

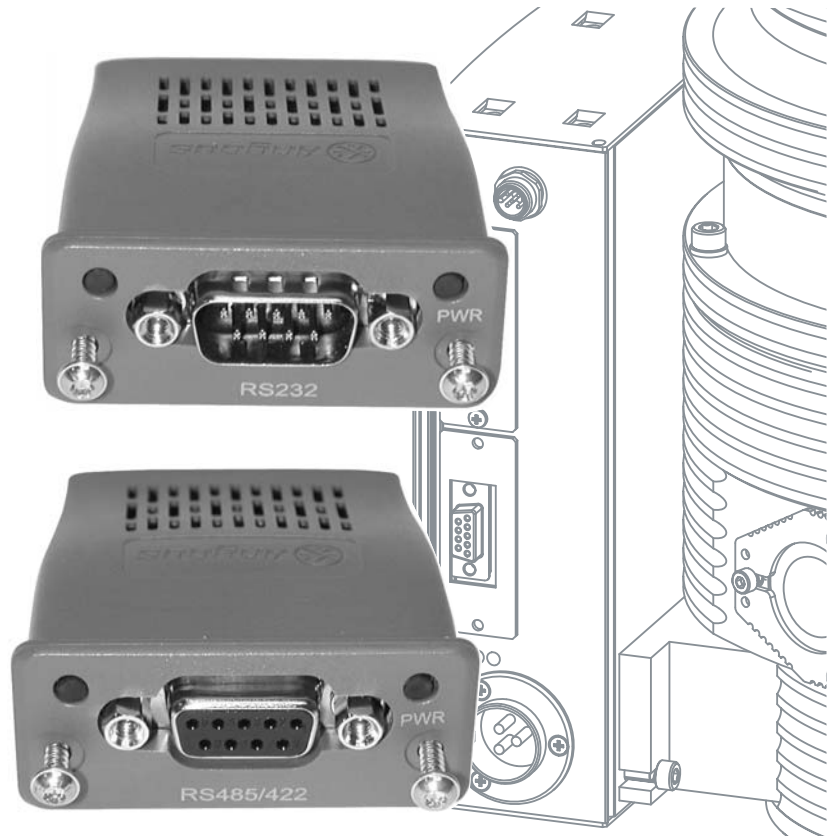
# RS 232 and RS 485 for MAG.DRIVE iS

Operating Instructions 17200309\_002\_00

Part Nos.

410300V0902

410300V0903



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# Safety Information

## Important Safety Information

Indicates procedures that must be strictly observed to prevent hazards to persons.

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

The Oerlikon Leybold Vacuum **frequency converter MAG.DRIVE iS with RS 232 or RS 485 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.

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

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

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### Warning

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### Caution

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### Caution

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# Description



Fig. 1.1 Interface modules

## 1 Description

### 1.1 Design and Function

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.

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

### 1.2 Supplied Equipment

- RS 232 module or RS 485 module for MAG.DRIVE iS
- Torx key T9
- Brief Instructions for module installation
- CD-ROM with Operating Instructionsand additional data

