

LDS3000

Protocol Descriptions

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This document applies to the software version stated on the cover page. If you need a different version, please contact our sales staff.

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

- 560-310 IO1000 Modul
- 560-315 BM1000 PROFIBUS
- 560-316 BM1000 PROFINET
- 560-317 BM1000 DeviceNET
- 560-318 BM1000 EtherNet/IP

1 Interface Protocols

1.1 Serial Interface Protocols

With the IO1000 module you can communicate with the LDS3000 via the following serial interface protocols:

- ASCII Protocol (enabled by default)
- LD Protocol

If you want to replace a LDS1000 or LDS2010 with a LDS3000 you can also use

- Binary Interface Protocol
- LDS1000 Compatibility Protocol

NOTICE

Do not use the last two protocols for new developments. They have limited functional range and may not be supported in future.

The serial interface protocol can be selected via DIP switch at the IO module IO1000 or via control unit CU1000. Please refer to appropriate documentation.

1.2 Field Bus Protocol

With the Bus module BM1000 you can communicate with the LDS3000 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 13dex/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.

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 20. 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 LDS3000: 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 |
|-----------------|---|------------------------|--------------|
| *CAL:CLOSED | report test leak closed (ext. cal. only) | 11 | W |
| *CAL:DYN | start external dynamic calibration | 4 | W |
| *CAL:EXT | start external calibration | 4 | W |
| *CAL:INT | start internal calibration | 4 | W |
| *CAL:FACTOR_M | start calibration machine factor | 4 | W |
| *CAL:FACTOR_S | start calibration machine factor | 4 | W |
| *CAL:PROOFEXT | Start external proof function | 4 | W |
| *CAL:PROOFINT | Start internal proof function | 4 | W |
| *CAL:STOP | abort calibration | 11 | W |
| *CLS | Clear Error | 5 | W |
| *CONFIG:AMPTest | When ON amplifier test during calibration (ON, OFF) | 370 | R/W |
| *CONFIG:ANODSET | Without argument current mass, 0..2 mass 2 ... 4 | 433, 434, 435 | R/W |
| *CONFIG:BEEP | (OFF, TRIGGER) | 417 | R/W |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|---------------------------|---|------------------------|--------------|
| *CONFig:BRIGHtness | Brightness off sniffer LED 0 ... 6 | 414 | R/W |
| *CONFig:BUSMODULe:ADDReSS | Field bus address nominal value | 331 | R/W |
| *CONFig:BUSMODULe:PROFILE | Field bus profile (HMS, INFICON) | 333 | R/W |
| *CONFig:BUTSniffer | (left)button of the sniffer probe (OFF, ON) | 412 | R/W |
| *CONFig:CALleak:EXTSniff | external test leak of current mass in sniff mode in current sniff unit | 392 | R/W |
| *CONFig:CALleak:EXTVac | external test leak of current mass in vacuum mode in current vac unit | 390 | R/W |
| *CONFig:CALleak:INT | internal test leak [mbar*l/s] | 394 | R/W |
| *CONFig:CALREQ | calibration request (OFF,ON);with read: (OFF, ON_REQUESTED, ON_NOTREQUESTED) | 419 | R/W |
| *CONF:CALWarn | Calibration warning W650 (OFF, ON) | 429 | R/S |
| *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:COMP | Compatibility mode (LDS1000, LDS2010,LDS3000, SL3000). All parameters are set to the default of the selected mode. | 2594 | R/W |
| *CONFig:CORSTDBY | correction of leak rate in stand by (OFF, ON) | 524 | R/W |
| *CONFig:DECADEZero | zero funktion "NORM","1-2","2-3", "19/20", "2", "3-4" | 410 | R/W |
| *CONFig:DISPL_LIM:HIGH | Number of decades lower than highest limit (0 ... 15 decades) | 397 | R/W |
| *CONFig:DISPL_LIM:LOW | Number of decades higher than lowest limit (0 ... 15 decades) | 397 | R/W |
| *CONFig:ERRor:AMPAlter | The preamp alternating test can be switched off (OFF, ON) | 1120 | R/W |
| *CONFig:FILTER | Leak rate filter "2ZONE","ICAL","FIXED","I_FIL", "I_FIL2" | 402 | R/W |
| *CONFig:HFBUTTON | Right sniffer button to switch flow (OFF,ON) | 415 | R/W |
| *CONFig:Highflow | OFF Disable high flow ON Enable high flow | 229 | R/W |
| *CONFig:LANGUage | Language (ENGLISH, DEUTch, FRANcAIS, ITALIANO, PORTUGUES, ESPANOL, KATAkana, CHINESE, RUSSIAN) | 398 | R/W |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|------------------------|---|------------------------|--------------|
| *CONFig:LIGHTAlarm | Sniffer white LED alarm configuration: DISABLED: always same brightness ON: higher brightness if trigger 1 is exceeded BLINK: blink, if trigger 1 is exceeded | 413 | R/W |
| *CONFig:LIMITS | Limits for interfaces: low,high limit low and high (with comma separated) in current leak rate unit. (at least factor 10 between both required) for activ mode sniff/Vac. | | R/W |
| *CONFig:LIMITS:LRSniff | Limits for interfaces: low,high limit low and high (with comma separated) in current leak rate unit. (at least factor 10 between both required) | 227 | R/W |
| *CONFig:LIMITS:LRVac | Limits for interfaces: low,high limit low and high (with comma separated) in current leak rate unit. (at least factor 10 between both required) | 226 | R/W |
| *CONFig:LIMITS:SNIFF | Limits for interfaces: low,high limit low and high (with comma separated) in current leak rate unit. (at least factor 10 between both required) | 227 | R/W |
| *CONFig:LIMITS:VAC | Limits for interfaces: low,high limit low and high (with comma separated) in current leak rate unit. (at least factor 10 between both required) | 226 | R/W |
| *CONFig:LRFilter | filter switch-over threshold in current leak rate | 403 | R/W |
| *CONFig:MASS | mass (2 (H ₂), 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 | operating mode (VAC, SNIFF, SL3000) (SL3000 read only) | 401 | R/W |
| *CONFig:PERcent | Gas percentage 1 ... 100 % | 416 | R/W |
| *CONFig:PLCINLINK:1 | Configuration of PLC-input. The following settings are possible: NOT_USED, DYN_CAL, EXT_CAL, INT_CAL, SNIFF, START, STOP, ZERO, ZERO_PULS, CLEAR, GAS_BALLAST, SEL_DYN_NORM, START_STOP, KEY1, KEY2, KEY3, CAL, ZERO_UPDATE, INT_LEAK, LEAK_PULS, HIGHFLOW, FACTOR_MACHINE, INT_PROOF, EXT_PROOF, CYCLE, MASS2_4. | 438 | R/W |
| *CONFig:PLCINLINK:n | n = 2 ... 10 see CONFig:PLCINLINK:1 | 438 | R/W |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|---------------------------|--|------------------------|--------------|
| *CONFig:PLCOURLINK | Assignment of PLC-outputs *CONFig:PLCOURLINK:1 for Pin 1 *CONFig:PLCOURLINK:2 for Pin 2 ... *CONFig:PLCOURLINK:8 for Pin 8 | 263 | R/W |
| *CONFig:PLCOURLINK:1 | Configuration of PLC-output. The following settings are possible: OPEN, TRIGGER_1, TRIGGER_2, TRIGGER_3, TRIGGER_4, READY, WARNING, ERROR, CAL_ACTIVE, EMISSION_ON, MEASURE, STANDBY, SNIFF, ERR/WARN, GAS BALLAST, INT_LEAK, CAL_STAB, CATHODE2, CAL_REQUEST, RUN_UP, ZERO_ACTIVE | 263 | R/W |
| *CONFig:PLCOURLINK:n | n = 2 ... 8 see CONFig:PLCOURLINK:1 | 263 | R/W |
| *CONFig:PRESSHigh | Pressure for upper flow limit (mbar) | 453 | R/W |
| *CONFig:PRESSLow | Pressure for lower flow limit (mbar) | 452 | R/W |
| *CONFig:PRESSXLHigh | Pressure for upper XL-flow limit (mbar) | 456 | R/W |
| *CONFig:PRESSXLLow | Pressure for lower XL-flow limit (mbar) | 455 | R/W |
| *CONFig:RECOder:LINK1 | Function at analog output channel 1 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, LR_LOG_H, EXTERN, EXP_INV, MANT_HYST, P1_1V_DEC, P2_1V_DEC) | 222 | R/W |
| *CONFig:RECOder:LINK2 | Function at analog output channel 2 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, LR_LOG_H, EXTERN, EXP_INV, MANT_HYST, P1_1V_DEC, P2_1V_DEC) | 222 | R/W |
| *CONFig:RECOder:SCALE | Analog out scaling "0.5V/DEC", "1V/DEC", "2V/DEC", "2.5V/DEC", "3V/DEC", "5V/DEC", "10V/DEC", "SPECIAL_1" | 223 | R/W |
| *CONFig:RECOder:UPPEREXP | Upper Exponent for analog out [mbar*l/s] | 224 | R/W |
| *CONFig:RS232 | Protocol (ASCII, LD, LDS1000) "LD", "ASCII", "ANYBUS", "BINARY", "LDS1000", "TUNNEL", read only: "SNIFF" | 26 | R/W |
| *CONFig:SEARCh | Search with Trigger2 in HIGH flow (ON, OFF) | 380 | R/W |
| *CONFig:SPEEDTMP | rotation speed of TMP in Hz | 501 | R/W |
| *CONFig:STANDBYDel | Standby time in minutes 1 ... 60, 0 = OFF | 480 | R/W |
| *CONFig:TRIGger1 | trigger1 in selected unit | 384 | R/W |
| *CONFig:TRIGger1:ATM*cc/s | trigger1 [Atm*cc/s] | | R/W |
| *CONFig:TRIGger1:G/a | trigger1 [g/a] | | R/W |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|---------------------------|---|------------------------|--------------|
| *CONFig:TRIGger1:MBAR*/s | trigger1 [mbar*/s] | 385 | R/W |
| *CONFig:TRIGger1:OZ/yr | trigger1 [oz/yr] | | R/W |
| *CONFig:TRIGger1:PA*m3/s | trigger1 [Pa*m3/s] | | R/W |
| *CONFig:TRIGger1:PPM | trigger1 [ppm] | | R/W |
| *CONFig:TRIGger1:TORR*/s | trigger1 [Torr*/s] | | R/W |
| *CONFig:TRIGger2 | trigger2 in selected unit | 384 | R/W |
| *CONFig:TRIGger2:ATM*cc/s | trigger2 [Atm*cc/s] | | R/W |
| *CONFig:TRIGger2:G/a | trigger2 [g/a] | | R/W |
| *CONFig:TRIGger2:MBAR*/s | trigger2 [mbar*/s] | 385 | R/W |
| *CONFig:TRIGger2:OZ/yr | trigger2 [oz/yr] | | R/W |
| *CONFig:TRIGger2:PA*m3/s | trigger2 [Pa*m3/s] | | R/W |
| *CONFig:TRIGger2:PPM | trigger2 [ppm] | | R/W |
| *CONFig:TRIGger2:TORR*/s | trigger2 [Torr*/s] | | R/W |
| *CONFig:TRIGger3 | trigger3 in selected unit | 384 | R/W |
| *CONFig:TRIGger3:ATM*cc/s | trigger3 [Atm*cc/s] | | R/W |
| *CONFig:TRIGger3:G/a | trigger3 [g/a] | | R/W |
| *CONFig:TRIGger3:MBAR*/s | trigger3 [mbar*/s] | 385 | R/W |
| *CONFig:TRIGger3:OZ/yr | trigger3 [oz/yr] | | R/W |
| *CONFig:TRIGger3:PA*m3/s | trigger3 [Pa*m3/s] | | R/W |
| *CONFig:TRIGger3:PPM | trigger3 [ppm] | | R/W |
| *CONFig:TRIGger3:TORR*/s | trigger3 [Torr*/s] | | R/W |
| *CONFig:TRIGger4 | trigger4 in selected unit | 384 | R/W |
| *CONFig:TRIGger4:ATM*cc/s | trigger4 [Atm*cc/s] | | R/W |
| *CONFig:TRIGger4:G/a | trigger4 [g/a] | | R/W |
| *CONFig:TRIGger4:MBAR*/s | trigger4 [mbar*/s] | 385 | R/W |
| *CONFig:TRIGger4:OZ/yr | trigger4 [oz/yr] | | R/W |
| *CONFig:TRIGger4:PA*m3/s | trigger4 [Pa*m3/s] | | R/W |
| *CONFig:TRIGger4:PPM | trigger4 [ppm] | | R/W |
| *CONFig:TRIGger4:TORR*/s | trigger4 [Torr*/s] | | R/W |
| *CONFig:UNIT:LRSniff | leak rate unit sniff mode (ATM*cc/s, MBAR*/s, PA*m3/s, TORR*/s, PPM, G/A,OZ/YR) | 432 | R/W |
| *CONFig:UNIT:LRVac | leak rate unit vac mode (ATM*cc/s, MBAR*/s, PA*m3/s, TORR*/s) | 431 | R/W |
| *CONFig:UNIT:Pressure | pressure unit (ATM, MBAR, PA, TORR) | 430 | R/W |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|------------------------|---|------------------------|--------------|
| *CONFig:UNIT:SNDisplay | Display unit sniff (incl. CU1000 display) (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A, OZ/YR) | 396 | R/W |
| *CONFig:UNIT:VACuum | Display unit vacuum (incl. CU1000 display) (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s) | 396 | R/W |
| *CONFig:ZEROSTART | zero at start (OFF, ON) | 409 | R/W |
| *CONFig:ZEROTIME | zerotime in seconds (0,5 ... 30 s) | 411 | R/W |
| *FACtor:CALSniff | calibration factor sniff (actual mass) | 521 | R/W |
| *FACtor:CALSLX | calibration factor sniff XL flow (actual mass) | 519 | R/W |
| *FACtor:CALVac | calibration factor vacuum (actual mass) | 520 | R/W |
| *FACtor:FACMachine | machine factor (actual mass) | 522 | R/W |
| *FACtor:FACSniff | sniff factor (actual mass) | 523 | R/W |
| *FACtor:RESistor | resistor factor 500G/15G | 504 | 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:POWer | time since switching on (in minutes) | 147 | R |
| *HOUR:TC | operating hours of TMP converter | 141 | R |
| *HOUR:TIME | Time (HH,MM) | 450 | R/W |
| *HOUR:TURBO | Operating hours of TMP | 140 | R |
| *IDN:BMNETType | Bus-Module network type | 324 | R |
| *IDN:BMSerial | serial-number Bus module | 325 | R |
| *IDN:BMVersion | software version Bus module | 323 | R |
| *IDN:CRC | check sum | 320 | R |
| *IDN:CUversion | software version control unit | 314 | R |
| *IDN:DEvice | name of instrument (MSB) | 301 | R |
| *IDN:DIP1 | MSB DipSwitch 1 | 321 | R |
| *IDN:DIP2 | MSB DipSwitch 2 | 321 | R |
| *IDN:IOversion | software version I/O module | 313 | R |
| *IDN:SERial | serial-number leak detector | 406 | R |
| *IDN:SNSerial | Serial number of sniffer probe | 404 | R |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|---------------------|--|------------------------|--------------|
| *IDN:SNType | Type of sniffer probe SL3000 3 m, SL3000XL 3 m, SL3000 5 m, SL3000XL 5 m, SL3000 10 m, SL3000XL 10 m, SL3000 15 m, SL3000XL 15 m, Sniffer LDS, ADAPTER, ADAPTER XL, FLOW STANDARD, FLOW STANDARD XL, UNKNOWN | 302 | R |
| *IDN:SNVersion | Software version of sniffer probe | 311 | R |
| *IDN:TCHARDware | Hardware version of the TMP frequency converter | | |
| *IDN:TCNAME | TMP frequency converter type | | |
| *IDN:TURBO | software version TMP controller | 315 | R |
| *IDN:VERsion | software version MSB | 310 | R |
| *MEASure:ACCEL:X | Probe acceleration value in X-direction | 1581 | R |
| *MEASure:ACCEL:Y | Probe acceleration value in Y-direction | 1581 | 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 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 |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|----------------------------------|---|------------------------|--------------|
| *MEASure:DIGITALOUT | state of the PLC inputs as binary number; inactive = 0, active = 1 Byte 0, Bit 0: PLC OUT 1 Byte 0, Bit 1: PLC OUT 2 Byte 0, Bit 2: PLC OUT 3 Byte 0, Bit 3: PLC OUT 4 Byte 0, Bit 4: PLC OUT 5 Byte 0, Bit 5: PLC OUT 6 Byte 0, Bit 6: PLC OUT 7 Byte 0, Bit 7: PLC OUT 8 | 262 | 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: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:P1 | p1 pressure in selected unit | 130 | R |
| *MEASure:P1:ATM | p1 pressure [atm] | | R |
| *MEASure:P1:MBAR | p1 pressure [mbar] | 131 | R |
| *MEASure:P1:PA | p1 pressure [Pa] | | R |
| *MEASure:P1:TORR | p1 pressure [Torr] | | R |
| *MEASure:P2 | P2 pressure in selected unit | 132 | R |
| *MEASure:P2:ATM | p2 pressure [atm] | | R |
| *MEASure:P2:MBAR | p2 pressure in [mbar] | 133 | R |
| *MEASure:P2:PA | p2 pressure [Pa] | | R |
| *MEASure:P2:TORR | p2 pressure [Torr] | | R |
| *MEASure:P3 | P3 pressure (only for service) | 134 | R |
| *MEASure:P4 | P4 pressure (only for service) | 135 | R |
| *MEASure:PHEAT | Cathode heating power [W] | 207 | R |
| *MEASure:SUPPRESS | suppressor potential [V] | 169 | 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:TEMPeratur:TCPump | TMP temperature bottom [°C] | 143 | R |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|--------------------------|--|------------------------|--------------|
| *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:U15N | -15 V supply [V] | 211 | R |
| *MEASure:U15P | +15 V supply [V] | 210 | R |
| *MEASure:U24 | 24 V supply [V] | 200 | R |
| *MEASure:U24IO | 24 V supply IO [V] | 213 | R |
| *MEASure:U24IO_OUT | 24V power out IO [V] | 219 | R |
| *MEASure:U24PI | 24 V power out pirani [V] | 214 | R |
| *MEASure:U24PWR1_2 | 24 V power out12 [V] | 215 | R |
| *MEASure:U24PWR3_4 | 24 V power out34 [V] | 216 | R |
| *MEASure:U24PWR5_6 | 24 V power out56 [V] | 217 | R |
| *MEASure:U24RC | 24V_2 power out RC [V] | 212 | R |
| *MEASure:U5 | +5 V supply [V] | 218 | R |
| *MEASure:UHEAT | Cathode heating voltage [V] | | R |
| *MEASure:UVV | preamplifier voltage [V] | 202 | R |
| *READ | leak rate in selected unit | 128 | R |
| *READ:ATM*cc/s | leak rate [Atm*cc/s] | | R |
| *READ:G/a | leak rate [g/a (only in sniff)] | | R |
| *READ:MBAR*I/s | leak rate [mbar*I/s] | 129 | R |
| *READ:PA*m3/s | leak rate [Pa*m3/s] | | R |
| *READ:PPM | leak rate [ppm (only in sniff)] | | R |
| *READ:TORR*I/s | leak rate [Torr*I/s] | | R |
| *RST:FACTORY | Sets all parameters to factory default | 1161 | W |
| *RST:SL3000 | Sets all parameters to factory default for use with SL3000 | 1161 | W |
| *SERVICE:EMISSion | Emission ON, OFF | 9 | R/W |
| *SERVICE:READBuffer | Read service buffer | 1300 ... 1310 | R |
| *SERVICE:TMP | Switch TMP on or off (ON, OFF) | 10 | R/W |
| *SERVICE:VALVE | ON: Opens internal testleak OFF: Closes internal testleak AUTO: Enables internal calibration | | R/W |
| *STArt | Start | 1 | W |
| *STArt:AMPTest | Starts Amplifier test | 371 | W |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|--------------------------------|--|------------------------|--------------|
| *STArt:AMPTest | NO_EMITsion Starts Amplifier test with suppressor | 2668 | W |
| *STATus | status of LDS3000 (ERROR, RUNUP, EMISSION, CAL_ACTIVE, STANDBY) "STBY", "ERROR", "CAL", "ACCL", "MEAS", "EMI OFF" | | R |
| *STATus:AMPTest | Possible answers (READY, RUNNING, RANGE ERROR 1...3, RANGE ERROR 2, 3, RANGE ERROR 3, OFFSET ERROR, GAIN ERROR 1, 2, GAIN ERROR 2, 3) | 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) | 260 | R |
| *STATus:CALHist | Calibration history *Factor, Test leak, Anode voltage, Mass, Date, Time, Cathode, State Calibration history entry 1 (newest) Calibration history entry 2 ... Calibration history entry 10 | 275 | R |
| *STATus:CAThode | actual state of the cathodes ON1, ON2, AUTO1, AUTO2, (automatic switching) OFF | 530 | R |
| *STATus:EMITsion | Emission status: STOP, START, WAIT, RAMP, REGUL, STABLE, DOWN, OFF | 264 | R |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|-------------------------|--|------------------------|--------------|
| *STATus:ERRHist | Actual error history entry In LDS2010 compatibility mode: dd.mm.yy hh.mm Exx Exx is error number from LDS2010 error number group All other compatibility modes: 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" | 290 | R |
| *STATus:ERRor | current number of error / warning („NO ERROR/WARNING“ or 3-digit failure number) | 290 | R |
| *STATus:MODE | actual vacuum mode ((VAC, SNIFF, SL3000) | 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:SNkey | Status of sniffer key. 0 = not pressed 1 = left key pressed, 2 = right key pressed, 3 = both keys pressed | 298 | R |
| *STATus:SWITCHONCounter | current number of switching on the MSB | 157 | R |
| *STATus:TRIGger | status of trigger S1,S2, S3, S4 with S1 ... S4 is "ON" or "OFF" depending of the states of trigger1 to trigger4 | 385 | R |
| *STATus:VALVE | status of valves 0 ... 255 as 8-bit binary number (0 = off; 1 = on) Bit 0 = Test leak Bit 4 = Sniffer valve Bit 1 = Gas ballast | 449 | R |
| *STATus:VALVE:TestLeak | ON, OFF | 12 | R/W |

