Protocol Descriptions

LX218

Vacuum Leak Detector

8200-000, 8200-001

From software version:
1.0

hLc89en1-01-(1804)

LINXON

INFICON GmbH

Bonner Strasse 498

50968 Cologne, Germany

Inhaltsverzeichnis

1 Interfaces and Protocols

Interface Connections

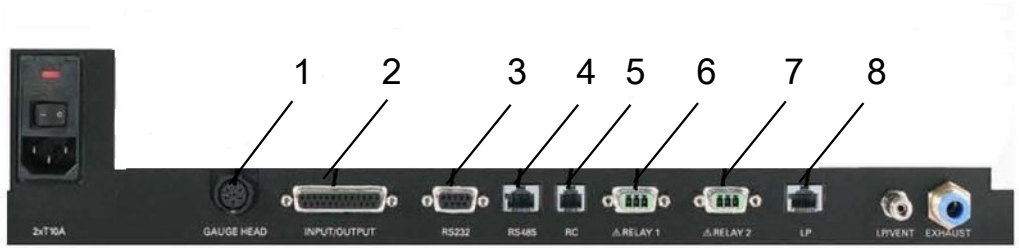

Fig. 1: Interface connections at the back of the device

Position	Description
1	GAUGE HEAD
2	INPUT/OUTPUT: Control and output signals
3	RS232: Connection for computer
4	RS485: Connection for computer
5	RC: Remote control or wireless transmitter
6	RELAY 1: Relay output
7	RELAY 2: Relay output
8	LP: Connection for sniffer probe

1.1 INPUT/OUTPUT Interface

INPUT/OUTPUT Interface

Input and output signals, 25-pin, D-sub, sockets

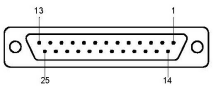

Fig. 2: Fig. 2: INPUT/OUTPUT: Control and output signals

Table 1: Table 1: INPUT/OUTPUT: Control and output signals

Pin	Assignment	Explanation
1	Canal 1	Analog output 0 … 10 V, Ri 3 Ω. (see table 13)

Pin	Assignment	Explanation
2	Channel 2	Analog output, data as above (see table 13)
3	AGND	Reference potential of analog outputs, galv. insulated
4		Audio output (headphones or active speakers)
5		Reference potential to audio output
6...13	DI 1...8	Digital inputs, +18 … 30 V (approx. 5 mA). The functions are triggered by the posi-tive flank. Same level as the control unit.
6	Start	Starts the measurement in Ready-to-start state.
7	Vent	Venting with setting "Venting manual" (see Chapter 6.4.4: "Define evacuation time & vent“)
8	ZERO	Function of the ZERO key. If pressed longer than 3s, ZERO is canceled.
9	Calibrate	Starts the calibration or for confirmation of "Calibrate Acknowledge" (PIN 19)
10	PARA 2	Upon activation: "Loading parameter set 2." Upon deactivation: "Loading parameter set 1."
11	Not used	
12	Not used	
13	Stop	Stops the measurement in measuring state.
14	DGND	Reference potential of the digital inputs, galvanically insulated

Pin	Assignment	Explanation
15…22	D01…8	Digital outputs, not galvanically insulated, active 24 V ± 10%, passive on DGND (0 V) Maximum allowed current: 800 mA for all outputs together Upon switching on, all outputs are active for approx. 1 s.
15	Ready to start	Enabled when the device is ready to evacuate the test volume.
16	Ready to measure	Enabled when the device measures, i.e. in either ULTRA, FINE, or GROSS state
17	Leak	Enabled when the alarm limit is activated and exceeded, disabled below 90% of this value
18	Error	Enabled in error state
19	Calibrate Acknowledge	Enabled if the device is waiting for a confirmation during calibration: internal calibra-tion: - Apply factors? external calibration: - Calibration leak opened and signal stable? - Calibration leak closed and signal stable? - Apply factors?
20	Not used	
21	Not used	
22	No leak	Active if the alarm setpoint was exceeded.

Pin	Assignment	Explanation
23	DGND (0V)	Reference potential of the digitals outputs, not galvanically insulated.
25	+24V	+24 V e.g. for actuating the digital inputs 0.8 A slow fuse

Example of digital inputs:

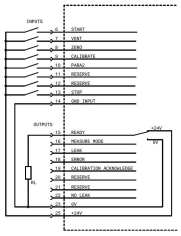

Fig. 3: Fig. 3: Example of digital inputs

When controlling via the +24V of the leak detector, there must be a connection between PIN 14 and PIN 23.

1.2 RS232 Interface

RS232 Interface

The RS232 interface enables communications between the device and a computer. A terminal can also be connected for test purposes.

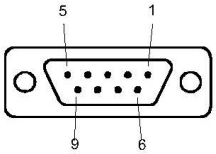

Fig. 4: Fig. 4: LX218 RS232 Connector

Pin	Signal	Comment
1	not used	
2	TXD	Transmission data (galvanically insulated)
3	RXD	Received data (galvanically insulated)
4	free	
5	GND	Reference potential (galvanically insulated)
6	not used	

Pin	Signal	Comment
7	not used	
8	not used	
9	not used	

Table 2: Table 2: RS-232 pin assignment

1.3 Serial Interface RS485

Serial Interface RS485

The connection of the device to a computer can be made through the serial interface RS485.

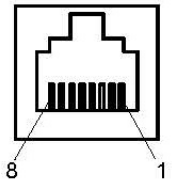

Fig. 5: Fig. 5: RS485 Connector

Plug: RS485 (8pin)

Pin	Comment
1	not used
2	+24 V
3	not used
4	not used
5	D+ (galvanically isolated)
6	GND (0 V)
7	D- (galvanically isolated)
8	not used

Table 3: Table 2: RS-232 pin assignment

The device may adopt the position of cases A, B or C in a bus. See Fig. 6:

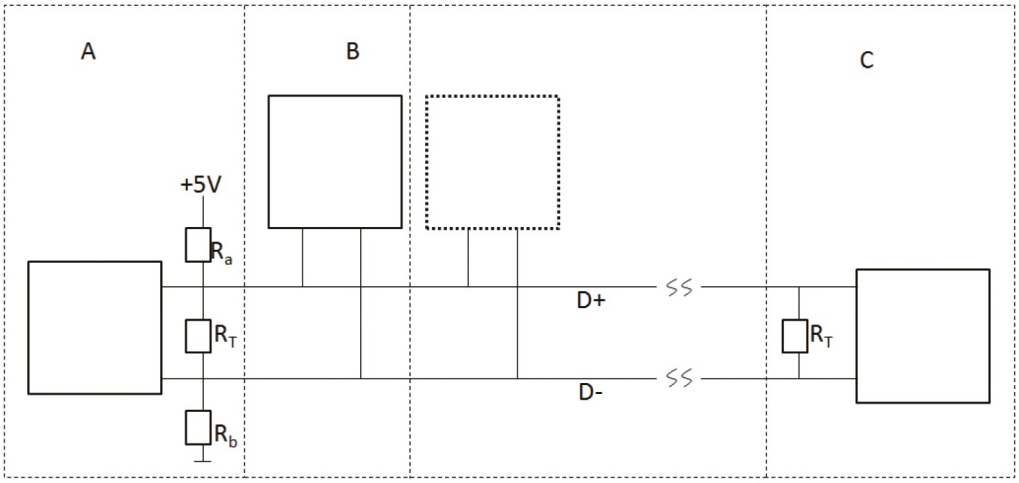

Fig. 6: Fig. 6: RS485 cable connection

A: LX218: with active termination

B: LX218: without termination (default setting).

C: LX218: with passive termination

The choice of LX218 connection can be made with the

DIP switch 1-3, Fig. 7: , according to Table 3.

DIP switch 4 has no function.

