

# PHOENIX L300i

## Leak detector

Interface description 10218\_002\_004

SB 300295109\_002\_A2

Cat.-Nr.

250000V01

250001V01

250002V01

251000V01

251001V01

251100V01

251101V01



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# Interface description

## 1 Serial Interface Protocols

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

- ASCII Protocol (Default)
- LD Protocol
- L200 format
- L200 LeakWare
- Diagnostics Protocol

The ASCII protocol is enabled by default.

### 1.1 Comparison between ASCII- and LD protocol

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

#### ASCII protocol:

Advantages:

- human readable
- easy to use with simple terminal program

Disadvantages:

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

#### LD protocol:

Advantages:

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

Disadvantages:

- Not human readable
- Not useable with simple terminal program

## 2 ASCII Protocol

### 2.1 Communication Parameters

#### Data format

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

### 2.2 Preface

The RS232 journal uses an ASCII format: so every leak detector can be controlled with a simple terminal program.

Choose the interface journal „ASCII“ to approach the leak detector with the computer via RS232 interface.

# Interface description

In case the leak detector shall also be controlled via computer (START, STOP, ZERO, etc.), affix the location of control at the leak detector to „All“, „RS232“ or „Local and RS232“.

**The command list in this interface description is valid from software version 3.0. Older software versions may not contain all functions of the command list.**

## 2.3 Interface connecting cable

The interface (RS232) is wired as data communication equipment (DCE). The connection is made via a 9-way sub-D socket at the leak detector. The signals are assigned as follows:

Pin	Name	Signal
2	RXD	Receive data (PHOENIX L300i --> PC)
3	TXD	Transmit data (PC --> PHOENIX L300i)
5	GND	Reference ground

The other pins are not used.

The levels on the RS 232 interface are defined as follows:

Level	Low (L)	High (H)
Voltage range	-3V ... - 25V	3V ... 25V
Logic state	logical 1	logical 0
Level designation	Mark	Space

A standard RS232 cable can be used (straight-through connecting cable, RxD and TxD not crossed). The RS232 hardware handshake must be switched off (in RS232 control program written by the user).

## 2.4 General information

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 „ok“ or „EXX“ (in case of an error). For a list of all error message see section 4.1.3. The transmission can be cancelled with ESC (ASCII code 27dec), ^C (ASCII code 3dec) or ^X (ASCII code 24dec).

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) 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] [.] [ddd] [e[sign]ddd] (d: digit)

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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.

Commands in brackets - as in \*status[:CAL] - are optional commands and do not necessarily need to be transmitted.

Timing recommendations:

Sample rate >100 ms

Timeout between request and answer from PHOENIX L300i: 1500 ms

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

## 2.5 Error messages

0	ERR_OK	command completed
1	ERR_CMD_START	wrong command start (no "**")
2	ERR_ERR_BLANK	illegal blank
3	ERR_CMD_WORD_1	command word 1 illegal
4	ERR_CMD_WORD_2	command word 2 illegal
5	ERR_CMD_WORD_3	command word 3 illegal
6	ERR_DISABLED	control by RS232 not enabled
7	ERR_ARGUMENT	argument faulty
8	ERR_NO_DATA	no data available
9	ERR_OVERFLOW	buffer overflow
10	ERR_INVALID	command invalid
11	ERR_NO_QUERY	query not allowed
12	ERR_QUERY	only query allowed
13	ERR_NOT_IMPLEMENTED	not yet implemented

## 2.6 Examples

PC to PHOENIX L300i	PHOENIX L300i to PC	meaning
*stat? (CR)	MEAS (CR)	mode
*status? (CR)	MEAS (CR)	mode
*read? (CR)	2.876E-7 (CR)	leak rate according to selected 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)	request value trigger 1
*conf:trig1 2.0E-9 (CR)	OK (CR)	set value trigger 1
*config:vacrange? (CR)	FINE_ONLY (CR)	status vacuum range
*config:vacrange gross_only (CR)	GROSS_ONLY (CR)	Setting gross only mode

