



UL3000/UL6000 Fab Series

Protocol Descriptions

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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

A write command may cause write access to the internal EEPROM of the device. This also applies to commands that write the same value that is already stored in the EEPROM.

Since the EEPROM has a limited write cycle endurance, unnecessary write commands should be avoided.

1.1 Serial Interface Protocols

With the IO1000 module you can communicate with a device from the UL3000/UL6000 Fab series via the following serial interface protocols:

- ASCII Protocol (enabled by default)
- LD Protocol

The serial interface protocol can be selected via DIP switch at the IO module IO1000 or via operating unit of a device from the UL3000/UL6000 Fab series. Please refer to appropriate documentation.

1.2 Field Bus Protocol

With the Bus module BM1000 you can communicate with a device from the UL3000/UL6000 Fab series via different fieldbus protocols (PROFIBUS-DP, PROFINET, DeviceNet, EtherNet/IP).

2 ASCII Protocol

2.1 Comparison between ASCII- and LD protocol

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

ASCII protocol:

Advantages:

- human readable
- easy to use with simple terminal program

Disadvantages:

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

LD protocol:

Advantages:

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

Disadvantages:

- Not human readable
- Not useable with simple terminal program

2.2 Communication Parameters

Data format

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

2.3 Command Format

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

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

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 27](#). 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, numerical or a text:

Boolean	0 / 1 or OFF / ON
Numeric	Integer (for example 42) real (for example 15.6) or exponential (for example 4.5E-7) Format: [sign] [ddd] [.] [e[sign]ddd] (d:digit)
Text	Command specific (for example INIT, ACCL, STBY, VENT, WAIT_EVAC, EVAC, MEAS, CAL or ERROR for command “*STATus”)

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

Timing recommendations for the PC/PLC - Program:

- Sample rate > 100 ms
- Timeout between request to and answer from device: 1500 ms

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

2.4 Commands

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

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CAL:REFeRence	Starts reference measurement ("Auto Leak Test"-Mode only). Command only works in state "VENT"	4	W
*CAL:SHOWCALLEAK	Show internal calibrated leak	4	W
*CAL:STARTPROOF	Start proof function	4	W
*CAL:STOP	abort calibration	11	W
*CLS	Clear Error	5	W
*CLS:VALUEChangEd	Clear the vlaue changed flag	1565	W
*CONFig:ALARMDelay	Alarm delay after evacuation [s]	602	R/W
*CONFig:AMBIENTHEGain	Gain for calibration of ambient helium concentration measurement	1911	R/W
*CONFig:AMBIENTHEOffset	Offset for calibration of ambient helium concentration measurement	1912	R/W
*CONFig:AMPTest	When ON amplifier test during calibration (ON, OFF)	370	R/W
*CONFig:ANODSET	Set anode voltage. Without argument for current mass. M2,M3,M4 for mass 2...4	433, 434, 435	R/W
*CONFig:AUDio	Audio alarm type (OFF, PIN, SET, TRIG, PROP)	600	R/W
*CONFig:BEEP	Beep-sound of base unit (OFF, ON)	604	R/W
*CONFig:BOOster	TMP2 mode (UL6000 only)	23	R/W
*CONFig:BOOSTERACTIVEStop	TMP2 active stop (UL6000 only)	24	R/W
*CONFig:BPUMPType	Backing pumpe type (TS620, NEODRY)	621	R/W
*CONFig:BRIGHTness	Brightness off sniffer LED 0...6	414	R/W
*CONFig:BUSMODULE:ADDReSS	Field bus address nominal value	331	R/W
*CONFig:CALleak:EXTSniff	External test leak in sniff mode	392, 393, 830, 831, 832, 837	R/W
*CONFig:CALleak:EXTVac	External test leak in vacuum mode	390, 391, 830, 831, 832, 835	R/W
*CONFig:CALleak:INT	Internal test leak in mbar*I/s	394	R/W
*CONFig:CALREQ	calibration request (OFF,ON);with read: (OFF, ON_REQUESTED, ON_NOTREQUESTED)	419	R/W

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:CAThode	Target state of the cathode OFF (not saved after power loss) ON1 (fix cathode 1) ON2 (fix cathode 2) AUTO (automatic switching cathode) with read: AUTO1 / AUTO2: Auto with cathode 1 respectively 2 actual active	530	R/W
*CONFig:CONTRol	Control via control unit key, RC1000 keys and sniffer keys enabled / disabled. (ON/OFF)	2591	R/W
*CONFig:ERRor:AMPAlter	Amplifier alternating monitoring error message(ON, OFF)	1120	R/W
*CONFig:FILTer	Leak rate filter "ICAL", "FIXED"	402	R/W
*CONFig:HYDros	HYDRO*S (DISABLED, OFF, ON)	565	R/W
*CONFig:IOMODULEPROTOcol	Interface protocol IO (LD,ASCII)	2593	R/W
*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:LIMITLOW	Lower display limit	454	R/W
*CONFig:MAINTenance:AIRfilter	Maintenance message for air filter (ON,OFF)	2660	R/W
*CONFig:MAINTenance:BACKINGpump	Maintenance message for backing pump (ON,OFF)	2660	R/W
*CONFig:MAINTenance:EXHAUSTfilter	Maintenance message for exhaust filter (ON,OFF)	2660	R/W
*CONFig:MAINTenance:EXPIRYleak	Maintenance message for reference leak (ON,OFF)	2660	R/W
*CONFig:MAINTenance:FOREpump	Maintenance message for backing pump (ON,OFF)	2660	R/W
*CONFig:MAINTenance:SNIFFERfilter	Maintenance message for sniffer tip filter (ON,OFF)	2660	R/W
*CONFig:MAINTenance:TMP	Maintenance message for TMP (ON,OFF)	2660	R/W
*CONFig:MAINTenance:TURBOpump	Maintenance message for TMP (ON,OFF)	2660	R/W
*CONFig:MASS	Mass (2 (H2), 3, 4(Helium))	506	R/W
*CONFig:MFAE	Actual anode potential reference [V]	167	R/W
*CONFig:MFAE:M2	Anode potential reference [V] mass 2	433	R/W
*CONFig:MFAE:M3	Anode potential reference [V] mass 3	434	R/W
*CONFig:MFAE:M4	Anode potential reference [V] mass 4	435	R/W
*CONFig:MODE	Mode (VAC, SNIFF, COMMANDER, AUTO)	401	R/W

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:MODEBPUMP	Backing pump mode 0 = fixed 1 = automatic	1190	R/W
*CONFig:PAGINGrequest	Paging request (ON,OFF)	1270	R/W
*CONFig:PARTCOUNT	Part number counting (ON,OFF)	670	R/W
*CONFig:PARTNO	Part number	672	R/W
*CONFig:PEVACgross	pressure limit EVAC -> GROSS	540, 580, 820	R/W
*CONFig:PFINEultra	pressure limit FINE -> ULTRA	543, 583, 823	R/W
*CONFig:PGROSSfine	pressure limit GROSS -> FINE	541, 581, 821	R/W
*CONFig:PLCINLINK:1	Configuration of PLC-input 1. The following settings are possible: NOT_USED, SNIFF, START, STOP, ZERO, VENT, CLEAR, PURGE, START_STOP, CAL and the inverted version with the prefix "INV_" (INV_START...)	438	R/W
*CONFig:PLCINlink:n	Configuration of PLC-input n. n = 2...10 see CONFig:PLCINLINK:1	438	R/W
*CONFig:PLCOUTLINK:1	Configuration of PLC-output 1. The following settings are possible: OPEN, TRIGGER_1, TRIGGER_2, TRIGGER_3, TRIGGER_4, READY, WARNING, ERROR, CAL_ACTIVE, CAL_REQUEST, RUN_UP, ZERO_ACTIVE, EMISSION_ON, MEASURE, STANDBY, SNIFF, ERR/WARN, GAS_BALLAST, INT_LEAK, CAL_STAB, CATHODE_2, VENT and the inverted version with the prefix "INV_" (INV_READY...)	263	R/W
*CONFig:PLCOUTlink:n	Configuration of PLC-output n. n = 2...8 see CONFig:PLCOUTLINK:1	263	R/W
*CONFig:PRESSCORrestion	Pressure correction (ON,OFF)	590	R/W
*CONFig:PRESSHigh	Pressure for upper flow limit (mbar). Deprecated, use *CONFig:PROTectio:n:PMAX instead	453	R/W
*CONFig:PRESSLow	Pressure for lower flow limit (mbar)	452	R/W
*CONFig:PROTectio:n:CONTamination	Contamination protection (ON,OFF)	1855	R/W
*CONFig:PROTectio:n:CONTLimit	Contamination protection limit	850, 1854, 1870	R/W

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:PROTectio:n:EVACtime	Maximum evacuation time (0 means infinite)	555	R/W
*CONFig:PROTectio:n:EVACtime2	Maximum evacuation time to 100 mbar	554	R/W
*CONFig:PROTectio:n:PARTicle	Particle protection	1860	R/W
*CONFig:PROTectio:n:PMAX	Maximum pressure in sniff	453, 826	R/W
*CONFig:PROTectio:n:PMIN	Minimum pressure in sniff	452, 825	R/W
*CONFig:PROTectio:n:SL3000PMAX	Maximum pressure in sniff (SL3000)	456, 510, 512	R/W
*CONFig:PROTectio:n:SL3000PMIN	Minimum pressure in sniff (SL3000)	455, 509, 511	R/W
*CONFig:PURGe	Automatic purge (PURGE_MANUAL, PURGE_AUTO)	228	R/W
*CONFig:RECOder:LINK1	Function at analog output channel 1 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, MANT_HYST, EXTERN)	222	R/W
*CONFig:RECOder:LINK2	Function at analog output channel 2 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, MANT_HYST, EXTERN)	222	R/W
*CONFig:RECOder:SCALE	Leak rate scaling of analog output in logarithmic mode (volt/decade): 0.5V/DEC, 1V/DEC, 2V/DEC, 2.5V/DEC, 3V/DEC, 5V/DEC, 10V/DEC	223	R/W
*CONFig:RECOder:UPPEREXP	Upper limit for the analog out at the I/O module. Value is exponent of the value in selected unit. Example: -5 = 1E-5	224	R/W
*CONFig:RS232	Protocol of current used interface port. Read always outputs "ASCII" (ASCII, LD) For protocol at IO1000 use command "*CONFig:IOMODULEPROTOcol ..."	26	R/W
*CONFig:SERIESErrmsg	Series error message for mode Auto Leak Test. "0" means "deactivated"		R/W
*CONFig:SHOWLEAKATRUP	Show int. cal. leak after runup (OFF, ON) (UL6000 only)	710	R/W
*CONFig:SHUTDown	Auto leak test: Shutdown (OFF, ON)	673	R/W
*CONFig:SNIFFer	SL3000 sniffer beep (ON,OFF)	417	R/W
*CONFig:SOFTVent	Soft Vent (UL6000 only)	564	R/W
*CONFig:SPEEDBPUMP	'Rotation frequency setting of the backing pump in Hz	625	R/W
*CONFig:SPEEDTMP	Rotation speed of TMP in Hz	501	R
*CONFig:STATEBPUMP	'Backing pump nominal status (ON, OFF)	14	R/W
*CONFig:SUPPRession	Offset suppression at start (OFF, INTERN, INLET)	548	R/W

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:TESTINGTime	Maximum testing time for Auto Leak Test	662	R/W
*CONFig:TESTINGTIMEMAX	Maximum testing time for Auto Leak Test	662	R/W
*CONFig:TESTINGTIMEMIN	Minimum testing time for Auto Leak Test	660	R/W
*CONFig:TMP2mode	TMP2 mode (UL6000 only)	23	R/W
*CONFig:TMPVENT	Venting TMP after power down	498	R/W
*CONFig:TRIGger1	Setpoint1 in interface unit	384	R/W
*CONFig:TRIGger1:ATM*cc/s	Setpoint1 in Atm*cc/s		R/W
*CONFig:TRIGger1:DISPlay	Setpoint1 in display unit	840	R/W
*CONFig:TRIGger1:G/a	Setpoint1 in grams per year		R/W
*CONFig:TRIGger1:MBAR*I/s	Setpoint1 in mbar*I/s	385	R/W
*CONFig:TRIGger1:MBAR*I/s:SNIFF	Setpoint1 in mbar*I/s for sniff mode	842	R/W
*CONFig:TRIGger1:MBAR*I/s:VAC	Setpoint1 in mbar*I/s for vacuum mode	841	R/W
*CONFig:TRIGger1:OZ/yr	Setpoint1 in ounce per year		R/W
*CONFig:TRIGger1:PA*m3/s	Setpoint1 in Pa*m3/s		R/W
*CONFig:TRIGger1:PPM	Setpoint1 in parts per million		R/W
*CONFig:TRIGger1:TORR*I/s	Setpoint1 in Torr*I/s		R/W
*CONFig:TRIGger2	Setpoint2 in interface unit	384	R/W
*CONFig:TRIGger2:ATM*cc/s	Setpoint2 in Atm*cc/s		R/W
*CONFig:TRIGger2:DISPlay	Setpoint2 in display unit	840	R/W
*CONFig:TRIGger2:G/a	Setpoint2 in grams per year		R/W
*CONFig:TRIGger2:LB/yr	Setpoint2 in display unit	840	R/W
*CONFig:TRIGger2:MBAR*I/s	Setpoint2 in mbar*I/s	385	R/W
*CONFig:TRIGger2:MBAR*I/s:SNIFF	Setpoint2 in mbar*I/s for sniff mode	842	R/W
*CONFig:TRIGger2:MBAR*I/s:VAC	Setpoint2 in mbar*I/s for vacuum mode	841	R/W
*CONFig:TRIGger2:OZ/yr	Setpoint2 in ounce per year		R/W
*CONFig:TRIGger2:PA*m3/s	Setpoint2 in Pa*m3/s		R/W
*CONFig:TRIGger2:PPM	Setpoint2 in parts per million		R/W
*CONFig:TRIGger2:TORR*I/s	Setpoint2 in Torr*I/s		R/W
*CONFig:TRIGger3	Setpoint3 in interface unit	384	R/W
*CONFig:TRIGger3:ATM*cc/s	Setpoint3 in Atm*cc/s		R/W
*CONFig:TRIGger3:DISPlay	Setpoint3 in display unit	840	R/W
*CONFig:TRIGger3:G/a	Setpoint3 in grams per year		R/W
*CONFig:TRIGger3:MBAR*I/s	Setpoint3 in mbar*I/s	385	R/W
*CONFig:TRIGger3:OZ/yr	Setpoint3 in ounce per year		R/W
*CONFig:TRIGger3:PA*m3/s	Setpoint3 in Pa*m3/s		R/W

