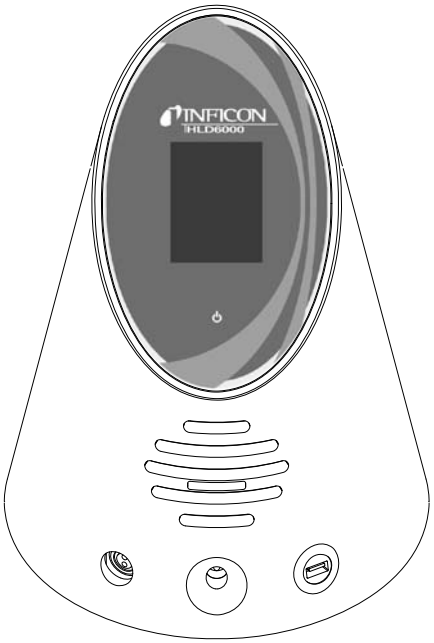
PROTOCOL DESCRIPTIONS



HLD6000

Interface Protocols

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INFICON

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

Content

1 Interface Protocols

1.1 Serial Interface Protocols

With the IO1000 module you can communicate with the HLD6000 via the following serial interface protocols:

- ASCII Protocol (enabled by default)
- LD Protocol

If you want to replace a HLD5000 with a HLD6000 you can also use

- Protocol "Simple"
- Protocol "Normal"

The interfaces protocols "Simple" and "Normal" are not described in this document. Please refer to the "HLD5000 Interface Description". Furthermore, please note no more supported serial interface commands in these protocols, see chapter 1.2.

"Simple" and "Normal" protocols use 9600 baud, 8 data bits, no parity, 1 stop bit. Slower baud rates (which are supporded by HLD5000) are not supported by HLD6000.

NOTICE

Do not use "Simple" or "Normal" protocol for new developments. They have limited functional range and may not be supported in future.

The serial interface protocol can be selected via DIP switch at the IO module IO1000 or via operating unit HLD6000. Please refer to appropriate documentation.

1.2 Not supported Commands in "Normal" and "Simple" Protocols

The following serial interface commands in "Normal" and "Simple" protocols are not supported by using HLD6000 any more:

1.2.1 Simple Protocol

: PIN number for the program menu

Reason: Totally different menu access control at the HLD6000

K : Display contrast setting

Reason: No Contrast setting for HLD6000 display

o : operating hours counter of the calibrated leak

Reason: COOL-Check has no operating counter

This command was only valid for the very first HLD5000 versions.

Changed behavior:

M : Most recent entry into error log and total number of entries

Now: Last 3 digits are error number, no message type

1.2.2 Normal Protocol

Command ‘T’

Command ‘T’ not supported

Reason: Totally different display / menu at the HLD6000

Display IDs

03: Program menu

Reason: Totally different menu access control at the HLD6000

Parameter IDs

2: Function of the probe button

‘3 = SEARCH’ omitted; no search-mode in HLD6000, use the second set point

20: Baud Rate

Reason: Fixed baud rate in HLD6000

35: PIN-Code

Reason: Totally different menu access control at the HLD6000

55: Contrast

Reason: No Contrast setting for HLD6000 display

56: Language

Reason: Different language setting, no influence on device behavior via serial interface

Remote IDs

00: Enable program menu

Reason: Totally different menu access control at the HLD6000

01: Lock program menu

Reason: Totally different menu access control at the HLD6000

11…18: Simulates a pressed Softkey

Reason: No Softkeys at HLD6000 front panel

Status IDs

67: Last error in error list

Changed: ‘T’ and ‘NN’ are used for the 3-digit error number

79: Current status of the LED display

Reason: No LED display in HLD6000

81: Menu status

Reason: Totally different menu at the HLD6000

1.3 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 ASCII Protocol

2.1 Communication Parameters

Data format

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

2.2 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 2.5, page 15. The transmission can be cancelled and the receive-buffer will be cleared with ESC (ASCII code 27dec/ 1Bhex), ^C (ASCII code 3dec/03hex) or ^X (ASCII code 24dec/18hex).

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

Parameter can be Boolean or numerical:

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

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

Timing recommendations for the PC/PLC - Program:

Sample rate > 100 ms

Timeout between request to and answer from Device: 1500 ms

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

2.3 Commands

Command	Meaning	Relates to LD cmd. no.	Read / Write
*BEEP	Output beep sound. Parameter: Typ,Volume "*BEEP 1,2" Typ: 1= 2000 Hz, 2=Dual (2000 and 1000 Hz), 3= 1000 Hz Volume: Volume between 1 and 15		W
*CAL	Start external calibration	4	W
*CAL:ACKnowledge	Acknowledge stable signal during external calibration	11	W
*CLS	Clear Error	5	W
*CONFig:AUDio	Audio alarm type (PIN, SET, TRIG, OFF)	600	R/W
*CONFig:BRIGHTness	Sniffer white LED brightness	414	R/W
*CONFig:BUTSniffer	button of the sniffer probe (OFF, ON)	422	R/W
*CONFig:CALleak	leak rate of external test leak		R/W
*CONFig:CALleak:G/a	leak rate of external test leak in g/a	388	R/W
*CONFig:CALleak:LB/yr	leak rate of external test leak in lb/yr		R/W
*CONFig:CALleak:MBAR*l/s	leak rate of external test leak in mbar*l/s		R/W
*CONFig:CALleak:OZ/yr	leak rate of external test leak in oz/yr		R/W
*CONFig:CALleak:PA*m3/s	leak rate of external test leak in Pa*m3/s		R/W
*CONFig:CALREQInterval	calibration request interval in minutes (0=calibration request off)	418	R/W
*CONFig:GAS	Gas type (smart probe only) (R134A, R22, R404A, R407C, R410A, R1234YF, R32, USER1, USER2, USER3)	486	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:PLCINLINK	Assignment of PLC-inputs *CONFig:PLCINLINK:1 for PLC input Pin1 *CONFig:PLCINLINK:2 for PLC input Pin2 ... *CONFig:PLCINLINK:10 for PLC input Pin10	438	R/W
*CONFig:PLCINLINK:1	Configuration of PLC-input. The following settings are possible: NOT_USED, EXT_CAL, START, STOP, CLEAR, START_STOP, VALID_TRIGGER.	438	R/W
*CONFig:PLCINLINK:n	n = 2...10 see CONFig:PLCINLINK:1	438	R/W
*CONFig:PLCOUTLINK	Assignment of PLC-outputs *CONFig:PLCOUTLINK:1 for Pin 1 *CONFig:PLCOUTLINK:2 for Pin 2 ... *CONFig:PLCOUTLINK:8 for Pin 8	263	R/W
*CONFig:RECorder:LINK1	Function at analog output channel 1 (OFF, LR_LIN, EXTERN)	222	R/W
*CONFig:RECorder:LINK2	Function at analog output channel 2 (OFF, LR_LIN, EXTERN)	222	R/W
*CONFig:RECorder:UPPERVAL	Upper limit for the analog out at IO module. The value sets the leak rate in g/a for an output voltage of 10V	225	R/W
*CONFig:RS232	Protocol (ASCII, LD, HLD4000, SIMPLE)	26	R/W

