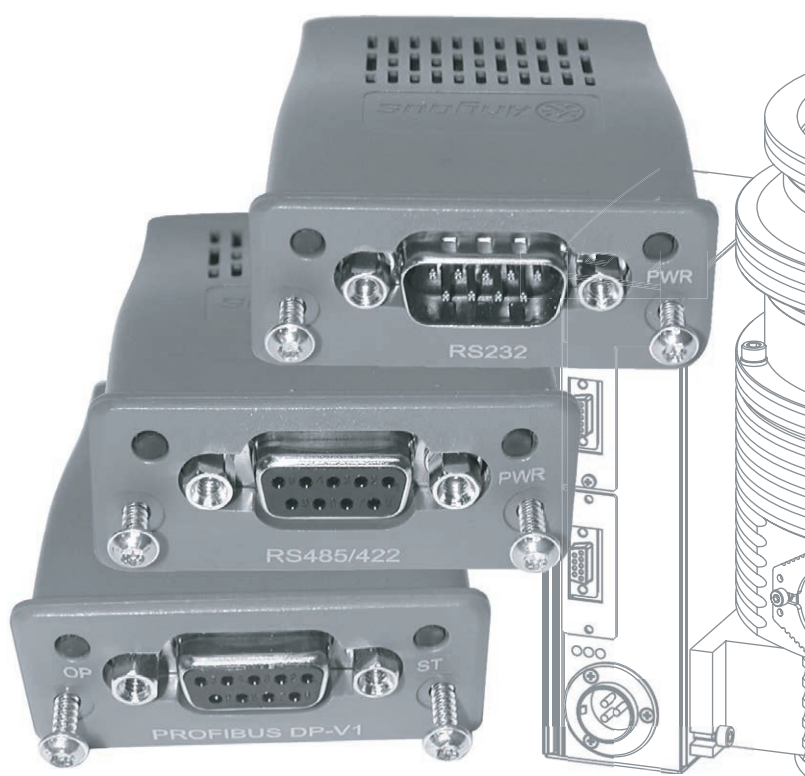
Operating Instructions 17200308_002_C0

Part Nos.

410300V0902

410300V0903

410300V0904



Contents

	Page
Important Safety Information	3
1 Description	4
1.1 Description of the RS 232 and RS 485 Interfaces	4
1.2 Description of the Profibus Interface	7
2 Installation	10
2.1 Installation	10
2.2 Connection	12
3 Description of the Telegram	13
3.1 Telegram for RS 232 and RS 485	13
3.2 Telegram for Profibus	14
4 Description of PKE, IND, Control and Status Bits	15
4.1 PKE: Parameter Number and Type of Access	15
4.2 Status and Control Bits (Status and Control Word)	16
4.3 Control Word (PZD1, STW) = 16 Control Bits	17
4.4 Status Word (PZD1, ZSW) = 16 Status Bits	18
5 Parameter List	19
6 Error Memory	24
7 Warnings	30
Annex: Profibus strings	34
Example 1: Starting the pump	35
Example 2: Setpoint active	35
Example 3: Read parameter 150	36
Example 4: Write parameter 150	37
Example 5: Reading the error code	38
Example 6: Reading out the number of pump operating hours in the event of a malfunction	39

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 Leybold **frequency converters MAG.DRIVE S and iS 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 MAG.DRIVE **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

1 Description

1.1 Description of the RS 232 and RS 485 Interfaces

The MAG Drive 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

Supplied Equipment

- RS 232 module or RS 485 module for MAG.DRIVE S/iS
- Torx key T9
- Brief Instructions for module installation

Description RS 232, RS 485

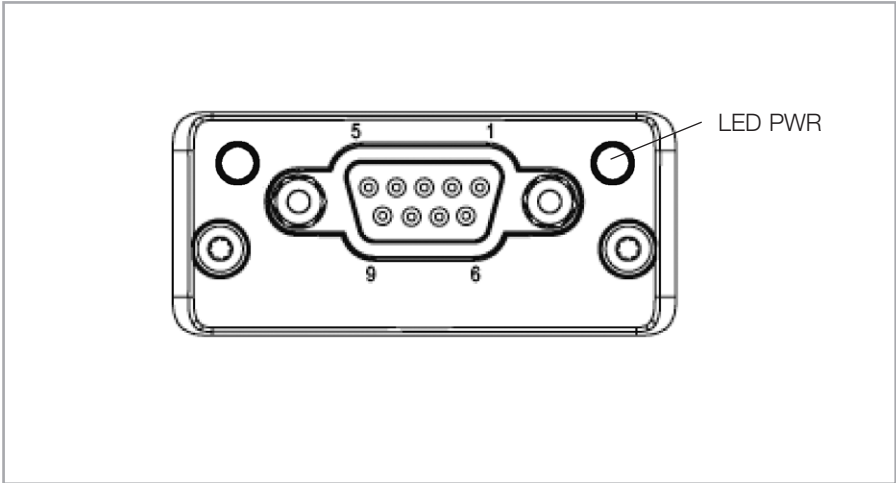
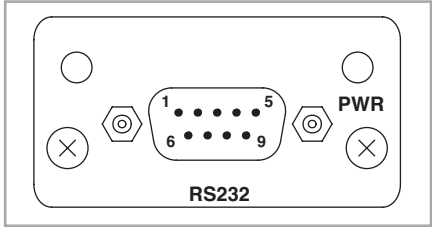


Fig. 1.2 Front

Technical Data RS 232

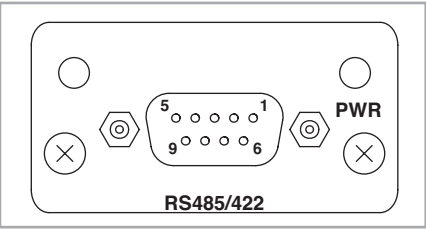
The module is designed as a DTE (Data Terminal Equipment, i.e. in order to connect the module another DTE such as a computer, a crossover cable must be used (0-Modem)

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



Technical Data RS 485 / 422

Pin	RS 422 Mode	RS 485 Mode
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
6	RxD inverted (Internally terminated (100 Ω) Receive data line	–
7	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

Max. cable length	100 m
Baud rate	
19200 Baud	
Address range	0 bis 32
Default address	0
Voltage level	see standards
Interface connection	Sub-D 9-way socket (female)

Ordering Information

RS 232 interface for MAG.DRIVE S/iS	410300V0902
RS 485 interface for MAG.DRIVE S/iS	410300V0903



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 MAG Drive iS 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 Profibus profile for vacuum pumps

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

Description Profibus

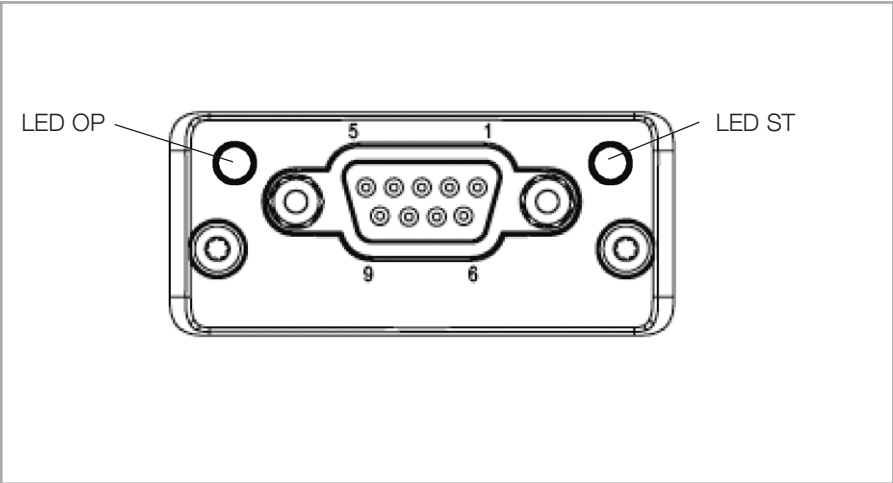


Fig. 1.4 Front

LED OP (Operation Mode)