	DIP 1 (RT = 121Ω)	DIP 2 (Rb = 562Ω)	DIP 3 (Ra = 562Ω)
A	closed	closed	closed
B	open	open	open
C	closed	open	open

Table 4: Table 3: bus termination, terminating resistors

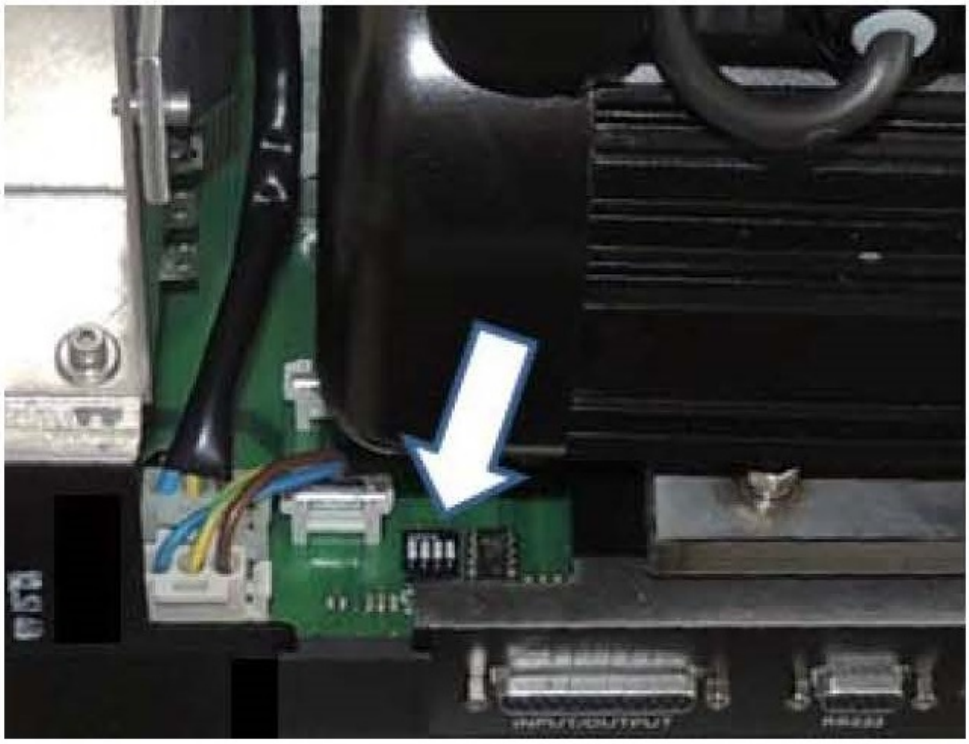

Fig. 7: Fig. 7: RS485 DIP switches

A twisted, screened two-wire cable is recommended for the connection!

After receiving a command it takes about 5 to 10 ms until the device sends a reply.

- Do not confuse the "RS485" connector with the "LP" connector. Otherwise the device will not function.

1.4 Remote Control

Remote Control

This remote control interface is designed as a serial port for controlling the device via the remote control. The remote control can be connected via a connection cable with an RJ45 plug. The remote control is not included in the scope of delivery of the device.

Pin	Signal
1	not used
2	+24 V (0.8 slow fuse)
3	0 V DGND (0 V)
4	RxD (intern. RS232)
5	TxD (intern. RS232)
6	not used
7	not used
8	not used

Table 5: Table 4: RC pin assignment

1.5 Relay 1, Relay 2

Relay 1, Relay 2

Relay contact, 230 V~, 3 A.,

Plug LX218 Power Subcon, 3-pin

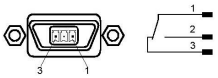

Fig. 8: Fig. 8: Relay 1, Relay 2

1.6 LP

LP

Connection for sniffer probe.

RJ-45, 8-pin

- Do not confuse the connectors! The connector is similar to the "RS485" connector.

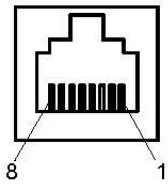

Fig. 9: Fig. 9: Connector: RJ-45 (8-pin)

Pin	Signal
1	not used
2	not used
3	ZERO
4	(LED red)
5	(LED green)
6	+24 V (0.8 A slow fuse)
7	not used
8	not used

Table 6: Table 5: Sniffer probe pin assignment

LED green: Leak detector is ready for measurement.

LED red: Setpoint is exceeded.

1.7 Serial Interface Protocols

Serial Interface Protocols

You can communicate with the device via the following serial interface protocols:

- LD Protocol
- ASCII Protocol
- Diagnostic Protocol (Only for internal use.)

The serial interface protocol can be selected at the menu of the device. Refer to LX218 operating instructions.

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 LD Protocol

2.1 Communication Parameters

Communication Parameters

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

2.2 Command Format

2.2.1 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 (Page 17)

Command	Meaning	
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 numberPage 17)
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, $X^8+X^5+X^4+1$

Cmd H/L: Command: Command-specifier

Bit 15 … 13	Meaning	High Nibble (Hex)
000	Read value	0
001	Write value	2
010	Read lower limit	4
011	Read upper limit	6
100	Read default value	8
101	Read command name in plain text	A
110	Read command info	C
111	Not used	E

Command info

Byte	Data type (see table “Data types”)
Byte	Number of array elements: 0 = no data, no array 1 = data, no array
Byte	Bit 0: 1 = Reading allowed, 0 = Reading not allowed

Byte	Data type (see table “Data types”)
	Bit 1: 1 = Writing allowed, 0 = Writing not allowed Bit 2 ... 7: not used (always 0)

Data types

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

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

Arrays

- Read single elements: Array index in first DATA-byte
- Write single elements: Array index in first DATA byte and values in following DATA bytes
- Read all elements: Pseudo array index 255 in first DATA byte
- Write all elements: Pseudo array index 255 in first DATA byte and values in following DATA bytes

- Response from slave (in case data are sent): Array index or pseudo array index in first DATA byte and values in following DATA bytes

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

Array parameters in commands table (see chapter 2.4): The number of array elements is set in brackets behind the data type.

2.3 Status Word

Status Word

Status word bit no.	Meaning
Bit 0	Device state Bit 0
Bit 1	Device state Bit 1
Bit 2	Device state Bit 2
Bit 3	Device state Bit 3
Bit 4	ZERO
Bit 5	Still warning
Bit 6	Measure range 0
Bit 7	Measure range 1
Bit 8	Measure range 2
Bit 9	Setpoint exceeded
Bit 10	Warnpoint exceeded
Bit 11	Not used
Bit 12	Paging
Bit 13	Device warning
Bit 14	Device error
Bit 15	Syntax/Command error

Value	Bit 3…0	Device state
0	0000	INIT
1	0001	RUNUP
2	0010	STANDBY
3	0011	VENT
4	0100	EVACUATION
5	0101	MEASURE
6	0110	CALIBRATION
7	0111	DISPLAY CAL
8	1000	ERROR

Value	Bit 3…0	Device state
9	1001	WAIT EVACUATION
10	1010	Not used
11	1011	Not used
12	1100	Not used
13	1101	Not used
14	1110	Not used
15	1111	Not used

Value	Bit 8…6	Meaning
0	000	NO RANGE
1	001	GROSS
2	010	FINE
3	011	ULTRA
4	100	EVACUATION
5	101	Not used
6	110	Not used
7	111	Not used

2.4 Commands

Commands

Command		Name	Data type	R/W	Meaning
dez	hex				
0	0000	NOP	NO_DATA	W	No operation, replies without data
1	0001	NO_DATA	NO_DATA	W	Switch to measure
2	0002	NO_DATA	NO_DATA	W	Switch to standby
3	0003	NO_DATA	NO_DATA	W	Switch to vent
4	0004	NO_DATA	NO_DATA	W	Start, acknowledge calibration
5	0005	NO_DATA	NO_DATA	W	Clear Error or Warning

Command		Name	Data type	R/W	Meaning
dez	hex				
6	0006	UINT8	UINT8	R/W	0 = Zero "Off" 1 = Zero "On" "Update" without data = toggle Zero state
9	0009	UINT8	UINT8	R/W	Emission nominal status 0 = OFF 1 = STANDBY 2 = ON
10	000A	UINT8	UINT8	R/W	TMP nominal status 0 = OFF 1 = ON
26	001A	Interface protocol	UINT8[2]	R/W	Interface protocol Index 0: Remote Control Index 1: RS232 / RS485 see table / enumerations
27	001B	Used interface	UINT8	R	Used interface 0 = Remote Control 1 = RS232 / RS485

