I N T E R F A C E D E S C R I P T I O N

jins80e1-d (1011)

Catalog No.

550-300
550-310
550-330

from software version

V 1.61

Modul1000

Helium Leak Detector

INFICON

Content

1 Preface

This document describes the RS232 interface of the Modul1000 and the "ASCII" and "Binary" communication protocol.

In case the leak detector shall be controlled via RS232 (for example START, STOP, ZERO, etc.), select control location "RS232" or "local and RS232" at the leak detector (see Technical Handbook).

Both interface protocols use these communication parameters:

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

You can select between two RS232 protocols:

- The ASCII protocol is a human readable protocol, which can be used with a simple terminal program. It is similar to SCPI (**S**tandard **C**ommands for **P**rogrammable **I**nstruments), a standard protocol widely used for measuring equipment.
- The binary protocol is optimized for secure and fast communication between the leak detector and a PC or PLC.

2 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 (Modul1000 → PC)
3	TXD	Transmit data (PC → Modul1000)
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

RS232 Connecting Cable

A standard RS232 cable can be used (straight-through connecting cable, RxD and TxD not crossed).

The RS232 hardware handshake must be switched off (in RS232 control program written by the user).

If switching off of the hardware handshake is not possible, an RS232 connecting cable wired as follows may also be used:

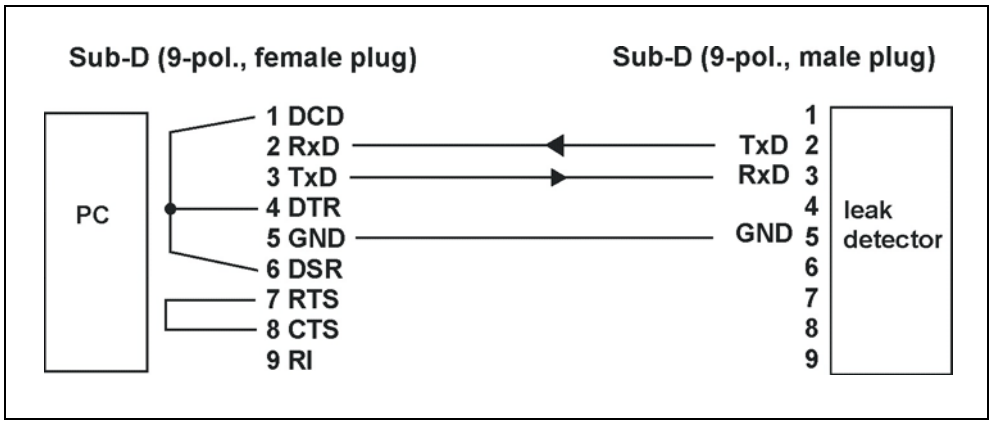

Fig. 1-1 RS232 Connecting Cable

3 ASCII Protocol

3.1 Command Format

In ASCII protocol any command starts with « * (ASCII code 42dec)» and is finished with the end sign selected (e.g. CR). 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 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)	

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.

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 Modul1000: 1500 ms

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

3.2 Error Messages

OK	ERR_OK	command completed
E01	ERR_CMD_START	wrong command start (no "*")
E02	ERR_ERR_BLANK	illegal blank
E03	ERR_CMD_WORD_1	command word 1 illegal
E04	ERR_CMD_WORD_2	command word 2 illegal
E05	ERR_CMD_WORD_3	command word 3 illegal
E06	ERR_DISABLED	control by RS232 not enabled
E07	ERR_ARGUMENT	argument faulty
E08	ERR_NO_DATA	no data available
E09	ERR_BUFFER_OVERFLOW	error buffer overflow
E10	ERR_INVALID	command invalid
E11	ERR_NO_QUERY	query not allowed
E12	ERR_QUERY	only query allowed
E13	ERR_NOT_IMPLEMENTED	not yet implemented

3.3 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 messurment
*conf:trig1? (CR)	1.0E-9	retrieve trigger 1
*conf:trig1 2.0E-9 (CR)	OK	set trigger 1

3.4 Command List ASCII Mode

*CLS			clear error
*IDN			identification
	:CRC		check sum
	:DEVice		name of instrument (Modul1000)
	:VERsion		software version
	:SERial		serial-number
	:TURBO		software version TC600
	:MC68		hardware identification MC68
	:IOversion		hardware identification IO panel
	:GBversion		hardware identification control panel
	:VDversion		hardware identification mother board
	:DIP1		MC68 DipSwitch 1
	:DIP2		MC68 DipSwitch 2

*STATus			status of Modul1000 (INIT, ACCL, STBY, VENT, WAIT_EVAC, EVAC, MEAS, CAL, ERROR)
	[:CAL]		mode calibration (IDLE, EVAC, OPEN, TUNE, TUNE_RES, CLOSE, STABLE_CLOSE, WAIT_OK)
	[:CALHist 1] [:CALHist 2] … [:CALHist 12]		CAL History 1 to 12 (date, time, type of calibration, mode, calibration factor)
	[:ADDCALHist 1] [:ADDCALHist 2] … [:ADDCALHist 12]		additional information for CAL_History entry 1 to 12 (mass, filament, ion current when test leak open, ion curren when test leak closed, nominal test leak rate)
	[:CALMode]		kind of calibration INT_AUTO, INT_MAN, EXT_AUTO, EXT_MAN, ZERO_POINT
	[:ERRor]		current number of error / warning
	[:ERRHist 1] [:ERRHist 2] … [:ERRHist 12]		error history entry 1 to 12.
	[:ERRorHist]		error History (1…12)
	[:ZERO]		zero
	[:RANGE]		measuring mode ULTRA (VACUUM), FINE (SNIFF), NONE
	[:RESULT]		status of Auto leak test
	[:TestLog 1] [:TestLog 2] … [:TestLog 12]		test protocol (for auto test leak)
	[:SECINEMEAS]		time since change of measuring mode [s]
	[:VALVE]		status of internal valves
	[:EXT_VALVE]		status of external valves
	[:PREAMPRESistor]		currently used resistance of pre-amplifier 13M, 470M, 15G, 500G
	PURGe		purge / gas ballast
*READ			leak rate in chosen unit
	[:ATM*CC/S]		current leak rat in atm*cc/s
	[:G/A]		current leak rate in g/a
	[:MBAR*L/S]		current leak rate in mbar*l/s
	[:OZ/YR]		current leak rate in oz/yr
	[:PA*M3/S]		current leak rate in Pa*m3/s
	[:PPM]		current leak rate in ppm
	[:TORR*L/S]		current leak rate in Torr*l/s
*STArt			start