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## 2.7 Command list

*CLS			clear Error
*IDN			identification
	:CRC		check sum
	:DEvice		name of instrument (PHOENIX L300i, PHOENIX L300i300 DRY PHOENIX L300i MODUL )
	:VERsion		software version
	:SERial		serial-number PHOENIX L300i
	:TCSERIAL		serial-number frequency converter
	:TURBO		software version of the TMP
	:MC68		hardware identification MC68
	:IOversion		hardware identification IO-board
	:GBversion		hardware identification control panel
	:VDversion		hardware identification mother board
	:DIP1		MC68 DipSwitch 1
	:DIP2		MC68 DipSwitch 2
*STATus			Device state: INIT (initialisation), ACCL (acceleration), STBY (standby), VENT (vented), EVAC (evacuation), MEAS (measuring), CAL (calibration), ERROR
	[:CAL]		mode calibration: EVAC, OPEN, TUNE, TUNE_RES, CLOSE, STABLE_CLOSE, WAIT_OK
	[:CALHist 1] [:CALHist 1] ... [:CALHist 12]		Calibration history starting from 1 to 12 (Date, Time, Cal.-type, Mode, Cal.-factor)
	[:CALMode]		kind of calibration, INT_AUTO, EXT
	[:ERRor]		actual error number
	[:ERRorHist 1] [:ERRorHist 2] ... [:ERRorHist 12]		Error history starting from 1 to 12
	[:ZERO]		zero
	[:TURBO]		Device state TMP
	[:RANGE]		measuring mode, (GROSS, FINE, PRECISION, PART1, PART2, PART3)
	[:PREAMPresistor]		Preamplifier resistor (13M, 470M, 15G, 500G, 13M_FIXED, 470M_Fixed, 15G_Fixed, 500G_Fixed)
	[:SECINmeas]		Time in measurement mode [s]
	[:PURGe]		Purge status: ON, OFF
*READ			Actual leak rate [selected unit]
	[:ATM*CC/S]		Actual leak rate [Atm*cc/s]
	[:G/A]		Actual leak rate [g/yr]

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	[:MBAR*L/S]		Actual leak rate [mbar*l/s]
	[:OZ/YR]		Actual leak rate [oz/yr]
	[:PA*M3/S]		Actual leak rate [Pa*m3/s]
	[:PPM]		Actual leak rate [ppm]
	[:TORR*L/S]		Actual leak rate [Torr*l/s]
*STArt			start
*STOp			stop
*VENt			vent
*PURGE		[:OFF]	Purge
*CAL			start calibration / proceed
*ZERO			zero on
	[:OFF]		zero off
*MEASure			
	:P1		inlet pressure [selected unit]
		[:ATM]	inlet pressure [atm]
		[:MBAR]	inlet pressure [mbar]
		[:PA]	inlet pressure [Pa]
		[:TORR]	inlet pressure [torr]
	:P2		foreline pressure [selected unit]
		[:ATM]	foreline pressure [atm]
		[:MBAR]	foreline pressure [mbar]
		[:PA]	foreline pressure [Pa]
		[:TORR]	foreline pressure [torr]
	:OFFset		offset current [A]
	:IMess		current raw values [A]
	:IFilter		current filtered [A]
	:UNV		amplifier voltage [V]
	:UVV		preamplifier voltage [V]
	:MIAP		anode potential [V]
	:MIKP		cathode potential [V]
	:MISP		suppressor potential [V]
	:MIAKP		anod-/cathode potential [V]
	:VALVE		valve voltage [V]
	:U24EXT		external voltage [V]
	:U24FB		voltage remote control [V]
	:DIGItalin		Digital in
	:TEMPeratur		
		:Amplifier	preamplifier temperature
		:Electronic	electronic temperature
	:TURBO		
		:Frequency	TMP frequency [Hz]
		:Voltage	TMP voltage [V]
		:Current	TMP current [A]
		:Power	TMP power [W]

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*CONFig			
	:AUDio		audio alarm type (PIN, SET, TRIG, PROP)
	:BACKGround		background display (on, off)
	:BEEP		beep-sound (on, off)
	:CALAccess		CAL access (on, off)
	:CALleak		
		:INT	leak rate internal test leak
		:EXTVAC	leak rate external test leak in vacuum mode
		:EXTSNIFF	leak rate external test leak in sniffer mode
	:CALREQ		calibration request (on, off)
	:CATHode		cathode (1, 2)
	:CONTRol		control location (LOCAL, RS232, PLC, LOCAL/RS232, LOCAL/PLC, ALL)
	:TRIGger1		trigger 1
	:TRIGger2		trigger 2
	:TRIGger3		trigger 3
	:LRFilter		leak rate filter type, (AUTO, FIXED)
	:LANGuage		language (ENGLISH, Deutsch, FRANCAIS, ITALIANO, POLSKI, ESPANOL, RUSSIAN, KATAKANA, CHINESE)
	:MASS		mass (2,3,4)
	:MFAE:		anode potential reference [V]
		:M2	anode potential mass 2 [V]
		:M3	anode potential mass 3 [V]
		:M4	anode potential mass 4 [V]
	:MODE		mode (VACUUM, SNIFF)
		:PEVACgross	pressure limit EVAC -> GROSS
		:PGROSSfine	pressure limit GROSS -> FINE
	:PROTection		protecting functions
		:CONTami-nation	contamination protect
		:CONTLimit	contamination limit
		:EVACtime	maximum evacuation time (0 – infinite)
		:EVAC2time	maximum evacuation time until 100 mbar (0 - infinite)
		:PMAX	maximum pressure in sniff
		:PMIN	minimum pressure in sniff
	:UNIT		
		:LR	leak rate unit (ATM*CC/S, G/A, MBAR*L/S, OZ/YR, PA*M3/S, PPM, TORR*L/S, SFT3/YR)
		:Pressure	pressure unit (ATM, MBAR, PA, TORR)
	:MINVOLume		minimum volume
	:PLCINlink		
		:1_1	Digital in control pin 1
		:1_2	Digital in control pin 2