Command		Name	Data type	R/W	Meaning
dez	hex				
128	0080	Leak rate [sel. unit]	FLOAT	R	Leak rate [sel. unit], limited to lower display limit
129	0081	Leak rate [mbar*l/s]	FLOAT	R	Leak rate [mbar*l/s], unlimited
130	0082	Internal pressure 1 [sel. unit]	FLOAT	R	Internal pressure 1 [sel. unit]
131	0083	Internal pressure 1 [mbar]	FLOAT	R	Internal pressure 1 [mbar]
132	0084	Internal pressure 2 [sel. unit]	FLOAT	R	Internal pressure 2 [sel. unit]
133	0085	Internal pressure 2 [mbar]	FLOAT	R	Internal pressure 2 [mbar]
134	0086	External pressure [sel. unit]	FLOAT	R	External pressure [sel. unit]
136	0088	External pressure [mbar]	FLOAT	R	External pressure [mbar]
138	008A	TMP actual rotation speed [Hz]	UINT16	R	TMP actual rotation speed [Hz]
139	008B	TMP power [W]	FLOAT	R	TMP power [W]
140	008C	TMP operation hours [h]	UINT32	R	TMP operation hours [h]
141	008D	Frequency converter operation hours [h]	UINT32	R	Frequency converter operation hours [h]

Command		Name	Data type	R/W	Meaning
dez	hex				
142	008E	Leak detector operation hours [h]	UINT32	R	Leak detector operation hours [h]
143	008F	TMP temperature bottom [deg. C]	FLOAT	R	TMP temperature bottom [deg. C]
144	0090	TMP temperature electronic [deg. C]	FLOAT	R	TMP temperature electronic [deg. C]
145	0091	TMP temperature bearing [deg. C]	FLOAT	R	TMP temperature bearing [deg. C]
146	0092	TMP temperature motor [deg. C]	FLOAT	R	TMP temperature motor [deg. C]
147	0093	Time since power on [min]	UINT32	R	Time since power on [min]
150	0096	TMP voltage [V]	FLOAT	R	TMP voltage as reported by TMP control-ler [V]
151	0097	TMP current [A]	FLOAT	R	TMP current as reported by TMP control-ler [A]
158	009E	TMP runup time [s]	UINT16	R	TMP runup time [s]
159	009F	Time in measure [s]	UINT16	R	Time in measure [s]
160	00A0	Time in evacuation [s]	UINT16	R	Time in evacuation [s]
161	00A1	Time in standby [s]	UINT16	R	Time in standby [s]

Command		Name	Data type	R/W	Meaning
dez	hex				
165	00A5	Electronic temperature [deg. C]	FLOAT	R	Electronic temperature [deg. C]
166	00A6	Preamplifier temperature [deg. C]	FLOAT	R	Preamplifier temperature [deg. C]
167	00A7	Anode voltage [V]	FLOAT	R	Anode voltage [V]
168	00A8	Cathode voltage [V]	FLOAT	R	Cathode voltage [V]
169	00A9	Suppressor voltage [V]	FLOAT	R	Suppressor voltage [V]
170	00AA	Anode-cathode voltage [V]	FLOAT	R	Anode-cathode voltage [V]
188	00BC	Maximum leak rate [sel. unit]	FLOAT	R	Maximum leak rate since last inquiry via interface [selected unit]
189	00BD	Maximum leak rate [mbar*l/s]	FLOAT	R	Maximum leak rate since last inquiry via interface [mbar*l/s]
202	00CA	Pre amplifier voltage [V]	FLOAT	R	Pre amplifier voltage [V]
212	00D4	24 V power out RC [V]	FLOAT	R	24 V power out RC [V]
213	00D5	24 V power out IO [V]	FLOAT	R	24 V power out IO [V]
221	00DD	Analog outputs [V]	FLOAT [2]	R	Analog outputs [V] Index 0: Channel 1 Index 1: Channel 2

Command		Name	Data type	R/W	Meaning
dez	hex				
222	00DE	Analog output configuration	UINT8[2]	R/W	Function of analog output Index 0: Channel 1 Index 1: Channel 2 see table / enumerations
223	00DF	Analog output leak rate scale (log. Only)	UINT8	R/W	Leak rate scaling of analog output in logarithmic mode see table / enumerations
224	00E0	Analog output upper exponent	SINT8	R/W	Upper limit for the analog out at the I/O modul. Value is exponent of the mbar*l/ s value. Example: -5 = 1E-5 mbar*l/ s
260	0104	Calibration status	UINT8	R	Status of calibration see table / enumerations
261	0105	PLC input state	UINT16	R	Get PLC input state see table / enumerations

Command		Name	Data type	R/W	Meaning
dez	hex				
262	0106	PLC output state	UINT16	R	Get PLC output state see table / enumera-tions
264	0108	Emission ac-tual status	UINT8	R	Emission ac-tual status 0 = OFF 1 = STANDBY 2 = ON
265	0109	Relais con-figuration	UINT8[2]	R/W	Relais con-figuration Index 0: Re-lais 1 Index 1: Relais 2 see table / enumera-tions
266	010A	TMP actual status	UINT8	R	TMP actual status 0 = OFF 1 = ON 2 = RUN-NING_UP 3 = RUN-NING_DOW N 4 = FAIL
275	0113	Calibration history	UINT8[*]	R	Calibration history To read send after the array in-dex 255 the UINT8 his-tory list in-dex (0...11).

Command		Name	Data type	R/W	Meaning
dez	hex				
					Without history list index you will get the last (newest) entry. see table / enumerations
280	0118	Used entries in cal history	UINT8	R	Used entries in cal history
281	0119	Used entries in error history	UINT8	R	Used entries in error history
282	011A	Used entries in TMP error history	UINT8	R	Used entries in TMP error history
287	011F	Error history	UINT8[*]	R	Error history To read send after the array index 255 the UINT8 history list index (0...11). Without history list index you will get the last (newest) entry. see table / enumerations
288	0120	TMP error history	CHAR[8]	R	TMP error history To read send after the array index 255 the

Command		Name	Data type	R/W	Meaning
dez	hex				
					UINT8 history list index: (0...9)see table / enumerations
290	0122	Number of actual error	UINT16	R	Error number of the actual error or warn-ing
297	0129	Present warnings	UINT8	R	Present warnings Each bit represents a warning see table / enumerations
299		HW-version	UINT8[4]	R	HW-version Index 1: IO board Index 2: display Index 3: backplane Index 4: MC68
300	012C	Device identification	UINT8[2]	R	Device identification Index 0, Manufacturer ID: 6 - KYKY Index 1, Device ID: 1 2 LX218, 3 LX218G

Command		Name	Data type	R/W	Meaning
dez	hex				
301	012D	Device name	CHAR[*]	R	Get device name as ASCII string, "LX218(G)"
310	0136	SW-version MC68	UINT8[3]	R	Software-version MC68 Index 0: Main version Index 1: Sub version Index 2: De-bug version
315	013B	SW-version TMP con-troller	CHAR[6]	R	SW version TMP con-troller (char-acter string from TMP controller)
317	013D	TMP con-troller name	CHAR[6]	R	TMP con-troller name (character string from TMP con-troller)
320	0140	CRC-code MC68	UINT16	R	Checksum MC68
321	0141	DIP switch MC68	UINT8	R	IP switch setting of the MC68: Bit7: S2, switch 4 Bit6: S2, switch 3 Bit5: S2, switch 2 Bit4: S2, switch 1

Command		Name	Data type	R/W	Meaning
dez	hex				
					Bit3..2: not used,always 0 Bit1: S1, switch 3 Bit0: S1, switch 2
385	0181	Setpoint [mbar*l/s]	FLOAT[3]	R/W	Setpoint [mbar*l/s] Index 0: Vacuum Index 1: Sniff Index 2: AutoTest
386	0182	Warning limit [%]	UNIT8[3]	R/W	Warning limit [%] Index 0: Vacuum Index 1: Sniff Index 2: AutoTest
390	0186	Test leak extern vacuum [mbar*l/s]	FLOAT[3]	R/W	Test leak extern vacuum [mbar*l/s] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium
392	0188	Test leak extern sniff [mbar*l/s]	FLOAT[3]	R/W	Test leak extern sniff [mbar*l/s] Index 0: Mass 2