*STOp			stop
*VENt			vent
*CAL		in STBY →	internal automatic calibration
		in MEAS →	extern manual calibration
	[:AUTO] in STBY	in STBY →	internal automatic calibration
	[.AUTO] in MEAS	in MEAS →	extern automatic calibration
	[:MAN] in STBY	in STBY →	internal manual calibration
	[:MAN] in MEAS	in MEAS →	extern manual calibration
*PURGe			purge / gas ballast on
	[:OFF]		purge / gas ballast off
*ZERO			zero
	[:OFF]		zero off
*MEASure			
	:P1		inlet pressure in chosen unit
		[:ATM]	inlet pressure in atm
		[:MBAR]	inlet pressure in mbar
		[:PA]	inlet pressure in Pa
		[:TORR]	inlet pressure in Torr
	:P2		foreline pressure
		[:ATM]	foreline pressure in atm
		[:MBAR]	foreline pressure in mbar
		[:PA]	foreline pressure in Pa
		[:TORR]	foreline pressure in Torr
	:PEXT1		pressure of the external pressure measuring point 1 in chosen unit
		[:ATM]	pressure of the external pressure measuring point 1 in atm
		[:MBAR]	pressure of the external pressure measuring point 1 in mbar
		[:PA]	pressure of the external pressure measuring point 1 in Pa
		[:TORR]	pressure of the external pressure measuring point 1 in Torr
	:OFFset		offset current [A]
	:IMess		current raw values [A]

	:IFilter		current filtered [A]
	:LRMAX		max. leak rate since last inquiry via interface in chosen unit
		[:ATM*CC/S]	max. leak rate since last inquiry via interface in Atm*cc/s
		[:G/A]	max. leak rate since last inquiry via interface in g/a
		[:MBAR*L/S]	max. leak rate since last inquiry via interface in mbar*l/s
		[:OZ/YR]	max. leak rate since last inquiry via interface in oz/yr
		[:PA*M3/S]	max. leak rate since last inquiry via interface in Pa*m3/s
		[:PPM]	max. leak rate since last inquiry via interface in ppm
		[:TORR*L/S]	max. leak rate since last inquiry via interface in Torr*l/s
	:MIAP		anode potential [V]
	:MIKP		cathode potential [V]
	:MISP		suppressor potential [V]
	:MIAKP		anod-/cathode potential [V]
	:TEMPeratur		
		:Amplifier	preamplifier temperature [°C]
		:Electronic	electronic temperature [°C]
	:TURBO		
		:Frequency	TMP frequency [Hz]
		:Voltage	TMP voltage [Hz]
		:Current	TMP current [A]
		:Power	TMP power [W]
	:DRIFT		current leak rate drift (A/s)
	:TAU		current filter time constant for I*CAL
	:DIGITALIN		state of the PLC inputs
	:UNV		amplifier voltage [V]
	:UVV		preamplifier voltage [V]
	:UF3f4		monitoring voltage of fuse F3 and F4 [V]
	:UF1f2		monitoring voltage of fuse F1 and F2 [V]
	:U15		monitoring voltage of + / -15 V [V]
	:VALVE		valve voltage [V]
*CONFig			
	:AUDio		audio alarm type (PIN, SET, TRIG, PROP)
	:ALARMDelay		alarm delay after evacuation [s]
	:BACKGround		background display (OFF, ON)
	:BEEP		beep-sound (OFF, ON)
	:CALAccess		CAL access (OFF, ON)
	:CALleak		leak rate of test leak
		:INT	internal test leak

		:EXTVAC	external test leak in vacuum mode
		:EXTSNIFF	external test leak in sniff mode
	:CALREQ		calibration request (OFF, ON)
	:CALSETTINGTime		time for transient effect at automatic calibration
	:CATHode		cathode
	:COMMANDPress		
		:1 :A	p_A Gross leak test
		:2 :B	P_B Evacuation press
		:3 :C	p_C Charging press
		:4 :D	p_D Discharging press
		:5 :E	Press. drop trig
		:6 :F	p_F
		:7 :G	p_G
	:COMMANDTime		
		:1 :A	t_A Gross leak test
		:2 :B	t_B Evacuation time
		:3 :C	t_C Charging time
		:4 :D	t_D Discharging time
		:5 :E	t_E Venting time
		:6 :F	t_F Ready to test
		:7 :G	t_G Measurement period
	:CONTrol		location of control (LOCAL, RS232, PLC, LOCAL/ RS232, LOCAL/PLC)
	:ICAL		type of filter ON=I*CAL, OFF=fixed
	:LANGuage		language (English, deutsch, italiano, francais, polski, nihongo [katakana], Chinese, espanol)
	:LCDAutorange		display range auto / manual
	:LCDContrast		LCD contrast (0-99)

	:LCDDECades		number of display decades
	:LCDInvert		invert display
	:LCDSCALELog		display scale lin. / log.
	:LIMITLOW		lower display limit
	:MASS		mass (2, 3, 4)
	:MFAE		anode potential reference
		:M2	mass 2
		:M3	mass 3
		:M4	mass 4
	:MINVOLume		minimum audio volume
	:MODE		mode (VAC, SNIFF, COMMANDER, AUTO)
	:PARTCOUNT		activate part number (OFF, ON)
	:PARTNO		part number
	:PROTection		protecting functions
		:CONTamination	contamination protection
		:CONTLimit	contamination protection limit
		:EVACtime	maximum evacuation time (0 – infinite)
		:EVACtime2	maximum evacuation time to 100 mbar
		:PMAX	maximum pressure in sniff
		:PMIN	minimum pressure in sniff
	:PARTIALFlow		
		:EVACuation	configuration of partial flow pump for evacuating Fore_PUMP, Fore_AND_Partial_flow_PUMP, Partial_flow_PUMP)
		:MEASure	configuration of partial flow pump for measuring mode Fore_PUMP, Fore_AND_Partial_flow_PUMP)