Command	Meaning	Relates to LD cmd. no.	Read / Write
*CONFig:STANDBYDel	Auto standby time in minutes 1…15, 0=OFF	480	R/W
*CONFig:TRIGger1	desired trigger1 in selected unit		R/W
*CONFig:TRIGger1:G/a	desired trigger1 in g/a	385	R/W
*CONFig:TRIGger1:LB/yr	desired trigger1 in lb/yr		R/W
*CONFig:TRIGger1:MBAR*l/s	desired trigger1 in mbar*l/s		R/W
*CONFig:TRIGger1:OZ/yr	desired trigger1 in oz/yr		R/W
*CONFig:TRIGger1:PA*m3/s	desired trigger1 in Pa*m3/s		R/W
*CONFig:TRIGger2	desired trigger2 in selected unit		R/W
*CONFig:TRIGger2:G/a	desired trigger2 in g/a	385	R/W
*CONFig:TRIGger2:LB/yr	desired trigger2 in lb/yr		R/W
*CONFig:TRIGger2:MBAR*l/s	desired trigger2 in mbar*l/s		R/W
*CONFig:TRIGger2:OZ/yr	desired trigger2 in oz/yr		R/W
*CONFig:TRIGger2:PA*m3/s	desired trigger2 in Pa*m3/s		R/W
*CONFig:UNIT	leak rate unit (g/a, lb/yr, mbar*l/s, oz/yr, Pa*m3/s)	432	R/W
*CONFig:UNIT:LR	leak rate unit (g/a, lb/yr, mbar*l/s, oz/yr, Pa*m3/s)	432	R/W
*CONFig:USERGASFAC1	Factor for user gas 1	485	R/W
*CONFig:USERGASFAC2	Factor for user gas 2	485	R/W
*CONFig:USERGASFAC3	Factor for user gas 3	485	R/W
*CONFig:VOLume	Volume (1…15)	420	R/W
*FACtor:CAL	Calibration factor	460	R/W
*FACtor:CALOFFset	Leak rate offset in g/a when sniffing air. Only valid for CO2 sniffer probes.	488	R/W
*FACtor:PHASE	Phase	459	R/W
*HOUR:DATE	Date (DD,MM,YYYY)	450	R/W
*HOUR:DEVice	operating hours of device	142	R
*HOUR:POWer	time since switching on (in minutes)	147	R
*HOUR:SNiffer	operating hours of sniffer probe	152	R
*HOUR:TIME	Time (HH,MM)	450	R/W
*IDN:BOOTversion	software version bootloader main board	318	R
*IDN:CRC	check sum	320	R
*IDN:CUversion	software version control unit	314	R
*IDN:DEVice	name of instrument (HLD6000)	301	R
*IDN:IOBOOTversion	software version boot loader I/O module	319	R
*IDN:IOSERIAL	Serial number I/O module	408	R
*IDN:IOversion	software version I/O module	313	R
*IDN:IRSENSERIAL	Serial number of IR-sensor	407	R
*IDN:PROBE	Probe HEX code	458	R
*IDN:PROBEBOOTversion	software version boot loader sniffer probe	332	R
*IDN:SERial	serial-number leak detector	406	R
*IDN:SNSerial	Serial number of sniffer probe	404	R
*IDN:SNVersion	Software version of sniffer probe	312	R
*IDN:TESTLeak	Test leak info	457	R
*IDN:VERsion	software version main board	310	R
*MEASure:ACCEL	Probe acceleration value	178	R
*MEASure:ACTTRIGger1	Actual trigger in selected unit		R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:ACTTRIGger1:G/a	Actual trigger1 in g/a	383	R
*MEASure:ACTTRIGger1:LB/yr	Actual trigger1 in lb/yr		R
*MEASure:ACTTRIGger1:MBAR*l/s	Actual trigger1 in mbar*l/s		R
*MEASure:ACTTRIGger1:OZ/yr	Actual trigger1 in oz/yr		R
*MEASure:ACTTRIGger1:PA*m3/s	Actual trigger1 in Pa*m3/s		R
*MEASure:ACTTRIGger2	Actual trigger in selected unit		R
*MEASure:ACTTRIGger2:G/a	Actual trigger1 in g/a	383	R
*MEASure:ACTTRIGger2:LB/yr	Actual trigger1 in lb/yr		R
*MEASure:ACTTRIGger2:MBAR*l/s	Actual trigger1 in mbar*l/s		R
*MEASure:ACTTRIGger2:OZ/yr	Actual trigger1 in oz/yr		R
*MEASure:ACTTRIGger2:PA*m3/s	Actual trigger1 in Pa*m3/s		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: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:IIRSOURCE	IR source current [A]	179	R
*MEASure:P1	Actual differential pressure p1	484	R
*MEASure:P1:NOMINAL	Nominal differential pressure p1	483	
*MEASure:P2	Actual differential pressure p2	484	R
*MEASure:P2:NOMINAL	Nominal differential pressure p2	483	R
*MEASure:REC0	Outpot voltage recorder channel 1	221	R
*MEASure:REC1	Outpot voltage recorder channel 2	221	R
*MEASure:SVALUE	S-Value	487	R
*MEASure:TEMPeratur:Electronic	Electronic temperature [°C]	165	R
*MEASure:TEMPeratur:Leak	Temperature of internal test leak [°C]	400	R
*MEASure:U12N	-12 V supply [V]	211	R
*MEASure:U12P	+12 V supply [V]	210	R
*MEASure:U24IO	24 V supply IO [V]	213	R
*MEASure:U24M12	24 V supply M12 connector [V]	219	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*MEASure:U3V3	+3.3 V supply [V]	201	R
*MEASure:U5	+5 V supply [V]	218	R
*MEASure:UIRSOURCE	IR source voltage [V]	179	R
*MEASure:UPROBE	Probe test voltage	177	R
*READ	leak rate in selected unit	128	R
*READ:G/a	leak rate in g/a	129	R
*READ:LB/yr	leak rate in lb/yr	---	R
*READ:MBAR*l/s	leak rate in mbar*l/s	---	R
*READ:OZ/yr	leak rate in oz/yr	---	R
*READ:PA*m3/s	leak rate in Pa*m3/s	---	R
*RST:CALHistory	Clears calibration history		W
*RST:ERRORHistory	Clears error history		W
*RST:FACTORY	Sets all parameters to factory default	1161	W
*SERVICE:READBuffer	Read service buffer: current number (359 ... 0) IR-sensor raugh data (signed 16 bit integer) leak rate in cg/a (float) diff press rough value p1 (signed 16 bit integer) diff press rough value p2 (signed 16 bit integer) Imod in cg/a with 1000 offset (unsigned 16 bit integer)		R
*SLEEP	Switch from Measure to Standby	2	W
*STANDBY	Switch from Measure to Standby	2	W
*STArt	Switch from Standby to Measure	1	W
*STATus	status of HLD6000 (RUNUP, MEAS, STANDBY, PROOF, CAL_INTERN, CAL_EXTERN, ERROR)	Status word	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: READY WAIT_STABLE_INT_CAL PHASE_INT_CAL FACT_INT_CAL KEEP_PROBE_STILL_INT_CAL WAIT_STABLE_PROOF ACK_NACK_PROOF KEEP_PROBE_STILL_PROOF WAIT_STABLE_EXT_CAL PHASE_EXT_CAL FACT_EXT_CAL EEP_PROBE_STILL_EXT_CAL PHASE_CAL_CO2 LEAK_CAL_CO2 PROBE_NOT_STILL_CAL_CO2 AIR_START_CAL_CO2 AIR_CAL_CO2 PROBE_NOT_STILL_AIR_CAL_CO2 RESULT_OK RESULT_TOO_HIGH RESULT_TOO_LOW PROOF_OK PROOF_NOT_OK PROOF_IMPOSSIBLE EXTERN_NOT_STABLE TIMEOUT RESULT_OFFSET_TOO_HIGH RESULT_DIFFERENCE_TOO_SMALL	260	R
*STATus:CALHist	Calibration history *STATus:CALHist Last cal history entry *STATus:CALHist:1 Entry 1 (newest) *STATus:CALHist:2 Entry 2 ... *STATus:CALHist:10 Entry 10 (oldest) Answer:Index, cal-factor, phase, leak rate, year/month/ day, hour:min:sec, INT/EXT/MAN, gas type, p1, p2, on time, probeID, S-value, temperature, cal state Example: 05 Fac:1.32E+01 Phase:35 Leak:3.59E+00 2013/02/07 15:23:25 EXT Smart R134a p1:+324 p2:-396 t_on:002 ProbeID:D535 S-value:550 T:+27.2 CalState:23	275	R
*STATus:ERRHist	Error history *STATus:ERRHist Actual entry *STATus:ERRHist:1 Entry 1 (newest) *STATus:ERRHist:2 Entry 2 ... *STATus:ERRHist:15 Entry 15 (oldest)	287	R
*STATus:ERRor	current number of error / warning („NO ERROR/ WARNING“ or "ERROR " and 3-digit failure number)	290	R
*STATus:ERRor:VALue	actual value according to the actual error / warning	289	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*STATus:ERRor:TEXT	Text of the actual error / warning	294	R
*STATus:LEAK:Gas	Gas type of internal reference leak	457	R
*STATus:LEAK:LREff	internal reference leak temperature compensated in g/a	394	R
*STATus:LEAK:LRNom	internal reference leak nominal in g/a	394	R
*STATus:LONGTERMHist	long term history internal index (0...9) of the entry Probe ID gas type prob selected gas type (smart) p1 actual value p2 actual value p1 nominal value p2 nominal value warning bits S-value Temperature main board device state minutes since start (255 max) switch on counter (last 2 digits) date without year time *STATus:LONGTERMH newest *STATus:LONGTERMH:1 Entry 1 (newest) *STATus:LONGTERMH:2 Entry 2 ... *STATus:LONGTERMH:10 Entry 10 (oldest)	341	R
*STATus:RESETSource	Source for last device reset: POWER_ON, LOW_POWER, WINDOW_WATCHDOG, INDEPENDENT_WATCHDOG, SOFTWARE and/or NRST_PIN	1815	R
*STATus:SNProbetype	Sniffer probe (NOT_DETECTED, HLD5000, HLD6000)	302	R
*STATus:SNkey	Status of sniffer key. 1=pressed, 0=not pressed	Status word	R
*STATus:SWITCHONCnt	Switch on counter	157	R
*STATus:TRIGger	status of trigger S1,S2 with S1…S2 is “ON” or “OFF” depending of the states of trigger1 and trigger2	385	R