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		:1_3	Digital in control pin 3
		:2_1	Digital in control 2 pin 1
		:2_2	Digital in control 2 pin 2
		:2_3	Digital in control 2 pin 3
	:PLCOUTlink		
		:5_6_7	Digital out control pin 5,6&7
		:8_9_10	Digital out control pin 8,9&10
		:11_12_13	Digital out control pin 11,12&13
		:14_15_16	Digital out control 2 pin 14,15&16
	:PURGe		purge/gas ballast (on, off)
	:SAMPLerate		sample rate of digital inputs [s]
	:SUPPReasion		background suppression (OFF, INTERN, INLET)
	:VACRANGE		vacuum range (NORMAL, FINE_ONLY, GROSS_ONLY, GROSS_ONLY_920Hz, PARTIAL_FLOW, PRECISION)
	:VOLume		volume
	:VENTdelay		vent delay (0, 1, 1.5, 2, NO)
	:ZERO		zero (OFF, ON, FINE)
	:RS232		mode (ASCII, binary)
*HOUR			
	:DATE		actual date
	:DEvice		operating hours PHOENIX L300i [h]
	:SERvice		
		:FORE	service foreline pump [h]
		:FILTER	service filter [h]
	:TIME		actual time
	:TURBO		operating hours TMP
	:RUNup		Run-up time
	:POWer		Time since power on [min]
*FACTOR			
	:CORrection		correction factor
	:FIGR		factor fine/gross
	:FREQ		factor 50/60 Hz
	:MACHine		machine factor
	:RESistor		factor resistance 500G/15G
	:SNIFf		actual calibration factor sniff
		:M2	calibration factor sniff mass 2
		:M3	calibration factor sniff mass 3
		:M4	calibration factor sniff mass 4
	:VACuum		actual calibration factor vacuum
		:M2	calibration factor vacuum mass 2
		:M3	calibration factor vacuum mass 3
		:M4	calibration factor vacuum mass 4
	:FI920		Factor Fine 920Hz / 1200Hz
	:GR920		Factor Fine 920Hz / 1200Hz

# Interface description

## **2.8 Calibration via RS232**

Two different kinds of calibration can be called via „\*CAL“:

### **2.8.1 Internal Automatic Calibration**

When the leak detector is in STAND-BY mode the command „\*CAL“ evokes an internal automatic calibration. The process is completely automatic. Via „\*STATUS?“ the computer can realise if the calibration routine is finished.

### **2.8.2 External Calibration**

When the leak detector is in measurement mode the command „\*CAL“ evokes a calibration routine for external calibration. Before starting the external calibrated leak has to be opened and the leak rate signal has to be stable. Via the command „\*STATUS:CAL?“ the computer can detect when the external calibrated leak has to be closed

When the external calibrated leak is closed and the leak rate signal is stable the computer has to advise the leak detector via a second command „\*CAL“. Via the command „\*STATUS?“ the computer can recognize when the calibration routine has finished.

# Interface description

## 2.9 Trouble Shooting

### 2.9.1 Common

Error	Possible Reason	Solution
No characters are received via the interface / the PHOENIX L300i 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
	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 PHOENIX L300i and PC / PLC match)
	Wrong protocol selected in the PHOENIX L300i	Select correct protocol in the PHOENIX L300i
	PC uses an USB-RS232 converter	In general the PHOENIX L300i 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 standard cable.
	Serial interface of PC is (still) occupied with a different program	Check if other programs (e.g. a synchronisation software for your hand-held computer) 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 PHOENIX L300i 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 PHOENIX L300i and PC / PLC match)
	Wrong protocol selected in the PHOENIX L300i	Select correct protocol in the PHOENIX L300i

# Interface description

## 2.9.2 ASCII Protocol

PHOENIX L300i does not reply / PHOENIX L300i 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)
PHOENIX L300i replies with „E06“	Control via RS232 not enabled in the PHOENIX L300i	Enable control via RS232 (see submenu CONTROL LOCATION)
PHOENIX L300i replies with error message to the first command only, following commands are interpreted correctly	Receiving buffer of the PHOENIX L300i was not empty before sending the first command (e.g. by plugging in the RS232 cable during operation)	In the ASCII protocol the PHOENIX L300i 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

# Interface description

## 3 LD-Protocol

### 3.1 Communication Parameters

#### Data format

Baudrate 38400, 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 (3.3)
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 (3.3)
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 source code)

# Interface description

## Cmd H/L: Command: Command-specifier

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

### Command name in plain text

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

### Command info

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

### Data types

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

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

### Arrays

# Interface description

- 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.