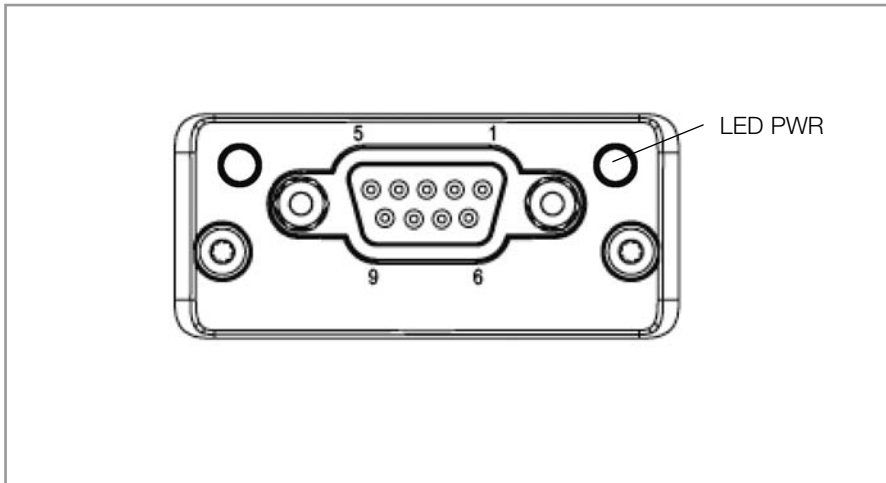


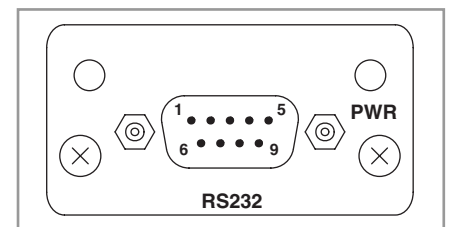
Fig. 1.2 Front

## 1.3 Technical Data

### RS 232

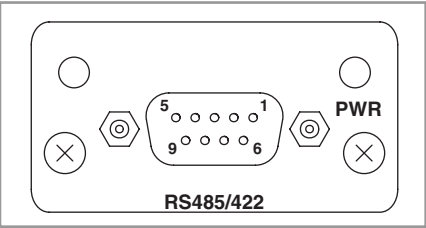
The module is designed as a DTE (Data Terminal Equipment, i.e. in order to connect the module another DTE such as a computer, a crossover cable must be used (0-Modem)

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



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	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 (Internally terminated (100 Ω) Receive data line	–
7	RxD inverted (Internally terminated (100 Ω) Receive data line	–
8	TxD Transmit data line	RxD/TxD Bidirectional data line
9	TxD inverted Transmit data line	RxD/TxD inverted 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)

### 1.4 Ordering Information

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

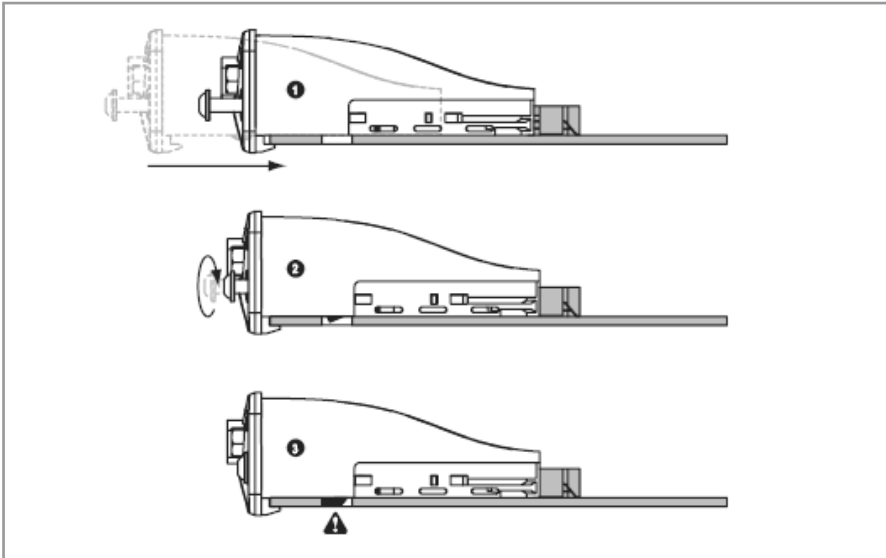


Fig.2.1 Installation

## 2 Installation

### 2.1 Installation

Generally both RS 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.

Normally it makes sense to install the RS interface in the CONTROL slot.

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

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**Caution**

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See Fig. 2.1, 2.2 and 2.3.

- 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.

