



PHOENIX Quadro PHOENIX Magno PHOENIX Vario

Leak detectors

Protocol Descriptions 300701205_002_C1
from software version Basic unit 1.11

Cat.-Nr.

250000V02
251000V02
251100V02
250001V02
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352200V02
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352201V02
250002V02



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Interface Protocols

The descriptive contents of the protocols is intended for use following products

- 252211V02 PHOENIX IO Interface
- 252212V02 PHOENIX Bus Interface Profibus
- 252213V02 PHOENIX Bus Interface ProfiNet
- 252214V02 PHOENIX Bus Interface DeviceNet
- 252215V02 PHOENIX Bus Interface EtherNet/IP

Interface Protocols

1 Interface Protocols

1.1 Serial Interface Protocols

With the I/O module you can communicate with the PHOENIX family via the following serial interface protocols:

- ASCII Protocol (enabled by default)
- LD Protocol

The serial interface protocol can be selected via DIP switch at the I/O module or via operating unit of the leak detector. Please refer to appropriate documentation.

1.2 Field Bus Protocol

With the Bus module you can communicate with the PHOENIX family via different fieldbus protocols (PROFIBUS-DP, PROFINET, DeviceNet, EtherNet/IP).

2 ASCII Protocol

2.1 Comparison between ASCII- and LD protocol

ASCII- and LD protocol have nearly the same functional range, but each of them have some advantages and disadvantages :

ASCII protocol:

Advantages:

- human readable
- easy to use with simple terminal program

Disadvantages:

- No checksum, therefor lower data security
- PC/ PLC software must convert numerical values from ASCII string to binary
- Lower efficiency (for example: 8 data bytes for one float value)

LD protocol:

Advantages:

- Leak detector status always transmitted in each slave telegram
- High data security due to CRC checksum
- Binary transmission of numerical values – no conversion needed in PC/PLC software
- High efficiency (for example: 4 Byte data bytes for one float value)

Disadvantages:

- Not human readable
- Not useable with simple terminal program

2.2 Communication Parameters

Data format

19200 baud, 8 data bits, no parity, 1 stop bit

2.3 Command Format

In ASCII protocol any command starts with « * » (ASCII code 42dec/2Ahex) and is finished with the end sign CR (ASCII code 13dec/0Dhex). There is no differentiation between upper and lower case. A blank is required between the command and the parameter, no other blanks are allowed.

There is a short and an extended form of the command. Either the short or the extended command must be used, no other abbreviations are allowed (The short form is here written in capitals but the SW don't difference upper and lower cases). Command Words have to be separated by a colon. A command can be composed of up to three words. Parameters have to be separated by a comma.

ASCII Protocol

Each command is answered with the requested data, „ok“ or „EXX“ (in case of an error). For a list of all error messages [see chapter 2.6, page 22](#). The transmission can be cancelled and the receive-buffer will be cleared with ESC (ASCII code 27dec/1Bhex), ^C (ASCII code 3dec/03hex) or ^X (ASCII code 24dec/18hex).

Some commands can be used as queries, some can be used to set menu parameter and some can be used for both. A query is marked by a „?“ (ASCII code 63dec/3Fhex) after the command; for setting data the command has to be followed by the new value to be set.

Parameter can be Boolean or numerical:

	Boolean	0 / 1 or OFF / ON
<No>	Numeric representation format: integer, real (15.6) or exponential (4.5 ⁻⁷)	
	Format: [space] [sign] [ddd] [.] [e[sign]ddd] (d:digit)	

Notice Always use a point as the decimal marker. If a comma is used during numerical data entry, the conversion of the number is cancelled at this point and only the integer part of the number will be used.

Timing recommendations for the PC/PLC - Program:

Sample rate > 100 ms

Timeout between request to and answer from device: 1500 ms

After sending a command the answer must be waited for before sending a new command. Otherwise the receive buffer may be overwritten.

2.4 Commands

Command	Meaning	Relates to LD cmd. no.	Read / Write
*BEEP	Output beep sound. Parameter: Type,Volume	423	W
*CAL	In Standby: internal calibration; In Measure: external calibration	4	W
*CAL:ACKnowledge	Acknowledge stable signal during external calibration	11	W
*CAL:CLOSED	Acknowledge stable signal during external calibration	11	W
*CAL:EXT	Start external calibration. Only possible in measure mode.	4	W
*CAL:INLET	Start inlet area background calculation.	4	W
*CAL:INT	Start internal proof function. Only possible during Standby.	4	W
*CAL:PROOFINT	Start internal proof function	4	W
*CAL:STARTPROOF	Start proof function	4	W
*CAL:STOP	abort calibration	11	W
*CLS	Clear Error	5	W

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CLS:VALUEChanged	Clear the value changed flag	1565	W
*CONFig:ALARMDelay	Alarm delay after evacuation [s]	602	R/W
*CONFig:AMPTest	When ON amplifier test during calibration (ON, OFF)	370	R/W
*CONFig:ANODSET	Set anode voltage. Without argument for current mass. M2,M3,M4 for mass 2...4	433, 434, 435	R/W
*CONFig:AUDio	Audio alarm type (OFF, PIN, SET, TRIG, PROP)	600	R/W
*CONFig:BEEP	Beep-sound of base unit (OFF, ON)	604	R/W
*CONFig:BRIGHTness	Brightness off sniffer LED 0...6	414	R/W
*CONFig:BUSMODULE:ADDReSS	Field bus address nominal value	331	R/W
*CONFig:CALleak:EXTSniff	External test leak in sniff mode	392, 393, 830, 831, 832, 837	R/W
*CONFig:CALleak:EXTVac	External test leak in vacuum mode	390, 391, 830, 831, 832, 835	R/W
*CONFig:CALleak:INT	Internal test leak in mbar*l/s	394	R/W
*CONFig:CALREQ	Calibration request (OFF,ON)	419	R/W
*CONFig:CATHode	Target state of the cathode OFF (not saved after power loss) ON1 (fix cathode 1) ON2 (fix cathode 2) AUTO (automatic switching cathode) with read: AUTO1 / AUTO2: Auto with cathode 1 respectively 2 actual active	530	R/W
*CONFig:CONTRol	Control via control unit key, RC1000 keys and sniffer keys enabled / disabled. (ON/OFF)	2591	R/W
*CONFig:ERRor:AMPAlter	Amplifier alternating monitoring error message(ON, OFF)	1120	R/W
*CONFig:FILTer	Leak rate filter "2ZONE","ICAL","FIXED","I_FIL", "I_FIL2"	402	R/W
*CONFig:IOMODULEPROTOcol	Interface protocol IO (LD,ASCII)	2593	R/W
*CONFig:LIMITLOW	Lower display limit	454	R/W
*CONFig:MAINTenance:AIRfilter	Maintenance message for air filter (ON,OFF)	2660	R/W
*CONFig:MAINTenance:BACKINGpump	Maintenance message for backing pump (ON,OFF)	2660	R/W
*CONFig:MAINTenance:EXHAUSTfilter	Maintenance message for exhaust filter (ON,OFF)	2660	R/W

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:MAINTenance:EXPIRYleak	Maintenance message for reference leak (ON,OFF)	2660	R/W
*CONFig:MAINTenance:FOREpump	Maintenance message for backing pump (ON,OFF)	2660	R/W
*CONFig:MAINTenance:SNIFFERfilter	Maintenance message for sniffer tip filter (ON,OFF)	2660	R/W
*CONFig:MAINTenance:TMP	Maintenance message for TMP (ON,OFF)	2660	R/W
*CONFig:MAINTenance:TURBOpump	Maintenance message for TMP (ON,OFF)	2660	R/W
*CONFig:MASS	Mass (2 (H2), 3, 4(Helium))	506	R/W
*CONFig:MFAE	Actual anode potential reference [V]	167	R/W
*CONFig:MFAE:M2	Anode potential reference [V] mass 2	433	R/W
*CONFig:MFAE:M3	Anode potential reference [V] mass 3	434	R/W
*CONFig:MFAE:M4	Anode potential reference [V] mass 4	435	R/W
*CONFig:MODE	Mode (VAC, SNIFF)	401	R/W
*CONFig:PAGINGrequest	Paging request (ON,OFF)	1270	R/W
*CONFig:PEVACgross	pressure limit EVAC -> GROSS	540, 580, 820	R/W
*CONFig:PFINEultra	pressure limit FINE -> ULTRA	543, 583, 823	R/W
*CONFig:PGROSSfine	pressure limit GROSS -> FINE	541, 581, 821	R/W
*CONFig:PLCINLINK:1	Configuration of PLC-input 1. The following settings are possible: NOT_USED, SNIFF, START, STOP, ZERO, VENT, CLEAR, PURGE, START_STOP, CAL and the inverted version with the prefix "INV_" (INV_START...)	438	R/W
*CONFig:PLCINlink:n	Configuration of PLC-input n. n = 2...10 see CONFig:PLCINLINK:1	438	R/W
*CONFig:PLCOUTLINK:1	Configuration of PLC-output 1. The following settings are possible: OPEN, TRIGGER_1, TRIGGER_2, TRIGGER_3, TRIGGER_4, READY, WARNING, ERROR, CAL_ACTIVE, CAL_REQUEST, RUN_UP, ZERO_ACTIVE, EMISSION_ON, MEASURE, STANDBY, SNIFF, ERR/WARN, GAS_BALLAST, INT_LEAK, CAL_STAB, CATHODE_2, VENT and the inverted version with the prefix "INV_" (INV_READY...)	263	R/W

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:PLCOUTLink:n	Configuration of PLC-output n. n = 2...8 see CONFig:PLCOUTLINK:1	263	R/W
*CONFig:PRESSCORrestion	Pressure correction (ON,OFF)	590	R/W
*CONFig:PRESSHigh	Pressure for upper flow limit (mbar). Deprecated, use *CONFig:PROTecton:PMAX instead	453	R/W
*CONFig:PRESSLow	Pressure for lower flow limit (mbar)	452	R/W
*CONFig:PROTecton:CONTamination	Contamination protection (ON,OFF)	1855	R/W
*CONFig:PROTecton:CONTLimit	Contamination protection limit	850, 1854, 1870	R/W
*CONFig:PROTecton:EVACtime	Maximum evacuation time (0 means infinite)	555	R/W
*CONFig:PROTecton:EVACtime2	Maximum evacuation time to 100 mbar	554	R/W
*CONFig:PROTecton:PARTicle	Particle protection	1860	R/W
*CONFig:PROTecton:PMAX	Maximum pressure in sniff	453, 826	R/W
*CONFig:PROTecton:PMIN	Minimum pressure in sniff	452, 825	R/W
*CONFig:PURGe	Automatic purge (PURGE_MANUAL, PURGE_AUTO)	228	R/W
*CONFig:RECorder:LINK1	Function at analog output channel 1 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, MANT_HYST, EXTERN)	222	R/W
*CONFig:RECorder:LINK2	Function at analog output channel 2 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, MANT_HYST, EXTERN)	222	R/W
*CONFig:RECorder:SCALE	Leak rate scaling of analog output in logarithmic mode (volt/decade): 0.5V/DEC, 1V/DEC, 2V/DEC, 2.5V/DEC, 3V/DEC, 5V/DEC, 10V/DEC	223	R/W
*CONFig:RECorder:UPPEREXP	Upper limit for the analog out at the I/O module. Value is exponent of the value in selected unit. Example: -5 = 1E-5	224	R/W
*CONFig:RS232	Protocol of current used interface port. Read always outputs "ASCII" (ASCII, LD)	26	R/W
*CONFig:SPEEDTMP	Rotation speed of TMP in Hz	501	R
*CONFig:SUPPReasion	Offset suppression at start (OFF, INTERN, INLET)	548	R/W
*CONFig:TMPVENT	Venting TMP after power down	498	R/W
*CONFig:TRIGger1	Setpoint1 in interface unit	384	R/W
*CONFig:TRIGger1:ATM*cc/s	Setpoint1 in Atm*cc/s		R/W
*CONFig:TRIGger1:DISPlay	Setpoint1 in display unit	840	R/W
*CONFig:TRIGger1:G/a	Setpoint1 in grams per year		R/W

