Short user guide LD 500

SALES OFFICE SOUTH

Zindelsteiner Straße 15
D-78052 VS-Tannheim
GERMANY
Tel.: +49 (0) 7705 978 99-0
Fax: +49 (0) 7705 978 99-20
info@cs-instruments.com

SALES OFFICE NORTH

Gewerbehof 14
D-24955 Harrislee
Germany
Tel.: +49 (0) 461 807 105-0
Fax: +49 (0) 461 807 105-15

1. Safety instructions

About this document

- Read this document carefully and familiarise yourself with the product before use. Pay particular attention to the safety instructions and warnings to prevent personal injury and product damage.
- Keep this document close at hand so you can refer to it if necessary.
- Pass the document on to future users of the product.

Ensuring safety

- Only use the product in an appropriate manner and for its intended purpose and within the parameters specified in the technical data. Do not use force.
- Never use the device to measure on or in the vicinity of live parts!
    - Maintain an adequate safety distance when performing leak detection operations on electrical systems to avoid dangerous electric shocks!
- Avoid any direct contact with hot or rotating parts.
- Always switch on the device first **before** putting on the headset! At high signal levels (headset bar chart in the red zone), the volume level may also be similarly high.
- Never point the integrated laser directly at the eyes! Strictly avoid directly exposing the eyes of humans and animals!
- **Laser module:** corresponds to DIN EN 60825-1: 2015-07 Class 2 (< 1 mW)
- Observe the prescribed storage and operating temperatures.
- Improper handling or use of force leads to loss of warranty.
- Any form of tampering with the device that does not conform with its designated use and is not described in the procedures will forfeit any warranty and exclude liability.
- The device is exclusively designed for the intended use as described here.

Protecting the environment

- Dispose of defective/empty batteries in accordance with the relevant legal provisions.
- At the end of its useful life, dispose of the product at the separate collection point specified for electrical and electronic equipment (observe local regulations) or return the product to CS Instruments GmbH & Co. KG for disposal.

CS Instruments GmbH & Co. KG offers no guarantee in relation to the suitability for any other purpose and accepts no liability for any printing errors in this operation manual. The same applies to consequential damage in connection with the delivery, capacity or use of this device.

2. Intended use

The LD 500 is a leak detector for quick and reliable leak detection in/on compressed air systems.
The LD500 leak detector evaluates the ultrasonic waves generated by the leakage based on distance and pressure.

It is solely designed and constructed for the intended use described here and may only be used for this purpose.

The user must verify that the device is suitable for the intended use. The technical data listed in this datasheet are binding.

Improper handling or operation outside the technical specifications is not permitted. Claims of any kind for damages arising from improper use are excluded.

3. Technical data LD500

Dimensions hand-held housing	263 x 96 x 280 mm (with preamp module and acoustic trumpet)
Weight	0.55 kg with preamp module and acoustic trumpet, complete set in case approx. 3.0 kg
Operating frequency	40 kHz (+/-2 kHz)
Power supply	Internal 7.4 V lithium-ion battery
Operating time	> 9 h (continuous operation)
Operating temperature	-5 °C to +40 °C
Charging	ext. battery charger (included in scope of delivery)
Charging time	max.4 h
Storage temperature	-20 °C to +50 °C
Laser	Wavelength 645 – 660 nm, output power < 1 mW (laser class 2)
Connections	3.5 mm stereo jack for headset, Power supply socket for connecting an external charger USB connection
Colour screen	3.5" touch panel TFT transmissive
Interface	USB for data export/import, SW update, etc.
Data logger	8 GB memory card storage (micro SD class 4)

4. The LD 500

|	
Unlock button for preamp module	Acoustic trumpet
	Camera
3.5" TFT colour display with touch panel	Preamp module
	USB connection
Foil keypad (4 buttons)	Plug-in connection for power supply (battery
On/Off button	Save button
	Volume (+/-)

5. Preparing the device

The device must be configured before starting the leakage scan. The user can access the menu by clicking the "Home" button.