State	Indication	Comment
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

Supplied Equipment

- Profibus module for MAG.DRIVE S/iS
- Torx key T9
- Brief Instructions for module installation

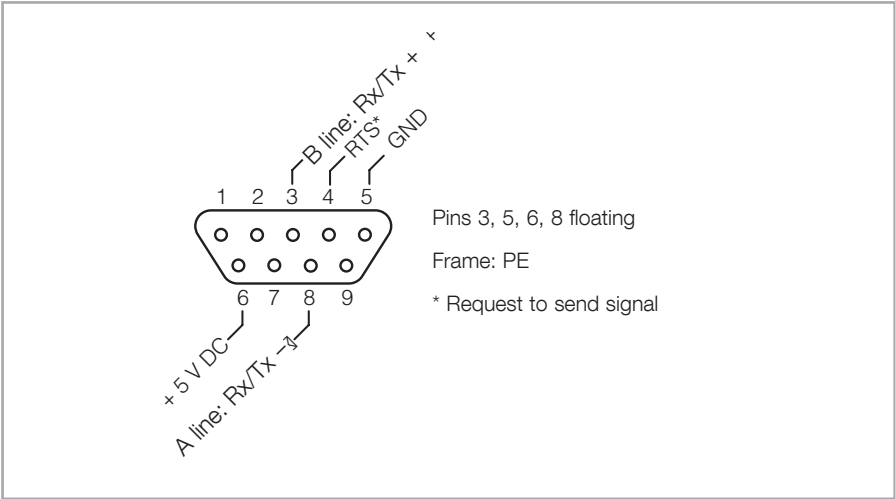


Fig. 1.5 Pin assignment for the socket

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	45.45 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	1 to 126
Voltage level	see standards
Interface connection	Sub-D 9-way socket (female)

Ordering Information

Profibus interface for MAG.DRIVE S/iS	410300V0904
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Installation

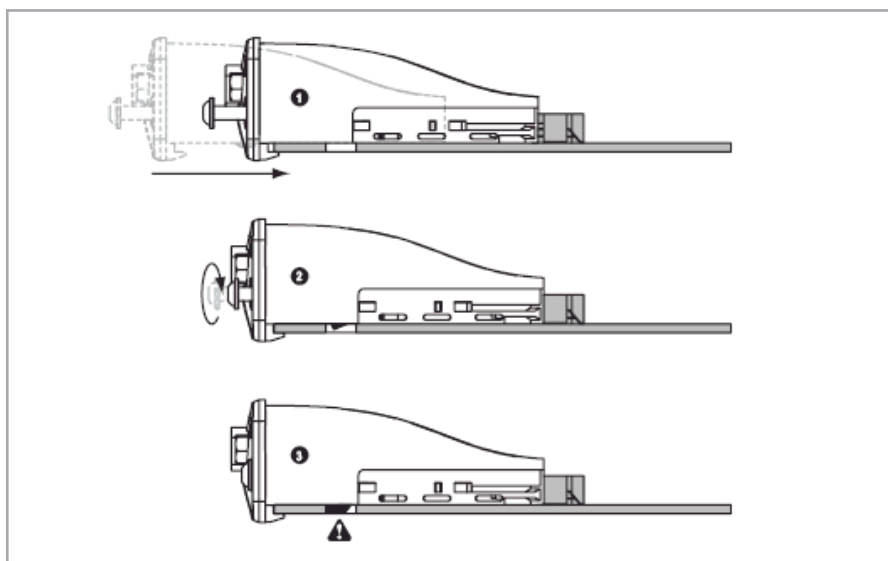


Fig. 2.1 Installation

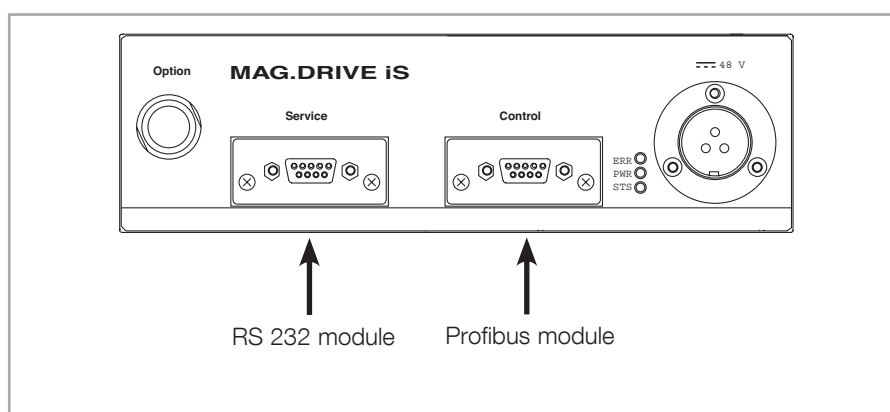


Fig. 2.2 Installation location for the modules for Profibus

2 Installation

2.1 Installation

Generally the modules work in both slots. The supplied PLC interface X1 works only in the CONTROL slot.

If you try to control via two installed interfaces, the interface in the CONTROL slot will have the higher priority.

For Profibus, the RS 232 module is needed to set up the address for the Profibus module. Insert the RS 232 module into the service slot, the Profibus module into the control slot.

NOTICE



Before inserting the module, ensure that the affixing screws have been fully screwed out.

See Fig. 2.1, 2.3 and 2.4.



Fig.2.3 Inserting the module



Torx key T9
(included in the
delivery)

Fig.2.4 Tightening the module

- 1 When inserting the module into the slot, press it with its plain side onto the frequency converter board.
- 2 Tighten the affixing screws until they make contact with the panel.
- 3 The affixing screws lock the module in place in the slot.

NOTICE

2.2 Connection

Before making any connections, switch the pump off and wait until it turns no longer. Then deenergise the frequency converter.

RS 232, RS 485

Connect the interface connector on the front of the frequency converter. The terminator is installed in the equipment. Please contact us for the address setup for RS 485.

Profibus

Connect the Profibus to the Profibus interface connector on the front of the frequency converter (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

6XV1830-0EH10

Default Bus address:

126

Address Setup for Profibus

1. Profibus service:

If the slave has the bus address 126 (default) then this can be changed through the standard Profibus service SAP 0x37 (Set_Slave_Add).

2. Setup parameter (via Profibus and RS 232/485)

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.

Parameterisation through the serial service interface (typically RS 232, built into the service slot)

For this, set parameter 918 to the desired address and set parameter 924 to the value „1“.

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 (48 V) and switch on again.

The watchdog for the Profibus communication has been set to 2 sec as default. I.e. after a communication break for > 2 sec the watchdog will be active and shut down the pump.