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:TRIGger3:PPM	Setpoint3 in parts per million		R/W
*CONFig:TRIGger3:TORR*I/s	Setpoint3 in Torr*I/s		R/W
*CONFig:TRIGger4	Setpoint4 in interface unit	384	R/W
*CONFig:TRIGger4:ATM*cc/s	Setpoint4 in Atm*cc/s		R/W
*CONFig:TRIGger4:DISPlay	Setpoint4 in display unit	840	R/W
*CONFig:TRIGger4:G/a	Setpoint4 in grams per year		R/W
*CONFig:TRIGger4:MBAR*I/s	Setpoint4 in mbar*I/s	385	R/W
*CONFig:TRIGger4:OZ/yr	Setpoint4 in ounce per year		R/W
*CONFig:TRIGger4:PA*m3/s	Setpoint4 in Pa*m3/s		R/W
*CONFig:TRIGger4:PPM	Setpoint4 in parts per million		R/W
*CONFig:TRIGger4:TORR*I/s	Setpoint4 in Torr*I/s		R/W
*CONFig:UNIT:LR	Leak rate interface unit of current mode (sniff or vac) (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A,OZ/YR) (...:UNITIF:...)	431, 432	R/W
*CONFig:UNIT:LRSniff	Leak rate unit sniff mode interface (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A,OZ/YR) (...:UNITIF:...)	432	R/W
*CONFig:UNIT:LRVac	Leak rate unit vac mode interface (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A) (...:UNITIF:...)	431	R/W
*CONFig:UNIT:Pressure	Pessure unit interface (ATM, MBAR, PA, TORR) (...:UNITIF:...)	430	R/W
*CONFig:UNITDI:LR	Leak rate display unit of current mode (sniff or vac) (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A,OZ/YR)	801, 802	R/W
*CONFig:UNITDI:LRSniff	Leak rate unit sniff mode display (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A,OZ/YR)	802	R/W
*CONFig:UNITDI:LRVac	Leak rate unit vac mode display (ATM*cc/s, MBAR*I/s, PA*m3/s, TORR*I/s, PPM, G/A)	801	R/W
*CONFig:UNITDI:Pressure	Pessure unit display (ATM, MBAR, PA, TORR)	800	R/W
*CONFig:VACRANGE	Active vacuum ranges: MASSIVE, GROSS, FINE and ULTRA as comma separated list	550	R/W
*CONFig:VENTdelay	Vent delay (WITH_STOP, MANUAL, NO_VENT)	553	R/W
*CONFig:VENTMODE	Vent delay (WITH_STOP, MANUAL, NO_VENT)	553	R/W
*CONFig:VOLume	Volume (0...15)	420	R/W
*CONFig:ZERO	Zero (OFF, I-ZERO2.0)	410	R/W

Command	Meaning	Relates to LD cmd. no.	Read / Write
*FACtor:ACDC	AC/DC factor	568	R
*FACtor:AUTOLeaktest:M2	Calibration factor auto leak test for mass 2	527	R
*FACtor:AUTOLeaktest:M3	Calibration factor auto leak test for mass 3	527	R
*FACtor:AUTOLeaktest:M4	Calibration factor auto leak test for mass 4	527	R
*FACtor:CALINTExt	Factor cal int ext	1909	R/W
*FACtor:MACHine:M2	Machine factor mass 2	522	R/W
*FACtor:MACHine:M3	Machine factor mass 3	522	R/W
*FACtor:MACHine:M4	Machine factor mass 4	522	R/W
*FACtor:PHASE15	Phase 15GOhm	566	R
*FACtor:PHASE500	Phase 500 GOhm	567	R
*FACtor:RESACDC	500GOhm AC/DC factor	569	R/W
*FACtor:RESistor	resistor factor 500G/15G	504	R/W
*FACtor:SL3000:M2	Calibration factor SL3000 for mass 2	519	R/W
*FACtor:SL3000:M3	Calibration factor SL3000 for mass 3	519	R/W
*FACtor:SL3000:M4	Calibration factor SL3000 for mass 4	519	R/W
*FACtor:SNiff:M2	Calibration factor sniff mass 2	521	R/W
*FACtor:SNiff:M3	Calibration factor sniff mass 3	521	R/W
*FACtor:SNiff:M4	Calibration factor sniff mass 4	521	R/W
*FACtor:ULFI	Factor ULTRA/FINE	1900	R/W
*FACtor:ULFINEHigh	Factor ULTRA/FINE_HIGH Only valid for UL6000	1907	R/W
*FACtor:ULGR	Factor ULTRA/GROSS	1903	R/W
*FACtor:ULMA	Factor ULTRA/MASSIVE	1906	R/W
*FACtor:ULSL2	Factor ULTRA/SL200	1890	R/W
*FACtor:ULSL3	Factor ULTRA/SL3000	1895	R/W
*FACtor:ULSL3	Calibration factor vacuum mass 2	520	R/W
*FACtor:VACuum:M3	Calibration factor vacuum mass 3	520	R/W
*FACtor:VACuum:M4	Calibration factor vacuum mass 4	520	R/W
*HOUR:BPUMP	Operating hours backing pump [h]	155	R
*HOUR:BPUMPCONTRoller	Operating hours backing pump controller [h]	154	R
*HOUR:BPUMPRUNNINGtime	Running time backing pump [h]	156	R
*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

Command	Meaning	Relates to LD cmd. no.	Read / Write
*HOUR:MAINTenance:AIRfilter	Time until next service for air filter [h]	1367	R
*HOUR:MAINTenance:BACKINGpump	Time until next service for backing pump [h]	1361	R
*HOUR:MAINTenance:EXHAUSTfilter	Time until next service for exhaust filter [h]	1365	R
*HOUR:MAINTenance:EXPIRYleak	Expiry date of reference leak [DD.MM.YYYY]	1370	R
*HOUR:MAINTenance:FOREpump	Time until next service for backing pump [h]	1361	R
*HOUR:MAINTenance:SNIFFERfilter	Time until next service for sniffer tip filter [h]	1369	R
*HOUR:MAINTenance:TMP	Time until next service for TMP [d]	1362	R
*HOUR:MAINTenance:TURBOpump	Time until next service for TMP [d]	1362	R
*HOUR:POWEr	Time since power on [min]	147	R
*HOUR:RUNup	Run up time [s]	158	R
*HOUR:SERVice:AIRfilter	Time until next service for air filter [h]	1367	R
*HOUR:SERVice:BACKINGpump	Time until next service for backing pump [h]	1361	R
*HOUR:SERVice:EXHAUSTfilter	Time until next service for exhaust filter [h]	1365	R
*HOUR:SERVice:EXPIRYleak	Expiry date of reference leak [DD.MM.YYYY]	1370	R
*HOUR:SERVice:FOREpump	Time until next service for backing pump [h]	1361	R
*HOUR:SERVice:SNIFFERfilter	Time until next service for sniffer tip filter [h]	1369	R
*HOUR:SERVice:TMP	Time until next service for TMP [d]	1362	R
*HOUR:SERVice:TURBOpump	Time until next service for TMP [d]	1362	R
*HOUR:TC	Operating hours frequency converter	141	R
*HOUR:TIME	Time (HH,MM)	450	R/W
*HOUR:TMP2:CONVERTer	TMP2 converter operation hours [h] (UL6000 only)	184	R
*HOUR:TMP2:OFF	TMP2 off time [d] (UL6000 only)	182	R
*HOUR:TMP2:PUMP	Operating hours TMP2 [h] (UL6000 only)	181	R
*HOUR:TURBO	Operating hours of TMP	140	R
*HYDros	Switch on HYDRO*S	22	W
*HYDros:OFF	Switch off HYDRO*S	22	W
*HYDros:ON	Switch on HYDRO*S	22	W
*IDN:ACCESSory	Detected accessory at accessory port (UNKNOWN, OPEN, SL200, TC1000)	247	R
*IDN:BMNETType	Bus-Module network type		R
*IDN:BMSerial	Serial number plug-in unit bus module	325	R
*IDN:BMVersion	software version Bus module	323	R
*IDN:BOOTversion	Software version bootloader main board	318	R
*IDN:BPUMPCONTRModel	Backing pump controller model information	348	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*IDN:BPUMPCONTRSerial	Backing pump controller serial number	347	R
*IDN:BPUMPMModel	Backing pump model information	349	R
*IDN:BPUMPSerial	Backing pump serial number	346	R
*IDN:BPUMPVERSION	Software version backing pump controller	345	R
*IDN:CRC	Check sum of firmware	320	R
*IDN:CUversion	Software version HMI	309	R
*IDN:DEvice	Name of instrument "UL3000 Fab", "UL3000 Fab PLUS", "UL3000 Fab CLEAN", "UL3000 Fab ULTRA" or "UL6000 Fab"	301	R
*IDN:DIP1	MSB DipSwitch 1	321	R
*IDN:DIP2	MSB DipSwitch 2	321	R
*IDN:IOBOOTversion	software version boot loader I/O module	319	R
*IDN:IOSERIAL	Serial number I/O module	408	R
*IDN:IOversion	Hardware identification IO panel	313	R
*IDN:MASSSTORSerial	Mass storage device (flash memory) serial number	354	R
*IDN:SErIal	Serial-number leak detector	406	R
*IDN:SNSerial	Serial number of sniffer probe	404	R
*IDN:SNType	Type of sniffer probe SL3000_3m, SL3000XL_3m, SL3000_5m, SL3000XL_5m, SL3000_10m, SL3000XL_10m, SL3000_15m, SL3000XL_15m, ADAPTER, ADAPTER_XL, FLOW_STANDARD, FLOW_STANDARD_XL, UNKNOWN	302	R
*IDN:SNVersion	Software version of sniffer probe	312	R
*IDN:TCHARDware	Hardware version of the TMP frequency converter	316	R
*IDN:TCNAME	Name of TMP frequency converter	317	R
*IDN:TMP2:CONTROLLERMODEl	TMP2 controller model (UL6000 only)	1445	R
*IDN:TMP2:CONTROLLERSERIAL	Serial number TMP2 controller (UL6000 only)	1443	R
*IDN:TMP2:CONROLLERVERsion	SW version TMP2 controller (UL6000 only)	1441	R
*IDN:TMP2:PUMPMODEl	TMP2 pump model (UL6000 only)	1444	R
*IDN:TMP2:PUMPSerial	Serial number TMP2 (UL6000 only)	1442	R
*IDN:TURBO	Software version TMP controller	315	R
*IDN:VERsion	Software version main board	310	R
*MEASure:ACCESSORYID	Accessories identification voltage [V]	246	R
*MEASure:AMBIENTHe	Last measurement result for helium concentration in purge gas (ambient)	1910	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:AMPTest	Amplifier test currents [A]	1620	R
*MEASure:ANALOGIN	Analog input voltage of I/O-module [V]	220	R
*MEASure:ANALOGOUT1	Output voltage analog output channel 1	221	R
*MEASure:ANALOGOUT2	Output voltage analog output channel 2	221	R
*MEASure:ANODCATH	Anode cathode difference [V]	170	R
*MEASure:ANODE	Anode voltage [V]	167	R
*MEASure:CATHODE	Cathode voltage [V]	168	R
*MEASure:BOOster	TMP2 frequency [Hz] (UL6000 only)	1419	R
*MEASure:BPUMP:Frequency	Backing pump rotation freq. [Hz]	1420	R
*MEASure:BPUMP:POWER	Backing pump power [W]	1424	R
*MEASure:BPUMP:CURRENT	Backing pump bus current [mA]	1425	R
*MEASure:BPUMP:LINEVOLTAGE	Backing pump line voltage [Vpk]	1426	R
*MEASure:BPUMP:BUSVOLTAGE	Backing pump bus voltage [Vdc]	1427	R
*MEASure:BPUMP:PHASEVOLTAGE	Backing pump 3phase voltage [Vrms]	1428	R
*MEASure:DIGITALIN	State of the PLC inputs as 16-bit binary number; inactive=0, active=1 Byte 0, Bit 0: PLC In 1 Byte 0, Bit 1: PLC In 2 Byte 0, Bit 2: PLC In 3 Byte 0, Bit 3: PLC In 4 Byte 0, Bit 4: PLC In 5 Byte 0, Bit 5: PLC In 6 Byte 0, Bit 6: PLC In 7 Byte 0, Bit 7: PLC In 8 Byte 1, Bit 0: PLC In 9 Byte 1, Bit 1: PLC In 10 Byte 1, Bit 2: DIP_1 Byte 1, Bit 3: DIP_2: Byte 1, Bit 4: DIP_3: Byte 1, Bit 5: DIP_4 Byte 1, Bit 6: DIP_5	261	R
*MEASure:DIGITALOUT	state of the PLC outputs as 16-bit binary number; inactive=0, active=1	262	R
*MEASure:FANCurrent	Fan current [A] Only valid for UL6000	250	R
*MEASure:HEATER	Heater Input [V]	172	R
*MEASure:IEMIS	Emission current [A]	171	R
*MEASure:IFilter	Filtered ion current [A]	1573	R
*MEASure:IMeas	Unfiltered ion current [A]	1568	R
*MEASure:IRaw	Ion current (raw value) [A]	1575	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:INLETOFFset:M2	Inlet area offset for mass 2 [A]	518	R
*MEASure:INLETOFFset:M3	Inlet area offset for mass 3 [A]	518	R
*MEASure:INLETOFFset:M4	Inlet area offset for mass 4 [A]	518	R
*MEASure:LRMAX	Maximum leak rate since last query via interface in interface unit	188	R
*MEASure:LRMAX:ATM*CC/S	Maximum leak rate since last query via interface in atm*cc/S		R
*MEASure:LRMAX:G/A	Maximum leak rate since last query via interface in grams per year		R
*MEASure:LRMAX:MBAR*L/S	Maximum leak rate since last query via interface in mbar*l/s	189	R
*MEASure:LRMAX:OZ/YR	Maximum leak rate since last query via interface in ounce per year		R
*MEASure:LRMAX:PA*M3/S	Maximum leak rate since last query via interface in Pa*m3/s		R
*MEASure:LRMAX:PPM	Maximum leak rate since last query via interface in parts per million		R
*MEASure:LRMAX:TORR*L/S	Maximum leak rate since last query via interface in Torr*l/s		R
*MEASure:MIAKP	anode-/cathode potential [V]	170	R
*MEASure:MIAP	Anode potential [V]	167	R
*MEASure:MIKP	Cathode potential [V]	168	R
*MEASure:MISP	Suppressor potential [V]	169	R
*MEASure:OFFset	Offset current [A]	1567	R
*MEASure:P1	p1 pressure (inlet) in interface unit	130	R
*MEASure:P1:ATM	p1 pressure (inlet) in atm		R
*MEASure:P1:DISPlay	p1 pressure (inlet) in display unit	810	R
*MEASure:P1:MBAR	p1 pressure (inlet) in mbar	131	R
*MEASure:P1:PA	p1 pressure (inlet) in Pa		R
*MEASure:P1:TORR	p1 pressure (inlet) in Torr		R
*MEASure:P2	p2 pressure (foreline) in interface unit	132	R
*MEASure:P2:ATM	p2 pressure (foreline) in atm		R
*MEASure:P2:DISPlay	p2 pressure (foreline) in display unit	811	R
*MEASure:P2:MBAR	p2 pressure (foreline) in mbar	133	R
*MEASure:P2:PA	p2 pressure (foreline) in Pa		R
*MEASure:P2:TORR	p2 pressure (foreline) in Torr		R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:P3	P3 pressure	812, 2480, 2481	R
*MEASure:P4	P4 pressure	813, 2482, 2483	R
*MEASure:P5	p5 pressure in interface unit (UL6000 only)	2484	R
*MEASure:P5:ATM	p5 pressure in atm (UL6000 only)		
*MEASure:P5:DISPlay	p5 pressure in display unit (UL6000 only)	814	R
*MEASure:P5:MBAR	p5 pressure in mbar (UL6000 only)	2485	R
*MEASure:P5:PA	p5 pressure in Pascal (UL6000 only)		
*MEASure:P5:TORR	p5 pressure in Torr (UL6000 only)		
*MEASure:PHEAT	Cathode heating power [W]	207	R
*MEASure:RESULTLR	Auto leak test result in interface unit	882	R
*MEASure:RESULTLR:ATM*cc/s	Auto leak test result in atm*cc/s		R
*MEASure:RESULTLR:DISPlay	Auto leak test result in display unit	884	R
MEASure:RESULTLR:MBAR/s	Auto leak test result in mbar*/s	880	R
*MEASure:RESULTLR:PA*m3/s	Auto leak test result Pa*m3/s		R
MEASure:RESULTLR:TORR/s	Auto leak test result in Torr*/s		R
*MEASure:RESULTLR:UNITDI	Auto leak test result in display unit	884	R
*MEASure:RORLR	Rate of Rise leak rate in interface unit (UL6000 only)	728	R
*MEASure:RORLR:ATM*cc/s	Rate of Rise leak rate in atm*cc/s (UL6000 only)		
*MEASure:RORLR:DISPlay	Rate of Rise leak rate in display unit (UL6000 only)		
MEASure:RORLR:MBAR/s	Rate of Rise leak rate in mbar*/s (UL6000 only)	727	R
*MEASure:RORLR:PA*m3/s	Rate of Rise leak rate in Pa*m3/s (UL6000 only)		
MEASure:RORLR:TORR/s	Rate of Rise leak rate in Torr*/s (UL6000 only)		
*MEASure:RORLR:UNITDI	Rate of Rise leak rate in display unit (UL6000 only)		
*MEASure:SAVEDOFFset:M2	Saved leak rate offset for mass 2	517	R
*MEASure:SAVEDOFFset:M3	Saved leak rate offset for mass 3	517	R
*MEASure:SAVEDOFFset:M4	Saved leak rate offset for mass 4	517	R
*MEASure:SNIFFERID	SL3000 sniffer identification voltage [V]	245	R
*MEASure:TEMPeratur:Amplifier	Preamplifier temperature [°C]	166	R
*MEASure:TEMPeratur:BPPCB	Backing pump temp. PCB Controller [°C]	1421	R
*MEASure:TEMPeratur:BPIGBT	Backing pump temp. IGBT [°C]	1422	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:TEMPeratur:BPPSUP	Backing pump temp. power supply [°C]	1423	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
*MEASure:TEMPeratur:TMP2Air	TMP2 controller air temperature [deg. C] (UL6000 only)	1431	R
*MEASure:TEMPeratur:TMP2Control	TMP2 controller heatsink temperature [deg. C] (UL6000 only)	1432	R
*MEASure:TEMPeratur:TMP2Pump	TMP2 pump temperature [deg. C] (UL6000 only)	1433	R
*MEASure:TESTINGtime:M2	Auto leak test, cal testing time M2	665	R
*MEASure:TESTINGtime:M3	Auto leak test, cal testing time M3	665	R
*MEASure:TESTINGtime:M4	Auto leak test, cal testing time M4	665	R
*MEASure:TESTOffset:M2	Auto Leak Test offset for mass 2	667	R
*MEASure:TESTOffset:M3	Auto Leak Test offset for mass 3	667	R
*MEASure:TESTOffset:M4	Auto Leak Test offset for mass 4	667	R
*MEASure:TURBO:Current	TMP current [A]	151	R
*MEASure:TURBO:Frequency	TMP frequency [Hz]	138	R
*MEASure:TURBO:Power	TMP power [W]	139	R
*MEASure:TURBO:Voltage	TMP voltage[V]	150	R
*MEASure:TURBO2:Current	TMP2 current [mA] (UL6000 only)	1435	R
*MEASure:TURBO2:Frequency	TMP2 frequency [Hz] (UL6000 only)	1419	R
*MEASure:TURBO2:Power	TMP2 power [W] (UL6000 only)	1434	R
*MEASure:TURBO2:Voltage	TMP2 voltage[V] (UL6000 only)	1438	R
*MEASure:U12	Internal 12 V supply [V]	240	R
*MEASure:U15N	-15 V supply [V]	211	R
*MEASure:U15P	+15 V supply [V]	210	R
*MEASure:U24	24 V supply [V]	200	R
*MEASure:U24DIV1	24V internal supply DIV1 [V]	233	R
*MEASure:U24DIV1	24V internal supply DIV2 [V]	234	R
*MEASure:U24FAN	24V supply for internal fans	241	R
*MEASure:U24IO	24 V supply IO [V]	213	R
*MEASure:U24IO_OUT	24V power out IO [V]	219	R
*MEASure:U24MSB	24 V supply MSB [V]	200	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:U24PCBOARD	24 V power supply for PC board [V]	216	R
*MEASure:U24PI	24 V power out pirani [V]	214	R
*MEASure:U24RC	24V power out for RC and option connector [V]	212	R
*MEASure:U24TMP	24V power out for TMP1 [V]	209	R
*MEASure:U24TMP2	24V power out for TMP2 [V]	244	R
*MEASure:U5	+5 V supply [V]	218	R
*MEASure:U5INTERNAL	Internal +5 V supply [V]	242	R
*MEASure:U5Sniffer	+5V supply for sniffer option [V]	243	R
*MEASure:UDCDCINValve	24V internal supply VALVE_DCDC [V] (UL6000 only)	251	R
*MEASure:UHEAT	Cathode heating voltage [V]	206	R
*MEASure:UP1	Internal pressure p1 [V]	2490	R
*MEASure:UP2	Internal pressure p2 [V]	2491	R
*MEASure:UP3	Internal pressure p3 [V]	2492	R
*MEASure:UP4	Internal pressure p4 [V]	2493	R
*MEASure:UVV	Preamplifier voltage [V]	202	R
*MEASure:UXP360IN	Identification voltage XP360 [V]	248	R
*MEASure:VALVE	Valve voltage [V]	208	R
*MEASure:VALVECurrent	Lowered valve supply current [A]	249	R
*MEASure:VALVE_LOWERED	Lowered valve voltage [V]	232	R
*PURGE	Purge on	15	W
*PURGE:OFF	Purge off	15	W
*READ	Leak rate in interface unit	128	R
*READ:ATM*cc/s	Leak rate in Atm*cc/s		R
*READ:MBAR*I/s	Leak rate in mbar*I/s	129	R
*READ:OZ/yr	Leak rate in ounce per year (only vaild in sniff)		R
*READ:PA*m3/s	leak rate in Pa*m3/s		R
*READ:PPM	Leak rate in parts per million (only vaild in sniff)		R
*READ:TORR*I/s	Leak rate in Torr*I/s		R
*READ:UNITDI	Leak rate in display unit (limited to lower display limit and D-zero)	860	R
*RST:CALHistory	Clears calibration history	1161	W
*RST:ERRORHistory	Clears error history	1161	W
*RST:FACTORY	Sets all parameters to factory default	1161	W
*SERVICE:TMP	Switch TMP (OFF, ON, RESET)	10	R/W