# Installation



Fig.2.2 Inserting the module

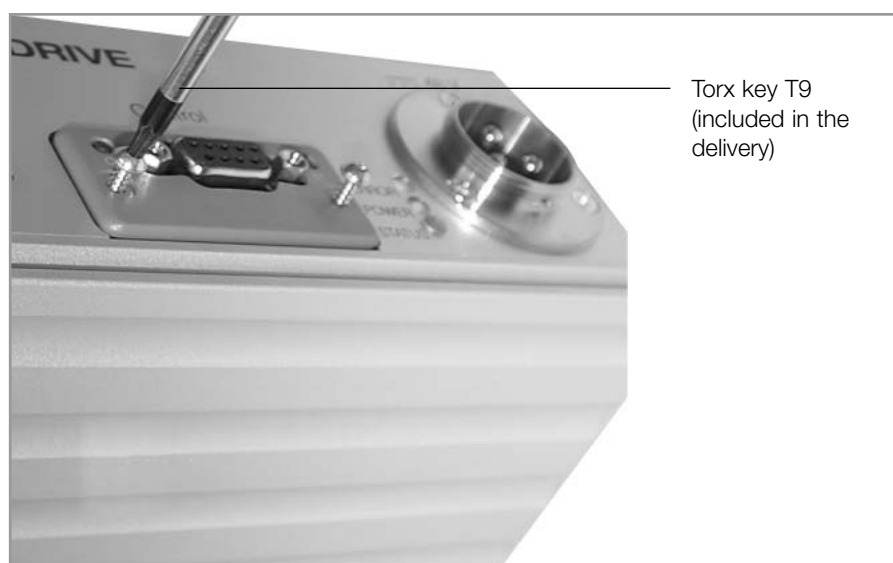


Fig.2.3 Tightening the module

## 2.2 Connection

### Caution

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

Connect the interface connector on the front of the frequency converter. The terminator is installed in the equipment.