Command		Name	Data type	R/W	Meaning
dez	hex				
					Index 1: Mass 3 Index 2: Mass 4 Helium
394	018A	Test leak intern [mbar*l/s]	FLOAT	R/W	Test leak intern in mbar*l/s
401	0191	Operation mode	UINT8	R/W	Operation mode 0 = Vacuum 1 = Sniff
402	0192	Leak rate filter	UINT8	R/W	Leak rate filter 0 = Dynamic 1 = Static 2 = Without
406	0196	Serial number leak detector	CHAR[10]	R	Serial number of leak detector
409	0199	Zero with Start time [s]	UINT16	R/W	Zero with Start time [s]
410	019A	Zero mode	UINT8	R/W	Zero mode 0 = Disabled 1 = Enabled 2 = with START
419	01A3	Calibration request enable	UINT8	R/W	Calibration request enable 0 = disabled 1 = enabled
420	01A4	Volume	UINT8	R/W	Volume (Volume >= Volume min)
421	01A5	01A5 Volume min	UINT8	R/W	01A5 Volume min

Command		Name	Data type	R/W	Meaning
dez	hex				
427	01AB	Calibration access	UINT8	R/W	Calibration access 0 = disabled 1 = enabled
428	01AC	Calibration unit	UINT8	R/W	Calibration unit 0 - mbarl/s 1 - Pam3/s 2 - Torrl/s 3 – sccm 4 – sccs 5 - Atm ccs (6 - ppm) (7 - g/a) (8 - oz/yr) 6...8 only in Sniff
430	01AE	Pressure unit	UINT8	R/W	Pressure unit 0 = mbar 1 = Pa 2 = atm 3 = Torr
431	01AF	Leak rate unit	UINT8	R/W	Leak rate unit 0 - mbarl/s 1 - Pam3/s 2 - Torrl/s 3 – sccm 4 – sccs 5 - Atm ccs (6 - ppm) (7 - g/a) (8 - oz/yr)

Command		Name	Data type	R/W	Meaning
dez	hex				
					6...8 only in Sniff
433	01B1	Anode set-point M2 [V]	UINT16	R/W	Anode volt-age setpoint for mass 2 (hy-drogen) in V
434	01B2	Anode set-point M3 [V]	UINT16	R/W	Anode volt-age setpoint for mass 3 in V
435	01B3	Anode set-point M4 [V]	UINT16	R/W	Anode volt-age setpoint for mass 4 (heli-um) in V
441	01B9	Calibration mode	UINT8	R/W	Calibration mode 0 = int. auto. 1 = int. man. 2 = extern
449	01C1	Valve state	UINT16	R	Valve state see table / enumera-tions
450	01C2	Date+Time [YMDhms]	UINT8[6]	R/W	Date and time use only with array-index 255 (all bytes) year (1..99), month, day, hour (0..23), min, sec
452	01C4	Min pres-sure Sniff [mbar]	FLOAT	R/W	Minimum pressure for sniff mode [mbar]

Command		Name	Data type	R/W	Meaning
dez	hex				
453	01C5	Max pressure Sniff [mbar]	FLOAT	R/W	Maximum pressure for sniff mode [mbar]
454	01C6	Lower leak rate limit	UINT8	R/W	Lower leak rate limit 0 = 1.0E-12 mbar*l/s 1 = 1.0E-11 mbar*l/s 2 = 1.0E-10 mbar*l/s 3 = 1.0E-9 mbar*l/s
502	01F6	Amplifier range	UINT8	R	Amplifier range 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm 4 = 13 MOhm (fixed) 5 = 470 MOhm (fixed) 6 = 15 GOhm (fixed) 7 = 500 GOhm (fixed)
504	01F8	500GOhm value	FLOAT	R/W	500GOhm value

Command		Name	Data type	R/W	Meaning
dez	hex				
506	01FA	Mass	UINT8	R/W	Mass 2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)
515	0203	Set desired leak rate	FLOAT	W	Set desired leak rate (KnL)
517	0205	Offset internal [A]	FLOAT[3]	R	Offset internal Index 0: mass 2 Index 1: mass 3 Index 2: mass 4
525	020D	Calibration factors	FLOAT[18]	R/W	Calibration factors see table / enumerations
529	0211	Warnings	UINT8	R/W	Warnings 0 = disabled 1 = enabled
530	0212	Cathode selection	UINT8	R/W	Cathode selection 1 = CAT 1 2 = CAT 2
540	021C	Pressure EVAC GROSS [mbar]	FLOAT	R/W	Pressure limit EVAC --> GROSS [mbar]
541	021D	Pressure GROSS FINE [mbar]	FLOAT	R/W	Pressure limit GROSS --> FINE [mbar]

Command		Name	Data type	R/W	Meaning
dez	hex				
543	021F	Pressure FINE UL-TRA [mbar]	FLOAT	R/W	Pressure limit FINE --> ULTRA [mbar]
548	0224	Background subtraction	UINT8	R/W	Background subtraction 0 = disabled 1 = enabled
550	0226	Vacuum ranges	UINT8[3]	R/W	Vacuum ranges Index 0: GROSS Index 1: FINE Index 2: UL-TRA
553	0229	Vent mode	UINT8	R/W	Vent mode 0 = Vent with Stop 1 = Vent manual 2 = No Vent
555	022B	Evacuation time [s]	UINT16	R/W	Evacuation time [s]
600	0258	Audio alarm type	UINT8	R/W	Audio alarm type 0 = Leak rate prop 1 = Trigger alarm 2 = Setpoint 3 = Pinpoint
602	025A	Audio alarm delay [s]	UINT16	R/W	Audio alarm delay
604	025C	Audio beep	UINT8	R/W	Audio beep 0 = disabled 1 = enabled

Command		Name	Data type	R/W	Meaning
dez	hex				
626	0272	Bypass evacuation	UINT8	R/W	Bypass option evacuation 0 = Fore pump only 1 = Both pumps 2 = External pump only
627	0273	Bypass measure	UINT8	R/W	Bypass option measure 0 = Fore pump only 1 = Both pumps
650	028A	Postamplifier range	UINT8	R	Postamplifier range 0 = 0.4 1 = 1.6 2 = 6.4 3 = 25.6 4 = 0.4 (FIXED) 5 = 1.6 (FIXED) 6 = 6.4 (FIXED) 7 = 25.6 (FIXED)
652	028C	Postamplifier voltage [V]	FLOAT	R	Postamplifier voltage [V]
1161	0489	Parameter reset	UINT8	W	Parameter reset:

Command		Name	Data type	R/W	Meaning
dez	hex				
					1 = Load factory set-tings 5 = Clear PINs 10 = Clear calibration history 11 = Clear error list 12 = Clear Maintenance list 13 = Clear Service list
1350	0546	Valve cycle counter	UINT32[6]	R	Valve cycle counter see table / enumera-tions
1360	0550	Maintenance device [h]	UINT32	R	Maintenance device [h]
1361	0551	Maintenance fore pump [h]	UINT32	R	Maintenance fore pump [h]
1362	0552	Maintenance TMP [h]	UINT32	R	Maintenance TMP [h]
1363	0553	Maintenance ion source [h]	UINT32	R	Maintenance ion source [h]
1399	0577	Group mea-sure [sel. unit]	UINT[12]	R	Measure-ment data [sel. Unit]☐ see table / enumera-tions
1400	0578	Group mea-sure	UNIT8[12]	R	Measure-ment data

Command		Name	Data type	R/W	Meaning
dez	hex				
					see table / enumerations
1567	061F	Offset current amplifier [A]	FLOAT	R	Offset current amplifier [A]
1568	0620	Unfiltered ion current [A]	FLOAT	R	Unfiltered ion current [A]
1573	0625	Filtered ion current [A]	FLOAT	R	Filtered ion current [A]
1854	073E	Gross leak limit [mbar*l/s]	FLOAT	R/W	Gross leak protection limit [mbar*l/s]
1855	073F	Gross leak protection	UINT8	R/W	Gross leak protection 0 = disabled 1 = enabled
2490	09BA	Internal pressure 1 [V]	FLOAT	R	Internal pressure 1 [V]
2491	09BB	Internal pressure 2 [V]	FLOAT	R	Internal pressure 2 [V]
2492	09BC	External pressure [V]	FLOAT	R	External pressure [V]
2501	09C5	Parameter set	UINT8	R/W	Parameter set 0 = load default 1, 2 = load 1, 2 4, 5 = save 1, 2
2591	0A1F	Control location	UINT8	R/W	Control location 0 = local

