INTERFACE DESCRIPTION

iins70e1-c (1005)

Catalog No.
550-000, 550-001
550-100, 550-101
550-500, 550-501

from software version
V 4.4 (UL1000)
V 4.4 (UL1000 Fab)
V 4.4 (UL5000)

UL1000 (Fab)/
UL5000

Helium Leak Detectors
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<th>Page</th>
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</tbody>
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1 Interface Description

1.1 Preface

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

Choose the interface protocol „ASCII“ to connect the leak detector with the computer via RS232 interface.

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

The following parameter of interfaces are in use:

19200 baud, 8 databits, 1 stopbit, no parity.

1.2 Interface Connecting Cable

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

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>RxD</td>
<td>Receive data (leak detector → PC)</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>Transmit data (PC → leak detector)</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Reference Ground</td>
</tr>
</tbody>
</table>

The other pins are not being used.

The levels on the RS232 interface are defined as follows:

<table>
<thead>
<tr>
<th>Level</th>
<th>Low (L)</th>
<th>High (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Range</td>
<td>-3 V ... -25 V</td>
<td>3 V ... 25 V</td>
</tr>
<tr>
<td>Logic State</td>
<td>logical 1</td>
<td>logical 0</td>
</tr>
<tr>
<td>Level Designation</td>
<td>Mark</td>
<td>Space</td>
</tr>
</tbody>
</table>

1.3 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 „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 63 dec) 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:

- **Boolean**
  - 0 / 1 or OFF / ON

- **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.

The following table lists all commands available in the ASCII mode.

**Notice**
- Between command words and Parameters is always a blank sign.

### 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:

![RS232 cable diagram]

**Fig. 1-1 RS232 cable**
1.4 Error messages

<table>
<thead>
<tr>
<th></th>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ERR_OK</td>
<td>command completed</td>
</tr>
<tr>
<td>1</td>
<td>ERR_CMD_START</td>
<td>wrong command start (no &quot;)&quot;)</td>
</tr>
<tr>
<td>2</td>
<td>ERR_ERR_BLANK</td>
<td>illegal blank</td>
</tr>
<tr>
<td>3</td>
<td>ERR_CMD_WORD_1</td>
<td>command word 1 illegal</td>
</tr>
<tr>
<td>4</td>
<td>ERR_CMD_WORD_2</td>
<td>command word 2 illegal</td>
</tr>
<tr>
<td>5</td>
<td>ERR_CMD_WORD_3</td>
<td>command word 3 illegal</td>
</tr>
<tr>
<td>6</td>
<td>ERR_DISABLED</td>
<td>control by RS232 not enabled</td>
</tr>
<tr>
<td>7</td>
<td>ERR_ARGUMENT</td>
<td>argument faulty</td>
</tr>
<tr>
<td>8</td>
<td>ERR_NO_DATA</td>
<td>no data available</td>
</tr>
<tr>
<td>9</td>
<td>ERR_BUFFER_OVERFLOW</td>
<td>buffer overflow</td>
</tr>
<tr>
<td>10</td>
<td>ERR_INVALID</td>
<td>command invalid</td>
</tr>
<tr>
<td>11</td>
<td>ERR_NO_QUERY</td>
<td>query not allowed</td>
</tr>
<tr>
<td>12</td>
<td>ERR_QUERY</td>
<td>only query allowed</td>
</tr>
<tr>
<td>13</td>
<td>ERR_NOT_IMPLEMENTED</td>
<td>not implemented</td>
</tr>
</tbody>
</table>

1.5 Parameter

- **Boolean**: 0 / OFF or 1 / ON respectively
- **<NRf> Numeric representation format**: integer, real (15.6) or exponent (4.5E-7)
  
  
  [space] [sign] [ddd] [.] [ddd] [e|E][sign]ddd

1.6 Examples

<table>
<thead>
<tr>
<th>Command</th>
<th>answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>*stat? (CR)</td>
<td>MEAS (CR) mode</td>
</tr>
<tr>
<td>*status? (CR)</td>
<td>MEAS (CR) mode</td>
</tr>
<tr>
<td>*read? (CR)</td>
<td>2.876E-7 (CR) leak rate according to programmed unit</td>
</tr>
<tr>
<td>*read:pa&quot;m3/s? (CR)</td>
<td>2.876E-6 (CR) leak rate in a different unit</td>
</tr>
<tr>
<td>*start (CR)</td>
<td>OK (CR) start measurement</td>
</tr>
<tr>
<td>*conf:trig1? (CR)</td>
<td>1.0E-9 retrieve trigger 1</td>
</tr>
<tr>
<td>*conf:trig1 2.0E-9 (CR)</td>
<td>OK set trigger 1</td>
</tr>
</tbody>
</table>
## 1.7 Command list