| Command | Meaning | Relates to LD cmd. no. | Read / Write |
|---------------------|---|------------------------|--------------|
| *STATus:WARNINGBits | Status of warnings as 32-bit binary number Bit 0 = warning pressure/flow too high Bit 1 = warning pressure rise Bit 2 = warning anode voltage Bit 3 = warning pirani Bit 4 = warning emission Bit 5 = warning suppressor Bit 6 = warning tmp Bit 7 = warning anybus Bit 8 = warning maintenance Bit 9 = warning IO disconnected Bit 10 = warning 5 V Bit 11 = warning 24 V heater Bit 12 = warning 24 V out12 Bit 13 = warning 24 V out34 Bit 14 = warning 24 V out56 Bit 15 = warning 24 V 8 Bit 16 = warning 24 V 9 Bit 17 = warning 24 V 10 Bit 18 = warning 24 V 11 Bit 19 = warning cathode voltage Bit 20 = warning MSB temperature Bit 21 = warning preamp temperature Bit 22 = warning cal request Bit 23 = warning sniffer disconnected Bit 24 = warning preamp disconnected Bit 25 = warning +15V Bit 26 = warning -15V Bit 27 = warning pressure XL flow Bit 28 = warning real time clock | 297 | R |
| *STATus:ZERO | Zero (ON, OFF) | 6 | R |
| *STOp | stop | 2 | W |
| *ZERO | switch zero on | 6 | W |
| *ZERO:OFF | switch zero off | 6 | W |
| *ZERO:ON | switch zero on | 6 | W |

2.5 Examples

External Calibration

- 1 Open testleak (move sniffer to leak)
- 2 Wait until stable
- 3 Start calibration: *CAL:EXT
- 4 wait until *STATUS:CAL? answers "CLOSE"
- 5 Close testleak (remove sniffer from leak)
- 6 Wait until stable
- 7 send: *CAL:CLOSED
- 8 wait until *STATUS:CAL? answers "IDLE"

| 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 trigger 1 |
| *conf:trig1 2.0E-9 (CR) | OK (CR) | set trigger 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 |
| E09 | error buffer overflow |
| E10 | command invalid |
| E11 | query not allowed |
| E12 | only query allowed |
| E13 | not yet implemented |

3 LD Protocol

3.1 Communication Parameters

Data format

Baudrate 19.200, 8 data bits, 1 stop bit, no parity

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 24) |
| 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 25) |
| 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 ... 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 |

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.