NOTICE

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...15		
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	PZD5	Current pump temperature (= P127)	0	0	Value (°C)
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

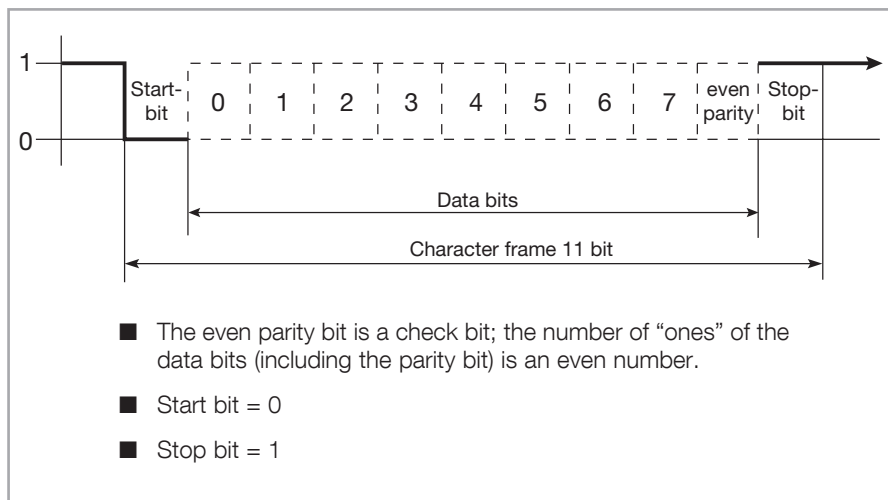


Fig. 3.1 Structure of a data frame for transferring a string byte

Telegram Profibus

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 Leybold homepage or is available upon request.

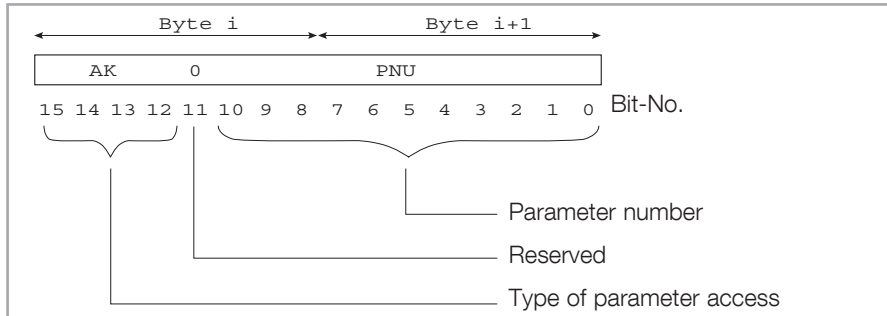


Fig. 4.1 Structure of the parameter section

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
1	0	0	1	Number of field elements of a field requested	0	1	1	0	Number of field elements of a field 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.

PKE, IND, Bits

Fault detection	Description
0	impermissible parameter number
1	parameter cannot be changed
2	min./max. restriction
3	wrong index value
4	no array
5	wrong data type
6	setting is not allowed
7	element was not changed
101	order unknown
104	password level too low

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.

4.3 Control Word (PZD1, STW) = 16 Control Bits

(Is sent to the pump for each access.)

PZD1

Bit	Command	Remark
0	*System Start/Stop	Value = 1 pump drive start Value = 0 pump drive stop (Start impossible if Bit 7 = 1; means Reset active)
1 to 5	No function	
6	*Enable main set point in PZD2	Value = 1 the value of PZD2 will be used as speed set point. Value = 0 the Set point value of PZD2 will be ignored.
7	*Failure reset Reset impossible , if Bit 0 = 1; Start active.	Changing from 0 to 1 clears all pending failures, if the causes are away. To avoid a continuously reset, only the transient from 0 to 1 may work as reset signal
8	*Activate Standby function	Value = 1 Activate the standby function: if the main value in PZD 2 is deactivated, the drive reference value of the drive speed must be the same value as parameter 150 Value = 0 Deactivate the standby function: if the main value in PZD 2 is deactivated, the drive reference value of the drive speed must be the same value as parameter 24 This bit corresponds to the alternative standby activation of parameter 151.
9	No function	
10	*Enable Process Data (Bit 0,6,7,8, 13, 14)	Value = 0: pump drive control by digital I/O signal, all bits in PZD1 will be ignored. Value = 1: System control by this interface. The digital I/O signal will be ignored.
11	** Purge gas On/Off	Value = 1: Purge gas valve open Value = 0: Purge gas valve closed
12	** Venting On/Off	Value = 1: Venting valve open Value = 0: Venting valve closed
13 to 14	No function	
15	*** Venting On/Off	Value = 1: Status of the venting valve depends on pump operating status Value = 0: Venting valve closed

* In order to activate the control function, bit 10 must be set.
Control via other methods is then disabled.

** For future applications

*** Parameter 134 must be set to 21, to activate the function.

4.4 Status Word (PZD1, ZSW) = 16 Status Bits

(Is sent together with each response from the frequency converter)

PZD1 Bit	Interpretation	Note
0	Ready to run	Bit 0 will be set after initialization of the system, if there is no failure pending.
1	No function	Value set to 0
2	Operation enabled	Bit 2 will be set if no failure condition is present, rotor is lifted and drive is active
3	Failure condition	Bit 3 will be set if any failure condition is pending und the pump drive is deactivated. The pump is not ready for start
4	Acceleration	Bit 4 will be set to 1, if the drive increases or tries to increase the speed of the pump (actual speed << speed reference value)
5	Deceleration	Bit 5 will be set to 1, if the drive decreases or tries to decrease the speed of the pump (actual speed >> actual speed reference value; also active during run out)
6	Switch on lock	Value inverse to Bit 2 of PZD1
7	Warning temperature	Temperature warning condition: one or more temperature limits are above the warning limits.
8	No function	Value set to 0
9	Parameter channel enabled	If set, the parameter channel is ready for operation; normally always = 1
10	Normal Operation reached	Bit 10 is set if the normal operation condition of the pump is true: „actual pump speed” ≥ „speed reference” * P25
11	Pump is rotating	Bit 11 is set if rotor rotates, $f > 3\text{Hz}$
12	Failure Counter	Bit 12 is set if the alarm level of internal counters have reached the set points, so that the system may not be operated any longer.
13	Warning overload	Bit 13 is set, if load condition leads to one or more of the overload conditions; definition is still open
14	No function	Value set to 0
15	Process channel enabled	Bit 15 is set to 1 if Bit 10 of PZD1 is set, recognized and the pump is controlled by this interface

5 Parameter List

It is possible to change certain parameters depending on the specific requirements and save these permanently. For this refer to the Annex, example 4.