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*CLS</td>
<td>clear Error</td>
</tr>
<tr>
<td>*IDN</td>
<td>identification</td>
</tr>
<tr>
<td>:CRC</td>
<td>check sum</td>
</tr>
<tr>
<td>:DEVice</td>
<td>name of instrument (UL1000, UL1000Fab, UL5000)</td>
</tr>
<tr>
<td>:VERsion</td>
<td>software version</td>
</tr>
<tr>
<td>:SERRial</td>
<td>serial-Number</td>
</tr>
<tr>
<td>:TURBO</td>
<td>software version TC600</td>
</tr>
<tr>
<td>:MC68</td>
<td>hardware identification MC68</td>
</tr>
<tr>
<td>:IOversion</td>
<td>hardware identification IO-Karte</td>
</tr>
<tr>
<td>:GBversion</td>
<td>hardware identification control panel</td>
</tr>
<tr>
<td>:VVersion</td>
<td>hardware identification mother board</td>
</tr>
<tr>
<td>:DIP1</td>
<td>MC68 DipSwitch 1</td>
</tr>
<tr>
<td>:DIP2</td>
<td>MC68 DipSwitch 2</td>
</tr>
<tr>
<td>:TURBO</td>
<td>software version frequency converter</td>
</tr>
<tr>
<td>*STATus</td>
<td>mode of calibration routine</td>
</tr>
<tr>
<td>[:CAL]</td>
<td>mode calibration</td>
</tr>
<tr>
<td>[:CALHist]</td>
<td>CAL History (1…12)</td>
</tr>
<tr>
<td>[:CALMode]</td>
<td>kind of calibration INT_AUTO, INT_MAN, EXT</td>
</tr>
<tr>
<td>[:ERRor]</td>
<td>error</td>
</tr>
<tr>
<td>[:ERRorHist]</td>
<td>error History (1…12)</td>
</tr>
<tr>
<td>[:ZERO]</td>
<td>zero</td>
</tr>
<tr>
<td>[:RANGE]</td>
<td>measuring mode GROSS, FINE, ULTRA</td>
</tr>
<tr>
<td>:BOOSTER</td>
<td>Booster-TMP State (UL5000 only): OFF, ACCL, NORM, FAIL</td>
</tr>
<tr>
<td>:RESULT</td>
<td>AutoLeakTest state/result: IDLE, RUNNING, PASS, FAIL</td>
</tr>
<tr>
<td>:TESTLog</td>
<td>Test-Log</td>
</tr>
<tr>
<td>*READ</td>
<td>leak rate (selected unit)</td>
</tr>
<tr>
<td>[:&lt;unit&gt;]</td>
<td>leak rate (desired unit)</td>
</tr>
<tr>
<td>*STArt</td>
<td>start</td>
</tr>
<tr>
<td>*STOp</td>
<td>stop</td>
</tr>
<tr>
<td>*PURGE</td>
<td>Purge on</td>
</tr>
<tr>
<td>:OFF</td>
<td>Purge off</td>
</tr>
<tr>
<td>*VENT</td>
<td>vent</td>
</tr>
<tr>
<td>*CAL</td>
<td>start calibration / proceed (see Chapter 1.8)</td>
</tr>
<tr>
<td>*ZERO</td>
<td>zero</td>
</tr>
<tr>
<td>[:OFF]</td>
<td>zero off</td>
</tr>
</tbody>
</table>
**MEAS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>inlet pressure</td>
</tr>
<tr>
<td>P2</td>
<td>foreline pressure</td>
</tr>
<tr>
<td>P3</td>
<td>inlet pressure (UL5000)</td>
</tr>
<tr>
<td>Offset</td>
<td>offset current [A]</td>
</tr>
<tr>
<td>IMess</td>
<td>current raw values [A]</td>
</tr>
<tr>
<td>IFilter</td>
<td>current filtered [A]</td>
</tr>
<tr>
<td>UNV</td>
<td>amplifier voltage [V]</td>
</tr>
<tr>
<td>UVV</td>
<td>preamplifier voltage [V]</td>
</tr>
<tr>
<td>MIAP</td>
<td>anode potential [V]</td>
</tr>
<tr>
<td>MIKP</td>
<td>cathode potential [V]</td>
</tr>
<tr>
<td>MISP</td>
<td>suppressor potential [V]</td>
</tr>
<tr>
<td>MIAKP</td>
<td>anod-/cathode potential [V]</td>
</tr>
<tr>
<td>VALVE</td>
<td>valve voltage [V]</td>
</tr>
<tr>
<td>U24EXT</td>
<td>external voltage [V]</td>
</tr>
<tr>
<td>U24FB</td>
<td>voltage remote control [V]</td>
</tr>
<tr>
<td>U24FAN</td>
<td>fan voltage [V]</td>
</tr>
<tr>
<td>TEMPeratur</td>
<td>amplifier preamplifier temperature [°C]</td>
</tr>
<tr>
<td></td>
<td>electronic temperature [°C]</td>
</tr>
</tbody>
</table>

