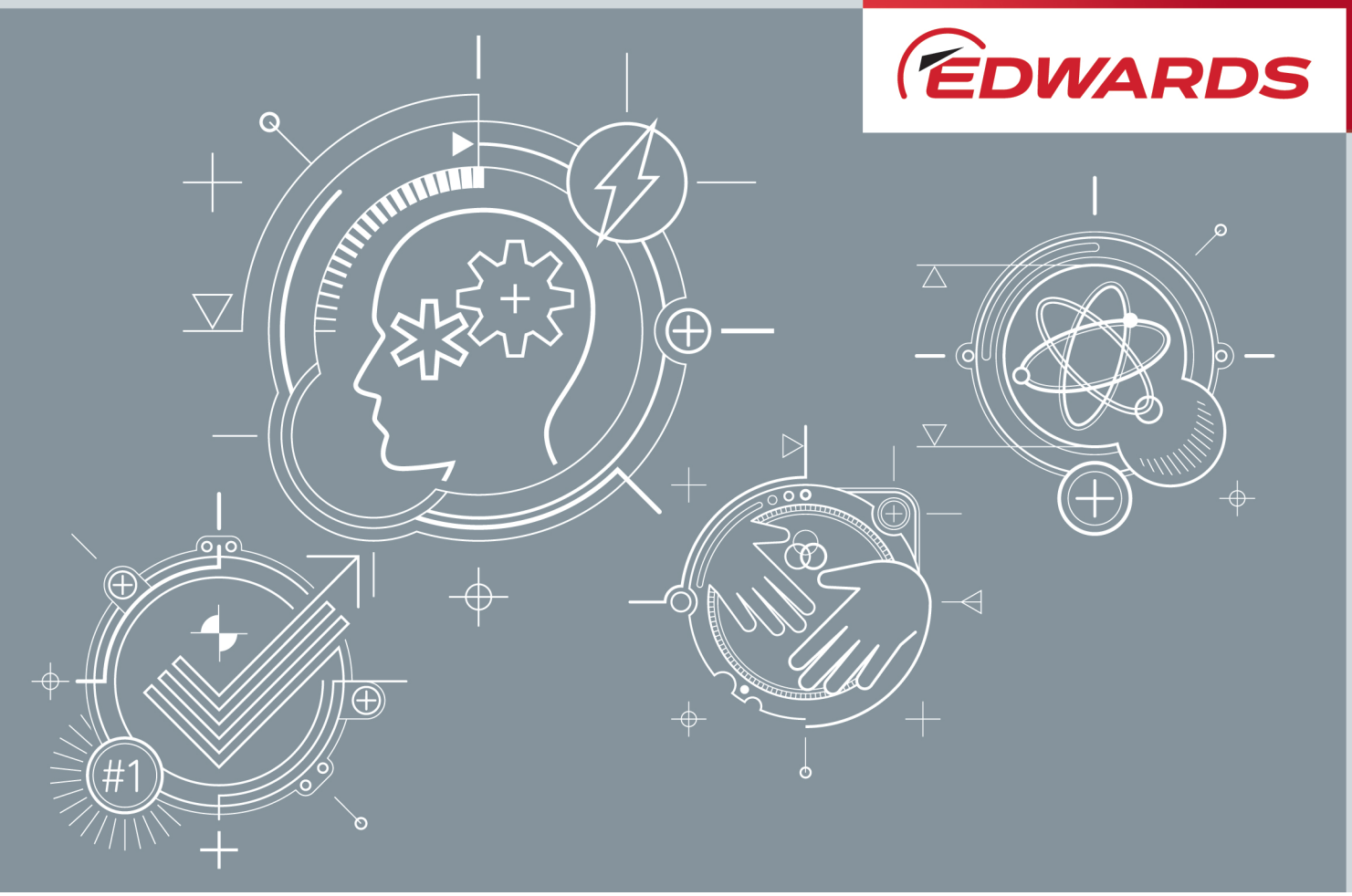


ELD500 ACCESSORIES INSTRUCTION MANUAL

Publication number: D13510840
Issue: D
Original Instructions

Copyright notice

Trademark credits

Contents

cg/8664/10/2019

List of Figures

This page has been intentionally left blank.

Introduction

This manual provides installation, operation and maintenance instructions for the Edwards range of accessories for the ELD500 leak detector.

The Item Numbers for the accessories are listed in the appropriate sections. The accessories must be used as specified in this manual. Read this manual before installing accessories onto the ELD500.

Important safety information is highlighted as WARNING and CAUTION instructions; obey these instructions. The use of WARNINGS and CAUTIONS is defined below.

WARNING:

Warnings are given where failure to observe the instruction could result in injury or death to people.

CAUTION:

Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment and process.

Note:

Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.

This page has been intentionally left blank.

RC Remote control

Intended use

The ELD500 RC has been designed to operate the ELD500 leak detector.

The ELD500 RC must only be used for the purpose and within the context outlined in this manual.

Use only Edwards accessories.

User requirements

Note:

The ELD500 RC must only be connected and operated by properly trained personnel.

- The user must be familiar with the function of the device; read and understand the operating instructions before connecting and operating the device.
- The user should consult local, state, and national agencies regarding specific requirements and regulations for devices with wireless transmission capability.
- For any questions regarding safety, operation and/or maintenance, the user should contact the nearest representative.

Restrictions of use

WARNING:

Danger in explosive environments. The ELD500 RC may only be used away from explosive environments.

Hazards in the event of intended use

WARNING:

Possible interference with pacemakers. The performance of pacemakers may be affected by the magnets on the back of the ELD500 RC. Observe the distances indicated by the pacemaker manufacturer.

When handling the ELD500 RC:

WARNING:

Possible liquid crystal hazard. If the display has broken, prevent liquid crystals from entering people's mouths or eyes. Use soap and water to wash hands, feet or clothes that have come into contact with liquid crystals.

WARNING:

Possible radiation hazard. When the device is operated, a minimum distance of 7 cm between the remote control and people must be observed, with the exception of hands and wrists.

Operation at a shorter distance than indicated above is not allowed. The ELD500 RC complies with part 15 of the FCC regulations*.

* *FCC: Federal Communications Commission, approval authority for communication devices (USA)*

When handling the rechargeable battery and power supply:

WARNING:

Possible short circuit hazard. In case of a short-circuit the battery might ignite, explode, leak battery fluid, or become overheated and cause burns.

Do not short-circuit the battery of the ELD500 RC Wireless.

WARNING:

Possible explosion hazard. The battery of the ELD500 RC Wireless can explode if it is extreme overheated.

Do not set fire to the battery as it might explode.

Note:

Charging the battery at higher temperatures (> 40 °C) decreases its service life.

CAUTION:

Possible risk of damage. The electronics of the ELD500 RC Wireless may be damaged by an incorrect supply voltage.

Only use the accompanying wall plug-in power supply.

Environmental conditions of the remote control (see Technical Data):

CAUTION:

Possible risk of damage. The ELD500 RC may be damaged if used outside through moisture, thick insulation, or intense dust.

Only use the device inside buildings.

CAUTION:

Possible risk of damage. Aggressive substances may damage the ELD500 RC beyond repair.

Avoid contact between the ELD500 RC and bases, acids, and solvents, and do not expose it to extreme climatic conditions.

CAUTION:

Possible risk of damage. The ELD500 RC may be damaged beyond repair by immersing in liquid. Do not switch on the ELD500 RC if liquid has penetrated the unit.

Contact the Edwards Service Department.

Storage and transportation of the remote control:

CAUTION:

Possible risk of damage. The ELD500 RC may be damaged by being stored in unfavourable conditions (too damp, too hot, too cold, too high above sea level) for months or years (see Technical Data).

If the ELD500 RC has been stored under such conditions, leave it switched off and contact Edwards Service.

CAUTION:

Possible risk of damage. The ELD500 RC may be damaged by improper transport.

Always transport the ELD500 RC in its original packaging.

Cleaning the remote control:

Note:

Clean the plastic housing of the ELD500 RC, the front foil and the display using a soft cloth, moistened with some water or soap suds. Do not use any solvents.

Operating the remote control:

Note:

The performance and reliability of the ELD500 RC can only be guaranteed if it is operated under the specified conditions of use (see Technical Data).

Note:

Any changes made to the ELD500 RC by the user may result in a violation of statutory provisions or may affect the EMC properties and safety of the product. Edwards does not accept any liability for the consequences of such changes.

Description

Use

The ELD500 RC Wired and ELD500 RC Wireless have been designed to operate the ELD500 leak detector.

The ELD500 RC is accommodated in a robust housing the shape of which enables ergonomic working. Magnets on the underside of the unit enable it to be attached to horizontal or vertical metal surfaces.

The ELD500 RC Wireless version enables remote operation up to a distance of 100 m, depending on reception conditions. The integrated rechargeable battery enables over 8 hours of operation, depending on the battery level.

The ELD500 RC Wired version enables remote operation of the leak detector in question up to a distance of 28 meters using a connection cable.

The leak rates can be displayed in digits or in a curve on the 3.5" colour display.

Measured values of up to several hours of recording can be stored in an internal memory. The data storage interval is adjustable. The data can easily be downloaded to a USB stick via the integrated USB interface to save it.

An internal trigger can be set to provide a warning if the maximum leak rates are exceeded. An optical warning is shown on the display and an acoustic warning signal with variable pitch proportionally to the leak rate is sounded on the integrated loudspeaker or the connected headphones.

Operating Elements

Figure 1 ELD500 RC

1. START button
2. ZERO button
3. POWER button
4. Touch Display
5. STOP button
6. Operating LED
7. Charge LED

POWER button	ELD500 RC Wireless: Power switch. After pressing and briefly holding the switch, the operating LED lights up as confirmation and flashes when the remote control is ready for use. Switch off by pressing and holding the button for more than 2 seconds.
	ELD500 RC Wired: The remote control turns on when the cable is plugged in. Pressing the Power button turns the display of the remote control on and off.
START button	Starts the leak test of the leak detector (see Operating the leak detector). (See the leak detector Technical Manual, and observe the menu option "Control location").
STOP button	Ends leak testing (see Operating the leak detector).
ZERO button	Activates the ZERO function (see Operating the leak detector).

Touch Display	Shows measurements displayed numerically or as a curve, indicates statuses and offers operating interfaces.
Operating LED	Flashes during normal operation.
Charging LED (ELD500 RC Wireless)	Lights up while the battery is being charged.

Back of the ELD500 RC

Figure 2 Back of the ELD500 RC

1. Magnets for attaching the remote control to metal surfaces.
2. M3 threaded bushings to attach holders
3. Sound outlet aperture for the integrated loudspeaker.
4. Eye for attaching carrying devices (e.g. wrist band).

CAUTION:

Risk of damage. Use screws that reach maximum 6 mm into the housing.

Supplied equipment

ELD500 RC Wireless

Supplied equipment:

- Connection cable, 4 m
- Wall plug-in power supply (for integrated battery)
- Radio transmitter
- Connection cable for radio transmitter
- Operating instructions

ELD500 RC Wired

Supplied equipment:

- ELD500 RC
- Connection cable, 4 m
- Operating instructions

ELD500 RC Wireless additional transmitter (for operating a second leak detector)

Supplied equipment:

- Radio transmitter
- Connection cable
- Installation instructions

Installation

Connection to the leak detector

ELD500 RC Wireless

The ELD500 RC Wireless is connected to the leak detector by means of a wireless data connection.

Connect the leak detector to the radio transmitter for this purpose (see Connecting the radio transmitter to the leak detector).

The ELD500 RC Wireless is shipped set-up for connection with the supplied radio transmitter. This way, the connection is immediately established upon turning the unit on.

Alternatively, it can also be connected by means of the enclosed cable, similar to connecting the ELD500 RC Wired. In this case only one connection cable must be used with the ELD500 RC Wireless, not more.

ELD500 RC Wired

The ELD500 RC Wired is connected to the leak detector by connecting the enclosed connection cable to the RJ25 socket (see Figure 5).

Connecting the radio transmitter to the leak detector

Connecting the radio transmitter for the ELD500 RC Wireless:

Use Velcro to position the radio transmitter (1) in a suitable location on the leak detector so that there is a direct line of sight between the antenna and the remote control.

Connect the connecting cable of the radio transmitter to the RJ25 socket of the leak detector (2).

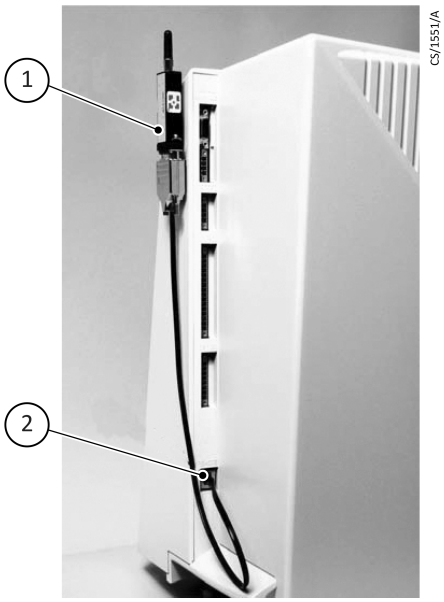
Note:

To extend the wireless operating range an extension cable also can be used to position the radio transmitter away from the leak detector, if reception is poor (e.g. at the ceiling of the room).

Note:

The operating range of the radio transmitter will be affected by metal objects if it's near, avoid installing the antenna near such objects.

Figure 3 Connecting the radio transmitter to the leak detector (ELD500 RC Wireless)



1. Radio transmitter
2. RJ25 socket

Contact area for remote control

Figure 4 Contact area for ELD500 RC

Inputs and outputs

The inputs and outputs of the ELD500 RC have covers to prevent large dirt particles and moisture from penetrating.

Note:

The IP42 safety class can only be guaranteed if the covers are closed.

RJ25 socket

The RJ25 socket is located at the underside of the ELD500 RC and closed with a protective plug when delivered.

Figure 5 RJ25 socket on the bottom of the remote control

Note:

Leave the protective plug in the socket when the cable is not connected.

Note:

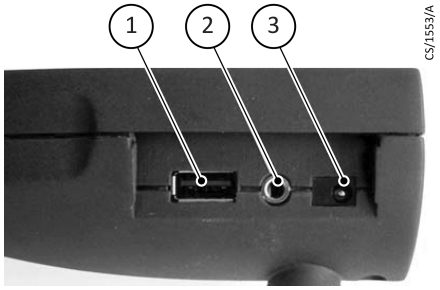
We recommend only inserting and removing the RJ25 plug as often as is necessary for operation.