Command		Name	Data type	R/W	Meaning
dez	hex				
					1 = RS232 2 = PLC 3 = local / RS232 4 = all
2628	0A44	Pressure sensor offset [mV]	SINT16[2]	R/W	Pirani offset [mV] Index 0: Offset p1 Index 1: Offset p2
2637	0A4D	Type of ext. pressure sensor	UINT8	R	Type of external pressure sensor 0= no gauge 5 = PSG500
2640	0A50	Used entries in service history	UINT8	R	Used entries in service history
2641	0A51	Service history	UINT8[12]	R	Service history To read send after the array index 255 the UINT8 service list index (0...11). Without index you will get the last (new-est) entry. see table / enumerations

Command		Name	Data type	R/W	Meaning
dez	hex				
2642	0A52	Used entries in maintenance history	UINT8	R	Used entries in maintenance history
2643	0A53	Maintenance history	UINT8[12]	R	Maintenance history To read send after the array index 255 the UINT8 maintenance list index (0...11). Without index you will get the last (new-est) entry. see table / enumerations
2660	0A64	Maintenance activ	UINT8	R/W	Maintenance activ 0= no gauge 1= enabled

2.5 Enumerations

Interface protocol (command 26)

Value	Meaning
0	ASCII (RS232/RS485 only)
1	Diagnostics (RS232/RS485 only)
2	LD Protocol (both)
3	RC (RC only)

Analog output configuration (command 222)

Analog output configuration (command 222)

Value	Meaning
0	off
1	Pressure p2
2	Pressure p1
3	Leak rate mantissa
4	Leak rate exponent
5	Leak rate linear
6	Leak rate logarithmic
7	Pressure p(ext)

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

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	5 V / decade
5	10 V / decade

State calibration (command 260)

State calibration (command 260)

Value	Meaning
0	Inactive
1	Wait "Test leak connected"
2	Pump down
3	Wait "Test leak signal stable"
4	Autotune
5	Measure ULTRA
6	Measure FINE
7	Measure GROSS

Value	Meaning
8	Wait "Test leak closed" or "Background stable"
9	Background ULTRA
10	Background FINE
11	Background GROSS
12	Wait "Calibration result"

PLC input state (command 261)

PLC input state (command 261)

Value Index Bit	Meaning
0	Pin 6 Start
0x0001	Pin 7 Vent
0x0002	Pin 8 Zero
0x0004	Pin 9 Calibrate
0x0008	Pin 10 Para 2
0x0010	Pin 11 -
0x0020	Pin 12 -
0x0040	Pin 13 Stop
0x0080	Sniffer button
0x0100	-
0x0200	-
0x0400	-
0x0800	-
0x1000	-
0x2000	-
0x4000	-
0x8000	-

PLC output state (command 262)

Value Index Bit	Meaning
0	Pin 15 Ready
0x0001	Pin 16 Measure mode
0x0002	Pin 17 Leak

Value Index Bit	Meaning
0x0004	Pin 18 Error
0x0008	Pin 19 Calibrate Acknowledge
0x0010	Pin 20 -
0x0020	Pin 21 -
0x0040	Pin 22 No Leak
0x0080	Relay 1
0x0100	Relay 2
0x0200	-
0x0400	-
0x0800	-
0x1000	-
0x2000	-
0x4000	-
0x8000	-

Relais configuration (command 265)

Relais configuration (command 265)

Value	Meaning
0	Off
1	Start
2	Stop
3	Start/Stop
4	Ready
5	Setpoint
6	On
7	Warn limit LR
8	Bypass valve
9	Warning
10	Error
11	Warning/Error
12	Vented

TMP error history (command 288)

Answer	ListNo, code
Example	5 Err006

Present warnings (command 297)

Value Index Bit	Meaning
0x01	-
0x02	-
0x04	-
0x08	Warning maintenance
0x10	Warning calibration request
0x20	Warning capillary
0x40	Warning temperature electronic
0x80	Warning temperature preamplifier

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

Index	Meaning
0	V1
1	V2
2	V3
3	V4
4	V5
5	V6
6	-
7	-

Calibration factor (command 525)

Index	Meaning
0	ULTRA, Vacuum, Mass 2
1	ULTRA, Vacuum, Mass 3
2	ULTRA, Vacuum, Mass 4 (Helium)
3	ULTRA, Sniff, Mass 2
4	ULTRA, Sniff, Mass 3
5	ULTRA, Sniff, Mass 4 (Helium) (not used)
6	FINE, Vacuum, Mass 2

Index	Meaning
7	FINE, Vacuum, Mass 3
8	FINE, Vacuum, Mass 4 (Helium)
9	FINE, Sniff, Mass 2
10	FINE, Sniff, Mass 3
11	FINE, Sniff, Mass 4 (Helium)
12	GROSS, Vacuum, Mass 2
13	GROSS, Vacuum, Mass 3
14	GROSS, Vacuum, Mass 4 (Helium)
15	GROSS, Sniff, Mass 2
16	GROSS, Sniff, Mass 3
17	GROSS, Sniff, Mass 4 (Helium) (not used)

2.6 Group commands

Group calibration history (command 275, one entry)

Meaning	Data type	Offset
Year	UINT8	0
Month	UINT8	1
Day	UINT8	2
Hour	UINT8	3
Minute	UINT8	4
Second	UINT8	5
Calibration mode	UINT8	6
Filament	UINT8	7
Measure mode	UINT8	8
Mass	UINT8	9
Anode voltage	UINT16	10
Factor ULTRA	FLOAT	12
Factor FINE	FLOAT	16
Factor GROSS	FLOAT	20
Calibrated leak [mbar*l/s]	FLOAT	24
Ion current (leak opened) [A]	FLOAT	28
Ion current (leak closed) [A]	FLOAT	32

Group error history (command 287, one entry)

Meaning	Data type	Offset
Year	UINT8	0
Month	UINT8	1
Day	UINT8	2
Hour	UINT8	3
Minute	UINT8	4
Second	UINT8	5
Priority	UINT8	6
Number	UINT16	7
Value	UINT16	9

Group measure, selected unit (command 1399)

Meaning	Data type	Offset	Command dec
Leak rate [sel. unit]	0	FLOAT	128
Internal pressure 1 [sel. unit]	4	FLOAT	130
Internal pressure 2 [sel. unit]	8	FLOAT	132

Group measure (command 1400)

Meaning	Data type	Offset	Command dec
Leak rate [mbar*l/s]	0	FLOAT	129
Internal pressure 1 [mbar]	4	FLOAT	131
Internal pressure 2 [mbar]	8	FLOAT	133

Group service history (command 2641, one entry)

Group maintenace history (command 2643, one entry)

Meaning	Data type	Offset
Year	UINT8	0
Month	UINT8	1
Day	UINT8	2
Hour	UINT8	3
Minute	UINT8	4

Meaning	Data type	Offset
Second	UINT8	5
Operating hours	UINT32	6
Hours	UINT32	7
Component 0 = TMP 1 = Fore pump 2 = Ion source 3 = Device	UINT18	9

2.7 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.	Error numbers	
1	ERR_CRC	CRC-failure
2	ERR_LEN	Illegal telegram length
10	ERR_CMD_ILLEGAL	command doesn't exist
11	ERR_DATA_LENGTH	Data length is not correct for the command
12	ERR_NO_READ	Read not allowed
13	ERR_NO_WRITE	Write not allowed
14	ERR_ARRAY_INDEX	Array-Index out of range or missing
20	ERR_CONTROL	Control actually not allowed with this interface
21	ERR_PASSWORD	Password not OK

Error No.	Error numbers	
22	ERR_CMD_NOT_ALLOWED	Command actually not allowed (e.g. calibration during Run-Up)
30	ERR_DATA	Data not in range
31	ERR_NO_DATA	No data available

3 ASCII Protocol

3.1 Examples

Examples

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

3.2 Communication Parameters

Communication Parameters

Data format	
Baudrate	19200, 8 data bits, 1 stop bit, no parity

3.3 Command Format

Command Format

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

There is a short and an extended form of the command. Either the short or the extended command must be used, no other abbreviations are allowed. 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 3.7: "Error Messages”. 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 (4.5-^{7})	
	Format: [space] [sign] [ddd] [.] [e[sign]ddd] (d:digit)	

Notice:

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

Timing recommendations for the PC/PLC - Program:

Sample rate > 100 ms

Timeout between request to and answer from the 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.