3.3 Status Word

| Status word bit no. | Meaning |
|---------------------|---|
| Bit 0 | 0 = Runup |
| Bit 1 | 1 = Measuring VAC |
| Bit 2 | 2 = Measuring SNIF |
| Bit 3 | 3 = Standby VAC 4 = Standby SNIF 5 = Calibration VAC 6 = Calibration SNIF 7...14 = not used 15 = Not READY |
| Bit 4 | ZERO |
| Bit 5 | Still warning |
| Bit 6 | Sniffer Key |
| Bit 7 | USER CHANGE |
| Bit 8 | PLC Output Change |
| Bit 9 | Trigger 1, 1 = Trigger 1 exceeded |
| Bit 10 | Trigger 2, 1 = Trigger 2 exceeded |
| Bit 11 | not used |
| Bit 12 | not used |
| Bit 13 | Device warning |
| Bit 14 | Device error |
| Bit 15 | Syntax/Command error |

3.4 Commands

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|---------|-------------------------------|-----|-----------|------------------------------------|---|---------------------------|
| dez | hex | | | | | | | |
| 0 | 0 | Control | NOP | R | NO_DATA | | "No operation", replies without data | X |
| 1 | 1 | Control | Start | W | NO_DATA | | Switch from "standby" to "measure" | |
| 2 | 2 | Control | Stop | W | NO_DATA | | Switch from "measure" to "standby" | |
| 4 | 4 | Control | Start calibration | W | UINT8 | 0, 0, 5 | Start calibration: 0 = internal 1 = external 2 = dynamic 3 = machine/sniff factor 4 = proof internal 5 = proof external | |
| 5 | 5 | Control | Clear error | W | NO_DATA | | Clear Error or Warning | |
| 6 | 6 | Control | Zero | R/W | UINT8 | 0, 0, 1 | 0 = Zero "Off" 1 = Zero "On" respectively update zero value | |
| 9 | 9 | Control | Emission nominal status | R/W | UINT8 | 0, 1, 1 | Emission nominal status 0 = off 1 = on | |
| 10 | A | Control | TMP nominal status | R/W | UINT8 | 0, 1, 1 | TMP nominal status 0 = off 1 = on | |
| 11 | B | Control | Calibration acknowledge | W | UINT8 | 0, 0, 1 | 1 = Continue calibration 0 = cancel calibration | |
| 12 | C | Control | Open/close int. testleak | R/W | UINT8 | 0, 0, 1 | 0 = close 1 = open incl. Emission monitoring (less sensitive) internal calibration will overwrite the state | |
| 18 | 12 | Control | Mute beep | R/W | UINT8 | 0, 1, 1 | Mute Beep 0 = ON, 1 = OFF | |
| 120 | 78 | Meas | Proof int testleak [mbar/l/s] | R | FLOAT | | Result of proof function | |
| 128 | 80 | Meas | Leak rate [sel. unit] | R | FLOAT | | Leak rate in selected unit | |
| 129 | 81 | Meas | Leak rate [mbar*l/s] | R | FLOAT | | Leak rate in mbar*l/s | |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|-------|--|-----|-----------|------------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 130 | 82 | Meas | Internal pressure 1 [sel. unit] | R | FLOAT | | Pressure p1 in selected unit | |
| 131 | 83 | Meas | Internal pressure 1 [mbar] | R | FLOAT | | Pressure p1 in mbar | |
| 132 | 84 | Meas | Internal Pressure 2 [sel. unit] | R | FLOAT | | Pressure p2 in selected unit | |
| 133 | 85 | Meas | Internal Pressure 2 [mbar] | R | FLOAT | | Pressure p2 | |
| 134 | 86 | Meas | Pressure sensor 3 | R | FLOAT | | Sensor (0 ... 10 V). Config via commands 2630,2634,2638 | |
| 135 | 87 | Meas | Pressure sensor 4 | R | FLOAT | | Sensor (0 ... 20 mA) config via commands 2632,2636,2639 | |
| 138 | 8A | Meas | TMP actual rotation speed [Hz] | R | UINT16 | | TMP actual rotation speed | |
| 139 | 8B | Meas | TMP power [W] | R | FLOAT | | TMP power in Watt as reportet by TMP controller | |
| 140 | 8C | Meas | TMP operation hours [h] | R | UINT32 | | TMP operation hours | |
| 141 | 8D | Meas | Frequency converter operation hours [h] | R | UINT32 | | Frequency converter operation hours [h] | |
| 142 | 8E | Meas | Leak detector operation hours | R | UINT32 | | Leak detector operation hours | |
| 143 | 8F | Meas | TMP temperature bottom [deg. C] | R | FLOAT | | TMP temperatur bottom [°C] | |
| 144 | 90 | Meas | TMP temperature electronic [deg. C] | R | FLOAT | | TMP temperatur electronic [°C] | |
| 145 | 91 | Meas | TMP temperature bearing [deg. C] | R | FLOAT | | TMP temperatur bearing [°C] | |
| 146 | 92 | Meas | TMP temperature motor [deg. C] | R | FLOAT | | TMP temperatur motor [°C] | |
| 147 | 93 | Meas | Time since power on [min] | R | UINT32 | | Time since power on [min] | |
| 148 | 94 | Meas | Cathode1 operation hours | | UINT32 | | Cathode1 operation hours | |
| 149 | 95 | Meas | Cathode2 operation hours | | UINT32 | | Cathode2 operation hours | |
| 150 | 96 | Meas | TMP voltage [V] | R | FLOAT | | TMP voltage as reported by TMP controller | |
| 151 | 97 | Meas | TMP current [A] | R | FLOAT | | TMP current as reported by TMP controller | |
| 157 | 9D | Meas | Switch on counter | R | UINT16 | | Counts the switch on cycles 0, 0, 65534 | |
| 165 | A5 | Meas | Electronic temperature [deg. C] | R | FLOAT | | MSB temperature [°C] | |

| Command | | Class | Name | R/W | Data type | Min-, Def-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|-------|-----------------------------------|-----|-----------|-----------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 166 | A6 | Meas | Preamplifier temperature [deg. C] | R | FLOAT | | Preamplifier temperature [°C] | |
| 167 | A7 | Meas | Anode voltage [V] | R | FLOAT | | Anode voltage [V] | |
| 168 | A8 | Meas | Cathode voltage [V] | R | FLOAT | | Cathode voltage [V] | |
| 169 | A9 | Meas | Suppressor voltage [V] | R | FLOAT | | Suppressor voltage [V] | |
| 170 | AA | Meas | Anode-cathode voltage [V] | R | FLOAT | | Anode-cathode voltage [V] | |
| 171 | AB | Meas | Emission current [A] | R | FLOAT | | Emission current [A] | |
| 172 | AC | Meas | Heater input [V] | R | FLOAT | | DAC Heater [V] | |
| 200 | C8 | Meas | 24 V supply [V] | R | FLOAT | | 24 V supply voltage for heater, processor, preamplifier [V] | |
| 202 | CA | Meas | Pre amplifier voltage [V] | R | FLOAT | | Pre amplifier voltage [V] | |
| 206 | CE | Meas | Heater voltage [V] | R | FLOAT | | Heater voltage [V] | |
| 207 | CF | Meas | Heater power [W] | R | FLOAT | | Heater power in W | |
| 209 | D1 | Meas | 24 V power out TMP [V] | R | FLOAT | | 24 V TMP, voltage [V] | |
| 210 | D2 | Meas | +15 V supply [V] | R | FLOAT | | +15 V voltage [V] | |
| 211 | D3 | Meas | -15 V supply [V] | R | FLOAT | | -15 V voltage [V] | |
| 212 | D4 | Meas | 24 V power out RC [V] | R | FLOAT | | 24 V RC, CU1000 voltage [V] | |
| 213 | D5 | Meas | 24 V supply IO [V] | R | FLOAT | | 24 V IO-Modul supply voltage [V] | |
| 214 | D6 | Meas | 24 V power out pirani [V] | R | FLOAT | | 24 V Pirani, sniffer voltage [V] | |
| 215 | D7 | Meas | 24 V power out12 [V] | R | FLOAT | | 24 V Power output 1,2 voltage [V] | |
| 216 | D8 | Meas | 24 V power out34 [V] | R | FLOAT | | 25 V Power output 3,4 voltage [V] | |
| 217 | D9 | Meas | 24 V power out56 [V] | R | FLOAT | | 26 V Power output 5,6 voltage [V] | |
| 218 | DA | Meas | +5 V supply [V] | R | FLOAT | | +5 V voltage [V] | |
| 219 | DB | Meas | 24V power out IO [V] | R | FLOAT | | 24 V Power out IO-Modul, voltage [V] | |
| 220 | DC | Meas | Analog input IO module [V] | R | FLOAT | | Analog input voltage IO module in [V] | |

| Command | | Class | Name | R/W | Data type | Min-, Def-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|-------|---|-----|-----------|--|---|---------------------------|
| dez | hex | | | | | | | |
| 221 | DD | Meas | Analog outputs IO [V] | R/W | FLOAT[2] | 0, 0, 10.25 | 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 | Param | Analog output configuration IO module | R/W | UINT8[2] | ANALOG-OUT 1: 0, 3, 12 ANALOG-OUT 2: 0, 4, 12 | Function of analog output Index [0]: Channel 1 Index [1]: Channel 2 0 = OFF 1 = P1 2 = P2 3 = Leak rate mantissa 4 = Leak rate exponent 5 = Leak rate linear 6 = Leak rate logarithmic 7 = Leak rate logarithmic H. 8 = Voltage settable by command 221 9 = Leak rate exponent invers 10 = Leak rate mantissa hysteresis 11 = P1 1V/decade 12 = P2 1V/decade | |
| 223 | DF | Param | Analog output leak rate scale (log. only) | R/W | UINT8 | 0, 0, 7 | Leak rate scaling of analog output in logarithmic mode 0 = 0.5 V/decade 1 = 1 V/decade 2 = 2 V/decade 3 = 2.5 V/decade 4 = 3 V/decade 5 = 5 V/decade 6 = 10 V/decade 7 = special 1 | |
| 224 | E0 | Param | Analog output upper exponent | R/W | SINT8 | -12, -5, 7 | Upper limit for the analog out at the I/O module. Value is exponent of the mbar*l/s value. Example: -5 = 1E-5 mbar*l/s | |

| Command | | Class | Name | R/W | Data type | Min-, Def-., Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|-------|-----------------------|-----|-----------|------------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 226 | E2 | Param | Leakrate limits vac | R/W | FLOAT[2] | 1E-12, 1E-11, 1E4 | Index [0]: lower limit [mbar/l/s] Index [1]: upper limit [mbar/l/s] Valid for command 128 "Leak rate [sel. unit]" and analog outputs | X |
| 227 | E3 | Param | Leakrate limits sniff | R/W | FLOAT[2] | 1E-8, 1E-7, 1E4 | Index [0]: lower limit [mbar*l/s] Index [1]: upper limit [mbar*l/s] Valid for command 128 "Leak rate [sel. unit]" and analog outputs | X |
| 228 | E4 | Param | Gasballast mode | R/W | UINT8 | 0, 0, 2 | 0 = off, 1 = on, 2 = on (continuous on, not PLC controlled) | |
| 229 | E5 | Param | Flow control | R/W | UINT8 | 0, 0, 3 | 0 = 25 sccm 1 = 300 sccm (low) 2 = 3000 sccm high flow 3 = standby flow | |

| Command | | Class | Name | R/W | Data type | Min-, Def., Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|----------------------------|-----|-----------|-----------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 260 | 104 | Status | State calibration | R | UINT8 | | Status of calibration 0 = READY 1-6 = INT CAL 11-14 = EXT CAL 15 = WAIT_ZERO_EXT 16 = MEAS_ZERO_EXT 21-24 = DYN CAL 25 = WAIT_ZERO_DYN 26 = MEAS_ZERO_DYN 31-36 = CAL Mach factor 37 = WAIT_TL_EXT_MACH 38 = MEAS_TL_EXT_MACH 39 = WAIT_ZERO_EXT_MACH 40 = MEAS_ZERO_EXT_MACH 41-44 = EXT PROOF 45-49 = INT PROOF 51 = FAIL CURRENT 52 = FAIL STATUS 53 = FAIL_TL_TO_SMALL 54 = FAIL_FACTOR 55 = WARN_FACTOR 56 = FAIL_EMIS 57 = PROOF_DEV 59 = PEAKERR | |
| 261 | 105 | Status | 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 | Status | PLC output state IO module | R | UINT8 | | Get PLC output state IO module Bit 0 ... 7 = PLCOut 1 ... 8 | |