## 3.3 Commands

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
0	0000	NOP	NO_DATA	R/W		No operation, replies without data
1	0001	Start	NO_DATA	W		Switch to measure
2	0002	Stop	NO_DATA	W		Switch to standby
3	0003	Vent	NO_DATA	W		Switch to vent
4	0004	Calibration	NO_DATA	W		Start, acknowledge calibration
5	0005	Clear error	NO_DATA	W		Clear Error or Warning
6	0006	Zero	UINT8	R/W		0 = Zero "Off" 1 = Zero "On" / "Update" without data = toggle Zero state
9	0009	Emission nominal status	UINT8	R/W		Emission nominal status 0 = OFF 1 = STANDBY 2 = ON
10	000A	TMP nominal status	UINT8	R/W		TMP nominal status 0 = OFF 1 = ON 5 = RESET
14	000E	Backing pump nominal status	UINT8	R/W		Backing pump nominal status 0 = OFF 1 = ON
15	000F	Gasballast	UINT8	R/W		Purge/gasballast 0 = OFF 1 = ON not for L300i DRY

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Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
17	0011	Calculate back-ground	UINT8	R/W		Calculate inlet area background not for L300i DRY
26	001A	Interface protocol	UINT8[2]	R/W	REMOTE 1/2: 4, 4, 5 SERIAL: 0, 0, 5	Interface protocol Index 0: REMOTE 1/2 Index 1: SERIAL see table / enumerations
27	001B	Used interface	UINT8	R		Used interface 0 = REMOTE 1/2 1 = SERIAL
128	0080	Leak rate [sel. unit]	FLOAT	R		Leak rate [sel. unit]
129	0081	Leak rate [mbar*l/s]	FLOAT	R	1.0E-12, 1.0E-12, 1.0E5	Leak rate [mbar*l/s]
130	0082	Internal pressure 1 [sel. unit]	FLOAT	R		Internal pressure 1 [sel. unit]
131	0083	Internal pressure 1 [mbar]	FLOAT	R	0, 0, 1000	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	0, 0, 1000	Internal pressure 2 [mbar]
138	008A	TMP actual rotation speed [Hz]	UINT16	R	0, 1200, 1500	TMP actual rotation speed [Hz]
139	008B	TMP power [W]	FLOAT	R	0, 0, 190	TMP power [W]
141	008D	Frequency converter operation hours [h]	UINT32	R		Frequency converter operation hours [h]
142	008E	Leak detector operation hours [h]	UINT32	R		Leak detector operation hours [h]
144	0090	TMP temperature electronic [deg. C]	FLOAT	R	-10, 0, 150	TMP temperature electronic [deg. C]
145	0091	TMP temperature bearing [deg. C]	FLOAT	R	-10, 0, 150	TMP temperature bearing [deg. C]
146	0092	TMP temperature motor [deg. C]	FLOAT	R	-10, 0, 150	TMP temperature motor [deg. C]



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Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
147	0093	Time since power on [min]	UINT32	R		Time since power on [min]
150	0096	TMP voltage [V]	FLOAT	R	0, 0, 24	TMP voltage [V]
151	0097	TMP current [A]	FLOAT	R	0, 0, 15	TMP current [A]
158	009E	Runup time [s]	UINT16	R	0, 0, 300	Runup time [s]
159	009F	Time in measure [s]	UINT16	R	0, 0, 60000	Time in measure [s]
165	00A5	Electronic temperature [deg. C]	FLOAT	R	-10, 0, 100	Electronic temperature [deg. C]
166	00A6	Preamplifier temperature [deg. C]	FLOAT	R	-10, 0, 100	Preamplifier temperature [deg. C]
167	00A7	Anode voltage [V]	FLOAT	R	0, 0, 8192	Anode voltage [V]
168	00A8	Cathode voltage [V]	FLOAT	R	0, 0, 8192	Cathode voltage [V]
169	00A9	Suppressor voltage [V]	FLOAT	R	0, 0, 8192	Suppressor voltage [V]
170	00AA	Anode-cathode voltage [V]	FLOAT	R	0, 0, 8192	Anode-cathode voltage [V]
202	00CA	Pre amplifier voltage [V]	FLOAT	R	-10.5, 0, 10.5	Pre amplifier voltage [V]
204	00CC	Pre amplifier voltage mod [mV]	FLOAT	R	0, 0, 2000	Pre amplifier voltage mod [mV]
208	00D0	24 V supply valve [V]	FLOAT	R	0, 0, 54	24 V supply valve [V]
212	00D4	24 V power out RC [V]	FLOAT	R	0, 0, 54	24 V power out RC [V]
213	00D5	24 V power out IO [V]	FLOAT	R	0, 0, 54	24 V power out IO [V]
221	00DD	Analog outputs [V]	FLOAT[2]	R	0, 10.237	Analog outputs [V] Index 0: Channel 1 Index 1: Channel 2
222	00DE	Analog output configuration	UINT8[2]	R/W	Index 0: 0, 5, 8 Index 1: 0, 6, 8	Analog output configuration Index 0: Channel 1 Index 1: Channel 2 see table / enumerations