**TURBO**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>TMP frequency [Hz]</td>
</tr>
<tr>
<td>Voltage</td>
<td>TMP voltage [Hz]</td>
</tr>
<tr>
<td>Current</td>
<td>TMP current [A]</td>
</tr>
<tr>
<td>Power</td>
<td>TMP power [W]</td>
</tr>
</tbody>
</table>

**BOOSTER**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALARMDelay</td>
<td>alarm delay after evacuation (0 ... 600, 65535)</td>
</tr>
<tr>
<td>Audio</td>
<td>audio alarm type (PIN, SET, TRIG, PROP)</td>
</tr>
<tr>
<td>BACKGROUND</td>
<td>background display (ON, OFF)</td>
</tr>
<tr>
<td>BEEP</td>
<td>beep-sound (ON, OFF)</td>
</tr>
<tr>
<td>BOOster</td>
<td>Booster-TMP Mode: ON, OFF</td>
</tr>
<tr>
<td>CALAccess</td>
<td>CAL access (ON, OFF)</td>
</tr>
<tr>
<td>CALleak</td>
<td>leak rate of test leak</td>
</tr>
<tr>
<td>INT</td>
<td>internal test leak</td>
</tr>
<tr>
<td>EXTVAC</td>
<td>external test leak in vacuum mode</td>
</tr>
<tr>
<td>EXTSNIFF</td>
<td>external test leak in sniff mode</td>
</tr>
<tr>
<td>CALREQ</td>
<td>calibration request</td>
</tr>
<tr>
<td>CATHode</td>
<td>cathode</td>
</tr>
<tr>
<td>CONTrol</td>
<td>control location (LOCAL, RS232, PLC, LOCAL/RS232, LOCAL/PLC)</td>
</tr>
<tr>
<td>FREQuenz</td>
<td>mains frequency (50/60Hz)</td>
</tr>
<tr>
<td>HYDros</td>
<td>HYDROS: DISABLED, ON, OFF</td>
</tr>
<tr>
<td>ICAL</td>
<td>filter type</td>
</tr>
<tr>
<td>LANGUAGE</td>
<td>language (ENGLISH, DEUTSCH, FRANÇAIS, ITALIANO, POLSKI, KATAKANA, CHINESE, ESPAÑOL, KOREAN)</td>
</tr>
<tr>
<td>LCDAutorange</td>
<td>display range (auto, manual)</td>
</tr>
<tr>
<td>LCDContrast</td>
<td>display contrast (0 ... 99)</td>
</tr>
<tr>
<td>LCDDECDades</td>
<td>number of display decades (2 ... 9)</td>
</tr>
<tr>
<td>LCDInvert</td>
<td>invert display</td>
</tr>
<tr>
<td>LCDSCALELog</td>
<td>display scale</td>
</tr>
<tr>
<td>LIMITLow</td>
<td>lower display limit (0 ... 7)</td>
</tr>
<tr>
<td>MASS</td>
<td>mass (2, 3, 4)</td>
</tr>
<tr>
<td>MFAE:</td>
<td>anode potential reference</td>
</tr>
<tr>
<td>Description</td>
<td>Value</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>MINVOLUME</td>
<td>Minimum audio volume (0 ... 15)</td>
</tr>
<tr>
<td>MODE</td>
<td>Mode (HYDROS, AUTO, VAC, SNIFF, SNIFFSP)</td>
</tr>
<tr>
<td>PARTCOUNT</td>
<td>Part counting enabled: ON, OFF</td>
</tr>
<tr>
<td>PARTNO</td>
<td>Current part number</td>
</tr>
<tr>
<td>PVEACGROSS</td>
<td>Pressure switching level: EVAC to GROSS</td>
</tr>
<tr>
<td>PGROSSFINE</td>
<td>Pressure switching level: GROSS to FINE</td>
</tr>
<tr>
<td>PROTECTION</td>
<td>Protecting functions</td>
</tr>
<tr>
<td>CONTaminaton &lt;b&gt;</td>
<td>Contamination protection (ON, OFF)</td>
</tr>
<tr>
<td>CONTLimit</td>
<td>Contamination protection limit</td>
</tr>
<tr>
<td>EVACtime</td>
<td>Maximum evacuation time (0 – infinite)</td>
</tr>
<tr>
<td>PARTICle &lt;b&gt;</td>
<td>Particle protection (ON, OFF)</td>
</tr>
<tr>
<td>PMAX</td>