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:TRIGger1:MBAR*I/s	Setpoint1 in mbar*I/s	385	R/W
*CONFig:TRIGger1:MBAR*I/s:SNIFF	Setpoint1 in mbar*I/s for sniff mode	842	R/W
*CONFig:TRIGger1:MBAR*I/s:VAC	Setpoint1 in mbar*I/s for vacuum mode	841	R/W
*CONFig:TRIGger1:OZ/yr	Setpoint1 in ounce per year		R/W
*CONFig:TRIGger1:PA*m3/s	Setpoint1 in Pa*m3/s		R/W
*CONFig:TRIGger1:PPM	Setpoint1 in parts per million		R/W
*CONFig:TRIGger1:TORR*I/s	Setpoint1 in Torr*I/s		R/W
*CONFig:TRIGger2	Setpoint2 in interface unit	384	R/W
*CONFig:TRIGger2:ATM*cc/s	Setpoint2 in Atm*cc/s		R/W
*CONFig:TRIGger2:DISPlay	Setpoint2 in display unit	840	R/W
*CONFig:TRIGger2:G/a	Setpoint2 in grams per year		R/W
*CONFig:TRIGger2:LB/yr	Setpoint2 in display unit	840	R/W
*CONFig:TRIGger2:MBAR*I/s	Setpoint2 in mbar*I/s	385	R/W
*CONFig:TRIGger2:OZ/yr	Setpoint2 in ounce per year		R/W
*CONFig:TRIGger2:PA*m3/s	Setpoint2 in Pa*m3/s		R/W
*CONFig:TRIGger2:PPM	Setpoint2 in parts per million		R/W
*CONFig:TRIGger2:TORR*I/s	Setpoint2 in Torr*I/s		R/W
*CONFig:TRIGger3	Setpoint3 in interface unit	384	R/W
*CONFig:TRIGger3:ATM*cc/s	Setpoint3 in Atm*cc/s		R/W
*CONFig:TRIGger3:DISPlay	Setpoint3 in display unit	840	R/W
*CONFig:TRIGger3:G/a	Setpoint3 in grams per year		R/W
*CONFig:TRIGger3:MBAR*I/s	Setpoint3 in mbar*I/s	385	R/W
*CONFig:TRIGger3:OZ/yr	Setpoint3 in ounce per year		R/W
*CONFig:TRIGger3:PA*m3/s	Setpoint3 in Pa*m3/s		R/W
*CONFig:TRIGger3:PPM	Setpoint3 in parts per million		R/W
*CONFig:TRIGger3:TORR*I/s	Setpoint3 in Torr*I/s		R/W
*CONFig:TRIGger4	Setpoint4 in interface unit	384	R/W
*CONFig:TRIGger4:ATM*cc/s	Setpoint4 in Atm*cc/s		R/W
*CONFig:TRIGger4:DISPlay	Setpoint4 in display unit	840	R/W
*CONFig:TRIGger4:G/a	Setpoint4 in grams per year		R/W
*CONFig:TRIGger4:MBAR*I/s	Setpoint4 in mbar*I/s	385	R/W
*CONFig:TRIGger4:OZ/yr	Setpoint4 in ounce per year		R/W
*CONFig:TRIGger4:PA*m3/s	Setpoint4 in Pa*m3/s		R/W
*CONFig:TRIGger4:PPM	Setpoint4 in parts per million		R/W
*CONFig:TRIGger4:TORR*I/s	Setpoint4 in Torr*I/s		R/W

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:UNIT:LR	Leak rate interface unit of current mode (sniff or vac) (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A,OZ/YR) (...:UNITIF:...)	431, 432	R/W
*CONFig:UNIT:LRSniff	Leak rate unit sniff mode interface (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A,OZ/YR) (...:UNITIF:...)	432	R/W
*CONFig:UNIT:LRVac	Leak rate unit vac mode interface (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A) (...:UNITIF:...)	431	R/W
*CONFig:UNIT:Pressure	Pessure unit interface (ATM, MBAR, PA, TORR) (...:UNITIF:...)	430	R/W
*CONFig:UNITDI:LR	Leak rate display unit of current mode (sniff or vac) (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A,OZ/YR)	801, 802	R/W
*CONFig:UNITDI:LRSniff	Leak rate unit sniff mode display (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A,OZ/YR)	802	R/W
*CONFig:UNITDI:LRVac	Leak rate unit vac mode display (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A)	801	R/W
*CONFig:UNITDI:Pressure	Pessure unit display (ATM, MBAR, PA, TORR)	800	R/W
*CONFig:VACRANGE	Active vacuum ranges: GROSS, FINE and ULTRA as comma separated list	550	R/W
*CONFig:VENTdelay	Vent delay (WITH_STOP, MANUAL, NO_VENT)	553	R/W
*CONFig:VENTMODE	Vent delay (WITH_STOP, MANUAL, NO_VENT)	553	R/W
*CONFig:VOLume	Volume (0...15)	420	R/W
*CONFig:ZERO	Zero (OFF,ON,ULTRA,STABLE)	410	R/W
*FACtor:MACHine	machine factor	522	R/W
*FACtor:RESistor	resistor factor 500G/15G	504	R/W
*FACtor:SNiff:M2	Calibration factor sniff mass 2	521	R/W
*FACtor:SNiff:M3	Calibration factor sniff mass 3	521	R/W
*FACtor:SNiff:M4	Calibration factor sniff mass 4	521	R/W
*FACtor:ULFI	Factor ultra/fine	1900	R/W
*FACtor:ULGR	Factor ultra/gross	1903	R/W
*FACtor:ULSL2	Factor ultra/SL300	1890	R/W
*FACtor:VACuum:M2	Calibration factor vacuum mass 2	520	R/W

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*FACtor:VACuum:M3	Calibration factor vacuum mass 3	520	R/W
*FACtor:VACuum:M4	Calibration factor vacuum mass 4	520	R/W
*HOUR:CATHODE1	Operating hours of cathode 1 [h]	148	R
*HOUR:CATHODE2	Operating hours of cathode 2 [h]	149	R
*HOUR:DATE	Date (DD.MM.YYYY)	450	R/W
*HOUR:DEvice	Operating hours of device	142	R
*HOUR:MAINTenance:AIRfilter	Time until next service for air filter [h]	1367	R
*HOUR:MAINTenance:BACKINGpump	Time until next service for backing pump [h]	1361	R
*HOUR:MAINTenance:EXHAUSTfilter	Time until next service for exhaust filter [h]	1365	R
*HOUR:MAINTenance:EXPIRYleak	Expiry date of reference leak [DD.MM.YYYY]	1370	R
*HOUR:MAINTenance:FOREpump	Time until next service for backing pump [h]	1361	R
*HOUR:MAINTenance:SNIFFERfilter	Time until next service for sniffer tip filter [h]	1369	R
*HOUR:MAINTenance:TMP	Time until next service for TMP [d]	1362	R
*HOUR:MAINTenance:TURBOpump	Time until next service for TMP [d]	1362	R
*HOUR:POWer	Time since power on [min]	147	R
*HOUR:RUNup	Run up time [s]	158	R
*HOUR:SERvice:AIRfilter	Time until next service for air filter [h]	1367	R
*HOUR:SERvice:BACKINGpump	Time until next service for backing pump [h]	1361	R
*HOUR:SERvice:EXHAUSTfilter	Time until next service for exhaust filter [h]	1365	R
*HOUR:SERvice:EXPIRYleak	Expiry date of reference leak [DD.MM.YYYY]	1370	R
*HOUR:SERvice:FOREpump	Time until next service for backing pump [h]	1361	R
*HOUR:SERvice:SNIFFERfilter	Time until next service for sniffer tip filter [h]	1369	R
*HOUR:SERvice:TMP	Time until next service for TMP [d]	1362	R
*HOUR:SERvice:TURBOpump	Time until next service for TMP [d]	1362	R
*HOUR:TC	Operating hours frequency converter	141	R
*HOUR:TIME	Time (HH,MM)	450	R/W
*HOUR:TURBO	Operating hours of TMP	140	R
*IDN:ACCESSory	Detected accessory at accessory port (UNKOWN, OPEN, SL300)	247	R
*IDN:BMNETType	Bus-Module network type		R
*IDN:BMSerial	Serial number plug-in unit bus module	325	R
*IDN:BMVersion	software version Bus module	323	R
*IDN:BOOTversion	Software version bootloader main board	318	R
*IDN:CRC	Check sum of firmware	320	R
*IDN:CUversion	Software version HMI	309	R

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*IDN:DEvIce	Name of instrument "Vario", "Quadro dry", "Quadro", "Magno dry", "Magno"	301	R
*IDN:DIP1	MSB DipSwitch 1	321	R
*IDN:DIP2	MSB DipSwitch 2	321	R
*IDN:IOBOOTversion	software version boot loader I/O module	319	R
*IDN:IOSERIAL	Serial number I/O module	408	R
*IDN:IOVersion	Hardware identification IO panel	313	R
*IDN:MASSSTORSERial	Mass storage device (flash memory) serial number	354	R
*IDN:SERial	Serial-number leak detector	406	R
*IDN:TCHARDware	Hardware version of the TMP frequency converter	316	R
*IDN:TCNAME	Name of TMP frequency converter	317	R
*IDN:TURBO	Software version TMP controller	315	R
*IDN:VERsion	Software version main board	310	R
*MEASure:ACCESSORYID	Accessories identification voltage [V]	246	R
*MEASure:AMPTest	Amplifier test currents [A]	1620	R
*MEASure:ANALOGIN	Analog input voltage of I/O-module [V]	220	R
*MEASure:ANALOGOUT1	Output voltage analog output channel 1	221	R
*MEASure:ANALOGOUT2	Output voltage analog output channel 2	221	R
*MEASure:ANODCATH	Anode cathode difference [V]	170	R
*MEASure:ANODE	Anode voltage [V]	167	R
*MEASure:CATHODE	Cathode voltage [V]	168	R
*MEASure:DIGITALIN	State of the PLC inputs as 16-bit binary number; inactive=0, active=1 Byte 0, Bit 0: PLC In 1 Byte 0, Bit 1: PLC In 2 Byte 0, Bit 2: PLC In 3 Byte 0, Bit 3: PLC In 4 Byte 0, Bit 4: PLC In 5 Byte 0, Bit 5: PLC In 6 Byte 0, Bit 6: PLC In 7 Byte 0, Bit 7: PLC In 8 Byte 1, Bit 0: PLC In 9 Byte 1, Bit 1: PLC In 10 Byte 1, Bit 2: DIP_1 Byte 1, Bit 3: DIP_2: Byte 1, Bit 4: DIP_3: Byte 1, Bit 5: DIP_4 Byte 1, Bit 6: DIP_5	261	R

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:DIGITALOUT	state of the PLC outputs as 16-bit binary number; inactive=0, active=1	262	R
*MEASure:HEATER	Heater Input [V]	172	R
*MEASure:IEMIS	Emission current [A]	171	R
*MEASure:IFilter	Filtered ion current [A]	1573	R
*MEASure:IMeas	Unfiltered ion current [A]	1568	R
*MEASure:IRaw	Ion current (raw value) [A]	1575	R
*MEASure:INLETOFFset:M2	Inlet area offset for mass 2 [A]	518	R
*MEASure:INLETOFFset:M3	Inlet area offset for mass 3 [A]	518	R
*MEASure:INLETOFFset:M4	Inlet area offset for mass 4 [A]	518	R
*MEASure:LRMAX	Maximum leak rate since last query via interface in interface unit	188	R
*MEASure:LRMAX:ATM*CC/S	Maximum leak rate since last query via interface in atm*cc/S		R
*MEASure:LRMAX:G/A	Maximum leak rate since last query via interface in grams per year		R
*MEASure:LRMAX:MBAR*L/S	Maximum leak rate since last query via interface in mbar*l/s	189	R
*MEASure:LRMAX:OZ/YR	Maximum leak rate since last query via interface in ounce per year		R
*MEASure:LRMAX:PA*M3/S	Maximum leak rate since last query via interface in Pa*m ³ /s		R
*MEASure:LRMAX:PPM	Maximum leak rate since last query via interface in parts per million		R
*MEASure:LRMAX:TORR*L/S	Maximum leak rate since last query via interface in Torr*l/sselected unit		R
*MEASure:MIAKP	anode-/cathode potential [V]	170	R
*MEASure:MIAP	Anode potential [V]	167	R
*MEASure:MIKP	Cathode potential [V]	168	R
*MEASure:MISP	Suppressor potential [V]	169	R
*MEASure:OFFset	Offset current [A]	1567	R
*MEASure:P1	p1 pressure (inlet) in interface unit	130	R
*MEASure:P1:ATM	p1 pressure (inlet) in atm		R
*MEASure:P1:DISPlay	p1 pressure (inlet) in display unit	810	R
*MEASure:P1:MBAR	p1 pressure (inlet) in mbar	131	R
*MEASure:P1:PA	p1 pressure (inlet) in Pa		R
*MEASure:P1:TORR	p1 pressure (inlet) in Torr		R