Command	Meaning	Relates to LD cmd. no.	Read / Write
*SERVICE:VALVECycle:V1	Valve cycle counter for V1	1350	R/W
*SERVICE:VALVECycle:V2	Valve cycle counter for V2	1350	R/W
*SERVICE:VALVECycle:V3	Valve cycle counter for V3	1350	R/W
*SERVICE:VALVECycle:V4A	Valve cycle counter for V4A	1350	R/W
*SERVICE:VALVECycle:V4B	Valve cycle counter for V4B	1350	R/W
*SERVICE:VALVECycle:V4C	Valve cycle counter for V4C	1350	R/W
*SERVICE:VALVECycle:V5	Valve cycle counter for V5	1350	R/W
*SERVICE:VALVECycle:V7	Valve cycle counter for V7	1350	R/W
*SERVICE:VALVECycle:V9	Valve cycle counter for V9	1350	R/W
*SERVICE:VALVECycle:V10	Valve cycle counter for V10	1350	R/W
*STArt	Start (switch from Standby to Measure)	1	W
*START:ROR	Start Rate of Rise measurement (UL6000 only)	25	W
*STATus	Status of leak detector (INIT, ACCL, STBY, VENT, WAIT_EVAC, EVAC, MEAS, CAL, ERROR)	Status word	R
*STATus:AMPTest	Possible answers (READY, RUNNING, SIGNAL TOO SMALL, SIGNAL TOO BIG, SIGNAL INSTABLE, RELAY ERROR)	370	R
*STATus:BOOster	Status Booster TMP (UL6000 only)	1439	R
*STATus:BPUMP:STATUS	Backing pump status	1429	R
*STATus:BPUMP:ERRORCODE	Backing pump error code	1430	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

Command	Meaning	Relates to LD cmd. no.	Read / Write
*STATus:CAL	status of calibration (IDLE, EVAC, OPEN, TUNE, TUNE_RES, CLOSE, STABLE_CLOSE, WAIT_OK, FAIL, STABLE_OPEN, AMBIENT_PREPARING, AMBIENT_VENTING, AMBIENT_REEVACUATE, AMBIENT_RESULT, SHOW_CAL_LEAK_PREPARING, SHOW_CAL_LEAK)	259, 260	R
*STATus:CALHist	Calibration history, entry 0 ... 19 *Factor, Test leak, Anode voltage, Mass, Date, Time, Cathode, State	275	R
*STATus:CAPSensor	TC1000 proximity switch status: CLOSED = Chamber / proximity switch closed OPEN = Chamber / proximity switch open	1471	R
*STATus:CATHode	actual state of the cathodes ON1, ON2, AUTO1, AUTO2, (automatic switching) OFF	530	R
*STATus:EMISsion	Emission status: STOP, START, WAIT, RAMP, REGUL, STABLE, DOWN, OFF	264	R
*STATus:ERRHist	Error history, entry 1 ... 20. ListNo 'ERR' or 'WRN' ErrNo ErrValue(float), year/month/day hour:min:sec 'SwOnCnt.' SwitchOnCnt 'OnTm:' MinSinceStart "WRNxxx vvv yy/mm/dd hh:mm:ss SwOnCnt: zzz OnTm: ttt" or "ERRxxx vvv yy/mm/dd hh:mm:ss SwOnCnt: zzz OnTm: ttt"	287	R
*STATus:ERRor	current number of error / warning („NO ERROR/ WARNING“ or 3-digit failure number)	290	R
*STATus:HMIKEYS	Status of HMI keys: START, STOP, ZERO. NO_KEY_PRESSED	2585	R
*STATus:HYDros	HYDRO*S status (DISABLED, NOT_ACTIVATABLE, ACTIVATABLE, ON)	570	R
*STATus:IOMODULEPROTOcol	Current active protocol of IO module. Settable via dip switch at IO module or via command *CONFIg::IOMODULEPROTOcol	1800	R
*STATus:IPADDRess	Ethernet IP address	351	R
*STATus:IPSUBNETMask	Ethernet IP sub net mask	352	R
*STATus:MACADDRess	Ethernet MAC address	353	R
*STATus:MAINTenanceHist	Maintenance history, entry 1 ... 20	2643	R
*STATus:MODE	actual vacuum mode (VAC, SNIFF)	401	R
*STATus:PREAMPRESistor	currently used resistance of pre-amplifier (13M, 470M, 15G, 500G, 13M_FIXED, 470M_FIXED, 15G_FIXED, 500G_FIXED)	502	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*STATus:PURGe	Purge / gas ballast	15	R
*STATus:RANGE	Measuring range(GROSS, FINE, ULTRA)	551	R
*STATus:RESETSorce	Source for last device reset: POWER_ON, LOW_POWER, WINDOW_WATCHDOG, INDEPENDENT_WATCHDOG, SOFTWARE and/or NRST_PIN	1815	R
*STATus:RESULT	Status of Auto leak test	680	R
*STATus:ROR	Rate of rise status (UL6000 only): NOT_POSSIBLE, ACTIVATABLE, ACTIVE	725	R
*STATus:SECINEvac	Time since last change to evacuation mode [s]	160	R
*STATus:SECINMeas	Time since last change to measuring mode [s]	159	R
*STATus:SECINRange	Time since last change to vacuum range [s]	163	R
*STATus:SECINStandby	Time since last change to standby mode [s]	161	R
*STATus:SECINVent	Time since last change to vent mode [s]	162	R
*STATus:SERIESErrmsg	Auto leak test: Successive failed tests	677	R
*STATus:SNkey	Status of sniffer key 0=not pressed 1=key pressed (SL200) / left key pressed (SL3000), 2=right key pressed (SL3000) 3=both keys pressed (SL3000)	298	R
*STATus:SWITCHONCnt	Switch on counter	157	R
*STATus:TESTLog	Auto test leak history, entry 1 ... 50		R
*STATus:TMP2	Status TMP2 (ON,OFF) (UL6000 only)	1439	R
*STATus:TMP2:CYCLECounter	TMP2 cycle counter (UL6000 only)	1447	R
*STATus:TMP2:CYCLETime	TMP2 cycle time [min] (UL6000 only)	1446	R
*STATus:TMP2:ERRORCode	TMP2 error code (UL6000 only)	1440	R
*STATus:TMP2:RUNUPTime	TMP2 runup time [s] (UL6000 only)	183	R
*STATus:TMPHist	TMP error history, entry 1 ... 10	288	R
*STATus:TRIGger	Status of leak rate setpoints S1,S2, S3, S4 with S1...S4 is "ON" or "OFF" depending on the states of setpoint 1 to setpoint 4	387	R
*STATus:TURBO	Device state TMP: (OFF, ON, RUN_UP, RUN_DOWN, FAIL, RESET)	266	R
*STATus:USEDInterface	Used interface	27	R
*STATus:VALUEChanged	Value changed flag	1565	R
*STATus:VALVE	Status of internal valves	449	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*STATus:VALVE:TestLeak	Status of internal valves as plain text. Provides a comma separated list of all open internal valves. (ALL_VALVES_CLOSED if all valves closed)		
*STATus:WARNINGBits	Warning-Bits which indicate pending warnings (see note)	297	R
*STATus:ZERO	Zero (ON, OFF)	6	R
*STOp	Stop (switch from Measure to Standby)	2	W
*STOP:ROR	Stop Rate of Rise measurement (UL6000 only)	25	W
*VENt	Vent inlet port	3	W
*ZERO	Switch zero on	6	W
*ZERO:OFF	Switch zero off	6	W

2.5 Examples

Command	Answer	Meaning
*stat? (CR)	MEAS (CR)	Get status of leak detector (long command)
*status? (CR)	MEAS (CR)	Get status of leak detector (short command)
*read? (CR)	2.876E-7 (CR)	Get leak rate according to programmed unit
*read:pa*m3/s? (CR)	2.876E-6 (CR)	Get leak rate in a different unit
*start (CR)	OK (CR)	start measurement
*conf:trig1? (CR)	1.0E-9 (CR)	Get setpoint 1
*conf:trig1 2.0E-9 (CR)	OK (CR)	set setpoint 1

2.6 Error Messages

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

3 LD Protocol

For an example Windows application for INFICON's LD serial interface protocol, please visit:

https://github.com/INFICON/LD_ProtocolExample

3.1 Communication Parameters

Data format

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

3.2 Command format

3.2.1 Telegram structure

Master sends

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

Slave answers

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

Command	Meaning	
ENQ	0x05	Start of master request
STX	0x02	Start of slave response
LEN	Number of telegram bytes	without ENQ(STX)/LEN, however with CRC max. 253, so the total slave telegram length is max. 255
ADR	Slave address	Slave address = 1: non-addressed bus. Address byte is ignored.
Stw H/L	Status word	Info from slave to master (see page 31)
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 32)

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

Cmd H/L: Command: Command-specifier

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

Command name in plain text

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

Command info

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

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

Data types

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

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

Arrays

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

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

Array parameters in commands table (see chapter 3.5): 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 1 = STANDBY 2 = EVACUATION 3 = MEASURE 4 = CALIBRATION 5 = ERROR
Bit 1	
Bit 2	
Bit 3	
Bit 4	
Bit 5	ZERO
Bit 6	Still pending device warning
Bit 7	Sniffer Key
Bit 8	not used
Bit 9	PLC Output Change
Bit 10	Setpoint 1, 1 = Setpoint 1 exceeded
Bit 11	Setpoint 2, 1 = Setpoint 2 exceeded
Bit 12	Value changed via interface command. Refer to command 1565.
Bit 13	not used
Bit 14	Unconfirmed device warning
Bit 15	Device error
	Syntax/Command error

3.4 Meaning of the "nonvolatile" column

See the table in the following chapter.