Command	Meaning	Relates to LD cmd. no.	Read / Write
*STATus:WARNINGBits	Warning-Bits which indicate pending warnings: WARNING_MAIN_EEPROM = 0x00000001 WARNING_LAMP = 0x00000002 WARNING_MAIN_TEMP = 0x00000010 WARNING_CAL_REQUEST = 0x00000020 WARNING_RTC = 0x00000040 WARNING_PROBE_COM = 0x00000080 WARNING_DIFF_PRESS = 0x00000100 WARNING_IO_DISCONNECT = 0x00000200 WARNING_PROBE_SUPPLY = 0x00000400 WARNING_I_MOD = 0x00000800 WARNING_PROBE_NO_ANSWER = 0x00001000 WARNING_PROBE_PARA = 0x00002000 WARNING_LEAK_EMPTY = 0x00004000 WARNING_LEAK_NEARLY_EMPTY = 0x00008000 WARNING_LEAK_EEPROM = 0x00010000 WARNING_LEAK_TEMP = 0x00020000 WARNING_LIGHT_BARRIER = 0x00040000 WARNING_AUDIO_AMPLIFIER = 0x00080000 WARNING_12V_OUT_OF_RANGE = 0x00100000 WARNING_12VN_OUT_OF_RANGE = 0x00200000 WARNING_5V_OUT_OF_RANGE = 0x00400000 WARNING_CU_DISCONNECT = 0x00800000 WARNING_3V3_OUT_OF_RANGE = 0x01000000 WARNING_24V_OUT_OF_RANGE = 0x02000000 WARNING_NO_ANSWER_BUS_MOD = 0x04000000	297	R
*STOp	Switch from Measure to Standby	2	W