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:P2	p2 pressure (foreline) in interface unit	132	R
*MEASure:P2:ATM	p2 pressure (foreline) in atm		R
*MEASure:P2:DISPlay	p2 pressure (foreline) in display unit	811	R
*MEASure:P2:MBAR	p2 pressure (foreline) in mbar	133	R
*MEASure:P2:PA	p2 pressure (foreline) in Pa		R
*MEASure:P2:TORR	p2 pressure (foreline) in Torr		R
*MEASure:P3	P3 pressure	812, 2480, 2481	R
*MEASure:P4	P4 pressure	813, 2482, 2483	R
*MEASure:PHEAT	Cathode heating power [W]	207	R
*MEASure:SAVEDOFFset:M2	Saved leak rate offset for mass 2	517	R
*MEASure:SAVEDOFFset:M3	Saved leak rate offset for mass 3	517	R
*MEASure:SAVEDOFFset:M4	Saved leak rate offset for mass 4	517	R
*MEASure:TEMPeratur:Amplifier	Preamplifier temperature [°C]	166	R
*MEASure:TEMPeratur:Electronic	Electronic temperature [°C]	165	R
*MEASure:TEMPeratur:TCBearing	TMP temperature bearing [°C]	145	R
*MEASure:TEMPeratur:TCElectronic	TMP electronic temperature [°C]	144	R
*MEASure:TEMPeratur:TCMotor	TMP motor temperature [°C]	146	R
*MEASure:TURBO:Current	TMP current [A]	151	R
*MEASure:TURBO:Frequency	TMP frequency [Hz]	138	R
*MEASure:TURBO:Power	TMP power [W]	139	R
*MEASure:TURBO:Voltage	TMP voltage[V]	150	R
*MEASure:U12	Internal 12 V supply [V]	240	R
*MEASure:U15N	-15 V supply [V]	211	R
*MEASure:U15P	+15 V supply [V]	210	R
*MEASure:U24	24 V supply [V]	200	R
*MEASure:U24DIV1	24V internal supply DIV1 [V]	233	R
*MEASure:U24DIV1	24V internal supply DIV2 [V]	234	R
*MEASure:U24FAN	24V supply for internal fans	241	R
*MEASure:U24IO	24 V supply IO [V]	213	R
*MEASure:U24IO_OUT	24V power out IO [V]	219	R
*MEASure:U24MSB	24 V supply MSB [V]	200	R
*MEASure:U24PCBOARD	24 V power supply for PC board [V]	216	R
*MEASure:U24PI	24 V power out pirani [V]	214	R

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:U24RC	24V power out for RC and option connector [V]	212	R
*MEASure:U24TMP	24V power out for TMP1 [V]	209	R
*MEASure:U24TMP2	24V power out for TMP2 [V]	244	R
*MEASure:U5	+5 V supply [V]	218	R
*MEASure:U5INTERNAL	Internal +5 V supply [V]	242	R
*MEASure:U5Sniffer	+5V supply for sniffer option [V]	243	R
*MEASure:UHEAT	Cathode heating voltage [V]	206	R
*MEASure:UP1	Internal pressure p1 [V]	2490	R
*MEASure:UP2	Internal pressure p2 [V]	2491	R
*MEASure:UVV	Preamplifier voltage [V]	202	R
*MEASure:VALVE	Valve voltage [V]	208	R
*MEASure:VALVE_LOWERED	Lowered valve voltage [V]	232	R
*PURGE	Purge on	15	W
*PURGE:OFF	Purge off	15	W
*READ	Leak rate in interface unit	128	R
*READ:ATM*cc/s	Leak rate in Atm*cc/s		R
*READ:MBAR*l/s	Leak rate in mbar*l/s	129	R
*READ:OZ/yr	Leak rate in ounce per year (only valid in sniff)		R
*READ:PA*m3/s	leak rate in Pa*m ³ /s		R
*READ:PPM	Leak rate in parts per million (only valid in sniff)		R
*READ:TORR*l/s	Leak rate in Torr*l/s		R
*READ:UNITDI	Leak rate in display unit (limited to lower display limit)	860	R
*RST:CALHistory	Clears calibration history	1161	W
*RST:ERRORHistory	Clears error history	1161	W
*RST:FACTORY	Sets all parameters to factory default	1161	W
*SERVICE:TMP	Switch TMP (OFF, ON, RESET)	10	R/W
*SERVICE:VALVECycle:V1	Valve cycle counter for V1	1350	R/W
*SERVICE:VALVECycle:V2	Valve cycle counter for V2	1350	R/W
*SERVICE:VALVECycle:V3	Valve cycle counter for V3	1350	R/W
*SERVICE:VALVECycle:V4A	Valve cycle counter for V4A	1350	R/W
*SERVICE:VALVECycle:V4B	Valve cycle counter for V4B	1350	R/W
*SERVICE:VALVECycle:V5	Valve cycle counter for V5	1350	R/W
*SERVICE:VALVECycle:V7	Valve cycle counter for V7	1350	R/W
*STArt	Start (switch from Standby to Measure)	1	W

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*STATus	Status of leak detector (INIT, ACCL, STBY, VENT, WAIT_EVAC, EVAC, MEAS, CAL, ERROR)	Status word	R
*STATus:AMPTest	Possible answers (READY, RUNNING, SIGNAL TOO SMALL, SIGNAL TOO BIG, SIGNAL INSTABLE, RELAY ERROR)	370	R
*STATus:BUSModule	Status Bus-Module "SETUP", "NW_INIT", "WAIT_PROCESS", "IDLE", "PROCESS_ACTIVE", "ERROR", "UNKNOWN", "EXCEPTION"	330	R
*STATus:BUSModule:ADDRESS	Field bus address	326	R
*STATus:BUSModule:BAUDRate	Baud rate at field bus	327	R
*STATus:BUSModule:DHCP	DHCP (ENABLED, DISABLED)	340	R
*STATus:BUSModule:ERRORCnt	Four error counters, format "a,b,c,d" a: Discarded commands b: Discarded responses c: Serial reception errors d: Fragmentation errors	329	R
*STATus:BUSModule:EXCEPTION	Exception Code of Bus module as hex value	328	R
*STATus:BUSModule:IPADDRESS	IP address of BM1000 (IP based field buses only)	337	R
*STATus:BUSModule:IPGATEWay	IP address of gateway	339	R
*STATus:BUSModule:IPSUBNETMask	IP subnet mask (IP based field buses only)	338	R
*STATus:BUSModule:STATIONName	BM1000 station name (PROFINET IO only)	336	R
*STATus:CAL	status of calibration (IDLE, INTCAL, EXTCAL, DYNCAL, CLOSE, FAIL)	259, 260	R
*STATus:CALHist	Calibration history, entry 0 ... 19 *Factor, Test leak, Anode voltage, Mass, Date, Time, Cathode, State	275	R
*STATus:CATHode	actual state of the cathodes ON1, ON2, AUTO1, AUTO2, (automatic switching) OFF	530	R
*STATus:EMISsion	Emission status: STOP, START, WAIT, RAMP, REGUL, STABLE, DOWN, OFF	264	R
*STATus:ERRHist	Error history, entry 1 ... 20. ListNo 'ERR' or 'WRN' ErrNo ErrValue(float), year/month/day hour:min:sec 'SwOnCnt:' SwitchOnCnt 'OnTm:' MinSinceStart "WRNxxx vvv yy/mm/dd hh:mm:ss SwOnCnt: zzz OnTm: ttt" or "ERRxxx vvv yy/mm/dd hh:mm:ss SwOnCnt: zzz OnTm: ttt"	287	R

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*STATus:ERRor	current number of error / warning („NO ERROR/WARNING“ or 3-digit failure number)	290	R
*STATus:HMIKEYS	Status of HMI keys: START, STOP, ZERO. NO_KEY_PRESSED	2585	R
*STATus:IOMODULEPROTOcol	Current active protocol of IO module. Settable via dip switch at IO module or via command *CONFig::IOMODULEPROTOcol	1800	R
*STATus:IPADDRess	Ethernet IP address	351	R
*STATus:IPSUBNETMask	Ethernet IP sub net mask	352	R
*STATus:MACADDRess	Ethernet MAC address	353	R
*STATus:MAINTenanceHist	Maintenance history, entry 1 ... 20	2643	R
*STATus:MODE	actual vacuum mode (VAC, SNIFF)	401	R
*STATus:PREAMPRESistor	currently used resistance of pre-amplifier (13M, 470M, 15G, 500G, 13M_FIXED, 470M_FIXED, 15G_FIXED, 500G_FIXED)	502	R
*STATus:PURGe	Purge / gas ballast	15	R
*STATus:RANGE	Measuring range (NONE, GROSS, FINE, ULTRA, GLIMPSE, PARTIAL_GROSS, PARTIAL_FINE, PARTIAL_ULTRA)	551	R
*STATus:RESETSorce	Source for last device reset: POWER_ON, LOW_POWER, WINDOW_WATCHDOG, INDEPENDENT_WATCHDOG, SOFTWARE and/or NRST_PIN	1815	R
*STATus:SECINEvac	Time since last change to evacuation mode [s]	160	R
*STATus:SECINMeas	Time since last change to measuring mode [s]	159	R
*STATus:SECINRange	Time since last change to vacuum range [s]	163	R
*STATus:SECINStandby	Time since last change to standby mode [s]	161	R
*STATus:SECINVent	Time since last change to vent mode [s]	162	R
*STATus:SNkey	Status of sniffer key 0=not pressed 1=key pressed	298	R
*STATus:SWITCHONCnt	Switch on counter	157	R
*STATus:TMPHist	TMP error history, entry 1 ... 10 Example: Output " 10.57 792 106" means Error 106 at 792 Hz TMP rotation frequency at operation hour 10.57	288	R

ASCII Protocol

Command	Meaning	Relates to LD cmd. no.	Read / Write
*STATus:TRIGger	Status of leak rate setpoints S1,S2, S3, S4 with S1...S4 is "ON" or "OFF" depending of the states of setpoint 1 to setpoint 4	387	R
*STATus:TURBO	Device state TMP: (OFF, ON, RUN_UP, RUN_DOWN, FAIL, RESET)	266	R
*STATus:USEDInterface	Used interface	27	R
*STATus:VALUEChanged	Value changed flag	1565	R
*STATus:VALVE	Status of internal valves	449	R
*STATus:WARNINGBits	Warning-Bits which indicate pending warnings (see note)	297	R
*STATus:ZERO	Zero (ON, OFF)	6	R
*STOp	Stop (switch from Measure to Standby)	2	W
*VENT	Vent inlet port	3	W
*ZERO	Switch zero on	6	W
*ZERO:OFF	Switch zero off	6	W

ASCII Protocol

2.5 Examples

Command	answer	
*stat? (CR)	MEAS (CR)	mode
*status? (CR)	MEAS (CR)	mode
*read? (CR)	2.876E-7 (CR)	leak rate according to programmed unit
*read:pa*m3/s? (CR)	2.876E-6 (CR)	leak rate in a different unit
*start (CR)	OK (CR)	start measurement
*conf:trig1? (CR)	1.0E-9 (CR)	retrieve setpoint 1
*conf:trig1 2.0E-9 (CR)	OK (CR)	set setpoint 1

2.6 Error Messages

Message	Meaning
OK	command completed
E01	wrong command start (no „*“)
E02	illegal blank
E03	command word 1 illegal
E04	command word 2 illegal
E05	command word 3 illegal
E06	control by RS232 not enabled
E07	argument faulty
E08	no data available
E10	command currently invalid
E11	query not allowed
E12	only query allowed
E14	command word 4 illegal

3 LD Protocol

3.1 Communication Parameters

Data format

19200 baud, 8 data bits, no parity, 1 stop bit

3.2 Command format

3.2.1 Telegram structure

Master sends

ENQ	LEN	ADR	CmdH	CmdL	DATA (n bytes)	CRC
0	1	2	3	4	5	5 + n

Slave answers

STX	LEN	StwH	StwL	CmdH	CmdL	DATA (n bytes)	CRC
0	1	2	3	4	5	6	6 + n

Command	Meaning	
ENQ	0x05	Start of master request
STX	0x02	Start of slave response
LEN	Number of telegram bytes	without ENQ(STX)/LEN, however with CRC max. 253, so the total slave telegram length is max. 255
ADR	Slave address	Slave address = 1: non-addressed bus. Address byte is ignored.
Stw H/L	Status word	Info from slave to master (see page 26)
Cmd H/L	Command	Bit 15 ... 13: Command-specifier Read/Write etc. (see table " Cmd H/L: Command: Command-specifier ") Bit 12: free Bit 11 ... 0: Command (see page 27)

LD Protocol

Command	Meaning	
DATA	Data belonging to master request (Slave reply to write command is sent without data)	$0 \leq n \leq 248$ If I/O module (7-byte additional header) is used, then limit maximum data length to 241.
CRC	Checksum	Calculate CRC for all bytes (except CRC byte) Polynomial: 0x98, Name: DOWCRC, Maxim/Dallas, $X^8+X^5+X^4+1$ Info: CRC calculation see file "CRC_calculation.c" (C source code)

Cmd H/L: Command: Command-specifier

Bit 15 ... 13	Meaning	High Nibble (Hex)	Comments
000	Read value	0	
001	Write value	2	
010	Read lower limit value	4	Min values also defined for read commands.
011	Read upper limit value	6	Max values also defined for read commands.
100	Read default value	8	Def values also defined for read commands.
101	Read command name in plain text	A	Please refer to chapter "Command name in plain text" below.
110	Read command info	C	Please refer to table "Command info" below
111	not used	E	

Command name in plain text

- 7-Bit ASCII, only printable characters (0x20 and 0x7E)
- Always in English
- Units in square brackets

Command info

1. Byte	Data type (see table "Data types")
---------	------------------------------------

2. Byte	Number of array elements: 0 = no data, no array 1 = data, no array 2 ... 255 = array
3. Byte	Bit 0: 1 = Reading allowed, 0 = Reading not allowed Bit 1: 1 = Writing allowed, 0 = Writing not allowed Bit 2 and 3: These bits indicate whether additional data is required for a read command: Bit 2=0 & Bit3=0: no additional data required Bit 2=1 & Bit3=0: 1 Byte additional data required Bit 2=0 & Bit3=1: 2 Byte additional data required Bit 2=1 & Bit3=1: 4 Byte additional data required Bit 4 ... 7: always 0 (not used)

Data types

Value	Meaning	Acronym	Comments
1	Signed 8 bit integer	SINT8	
2	Signed 16 bit integer	SINT16	
3	Signed 32 bit integer	SINT32	
4	Unsigned 8 bit integer	UINT8	
5	Unsigned 16 bit integer	UINT16	
6	Unsigned 32 bit integer	UINT32	
7	Character	CHAR	ISO 8859-1; printable characters
16	Signed 64 bit integer	SINT64	
17	Unsigned 64 bit integer	UINT64	
18	Floating point/real number	FLOAT	IEEE 754
20	no data	NO_DATA	For commands without data, such as Start (LD command 4)

All data types are used in Big Endian format (Motorola format), i.e. the byte with the highest-order bits is transferred first.