	:PLCINLINK	:3, 4, 5, 6, 7, 8, 9, 10	configuration PLC input NOt_used, START, STOP, START/STOP, VENT, ZERO, CAL, CAL_EXTern, CAL_INTern, CLEAR, GAS_ballast, CYCLE, GAS_BALLAST_ON, GAS_BALLAST_OFF, ZERO_ON, SNIFF All functions can be inverted by using the command with the prefix "INV_" (INV_START, INV_STOP, ...)
	:PLCOUTLINK	:3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	configuration PLC output OPEN, CLOSE, TRIGGER_1, TRIGGER_2, TRIGGER_3, ZERO_ACTIVE, EMISSION_ON, MEASURE, STANDBY, VENT, ERROR, WARNING, CAL_ACTIVE, CAL_REQUEST, STROBE, GAS_BALLAST, CYCLE_ACTIVE, PUMP_DOWN, SNIFF All functions can be inverted by using the command with the prefix "INV_" (INV_OPEN, INV_CLOSE, ...)
	:PURGe		automatic purge (PURGE_MANUAL, PURGE_AUTO, GAS_BALLAST_MANUAL)

	;PURGESETTLINGTime		time from closing the purge valve to opening the valve V2 (2 ... 20s)
	:RECorder		recorder
		:LINK1_2	Recorder mode (pin 1-2) (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, P1_L200, P2_L200)
		:LINK3_4	Recorder mode (Pin 3-4) (OFF, P1, P2, MANT, EXP, LR_LIN, LR_LOG, P1_L200, P2_L200)
		:ONLYMEAS	leak rate only in measure (OFF, ON)
		:SCALE	recorder scale
		:UPPEREXP	recorder upper limit
	:RS232		mode (ascii, binary)
	:SERIESErrmsg		series error message for mode AutoLeakTest “0” means “deactivated”
	:SUPPRession		offset suppression at start (OFF, INTERN, INLET)
		AUTOLeaktest	on, off
		COMMAnder	on, off, stable
	:TESTINGTime		testing time for auto leak test
	:TIMEAXIS		release of the time axis of Q(t) display (AUTO, 8,16, 32, 48, 64, 80 …)
	:TRIGger1		Trigger 1
	:TRIGger2		Trigger 2
	:TRIGger3		Trigger 3
	:UNIT		
		:LR	leak rate unit
		:Pressure	pressure unit
	:VENTdelay		vent delay (0, 1, 1.5, 2, NO)

	:ZERO		zero (OFF, ON, STABLE)
	:PEXT1		
		:FULLP	pressure when external pressure sensor is rejecting fully
		:FULLU	Voltage when external pressure sensor is rejecting fully [V] If the external pressure sensor provides a current as output signal, the result must be multiplied by 500 Ohm to get the voltage. e.g.: 20 mA * 500 Ohm = 10 V
		:ZEROP	pressure at zero point of external pressure sensor
		:ZEROU	Voltage at zero point when external pressure sensor is rejecting fully [V] If the external pressure sensor provides a current as output signal, the result must be multiplied by 500 Ohm to get the voltage. e.g.: 20 mA * 500 Ohm = 10 V
		:CHARacteristic	type of characterisitc of the external pressure measuring point LIN_VOLTAGE, LOG_VOLTAGE, LIN_CURRENT, LOG_CURRENT
	:VOLume		audio volume
*HOUR			
	:DATE		date
	:DEVICE		operating hours
	:POWER		time since power on [min]
	:RUNUP		run up time [s]
	:SERVice		
		:FILTER	service filter
		:DEVICE	service device
	:TIME		time
	:TURBO		operating hours TMP
	:TC		operating hours frequency converter

3.5 Calibration

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

3.5.1 Internal Automatic Calibration

When the leak detector is in STAND-BY mode the command „*CAL“ evokes an internal autmatical calibration.

The process is completely automatically.

Via „STATus:CAL?“ the computer can realise if the calibration routine is finished.

3.5.2 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 opend 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 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.

4 Binary Protocol

4.1 Command Structure

In binary protocol the command to the leak detector always starts with STX (0x05).

It is followed by a byte which indicates the length of the telegram (inclusive Start-Byte and checksum). The next byte is the command number. The command byte may be followed by additional information (parameter and/or data). Please refer to "Command list" (chapter 4.5) for detailed information about command number, parameter and data format.

Every telegram ends with a checksum. The checksum is the sum of all bytes before the checksum byte modulo 256 (decimal).

The leak detector replies to every valid command with an acknowledgement. This answer starts with the length byte followed by the command number, additional data (optional) and the checksum.

In case of an error, the leak detector answers with an error byte instead of the command number (refer to "Error Messages" in chapter 4.4).

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

4.2 Examples

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

PC ➔ Leak detector

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

Leak detector ➔ PC

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

Example 1: Get trigger level 2 in mbarl/s

PC ➔ leak detector

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

leak detector ➔ PC:

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

4.3 Data Format

float	4 bytes, after IEEE754 ($\pm 10^{\pm 38}$), 3 bytes mantissa, 1 byte exponent / sign
unsigned long int [ulint]:	4 bytes, integral number without sign MSB … LSB (0 … 4294967295)
unsigned short int [usint]:	2 bytes, integral number without sign MSB, LSB (0 … 65535)
signed short int	2 bytes, integral number with sign MSB, LSB (-32768…32767)
unsigned char [uchar]:	1 byte, integral number without sign (0…255)

4.4 Error Messages

230	RS232Host	command currently not allowed (host control)
231	RS232Fb	command currently not allowed (remote control)
232	RS232Invalid	command currently not allowed (i.e. CAL when running up)
233	RS232PW1disable	pass word 1 disabled (menu function)
234	RS232PW2disable	pass word 2 disabled (service function)
235	RS232CmdFailed	execution of command failed
240	RS232Cmd	command does not exist
241	RS232FbChecksum	hand unit: checksum wrong
242	RS232FbTimeout	hand unit: timeout
243	RS232Len	number or length of part of parameter defective
244	RS232Para	parameter not in valid range
252	RS232Start	first sign wrong (unequal, 0x05)
253	RS232Checksum	transmitted and calculated checksum unequal
254	RS232Timeout	time out
255	RS232Buffer	buffer overflow