5.1 Setting the language
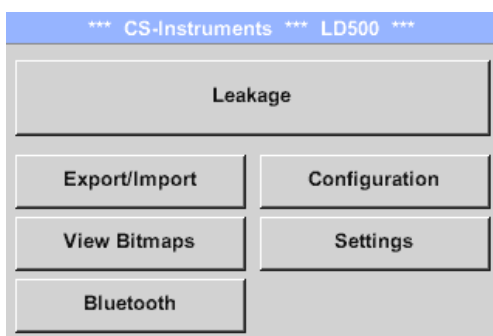
Home → Settings → Device Settings → Set Language → English

5.2 Checking the current firmware and firmware updates

Regularly check the CS INSTRUMENTS homepage for a new firmware version. We are continuously developing the product so you can use the device with the most up-to-date software version including all available functions.

1. Check firmware status on the homepage and download it from the following URL:
   https://www.cs-instruments.com/downloads/software/firmware-leak-detectors
2. Check firmware in LD500

   Path: Home→ Settings → About LD500 → Software Version

3. If the firmware is out of date, download the new version from the CS Instruments homepage
4. Unpack the ZIP file
5. Copy the DEV0004 folder to a USB stick

The folder structure must be as follows:
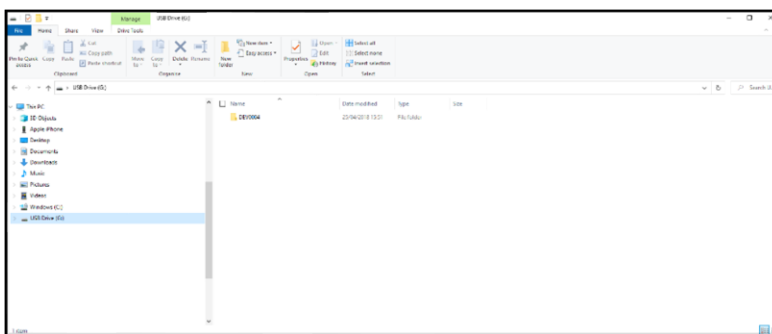
6. Connect the USB stick to the LD500 and connect the power supply
7. Perform system update with:
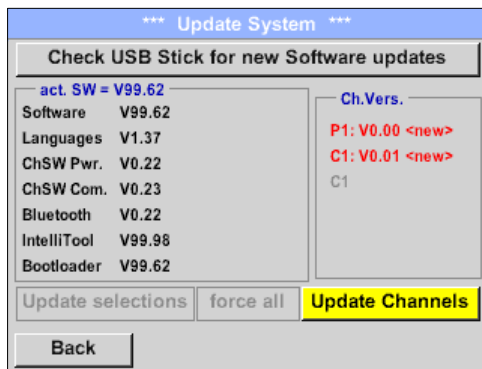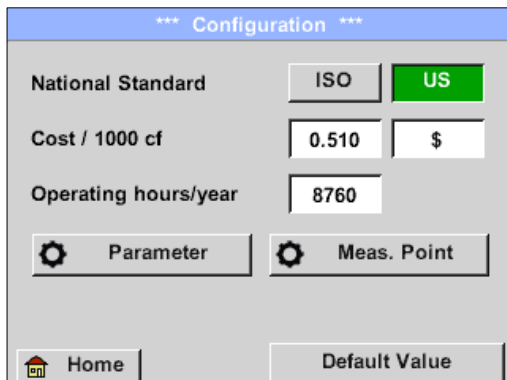
Path: Home → Settings → Device Settings → System Update

