Profinet Interface for MAG integra

Operating Instructions 300881108_002_C0

Contents

Original installation and 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 Leybold **frequency converters MAG.DRIVE iM with Profinet 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.

"Trained personnel" for the operation of this pump are

- skilled workers with knowledge in the fields of mechanics, electrical engineering and vacuum technology, and

- personnel specially trained for the operation of vacuum pumps.

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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.

Description

1   Description

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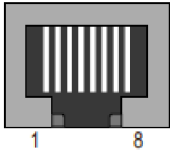
In a Profinet environment, a difference is made between master and slave units. Here the master units control all traffic. They transmit data to the related slaves and request data from these. It is possible to run one or several masters in a system.

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

1.2   Ethernet Interface (RJ45 connector)

The Profinet option shows two RJ45 connectors each serving as input or output. This facilitates connecting several devices in series. Only use industrial approved Profinet cables to ensure for stable communications.

The Ethernet interface operate at 100 Mbit, full duplex, as required by PROFINET specifications.

Pin no.	Signal	Description	Connector
1	TD+		
2	TD-		
3	RD+		
6	RD-		
4, 5, 7, 8		connected to chassis ground over serial RC circuit	
Housing		Cable shield	

Description

1.3   Profinet Status-LEDs

LED	Item
1	Network status
2	Module status
3	Link / Activity (Port 1)
4	Link / Activity (Port 2)
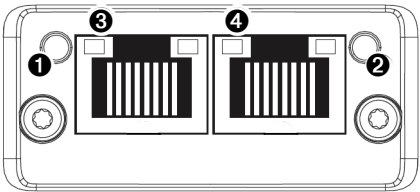
Test sequences are performed on the Network and Module status LEDs during start-up.

Description

Network Status LED

LED State	Description	Comments
Off	offline	- no power - no connection with IO controller
Green	online (RUN)	- connection with IO controller established - IO controller in RUN state
Green (1 flash)	online (STOP)	- connection with IO controller established - IO controller in STOP state or IO data bad - IRT synchronization not finished
Green (blinking)	blink	- used by engineering tools to identify the node on the network
Red	fatal event	- major internal error (this indication is combined with a red Module Status LED)
Red (1 flash)	station name error	- station name not set
Red (2 flashes)	IP address error	- IP address not set
Red (3 flashes)	configuration error	- expected ID differs from real identification

Module Status LED

LED State	Description	Comments
Off	not initialized	- no power - module in SETUP or NW_INIT state
Green	normal operation	- module has shifted from the NW_INIT state
Green (1 flash)	diagnostics event	- diagnostic event(s) present
Red	exception error	- device in EXCEPTION state
	fatal event	- major internal error (this indication is combined with a red Network Status LED)
Alternating Red / Green	Firmware update	- **Do Not** power off the module! Turning off the module during this phase could cause permanent damage.

Link / Activity LED

LED State	Description	Comments
Off	no link	- no link, no communication present
Green	link	- Ethernet link established, no communication present
Green (flickering)	activity	- Ethernet link established, communication present

2   GSDML file

The master configuration software receives all necessary information about a Profinet device via its corresponding GSDML file.

Visit www.leybold.com/ ➔ Downloads ➔ Download Software, to download the latest GSDML file.

Documented in the GSDML (GSD Markup Language) file are all relevant information of the corresponding device used. The file format has been defined in the standards so that proprietary project tools from different manufacturers can be used.

Configuration

3 Configuration via the Siemens TIA Portal

As an example, the system's configuration is described by using the TIA Portal tools. Configurations using other tools should be similar.

3.1 Installing the GSDML file

First of all, the GSDML file must be loaded into the configuration software.

From the **Options** menu select **Manage general station description files (GSD)**.
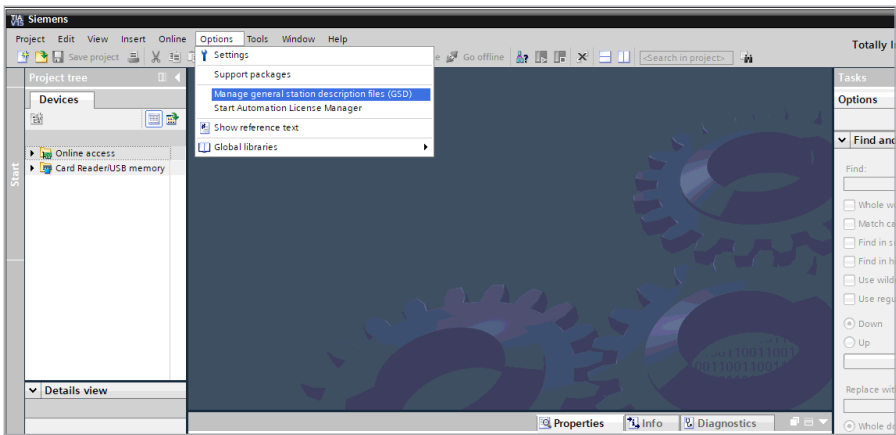
Then select the GSDML file's source directory, and load the file.
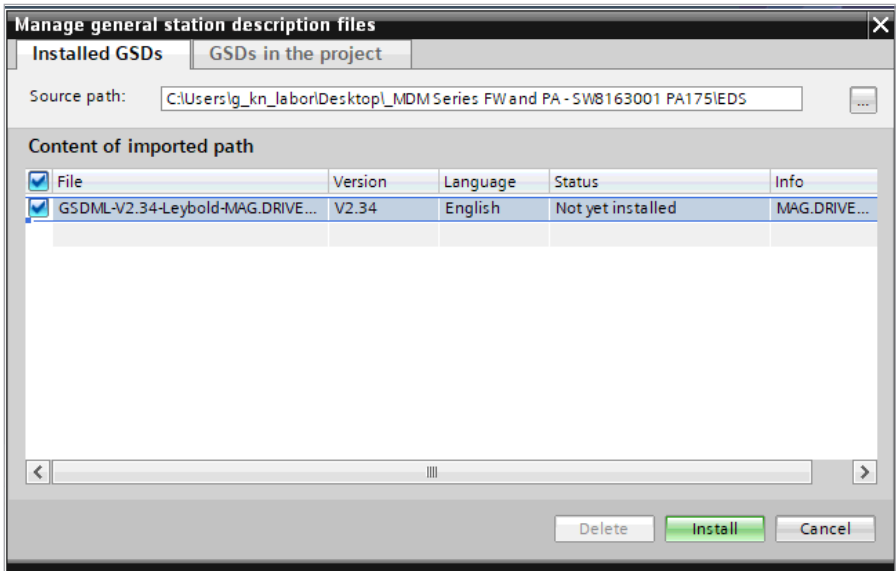
The device will then be listed and available in the hardware catalogue.