# Interface description

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
223	00DF	Analog output leak rate scale (log. only)	UINT8	R/W	0, 1, 5	Leak rate scaling of analog output in logarithmic mode see table / enumerations
224	00E0	Analog output upper exponent	SINT8	R/W	-12, -5, 7	Upper limit for the analog out at the I/O modul. Value is exponent of the mbar*/s value. Example: -5 = 1E-5 mbar*/s
228	00E4	Automatic purge	UINT8	R/W	0, 1, 1	Automatic purge L300i MODUL only
260	0104	Calibration status	UINT8[3]	R		Calibration status Index 0: task state Index 1: calibration mode Index 2: calibration state see table / enumerations
261	0105	PLC input state	UINT8	R	0, 0, 127	PLC input state Bit 0..6 = PLCin 1..7 Bit7 = not used, always 0 see table / enumerations
262	0106	PLC output state	UINT8	R	0, 0, 15	PLC output state Bit 0..3 = PLCin 1..4 Bit5..7 = not used, always 0 see table / enumerations
263	0107	PLC output configuration	UINT8[4]	R/W	Index 0: 0,2,16 Index 1: 0,3,16 Index 2: 0,4,16 Index 3: 0,6,16	PLC output configuration Index 0: CONTROL Pin 5,6,7 Index 1: CONTROL Pin 8,9,10 Index 2: CONTROL Pin 11,12,13 Index 3: CONTROL Pin 14,15,16 see table / enumerations
264	0108	Emission actual status	UINT8	R	0,0,2	Emission actual status 0 = OFF 1 = STANDBY 2 = ON

# Interface description

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
266	010A	TMP actual status	UINT8	R	0,0,4	TMP actual status 0 = OFF 1 = ON 2 = RUNNING_UP 3 = RUNNING_DOWN 4 = FAIL
275	0113	Calibration history	CHAR[*]	R		Calibration 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
280	0118	Used entries in cal history	UINT8	R	0,0,12	Used entries in cal history
281	0119	Used entries in error history	UINT8	R	0,0,12	Used entries in error history
282	011A	Used entries in TMP error history	UINT8	R	0,0,12	Used entries in TMP error history
287	011F	Error history	CHAR[*]	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[*]	R		TMP error history To read send after the array index 255 the UINT8 history list index: TD400: 0...11 TDS: 0...7 see table / enumerations
290	0122	Number of actual error	UINT8	R	0,0,255	Error number of the actual error or warning
297	0129	Present warnings	UINT8	R	0,0,127	Present warnings Each bit represents a warning see table / enumerations

# Interface description

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
298	012A	Sniffer button	UINT8	R	0,0,1	Read state sniffer button 1 = pressed
299	012B	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: 2 - OLV Index 1: 2-"", 3-"DRY, 4-"MODUL"
301	012D	Device name	CHAR[*]	R		Get device name as ASCII string, "PHOENIX L300i ..."
310	0136	SW-version MC68	UINT8[3]	R		Software-version MC68 Index 0: Main version Index 1: Sub version Index 2: Debug version
315	013B	SW-version TMP controller	UINT8[3]	R		SW version TMP controller Index 0: Main version Index 1: Sub version Index 2: Index
316	013C	HW-version TMP controller	CHAR[*]	R		HW-version TMP controller
317	013D	TMP controller name	CHAR[*]	R		TMP controller name
320	0140	CRC-code MC68	UINT16	R	0,0,65535	Checksumme MC68
321	0141	DIP switch MC68	UINT8	R		DIP switch setting of the MC68: Bit7: S2, switch 4 Bit6: S2, switch 3 Bit5: S2, switch 2 Bit4: S2, switch 1 Bit3..2: not used,always 0 Bit1: S1, switch 3 Bit0: S1, switch 2