8. Click on the "Check USB Stick for new Software updates" box
9. Available update is shown
10. Execute the "force all" function to perform the update
11. Restart the device and update the channels
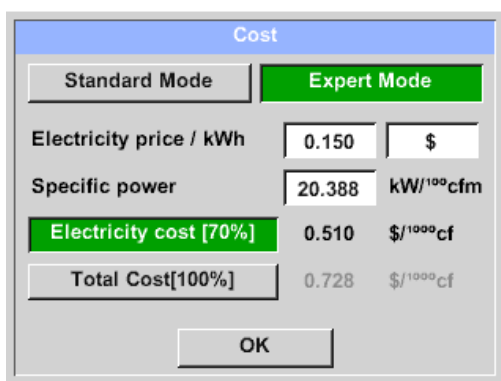
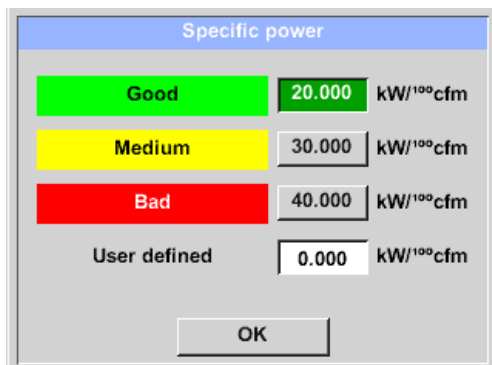The device is now up-to-date

5.3 Configuration of LD500

In the configuration settings, the unit system can be selected and the required parameters entered to calculate the leakage costs per year.

→ Select ISO or US unit system
→ To define the costs, call up the text field "Costs/1000 Nm³"
→ Enter working hours per year (compressed air system is operated actively)

There are 2 variants available to define the costs:

- **Standard mode:** Cost per 1,000 volume units. The costs and the currency can be entered directly. Standard value: €19 / 1,000 m³ or €0.58 / 1,000 cf.
- **Expert mode:** The electricity costs/kWh as well as the specific output of the system can be defined here in detail.

The specific output refers to the efficiency of the compressor system. For example, how much electrical energy (kWh) is required to produce 1 cubic metre of compressed air (m³). Three predefined system values are created for this, as well as a user-defined input field for individual entry.

The cost type can also be set in expert mode. The "Electricity costs [70%]" are calculated by the "consumed electrical energy" of the compressed air system, which typically represents 70% of the total costs. For "Total costs [100%]", the investment and maintenance costs are taken into account, which are in addition to the electricity costs over the entire service life of the compressors.
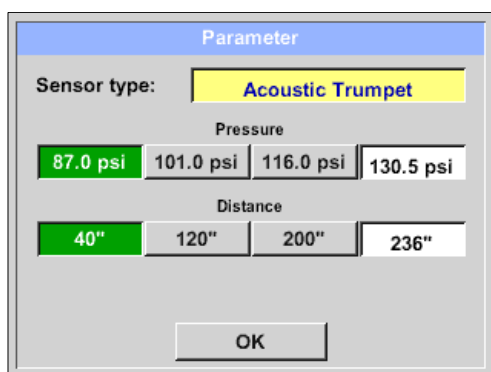
5.3.1 Setting the LD500 parameters
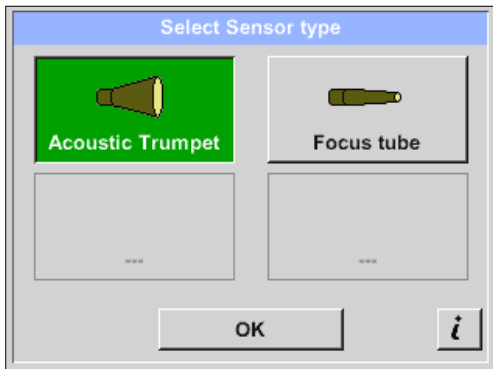
Entering the parameters is necessary for the calculation of the leak flow rate.
The following settings must be made.

➔ Sensor type
Change the sensor type according to the application and ambient conditions, see chapter 6.4.


Home ➔ Configuration ➔ Parameter ↘ Pressure and distance
Values for the pressure and distance can be freely selected in the two fields with the white coloured background, provided these are within the valid selection range.