4.5 Command List

No	Name	Description	Parameter	Data format
0	SetASCII	Switch to ASCII protocol		
1	GetP1	Get inlet pressure p1	Byte 0: Unit (0-mbar, 1-Pa, 2-Torr)	float
2	GetP2	Get fore vacuum pressure p2	Byte 0: Unit (0-mbar, 1-Pa, 2-Torr)	float
3	GetPext	Get pressure of external pressure gauge pext	Byte 0: Unit (0-mbar, 1-Pa, 2-Torr)	float
5	GetDeviceID	Get device identification	No	uchar (always 4 for Modul1000)
6	GetSWCheckSum	Get checksum leak detector software	No	usint
7	GetTurboVersion	Get TMP version number	No	string (6 Bytes)
8	GetVersion	Get software version (Main- and sub-version number)	No	2 Bytes Byte 0: Main version number Byte 1: Sub version number

No	Name	Description	Parameter	Data format
9	SetSecInMeas	Time, since device is in measurement mode	No	unsigned integer [s]
10 11	GetValve SetValve	Get / set Internal valves For set commando (11) automatic must be switched off (see command 18)	No	unsigned integer V1 0x0001 V3 0x0002 V7 0x0004 V6 0x0008 V2 0x0010 V4 0x0020
12 13	GetValveCtrl SetValveCtrl	Get / set lowered valve voltage	Byte 0: 0-lowered, 1- high, 2-auto	unsigned char
14	GetSpsInput	Get PLC input state	No	unsigned integer Bit0 DigitalIn Pin3 Bit1 DigitalIn Pin4 Bit2 DigitalIn Pin5 Bit3 DigitalIn Pin6 Bit4 DigitalIn Pin7 Bit5 DigitalIn Pin8 Bit6 DigitalIn Pin9 Bit7 DigitalIn Pin10 Bit8 Accessories Pin 3 Bit9 Accessories Pin 6
15	SetRelais	Set digital output (only for test purposes)	No	unsigned integer Bit0 DigitalOut Pin3 Bit1 DigitalOut Pin4 Bit2 DigitalOut Pin5 Bit3 DigitalOut Pin6 Bit4 DigitalOut Pin7 Bit5 DigitalOut Pin8 Bit6 DigitalOut Pin9 Bit7 DigitalOut Pin10 Bit8 DigitalOut Pin11 Bit9 DigitalOut Pin12 Bit10 DigitalOut Pin13 Bit11 DigitalOut Pin14 Bit12 Accessories Pin 4 & 7 Bit13 Accessories Pin 5 & 8 Values ≥ 65280 switch back to normal mode.
17	SetRecorder	Set recorder output (only for test purposes) Values greater than 10000 switch back to normal mode.	Byte 0: 0=port 1, 1=port 2	unsigned integer [mV]

No	Name	Description	Parameter	Data format
18	SetAutomatik	Set automatic On/Off	No	uchar 0=Automatic off; 1=Automatic On
20 21	GetTurboCtrl SetTurboCtrl	Get / set TMP state	No	2 Bytes Byte 0: Nominal condition (0-off, 1-reduced, 2-Normal) Byte 1: Actual condition (0-off, 1-reduced, 2-normal, 3-up, 4-down, 5-Err)
22	GetTurboF	Get TMP frequency	No	unsigned integer [Hz]
23	GetTurboI	Get TMP current	No	unsigned integer [0.01 A]
24	GetTurboP	Get TMP power	No	unsigned integer [W]
25	GetTurboH	Get TMP operation hours	No	unsigned long integer [h]
26	GetTCH	Get frequency converter operation hours	No	unsigned long integer [h]
27	GetTurboRunupTime	Get Turbo run-up time	No	unsigned integer [s]
28 29	GetExtValves SetExtValves	Get / set external valves output	No	2 Bytes Bit0 Valves Pin5 V30 Bit1 Valves Pin6 V31 Bit2 Valves Pin7 V32 Bit3 Valves Pin8 V33 Bit4 Valves Pin9 V34 Bit5 Valves Pin10 V35 Bit6 Valves Pin11 V36 Bit7 Valves Pin12 V37 Bit8 Valves Pin13 V20 Bit9 Valves Pin14 V21 Bit10 Valves Pin15 V22 The value 0xFFFF switches to normal operatioin.
30 31	GetRangeVV SetRangeVV	Get / set preamplifier range	No	unsigned char 0=13MOhm auto 1=470MOhm auto 2=15GOhm auto 3=-500GOhm auto 4=13MOhm manual 5=470MOhm manual 6=15GOhm manual 7=500GOhm manual

No	Name	Description	Parameter	Data format
32 33	GetRangeNV SetRangeNV	Get set post amplifier range	No	unsigned char auto: 0-0.4; 1-1.6; 2-6.4; 3-25.6 manual: 4-0.4; 5-1.6; 6-6.4; 7-25.6
34 35	GetR43 SetR43	Get / set 500GOhm => 15GOhm factor	No	float
36 37	GetCalFac SetCalFac	Get / set calibration factor	Byte 0: 0: mass2 /vacuum mode 1: mass3 /vacuum mode 2: mass 4 /vacuum mode 3: mass 2 / sniff mode 4: mass 3 / sniff mode 5: mass / sniff mode 6: mass 2 / auto leak test 7: mass 3 / auto leak test 8: mass 4 / auto leak test 9: mass 2 / commander 10: mass 3 / commander 11: mass 4 / commander	float
38	GetMinSinceStart	Get time since power on	No	unsigned long integer [min]
39	GetZustArange	Get Autoranging state	No	unsigned char
40 41	GetMass SetMass	Get / set mass (0/1/2 for mass 2/3/4)	No	unsigned char
42 43	GetMFAE SetMFAE	Get / set anode voltage	Byte 0: Mass (0/1/2 for mass 2/3/4)	unsigned integer [V]
44	GetMSCtrl	Get MSV state	No	2 Bytes Byte 0: Nominal condition (0-off, 1-Saving mode, 2-Normal mode) Byte 1: Actual condition (0-off, 1-Saving mode, 2-Normal mode)
45	SetMSCtrl	Set MSV state	No	unsigned char (0-off, 1-Saving mode, 2-Normal mode)