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
1	Pump unit identifier	100	201	201		r	u16	201 = MAG.DRIVE S; (Vers. 117, 25. June 2007, Ch.Harig)
2	Software version xxx.yy.zz	8010000	8015500			r	i32	xxx.yy: Version, zz: Correction index
		2147483647						
3	Actual frequency	0	1200	0	rps	r	u16	Actual value of the rotor frequency.
4	Actual intermediate circuit voltage	0	1000	480	0,1 V	r	u16	Actual intermediate circuit voltage of the converter.
5	Actual current	0	100	0	0,1 A	r	u16	Actual motor current
6	Actual electrical power	0	5000	0	0,1 W	r	u16	Actual drive input power.
7	Actual motor temperatur	0	150	0	°C	r	u16	Actual value of the motor temperature.
8	Save data command	-2147483648		0		r/w	i32	A write command with any value saves temporary data into nonvolatile memory.
		2147483647						
11	Actual converter temperatur	0	100	0	°C	r	u16	Actual heat sink temperature of the converter.
16	Motor temperature warning threshold	5	250	110	°C	r	u16	Exceeding the motor temperature warning threshold results in a warning.
17	Nominal motor current	0	200	45	0,1 A	r	u16	Maximum permissible motor current
18	Maximum frequency	0	1200	980	Hz	r	u16	Highest permissible frequency
19	Minimum frequency	0	1200	230	Hz	r	u16	Lowest permissible frequency
20	Critical frequency	0	1200	200	Hz	r	u16	When the pump is accelerating this frequency must be reached within the maximum passing time (P183). After run-up: Switch-off threshold because of overload.
21	Motor overload limit	0	200	45	0,1 A	r	u16	Max. current level during normal operation; Higher current value leads to „overload“ and stops the pump if the durance accedes a certain time.
23	Pump type	200	300	200		r	u16	Code no. of the connected turbo pump: 230 = Mag 300/400; 260 = Mag 600
24	Setpoint frequency	600	1200	980	Hz	r/w	u16	Setpoint of the rotor frequency
25	Normal operation	35	99	90	%	r/w	u16	Setpoint of the frequency dependent normal operation level
32	Max. run-up time	0	3600	420	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	3600	0	s	r/w	u16	Delays the start of the pump to allow leadtime for the fore vacuum pump for example.
38	Start cycle counter	0	65535	0		r	u16	Counts all run-ups of the pump from stand-still.
50	Pump catalog no.	0		0		r	i32	Last 9 digits of the pump's catalog number.
		2147483647						
52	Pump serial no.	0		0		r	i32	Last 9 digits of the pump's serial number.
		2147483647						

Parameter list

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
54	Date of manufacturing	0		0		r	i32	Manufacturing date of the pump [DDMMYY].
		2147483647						
56	Date of last service	0		0		r	i32	Last service date of the pump [DDMMYY].
		2147483647						
60	Last service operating hours	0		0	0,01 h	r	i32	Number of operating hours at the last service event.
		2147483647						
62	Date of last repair	0		0		r	i32	Last repair date of the pump [DDMMYY].
		2147483647						
66	Last repair operation hours	0		0	0,01 h	r	i32	Number of operating hours at the last repair event.
		2147483647						
86	Number of repairs	0	65535	0		r	u16	Number of all repairs
105	Counted magn. bearing touch downs	0	65535	0		r	u16	Actual number of recognized magnetic bearing touch downs
106	Accumulated time of MB touch downs	0		0	0,01 s	r	i32	Actual total amount of time during recognized bearing touch downs
		2147483647						
109	Max. no. of touch downs	0	65535	1000		r	u16	Maximum number of touch downs until warning or error indication.
110	Max. amount of touch down time	0		360000	0,01 s	r	i32	Max. amount of touch down time until warning or error indication
		2147483647						
125	Bearing temperature	0	150	0	°C	r	u16	Actual value of the bearing temperature
126	Bearing temperature warning threshold	5	250	85	°C	r	u16	Warning level of the bearing temperature
131	Bearing temperature error threshold	10	250	90	°C	r	u16	Error level of the bearing temperature
133	Motor temperature error threshold	10	250	115	°C	r	u16	Error level of the motor temperature
134	Option 24 volts behavior	0	21	19		r/w	u16	Selects the behavior of the 24 volt auxiliary supply (fan, valve etc.)
	0: always deactive 1: failure 2: no failure 3: warning 4: no warning 5: at speed 6: not at speed 7: motor rotates 8: motor does not rotate 9: reference speed reached 10: warning supply voltage low 11: warning supply voltage high 12: warning motor temperature high 13: warning converter temp. power stage 14: warning converter temp. air inside 15: warning pump bearing temperature 16: warning pump speed too high 17: warning pump motor overload 18: serial interface controlled 19: always active 20: option brake operation 21: vent valve option							

Parameter list

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
139	Current reduction factor	30	100	100	%	r/w	u16	Is used for the reduction of the maximum consumption current, e.g. for adaption of low performance power supplies. Note: values < 100 reduce the pump performance and increase the run-up time.
140	Intermediate circuit current	0	100	0	0,1 A	r	u16	Actual average intermediate circuit current of the converter.
143	Actual motor voltage	-1000	1000	0	0,1 V	r	i16	Actual motor rms coil voltage
144	Run-up cycles warning threshold	0	65535	27000		r	u16	Warning level of start cycle numbers
145	Run-up cycles error threshold	0	65535	30000		r	u16	Error level of start cycle numbers
146	Stand-by cycle counter	0	65535	0		r	u16	Counts all run-ups from stand-by up to normal speed.
147	Run-up cycle counter	0	65535	0		r	u16	Number of all start-up events from stand-still and stand-by up to normal speed.
150	Stand-by frequency	0	1200	250		r/w	u16	Stand-by operation frequency setpoint
154	Pump op. hours warning threshold	0	9000000	2147483647	0,01 h	r	i32	Pump operating hours warning level
155	Pump op. hours error threshold	0	10000000	2147483647	0,01 h	r	i32	Pump operating hours alarm level
157	Pump op. hours blocked-start threshold	0	9500000	2147483647	0,01 h	r	i32	Start-up is blocked, if this number of operation hours is reached.
171	Error code memory	0	1000	0		r	u16	Indexed parameter for storing the most recent 40 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 39. See Section 6 for the error codes. Max. Index = 39
174	Error rotor frequency	0	1200	0		r	u16	Actual speed, when error occurred. Access analogously as for parameter 171. Max. Index = 39
176	Error operating hours	0	0	2147483647		r	i32	Pump operating hours, when error occurred. Access analogously as for parameter 171. Max. Index = 39
181	Profibus control watchdog	0	200	200	0,1 s	r/w	u16	0.0 = no supervision of cyclic control messages xx.x = watchdog triggers xx.x sec. after missing of control messages and stops the pump with an error message.
182	RS 232/485 control watchdog	0	200	0	0,1 s	r/w	u16	0.0 = no supervision of cyclic control messages xx.x = watchdog triggers xx.x sec. after missing of control messages and stops the pump with an error message.

Parameter list

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
183	Max. passing time	0	1200	360	s	r	u16	Maximum permissible time amount from start to minimum speed.
184	Converter operating hours	0	65535	0	h	r	u16	Counts the operating hours of the converter during active pump operation.
220	Peak orbit level 1	0	65535	0	1/2^14	r	u16	Actual peak value of the level 1 radial bearing amplitude.
221	Peak orbit level 2	0	65535	0	1/2^14	r	u16	Actual peak value of the level 2 radial bearing amplitude.
222	Peak amplitude Z	0	65535	0	1/2^14	r	u16	Actual peak value of the Z bearing amplitude.
227	Warning bits 1	0	65535	0		r	u16	Active warnings described bit per bit. See Section 7 for meaning.
228	Warning bits 2	0	65535	0		r	u16	Active warnings described bit per bit. See Section 7 for meaning.
230	Warning bits 3	0	65535	0		r	u16	Active warnings described bit per bit. See Section 7 for meaning.
232	Warning bits 4	0	65535	0		r	u16	Detailed MAG bearing conditions
243	Time delay SEMI F47	0	9999	5	s	r/w	u16	Adjustable time which in the case of an input voltage breakdown is bridged without an error message. For the entire duration, the converter will indicate a normal operation. Auxiliary parameter for fulfilling SEMI F47 requirements.
254	RS485 address set	0	31	0		r/w	u8	Address setup of passive serial interfaces as RS232, RS485 etc. in the Control Slot
260	Current upper limit of vent valve	0	1000	0	0,1 A	r	u16	
261	Current lower limit of vent valve	0	1000	0	0,1 A	r	u16	
262	Frequency lower limit of vent valve	0	1000	100	Hz	r	u16	
263	No. of touch downs at generator operation	0	65535	0		r	u16	
264	Max. no. of touch downs at generator operation	0	65535	0		r	u16	
265	Frequency lower limit at generator operation	0	1000	200	Hz	r	u16	
266	No. of touch downs at full shut down (PK)	0	65535	0		r	u16	
267	No. of touch downs at full shut down (converter)	0	65535	0		r	u16	
268	Max. no. of touch downs at full shut down	0	65535	0		r	u16	
312	Catalog no. of converter	0	255	0	:CHAR	r	u16	Catalog no. of converter, max. Index = 10
315	Serial no. of converter	0	255	0	:CHAR	r	u16	Serial no. of converter, max. Index = 10
343	Acceleration current	0	200	45	0,1 A	r	u16	Motor current setpoint during acceleration
344	Cable length	0	65535	0	m	r	u16	Length of pump cable