3.2   Adding the Device

From the **Hardware catalogue** select the **MAG.DRIVE-iM** entry, to add the device to the system.
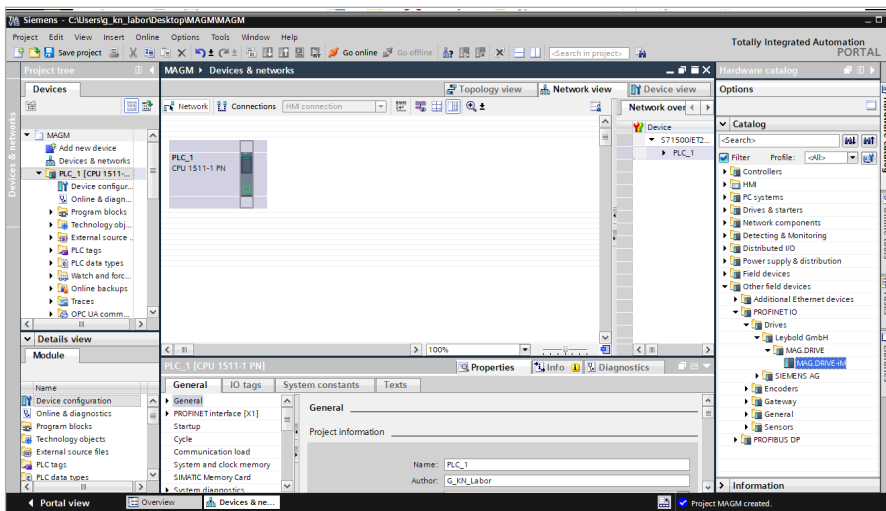
Then connect the device to the control.
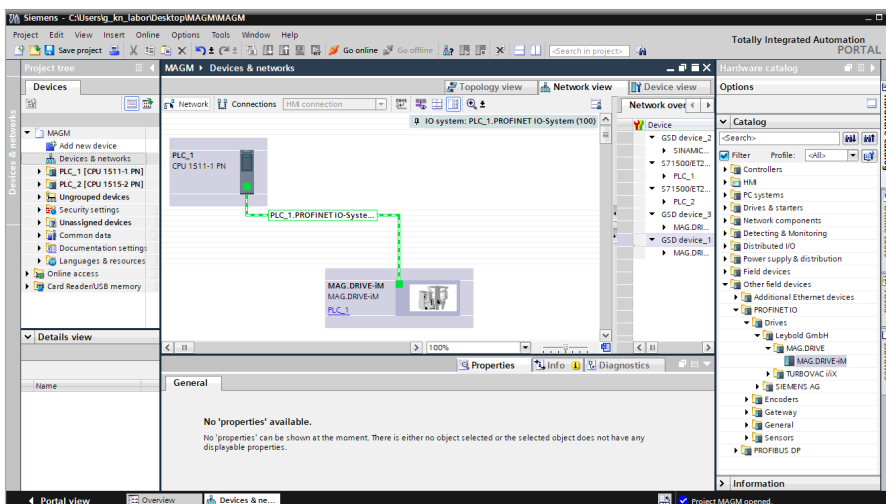
Configuration

3.3 Creating the Slave Configuration

The configuration of the modules is done automatically.

There is only one permissible configuration:

3.3.1 PPO1

Byte no.	Abbreviation	Description	Input	Output
0-1	PKE	Parameter number and type of access	PKE_In	PKE_Out
2-3	IND	Parameter index	IND_In	IND_Out
4-7	PWE	Parameter value	PWE_HW_In + PWE_LW_In	PWE_HW_Out + PWE_LW_Out
8-9	PZD1: ZSW STW	Status and control bits	PZD1_In	PZD1_Out
10-11	PZD2: HIW HSW	Current rotor frequency	PZD2_In	PZD2_Out
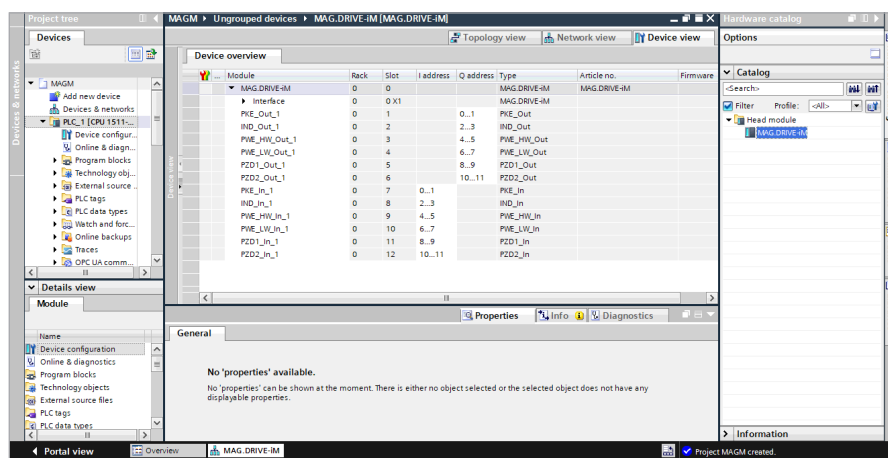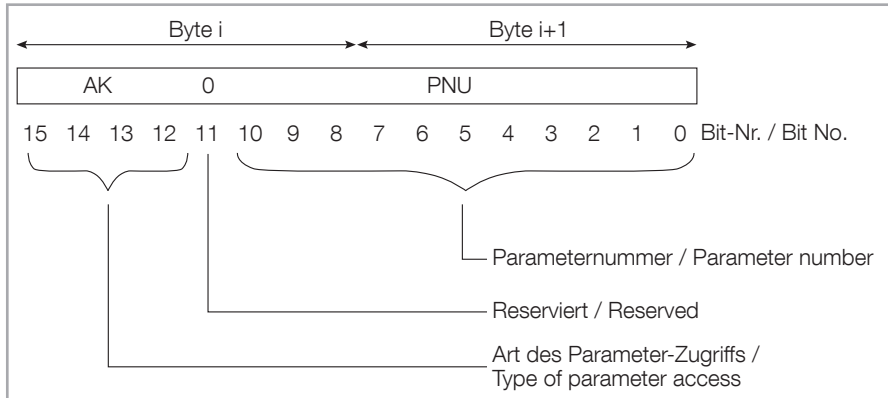
Fig. 4.1 Structure of the parameter section

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 no.					Bit no.				
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.

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

(is sent to the pump for each access)

PZD1

Bit	Command	Remarks
0	*System Start/Stop	Value = 1: pump drive start Value = 0: pump drive stop (start impossible if Bit 7 = 1; means Reset active)
1	Request to run shaking process	Value = 0 Do not shake Value = 1 Shake A detected change from 0 to 1 initiates the request. This function has been implemented only for some MAG models. Before using this function please consult Leybold first.
2 – 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, 11, 12)	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 – 15	No function	

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

** The purge gas supply must be switched on for venting to function.

PKE, IND, Bits

(is sent with with each response from the frequency converter)

PZD1

Bit	Interpretation	Description
0	Ready to run	Bit 0 will be set after initialization of the system, if there is no failure pending.
1	Shaking status	Value = 0; currently no shaking is in progress. Value = 1; currently shaking is in progress. The duration of an active shaking process amounts to approximately 2 seconds. After shaking has been completed, the bit is reset to 0 again. In order to allow more time for a possible evaluation, the bit is reset after approximately 5 seconds irrespectively of the real shaking duration. This function has been implemented only for some MAG models.
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 > 3Hz.
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.
14	Collective warning	Bit 14 is set, if a warning is existent.
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.

Parameter List

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.

r = readable, w = writeable

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
1	Converter type	100	300	211		r	u16	211=MAG.DRIVE iM;
2	Software version	8010000	2147483647	8015500		r	i32	xx.yy: version, zz: correction index
3	Actual frequency	0	650	0	Hz	r	u16	Actual rotor frequency
4	Actual intermediate circuit voltage	0	500		0.1 V	r	u16	Actual intermediate circuit voltage of the converter.
5	Actual current	0	1000	0	0.1 A	r	u16	Actual motor current
6	Actual electrical power	0	10000	0	0.1 W	r	u16	Actual drive input power.
7	Actual motor temperature	0	150	0	°C	r	u16	Actual value of the motor temperature.
8	Save data command	-1	100000	0		r/w	i32	A write command with any value saves temporary data into nonvolatile memory.
11	Actual converter temperature	0	100	0	°C	r	u16	Actual heat sink temperature of the converter.
16	Motor temperature warning threshold	5	250	80	°C	r	u16	Exceeding the motor temperature warning threshold results in a warning.
17	Nominal motor current	0	200	18	0.1 A	r	u16	Maximum permissible motor current
18	Maximum frequency	0	650		Hz	r	u16	Highest permissible frequency
19	Minimum frequency	0	650	230	Hz	r	u16	Lowest permissible frequency
20	Critical frequency	0	650	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 acceeds a certain time.
23	Pump type	200	400	200		r	u16	Code no. of the connected turbo pump: 330=MAG 1300 360=MAG 1600 390=MAG 2000
24	Setpoint frequency	0	650		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.