2.4 Examples

External Calibration

To execute an external calibration via ASCII-protocol proceed as follows:

1 Move sniffer to external leak

2 Start calibration with command *CAL:EXT

3 Wait until leack rate signal is stable

4 Acknowledge stable signal with command *CAL:ACK

5 Poll *STATUS:CAL? Until it answers "RESULT_OK"

6 Remove sniffer from external leak

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

2.5 Error Messages

Message	**Meaning**
OK	command completed
E01	wrong command start (no „*“)
E02	illegal blank
E03	command word 1 illegal
E04	command word 2 illegal
E05	command word 3 illegal
E06	control by RS232 not enabled
E07	argument faulty
E08	no data available
E09	error buffer overflow
E10	command actually invalid
E11	query not allowed
E12	only query allowed
E13	command not implemented

3 LD Protocol

3.1 Communication Parameters

Data format

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

3.2 Command Format

3.2.1 Telegram Structure

Master sends

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

Slave answers

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

Command	Meaning	
ENQ	0x05	Start of master request
STX	0x02	Start of slave response
LEN	Number of telegram bytes	without ENQ(STX)/LEN, however with CRC max. 253, so the total slave telegram length is max. 255
ADR	Slave address	Slave address = 1: non-addressed bus. Address byte is ignored.
Stw H/L	Status word	Info from slave to master. Please use ADR=1 only. Concerning status see page 19.
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 20)

Command	Meaning	
DATA	Data belonging to master request (Slave reply to write command is sent without data)	0 ≤ n ≤ 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 document "CRC_calculation.c" (C souce 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 (from 0x20 to 0x7E)
- Always in English
- Units in square brackets

Command info

1. Byte	Data type (see table “Data types”)
2. Byte	Number of array elements: 0 = no data, no array 1 = data, no array 2 ... 255 = array
3. Byte	Bit 0: 1 = Reading allowed, 0 = Reading not allowed Bit 1: 1 = Writing allowed, 0 = Writing not allowed Bit 2 ... 7: always 0 (not used)

Data types

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

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

Arrays

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

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

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

3.3 Status Word

Status word bit no.	Meaning
Bit 0	Device state: 0 = Runup 1 = Standby 2 = Measure 3 = Calibration internal 4 = Calibration external 5 = Proof 6 = Not used 7 = Not ready
Bit 1	
Bit 2	
Bit 3	not used
Bit 4	not used
Bit 5	Still pending device warning. Is 1 even if warning is confirmed via command "Clear error" (Command No. 5) as long as reason for warning still exists.
Bit 6	Sniffer Key
Bit 7	not used
Bit 8	PLC Output Change
Bit 9	Setpoint exceeded
Bit 10	Actual valid setpoint:0=Setpoint 1, 1=Setpoint 2
Bit 11	Value changed via interface command
Bit 12	Light barrier
Bit 13	Unconfirmed device warning
Bit 14	Device error
Bit 15	Syntax/Command error

3.4 Commands

Command		Class	Name	R/W	Data type	Description
dez	hex					
0	0	Control	NOP	R	NO_DATA	"No operation", replies without data
1	1	Control	Start	W	NO_DATA	Switch from "standby" to "measure"
2	2	Control	Stop	W	NO_DATA	Switch from "measure" to "standby"
4	4	Control	Calibration	W	NO_DATA	Start calibration with ext. Testleak
5	5	Control	Clear error	W	NO_DATA	Clear Error or Warning
11	B	Control	Calibration acknowledge	W	UINT8	1 = Continue calibration 0 = cancel calibration
128	80	Meas	Leak rate [sel. unit]	R	FLOAT	Leak rate in selected unit
129	81	Meas	Leak rate [g/a]	R	FLOAT	Leak rate in g/a
142	8E	Meas	Leak detector operation hours	R	UINT32	Leak detector operation hours
147	93	Meas	Time since power on [min]	R	UINT32	Time since power on [min]
152	98	Meas	Probe operation hours [h]	R	UINT32	Probe operation hours
157	9D	Meas	Switch on counter	R	UINT16	Counts the switch on cycles 0 ... 65534
165	A5	Meas	Electronic temperature [deg. C]	R	FLOAT	Mainboard Temperatur in °C
177	B1	Meas	Probe test voltage [V]	R	FLOAT	Probe test voltage
178	B2	Meas	Probe acceleration value	R	UINT16	Probe acceleration value
179	B3	Meas	IR source voltage [V]	R	FLOAT	IR source voltage
180	B4	Meas	IR source current [I]	R	FLOAT	IR source current
201	C9	Meas	3.3 V supply [V]	R	FLOAT	3.3 V supply voltage for processor
210	D2	Meas	+12 V supply [V]	R	FLOAT	+12 V Spannung in V
211	D3	Meas	-12 V supply [V]	R	FLOAT	-12 V Spannung in V
213	D5	Meas	24 V supply IO [V]	R/W	FLOAT	24 V IO-Modul supply voltage [V] write for internal use only
218	DA	Meas	+5 V supply [V]	R	FLOAT	+5 V Spannung in V
219	DB	Meas	24V power out M12 [V]	R	FLOAT	24 V out M12, Spannung in V
220	DC	Meas	Analog input IO module [V]	R/W	FLOAT	Analog input voltage IO module in [V] write for internal use only
221	DD	Meas	Analog outputs IO [V]	R	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 2.
222	DE	Param	Analog output configuration IO module	R/W	UINT8[2]	Function of analog output Index 0: Channel 1 Index 1: Channel 2 Functions 0: 0 V fixed 1: leak rate linear (see command 225) 2: Voltage setable by command 221
225	E1	Param	Analog output upper value [g/a for 10V]	R/W	FLOAT	Upper limit for the analog out at IO module (Default: 1). The value sets the leak rate in g/a for an output voltage of 10V (Min: 10; Default: 100; Max.: 1000).