The **pressure** can be set variably between 1 – 10 bar.

Different **distances** from the LD500 to the leakage are defined for the different **sensor types** to calculate valid leakage loss and costs per year. These distances must be adhered to as accurately as possible, see chapter 6.4.

5.3.2 Setting the LD500 measurement place
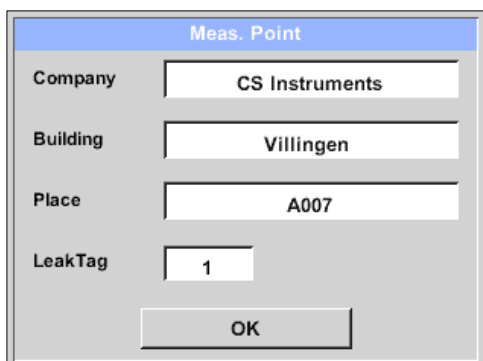
Home ➔ Configuration ➔ Measurement place ↘
The measurement place is stored for each leakage in its journal data (xml file). This information can be viewed later in the software leakage report.

The company and building can be recorded upon entering the building, the place identifies the exact position of the leakage so it can be easily found again when doing repairs.

➔ LeakTag: will automatically increase by one (1) after storing a measurement.

6. Leakage detection

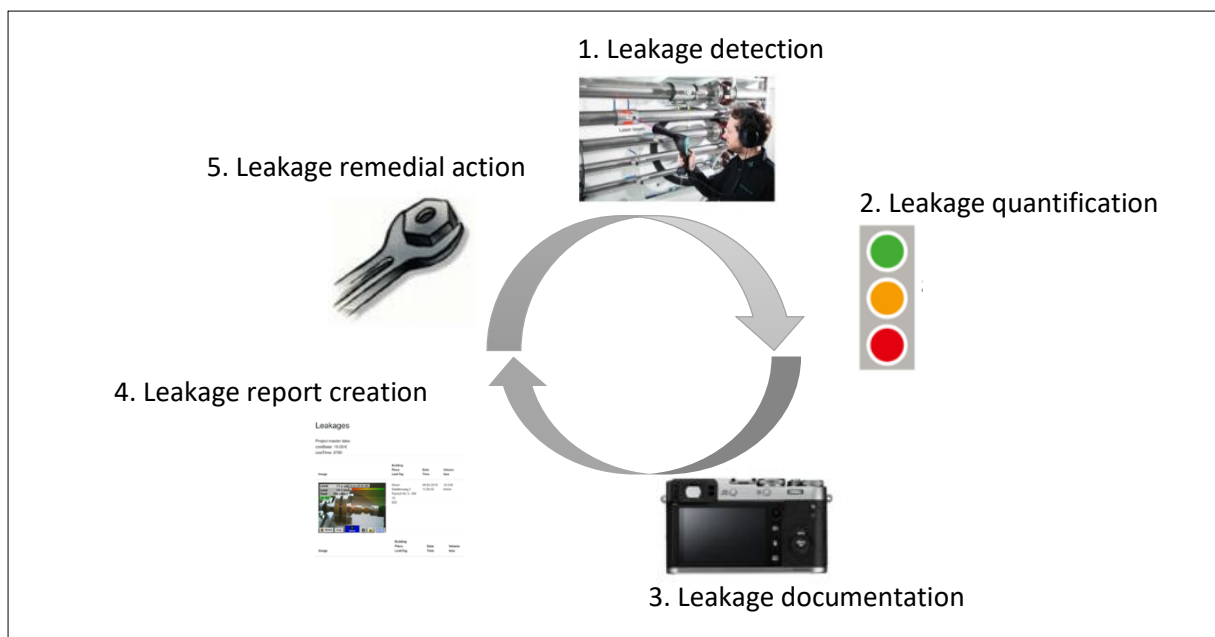This chapter describes the best use of the device in practice.