Parameter List

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
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.
44	Pump operating hours	0	2147483647	0	0.01 h	r	i32	Counter of total operating hours of the pump.
45	Maximum type frequency	0	650		Hz	r	i16	Maximum type depending pump frequency. Highest usable frequency of this pump type.
50	Pump catalog no.	0	2147483647	0		r	i32	Last 9 digits of the pump's catalog number.
52	Pump serial no.	0	2147483647	0		r	i32	Last 9 digits of the pump's serial number.
54	Date of manufacturing	0	2147483647	0		r	i32	Manufacturing date of the pump [DDMMYY].
56	Date of last service	0	2147483647	0		r	i32	Last service date of the pump [DDMMYY].
60	Last service operating hours	0	2147483647	0	0.01 h	r	i32	Number of operating hours at the last service event.
62	Date of last repair	0	2147483647	0		r	i32	Last repair date of the pump [DDMMYY].
66	Last repair operation hours	0	2147483647	0	0.01 h	r	i32	Number of operating hours at the last repair event.
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	2147483647	0	0.01 s	r	i32	Actual total amount of time during recognized bearing touch downs
109	Max. no. of touchdowns	0	65535	1000		r	u16	Maximum number of touch downs until warning or error indication.
110	Max. amount of touch down time	0	2147483647	360000	0.01 s	r	i32	Max. amount of touch down time until warning or error indication
125	Bearing temperature	0	150	0	°C	r	u16	Actual value of the bearing temperature
126	Bearing temperature warning threshold	5	250	80	°C	r	u16	Warning level of the bearing temperature
131	Bearing temperature error threshold	10	250	85	°C	r	u16	Exceeding the bearing temperature error threshold causes the pump to be switched off.
133	Motor temperature error threshold	10	250	90	°C	r	u16	Exceeding the motor temperature error threshold causes the pump to be switched off.

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
143 Actual motor voltage	-5000	5000	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	650	250	Hz	r/w	u16	Stand-by operation frequency setpoint
154 Pump op. hours warning threshold	0	2147483647	9000000	0.01 h	r	i32	Pump operating hours warning level
155 Pump op. hours error threshold	0	2147483647	10000000	0.01 h	r	i32	Pump operating hours alarm level
157 Pump op. hours blocked-start threshold	0	2147483647	9500000	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 corresponding section Error Memory for the error codes.
174 Error rotor frequency	0	650	0	Hz	r	u16	Actual speed, when error occured. Access analogously as for parameter 171.
176 Error operating hours	0	2147483647	0	0.01 h	r	i32	Operating hours, when error occured. Access analogously as for parameter 171.
181 Fieldbus control watch-dog	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 USS 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.
183 Max. passing time	0	1200	360	s	r	u16	Maximum permissible time amount from start to minimum speed.

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
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 corresponding Section Warnings for meaning. 0=Pump Motor Temperature Too high 1=Converter Housing Temperature Too High 2=Bearing Temperature Too High 3=n/a 4=n/a 5=n/a 6=Over speed 7=n/a 8=n/a 9=n/a 10=MAG Unbalance at the Upper Bearing 11=MAG Unbalance at the Lower Bearing 12=MAG Oscillation at the Axial Bearing 13=n/a 14=n/a 15=n/a
228 Warning bits 2	0	65535	0		r	u16	Active warnings descibed bit per bit. See corresponding Section Warnings for meaning. 0=n/a 1=n/a 2=n/a 3=n/a 4=n/a 5=n/a 6=n/a 7=n/a 8=n/a 9=n/a 10=n/a 11=Magnetic Bearing has not Llifted 12=MAG Bearing Overload (Level 1) 13=Converter Power Stage Temperature Too High 14=n/a 15=n/a

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
230 Warning bits 3	0	65535	0		r	u16	Active warnings descibed bit per bit. See corresponding Section Warnings for meaning. 0=n/a 1=n/a 2=n/a 3=n/a 4=MAG Bearing Overload (Level 2) 5=Max. Number of Pump Run-up Cycles are reached 6=Max. Number of Pump Operation Hours are reached 7=n/a 8=High load 9=MAG Bearing Overload Z-Axis 10=n/a 11=Overload 12=MAG Radial Bearing Displacement 13=n/a 14=Supply Voltage too high or too low 15=Motor Start Locked
232 Warning bits 4	0	65535	0		r	u16	Detailed MAG bearing conditions 0=MAG Bearing Overload 0 1=MAG Bearing Overload 1 2=MAG Bearing Overload 2 3=MAG Bearing Overload 3 4=MAG Bearing Overload 4 Z-Axis 5=MAG Bearing Overload 5 6=MAG Bearing Overload 6 7=n/a 8=MAG Upper Radial Bearing Displacement X1 9=MAG Upper Radial Bearing Displacement Y1 10=MAG Lower Radial Bearing Displacement X2 11=MAG Lower Bearing Radial Displacement Y2 12=MAG Axial Bearing Displacement Z 13=High Number of Auxiliary Bearing Impacts 14=High Amount of Cumulated Bearing touch Down Time 15=High No. of Touch Down Bearing Run Downs

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
233 Warning bits 5	0	65535	0		r	u16	Active warnings described bit per bit. See corresponding Section Warnings for meaning. 0=Warning Flange Temperature 1=Warning Magnetic Bearing Temperature 2=Shake Warning 3=n/a 4=n/a 5=n/a 6=n/a 7=n/a 8=n/a 9=n/a 10=n/a 11=n/a 12=n/a 13=n/a 14=n/a 15=n/a
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	u16	Address setup of passive serial interfaces as RS232, RS485 etc. in the Control Slot
263 No. of touch downs at generator op.	0	65535	0		r	u16	No. of touchdowns at generator operation
264 Max. no. of touch downs at generator op.	0	65535	0		r	u16	Max. no. of touchdowns at generator operation
265 Frequency lower limit at generator op.	0	650	200	Hz	r	u16	Frequency lower limit at generator operation
266 No. of touch downs at full shut down PK	0	65535	0		r	u16	No. of touchdowns at full shut down (PK)
267 No. of touch downs at full shut down c.	0	65535	0		r	u16	No. of touchdowns at full shut down converter
268 Max. no. of touch downs at full shut d.	0	65535	0		r	u16	Max. no. of touchdowns at full shut down

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
303 Actual operating status	0	65535	0		r	i32	Active status described bit per bit. 0=Normal operation 1=Ready for switch on 2=Speed is increasing 3=Speed is dropping 4=Generator operation 5=Stand-by activated 6=Stand-by reached 7=Motor frequency 0 8=Setpoint frequency reached 9=Starttimer runs 10=Warning overtemperature 11=Overload 12=Highload 13=Normal operation 14=Minimum frequency reached 15=External failure
312 Catalog no. of converter	0	255	0		r	u16	Catalogue number of the converter. One ASCII char per index.
315 Serial no. of converter	0	255	0		r	u16	Serial no. of converter
343 Acceleration current	0	200	18	0.1 A	r	u16	Motor current setpoint during acceleration
346 START/STOP buttons interlock	0	1	0		r/w	u16	0=START/STOP buttons unlocked 1=START/STOP buttons interlocked
350 Catalog no. of pump	0	127	0		r	u16	Catalogue number of the pump. One ASCII char per index.
354 Dataset of pump	0	127	0		r	u16	Dataset revision no. of the Pump Code memory
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	0	l/s	r	u16	Pumping speed of the pump
399 Pump name	0	65407	0		r	u16	Pump description; ASCII sequence
764 Current mains side	0	65535		0.001 A	r	u16	Current mains side
767 Version communication profile	0	999		0,01	r	u16	Version communication profile
772 Add. index for data version PK Data	0	99	0		r	u16	Additional index for data version PK Data Set
774 DC voltage on valve outputs	0	65535		0.1 V	r	u16	DC Voltage on Valve Outputs
775 Error code memory safety systen	0	31			r	u16	Error Code memory Safety Controller SR 1
776 Error code memory safety systen	0	31			r	u16	Error Code memory Safety Controller SR 2
777 Error code memory safety systen	0	65535			r	u16	Error Code memory Safety Controller Operation hours