3.4 Commands

Commands

Command	Meaning	Relates to LD cmd. no.	Read/Set
*CAL	Start calibration, acknowledge closed external test leak	4	W
*CLS	Clear Error	5	W
*CONFig:ALARMDelay	Alarm delay after evacuation [s]	602	R/W
*CONFig:AUDio	Audio alarm type (PIN, SET, TRIG, PROP)	600	R/W

Command	Meaning	Relates to LD cmd. no.	Read/Set
*CONFig:BEEP	Beep-sound (OFF, ON)	604	R/W
*CONFig:CALAccess	CAL access (OFF, ON)	427	R/W
*CONFig:CALleak:EXTSniff	External test leak in sniff mode	392	R/W
*CONFig:CALleak:EXTVac	External test leak in vacuum mode	390	R/W
*CONFig:CALleak:INT	Internal test leak	394	R/W
*CONFig:CALREQ	Calibration request (OFF,ON)	419	R/W
*CONFig:CAThode	Cathode (1,2)	530	R/W
*CONFig:CONTrol	location of control (LOCAL, RS232, PLC, LOCAL/ RS232, ALL)	2591	R/W
*CONFig:FILTER	Leak rate filter "DYNAMIC","STATIC"," WITHOUT"	402	R/W
*CONFig:LANGuage	Language (ENGlish, CHInese)	398	R/W
*CONFig:LCDAutorange	Display range auto / manual	---	R/W
*CONFig:LCDDECades	Number of display decades	---	R/W
*CONFig:LCDInvert	Invert display	---	R/W
*CONFig:LCDSCALELog	Display scale lin. / log.	---	R/W
*CONFig:LIMITLOW	Lower display limit	454	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

Command	Meaning	Relates to LD cmd. no.	Read/Set
*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:MINVOLume	Minimum audio volume	421	R/W
*CONFig:MODE	Mode (VAC, SNIFF)	401	R/W
*CONFig:PARTIALFlow:EVACuation	Configuration of partial flow pump for evacuating (Fore_PUMP, Fore_AND_Partial_flow_PUMP, Partial_flow_PUMP)	626	R/W
*CONFig:PARTIALFlow:MEASure	Configuration of partial flow pump for measuring mode (Fore_PUMP, Fore_AND_Partial_flow_PUMP)	627	R/W
*CONFig:PEVACgross	pressure limit EVAC -> GROSS in mbar	540	R/W
*CONFig:PFINEultra	pressure limit FINE -> ULTRA in mbar	543	R/W
*CONFig:PGROSSfine	pressure limit GROSS -> FINE in mbar	541	R/W
*CONFig:PLCOUTLINK	Configuration of Relais Output 1 (*CONFig:PLCOUTLINK:1) or 2 (*CONFig:PLCOUTLINK:2). The following settings are possible: "OFF", "START", "STOP", "START_STOP", "READY", "SET-	265	R/W

Command	Meaning	Relates to LD cmd. no.	Read/Set
	POINT", "ON", "WARN_LIMIT", "BYPASS", "WARNING", "ERROR", "WARNING_ERROR", "VENTED"		
*CONFig:PROTection:☐ CONTamination	Gross leak protection (ON,OFF)	1855	R/W
*CONFig:PROTection:CONTLimit	Gross leak protection limit	1854	R/W
*CONFig:PROTection:EVACtime	Maximum evacuation time (0 means infinite)	555	R/W
*CONFig:PROTection:PMAX	Maximum pressure in sniff	453	R/W
*CONFig:PROTection:PMIN	Minimum pressure in sniff	452	R/W
*CONFig:RECorder:LINK 1	Function at analog output channel 1 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, PEXT)	222	R/W
*CONFig:RECorder:LINK 2	Function at analog output channel 2 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, PEXT)	222	R/W
*CONFig:RECorder:SCALE	Analog leak rate scale	223	R/W
*CONFig:RECorder:UPPEREXP	Analog output upper exponent	224	R/W
*CONFig:RS232	RS232 protocol (ASCII, BINARY, LD)	26	R/W

Command	Meaning	Relates to LD cmd. no.	Read/Set
*CONFig:SETPoint	Leak rate setpoint in selected unit	385	R/W
*CONFig:SUP-PRession	Offset suppression (OFF, ON)	548	R/W
*CONFig:TIMEAXIS	Resolution of the time axis of Q(t) graph	---	R/W
*CONFig:UNIT:LR	Leak rate unit (mbar*l/s, Pa*m3/s, Torr*l/s, sccm, sccs, atm*cc/s, ppm, g/a, oz/yr)	431	R/W
*CON-Fig:UNIT:Pressure	Pressure unit (mbar, Pa, atm, Torr)	430	R/W
*CON-Fig:VACRANGE	Active vacuum ranges: GROSS, FINE and ULTRA as comma seper-ated list	550	R/W
*CONFig:VOLume	Volume	420	R/W
*CONFig:WARN-Limit	Warning limit	386	R/W
*CONFig:ZERO	Zero mode (OFF, ON, AT_START)	410	R/W
*FACtor:RESistor	Resistor factor 500G/15G	504	R/W
*FACtor:SNiff:M2	Calibration factor sniff mass 2	525	R/W
*FACtor:SNiff:M3	Calibration factor sniff mass 3	525	R/W
*FACtor:SNiff:M4	Calibration factor sniff mass 4	525	R/W
*FACtor:VAC-UUM_Fine:M2	Calibration factor vacuum FINE mass 2	525	R/W
*FACtor:VAC-UUM_Fine:M3	Calibration factor vacuum FINE mass 3	525	R/W

Command	Meaning	Relates to LD cmd. no.	Read/Set
*FACtor:VACUUM_Fine:M4	Calibration factor vacuum FINE mass 4	525	R/W
*FACtor:VACUUM_Gross:M2	Calibration factor vacuum GROSS mass 2	525	R/W
*FACtor:VACUUM_Gross:M3	Calibration factor vacuum GROSS mass 3	525	R/W
*FACtor:VACUUM_Gross:M4	Calibration factor vacuum GROSS mass 4	525	R/W
*FACtor:VACUUM_Ultra:M2	Calibration factor sniff mass 2	525	R/W
*FACtor:VACUUM_Ultra:M3	Calibration factor sniff mass 3	525	R/W
*FACtor:VACUUM_Ultra:M4	Calibration factor sniff mass 4	525	R/W
*HOUR:DATE	Date (DD,MM,YYYY)	450	R/W
*HOUR:DEVice	Operating hours of device	142	R
*HOUR:POWer	Time since power on [min]	147	R
*HOUR:RUNUP	Run up time [s]	158	R
*HOUR:SERVice:DEVICE	Opration hour timer reading at last service (complete leak detector) [h]	1360	R
*HOUR:SERVice:FOREPUMP	Opration hour timer reading at last fore pump service (complete leak detector) [h]	1361	R
*HOUR:SERVice:IONSOURCE	Opration hour timer reading at last ion source service (com-plete leak detector) [h]	1363	R

Command	Meaning	Relates to LD cmd. no.	Read/Set
*HOUR:SER-Vice:TURBO	Opration hour timer reading at last TMP service [h]	1362	R
*HOUR:TC	Operating hours frequency converter	141	R
*HOUR:TIME	Time (HH,MM)	450	R/W
*HOUR:TURBO	Operating hours of TMP	140	R
*IDN:CRC	Check sum of firmware	320	R
*IDN:DEVice	Name of instrument (always "LX218(G)")	301	R
*IDN:DIP1	MSB DipSwitch 1	321	R
*IDN:DIP2	MSB DipSwitch 2	321	R
*IDN:GBversion	Hardware identification control panel	299	R
*IDN:IOversion	Hardware identification IO panel	299	R
*IDN:IOversion	Hardware identification MC68	299	R
*IDN:SERial	Serial-number leak detector	406	R
*IDN:TCNAME	Name of TMP frequency converter	317	R
*IDN:TURBO	Software version TMP controller	315	R
*IDN:VDversion	Hardware identification mother board	299	R
*IDN:VERsion	Software version leak detector	310	R
*MEASure:DIGI-TALIN	State of the digital inputs 0x0001 Pin 6 Start 0x0002 Pin 7 Vent 0x0004 Pin 8 Zero 0x0008 Pin 9 Calibrate	261	R

Command	Meaning	Relates to LD cmd. no.	Read/Set
	0x0010 Pin 10 Para 2 0x0020 Pin 11 --- 0x0040 Pin 12 --- 0x0080 Pin 13 Stop 0x0100 Sniffer button		
*MEASure:PEXT	Pressure (external) in selected unit	134	R
*MEASure:PEXT:ATM	Pressure (external) in atm		R
*MEASure:PEXT:MBAR	Pressure (external) in mbar	136	R

