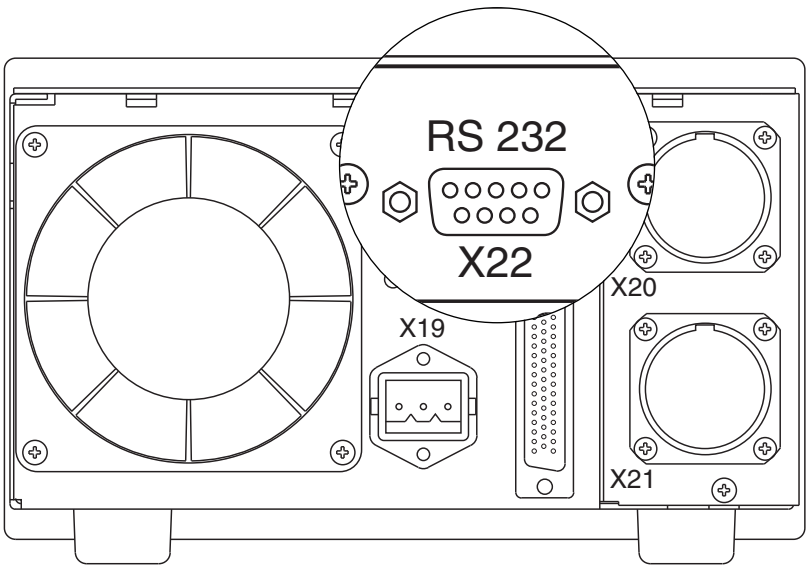
oerlikon
leybold vacuum

RS 232 Interface for MAG.DRIVE*digital*

Operating Instructions 17200148_002_A1

Part No.
400035V0014



Contents

Installation and operation of the MAG.DRIVE*digital* is described in the Operating Instructions for the pump system, for example GA05141 for the MAG*digital*. Described in these Operating Instructions is only the RS 232 interface of the MAG.DRIVE*digital*.

Important Safety Information

The Oerlikon Leybold Vacuum MAG.DRIVE*digital* frequency converter with RS 232 interface has 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 Interfaces **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 your nearest Oerlikon Leybold Vacuum office.

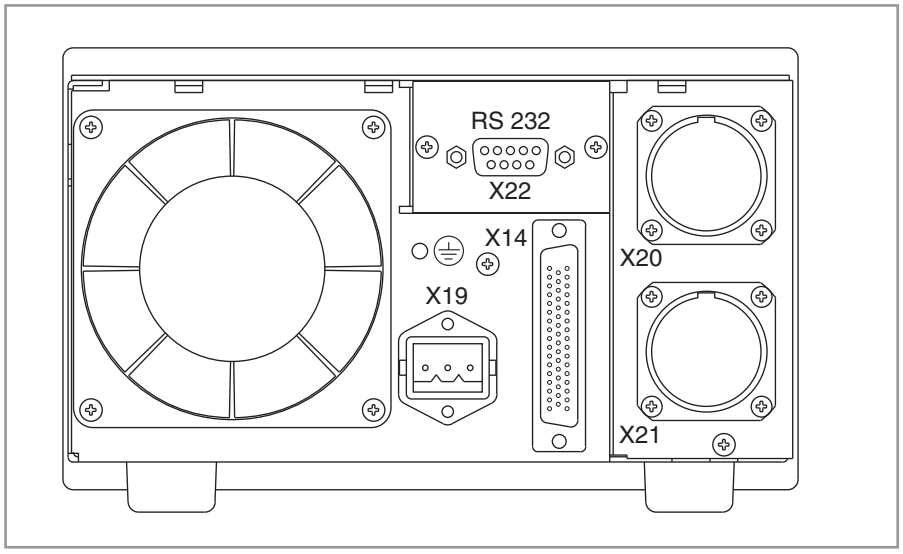


Fig. 1 MAG.DRIVE*digital* with RS 232 interface

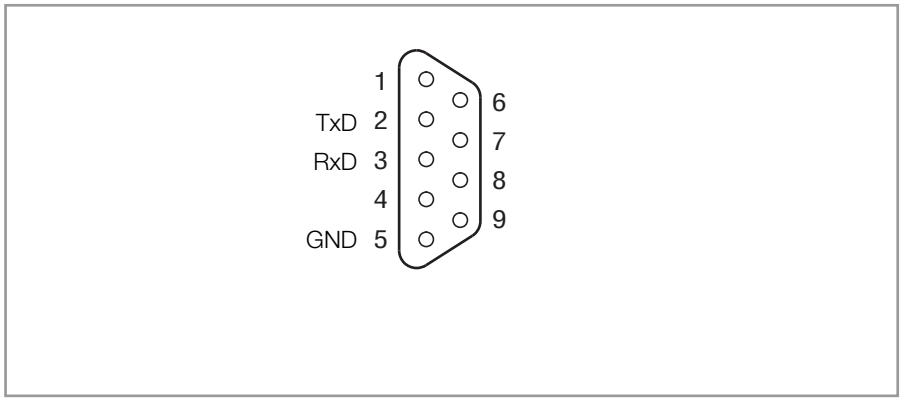


Fig. 2 Pin assignment for the socket at the frequency converter (female - RS 232)

Warning

Before making any connections, deenergise the frequency converter and wait until the pump no longer turns. Since in spite of this dangerous voltages can remain present, the equipment must only be opened by a trained electrician.

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

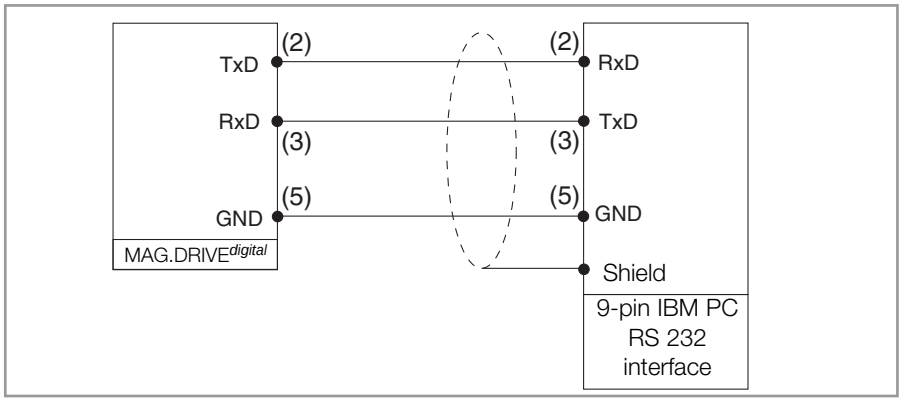


Fig. 3 Providing a RS 232 connection

1 Description

Technical data

Standards	DIN 66020
Protocol	acc. to USS protocol specification
Transmission rate	9600 baud
Address	0; not addressable
Max. cable length	5 m
Nominal voltage level (see also “Standards”)	at the receiver logic "0": 3 ... 15 V logic "1": - 3 ... - 15 V
Interface connector	9 way Sub-D type, socket on the instrument (female) thread UNC4-40

Note: If on the controlling side an interface in accordance with the PC standard is present, then a commercially available straight through cable may be used.

USS protocol

The USS protocol (universal serial interface protocol) defines a master-slave access principle for communications via a serial bus. When using the RS 232 interface, only one slave is permissible on the bus in addition to the master. The slave is selected from the master using an address character in the telegram. A slave can never send uninitiated. Communications is realized in the half duplex mode. The master function cannot be transferred (single master system).

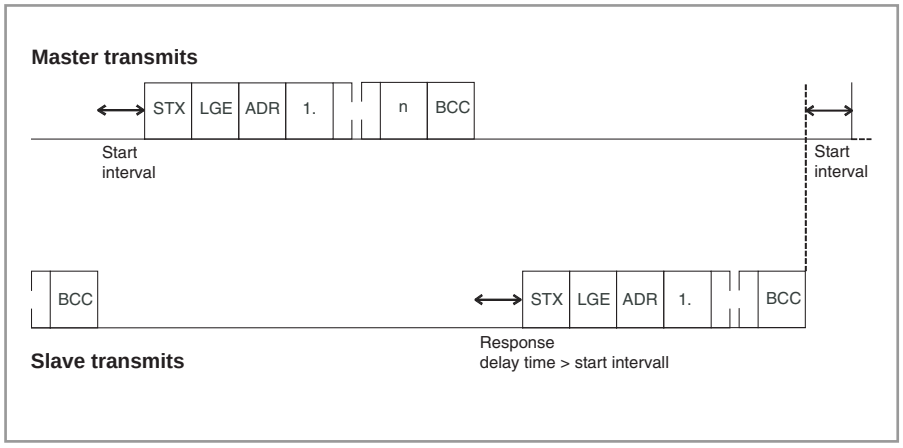


Fig. 4 Data transfer

2 Telegram data transfer

The master sends telegrams (task telegrams) to the slave and expects a response telegram from the addressed slaves. A slave must send a response telegram, if:

- it received a task telegram, fault-free and
- it was addressed in this task telegram.