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
778 Installed motor type	0	1			r	u16	0=Beta Stand 1=Series Stand
779 Maximum braking current	-500	0	85	0.01 A	r	i16	Maximum motor current during braking
780 Alarm temperature power stage	0	65535	85	°C	r	u16	Alarm temperature power stage bearing board (heat sink bearing board)
781 Warning temperature power stage	0	65535	80	°C	r	u16	Warning temperature power stage bearing board (heat sink bearing board)
782 Maximum overload time	0	65535	420	s	r	u16	Maximum allowed time in overload condition
783 Maximum highload time	0	65535	420	s	r	u16	Maximum allowed time in highload condition
786 Alarm temperature converter (heat sink)	5	100		°C	r	u16	Alarm level heat sink temperature converter
787 Alarm temperature converter (air temp.)	5	100		°C	r	u16	Alarm temperature converter (air temperature inside)
796 Revision control board	0	256			r	u16	Revision control board 1054.023.x
797 Variant control board	0	256			r	u16	Variant control board 1054.023.x
798 Revision transfer board	0	256			r	u16	Revision transfer board 1054.083.x
799 Revision power board	0	256			r	u16	Revision power board 1054.013.x
801 Magnetic bearing current	-32768	32767	0	0.01 A	r	i16	Actual magnetic bearing current 1a, 2a, 1b, 2b, Z
804 Supply voltage	0	65535	0	0.1 V	r	u16	Actual supply voltage at the AC connector.
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

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
819 Mag. bearing current Z	-32768	32767	0	mA	r	i16	Actual magnetic bearing current of Z axle
824 Preselect output X200	0	199	27		r/w	u16	Selects the behavior of the 24 volt PK auxiliary X200 0=OFF: always deactive 1=ERR: failure 2=/ERR: no failure 3=WARN: warning 4=/WARN: no warning 5=NRF: at speed 6=/NRF: not at speed 7=ROT: motor rotates 8=/ROT: motor does not rotate 9=REF: reference speed reached 10=WUV: warning supply voltage low 11=WOV: warning supply voltage high 12=WOTM: warning motor temperature high 13=WOTI: warning converter temp. power stage 14=WOTD: warning converter temp. air inside 15=WOTB: warning pump bearing temperature 16=WLS: warning pump speed too high 17=WIT: warning pump motor overload 18=BUS: serial interface controlled 19=ON: always active 20=DE: RS485 transmit/receive control 21=VALVE: vent valve option 22=Purge Valve OFF 23=Purge Valve ON 24=Venting Valve OFF 25=Venting Valve ON 26=Cooling Valve OFF 27=Cooling Valve ON

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
825 Preselect output X201	0	199	24		r/w	u16	Selects the behavior of the 24 volt PK auxiliary X201 0=OFF: always deactive 1=ERR: failure 2=/ERR: no failure 3=WARN: warning 4=/WARN: no warning 5=NRF: at speed 6=/NRF: not at speed 7=ROT: motor rotates 8=/ROT: motor does not rotate 9=REF: reference speed reached 10=WUV: warning supply voltage low 11=WOV: warning supply voltage high 12=WOTM: warning motor temperature high 13=WOTI: warning converter temp. power stage 14=WOTD: warning converter temp. air inside 15=WOTB: warning pump bearing temperature 16=WLS: warning pump speed too high 17=WIT: warning pump motor overload 18=BUS: serial interface controlled 19=ON: always active 20=DE: RS485 transmit/receive control 21=VALVE: vent valve option 22=Purge Valve OFF 23=Purge Valve ON 24=Venting Valve OFF 25=Venting Valve ON 26=Cooling Valve OFF 27=Cooling Valve ON

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
826 Preselect output X202	0	199	23		r/w	u16	Selects the behavior of the 24 volt PK auxiliary X202 0=OFF: always deactive 1=ERR: failure 2=/ERR: no failure 3=WARN: warning 4=/WARN: no warning 5=NRF: at speed 6=/NRF: not at speed 7=ROT: motor rotates 8=/ROT: motor does not rotate 9=REF: reference speed reached 10=WUV: warning supply voltage low 11=WOV: warning supply voltage high 12=WOTM: warning motor temperature high 13=WOTI: warning converter temp. power stage 14=WOTD: warning converter temp. air inside 15=WOTB: warning pump bearing temperature 16=WLS: warning pump speed too high 17=WIT: warning pump motor overload 18=BUS: serial interface controlled 19=ON: always active 20=DE: RS485 transmit/receive control 21=VALVE: vent valve option 22=Purge Valve OFF 23=Purge Valve ON 24=Venting Valve OFF 25=Venting Valve ON 26=Cooling Valve OFF 27=Cooling Valve ON
827 Master select output X200	0	2	0		r/w	u16	Temporary master select 24V PK output X200 0=Selection according parameter 824 1=ON 2=OFF
828 Master select output X201	0	2	0		r/w	u16	Temporary Master Select 24V PK Output X201 0=Selection according parameter P825 1=ON 2=OFF

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
829 Master select output X202	0	2	0		r/w	u16	Temporary Master Select 24V PK Output X202 0=Selection according parameter P826 1=ON 2=OFF
833 Temperature power stage bearing board	0	150	0	°C	r	u16	Actual temperature power stage bearing board
834 Flange temperature	0	150	0	°C	r	u16	Actual temperature of the basic flange
839 Operating time and cycle supervision	0	3	0		r/w	u16	Behavior if the maximum permissible operating hours and operating cycles are exceeded. Warning messages can not be switched off. 0=No error messages 1=Only error when operating hours exceeded 2=Only error when operation cycles exceeded 3=Error when operating hours or operating cycles exceeded
848 Profile adapter version	0	65535			r	u16	Version of the Profibus/USS Profile Adapter
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
880 Flange temperature warning threshold	10	250	37	°C	r	u16	Warning level of the flange temperature

Parameter List

No. Designation	Min.	Max.	Default	Unit	r/w	Format	Description
881 Flange temperature error threshold	10	250	40	°C	r	u16	Error level of the flange temperature
882 Warn. temperature converter (heat sink)	5	100	80	°C	r	u16	Warning level heat sink temperature converter
883 Warn. temperature converter (air temp.)	5	100	80	°C	r	u16	Warning temperature converter (air temperature inside)
918 Set parameter bus address	0	65535	126		r/w	u16	Parameter for setting the bus address. 0 to 125 are valid addresses for Profibus. When the parameter value is set to 126 then the address can be set over the Provibus service Set_Slave_Add.
923 Active bus address	0	65535	126		r	u16	Effective bus address
924 Type of bus address	0	2	1		r/w	u16	Source of Profibus address. 0=Network 1=Parameter 2=Address switch