## 3 Description of the Telegram

### 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

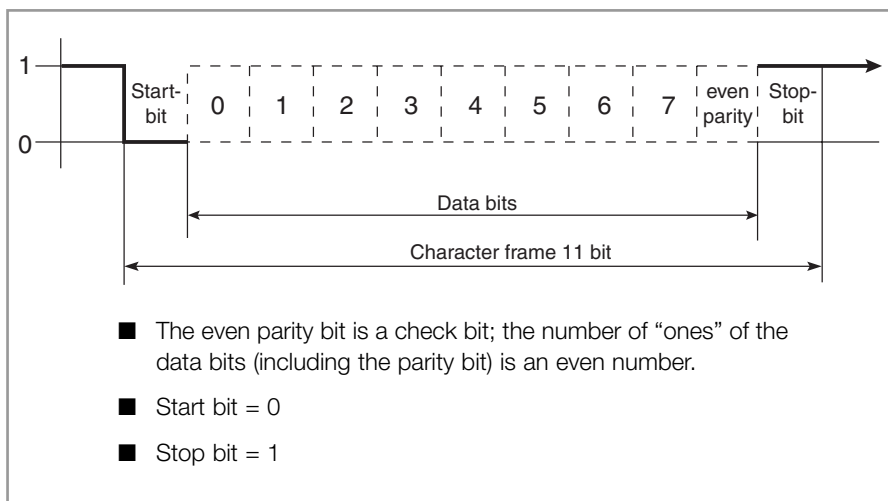


Fig. 3.1 Structure of a data frame for transferring a string byte

# PKE, IND, Bits

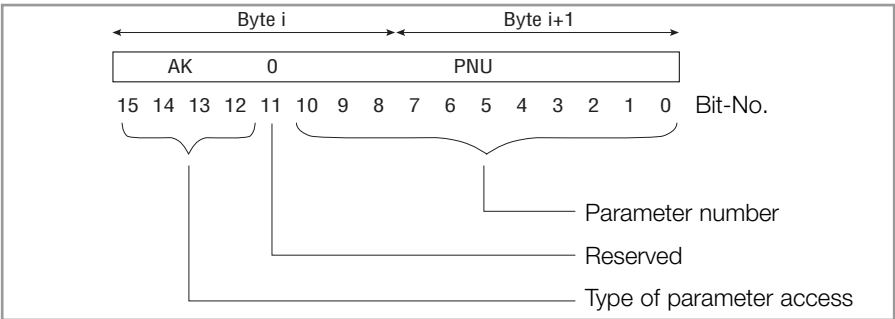


Fig. 4.1 Structure of the parameter section

## 4 Description of PKE, IND, Control and Status Bits

### 4.1 PKE: Parameter Number and Type of Access

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

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

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

Type of Parameter Access to the Frequency Converter (Query Designator)					Type of Parameter Response from the Frequency Converter (Reply Designator)				
Bit number					Bit number				
15	14	13	12		15	14	13	12	
0	0	0	0	No access	0	0	0	0	No response
0	0	0	1	Parameter value requested	0	0	0	1	16 bit value is sent
					0	0	1	0	32 bit value is sent
0	0	1	0	Write a 16 bit value	0	0	0	1	16 bit value is sent
0	0	1	1	Write a 32 bit value	0	0	1	0	32 bit value is sent
0	1	1	0	Field value requested*	0	1	0	0	16 bit field value is sent
					0	1	0	1	32 bit field value is sent
0	1	1	1	Write a 16 bit field value*	0	1	0	0	16 bit field value is sent
1	0	0	0	Write a 32 bit field value*	0	1	0	1	32 bit field value is sent
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 2 (PWE2) an error number is provided.

### Parameter Index IND

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

## 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 to 15	No function	

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

# PKE, IND, Bits

## 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 PZD2
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

# Parameter list

## 5 Parameter list

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
1	Pump unit identifier	100	201	201		r	u16	201 = MAG.DRIVE iS
2	Software version xxx.yy.zz	2147483647 8010000		8010000		r	u32	xxx.yy: Version, zz: Correction index
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 temperature	0	150	0	°C	r	u16	Actual value of the motor temperature.
11	Actual converter temperature	0	100	0	°C	r	u16	Actual heat sink temperature of the converter.
16	Motor temperature warning threshold	0	140	110	°C	r	u16	Exceeding the motor temperature warning threshold results in a warning.
17	Nominal motor current	0	100	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	100	45	0.1 A	r	u16	Max. current level during normal operation; Higher current value leads to "overload" and stops the pump if the duration exceeds 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 forevacuum 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	2147483647		r	i32	Last 9 digits of the pump's catalog number.
52	Pump serial no.	0	0	2147483647		r	i32	Last 9 digits of the pump's serial number.
54	Date of manufacturing	0	0	2147483647		r	i32	Manufacturing date of the pump [DDMMYY].
56	Date of last service	0	0	2147483647		r	i32	Last service date of the pump [DDMMYY].

# Parameter list

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
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	0	140	85	°C	r	u16	Warning level of the bearing temperature
131	Bearing temperature error threshold	0	140	90	°C	r	u16	Error level of the bearing temperature
133	Motor temperature error threshold	0	140	115	°C	r	u16	Error level of the motor temperature
134	Option 24 volts behavior	0	20	19		r/w	u16	Selects the behavior of the 24 volt auxiliary supply (fan). 19: Always 24 V fed.
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	0.01 h	r	i32	Pump operating hours warning level
		2147483647						
155	Pump op. hours error threshold	0		10000000	0.01 h	r	i32	Pump operating hours alarm level
		2147483647						

# Parameter list

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
156	Start cycles error threshold	0	65535	28500		r	u16	Number of start cycles alarm level
157	Pump op. hours blocked-start threshold	0		500000		r	i32	Start-up is blocked, if this number of operation hours is reached.
			2147483647		0.01 h			
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.
176	Error operating hours	0		0		r	i32	Pump operating hours, when error occurred. Access analogously as for parameter 171.
			2147483647					
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.
184	Converter operating hours	0	65535	0	h	r	u16	Counts the operating hours of the converter during active pump operation.
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.
243	Time delay semi F47	0	65535	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.
343	Acceleration current	0	100	45	0.1 A	r	u16	Motor current setpoint during acceleration

# Parameter list

No.	Designation	Min.	Max.	Default	Unit	r/w	Format	Description
350	Catalog number of pump	0	65535	0	:CHAR	r	u16	Catalogue number of the pump. One ASCII char per index.
390	Actual cooler temperature	0	150	0	°C	r	u16	Actual value of the converter power stage cooling device temperature.
398	Pump volume	0	3200	300	l/s	r	u16	Pumping speed of the pump
399	Pump type	0	65535	0	:CHAR	r	u16	Pump description; ASCII sequence
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).