No	Name	Description	Parameter	Data format
46 47	GetMSKat SetMSKat	Get / set active filament	No	unsigned char (0=Cathode 1, 1=Cathode 2)
48 49	GetMSConfig SetMSConfig	Get / set MS configuration	No	2 Byte Byte 0: MFAE Command variable Anode potential externally Byte 1: METS Suppressor test function
50 51	GetZero SetZero	Get / set Zero On/Off	No	uchar 0=off / 1=on
52	Start	Start	No	No
53	Stop	Stop	No	No
54	GetCal	Get calibration state	No	uchar 0=idle 1=evacuation 2=wait_stable_open 3=auto_tune 4=auto_tune_restart 5=wait_close 6=wait_stable_close 7=wait_okay
55	Cal	Start calibration	No	No
56 57	GetTrigger SetTrigger	Get / set trigger	Byte 0: 1...3 for Trigger 1...3 Byte 1: Unit: 0-mbar*l/s, 1-Pa*m³/s, . 2-atmcc/s, 3-Torrl/s; at Sniff additionally: 4-ppm, 5-g/a	float
58 59	GetOpMode SetOpMode	Get set operation mode	No	uchar 0=Commander 1=Auto Leak Test 2=Vacuum 3=Sniff
60 61	GetGasballast SetGasballast	Get / set Gasballast	Byte 0: 0 - close gasballast / purge valve 1- open gasballast / purge valve in standby	

No	Name	Description	Parameter	Data format
62	GetErrorCode	Get current error code	No	uchar 0=No error
63	ClearError	Clear error	No	No
64 65	GetSuppressionAutoleaktest GetSuppressionAutoleaktest	Get / Set Autoleaktest suppresion	Byte 0: 0 - off 1 - on	unsigned char
66 67	GetTL SetTL	Get / Set test leak value	Byte 0: 0-int.TL; 1-ext.TL-vac; 2-ext.TL-sniff Byte 1: Unit: 0-mbar*l/s, 1-Pa*m³/s, .2-atmcc/s, 3-Torrl/s; at Sniff/ext. additionally: 4-ppm, 5-g/a	float
68	GetRunHours	Get Operation hours	No	ulong
70	GetSerialNr	Get serial number	No	11 Bytes ASCII-String
72	GetState	Get device state	No	0=init 1=runup 2=standby 3=vent 4=evac 5=measure 6=calibration 7=error 8=wait_evac
73	SetLrSetpoint	Set I*CAL leak rate to defined value	No	float
74 75	GetConfigExtValves SetConfigExtValves	configuration for external valves outputs	2 Bytes	Bit0 Valves Pin5 V30 Bit1 Valves Pin6 V31 Bit2 Valves Pin7 V32 Bit3 Valves Pin8 V33 Bit4 Valves Pin9 V34 Bit5 Valves Pin10 V35 Bit6 Valves Pin11 V36 Bit7 Valves Pin12 V37 Bit8 Valves Pin13 V20 Bit9 Valves Pin14 V21 Bit10 Valves Pin15 V22 0=control internal 1=control external with command 29

No	Name	Description	Parameter	Data format
76 77	GetSuppressionCommander SetSuppressionCommander	Get / Set Commander suppression	Byte 0: 0 - off, 1 - on, 2 - stable	unsigned char
78 79	GetMFac SetMFac	Get / set machine factor	No	float
80 81	GetFacUltraFine SetFacUltraFine	Get set ULTRA-FINE factor	No	float
82 83	GetZeroMode SetZeroMode	Get / set zero mode	No	uchar 0=Zero enable 1=zero disable 2=I*ZERO
84 85	GetSuppressionVacuum SetSuppresssionVacuum	Get / Set Vacuum suppression	Byte 0: 0 - off, 1- inern only, 2 - inlet	unsigned char
86 87	GetCalRequest SetCalRequest	Get / set calibration request	No	uchar 0=off 1=on
88 89	GetVolume SetVolume	Get / set volume	No	uchar
90 91	GetTriggerAlarmTyp SetTriggerAlarmTyp	Get /set trigger alarm type	No	
92 93	GetUnit SetUnit	Get /Set leak unit	No	Byte 0: leak rate unit Byte 0: Pressure unit
94	SetIOffset	Set offset current	No	float [A]
95	GetLr	Get I*CAL leak rate without offset correction	Byte 0: Unit (0-mbar*l/s, 1-Pa*m³/s, ...)	floar
96	GetIOffset	Get offset current	No	float [A]
97	GetIFilter	Get filtered ion current	No	float [A]
98	GetImess	Get unfiltered ion current	No	float [A]
99	GetLr	Get leak rate	Byte 0: Unit (0-mbar*l/s, 1-Pa*m³/s, ...)	float
100	GetUNV	Get post amplifier voltage	No	float [mV]
101	GetUVV	Get pre amplifier voltage	No	float [V]

No	Name	Description	Parameter	Data format
102	GetUp	Get pressure gauge voltage (internal & external)	Byte 0: 1=p1 2=p2 3=pext1 4=pext2	float [mV]
105	GetElTa	Get electronic temperature	No	float [°C]
106	GetEvsTa	Get preamplifier temperature	No	float [°C]
107	GetMiap	Get anode voltage	No	float [V]
108	GetMikp	Get cathode voltage	No	float [V]
109	GetMisp	Get suppressor voltage [V]	No	float [V]
110	GetMiakp	Get anode-cathode voltage	No	float [V]
111	GetUValve	Get valve voltage	No	float [V]
112	GetUf3f4	Monitoring voltage of fuse F3 and F4	No	float
113	GetUf1f2	Monitoring voltage of fuse F1 and F2	No	float
114	GetU15	Monitoring voltage of +/-15V	No	float
119	ParaReset	Reset parameter	Byte 0: 1=load factory default settings	No
122 123	GetCtrlMode SetCtrlMode	Get / set control location	No	uchar 0=local 1=RS232 2=PLC 3=RS232 & local 4=local & PLC
124	GetMeasRange	Get measure range	No	uchar
125	GetAutoLeakTestResult	Get AutoLeakTest result	No	uchar
126	GetLrMaxV24	Get max. leak rate since last query over RS232	Byte 0: Unit (0-mbar*l/s, 1-Pa*m³/s, ...)	float
127	GetTau	Get current equivalent tau (I*CAL only)	No	usint
128	GetDrift	Get current drift	No	float
129	GetCalMode	Get calibration mode	No	uchar
130 131	GetPartNrEnabled SetPartNrEnabled	Get / set part number enabled	No	uchar