The slave may not send data if these conditions are not fulfilled. For the master, the connection is established to the associated slave, if it receives a response telegram from the slave after a defined processing time (response delay time.

Data transfer interruption

With default settings, the control rights of the RS 232 bus are returned to the next lower priority level when there is no data transfer during 1 second. I.e. in case of a control cable interruption the pump does nor change its status but can e.g. be stopped with the STOP key. This behaviour is set in Parameters 179 and 182, see Section 4.3.

2.1 Data transfer procedure

A start interval without characters at least 2 characters long is specified for the master before STX, so that the slave can clearly identify the start of a telegram. This start interval is part of the telegram. A valid telegram start is exclusively specified by an STX with a previous start interval.

Data transfer is always realized as follows (half duplex operation):

The time between the last task telegram character (BCC) and the start of a response telegram (STX) is the response delay time. If the node does not respond within the maximum permissible response delay time of 20 ms, the "node X not transmitting" error signal is deposited in the master.

2.2 Task and response processing

The task- and response processing describes the sequence, both from a timing and function perspective, of data transfer for the PKW interface between master and slave.

- The master can only issue one task to an interface, and must wait for the appropriate response ID. The master must repeat its task as long as the response ID is waited for!
- The task must be completely sent in one telegram. Split task telegrams are not permitted; this is also valid for response telegrams!
- Every task change signifies a new task, which must be responded to with the associated response. The task ID "no task" should be considered just like any other task ID and must be responded to using response ID "no response"!
- If information is not required by the PKW interface in cyclic operation (only PZD 2) data are important), then the task "no task" must be issued.
- If there are significant time differences between the cyclic telegram sequence and the response in the converter, then the slave sends the response to the "old task" in the transition phase between "old task" and "new task" until it identifies the "new task" and the appropriate response has been prepared.
- When communications are first established between master and slave (the first time that the slave responds), the slave can only respond with the ID "no response" in the transition phase in which a response is prepared in the converter.
- If the master does not receive a response ID, associated with the task, from the addressed slave, the error message "node x does not respond" error message should be stored in the master.
- If the master does not have the PKW change rights, all changes from the converter are not processed, and a response is issued with the ID "no PKW change rights". All read tasks are processed.
- The slave does not expect an acknowledgement from the master as to whether the response telegram was received.
- Identification of the response to a task issued in the master: The master identifies the correct response in the response telegram by evaluating the response ID, the parameter number (PNU), and if required, by the value in IND and the parameter value.
- Identification of the new task in the slave: Each task, which the master issues after it receives a valid response to the old task, is identified as new task by the slave.

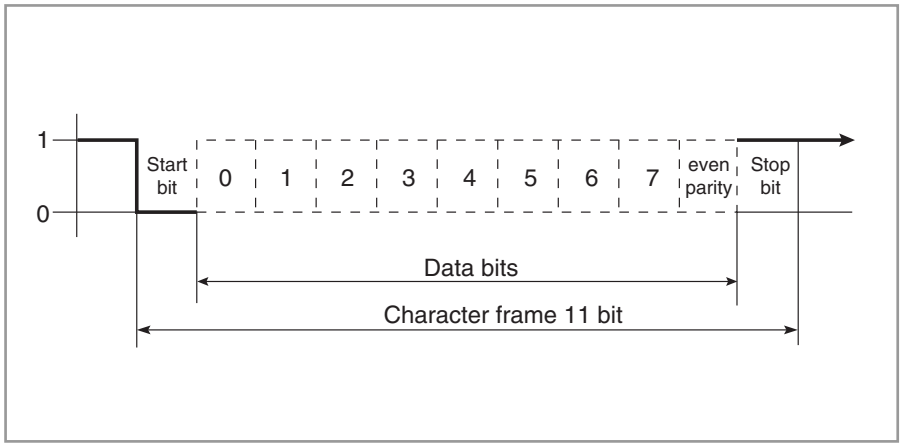


Fig. 5 Character frame with one stop bit

3 Character frames

Each transferred character begins with a start bit and ends with a stop bit. 8 data bits are transferred. If required, each character (byte) has a parity bit (even parity: The number of ones in the data bit, including the parity bit, is even). An error message is generated if this character frame is not maintained.

3.1 Telegram structure

Each telegram begins with the STX start character, followed by the length LGE and the address byte ADR. This is then followed by the net data characters. The telegram is completed by the BCC character (block check character).

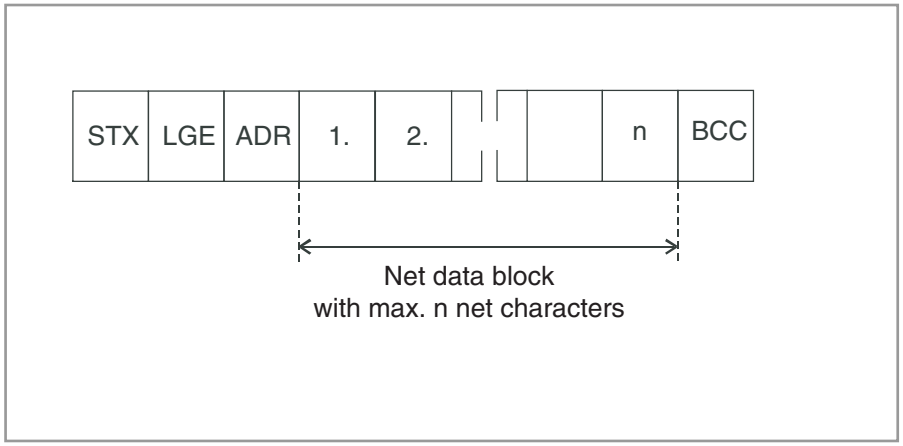


Fig. 6 Block check character (BCC)

Character frames

3.2 Data coding

- STX (start of text): ASCII characters: 02 hex.
- LGE (telegram length): 1 byte, contains the telegram length as binary number. Refer to Section3.3 Telegram length.
- ADR (address byte): 1 byte, contains the slave address and the telegram type binary coded. Refer to Section 3.3 Address byte assignment.
- Net data characters: Each 1 byte (8 data bits), contents depending on the task.
- Net data block: The net data block can be programmed in 4 different lengths. Refer to Section 3.3 Telegram length.
- BCC: Block check character; generation rules.
  Refer to Section 3.3 BCC generation.

3.3 Telegram length

Telegram transfer is realized with a fixed telegram length. This length must be set before first startup. The net data block (n net characters), address byte ADR and the BCC byte are included in the telegram length.

Thus, the following is obtained for the fixed telegram length:

For the MAG.DRIVE*digital* only one fixed lenght is implemented.

TYPE 1: 4 / 2 words (12 Bytes) LGE = 14 Bytes

Address byte assignment

Because of the used RS 232 communication the adress byte has to be always the value zero.

BCC generation

The BCC byte (block check character) is determined by EXOR.