Connections on the side

Note:

Fold the protective strip upwards before connecting a plug (not shown).

Figure 6 Connections on the side (without cover)



1	USB connection Insert the USB stick (FAT formatted) to record data.
2	3.5 mm jack for stereo headphones Standard stereo headphones with a 3.5 mm jack plug and > 2 x 32 Ohm impedance can be connected to the jack. If the headphones are inserted, the volume of the integrated loudspeaker is automatically lowered.
3	Charging socket for the enclosed power supply.

Wall plug-in power supply

WARNING:

Possible risk of voltage hazard. Do not open the external power supply of the ELD500 RC Wireless. This might result in electric shock and/or injuries.

WARNING:

Risk due to incorrect power supply unit. Using an external power supply which has not been approved by the manufacturer of the remote control may result in electric shock, damage and/or injuries. Only use the power supply which was enclosed with the ELD500 RC Wireless.

Figure 7 Wall plug-in power supply of the ELD500 RC Wireless

Connect the plug of the power supply to the socket of the ELD500 RC Wireless to charge the integrated battery (see Figure 6, item 3).

The ELD500 RC Wireless is always switched on while the power supply cable is connected and the battery is being charged, the Charging LED is lit.

Short pressing of the "POWER" button reduces the back light intensity, pressing it for a time longer than about 10 seconds performs a reset of the remote control.

The LED switches off as soon as the battery has fully charged.

The battery can be charged during operation.

You can use the enclosed power supply all over the world; adapt it with the interchangeable blades to the national design (Europe, North America, Japan, UK, China, Australia, see Mains power for wall plug-in power supply).

Operation

Starting up the ELD500 RC

After starting up, a start screen with a "Welcome" message is shown on the touch display.

Figure 8 Touch-Display of the ELD500 RC

The ELD500 RC Wireless searches for a receiver (radio transmitter) of a leak detector after starting up to connect with it.

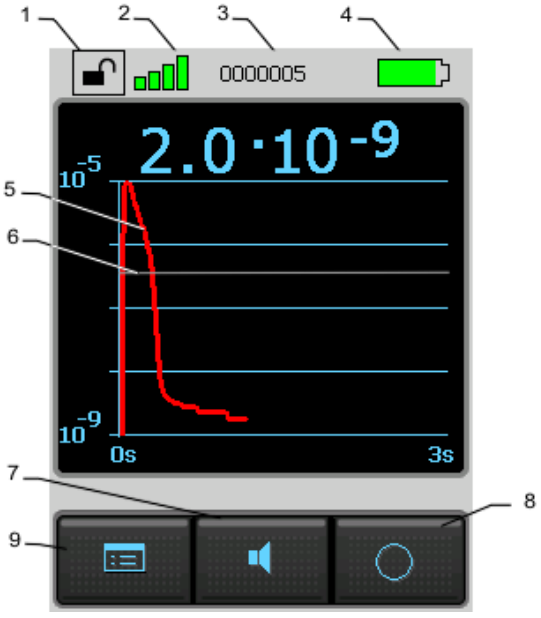
If no devices with which a connection is possible were found in the area, a message "no data connection" is displayed.

The establishing of a data connection is described in Connecting/disconnecting (ELD500 RC Wireless).

If a data connection with a leak detector is established the ELD500 RC Wireless shows the measuring screen on the display (see Figure 9).

Touch display operation

Figure 9 Symbols and information on the display



1 Lock/unlock buttons
2 Wireless connection
3 Data set of the entry (current number)
4 Charging status display
5 Display of measured values
6 Trigger level
7 Sound volume
8 Toggle display of measured values
9 Menu (access to the main menu)

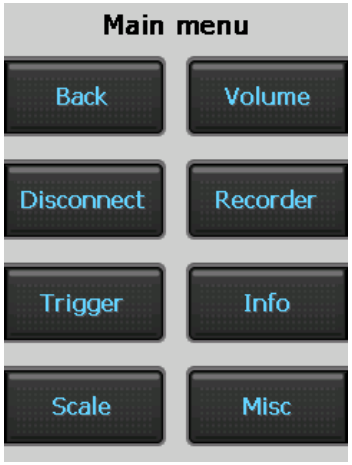
Display functions

The touch display functions can be used by lightly touching the relevant symbol on the display with a finger or a blunt pen.

Lock buttons	Touch and hold the symbol for more than 2 seconds to lock out the touch display and the hardware buttons START, STOP and ZERO operation. The touch display then becomes dark. Unlock: Touch and hold the symbol for more than 2 seconds.
Connection	Shows whether the ELD500 RC Wireless is connected to the leak test device by a wireless link.
Data recording	The number of the active data record is displayed.
Menu	To access the main menu.
Sound volume	Enables adjusting the volume of the loudspeaker in the leak detector or in the remote control.
Toggle display of measured values	Enables to toggle between a large digital display of the values or a display of the progress over time (diagram).

Main menu for configuration

Figure 10 Main menu on the touch display



The "Menu" symbol (Figure 9 item 9) can be used to access the main menu for the configuration of the remote control.

The functions of the individual buttons are described in more detail in the following.

Buttons with basic functions

Figure 11 Buttons with basic functions

If displayed, these buttons have the following functions:

?	Opens a help window for the current display. • Select "?" • Use the arrow keys to scroll through longer texts • Close the window with "OK"
X	Closes the current page. No changes made will be saved.
OK	Closes the current page and saves the changed settings. The remote control will now work with these settings.

Connecting/disconnecting (ELD500 RC Wireless)

The ELD500 RC Wireless searches for a receiver (radio transmitter) of a leak detector after turning on or after pressing the "Connect" button.

If no connection is found in the area within 20 seconds, the search is aborted.

The button "Connect" is displayed in the main menu when there is no connection to a leak detector yet.

After establishing the connection, the function of the button changes to "Disconnect".

Close an existing connection with "Disconnect"; the main menu is displayed.

Connecting to a leak detector:

Figure 12 Display of connectable devices for the connection

Pressing the "Connect" button of the main menu starts the search.

If devices with which a connection is possible were found in the area, they are displayed in the list "Connectable devices".

Select the desired device and connect to it by pressing "Connect".

The main menu opens automatically.

Press "Cancel" to end the connection process and return to the main menu.

Setting the trigger level

Figure 13 Trigger level menu

The basic level and exponent of the trigger level of the remote control are set here.

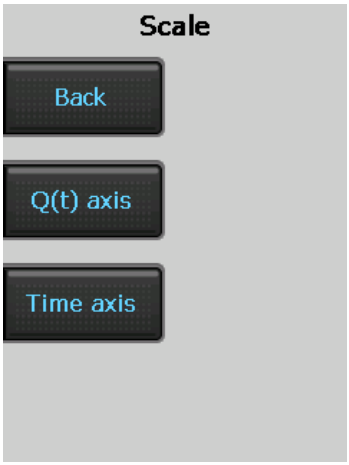
- The individual input fields can be selected with "<" and ">".
- The selected field is marked red and can be changed.
- Use the numeric keypad to enter the desired digit.
- After entering a digit, the mark changes to the next field.
- Confirm the set level with "OK".

Note:

The trigger level set here does not correspond to the trigger level set on the leak detector but only applies to the acoustic alarm signal of the ELD500 RC.

Scale: scaling of the leak-rate curve

Figure 14 Scale menu



Scaling options of the leak-rate curve and the bar graph:

- Q(t) axis:
  Opens a sub-menu with a choice between linear and logarithmic display of the measured values and automatic scaling (see Figure 15).
- Time axis:
  Opens a sub-menu for the scaling of the time axis (see Figure 16).

Figure 15 Scale sub-menu

Scaling options of the leak-rate curve and the bar graph:

- Lin / Log:
  Toggle between linear and logarithmic.
- For logarithmic scaling:
  Select number of decades between 1 and 15 (with the arrow keys).
- Automatic scaling:
  Can be turned on or off.
- Confirm the set level with "OK".

The selected values are displayed in the centre.

Figure 16 Menu scaling of the time axis

Scaling the time axis of the leak-rate curve:

- The selected value is displayed in the centre.
- The shown time in this menu is the displayed range of the time axis of the leak-rate curve.

Sound volume

In this menu you can set the volume of the acoustic signals at the leak detector and at the remote control using the "Arrow up" and "Arrow down" buttons.

The volume of the loudspeaker of the remote control and the connected leak detector can be adjusted within 15 volume levels.

Both devices play an example tone at the volume corresponding to the set levels.

Figure 17 Volume menu

Setting the volume:

- Set the volume of the leak detector and/or the remote control with the arrow keys.
- Level 0: the volume is turned off.
- Confirm the set level with "OK".

The volume of the leak detector is overwritten by the remote control.

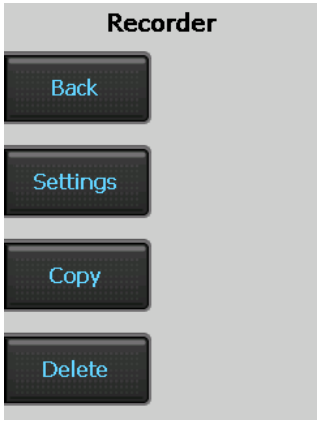
WARNING:

Possible risk of hearing damage. The hearing may be damaged by the alarm signal. If a high volume is set, only briefly expose the hearing to the alarm signal or use ear protection.

Recorder

Recording measurements, copying or deleting recorded data.

Figure 18 Recorder menu



- Select "Settings" to start, to stop or to configure the recording of measurements. Opens a sub-menu (see Figure 19).
- Select "Copy" to write recorded data to a plugged-in USB stick. Opens a sub-menu (see Figure 20).
- Select "Delete" to erase data from the internal memory. Opens a sub-menu (see Figure 21).

Preparing and configuring of recording

Figure 19 Recorder sub-menu settings

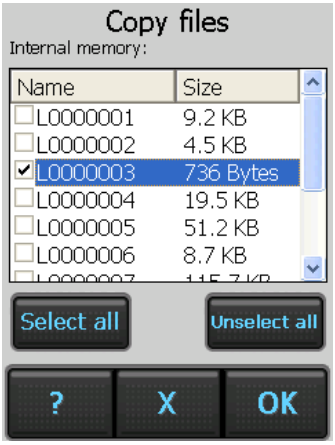
- Select "Auto record On" to prepare the recording. The recording to a new data file will start if the measurement mode will be activated.
- If the measurement mode is stopped again the recording quits and the data file is closed.
- Select "Auto record Off" if no recording should be done.
- "Interval" is the duration between the storage of two measured values to the data file.
- "Memory location" selects the storage to the USB stick or the internal memory

Note:

Set correct values of date and time to identify the appropriate data files after recording (See Set Time and Date*).*

Recorded data files can be copied to a plugged-in USB stick.

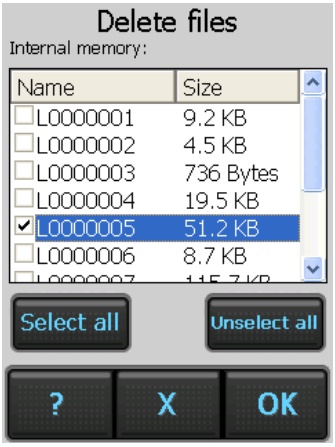
Figure 20 Recorder sub-menu copy files



- Plug-in the USB stick to the ELD500 RC.
- Select the files by touching the checkbox or use the "Select all" button.
- Press "OK" to copy the selected files to the USB stick.
- Apply the shown message with "OK".
- The USB stick can be unplugged.

Recorded data files can be deleted from the internal memory.

Figure 21 Recorder sub-menu delete files

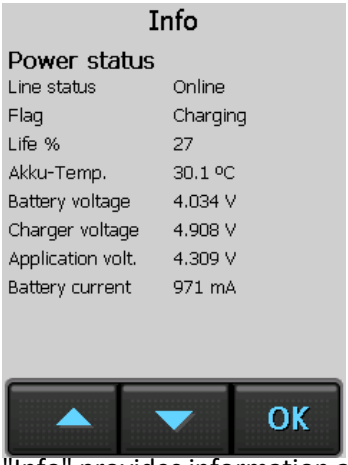


- Select the files by touching the checkbox or use the "Select all" button.
- Press "OK" to delete the selected files
- Apply the shown message with "OK" if the selected files should be deleted.

- A message confirms that the files are deleted, apply with "OK".

Info: device information

Figure 22 Info menu



"Info" provides information about the power level of the battery, the wireless connection, etc., and gives information on the current version over 4 pages.

Detailed information:

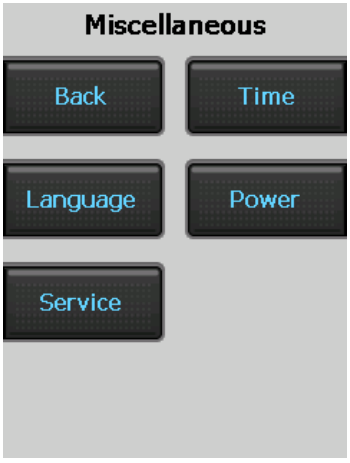
- Select the desired information with the arrow keys.
- Return to the main menu with "OK".

Miscellaneous

In the "Miscellaneous" menu, you can set the language, make software updates, set the time and the date, and select energy-saving options.

The menu point Service offers expanded functions and test options via an access PIN.

Figure 23 Miscellaneous menu, sub-menu Language



Language selection:

- By clicking on "Language", the sub-menu is opened for selecting the language.
- The current language is displayed in the centre. Available are: German, English, French, Spanish, Russian and Chinese.
- Select the desired language with the arrow keys and confirm with "OK".

Energy-saving options, time and date:

- See the following chapter.

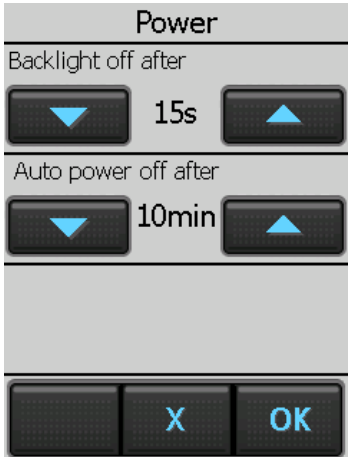
Service:

- The service menu is accessible via a PIN.

Energy-saving options (ELD500 RC Wireless)

The background illumination can be automatically decreased after a time between 15 seconds and 10 minutes ("Backlight off"). This lowers the energy consumption and the operating time of the battery is extended.