Arrays

- Read single elements: Array index in first DATA-byte
- Write single elements: Array index in first DATA byte and values in following DATA bytes
- Read all elements: Pseudo array index 255 in first DATA byte
- Write all elements: Pseudo array index 255 in first DATA byte and values in following DATA bytes
- Response from slave (in case data are sent): Array index or pseudo array index in first DATA byte and values in following DATA bytes

All elements of an array have the same Min/Def/Max value.

Array parameters in commands table (see chapter 3.4): The number of array elements is set in brackets behind the data type.

LD Protocol

3.3 Status Word

Status word bit no.	Meaning
Bit 0	0 = RUNUP 1 = STANDBY 2 = EVACUATION 3 = MEASURE 4 = CALIBRATION 5 = ERROR
Bit 1	
Bit 2	
Bit 3	
Bit 4	
Bit 5	ZERO
Bit 6	Still pending device warning
Bit 7	Sniffer Key
Bit 8	not used
Bit 9	PLC Output Change
Bit 10	Setpoint 1, 1 = Setpoint 1 exceeded
Bit 11	Setpoint 2, 1 = Setpoint 2 exceeded
Bit 12	Value changed via interface command. Refer to command 1565.
Bit 13	not used
Bit 14	Unconfirmed device warning
Bit 15	Device error
	Syntax/Command error

3.4 Commands

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
0	0	NOP	R	NO_DATA	"No operation", replies without data	X
1	1	Start	W	NO_DATA	Start	
2	2	Stop	W	NO_DATA	Stop	
3	3	Vent	R/W	UINT8	Vent 0 = OFF 1 = ON	
4	4	Start calibration	W	UINT8	Start calibration: 0 = internal 1 = proof 2 = external 3 = inlet offset 4 = Mass scan	
5	5	Clear error	W	NO_DATA	Clear Error or Warning	
6	6	Zero	R/W	UINT8	0 = Zero "Off" 1 = Zero "On" respectively update zero value	
9	9	Emission nominal status	R/W	UINT8	Emission nominal status 0 = off 1 = on	
10	A	TMP nominal status	R/W	UINT8	TMP nominal status 0 = off 1 = on	
11	B	Calibration acknowledge	W	UINT8	Calibration acknowledge 0 = cancel 1 = continue	
14	E	Backing pump nominal status	R/W	UINT8	Backing pump nominal status 0 = off 1 = on	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
15	F	Purge/gasballast	R/W	UINT8	Purge 0 = OFF 1 = ON	
128	80	Leak rate [interface unit]	R	FLOAT	Leak rate [interface unit] (limited to lower display limit, refer to command number 454)	
129	81	Leak rate [mbar*l/s]	R	FLOAT	Leak rate [mbar*l/s] (unlimited)	
130	82	Internal pressure 1 [interface unit]	R	FLOAT	Pressure p1 in interface unit	
131	83	Internal pressure 1 [mbar]	R	FLOAT	Pressure p1 in mbar	
132	84	Internal pressure 2 [sel. unit]	R	FLOAT	Pressure p2 in selected unit	
133	85	Internal pressure 2 [mbar]	R	FLOAT	Pressure p2 [mbar]	
137	89	TMP runup time [s]	R	UINT16	TMP runup time [s]	
138	8A	TMP actual rotation speed [Hz]	R	UINT16	TMP actual rotation speed	
139	8B	TMP power [W]	R	FLOAT	TMP power in Watt as reported by TMP controller	
140	8C	TMP operation hours [h]	R	UINT32	TMP electronic operation hours	
141	8D	Frequency converter operation hours [h]	R	UINT32	Frequency converter operation hours [h]	
142	8E	Leak detector operation hours	R	UINT32	Leak detector operation hours	
144	90	TMP temperature electronic [deg. C]	R	FLOAT	TMP temperature electronic [deg. C]	
145	91	TMP temperature bearing [deg. C]	R	FLOAT	TMP temperature bearing [deg. C]	
146	92	TMP temperature motor [deg. C]	R	FLOAT	TMP temperature motor [deg. C]	
147	93	Time since power on [min]	R	UINT32	Time since power on [min]	
148	94	Cathode1 operation hours	R	UINT32	Cathode1 operation hours	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
149	95	Cathode2 operation hours	R	UINT32	Cathode2 operation hours	
150	96	TMP voltage [V]	R	FLOAT	TMP voltage as reported by TMP controller	
151	97	TMP current [A]	R	FLOAT	TMP current as reported by TMP controller	
157	9D	Switch on counter	R	UINT16	Counts the switch on cycles 0, 0, 65534	
158	9E	Runup time [s]	R	UINT16	Runup time [s]	
159	9F	Time in measure [s]	R	UINT16	Time in measure [s]	
160	A0	Time in evacuation [s]	R	UINT16	Time in evacuation [s]	
161	A1	Time in standby [s]	R	UINT16	Time in standby [s]	
162	A2	Time in vent [s]	R	UINT16	Time in standby [s] (venting valve opened)	
163	A3	Time in vacuum range [s]	R	UINT16	Time in vacuum range [s]	
165	A5	Electronic temperature [deg. C]	R	FLOAT	MSB temperature in °C	
166	A6	Preamplifier temperature [deg. C]	R	FLOAT	Preamplifier temperature [°C]	
167	A7	Anode voltage [V]	R	FLOAT	Anode voltage [V]	
168	A8	Cathode voltage [V]	R	FLOAT	Cathode voltage [V]	
169	A9	Suppressor voltage [V]	R	FLOAT	Suppressor voltage [V]	
170	AA	Anode-cathode voltage [V]	R	FLOAT	Anode-cathode voltage [V]	
171	AB	Emission current [A]	R	FLOAT	Emission current [A]	
172	AC	Heater input [V]	R	FLOAT	DAC Heater [V]	
188	BC	Maximum leak rate [sel. unit]	R	FLOAT	Maximum leak rate since last query via interface [interface unit]	
189	BD	Maximum leak rate [mbar*l/s]	R	FLOAT	Maximum leak rate since last query via interface [mbar*l/s]	
200	C8	24 V supply [V]	R	FLOAT	24 V supply voltage for heater, processor, preamplifier in V	
202	CA	Pre amplifier voltage [V]	R	FLOAT	Pre amplifier voltage [V]	
206	CE	Heater voltage [V]	R	FLOAT	Heater voltage in V	
207	CF	Heater power [W]	R	FLOAT	Heater power in W	
208	D0	24 V supply valve [V]	R	FLOAT	24 V supply voltage for valves	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
209	D1	24 V power out TMP [V]	R	FLOAT	24 V TMP, MSB Pin C30 voltage	
210	D2	+15 V supply [V]	R	FLOAT	+15 V supply voltage	
211	D3	-15 V supply [V]	R	FLOAT	-15 V supply voltage	
212	D4	24 V power out RC/Option [V]	R	FLOAT	External 24 V output voltage for remote control port and OPTION connector	
213	D5	24 V supply IO [V]	R/W	FLOAT	24 V IO-Modul supply voltage [V] write for internal use only	
214	D6	24 V power out pirani [V]	R	FLOAT	24 V output voltage for pirani, MSB Pin C31	
216	D8	24 V supply PC-board [V]	R	FLOAT	24 V PC board voltage MSB Pin B30	
218	DA	+5 V supply [V]	R	FLOAT	+5 V supply voltage	
219	DB	24V power out IO [V]	R	FLOAT	24 V output voltage for IO-Modul, MSB Pin B30	
220	DC	Analog input IO module [V]	R/W	FLOAT	Analog input voltage IO module in [V] write for internal use only	
221	DD	Analog outputs IO [V]	R/W	FLOAT[2]	Analog output voltage for IO module in [V] It is possible to write an arbitrary voltage value, if the "Analog output configuration" (command 222) of the accordant channel is set to 8	
222	DE	Analog output configuration IO module	R/W	UINT8[2]	Function of analog output Index 0: Channel 1 Index 1: Channel 2 Functions see table "Analog output configuration"	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
223	DF	Analog output leak rate scale (log. only)	R/W	UINT8	Leak rate scaling of analog output in logarithmic mode Functions see table "Analog output configuration"	
224	E0	Analog output upper exponent	R/W	SINT8	Upper limit for the analog out at the I/O module. Value is exponent of the value in selected unit. Example: -5 = 1E-5	
228	E4	Automatic purge	R/W	UINT8	Automatic purge 0=disabled 1=enabled (default)	
232	E8	Lowered valve supply voltage [V]	R	FLOAT	Lowered valve supply voltage [V]	
233	E9	24V internal supply DIV1[V]	R	FLOAT	24V internal supply DIV1[V]	
234	EA	24V internal supply DIV2[V]	R	FLOAT	24V internal supply DIV2[V]	
237	ED	IF board identification voltage [V]	R	FLOAT	IF board identification voltage [V]	
240	F0	12V internal supply [V]	R	FLOAT	12V internal supply voltage	
241	F1	24V fan supply [V]	R	FLOAT	24V supply voltage for internal fans	
242	F2	5V internal supply [V]	R	FLOAT	Internal 5V supply at VI15 board	
244	F4	24V power out TMP 2 [V]	R	FLOAT	24V power supply for second TMP	
246	F6	Accessories identification voltage [V]	R	FLOAT	Identification voltage for devices at accessories connector	
247	F7	Accessory	R	UINT8	Detected accessory at accessory port: 0 = UNKNOWN 1 = OPEN 2 = SL300	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
259	103	Text of calibration state	R	CHAR[*]	Text of an calibration state / result To read send after the index the UINT8 state number Without state number you will get the actual calibration state Use only with index=255!	X
260	104	State calibration	R	UINT8	Status of calibration See table "State calibration"	
261	105	PLC input state IO module	R/W	UINT16	Get PLC input state and DIP switch state IO module Bit 0..9 = PLCin 1..10 Bit 10..15 = DIP 1..6 (S1.1,S1.2,S1.3,S1.4,S2.1,S2.2) write for internal use only	
262	106	PLC output state IO module	R	UINT8	Get PLC output state IO module Bit0..7 = PLCOut 1..8	
263	107	PLC output configuration IO module	R/W	SINT8[8]	Index 0...7 = PLC_OUT1 ... PLC_OUT_8 See table "PLC output conf."	
264	108	Emission actual status	R	UINT8	Emission status: STOP= 0 START= 1 WAIT= 2, RAMP= 3, REGULATE= 4 STABLE= 5 DOWN= 6 OFF= 7	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
266	10A	TMP actual status	R	UNIT8	TMP actual status 0 = OFF 1 = ON 2 = RUNNING_UP 3 = RUNNING_DOWN 4 = FAIL 5 = RESET	
275	113	Calibration log	R	CHAR[*]	Text of a calibration in calibration log. To read send after the array index 255 the UINT8 history list index (0...19). Without index or index 0 you will get the last (newest) entry. Index 19 is the eldest on. Answer format: ListNo, Calfac(float), Testleak(float), Anodevoltage, Mass, VAC or SNIF, year/month/day, hour:min:sec, Cathode, cal state Example: ""00 Fac: 1.04E+0 Leak: 2.70E-7 Anod: 469 M4 VACi 2015/08/25 09:26:11 Cat: 1"	X
280	118	Used entries in calibration log	R	UINT8	Used entries in calibration log	X
281	119	Used entries in error log	R	UINT8	Used entries in error log	X
282	11A	Used entries in TMP error log	R	UINT8	Used entries in TMP error log	X