N/A	not applicable
no	Parameter value is not stored in non-volatile memory
yes	Parameter value is stored non-volatile in the EEPROM of the basic unit
yes (xxx)	Parameter value is stored non-volatile in unit "xxx" (for example TMP = TMP controller, RTC = realtime clock etc.)

3.5 Commands

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
0	0	NOP	R	N/A	NO_DATA	"No operation", replies without data	X
1	1	Start	W	N/A	NO_DATA	Start	
2	2	Stop	W	N/A	NO_DATA	Stop	
3	3	Vent	R/W	no	UINT8	Vent 0 = OFF 1 = ON	
4	4	Start calibration	W	N/A	UINT8	Start calibration: 0 = internal 1 = proof 2 = external 3 = inlet offset 4 = Mass scan 6 = Reference measurement	
5	5	Clear error	W	N/A	NO_DATA	Clear Error or Warning	
6	6	Zero	R/W	no	UINT8	0 = Zero "Off" 1 = Zero "On" respectively update zero value	
9	9	Emission nominal status	R/W	no	UINT8	Emission nominal status 0 = off 1 = on	
10	A	TMP nominal status	R/W	no	UINT8	TMP nominal status 0 = off 1 = on	
11	B	Calibration acknowledge	W	N/A	UINT8	Calibration acknowledge 0 = cancel 1 = continue	
14	E	Backing pump nominal status	R/W	no	UINT8	Backing pump nominal status 0 = off 1 = on	
15	F	Purge/gasballast	R/W	no	UINT8	Purge 0 = OFF 1 = ON	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
21	15	TMP2 nominal status	R/W	no	UINT8	TMP2 nominal status (UL6000 only) 0 = off 1 = on 2=Soft Start	
22	16	HYDROS	R/W	no	UINT8	HYDROS 0= switch off 1= switch on	
23	17	TMP2 mode	R/W	yes	UINT8	UL6000 only: 0 = TMP2 (Booster-TMP) off 1 = TMP2 (Booster-TMP) auto	
24	18	TMP2 active stop	R/W	yes	UINT8	TMP2 (Booster-TMP) active stop (UL6000 only): 0 = no active stop 1 = active decelerating in stop	
25	19	Rate of rise set	R/W	no	UINT8	Rate of Rise(UL6000 only) 0= switch off 1= switch on 2= failure (only read)	
128	80	Leak rate [interface unit]	R	no	FLOAT	Leak rate [interface unit] (limited to lower display limit, refer to command number 454)	
129	81	Leak rate [mbar*l/s]	R	no	FLOAT	Leak rate [mbar*l/s] (unlimited)	
130	82	Internal pressure 1 [interface unit]	R	no	FLOAT	Pressure p1 in interface unit	
131	83	Internal pressure 1 [mbar]	R	no	FLOAT	Pressure p1 in mbar	
132	84	Internal pressure 2 [sel. unit]	R	no	FLOAT	Pressure p2 in selected unit	
133	85	Internal pressure 2 [mbar]	R	no	FLOAT	Pressure p2 [mbar]	
137	89	TMP runup time [s]	R	no	UINT16	TMP runup time [s]	
138	8A	TMP actual rotation speed [Hz]	R	no	UINT16	TMP actual rotation speed	
139	8B	TMP power [W]	R	no	FLOAT	TMP power in Watt as reportet by TMP controller	
140	8C	TMP operation hours [h]	R	yes (TMP)	UINT32	TMP operation hours	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
141	8D	Frequency converter operation hours [h]	R	yes (TMP)	UINT32	Frequency converter operation hours [h]	
142	8E	Leak detector operation hours	R	yes	UINT32	Leak detector operation hours	
143	8F	TMP temperature bottom [deg. C]	R	no	FLOAT	TMP temperature bottom [deg. C]	
144	90	TMP temperature electronic [deg. C]	R	no	FLOAT	TMP temperature electronic [deg. C]	
145	91	TMP temperature bearing [deg. C]	R	no	FLOAT	TMP temperature bearing [deg. C]	
146	92	TMP temperature motor [deg. C]	R	no	FLOAT	TMP temperature motor [deg. C]	
147	93	Time since power on [min]	R	no	UINT32	Time since power on [min]	
148	94	Cathode1 operation hours	R	yes	UINT32	Cathode1 operation hours	
149	95	Cathode2 operation hours	R	yes	UINT32	Cathode2 operation hours	
150	96	TMP voltage [V]	R	no	FLOAT	TMP voltage as reported by TMP controller	
151	97	TMP current [A]	R	no	FLOAT	TMP current as reported by TMP controller	
154	9A	Backing pump converter operation hours [h]	R	yes (BP)	UINT32	Backing pump frequency converter operation hours [h]	
155	9B	Backing pump operation hours [h]	R	yes (BP)	UINT32	Backing pump operation hours [h]	
156	9C	Backing pump running time [h]	R	yes (BP)	UINT32	Backing pump running time [h] (Neodry only)	
157	9D	Switch on counter	R	yes	UINT16	Counts the switch on cycles 0, 0, 65534	
158	9E	Runup time [s]	R	no	UINT16	Runup time [s]	
159	9F	Time in measure [s]	R	no	UINT16	Time in measure [s]	
160	A0	Time in evacuation [s]	R	no	UINT16	Time in evacuation [s]	
161	A1	Time in standby [s]	R	no	UINT16	Time in standby [s]	
162	A2	Time in vent [s]	R	no	UINT16	Time in standby [s] (venting valve opened)	
163	A3	Time in vacuum range [s]	R	no	UINT16	Time in vacuum range [s]	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
165	A5	Electronic temperature [deg. C]	R	no	FLOAT	MSB temperature in °C	
166	A6	Preamplifier temperature [deg. C]	R	no	FLOAT	Preamplifier temperature [°C]	
167	A7	Anode voltage [V]	R	no	FLOAT	Anode voltage [V]	
168	A8	Cathode voltage [V]	R	no	FLOAT	Cathode voltage [V]	
169	A9	Suppressor voltage [V]	R	no	FLOAT	Suppressor voltage [V]	
170	AA	Anode-cathode voltage [V]	R	no	FLOAT	Anode-cathode voltage [V]	
171	AB	Emission current [A]	R	no	FLOAT	Emission current [A]	
172	AC	Heater input [V]	R	no	FLOAT	DAC Heater [V]	
181	B5	TMP2 operation hours [h]	R	yes (TMP)	UINT32	TMP2 running time [h] (UL6000 only)	
182	B6	TMP2 off time [d]	R	yes	UINT16	TMP2 off time [d] (UL6000 only)	
183	B7	TMP2 runup time [s]	R	no	UINT16	TMP2 runup time [s] (UL6000 only)	
188	BC	Maximum leak rate [sel. unit]	R	no	FLOAT	Maximum leak rate since last query via interface [interface unit]	
189	BD	Maximum leak rate [mbar*I/s]	R	no	FLOAT	Maximum leak rate since last query via interface [mbar*I/s]	
200	C8	24 V supply [V]	R	no	FLOAT	24 V supply voltage for heater, processor, preamplifier in V	
202	CA	Pre amplifier voltage [V]	R	no	FLOAT	Pre amplifier voltage [V]	
206	CE	Heater voltage [V]	R	no	FLOAT	Heater voltage in V	
207	CF	Heater power [W]	R	no	FLOAT	Heater power in W	
208	D0	24 V supply valve [V]	R	no	FLOAT	24 V supply voltage for valves	
209	D1	24 V power out TMP [V]	R	no	FLOAT	24 V TMP, MSB Pin C30 voltage	
210	D2	+15 V supply [V]	R	no	FLOAT	+15 V supply voltage	
211	D3	-15 V supply [V]	R	no	FLOAT	-15 V supply voltage	
212	D4	24 V power out RC/Option [V]	R	no	FLOAT	External 24 V output voltage for remote control port and OPTION connector	
213	D5	24 V supply IO [V]	R/W	no	FLOAT	24 V IO-Modul supply voltage [V] write for internal use only	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
214	D6	24 V power out pirani [V]	R	no	FLOAT	24 V output voltage for pirani, MSB Pin C31	
216	D8	24 V supply PC-board [V]	R	no	FLOAT	24 V PC board voltage MSB Pin B30	
218	DA	+5 V supply [V]	R	no	FLOAT	+5 V supply voltage	
219	DB	24V power out IO [V]	R	no	FLOAT	24 V output voltage for IO-Modul, MSB Pin B30	
220	DC	Analog input IO module [V]	R/W	no	FLOAT	Analog input voltage IO module in [V] write for internal use only	
221	DD	Analog outputs IO [V]	R/W	no	FLOAT[2]	Analog output voltage for IO module in [V] It is possible to write an arbitrary voltage value, if the "Analog output configuration" (command 222) of the accordant channel is set to 8	
222	DE	Analog output configuration IO module	R/W	yes	UINT8[2]	Function of analog output Index 0: Channel 1 Index 1: Channel 2 Functions see table "Analog output configuration"	
223	DF	Analog output leak rate scale (log. only)	R/W	yes	UINT8	Leak rate scaling of analog output in logarithmic mode Functions see table "Analog output leak rate scale (log. only)"	
224	E0	Analog output upper exponent	R/W	yes	SINT8	Upper limit for the analog out at the I/O module. Value is exponent of the value in selected unit. Example: -5 = 1E-5	
228	E4	Automatic purge	R/W	yes	UINT8	Automatic purge 0=disabled 1=enabled (default)	
232	E8	Lowered valve supply voltage [V]	R	no	FLOAT	Lowerd valve supply voltage [V]	
233	E9	24V internal supply DIV1[V]	R	no	FLOAT	24V internal supply DIV1[V]	
234	EA	24V internal supply DIV2[V]	R	no	FLOAT	24V internal supply DIV2[V]	
240	F0	12V internal supply [V]	R	no	FLOAT	12V internal supply voltage	
241	F1	24V fan supply [V]	R	no	FLOAT	24V supply voltage for internal fans	
242	F2	5V internal supply [V]	R	no	FLOAT	Internal 5V supply at VI15 board	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
243	F3	5V supply sniffer option[V]	R	no	FLOAT	5V supply for sniffer optional VI15 board	
245	F5	Sniffer identification voltage [V]	R	no	FLOAT	SL3000 sniffer identification voltage	
246	F6	Accessories identification voltage [V]	R	no	FLOAT	Identification voltage for devices at accessories conector	
247	F7	Accessory	R	no	UINT8	Detected accessory at accessory port: 0 = UNKNOWN 1 = OPEN 2 = SL200 3 = TC1000	
248	F8	Identification voltage XP360 [V]	R	no	FLOAT	Identification voltage at internal XP360 connector in Volt. (UL6000 only)	
249	F9	Lowered valve supply current [A]	R	no	FLOAT	Total valve supply current for all lowered valves in Ampere. (UL6000 only)	
250	FA	Fan current [A]	R	no	FLOAT	Total fan supply current for internal fans. (UL6000 only)	
251	FB	24V internal supply VALVE DCDC [V]	R	no	FLOAT	24 V internal supply voltage in Volt for DC/DC converter for lowered valve voltage generation	
259	103	Text of calibration state	R	N/A	CHAR[*]	Text of an calibration state / result To read send after the index the UINT8 state number (see table "State calibration") Without state number you will get the actual calibration state Use only with index=255!	X
260	104	State calibration	R	no	UINT8	Status of calibration See table "State calibration"	
261	105	PLC input state IO module	R/W	no	UINT16	Get PLC input state and DIP switch state IO module Bit 0..9 = PLCin 1..10 Bit 10..15 = DIP 1..6 (S1.1,S1.2,S1.3,S1.4,S2.1,S2.2) write for internal use only	
262	106	PLC output state IO module	R	no	UINT8	Get PLC output state IO module Bit0..7 = PLCOut 1..8	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
263	107	PLC output configuration IO module	R/W	yes	SINT8[8]	Index 0...7 = PLC_OUT1 ... PLC_OUT_8 See table "PLC output conf."	
264	108	Emission actual status	R	no	UINT8	Emission status: STOP= 0 START= 1 WAIT= 2, RAMP= 3, REGULATE= 4 STABLE= 5 DOWN= 6 OFF= 7	
266	10A	TMP actual status	R	no	UNIT8	TMP actual status 0 = OFF 1 = ON 2 = RUNNING_UP 3 = RUNNING_DOWN 4 = FAIL 5 = RESET	
275	113	Calibration log	R	yes	CHAR[*]	Text of a calibration in calibration log. To read send after the array index 255 the UINT8 history list index (0...19). Without index or index 0 you will get the last (newest) entry. Index 19 is the eldest on. Entry format: see enumerations table	X
280	118	Used entries in calibration log	R	yes	UINT8	Used entries in calibration log	X
281	119	Used entries in error log	R	yes	UINT8	Used entries in error log	X
282	11A	Used entries in TMP error log	R	yes (TMP)	UINT8	Used entries in TMP error log	X