Figure 24 Energy menu



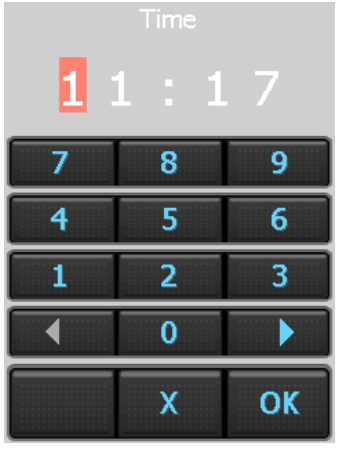
- Set the time period for "Backlight off" with "Arrow up" and "Arrow down".
- The remote control can be turned off if it is not used after an adjustable time between 5 minutes and 4 hours. Set the time period with "Arrow up" and "Arrow down".
- Confirm the settings with "OK".

Resetting the decreased background illumination:

- By tapping on the touch display, the regular background illumination is turned on again.

Set Time and Date

Figure 25 Time menu



Setting the time:

- The fields can be selected individually with "<" and ">".
- The field selected for change is marked red.
- Make changes via the numeric keypad.
- After changing a digit, the red mark automatically changes to the next field.
- Confirm the set time with "OK".
- The date can be set in the same way.

Note:

The ELD500 RC Wired cannot store date and time if the connecting cable is removed or the leak detector is turned off.

Operating the leak detector

The "START/STOP" and "ZERO" buttons on the remote control can be used to operate the leak detector in the same manner as on the actual leak detector.

Note:

You must observe the operating instructions of the leak detector in any case.

If the remote control displays a menu page of the configuration, you can change to the status display of the leak detector with "Back".

The leak detector can be in the modes "Runup" or "Stand-By":

Figure 26 "Runup" and "Stand-By" status displays

START button

Pressing the START button for the first time activates the leak detector so that it starts measuring.

If the START button is pressed again while measuring, the maximum leak rate display (holding function) is activated. This displays the maximum leak rate which has occurred since "START".

Press "START" again to re-initialise the holding function. (See the Operating instructions of the leak test device used.)

After starting up, the leak test device can be in “Evacuating” (Pumping down) or "Measure" mode:

Figure 27 "Evacuating" and "Measure" status displays (numerical and bar graph)

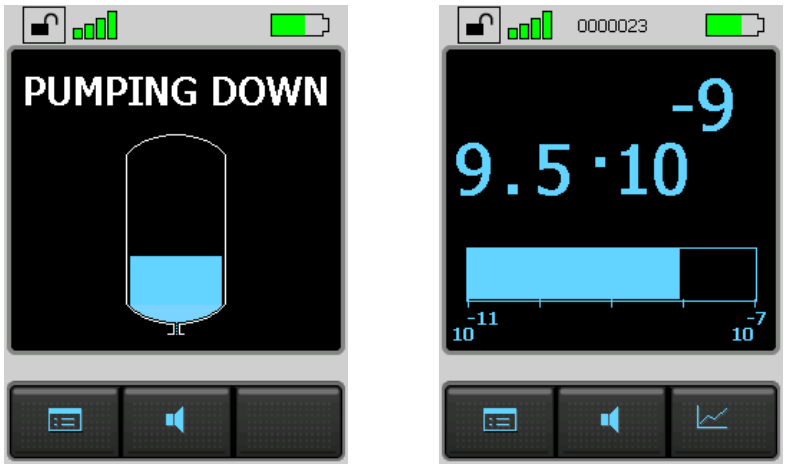


Figure 28 "Measure" (curve) and "Vented" status displays

STOP button

Pressing the STOP button interrupts the measurements.

The inlet is vented if the button is pressed and held. (See the Operating Instructions of the leak test device used.)

ZERO button

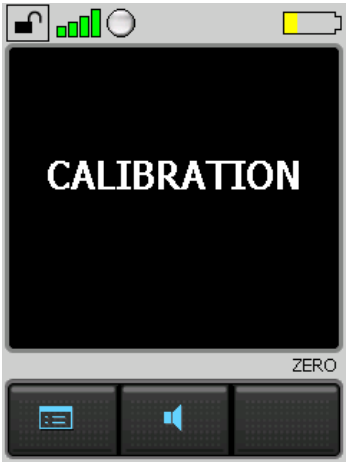
Pressing the ZERO button activates the background suppression in the leak detector.

(See the operating instructions of the leak detector.)

Note:

The "Calibration" function can only be activated on the leak detector, not with the remote control.

Figure 29 "Calibration" status display



Paging-Function

With the paging function the ELD500 RC Wireless can easily be located if it has been misplaced.

Open the following menu at the leak detector:

Settings - Miscellaneous - Paging function

Pressing the button "On" lets an acoustic signal sound at the remote control, the button "Off" quits this signal.

Maintenance

Maintenance

WARNING:

Possible short circuit hazard. The battery might ignite, explode, leak battery fluid, or become overheated and cause burns due to short circuit. Do not short-circuit the battery of the ELD500 RC Wireless.

WARNING:

Possible explosion hazard. Do not set fire to the battery of the ELD500 RC Wireless.

The ELD500 RC does not require any maintenance.

Only the battery of the ELD500 RC Wireless needs replacing if its storage capacity becomes less.

Note:

Only use batteries approved by Edwards. Do not use any damaged batteries.

Note:

The battery is a wearing part and subject to a six-month warranty period.

Replacing the battery (ELD500 RC Wireless)

- Loosen the 6 screws and remove the lower shell.
- Carefully pull the plug out of the circuit board socket.
- Release the battery bracket and remove the battery.
- Install the new battery and follow the instructions above in reverse order.
- Dispose of the old battery in accordance with the applicable regulations.

Cleaning

Note:

Do not use any solvents.

Clean the plastic housing of the device, the front foil and the display using a soft cloth, moistened with some water or soap suds.

Transport and disposal

Transporting

WARNING:

Possible risk of damage. The ELD500 RC may be damaged by improper transport. Always transport the ELD500 RC in its original packaging.

Disposal

Dispose of the device in accordance with the applicable statutory provisions on the disposal of electronic devices, especially also regarding the installed rechargeable battery.

Technical Data

Weight/dimensions

Dimensions (L x W x H)	210 x 90 x 46 mm
Weight ELD500 RC Wired	ca. 0.4 kg
Weight ELD500 RC Wireless	ca. 0.5 kg
Type of protection	IP 42

Characteristics

Audio alarm at 1 m distance	70 db(A) maximum
Headphone jack stereo 3.5 mm	> 2 x 32 Ohm
Range of wireless transmission	> 100 m in free field
HF output power	+6 dBm (4 mW)
Frequency of wireless transmission	2.4 GHz
Internal memory capacity	64 MB, 32 MB of which is available for recording data
Battery operation time (ELD500 RC Wireless)	> 8 hours (depending on battery level)
Display	TFT-Touch 1/4 VGA / 3.5 inch 240 x 320 px, maximum error 4 px
ELD500 RC Wireless charging voltage from power supply	24 V d.c., maximum 0.7 A
ELD500 RC Wired supply voltage from leak detector	24 V d.c., maximum 0.7 A

Environmental Conditions

Only for use within buildings.	EN 61010
Permissible ambient temperature (during operation)	+5 to +40 °C
Permissible storage temperature	-10 to +60 °C
Maximum relative humidity	80% to 31 °C, linear decreasing 50% at 40 °C
Maximum permissible height above sea level (during operation)	2000 m

Mains power for wall plug-in power supply

Mains voltages and frequencies	100 - 250 V a.c. 50/60 Hz
Interchangeable blades of mains plug	Europe, North America, Japan, UK, China, Australia
Power consumption	maximum 30 VA

Wireless permits of ELD500 RC Wireless

CE, FCC, IC, TELEC, MIC, MII

Ordering information

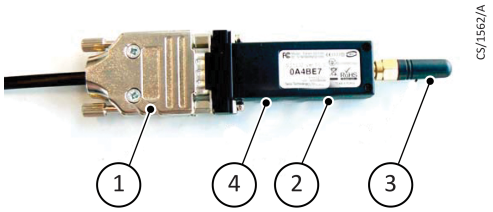
Product description	Item number
ELD500 RC Wired	D13550100
ELD500 RC Wireless	D13550110
Accessories:	
8 m extension cable	14022
Additional wireless transmitter (to operate a second leak detector)	D13550130
Wall plug-in power supply RC310WL	D13510713

This page has been intentionally left blank.

RC wireless transmitter

Part Number: D13550130

Figure 30 Wireless transmitter with plug and antenna



1. Sub-D Plug
2. Wireless transmitter
3. Antenna
4. On/Off switch

Preparing the wireless transmitter (See Figure 30):

1. Take the Sub-D plug.
2. Connect it with the wireless transmitter.
3. Fix the antenna.
4. Set the switch to "ON".

Use only this special plug (1) with integrated adaptor.

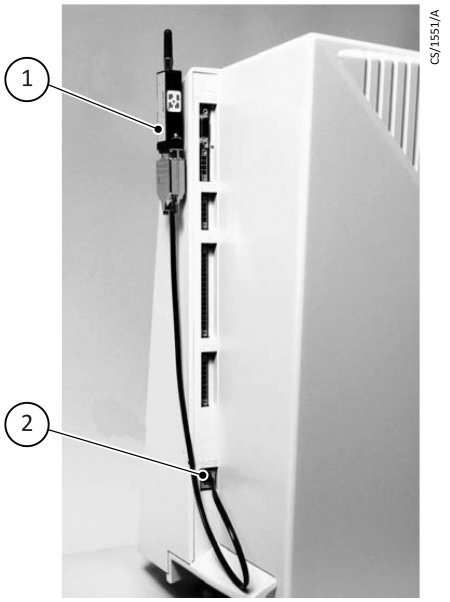
Installation of the wireless transmitter (See Figure 31):

1. Use Velcro® to position the wireless transmitter (1) in a suitable location on the leak test device so that there is a direct line of sight between the transmitter and the remote control.
2. Connect the connection cable of the wireless transmitter to the RJ45 socket of the leak test device (2).

If reception is poor, you can also use an extension cable to position the wireless transmitter away from the leak test device, e.g. against the ceiling of the room, to extend the wireless operating range.

Avoid installing the antenna of the wireless transmitter near metal objects as this will affect its operating range.

Figure 31 Wireless transmitter installed at leak detector



1. Wireless transmitter
2. RJ45 socket

Technical specifications

Producer	SENA
Frequency	2.4 GHz
Power range	18 dBm
Sensitivity	-88 dBm
Supply	Integrated
Conformity	Approval CE, FCC, MIC, TELEC, IC

SL Extender interface

Description

General

These Operating Instructions contain important information on the operation of the ELD500 SL extender interface.

Please unpack the ELD500 SL extender interface immediately after delivery, even if it is to be put into operation at a later date.

Note:

The shipping container and packaging materials must be kept in the event of any complaints about damage.

Check that the ELD500 SL extender interface is complete (see Standard specification) and carefully examine it visually for shipping damage.

If any damage is discovered, report it immediately to the forwarding agent and insurer. If the damaged part has to be replaced, please get in touch with the orders department.

Purpose

The ELD500 SL extender interface is an accessory to the ELD500 leak detector. It is used to carry out leak tests on over-pressure systems.

Small amounts of ambient air are taken up together with the helium leaking from the system to be tested and this is supplied to the inlet of the helium leak detector. Already minute amounts of helium (< 1 ppm) are detected and indicated.

Technical data

Detectable leak rate (typical)	< 10^{-6} mbar ls^{-1}
Gas throughput	Approximately 2 mbar ls^{-1}
Gas inlet rate to the leak detector	Approximately 2 x 10^{-3} mbar ls^{-1}
Connection flange	Small flange DN 25 KF with compression fitting and KF clamping ring
Mains voltage	100 V a.c. (-10%) to 240 V a.c. (+10%)
Mains frequency	50/60 Hz
Power consumption	60 VA
Weight (without sample line)	3.5 kg

Part number	14008
Colour	Red
Length of line	5 m
Response time	1 second
Weight	0.5 kg

Part number	14009
Colour	Green
Length of line	20 m
Response time	< 6 seconds
Weight	1 kg

Part number	12183
Colour	Blue
Length of line	50 m
Response time	18 seconds
Weight	2.5 kg

Technical description

The ELD500 SL extender interface consists of a gas pump and a sample line (Figure 32).

A micro-porous ceramic material, which can pass gas, is placed at connection flange (Figure 32 item 7), of the pump. Thus only a specific amount of gas of approximately 2 x 10^{-3} mbar ls^{-1} is allowed to pass into the leak detector.

Due to the micro-porous structure of the ceramic material helium is allowed to enter, mostly holding back all other gases. Therefore this ceramic piece is called separator.

The built-in gas pump supplies the gas through the sample line (Figure 32 item 9) to the separator. The inlet port of the pump is equipped with the gas inlet socket (Figure 32 item 6), to which the sample line is connected via its corresponding gas inlet plug (Figure 32 item 8).

The other end of the sample line is provided with a handle (Figure 32 item 10), containing the fine tip (Figure 32 item 12) of the sample probe. This tip is provided with a small dust filter.

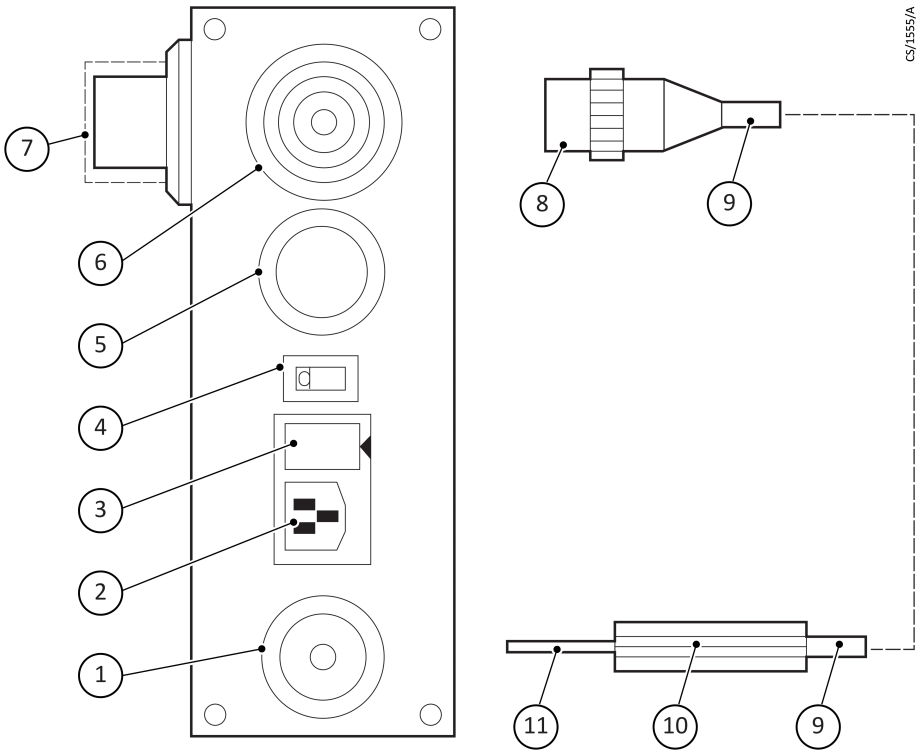
The small quantity of gas (approximately 2 mbar ls^{-1}) taken up by the sample tip is supplied to the separator.