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
287	11F	Error log	R	CHAR[*]	Text of an error/warning in error log. To read send after the array index 255 the UINT8 history list index (0...19). Without index or index 0 you will get the last (newest) entry. Index 19 is the eldest one. Answer: ListNo 'ERR' or 'WRN' ErrNo ErrValue(float), year/month/day hour:min:sec 'SwOnCnt.' SwitchOnCnt 'OnTm:' MinSinceStart Example: "01 ERR502 2.022E-3 2015/08/25 08:51:32 SwOnCnt: 030 OnTm: 004 Pressure sensor 2 not connected"	X
288	120	TMP error log	R	CHAR[*]	Text of an error/warning in TMP error log. To read send after the array index 255 the UINT8 history list index (0...9). Without index or index 0 you will get the last (newest) entry. Index 9 is the eldest one. Example: Output " 10.57 792 106" means Error 106 at 792 Hz TMP rotation frequency at operation hour 10.57	X
289	121	Value of actual error	R	FLOAT	Value associated with the actual error or warning	
290	122	Number of actual error or warning	R	UINT16	Error number of the actual error or warning	
291	123	List of signal values of active errors	R	FLOAT[10]	Lists the signal values of the errors/warnings since the last "clear error"	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
294	126	Text of error number	R	CHAR[*]	text of an error/warning number To read send after the index the UINT16 error number Without error number you will get the actual error/warning Use only with index=255!	X
295	127	Text of warning bits	R	CHAR[*]	Explanation text for a specific warning bit: To read, send after the index the UINT8 bit position Use only with index=255!	X
296	128	List of active errors or warnings	R	UINT16[10]	Lists the error/warning numbers since the last "clear error"	
297	129	Present warnings	R	UINT32	Each bit represents a warning, see enumerations table	
298	12A	Sniffer button	R	UINT8	Read state sniffer button 1 = pressed	
300	12C	Device identification	R	UINT8[2]	Device identification Index 0: 2 - Leybold Index 1: 10 -Phoenix family	
301	12D	Device name	R	CHAR[*]	Get device name as ASCII string, "Vario", "Quadro dry", "Quadro", "Magno dry", "Magno"	
309	135	SW-version web server	R/W	UINT8[3]	Software version of web server based operating unit Index 0: Main version Index 1: Sub version Index 2: Debug version write for internal use only	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
310	136	SW-version MSB	R	UINT8[3]	Software version MSB Index 0: Main version Index 1: Sub version Index 2: Debug version	
313	139	SW-version I/O module	R/W	UINT8[3]	Software version IO module Index 0: Main version Index 1: Sub version Index 2: Debug version write for internal use only	
315	13B	SW version TMP controller	R	CHAR[6]	SW version TMP controller (character string from TMP controller)	
316	13C	HW-version TMP controller	R	CHAR[6]	HW version TMP controller (character string from TMP controller)	
317	13D	TMP controller name	R	CHAR[6]	TMP controller name	
318	13E	SW version boot loader	R	UINT8[3]	Software version of boot loader	
319	13F	SW version boot loader I/O module	R/W	UINT8[3]	Software version of boot loader IO module write for internal use only	
320	140	CRC-code MSB	R	UINT32	CRC-code interface board abcdwxyz (hex) abcd: calculated value wxyz: nominal value	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
321	141	DIP switch MSB	R	UINT8	DIP switch setting of the MSB: Bit7: S171, switch 4 Bit6: S171, switch 3 Bit5: S171, switch 2 Bit4: S171, switch 1 Bit3: S170, switch 4 Bit2...0: not used, always 0 Bit 4/5/6 Device type x000xxxx - Vario x001xxxx - Quadro dry x011xxxx - Magno dry x101xxxx - Quadro x110xxxx - Magno	
322	142	Field bus status word	R	UINT16	Status word for Bus module refer to Bus module documentation	
323	143	SW version bus module	R	UINT8[3]	SW version bus module	
324	144	Bus module fieldbus type	R	UINT16	Bus module fieldbus type. Refer to AnybusCC specification for enumeration.	
325	145	Serial number plug-in unit bus module	R	UINT8[4]	Serial number plug-in unit bus module	
326	146	Field bus address actual value	R	UINT8	Fieldbus address actual value Refer to AnybusCC specification for enumeration.	
327	147	Field bus baud rate	R	UINT8	Baud rate at field bus Refer to AnybusCC specification for enumeration.	
328	148	Exception code bus module	R	UINT8	Exception code bus module	
329	149	Error counters bus module	R	UINT16[4]	Error counters bus module Index: 0: Discarded commands 1: Discarded Responses 2: Serial Reception errors 3: Fragmentation errors	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
330	14A	Bus module state	R	UINT8	State of bus module 0 = SETUP 1 = NW_INIT 2 = WAIT_PROCESS 3 = IDLE 4 = PROCESS_ACTIVE 5 = ERROR 6 = UNKNOWN 7 = EXCEPTION	
331	14B	Field bus address nominal value	R/W	UINT8	Fieldbus address nominal value Refer to AnybusCC specification for enumeration.	
336	150	Field bus station name	R	CHAR[*]	BM1000 Station name (PROFINET IO only)	
337	151	Field bus IP address	R	UINT8[4]	BM1000 IP address (IP based field busses only)	
338	152	Field bus IP subnet mask	R	UINT8[4]	BM1000 IP address (IP based field busses only)	
339	153	Field bus gateway IP address	R	UINT8[4]	BM1000 gateway IP address (IP based field busses only)	
340	154	Field bus DHCP enabled	R	UINT8	BM1000 DHCP (IP based field busses only) 0=disabled; 1=enabled	
351	15F	Ethernet IP address	R/W	UINT8[4]	IP address of Ethernet port. Write for internal use only. IP address cannot be set via this command.	
352	160	Ethernet IP sub net mask	R/W	UINT8[4]	IP sub net mask of Ethernet port. Write for internal use only. IP sub net mask cannot be set via this command.	
353	161	Ethernet MAC address	R/W	UINT8[6]	MAC address of Ethernet port. Write for internal use only. MAC address cannot be set via this command.	
354	162	Mass storage serial number	R/W	CHAR[30]	Serial number of solid state drive. Write for internal use only.	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
355	163	Serial number TMP	R	CHAR[11]	Serial number of TMP. See command 405 for serial number of TMP converter.	X
356	164	Serial number TMP communication electronic	R	CHAR[11]	Serial number of TMP communication electronic (front end). See command 405 for serial number of TMP converter.	X
370	172	Amp test during calibration	R/W	UINT8	Amplifier test during internal calibration 0 = Off 1 = ON	
371	173	Run Amp test	R/W	UINT8	Write: Write value 1 to run Amplifier test Read: Amplifier test state	
384	180	Setpoint [interface unit]	R/W	FLOAT[4]	Setpoint in interface unit	
385	181	Setpoint [mbar*l/s]	R/W	FLOAT[4]	Setpoint in mbar*l/s	
387	183	Setpoint status	R	UINT8	Setpoint status: 0=Leak rate <setpoint 1=Leak rate > setpoint Bit 0: Setpoint 1 Bit 1: Setpoint 2 Bit 2: Setpoint 3 Bit 3: Setpoint 4	
390	186	Test leak extern vacuum [mbar*l/s]	R/W	FLOAT[3]	Test leak extern Vacuum [mbar*l/s] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	
391	187	Test leak extern vacuum [interface unit]	R/W	FLOAT[3]	Test leak extern Vacuum [interface unit] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	
392	188	Test leak extern sniff [mbar*l/s]	R/W	FLOAT[3]	Test leak extern Sniff [mbar*l/s] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
393	189	Test leak extern sniff [interface unit]	R/W	FLOAT[3]	Test leak extern Sniff [interface unit] Index 0: Mass2 Index 1: Mass 3 Index 2: Mass 4 Helium	
394	18A	Test leak intern [mbar*l/s]	R/W	FLOAT	Testleak intern in mbar*l/s	
401	191	Operation mode	R/W	UINT8	0 = VACUUM 1 = SNIFF	
402	192	Leak rate filter	R/W	UINT8	0 = Fixed 1 = Auto	
405	195	Serial number TMP controller	R	CHAR[11]	Serial number TMP controller	X
406	196	Serial number leak detector	R	CHAR[11]	Serial number of the complete leak detector	X
408	198	Serial number IO module	R/W	CHAR[11]	Serial number of the IO module	X
410	19A	Zero mode	R/W	UINT8	Zero mode 0 = disabled 1 = enabled 2 = at ULTRA 3 = SMART	
419	1A3	Calibration request enable	R/W	UINT8	0 = Calibration request disabled 1 = Calibration request enabled	
420	1A4	Volume	R/W	UINT8	Volume (Min.: 0; Default: 2; Max.: 15)	
430	1AE	Pressure interface unit	R/W	UINT8	Pressure unit interface mbar = 0 Pa = 1 atm = 2 Torr = 3	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
431	1AF	Leak rate interface unit vacuum	R/W	UINT8	Leak rate unit vacuum interface 0 - mbar*l/s 1 - Pa*m ³ /s 2 - Atm ccs 3 - Torr*l/s	
432	1B0	Leak rate interface unit sniff	R/W	UINT8	Leak rate unit sniff interface 0 - mbar*l/s 1 - Pa*m ³ /s 2 - Atm ccs 3 - Torr*l/s 4 - ppm 5 - g/a 6 - oz/yr	
433	1B1	Anode setpoint M2 [V]	R/W	UINT16	Anode voltage setpoint for mass 2 (hydrogen) in V	
434	1B2	Anode setpoint M3 [V]	R/W	UINT16	Anode voltage setpoint for mass 3 in V	
435	1B3	Anode setpoint M4 [V]	R/W	UINT16	Anode voltage setpoint for mass 4 (helium) in V	
436	1B4	Emission current setpoint [A]	R/W	FLOAT	Emission current setpoint [A]	
438	1B6	PLC input configuration IO module	R/W	UINT8[10]	Configuration of PLC input port of the IO module Index 0...9 = PLC_IN1...PLC_IN10 See table "PLC input conf."	
442	1BA	Purge in measure	R/W	UINT8	Purge in measure 0 = disabled 1 = enabled (Quadro dry only)	
449	1C1	Valve state	R	UINT16	Valve state see table / enumerations	
450	1C2	Date+Time [YMDhms]	R/W	UINT8[6]	Date and time use only with array-index 255 (all bytes) year (1..99), month, day, hour (0..23), min, sec	X