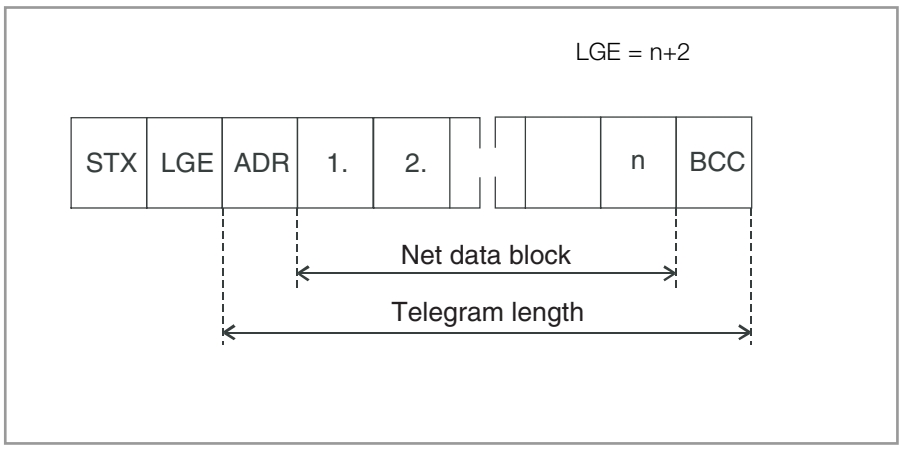


Fig. 7 Telegram length

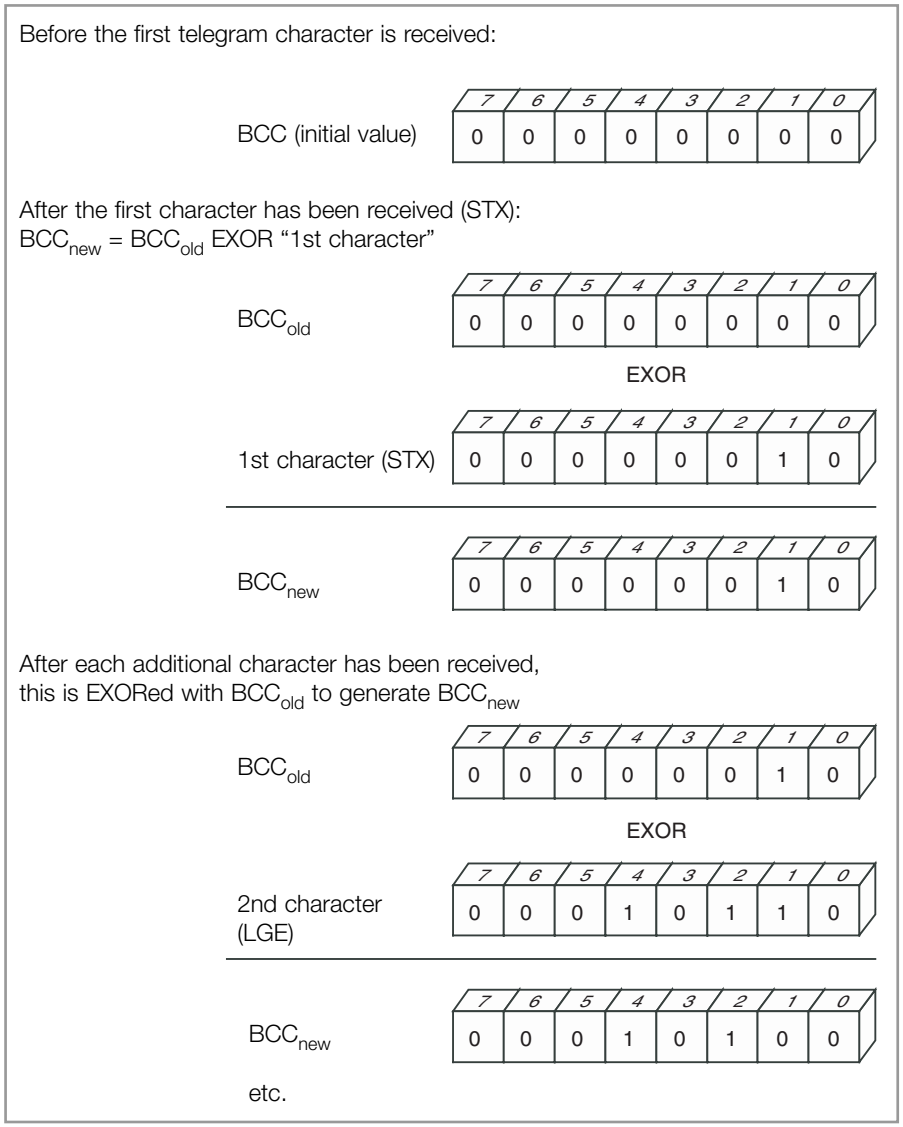


Fig. 8 Example for BCC generation

Net data block

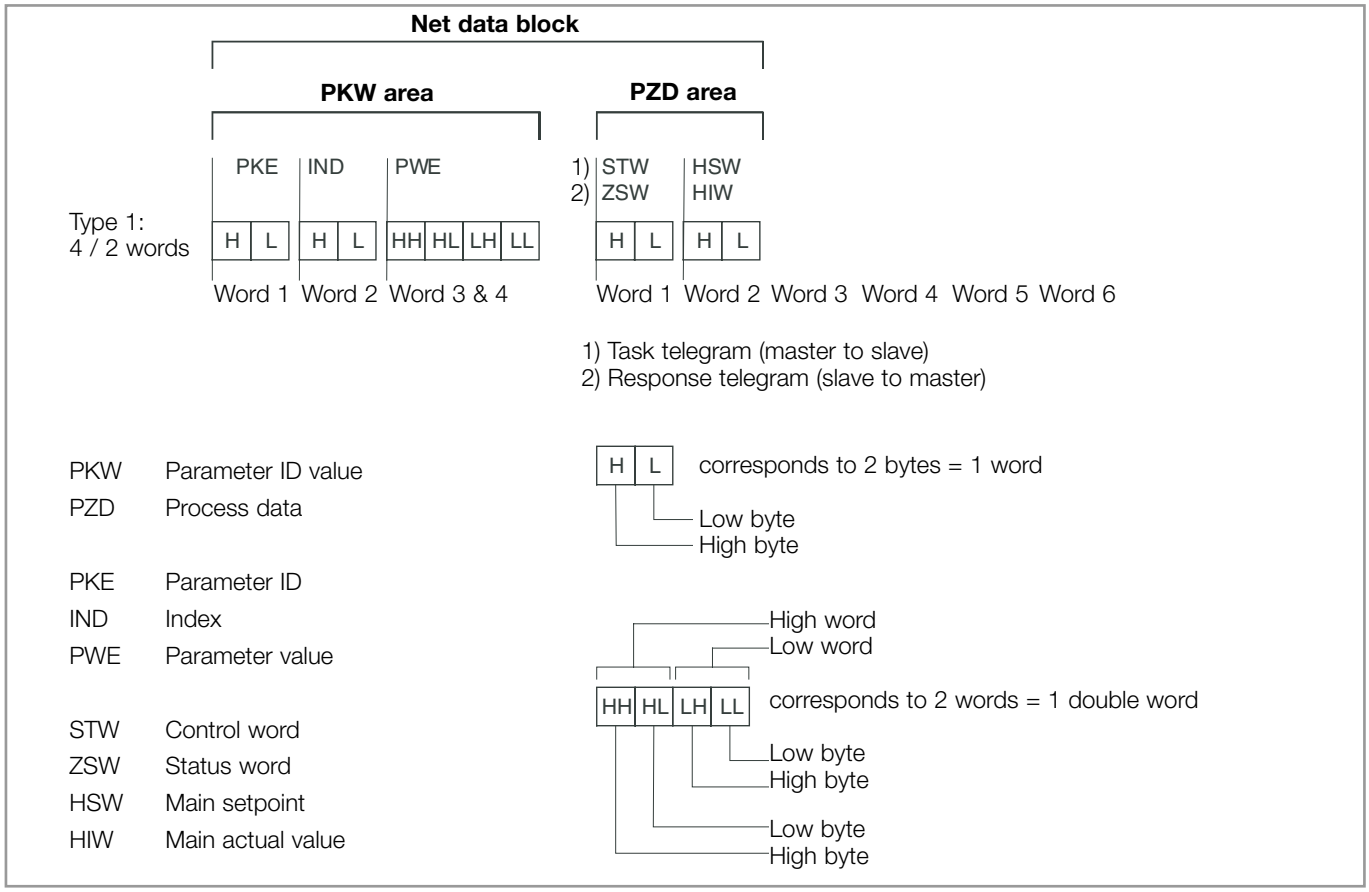


Fig. 9 Structure of the net data block

4 Net data block

For the MAG.DRIVE*digital* type 1 is implemented.

PKW area

The PKW area refers to the handling of the parameter ID value interface. PKW interface is not a physical interface, but is a mechanism, which controls parameter transfer between two communication partners, i.e. reading and writing parameter values. All of the tasks, which are realized via the PKW interface, are OPERATOR CONTROL AND VISUALIZATION tasks.

PZD area

The PZD area includes all of the signals necessary for the AUTOMATION:

- Control word and setpoints (from the master to the slave),
- Status word and actual values (from the slave to the master).

Definition acc. to USS:

Depending on the data transfer direction, the control word or the status word is transferred in **PZD1**.

The main setpoint or the main actual value is always sent in **PZD2**.

No speed setting is possible during pump rotation.

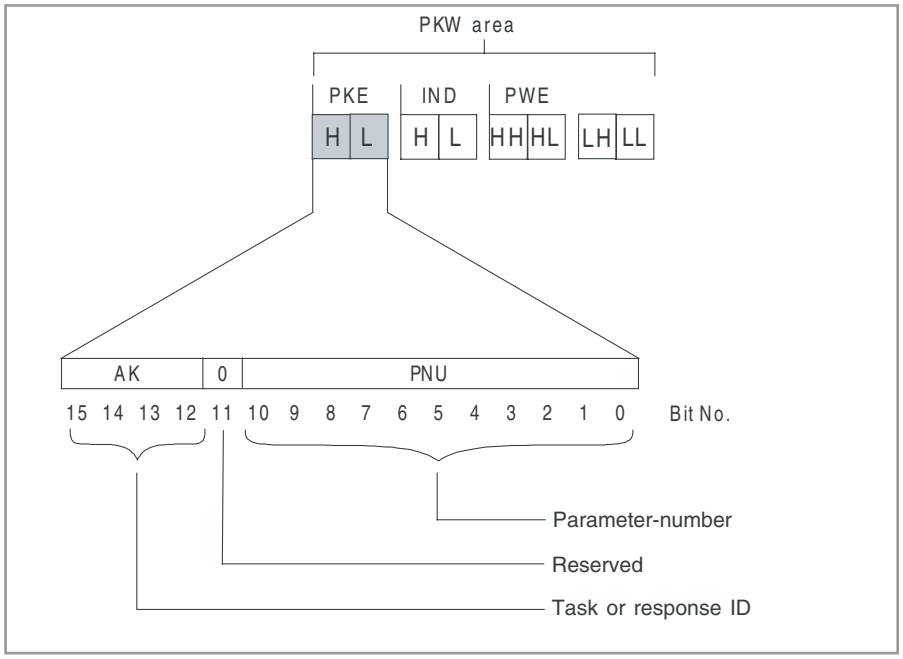


Fig. 10 PKE (parameter ID)

4.1 PKE (parameter ID)

Task- and response ID (AK)
The tasks, which are issued by the master to the slave are coded in the task ID. The slave processes the task and formulates the appropriate answer which is then returned, coded as response ID to the master. The task- and response ID is defined so that a task or a response is clearly identified by the parameter ID (PKE=AK+PNU). Specific tasks or responses are additionally defined by the index word IND. (refer to "Index word").