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
287	11F	Error log	R	yes	CHAR[*]	Text of an error/warning in error log. To read send after the array index 255 the UINT8 history list index (0...19). Without index or index 0 you will get the last (newest) entry. Index 19 is the eldest one. Entry format: see enumerations table	X
288	120	TMP error log	R	yes (TMP)	CHAR[*]	Text of an error/warning in TMP error log. To read send after the array index 255 the UINT8 history list index (0...9). Without index or index 0 you will get the last (newest) entry. Index 9 is the eldest one. Entry format: see enumerations table	X
289	121	Value of actual error	R	no	FLOAT	Value associated with the actual error or warning	
290	122	Number of actual error or warning	R	no	UINT16	Error number of the actual error or warning	
291	123	List of signal values of active errors	R	N/A	FLOAT[10]	Lists the signal values of the errors/warnings since the last "clear error"	
294	126	Text of error number	R	N/A	CHAR[*]	text of an error/warning number To read send after the index the UINT16 error number Without error number you will get the actual error/warning Use only with index=255!	X
295	127	Text of warning bits	R	N/A	CHAR[*]	Explanation text for a specific warning bit: To read, send after the index the UINT8 bit position Use only with index=255!	X
296	128	List of active errors or warnings	R	no	UINT16[10]	Lists the error/warning numbers since the last "clear error"	
297	129	Present warnings	R	no	UINT32	Each bit represents a warning . See table "Present warnings"	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
298	12A	Sniffer button	R	no	UINT8	Read state SL3000 sniffer button Bit 0 = 1: Left Button pressed Bit 1 = 1: Right button pressed	
300	12C	Device identification	R	N/A	UINT8[2]	Device identification Index 0, Manufacturer ID: 1 - INFICON Index 1, Device ID: 6 - UL3xxx	
301	12D	Device name	R	N/A	CHAR[*]	Get device name as ASCII string "UL3000 Fab", "UL3000 Fab PLUS", "UL3000 Fab CLEAN", "UL3000 Fab ULTRA" or "UL6000 Fab"	
302	12E	Sniffer probe type	R/W	N/A	UINT8	READ: 0 = SL3000 3m 1 = SL3000XL 3m 2 = Adapter 3 = Adapter XL 4 = Flow standard 5 = Flow standard XL 10 = SL3000 5 m 11 = SL3000XL 5m 20 = SL3000 10m 21 = SL3000XL 10 m 30 = SL3000 15m 31 = SL3000XL 15m 255 = no Sniffer / unknown	
309	135	SW-version web server	R/W	N/A	UINT8[3]	Software version of web server based operating unit Index 0: Main version Index 1: Sub version Index 2: Debug version write for internal use only	
310	136	SW-version MSB	R	N/A	UINT8[3]	Software version MSB Index 0: Main version Index 1: Sub version Index 2: Debug version	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
312	138	SW-version sniffer probe	R	N/A	UINT8[3]	Software version probe Index 0: Main version Index 1: Sub version Index 2: always 0	
313	139	SW-version I/O module	R/W	N/A	UINT8[3]	Software version IO module Index 0: Main version Index 1: Sub version Index 2: Debug version write for internal use only	
315	13B	SW version TMP controller	R	N/A	CHAR[6]	SW version TMP controller (character string from TMP controller)	
316	13C	HW-version TMP controller	R	N/A	CHAR[6]	HW version TMP controller (character string from TMP controller)	
317	13D	TMP controller name	R	N/A	CHAR[6]	TMP controller name (character string from TMP controller)	
318	13E	SW version boot loader	R	N/A	UINT8[3]	Software version of boot loader	
319	13F	SW version boot loader I/O module	R/W	N/A	UINT8[3]	Software version of boot loader IO module write for internal use only	
320	140	CRC-code MSB	R	N/A	UINT32	CRC-code interface board abcdwxyz (hex) abcd: calculated value wxyz: nominal value	
321	141	DIP switch MSB	R	no	UINT8	DIP switch setting of the MSB: Bit7: S171, switch 4 Bit6: S171, switch 3 Bit5: S171, switch 2 Bit4: S171, switch 1 Bit3: S170, switch 4 Bit2...0: not used,always 0 Bit 4/5 Device type xx01xxxx - UL3000 Fab xx10xxxx - UL3000 Fab PLUS / ULTRA / CLEAN xx11xxxx - UL6000 Fab	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
322	142	Field bus status word	R	no	UINT16	Status word for Bus module refer to Bus module documentation	
323	143	SW version bus module	R	N/A	UINT8[3]	SW version bus module	
324	144	Bus module fieldbus type	R	no	UINT16	Bus module fieldbus type. Refer to AnybusCC specification for enumeration.	
325	145	Serial number plug-in unit bus module	R	N/A	UINT8[4]	Serial number plug-in unit bus module	
326	146	Field bus address actual value	R	no	UINT8	Fiedbus address actual value Refer to AnybusCC specification for enumeration.	
327	147	Field bus baud rate	R	no	UINT8	Baud rate at field bus Refer to AnybusCC specification for enumeration.	
328	148	Exception code bus module	R	no	UINT8	Exception code bus module	
329	149	Error counters bus module	R	no	UINT16[4]	Error counters bus module Index: 0: Discarded commands 1: Discarded Responses 2: Serial Reception errors 3: Fragmentation errors	
330	14A	Bus module state	R	no	UINT8	State of bus module 0 = SETUP 1 = NW_INIT 2 = WAIT_PROCESS 3 = IDLE 4 = PROCESS_ACTIVE 5 = ERROR 6 = UNKNOWN 7 = EXCEPTION	
331	14B	Field bus address nominal value	R/W	yes	UINT8	Fiedbus address nominal value Refer to AnybusCC specification for enumeration.	
336	150	Field bus station name	R	yes (BM)	CHAR[*]	BM1000 Station name (PROFINET IO only)	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
337	151	Field bus IP address	R	yes (BM)	UINT8[4]	BM1000 IP address (IP based field busses only)	
338	152	Field bus IP subnet mask	R	yes (BM)	UINT8[4]	BM1000 IP address (IP based field busses only)	
339	153	Field bus gateway IP address	R	yes (BM)	UINT8[4]	BM1000 gateway IP address (IP based field busses only)	
340	154	Field bus DHCP enabled	R	yes (BM)	UINT8	BM1000 DHCP (IP based field busses only) 0=disabled; 1=enabled	
345	159	SW version backing pump controller	R	N/A	CHAR[30]	SW version backing pump controller: Index 0...9: Program listing code and revision Index 10...19: Parameter listing code and revision Index 20...29: Controller modification Level	
346	15A	Serial number backing pump	R	N/A	CHAR[10]	Serial number backing pump	
347	15B	Serial number backing pump controller	R	N/A	CHAR[10]	Serial number backing pump controller	
348	15C	Backing pump model	R	N/A	CHAR[10]	Backing pump model (UL3000 and TS620 only)	
349	15D	Backing pump controller model	R	N/A	CHAR[10]	Backing pump controller model (TS620 only)	
351	15F	Ethernet IP address	R/W	N/A	UINT8[4]	IP address of Ethernet port. Write for internal use only. IP address cannot be set via this command.	
352	160	Ethernet IP sub net mask	R/W	N/A	UINT8[4]	IP sub net mask of Ethernet port. Write for internal use only. IP sub net mask cannot be set via this command.	
353	161	Ethernet MAC address	R/W	N/A	UINT8[6]	MAC address of Ethernet port. Write for internal use only. MAC address cannot be set via this command.	
354	162	Mass storage serial number	R/W	N/A	CHAR[30]	Serial number of solid state drive. Write for internal use only.	
370	172	Amp test during calibration	R/W	yes	UINT8	Amplifier test during internal calibration 0 = Off 1 = ON	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
371	173	Run Amp test	R/W	no	UINT8	Write: Write value 1 to run Amplifier test Read: Amplifier test state	
384	180	Setpoint [interface unit]	R/W	N/A	FLOAT[4]	Setpoint in interface unit	
385	181	Setpoint [mbar*l/s]	R/W	yes	FLOAT[4]	Setpoint in mbar*l/s	
387	183	Setpoint status	R	no	UINT8	Setpoint status: 0=Leak rate <setpoint 1=Leak rate > setpoint Bit 0: Setpoint 1 Bit 1: Setpoint 2 Bit 2: Setpoint 3 Bit 3: Setpoint 4	
390	186	Test leak extern vacuum [mbar*l/s]	R/W	yes	FLOAT[3]	Test leak extern Vacuum [mbar*l/s] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	
391	187	Test leak extern vacuum [interface unit]	R/W	N/A	FLOAT[3]	Test leak extern Vacuum [interface unit] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	
392	188	Test leak extern sniff [mbar*l/s]	R/W	yes	FLOAT[3]	Test leak extern Sniff [mbar*l/s] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	
393	189	Test leak extern sniff [interface unit]	R/W	N/A	FLOAT[3]	Test leak extern Sniff [interface unit] Index 0: Mass2 Index 1: Mass 3 Index 2: Mass 4 Helium	
394	18A	Test leak intern [mbar*l/s]	R/W	yes	FLOAT	Testleak intern in mbar*l/s	
401	191	Operation mode	R/W	yes	UINT8	0 = VACUUM 1 = SNIFF 2 = SL3000	
402	192	Leak rate filter	R/W	yes	UINT8	0 = Fixed 1 = I•CAL	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
404	194	Serial number sniffer probe	R/W	N/A	CHAR[11]	Serial number of SL3000	X
406	196	Serial number leak detector	R	yes	CHAR[11]	Serial number of the complete leak detector	X
408	198	Serial number IO module	R/W	N/A	CHAR[11]	Serial number of the IO module	X
410	19A	Zero mode	R/W	yes	UINT8	Zero mode 0 = disabled 1 = I*ZERO 2.0 2 = enabled	
413	19D	Sniffer LED alarm configuration	R/W	yes	UINT8	Configures the behavior of the white sniffer probe 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	Sniffer white LED brightness	R/W	yes	UINT8	Configures the brightness of the white sniffer probe LEDs in case of normal measurement: 0=off ... 6=max Brightness	
417	1A1	Sniffer beep	R/W	yes	UINT8	0= Beep disabled 1=Beep if setpoint 1 is exceeded	
419	1A3	Calibration request enable	R/W	yes	UINT8	0 = Calibration request disabled 1 = Calibration request enabled	
420	1A4	Volume	R/W	yes	UINT8	Volume (Min.: 0; Default: 2; Max.: 15)	
423	1A7	Speaker beep	W	N/A	UINT8[2]	Performs a speaker beep. Index 0: Typ Index 1: Volume (1..15) Typ: 1=2000Hz, 2=first 2000Hz, then 1000Hz	X
430	1AE	Pressure interface unit	R/W	yes	UINT8	Pressure unit interface mbar = 0 Pa = 1 atm = 2 Torr = 3	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
431	1AF	Leak rate interface unit vacuum	R/W	yes	UINT8	Leak rate unit vacuum interface 0 - mbar*l/s 1 - Pa*m ³ /s 2 - Atm ccs 3 - Torr*l/s	
432	1B0	Leak rate interface unit sniff	R/W	yes	UINT8	Leak rate unit sniff interface 0 - mbar*l/s 1 - Pa*m ³ /s 2 - Atm ccs 3 - Torr*l/s 4 - ppm 5 - g/a 6 - oz/yr	
433	1B1	Anode setpoint M2 [V]	R/W	yes	UINT16	Anode voltage setpoint for mass 2 (hydrogen) in V	
434	1B2	Anode setpoint M3 [V]	R/W	yes	UINT16	Anode voltage setpoint for mass 3 in V	
435	1B3	Anode setpoint M4 [V]	R/W	yes	UINT16	Anode voltage setpoint for mass 4 (helium) in V	
436	1B4	Emission current setpoint [A]	R/W	no	FLOAT	Emission current setpoint [A]	
438	1B6	PLC input configuration IO module	R/W	yes	UINT8[10]	Configuration of PLC input port of the IO module Index 0...9 = PLC_IN1...PLC_IN10 See table "PLC input conf."	
446	1BE	Serial number test leak	R/W	yes	CHAR[11]	Serial number of the internal test leak	
449	1C1	Valve state	R	no	UINT16	Valve state see table "Valve numbers" column "Bit assignment" Bit set means valve is open	
450	1C2	Date+Time [YMDhms]	R/W	yes (RTC)	UINT8[6]	Date and time use only with array-index 255 (all bytes) year (1..99), month, day, hour (0..23), min, sec	X
452	1C4	Min pressure sniff [mbar]	R/W	yes	FLOAT	Minimum pressure p1 in mbar for sniff mode. If pressure falls below this value, warning 540 (Flow too low) is generated.	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
453	1C5	Max pressure sniff [mbar]	R/W	yes	FLOAT	Maximum pressure p1 in mbar for sniff. If pressure rises above this value, warning 542 (Sniffer broken) is generated.	
454	1C6	Lower leak rate limit	R/W	yes	UINT8	Lower leak rate limit (decades) 0 = 1E-12 mbar*I/s @ ULTRA 1 = 1.0E-11 mbar*I/s @ ULTRA ... 6 = 1.0E-6 mbar*I/s @ ULTRA	
455	1C7	Min pressure SL3000 sniff [mbar]	R/W	yes	FLOAT	Minimum pressure (P4) for flow monitoring of SL3000	
456	1C8	Max pressure SL3000 sniff [mbar]	R/W	yes	FLOAT	Maximum pressure (p4) for flow monitoring of SL3000	
498	1F2	TMP venting enable	R/W	yes	UINT8	TMP venting enable 0 = disabled 1 = enabled	
501	1F5	TMP rotation speed	R/W	yes	UINT16	TMP rotation speed 1000, 1500Hz	
502	1F6	Amplifier range	R/W	no	UINT8	Amplifier range Amplifier control location see 508 automatically set (not auto) 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm	
504	1F8	500GOhm value	R/W	yes	FLOAT	500GOhm value	
506	1FA	Mass	R/W	yes	UINT8	2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)	
508	1FC	Amplifier control location	R/W	no	UINT8	Amplifier control location 1 = automatic on (default) 0 = automatic off Write access only possible if "Manual control for service" is active	
509	1FD	Min pressure sniff SL3000 [interface unit]	R/W	N/A	FLOAT	Min pressure sniff SL3000 [interface unit]	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
510	1FE	Max pressure sniff SL3000 [interface unit]	R/W	N/A	FLOAT	Max pressure sniff SL3000 [interface unit]	
511	1FF	Min pressure sniff SL3000 [display unit]	R/W	N/A	FLOAT	Min pressure sniff SL3000 [display unit]	
512	200	Max pressure sniff SL3000 [display unit]	R/W	N/A	FLOAT	Max pressure sniff SL3000 [display unit]	
516	204	Offset electrical 500G [A]	R	yes	FLOAT	Electrical offset 500G	
517	205	Offset internal [A]	R	yes	FLOAT[3]	Standby internal Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
518	206	Offset inlet [A]	R	yes	FLOAT[3]	Offset inlet area Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
519	207	Calibration factors SL3000 sniff	R/W	yes	FLOAT[3]	Calibration factors for SL3000 sniff mode Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
520	208	Calibration factors vacuum	R/W	yes	FLOAT[3]	Calibration factors for vacuum mode Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
521	209	Calibration factors SL200 sniff	R/W	yes	FLOAT[3]	Calibration factors for SL200 sniff mode Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
522	20A	Machine factors vacuum	R/W	yes	FLOAT[3]	Machine factors for vacuum mode Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
527	20F	Calibration factors Auto LT	R/W	yes	FLOAT[3]	Calibration factors for Auto Leak Test Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
530	212	Cathode selection	R/W	yes	UINT8	Cathode selection 0 = CAT1 1 = CAT2 2= Auto Cat1 (def.) 3= Auto Cat2	
540	21C	Pressure EVAC GROSS [mbar]	R/W	yes	FLOAT	Pressure limit in mbar for EVAC to GROSS transition. Setting only becomes effective in the following measuring cycle. Also refer to command 580 and 820.	
541	21D	Pressure GROSS FINE [mbar]	R/W	yes	FLOAT	Pressure limit in mbar for GROSS to FINE transition. Setting only becomes effective in the following measuring cycle. Also refer to command 581 and 821.	
543	21F	Pressure FINE ULTRA [mbar]	R/W	yes	FLOAT	Pressure limit in mbar for FINE to ULTRA transition. Setting only becomes effective in the following measuring cycle. Also refer to command 583 and 823	
548	224	Background suppression	R/W	yes	UINT8	Background suppression 0 = disabled 1 = internal only 2 = inlet area	
550	226	Vacuum ranges	R/W	yes	UINT8[4]	Vacuum ranges Index 0: GROSS Index 1: FINE Index 2: ULTRA Index 3: MASSIVE (TRUE-range enabled, FALSE-range disabled)	
551	227	Vacuum state	R	no	UINT8	Vacuum state (current vacuum range) 0 = None 1 = GROSS 2 = FINE 3 = ULTRA 4 = MASSIVE	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
553	229	Vent mode	R/W	yes	UINT8	Vent mode 0 = Vent with Stop 1 = Vent manual 2 = No Vent	
554	22A	Max. evacuation time gross leak [s]	R/W	yes	UINT16	Maximum evacuation time gross leak (until 100 mbar). If this time is exceeded, the leak detector shows error message no. 580. 0 = infinite	
555	22B	Max. evacuation time until measure [s]	R/W	yes	UINT16	Maximum evacuation time until measure mode. This means until first selected vacuum range, for example GROSS. If this time is exceeded, the leak detector shows error message no. 581. 0 = infinite	
564	234	Soft Vent	R/W	yes	UINT8	Soft vent (UL6000 only) 0 = normal vent 1 = soft vent	
565	235	HYDROS mode	R/W	yes	UINT8	HYDROS 0 = disabled 1 = enabled; auto off 2 = enabled; auto on	
566	236	HYDROS phase 15G	R	yes	UINT8	HYDROS phase 15G-range	
567	237	HYDROS phase 500G	R	yes	UINT8	HYDROS phase 500G-range	
568	238	HYDROS AC/DC-factor	R/W	yes	FLOAT	HYDROS AC/DC-factor	
569	239	HYDROS resistor factor	R/W	yes	FLOAT	HYDROS resistor factor	
570	23A	HYDROS state	R	no	UINT8	HYDROS state 0 = disabled 1 = enabled; not activatable 2 = enabled, off, but activatable 3 = activ	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
572	23C	Min pressure sniff [interface unit]	R/W	N/A	FLOAT	Minimum pressure p1 in interface unit for sniff mode. If pressure falls below this value, warning 540 (Flow too low) is generated.	
573	23D	Max pressure sniff [interface unit]	R/W	N/A	FLOAT	Maximum pressure p1 in interface unit for sniff. If pressure rises above this value, warning 542 (Sniffer broken) is generated.	
574	23E	Popup message number	R	no	UINT8	Number of pop message. "0" means no message	
575	23F	Text of popup message number	R	N/A	CHAR[*]	text of popup message To read send after the index the UINT8 popup message number Without error number you will get the text of the actual popup message Use only with index=255!	X
576	240	Clear popup message	W	N/A	NO_DATA	Clear popup message. Sets number of popup message to "0"	X
580	244	Pressure EVAC GROSS [interface unit]	R/W	N/A	FLOAT	Pressure limit in interface unit for EVAC to GROSS transition. Setting only becomes effective in the following measuring cycle. Also refer to command 430, 540 and 820.	
581	245	Pressure GROSS FINE [interface unit]	R/W	N/A	FLOAT	Pressure limit in interface unit for GROSS to FINE transition. Setting only becomes effective in the following measuring cycle. Also refer to command 430, 581 and 821.	
583	247	Pressure FINE ULTRA [interface unit]	R/W	N/A	FLOAT	Pressure limit in interface unit for FINE to ULTRA transition. Setting only becomes effective in the following measuring cycle. Also refer to command 430, 543 and 823.	
590	24E	Pressure correction	R/W	no	UINT8	Pressure correction 0 = disabled 1 = enabled	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
592	250	TMP2 correction	R/W	no	UINT8	TMP2 correction 0 = disabled 1 = enabled (UL6000 only)	
600	258	Audio alarm type	R/W	yes	UINT8	Audio alarm type 0 = Alarm off 1 = Trigger alarm 2 = Setpoint 3 = Pinpoint 4 = Leak rate prop	
602	25A	Audio alarm delay [s]	R/W	yes	UINT16	Audio alarm delay [s]	
604	25C	Audio beep	R/W	yes	UINT8	Audio beep 0 = disabled 1 = enabled	
621	26D	Backing pump type	R/W	yes	UINT8	Backing pump type 0 = unknown 1 = TS620 2 = NeoDry36G	
625	271	Backing pump rotation speed [Hz]	R/W	N/A	UINT8	Rotation frequency setting of the backing pump Write access only possible if "Manual control for service" is active	
660	294	Auto LT testing time min [s]	R/W	yes	UINT16	Auto leak test testing time min [s] (UL3000 only)	
662	296	Auto LT testing time max [s]	R/W	yes	UINT16	Auto leak test testing time max [s] (UL3000 only)	
665	299	Auto LT CAL testing time [s]	R	yes	UINT16[3]	Auto leak test testing time at last calibration [s] (UL3000 only)	
667	29B	Auto LT offset [A]	R	yes	FLOAT[3]	Auto leak test offset [A] (UL3000 only)	
670	29E	Auto LT part numbering	R/W	yes	UNIT8	Auto leak test part numbering (UL3000 only)	
672	2A0	Auto LT part number	R/W	yes	UNIT32	Auto leak test part number (UL3000 only)	
673	2A1	Auto LT shutdown	R/W	no	UNIT8	Auto leak test shutdown (UL3000 only)	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
675	2A3	Auto LT series error message limit	R/W	yes	UNIT8	Auto leak test series error message limit (0 = disabled) (UL3000 only)	
677	2A5	Auto LT series error message	R	no	UNIT8	Auto leak test series error message count (UL3000 only)	
680	2A8	Auto LT info [mbar*l/s]	R	no	FLOAT[4]	Auto leak test info: (UL3000 only) Index 0 = State Index 1 = Timer Index 2 = leak rate [mbar*l/s] Index 3 = Partnumber	
682	2AA	Auto LT info [interface unit]	R	no	FLOAT[4]	Auto leak test info: (UL3000 only) Index 0 = State Index 1 = Timer Index 2 = leak rate [interface unit] Index 3 = Partnumber	
684	2AC	Auto LT info [display unit]	R	no	FLOAT[4]	Auto leak test info: (UL3000 only) Index 0 = State Index 1 = Timer Index 2 = leak rate [display unit] Index 3 = Partnumber	
690	2B2	Result log	R	yes	CHAR[*]	Text of test in the result log. To read send after the array index 255 the UINT8 history list index (0...19). Without index or index 0 you will get the last (newest) entry. Index 19 is the eldest on. Entry format: see enumerations table	X
691	2B3	Result log [display unit]	R	N/A	CHAR[*]	Text of test in the result log. To read send after the array index 255 the UINT8 history list index (0...19). Without index or index 0 you will get the last (newest) entry. Index 19 is the eldest on. Entry format: see enumerations table	
692	2B4	Used entries in result log	R	yes	UINT8	Used entries in result log	X