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	Motor temperature error	The motor temperature has exceeded the error threshold.	Forevacuum pressure too high, gas flow too high, defective fan, Water cooling switched off.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak, check process. Replace fan. Switch water cooling on.
3	Supply voltage failure	Intermediate circuit voltage is too low or maximum generator operating mode duration exceeded.	Mains supply voltage is too low. Mains voltage has failed.	Check voltage at the mains feed point. Remedy mains power failure.
4	Converter temperature failure	Overtemperature at the power output stage or inside the frequency converter.	Ambient temperature too high. Inadequate cooling owing to cooling water which is too warm.	Do not exceed the maximum ambient temperature of 45 °C. Improve cooling, comply with specified cooling water temperature and cooling water quantity.
5	Overload failure	Rotational speed has dropped below the minimum speed.	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak, check process.
6	Run-up failure	Pump has not attained its normal operating frequency after the maximum run-up time has elapsed.	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak, check process.
7	Run-up time failure	Maximum permissible bearing temperature was exceeded.	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process.
9	Bearing temperature failure	Maximum permissible bearing temperature was exceeded.	Forevacuum pressure is too high. Gas flow is too high. Water cooling switched off. Water cooling disabled or cooling water throughput or cooling water temperature inadequate.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Replace fan. Ensure sufficient water cooling.
12	Orbit monitoring, level XY1	Deflection of the rotor at the radial magnetic bearing on the high vacuum side is too high.	Mechanical impacts, possibly through maintenance work. Cross influences of vibrations between several pumps. Vibration influences through external exciting. Balancing condition of the rotor insufficient due to deposits or wear.	Remove external influences. Should the error still occur inform Leybold Service; have the pump replaced.

Error Memory

Error code	Designation	Description	Possible cause	Remedy
13	Orbit monitoring, level XY2	Deflection of the rotor at the radial magnetic bearing on the forevacuum side is too high.	Mechanical impacts, possibly through maintenance work. Cross influences of vibrations between several pumps. Vibration influences through external exciting. Balancing condition of the rotor insufficient due to deposits or wear.	Remove external influences. Should the error still occur inform Leybold Service; have the pump replaced.
14	Axial orbit monitoring	Deflection of the rotor at the axial bearing is too high.	Venting gas flow is too high, mechanical impacts, possibly through maintenance work. Cross influences of vibrations between several pumps. Vibration influences through external exciting.	Remove external influences. Should the error still occur inform Leybold Service; have the pump replaced.
16	Overload duration failure	After having attained its normal operating frequency the pump was operated for a longer period of time below its normal operating frequency.	Forevacuum pressure too high. Gas flow too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process.
17	Motor current failure	Motor current below setpoint current.	With start command being present: frequency converter not properly connected to the pump or damaged connector between pump and frequency converter. Internal fault within the frequency converter.	Inform Leybold Service; have connectors and if required the cable checked. Have the converter replaced.
19	Passthrough time failure	The pump did not attain its minimum speed within the maximum passthrough time.	Forevacuum pressure too high when starting the system. Seized rotor.	Reduce forevacuum pressure. Check to ensure that the rotor rotates freely.
26	Bearing temperature sensor failure	Bearing temperature sensor is defective.	Component is defective, sensor short-circuit or interruption.	Inform Leybold Service. If required have converter respectively pump replaced.
28	Motor temperature sensor failure	Motor temperature sensor is defective.	Component is defective, sensor short-circuit or interruption.	Inform Leybold Service. If required have converter respectively pump replaced.
31	High load duration failure	Motor current has exceeded the warning threshold too long (time span defined through parameter "Overload time 2").	Forevacuum pressure is too high. Gas flow is too high.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process conditions.
39	Magnetic bearing start-up failure	Magnetic bearing is not able to lift the rotor properly.	Pump was shock vented. Excessively high vibrations or mechanical impacts from the system. Vibration influences between several pumps.	Refer to the pump manual for correct venting of the pump. Avoid vibrations or mechanical impacts.

Error Memory

Error code	Designation	Description	Possible cause	Remedy
43	Overspeed failure	The actual frequency exceeds the setpoint frequency.	Setpoint frequency was changed during operation via a serial interface, RS 232, for example.	Provide for correct speed setting.
63	Internal parameter failure		There is a parameter mismatch which occurred during start-up or while saving the parameters. The pump was disconnected from its power supply while storing important system data was in progress.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
65	Internal communication failure	Failure of internal data communication with the frequency converter.	Cyclic pump communication has failed.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON.
66	Magnetic bearing current too high	Overloading of one or several magnetic bearing power output stages.	Excessively high vibrations or mechanical impacts from the system.	Reduce the level of vibrations or mechanical impacts.
67	Internal overload		Internal drive overload.	Stop the pump. Wait for standstill. Switch mains power OFF and ON again and restart the system.
71	First time initialisation failure of the parameter list.	Interface parameter/table mapping error.	First time initialisation of the pump parameters has failed.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON.
73	First time initialisation failure of the parameter list.	The registered number of start and standby cycles exceeds the maximum permissible number for safe operation.	Very high number of starts respectively much use of the standby function.	Have the pump serviced.
74	Number of operating hours exceeded.	The number of operating hours of the pump exceeds the maximum permissible number of hours for safe operation.	The number of operating hours of the system has reached the level necessary for servicing.	Have the pump serviced.
75	Failure during the initialisation of the pump data.	Failure during identification and initialisation of the pump.	Failure in frequency converter or in the pump.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

Error code	Designation	Description	Possible cause	Remedy
77	Too many touch-down bearing contacts were detected.	The registered number of touchdown bearing contacts exceeds the permissible alarm limit.	Due to external or internal influences of the pump the turbo rotor makes contact with the emergency bearings (touchdown bearings): mechanical impacts, possibly due to maintenance work. Vibration influences between several pumps. Vibration influences due to external exciting. Balancing condition of the rotor inadequate due to deposits or wear. Magnetic suspension is defective. Full or partial shutdown of the pump without magnetic bearing support due to mains power failure or failure in the frequency converter.	Have the pump serviced. If required check frequency converter and the connections. Check installation orientation of the pump and if required correct it. Avoid external influences (vibrations, impacts etc.). Review electric power supply and control concept.
78	Bearing contact time too long was detected.	The registered total duration of all touchdown bearing contacts exceeds the permissible alarm limit.	Due to external or internal influences of the pump the turbo rotor makes contact with the emergency bearings (touchdown bearings): mechanical impacts, possibly due to maintenance work. Vibration influences between several pumps. Vibration influences due to external exciting. Balancing condition of the rotor inadequate due to deposits or wear. Magnetic suspension is defective. Full or partial shutdown of the pump without magnetic bearing support due to mains power failure or failure in the frequency converter.	Have the pump serviced. If required check frequency converter and the connections. Check installation orientation of the pump and if required correct it. Avoid external influences (vibrations, impacts etc.). Review electric power supply and control concept.
79	Internal communication failure.	Failure of the internal data communication of the frequency converter.	Failure in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
80	Invalid interface module combination.	Configuration of the interface module slots is inconsistent.	Two active Fieldbus modules were inserted, the X1 24 V PLC module has been inserted into the "Service" slot.	Correct installation of the interface modules: use control interface slot (CONTROL) with Fieldbus module (Profibus), RS 485, RS 232 or X1. Equip the service slot with a RS 232, a RS 485 or an USB module only.
81	Watchdog for monitoring of USS communication has responded.	Cyclic communication has failed for a longer period of time than defined through P 182.	Cable running to the controller was removed. Controller has interrupted communication. Interface module is defective.	Reinsert cable. Check controller. Inform Leybold Service.