| Command | | Class | Name | R/W | Data type | Min-, Def-., Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|---------------------------------------|-----|-----------|---|---|---------------------------|
| dez | hex | | | | | | | |
| 263 | 107 | Param | PLC output configuration IO module | R/W | SINT8[8] | Default: PLC_OUT1:-2, PLC_OUT2:-3, PLC_OUT3:-4, PLC_OUT4:-5, PLC_OUT5: 6, PLC_OUT6:-8 PLC_OUT7:-10, PLC_OUT8:-1 Min -20 Max 20 | Index [0 ... 7] = PLC_OUT1 ... PLC_OUT_8 use negative values for inverted functions 0 = OPEN 1 = OPEN 2 = TRIG1 3 = TRIG2 4 = TRIG3 5 = TRIG4 6 = READY 7 = WARNING 8 = ERROR 9 = CAL_ACTIVE 10 = CAL_REQUEST 11 = RUN_UP 12 = ZERO_ACTIVE 13 = EMISSION_ON 14 = MEASURE 15 = STANDBY 16 = SNIFF 17 = ERROR_WARNING 18 = GASBALLAST 19 = STAT_TL 20 = CAL_STABLE 21 = CATHODE2 | |
| 264 | 108 | Status | Emission actual status | R | UINT8 | | Emission status: 0 = STOP 1 = START 2 = WAIT 3 = RAMP 4 = REGULATE 5 = STABLE 6 = DOWN 7 = OFF | |
| 274 | 112 | Status | Last entry in cal history | | UINT8 | | History list index of the last (newest) entry in the calibration history | |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|-----------------------------|-----|-----------|------------------------------------|---|---------------------------|
| dez | hex | | | | | | | |
| 275 | 113 | Status | Cal history | | CHAR[*] | | Text of calibration in the history list. To read send after the array index 255 the UINT8 history list index (0 ... 9). Without history list index you will get the last (newest) entry. Answer: ListNo, 'Fac:', Calfac(float), 'Leak:', Testleak(float), 'Anod:', Anodevoltage, 'M', Mass, 'XXXX', year/month/day, hour:min:sec, 'Cat:', Cathode, 'State:', cal state XXXX: VACi = VAC internal VACe = VAC external VACd = VAC dynamic VACM = VAC machine factor SNFi = Sniff internal SNFe = Sniff external SNFd = Sniff dynamic SNFM = Sniff machine factor SNFL = SL3000XL low flow SNFH = SL3000XL high flow Example: 08 Fac: 1.00E+0 Leak: 2.00E-6 Anod: 910 M2 VACe 2014/04/17 09:36:01 Cat: 1 State: 000 | X |
| 277 | 115 | Status | Last entry in error history | R | UINT8 | | Index of the last (newest) entry in the error history list | |

| Command | | Class | Name | R/W | Data type | Min-, Def-., Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|--|-----|------------|------------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 287 | 11F | Status | Error history | R | CHAR[*] | | Text of an error/warning in the history list. To read send after the array index 255 the UINT8 history list index (0 ... 15). Without history list index you will get the last (newest) entry. Entry format: ListNo, 'ERR' or 'WRN', ErrNo, ErrValue(float), year/month/day, hour:min:sec, 'SwOnCnt:', SwitchOnCnt, 'OnTm:', MinSinceStart Example: 05 WRN220 2.103E+1 2014/17/04 09:37:48 SwOnCnt: 028 OnTm: 035 | X |
| 288 | 120 | Status | TMP error history | R | CHAR[*] | | Text of an error/warning in the TMP history list. To read send after the array index 255 the UINT8 history list index (1 ... 10). Entry format: ListNo, 'ERR' or 'WRN', >ErrNO Example: 05 WRN220 | X |
| 289 | 121 | Status | Value of actual error | R | FLOAT | | Value associated with the actual error or warning | |
| 290 | 122 | Status | Number of actual error | R | UINT16 | | Error number of the actual error or warning | |
| 291 | 123 | Status | List of signal values of active errors | R | FLOAT[10] | | Lists the signal values of the errors/warnings since the last "clear error" | |
| 294 | 126 | Status | 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 |
| 296 | 128 | Status | List of active errors | R | UINT16[10] | | Lists the error/warning numbers since the last "clear error" | |

| Command | | Class | Name | R/W | Data type | Min-, Def., Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|-----------------------|-----|-----------|-----------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 297 | 129 | Status | Present warnings | R | UINT32 | | Each bit represents a warning Bit 0: Warning pressure/flow Bit 1: Warning pressure rise Bit 2: Warning anode voltage Bit 3: Warning pirani Bit 4: Warning emission Bit 5: Warning suppressor Bit 6: Warning TMP Bit 7: Warning Anybus Bit 8: Warning maintenance Bit 9: Warning I/O disconnected Bit 10: Warning 5V Bit 11: Warning U24VHz Bit 12: Warning U24V Pwr12 Bit 13: Warning U24V Pwr 34 Bit 14: Warning U24V Pwr 56 Bit 15: Warning U24V8 Bit 16: Warning U24V9 Bit 17: Warning U24V10 Bit 18: Warning U24V11 Bit 19: Warning cathode voltage Bit 20: Warning temperature MSB Bit 21: Warning temp. preamplifier Bit 22: Warning calibration request Bit 23: Warning sniffer not connected Bit 24: Preamp output too low Bit 25: Warning +15V Bit 26: Warning -15V Bit 27: Warning XL flow | |
| 298 | 12A | Status | Sniffer button | R | UINT8 | | Read state sniffer button 1 = pressed SL3000: 1 = left, 2 = right SL3000XL: Bit 0 = left, Bit 1 = right | |
| 300 | 12C | Status | Device identification | R | UINT8[2] | | Device identification, always {1,45} for MSB | |
| 301 | 12D | Status | Device name | R | CHAR[*] | | Get device name as ASCII string, 'always "MSB" | |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|-------------------------------------|-----|-----------|------------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 302 | 12E | Status | Sniffer probe type | R | UINT8 | | READ: 0 = SL3000 3 m 1 = SL3000XL 3 m 2 = Adapter 3 = Adapter XL 4 = Flussnormal 5 = Flussnormal XL 10 = SL3000 5 m 11 = SL3000XL 5 m 20 = SL3000 10 m 21 = SL3000XL 10 m 30 = SL3000 15 m 31 = SL3000XL 15 m 254 = Sniffer LDS 255 = no Sniffer | X |
| 310 | 136 | Status | SW-version MSB | R | UINT8[3] | | Software version MSB Index [0]: Main version Index [1]: Sub version Index [2]: Debug version | |
| 311 | 137 | Status | SW-version probe programming master | R | UINT8[3] | | SW-Version of sniffer probe (SL3000XL) | |
| 313 | 139 | Status | 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 | |
| 314 | 13A | Status | SW-version control unit | R/W | UINT8[3] | | Software version control unit Index [0]: Main version Index [1]: Sub version Index [2]: Debug version write for internal use only | |
| 315 | 13B | Status | SW version TMP controller | R | CHAR[6] | | SW version TMP controller (character string from TMP controller) | |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|-----------------------------------|-----|-----------|------------------------------------|---|---------------------------|
| dez | hex | | | | | | | |
| 316 | 13C | Status | HW-version TMP controller | R | CHAR[6] | | HW version TMP controller (character string from TMP controller) | |
| 317 | 13D | Status | TMP controller name | R | CHAR[6] | | TMP controller name (character string from TMP controller) | |
| 318 | 13E | Status | SW version boot loader | R | UINT8[3] | | Software version of boot loader | |
| 319 | 13F | Status | 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 | Status | CRC-code MSB | R | UINT32 | | CRC-code interface board abcdwxyz (hex) abcd: caclulated value wxyz: nominal value | |
| 321 | 141 | Status | DIP switch MSB | R | UINT8 | | DIP switch setting of the MSB: Bit 7: S171, switch 4 Bit 6: S171, switch 3 Bit 5: S171, switch 2 Bit 4: S171, switch 1 Bit 3: S170, switch 4 Bit 2 ... 0: not used,always 0 | |
| 322 | 142 | Status | Field bus status word | R | UINT16 | | Status word for Bus module refer to Bus module documentation | |
| 323 | 143 | Status | SW version bus module | R | UINT8[3] | | SW version bus module | |
| 324 | 144 | Status | Bus module fieldbus type | R | UINT16 | | Bus module fieldbus type. 0x0005 Profibus 0x0020 CANOpen 0x0065 ControlNet 0x0084 Profinet IO 0x0096 Profinet IO 2-port 0x0085 Ethernet IP 0x0087 EtherCAT 0x0080 Modbus TCP 0x0090 CCLink 0x0045 ModbusRTU 0x0025 DeviceNet | |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|---------------------------------------|-----|-----------|------------------------------------|---|---------------------------|
| dez | hex | | | | | | | |
| 325 | 145 | Status | Serial number plug-in unit bus module | R | UINT8[4] | | Serial number plug-in unit bus module | |
| 326 | 146 | Status | Field bus address actual value | R | UINT8 | | Fiedbus address actual value Refer to AnybusCC specification for enumeration. | |
| 327 | 147 | Status | Field bus baud rate | R | UINT8 | | Baud rate at field bus Refer to AnybusCC specification for enumeration. | |
| 328 | 148 | Status | Exception code bus module | R | UINT8 | | Exception code bus module | |
| 329 | 149 | Status | Error counters bus module | R | UINT16[4] | | Error counters bus module Index [0] = Discarded commands Index [1] = Discarded Responses Index [2] = Serial Reception errors Index [3] = Fragmentation errors | |
| 330 | 14A | Status | 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 | Param | Field bus address nominal value | R/W | UINT8 | 0, 126, 255 | Fiedbus address nominal value Refer to AnybusCC specification for enumeration. | |
| 333 | 14D | Param | Field bus profile | R/W | UINT8 | | Fieldbus profile: 0=HMS_default | |
| 336 | 150 | Status | Field bus station name | R | CHAR[*] | | BM1000 Station name (PROFINET IO only) | |
| 337 | 151 | Status | Field bus IP address | R | UINT8[4] | | BM1000 IP address (IP based field busses only) | |
| 338 | 152 | Status | Field bus IP subnet mask | R | UINT8[4] | | BM1000 IP address (IP based field busses only) | |
| 339 | 153 | Status | Field bus gateway IP address | R | UINT8[4] | | BM1000 gateway IP address (IP based field busses only) | |
| 340 | 154 | Status | Field bus DHCP enabled | R | UINT8 | | BM1000 DHCP (IP based field busses only) | |