Parameter list

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
350	Catalog number of pump	0	127	0	:CHAR	r	u16	Catalogue number of the pump. One ASCII char per index, max. Index = 18
390	Actual cooler temperature	0	150	0	°C	r	u16	Actual value of the converter power stage cooling device temperature.
398	Pump volume	0	65535	300	l/s	r	u16	Pumping speed of the pump
399	Pump type	0	65407	0	:CHAR	r	u16	Pump description; ASCII sequence, max. Index = 18
801	Magnetic bearing current	-32768	32767	0	0,01 A	r	i16	Actual magnetic bearing current 1a, 2a, 1b, 2b, Z, max. Index = 4
815	Mag. bearing current 1a	-32768	32767	0	mA	r	i16	Actual magnetic bearing current 1a of high vacuum side
816	Mag. bearing current 2a	-32768	32767	0	mA	r	i16	Actual magnetic bearing current 2a of foreline side
817	Mag. bearing current 1b	-32768	32767	0	mA	r	i16	Actual magnetic bearing current 1b of high vacuum side
818	Mag. bearing current 2b	-32768	32767	0	mA	r	i16	Actual magnetic bearing current 2b of foreline side
819	Mag. bearing current Z	-32768	32767	0	mA	r	i16	Actual magnetic bearing current of Z axle
872	Mag. bearing current 1c	-32768	32767	0	mA	r	i16	Actual magnetic bearing current 1c of high vacuum side
873	Mag. bearing current 2c	-32768	32767	0	mA	r	i16	Actual magnetic bearing current 2c of foreline side
918	Set parameter bus address	0	65535	126		r/w	u16	Set parameter bus address
923	Active bus address	0	65535	126		r	u16	Effective bus address
924	Type of bus Address	0	1	0		r/w	u16	Choice of parameter bus address (value=1) or network bus address (value=0).

Error memory

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

Error code	Designation	Description	Possible cause	Remedy
2	Pump Motor Temperature is too high	The motor temperature has exceeded the error threshold.	The cooling water flow is too low or the cooling water temperature is too high.	Cooling system needs to be improved
			The converter is overloaded due to too high gas load.	The gas load needs to be reduced.
			Frequent acceleration and deceleration of the pump.	Allow converter to cool down between the cycles.
3	Supply Voltage Failure	The supply voltage is out of the specified voltage range.	Usage of a wrong power supply unit	Replace the power supply by a more powerful one.
			Misaligned output voltage	The output voltage of the power supply should be adjusted.
			Voltage drop across the supply cable	Adjust the output voltage of the power supply, increase the copper area of the cable, use a shorter DC cable
4	Converter Temperature Failure	The temperature sensor inside of the converter reads too high temperature value.	The cooling water flow is too low or the cooling water temperature is too high.	Cooling system needs to be improved
			The converter is overloaded due to too high gas load.	Reduce the gas flow.
			Frequent acceleration and deceleration of the pump.	Allow converter to cool down between the cycles.
6	Overload Failure	Rotational speed dropped below the shutdown frequency threshold (140 Hz).	Backing pressure too high during operation.	Reduce backing pressure.
			Too high gas flow during operation	Reduce process gas flow.
			High vacuum pressure too high.	Check the chamber pressure during operation.
7	Accel. Time	The pump does not reach the normal operation frequency during the adjusted maximum acceleration time.	Backing pressure or gas load is too high during start-up.	Reduce backing pressure and / or gas flow.
			Parameter „Accel. Time“ is not set correctly.	Set parameter „Accel. Time“
9	Bearing Temperature too high	The temperature sensor inside the pump reads a higher temperature value than the failure threshold.	Missing cooling device (water or air).	Apply a air or water cooling device according to specifications.
			Cooling water flow too low or cooling water temperature too high.	Check cooling water tubes for deposits.
			Air temperature too high	Cooling system needs to be improved
			Air cooling device blocked by dust	The gas load needs to be reduced.
			Frequent acceleration and deceleration of the pump.	Allow pump to cool down between the cycles.

Error memory

Error code	Designation	Description	Possible cause	Remedy
12	Radial Bearing Unbalance Failure at the Upper Magnetic Bearing	The radial magnetic bearing near the high vacuum flange takes a too large orbit.	Resonance effects between different pumps could increase the unbalance amplitude of a certain pump. Deposition of material from the pumped media at the turbo rotor could cause unbalance.	Setup the pumps to a slightly different rotation frequency or isolate the pumps from dynamic influence. Check the pumped media for suitability with this pump design.
13	Radial Bearing Unbalance Failure at the Lower Magnetic Bearing	The radial magnetic bearing near the high vacuum flange takes a too large orbit.	Due to aggressive media, abrasion at the turbo rotor could cause unbalance.	
14	Axial Bearing Unbalance Failure	The radial magnetic bearing near the high vacuum flange takes a too high oscillation amplitudes.	Resonance effects between different pumps could increase the unbalance amplitude of a certain pump. The environmental vibration might be too heavy	Setup the pumps to a slightly different rotation frequency or isolate the pumps from dynamic influence. Reduce the vibration which might affect the pump
16	Overload Duration Failure	The rotational speed has dropped below normal operation frequency and stays there for longer than the maximum „Acceleration Time“.	Backing pressure or processgas flow too high during operation. Parameters „Accel. Time“ or „Normal Operation“ are not set correctly	Check backing pressure and process gas flow Check parameter „Normal Operation“ and parameter „Acceleration Time“ for correct setting.
17	Pump Motor Current Failure		On START command: DRIVE cable not connected or connectors damaged.. DRIVE cable interrupted during operation of the MAG.	Check cables and connectors, straighten pins if required. Reconnect or replace DRIVE cable
19	Starting Time exceeded	The frequency has not reached the minimum frequency during the startup time frame	Backing pressure too high during start-up. Rotor blocked.	Reduce backing pressure Check if the rotor rotates freely.