Parameter number (PNU)
The parameter number is contained in bits 0 to 10. You will find the parameters, arranged in increasing numbers according to the PNU, in the parameter list of the appropriate device firmware.

Functions of the task ID AK

AK bit No. 15 14 13 12	Function master to slave	Description
0 0 0 0	No task	No task
0 0 0 1	Request PWE	Request a parameter value (PWE). (16 or 32 bit) [1]
0 0 1 0	Change PWE (word)	Write a parameter value (PWE) in word format (16bit) [1]
0 0 1 1	Change PWE (double word)	Write a parameter value (PWE) in the double word format (32bit) [1]
0 1 1 0	Request PWE (array) [2]	Read a parameter value from an array. The location within the array from which the value should be read, is located in IND. Example: If IND = 4, then the PWE is transferred, which is located in the 5th element of the array. (16 or 32 bit) [1]
0 1 1 1	Change PWE (array word) [2]	Write a parameter value (PWE) in word format to a specific location in an array. (as for reading) (16 bit) [1]
1 0 0 0	Change PWE (array double word) [2]	Write a parameter value (PWE) in double-word format to a specific location in an array. (as for ID 0111) (32 bit) [1]
1 0 0 1	Request the number of array elements	Read the number of elements of an array [1]

It is always possible to read parameter values. Writing into parameters is possible depending on the password level

Functions of the response ID AK

AK bit No. 15 14 13 12	Function slave to master	Description
0 0 0 0	No response	No response
0 0 0 1	Transfer PWE (word)	Transferring a parameter value (PWE) as word (16bit) [1]
0 0 1 0	Transferring PWE (double word)	Transferring a parameter value (PWE) as double word (32bit) [1]
0 1 0 0	Transferring PWE (array word) [2]	Transferring a parameter value from the element specified in IND+1 within an array. (16 bit) [1]
0 1 0 1	Transferring PWE (array double word) [2]	As for ID 0100, only PWE in the double-word format. (32 bit) [1]
0 1 1 0	Transferring the number of array elements [2]	Transferring the number of elements of a field.
0 1 1 1	Tasks cannot be executed (with error number) [2]	The slave cannot execute the selected task. Refer to the error number for the reason.
1 0 0 0	No PKW operator control rights (authorization)	Parameter values may not be changed only read by the interface on which this protocol is running.

1) 16-bit parameter values are located in word 4 of the net data. 32-bit parameter values are located in word 3 and 4 of the net data.
2) For all tasks, which refer to an array (= one-dimensional field), the value, which is located in IND in the net data block is required to uniquely define the task.

Error ID	Description
0	Illegal parameter No.
1	Parameter cannot be changed
2	Min/ max limit
3	Erroneous index value
4	No array
5	Incorrect data type
101	Task unknown
104	Password level too low

4.2 Status and Control Bits (Status and Control Word)

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

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

Is sent to the pump for each access.

Bit	Description
0	Start pump
1 to 6	Reserved, must always be set to 0
7	Acknowledge fault
8	Standby speed
9	Reserved, must always be set to 0
10	Enable process data; enables bit 0, 6, 7, 8, 11, 12
11	Purge gas ON*
12	Venting ON*
13 to 15	Reserved, must always be set to 0

* Bit 11 and 12 are only operative provided the purge/vent function has been set through parameter 22 to remote control (control connector X14). This is the default setting

The system has 2 speed setpoints:

- Parameter 24: Nominal speed for normal operation
- Parameter 150: Standby speed

By means of bit 8 it is possible to select between the 2 values. A bit which has been set enables the standby speed. Changing of the two parameter values is possible through the plug-on controller of the frequency converter. Through the bus interface the values can only be read during operation. Write access is only possible with pump at standstill.

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

Is sent together with each response from the frequency converter.

Bit	Description	Remark
0	Ready for switch on	
1		ignore
2	Operation enabled	frequency converter is active
3	Fault condition is active	
4	Pump speed is increasing	
5	Pump speed is dropping	
6	Switch on lock	
7	Warning temperature	
8	Cooling water temperature failure	
9	Frequency converter accepts parameter	
10	Normal operation	
11	Pump is revolving	Frequency > 3 Hz
12		Ignore
13	Warning high load	
14	Warning purge not active	
15	Remote has been activated	Is set if Bit 10 in the control word is set

4.3 Main parameter list

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
1	Converter identification	103	103		103	u16	r
2	Software version	10101	65535	0.00.00	3.03.05	u16	r
3	Frequency - actual value	0	1000	Hz	-	u16	r
4	Intermediate circuit voltage Uzk	0	1500	0.1V	-	u16	r
5	Motor current - actual value	0	200	0.1A	-	u16	r
6	Power	0	65535	0.1W	-	u16	r
7	Motor temperature - actual value	0	150	°C	-	s16	r
8	Save data command A write command with any value saves temporary data into nonvolatile memory.	0	65535	0	-	s16	w
11	Converter temperature - actual value	0	1000	°C	-	s16	r
16	Motor warning temperature	0	P133	°C	130	u16	r
17	Motor nominal current	0	250	0.1A	200	u16	r
18	Nominal frequency	0	1050	Hz	490	u16	r
22	Function Purge/Venting: 0 = Purge Off 1 = Purge On 2 = Vent 3 = Function select through X14	0	3	-	3	u16	r/w
23	Pump type 10 = MAG M version 11 = MAG C version 12 = MAG CT version 13 = MAG CTF version 14 = MAG CF version	0	65535		20	u16	r
24	Nominal frequency Write access only possible with pump at standstill	P19	P18	Hz	-	u16	r/w
25	Normal operation factor of nominal frequency P24 but >P20 Setpoint of the frequency dependent normal operation level	35	99	%	95	u16	r/w
26	Indicating relay bearing temperature threshold	0	200	°C	90	u16	r/w
27	Indicating relay motor current threshold	0	P17	0.1A	70	u16	r/w
28	Indicating relay frequency threshold	0	P18	Hz	200	u16	r/w
29	Function of options relay (relay 6) Indicating relay function (conditional) 0 = Bearing temperature 1 = Motor current 2 = Frequency 3 = No cooling water 4 = No purge gas 5 = Temperature TMS OK 6 = Venting 7 = Pump standstill 8 = Start command 9 = Power supply OK 10 = Mains failure 11 = Standby	0	11	-	0	u16	r/w

Parameters

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
32	max. run-up time; max. overload time	P500	P501	s		u16	r/w
35	Display language 0 = German, 1 = English	0	1			u16	r/w
36	Start delay time: Delays the start of the pump to allow leadtime for the fore vacuum pump for example.	0	65535	s		u16	r/w
38	Number of start commands	0	65535	-	-	u16	r
44	No. of pump op. hours	0	1677216	0.1h		s32	r
102	Unbalance PVW13 limit (Limit for position signals of the rotor)	0	100	%		u16	r
103	Unbalance PVW24 limit (Limit for position signals of the rotor)	0	100	%		u16	r
104	Unbalance PZ12 limit (Limit for position signals of the rotor)	0	100	%		u16	r
122	TMS setpoint temperature	P503	P504	°C		u16	r/w
123	Actual value TMS temperature	0	140	°C	-	u16	r
125	Actual value magnetic bearing temperature	0	140	°C	-	u16	r
126	Bearing warning temperature	0	P131	°C		u16	r
127	Actual cooling water temperature	0	140	°C	-	u16	r
128	Cooling water warning temperature	0	P132	°C		u16	r
131	Bearing shutdown temperature	0	140	°C		u16	r
132	Cooling water shutdown temperature	0	140	°C		u16	r
133	Motor shutdown temperature	0	150	°C		u16	r
146	Actual value for number of standby cycles	0	65535	-	-	u16	r
147	Number of operating cycles (start cycles + standby cycles) actual value	0	2147483647	-	-	u32	r
150	Standby speed setpoint Write access is only possible with the pump at standstill	P19 + 20	P18 * P25 - 20	Hz	350	u16	r/w
151	Enabling standby 0 = Normal operation, 1 = Standby speed Caution: This parameter is not adjusted to Bit 8 in the control word			-	0	u16	r/w
167	Realtime time	0	2359	hh.mm	-	u16	r
168	Realtime date	0		yy.mm.dd	-	u32	r
171	Failure number (0..19) (see Section 5) 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 19.	0	255	-	-	u16	r
172	Failure date (0..19) Date, when error occurred. Access analogously as for parameter 171.	0		dd.mm.yy	-	u32	r
173	Failure time (0..19) Time, when error occurred. Access analogously as for parameter 171.	0	2359	hh.mm	-	u16	r
174	Failure frequency (0..19) Actual speed, when error occurred. Access analogously as for parameter 171.	0	P18	Hz	-	u16	r
176	Failure operating hours (0..19) Operating hours, when error occurred. Access analogously as for parameter 171.	0	16777216	0.01h	-	u32	r