Command		Class	Name	R/W	Data type	Description
dez	hex					
260	104	Status	State calibration	R	UINT8	Status of calibration 0 = Ready 1 = Internal CAL: Wait for stable signal 2 = Internal CAL: Phase calculation 3 = Internal CAL: Factor calculation 9 = Internal CAL: Messgae: "Please keep Probe still" 11 = Proof: Wait for stable signal 13 = Proof: Colculation if value is OK or not OK 19 = Proof: Message: "Please keep Probe still" 21 = External CAL: Wait for stable signal 22 = External CAL: Phase calculation 23 = External CAL: Factor calculation 29 = External CAL: Message: "Please keep Probe still" 31 = CAL_STATE_WAIT_STABLE_EXT_CO2 32 = CAL_STATE_PHASE_EXT_CO2 33 = CAL_STATE_LEAK_EXT_CO2 34 = CAL_STATE_KEEP_PROBE_STILL_EXT_CO2 35 = CAL_STATE_WAIT_AIR_START_EXT_CO2 36 = CAL_STATE_AIR_EXT_CO2 39 = CAL_STATE_KEEP_PROBE_STILL_AIR_EXT_CO2 51 = CAL finished: Result OK 52 = Internal CAL finished: Result too high 53 = Internal CAL finished: Result too low 54 = Proof finished: Result OK 55 = Proof finished: Result not OK 56 = CAL/Proof impossible, e.g. no COOL Check connected or empty 57 = CAL_STATE_EXTERN_NOT_STABLE 58 = CAL/Proof canceled due to timeout (5 Minutes) 59 = CAL_STATE_RESULT_OFFSET_TOO_HIGH 60 = CAL_STATE_RESULT_DIFFERENCE_TOO_SMALL 61 = External CAL finished: Result OK 62 = External CAL finished: Result too high 63 = External CAL finished: Result too low
261	105	Status	PLC input state IO module	R/W	UINT16	Get PLC input state and DIP switch state IO module Bit 0..9 = PLCin 1..10 Bit 10..15 = DIP 1..6 (S1.1,S1.2,S1.3,S1.4,S2.1,S2.2)
262	106	Status	PLC output state IO module	R	UINT8	Get PLC output state IO module Bit0..7 = PLCOut 1..8

Command		Class	Name	R/W	Data type	Description
dez	hex					
263	107	Param	PLC output configuration IO module	R/W	SINT8[8]	Index 0...7 = PLC_OUT1 ... PLC_OUT_8 -18 = INTERNAL_CAL_POSSIBLE_N -17 = ERR_OR_WARN_N -16 = SNIFFER_CONNECTED_N -15 = STANDBY_N -14 = MEASURE_N -13 = LIGHT_BARRIER_N -12 = SNIFFER_BUTTON_N -11 = RUN_UP_N -10 = CAL_REQUEST_N -9 = CAL_PROOF_ACTIVE_N -8 = ERROR_N -7 = WARNING_N -6 = PROOF_ACTIVE_N -5 = EXTERNAL_CAL_ACTIVE_N -4 = INTERNAL_CAL_ACTIVE_N -3 = TRIG2_N -2 = TRIG1_N -1 = OPEN_N 0 = OPEN 1 = OPEN 2 = TRIG1 3 = TRIG2 4 = INTERNAL_CAL_ACTIVE 5 = EXTERNAL_CAL_ACTIVE 6 = PROOF_ACTIVE 7 = WARNING 8 = ERROR 9 = CAL_PROOF_ACTIVE 10 = CAL_REQUEST 11 = RUN_UP 12 = SNIFFER_BUTTON 13 = LIGHT_BARRIER 14 = MEASURE 15 = STANDBY 16 = SNIFFER_CONNECTED 17 = ERR_OR_WARN 18 = INTERNAL_CAL_POSSIBLE Default: PLC_OUT1: CONF_PLC_OUT_TRIG1_N PLC_OUT2: CONF_PLC_OUT_TRIG2_N PLC_OUT3: CONF_PLC_OUT_OPEN PLC_OUT4: CONF_PLC_OUT_OPEN PLC_OUT5: CONF_PLC_OUT_MEASURE PLC_OUT6: CONF_PLC_OUT_ERROR_N PLC_OUT7: CONF_PLC_OUT_CAL_REQUEST_N PLC_OUT8: CONF_PLC_OUT_OPEN_N
274	112	Status	Last entry in cal history		UINT8	History list index of the last (newest) entry in the calibration history