6.1 Leakage detection procedure

The following procedure should be performed in the company on a periodic basis to consistently keep the leakage rate to a minimum. The aim should be a sustainable leakage rate of 5 to 10 % as one-time detection and elimination does not permanently reduce the leakage rate and new leakages will occur again afterwards.

Tip:

To determine the ideal time, the use of a volume flow sensor (VA500) in the main pipe behind the tank is recommended. At least one week (Monday to Sunday) is recommended as the measurement period. If an LD 510 is purchased, the volume flow sensor can be connected to it. During production stops, the volume flow profile shows the leakage rate. If the threshold value is exceeded, leak detection can be contracted.
The volume flow measurement can also be used to validate the result of the leak detection and elimination, as this must reduce the volume flow during stoppages.

1. Leakage detection

2. Leakage quantification

3. Leakage documentation

4. Leakage report creation

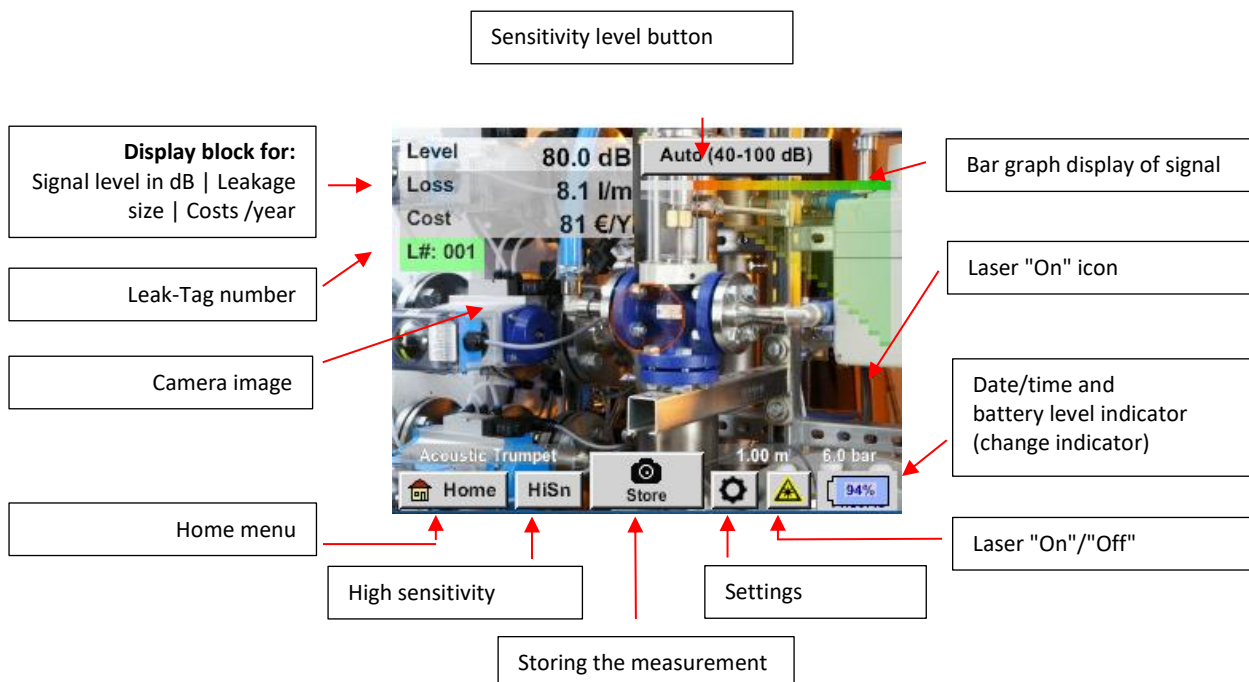5. Leakage remedial action

6.2 Possible causes of leakage:

Generally, leakages can be found at the connection elements in the compressed air system.
- Leaking couplings and hose clamps
- Leaking screw and flange compressors
- Porous/defective hoses
- Porous/defective seals of tools and machines
- Faulty steam traps
- Leaking or incorrectly installed dryer, filter and maintenance units
- etc.