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
693	2B5	Result log [interface unit]	R	N/A	CHAR[*]	Text of test in the result log. To read send after the array index 255 the UINT8 history list index (0...19). Without index or index 0 you will get the last (newest) entry. Index 19 is the eldest on. Entry format: see enumerations table	
710	2C6	Show int. cal. leak after runup	R/W	yes	UINT8	Show internal calibrated leak after runup (UL6000 only) 0 = disabled 1 = enabled (Operation mode vacuum only)	
725	2D5	Rate of rise status	R	N/A	UINT8	Rate of rise 0 = not possible 1 = activatable 2 = activ	
727	2D7	Rate of rise leak rate [mbarl/s]	R	N/A	FLOAT	leak rate measured as rate of rise	
728	2D8	Rate of rise leak rate [interface unit]	R	N/A	FLOAT	leak rate measured as rate of rise	
729	2D9	Rate of rise leak rate [display unit]	R	N/A	FLOAT	leak rate measured as rate of rise	
733	2DD	Volume test object [l]	R/W	yes	FLOAT	Volume of the test object in liter (for "Rate of Rise" measurement only)	
800	320	Pressure display unit	R/W	yes	UINT8	Pressure unit display mbar = 0 Pa = 1 atm = 2 Torr = 3	
801	321	Leak rate display unit vacuum	R	yes	UINT8	Leak rate unit vacuum display 0 - mbar*l/s 1 - Pa*m ³ /s 2 - Atm ccs 3 - Torr*l/s	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
802	322	Leak rate display unit sniff	R	yes	UINT8	Leak rate unit sniff display 0 - mbar*l/s 1 - Pa*m3/s 2 - Atm ccs 3 - Torr*l/s 4 - ppm 5 - g/a 6 - oz/yr	
810	32A	Internal pressure 1 [display unit]	R	no	FLOAT	Pressure p1 in display unit	
811	32B	Internal pressure 2 [display unit]	R	no	FLOAT	Pressure p2 in display unit	
812	32C	Internal pressure 3 [display unit]	R	no	FLOAT	Pressure p3 in display unit	
813	32D	Internal pressure 4 [display unit]	R	no	FLOAT	Pressure p4 in display unit	
814	32E	Internal pressure 5 [display unit]	R	no	FLOAT	Pressure p5 in display unit	
820	334	Pressure EVAC GROSS [display unit]	R/W	N/A	FLOAT	Pressure limit in display unit for EVAC to GROSS transition. Setting only becomes effective in the following measuring cycle. Also refer to command 540, 580 and 800.	
821	335	Pressure GROSS FINE [display unit]	R/W	N/A	FLOAT	Pressure limit in display unit for GROSS to FINE transition. Setting only becomes effective in the following measuring cycle. Also refer to command 541, 581 and 800.	
823	337	Pressure FINE ULTRA [display unit]	R/W	N/A	FLOAT	Pressure limit in display unit for FINE to ULTRA transition. Setting only becomes effective in the following measuring cycle. Also refer to command 543, 583 and 800.	
825	339	Min pressure sniff [display unit]	R/W	N/A	FLOAT	Minimum pressure p1 in display unit for sniff mode. If pressure falls below this value, warning 540 (Flow too low) is generated.	
826	33A	Max pressure sniff [display unit]	R/W	N/A	FLOAT	Maximum pressure p1 in display unit for sniff. If pressure rises above this value, warning 542 (Sniffer broken) is generated.	
830	33E	Test leak extern [mbar*l/s]	R/W	yes	FLOAT	Test leak extern [mbar*l/s] (current mode and mass)	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
831	33F	Test leak extern [interface unit]	R/W	N/A	FLOAT	Test leak extern [interface unit] (current mode and mass)	
832	340	Test leak extern [display unit]	R/W	N/A	FLOAT	Test leak extern [display unit] (current mode and mass)	
835	343	Test leak extern vacuum [display unit]	R/W	N/A	FLOAT[3]	Test leak extern Vacuum [display unit] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	
837	345	Test leak extern sniff [display unit]	R/W	N/A	FLOAT[3]	Test leak extern Sniff [display unit] Index 0: Mass2 Index 1: Mass 3 Index 2: Mass 4 Helium	
840	348	Setpoint [display unit]	R/W	N/A	FLOAT[4]	Setpoint in display unit	
841	349	Setpoint VAC [mbar*l/s]	R/W	yes	FLOAT[4]	Setpoints in mbar*l/s for Vacuum and Auto Leak Test mode. Index 0: Setpoint 1 Index 1: Setpoint 2 Index 2: Setpoint 3 Index 3: Setpoint 4	
842	34A	Setpoint SNIFF [mbar*l/s]	R/W	yes	FLOAT[4]	Setpoints in mbar*l/s for SL200 and SL3000 sniff mode. Index 0: Setpoint 1 Index 1: Setpoint 2 Index 2: Setpoint 3 Index 3: Setpoint 4	
850	352	Gross leak protection limit [display unit]	R/W	N/A	FLOAT	Gross leak protection limit [display unit]	
860	35C	Leak rate [display unit]	R	no	FLOAT	Leak rate [display unit] (limited to lower display limit, refer to command number 454)	
865	361	Group measure [display unit]	R	no	UNIT8[19]	Measurement data in display unit see table "Group measure, display unit"	X
870	366	Convert Pressure	R/W	N/A	FLOAT[4]	Convert pressure (Index - Unit)	X