Error memory

Error code	Designation	Description	Possible cause	Remedy
26	Bearing Temperature Sensor Defective		Temperature sensor defective, connection shorted or interrupted	Check for correct pump cable connection.
28	Motor Temperature Sensor Defective			
31	Highload Duration Failure	The actual motor current exceeds the maximum working level for more than twice the acceleration duration.	Backing pressure or processgas flow too high during operation.	Check backing pressure and process gas flow
39	Magnetic Bearing Startup Failure	The magnetic bearing system is not able to lift the rotor properly	Shock venting occurred Too high amplitude or force of mechanical shocks or vibration from the mounting rack. Resonance effects between different pumps could increase the unbalance amplitude of a certain pump.	Refer to the pump manual for correct venting of the pump. Reduce the vibration or shocks influence which might affect the pump Setup the pumps to a slightly different rotation frequency or isolate the pumps from dynamic influence.
43	Overspeed	The actual frequency exceeds the setpoint frequency	The frequency setpoint has been set during operation with serial interface e.g. RS232.	Provide for correct speed setting.
63	Internal Parameter Failure		There is a parameter mismatch occurred during the startup initialisation of the pump or while parameters are stored permanently. The pump was disconnected during storing of important system data.	Stop the pump, wait for stillstand, remove the supply voltage temporarily and start the system once more. When using any serial interface with any appropriate tool, initiate a permanent storage procedure manually. Set parameter 8, see example 4.
65	Cyclic Pump Communication Failed	Failure of the internal data communication of the converter	The continuous pump communication failed.	Check the pump connectors and cable. Stop the pump, wait for stillstand, remove the supply voltage temporarily and start the system once more.
66	Current Load of Magnetic Bearings Too High	Overload of at least one magnetic bearing output	In case of MAG600 in horizontal mounting position the orientation is suboptimal adjusted Defective pump cable Too high amplitude or force of mechanical shocks or vibration from the mounting rack.	Check the MAG600 for correct installation and adjustment referring to the manual Inspect the cable for damages, and of the correct version is used Reduce the vibration or shocks influence which might affect the pump

Error memory

Error code	Designation	Description	Possible cause	Remedy
67	Internal Overload		Internal drive overload	Stop the pump, wait for stillstand, remove the supply voltage temporarily and start the system once more.
71	First Time Initialisation Failure		First initialisation of pump parameters failed.	Stop the pump, wait for stillstand, remove the supply voltage temporarily and start the system once more.
73	Operating Cycles	The registered number of start and standby cycles exceeds the permissible alarm limit during system start. The system can no longer be started.	Intensive utilisation of the standby mode or a high number of starting processes. (By default setup this alarm is disabled and only a warning occurs)	Have the pump serviced.
74	Operating Hours	The number of operating hours of the pump has reached the preset alarm limit during system start. The system can no longer be started.	The number of operating hours of the system has reached the level necessary for servicing. (By default setup this alarm is disabled and only a warning occurs)	Have the pump serviced.
75	Pump Initialisation Failure	There is a parameter mismatch occurred during the startup initialisation of the pump.	Defective pump cable Failure in pump or converter	Check cables and connectors for damages. Reconnect or replace the pump cable Stop the pump, wait for stillstand, remove the supply voltage temporarily and start the system once more.
77	Number of Bearing Touch Downs Failure	The registered number of auxiliary bearing touches exceeds the permissible alarm limit.	Shock venting occurred Too high amplitude or force of mechanical shocks or vibration from the mounting rack.	Refer to the pump manual for correct venting of the pump. Reduce the vibration or shocks influence which might affect the pump
78	Bearing Touch Down Time Failure	The registered cumulated time of auxiliary bearing touches exceeds the permissible alarm limit.	Resonance effects between different pumps could increase the unbalance amplitude of a certain pump.	Setup the pumps to a slightly different rotation frequency or isolate the pumps from dynamic influence.

Error memory

Error code	Designation	Description	Possible cause	Remedy
79	Internal Communication Failure	Failure of the internal data communication of the converter	A failure of the converter internal data or parameter handling occurred, inconsistent data were found.	Stop the pump, wait for stillstand, remove the supply voltage temporarily and start the system once more.
80	Invalid Interface Module Combination	Configuration of the interface modul slot is inconsistent	<p>An invalid combination of interface module ist in use.</p> <p>The X1 module (24 Volt SPS) interface can only be used in the control slot.</p> <p>Only one active interface module like Profibus, DeviceNet, Ethernet/IP etc. can be used in one converter unit.</p>	<p>Place the X1 module (24 Volt SPS) interface in the control slot.</p> <p>Use only one active interface module like Profibus, DeviceNet, Ethernet/IP etc. in one converter unit.</p>
81	RS232/RS485 Communication Interruption Failure	Cyclic communication fail for a longer period than in P182 defined	<p>The RS232 / RS485 supervision mechanism detects missing communication.</p> <p>By default setup the supervision is disabled.</p>	Switch off either the communication supervision, or make sure the cyclic telegram exchange fits to the selected time out value of the watchdog.
82	Fieldbus Communication Interruption Failure	Cyclic communication fail for a longer period than in P925 defined	<p>The fieldbus (Profibus, DeviceNet etc.) supervision mechanism detects missing communication.</p> <p>By default setup the watchdog is set to about 2 seconds.</p>	<p>Switch off either the communication supervision, or make sure the cyclic telegram exchange fits to the selected time out value of the watchdog.</p> <p>For the default setup the telegram exchange should run faster than 1 telegram per second.</p>
90	Pump Speed Adjustment Failure	Frequency setpoint is above the maximum frequency in parameter 45	The selected pump speed is higher than the nominal speed.	Make sure only a permitted speed value is sent to the pump controller.

Error memory

Error code	Designation	Description	Possible cause	Remedy
91	Pump Cable Length Failure	Failure by detecting the cable length	The detected cable length is not supported	Check the installation for usage of correct cable.
92	External Pump Controller and Cable Length of „0 m“ Failure	External converter MAG.DRIVE S couldn't be driven without cable. The detected cable length „0m“ is a failure.	External pump controller with zero meter cable is not correct.	Stop the pump, wait for stillstand, remove the supply voltage temporarily and start the system once more.
93	Cable Parameter Faulty		Failure during cable detection	
201	Controller Hardware Failure	Failure in the controlling computer of the converter	External parasitic coupling or failure in the converter electronics.	Stop the pump, wait for stillstand, remove the supply voltage temporarily and start the system once more.
203	Failure during selftest	Failure in the parameter table allocation		
204	RAM array insufficient for scope functionality	Failure in the controlling computer of the converter		
206	Pump Parameter Failure	Failure during identification and initiation of the pump or the converter	There is inconsistent pump data	Stop the pump, wait for stillstand, remove the supply voltage temporarily and start the system once more.
209	Pump Initialisation Failure	Failure during identification and initiation of the pump or the converter	There is inconsistent pump data after a power on sequence	Wait for stillstand of the pump, remove the supply voltage temporarily and start the system once more.
213	Supply Voltage Too High	The drive circuitry was deactivated due to an overvoltage detected.	Usage of a wrong power supply unit. Misaligned output voltage	A wrong power supply unit is in use. The output voltage of the power supply should be adjusted.

Theoretically there are further error codes. Should these be displayed, please contact Leybold.

In the case of malfunctions also note the troubleshooting information provided in the Operating Instructions for the pump.

Warnings

7 Warnings

Possibly present current warning conditions can be read through the parameters 227, 228 and 230.

If a warning condition is fulfilled, then the corresponding bit is set. If several warning conditions are fulfilled, then their weights are added. When converting this decimal value to a binary value, then the individual bits can be assigned to the warning messages.