6.3 Surface leakage detection with the LD 500

After start-up, the device shows the leakage detection view. The following figure lists the various functions and displays.

Sensitivity level button

Display block for:
Signal level in dB | Leakage size | Costs /year

Bar graph display of signal

Laser "On" icon

Leak-Tag number

Camera image

Date/time and battery level indicator (change indicator)

Home menu

Laser "On"/"Off"

High sensitivity

Settings

Storing the measurement

6.4 Selection of accessories

To simplify leakage detection for the user, several attachments are available for different measuring conditions.
Note on the distance setting for the quantification function:
The distances to be maintained for quantifying the leakage always refer to the front of the respective attachment measured to the leakage.

6.4.1 Acoustic trumpet (standard attachment)

The acoustic trumpet bundles incident ultrasonic waves, thereby extending the range of the device. This behaviour makes it ideal for medium distances.
The leakage can be heard from large distances, for precise detection, the user must approach the leakage and consistently follow the "loudest" point. Individual compressed air components are then checked for precise detection.
Quantification distance (distance) → 1 – 6 m
Use of acoustic trumpet:
• Average distance to pipe/component 0.2 – 6 m

- Low interfering noise
- Leakage freely accessible
- Use at distances of up to 6 metres if no parabolic mirror available

6.4.2 Straightening tube

The straightening tube permits only very few ultrasonic waves to pass in the direction of the ultrasonic transducer, allowing leakages to be located very precisely.

For this reason, the use of the straightening tube is recommended for small distances, for the precise detection of the corresponding leakage.

Quantification distance: (Distance) → 0.2 m

Use of straightening tube:
- Short distance to pipe/component 0.05 m
- Pipe/component freely accessible
- Pipes and components to be inspected are very close together
- Medium to high noise
- Use when no gooseneck available

6.4.3 Gooseneck

Before the gooseneck can be used, its data – located on the USB stick shipped with the attachment – must first be imported into the LD500, if it was reordered.
Import:
Home → Export/Import → Import → New tool → Gooseneck_xxxxxxxx

The gooseneck should be used if the pipes and components to be inspected are physically very close. In addition, the shape of the gooseneck can be flexibly adapted to easily inspect hard-to-reach pipes and components.

The sensitivity of the gooseneck has been reduced to dampen noise. This makes it ideal for targeted, local testing of compressed air components at high noise levels, for example in systems using pneumatic cylinders and in compressed air distribution cabinets.
Quantification distance (distance) → 0.05 m

Use of gooseneck:
- Short distance to pipe/component 0.05 m
- Leakage not freely accessible
- Medium to high ultrasonic noise
- Pipes and components to be inspected are very close together

6.4.4 Parabolic mirror

Before the parabolic mirror can be used, its data – located on the supplied USB stick – must be imported into the LD500, if it was reordered.

Import:
Export/Import → New tool → Parabol_xxxxxxxx

The parabolic mirror bundles horizontally incident ultrasound in its focal point where the ultrasonic transducer is located. On the one hand, this leads to a considerable amplification of the measured ultrasound (high range) and, on the other hand, to a very precise directional behaviour, since ultrasound that does not incident horizontally is reflected by the reflector.

The combination of these two characteristics enables the parabolic mirror to precisely locate leaks at large distances.

Quantification distance (distance) → 3 – 12 m

Use of parabolic mirror:
- Large distance to pipe/components 3 – 15 m
- Interfering noise
- Leakage not freely accessible (behind a fence)
- Near leaks (superimposition)

6.5 Change of sensitivity levels

Ultrasound levels can be understood as a "loudness" of the leakage.

With the "Sensitivity" button, the sensitivity of the LD500 can be adjusted to the environment, which strongly influences the acoustic behaviour of the device and increases or decreases the valid value range. A reduction in sensitivity reduces the range of the leakage reading but the "responding area", indicated by the circle in the display, also gets smaller, which considerably simplifies detection.