## 6 Error Memory

Parameter 171 contains in the case of an error, the corresponding error code. Listed in the following are the possible error codes and their causes.

Error code	Designation	Description	Possible cause	Remedy
1	Overload warning	This speed of the pump has dropped below the normal operating threshold	Vacuum pressure too high	Check ultimate pressure of the backing pump and if required install a larger backing pump
			Gas flow too high	Seal leak, check process
2	Motor temperature error	The motor temperature has exceeded the shutdown threshold	Vacuum pressure too high	Check ultimate pressure of the backing pump and if required install a larger backing pump
			Gas flow too high	Seal leak, check process
			Fan is defective	Replace the fan
			Water cooling switched off	Switch on water cooling
3	Supply voltage error	Intermediate circuit voltage is too low or maximum duration in generator mode has been exceeded	DC supply voltage below 48V	Check the voltage at the power supply and if required set up correctly
			Mains voltage has failed	Remedy mains power failure
4	Converter temperature error	Overtemperature at the output stage or within the frequency converter	Ambient temperature too high	Maintain the ambient temperature below 45°C max.
			Insufficient cooling	Improve cooling
5	Overspeed warning	The actual frequency exceeds the setpoint by more than 10 Hz.	Frequency converter is defective	Inform Oerlikon Leybold Vacuum Service.
6	Overload error	The rotary speed of the pump has dropped below the minimum speed	Vacuum pressure too high	Check ultimate pressure of the backing pump and if required install a larger backing pump
			Gas flow too high	Seal leak, check process
7	Run up time error	The pump has not reached its normal operating frequency after the maximum run-up time has elapsed	Vacuum pressure too high	Check ultimate pressure of the backing pump and if required install a larger backing pump
			Gas flow too high	Seal leak, check process
8	Pump error	Pump could not be identified or no pump has been connected	Pump not correctly connected to the frequency converter	Check connection between pump and frequency converters
			Defective hardware	Inform Oerlikon Leybold Vacuum Service

# Error memory

Error code	Designation	Description	Possible cause	Remedy
9	Bearing temperature error	The maximum permissible bearing temperature was exceeded	Vacuum pressure too high	Check ultimate pressure of the backing pump and if required install a larger backing pump
			Gas flow too high	Seal leak, check process
			Fan is defective	Replace the fan
			Water cooling switched off	Switch on water cooling
12	Orbit monitoring level XY1	Deflection of the rotor at the radial magnetic bearing on the high vacuum side was too great	Mechanical impacts, possibly due to maintenance work	Remove external influences. If the error still occurs, inform Oerlikon Leybold Vacuum Service
			Interacting vibrations between several pumps	
			Vibration influence from external excitation	
			Balancing condition of the rotor is inadequate	
13	Orbit monitoring level XY2	Deflection of the rotor at the radial magnetic bearing on the forevacuum side was too great	Mechanical impacts, possibly due to maintenance work	Remove external influences. If the error still occurs, inform Oerlikon Leybold Vacuum Service
			Interacting vibrations between several pumps	
			Vibration influence from external excitation	
			Balancing condition of the rotor is inadequate	
14	Orbit monitoring axial	Deflection of the rotor at the axial bearing is too great	Mechanical impacts, possibly due to maintenance work	Remove external influences. If the error still occurs, inform Oerlikon Leybold Vacuum Service
			Interacting vibrations between several pumps	
			Vibration influence from external excitation	
16	Constant overload error	The speed of the pump has dropped below the normal operation threshold and has stayed there for some time	Vacuum pressure too high	Check ultimate pressure of the backing pump and if required install a larger backing pump
			Gas flow too high	Seal leak, check process
17	Motor current error	Motor current is below nominal current	Cable fault Faulty connector	Inform Oerlikon Leybold Vacuum Service
18	Motor connection error	Connection between pump and frequency converter is faulty	Pump not correctly connected to the frequency converter	Check connection between pump and frequency converter