Command		Class	Name	R/W	Data type	Description
dez	hex					
275	113	Status	Cal history		CHAR[*]	Text of calibration in the history list. To read send after the array index 255 the UINT8 history list index (0...9). Without history list index you will get the last (newest) entry. Entry format: Answer: Index, cal-factor, phase, leak rate, year/month/ day, hour:min:sec, INT/EXT/MAN, gas type, p1, p2, on time, probeID, S-value, temperature, cal state Example: 05 Fac:1.32E+01 Phase:35 Leak:3.59E+00 2013/02/07 15:23:25 EXT Smart R134a p1:+324 p2:-396 t_on:002 ProbeID:D535 S-value:550 T:+27.2 CalState:23
277	115	Status	Last entry in error history	R	UINT8	Index of the last (newest) entry in the error history list
287	11F	Status	Error history	R	CHAR[*]	Text of an error/warning in the history list. To read send after the array index 255 the UINT8 history list index (0...15). Without history list index you will get the last (newest) entry. Entry format:
289	121	Status	Value of actual error	R	FLOAT	Value associated with the actual error or warning
290	122	Status	Number of actual error	R	UINT16	Error number of the actual error or warning
294	126	Status	Text of error number	R	CHAR[*]	text of an error/warning number To read send after the index the UINT16 error number Without error number you will get the actual error/warning Use only with index=255!
295	127	Status	Text of warning bits	R	CHAR[*]	Explanation text for a specific warning bit: To read, send after the index the UINT8 bit position Use only with index=255!
296	128	Status	List of active errors	R	UINT16[10]	Lists the error/warning numbers since the last "clear error"

Command		Class	Name	R/W	Data type	Description
dez	hex					
297	129	Status	Present warnings	R	UINT32	Each bit represents a warning Bit 0 = Warning main EEPROM Bit 1 = Warning IR source Bit 2 = not used Bit 3 = not used Bit 4 = WARNING_MAIN_TEMP Bit 5 = WARNING_CAL_REQUEST Bit 6 = WARNING_RTC Bit 7 = WARNING_PROBE_COM Bit 8 = WARNING_DIFF_PRESS Bit 9 = WARNING_IO_DISCONNECT Bit 10 = WARNING_PROBE_SUPPLY Bit 11 = WARNING_I_MOD Bit 12 = WARNING_PROBE_NO_ANSWER Bit 13 = WARNING_PROBE_PARA Bit 14 = WARNING_LEAK_EMPTY Bit 15 = WARNING_LEAK_NEARLY_EMPTY Bit 16 = WARNING_LEAK_EEPROM Bit 17 = WARNING_LEAK_TEMP Bit 18 = WARNING_LIGHT_BARRIER Bit 19 = WARNING_AUDIO_AMPLIFIER Bit 20 = WARNING_12V_OUT_OF_RANGE Bit 21 = WARNING_12VN_OUT_OF_RANGE Bit 22 = WARNING_5V_OUT_OF_RANGE Bit 23 = WARNING_CU_DISCONNECT Bit 24 = WARNING_3V3_OUT_OF_RANGE Bit 25 = WARNING_24V_OUT_OF_RANGE Bit 26 = WARNING_NO_ANSWER_BUS_MOD Bit 27 = WARNING_LAMP_VOLTAGE
300	12C	Status	Device identification	R	UINT8[2]	Device identification, always {1,50} for HLD6000
301	12D	Status	Device name	R	CHAR[*]	Get device name as ASCII string, always "HLD6000"
302	12E	Status	Sniffer probe type	R	UINT8	0: probe not detected 1: HLD5000-probe 2: HLD6000-probe
310	136	Status	SW-version main board	R	UINT8[3]	Software version Index 0: Main version Index 1: Sub version Index 2: Debug version
311	137	Status	SW-version probe programming master	R	UINT8[3]	Software version of master, by which this sniffer probe was programmed Index 0: Main version Index 1: Sub version Index 2: always 0
312	138	Status	SW-version sniffer probe	R	UINT8[3]	Software version probe Index 0: Main version Index 1: Sub version Index 2: always 0

Command		Class	Name	R/W	Data type	Description
dez	hex					
313	139	Status	SW-version I/O module	R/W	UINT8[3]	Software version IO module Index 0: Main version Index 1: Sub version Index 2: Debug version write for internal use only
314	13A	Status	SW-version control unit	R/W	UINT8[3]	Software version control unit Index 0: Main version Index 1: Sub version Index 2: Debug version write for internal use only
318	13E	Status	SW version boot loader	R	UINT8[3]	Software version of boot loader
319	13F	Status	SW version boot loader I/O module	R/W	UINT8[3]	Software version of boot loader IO module write for internal use only
320	140	Status	CRC-code main board	R	UINT32	CRC-code main board High word: Caclulated value Low word: Nominal value
321	141	Status	DIP switch main board	R	UINT8	DIP switch setting of Mainboard: Bit7: S100, switch 4 Bit6: S100, switch 3 Bit5: S100, switch 2 Bit4: S100, switch 1 Bit3...0: not used,always 0
332	14C	Status	SW version boot loader sniffer probe	R	UINT8[3]	Software version of boot loader sniffer probe.
341	155	Status	Last entry in long term history list	R		Text of long term history list. To read send after the array index 255 the UINT8 history list index (0...9). Without history list index you will get the last (newest) entry. Entry format: see enumerations table
342	156	Status	Long term history list	R		Index of the last (newest) entry in the long term history list
383	17F	Param	Actual setpoint [g/a]	R	FLOAT[2]	Actual leackage rate setpoint in g/a
385	181	Param	Setpoint [g/a]	R/W	FLOAT[2]	Desired leakage rate setpoint in g/a; for actual used setpoint see command 383
388	184	Param	Test leak extern [g/a]	R/W	FLOAT	External test leak in g/a (Min.: 0.2; Default: 5; Max: 99)
394	18A	Meas	COOL-Check leak rate [g/a]	R	FLOAT[3]	Leak rate of internal reference leak in g/a 0: nominal lr at 20 deg.C 1: Temperatur compensated lr 2: T compensated lr for actual gas
400	190	Meas	COOL-Check temperature [deg. C]	R	FLOAT	Temperatur of internal reference leak in degree celsius
404	194	Status	Serial number sniffer probe	R	CHAR[11]	Serial number sniffer probe (ASCII)
406	196	Status	Serial number leak detector	R	CHAR[11]	Serial number of the complete leak detector (ASCII)
407	197	Status	Serial number IR sensor	R	CHAR[11]	Serial number of IR sensor in sniffer probe (ASCII)
408	198	Status	Serial number IO module	R/W	CHAR[11]	Serial number of the IO module