Sensitivity levels
0 – 60 dB = Highest sensitivity level of the device (use with small leaks and no noise), selection with the "*HiSn*" button or the "*Sensitivity*" button
10 – 70 dB = Leakages and noises get "less noisy", the range is reduced.
20 – 80 dB = Leakages and noises get "less noisy", the range is reduced.
30 – 90 dB = Leakages and noises get "less noisy", the range is reduced.
40 – 100 dB = Most insensitive stage (large leaks, many noises → for heavy-duty application)

By default, the LD500 is set to the auto function and will automatically switch between levels (10 – 70 dB to 40 – 100 dB).

The highest sensitivity level 0 – 60 dB of the unit can be set using the "**HiSn**" button or by manually changing the sensitivity level using the "Sensitivity" button. This mode should be used for the detection of small leaks in a quiet environment.

6.5.1 Sensitivity level button
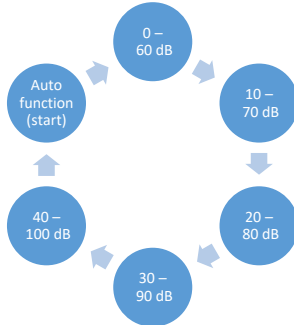
You can manually switch between individual levels with the "Sensitivity" button or use the auto function to adjust the level. The order is shown in the chart on the left.

6.5.2 Auto function (default)

The auto function (automatic change of the sensitivity levels) is activated by default. This means that the measured ultrasound level is used to automatically adjust the optimum measurement range.
Example: Level = 71 dB → Level: 20 – 80 dB

6.5.3 Manual sensitivity adjustment

It is also possible to switch between sensitivity levels. This can be done with the "Sensitivity" button.

It helps the user to reduce interfering noise and detect leakages as easily and quickly as possible. The user should frequently increase and decrease the sensitivity to scan the target surface for leakages with the adjusted sensitivity. Decreasing the sensitivity makes the device react to a smaller area but also reduces the range.

6.5.4 Procedure for leakage detection

Different approaches to leakage detection are recommended depending on the ambient conditions.

Option 1 – In what direction can the leakage be heard? This method is used to aim in all directions and find the loudest point. The loudest point should then be approached to precisely locate the leakage. Works well when there is less interference from noise.
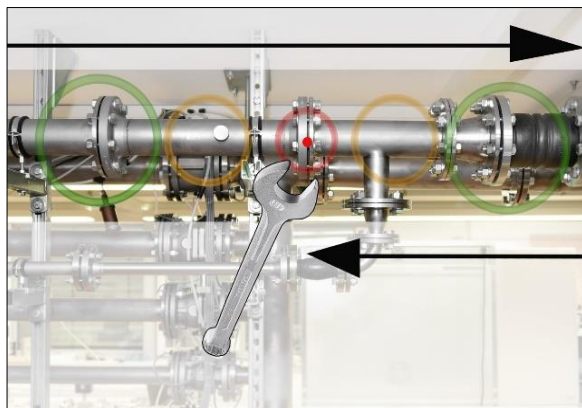
Option 2 – Patrol the compressed air network. Alternatively, in case of increased noise, leakage detection can be facilitated by the user listening to the compressed air network "bit by bit".

This means from the compressor room to the end user. If noise is detected, it is recommended to manually reduce the sensitivity of the device and to use the gooseneck for small distances, and the parabolic mirror for larger distances. The following also applies to this method in general: The shorter the distance to the pipe, the easier it is to detect a leakage.

Option 3 – Leakage detection during production stoppage

Production and manufacturing processes may give rise to ultrasound noises at times. If, for example, a pneumatic system blows off air at regular intervals, the LD 500 picks up on this.

If leakage detection is severely impeded by these interfering noises, it is recommended to perform leakage detection according to **Option 1** or **Option 2**, if the pipes are pressurised but the manufacturing processes have been stopped. These are the quickest and easiest ways to detect leakages.