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
179	FallbackPZD1						
	Response when cancelling the control rights or in the case of a communication interruption of the bus adapter Behaviour in case bit 10 in the control word of the bus adapter is cancelled or when interrupting the communication between converter and bus adapter (see also P182). Here it is assumed that the respective bus adapters perform a cyclic communication on the USS side, so that the respective converter electronics is capable of detecting a communication interruption The bits in parameter 179 represent an equivalent to the control word in the USS protocol. The actions linked to these bits are run provided bit 10 in the control word (USS protocol for bus adapter) is cancelled or if there are interruptions in the communication between converter and bus adapter. Here bit 10 is of special significance: Bit 10 = 0: The control rights are returned to the next lower priority level. All other bits are not relevant. Bit 10 = 1 : The control rights remain unchanged. The actions linked to the other bits are run.	0	65535		0	u16	r/w
182	Fieldbus RS232 Timeout						
	Delay when cancelling the control rights of the bus adapter and time-out in the case of a communication interruption. Defines the time characteristic when cancelling bit 10 in the control word of the USS protocol or when an interruption in the communication between bus adapter and converter and electronics is detected. Handling when cancelling bit 10 or when there is an interruption on the communication side of the USS bus adapter, is the same. Value 0 indefinite time delay. In this way a change of the control right is inhibited. Values 1 ..6553.5: A change in the control right corresponding to the setting of parameter 179 is only effected after the time span defined through parameter 182 has elapsed.	0	65535	0.1s	10	u16	r/w
184	Converter operating hours	0	2147483647	0.01h	-	u32	r
200	Unbalance PZ12 (Actual position signals of the rotor)	-20000	19999	0.01%		s16	r
201	Unbalance PV13 (Actual position signals of the rotor)	-20000	19999	0.01%		s16	r
204	Unbalance PW24 (Actual position signals of the rotor)	-20000	19999	0.01%		s16	r
209	Actual value from Analog input 1	0	10000	0.01%		u16	r
210	Actual value from Analog input 2	0	10000	0.01%		u16	r
214	Function Purge/Venting; actual value 0 = Purge Gas OFF 1 = Venting ON 2 = Purge ON	0	2	-		u16	r
220	PVW13 peak (Actual value of position signals)	0	19999	0.305mV		u16	r
221	PVW24 peak (Actual value of position signals)	0	19999	0.305mV		u16	r
222	PZ12 peak (Actual value of position signals)	0	19999	0.305mV		u16	r
227	Warning_Bits 1 see section 6	0	65535	-	-	u16	r
228	Warning_Bits 2 see section 6	0	65535	-	-	u16	r
229	Actual value of TMS heating current	0	1000	0.1A	-	u16	r
230	Warning_Bits 3 see section 6	0	65535	-	-	u16	r
240	Function of options relay (relay 7) Bit 0 to 10 as P29	0	11	-		u16	r/w

Parameters

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
241	Function for digital input X14.45 0 = Without function 1 = Standby 2 = Failure reset	0	2	-	1	u16	r/w
242	Function for digital input X14.46 0 = Without function 1 = Standby 2 = Failure reset	0	2	-	2	u16	r/w
245	Max. firmw. vers. conv.	0	65535			u16	r
246	Min. firmw. vers. conv.	0	30311			u16	r
303	Pump status Bit 0 Normal operation Bit 1 Pump ready Bit 2 Speed is increasing Bit 3...Speed is dropping Bit 4...Generator operation Bit 5...Standby Bit 6...reserved Bit 7...reserved	0	65535	-	-	u16	r
312	Converter catalogue number (Index 0...10)	0	65535	ASCII	-	u16	r
313	Converter product name (Index 0...10)	0	65535	ASCII	-	u16	r
315	Converter serial number (Index 0...10)	0	65535	ASCII	-	u16	r
316	Hardware version converter	0	65535			u16	r
318	Function of options relay (relay 8) Bit 0 to 10 as P29	0	11	-	8	u16	r/w
319	Function of options relay (relay 9) Bit 0 to 10 as P29	0	11	-	10	u16	r/w
325	Failure memory 1 (Parameter which is to be saved)	0	1023	-	125	u16	r
326	Failure memory 2 (Parameter which is to be saved)	0	1023	-	123	u16	r
327	Failure memory 3 (Parameter which is to be saved)	0	1023	-	127	u16	r
328	Failure memory 4 (Parameter which is to be saved)	0	1023	-	7	u16	r
329	Failure memory 5 (Parameter which is to be saved)	0	1023	-	303	u16	r
330	Failure memory 1 parameter value (array 0..19)	0	65535	-	-	u16	r
331	Failure memory 2 parameter value (array 0..19)	0	65535	-	-	u16	r
332	Failure memory 3 parameter value (array 0..19)	0	65535	-	-	u16	r
333	Failure memory 4 parameter value (array 0..19)	0	65535	-	-	u16	r
334	Failure memory 5 parameter value (array 0..19)	0	65535	-	-	u16	r
335	Failure memory 1 saved parameter (array 0..19)	0	1023	-	-	u16	r
336	Failure memory 2 saved parameter (array 0..19)	0	1023	-	-	u16	r
337	Failure memory 3 saved parameter (array 0..19)	0	1023	-	-	u16	r
338	Failure memory 4 saved parameter (array 0..19)	0	1023	-	-	u16	r
339	Failure memory 5 saved parameter (array 0..19)	0	1023	-	-	u16	r

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
348	Scale factor analog outp.	0	10000	0.01%		u16	r/w
349	Version of the data set AMB	0	65535	z.yy	-	u16	r
350	Catalogue number of the pump (Array 0...10 of ASCII character)	0	65535	ASCII	-	u16	r
352	Software version pump identifier; states the revision status of the software: x.yy.zz	0	65535	z.yy.xx	-	u16	r
353	Hardware or version of the pump identifier z --> Layout yy --> modification index xx --> circuit diagram edition	0	65535	z.yy.xx	-	u16	r
354	Type and version of the data set of the pump identifier	65535	x.yy		-	u16	r
355	Serial number of the pump (Array 0...10 ASCII characters)	0	65535	ASCII	-	u16	r
356	Parameter for analog output Defines, which parameter value has to be transfer to the analog output	0	1023		125	u16	r/w
397	Pump type text (Index 0...2)	0	65535	ASCII		u16	r
398	Pump size (e.g. 1500 for MAG 1500)	0	65535	ASCII	-	u16	r
399	Pump name (Index 0...13)	0	65535	ASCII		u16	r

Access: r: read-only; r/w : read and write

4.4 Additional parameters (for information)

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
9	Password (only for internal use)						r
10	Only for internal use	0	65535			u16	r
12	Only for internal use	0	2			u16	r/w
13	Only for internal use	0	1			u16	r
14	Kp factor (frequency regulator)	0	300			u16	r
15	Tn factor (frequency regulator	0	5000	ms		u16	r
19	Minimum frequency	0	500	Hz	200	u16	r
20	internal frequency setpoint	0	500	Hz	300	u16	r
30	only for internal use	0	5			u16	r/w
31	only for internal use	0	20			u16	r/w
33	only for internal use	0	1			u16	r/w
37	Bus adress for communication port	0	31			u16	r/w
39	No. of TMS failures	0	65535			u16	r
40	No. of all errors	0	65535			u16	r
41	No. of overload errors	0	65535			u16	r
42	No. of motor temp. errors	0	65535			u16	r
43	No. of mains volt fails	0	65535			u16	r
50	Only for internal use	0	2147483647			u32	r
52	Only for internal use	0	2147483647			u32	r
54	Production date	0	2147483647	0.00.00	-	u32	r
56	Service date	0	2147483647	0.00.00	-	u32	r
58	only for internal use	-2147483647	2147483647			s32	r
60	Operating hours count since last maintenance	0	2147483647	0.01h	0	u32	r
62	Repair date	0	2147483647	0.00.00	0	u32	r
64	Repair identification	0	2147483647	-	0	u32	r
66	Operating hours count since last repair	0	2147483647	0.01h	0	u32	r
68	only for internal use.	-2147483647	2147483647			s32	r
70	Only for internal use	-2147483647	2147483647			s32	r
72	Only for internal use	-2147483647	2147483647			s32	r
74	Only for internal use	0	65535	m/s^2		u16	r
76	Only for internal use	0	65535	m/s^2		u16	r
78	Only for internal use	0	65535	m/s^2		u16	r
80	Only for internal use	0	65535	0.001 m/s^2		u16	r
82	Only for internal use	0	65535	s		u16	r
84	Only for internal use	0	65535			u16	r
85	Only for internal use	0	65535			u16	r