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
872	368	Convert leak rate	R/W	N/A	FLOAT[7]	Convert leak rate (Index - Unit)	X
880	370	Leak rate limit [mbar*l/s]	R	no	FLOAT[3]	Leak rate limit in mbar*l/s [0] = low [1] = low user [2] = high	
882	372	Leak rate limit [interface unit]	R	no	FLOAT[3]	Leak rate limit in interface unit [0] = low [1] = low user [2] = high	
884	374	Leak rate limit [display unit]	R	no	FLOAT[3]	Leak rate limit in display unit [0] = low [1] = low user [2] = high	
887	377	Potential D-ZERO value [display unit]	R	no	FLOAT	Potential D-zero value in display unit	
890	37A	Peak hold leak rate [mbar*l/s]	R	no	FLOAT	Peak hold leak rate [mbar*l/s] Peak hold function can be activated by pressing START in measuring mode.	
892	37C	Peak hold leak rate [interface unit]	R	no	FLOAT	Max leak rate [interface unit] Peak hold function can be activated by pressing START in measuring mode.	
894	37E	Peak hold leak rate [display unit]	R	no	FLOAT	Max leak rate [display unit] Peak hold function can be activated by pressing START in measuring mode.	
1120	460	Amplifier alternating monitoring	R/W	yes	UINT8	Enables resp. Disables amplifier alternating monitoring (Error message 358) 0 = disabled, 1 =enabled Enabled by default	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
1161	489	Parameter reset	W	N/A	UINT8	Parameter reset: 0: Load factory settings 3: Clear error history 4: Clear calibration history 6: Restart bus module 8: HMI Soft reset 9: HMI Power reset 10: TMP replaced 12: Clear test history 13: Load HMI factory settings	X
1190	4A6	Backing pump mode	R/W	yes	UINT8	Backing pump mode 0 = fixed rotation speed 1 = automatic rotation speed regulation (default)	
1270	4F6	Paging request	R/W	no	UINT8	Paging request (RC1000) 0 = off 1 = on	
1284	504	Control word	R/W	no	UINT16	Control word (used for Bus module)	
1285	505	Stop service buffer	R/W	no	UINT8	Stop service buffer 0=recording active 1=recording stopped	
1350	546	Valve cycle counter	R	yes	UINT32[16]	Valve cycle counter see table "Valve numbers" column "Valve No." for array index	
1361	551	Maintenance backing pump [h]	R/W	yes	UINT32	Maintenance backing pump [h] 0 ... 12000 h (default: 8000 h) (TS620 only)	
1362	552	Maintenance TMP [d]	R/W	yes	UINT32	Maintenance TMP [d] 0 ... 1095 d (default: 1095 d)	
1364	554	Maintenance backing pump 2 [h]	R/W	yes	UINT32	Maintenance backing pump 2 [h] 0 ... 16000 h (default: 16000 h) (Neodry only)	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
1365	555	Maintenance exhaust filter [h]	R/W	yes	UINT32	Maintenance exhaust filter [h] 0 ... 4000h (default: 2500 h) (TS620 only)	
1367	557	Maintenance air filter [h]	R/W	yes	UINT32	Maintenance air filter [h] 0 ... 4000h (default: 2500 h)	
1369	559	Maintenance sniffer tip filter [h]	R/W	yes	UINT32	Maintenance sniffer tip filter [h] 0 ... 4000h (default: 1000 h)	
1370	55A	Expiry date reference leak [YMD]	R/W	yes	UINT8[3]	Expiry date of internal reference leak year (1..99), month, day	
1399	577	Group measure [interface unit]	R	no	UNIT8[19]	Measurement data in interface unit see table "Group measure, interface unit"	X
1400	578	Group measure	R	no	UNIT8[19]	Measurement data see table "Group measure, mbar / mbar*l/s"	
1419	58B	TMP2 rotation freq. [Hz]	R	no	SINT32	Current TMP2 (Booster-TMP) rotation frequency in Hz. UL6000 only	
1420	58C	Backing pump rotation freq. [Hz]	R	no	SINT32	Current backing pump rotation freq. [Hz]	
1421	58D	Backing pump temp. PCB Controller [GrdC]	R	no	SINT32	Backing pump temperature PCB Controller in degree celsius	
1422	58E	Backing pump temp. IGBT [GrdC]	R	no	SINT32	Backing pump temperature IGBT in degree celsius	
1423	58F	Backing pump temp. power supply [GrdC]	R	no	SINT32	Backing pump temp. power supply in degree celsius	
1424	590	Backing pump power [W]	R	no	SINT32	Backing pump power [W]	
1425	591	Backing pump bus current [mA]	R	no	SINT32	Backing pump bus current [mA]	
1426	592	Backing pump line voltage [Vpk]	R	no	SINT32	Backing pump line voltage [Vpk]	
1427	593	Backing pump bus voltage [Vdc]	R	no	SINT32	Backing pump bus voltage [Vdc]	
1428	594	Backing pump 3phase voltage [Vrms]	R	no	SINT32	Backing pump 3phase voltage [Vrms]	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
1429	595	Backing pump status	R	no	SINT32	Backing pump status: Stop = 0 Waiting intlk = 1 Starting = 2 Auto-tuning = 3 Braking = 4 Normal = 5 Fail = 6	
1430	596	Backing pump error code	R	no	SINT32	Backing pump error code	
1431	597	TMP2 controller air temperature [deg. C]	R	no	SINT32	TMP2 (Booster-TMP, UL6000 only): Controller air temperature in degree celsius	
1432	598	TMP2 controller heatsink temperature [deg. C]	R	no	SINT32	TMP2 (Booster-TMP, UL6000 only): Controller heatsink temperature in degree celsius	
1433	599	TMP2 pump temperature [deg. C]	R	no	SINT32	TMP2 (Booster-TMP, UL6000 only): Pump temperature in degree celsius	
1434	59A	TMP2 power [W]	R	no	SINT32	TMP2 (Booster-TMP, UL6000 only): Pump power in Watt	
1435	59B	TMP2 current [mA]	R	no	SINT32	TMP2 (Booster-TMP, UL6000 only): Pump current in Milliampere (direct current)	
1438	59E	TMP2 voltage [V]	R	no	SINT32	TMP2 (Booster-TMP, UL6000 only): Pump voltage in Volt (direct current)	
1439	59F	TMP2 status	R	no	SINT32	TMP2 (Booster-TMP, UL6000 only) status: Stop = 0 Waiting intlk = 1 Starting = 2 Auto-tuning = 3 Braking = 4 Normal = 5 Fail = 6	
1440	5A0	TMP2 error code	R	no	SINT32	TMP2 (Booster-TMP, UL6000 only): Error code	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
1441	5A1	SW version TMP2 controller	R	N/A	CHAR[34]	SW version TMP2 controller: Index 0...11: Program listing code and revision Index 12...23: Parameter listing code and revision Index 24...33: Controller modification Level (UL6000 only)	
1442	5A2	Serial number TMP2	R	N/A	CHAR[10]	Serial number TMP2 (UL6000 only)	
1443	5A3	Serial number TMP2 controller	R	N/A	CHAR[10]	Serial number TMP2 controller (UL6000 only)	
1444	5A4	TMP2 model	R	N/A	CHAR[11]	TMP2 model (UL6000 only)	
1445	5A5	TMP2 controller model	R	N/A	CHAR[11]	TMP2 controller model (UL6000 only)	
1446	5A6	TMP2 cycle time [min]	R	N/A	UINT32	TMP2 cycle time (UL6000 only)	
1447	5A7	TMP2 cycle counter	R	N/A	UINT32	TMP2 cycle counter (UL6000 only)	
1471	5BF	Status of Cap Sensor	R	no	UINT8	TC1000 proximity switch status: (UL3000 only) 0 = Chamber / proximity switch closed 1 = Chamber / proximity switch open	
1560	618	Offset current amplifier old [A]	R	no	FLOAT	Offset current amplifier old [A]	
1561	619	Delta_t for BOOST filter	R/W	yes	FLOAT	Delta_t for BOOST filter (80 ms per digit)	
1562	61A	Factor p for BOOST filter	R/W	yes	FLOAT	Factor p for BOOST filter (0...0.9999)	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
1564	61C	Value changed reason	R	no	UINT32	Cause of setting the value changed flag (see status word bit 11). Bit 0: Mass (506), Bit 1: Operation mode (401), Bit 2: Setpoint 1 (385), Bit 3: Setpoint 2 (385), Bit 4: Leak rate unit (432, 802, 431, 801), Bit5: Pressure unit (430, 800), Bit 6: TMP rotation speed (501), Bit 7: PARA_KATHODE (530), Bit 8: Date+Time (450), Bit 9: Automatic-Contol Off Bit 10: HYDRO*S mode (565) Bit 11: HYDRO*S state (570) Bit 12: Display-User-Limit (884), Bit 13: Popup message (574) Bit 14: Parameter Reset (1161 with value 13) Bit 13 ... 21: not used Bit 22: Rate of Rise State (25) Bit 23 ... 31: not used	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
1565	61D	Value changed flag	R/W	no	UNIT8	Value changed flag Read: Same value as Statusword Bit 11 Write: Write 0 to clear value changed flag Bit will be set if one or more Values of this list has been changed (foe example via interface commando): Mass (506), Operation mode (401), Setpoint 1, Setpoint 2, Leak rate unit, Pressure unit, TMP rotation speed (501), Cathode (530), Date+Time (450), Automatic control Off HYDRO*S Mode (565) Changes in HYDRO*S state (570) Display-User-Limit, New Popup-Message	
1567	61F	Offset current [A]	R	no	FLOAT	Currently subtracted offset current [A]	
1568	620	Ion current (p cor.) [A]	R	no	FLOAT	Pressure corrected ion current in A	
1573	625	Ion current (p,ULTRA cor. / filtered) [A]	R	no	FLOAT	Ion current in A. Filtered, pressure corrected and converted to vacuum range ULTRA	
1575	627	Ion current (raw) [A]	R	no	FLOAT	Ion current in A. Raw value, identical with "preamplifier voltage" multiplied by "preamplifier resistor"	
1577	629	Standby offset valid	R	no	UINT8	Value is true, if the current standby offset would be considered as offset with START.	
1616	650	Cathode test heater power [W]	R	no	FLOAT[2]	Cathode test during runup Index 0: heater power cathode 1 Index 1: heater power cathode 2	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
1618	652	Amplifier test voltages [V]	R	no	FLOAT[4]	Amplifier test during internal calibration Index 0: voltage 13M Index 1: voltage 470M Index 2: voltage 15G Index 3: voltage 500G	
1620	654	Amplifier test currents [A]	R	no	FLOAT[5]	Test currents ca. 1.3E-11 A	
1755	6DB	Unlock key	W	N/A	CHAR[12]	Key for unlocking additional features 12 digits, always whole array	X
1760	6E0	Unlocked features	R	no	UINT8	Bit field of unlocked features (via command 1755) Each bit represents one feature. 1 means: Feature is unlocked	
1795	703	Progress bar [%]	R	no	UINT8	Progress bar in percent during run up phases	
1800	708	Active protocol IO	R	no	UINT8	Active interface protocol for I/O module. Defined by DIP switch at I/O module or command 2593. Values: See enumerations table	
1810	712	Emission failure counter	R	no	UINT16	Emission failure counter	
1815	717	Reset source	R	no	UINT8	Shows the last reason of reset	
1854	73E	Gross leak protection limit [mbar*l/s]	R/W	yes	FLOAT	Gross leak protection limit [mbar*l/s]	
1855	73F	Gross leak protection	R/W	yes	UINT8	Gross leak protection 0 = disabled 1 = enabled	
1860	744	Particle protection	R/W	yes	UINT8	Particle protection 0 = disabled 1 = enabled	
1870	74E	Gross leak protection limit [interface unit]	R/W	N/A	FLOAT	Gross leak protection limit [interface unit]	
1890	762	Factor ULTRA SL200	R/W	yes	FLOAT	Sensitivity factor between ULTRA and SL200 sniff	
1895	767	Factor ULTRA SL3000	R/W	yes	FLOAT	Sensitivity factor between ULTRA and SL3000 sniff	
1900	76C	Factor ULTRA FINE	R/W	yes	FLOAT	Sensitivity factor between ULTRA and FINE	
1903	76F	Factor ULTRA GROSS	R/W	yes	FLOAT	Sensitivity factor between ULTRA and GROSS	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
1906	772	Factor ULTRA MASSIVE	R/W	yes	FLOAT	Sensitivity factor between ULTRA and GROSS	
1907	773	Factor ULTRA FINE_HIGH	R/W	yes	FLOAT	Sensitivity factor between ULTRA and FINE_HIGH (UL6000 only)	
1909	775	Factor cal int ext	R/W	yes	FLOAT	Factor cal intern extern Only valid for UL6000	
1910	776	Ambient helium concentration [ppm]	R	no	FLOAT	Last measurement result for helium concentration in purge gas (ambient)	
1911	777	Ambient helium concentration cal. gain [ppm/A]	R/W	yes	FLOAT	Gain for calibration of ambient helium concentration measurement	
1912	778	Ambient helium concentration cal. offset [ppm]	R/W	yes	FLOAT	Offset for calibration of ambient helium concentration measurement	
2480	9B0	Internal pressure 3 [interface unit]	R	no	FLOAT	Pressure p3 [interface unit] (UL6000 only)	
2481	9B1	Internal pressure 3 [mbar]	R	no	FLOAT	Pressure p3 [mbar] (UL6000 only)	
2482	9B2	Internal pressure 4 [interface unit]	R	no	FLOAT	Pressure p4 [interface unit] (Sniffer line)	
2483	9B3	Internal pressure 4 [mbar]	R	no	FLOAT	Pressure p4 [mbar] (Sniffer line)	
2484	9B4	Internal pressure 5 [interface unit]	R	no	FLOAT	Pressure p5 [interface unit] (UL6000 only)	
2485	9B5	Internal pressure 5 [mbar]	R	no	FLOAT	Pressure p5 [mbar] (UL6000 only)	
2490	9BA	Internal pressure 1 [V]	R	no	FLOAT	Pressure p1 [V]	
2491	9BB	Internal pressure 2 [V]	R	no	FLOAT	Pressure p2 [V]	
2492	9BC	Internal pressure 3 [V]	R	no	FLOAT	Pressure p3 [V] (UL6000 only)	
2493	9BD	Internal pressure 4 [V]	R	no	FLOAT	Pressure p4 [V] (Sniffer line)	

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
2580	A14	Test HMI LED	R/W	no	UINT8[3]	Test HMI LED [0]: START [1]: STOP/VENT [2]: ZERO 0 = off 1 = red 2 = green 3 = blue	X
2585	A19	HMI button	R	no	UINT8[3]	Read state HMI buttons [0]: START [1]: STOP/VENT [2]: ZERO 0 = inactive 1 = active	
2589	A1D	Runup interlock		yes		Interlock (only valid for Operation Mode Vacuum or SL3000) 0 = no interlock 1 = interlock enabled. Dongle at option port must be used to enable operation	
2591	A1F	Local control	R/W	yes	UINT8	Local control (hardware button) 0 = START, STOTP,ZERO and Calibration is locked 1 = START, STOTP,ZERO and calibration is allowed 2 = START, STOTP,ZERO and calibration is allowed, if a user is logged in	
2593	A21	Interface protocol IO	R/W	yes	UINT8	Selected interface protocol for I/O module. Only valid if DIP switch at I/O module is set to "000" 0 = LD 1 = ASCII	
2642	A52	Used entries in maintenance log	R	yes	UINT8	Used entries in maintenance log	X

Command dec	Command hex	Name	Read / Write	non volatile	Data type	UL3000 / UL6000	No fieldbus support
2643	A53	Maintenance log	R	yes	CHAR[*]	Text of a maintenance in maintenance log. To read send after the array index 255 the UINT8 maintenance list index (0...19). Without index, you will get the last (newest) entry. Example: ""00 2016/06/10 OpTm: 229 Bpump Lubricant ExhaustF AirF SnifferF RefLeak TMP"	
2650	A5A	Set suppressor voltage [V]	R/W	no	FLOAT	Suppressor voltage for test	X
2660	A64	Maintenance warning active	R/W	yes	UINT8	Maintenance warning active (0: disable, 1: enabled) Bit 0 = Backing pump Bit 1 = TMP Bit 2 = Exhaust filter Bit 3 = Air filter Bit 4 = Sniffer tip filter Bit 5 = Expiry date reference leak Bit 6 = not used Bit 7 = not used	
2663	A67	Test good bad LED	R/W	no	UINT8	Test good / bad LED for SL200 or TC1000 0 = auto 1 = good 2 = bad 3 = good and bad 4 = off	X

3.6 Enumerations

Group measure, interface unit (command 1399)

Meaning	Data type	Offset	Command dec
Leak rate [interface unit]	FLOAT	0	128
p1 or p4 (in SL3000 mode) [interface unit]	FLOAT	4	130
p2 [interface unit]	FLOAT	8	132
p3 [interface unit]	FLOAT	12	2480
Individual bits: Bit 0: Vent Bit 1: Purge Bit 2: Offset new Bit 3: Underrange Bit 4: Overage Bit 5: "Zero stable" or "Zero update allowed" Bit 6: Show maximum leak rate Bit 7...15: not used	UNIT16	16	
Vacuum state	UNIT8	18	551