From this quantity of gas only approximately 2 x 10^{-3} mbar ls^{-1} is supplied to the leak detector. The remaining part is released to the ambient air.

A pushbutton marked "TEST" (Figure 32 item 5) is placed on the side of the ELD500 SL extender interface to briefly switch off the sample pump.

As a result of this, the pressure in front of the separator increases from 200 mbar to atmospheric pressure, resulting in a corresponding increase in the signal, thereby indicating correct functioning.

Figure 32 ELD500 SL extender interface



1. Blind plug
2. Mains socket
3. Fuse holder
4. Mains switch
5. "TEST" pushbutton
6. Socket for gas inlet plug
7. Connection flange
8. Plug of the sampling probe (gas inlet plug)
9. Sample line
10. Handle
11. Sample probe with filter insert

Equipment

Standard specification

- ELD500 SL extender interface
- Mains cable
- Three O-rings 2.57 x 1.78 mm for gas inlet plug
- Two fuses T 1.0
- Operating instructions

Accessory

Product description	Item number
Calibrated leak CL - HE 4 to 6	D13550950

Operation

Mains connection and exchanging the ELD500 SL extender interface

The ELD500 SL extender interface is equipped with a wide voltage range power supply unit covering 100 to 240 V a.c. (± 10%) 50/60 Hz. There is no need to select the mains voltage.

Use the mains cable supplied which fits into the corresponding sockets on the appliances ELD500 (see corresponding operating instructions).

Vacuum connection

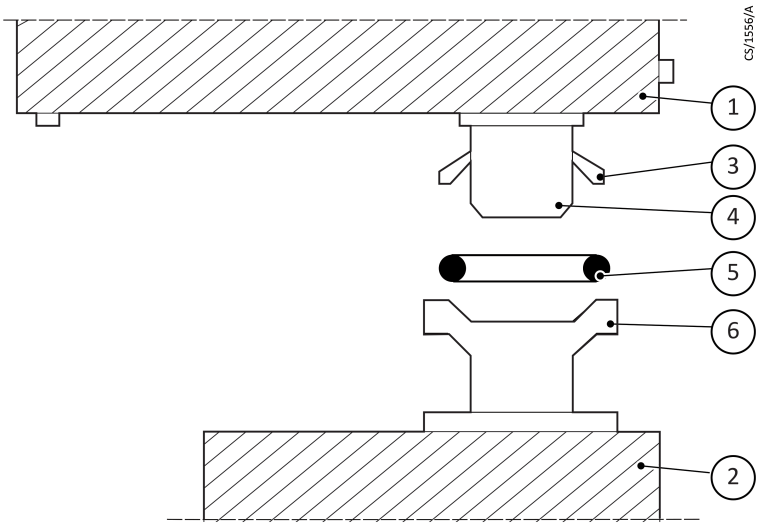
Before making any connections, check the seating of the O-ring (Figure 33 item 5) and the conical metal ring (Figure 33 item 3) on the connection flange (Figure 33 item 4).

The ELD500 SL extender interface is placed on the helium leak detector in such a way that the vacuum connection (Figure 33 item 4) enters the open inlet of the helium leak detector (Figure 33 item 6).

Align the ELD500 SL extender interface by turning it and then tighten the connection with a KF-clamping ring.

The sample line (Figure 32 item 9) is connected by screwing the gas inlet plug (Figure 32 item 8) into the corresponding socket (Figure 32 item 6) on the housing of the ELD500 SL extender interface.

Figure 33 Connection of the SL extender interface to the ELD500 leak detector



1. Housing of the ELD500 SL extender interface
2. Housing of the ELD500
3. Conical ring (metal)
4. Connection flange of the ELD500 SL extender interface
5. O-Ring
6. Connection flange of the ELD500

Initial operation

1. Connect to the mains according to Mains connection and exchanging the ELD500 SL extender interface.
2. Make the vacuum connection, according to Vacuum connection.
3. Switch on the ELD500 SL extender interface via mains switch (Figure 32 item 4).
4. Switch on the helium leak detector.
5. After switching on the helium leak detector wait for the unit to run-up until the Stand-by mode is reached.

By operating the pushbutton "PUMP/START" pump the ELD500 SL extender interface down until it is ready for operation. This is indicated by:

- transition to leak rate indication and
- indication of an air helium background.

Function test

1. Suppress the helium background by pressing the zero button at the leak detector.
2. Press "TEST" pushbutton (Figure 32 item 5) on the ELD500 SL extender interface; the indication will then change from zero to several 10^{-9} mbar ls^{-1}.

A calibrated leak (for example CL - He 4-6) can be used to test the response time of the arrangement.

Calibration

Using a calibrated leak together with the "CAL" mode of the helium leak detector a correct quantitative leak rate indication can be obtained.

The helium leak detector will at first indicate the natural helium content of air. This may be suppressed by pushing the zero button at the leak detector.

When holding the sample probe tip (Figure 32 item 12) close to the calibrated leak an uncalibrated indication will appear, which is typically incorrect by approximately 3 orders of magnitude. Call up the external calibration.

With the numeric key pad the value as on the calibrated leak can be entered, thereby correcting the indicated value accordingly.

It should be noted that the measured leak rate strongly depends on the distance and the speed at which the probe is moved. Therefore several runs with typical sniffing parameters are required until the maximum indication corresponds to the correct value as on the calibrated leak. Then operate the "ENTER" pushbutton to store the value.

Note:

Extensive hints concerning the calibration, sample probe leak detection method, leak testing in general, local and integral leak detection using the ELD500 SL extender interface are given in the ELD500 helium leak detector operating instructions.

Troubleshooting

1. When pumping down the ELD500 SL extender interface, the leak detector is not ready for operation within 2 minutes

Possible causes:

- Sample line not connected.
- ELD500 SL extender interface is not connected to the mains.
- The connection flange is not connected tightly enough.
- Internal leak within the leak detector.
- Leaky vacuum connection.

Clearing the fault:

- Connect sample line.
- Connect the ELD500 SL extender interface to the mains.
- Check seating and re-tighten if required.
- Subject leak detector to an integral leak test.
- Check O-ring.

2. Air helium concentration < 5 x 10^{-9} mbar ls^{-1}

Possible causes:

- Incorrect calibration.
- Separator clogged.

Clearing the fault:

- Recalibrate using a calibrated leak.
- Check display with a calibrated leak, if no reaction exchange separator according to Exchanging the separator.

3. Air helium concentration > 10^{-4} mbar ls^{-1}

Possible causes:

- Incorrect calibration.
- Separator faulty or inserted with a leak.

Clearing the fault:

- Recalibrate using a calibrated leak.
- Exchange separator according to Exchanging the separator.

4. Reaction to a calibrated leak is much too strong or much too weak.

Possible cause:

- Incorrect calibration.

Clearing the fault:

- Recalibrate; if unsuccessful check calibrated leak, also check causes 2 and 3.

5. No reaction to a calibrated leak.

Possible causes:

- Separator clogged.
- Filter tip clogged.
- Sample line clogged.

Clearing the fault:

- Check cause 2.
- Exchange filter according to Exchanging the dust filter in the probe tip.
- Blow out sample line.

6. Response time until a calibrated leak indication occurs is over 2 seconds with a 5 minute sample line.

Possible causes:

- Filter tip clogged.
- Sample line clogged.

Clearing the fault:

- Exchange filter according to Exchanging the dust filter in the probe tip.
- Blow out sample line.

Maintenance

When operating the ELD500 SL extender interface for prolonged periods of time under dusty or damp conditions the tip of the sample probe or the separator may be become contaminated or clogged. The affected parts will then have to be exchanged.

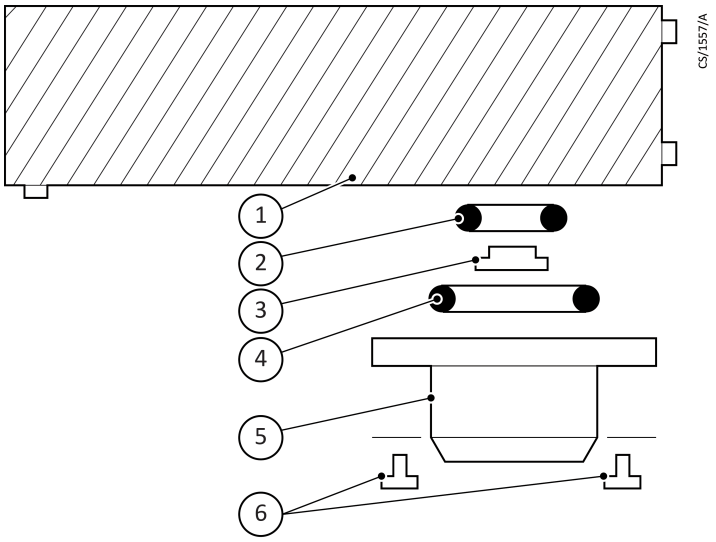
Any further maintenance is not required especially as the ELD500 SL extender interface sample pump is maintenance-free.

Exchanging the separator

In case the separator has become contaminated or clogged it can be exchanged as follows:

- Detach the ELD500 SL extender interface from the helium-leak detector.
- Remove the connection flange (Figure 34 item 5) on the ELD500 SL extender interface by loosening the screws (Figure 34 item 6).
- Exchange the separator (Figure 34 item 3) and if required also the O-rings (Figure 34 item 2) respectively (Figure 34 item 4) (all parts must be kept clean, do not grease).
- After having inserted the separator (Figure 34 item 3) and the O-rings (Figure 34 item 2) respectively (Figure 34 item 4) again attach the connection flange (Figure 34 item 5) by tightening the four screws (Figure 34 item 6) (tighten screws clockwise).
- Attach the ELD500 SL extender interface to the leak detector (see Vacuum connection).
- Check operation as described in Function test.

Figure 34 Exchanging the separator



1. Housing
2. O-Ring
3. Separator
4. O-Ring
5. Connection flange
6. Fixing screws

Exchanging the dust filter in the probe tip

In case the filter in the probe tip (Figure 32 item 11) has become contaminated or clogged it can be exchanged as follows:

- Switch the leak detector to "sleep".
- Remove dirty felt discs by means of tweezers and replace them
  or
  unscrew capillary filter and replace.
- Switch on the leak detector.

Service

If you send an appliance to Edwards, indicate whether the appliance is free of substances damaging to health or whether it is contaminated. If it is contaminated also indicate the nature of hazard. To do so, you must use a preprinted form which we shall send to you upon request.

A copy of this form is printed at the end of the operating instructions: Return of Edwards Equipment: Declaration (HS2).

Either fasten this form at the appliance or simply enclose it to the appliance.

This declaration of contamination is necessary to comply with legal requirements and to protect our staff.

Edwards must return any appliance without a declaration of contamination to the sender's address.

WARNING:

The appliance must be packed in such a way, that it will not be damaged during shipping and so that any contaminants are not released from the package.

Spare parts

Refer to spare parts list.

Spare parts for SL extended interface

Product description	Item number
He-separator for extended interface	D13550201
Set (5 x O-ring 22 x 5 and 5 x O-ring 2.6 x 1.8)	D13550202
Central connection piece	D13550203
Diaphragm vacuum pump DC (membrane pump of inficon)	D13550204
Kit spare diaphragm	D13550206
Power supply	D13550207

Spare parts for sniffer lines in extended interface

Product description	Item number
Spare filter 50 pieces	D13550208
Capillary filter 5 pieces	D13550209
Inlet capillary for 5 m and 20 m lines	D13550210
Replacement handle for extended interface	D13550211
Gas inlet plug	D13550212
Sniffer line red, 5 m (for 14008)	D13550213
Sniffer line green, 20 m (for 14009)	D13550214
Sniffer line grey, 50 m (for 12183)	D13550215

SL Sniffer line

Personnel qualifications

All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed.

General safety instructions

The Edwards ELD500 SL has been designed for safe and efficient operation when used properly and in accordance with these operating instructions. Observe all safety precautions described in this section and throughout this operating instructions and the operating instructions of the connected leak detector. The sniffer line must only be operated in the proper condition and under the conditions described in the operating instructions. It must be operated and maintained by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to our nearest office.

Risk clogging

Liquid can cause clogging of the sniffer tip and line.

- Do not aspirate any liquids (for example, water, adhesive substances).
- Before you begin to work, find out whether any vacuum components are contaminated with harmful gas.
- Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.
- Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.
- Communicate the safety instructions to other users.

Intended use

The ELD500 SL is used for locating gas leaks on test objects in conjunction with the ELD500 leak detector.

Product identification

This product applies to sniffer lines with item number D13550300. The item number can be taken from the product name plate.

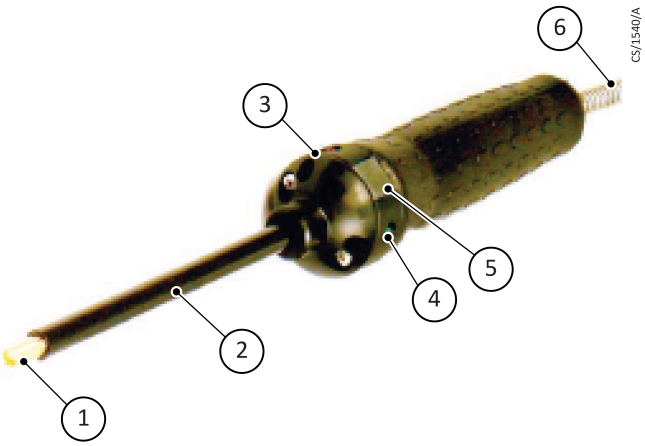
We reserve the right to make technical changes without prior notice.

Description

The ELD500 SL is used for locating gas leaks on test objects in conjunction with leak detectors.

Design

Figure 35 ELD500 SL hand probe



1 Capillary filter
2 Sniffer tip, 120 mm length
3 Indicator “leak” red
4 Indicator “ready” green
5 Key
6 Sniffer line

Operating-/Display Element	Function of the leak detector
LED red	Exceeded threshold of leak rate of Trigger 1
LED green	Fallen below threshold of leak rate of Trigger 1
Key	ZERO on / off

The function of the key and the meaning of the display is explained in the Technical Handbook of the leak detector.