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Error code	Designation	Description	Possible cause	Remedy
82	Watchdog for monitoring Fieldbus communication has responded.	Cyclic communication has failed for a longer period of time than defined through P 925.	Cable running to the controller was removed. Controller has interrupted communication. Fieldbus interface is defective.	Reinsert cable. Check controller. Inform Leybold Service; have frequency converter replaced.
90	Setpoint speed setting higher than permissible.	Frequency setpoint is higher than the maximum value defined through parameter 45.	Incorrect setpoint entry or parameterisation of the pump is in error.	Correct setpoint entry or run a software respectively parameter update.
200	Pump identification temperature failure	Temperature in the pump identification is too high.	Forevacuum pressure is too high. Gas flow is too high. Water cooling switched off.	Check ultimate pressure of the forevacuum pump and if required install a larger forevacuum pump. Seal off leak. Check process. Water cooling disabled or cooling water throughput or cooling water temperature inadequate.
201	Unidentifiable failure on control board	Failure affecting the control computer of the frequency converter.	External interference or hardware failure affecting the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
203	Failure during self test	Failure affecting the parameter table mapping.	External interference or hardware failure affecting the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
204	RAM area insufficient for scope functionality	Failure in the control computer of the frequency converter.	External interference or hardware failure affecting the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
206	Pump parameter failure	Failure during identification and initialisation of the pump or the frequency converter.	Failure in the frequency converter, in the pump respectively in the pump's cables.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
209	Pump initialisation failure	Failure during identification and initialisation of the pump or the frequency converter.	Failure in the frequency converter, in the pump respectively in the pump's cables.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
210	Non-cyclic data transfer to pump identification interrupted (parameter transfer)	Communication malfunction with data memory of pump identification.	Temporary EMC interference. Defective hardware.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

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Error code	Designation	Description	Possible cause	Remedy
213	Intermediate circuit overvoltage	The power supply voltage is too high.	The frequency converter has detected an intermediate circuit voltage which is too high.	Check power supply on the mains power side.
913	Temperature Power Stage Bearing electronic	The temperature has exceeded the error threshold.	The Cooling water flow is too low or the cooling water temperature is too high. Ambiant temperature to high. Too high amplitude or force of mechanical shocks or vibration fto the system.	Check cooling conditions Check ambiant conditions Reduce the vibration or shocks influence which might affect the pump
914	Initialisation of parameter 893 was not yet run	Movement range in yM saved in the pump's memory needs to be updated.	When shifting the values this failure should no longer be able to occur.	
915	Intermediate circuit voltage is too low	Intermediate circuit voltage has dropped below the necessary value.	Unstable mains power supply. Equipment failure.	Check the mains power supply
916	Sensor alignment Channel Z	Automatic sensor alignment for channel Z resulted for parameter SGAIN and/or SOFFS values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.
917	Sensor alignment channel Y2	Automatic sensor alignment for channel Y2 resulted for parameter SGAIN and/or SOFFS in values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.
918	Sensor alignment Channel X2	Automatic sensor alignment for channel X2 resulted for parameter SGAIN and/or SOFFS in values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.
919	Sensor alignment Channel Y1	Automatic sensor alignment for channel Y1 resulted for parameter SGAIN and/or SOFFS in values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.

Error Memory

Error code	Designation	Description	Possible cause	Remedy
920	Sensor alignment Channel X1	Automatic sensor alignment for channel X1 resulted for parameter SGAIN and/or SOFFS in values outside the range which can be typically tolerated.	Parameter changes in the pump's memory.	System needs to be recalibrated and aligned by Leybold.
921	Current controller initialisation	Initialisation failure affecting the current controllers.		Re-initialisation attempt by the system by restarting.
922	Initialisation MM module	Initialisation failure of different controller modules.		Re-initialisation attempt by the system by restarting.
923	Initialisation position task 2	Initialisation failure of software module position task 2.		Re-initialisation attempt by the system by restarting.
924	Initialisation position task 1	Initialisation failure of software module position task 1.		Re-initialisation attempt by the system by restarting.
925	Software not capable of running on the target system	Software is not capable of running on this control board.	Uploading of an incorrect software version.	Load correct software version.
926	Floating point error has occurred	The floating point unit has signalled a failure, error code in debug variable, error code floating point, message after software reset.		Re-initialisation attempt by the system by restarting.
927	System stack overflow	Not enough unoccupied memory in the system stack, message after software reset.		Re-initialisation attempt by the system by restarting.
928	User stack overflow	Not enough unoccupied memory any more.		Re-initialisation attempt by the system by restarting.
929	System stack overflow	System stack overflow, message after software reset.		Re-initialisation attempt by the system by restarting.
930	System stack underflow	System stack underflow, message after software reset.		Re-initialisation attempt by the system by restarting.
931	Word access failure	Illegal word access, message after software reset.		Re-initialisation attempt by the system by restarting.
932	Undefined operation code for protected commands	Programme was detected as incorrect and cannot be run.	Temporary problem or inadmissible changes in the flash/RAM memory.	After the system has arrived at standstill, disconnect it from the power supply to re-initialise the software.

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Error code	Designation	Description	Possible cause	Remedy
933	Memory access error	Access to the system memory has been found to be in error.	Temporary problem or inadmissible changes in the flash/RAM memory.	After the system has arrived at standstill, disconnect it from the power supply to re-initialise the software.
934	Undefined operation code	Programme code was detected as being in error and cannot be run.	Temporary problem or inadmissible changes in the flash/RAM memory.	After the system has arrived at standstill, disconnect it from the power supply to re-initialise the software.
935	External failure affecting the safety processors	At least one of the safety processors has detected a failure.	For further analysis the status words and control words of the processors need to be read out.	System locks the power output stage of the drive unit. Wait for the system to arrive at standstill and try to enable the system by switching the mains power off and on again.
936	The current offset and gain values deviate from the initial data.			
937	The SOFFset values are outside of the defined range (initialisation).			
938	Cable parameters SOFFS, SGAIN and XGAIN are at their factory defaults.			
939	Cancellation during calculation of the checksum across the range of the static parameters in the pump identification.			
940	Cancellation during the calculation of the checksum across the range of the static parameters in the frequency converter.			
941	Incompatible compiling of the profile adapter version.	Interface parameter table mapping error.	Failure during software update.	If required repeat the software update, respectively check combination of software and profile adapter file.
949	Checksum error during initialisation of the equipment settings.	Failure while operating or identifying and initialising the pump.	Failure in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
950	Checksum error during initialisation of the autosave parameters	Failure while operating or identifying and initialising the pump.	Failure in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
951	Error while writing a string parameter to the fixed parameter memory.	Failure while operating or identifying and initialising the pump.	Failure in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

Error Memory

Error code	Designation	Description	Possible cause	Remedy
952	Failure during reading of the permanent parameter memory during the start-up phase.	Failure during operation or while identifying and initialising the pump.	Malfunction in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
953	Failure while writing to the fixed parameter memory.	Failure during operation or while identifying and initialising the pump.	Malfunction in the frequency converter, in the pump respectively in the pump's cable.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
955	Watchdog for monitoring the communication via Lustbus has responded.	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
956	Profile adapter: no opcode	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
957	Profile adapter: invalid opcode	Profile adapter: invalid opcode	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
958	Profile adapter: failure during reading of parameters.	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
959	Profile adapter: failure during writing of parameters	Failure affecting the internal data communication of the frequency converter.	Malfunction in the frequency converter.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
979	General failure during floating point calculation	Failure affecting the control computer of the frequency converter.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
980	Not enough memory for module parameters	Failure affecting the control computer of the frequency converter.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

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Error code	Designation	Description	Possible cause	Remedy
982	Failure during initialisation of the generator mode.	Internal frequency converter failure.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
983	Failure during initialisation of the speed controller.	Internal frequency converter failure.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
984	Failure during initialisation of rotational speed calculation.	Internal frequency converter failure.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
985	Failure during initialisation of the current controller.	Internal frequency converter failure.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
986	Failure during initialisation of the controller.	Internal frequency converter failure.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
987	Internal failure of the state machine controller.	Internal frequency converter failure.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
988	Failure during initialisation of the motor protection module.	Internal frequency converter failure.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
989	Internal failure affecting the number formats.	Internal frequency converter failure.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
990	Failure during internal parameter access via KP 200. A parameter could not be read or written.	Internal frequency converter failure.	External interference or hardware fault of the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

Error Memory

Error code	Designation	Description	Possible cause	Remedy
991	Failure during initialisation of a parameter with its saved setting.	Internal frequency converter failure.	External interference or hardware fault in the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
992	User stack has exceeded the maximum size.	Internal frequency converter failure.	External interference or hardware fault in the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
994	Runtime error during checking of the assisting parameter	Internal frequency converter failure.	External interference or hardware fault in the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
995	An exception was initiated.	Internal frequency converter failure.	External interference or hardware fault in the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
996	Non-identifiable parameter access level.	Internal frequency converter failure.	External interference or hardware fault in the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.
997	Runtime error during enabling of an assisting parameter.	Internal frequency converter failure.	External interference or hardware fault in the frequency converter electronics.	If required, stop the pump respectively wait for it to arrive at standstill, switch power supply voltage OFF and ON; if required have the frequency converter replaced.