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
86	Only for internal use	0	65535			u16	r
87	Only for internal use	0	65535			u16	r
99	Only for internal use	0	3			u16	r
100	Magn. bearing identifier	0	65535			u16	r
101	No. of magn. bearing axis	0	65535			u16	r
105	Only for internal use	0	65535			u16	r
106	Only for internal use	0	65535	0.01s		u16	r
107	Only for internal use	0	65535	0.01µm		u16	r
108	Only for internal use	0	100	%		u16	r
109	Only for internal use	0	20			u16	r
110	Only for internal use	0	1000	0.1s		u16	r
111	ABS release frequency	0	1050	Hz		u16	r
112	Only for internal use	0	200	0.1A		u16	r
113	Standardis. PV13	0	500	0.01V		u16	r
114	Standardis. PW24	0	500	0.01V		u16	r
115	Standardis. PZ12	0	500	0.01V		u16	r
117	Only for internal use	0	1050	0.1Hz		u16	r
118	Only for internal use	0	10000	0.1s		u16	r
120	Only for internal use	0	1			u16	r
121	Only for internal use.	0	100	0.1Hz		u16	r
129	Only for internal use	0	1			u16	r/w
144	Number of start cycles warning limit	0	200000	-		u16	r
145	Shutdown limit for number of start cycles during operation	0	300000	-		u16	r
148	Scale factor standby	0	1000	0.01%	100	u16	r
149	Hysteresis standby	5	50	Hz	20	u16	r
154	Operating hours warning limit	0	2147483647	0.01h	3700000	u32	r
155	Operating hours during operation error limit	0	2147483647	0.01h	4000000	u32	r
156	Cycle counter upon start limit	0	300000	-	4700	u16	r
157	Operating hours upon start error limit	0	2147483647	0.01h	3900000	u32	r
158	Enabling Warning/Alarm for limits Parameter 145,155,156,157 0 = Warning 1 = Alarm	0	1	-	0	u16	r/w
160	Setclock	0	1			u16	r
161	Adjustseconds	0	59			u16	r
162	Adjustminutes	0	59			u16	r
163	Adjusthours	0	23			u16	r
164	Adjustdays	1	31			u16	r
165	Adjustmonths	1	12			u16	r

Parameters

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
166	Adjustyears	1991	2089			u16	r
169	only for internal use	-2147483647	2147483647			u32	r
170	only for internal use	-2147483647	2147483647			u32	r
175	only for internal use	0	65535			u16	r
207	Only for internal use	0	2000	mbar		s16	r
208	Only for internal use	0	250	mbar		s16	r
212	Only for internal use	0	10000	0.1Hz		u16	r
213	Only for internal use	0	10000	0.1Hz		u16	r
215	Only for internal use	0	25			u16	r
216	Only for internal use	0	1050	Hz		u16	r
231	Only for internal use	0	65535			u16	r
243	Time delay SEMI F47	0	2000	0.01s	500	u16	r
244	Max. time delay SEMI F47	0	65535	0.01s	6000	u16	r
300	Only for internal use	0	65535			s32	r
301	Only for internal use	-2147483647	2147483647			s32	r
302	Only for internal use	-2147483647	2147483647			u16	r
305	Only for internal use.	0	100	°C	20	u16	r
306	Only for internal use	0	100	°C	20	u16	r
311	Only for internal use	0	65535	ASCII		u16	r
314	Only for internal use	0	65535	ASCII		u16	r
320	ABS off frequency	0	1050	Hz	140	u16	r
321	Current trip warning time	0	65535	0.1s		u16	r
322	Current trip alarm time	0	65535	0.1s		u16	r
323	Supply overld. warn. time	0	65535	0.1s		u16	r
324	Supply overld. alarm time	0	65535	0.1s		u16	r
340	Only for internal use	0	19			u16	r
341	Only for internal use	0	65535			u16	r
347	Only for internal use	0	200	0.1A		u16	r
351	Only for internal use	0	1050	Hz		u16	r
357	Only for internal use	20	250	0.1A	200	u16	r
358	Only for internal use	20	250	0.1A	180	u16	r
359	Only for internal use	0	150	°C	120	u16	r
360	Only for internal use	-999999	999999			s32	r
361	Only for internal use	-999999	999999			s32	r
362	Only for internal use	-999999	999999			s32	r
363	Only for internal use	-999999	999999			s32	r

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
364	Only for internal use	-999999	999999			s32	r
365	Only for internal use	-999999	999999			s32	r
366	Only for internal use	-999999	999999			s32	r
367	Only for internal use	-99999	99999			s32	r
368	Only for internal use	-99999	99999			s32	r
369	Only for internal use	-99999	99999			s32	r
370	Only for internal use	-99999	99999			s32	r
371	Only for internal use	-99999	99999			s32	r
372	Only for internal use	-99999	99999			s32	r
373	Only for internal use	-99999	99999			s32	r
374	Only for internal use	20	250	0.1A	40	u16	r
375	Only for internal use	0	250	0.1A	200	u16	r
376	Only for internal use	0	50		20	u16	r
377	Only for internal use	0	500		30	u16	r
378	Only for internal use	0	500		70	u16	r
379	Heating on hysteresis	-10	10	K	-1	s16	r
380	Heating off hysteresis	-10	10	K	0	s16	r
381	Cool. valve off hyst.	-10	10	K	0	s16	r
382	Cool. valve on hyst.	-10	10	K	-1	s16	r
386	Only for internal use	0	140	°C		u16	r
400	Pump identifier	0	65535			u16	r
401	AMB software version	0	65535	z.yy.xx	-	u16	r
402	Only for internal use	0	65535			u16	r
403	Only for internal use	0	65535			u16	r
404	Only for internal use	0	65535			u16	r
405	Only for internal use	0	65535			u16	r
406	Only for internal use	0	65535			u16	r
407	Only for internal use	0	65535			u16	r
408	Only for internal use	0	65535			u16	r
410	Out init vec. rev 13	0	65535			u16	r
411	Out init vec. imv 13	0	65535			u16	r
412	Out init vec. rev 24	0	65535			u16	r
413	Out init vec. imv 24	0	65535			u16	r
414	Out init vec. rew 13	0	65535			u16	r
415	Out init vec. imw 13	0	65535			u16	r
416	Out init vec. rew 24	0	65535			u16	r
417	Out init vec. imw 24	0	65535			u16	r

Parameters

No.	Designation	Min. value	Max. value	Unit	Default	Type	Access
420	Out init vec. rev 13 AMB	0	65535			u16	r
421	Out init vec. imv 13 AMB	0	65535			u16	r
422	Out init vec. rev 24 AMB	0	65535			u16	r
423	Out init vec. imv 24 AMB	0	65535			u16	r
424	Out init vec. rew 13 AMB	0	65535			u16	r
425	Out init vec. Imw 13 AMB	0	65535			u16	r
426	Out init vec. rew 24 AMB	0	65535			u16	r
427	Out init vec. Imw 24 AMB	-32767	32767			u16	r
428	Only for internal use	0	65535			u16	r
448	Only for internal use	0	65535			u16	r
449	Only for internal use	0	25			u16	r
450	Only for internal use	0	65535			u16	r
451	Only for internal use	0	65535			u16	r
452	Only for internal use	0	3			u16	r
453	Only for internal use	0	100			u16	r
454	Only for internal use	0	100			u16	r
455	Only for internal use	0	100			u16	r
500	Minimum value for maximum run-up time	0	P501	s	-	u16	r
501	Maximum value for maximum run-up time	P500	10000	s	-	u16	r
502	Max. start delay	0	10000	s		u16	r
503	Min. selectable TMS setpoint temperature	0	P504	°C	-	u16	r
504	Max. selectable TMS setpoint temperature	P503	140	°C		u16	r
506	Only for internal use	0	65535			u16	r
507	Only for internal use	0	16777216	h		u16	r
508	Only for internal use	0	10000	h		u16	r
800	Only for internal use	0	65535			u16	r
801	Only for internal use	0	65535			u16	r
803	Only for internal use	0	0			u16	r
1019	Data Conflict (Index 0...1)	0	65535			u16	r
1020	Only for internal use	0	65535			u16	r/w

5 Failure Memory

Possibly existing failure states can be called through parameter 171.