| Command | | Class | Name | R/W | Data type | Min-, Def-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|---------------------------------------|-----|-----------|-----------------------------------|---|---------------------------|
| dez | hex | | | | | | | |
| 370 | 172 | Param | Amp test | R/W | UINT8 | | 0 = no test with calibration 1 = test with calibration | |
| 371 | 173 | Status | Run Amp test | R/W | UINT8 | | write: 1 = test now read: 0 = Ready 1 ... 13 test running | |
| 380 | 17C | Param | Search active | R/W | UINT8 | 0, 0, 1 | 0 = Off 1 = ON trigger2 for search in HIGHFLOW SL3000XL only | |
| 385 | 181 | Param | Trigger [mbar*l/s] | R/W | FLOAT[4] | 1E-12, 1E-5, 1E3 | Trigger in mbar*l/s | |
| 387 | 183 | Status | Trigger status | R | UINT8 | | Trigger status: 0 = Leck rate < trigger level 1 = Leak rate > trigger level Bit 0 = Trigger1 Bit 1 = Trigger2 Bit 2 = Trigger3 Bit 3 = Trigger4 | |
| 390 | 186 | Param | Test leak extern vacuum [mbar*l/s] | R/W | FLOAT[3] | 1E-9, 9.9E-1, 9.9E-1 | Test leak extern Vacuum [mbar*l/s] Index [0] = Mass 2 Index [1] = Mass 3 Index [2] = Mass 4 Helium | |
| 392 | 188 | Param | Test leak extern sniff [mbar*l/s] | R/W | FLOAT[3] | 5.0E-6, 9.9E-1, 9.9E-1 | Test leak extern for sniff mode in mbar*l/s Index [0] = Mass2 forming gas 5/95 Index [1] = Mass 3 Index [2] = Mass 4 Helium | X |
| 394 | 18A | Param | Testleak intern [mbar*l/s] | R/W | FLOAT | 1E-9, 9.9E-1, 9.9E-1 | Testleak intern in mbar*l/s | |
| 396 | 18C | Param | Display unit | R/W | UINT8[2] | 0, 0, 3 | Index [0] = VAC Index [1] = SNIFF 0 = mbar/l/s 1 = Pa m3/s 2 = Atm ccs 3 = Torr/l/s | X |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|---|-----|-----------|------------------------------------|---|---------------------------|
| dez | hex | | | | | | | |
| 397 | 18D | Param | Display limit | R/W | UINT8[2] | 0,1,15 | Index [0] = lower limit [mbar/l/s] Index [1] = upper limit [mbar/l/s] 0 = normal 1 ... 15 decades higher. In sniff modes the maximum is 11. The space for operation is minimum one decade. When setting is a smaller space, the upper limit will be shifted up. | X |
| 398 | 18E | Param | Language | R/W | UINT8 | Def. english=9 | englisch = 9 german = 7 french = 12 italian = 16 spanish = 10 portuguese = 22 russian = 25 chinese = 4 katakana = 17 Numbers according to Microsoft LCID | X |
| 399 | 18F | Status | Current display limit [selcted unit] | R | FLOAT[2] | | Display limit in current unit Index [0] = lower limit Index [1] = upper limit | |
| 401 | 191 | Param | Operation mode | R/W | UINT8 | 0, 0, 2 | 0 = VACUUM 1 = SNIFF 2 = SL3000XL (SL3000XL read only) | |
| 402 | 192 | Param | Leak rate filter | R/W | UINT8 | 0, 1 ,4 | 0 = 2-zone 1 = I•CAL 2 = Fixed 3 = I-Filter 4 = I-Filter slope suppress | |
| 403 | 193 | Param | Leak rate threshold for averaging time [mbar•l/s] | R/W | FLOAT | 1E-11, 1E-10, 9.9E3 | Leak rate threshold for averaging time in mbar•l/s for 2 zone filter. Below this value the averaging time is 10,24s. Above this value the averaging time is 160ms. | |
| 404 | 194 | Status | Serial number sniffer probe | R | CHAR[11] | | Serial number of sniffer SL3000XL | X |
| 406 | 196 | Status | Serial number leak detector | R | CHAR[11] | | Serial number of the complete leak detector | X |
| 407 | 197 | Status | Serial number MSB | R | CHAR[11] | | Serial number of the MSB | X |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|---------------------------------|-----|-----------|------------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 408 | 198 | Status | Serial number IO module | R/W | CHAR[11] | | Serial number of the IO module | X |
| 409 | 199 | Param | Zero with start | R/W | UINT8 | 0, 0, 1 | Zero with Start 0 = OFF 1 = ON | |
| 410 | 19A | Param | Zero mode | R/W | UINT8 | 0, 0, 5 | suppressed decades: 0 = suppress all 1 = 1 -2 decades background suppression 2 = 2 -3 decades background suppression 3 = 2 decades background suppression 4 = 3-4 decades background suppression 5 = 19/20 of the raw signal background suppression | |
| 411 | 19B | Param | Zero time | R/W | UINT16 | 5, 50, 300 | Update interval for offset value if leakrate signal is negative. Resolution 0,1 s (50 = 5,0 s) | |
| 412 | 19C | Param | Zero Sniffer key enable | R/W | UINT8 | 0, 1, 1 | 0 = zero key disabled 1 = zero key enabled | |
| 413 | 19D | Param | Sniffer LED alarm configuration | R/W | UINT8 | 0, 2, 2 | Configures the behavior of the white sniffer pobe LEDs in case of trigger alarm: 0 = disabled (same Brightness as during normal measurement) 1 = on (higher brightness as during normal measurement if possible) 2 = blink | |
| 414 | 19E | Param | Sniffer white LED brightness | R/W | UINT8 | 0, 5, 6 | Configures the brightness of the white sniffer pobe LEDs in case of normal measurement: 0 = off ... 6 = max Brightness | |
| 415 | 19F | Param | Flow Sniffer key enable | R/W | UINT8 | 0, 1, 1 | 0 = flow key disabled 1 = flow key enabled | |
| 416 | 1A0 | Param | Gas percentage | R/W | FLOAT[3] | 1, 100, 100 | Forming gas percentage (5 %) Index [0] = H2 Index [1] = Mass3 Index [2] = Helium | X |
| 417 | 1A1 | Param | Sniffer beep | R/W | UINT8 | 0, 1, 1 | 0 = Beep disabled 1 = Beep when Trigger1 | |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|-------|-------------------------------|-----|-----------|------------------------------------|---|---------------------------|
| dez | hex | | | | | | | |
| 419 | 1A3 | Param | Calibration request enable | R/W | UINT8 | 0, 1, 1 | 0 = Calibration request disabled 1 = Calibration request enabled | |
| 429 | 1AD | Param | Warn active | R/W | UINT16 | 0, 0, 1 | Bit 0: 0 = No warning 1 = Warning when calibrating in the first 20 minutes | |
| 430 | 1AE | Param | Pressure unit | R/W | UINT8 | 0, 0, 3 | Pressure unit 0 = mbar 1 = Pa 2 = atm 3 = Torr | |
| 431 | 1AF | Param | Leak rate unit vacuum | R/W | UINT8 | 0, 0, 3 | Leak rate unit vacuum 0 = mbar/s 1 = Pam ³ /s 2 = Atm ccs 3 = Torr/s | |
| 432 | 1B0 | Param | Leak rate unit sniff | R/W | UINT8 | 0, 0, 6 | Leak rate unit sniff 0 = mbar/s 1 = Pam ³ /s 2 = Atm ccs 3 = Torr/s 4 = ppm 5 = g/a 6 = oz/yr | |
| 433 | 1B1 | Param | Anode setpoint M2 [V] | R/W | UINT16 | 785, 905, 995 | Anode voltage setpoint for mass 2 (hydrogen) [V] | |
| 434 | 1B2 | Param | Anode setpoint M3 [V] | R/W | UINT16 | 510, 610, 670 | Anode voltage setpoint for mass 3 [V] | |
| 435 | 1B3 | Param | Anode setpoint M4 [V] | R/W | UINT16 | 390, 465, 520 | Anode voltage setpoint for mass 4 (helium) [V] | |
| 436 | 1B4 | Param | Emission current setpoint [A] | R/W | FLOAT | 1E-4, 2.5E-3, 2.8E-3 | Emission current setpoint [A] | |

| Command | | Class | Name | R/W | Data type | Min-, Def-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|-------|--------------------------------------|-----|-----------|---|---|---------------------------|
| dez | hex | | | | | | | |
| 438 | 1B6 | Param | PLC input configuration IO module | R/W | UINT8[10] | Default: PLC_IN 1: 11 PLC_IN 2: 4 PLC_IN 3:-12 PLC_IN 4: 7 PLC_IN 5: 2 PLC_IN 6: 3 PLC_IN 7:9 PLC_IN 8:17 PLC_IN 9:0 PLC_IN 10: 0 Min -24 Max 24 | Configuration of PLC input port of the IO module Index [0 ... 9] = PLC_IN1 ... PLC_IN10 Use negative values for inverted functions. 0 = NO_FUNCTION 1 = DYN_CAL 2 = CAL_EXTERN 3 = CAL_INTERN 4 = SNIFF_VAC 5 = START 6 = STOP 7 = ZERO 8 = ZERO_PULS 9 = CLEAR 10 = GASBALLAST 11 = SELECT_DYN_NORMAL 12 = START_STOP 13 = KEY_1 14 = KEY_2 15 = KEY_3 16 = CAL 17 = ZERO update 18 = open TL 19 = open/close TL with pulse 20 = XL Flow 21 = CAL MACHINE 22 = PROOF INT 23 = PROOF EXT 24 = START/STOP Pulse | |
| 439 | 1B7 | Param | Key switch state | R | UINT8 | | Key switch state 0 = inactive, 1 = active, 2 = not used Bit 0&1: KEY_1 Bit 2&3: KEY_2 Bit 4&5: KEY_3 Bit 6&7: not used | |

| Command | | Class | Name | R/W | Data type | Min-, Def-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|-------|-----------------------------|-----|-----------|-----------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 448 | 1C0 | Param | Valve control location | R/W | UINT16 | | 0 = All valves/outputs controlled by leak detector Set any bit to enable valve/output control by write command 449 See command 449 for a list of possible valves/outputs | |
| 449 | 1C1 | Param | Switch valves | R/W | UINT16 | | Bit 0 = Test leak valve Bit 1 = gas ballast valve Bit 2 = output 3 Bit 3 = output 4 Bit 4 = sniffer valve Bit 5 = output 6 To enable control by this command, see command 448 | |
| 450 | 1C2 | Param | Date+Time [YMDhms] | R/W | UINT8[6] | | Date and time use only with array-index 255 (all bytes) Index [0] = year (0 ... 99) Index [1] = month (1 ... 12) Index [2] = day (1 ... 31) Index [3] = hour (0 ... 23) Index [4] = minute (0 ... 59) Index [5] = second (0 ... 59) | X |
| 452 | 1C4 | Param | Min pressure sniff | R/W | FLOAT | 1E-3, 4E-1, 18 | Minimum pressure p1 in mbar for sniffer mode. If pressure falls below this value, warning 540 (Flow too low) is generated. | |
| 453 | 1C5 | Param | Max pressure sniff | R/W | FLOAT | 1E-3, 2, 18 | Maximum pressure p1 in mbar for sniff. If pressure rises above this value, warning 542 (Sniffer broken) is generated. | |
| 455 | 1C7 | Param | Min pressure XL sniff | R/W | FLOAT | 100, 150, 300 | XL flow (P2) too low warn 550 | |
| 456 | 1C8 | Param | Max pressure XL sniff | R/W | FLOAT | 200, 400, 600 | XL flow (P2) too high warn 552 | |
| 480 | 1E0 | Param | Auto standby interval [min] | R/W | UINT8 | 0, 10, 60 | Auto standby interval 0 = OFF | |
| 499 | 1F3 | Param | Fan output TMP controller | R/W | UINT8 | 0, 0, 1 | 0 = always on 1 = temperature controlled | |
| 501 | 1F5 | Param | TMP rotation speed | R/W | UINT16 | 1000, 1500, 1500 | TMP rotation speed setpoint 1000, 1500 Hz | |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|-------|-----------------------------|-----|-----------|---|--|---------------------------|
| dez | hex | | | | | | | |
| 502 | 1F6 | Param | Amplifier range | R/W | UINT8 | 0, 3, 3 | Amplifier range Amplifier control location 508 automatically set (not auto) 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm | |
| 504 | 1F8 | Param | 500GOhm value | R/W | FLOAT | 4.5E1, 5E11, 5.5E11Ohm | 500GOhm value | |
| 506 | 1FA | Param | Mass | R/W | UINT8 | 2, 4, 4 | 2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium) | |
| 508 | 1FC | Param | Amplifier control location | R/W | UINT8 | 0 = controlled by write command 502 1 = controlled auto | Amplifier control location | |
| 519 | 207 | Param | Cal factors sniff high flow | R/W | FLOAT[3] | 0.01, 1, 100 | Calibration factors for sniff mode high flow Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4 | |
| 520 | 208 | Param | Calibration factors vacuum | R/W | FLOAT[3] | 0.01, 1, 5000 | Calibration factors for vacuum mode Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4 | |
| 521 | 209 | Param | Calibration factors sniff | R/W | FLOAT[3] | 0.01, 1, 100 | Calibration factors for sniff mode Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4 | |
| 522 | 20A | Param | Machine factors vacuum | R/W | FLOAT[3] | 1E-4, 1, 1E5 | Machine factors for vacuum mode Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4 | |
| 523 | 20B | Param | Machine factors sniff | R/W | FLOAT[3] | 1E-4, 1, 1E4 | Machine factors for sniff mode Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4 | |