Command		Class	Name	R/W	Data type	Description
dez	hex					
413	19D	Param	Sniffer LED alarm configuration	R/W	UINT8	Configures the behavior of the white sniffer pobe LEDs in case of trigger alarm: 0=disabled (same Brightness as during normal measurement) 1=on (higher brightness as during normal measurement if possible) 2=blink (Default: 2)
414	19E	Param	Sniffer white LED brightness	R/W	UINT8	Configures the brightness of the white sniffer pobe LEDs in case of normal measurement: 0=off ... 6=max Brightness (Default: 4)
418	1A2	Param	Cal. request interval	R/W	UINT16	Calibration request interval [min.] (Min: 0; Default: 60; Max: 1440)
420	1A4	Param	Volume	R/W	UINT8	Volume of Triggeralarm (Min.: 0; Default: 5; Max.: 15)
422	1A6	Param	Probe key config	R/W	UINT8	Configuration of probe key 0: probe button not used for trigger switching 1: probe button switches between trigger1 and trigger 2 (Default: 1)
423	1A7	Param	Speaker beep	W	UINT8[2]	Performs a speaker beep. Index 0: Typ Index 1: Volume (0..15) Typ: 1=2000Hz, 2=first 2000Hz, then 1000Hz
424	1A8	Status	Time until next calibration request [s]	R/W	UINT32	Time until next calibration request in seconds
425	1A9	Param	Activate Calibration request	R/W	UINT8	0 = deactivate a calibration request 1 = activate a calibration request (Default: 0)
432	1B0	Param	Leak rate unit	R/W	UINT8	Leak rate unit 0 - g/a 1 - lb/yr 2 - mbarl/s 3 - oz/yr 4 - Pam3/s (Default: g/a)

Command		Class	Name	R/W	Data type	Description
dez	hex					
438	1B6	Param	PLC input configuration IO module	R/W	UINT8[10]	Configuration of PLC input port of the IO module Index 0...9 = PLC_IN1...PLC_IN10 See table -6 = VALID_TRIGGER_N -5 = START_STOP_N -4 = CLEAR_N -3 = STOP_N -2 = START_N -1 = CAL_EXTERN_N 0 = NO_FUNCTION 1 = CAL_EXTERN 2 = START 3 = STOP 4 = CLEAR 5 = START_STOP 6 = VALID_TRIGGER Default: PLC_IN 1: NO_FUNCTION PLC_IN 2: NO_FUNCTION PLC_IN 3: START_STOPPLC_IN 4: NO_FUNCTION PLC_IN 5: CAL_EXTERN PLC_IN 6: NO_FUNCTION PLC_IN 7: CLEAR PLC_IN 8: NO_FUNCTION PLC_IN 9: NO_FUNCTION PLC_IN 10: NO_FUNCTION
440	1B8	Meas	Remaining life time COOL-Check [d]		UINT16	Days until internal reference leak is empty
450	1C2	Param	Date+Time [YMDhms]	R/W	UINT8[6]	Date and time use only with array-index 255 (all bytes) year (1..99), month, day, hour (0..23), min, sec
459	1CB	Param	Phase	R/W	UINT8	Phase (Min: 0; Max:39)
460	1CC	Param	Calibration factor instrument	R/W	FLOAT	Calibration factor (Min: 6, Default: 15, Max.: 80)
480	1E0	Param	Auto standby interval [min]	R/W	UINT8	Auto standby interval 0 = OFF
485	1E5	Param	User gas factors	R/W	FLOAT[3]	Gas factors for user gases: Index 0: User gas 1 Index 1: User gas 2 Index 2: User gas 3
486	1E6	Param	Gas type (smart probe only)	R/W	UINT8	Gas type (smart probe only) 5 = R22 22 = R404A 23 = R407C 24 = R410A 25 = R134A 26 = HFO1234YR 27 = R32 40 = USER-GAS 1 41 = USER-GAS 2 42 = USER-GAS 3
489	1E9	Param	ID of last calibrated probe	R	UINT16	ID of last calibrated probe (Min.: 0; Default: 2; Max.: 15)
490	1EA	Param	Probe ID	R	UINT16	ID of actual probe

Command		Class	Name	R/W	Data type	Description
dez	hex					
600	258	Param	Audio alarm type	R/W	UINT8	Audio alarm type 0 = Alarm off 1 = Trigger alarm 2 = Setpoint 3 = Pinpoint (Default: Setpoint)
1161	489	Control	Parameter reset	W	UINT8	Parameter reset: 0: Load factory settings
1581	62D	Meas	Acceleration	R	SINT16[3]	[0] = X-value [1] = Max (Y & Z)-value [2] = 0
1631	65F	Meas	Light barrier voltages [V]	R	FLOAT[2]	Light barrier voltages at photodiode Index 0: LED is off Index 1: LED is on
1800	708	Status	Active protocol IO	R	UINT8	Active interface protocol for I/O module. Defined by DIP switch at I/O module or command 2593. Values: See command 2593
1815	717	Status	Reset source	R	UINT8	Shows the last reason of reset
2593	A21	Param	Interface protocol IO	R/W	UINT8	Selected interface protocol for I/O module. May be overwrite if DIP switch at I/O module are not set to "000" 0 = LD 1= ASCII don't use following settings for new constructions 8= 'Normal' of the HLD5000 9 = 'Simple' of the HLD500 (Default: ASCII)
2659	A63	Param	Sniffer tip filter change request	R/W	UINT8	Sniffer tip filter change request: 0=0ff, 1=on (Default: on)

3.5 Error Messages

Telegram error handling

- Slave discards all characters until it receives a ENQ 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 HLD6000, you need an INFICON Bus-Module BM1000 connected to the I/O port of the HLD6000.