Example: imbalance affecting the X-axis, imbalance affecting the Y-axis

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3072 →	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0

P227, Weight Bit	Designation	Possible cause	Remedy
0 1	Pump Motor Temperature too high	The cooling water flow is too low or the cooling water temperature is too high.	Cooling system needs to be improved
1 2	Converter Housing Temperature too high	The converter is overloaded due to too high gas load.	The gas load needs to be reduced.
2 4	Bearing Temperature too high	Frequent acceleration and deceleration of the pump.	Allow converter to cool down between the cycles.
3, 4	–		
6 64	Overspeed	The actual frequency exceeds the set point frequency. The frequency setpoint has been set during operation with serial interface e.g. RS232.	Let the pump slow down or provide for correct speed setting.
7-9	–		
10 1024	MAG Unbalance at the Upper Bearing	The radial magnetic bearing near the high vacuum flange takes a too large orbit. Possible causes: Deposition of material from the pumped media at the turbo rotor Due to aggressive media, abrasion at the turbo rotor	Check the pumped media for suitability with this pump design
11 2048	MAG Unbalance at the Lower Bearing	The radial magnetic bearing near the foreline flange takes a too large orbit. Possible causes: Deposition of material from the pumped media at the turbo rotor Due to aggressive media, abrasion at the turbo rotor	Check the pumped media for suitability with this pump design
12 4096	MAG Oscillation at the Axial Bearing	The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
13-15	–		

P228, Bit	Weight	Designation	Possible cause	Remedy
0-10		–		
11	2048	Magnetic Bearing has not lifted	<p>Due to a previous failure the magnetic bearing system is blocked.</p> <p>There was a fatal error before, which is not resettable.</p>	<p>When the pump is stillstanding, disconnect the pump from the power supply and reconnect it.</p> <p>If this behaviour is repeated by the pump, then contact the Leybold service department</p>
12	4096	MAG Bearing Overload (Level 1)	<p>The magnetic bearing current no.0,1 or 5 is too high.</p> <p>In case of MAG W 600/700 the orientation in horizontal use might be bad.</p> <p>The environmental vibration might be too heavy.</p>	<p>Optimize the orientation as shown in the MAG W 600/700 manual.</p> <p>Reduce vibration which might affect the pump.</p>
13	8192	Converter Power Stage Temperature too high	<p>The cooling water flow is too low or the cooling water temperature is too high.</p> <p>The Converter is overloaded due to too high gas load.</p> <p>Frequent acceleration and deceleration of the pump.</p>	<p>Cooling system needs to be improved</p> <p>The gas load needs to be reduced.</p> <p>Allow converter to cool down between the cycles.</p>
14, 15		–		

P230, Bit	Weight	Designation	Possible cause	Remedy
0-3		–		
4	16	MAG Bearing Overload (Level 2)	<p>The magnetic bearing current no.2, 3 or 6 is too high.</p> <p>In case of MAG W 600/700 the orientation in horizontal use might be bad.</p> <p>The environmental vibration might be too heavy.</p>	<p>Optimize the orientation as shown in the MAG W 600/700 manual</p> <p>Reduce vibration which might affect the pump.</p>
5	32	Max. Number of Pump Runup Cycles are reached		Arrange a service date at Leybold for this pump.
6	64	Max. Number of Pump Operation Hours are reached		Arrange a service date at Leybold for this pump.

Warnings

P230, Bit	Weight	Designation	Possible cause	Remedy
8	256	High load	The motor current during normal operation is too high. Possible causes: Backing pressure too high during operation. Too high amount of gas flow during operation	Reduce backing pressure or process gas flow. Check the chamber pressure during operation.
9	512	MAG Bearing Overload Z-Axis	The magnetic bearing current no.4 is too high. The environmental vibration might be too heavy	Reduce vibration which might affect the pump.
10		–		
11	2048	Overload	The rotational speed dropped below normal operation frequency. Possible causes: Backing pressure too high during operation. Too high amount of gas flow during operation Parameter „Normal Operation“ is not set correctly.	Reduce backing pressure or process gas flow. Check the chamber pressure during operation. Check the „normal operation“ level adjustment.
12	4096	MAG Radial Bearing Displacement	At least one magnetic bearing is displaced in radial direction. In case of MAG W 600/700 the orientation in horizontal use might be bad. The environmental vibration might be too heavy.	Optimize the orientation as shown in the MAG W 600/700 manual Reduce vibration which might affect the pump.
13		–		
14	16384	Supply Voltage too high or too low	The voltage from the power supply unit is too high or too low. Usage of a wrong power supply unit Misaligned output voltage Too high load Voltage drop across the supply cable	Use correct power supply. Adjust the output voltage of the power supply. Replace the power supply by a more powerful one. Increase the copper area of the cable
15	32768	Motor Start Locked	Due to a previous failure the start is locked. There was a fatal error before, which is not resettable.	„When the pump is stillstanding, disconnect the pump from the power supply and reconnect it. If this behaviour is repeated by the pump, then contact the Leybold service department.

P232, Bit	Weight	Designation	Possible cause	Remedy
0	1	MAG Bearing Overload 0	The magnetic bearing current no.0, 1, 2 or 3 is too high.	
1	2	MAG Bearing Overload 1	In case of MAG W 600/700 the orientation in horizontal use might be bad.	Optimize the orientation as shown in the MAG W 600/700 manual
2	4	MAG Bearing Overload 2	The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
3	8	MAG Bearing Overload 3		
4	16	MAG Bearing Overload 4 Z-Axis	The magnetic bearing current no.4 is too high. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
5	32	MAG Bearing Overload 5	The magnetic bearing current no.5 or 6 is too high.	
6	64	MAG Bearing Overload 6	In case of MAG W 600/700 the orientation in horizontal use might be bad. The environmental vibration might be too heavy.	Optimize the orientation as shown in the MAG W 600/700 manual Reduce vibration which might affect the pump.
7	128	reserved		
8	256	MAG Upper Radial Bearing Displacement X1	The magnetic bearing near the high vacuum flange is displaced in radial direction	
9	512	MAG Upper Radial Bearing Displacement Y1	In case of MAG W 600/700 the orientation in horizontal use might be bad. The environmental vibration might be too heavy.	Optimize the orientation as shown in the MAG W 600/700 manual Reduce vibration which might affect the pump.
10	1024	MAG Lower Radial Bearing Displacement X2	The magnetic bearing near the foreline flange is displaced in the radial direction	
11	2048	MAG Lower Radial Bearing Displacement Y2	In case of MAG W 600/700 the orientation in horizontal use might be bad. The environmental vibration might be too heavy.	Optimize the orientation as shown in the MAG W 600/700 manual Reduce vibration which might affect the pump.
12	4096	MAG Axial Bearing Displacement Z	The magnetic bearing is displaced in Z axis direction. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
13	8192	High Number of Auxiliary Bearing Impacts	The environmental vibration might be too heavy or too many shocks or impacts interfered the pump	Reduce vibration which might affect the pump. Avoid shocks or impacts at the pump.
14	16384	High Amount of Cumulated Bearing Touch Down Time	Too many full or partial auxiliary bearing run downs affected the pump	Avoid stopping the pump by switching off the mains power.
15	32768	High No. of Touch Down Bearing Run Downs		Avoid disconnecting the pump cable, when the pump is still running

Profibus strings

Annex: Profibus strings

Detailed in the following table is the complete structure of the Profibus string as described in detail on the preceding pages.