# Interface description

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
385	0181	Trigger [mbar*l/s]	FLOAT[3]	R/W	1.0E-12, 1.0E-9, 1.0E3 1.0E-12, 1.0E-8, 1.0E3 1.0E-12, 1.0E-7, 1.0E3	Trigger [mbar*l/s] Index 0: Trigger 1 Index 1: Trigger 2 Index 2: Trigger 3
390	0186	Test leak extern vacuum [mbar*l/s]	FLOAT	R/W	1.0E-9, 1.0E-7, 0.01	Test leak extern vacuum [mbar*l/s]
392	0188	Test leak extern sniff [mbar*l/s]	FLOAT	R/W	1.0E-6, 1.0E-5, 0.1	Test leak extern sniff [mbar*l/s]
394	018A	Test leak intern in [mbar*l/s]	FLOAT	R/W	1.0E-8, 1.0E-6, 1.0E-5	Test leak intern in mbar*l/s
401	0191	Operation mode	UINT8	R/W	0,0,1	Operation mode 0 = VACUUM 1 = SNIFF
402	0192	Leak rate filter	UINT8	R/W	0,0,1	Leak rate filter 0 = Auto 1 = Fixed
405	0195	Serial number TMP controller	CHAR[*]	R		Serial number TMP controller
406	0196	Serial number leak detector	CHAR[*]	R/W		Serial number of the leak detector
410	019A	Zero mode	UINT8	R/W	0,1,2	Zero mode 0 = Zero disabled 1 = Zero enabled 2 = Zero at FINE
419	01A3	Calibration request enable	UINT8	R/W	0,0,1	Calibration request enable 0 = disabled 1 = enabled
420	01A4	Volume	UINT8	R/W	0,2,15	Volume (Volume >= Volume min)
421	01A5	Volume min	UINT8	R/W	0,0,15	Volume min
430	01AE	Pressure unit	UINT8	R/W	0,0,3	Pressure unit 0 = mbar 1 = Pa 2 = atm 3 = Torr

# Interface description

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
431	01AF	Leak rate unit	UINT8	R/W	0,0,7	Leak rate unit 0 = mbarl/s 1 = Pam <sup>3</sup> /s 2 = Atm ccs 3 = Torr/s 4 = sft <sup>3</sup> /yr (5 = ppm) (6 = g/a) (7 = oz/yr) 5...7 only in Sniff
433	01B1	Anode setpoint M2 [V]	UINT16	R/W	785, 905, 995	Anode voltage setpoint for mass 2 (hydrogen) in V
434	01B2	Anode setpoint M3 [V]	UINT16	R/W	510, 610, 670	Anode voltage setpoint for mass 3 in V
435	01B3	Anode setpoint M4 [V]	UINT16	R/W	390, 465, 520	Anode voltage setpoint for mass 4 (helium) in V
437	01B5	PLC sample rate	UINT8	R/W	10, 25, 100	PLC sample rate [ms] 10, 15, 20, 25, 30, 50, 100
438	01B6	PLC input configuration	UINT8[6]	R/W	INDEX 0: 0, 1, 8 INDEX 1: 0, 2, 8 INDEX 2: 0, 3, 8 INDEX 3: 0, 4, 8 INDEX 4: 0, 5, 8 INDEX 5: 0, 6, 8	Configuration of PLC input Index 0: CONTROL Pin 1 Index 1: CONTROL Pin 2 Index 2: CONTROL Pin 3 Index 3: CONTROL 2 Pin 1 Index 4: CONTROL 2 Pin 2 Index 5: CONTROL 2 Pin 3 see table / enumerations
442	01BA	Purge in measure	UINT8	R/W	0, 1, 1	Purge enable 0 = disabled 1 = enabled L300i DRY only
449	01C1	Valve state	UINT16	R		Valve state see table / enumerations

# Interface description

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
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 pressure sniff [mbar]	FLOAT	R/W	0, 0.05, 0.15	Minimum pressure for sniff [mbar]
453	01C5	Max pressure sniff [mbar]	FLOAT	R/W	0.05, 0.15, 0.2	Maximum pressure for sniff [mbar]
454	01C6	Lower leak rate limit	UINT8	R/W	0, 0, 6	Lower leak rate limit exponent
502	01F6	Amplifier range	UINT8	R	0, 3, 7	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	30, 33.26, 40	Factor 15 GOhm to 500 GOhm
506	01FA	Mass	UINT8	R/W	2, 4, 4	Mass 2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)
517	0205	Offset internal [A]	FLOAT[3]	R	-2.5E-10, 6.25E-15, 5.0E-9	Offset internal [A] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4
518	0206	Offset inlet [A]	FLOAT[3]	R	1.25E-17, 2.5E-15, 5.0E-9	Offset inlet [A] Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4
520	0208	Calibration factors vacuum	FLOAT[3]	R/W	1.0E-6, 1.0, 1.0E6	Calibration factors for vacuum mode Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4
521	0209	Calibration factors sniff	FLOAT[3]	R/W	1.0E-6, 1.0, 1.0E6	Calibration factors for sniff mode Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4