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 HLD6000. For example IFCN0E8D.GSD file for PROFIBUS.

4.2 Setup

► Select the “Bus“ at the HLD6000 display page
“Settings > Setup > Interfaces > Device sel. > Module at M12 connector”.

► Select the field bus address at the HLD6000 display page
“Settings > Setup > Interfaces > Bus Module > Address”.

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 Read 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.

Title	Byte	Bit	Name	Meaning	Similar to PLC Input	Similar to RS232 ASCII cmd.	Similar to RS232 LD cmd.
control word	1 (low byte)	0	Start	Transition 0->1: Switch from standby to measure	Start	*Start	1
		1	Stop	Transition 0->1: Switch from measure to standby	Stop	*Stop	2
		2	Clear	Transition 0->1:Clears errors and warnings	Clear	*CLS	5
		3	Valid setpoint	Transition 0->1: Switch to Setpoint 2 Transition 1->2: Switch to Setpoint 1			
		4...6	not used	reserved for further use			
		7	Cal_extern	Transition 0->1: Start external calibration Transition 1->0: Acknowledge		*CAL	4
	2 (high byte)	0...7	not used	reserved for further use			

Attention:

If you want to use "Valid setpoint" function via fieldbus please make sure, that the "probe key configuration" ist set to "off".

4.3.2 Write 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 sends high byte first, DeviceNet and EtherNet/IP sends 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 (low byte)	0	Device state	0=Run up 1=Standby 2=Measure 3=Calibration internal 4=Calibration external 5=Proof 6=Not used 7=Not ready	Run up, CAL active, Proof active, Error, Measure	*STATUS?	status word
		1					
		2					
		3	not used				
		4	not used				
		5	Still pending device warning		Warning	*STATUS:WARNINGBITS?	
		6	Sniffer key	0 = Sniffer probe key not pressed 1 = Sniffer probe key pressed	Sniffer button	*STATUS:SNKEY?	
		7	not used				
	2 (high byte)	0	Calibration request active	1= Leak detector requests a calibration	CAL_REQUEST	*STATUS:WARNINGBITS?	
		1	Setpoint		Trigger1, Trigger2	*STATUS:TRIGGER?	
		2	Active setpoint				
		3	not used				
		4	Light barrier		Light barrier		
		5	Unconfirmed device warning				
		6	Device error		Error	*STATUS:ERROR?	
		7	not used				

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 (g/a)	Actual leak rate in g/a (IEEE 754 float value)	Analog output	*READ:g/a?	129
pressure_or_flow	7...10		not used				
error_code	11...12		Actual error number	Error/warning code (16 bit unsigned integer)	Error	*STATUS:ERROR?	290
trigger_status	13	0	Status of Setpoint 1	0 = Leak rate lower than setpoint 1 = Leak rate higher than setpoint	Trigger 1	*STATUS:TRIGger?	387
		1	Status of Setpoint 2		Trigger 2		
		2 ... 7	not used	always 0			
calibration_status	14		calibration_status	For possible values please refer to table "State calibration (command 260). See chapter 3.4, Commands.	CAL active	*STATUS:CAL?	260
leak_detector ID	15		leak_detector ID	always 50 for HLD6000		*IDN:DEVice?	303
device specific float 1	16...19		device specific float 1	Differential pressure p1 in arbitrary unit (IEEE 754 float value)		*MEAS:p1?	343

Title	Byte	Bit	Name	Meaning	Similar to IO1000 Output	Similar to RS232 ASCII cmd.	Similar to RS232 LD cmd.
device specific float 2	20...23		device specific float 2	Differential pressure p2 in arbitrary unit (IEEE 754 float value)		*MEAS:p2?	344
device specific float 3	24...27		not used	reserved for further use, always 0			
device specific word	28...29		not used	reserved for further use, always 0			

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 * 255 + index +1 slot = (ADI-1) / 255 index = (ADI-1) 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	Instance_number = 506
EtherNet/IP	Object number A2h (ADI object) Instance_number = LD_command_number	Instance_number = 506

Fieldbus supports all commands from LD protocoll, except the commands in the following list:

LD_Command number	Name
26	Interface protocol (read only)
27	Used interface
275	Cal history
287	Error history
294	Text of error number
295	Text of warning bit
341	Last entry in long term history list
342	Long term history list
408	Serial number IO module
423	Speaker beep
426	Front panel LED state
450	Date+Time [YMDhms]
457	COOL-Check information
458	Probe HEX code
619	Pump power attenuation
1145	Gas correction factor
1161	Parameter reset

4.5 Hardware Configuration for PROFIBUS

Sequence of the data words (slots) must be:

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

Steckplatz	DP-Kennung	Bestellnummer / Bezeichnung	E-Adresse	A-Adresse
1	224	control word		1...2
2	208	status word	3...4	
3	209	leak rate	5...8	
4	209	pressure_or_flow	9...12	
5	208	error code	13...14	
6	144	trigger status	15	
7	144	calibration status	16	
8	144	leak detector ID	17	
9	209	device specific float 1	18...21	
10	209	device specific float 2	22...25	
11	209	device specific float 3	26...29	
12	208	device specific word	30...31	

Example hardware configuration (detail from PLC configuration window)

4.5.1 Assignment of the PROFIBUS Address

The PROFIBUS address can be assigned via HLD6000 display or via the hardware configuration tool of the PLC.

► To assign the PROFIBUS address via HLD6000 display select “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 HLD6000.

4.6 Diagnosis with the HLD6000 base unit

The current state of the BM1000 is visible at the info menu of the HLD6000 base unit. See menu tree “information“, “Bus module“.

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 chapter 4 of the IO1000 documentation.
	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

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 not time out function which will empty the receiving buffer automatically. Therefore, the buffer should be emptied before the first command by sending of ESC, ^C or ^X

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 replys with CRC error (error code 1)	Wrong CRC calculation	Check you CRC code calculation. See example C source file "CRC_calculation.c" provided by INFICON. Check your code with unit test function in this source code file.

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