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
452	1C4	Min pressure sniff [mbar]	R/W	FLOAT	Minimum pressure p1 in mbar for sniff mode. If pressure falls below this value, warning 540 (Flow too low) is generated.	
453	1C5	Max pressure sniff [mbar]	R/W	FLOAT	Maximum pressure p1 in mbar for sniff. If pressure rises above this value, warning 542 (Sniffer broken) is generated.	
454	1C6	Lower leak rate limit	R/W	UINT8	Lower leak rate limit (decades) 0 = 1E-12 mbar*l/s @ ULTRA 1 = 1.0E-11 mbar*l/s @ ULTRA ... 6 = 1.0E-6 mbar*l/s @ ULTRA	
498	1F2	TMP venting enable	R/W	UINT8	TMP venting enable 0 = disabled 1 = enabled	
501	1F5	TMP rotation speed	R/W	UINT16	TMP rotation speed 1000, 1500Hz	
502	1F6	Amplifier range	R/W	UINT8	Amplifier range Amplifier control location see 508 automatically set (not auto) 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm	
504	1F8	500GOhm value	R/W	FLOAT	500GOhm value	
506	1FA	Mass	R/W	UINT8	2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)	
508	1FC	Amplifier control location	R/W	UINT8	Amplifier control location	
516	204	Offset electrical 500G [A]	R	FLOAT	Electrical offset 500G	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
517	205	Offset internal [A]	R	FLOAT[3]	Standby internal Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
518	206	Offset inlet [A]	R	FLOAT[3]	Offset inlet area Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
520	208	Calibration factors vacuum	R/W	FLOAT[3]	Calibration factors for vacuum mode Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
521	209	Calibration factors SL300 sniff	R/W	FLOAT[3]	Calibration factors for SL300 sniff mode Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
522	20A	Machine factors vacuum	R/W	FLOAT[3]	Machine factors for vacuum mode Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
523	20B	Machine factors sniff	R/W	FLOAT[3]	Machine factors for sniff mode Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
530	212	Cathode selection	R/W	UINT8	Cathode selection 0 = CAT1 1 = CAT2 2= Auto Cat1 (def.) 3= Auto Cat2	
540	21C	Pressure EVAC GROSS [mbar]	R/W	FLOAT	Pressure limit in mbar for EVAC to GROSS transition. Setting only becomes effective in the following measuring cycle. Also refer to command 580 and 820.	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
541	21D	Pressure GROSS FINE [mbar]	R/W	FLOAT	Pressure limit in mbar for GROSS to FINE transition. Setting only becomes effective in the following measuring cycle. Also refer to command 581 and 821.	
543	21F	Pressure FINE ULTRA [mbar]	R/W	FLOAT	Pressure limit in mbar for FINE to ULTRA transition. Setting only becomes effective in the following measuring cycle. Also refer to command 583 and 823	
550	226	Vacuum ranges	R/W	UINT8[4]	Vacuum ranges Index 0: GROSS Index 1: FINE Index 2: ULTRA (TRUE-range enabled, FALSE-range disabled)	
551	227	Vacuum state	R	UINT8	Vacuum state (current vacuum range) 0 = None 1 = GROSS 2 = FINE 3 = ULTRA 4 = GLIMPSE 5 = PARIAL GROSS 6 = PARTIAL FINE 7 = PARTIAL ULTRA	
553	229	Vent mode	R/W	UINT8	Vent mode 0 = Vent with Stop 1 = Vent manual 2 = No Vent	
554	22A	Max. evacuation time gross leak [s]	R/W	UINT16	Maximum evacuation time gross leak (until 100 mbar). If this time is exceeded, the leak detector shows error message no. 580. 0 = infinite	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
555	22B	Max. evacuation time until measure [s]	R/W	UINT16	Maximum evacuation time until measure mode. This means until first selected vacuum range, for example GROSS. If this time is exceeded, the leak detector shows error message no. 581. 0 = infinite	
572	23C	Min pressure sniff [interface unit]	R/W	FLOAT	Minimum pressure p1 in interface unit for sniff mode. If pressure falls below this value, warning 540 (Flow too low) is generated.	
573	23D	Max pressure sniff [interface unit]	R/W	FLOAT	Maximum pressure p1 in interface unit for sniff. If pressure rises above this value, warning 542 (Sniffer broken) is generated.	
574	23E	Popup message number	R	UINT8	Number of pop message. "0" means no message	
575	23F	Text of popup message number	R	CHAR[*]	text of popup message To read send after the index the UINT8 popup message number Without error number you will get the text of the actual popup message Use only with index=255!	X
576	240	Clear popup message	W	NO_DATA	Clear popup message. Sets number of popup message to "0"	X
580	244	Pressure EVAC GROSS [interface unit]	R/W	FLOAT	Pressure limit in interface unit for EVAC to GROSS transition. Setting only becomes effective in the following measuring cycle. Also refer to command 430, 540 and 820.	
581	245	Pressure GROSS FINE [interface unit]	R/W	FLOAT	Pressure limit in interface unit for GROSS to FINE transition. Setting only becomes effective in the following measuring cycle. Also refer to command 430, 581 and 821.	
583	247	Pressure FINE ULTRA [interface unit]	R/W	FLOAT	Pressure limit in interface unit for FINE to ULTRA transition. Setting only becomes effective in the following measuring cycle. Also refer to command 430, 543 and 823.	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
590	24E	Pressure correction	R/W	UINT8	Pressure correction 0 = disabled 1 = enabled	
600	258	Audio alarm type	R/W	UINT8	Audio alarm type 0 = Alarm off 1 = Trigger alarm 2 = Setpoint 3 = Pinpoint 4 = Leak rate prop	
602	25A	Audio alarm delay [s]	R/W	UINT16	Audio alarm delay [s]	
604	25C	Audio beep	R/W	UINT8	Audio beep 0 = disabled 1 = enabled	
620	26C	Pumping speed backing pump [m ³ /h]	R/W	UINT8	Pumping speed of external backing pump [m ³ /h] (only valid for "Vario")	
621	26D	Backing pump type	R/W	UINT8	Backing pump type 0 = wet 1 = dry only valid for "Vario"	
622	26E	Pumping speed partial flow pump [m ³ /h]	R/W	UINT8	Pumping speed of partial flow pump 4...80 [m ³ /h]	
623	26F	QuickPump time [s]	R/W	UINT16	Quick pump time 60000 = infinite	
624	270	Mode V8	R/W	UINT8	Behavior of external bypass valve (V8ext) 0 = open 1 = automatic	
628	274	Partial flow enabled	R/W	UINT8	Partial flow 0 = disabled 1 = enabled	
629	275	Pressure limit GLIMPSE to P-GROSS [mbar]	R/W	FLOAT	Pressure limit for transition from GLIMPSE to Partial_GROSS in mbar. Also refer to command 646 and 647.	
646	286	Pressure limit GLIMPSE to P-GROSS [interface unit]	R/W	FLOAT	Pressure limit for transition from GLIMPSE to Partial_GROSS in interface unit. Also refer to command 430, 629 and 647.	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
647	287	Pressure limit GLIMPSE to P-GROSS [display unit]	R/W	FLOAT	Pressure limit for transition from GLIMPSE to Partial_GROSS in display unit. Also refer to command 629 and 646, 800.	
800	320	Pressure display unit	R/W	UINT8	Pressure unit display mbar = 0 Pa = 1 atm = 2 Torr = 3	
801	321	Leak rate display unit vacuum	R		Leak rate unit vacuum display 0 - mbar*l/s 1 - Pa*m ³ /s 2 - Atm ccs 3 - Torr*l/s	
802	322	Leak rate display unit sniff	R		Leak rate unit sniff display 0 - mbar*l/s 1 - Pa*m ³ /s 2 - Atm ccs 3 - Torr*l/s 4 - ppm 5 - g/a 6 - oz/yr	
810	32A	Internal pressure 1 [display unit]	R	FLOAT	Pressure p1 in display unit	
811	32B	Internal pressure 2 [display unit]	R	FLOAT	Pressure p2 in display unit	
812	32C	Internal pressure 3 [display unit]	R	FLOAT	Pressure p3 in display unit (not used)	
813	32D	Internal pressure 4 [display unit]	R	FLOAT	Pressure p4 in display unit (not used)	
820	334	Pressure EVAC GROSS [display unit]	R/W	FLOAT	Pressure limit in display unit for EVAC to GROSS transition. Setting only becomes effective in the following measuring cycle. Also refer to command 540, 580 and 800.	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
821	335	Pressure GROSS FINE [display unit]	R/W	FLOAT	Pressure limit in display unit for GROSS to FINE transition. Setting only becomes effective in the following measuring cycle. Also refer to command 541, 581 and 800.	
823	337	Pressure FINE ULTRA [display unit]	R/W	FLOAT	Pressure limit in display unit for FINE to ULTRA transition. Setting only becomes effective in the following measuring cycle. Also refer to command 543, 583 and 800.	
825	339	Min pressure sniff [display unit]	R/W	FLOAT	Minimum pressure p1 in display unit for sniff mode. If pressure falls below this value, warning 540 (Flow too low) is generated.	
826	33A	Max pressure sniff [display unit]	R/W	FLOAT	Maximum pressure p1 in display unit for sniff. If pressure rises above this value, warning 542 (Sniffer broken) is generated.	
830	33E	Test leak extern [mbar*l/s]	R/W	FLOAT	Test leak extern [mbar*l/s] (current mode and mass)	
831	33F	Test leak extern [interface unit]	R/W	FLOAT	Test leak extern [interface unit] (current mode and mass)	
832	340	Test leak extern [display unit]	R/W	FLOAT	Test leak extern [display unit] (current mode and mass)	
835	343	Test leak extern vacuum [display unit]	R/W	FLOAT[3]	Test leak extern Vacuum [display unit] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	
837	345	Test leak extern sniff [display unit]	R/W	FLOAT[3]	Test leak extern Sniff [display unit] Index 0: Mass2 Index 1: Mass 3 Index 2: Mass 4 Helium	
840	348	Setpoint [display unit]	R/W	FLOAT[4]	Setpoint in display unit	
841	349	Setpoint VAC [mbar*l/s]	R/W	FLOAT[4]	Setpoints in mbar*l/s for Vacuum mode. Index 0: Setpoint 1 Index 1: Setpoint 2 Index 2: Setpoint 3 Index 3: Setpoint 4	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
842	34A	Setpoint SNIFF [mbar*l/s]	R/W	FLOAT[4]	Setpoints in mbar*l/s for Sniff mode. Index 0: Setpoint 1 Index 1: Setpoint 2 Index 2: Setpoint 3 Index 3: Setpoint 4	
850	352	Gross leak protection limit [display unit]	R/W	FLOAT	Gross leak protection limit [display unit]	
860	35C	Leak rate [display unit]	R	FLOAT	Leak rate [display unit] (limited to lower display limit, refer to command number 454)	
865	361	Group measure [display unit]	R	UNIT8[19]	Measurement data in display unit see table / enumerations	X
870	366	Convert Pressure	R/W	FLOAT[4]	Convert pressure (Index - Unit)	X
872	368	Convert leak rate	R/W	FLOAT[7]	Convert leak rate (Index - Unit)	X
880	370	Leak rate limit [mbar*l/s]	R	FLOAT[3]	Leak rate limit in mbar*l/s [0] = low [1] = low user [2] = high	
882	372	Leak rate limit [interface unit]	R	FLOAT[3]	Leak rate limit in interface unit [0] = low [1] = low user [2] = high	
884	374	Leak rate limit [display unit]	R	FLOAT[3]	Leak rate limit in display unit [0] = low [1] = low user [2] = high	
1120	460	Amplifier alternating monitoring	R/W	UINT8	Enables resp. Disables amplifier alternating monitoring (Error message 358) 0 = disabled, 1 = enabled Enabled by default	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
1161	489	Parameter reset	W	UINT8	Parameter reset: 0: Load factory settings 3: Clear error history 4: Clear calibration history 6: Restart bus module 8: HMI Soft reset 9: HMI Power reset 10: TMP replaced	X
1270	4F6	Paging request	R/W	UINT8	Paging request (RC1000) 0 = off 1 = on	
1284	504	Control word	R/W	UINT16	Control word (used for Bus module)	
1285	505	Stop service buffer	R/W	UINT8	Stop service buffer 0=recording active 1=recording stopped	
1350	546	Valve cycle counter	R	UINT32[]	Valve cycle counter see table / enumerations	
1361	551	Maintenance backing pump [h]	R/W	UINT32	Maintenance backing pump [h] 0 ... 12000 h (default: 8000 h)	
1362	552	Maintenance TMP [d]	R/W	UINT32	Maintenance TMP [d] 0 ... 1095 d (default: 1095 d)	
1365	555	Maintenance exhaust filter [h]	R/W	UINT32	Maintenance exhaust filter [h] 0 ... 4000h (default: 2500 h)	
1367	557	Maintenance air filter [h]	R/W	UINT32	Maintenance air filter [h] 0 ... 4000h (default: 2500 h)	
1369	559	Maintenance sniffer tip filter [h]	R/W	UINT32	Maintenance sniffer tip filter [h] 0 ... 4000h (default: 1000 h)	
1370	55A	Expiry date reference leak [YMD]	R/W	UINT8[3]	Expiry date of internal reference leak year (1..99), month, day	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
1399	577	Group measure [interface unit]	R	UNIT8[19]	Measurement data in interface unit see table / enumerations	X
1400	578	Group measure	R	UNIT8[19]	Measurement data see table / enumerations	
1560	618	Offset current amplifier old [A]	R	FLOAT	Offset current amplifier old [A]	
1564	61C	Value changed reason	R	UINT32	Cause of setting the value changed flag (see status word bit 11). Bit 0: Mass (506), Bit 1: Operation mode (401), Bit 2: Setpoint 1 (385), Bit 3: Setpoint 2 (385), Bit 4: Leak rate unit (432, 802, 431, 801), Bit 5: Pressure unit (430, 800), Bit 6: TMP rotation speed (501), Bit 7: PARA_KATHODE (530), Bit 8: Date+Time (450), Bit 9: Automatic-Control Off (1165) Bit 10: not used Bit 11: not used Bit 12: Display-User-Limit (884), Bit 13: Popup message (574) Bit 14: Parameter Reset (1161 with value 13) Bit 16 ... 31: not used	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
1565	61D	Value changed flag	R/W	UNIT8	Value changed flag Read: Same value as Statusword Bit 11 Write: Write 0 to clear value changed flag Bit will be set if one or more Values of this list has been changed (foe example via interface commando): Mass (506), Operation mode (401), Setpoint 1, Setpoint 2, Leak rate unit, Pressure unit, TMP rotation speed (501), Cathode (530), Date+Time (450), Automatic-Contol Off (1165) Display-User-Limit, New Popup-Message	
1567	61F	Offset current [A]	R	FLOAT	Currently subtracted offset current [A]	
1568	620	Ion current (p cor.) [A]	R	FLOAT	Pressure corrected ion current in A	
1573	625	Ion current (p,ULTRA cor. / filtered) [A]	R	FLOAT	Ion current in A. Filtered, pressure corrected and converted to vacuum range ULTRA	
1575	627	Ion current (raw) [A]	R	FLOAT	Ion current in A. Raw value, identical with "preamplifier voltage" multiplied by "preamplifier resistor"	
1577	629	Standby offset valid	R	UINT8	Value is true, if the current standby offset would be considered as offset with START.	
1616	650	Cathode test heater power [W]	R	FLOAT[2]	Cathode test during runup Index 0: heater power cathode 1 Index 1: heater power cathode 2	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
1618	652	Amplifier test voltages [V]	R	FLOAT[4]	Amplifier test during internal calibration Index 0: voltage 13M Index 1: voltage 470M Index 2: voltage 15G Index 3: voltage 500G	
1620	654	Amplifier test currents [A]	R	FLOAT[5]	Test currents ca. 1.3E-11 A	
1621	655	Int. ADC values	R	UINT16[16]	Values of internal ADC MSB	
1795	703	Progress bar [%]	R	UINT8	Progress bar in percent during run up phases	
1800	708	Active protocol IO	R	UINT8	Active interface protocol for I/O module. Defined by DIP switch at I/O module or command 2593. Values: 0 = LD protocol 1 = ASCII protocol	
1810	712	Emission failure counter	R	UINT16	Emission failure counter	
1815	717	Reset source	R	UINT8	Shows the last reason of reset	
1820	71C	Dropped requests	R	UINT16[2]	Dropped requests [0]: Average [1]: Max	X
1854	73E	Gross leak protection limit [mbar*l/s]	R/W	FLOAT	Gross leak protection limit [mbar*l/s]	
1855	73F	Gross leak protection	R/W	UINT8	Gross leak protection 0 = disabled 1 = enabled	
1860	744	Particle protection	R/W	UINT8	Particle protection 0 = disabled 1 = enabled	
1870	74E	Gross leak protection limit [interface unit]	R/W	FLOAT	Gross leak protection limit [interface unit]	
1890	762	Factor ULTRA SL300	R/W	FLOAT	Factor ULTRA -> SL300	
1900	76C	Factor ULTRA FINE	R/W	FLOAT	Factor ULTRA -> FINE	
1903	76F	Factor ULTRA GROSS	R/W	FLOAT	Factor ULTRA -> GROSS	
2480	9B0	Internal pressure 3 [sel. unit]	R	FLOAT	Pressure p3 [selected unit] (not used)	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
2481	9B1	Internal pressure 3 [mbar]	R	FLOAT	Pressure p3 [mbar] (not used)	
2482	9B2	Internal pressure 4 [sel. unit]	R	FLOAT	Pressure p4 [selected unit] (Sniffer line)	
2483	9B3	Internal pressure 4 [mbar]	R	FLOAT	Pressure p4 [mbar] (not used)	
2490	9BA	Internal pressure 1 [V]	R	FLOAT	Pressure p1 [V]	
2491	9BB	Internal pressure 2 [V]	R	FLOAT	Pressure p2 [V]	
2492	9BC	Internal pressure 3 [V]	R	FLOAT	Pressure p3 [V] (not used)	
2493	9BD	Internal pressure 4 [V]	R	FLOAT	Pressure p4 [V] (not used)	
2580	A14	Test HMI LED	R/W	UINT8[3]	Test HMI LED [0]: START [1]: STOP/VENT [2]: ZERO 0 = off 1 = red 2 = green 3 = blue	
2585	A19	HMI button	R	UINT8[3]	Read state HMI buttons [0]: START [1]: STOP/VENT [2]: ZERO 0 = inactive 1 = active	
2591	A1F	Local control	R/W	UINT8	Local control (hardware button) 0 = disabled 1 = enabled	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
2593	A21	Interface protocol IO	R/W	UINT8	Selected interface protocol for I/O module. Only valid if DIP switch at I/O module is set to "000" 0 = LD 1 = ASCII	
2642	A52	Used entries in maintenance log	R	UINT8	Used entries in maintenance log	X
2643	A53	Maintenance log	R	CHAR[*]	Text of a maintenance in maintenance log. To read send after the array index 255 the UINT8 maintenance list index (0...19). Without index, you will get the last (newest) entry. Example: ""00 2016/06/10 OpTm: 229 Bpump Lubricant ExhaustF AirF SnifferF RefLeak TMP"	
2650	A5A	Set suppressor voltage [V]	R/W	FLOAT	Suppressorvoltage for test	X
2660	A64	Maintenance warning active	R/W	UINT8	Maintenance warning active (0: disable, 1: enabled) Bit 0 = Backing pump Bit 1 = TMP Bit 2 = Exhaust filter Bit 3 = Air filter Bit 4 = Sniffer tip filter Bit 5 = Expiry date reference leak Bit 6 = not used Bit 7 = not used	