# Error memory

Error code	Designation	Description	Possible cause	Remedy
19	Pass-through time error	The pump has not reached the minimum speed after the maximum pass-through time.	Vacuum pressure too high Gas flow too high Blocked rotor	Check ultimate pressure of the backing pump and if required install a larger backing pump Seal leak, check process Checked to see that the rotor turns freely. Inform the service in case of a blocked or damaged pump
26	Bearing temperature sensor error, top	The bearing temperature sensor is defective.	Defective component, short-circuit or broken cable	Inform Oerlikon Leybold Vacuum Service
28	Motor temperature sensor error	The motor temperature sensor is defective	Defective component, short-circuit or broken cable	Inform Oerlikon Leybold Vacuum Service
31	Constant high load error	The motor current has exceeded the warning level for too long	Vacuum pressure too high Gas flow too high	Check ultimate pressure of the backing pump and if required install a larger backing pump Seal leak, check process
39	General magnetic bearing error	General magnetic bearing error	Error during self test Magnetic bearing is defective	If the error cannot be acknowledged or appears repeatedly, inform Oerlikon Leybold Vacuum Service
73	Start cycles exceeded	The recorded number of start and standby cycles exceeds the permissible alarm limit.	Intensive utilisation of the standby function or very high number of start-ups	Have the pump serviced
74	Running time exceeded by the application	The operating time of the pump reaches the provided for alarm limit.	Running time of the system has reached a necessary servicing point of time	Have the pump serviced
77	Too many bearing touchdowns were detected.	The recorded number of bearing touchdowns exceeds the permissible alarm limit.	Frequent pump shutdown due to mains power failures	Have the pump serviced
78	A too long bearing touchdown time was detected.	The recorded total duration of all touchdown contacts exceeds the permissible alarm limit.	Frequent pump shutdown due to mains power failures	Have the pump serviced
81	Watchdog for monitoring the USS communication has responded	The cyclic communication has failed for a longer period of time as defined through P182	Cable connected to the controller was removed Controller has interrupted communication Interface plug-in is defective	Insert the cable again Check controller Inform OerlikonLeybold Vacuum Service

In theory also further codes are possible. Should these occur please contact Oerlikon Leybold Vacuum.

In the case of malfunctions please 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.

P227, Bit	Designation	Condition
0	Motor temperature warning	$P7 > P16$
1	Converter temperature warning	$P11 > \text{warning threshold for converter temperature (69°C)}$
2	Bearing temperature warning, top	$P125 > P126$
3, 4	–	
5	Weak PK communication	P228, Bit 6 or 7
6	Overspeed warning	$P3 > P18+10$
7 to 9	–	
10	Unbalance X axis	$P220 > 164/500 \cdot P102 \cdot P113$
11	Unbalance Y axis	$P221 > 164/500 \cdot P103 \cdot P114$
12	Unbalance Z axis	$P222 > 164/500 \cdot P104 \cdot P115$
13 to 15	–	

### P228, Bit

0 to 10	–	
11	Magnetic bearing not lifted	Rotor of the pump cannot be lifted
12	Magnetic bearing overloaded (Level 1)	Current too high in the magnetic bearing
13	Internal electronics overloaded	Overtemperature
14, 15	–	

### P230, Bit

0	PK CRC data error	Faulty data in the received string
1	PK CRC protocol error	Protocol error in the received string
2	PK timeout error	
3	–	
4	Magnetic bearing overloaded (Level 2)	Current too high in the magnetic bearing
5	Warning threshold run-up cycles exceeded	$P147 > P144$
6	Warning threshold pump operating hours exceeded	
7	Firmware error	
8	High load	
9	Magnetic bearing overloaded (Level 3)	Current too high in the magnetic bearing
10	There has been a bearing touchdown	$P105 > P109$ or $P106 > P110$
11	Overload	$P3 < P25 \cdot P24$ (attained after normal operation)
12	W_Limits	Mechanical distance magnetic bearing too small
13	–	
14	Supply voltage warning	
15	Start disable due to an error	

[illegible]

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