No.	Description	Run down	Active braking	Entry in failure memory	Remark/condition (P = Parameter)
0	No failure	—	—	—	
1	Overload (load limit exceeded)	no	no	yes	P3 < P25 x P24
2	Motor temperature too high	yes	yes	yes	P7 > P133
3	There has been a mains failure	yes	no	yes	Mains failure while the pump was operative
4	Converter temperature too high	yes	yes	yes	
5	An overspeed has occurred	no	no	no	P3 > (P24 + 10 Hz)
6	During overload the shutdown frequency has dropped below the limit	yes	yes	yes	
7	Max. run-up time was exceeded	yes	yes	yes	in P32 (P3 > P25 x P24) not reached
8	Pump identification communication failure	yes	yes	no	Internal electronics failure
9	Bearing temperature too high	yes	yes	yes	P125 > P131
10	Cooling water temperature too high	yes	yes	yes	P127 > P132
11	Warning TMS failure	no	no	no	
12	Warning Unbalance PVW13	no	no	no	
13	Warning Unbalance PVW24	no	no	no	
14	Warning Unbalance PZ12	no	no	no	
15	Warning magnetic bearings	no	no	no	
16	Max. overload time has been exceeded	yes	yes	yes	(P3 < P25 x P24) longer than P32
17	No motor current	yes	no	yes	
18	Pump connection converter failure	yes	yes	yes	
19	Run-up time has been exceeded	yes	yes	yes	P20 in P22 not reached
20 to 24	TMS failure	yes	yes	yes	
26	Bearing temperature sensor short-circuit failure	yes	yes	yes	
27	Cooling water temperature sensor short-circuit	yes	yes	yes	
28	Motor temperature sensor short-circuit	yes	yes	yes	
29	Bearing temperature sensor interruption failure	yes	yes	yes	
30	Cooling water temperature sensor interruption failure	yes	yes	yes	
31, 32	Internal connection failure	no	no	no)	

Failure memory

No.	Description	Run down	Active braking	Entry in failure memory	Remark/condition (P = Parameter)
33	Magnetic bearing overload PZ12	yes	yes	yes	
34	Magnetic bearing overload PV13	yes	yes	yes	
35	Magnetic bearing overload PW24	yes	yes	yes	
37	Flow warning	no	no	no)	
38	Warning operation without purge gas	no	no	no	
39	Magnetic bearing failure	yes	yes	yes	
40	Magnetic bearing, purge gas OFF	yes	yes	yes	
41	Magnetic bearing, purge gas ON	yes	yes	yes	
42	Magnetic bearing code wrong	yes	yes	yes	
43 to 55	Internal failure	yes	yes	yes	If one of the failures 43 to 55 occurs, functioning of the MAG should be checked for safety reasons. For this consult us.
56	External shutdown for protection	yes	no	no	Emergency contact at the hardware interface is interrupted.
57 to 62	Internal failure	no	no	no	
63	Internal communication failure (SPI)	yes	yes	yes	
64	Magnetic bearing electronics not properly initialised (data set error)	yes	yes	yes	
65	Internal communication timeout	yes	yes	yes	
66	Magnetic bearing overloaded	yes	yes	yes	
67	Internal overload	yes	yes	yes	
68	Rotor not lifted	yes	yes	yes	
69	ABS inactive warning	no	no	no	
70	ABS active warning	no	no	no	
71	Failure during parameter download	—	—	no	
72	Failure during firmware download	—	—	no	
73	Operating cycles limit has been reached	yes	yes	yes	
74	Operating hours limit has been reached	yes	yes	yes	
75	Faulty configuration	—	—	no	
76	Firmware update is required	—	—	no	

6 Parameter Warning

Possibly existing current warning states can be called through the parameters 227, 228, and 230.

The parameters 227 (Warning_Bits 1)

228 (Warning_Bits 1)

230 (Warning_Bits 1)

have been assigned for this as follows:

Parameter 227

Bit	Description
0	Motor temperature
1	Converter temperature
2	Bearing temperature
3	Cooling water temperature
4	TCU temperature
5	Pump identifier communication
6	Overspeed
7	TCU collective warning
8	No flow
9	Magnetic bearing code
10	Imbalance PVW13 warning
11	Imbalance PVW24 warning
12	Imbalance PZ12 warning
13	No purge gas
14	Too much purge gas
15	Operation without purge gas

Warnings

Parameter 228

Bit	Description
0	TMS heater failed
1	TMS time error
2	TMS Pt 100 defective
3	TMS heating current too high
4	TMS fuse defective
5	
6	Pump identifier read error
7	Pump identifier write error
8	Pump identifier without communication upon switch on
9	ABS inactive
10	ABS active
11	Magnetic bearing inactive
12	Magnetic bearing overloaded
13	Internal overload
14	SPI communication (AMB2SR)
15	SPI communication (SR2AMB)

Parameter 230

Bit	Description
0	Pump identifier CRC data error
1	Pump identifier CRC protocol error
2	Pump identifier timeout
3	TMS temperature incorrect
4	Unassigned
5	Number of cycles
6	Number of hours
7	EEPROM contents
8 to 15	Unassigned

oerlikon
leybold vacuum

CE

EC Manufacturer's and Conformance Declaration

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

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

Designation:	Frequency converter
Model:	**MAG.DRIVE*digital***
Part No.:	400035V0014

The products comply to the following guidelines

- EC Low-Voltage Equipment Guidelines (2006/95/EG)
- EC Directive on Electromagnetic Compatibility (2004/108/EG)

Related, harmonized standards

- EN 61010-1: 2001 Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
- EN 61000-6-4:2007 Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments
- EN 61000-6-2:2005 Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments

Cologne, 20. 10. 2008

Dr. Ulrich Jung
Vice-President
Head of Product Development

Cologne, 15. 10. 08

i. V.

Harald Udelhoven
Head of Quality Management

Oerlikon Leybold Vacuum GmbH
Bonner Strasse 498
D-50968 Cologne
Phone: +49-221-347 0
Fax: +49-221-347 1250
documentation.vacuum@oerlikon.com

Sales and Service

Germany

Oerlikon
Leybold Vacuum GmbH
Bonner Strasse 498
D-50968 Cologne
Phone: +49-(0)221-347 1234
Fax: +49-(0)221-347 1245
sales.vacuum@oerlikon.com
www.oerlikon.com

Oerlikon
Leybold Vacuum GmbH
Sales Area North/Northeast
Branch Office Berlin
Industriestrasse 10b
D-12099 Berlin
Phone: +49-(0)30-435 609 0
Fax: +49-(0)30-435 609 10
sales.vacuum.bn@oerlikon.com

Oerlikon
Leybold Vacuum GmbH
Sales Area South/Southwest
Branch Office Munich
Sendlinger Strasse 7
D-80331 Munich
Phone: +49-(0)89-357 33 9-10
Fax: +49-(0)89-357 33 9-33
sales.vacuum.mn@oerlikon.com
service.vacuum.mn
@oerlikon.com

Oerlikon
Leybold Vacuum GmbH
Sales Area West & Benelux
Branch Office Cologne
Bonner Strasse 498
D-50968 Cologne
Phone: +49-(0)221-347 1270
Fax: +49-(0)221-347 1291
sales.vacuum.kn@oerlikon.com

Oerlikon
Leybold Vacuum GmbH
Service Competence Center
Emil-Hoffmann-Strasse 43
D-50996 Cologne-Suerth
Phone: +49-(0)221-347 1439
Fax: +49-(0)221-347 1945
service.vacuum.kn@oerlikon.com

Oerlikon
Leybold Vacuum GmbH
Mobil Customer Service
Emil-Hoffmann-Strasse 43
D-50996 Cologne-Suerth
Phone: +49-(0)221-347 1765
Fax: +49-(0)221-347 1944
service.vacuum.kn@oerlikon.com

Oerlikon
Leybold Vacuum
Dresden GmbH
Zur Wetterwarte 50, Haus 304
D-01109 Dresden
Service:
Phone: +49-(0)351-88 55 00
Fax: +49-(0)351-88 55 041
info.vacuum.dr@oerlikon.com

Europe

Belgium

Oerlikon
Leybold Vacuum Nederland B.V.
Belgisch bijkantoor
Leuvensesteenweg 542-9A
B-1930 Zaventem
Sales:
Phone: +32-2-711 00 83
Fax: +32-2-720 83 38
sales.vacuum.zv@oerlikon.com
Service:
Phone: +32-2-711 00 82
Fax: +32-2-720 83 38
service.vacuum.zv@oerlikon.com

France

Oerlikon
Leybold Vacuum France S.A.
7, Avenue du Québec
Z.A. Courtaboeuf 1 - B.P. 42
F-91942 Courtaboeuf Cedex
Sales and Service:
Phone: +33-1-69 82 48 00
Fax: +33-1-69 07 57 38
sales.vacuum.or@oerlikon.com