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.

7 Warnings

Possibly present current warning conditions can be read through the parameters 227, 228, 230, 232 and 233.

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 Bit	Designation	Possible cause	Remedy
0	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	Converter Housing Temperature too high	The converter is overloaded due to too high gas load.	The gas load needs to be reduced.
2	Bearing Temperature too high	Frequent acceleration and deceleration of the pump.	Allow converter to cool down between the cycles.
3-5	–		
6	Overspeed	The frequency setpoint has been set during operation with serial interface e.g. RS232.	Provide for correct speed setting.
7-9	–		
10	MAG Unbalance at the Upper Bearing	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	MAG Unbalance at the Lower Bearing	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	MAG Oscillation at the Axial Bearing	The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
13-15	–		

P228 Bit	Designation	Possible cause	Remedy
0-10	–		
11	Magnetic Bearing has not lifted	There was a fatal error before, which is not resetable.	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
12	MAG Bearing Overload (Level 1)	The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
13	Converter Power Stage Temperature too high	The cooling water flow is too low or the cooling water temperature is too high. The converter is overloaded due to too high gas load. Frequent acceleration and deceleration of the pump.	Cooling system needs to be improved. The gas load needs to be reduced. Allow converter to cool down between the cycles.
14, 15	–		

Warnings

P230 Bit	Designation	Possible cause	Remedy
0-3	–		
4	MAG Bearing Overload (Level 2)	The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
5	Max. Number of Pump Runup Cycles are reached	The recommended max. number of start cycles of the pump are reached.	Arrange a service date at Leybold for this pump.
6	Max. Number of Pump Operation Hours are reached	The recommended max. number of operating hours of the pump are reached.	Arrange a service date at Leybold for this pump.
7	–		
8	High load	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	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	Overload	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	MAG Radial Bearing Displacement	The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
13	–		
14	Supply Voltage too high or too low	Usage of a wrong power supply unit.	Use correct power supply.
		Misaligned output voltage.	Adjust the output voltage of the power supply.
		Too high load.	Replace the power supply by a more powerful one.
		Voltage drop across the supply cable.	Increase the copper area of the cable
15	Motor Start Locked	There was a fatal error before, which is not resetable.	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.

Warnings

P232 Bit	Designation	Possible cause	Remedy
0	MAG Bearing Overload 0	The magnetic bearing current for the individual axes is too high.	Reduce vibration which might affect the pump.
1	MAG Bearing Overload 1		
2	MAG Bearing Overload 2		
3	MAG Bearing Overload 3		
4	MAG Bearing Overload 4 Z-Axis	The environmental vibration might be too heavy.	
5	MAG Bearing Overload 5		
6	MAG Bearing Overload 6		
7	–		
8	MAG Upper Radial Bearing Displacement X1	The magnetic bearing close to the high vacuum flange has been shifted radially. The environmental vibration might be too heavy.	Reduce vibration which might affect the pump.
9	MAG Upper Radial Bearing Displacement Y1		
10	MAG Lower Radial Bearing Displacement X2	The magnetic bearing close to the forevacuum flange has been shifted radially. The environmental vibration might be too heavy.	
11	MAG Lower Radial Bearing Displacement Y2		
12	MAG Axial Bearing Displacement Z	The magnetic bearing has been shifted axially. The environmental vibration might be too heavy.	
13	High Number of Auxiliary Bearing Impacts	The environmental vibration might be too heavy or to many shocks or impacts interfered the pump	Reduce vibration which might affect the pump. Avoid shocks or impacts at the pump.
14	High Amount of Cumulated Bearing Touch Down Time	Too many f ull or partial auxiliary bearing run downs affected the pump.	
15	High No. of Touch Down Bearing Run Downs	The number of partial or full touchdowns into the touchdown bearings is too high.	Avoid stopping the pump by switching off the mains power.
		The environmental vibration might be too heavy or to many shocks or impacts interfered the pump	Avoid disconnecting the pump cable, when the pump is still running"
		Too many full or partial auxiliary bearing run downs affected the pump.	

Warnings

P233 Bit	Designation	Possible cause	Remedy
0	Flange temperature above warning limit.	The Cooling water flow is too low or the cooling water temperature is too high.	The 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.
1	Temperature power stage bearing electronic	Ambiant temperature to high.	Improve cooling conditions
		The Cooling water flow is too low or the cooling water temperature is too high.	
		Too high amplitude or force of mechanical shocks or vibration fto the system.	Reduce the vibration or shocks influence which might affect the pump
2	Shake warning	The pump has been operated for such a long duration (default 4000 hours) that it shaking and cleaning are needed to remove dust deposited inside.	See pump Operating Instructions.
3-15	–		

8   Device Behaviour at Start-up and IOPS = bad

All IO data are zeroed, when the device is switched on. The device is stopped.

In case of network interruptions or PLC mode changes from RUN to STOP, the last data received from the controller are used.

A watchdog can be configured via parameter 181, which in case of a network interruption safely shuts down the pump after a preset time with an error message.

Annex

Telegram examples

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

Abr.	Description	Value (Dez/Hex/Bin)	Bit	Byte	Word	Bit	Value (Bin/Hex/Dez)	Description	Abr.
PKE	Query designator / Res. / Parameter number		7–0	0, 1	0	15–0		Reply designator / Res. / Parameter number	PKE
IND	Parameter Index		7–0	2	1	15–0		Parameter Index	IND
-	Reserved		7–0	3		7–0		Reserved	-
PWE	Parameter value		7–0	4, 5	2	15–0		Parameter value	PWE
			7–0	6, 7	3	15–0			
PZD1	Control word		7–0	8, 9	4	15–0		Status word	PZD1
PZD2	Setpoint rotor speed		7–0	10, 11	5	15–0		Actual rotor speed	PZD2

Control word (PZD1) bit assignments:

Bit	Control word
2	Activate remote
0	Standby speed
7	Error reset
6	Enable setpoint
0	Start/Stop

Status word (PZD1) bit assignments:

Bit	Status word
15	Remote active
14	-
13	Warning overload
12	Failure counter
11	Pump is rotating
10	Normal operation
9	Parameter accepted
8	-
7	Warning temperature
6	Switch-on lock
5	Deceleration
4	Acceleration
3	Error active
2	Operation enabled
1	-
0	Ready to start

Example 1 — Starting the pump

Abr.		Description	Dez	Hex	Bin	Bit	Byte	Word	Bit	Bin	Hex	Dez	Description		Abr.
① PZD1	Control word	-	4	4	0	7	8	4	15	1	8E	142	Remote active	Status word	PZD1 ③
		-			0	6			14	0			-		
		-			0	5			13	0			Warning overload		
		-			0	4			12	0			Failure counter		
		-			0	3			11	1			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	1	1	0	7	9	4	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			3	0			Error active		
		-			0	2			2	1			Operation enabled		
		-			0	1			1	0			-		
		Start/Stop			1	0			0	1			Ready to start		
PZD2	Setpoint rotor speed		0	0	0	7	10	5	15	0	3	800		Actual rotor speed	PZD2 ②
					0	6			14	0					
					0	5			13	0					
					0	4			12	0					
					0	3			11	0					
					0	2			10	0					
					0	1			9	1					
					0	0			8	1					
			0	0	0	7	11	5	7	0	20				
					0	6			6	0					
					0	5			5	1					
					0	4			4	0					
					0	3			3	0					
					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.