No	Name	Description	Parameter	Data format
132 133	GetPartNr SetPartNr	Get / set part number	No	ulint
134 135	GetTimeBaseAutoScale SetTimeBaseAutoScale	Get / set time base auto scale of Q(t) graph	No	uchar
136 137	GetTimeBase SetTimeBase	Get / set time base of Q(t) graph	No	uchar
138 139	GetVentDelay SetVentDelay	Get /set vent delay	No	uchar
140 141	GetBgVisible SetBgVisible	Get / set background visible in Stand-By (on/off)	No	uchar
142 143	GetBeepOnOff SetBeepOnOff	Get / set beep (on/off)	No	uchar
144 145	GetDirectCalAccess SetDirectCalAccess	Get /set direct calibration acces via Stand-By display (on/off)	No	uchar
146 147	GetSeriesErrMsg SetSeriesErrMsg	Get / set series error message	No	uchar
148 149	GetLrFilter SetLrFilter	Get / set leak rate filter	No	uchar
150 151	GetLCDControl	Get / Set LCD control	No	uchar
152	GetLRStatus TrigPress	Get leak rate / state / trigger and pressure	Byte 0: unite leak rate Byte 1: unit pressure	float (leak rate) float (pressure) uchar (state + trigger)
153	Vent	Vent inlet port	No	No

5 Trouble Shooting

5.1 Common

Error	Possible Reason	Solution
No characters are received via the interface / the Modul1000 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 Modul1000 and PC / PLC match)
	Wrong protocol selected in the Modul1000	Select correct protocol in the Modul1000
	PC uses an USB-RS232 converter	In general the Modul1000 will also work with an USB-RS232-converter. However, these often cause multiple difficult to track problems (driver, flow control.) Please test your PC program on a “real” RS232 interface first preferably. Especially with USB-RS232-converters it is often helpful to use a cable according to the wiring diagram in Section 2
	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 Modul1000 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 Modul1000 and PC / PLC match)
	Wrong protocol selected in the Modul1000	Select correct protocol in the Modul1000

5.2 ASCII Protocol

Error	Possible Reason	Solution
Modul1000 does not reply / Modul1000 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)
Modul1000 replies with „E06“	Control via RS232 not enabled in the Modul1000	Enable control via RS232 (see submenu CONTROL LOCATION)
Modul1000 replies with error message to the first command only, following commands are interpreted correctly	Receiving buffer of the Modul1000 was not empty before sending the first command (e.g. by plugging in the RS232 cable during operation)	In the ASCII protocol the Modul1000 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

6 List of menu parameter and ASCII/ Binary protocol

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
Scale linear/ logarithmic	Main Menu -> View ->Scale linear/logarithmic	Off=linear, On=Logarithmic	log.	*CONFig:LCDSCALELog	
Scale decade count	Main Menu -> View ->Scale linear/logarithmic	2 to 9	4	*CONFig:LCDDECades	
Display-range auto/manual	Main Menu -> View ->Display range auto/manual	0=man., 1=auto man: 1E-8 mbar l/s to 1E+3 mbar l/s	auto	*CONFig:LCDAutorange	
Time axis	Main Menu -> View ->Time axis	auto, 16s to 960s	32s	*CONFig:TIMEAXIS	SetTimeBaseAutoScale SetTimeBase
Contrast	Main Menu -> View -> Contrast	0 to 99	50	*CONFig:LCDContrast	
Invert display	Main Menu -> View -> Contrast	on, off	on	*CONFig:LCDInvert	
Background in standby	Main Menu -> View -> Background in standby	on, off	off	*CONFig:BACKGround	SetBgVisible
Lower display limit	Main Menu -> View -> Lower display limit	1E-12mbarl/s to 1E-5mbarl/s	1E-12mbarl/s	*CONFig:LIMITLOW	
Mode	Main Menu -> Mode	Vacuum, Sniff, Commander, Auto leak test	Vacuum	*CONFig:MODE	SetOpMode
Trigger level 1	Main Menu -> Trigger & Alarms -> Trigger Level 1	1E-12mbarl/s bis 1E3mbarl/s	1E-9mbarl/s	*CONFig:TRIG1	SetTrigger1
Trigger level 2	Main Menu -> Trigger & Alarms -> Trigger Level 2	1E-12mbarl/s bis 1E3mbarl/s	1E-8mbarl/s	*CONFig:TRIG2	SetTrigger2
Trigger level 3	Main Menu -> Trigger & Alarms -> Trigger Level 3	1E-12mbarl/s bis 1E3mbarl/s	1E-7mbarl/s	*CONFig:TRIG3	SetTrigger3
Minimum volume	Main Menu -> Trigger & Alarms -> Volume	0 to 15	0	*CONFig:MINVOLume	SetVolume
Volume	Main Menu -> Trigger & Alarms -> Volume	0 to 15	2	*CONFig:VOLume	

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
Beep sound	Main Menu -> Trigger & Alarms -> Volume	on,off	on	*CONFig:BEEP	SetBeepOnOff
Unit pressure	Main Menu -> Trigger & Alarms -> Units	mbar, Pa, Atm, Torr	mbar	*CONFig:UNIT:Pressure	SetUnit 0
Unit leak rate	Main Menu -> Trigger & Alarms -> Units	mbarl/s, Pam³/s, Atmcc/s, Torrl/s, ppm, g/a, oz/yr, atmcc/min	mbarl/s	*CONFig:UNIT:LR	SetUnit 1
Alarm delay	Main Menu -> Trigger & Alarms -> Alarm delay	0s to 600s	30s	*CONFig:ALARMDelay	
Audio alarm type	Main Menu -> Trigger & Alarms -> Audio alarm type	Leckrate proportional, Alarmtrigger, Setpoint, Pinpoint	Trigger alarm	*CONFig:AUDio	SetTriggerAlarmTyp
Purge & Gas ballast	Main Menu -> Settings -> Vacuum settings -> Purge & Gas ballast	Manual purge, Manual Gas ballast, Automatic purge	man. Gasballast	*CONFig:PURGe	
Vent delay	Main Menu -> Settings -> Vacuum settings -> Vent delay	immediately, 1s, 1.5s, 2s, no vent	2s	*CONFig:VENTdelay	SetVentDelay
Partial flow Evacuation	Main Menu -> Settings -> Vacuum settings -> Partial flow	Forepump, Partialflowpump, Fore- and Partialflowpump	without partial flow pump	*CONFig:PARTIALFlow:EVACuation	
Partial flow Measurement mode	Main Menu -> Settings -> Vacuum settings -> Partial flow	Forepump, Fore- and Partialflowpump	without partial flow pump	*CONFig:PARTIALFlow:MEASure	
Measurement period	Main Menu -> Settings -> Vacuum settings -> Auto Leak Test settings -> Measurement period	1s to 1800s	10s	*CONFig:TESTINGTime	
Series error message	Main Menu -> Settings -> Vacuum settings -> Auto Leak Test settings -> Series error message	disable, 1 to 9	5	*CONFig:SERIESErrmsg	GetSeriesErrMsg
Part number enable		on,off	off	*CONFig:PARTCOUNT	SetPartNrEnabled