Oerlikon
Leybold Vacuum France S.A.
Valence Factory
640, Rue A. Bergès - B.P. 107
F-26501 Bourg-lès-Valence Cedex
Phone: +33-4-75 82 33 00
Fax: +33-4-75 82 92 69
info.vacuum.vc@oerlikon.com

Great Britain

Oerlikon
Leybold Vacuum UK Ltd.
Unit 2
Silverglade Business Park
Leatherhead Road
UK-Chessington, Surrey KT9 2QL
Sales:
Phone: +44-13-7273 7300
Fax: +44-13-7273 7301
sales.vacuum.ln@oerlikon.com
Service:
Phone: +44-20-8971 7030
Fax: +44-20-8971 7003
service.vacuum.ln@oerlikon.com

Italy

Oerlikon
Leybold Vacuum Italia S.p.A.
8, Via Trasimeno
I-20128 Milano
Sales:
Phone: +39-02-27 22 31
Fax: +39-02-27 20 96 41
sales.vacuum.mi@oerlikon.com
Service:
Phone: +39-02-27 22 31
Fax: +39-02-27 22 32 17
service.vacuum.mi@oerlikon.com

Netherlands

Oerlikon
Leybold Vacuum Nederland B.V.
Proostwetering 24N
NL-3543 AE Utrecht
Sales and Service:
Phone: +31-(30) 242 6330
Fax: +31-(30) 242 6331
sales.vacuum.ut@oerlikon.com
service.vacuum.ut@oerlikon.com

Spain

Oerlikon
Leybold Vacuum Spain, S.A.
C/. Huelva, 7
E-08940 Cornellà de Llobregat
(Barcelona)
Sales:
Phone: +34-93-666 46 16
Fax: +34-93-666 43 70
sales.vacuum.ba@oerlikon.com
Service:
Phone: +34-93-666 49 51
Fax: +34-93-685 40 10
service.vacuum.ba@oerlikon.com

Sweden

Oerlikon
Leybold Vacuum Scandinavia AB
Box 9084
SE-40092 Göteborg
Sales and Service:
Phone: +46-31-68 84 70
Fax: +46-31-68 39 39
info.vacuum.gt@oerlikon.com
Visiting/delivery address:
Datavägen 57B
SE-43632 Askim

Switzerland

Oerlikon
Leybold Vacuum Schweiz AG
Leutschenbachstrasse 55
CH-8050 Zürich
Sales:
Phone: +41-44-308 40 50
Fax: +41-44-302 43 73
sales.vacuum.zh@oerlikon.com
Service:
Phone: +41-44-308 40 62
Fax: +41-44-308 40 60
service.vacuum.zh@oerlikon.com

America

USA

Oerlikon
Leybold Vacuum USA Inc.
5700 Mellon Road
USA-Export, PA 15632
Phone: +1-724-327-5700
Fax: +1-724-325-3577
info.vacuum.ex@oerlikon.com
Sales:
Eastern & Central time zones
Phone: +1-724-327-5700
Fax: +1-724-333-1217
Pacific, Mountain, Alaskan &
Hawaiian time zones
Phone: +1-480-752-9191
Fax: +1-480-752-9494
Service:
Phone: +1-724-327-5700
Fax: +1-724-325-3577

Latin America

Oerlikon
Leybold Vacuum USA Inc.
Brazilian Office
Av. Dória 360 cj. 12 Campo Belo
04635-070 São Paulo SP BRAZIL
Sales:
Phone: +55 11-3554 3117
Fax: +55 11-3554 3117
Nelson.Batistucci@oerlikon.com

Asia

P.R. China

Oerlikon
Leybold Vacuum (Tianjin)
International Trade Co. Ltd.
Beichen Economic
Development Area (BEDA),
No.8 Western Shuangchen Road
Tianjin 300400
China
Sales and Service:
Phone: +86-22-2697 0808
Fax: +86-22-2697 4061
Fax: +86-22-2697 2017
sales.vacuum.tj@oerlikon.com
service.vacuum.tj@oerlikon.com

Oerlikon
Leybold Vacuum
(Tianjin) Co. Ltd.
Beichen Economic
Development Area (BEDA),
No.8 Western Shuangchen Road
Tianjin 300400
China
Sales and Service:
Phone: +86-22-2697 0808
Fax: +86-22-2697 4061
Fax: +86-22-2697 2017
info.vacuum.tj@oerlikon.com
service.vacuum.tj@oerlikon.com

Oerlikon
Leybold Vacuum (Tianjin)
International Trade Co. Ltd.
Shanghai Branch:
Add: No.33
76 Futedong San Rd.
Waigaoqiao FTZ
Shanghai 200131
China
Sales and Service:
Phone: +86-21-5064-4666
Fax: +86-21-5064-4668
info.vacuum.sh@oerlikon.com
service.vacuum.tj@oerlikon.com

Oerlikon
Leybold Vacuum (Tianjin)
International Trade Co. Ltd.
Guangzhou Office and
Service Center
1st F, Main Building
Science City Plaza,
No.111 Science Revenue,
Guangzhou Science City
(GZSC) 510663, Guangzhou,
China
Sales:
Phone: +86-20-8723-7873
Phone: +86-20-8723-7597
Fax: +86-20-8723-7875
info.vacuum.gz@oerlikon.com
service.vacuum.tj@oerlikon.com

Oerlikon
Leybold Vacuum (Tianjin)
International Trade Co. Ltd.
Beijing Branch:
1-908, Beijing Landmark Towers
8 North Dongsanhuan Road
Chaoyang District
Beijing 100004
China
Sales:
Phone: +86-10-6590-7622
Fax: +86-10-6590-7607
sales.vacuum.bj@oerlikon.com

India

Oerlikon
Leybold Vacuum India Pvt Ltd.
EL-22, J Block
MIDC Bhosari
Pune 411026
India
Sales and Service:
Phone: +91-20-3061 60000
Fax: +91-20-2712 1571
sales.vacuum.pu@oerlikon.com
service.vacuum.pu@oerlikon.com

Japan

Oerlikon
Leybold Vacuum
Japan Co., Ltd.
Headquarter
23-3, Shin-Yokohama
3-chome
Tobu A.K. Bldg. 4th Floor
Kohoku-ku
Yokohama-shi 222-0033
Sales:
Phone: +81-45-471-3330
Fax: +81-45-471-3323
info.vacuum.yh@oerlikon.com
sales.vacuum.yh@oerlikon.com

Oerlikon
Leybold Vacuum
Japan Co., Ltd.
Osaka Sales Office
5-13, Kawagishi-machi
Suita-chi
Osaka 564-0037
Phone: +81-6-6393-5211
Fax: +81-6-6393-5215
info.vacuum.os@oerlikon.com
sales.vacuum.os@oerlikon.com

Oerlikon
Leybold Vacuum
Japan Co., Ltd.
Tsukuba Technical Service Center
Kogyo Danchi
21, Kasuminosato,
Ami-machi, Inashiki-gun
Ibaraki-ken, 300-0315
Service:
Phone: +81-298 89 2841
Fax: +81-298 89 2838
info.vacuum.iik@oerlikon.com
sales.vacuum.iik@oerlikon.com

Korea

Oerlikon
Leybold Vacuum Korea Ltd.
3F. Jellzone 2 Tower, 159-4
Jeongja-Dong, Bundang-Gu
Sungnam-Si, Gyeonggi-Do
Korea 463-384
Sales:
Phone: +82-31 785 1367
Fax: +82-31 785 1359

623-7, Upsung-Dong
Cheonan-Si
Chungcheongnam-Do
Korea 330-290
Service:
Phone: +82-41 589 3035
Fax: +82-41 588 0166

Singapore

Oerlikon
Leybold Vacuum
Singapore Pte Ltd.
1 Science Park Road
Singapore Science
Park 2
#02-12, Capricorn Building
Singapore 117528
Sales and Service:
Phone: +65-6303 7000
Fax: +65-6773 0039
sales.vacuum.sg@oerlikon.com
service.vacuum.sg@oerlikon.com

Taiwan

Oerlikon
Leybold Vacuum Taiwan Ltd.
No 416-1, Sec. 3
Chung-Hsin Rd., Chu-Tung
Hsin-Chu, Taiwan, R.O.C.
Sales and Service:
Phone: +886-3-500 1688
Fax: +886-3-583 3999
sales.vacuum.hc@oerlikon.com
service.vacuum.hc@oerlikon.com

Oerlikon
Leybold Vacuum USA Inc.
5700 Mellon Road
USA-Export, PA 15632
Phone: +1-724-327-5700
Fax: +1-724-325-3577
info.vacuum.ex@oerlikon.com

Oerlikon
Leybold Vacuum GmbH
Bonner Strasse 498
D-50968 Cologne
Phone: +49-(0)221-347 0
Fax: +49-(0)221-347 1250
info.vacuum@oerlikon.com

oerlikon
leybold vacuum

www.oerlikon.com

LV_09979_2008 11.08