Command dec	Command hex	Name	Read / Write	Data type	Description	No fieldbus support
2663	A67	Test good bad LED	R/W	UINT8	Test good / bad LED SL300 0 = auto 1 = good 2 = bad 3 = good and bad 4 = off	X
2664	A68	Test status LED	R/W	UINT8	Test status LED (VI15) 0 = auto, 1 = red, 2 = green, 3 = blue, 4 = off	X

3.5 Enumeration tables

Present warnings (command 297)

Value Index / Bit	Meaning
0x00000001	Warning pressure/flow
0x00000002	not used
0x00000004	Warning anode voltage
0x00000008	not used
0x00000010	Warning emission
0x00000020	Warning suppressor
0x00000040	Warning TMP
0x00000080	Warning Anybus
0x00000100	Warning maintenance
0x00000200	Warning I/O disconnected
0x00000400	Warning 5V
0x00000800	Warning U24VHz
0x00001000	Warning supply voltages
0x00080000	Warning cathode voltage
0x00100000	Warning temperature MSB
0x00200000	Warning temperature preamplifier
0x00400000	Warning calibration request
0x00800000	Warning operating unit disconnected
0x01000000	Preamp output too low
0x02000000	Warning +15V out of range
0x04000000	Warning +15V out of range
0x10000000	Warning real time clock

Valve state (command 449) and Valve cycle counter (command 1350)

Index / Bit	Valve No. (Cmd. 471 & 472)	Meaning
0 / 0x0001	1	V1
1 / 0x0002	2	V2a
2 / 0x0004	3	V3
3 / 0x0008	4	V4a
4 / 0x0010	5	V4b
5 / 0x0020	6	not used
6 / 0x0040	7	V5
7 / 0x0080	8	V7
8 / 0x0100	9	not used
9 / 0x0200	10	not used
10 / 0x0400	11	V2b
11 / 0x0800	12	V8

Group measure, display unit (command 865)

Meaning	Data type	Offset	Command dec
Leak rate [display unit]	FLOAT	0	860
p1 [display unit]	FLOAT	4	810
p2 [display unit]	FLOAT	8	811
not used	FLOAT	12	812
Individual bits Bit 0: Vent Bit 1: Purge Bit 2: Offset new Bit 3: Underrange Bit 4: Overage Bit 5: "Zero stable" or "Zero update allowed" Bit 6: Show maximum leak rate Bit 7...15: not used	UNIT16	16	
Vacuum state	UNIT8	18	551

Group commands

Group measure, interface unit (command 1399)

Meaning	Data type	Offset	Command dec
Leak rate [display unit]	FLOAT	0	128
p1 [interface unit]	FLOAT	4	130
p2 [interface unit]	FLOAT	8	132
not used	FLOAT	12	2480
Individual bits Bit 0: Vent Bit 1: Purge Bit 2: Offset new Bit 3: Underrange Bit 4: Overrange Bit 5: "Zero stable" or "Zero update allowed" Bit 6: Show maximum leak rate Bit 7...15: not used	UNIT16	16	
Vacuum state	UNIT8	18	551

Group measure, mbar / mbar*l/s (command 1400)

Meaning	Data type	Offset	Command dec
Leak rate [display unit]	FLOAT	0	129
p1 [mbar]	FLOAT	4	131
p2 [mbar]	FLOAT	8	133
not used	FLOAT	12	2481
Individual bits Bit 0: Vent Bit 1: Purge Bit 2: Offset new Bit 3: Underrange Bit 4: Overrange Bit 5: "Zero stable" or "Zero update allowed" Bit 6: Show maximum leak rate Bit 7...15: not used	UNIT16	16	
Vacuum state	UNIT8	18	551

3.6 Error messages

Telegram error handling

- Slave discards all characters until it receives a STX as telegram start identifier.
- Slave does not generate an error message, if address is not correct.
- Slave reports CRC errors with error message 1 (CRC failure)
- Slave reports length errors with error message 2 (Illegal telegram length) or 11 (Data length is not correct for the command)

To prevent the response from colliding with the next request, the slaves do not respond in case of a timeout.

Error numbers (if status word Bit 15 is set 1)

Error No.	Meaning
1	CRC-failure
2	Illegal telegram length
10	command doesn't exist
11	Data length is not correct for the command
12	Read not allowed
13	Write not allowed
14	Array-Index out of range or missing
20	Control actually not allowed with this interface
21	Password not OK
22	Command actually not allowed (e.g. calibration during Run-Up)
30	Data not in range
31	No data available

In case of error: STX, LEN, Stw, Cmd and one Data-Byte (with error number) sent

Fieldbus Communication

4 Fieldbus Communication

4.1 Preface

In order to use fieldbus communication with the leak detector, you need a Bus module BM1000 connected to the LD port of the leak detector.

Fieldbus systems normally support device-specific configuration files e.g. GSD files for the PROFIBUS field bus system.

You will find the appropriate configuration files on the USB memory stick which is supplied with your BM1000.

4.2 Setup

- ▶ Select the “Bus modul“ at the operating unit: “ > Setup > Accessories > Device Selection”.
- ▶ Enter the field bus address at the operating unit: “ > Setup > Accessories > Bus Module”.

Attention:

Address and profile do not come into effect until a restart of the leak detector (power off/power on)!

4.3 Process Data Mapping for Cyclic Data Transfer

4.3.1 Write Process Data (PLC → Leak Detector)

This data word (2 Bytes) is send periodically from the field bus master (e.g. programmable logic controller) to the leak detector.

PROFIBUS and PROFINET IO receive high byte first, DeviceNet and EtherNet/IP receive low byte first.

Byte	Bit	Name	Meaning	Similar to PLC Input	Similar to RS232 ASCII cmd.	Similar to RS232 LD cmd.
1 (high byte)	0	(not used)				
	1	Zero	Transition 0 -> 1: 0x02 = Zero on Transition 1 -> 0: 0x00 = Zero off	ZERO	*ZERO	6
	2	Clear	Transition 0 -> 1: 0x04=Clears errors and warnings	Clear	*CLS	5
	3	Start/Stop	Transition 0 -> 1: 0x08= Start Transition 1 -> 0: 0x00= Stop	Start/Stop	*START/*STOP	1, 2
	4	CAL intern	Transition to 0: 0x00 = Cancel internal calibration Transition to 1: 0x10 = Start internal calibration	CAL intern	*CAL:INT	4
	5					
	6	CAL extern	Transition to 0: 0x00 = Cancel external calibration Transition to 1: 0x40 = Start external calibration Transition to 2: 0x80 = Acknowledge closed test leak	CAL extern/CAL dynamic	*CAL:EXT	4
2 (low byte)	0	Gas ballast	Transition 0 -> 1: 0x01 = Purge / Gasballast on Transition 1 -> 0: 0x00 = Purge / Gasballast off	Gasballast		
	1					
	2	not used	not used			
	3					
	4	not used	not used			
	5					
	6	Sniff/Vac	0 = VAC 0x40 = SNIF 0x80 = according to PLC-Input 0xC0 = not used	Sniff	*CONFIG:MODE	401
	7					

The current state of this value is visible at the operating unit via:
"Diagnosis > Information > Accessories > Bus module".

4.3.2 Read Process Data (Leak Detector → PLC)

These 29 data bytes are send periodically from the leak detector to the field bus master (e.g. a programmable logic controller):
Attention: PROFIBUS and PROFINET IO send high byte first, DeviceNet and EtherNet/IP send low byte first.