# Interface description

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
522	020A	Machine factor	FLOAT	R/W	1.0E-6, 1.0, 1.0E6	Machine factor
523	020B	Factor sniff	FLOAT	R/W	1.0E-6, 1.0, 1.0E6	Factor sniff
530	0212	Cathode selection	UINT8	R/W	0, 0, 1	Cathode selection 0 = cathode 1 1 = cathode 2
540	021C	Pressure EVAC GROSS [mbar]	FLOAT	R/W	3, 15, 15	Pressure limit EVAC --> GROSS [mbar]
541	021D	Pressure GROSS FINE [mbar]	FLOAT	R/W	0.02, 0.1, 0.1	Pressure limit GROSS --> FINE [mbar]
548	0224	Background suppression	UINT8	R/W	0, 1, 2	Background suppression 0 = disabled 1 = internal 2 = inlet area
550	0226	Vacuum ranges	UINT8	R/W	0, 0, 5	Vacuum ranges see table / enumerations
552	0228	Vent delay	UINT8	R/W	0, 3, 4	Vent delay 0 = immediately 1 = 1 second 2 = 1.5 seconds 3 = 2 seconds 4 = no vent
555	022B	Evacuation time	UINT16[2]	R/W	Index 0: 0, 600, 900 Index 1: 0, 1800, 1800	Evacuation time [sec] Index 0: time to 100 mbar Index 1: time to measure 0 = infinite
600	0258	Audio alarm type	UINT8	R/W	0, 1, 3	Audio alarm type 0 = Leak rate prop 1 = Trigger alarm 2 = Setpoint 3 = Pinpoint
602	025A	Audio alarm delay	UINT16	R/W	0, 30, 60000	Audio alarm delay 0, 1, 2, 3, ... 10, 12, 14, ... 30, 35, 40, ... 100, 110, 120, 300, 330, 360, ... 600 60000 = infinite



# Interface description

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
604	025C	Audio beep	UINT8	R/W	0, 1, 1	Audio beep 0 = disabled 1 = enabled
620	026C	Fore pump	UINT8	R/W	4, 25, 80	Fore pump 4...80 [m³/h] L300i MODUL only
621	026D	Fore pump type	UINT8	R/W	0, 1, 1	Fore pump type 0 = wet 1 = dry L300i MODUL only
622	026E	Partial flow pump	UINT8	R/W	4, 25, 80	Partial flow pump 4...80 [m³/h] not for L300i DRY
623	026F	Quick pump time	UINT16	R/W	0, 60000, 60000	Quick pump time 0, 1, 2, 3, ... 10, 12, 14, ... 30, 35, 40, ... 100, 110, 120, ... 240 60000 = infinite not for L300i DRY
624	0270	Mode V8	UINT8	R/W	0, 1, 1	Mode V8 0 = open 1 = automatic not for L300i DRY
1160	0488	Internal	UINT16	W		internal use only
1161	0489	Parameter reset	UINT8	W		Parameter reset: 0 = Load factory settings
1350	0546	Valve cycle counter	UINT32[11]	R	0, 0, 100000000	Valve cycle counter see table / enumerations
1352	0548	Next service fore pump	FLOAT	R	0, 0, 9500	Next service fore pump
1354	054A	Next service filter	FLOAT	R	0, 0, 4000	Next service filter L300i - Oil filter L300i DRY - Exhaust filter L300i MODUL - Exhaust filter
1567	061F	Offset current [A]	FLOAT	R		Offset current amplifier [A]
1568	0620	Unfiltered ion current [A]	FLOAT	R		Unfiltered ion current in A
1573	0625	Filtered ion current [A]	FLOAT	R		Filtered ion current in A

# Interface description

Command dec	Command hex	Name	Data type	Read/Write	Min-, Def-, Max-value	Meaning
1630	065E	Back-ground calculation [A]	FLOAT	R		Results inlet area back-ground calculation Index 0 = Offset internal Index 1 = Offset external old Index 2 = Offset external new
1854	073E	Contamination limit [mbar*I/s]	R/W	FLOAT	1.0E-6, 1.0E-3, 1.0E3	Contamination limit
1855	073F	Contamination protection	R/W	UINT8	0, 0, 1	Contamination protection 0 = disabled 1 = enabled
2500	09C4	Last parameter set	CHAR[*]	R		Last parameter set see table / enumerations
2501	09C5	Parameter set	UINT8	R/W		Parameter set 0 = load default 1...3 = load 1...3 4...6 = save 1...3
2591	0A1F	Control location	UINT8	R/W	0, 0, 5	Control location 0 = local 1 = RS232 2 = PLC 3 = local / RS232 4 = local / PLC 5 local / PLC / RS232
2660	0A64	Maintenance activ	UINT8	R/W	0, 0, 1	Service message oil filter 0 = disabled 1 = enabled

# Interface description

## 3.4 Enumerations

### LD communication protocol status word

Status word bit no.	PHOENIX L300i
Bit 0	Device state Bit 0
Bit 1	Device state Bit 1
Bit 2	Device state Bit 2
Bit 3	Sniffer button
Bit 4	ZERO
Bit 5	Still warning
Bit 6	Range 0
Bit 7	Range 1
Bit 8	Range 2
Bit 9	Trigger 1 exceeded
Bit 10	Trigger 2 exceeded
Bit 11	Trigger 3 exceeded
Bit 12	
Bit 13	Device Warning
Bit 14	Device Error
Bit 15	Syntax / Command error