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
Machine factor	Main Menu -> Settings -> Vacuum settings -> Machine factor	1E-6 to 1E6	1,00E+00	*FACtor:MACHine	SetMFac
leak rate external test leak for sniffer mode	Entry only at start of calibration	1E-6mbarl/s to 1E-mbarl/s	1E-5mbarl/s	*CONFig:CAL:EXTSniff	SetTL 2
Leak rate internal test leak	Main Menu -> Settings -> Vacuum settings -> Leak rate internal test leak	1E-9mbarl/s to 1E-5mbarl/s	1E-6mbarl/s	*CONFig:CAL:INT	SetTL 0
leak rate external test leak for vacuum mode	Entry only at start of calibration	1E-9mbarl/s to 1E-3mbarl/s	1E-7mbarl/s	*CONFig:cal:EXTVac	SetTL 1
Background suppression	Main Menu -> Settings -> Zero & Background -> Background suppression	off, inlet area, internal only	intern only	*CONFig:SUPPRession	SetSuppression Vacuum
Backgroundsuppression Autoleaktest	Main Menu -> Settings -> Vacuum settings -> Reference measurement	off, on	on	*CONFig:SUPPRession:AUTOLeaktest	SetSuppression Auotleaktest
Backgroundsuppression Commander	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Backgrund suppression	off, on, stable	on	*CONFig:SUPPRession:COMMAnder	SetSupptession Commander
Zero	Main Menu -> Settings -> Zero & Background -> Zero	disable, enabled, I-Zero	enabled	*CONFig:ZERO	SetZeroMode
Mass	Main Menu -> Settings -> Mass	2, 3, 4	4	*CONFig:MASS	
Control location	Main Menu -> Settings -> Interfaces -> Control location	PLC, RS232, local and PLC, local and RS232, local, all	local	*CONFig:CONTrol	SetCtrlMode
RS232 protocol	Main Menu -> Settings -> Interfaces -> RS232 protocol	Binary, ASCII, UL2xxLeakware	ASCII	*CONFig:RS232	SetASCII

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
Characteristic external pressure gauge	Main Menu -> Settings -> Interfaces -> External pressure gauge -> Characteristic	linear 4 to 20mA, linear 0 to 10V, log 4 to 20mA, log 0 to 10V	lin. 4-20mA	*CONFig:PEXT1:CHARacteristic	
Zero point signal external pressure gauge	Main Menu -> Settings -> Interfaces -> External pressure gauge -> Zero point	0mA to 20mA or 0V to 10V	4mA resp. 2V	*CONFig:PEXT1:ZEROU	
Full scale signal external presure gauge	Main Menu -> Settings -> Interfaces -> External pressure gauge -> Full scale	0,1V to 10V or 0.2mA to 20mA	20mA resp. 10V	*CONFig:PEXT1:FULLU	
Zero point pressure external pressure gauge	Main Menu -> Settings -> Interfaces -> External pressure gauge -> Zero point	1E-11 mbar to 1E+04 mbar	1E0 mbar	*CONFig:PEXT1:ZEROP	
Full scale pressure external pressure gauge	Main Menu -> Settings -> Interfaces -> External pressure gauge -> Full scale	1E-4 mbar to 5E5 mbar	1E4 mbar	*CONFig:PEXT1:FULLP	
PLC output Pin 3…14	Main Menu -> Settings -> Interfaces -> Define PLC outputs	TRIGGER_1, TRIGGER_2, TRIGGER_3, ZERO_ACTIVE, EMISSION_ON, MEASURE, STANDBY, VENTED, ERROR, WARNING, CAL_ACTIVE, CAL_REQUEST, REC_STROBE, GAS_BALLAST, CYCLE_ACTIVE, SNIFF, PUMP_DOWN, OPEN, CLOSE	3 - TRIGGER_1 4 - TRIGGER_2 5 - TRIGGER_3 6 - ZERO_ACTIVE 7 - EMISSION_ON 8 - ERROR 9 - CAL_ACTIVE 10 - CAL_REQUEST 11 - OPEN 12 - OPEN 13 - OPEN 14 - OPEN	From *CONFig:PLCOUTLINK:3to *CONFig:PLCOUTLINK:14	

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
PLC input Pin 3…10	Main Menu -> Settings -> Interfaces -> Define PLC inputs	NOT_USED, START, STOP, START/STOP, VENT, ZERO, CAL, CAL_EXTERN, CAL_INTERN, CLEAR, GAS_BALLAST, CYCLE, GAS_BALLAST_ON, GAS_BALLAST_OFF, ZERO_ON, SNIFF All functions can be inverted by using the command with the prefix "INV_" (INV_START, INV_STOP, ...)	3 - START 4 - STOP 5 - ZERO 6 - CAL 7 - CAL_INTERN 8 - CAL_EXTERN 9 - CLEAR 10 - GASBALLAST	From *CONFig:PLCINLINK:3 to *CONFig:PLCINLINK:10	
Recorder output 1-2	Main Menu -> Settings -> Interfaces -> Recorder -> Recorder output	Off, p1, p2, LR mantissa, LR exponent, LR linear, LR log., p1 (UL200), p2 (UL200), LR log. H.	LR mantissa	*CONFig:RECorder:link1_2	
Recorder output 3-4	Main Menu -> Settings -> Interfaces -> Recorder -> Recorder output	Off, p1, p2, LR mantissa, LR exponent, LR linear, LR log., p1 (UL200), p2 (UL200), LR log. H.	LR exponent	*CONFig:RECorder:link3_4	