| Command | | Class | Name | R/W | Data type | Min-, Def-., Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|---------|----------------------------------|-----|------------|------------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 524 | 20C | Param | Machine factor in standby on/off | R/W | UINT8 | 0, 0, 1 | machine factor in standby 0 = OFF, 1 = ON | |
| 529 | 211 | Param | Enable warning | R/W | UINT8 | 0, 1, 1 | 0 = no warning without sniffer 1 = warning without sniffer | |
| 530 | 212 | Param | Cathode selection | R/W | UINT8 | 0, 2, 4 | 0 = CAT1 1 = CAT2 2 = Auto Cat1 3 = Auto Cat2 4 = OFF | |
| 1120 | 460 | Control | Amp alternate test on | R/W | UINT8 | 0, 1, 1 | 0 = OFF, 1 = ON (Default is ON) | |
| 1161 | 489 | Control | Parameter reset | W | UINT8 | | Parameter reset: 0 = Load factory settings 10 = PARA_RESET_LDS1000_MODE 11 = PARA_RESET_LDS2010_MODE 12 = PARA_RESET_SL3000XL_MODE | X |
| 1284 | 504 | Control | Control word | R/W | UINT16 | | Control word (used for Bus module) | |
| 1285 | 505 | Control | Stop service buffer | R/W | UINT8 | | 0 = save new information 1 = no new information | |
| 1300 | 514 | Meas | Service buffer ion current | R | FLOAT[150] | | To read send after the array index 255 the UINT8 block number, each block 10 values (block 14 is newest) | X |
| 1301 | 515 | Meas | Service buffer pressure 1 | R | FLOAT[150] | | see command 1300 | X |
| 1302 | 516 | Meas | Service buffer emis current | R | FLOAT[150] | | see command 1300 | X |
| 1303 | 517 | Meas | Service buffer anode voltage | R | FLOAT[150] | | see command 1300 | X |
| 1304 | 518 | Meas | Service buffer cathode voltage | R | FLOAT[150] | | see command 1300 | X |
| 1305 | 519 | Meas | Service buffer heater power | R | FLOAT[150] | | see command 1300 | X |
| 1306 | 51A | Meas | Service buffer leakrate | R | FLOAT[150] | | see command 1300 | X |
| 1307 | 51B | Meas | Service buffer TMP mode | R | UINT8[150] | | see command 1300 | X |
| 1308 | 51C | Meas | Service buffer TMP speed | R | FLOAT[150] | | see command 1300 | X |
| 1309 | 51D | Meas | Service buffer emission mode | R | UINT8[150] | | see command 1300 | X |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|--------|-----------------------------|-----|------------|------------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 1310 | 51E | Meas | Service buffer sensor 3 | R | FLOAT[150] | | see command 1301 | X |
| 1568 | 620 | Meas | Unfiltered ion current [A] | R | FLOAT | | Unfiltered ion current in A | |
| 1573 | 625 | Meas | Filtered ion current [A] | R | FLOAT | | Filtered ion current in A | |
| 1581 | 62D | Meas | Acceleration | R | UINT8[3] | | Index [0] = X-value Index [1] = Y-value Index [2] = 0 | |
| 1620 | 654 | Meas | Amplifier test currents [A] | R | FLOAT[5] | | Test currents ca. 1.3E-11 A Index [0] = Offset 500G Index [1] = Current 13M Index [2] = Current 470M Index [3] = Current 15G Index [4] = Current 500G | |
| 1621 | 655 | Meas | Int. ADC values | R | UINT16[16] | | Values of internal ADC MSB | |
| 1623 | 657 | Meas | ADC SPI values | R | FLOAT[9] | | | |
| 1800 | 708 | Status | Active protocol IO | R | UINT8 | | Active interface protocol for I/O module. Defined by DIP switch at I/O module or command 2593. | |
| 1815 | 717 | Status | Reset source | R | UINT8 | | Shows the last reason of reset | |
| 2593 | A21 | Param | Interface protocol IO | R/W | UINT8 | 0, 1, 4 | Selected interface protocol for I/O module. Only valid if DIP switch at I/O module is set to "000" 0 = LD 1 = ASCII 3 = LDS2010 Binary 4 = LDS1000 | |
| 2594 | A22 | Param | Compatilby Mode | R/W | UINT8 | 0, 2, 3 | Selected Compatibility Mode 0 = LDS1000 1 = LDS2010 2 = LDS3000 3 = SL3000 | |
| 2627 | A43 | Param | Pressure sensor type | R/W | UINT8[2] | | Index [0]: Reserved (Not used) Index [1]: Pressure gauge p2 0 = PSG500 1 = SL3000XL adapter | |

| Command | | Class | Name | R/W | Data type | Min-, Def-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|---------|----------------------------|-----|-----------|-----------------------------------|---|---------------------------|
| dez | hex | | | | | | | |
| 2628 | A44 | Param | Pressure sensor offset | R/W | FLOAT[2] | | Index [0]: Offset p1 Index [1]: Offset p2 (only valid if sensor type = SL3000XL adapter) | |
| 2629 | A45 | Param | Pressure sensor gain | R/W | FLOAT[2] | | Index [0]: Gain p1 Index [1]: Gain p2 (only valid if sensor type = SL3000XL adapter) | |
| 2630 | A46 | Param | P3 min max pressure | R/W | FLOAT[2] | 0, 5E-4, 1E4 | Range sensor 3 (0 ... 10 V) | |
| 2632 | A48 | Param | P4 min max pressure | R/W | FLOAT[2] | 0, 0, 1E4 | Range sensor 4 (0 ... 20 mA) | |
| 2634 | A4A | Param | P3 min max voltage | R/W | FLOAT[2] | -10, 1.9, 10 | Voltage range sensor 3 (0 ... 10 V) | |
| 2636 | A4C | Param | P4 min max current | R/W | FLOAT[2] | -20, 4, 20 | Current range sensor 4 (0 ... 20 mA) | |
| 2638 | A4E | Param | P3 mode | R/W | UINT8 | 0, 1, 1 | Sensor 3 mode 0 = lin, 1 = log | |
| 2639 | A4F | Param | P4 mode | R/W | UINT8 | 0, 0, 1 | Sensor 4 mode 0 = lin, 1 = log | |
| 2650 | A5A | Param | Set suppressor voltage [V] | R/W | FLOAT | | Suppressorvoltage for test | X |
| 2660 | A64 | Param | Maintenance activ | R/W | UINT8 | 0, 1, 3 | 0 = off, 1 = TMP 2 = Membrane pump 3 = TMP + Membrane pump | |
| 2661 | A65 | Control | Set maintenance | W | UINT8 | | 1 = bearing/lubricant 2 = TMP novated 3 = Membrane pump | X |
| 2662 | A66 | Param | Maintenance done | R | CHAR[*] | | To read send after the array index 255 the UINT8 maintenance list index (0 ... 9). Without history list index you will get the last (newest) entry Entry format: "ListNo year/month/day type". Example 3 12/06/01 bearing/lubricant | X |

| Command | | Class | Name | R/W | Data type | Min-, Def.-, Max- value LDS3000 | LDS3000 MSB | No fieldbus support |
|---------|-----|-------|---------------------------|-----|-----------|------------------------------------|--|---------------------------|
| dez | hex | | | | | | | |
| 2663 | A67 | Param | Test sniffer LED | R/W | UINT8 | | 0 = auto, 1 = Good 2 = Bad 3 = Good+Bad 4 = off | X |
| 2664 | A68 | Param | Test status LED | R/W | UINT8 | | 0 = auto 1 = red 2 = green 3 = blue 4 = off | X |
| 2665 | A69 | Param | Maintenance membrane done | R | CHAR[*] | | To read send after the array index 255 the UINT8 maintenance list index (0). Without history list index you will get the last (newest) entry Entry format: "ListNo year/month/day type". | X |

3.5 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

4 Fieldbus Communication

4.1 Preface

In order to use fieldbus communication with LDS3000, you need an INFICON Bus-Module BM1000 connected to the I/O port of the LDS3000.

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

You will find the appropriate confi

guration files on the USB memory stick which is supplied with your LDS3000.

Attention:

For the PROFIBUS field bus you can select between two different profiles:

- INFICON (IFCN0E8D.GSD file)
- HMS (HMSB1811.GSD file)

It is strongly recommended to use the INFICON profile, because the setup process in your fieldbus configuration tool (e.g. SIMATIC Manager for PROFIBUS) will be much easier.

Only use HMS profile, if you need it for backward compatibility.

4.2 Setup

- ▶ Select the "Bus modul" at the control unit (CU1000): "Menu > Settings > Setup > Interfaces > Device sel. > Module at I/O connector".
- ▶ Select the field bus address at the control unit (CU1000): "Menu > Settings > Setup > Interfaces > Bus Module > Address".
- ▶ Select the desired profile (HMS or INFICON) at the control unit (CU1000): "Menu > Settings > Setup > Interfaces > Bus Module > Profile".

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 | CAL intern | *CAL:INT | 4 |
| | 5 | | Transition to 1: 0x10 = Start internal calibration | | | |
| | 6 | CAL extern | Transition to 0: 0x00 = Cancel external or dyn. calibration | CAL extern/CAL dynamic | *CAL:EXT | 4 |
| 7 | Transition to 1: 0x40 = Start external or. dyn. calibration Transition to 2: 0x80 = Acknowledge closed test leak | | | | | |
| 2 (low byte) | 0 | Gas ballast | Transition 0 -> 1: 0x01 = Gasballast on | Gasballast | | |
| | 1 | | Transition 1 -> 0: 0x00 = Gasballast off (if Gasballast mode != GASBALLAST_ON) | | | |
| | 2 | Zero mode | 0 = normal | | | |
| | 3 | | 0x04 = 1 ... 2 dec. 0x08 = 2 ... 3 dec. 0x0C = 19/20 part of the value | | | |
| | 4 | | CAL mode | | | |
| | 5 | 0x10 = dyn. CAL 0x20 ... 0x30 = not used | | | | |
| | 6 | Sniff/Vac | 0 = VAC | Sniff | *CONFIG:MODE | 401 |
| 7 | 0x40 = SNIF 0x80 = according to PLC-Input 0xC0 = not used | | | | | |

Data format of write process data is always the same regardless of whether you use HMS profile or INFICON profile.

The current state of this value is visible at the CU1000 control unit via:
"Menu > Info > Interfaces > Page 2, Info Bus module, value 'control word'".

4.3.2 Read Process Data (Leak Detector → PLC)

4.3.2.1 HMS profile

These 12 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.

| Byte | Bit | Name | Meaning | Similar to PLC Output | Similar to RS232 ASCII cmd. | Similar to RS232 LD cmd. |
|---------------------|-----|----------------------------|---|----------------------------------|-----------------------------|--------------------------|
| 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 | | | | | | |
| | | | | | | |

| Byte | Bit | Name | Meaning | Similar to PLC Output | Similar to RS232 ASCII cmd. | Similar to RS232 LD cmd. |
|------|-----|----------------------|---|--------------------------------------|-----------------------------|--------------------------|
| 3 | | Leak rate (mbar l/s) | Actual leak rate in mbar l/s (IEEE 754 float value) | Recorder output (LR_LIN, LR_LOG ...) | *READ:MBAR*I/S? | 129 |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | Pressure | Pressure in mbar(IEEE 754 float value) | Recorder output (P1) | *MEAS:P:MBAR? | 83 |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | Actual error number | Error/warning code (16 bit unsigned integer) | | *STATUS:ERROR? | 290 |
| 12 | | | | | | |

4.3.2.2 INFICON profile

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 IO1000 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 | Calibarion 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 IO1000 Output | Similar to RS232 ASCII cmd. | Similar to RS232 LD cmd. |
|-------------------------|-----------|---------|----------------------------------|---|-----------------------------------|-----------------------------|--------------------------|
| leak rate | 3 ... 6 | | Leak rate (mbar ³ /s) | Actual leak rate in mbar l/s (IEEE 754 float value) | Analog output (LR_LIN, LR_LOG...) | *READ:MBAR*I/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 25. | CAL active | *STATUS:CAL? | 260 |
| leak_detector ID | 15 | | leak_detector ID | always 45 for LDS3000 MSB | | *IDN:DEvice? | 303 |
| 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 | Pressure p3 in user specific unit (IEEE 754 float value) | | *MEAS:P3? | 134 |
| device specific float 3 | 24 ... 27 | | device specific float 3 | Pressure p4 in user specific unit (IEEE 754 float value) | | *MEAS:P4? | 135 |
| 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 = 506dez = 01FAhex |
| DeviceNet | Object number A2h (ADI object) Instance_number = LD_command_number Attribute 5 (Value) | Instance_number = 506 |
| EthernetIP | 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 |
| 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) | $\pm 1.17549435E-38 \dots$ $\pm 3.40282347E+38$ |

4.5 Hardware Configuration for Profibus

4.5.1 Hardware configuration with HMS profile

HMS profile is not recommended, use INFICON profile if possible (refer to [chapter 4.1 “Preface”](#)).