Value	Bit 2..0	Device state
0	000	INIT
1	001	RUNUP
2	010	STANDBY
3	011	VENT
4	100	EVACUATION
5	101	MEASURE
6	110	CALIBRATION
7	111	ERROR

Value	Bit 8..6	Measure range
0	000	NO RANGE
1	001	GROSS
2	010	FINE
3	011	NO RANGE
4	100	PRECISION
5	101	PARTIALFLOW 1
6	110	PARTIALFLOW 2
7	111	PARTIALFLOW 3

### Interface protocol (command 26)

# Interface description

Value	Meaning
0	ASCII (SERIAL only)
1	Diagnostics (SERIAL only)
2	L200 Leakware (SERIAL only)
3	L200 (SERIAL only)
4	RC310 (REMOTE 1/2 only)
5	LD Protocol (both)

## Analog output configuration (command 222)

Value	Meaning
0	off
1	p1 (L200)
2	p1 (Pirani)
3	p2 (L200)
4	p2 (Pirani)
5	LR mantissa
6	LR exponent
7	LR linear
8	LR log.

# Interface description

## 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 )

Value	Index 0: Meaning
0	Task idle
1	Task start
2	Task running
3	Task stop

Value	Index 1: Meaning
0	CAL idle
1	CAL internal (no user action required)
2	CAL external (acknowledge at "6" required)

Value	Index 2: Meaning
0	CAL_IDLE
1	CAL_EVAC
2	CAL_WAIT_STABLE_OPEN
3	CAL_TUNE
4	CAL_TUNE_RESTART
5	CAL_WAIT_CLOSE
6	CAL_WAIT_STABLE_CLOSE
7	CAL_WAIT_OK

## PLC input state (command 261)

Value	Meaning
0x01	CONTROL Pin 1
0x02	CONTROL Pin 2
0x04	CONTROL Pin 3
0x08	CONTROL 2 Pin 1
0x10	CONTROL 2 Pin 2
0x20	CONTROL 2 Pin 3
0x20	OPTION Pin 6
0x80	----

# Interface description

## PLC output state (command 262)

Value	Meaning
0x01	CONTROL Pin 5,6,7
0x02	CONTROL Pin 8,9,10
0x04	CONTROL Pin 11,12,13
0x08	CONTROL Pin 14,15,16
0x10	-----
0x20	-----
0x20	-----
0x80	-----

## PLC output configuration (command 263)

Value	Meaning
0	OPEN
1	CLOSE
2	TRIGGER_1
3	TRIGGER_2
4	TRIGGER_3
5	ZERO_ACTIVE
6	READY
7	FAIL
8	CAL_ACTIVE
9	CAL_REQUEST
10	WARNING
11	REC_STROBE
12	GAS_BALLAST
13	PUMP_DOWN
14	STANDBY
15	VENT
16	EMISSION_ON

## Cal history (command 275)

**Answer:** ListNo, year/month/day, hour:min, type, mode, factor

**Example:** 0 13/01/24 08:54 EXT VAC 9.220E-01

## Error history (command 287)

**Answer:** ListNo, year/month/day, hour:min, type, number

**Example:** 0 13/01/24 08:57 E72

## TMP error history (command 288)

**Answer:** ListNo, operating hours, frequency, code

**Example:** 5 483.23 1145 123

# Interface description

## Present warnings (command 297)

Value	Meaning
0x00000001	Warning temperature preamplifier
0x00000002	Warning temperature electronic
0x00000004	Warning capillary
0x00000008	Warning calibration request
0x00000010	Warning proportional valve
0x00000020	Warning maintenance fore pompe
0x00000040	Warning maintenance filter
0x00000080	-----

## PLC input configuration (command 438)

Value	Meaning
0	NOT_USED
1	START
2	STOP
3	ZERO
4	CAL
5	CAL_INTERN
6	CAL_EXTERN
7	CLEAR
8	GAS_BALLAST

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

Value Index / Bit	Meaning
0	V1
1	V2a
2	V2b
3	V3
4	V4a
5	V4b
6	V6
7	V7
8	V8 (external)
9	V9 (external)
10	V10 (external)

# Interface description

## Vacuum ranges (command 550)

Value	Meaning
0	NORMAL
1	FINE_ONLY
2	GROSS_ONLY
3	PARTIAL_FLOW (L300i and L300i MODUL only)
4	PRECISION (L300i DRY only)
5	GROSS_ONLY_920HZ
6	CAL_EXTERN

## Last parameter set (command 2501)

**Answer:** No Name\_\_\_\_\_ year/month/day hour:min:sec

**Example:** 0 Default\_\_ 12/09/26 11:08:36

## 3.5 Error messages

Telegram error handling

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

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

### Error numbers (for Stw: Bit 15 to 1)

Error number	Meaning
1	CRC-failure
2	Illegal telegram lenght
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



# Interface description

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