Title	Byte	Bit	Name	Meaning	Similar to I/O module Output	Similar to RS232 ASCII cmd.	Similar to RS232 LD cmd.
status word	1 (high byte)	0	not used	always 1			
		1	Zero active	0 = off 0x02 = on	ZERO active	*STATUS:ZERO?	
		2	Error	0 = no error 0x04 = error	Error		Status word
		3	Warning	0 = no warning 0x08 = warning	Warning		Status word
		4	State internal calibration	0 = inactive 0x10 = active 0x20/0x30 = not used	CAL active	*STATUS:CAL?	260
		5					
		6	State external calibration	0 = inactive 1 = 0x40 = active 2 = 0x80 = waiting for test leak closed 3 = 0xC0 = not used	CAL active	*STATUS:CAL?	260
		7					
	2 (low byte)	0	Calibration request	0 = CAL request function disabled 1 = 0x01 = CAL request function enabled but no CAL requested 2 = 0x02 = CAL request function enabled and CAL requested 3 = 0x03 = not used	CAL request	*CONFIG:CALREQ?	419
		1					
		2	Emission	0 = 0x00 = Emission off 1 = 0x04 = Cathode 1 fixed 2 = 0x08 = Cathode 2 fixed 3 = 0x0C = Cathode 1 auto 4 = 0x10 = Cathode 2 auto	Emission on	*STATUS:CATHODE?	530
		3					
		4					
		5	State	0 = 0x00 = Standby 1 = 0x20 = Error 2 = 0x40 = Calibration 3 = 0x60 = Runup 4 = 0x80 = Measure 5 = 0xA0 = Emission Off 6 ... 7 = 0xC0 ... 0xE0 = not used	Run up, CAL active, Error, Ready,	*STATUS?	Status word
		6					
		7					

Title	Byte	Bit	Name	Meaning	Similar to I/O module Output	Similar to RS232 ASCII cmd.	Similar to RS232 LD cmd.
leak rate	3 ... 6		Leak rate (mbar*/l/s)	Actual leak rate in mbar l/s (IEEE 754 float value)	Analog output (LR_LIN, LR_LOG...)	*READ:MBAR*/l/s?	129
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)	Analog output (Pressure p1)	*MEAS:P:MBAR?	83
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)		*STATUS:ERROR?	290
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level	Trigger 1	*STATUS:TRIGger?	387
		1	Status of Trigger 2		Trigger 2		
		2	Status of Trigger 3		Trigger 3		
		3	Status of Trigger 4		Trigger 4		
		4 ... 7	not used	always 0			
calibration_status	14		calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 27.	CAL active	*STATUS:CAL?	260
leak_detector ID	15		leak_detector ID	always 10 for PHOENIX family		*IDN:DEvice?	
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)		*MEAS:P2:MBAR?	133
device specific float 2	20 ... 23		device specific float 2	reserved for further use, always 0			
device specific float 3	24 ... 27		device specific float 3	reserved for further use, always 0			
device specific word	28 ... 29		device specific word	reserved for further use, always 0			304

4.4 Acyclic Data Transfer

If you want to use acyclic data transfer with PROFIBUS, you must use a PROFIBUS master which supports DPV1 data transfers. A PROFIBUS master which supports DPV0 only, can only use cyclic data transfer.

4.4.1 Addressing Rules for Acyclic Access

Mapping from LD command number to field bus:

Fieldbus	Rule	Example for LD_command_number 506 (Mass)
PROFIBUS	$LD_command_number = slot \cdot 255 + index + 1$ $slot = (ADI - 1) / 255$ $index = (ADI - 1) \text{ MOD } 255$	Slot = 1 index = 250
PROFINET IO	Application Process Instance (API) = 0 Slot = 0 Subslot = 1 $Index = LD_command_number$	API = 0 Slot = 0 Subslot = 1 $Index = 506_{\text{dez}} = 01FA_{\text{hex}}$
DeviceNet	Object number A2h (ADI object) $Instance_number = LD_command_number$ Attribute 5 (Value)	Instance_number = 506
Ethernet/IP	Object number A2h (ADI object) $Instance_number = LD_command_number$ Attribute 5 (Value)	Instance_number = 506

Fieldbus supports all commands from LD protocol, except the commands which are marked accordingly in LD command list ([refer to chapter 3.4](#)).

4.4.2 CIP Object "ADI object" (A2h)

The following text only applies to DeviceNet and Ethernet/IP:

Instance Attributes:

#	Name	Access	Type	Description
1	Name	Get	SHORT_STRING	Parameter name (Including length)
2	ABCC Data type	Get	USINT	Data type of instance value
3	No. of elements	Get	USINT	Number of elements of the specified data type

#	Name	Access	Type	Description
4	Descriptor	Get	USINT	Bit field describing the access rights for this instance <u>Bit:Meaning:</u> 0 Set = Get Access 1 Set = Set Access
5	Value ^a	Get/Set	Determined by attribute #2	Instance value
6	Max value ^a	Get		The maximum permitted parameter value
7	Min value ^a	Get		The minimum permitted parameter value
8	Default value ^a	Get		The default parameter value

a. Converted to/from CIP standard by the module

ABCC Data type:

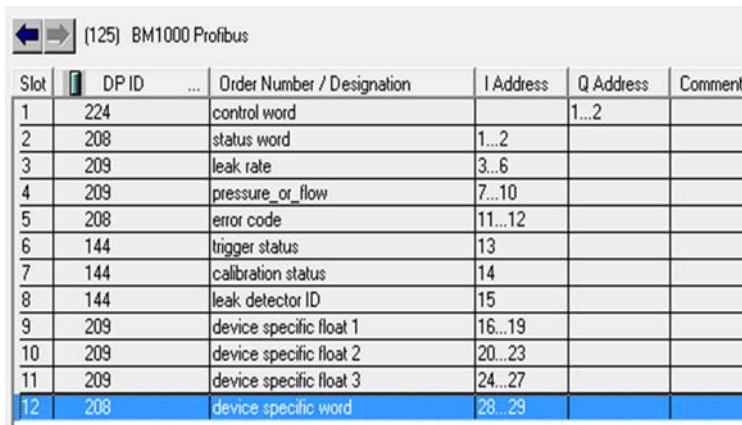
#	Type	Bits	Description	Range
1	SINT8	8	Signed 8 bit integer	-128... +127
2	SINT16	16	Signed 16 bit integer	-32768... +32767
3	SINT32	32	Signed 32 bit integer	$-2^{31} \dots +(2^{31}-1)$
4	UINT8	8	Unsigned 8 bit integer	0... +255
5	UINT16	16	Unsigned 16 bit integer	0... +65535
6	UINT32	32	Unsigned 32 bit integer	0... $+(2^{32}-1)$
7	CHAR	8	Character (ISO 8859-1)	0... +255
16	SINT64	64	Signed 64 bit integer	$-2^{63} \dots +(2^{63}-1)$
17	UINT64	64	Unsigned 64 bit integer	0... $+(2^{64}-1)$
18	FLOAT	32	Floating point (IEC 60559)	$\pm 1.17549435\text{E}-38 \dots$ $\pm 3.40282347\text{E}+38$

Fieldbus Communication

4.5 Hardware Configuration for Profibus

Attention:

You must use IFCN0E8D.GSD file for this configuration.



Slot	DP ID	...	Order Number / Designation	I Address	Q Address	Comment
1	224		control word		1...2	
2	208		status word	1...2		
3	209		leak rate	3...6		
4	209		pressure_or_flow	7...10		
5	208		error code	11...12		
6	144		trigger status	13		
7	144		calibration status	14		
8	144		leak detector ID	15		
9	209		device specific float 1	16...19		
10	209		device specific float 2	20...23		
11	209		device specific float 3	24...27		
12	208		device specific word	28...29		

Fig. 1 Example hardware configuration (detail from PLC configuration window)

4.5.1 Assignment of the PROFIBUS Address

The PROFIBUS address can be assigned via operating unit or via the hardware configuration tool of the PLC.

To assign the PROFIBUS address via operating unit select

- ▶ “Main Menu > Settings > Set up > Interfaces > Bus module > Address”.

To assign the PROFIBUS address via hardware configuration tool of the PLC

- ▶ refer to the documentation of your PLC.

Fieldbus Communication

If you use a Siemens Step 7 you can also

- refer to the document: "How to configure an Anybus PROFIBUS slave module with Siemens Step 7". You will find this document on the USB memory stick which is supplied with your BM1000.

4.5.2 Diagnosis with the operating unit

The current state of the BM1000 is visible in the info menu of the operating unit:

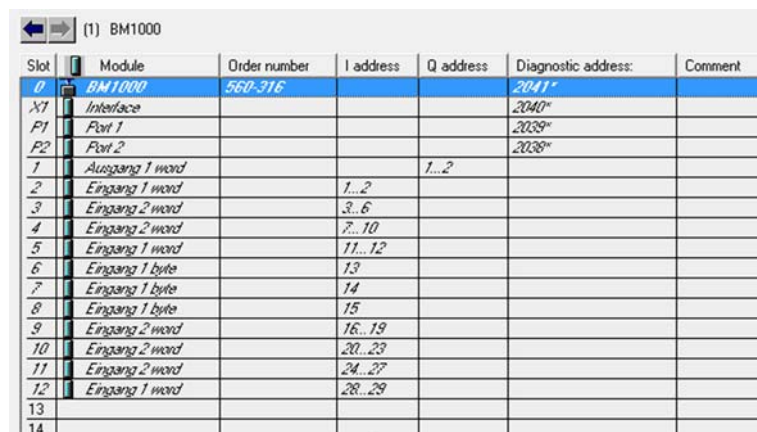
"Diagnosis > Information > Accessories > Bus module".

4.6 Hardware Configuration for PROFINET

4.6.1 Hardware Configuration

Attention:

You must use the GSDML-V2.3-Inficon-BM1000_PROFINET-20131206.XML file. In addition you must put the Bitmap File GSDML-0282-03E8-INFICON-BM1000.BMP in the same folder as the xml file.



Slot	Module	Order number	I address	Q address	Diagnostic address:	Comment
0	BM1000	560-316			2041*	
X1	Interface				2040*	
P1	Port 1				2039*	
P2	Port 2				2038*	
1	Ausgang 1 word			1...2		
2	Eingang 1 word		1...2			
3	Eingang 2 word		3...6			
4	Eingang 2 word		7...10			
5	Eingang 1 word		11...12			
6	Eingang 1 byte		13			
7	Eingang 1 byte		14			
8	Eingang 1 byte		15			
9	Eingang 2 word		16...19			
10	Eingang 2 word		20...23			
11	Eingang 2 word		24...27			
12	Eingang 1 word		28...29			
13						
14						

Fig. 2 Sequence of the data words (slots) for PROFINET

4.6.2 Assignment of the PROFINET address

The PROFINET address can only be assigned via the hardware configuration tool of the PLC. To assign the PROFINET IP address via hardware configuration tool of the PLC, please refer to the documentation of the PLC.

Trouble Shooting

5 Trouble Shooting

5.1 Serial communication via RS232 (common)

Error	Possible Reason	Solution
No characters are received via the interface/the leak detector does not answer	Wrong cable	Please use a 1:1 cable, (NO null-modem cable, also called cross-over cable!)
	Problems with flow control	Deactivate flow control in PC/PLC or use cable according to the wiring diagram in Section 2
	Wrong COM-Port used at PC	Select correct COM-Port
No characters are received via the interface/the leak detector does not answer	Wrong interface parameters (Baud rate, Data bits, Parity, Stop bits)	Check if interface parameters (Baud rate, number of data bits, parity bit and number of stop bits in the leak detector and PC/PLC match)
	Wrong protocol selected in the leak detector	Select correct protocol in the leak detector
	PC uses an USB-RS232 converter	In general the I/O module will also work with an USB-RS232 converter. However, these often cause multiple difficult to track problems (driver, flow control.) Please test your PC program on a "real" RS232 interface first preferably. Especially with USB-RS232-converters it is often helpful to use a cable according to the wiring diagram in chapter 4 of the I/O module documentation.
	Serial interface of PC is (still) occupied with a different program	Check if other programs uses the serial interface. It is also possible that an already closed program has not released the interface again yet. In this case a restart of the PC will help.
The leak detector replies with "unreadable" characters	Wrong interface parameters (Baud rate, Data bits, Parity, Stop bits)	Check if interface parameters (Baud rate, number of data bits, parity bit and number of stop bits in the I/O module and PC/PLC match)
	Wrong protocol selected in the leak detector	Select correct protocol in the leak detector

5.2 ASCII Protocol specific

Error	Possible Reason	Solution
I/O module does not reply/ leak detector replies after several command with "E10"	"Carriage Return" at the end of the command is missing	Finish all commands with "Carriage Return" (ASCII 0dhex/13dez)
leak detector replies with error message to the first command only, following commands are interpreted correctly	Receiving buffer of the leak detector was not empty before sending the first command (e.g. by plugging in the RS232 cable during operation)	In the ASCII protocol the leak detector has no time out function which will empty the receiving buffer automatically. Therefore, the buffer should be emptied before the first command by sending of ESC, ^C or ^X

5.3 LD Protocol specific

Error	Possible Reason	Solution
I/O module does not reply	Wrong Address	Always use Address 1 in LD protocol.
	Other protocol errors	Try to use NOP command (05hex 04hex 01hex 00hex 00hex 77hex) first, to check if connection works in general. The answer should be 02hex 05hex XXhex XXhex 00hex 00hex XXhex
I/O module replies with CRC error (error code 1)	Wrong CRC calculation	Check you CRC code calculation. See example C source file "CRC_calculation.c" provided by Leybold. Check your code with unit test function in this source code file.

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