<td>Maximum pressure in sniff</td>
</tr>
<tr>
<td>PMIN</td>
<td>Minimum pressure in sniff</td>
</tr>
<tr>
<td>PURGe &lt;b&gt;</td>
<td>Automatic purge: ON, OFF</td>
</tr>
<tr>
<td>RECorder</td>
<td>Recorder output</td>
</tr>
<tr>
<td>LINK1_2 / 12</td>
<td>Off, p1, p2, mant, exp, lr_lin, lr_log, p3</td>
</tr>
<tr>
<td>LINK3_4 / 34</td>
<td></td>
</tr>
<tr>
<td>RS232</td>
<td>RS232 mode (ascii, binary)</td>
</tr>
<tr>
<td>SUPPRESSION</td>
<td>Background suppression: OFF, INTERN, INLET</td>
</tr>
<tr>
<td>TESTINGTime</td>
<td>Maximum testing time for AutoLeakTest</td>
</tr>
<tr>
<td>TESTINGTIMEmax</td>
<td></td>
</tr>
<tr>
<td>TESTINGTIMEMIN</td>
<td>Minimum testing time for AutoLeakTest</td>
</tr>
<tr>
<td>TIMEAXIS</td>
<td>Time axis resolution: AUTO or time in seconds</td>
</tr>
<tr>
<td>TMPVENT</td>
<td>TMP vent after power off: ON, OFF</td>
</tr>
<tr>
<td>TRIGger1</td>
<td>Trigger 1</td>
</tr>
<tr>
<td>TRIGger2</td>
<td>Trigger 2</td>
</tr>
<tr>
<td>UNIT</td>
<td></td>
</tr>
<tr>
<td>LR</td>
<td>Leak rate unit (mbar<em>l/s, Pa</em>m²/s, atm<em>cc/s, Torr</em>l/s, ppm, g/a, oz/yr)</td>
</tr>
<tr>
<td>Pressure</td>
<td>Pressure unit (mbar, Pa, atm, Torr)</td>
</tr>
<tr>
<td>VENTdelay</td>
<td>Vent delay (0, 1, 1.5, 2, NO)</td>
</tr>
<tr>
<td>VOLUME</td>
<td></td>
</tr>
<tr>
<td>ZERO</td>
<td>Zero (OFF, ON, ULTRA)</td>
</tr>
<tr>
<td>HOUR</td>
<td></td>
</tr>
<tr>
<td>DATE</td>
<td>Date</td>
</tr>
<tr>
<td>DEVICE</td>
<td>Operating hours</td>
</tr>
<tr>
<td>POWER</td>
<td>Time since power on</td>
</tr>
<tr>
<td>RUNup</td>
<td>Run-up time</td>
</tr>
<tr>
<td>SERVICE</td>
<td></td>
</tr>
<tr>
<td>TURBO</td>
<td>Service turbopump</td>
</tr>
<tr>
<td>FORE</td>
<td>Service foreline pump</td>
</tr>
<tr>
<td>FILTER</td>
<td>Service filter</td>
</tr>
<tr>
<td>TIME</td>
<td>Time</td>
</tr>
<tr>
<td>TURBO operating hours TMP</td>
<td></td>
</tr>
<tr>
<td>TC</td>
<td>Operating hours frequency converter</td>
</tr>
<tr>
<td>FACTOR</td>
<td></td>
</tr>
<tr>
<td>VACuum</td>
<td>Calibration factor vacuum (selected mass)</td>
</tr>
<tr>
<td>M2</td>
<td>Calibration factor vacuum (mass 2)</td>
</tr>
<tr>
<td>M3</td>
<td>Calibration factor vacuum (mass 3)</td>
</tr>
<tr>
<td>M4</td>
<td>Calibration factor vacuum (mass 4)</td>
</tr>
<tr>
<td>SN</td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>:SNIF</td>
<td>calibration factor sniff</td>
</tr>
<tr>
<td>M2</td>
<td>calibration factor sniff (mass 2)</td>
</tr>
<tr>
<td>M3</td>
<td>calibration factor sniff (mass 3)</td>
</tr>
<tr>
<td>M4</td>
<td>calibration factor sniff (mass 4)</td>
</tr>
<tr>
<td>MACHine</td>
<td>machine factor</td>
</tr>
</tbody>
</table>
1.8 **Calibration via RS232**

Two different kinds of calibration can be called via "CAL":

1.8.1 **Internal Automatical 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.

1.8.2 **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 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.