Technical data

Sniffer line length

Figure 36 ELD500 SL general view

The sniffer line has an effective length of 4 meters from the KF25 flange to the hand probe.

Gas throughput

ca. 15…25 sccm

Connection

Vacuum connection	KF25 flange
Electrical connection	8-pin plug

Installation

Connection

Figure 37 ELD500 SL connections with KF25 flange and 8-pin plug

1. KF25 flange
2. 8-pin plug

1. Connect the ELD500 SL with KF25 flange to the inlet port of the leak detector.
2. Connect the 8-pin plug of the ELD500 SL with the input “OPTION” of the leak detector.

The sniffer line is ready to work.

Maintenance

Service

WARNING:

Contaminated parts can be detrimental to health and environment.

Before you begin to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

CAUTION:

Dirt and damage can impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damage.

CAUTION:

Touching the product with bare hands increases the desorption rate.

Always wear clean, lint-free gloves and use clean tools when working in this area.

Whenever equipment is sent back, indicate whether the equipment is contaminated or is free of substances which could pose a health hazard. If it is contaminated, specify exactly which substances are involved. You must use the form we have prepared for this purpose.

A copy of this form has been reproduced at the end of these operating instructions: Return of Edwards Equipment: Declaration (HS2).

Attach the form to the equipment or enclose it with the equipment.

This statement detailing the type of contamination is required to satisfy legal requirements and for the protection of our employees. We must return to the sender any equipment which is not accompanied by a contamination statement.

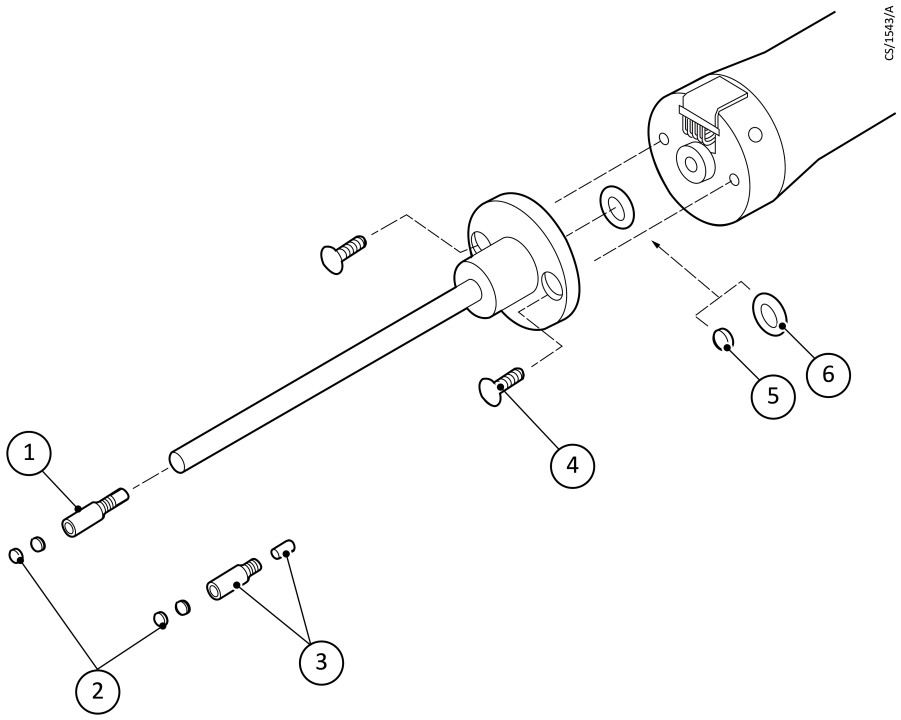
Maintenance work

Sniffer probe clogged

Clogging of the sniffer probe may be due to:

- Clogging of capillary filter: refer to Replacing the felt discs or the capillary filter.
- Clogging of sinter filter: refer to Checking/replacing the sinter filter.
- Clogging of sniffer probe capillary → replace sniffer tip.
- Damage of sniffer tip → replace sniffer tip.
- Clogging/damage of sniffer line → replace ELD500 SL.

Figure 38 Sniffer tip



1. Capillary filter (plastic version; standard)
2. Felt discs
3. Capillary filter
   (Metallic version with seal; option)
4. Phillips screws
5. Sinter filter
6. Seal

Replacing the felt discs or the capillary filter

- Switch the leak detector off or disconnect the sniffer line.
- Remove dirty felt discs by means of tweezers and replace them.

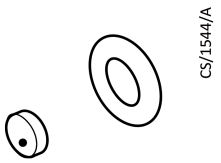
or

- unscrew capillary filter and replace it.
  (If using the metallic version, do not forget the seal.)

Checking/replacing the sinter filter

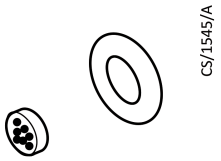
- Switch the leak detector off or disconnect the sniffer line.
- Remove the two Phillips screws.
- Remove the sinter filter with the seal.
- Visually check the filter for contamination:

Figure 39 Not/only slightly contaminated



Continue to use the sinter filter together with the seal.

Figure 40 Severely contaminated



Replace sinter filter and the seal.

- Reinstall the sniffer tip.
- Now you can use the sniffer line again.

Spare parts for sniffer lines

Product description	Item number
Spare filter 50 pieces	D13550208
Capillary filter 5 pieces	D13550209
Inlet capillary for 5 m and 20 m lines	D13550210
Sinter filter 5 pieces	D13550301
L1 120 mm, stiff	D13550302
L1 120 mm, flexible	D13550303
L1 385 mm, stiff	D13550304
L1 385 mm, flexible	D13550305

Waste Disposal

The equipment may have been contaminated by the process or by environmental influences. In this case the equipment must be decontaminated in accordance with the relevant regulations. We offer this service at fixed prices.

Further details are available on request.

CAUTION:

Contaminated parts can be detrimental to health and environment.

Before beginning any work, first find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Separate clean components by material make-up, and dispose of accordingly.

When sending any equipment back to Edwards, observe the regulations provided in Service.

This page has been intentionally left blank.

Partial flow adaptor

The ELD500 partial flow adaptor has been designed for safe and efficient operation when used properly and in accordance with these operating instructions. Observe all safety precautions described in this section and throughout this operating instructions. It must be operated and maintained by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to our nearest office.

Warranty

Edwards covers no responsibility nor warranty if the user or third parties:

- Disregard the information in this document.
- Utilize the product not according to the defined use.
- Make any kind of changes (modifications, alterations, etc.) to the product.

Safety information

- Unpack the partial flow adaptor immediately after delivery, even if it is to be put into operation at a later date.
- Retain the shipping container and the packaging materials in the event of complaints about damage.
- Check that the partial flow adaptor is complete (see Equipment) and subject it to a careful visual check.
- If any damage is discovered, report it immediately to the forwarding agent and insurer. If the damaged part has to be replaced, please contact Customer Service.

Purpose

The partial flow adaptor is operated in connection with the ELD500 leak detector. In the partial flow operation the test sample is evacuated in addition via an auxiliary pump. Consequently the following advantages result:

- Faster response time.
- Readiness to measure already as of 1000 mbar inlet pressure.
- Fast venting of big test samples.

Description

Partial flow operation of the ELD500

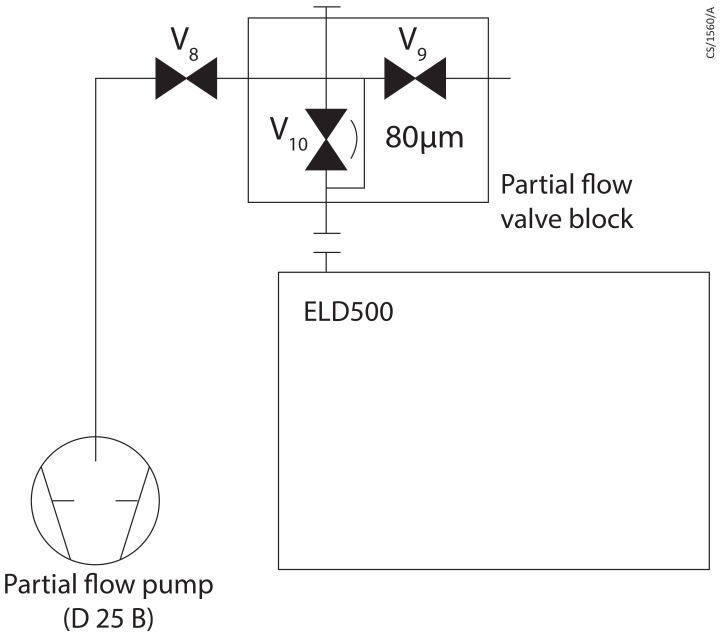
The valve block is at the heart of the partial flow adaptor. This valve block consists of two firmly mounted valves V9 and V10 as well as a bypass orifice. The connection to the partial flow pump is provided via a separate DN 25 right-angle valve V8 and pipe bend or an elbow (see Figure 41).

By operating the Start pushbutton on the hand unit of the ELD500, valves V8 and V10 are opened in order to evacuate the test sample via the external partial flow pump (generally an E2M28 or XDS35i-enhanced) and also via the internal backing pump. If within the quick point time (see also the ELD500 instruction manual, D13510880) a pressure of 3 mbar is reached, the ELD500 will switch to the GROSS mode with running partial flow pump; the detection limit is 1×10^{-8} mbar ls^{-1}. Further evacuation lets the leak detector enter the FINE mode at 0.1 mbar with active partial flow pump. The lowest detectable leak rate is now 5×10^{-10} mbar ls^{-1}.

If it is not possible to evacuate the test sample within the quick point time to below 3 mbar, for example because the volume of the test sample is over 1 to 2 l or if a gross leak is present, valve V10 is closed again, i.e. the test sample is then exclusively evacuated by the partial flow pump. The only vacuum link which now exists to the ELD500 is via the bypass orifice (see Figure 41). Thus, the amount of gas flowing into the leak detector is so small, that even at atmospheric pressure (1000 mbar) within the test sample, the pressure in the inlet area of the ELD500 will be 3 mbar so that the ELD500 can run in the GROSS mode. The detection limit is 2×10^{-5} mbar ls^{-1}.

If a test sample pressure of approximately 500 mbar is decreased the detection limit is 5×10^{-6} mbar ls^{-1}.

Figure 41 Vacuum diagram



If 3 mbar are decreased, V10 is opened and as described before the GROSS mode is attained with the partial flow pump (V8 and V10 open).

The partial flow valve V8 closes at an inlet pressure of $< 10^{-2}$ mbar when the "NORMAL" partial flow mode has been selected. If the "oil-free" partial mode was selected, valve V8 closes already at a pressure of < 0.1 mbar. In both cases the ELD500 is running in the FINE mode at its full detection sensitivity of 5×10^{-11} mbar ls^{-1}.

By actuation and pressing down the Stop key (Vent function) the test sample is subjected to fast ventilation (V8 and V10 closed) via V9 (diameter 6 mm).

The valves are fully automatically controlled by the ELD500 via the delivered cable (see Figure 42 item 5).

Examples:

For a quick point time of T_Q = 0 seconds and by operating "START", the valve V10 is initially not opened. This setting is recommended in the case of large volumes and dirty test samples.

For T_Q = ∞ (>>) valve V10 is opened upon operating "START". At an inlet pressure of pE < 3 mbar the leak detector will enter into the measurement mode and display leak rates. V10 remains open until pressing "STOP". The setting of T_Q is recommended in such cases where it is acceptable to wait until the leak detector enters into the measurement mode and when it is not necessary to display a leak rate before that time.

Equipment

Standard specification

- Partial flow valve block
- DN 25 KF right angle valve
- Control cable
- Vacuum hose
- Small flange connections
- 90° elbow/pipe bend

Operation

For proper start up and operation of the partial flow adaptor it is absolutely necessary to take note of the information provided in the separate operating instructions for the components of the system besides the information given in these operating instructions.

Start up

An overview of the arrangement of the partial flow adaptor is given in Figure 42.

Switch the ELD500 off and disconnect any possibly connected test objects from the test port. Connect the partial flow valve block (see Figure 42 item 2) to the test port of the ELD500. When doing so, the metal filter on the rear should point backwards and the lateral vacuum flange should point to the left.

In order to exclude the effects of any interference, the right-angle valve DN 25 KF (see Figure 42 item 1) must now be flanged to the side port of the partial flow valve block (see Figure 42 item 2) so that the second flange points to the front and so that the LEDs of the valve point to the left.

The partial flow pump (see Figure 42 item 8) is connected via the vacuum hose (see Figure 42 item 9) and the pipe bend/elbow (see Figure 42 item 10) to the DN 25 KF right-angle valve (see Figure 42 item 1). Provide the electrical connection through connection cable (see Figure 42 item 5) as follows:

1. Screw together the round connection plug with the cable coupling of the right angle valve.
2. Connect plug (see Figure 42 item 3) to valve V9.

3. Connect plug (see Figure 42 item 4) to valve V10.

Note:

The designation is glued onto the corresponding cable plugs and valves.

4. Connect plug (see Figure 42 item 6) to the 8-way socket (OPTION) on the face of the ELD500.

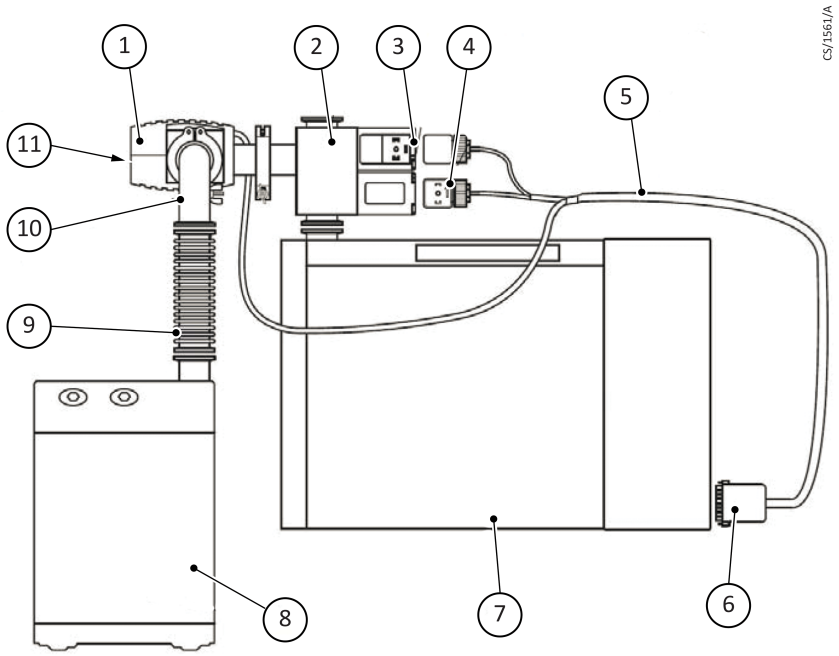
Switch on the partial flow pump.