*CAL	Start calibration, acknowledge closed external test leak	4	W
*CLS	Clear Error	5	W
*CONFig:ALARMDelay	Alarm delay after evacuation [s]	602	R/W
*CONFig:AUDio	Audio alarm type (PIN, SET, TRIG, PROP)	600	R/W
*CONFig:BEEP	Beep-sound (OFF, ON)	604	R/W
*CONFig:CALAccess	CAL access (OFF, ON)	427	R/W
*CONFig:CALleak:EXTSniff	External test leak in sniff mode	392	R/W
*CONFig:CALleak:EXTVac	External test leak in vacuum mode	390	R/W
*CONFig:CALleak:INT	Internal test leak	394	R/W
*CONFig:CALREQ	Calibration request (OFF,ON)	419	R/W
*CONFig:CAThode	Cathode (1,2)	530	R/W
*CONFig:CONTrol	location of control (LOCAL, RS232, PLC, LOCAL/RS232, ALL)	2591	R/W
*CONFig:FILTER	Leak rate filter "DYNAMIC","STATIC","WITHOUT"	402	R/W

*CONFig:LANGuage	Language (ENGlish, CHInese)	398	R/W
*CONFig:LCDAutorange	Display range auto / manual	---	R/W
*CONFig:LCDDECades	Number of display decades	---	R/W
*CONFig:LCDInvert	Invert display	---	R/W
*CONFig:LCDSCALELog	Display scale lin. / log.	---	R/W
*CONFig:LIMITLOW	Lower display limit	454	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:MINVOLume	Minimum audio volume	421	R/W
*CONFig:MODE	Mode (VAC, SNIFF)	401	R/W
*CONFig:PARTIALFlow:EVACuation	Configuration of partial flow pump for evacuating (Fore_PUMP, Fore_AND_Partial_flow_PUMP, Partial_flow_PUMP)	626	R/W
*CONFig:PARTIALFlow:MEASure	Configuration of partial flow pump for measuring mode (Fore_PUMP, Fore_AND_Partial_flow_PUMP)	627	R/W
*CONFig:PEVACgross	pressure limit EVAC -> GROSS in mbar	540	R/W
*CONFig:PFINEultra	pressure limit FINE -> ULTRA in mbar	543	R/W
*CONFig:PGROSSfine	pressure limit GROSS -> FINE in mbar	541	R/W
*CONFig:PLCOUTLINK	Configuration of Relais Output 1 (*CONFig:PLCOUTLINK:1) or 2 (*CONFig:PLCOUTLINK:2). The following settings are possible:	265	R/W

	"OFF", "START", "STOP", "START_STOP", "READY", "SETPOINT", "ON", "WARN_LIMIT", "BYPASS", "WARNING", "ERROR", "WARNING_ERROR", "VENTED"		
*CONFig:PROTection:☐ CONTamination	Gross leak protection (ON,OFF)	1855	R/W
*CONFig:PROTection:CONTLimit	Gross leak protection limit	1854	R/W
*CONFig:PROTection:EVACtime	Maximum evacuation time (0 means infinite)	555	R/W
*CONFig:PROTection:PMAX	Maximum pressure in sniff	453	R/W
*CONFig:PROTection:PMIN	Minimum pressure in sniff	452	R/W
*CONFig:RECorder:LINK1	Function at analog output channel 1 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, PEXT)	222	R/W
*CONFig:RECorder:LINK2	Function at analog output channel 2 (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, PEXT)	222	R/W
*CONFig:RECorder:SCALE	Analog leak rate scale	223	R/W
*CONFig:RECorder:UPPEREXP	Analog output upper exponent	224	R/W
*CONFig:RS232	RS232 protocol (ASCII, BINARY, LD)	26	R/W
*CONFig:SETPoint	Leak rate setpoint in selected unit	385	R/W
*CONFig:SUPPRession	Offset suppression (OFF, ON)	548	R/W
*CONFig:TIMEAXIS	Resolution of the time axis of Q(t) graph	---	R/W
*CONFig:UNIT:LR	Leak rate unit (mbar*l/s, Pa*m3/s, Torr*l/s, sccm, sccs, atm*cc/s, ppm, g/a, oz/yr)	431	R/W
*CONFig:UNIT:Pressure	Pressure unit (mbar, Pa, atm, Torr)	430	R/W

*CON-Fig:VACRANGE	Active vacuum ranges: GROSS, FINE and ULTRA as comma seperated list	550	R/W
*CONFig:VOLume	Volume	420	R/W
*CONFig:WARN-Limit	Warning limit	386	R/W
*CONFig:ZERO	Zero mode (OFF, ON, AT_START)	410	R/W
*FACtor:RESistor	Resistor factor 500G/15G	504	R/W
*FACtor:SNiff:M2	Calibration factor sniff mass 2	525	R/W
*FACtor:SNiff:M3	Calibration factor sniff mass 3	525	R/W
*FACtor:SNiff:M4	Calibration factor sniff mass 4	525	R/W
*FACtor:VAC-UUM_Fine:M2	Calibration factor vacuum FINE mass 2	525	R/W
*FACtor:VAC-UUM_Fine:M3	Calibration factor vacuum FINE mass 3	525	R/W
*FACtor:VAC-UUM_Fine:M4	Calibration factor vacuum FINE mass 4	525	R/W
*FACtor:VAC-UUM_Gross:M2	Calibration factor vacuum GROSS mass 2	525	R/W
*FACtor:VAC-UUM_Gross:M3	Calibration factor vacuum GROSS mass 3	525	R/W
*FACtor:VAC-UUM_Gross:M4	Calibration factor vacuum GROSS mass 4	525	R/W
*FACtor:VAC-UUM_Ultra:M2	Calibration factor sniff mass 2	525	R/W
*FACtor:VAC-UUM_Ultra:M3	Calibration factor sniff mass 3	525	R/W
*FACtor:VAC-UUM_Ultra:M4	Calibration factor sniff mass 4	525	R/W
*HOUR:DATE	Date (DD,MM,YYYY)	450	R/W
*HOUR:DEVice	Operating hours of device	142	R
*HOUR:POWer	Time since power on [min]	147	R
*HOUR:RUNUP	Run up time [s]	158	R
*HOUR:SER-Vice:DEVICE	Opration hour timer reading at last ser-vice (complete leak de-tector) [h]	1360	R
*HOUR:SER-Vice:FOREPUMP	Opration hour timer reading at last fore pump service (com-plete leak detector) [h]	1361	R
*HOUR:SER-Vice:IONSOURCE	Opration hour timer reading at last ion source service (com-plete leak detector) [h]	1363	R

*HOUR:SER-Vice:TURBO	Opration hour timer reading at last TMP service [h]	1362	R
*HOUR:TC	Operating hours frequency converter	141	R
*HOUR:TIME	Time (HH,MM)	450	R/W
*HOUR:TURBO	Operating hours of TMP	140	R
*IDN:CRC	Check sum of firmware	320	R
*IDN:DEVice	Name of instrument (always "LX218(G)")	301	R
*IDN:DIP1	MSB DipSwitch 1	321	R
*IDN:DIP2	MSB DipSwitch 2	321	R
*IDN:GBversion	Hardware identification control panel	299	R
*IDN:IOversion	Hardware identification IO panel	299	R
*IDN:IOversion	Hardware identification MC68	299	R
*IDN:SERial	Serial-number leak detector	406	R
*IDN:TCNAME	Name of TMP frequency converter	317	R
*IDN:TURBO	Software version TMP controller	315	R
*IDN:VDversion	Hardware identification mother board	299	R
*IDN:VERsion	Software version leak detector	310	R
*MEASure:DIGI-TALIN	State of the digital inputs 0x0001 Pin 6 Start 0x0002 Pin 7 Vent 0x0004 Pin 8 Zero 0x0008 Pin 9 Calibrate 0x0010 Pin 10 Para 2 0x0020 Pin 11 --- 0x0040 Pin 12 --- 0x0080 Pin 13 Stop 0x0100 Sniffer button	261	R
*MEASure:PEXT	Pressure (external) in selected unit	134	R
*MEA-Sure:PEXT:ATM	Pressure (external) in atm		R
*MEA-Sure:PEXT:MBAR	Pressure (external) in mbar	136	R
*MEA-Sure:PEXT:PA	Pressure (external) in Pa		R
*MEA-Sure:PEXT:TORR	Pressure (external) in Torr		R
*MEASure:IFilter	Filtered ion current [A]	1573	R