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
Recorder output scale Upper limit	Main Menu -> Settings -> Interfaces -> Recorder -> Recorder scale	1E-11mbarl/s to 1E7mbarl/s	1E-5mbarl/s	*CONFig:RECorder: upperexp	
Recorder scale	Main Menu -> Settings -> Interfaces -> Recorder scale	0.5V/Decade to 10V/ Decade	1V/Decade	*CONFig:RECorder: scale	
Leak rate output via recorder output	Main Menu -> Settings -> Interfaces -> Recorder scale	always, measurement mode only	always	*CONFig:RECorder: onlymeas	
Date & Time	Main Menu -> Settings -> Miscellaneous -> Time & Date	01.01.2005 12:00	*HOUR:DATE *HOUR:TIME		
Language	Main Menu -> Settings -> Miscellaneous -> Language	ENGLISH, DEUTSCH, ITALIANO, FRANCAIS, POLSKI, NIHONGO (KATAKANA), CHINESE, ESPANOL	english	*CONFig:LANGuage	
Leak rate filter	Main Menu -> Settings -> Miscellaneous -> Leak rate filter	Fixed, I-CAL	I-CAL	*CONFig:ICAL	SetLrFilter
Part number enable	Main Menu -> Settings -> Miscellaneous -> Part number OR Main Menu -> Settings -> Vacuum settings -> Auto Leak Test settings -> Part number	0 bis 999999, disabled	disabled	*CONFig:PARTNO	SetPartNrEnabled
CAL settling time	Main Menu -> Settings -> CAL settling time	10s to 300s	10s	*CONFig:CALSETTLINGTime	
Service interval air filter	Main Menu -> Settings -> Service interval air filter	500hrs. to 4000hrs.	1500Std.	*HOUR:SERVice:FILTER	
Service message air filter	Main Menu -> Settings -> Service message air filter	on,off	on		
Calibration request	Main Menu -> Monitoring functions -> Calibration request	on,off	off	*CONFig:CALREQ	SetCalRequest

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
Contamination protection	Main Menu -> Monitoring functions -> Contamination protection	on,off	off	*CONFig:PROTection:CONTamination	
limit value for contamination protection	Main Menu -> Monitoring functions -> Contamination protection	1E-6mbarl/s to 1E3mbarl/s	1E-3 mbarl/s	*CONFig:PROTection:CONTLimit	
Pressure limits for vacuum ranges	Main Menu -> Monitoring functions -> Pressure limits for vacuum ranges	0.1mbar to 0.4mbar	0.4mbar		
Pressure limit for sniff mode minimum	Main Menu -> Settings -> Monitoring functions -> Pressure limits for sniff mode	0.05 mbar to 2.00 mbar	0.5mbar	*CONFig:PROTection:PMIN	
Pressure limit for sniff mode maximum	Main Menu -> Settings -> Monitoring functions -> Pressure limits for sniff mode	0.05 mbar to 2.00 mbar	1.5mbar	*CONFig:PROTection:PMAX	
Max. evacuation time until p < 100mbar	Main Menu -> Monitoring functions -> Maximum evacuation time	1s to 900s, infinite	10min	*CONFig:PROTection:EVACtime2	
Max. evacuation time until measurement	Main Menu -> Monitoring functions -> Maximum evacuation time	5s to 1800s, infinite	30min	*CONFig:PROTection:EVACtime	
Access to CAL function	Main Menu -> Access control -> Access to CAL function	on,off	on	*CONFig:CALAccess	SetDirectCalAccess
t_A evacuation time	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander timing -> t_A Gross leak test	0.1s to 95s	7s	*CONFig:COMMANDTime:1 *CONFig:COMMANDTime:A	

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
t_B zero delay	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander timing -> t_B Evacuation time	0.1s to 95s	30s	*CONFig:COMMANDTime:2 *CONFig:COMMANDTime:B	
t_C charging time	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander timing -> t_C Charging time	0.1s to 95s	30s	*CONFig:COMMANDTime:3 *CONFig:COMMANDTime:C	
t_D discharging time	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander timing -> t_D Discharging time	0.1s to 95s	5s	*CONFig:COMMANDTime:4 *CONFig:COMMANDTime:D	
t_E venting time	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander timing -> t_E Venting time	0.1s to 95s	30s	*CONFig:COMMANDTime:5 *CONFig:COMMANDTime:E	
t_F ready to test	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander timing -> t_F Ready to test	0.1s to 95s	5s	*CONFig:COMMANDTime:6 *CONFig:COMMANDTime:F	
t_G measurement period	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander timing -> t_G Measurement period	0.1s to 95s	1s	*CONFig:COMMANDTime:7 *CONFig:COMMANDTime:G	

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
p_A Gross leak test	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander pressures -> p_A Gross leak test	0mbar to 1E4mbar	9E2mbar	*CONFig:COMMANDPress:1 *CONFig:COMMANDPress:A	
p_B evacuation pressure	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander pressures -> p_B Evacuation press.	0mbar to 1E4mbar	4E1mbar	*CONFig:COMMANDPress:2 *CONFig:COMMANDPress:B	
p_C charging pressure	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander pressures -> p_C Charging press.	0mbar to 1E4mbar	2E3mbar	*CONFig:COMMANDPress:3 *CONFig:COMMANDPress:C	
p_D discharging pressure	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander pressures -> p_D Discharging press.	0mbar to 1E4mbar	1.1E3mbar	*CONFig:COMMANDPress:4 *CONFig:COMMANDPress:D	
p_E pressure drop trigger	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander pressures -> p_E Press. Drop trig.	0mbar to 1E4mbar	4E1mbar	*CONFig:COMMANDPress:5 *CONFig:COMMANDPress:E	
p_F	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander pressures -> p_F	0mbar to 1E4mbar	1E1mbar	*CONFig:COMMANDPress:6 *CONFig:COMMANDPress:F	
p_G	Main Menu -> Settings -> Vacuum settings -> Commander functions -> Commander pressures -> p_G	0mbar to 1E4mbar	1E1mbar	*CONFig:COMMANDPress:7 *CONFig:COMMANDPress:G	

Menu Parameter	Menu access	Range	Default factory setting	ASCIIProtocol	BinaryProtokol
cathode	Main Menu -> Info -> Service -> Switch filament	*CONFig:CAThode			

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