Switch the ELD500 on.

Select through the software menu of the ELD500:

- Line 2 : the "partial flow" operating mode and
- Line 10 : "Evactime 1" 5 seconds or higher
- Line 29 : the nominal pumping speed of the partial flow pump. Connect the test sample to the partial flow valve block (see Figure 42 item 2).

Figure 42 Set of partial flow valves for the ELD500



1. DN 25 KF right angle valve with electronics unit
2. Partial flow valve block
3. Connection plug for valve V9
4. Connection plug for valve V10
5. Connection cable
6. Connection plug for the ELD500
7. ELD500
8. Partial flow pump
9. Vacuum hose
10. 90° elbow/pipe bend
11. LEDs

Maintenance

Service

WARNING:

Whenever you send us in equipment, indicate whether the equipment is contaminated or is free of substances which could pose a health hazard. If it is contaminated, specify exactly which substances are involved. You must use the form we have prepared for this purpose.

A copy of this form has been reproduced at the end of these operating instructions: Return of Edwards Equipment: Declaration (HS2).

Attach the form to the equipment or enclose it with the equipment.

This statement detailing the type of contamination is required to satisfy legal requirements and for the protection of our employees. Edwards must return to the sender any equipment which is not accompanied by a contamination statement

Waste disposal

The equipment may have been contaminated by the process or by environmental influences. In this case the equipment must be decontaminated in accordance with the relevant regulations. We offer this service at fixed prices.

Further details are available on request.

CAUTION:

Contaminated parts can be detrimental to health and environment. Before beginning any work, first find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Separate clean components according to their materials, and dispose of these accordingly. We offer this service. Further details are available on request.

When sending us any equipment, observe the regulations given in Service.

This page has been intentionally left blank.

Calibrated leak - internal

Description

General

These operating instructions contain important information on how to mount the test leak CL - Internal.

Note:

Indicates special technical requirements that the user must comply with.

Unpack the calibrated leak CL - Internal immediately after delivery, even if it is to be put into operation at a later date.

Note:

The shipping container and packaging materials must be kept in the event of complaints about damage.

Check the calibrated leak CL - Internal for completeness (see Supplied parts) and carefully examine it visually. If any damage is discovered, report it immediately to the forwarding agent and insurer. If the damaged part has to be replaced, please get in touch with the orders department.

Technical Data

Nominal calibration range	10^{-7} mbar l/s
Tolerance of nominal calibration range	± 15%
Temperature coefficient	< 0.5% / °C
Leak type	Capillary
Calibrated for	Helium
Filling	Helium
Filling pressure	2.9 bar
Connecting flange	Special adaptor

Purpose

The calibrated Leak CL - Internal with the helium reservoir is used for alignment of the helium mass spectrometer in the helium leak detector as well as for calibrating the leak rate indication.

It is equipped with a solenoid valve which is actuated via the control electronics of the leak detector.

Supplied parts

The supplied parts of the CL - Internal comprises in addition:

- O-ring 12 x 1.5
- Two cheese head screws M 3 x 25
- Sticker stating the leak rate

Assembly

Tools required

- Cross-head screwdriver, size 1
- Hex socket screw key, size 2.5

Installing/uninstalling the CL - Internal

See also documentation of the leak detector.

Loosen CL - Internal from the valve block by unscrewing the screws M3. Take off the electrical connection. For installing take care that the o-ring and the sealing surfaces are clean.

Leak tightness test

Start the helium leak detector and spray a little helium through the intake opening of the TMP fan into the leak detector.

Note:

In the range of 10^{-9} mbar l/s no indication must appear.

Entering the value of the calibrated leak

To enter the value of the calibrated leak please refer to the Technical Handbook, Section "The menu function (Overview)" or the "Description of the individual menu functions" under menu item "Cal leak 0.0E-07".

Factory inspection

Calibrated leaks are not subject to wear and the helium loss of the calibrated leak CL - Internal, being less than 2% per year, is negligible. Nevertheless, the leak rate may change over years due to external influences. A factory inspection is, therefore, advisable once a year.

A test certificate, if required for the helium calibrated leak, can be obtained through Edwards. In that case, the calibrated leak should be forwarded to us and will be returned inspected and recertified with the test certificate, charges applicable.

The helium flow rate stated on the main label is the actual leak rate of the calibrated leak. See Adjustment of leak rate.

Calibrated leak - He 4-6

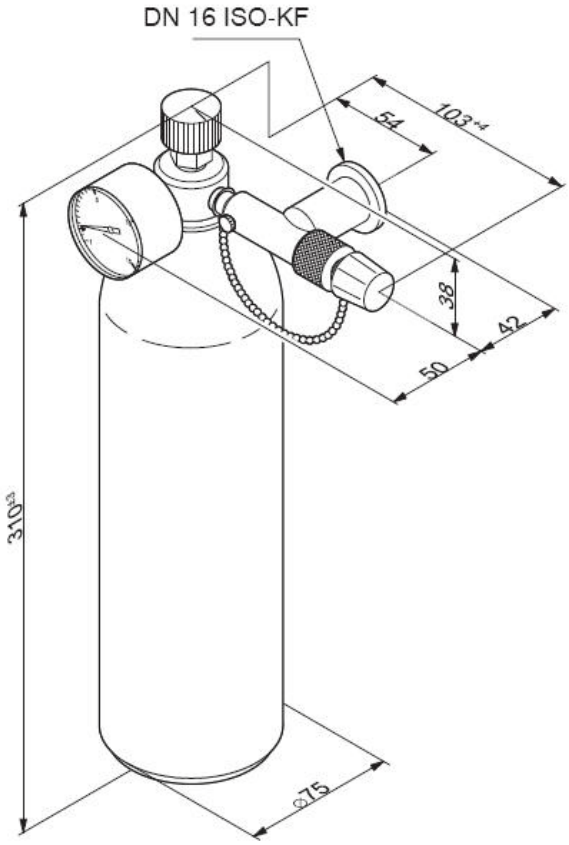
The CL - He 4-6 has been designed for safe and efficient operation when used properly and in accordance with these operating instructions. Observe all safety precautions described in this section and throughout this operating instructions and the operating instructions of the connected leak detector. Address any further safety, operation and/or maintenance questions to our nearest office.

Technical data

Calibrated Leak	
Nominal leak rate range 4-6	5×10^{-6} mbar ls^{-1}
Uncertainty of the leak rate*	± 15%
Leak rate	Printed on calibrated leak
Leak rate adjustment range 4-6	10^{-4} to 10^{-6} mbar ls^{-1}
Temperature coefficient	Negligible
Leak type	Capillary
Calibrated for	Helium
Connecting flange	DN 16 ISO-KF
Manometer reading	-1 to +15 bar (over-pressure)
Helium cylinder	
Test gas	Helium 5.0
Purity	99.999 Volume - %
Bottle capacity	1 l
Filling pressure	12 bar
Filling amount	12 l
Inlet pressure maximum	Maximum 12 bar
Weight	
With gas cylinder	425 g
Without gas cylinder	300 g

* *With manometer reading 0 bar and p<1 mbar at connecting flange.*

Figure 43 Dimensional drawing



Supplied equipment

1	Calibrated leak complete with manometer, gas reservoir shut-off valve and leak shut-off valve
1	Helium bottle (He 5.0; 12 bar; 1 l)
1	Holder for setting up the helium bottle with calibrated leak
1	Installation Instructions for the holder

Operating and handling

Always unscrew valve (Figure 46 item 6) for a short time only. The leak outlet area on valve (Figure 46 item 6) should not be touched, particularly not with your fingers or greasy objects.

Retain the protection cap for the flange and fit it each time the calibrated leak is removed.

CAUTION:

The reservoir cylinder is pressurised. Protect it against direct sun light, temperatures over 50 °C and damage.

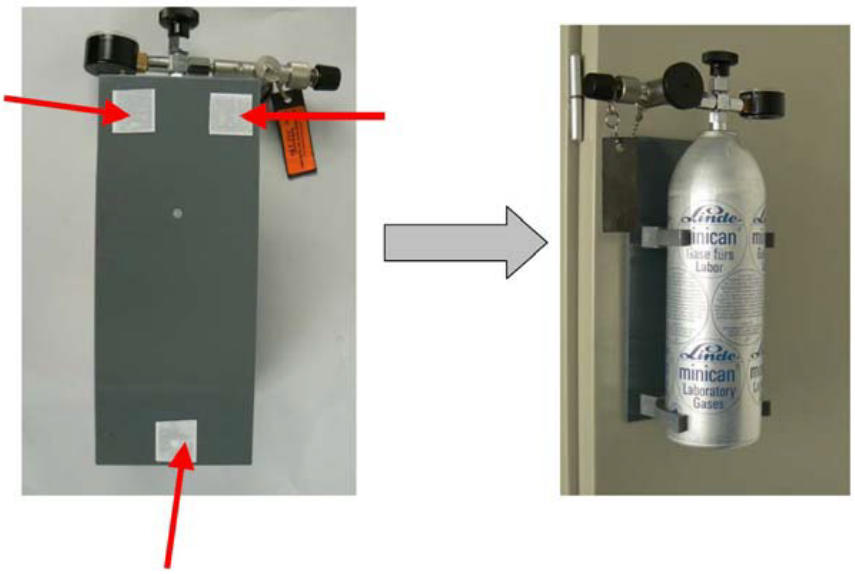
Holder

The holder included is used for safe storage of the CL - He 4-6.

Wall fastening

To fasten the CL - He 4-6 on vertical surfaces a hook-and-loop tape (within delivery) can be used. Apply strips of this tape on the basic plate as shown. Apply the counter parts of the tape on the surface, put carrier in the appropriate position on the tape strips.

Figure 44 Vertical surface mounting



Mounting on walls or wooden panels

1. Remove 2 screws M6 from carrier.
2. For mounting the carrier use suitable screws in the appropriate lengths.
3. Use dowels for mounting onto walls.

Figure 45 Wall/wooden panel mounting

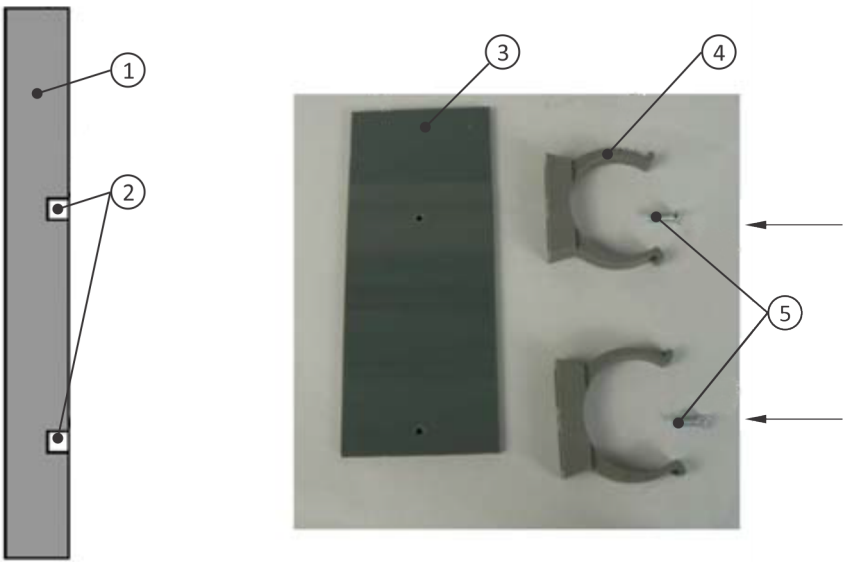
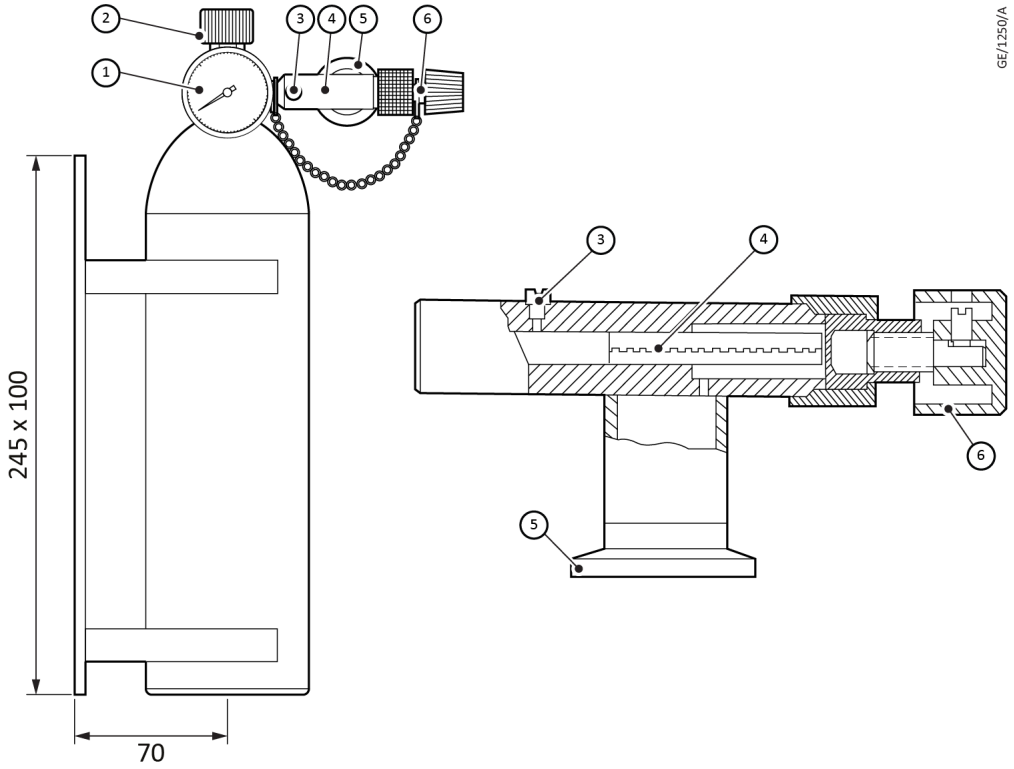


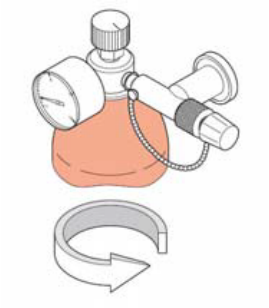
Figure 46 Calibrated leak CL-HE 4 to 6 complete



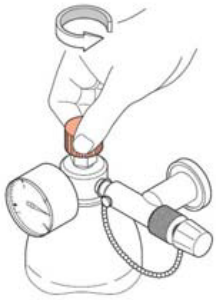
1. Over-pressure manometer for test gas pressure
2. Test gas supply shut-off valve
3. Vent screw
4. Body with leak capillary
5. Connecting flange DN 16 ISO-KF
6. Shut-off valve for leak outlet orifice
7. Test gas bottle
8. Holder

First use or changing the type of gas

1. Close all valves and the vent screw.
2. Unscrew old test gas bottle.
3. Remove protective cap from new test gas bottle.
4. Screw in the new reservoir (hand tight) right up to the stop.