*MEASure:IMeas	Unfiltered ion current [A]	1568	R
*MEASure:LR-MAX	Maximum leak rate since last inquiry via interface in selected unit	---	R
*MEASure:MIAKP	Anode-/cathode potential [V]	170	R
*MEASure:MIAP	Anode potential [V]	167	R
*MEASure:MIKP	Cathode potential [V]	168	R
*MEASure:MISP	Suppressor potential [V]	169	R
*MEASure:OFFset	Offset current [A]	1567	R
*MEASure:P1	p1 pressure (fore line) in selected unit	130	R
*MEA-Sure:P1:ATM	p1 pressure (fore line) in atm		R
*MEA-Sure:P1:MBAR	p1 pressure (fore line) in mbar	131	R
*MEASure:P1:PA	p1 pressure (fore line) in Pa		R
*MEA-Sure:P1:TORR	p1 pressure (fore line) in Torr		R
*MEASure:P2	p2 pressure (inlet) in selected unit	132	R
*MEA-Sure:P2:ATM	p2 pressure (inlet) in atm		R
*MEA-Sure:P2:MBAR	p2 pressure (inlet) in mbar	133	R
*MEASure:P2:PA	p1 pressure (inlet) in Pa		R
*MEA-Sure:P2:TORR	p2 pressure (inlet) in Torr		R
*MEASure:REC0	Outpot voltage recorder channel 1	221	R
*MEASure:REC1	Outpot voltage recorder channel 2	221	R
*MEA-Sure:SAVEDOFF-set:M2	Saved leak rate offset for mass 2	517	R
*MEA-Sure:SAVEDOFF-set:M3	Saved leak rate offset for mass 3	517	R
*MEA-Sure:SAVEDOFF-set:M4	Saved leak rate offset for mass 4	517	R
*MEASure:TEM-Peratur:Amplifier	Preamplifier temperature [°C]	166	R
*MEASure:TEM-Peratur:Electronic	Electronic temperature [°C]	165	R

*MEASure:TEM-Peratur:TCBear-ing	TMP temperature bearing [°C]	145	R
*MEASure:TEM-Peratur:TCElec-tronic	TMP electronic temperature [°C]	144	R
*MEASure:TEM-Peratur:TCMotor	TMP motor temperature [°C]	146	R
*MEASure:TEM-Peratur:TCPump	TMP temperature bottom [°C]	143	R
*MEA-Sure:TURBO:Cur-rent	TMP current [A]	151	R
*MEA-Sure:TURBO:Fre-quency	TMP frequency [Hz]	138	R
*MEA-Sure:TURBO:Pow er	TMP power [W]	139	R
*MEA-Sure:TURBO:Volt-age	TMP voltage[V]	150	R
*MEASure:UFB	Remote control voltage [V]	212	R
*MEASure:UNV	Amplifier voltage [V]	652	R
*MEASure:UOUT	Voltage extern [V]	213	R
*MEASure:UVV	Preamplifier voltage [V]	202	R
*READ	Leak rate in selected unit	128	R
*READ:ATM*cc/s	Leak rate in Atm*cc/s		R
*READ:G/a	leak rate in g/a (only in sniff)		R
*READ:MBAR*l/s	Leak rate in mbar*l/s	129	R
*READ:OZ/yr	Leak rate in oz/yr (only vaild in sniff)		R
*READ:PA*m3/s	Leak rate in $Pa*m^3/s$		R
*READ:PPM	Leak rate in ppm (only vaild in sniff)		R
*READ:TORR*l/s	Leak rate in Torr*l/s		R
*STArt	Start (switch from Standby to Measure)	1	W
*STATus	Status of leak detector (INIT, ACCL, STBY, VENT, WAIT_EVAC, EVAC, MEAS, CAL, ERROR)	Status word	R
*STATus:CAL	Calibration status:	260	R

	"IDLE", "WAIT", "EVAC", "WAIT_TL_STABLE", "TUNE", "TL_OPEN_ULTRA", "TL_OPEN_FINE", "TL_OPEN_GROSS", "WAIT_CLOSE", "TL_CLOSE_ULTRA", "TL_CLOSE_FINE", "TL_CLOSE_GROSS", "WAIT_RESULT"		
*STATus:CALHist	Calibration history 1 to 12 (date, time, type of calibration, mode, calibration factors)	275	R
*STATus:CALMode	Kind of calibration (AUTO, MANUAL, EXTERNAL)	---	R
*STATus:ERRHist	Error history *STATus:ERRHist Actual entry *STATus:ERRHist:1 Entry 1 (newest) *STATus:ERRHist:2 Entry 2 ... *STATus:ERRHist: 2 Entry 2 (oldest)	287	R
*STATus:ERRor	Current number of error / warning („NO ERROR/WARNING“ if no error / warning)	290	R
*STATus:MAINTenanceHist	Maintenance history 1 to 12	2643	R
*STATus:PREAMPRESistor	Currently used resistance of pre-amplifier (13M, 470M, 15G, 500G, 13M_FIXED, 470M_FIXED, 15G_FIXED,500G_FIXED)	502	R
*STATus:RANGE	Measuring range (GROSS, FINE, ULTRA)	Status word	R
*STATus:SECINMEAS	Time since change of measuring mode [s]	159	R
*STATus:SERviceHist	Service history 1 to 12	2641	R
*STATus:ZERO	Zero (ON, OFF)	6	R
*STOp	Stop (switch from Measure to Standby)	2	W
*VENt	Vent inlet port	3	W
*ZERO	Switch zero on	6	W
*ZERO:OFF	Switch zero off	6	W
*ZERO:ON	Switch zero on	6	W

3.5 External Calibration Sequence

External Calibration Sequence

1. Open test leak
2. Start calibration: *CAL
3. Wait until *STATUS:CAL? answers "WAIT_TL_STABLE"
4. Send *CAL if signal is stable
5. Wait until *STATUS:CAL? answers "WAIT_CLOSE"
6. Close test leak
7. Send *CAL
8. Wait until *STATUS:CAL? answers "WAIT_RESULT"
9. Send *CAL to accept new calibration factors

3.6 Internal Calibration Sequence

Internal Calibration Sequence

1. Start caribration: *CAL
2. Wait until *STATUS:CAL? answers "WAIT_RESULT"
3. Send *CAL to accept new calibration factors

3.7 Error Messages

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

Message	Meaning
E10	command invalid
E11	query not allowed
E12	only query allowed
E13	not yet implemented

4 Trouble Shooting

4.1 Serial communication via RS232 (common)

Serial communication via RS232

Error	Possible Reason	Solution
No characters are received via the interface/the leak detector does not answer	Wrong cable	Please use a 1:1 cable, (NO null-modem cable, also called cross-over cable!)
	Problems with flow control	Deactivate flow control in PC/PLC or use cable according to the wiring diagram in Section 2
	Wrong COM-Port used at PC	Select correct COM-Port
No characters are received via the interface/the leak detector does not answer	Wrong interface parameters (Baud rate, Data bits, Parity, Stop bits)	Check if interface parameters (Baud rate, number of data bits, parity bit and number of stop bits in the leak detector and PC/PLC match)
	Wrong protocol selected in the leak detector	Select correct protocol in the leak detector
	PC uses an USB-RS232 converter	In general the device will also work with an USBRS232- converter. However, these often cause multiple difficult to track problems (driver, flow control.) Please test your PC program on a “real” RS232 interface first preferably. Especially with USB-RS232- converters it is often helpful to use a cable according to the wiring diagram in chapter 4 of the device documentation.

Error	Possible Reason	Solution
	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 device and PC/PLC match)
	Wrong protocol selected in the leak detector	Select correct protocol in the leak detector

4.2 LD Protocol Specific

LD Protocol Specific

Error	Possible Reason	Solution
Device 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
Device replys with CRC error (error code 1)	Wrong CRC calculation	Check you CRC code calculation.

4.3 ASCII Protocol Specific

ASCII Protocol Specific

Error	Possible Reason	Solution
Device 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

LINXON

info@linxon.net
www.linxon.net