Attention:

You must select HMS profile and must use HMSB1811.GSD file for this configuration.

Sequence of the data words (slots) must be:

- Output at first, inputs at second.
- One or two words are accessible at once.
- Output and inputs must have the same memory start address.

Example hardware configuration (detail from PLC configuration window):

| Slot | DP ID | Order Number / Designation | I Address | Q Address | Comment |
|------|-------|----------------------------|-----------|-----------|---------|
| 1 | 224 | Output 1 words | | 1...2 | |
| 2 | 208 | Input 1 word | 1...2 | | |
| 3 | 209 | Input 2 words | 3...6 | | |
| 4 | 209 | Input 2 words | 7...10 | | |
| 5 | 208 | Input 1 word | 11...12 | | |

Fig. 1 Example hardware configuration (HMSB1811.GSD)

4.5.2 Hardware configuration with INFICON profile

Attention:

You must select INFICON profile and 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. 2 Example hardware configuration (detail from PLC configuration window)

4.5.3 Assignment of the PROFIBUS Address

The PROFIBUS address can be assigned via CU1000 or via the hardware configuration tool of the PLC.

To assign the PROFIBUS address via CU1000 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.

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 LDS3000.

4.5.4 Diagnosis with the CU1000 Info Menu

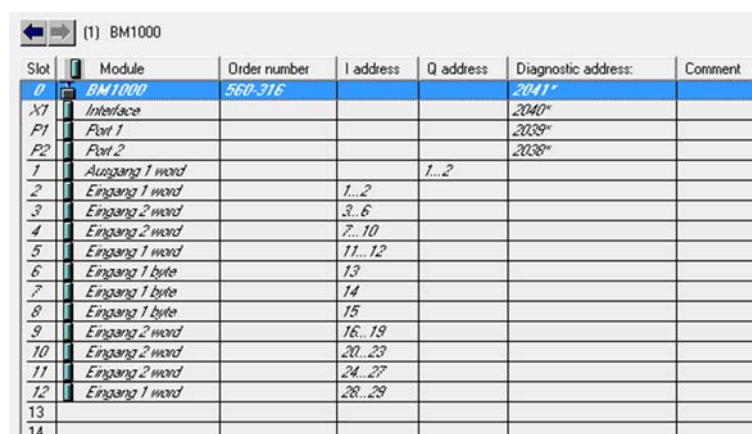
The current state of the BM1000 is visible in the info menu of the control unit CU1000: "Menu > Info > Interfaces, Page 2 - Info Bus module".

4.6 Hardware Configuration for PROFINET

4.6.1 Hardware Configuration with INFICON profile

Attention:

You must select INFICON profile and must use the GSDML-V2.3-Inficon-BM1000_PROFINET-20131206.XML file. In addition you must put the INFICON 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. 3 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.

5 LDS1000 Protocol

5.1 Interface Parameters

So that the connected instruments (PC) may communicate with the LDS3000, it is required to set-up the interface parameters on the connected instruments.

The settings for the LDS1000 protocol are:

9600 baud, 8 data bits, no parity, 1 stop bit, No handshake and CR as the end sign.

5.2 Interface Commands

The list is ordered to their functions.

The interface commands are composed of the following parts:

Structure

COMMAND <cr>

COMMAND PARAMETER <cr> COMMAND PARAMETER,

PARAMETER <cr>

<cr>: Carriage return (13d)

Example

STOP <cr> G10 <cr>

U24.0 <cr>

There exist several types of command. The main functions of the leak detector are in plain text which points to the function. For example, the command "START <cr>" starts the measurement mode. In response to this command, the PC receives "OK <cr>". A list of the main functions is provided in Chapter [5.2.1](#).

Besides this, conditions may be queried through commands which begin with a "S" for "Status" and which have a parameter attached. A list of all status query commands is given in Chapter [5.2.2](#).

Measurement quantities can be queried through the command "G" for "Get", for example: "G1<cr>". The LDS3000 will then respond by outputting the current leak rate. All measurement quantities which may be queried are listed in Chapter [5.2.3](#).

If the entry of settings is required in the way normally performed through the menus shown on the Control Unit, the command "U" for "Update" may be used to change the corresponding parameter. The parameter itself may be output via the serial interface through the command "Q" for "Query". For example, "U 0, 1.0E-04<cr>" changes the level for the first trigger to 1E-4. The commands used to set and query parameters are listed in Chapter [5.2.4](#).

Through "Q 0<cr>" the trigger level can be read.

Less frequently used functions which normally will only be run for servicing can be invoked through the command "F" for "Function". For example: "F10<cr>" switches the emission off. A list of these functions is given in Chapter [5.2.5](#).

During servicing the command "V" for "Valves" may be used to switch the valves. For example: "V 1,0 <cr>" opens the internal calibrated leak.

Through the reset character <ESC> (27d or 1Bh) without <cr> the interface of the LDS1000 may be reset back to a defined state. A received string which might be processed at that moment is erased and its processing is terminated. Receiving of the <ESC> character is acknowledged by "OK<cr>" (Note: Some terminal programs may not display character "0" when local echo is on.). Thereafter, the interface is ready to receive. Through this character it is easily possible to check whether or not the data link has been properly installed.

5.2.1 Main functions

| Command | Meaning | Reply from leak detector |
|----------|--|--------------------------|
| LR | Leak rate, date, time, output status | |
| START | Start measurement mode, suppress the background which was measured upon operating START | OK |
| STOP | Stop the measurement mode, display the current background level | OK |
| ZERO | ZERO mode on, suppress the background which was measured upon operating ZERO | OK |
| ZERO OFF | ZERO mode off, display the background which was measured upon operating ZERO | OK |
| CAL | In STANDBY mode: Start internal calibration In MEASURE mode: Start external calibration | OK |
| CLEAR | Interrupt calibration/erase error status | OK |

Example sequence of commands for external calibration:

| | Command | Reply from the LDS3000 | Meaning |
|---|---------|------------------------|--|
| 1 | START | OK | The leak detector enters the measurement mode, the calibrated leak must be opened, wait until the signal has stabilised. |
| 2 | CAL | OK | External calibration is being started. |
| 3 | S12 | 1 | External calibration is running. |
| 4 | S12 | 2 | Calibrated leak must be closed, wait until the signal is stable. |
| 5 | CAL | OK | Calibration is continued. |
| 6 | S12 | 0 | Calibration complete, the leak detector is in the measurement mode, the instrument is running in the MEASUREMENT mode. |

The internal calibration process runs automatically. After calibration, the LDS3000 will be in the STANDBY mode.

5.2.2 Status Requests

Besides the main functions, there exist a variety of request commands for outputting the status which reflect the current state of the LDS3000.

For example: "S 2<cr>". The LDS3000 replies by: "00000110<cr>", for example. This means that the LDS3000 is in the "Measure" mode.

Status Information:

| | Meaning | Representation |
|-----|---|--|
| S2 | Instrument status (number) | xxxxxxx (always 8 characters) (Byte 0 right) Byte 0 0 = VAC 1 = SNIF Byte 1 always 0 Byte 2 0 = STANDBY 1 = MEASURE Byte 3 0 = CAL inactive 1 = CAL active Byte 4 refers to external calibration, 0 = STANDARD 1 = DYNAMIC Byte 5 -- Byte 6 ACCELERATION BYTE 7 FAIL |
| S3 | Relay status | xxxx xxxx (always 8 characters) (Byte 0 first) Byte 0: < TRIG 1 Byte 1: < TRIG 2 Byte 2: < TRIG 3 Byte 3: < TRIG 4 Byte 4: Ready Byte 5: always 0 Byte 6: CAL-REQUEST Byte 7: no ERROR |
| S4 | Exceeding of measurement range limits (leak rate) | Useful when leak rates are queried through the command G1. 0 = within the measurement range 1 = Underrange. The actual leak rate is below the output value. This may occur in particular after activating the Zero function or when restricting the measurement range through "MANUAL". 2 = Overage |
| S6 | Key switch status | 0 = Key switch defective 1 = No key 2 = Key 1 3 = Key 2 4 = Key 3 |
| S10 | Current error | 0 = no error/warning > 0 = error number (not yet acknowledged). If the error is no longer present, the message may be erased through "CLEAR". |
| S12 | External CAL status | 0 = inactive 1 = active; calibration is running at the moment. 2 = "Close" The external calibrated test leak must be closed and acknowledged through CAL after the signal has stabilised. |
| S14 | ZERO status | "Zero" 0 = no correction 1 = a constant leak rate is suppressed |

| | Meaning | Representation |
|--|--|---|
| S18 | CAL request status | See command Q/U 19 0 = no request 1 = request is present (temperature difference of 5°) |
| Service information, may be subject in case of further questions or in case of an error. | | |
| S30 | software version | e.g.:1.00 |
| S31 | Serial number | xxxxxxxxxxxxxx |
| S32 | Operating hours counter | xxxxxx |
| S35 | Valve position | xy (always 2 characters) "1" valve open "0" valve closed Byte x Valve for calibrated leak Byte y Sniffer valve |
| S39 | Status of the remote control inputs | xxxxxx (always 7 signs) (Byte 0 first) Byte 0: Input 7 Byte 1: Input 6 Byte 2: Input 5 Byte 3: Input 4 Byte 4: Input 3 Byte 5: Input 2 Byte 6: Input 1 Byte 7: always 0 |
| S41 | Preamplifier | Amplification of the preamplifier can be changed through F26 ... F30. xy x: Status: 0 = auto, 1 = manuell y: Amplification: 0 = 13M; 1 = 470M; 2 = 15G; 3 = 0,5T |
| S42 | Turbo pump | xxxxx (Byte 0 first) Byte 0: speed too low Byte 1: speed too high Byte 2: always 0 Byte 3: FAIL converter ("1"-Error) Byte 4: running up/acceleration |
| S43 | Emission control | xxxxx (Byte 0 first) Byte 0: Status number Byte 1: Nominal status 0 = off, 1 = Standby, 2 = on Byte 2: Actual status 0 = off, 1 = Standby, 2 = on Byte 3: Cathode 1 = Cathode 1, 2 = Cathode 2 |
| S51 | Calibration factor M4 Vacuum | e.g.: 7.492E-13 |
| S52 | Calibration M4 Sniff | e.g.: 7.492E-13 |
| S70 | Output the number of the current interface error | "ok", if no error is present. |
| S72 | Output the number of the current error message (except interface errors) | e.g.: ER53 12.Oct. 11:50 |
| S73 | Output the number of the wrong parameter | "ok", if no error is present. |

5.2.3 Request for Measurement Data

Measurement data can be queried through the command G for "GET".

| Command | Meaning | Representation |
|---------|---|----------------|
| G6 | Forevacuum pressure (PV) in volts (1000 mbar: 10.0V). | e.g.: 02.629 |
| G7 | Preamplifier signal (EVS) in volts. | e.g.: 01.456 |
| G8 | Electronics temperature (ELTA) in °C | e.g.: 23.5 |
| G9 | Amplifier temperature (EVSTA) in °C | e.g.: 29,2 |
| G10 | Anode potential (MIAP) in volts. | e.g.: 457 |
| G11 | Cathode potential (MIKP) in volts. | e.g.: 378 |
| G12 | Suppressor potential (MISP) in volts. | e.g.: 330 |
| G13 | Anode-Cathode potential (MIAKP) in volts. | e.g.: 79 |
| G19 | Speed of the turbopump (TMP) in Hz. | e.g.: 1048 |

5.2.4 Entry of Instrument Settings

The settings of parameters in the control modus "RS232" may be changed via the command "U" for update when the jumper XJ1 has been set to RS232. The parameters may be output via the serial interface through the command "Q" for query. For example, "U0, 1.0E-4<cr>" changes the level for the first trigger to 1.0x 10⁻⁴.

Through "Q0<cr>" the trigger level can be read.

The settings are each explained in the Technical Handbook jina50e1-a.