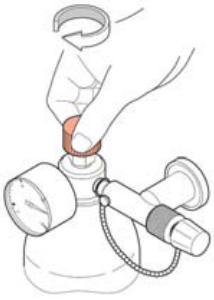


5. Open the test gas supply on the reservoir (the knob turns downwards). See Figure 46, item 2.



The pressure gauge must now indicate the pressure of the gas bottle.

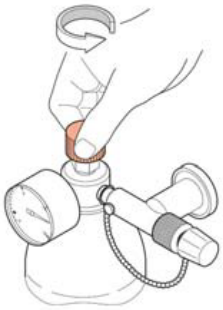
6. Close the blocking valve on the reservoir (the knob turns upwards).



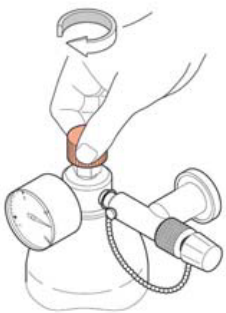
7. Open the vent screw so far that the pressure drops to 0 bar (purge).

8. Close the vent screw.

9. Open the test gas supply, so that the pressure reaches the pressure of the test gas cylinder.



10. Close test gas supply.

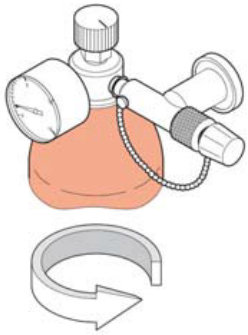


Repeat process steps 6 through 10 twice, so as to ensure that the gas reservoir ahead of the calibrated leak has been exchanged completely. The calibrated leak will now be ready. The desired pressure can be adjusted with the venting screw.

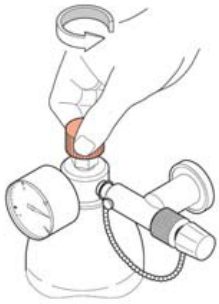
Changing the reservoir cylinder without changing the type of gas

1. Close all valve (the knob turns upwards).
2. Unscrew the old test gas bottle.

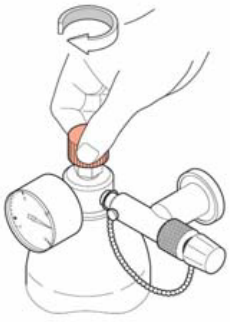
3. After removing the protective cap screw on the new test gas bottle.



4. Open the test gas supply. See Figure 46, item 2.
   The manometer displays now the test gas bottle pressure.



5. Close the test gas supply.



6. Open the vent screw so far, that the pressure drops to the desired pressure. See Figure 46, item 3.

7. Close the vent screw.

The CL - He 4-6 is now ready for operation.

Storage when unused

Put the protective cap on the connection flange DN 16 KF and make sure that all valves and the vent screw are closed. Store the CL - He 4-6 in a lying position or standing upright in the holder, protected against impact shock and high temperatures.

Maintenance

It is recommended to re-tighten the union nut of the valve from time to time at a torque of 2.5 Nm by turning it in the clockwise direction (how often this will be required will depend on how much the calibrated leak is being used). Thereafter it must be easily possible to turn the knob with two fingers.

Applications

Use for vacuum leak detection

The CL - He 4-6 can be fitted by its DN 16 KF flange connection to any leak detector or any vacuum apparatus and can then be used for tuning the mass spectrometer as well as for checking response time and detection sensitivity.

To adjust the test leak rate, see First use or changing the type of gas.

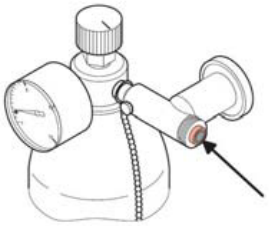
Use for overpressure leak tests (sniffer probe)

The CL - He 4-6 is set up in holder (see Figures 47 and 48). By unscrewing the valve at the swivel nut the CL - He 4-6 becomes accessible for a sniffer probe tip.

Figure 47 Unscrewing valve for sniffer probe tip access

The leak outlet orifice itself is on the face of the sealed-in tubulation which is now visible. The sniffer probe can be inserted into this small orifice. With the screw cap removed the port leaks at the desired reference level.

Figure 48 Leak out orifice location



Clogging of the leak capillary

CAUTION:

The size of the leak outlet orifice can change or get choked due to contamination. Do not touch the leak outlet orifice with the fingers or with greasy objects. When no longer using the calibrated leak, close the valve.

The measured leak rate will depend on the distance between sniffer tip and leak, and also on the speed at which the sniffer tip is moved past the leak.

The size of the leak will depend on the pressure as indicated on the pressure gauge and it may be determined from the calibration curve.

Using search gases other than helium

When using test gases other than helium, leak rates can only approximately be determined, the reason being that the 10^{-8} to 10^{-4} mbar ls^{-1} range includes just the transition-flow region between molecular and laminar gas flow. Moreover, the individual flow profile of the respective capillary will affect the conversion factor. In the molecular flow region it applies for the leak rate q of different gases at otherwise equal conditions:

$$\frac{q_x}{q_{He}} = \sqrt{\frac{M_{He}}{M_x}}$$

M= relative molecular mass

In the laminar flow region it applies:

$$\frac{q_x}{q_{He}} = \frac{\eta_{He}}{\eta_x}$$

η = dynamic viscosity

Some values of dynamic viscosity η in 10^{-5} Pa s.

	He	R 134a	N2O2	Ar	H2
h	1.96	1.36	1.82	2.21	0.88

The resulting values must be used according to the predominant type of gas flow, i.e. for leak rates lower than 10^{-5} mbar ls^{-1} mainly molecular flow and for leak rates higher than 10^{-5} mbar ls^{-1} mainly laminar flow can be assumed.

Adjustment of leak rate

The nominal leak rate was measured during production at a test gas pressure of 1 bara versus a pressure of lower than 1 mbar at the connecting flange and is shown on the label. The adjustment diagrams are valid for nominal leak rate of 5 x 10^{-6} mbar ls ±10% for the CL - He 4-6. The leak rate is pressure dependent and can be found in Figures 49 or 50. Upon request, individual calibration of a single test leak as a function of the search-gas pressure can be made in our factory at cost price.

If you suspect the nominal leak rate has changed after longer use, recalibration of the test leak can be made in our factory against charge. When demanding higher accuracy Edwards recommends a recalibration once a year.

If a calibration certificate is required, it can be issued by Service. Calibration and calibration certificates are available to order, charges applicable.

The test leak rates depend on the adjusted pressure [bar rel], see Figures 49 and 50.

If a significant deviation from the nominal leak rate of 5 x 10^{-6} mbar ls occurs, a factor can be calculated based on the leak rate diagrams. The nominal leak rate is to be multiplied by this factor.

Calculation of the factor:

$$Factor = \frac{Leak\ rate\ (from\ diagram)}{5 \times 10^{-5}\ \text{resp}\ 5 \times 10^{-6}}$$

Figure 49 Diagram leak rate/pressure sniffing operation

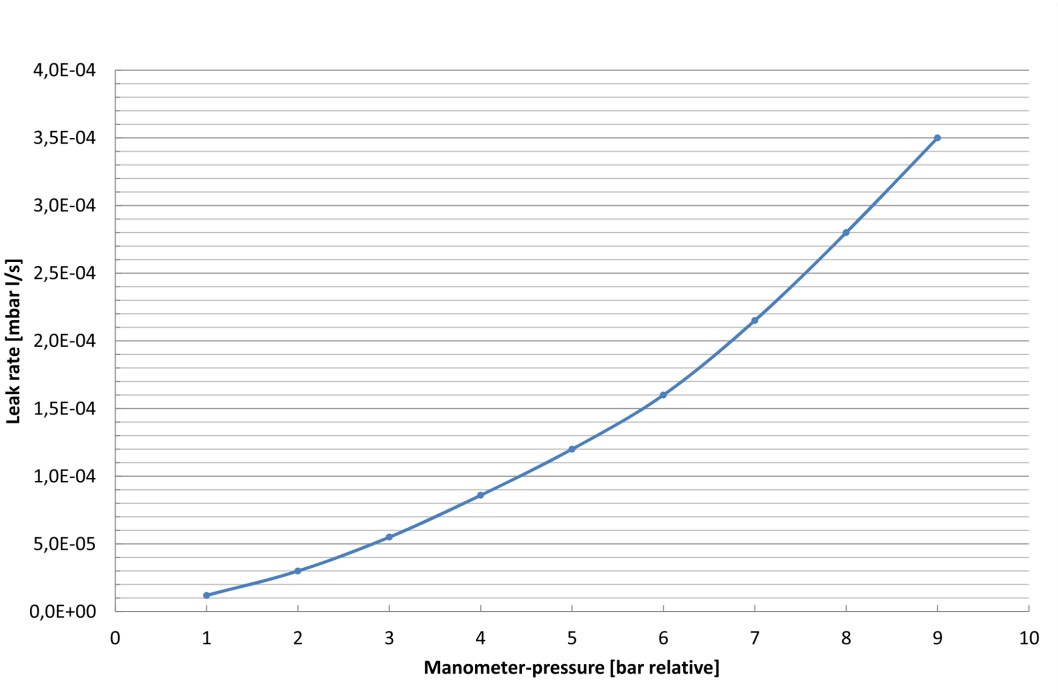
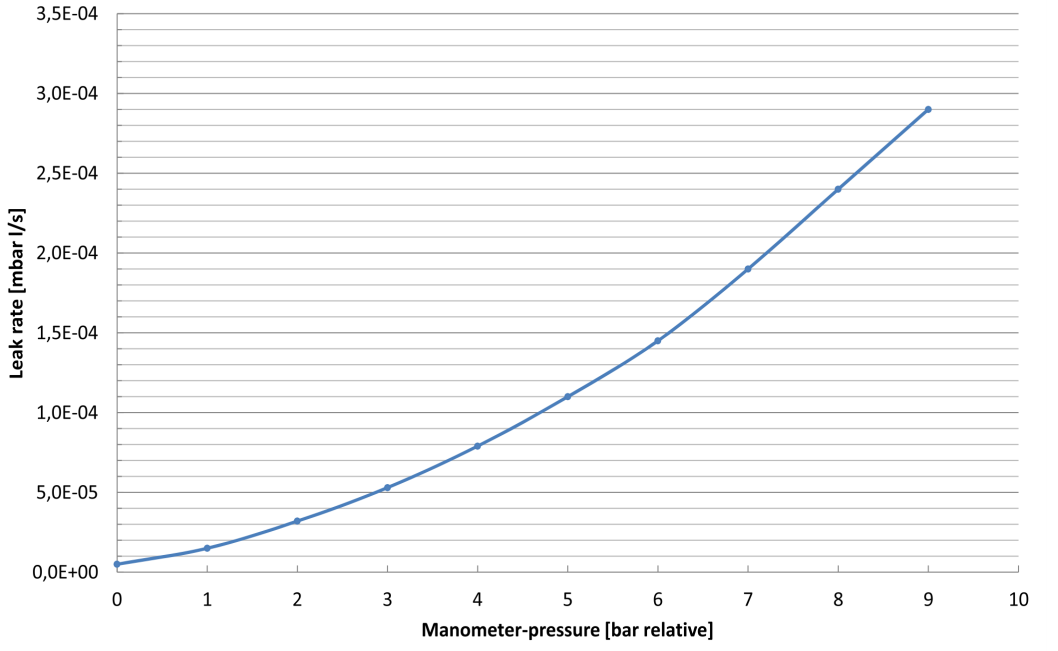


Figure 50 Diagram leak rate/pressure vacuum operation



This page has been intentionally left blank.

Calibrated leak He 8

The calibrated leak He 8 has been designed for safe and efficient operation when used properly in accordance with these Operating Instructions. Observe all safety precautions described in this section and throughout these Operating Instructions and the Operating Instructions of the connected leak detector. The calibrated leak He 8 must only be operated in the proper condition and under the conditions described in the Operating Instructions. The calibrated leak He 8 must be operated and maintained by trained personnel only. Consult local, state and national agencies regarding specific requirements and regulations.
Address any further safety, operation and/or maintenance questions to our nearest office.

We reserve the right to make technical changes without prior notice.

Description

The calibrated leak He 8, which includes its own helium supply, is used for tuning a helium mass spectrometer and for calibrating the leak rate indication. The calibrated leak He 8 is equipped with a diaphragm valve to shut off the emission of helium gas during zero-checking of the leak detector. This means that the actual leak is not closed. The helium supply, which lasts for more than 10 years, flows continuously through the leak and collects before the valve when it is closed. On opening the valve, the accumulated helium streams out and causes a temporary deflection on the leak rate meter which is greater than the nominal leak rate.

The nominal leak rate does not apply if the calibrated leak is fitted to a vacuum system at pressure of less than 1 mbar. When the calibrated leak He 8 is laid off for storage, the valve must always remain open to prevent absorption of helium in the sealing diaphragm. Such absorbed helium would falsify the nominal leak rate and could only be removed by pumping over a long time. Close the connecting flange using a protective cap or black flange.

In exceptional cases (particularly when using the calibrated leak on older-type systems) it might occur that an exact conformity of the calibrated leak rate with the leak detector reading cannot be achieved. In most of these cases the pumping speed available at the mass spectrometer will be too low. If this occurs, contact Edwards.

Technical data

Calibrated Leak	He 8
Part Number	D13550943
Calibration range	10^{-8*} mbar ls^{-1}
Inaccuracy	± 15%
Gas supply	Helium
Connecting flange	DN 10 ISO-KF
Temperature coefficient	+3.5% / °C
Max ambient temperature	70 °C

* *At a pressure < 1 mbar at the KF flange connection.*

Handling of calibrated leaks

Calibrated leaks are delicate instruments and should be carefully handled and protected against shocks. Calibrated leaks are made of glass contained in a protective metal tube. Therefore, calibrated leaks should be stored in a dry dust-free location. When unused, the built-in valve should remain open - see Description.