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

Meaning	Data type	Offset	Command dec
Leak rate [mbar*I/s]	FLOAT	0	129
p1 or p4 (in SL3000 mode) [mbar]	FLOAT	4	131
p2 [mbar]	FLOAT	8	133
p3 [mbar]	FLOAT	12	2481
Individual bits: Bit 0: Vent Bit 1: Purge Bit 2: Offset new Bit 3: Underrange Bit 4: Overage Bit 5: "Zero stable" or "Zero update allowed" Bit 6: Show maximum leak rate Bit 7...15: not used	UNIT16	16	
Vacuum state	UNIT8	18	551

Group measure, display unit (command 865)

Meaning	Data type	Offset	Command dec
Leak rate [display unit]	FLOAT	0	860
p1 or p4 (in SL3000 mode) [display unit]	FLOAT	4	810
p2 [display unit]	FLOAT	8	811
p3 [display unit]	FLOAT	12	812
Individual bits Bit 0: Vent Bit 1: Purge Bit 2: Offset new Bit 3: Underrange Bit 4: Overrange Bit 5: "Zero stable" or "Zero update allowed" Bit 6: Show maximum leak rate Bit 7...15: not used	UNIT16	16	
Vacuum state	UNIT8	18	551

Analog output configuration (command 222)

Value	Meaning
0	off
1	Pressure p1
2	Pressure p2
3	LR mantissa
4	LR exponent
5	LR linear
6	LR log.
7	LR mantissa with hysteresis
8	Voltage settable by command 221

Analog output leak rate scale (log. only) (command 223)

Value	Meaning
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

State calibration (command 260, 259)

Value	Meaning
0	Inactive
5	Mass scan
11	Internal CAL: Preparing
12	Internal CAL: Peakfind
13	Internal CAL: Preamplifier check
14	Internal CAL: Measure leak
15	Internal CAL: Measure background
16	Internal CAL: HYDRO*S measure leak
17	Internal CAL: HYDRO*S measure background
20	Internal CAL: OK
21	Internal CAL: Peak not found
22	Internal CAL: Signal too small
23	Internal CAL: Calfac too low
24	Internal CAL: Calfac too high
25	Internal CAL: Calfac lower than last (< 50%)
26	Internal CAL: Calfac higher than last (> 200%)
27	Internal CAL: Hydros Error
30	Proof: Preparing
31	Proof: Measure leak
32	Proof: Measure background
40	Proof: OK
41	Proof: Signal too small
42	Proof: Calfac too low
43	Proof: Calfac too high
44	Proof: Calfac lower than last (< 80%)
45	Proof: Calfac higher than last (> 120%)
51	External CAL: Preparing
52	External CAL: Wait "TL value, Signal stable"
53	External CAL: Peakfind
54	External CAL: Measure leak
55	External CAL: Wait "Background stable"
56	External CAL: Measure background
57	External CAL: HYDRO*S measure leak
58	External CAL: HYDRO*S measure background
60	External CAL: OK
61	External CAL: Peak not found
62	External CAL: Signal too small
63	External CAL: Calfac too low
64	External CAL: Calfac too high

Value	Meaning
65	External CAL: Calfac lower than last (< 50%)
66	External CAL: Calfac higher than last (> 200%)
67	External CAL: Hydros Error
71	Inlet: Preparing
72	Inlet: Wait "vented" (25 seconds)
73	Inlet: Wait "measure" (120 seconds)
74	Inlet: Wait "measure" (offset too high)
75	Inlet: Wait "measure" (offset ok)
90	AutoLT Reference: Preparing
91	AutoLT Reference: Evacuation 1
92	AutoLT Reference: Vent 1
93	AutoLT Reference: Evacuation 2
94	AutoLT Reference: Vent 2
95	AutoLT Reference: Evacuation 3
96	AutoLT Reference: Measure
97	AutoLT Reference: OK
98	AutoLT Reference: FAIL
100	Ambient helium meas.: Preparing
101	Ambient helium meas.: Vent and measure
102	Ambient helium meas.: Reevacuate
103	Ambient helium meas.: Result
110	Show internal calibrating leak: Preparing
111	Show internal calibrating leak: Show value
115	External CAL: Wait "TL value, Signal stable"
116	External CAL: Wait "Background stable"

PLC output configuration IO module (command 263)

Use negative values for inverted functions.

Value	Function
0	OPEN
1	OPEN
2	TRIG1
3	TRIG2
4	TRIG3
5	TRIG4
6	READY
7	WARNING
8	ERROR
9	CAL_ACTIVE

Value	Function
10	CAL_REQUEST
11	RUN_UP
12	ZERO_ACTIVE
13	EMISSION_ON
14	MEASURE
15	STANDBY or EVACUATION
16	SNIFF
17	ERROR_WARNING
18	PURGE
19	STAT_TL
20	CAL_STABLE
21	CATHODE 2
22	VENT

PLC input configuration IO module (command 438)

Use negative values for inverted functions.

Value	Function
0	NO_FUNCTION
1	SNIFF_VAC
2	START
3	STOP
4	ZERO
5	VENT
6	CLEAR
7	CAL (in StBy: intern; in Meas: extern)
8	PURGE
9	START_STOP
10	Photointerrupter

Present warnings (command 297)

Value Index / Bit	Meaning	Bit No.
0x00000001	Warning pressure/flow	0
0x00000002	not used	1
0x00000004	Warning anode voltage	2
0x00000008	Warning P5	3
0x00000010	Warning emission	4
0x00000020	Warning suppressor	5
0x00000040	Warning TMP	6
0x00000080	Warning Anybus	7
0x00000100	Warning maintenance	8
0x00000200	Warning I/O disconnected	9
0x00000400	Warning 5V	10
0x00000800	Warning U24VHz	11
0x00001000	Warning supply voltages	12
0x00002000	Warning fan current	13
0x00004000	not used	14
0x00008000	not used	15
0x00010000	not used	16
0x00020000	not used	17
0x00040000	Auto Leak Test: Too many consecutive tests failed	18
0x00080000	Warning cathode voltage	19
0x00100000	Warning temperature MSB	20
0x00200000	Warning temperature preamplifier	21
0x00400000	Warning calibration request	22
0x00800000	Warning operating unit not connected	23
0x01000000	Preamp output too low	24
0x02000000	Warning +15V out of range	25
0x04000000	Warning -15V out of range	26
0x08000000	Warning Backing Pump	27
0x10000000	Warning real time clock	28
0x20000000	Warning Backing Pump Temperature too low	29
0x40000000	Warning TMP2	30
0x80000000	not used	31

Valve numbers (Command 449, 1350)

Bit assignment	Valve No.	Meaning
0 / 0x0001	1	V1
1 / 0x0002	2	V2a
2 / 0x0004	3	V3
3 / 0x0008	4	V4a
4 / 0x0010	5	V4b
5 / 0x0020	6	V4c
6 / 0x0040	7	V5
7 / 0x0080	8	V7
8 / 0x0100	9	V9
9 / 0x0200	10	V10
10 / 0x0400	11	V2b
11 / 0x0800	12	V11
12 / 0x1000	13	V12
13 / 0x2000	14	V13
14 / 0x4000	15	V14
15 / 0x8000	16	V15

3.7 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 a device from the UL3000 Fab series, you need an INFICON Bus-Module BM1000 connected to the LD port of the leak detector.

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

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

4.2 Setup

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

Attention:

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

4.3 Process Data Mapping for Cyclic Data Transfer

4.3.1 Write Process Data (PLC → Leak Detector)

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

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

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

The current state of this value is visible at the operating unit via:

“ > Accessories > Bus module”.

4.3.2 Read Process Data (Leak Detector → PLC)

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

Title	Byte	Bit	Name	Meaning	Similar to 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	Calibration request	0 = CAL request function disabled 1 = 0x01 = CAL request function enabled but no CAL requested 2 = 0x02 = CAL request function enabled and CAL requested 3 = 0x03 = not used	CAL request	*CONFIG:CALREQ?	419
		1					
		2	Emission	0 = 0x00 = Emission off 1 = 0x04 = Cathode 1 fixed 2 = 0x08 = Cathode 2 fixed 3 = 0x0C = Cathode 1 auto 4 = 0x10 = Cathode 2 auto	Emission on	*STATUS:CATHODE?	530
		3					
		4					
		5	State	0 = 0x00 = Standby 1 = 0x20 = Error 2 = 0x40 = Calibration 3 = 0x60 = Runup 4 = 0x80 = Measure 5 = 0xA0 = Emission Off 6 ... 7 = 0xC0 ... 0xE0 = not used	Run up, CAL active, Error, Ready,	*STATUS?	Status word
		6					
		7					

Title	Byte	Bit	Name	Meaning	Similar to IO1000 Output	Similar to RS232 ASCII cmd.	Similar to RS232 LD cmd.
leak rate	3 ... 6		Leak rate (mbar*/l/s)	Actual leak rate in mbar l/s (IEEE 754 float value)	Analog output (LR_LIN, LR_LOG...)	*READ:MBAR*/l/s?	129
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)	Analog output (Pressure p1)	*MEAS:P:MBAR?	83
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)		*STATUS:ERROR?	290
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level	Trigger 1	*STATUS:TRIGger?	387
		1	Status of Trigger 2		Trigger 2		
		2	Status of Trigger 3		Trigger 3		
		3	Status of Trigger 4		Trigger 4		
		4 ... 7	not used	always 0			
calibration_status	14		calibration_status	For possible values please refer to command 260 in table 3.5, "Commands," page 32.	CAL active	*STATUS:CAL?	260
leak_detector ID	15		leak_detector ID	always 6 for UL3000 Fab		*IDN:DEvice?	
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)		*MEAS:P2:MBAR?	133
device specific float 2	20 ... 23		device specific float 2	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
Ethernet/IP	Object number A2h (ADI object) Instance_number = LD_command_number Attribute 5 (Value)	Instance_number = 506

Fieldbus supports all commands from LD protocol, except the commands which are marked accordingly in LD command list ([refer to chapter 3.5](#)).

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

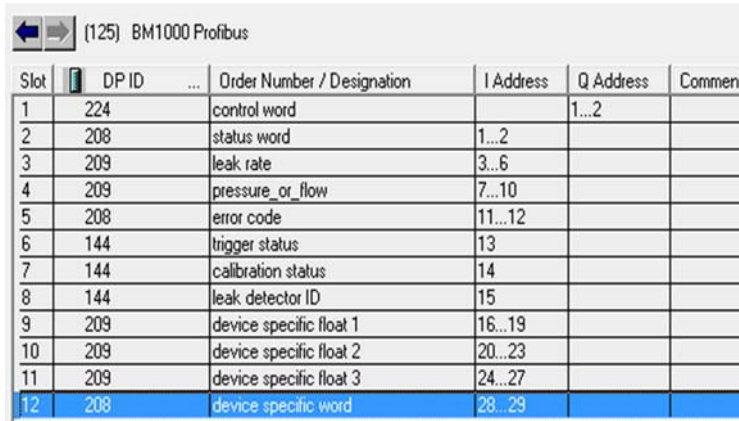
ABCC Data type:

#	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)	$\pm 1.17549435\text{E}-38 \dots$ $\pm 3.40282347\text{E}+38$

4.5 Hardware Configuration for Profibus

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

4.5.1 Assignment of the PROFIBUS Address

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

To assign the PROFIBUS address via operating unit select

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

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

- ▶ refer to the documentation of your PLC.

If you use a Siemens Step 7 you can also

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

4.5.2 Diagnosis with the operating unit

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

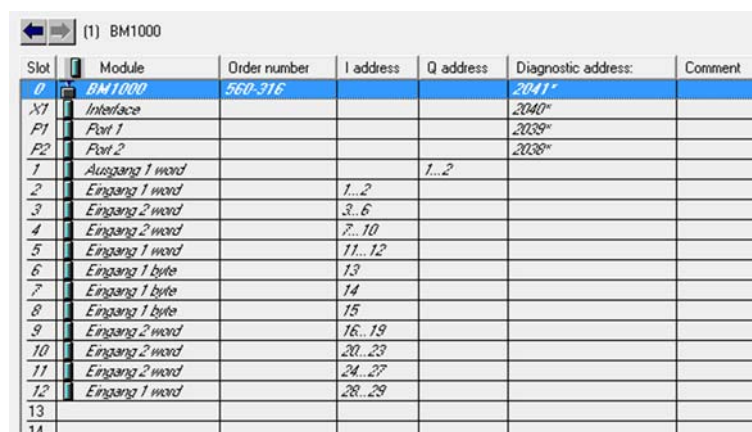
" > Accessories > Bus module".

4.6 Hardware Configuration for PROFINET

4.6.1 Hardware Configuration

Attention:

You must use the GSDML-V2.3-Inficon-BM1000_PROFINET-20131206.XML file. In addition you must put the 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. 2 Sequence of the data words (slots) for PROFINET

4.6.2 Assignment of the PROFINET address

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

5 Trouble Shooting

5.1 Serial communication via RS232 (common)

Error	Possible Reason	Solution
No characters are received via the interface/the leak detector does not answer	Wrong cable	Please use a 1:1 cable, (NO null-modem cable, also called cross-over cable!)
	Problems with flow control	Deactivate flow control in PC/PLC or use cable according to the wiring diagram in the following.
	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 USB-RS232 converter. However, these often cause multiple difficult to track problems (driver, flow control.) Please test your PC program on a "real" RS232 interface first preferably. Especially with USB-RS232-converters it is often helpful to use a cable according to the wiring diagram in chapter 4 of the 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

RS232 Connecting Cable

A standard RS232 cable can be used (straight-through connecting cable, RxD and TxD not crossed). The RS232 hardware handshake must be switched off (in RS232 control program written by the user). If switching off of the hardware handshake is not possible, an RS232 connecting cable wired as follows may also be used:

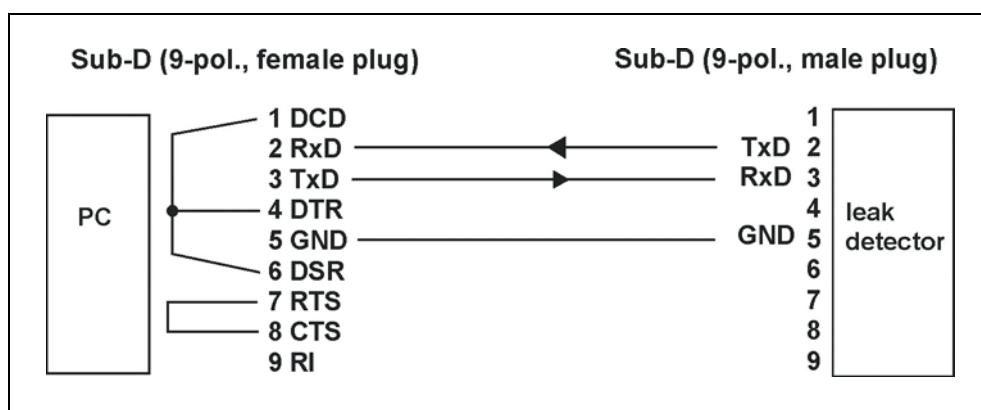


Fig. 7-1 RS232 cable

5.2 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 no time out function which will empty the receiving buffer automatically. Therefore, the buffer should be emptied before the first command by sending of ESC, ^C or ^X

5.3 LD Protocol specific

Error	Possible Reason	Solution
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.