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		0		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							
-	Reserved					7	3		7					Reserved	-
					6			6							
					5			5							
					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		15							
					6			14							
					5			13							
					4			12							
					3			11							
					2			10							
					1			9							
					0			8							
				7	3		7								
				6			6								
				5			5								
				4			4								
				3			3								
				2			2								
				1			1								
				0			0								
PZD1	Control word	-				7	8		15				Remote active	Status word	PZD1
		-				6			14				-		
		-				5			13				Warning overload		
		-				4			12				Failure counter		
		-				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		
		-				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							

Profibus strings

Abr.		Description	Value				Byte	Word	Value				Description		Abr.
			Dez	Hex	Bin	Bit			Bit	Bin	Hex	Dez			
①	PZD1	Control word	-	4	0	7	8	4	15	1	8E	142	Remote active	③	PZD1
			-	4	0	6			14	0			-		
			-		0	5			13	0			Warning overload		
			-		0	4			12	0			Failure counter		
			-		0	3	9	4	11	1	5	5	Pump is rotating		
			Activate remote		1	2			10	1			Normal operation		
			-		0	1			9	1			Parameter accepted		
			Standby speed		0	0			8	0			-		
			Error reset		0	7	5	5	7	0	5	5	Warning temperature		
			Enable setpoint		0	6			6	0			Switch-on lock		
			-		0	5			5	0			Deceleration		
			-		0	4			4	0			Acceleration		
			-		0	3	11	5	3	0	20	20	Error active		
			-		0	2			2	1			Operation enabled		
			-		0	1			1	0			-		
			Start/Stop		1	0			0	1			Ready to start		
②	PZD2	Setpoint rotor speed	-	0	0	7	10	5	15	0	800	800		②	PZD2
			-		0	6			14	0					
			-		0	5			13	0					
			-		0	4			12	0					
			-		0	3	11	5	11	0	20	20			
			-		0	2			10	0					
			-		0	1			9	1					
			-		0	0			8	1					
			-		0	7	11	5	7	0	20	20			
			-		0	6			6	0					
			-		0	5			5	1					
			-		0	4			4	0					
			-		0	3	11	5	3	0	20	20			
			-		0	2			2	0					
			-		0	1			1	0					
			-		0	0			0	0					

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 800 Hz ② during normal operation ③.

Abr.		Description	Value				Byte	Word	Value				Description		Abr.
			Dez	Hex	Bin	Bit			Bit	Bin	Hex	Dez			
①	PZD1	Control word	-	4	0	7	8	4	15	1	8E	142	Remote active	④	PZD1
			-		0	6			14	0			-		
			-		0	5			13	0			Warning overload		
			-		0	4			12	0			Failure counter		
			-		0	3	9	4	11	1	5	5	Pump is rotating		
			Activate remote		1	2			10	1			Normal operation		
			-		0	1			9	1			Parameter accepted		
			Standby speed		0	0			8	0			-		
			Error reset		0	7	5	5	7	0	5	5	Warning temperature		
			Enable setpoint		1	6			6	0			Switch-on lock		
			-		0	5			5	0			Deceleration		
			-		0	4			4	0			Acceleration		
			-		0	3	11	5	3	0	BD	BD	Error active		
			-		0	2			2	1			Operation enabled		
			-		0	1			1	0			-		
			Start/Stop		1	0			0	1			Ready to start		
②	PZD2	Setpoint rotor speed	-	700	0	7	10	5	15	0	700	700		③	PZD2
			-		0	6			14	0					
			-		0	5			13	0					
			-		0	4			12	0					
			-		0	3	11	5	11	0	2	2			
			-		0	2			10	0					
			-		1	1			9	1					
			-		0	0			8	0					
			-		1	7	11	5	7	1	BD	BD			
			-		0	6			6	0					
			-		1	5			5	1					
			-		1	4			4	1					
			-		1	3	11	5	3	1					
			-		1	2			2	1					
			-		0	1			1	0					
			-		0	0			0	0					

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.

Profibus strings

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	Dez	Value Hex	Bin	Bit	Byte	Word	Bit	Bin	Value Hex	Dez	Description		Abr.		
②	PKE	Query designator	1	10	0 7	0	0	0	15	0	10	1		Reply designator	④		
		Res.	0	0 6	14				0	Res.		0					
		Parameter number	150	96	0 5				13	0		96				12	1
					0 4				11	0						150	
					0 3				10	0							
					0 2				9	0							
					0 1				8	0							
					0 0				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 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															
PWE	Parameter value		0	0	0 7	4	2	0	15	0	250		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							
PWE	Parameter value		0	0	0 7	6	3	0	15	0	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	1							
					0 6				6	1							
					0 5				5	1							
					0 4				4	1							
					0 3				3	1							
					0 2				2	0							
					0 1				1	1							
					0 0				0	0							

Profibus strings

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

Example 4:

Write parameter 150

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

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.

Profibus strings

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 message 39, general magnetic bearing fault ⑥.

Abr.		Description	Value				Word	Value				Description	Abr.
			Dez	Hex	Bin	Bit		Bit	Bin	Hex	Dez		
③	Query designator							15	0				⑤
	Res.		0	60	0 7	1	14	0	1				
②	PKE	Parameter number	171	AB	0 4	6	13	0	40	171	4		PKE
					0 3	5	12	0					
					0 2	4	11	0					
					0 1	3	10	0					
					0 0	2	9	0					
					1 7	1	8	0					
					0 6	0	7	1					
					1 5	0	6	1					
					0 4	0	5	1					
					1 3	0	4	0					
					0 2	0	3	1					
					1 1	0	2	0					
					0 0	0	1	1					
					1 0	0	0	1					
①	IND	Parameter Index	1	1	0 7	2	15	0	1	1			④
	Res.		0	0	0 6	1	14	0	0				
	Reserved				0 5	0	13	0				Reserved	.
					0 4	0	12	0					
					0 3	0	11	0					
					0 2	0	10	0					
					0 1	0	9	0					
					0 0	0	8	1					
					0 7	0	7	0					
					0 6	0	6	0					
					0 5	0	5	0					
					0 4	0	4	0					
					0 3	0	3	0					
					0 2	0	2	0					
					0 1	0	1	0					
					0 0	0	0	0					
	PWE	Parameter value	0	0	0 7	4	15	0	0	39		Parameter value	PWE
					0 6	0	14	0					
					0 5	0	13	0					
					0 4	0	12	0					
					0 3	0	11	0					
					0 2	0	10	0					
					0 1	0	9	0					
					0 0	0	8	0					
					0 7	0	7	0					
					0 6	0	6	0					
					0 5	0	5	0					
					0 4	0	4	0					
					0 3	0	3	0					
					0 2	0	2	0					
0 1	0	1	0										
0 0	0	0	0										
			0	0	0 7	6	15	0	0				
					0 6	0	14	0					
					0 5	0	13	0					
					0 4	0	12	0					
					0 3	0	11	0					
					0 2	0	10	0					
					0 1	0	9	0					
					0 0	0	8	0					
					0 7	0	7	0					
					0 6	0	6	0					
					0 5	0	5	1					
					0 4	0	4	0					
					0 3	0	3	0					
					0 2	0	2	1					
0 1	0	1	1										
0 0	0	0	1										
			0	0	0 7	7	15	0	0				
					0 6	0	14	0					
					0 5	0	13	0					
					0 4	0	12	0					
					0 3	0	11	0					
					0 2	0	10	0					
					0 1	0	9	0					
					0 0	0	8	0					
					0 7	0	7	0					
					0 6	0	6	0					
					0 5	0	5	1					
					0 4	0	4	0					
					0 3	0	3	0					
					0 2	0	2	1					
0 1	0	1	1										
0 0	0	0	1										

Profibus strings

[illegible]

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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