If the sealed-off glass tip in the gas filling port of the calibrated leak He 8 becomes damaged due to rough handling, a loss of search gas may cause a change of the nominal leak rate.

Maintenance

Return of equipment

In order to comply with law (occupational, health and safety regulations, safety at work law and regulations for environmental protection) vacuum pumps, components and measuring instruments returned to the manufacturer can be repaired only when certain procedures are followed. Read form HS1 and fill out HS2, which can be found at the back of printed manuals or can be downloaded from http://edwardsvacuum.com/HSForms/.

Factory inspection

Calibrated leaks are not subject to wear and the helium loss is less than 1% per year. Nevertheless, the leak rate may change over time due to external influences. A yearly factory inspection is therefore advisable.

Waste disposal

The equipment may have been contaminated by the process or by environmental influences. In this case the equipment must be decontaminated in accordance with the relevant regulations.

CAUTION:

Before beginning any work, first find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Separate clean components according to their materials and dispose of them accordingly.

When returning any equipment observe the guidance given in Return of equipment.

Calibrated leak - screwed socket

The calibrated leak with screw in sleeve has been designed for safe and efficient operation when used properly and in accordance with these operating instructions. Observe all safety precautions described in this section and throughout this operating instructions.

The calibrated leak with screw in sleeve must only be operated in the proper condition and under the conditions described in the operating instructions. It must be operated by trained personnel only. Consult local, state, and national agencies regarding specific requirements and regulations. Address any further safety, operation and/or maintenance questions to the nearest Edwards office.

Safety Information

- The calibrated leak is only designed for the described purpose (see Description). A different use can cause risks for health and for the calibrated leak.
- To ensure the correct operation and accuracy of the measurement, an authorised Service should verify the calibrated leak annually.
- De-pressurizing the Helium pressure from the test leak at more than 2 bar per second may cause a blockage of the test leak, due to condensation. Disregarding this instruction will lead to a loss of warranty.

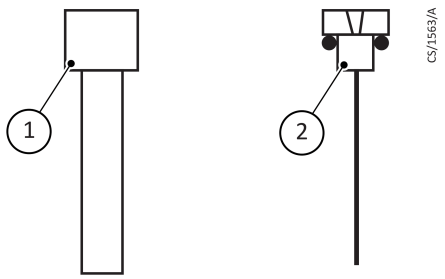
Description

The calibrated leak with screw in sleeve is designed to prepare a test sample with a specific helium leak rate. In a leak detection system this master test sample is used for:

- calibration of the vacuum system
- evaluation of the machine factor for the system
- verification of the test procedure

Design

Figure 51 Transport casing and calibrated leak



1. Transport casing
2. Calibrated leak

Technical Data

Part number	D13550930
Leak rate Q	Customised in the range of 10^{-2} mbar ls < Q < 10^{-7} mbar ls
Accuracy	± 15%
Calibration gas	Helium
Maximum pressure	20 to 40 bar if the capillary is conventionally glued in (see Assembly instructions)

Installation

The capillary of the calibrated leak is made up of super-sensitive quartz material.

The calibrated leak has to be handled with highest care. To prevent the destruction of the calibrated leak it may not be exposed to vibrations or other stresses and strains. In addition it is very important to assure that the system is de-pressurized at maximum 2 bar per second to avoid a blockage of the leak due to condensation.

Assembly instructions

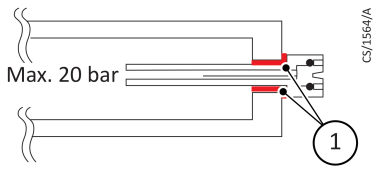
All bonds have to be glued with a two-part epoxy adhesive with a minimum lap shear strength of 23 Mpa.

Operating pressures up to 20 bar

If the maximum operating pressure that is exposed to the calibrated leak is below 20 bar, the transport casing can be glued as a retainer for the calibrated leak into the test sample.

Advantage: The calibrated leak is detachable connected to the test sample.

Figure 52 Operating pressures up to 20 bar



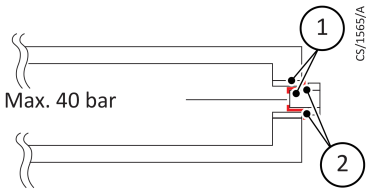
1. Two-part epoxy adhesive

Operating pressures higher than 20 bar

If the test leak should be used at pressures higher then 20 bar up to the maximum pressure of 40 bar, the calibrated leak must be screwed and sealed in the thread, of the calibrated leak. The transport casing may not be used.

The calibrated leak is non-detachable connected to the test sample.

Figure 53 Operating pressures higher than 20 bar



1. M3.5
2. Two-part epoxy adhesive

Operating pressures less than 1 bar

In such cases it is essential to ensure that 100% helium is in front of the capillary. Please evacuate both sides of the test leak to less than 1 mbar, otherwise residual air at the helium side could reduce the leak rate, or air from the outlet side of the test leak could flow into the helium side. In this case the leak rate will also be reduced.

Maintenance

Service

WARNING:

Whenever you send us in equipment, indicate whether the equipment is contaminated or is free of substances which could pose a health hazard. If it is contaminated, specify exactly which substances are involved. You must use the form we have prepared for this purpose.

A copy of this form has been reproduced at the end of these operating instructions: Return of Edwards Equipment: Declaration (HS2).

Attach the form to the equipment or enclose it with the equipment.

This statement detailing the type of contamination is required to satisfy legal requirements and for the protection of our employees. Edwards must return to the sender any equipment which is not accompanied by a contamination statement.

Waste disposal

The equipment may have been contaminated by the process or by environmental influences. In this case the equipment must be decontaminated in accordance with the relevant regulations. We offer this service at fixed prices.

Further details are available on request.

CAUTION:

Contaminated parts can be detrimental to health and environment. Before beginning any work, first find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Separate clean components according to their materials, and dispose of these accordingly. We offer this service. Further details are available on request.

When sending us any equipment, observe the regulations given in Service.

This page has been intentionally left blank.

Interface description

Serial Interface Protocols

You can communicate with the ELD500 via the following serial interface protocols:

- ASCII Protocol (Default)
- LD Protocol
- Diagnostics Protocol

The ASCII protocol is enabled by default.

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, therefore 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 usable with simple terminal program

ASCII Protocol

Communication Parameters

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

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.

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".

Note:

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.

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 (ELD500 --> PC)
3	TXD	Transmit data (PC --> ELD500)
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	-3 V to -25 V	3 V to 25 V
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).

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 Error messages. 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)	

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 ELD500: 1500 ms

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

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

Examples

PC to ELD500	ELD500 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

Command list

*CLS			clear Error
*IDN			identification
	:CRC		check sum
	:DEVice		name of instrument (ELD500 Wet, ELD500 Dry, ELD500 Flex)
	:VERsion		software version
	:SERial		serial-number ELD500
	: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]		Calibration history starting from 1 to 12 (Date, Time, Cal.-type, Mode, Cal.-factor)
	[:CALHist 1]		
	...		
	[:CALHist 12]		
	[:CALMode]		kind of calibration, INT_AUTO, EXT
	[:ERRor]		actual error number
	[:ERRorHist 1]		Error history starting from 1 to 12
	[:ERRorHist 2]		
	...		
	[:ERRorHist 12]		
	[:ZERO]		zero
	[:TURBO]		Device state TMP
	[:RANGE]		measuring mode, (GROSS, FINE, PRECISION, PART1, PART2, PART3)
	[:PREAMPresistor]		Pre-amplifier 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]
	[: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		pre-amplifier 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	pre-amplifier temperature
		:Electronic	electronic temperature

*CONFig	:TURBO		
		:Frequency	TMP frequency [Hz]
		:Voltage	TMP voltage [V]
		:Current	TMP current [A]
		:Power	TMP power [W]
	: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

(0 – infinite)	:PROTection		protecting functions
		:CONTaminatio n	contamination protect
		:CONTLimit	contamination limit
		:EVACtime	maximum evacuation time
		: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
		: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]
	:SUPPRession		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

Calibration via RS232

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

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.

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.

Fault finding

Common

Error	Possible Reason	Solution
No characters are received via the interface / the ELD500 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 ELD500 and PC / PLC match)
	Wrong protocol selected in the ELD500	Select correct protocol in the ELD500
	PC uses an USB-RS232 converter	In general the ELD500 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.

Error	Possible Reason	Solution
The ELD500 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 ELD500 and PC / PLC match)
	Wrong protocol selected in the ELD500	Select correct protocol in the ELD500

ASCII Protocol

ELD500 does not reply / ELD500 replies after several command with "E10" (ASCII 0dhex / 13dez)	"Carriage Return" at the end of the command is missing	Finish all commands with "Carriage Return"
ELD500 replies with "E06"	Control via RS232 not enabled in the ELD500	Enable control via RS232 (see sub-menu control location)
ELD500 replies with error message to the first command only, following commands are interpreted correctly	Receiving buffer of the ELD500 was not empty before sending the first command (e.g. by plugging in the RS232 cable during operation)	In the ASCII protocol the ELD500 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

LD Protocol

Communication Parameters

Data format	
Baudrate	38400, 8 data bits, 1 stop bit, no parity

Command format

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 maximum 253, so the total slave telegram length is maximum 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 to 13: Command-specifier Read/Write etc. (see table "Cmd H/L: Command: Command-specifier") Bit 12: free Bit 11 to 0: Command (3.3)
DATA	Data belonging to master request	0 <= n <= 248
	(Slave reply to write command is sent without data)	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)

Cmd H/L: Command: Command-specifier

Bit 15 to 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.

Bit 15 to 13	Meaning	High Nibble (Hex)	Comments
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

- 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.

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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
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
17	0011	Calculate background	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	Interface protocol
					SERIAL: 0, 0, 5	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]

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
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 [°C]
145	0091	TMP temperature bearing [deg. C]	FLOAT	R	-10, 0, 150	TMP temperature bearing [°C]
146	0092	TMP temperature motor [deg. C]	FLOAT	R	-10, 0, 150	TMP temperature motor [°C]
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]

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
165	00A5	Electronic temperature [deg. C]	FLOAT	R	-10, 0, 100	Electronic temperature [°C]
166	00A6	Pre amplifier temperature [deg. C]	FLOAT	R	-10, 0, 100	Pre-amplifier temperature [°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, 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	Analog output configuration
					Index 1: 0, 6, 8	Index 0: Channel 1
						Index 1: Channel 2
						see table / enumerations
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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
224	00E0	Analog output upper exponent	SINT8	R/W	-12, -5, 7	Upper limit for the analog out at the I/O module. Value is exponent of the mbar l/s value. Example: -5 = 1E-5 mbar l/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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
263	0107	PLC output configuration	UINT8[4]	R/W	Index 0: 0,2,16	PLC output configuration
					Index 1: 0,3,16	Index 0: CONTROL Pin 5,6,7
					Index 2: 0,4,16	Index 1: CONTROL Pin 8,9,10
					Index 3: 0,6,16	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
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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
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
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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
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
385	0181	Trigger [mbar*l/s]	FLOAT[3]	R/W	1.0E-12, 1.0E-9, 1.0E3	Trigger [mbar l/s]
					1.0E-12, 1.0E-8, 1.0E3	Index 0: Trigger 1
					1.0E-12, 1.0E-7, 1.0E3	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 [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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
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
431	01AF	Leak rate unit	UINT8	R/W	0,0,7	Leak rate unit
						0 = mbarl/s
						1 = Pam3/s
						2 = Atm ccs
						3 = Torrl/s
						4 = sft3/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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
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	Configuration of PLC input
					INDEX 1: 0, 2, 8	Index 0: CONTROL Pin 1
					INDEX 2: 0, 3, 8	Index 1: CONTROL Pin 2
					INDEX 3: 0, 4, 8	Index 2: CONTROL Pin 3
					INDEX 4: 0, 5, 8	Index 3: CONTROL 2 Pin 1
					INDEX 5: 0, 6, 8	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
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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
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
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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
555	022B	Evacuation time	UINT16[2]	R/W	Index 0: 0, 600, 900	Evacuation time [sec]
					Index 1: 0, 1800, 1800	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
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]
						ELD500 Flex only
621	026D	Fore pump type	UINT8	R/W	0, 1, 1	Fore pump type
						0 = wet
						1 = dry
						ELD500 Flex only
622	026E	Partial flow pump	UINT8	R/W	4, 25, 80	Partial flow pump
						4...80 [m³/h]
						not for ELD500 Dry

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
623	026F	Quick point time	UINT16	R/W	0, 60000, 60000	Quick point time 0, 1, 2, 3, ... 10, 12, 14, ... 30, 35, 40, ... 100, 110, 120, ... 240 60000 = infinite not for ELD500 Dry
624	0270	Mode V8	UINT8	R/W	0, 1, 1	Mode V8 0 = open 1 = automatic not for ELD500 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, 1000000000	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 ELD500 Wet - Oil filter ELD500 Dry - Exhaust filter ELD500 Flex - 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

Command dec	Command hex	Name	Data type	Read/ Write	Min-, Def-, Max-value	Meaning
1630	065E	Background calculation [A]	FLOAT	R		Results inlet area background calculation
						Index 0 = Offset internal
						Index 1 = Offset external old
						Index 2 = Offset external new
1854	073E	Contamination limit [mbar*l/s]	R/W	FLOAT	1.0E-6, 1.0E-3, 1.0E3	Contamination limit
1855	073F	Contamination protect	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

Enumerations

LD communication protocol status word

Status word bit no.	ELD500
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)

Value	Meaning
0	ASCII (SERIAL only)
1	Diagnostics (SERIAL only)
4	ELD500 RC (REMOTE 1/2 only)
5	LD Protocol (both)

Analog output configuration (command 222)

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

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	-----

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

Value	Meaning
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
```

Present warnings (command 297)

Value	Meaning
0x00000001	Warning temperature pre-amplifier
0x00000002	Warning temperature electronic
0x00000004	Warning capillary
0x00000008	Warning calibration request
0x00000010	Warning proportional valve
0x00000020	Warning maintenance fore pumpe
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)

Vacuum ranges (command 550)

Value	Meaning
0	NORMAL
1	FINE_ONLY
2	GROSS_ONLY
3	PARTIAL_FLOW (ELD500 Wet and ELD500 Flex only)
4	PRECISION (ELD500 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

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