In order to use the commands U51 to U66 the password needs to be entered.

| Command | Meaning | Representation |
|---------|---|--|
| Q/U0 | Trigger 1 in current unit | e.g.: 1.0E-5 |
| Q/U1 | Trigger 2 in current unit | e.g.: 1.0E-5 |
| Q/U2 | Trigger 3 in current unit | e.g.: 1.0E-5 |
| Q/U3 | Trigger 4 in current unit | e.g.: 1.0E-5 |
| Q4 | Output the operating mode | x, y (always 2 signs) X: 0 = SPS, 1 = RS232 Y: 0 = VAC, 1 = SNIF |
| U4 | Select operating mode This setting is not saved when switching the mains power off. | 0 = VAC 1 = SNIF |
| Q/U7 | Sensitivity Threshold. Leak rate in current unit at which the sensitivity (averaging time) is switched over. | e.g.: 1.0E-10 |
| Q/U8 | Zero time in seconds (period of time for which the leak rate signal must remain below the saved background level until the saved background level itself is corrected). | e.g.: 5 |
| Q10 | Always 0 | |
| Q11 | Limit-Low in current unit | e.g.: 1.0E-8 |
| Q12 | Limit-HIGH in current unit | e.g.: 1.0E4 |
| Q/U13 | Machine factor for VAC | e.g.: 1.0E0 |
| Q/U14 | Correction factor for SNIF | e.g.: 1.0E0 |

| Command | Meaning | Representation |
|---------|---|--|
| Q/U16 | Operating mode for ext. CAL The setting is not saved when switching off the mains power. | 0 = with autotune 1 = dyn. CAL without autotune |
| Q/U19 | Request for CAL (Enable CAL message for a temperature difference of 5 °C). | 0 = off 1 = on |
| Q/U20 | Mass of the gas which is detected in the mass spectrometer | 2, 3, 4 e.g.: 4 |
| Q/U21 | Date | e.g.: 24.Nov04 Abbreviations for the months: Jan, May, Sep, Feb, Jun, Oct, Mar, Jul, Nov, Apr, Aug, Dec |
| Q/U22 | Time | e.g.: 14:40:07 |
| Q/U24 | Unit (unit of measurement for pressure and leak rate in VAC and SNIF) ppm and g/a is not available for VAC | 0 = mbar and mbar l/s 1 = Pa and Pa m ³ /s 2 = atm and atm cc/s 3 = mbar and g/a 4 = mbar and ppm 5 = Torr and Tor l/s |
| Q/U27 | Leak rate of the internal calibrated leak (always in mbar l/s | e.g.: 1.0E-7 9.9E-1 for not available |
| Q/U28 | leak rate of the external calibrated leak | e.g.: 1.0E-5 9.9E-1 for not available |
| Q/U31 | Number of suppressed decades | 0 = 1 to 2 decades 1 = 2 to 3 decades 2 = 3 to 4 decades 3 = 2 decades 4 = complete value 5 = 19/20 of value |
| Q/U32 | Zero suppression when START | 0 = off 1 = on |
| U45 | Compatibility Mode | 2 = LDS2010-Mode 3 = LDS3000-Mode |
| Q/U56 | Factor 500G - 15G | |
| Q/U57 | MSV anode potential for masse 2 in volts | e.g.: 890 |
| Q/U58 | MSV anode potential for masse 3 in volts | e.g.: 590 |
| Q/U59 | MSV anode potential for masse 4 in volts | e.g.: 455 |
| Q/U66 | Always 0 | |

5.2.5 Running of service functions

These function calls are not required for normal measurement operations. They are thus all protected by the password (see command U5) with the exception of function F3. The control mode must be set to RS232.

| Command | Meaning |
|----------------|--|
| F3 | Parameter RESET, resetting of all parameters (except internal test leak and LCD-contrast) to factory defaults. Erase error memory. |
| F17 | Switch on cathode 1 |
| F18 | Switch on cathode 2 (MEK2 = on) |
| | Hardware RESET (same as when switching OFF and the ON again) |

6 Binary Interface Protocol

6.1 Communication Parameters

Data format

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

6.2 Data Format

| | |
|-----------------------------|---|
| float | 4 Bytes, IEEE754 ($\pm 10^{\pm 38}$), 3 Byte Mantissa, 1 Byte Exponent/Sign |
| unsigned long int [ulint]: | 4 Bytes, integer without algebraic sign MSB ... LSB (0 ... 4294967295) |
| unsigned short int [usint]: | 2 Bytes, integer without algebraic sign MSB, LSB (0 ... 65535) |
| signed short int | 2 Bytes, integer without algebraic sign MSB, LSB (-32768 ... 32767) |
| unsigned char [uchar]: | 1 Byte, integer without algebraic sign (0 ... 255) |
| unsigned char [uchar]: | 1 Byte, character ASCII Code (0 ... 255) |

6.3 Commands

In binary protocol the command to the leak detector always starts with STX (0x05). It is followed by a byte which indicates the length of the telegram (inclusive Start-Byte and checksum). The next byte is the command number. The command byte may be followed by additional information (parameter and/or data). Please refer to table "Commands" for detailed information about command number, parameter and data format.

Every telegram ends with a checksum. The checksum is the sum of all bytes before the checksum byte modulo 256 (decimal). The leak detector replies to every valid command with an acknowledgement. This answer starts with the length byte followed by the command number, additional data (optional) and the checksum.

In case of an error, the leak detector answers with an error byte instead of the command number (refer to chapter "Error Messages").

Timeout to receive data between 2 sign is: 1000 ms.

| No. | Name | Description | Parameter | Data |
|-----|-------------|----------------------|---|------------|
| 2 | GetPv | Fore vacuum pressure | Byte 0: unit 0 = mbar 1 = Pa 2 = atm 3 = Torr | Pv [float] |
| 5 | GetDeviceID | Device type | | 45dec. |

| No. | Name | Description | Parameter | Data |
|----------|--------------------------------|-------------------------------|--|--|
| 8 9 | GetGasballast SetGasballast | Gas ballast valve | | Byte 0: 0 = off 1 = on 2 = main fail safe -on |
| 36 37 | GetCalFac SetCalFac | Calibration factor | Byte 0: 0 = VAC 1 = SNIF | Factor [float] |
| 40 41 | GetMass SetMass | Measure mass | | [uchar, 2/3/4 for mass 2/3/4] |
| 50 51 | GetZero SetZero | Zero (suppress background) | | 0 = off 1 = on |
| 54 | GetCal | Read calibration state | 0 = int.Cal 1 = ext.Cal | 0 = inactive 1 = active 2 = wait for calibrated leak close (only at external calibrations) |
| 55 | SetCal | Start/Stop calibration | 0 = int.Cal 1 = ext.Cal | 0 = stop; 1 = start 2 = finish (TL close; only at external calibrations) |
| 56 57 | GetTrigger SetTrigger | Set/read trigger | Byte 0: 1 ... 4 for Trigger 1 ... 4 Byte 1: Unit: 0 = mbar l/s 1 = Pa m ³ /s 2 = atm cc/s 3 = Torr l/s In sniff mode additional 4 = ppm 5 = g/a | [float]: Trigger value |
| 58 59 | GetOpMode SetOpMode | Set/read operation mode | | 0 = VAC 1 = SNIF |
| 60 61 | GetStBy SetStBy | Stand-By read/set | | 0 = Stand-By 1 = measurement |
| 62 | GetErrorCode | Read actual error number | | Actual error number (1 Byte), 0 = no error |
| 63 | SetClearError | Quit error/cancel calibration | | |

| No. | Name | Description | Parameter | Data |
|----------|--|---|---|--|
| 66 67 | GetTL SetTL | Value of the calibrated leak read/set | Byte 0: 0 = int.TL 1 = ext.TL-VAC 2 = ext.TL-SNIF Byte 1: Unit 0 = mbar l/s 1 = Pa m ³ /s 2 = atm cc/s 3 = Torr l/s In sniff mode additionally: 4 = ppm 5 = g/a | 5 [float]: value calibrated leak (Int.. cal : 1E-15mbar l/s for no internal calibrated leak in use) |
| 68 69 | GetFilterSetPoint SetFilterSetPoint | Leak rate for switching the averting time | Unit: 0 = mbar l/s 1 = Pa m ³ /s 2 = atm cc/s 3 = Torr l/s In sniff mode additionally: 4 = ppm 5 = g/a | [float]: LR-limit value |
| 70 | GetSerialNumber | Read serialnumber | | |
| 72 | GetState | State of the device | | 0 = Standby 1 = error 2 = Cal 3 = run up 4 = ready 5 = Emission off |
| 74 | GetOpHours | Read operating hours | | [unit; h]; |
| 76 | GetSWVersionNr | Read software version | | Byte 0: Main-Version; Byte 1: Sub-Version |
| 78 79 | GetFacMachine SetFacMachine | Read / set machine factor | | [float] |
| 82 83 | GetZeroMode SetZeroMode | Choice zero function | | 0 = 2-3 Decades; 1 = 1-2 Decades; 2 = 19/20 of valuet; 3 = 2 Decades; 4 = 3-4Decades 5 = complete value |
| 84 85 | GetFacSniff SetFacSniff | Read sniff factor | | [float] |

| No. | Name | Description | Parameter | Data |
|----------|--------------------|---------------|---|--|
| 92 93 | GetUnit SetUnit | unit read/set | | Byte 0: LR-VAC Byte 1: LR-SNIF Byte 2: pressure 0 = mbar / mbar l/s 1 = Pa / Pa m ³ /s 2 = atm / atm cc/s 3 = Torr / Torr l/s only for LR-sniff: 4 = ppm 5 = g/a |
| 99 | GetLr | Leak rate | Unit 0 = mbar l/s, 1 = Pa m ³ /s 2 = atm cc/s 3 = Tor l/s In sniff mode additionally: 4 = ppm, 5 = g/a) | [float] |

Example 1: Set trigger level 2 to 1.2E-7 mbar l/s

PC → Leak detector

| | | | | | | | | | |
|-------|--------|---------|---------|---------|-----------------------|------|------|------|----------|
| 5 | 10 | 57 | 2 | 0 | 52 | 0 | 217 | 89 | 176 |
| 0x05 | 0x0A | 0x39 | 0x02 | 0x00 | 0x34 | 0x00 | 0xD9 | 0x59 | 0xB0 |
| Start | Length | Command | Para0 | Para1 | Data | Data | Data | Data | Checksum |
| | | Trigger | Trig. 2 | mbarl/s | 1.2E-7 (4-Byte float) | | | | |

Leak detector → PC

| | | |
|--------|---------|----------|
| 3 | 57 | 60 |
| 0x03 | 0x39 | 0x3C |
| Length | Command | Checksum |

Example 2: Get trigger level 2 in mbar l/s

PC → leak detector

| | | | | | |
|-------|--------|---------|---------|---------|----------|
| 5 | 6 | 56 | 2 | 0 | 69 |
| 0x05 | 0x06 | 0x38 | 0x02 | 0x00 | 0x45 |
| Start | Length | Command | Para0 | Para1 | Checksum |
| | | Trigger | Trig. 2 | mbarl/s | |

leak detector → PC:

| | | | | | | |
|--------|---------|-----------------------|------|------|------|----------|
| 7 | 57 | 52 | 0 | 217 | 89 | 166 |
| 0x07 | 0x39 | 0x34 | 0x00 | 0xD9 | 0x59 | 0xA6 |
| Length | Command | Data | Data | Data | Data | Checksum |
| | | 1.2E-7 (4-Byte float) | | | | |

6.4 Error messages

| | |
|-----|--|
| 232 | Command temporary not allowed (for example starting calibration during run-up) |
| 240 | Command does not exist |
| 243 | Wrong telegram length |
| 244 | Parameter not in valid range |
| 252 | First character wrong (not 0x05) |
| 253 | Transmitted and calculated checksum not equal |
| 254 | Timeout (Transmission of a command not completed within 500 msec) |
| 255 | Buffer overflow (Overflow of the receive buffer) |

7 Trouble Shooting

7.1 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 IO1000 will also work with an USBRS232- 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 IO1000 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 IO1000 and PC/PLC match) |
| | Wrong protocol selected in the leak detector | Select correct protocol in the leak detector |

7.2 ASCII Protocol specific

| Error | Possible Reason | Solution |
|--|---|---|
| IO1000 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 not 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 |

7.3 LD Protocol specific

| Error | Possible Reason | Solution |
|--|-----------------------|---|
| IO1000 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 |
| IO1000 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 INFICON. Check your code with unit test function in this source code file. |



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