Example 2: Setpoint active

Abr.		Description	Dez	Hex	Bin	Bit	Byte	Word	Bit	Bin	Hex	Dez	Description		Abr.
① PZD1	Control word	-	4	4	0	7	8	4	15	1	8E	142	Remote active	Status word	PZD1 ④
		-			0	6			14	0			-		
		-			0	5			13	0			Warning overload		
		-			0	4			12	0			Failure counter		
		-			0	3			11	1			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	65	41	0	7	9	4	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			3	0			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		2		0	7	10	5	15	0	2	700		Actual rotor speed	PZD2 ③
					0	6			14	0					
					0	5			13	0					
					0	4			12	0					
					0	3			11	0					
					0	2			10	0					
					1	1			9	1					
					0	0			8	0					
			700	BC	1	7	11	5	7	0	BD				
					0	6			6	0					
					1	5			5	1					
					1	4			4	1					
					1	3			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.

Annex

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 (Dez/Hex/Bin)	Bit	Byte	Word	Bit	Value (Bin/Hex/Dez)	Description	Abr.
PKE	Parameter number	1 / 0 / 10 ... 150 / 96	7 6 5 4 3 2 1 0 / 7 6 5 4 3 2 1 0	0 / 1	0	15 14 13 12 11 10 9 8 / 7 6 5 4 3 2 1 0	1 / 10 ... 150 / 96	Parameter number	PKE
IND	Parameter Index	0 / 0	7 6 5 4 3 2 1 0	2	1	15 14 13 12 11 10 9 8	0 / 0	Parameter Index	IND
-	Reserved	0 / 0	7 6 5 4 3 2 1 0	3		7 6 5 4 3 2 1 0	0 / 0	Reserved	-
PWE	Parameter value	0	7 6 5 4 3 2 1 0	4 5 6 7	2 3	15...0	0 / 0 / 250 / FA	Parameter value	PWE

(Query designator / Res. on left; Reply designator / Res. on right)

Abr.	Field	Description	Dez	Hex	Bin	Bit	Byte	Word	Bit	Bin	Hex	Dez	Description	Field	Abr.
	Query designator		2	20	0	7	0	0	15	0	20	2		Reply designator	
					0	6			14	0					
					1	5			13	**1**					
					0	4			12	0					
	Res.		0		0	3			11	0		0		Res.	
					0	2			10	0					
PKE	Parameter number				0	1			9	0				Parameter number	PKE
			150		0	0			8	0		150			
					1	7	1		7	1					
					0	6			6	0					
					0	5			5	0					
			96		1	4			4	1		96			
					0	3			3	0					
					1	2			2	1					
					1	1			1	1					
					0	0			0	0					
	Parameter Index		0	0	0	7	2	1	15	0	0	0		Parameter Index	
					0	6			14	0					
					0	5			13	0					
IND					0	4			12	0					IND
					0	3			11	0					
					0	2			10	0					
					0	1			9	0					
					0	0			8	0					
	Reserved		0	0	0	7	3		7	0	0	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					
	Parameter value		0	0	0	7	4	2	15	0	0	0		Parameter value	
					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	5		7	0					
					0	6			6	0					
					0	5			5	0					
			0		0	4			4	0		0			
					0	3			3	0					
					0	2			2	0					
					0	1			1	0					
PWE					0	0			0	0					PWE
					0	7	6	3	15	0					
					0	6			14	0					
			500		0	5			13	0		500			
					0	4			12	0					
				1	0	3			11	0	1				
					0	2			10	0					
					0	1			9	0					
					1	0			8	1					
					1	7	7		7	1					
					1	6			6	1					
					1	5			5	1					
				F4	1	4			4	1	F4				
					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 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.

Annex

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.

③

②

①

⑤

④

⑥

Abr.	Description	Value (Dez)	Value (Hex)	Value (Bin)	Bit	Byte	Word	Bit	Value (Bin)	Value (Hex)	Value (Dez)	Description	Abr.
	Query designator	6		0	7			15	0		4	Reply designator	
				1	6			14	1				
				1	5			13	0				
	Res.	0	60	0	4	0		12	0	40	0	Res.	
				0	3			11	0				
PKE	Parameter number			0	2			10	0			Parameter number	PKE
				0	1			9	0				
				0	0		0	8	0				
		171		1	7			7	1	171			
				0	6			6	0				
				1	5			5	1				
			AB	0	4	1		4	0	AB			
				1	3			3	1				
				0	2			2	0				
				1	1			1	1				
				1	0			0	1				
	Parameter Index	1	1	0	7			15	0	1	1	Parameter Index	IND
				0	6			14	0				
				0	5			13	0				
IND				0	4	2		12	0				
				0	3			11	0				
				0	2			10	0				
				0	1			9	0				
				1	0		1	8	1				
	Reserved	0	0	0	7			7	0	0	0	Reserved	-
				0	6			6	0				
				0	5			5	0				
-				0	4	3		4	0				
				0	3			3	0				
				0	2			2	0				
				0	1			1	0				
				0	0			0	0				
			0	0	7			15	0	0	0		
				0	6			14	0				
				0	5			13	0				
				0	4	4		12	0				
				0	3			11	0				
				0	2			10	0				
				0	1			9	0				
				0	0		2	8	0				
			0	0	7			7	0	0	0		
				0	6			6	0				
				0	5			5	0				
				0	4	5		4	0				
PWE	Parameter value	0		0	3			3	0		39	Parameter value	PWE
				0	2			2	0				
				0	1			1	0				
				0	0			0	0				
			0	0	7			15	0	0			
				0	6			14	0				
				0	5			13	0				
				0	4	6		12	0				
				0	3			11	0				
				0	2			10	0				
				0	1			9	0				
				0	0		3	8	0				
			0	0	7			7	0	27			
				0	6			6	0				
				0	5			5	1				
				0	4	7		4	0				
				0	3			3	0				
				0	2			2	1				
				0	1			1	1				
				0	0			0	1				

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.

Abr.	Description	Dez	Hex	Bin	Bit	Byte	Word	Bit	Bin	Hex	Dez	Description	Abr.
PKE	Query designator	6	60	0	7	0	0	15	0	50	5	Reply designator	PKE
				1	6			14	1				
				1	5			13	0				
	Res.	0		0	4			12	1		0	Res.	
				0	3			11	0				
				0	2			10	0				
				0	1			9	0				
	Parameter number	176		0	0			8	0		176	Parameter number	
			B0	1	7	1		7	1	B0			
				0	6			6	0				
				1	5			5	1				
				1	4			4	1				
				0	3			3	0				
				0	2			2	0				
				0	1			1	0				
				0	0			0	0				
IND	Parameter Index	1	1	0	7	2	1	15	0	1	1	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				
				1	0			8	1				
-	Reserved	0	0	0	7	3		7	0	0	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	0	0	0	7	4	2	15	0	0	2792	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	0	7	5		7	0	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				
			0	0	7	6	3	15	0	0A			
				0	6			14	0				
				0	5			13	0				
				0	4			12	0				
				0	3			11	1				
				0	2			10	0				
				0	1			9	1				
				0	0			8	0				
			0	0	7	7		7	1	E8			
				0	6			6	1				
				0	5			5	1				
				0	4			4	0				
				0	3			3	1				
				0	2			2	0				
				0	1			1	0				
				0	0			0	0				

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