6.6 Other problems that can make measuring more difficult

wall
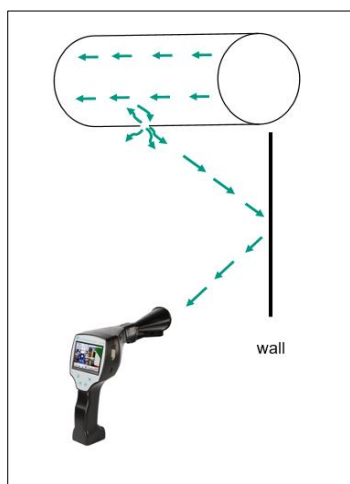
There may be further problems in leakage detection, these are described in the following sub-chapter.

To reduce any problems, we generally recommend to use the correct attachment, as outlined in chapter 6.4 Selection of accessories, and to reduce the sensitivity.

Reflections: If leakages can be heard in walls but there are no pipes, this is a reflected ultrasound of a leakage. In this case, it is recommended to reduce sensitivity (manually switch to a higher range until it can no longer be heard). Additionally, aim should be taken in a direction parallel to the reflection surface as this is where the leakage is located. The leakage will be noisier than the reflected ultrasound.

Superimposition of leaks: If leaks are close to one another, the emitted ultrasound overlaps. In this case, it is recommended to seal the leakages using a cloth. This enormously increases the accuracy of the measurement, especially for the quantification of the leakage. At the same time, measurements should be taken in close proximity to the components.

Reducing sensitivity and, in particular, using a parabolic mirror (for large distances) and a gooseneck (for smaller distances) can also make detection a lot easier.

Very large leakages: Very large leakages generate a strong ultrasonic field, which can possibly generate an ultrasonic signal in the entire room. Here again, it is recommended to reduce the sensitivity and check close to the individual components. The aim is to detect leakages by using the volume level of the loudest point.

If the leak cannot be accessed, using a parabolic mirror is recommended, as it has very good directionality.
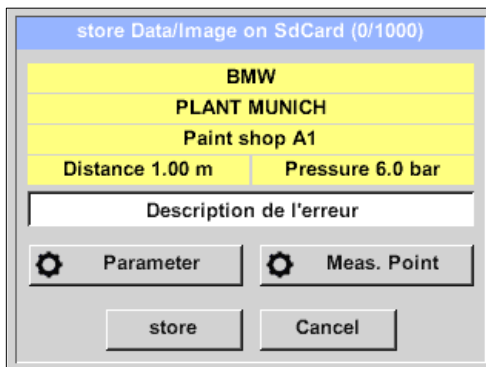
Lamps and motors:
Interfering noise: Electrical buzzing → do not mix up with leakage!

Some systems and machines can also generate ultrasound that is in a similar frequency range, for example fluorescent tubes or motors. These generally "sound" different than the typical "hissing" of leakages and should not be mistaken for them.
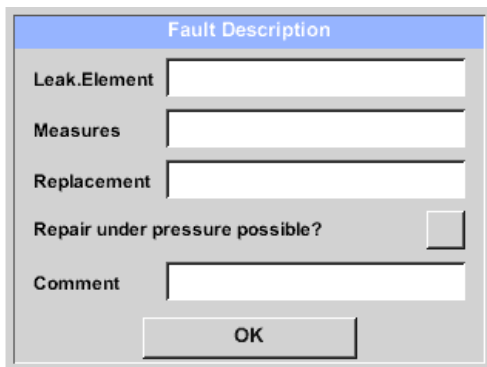
If ultrasound can be heard and it clearly does not emanate from the compressed air system, the sensitivity of the device should be reduced in order to suppress the ultrasound. If this does not suffice, the noise must be ignored.

6.7 Documenting the leakage

If the leakage has been found, the pressure and distance to the leakage adjusted and the leakage described, it can be "captured" with the "Save" button.
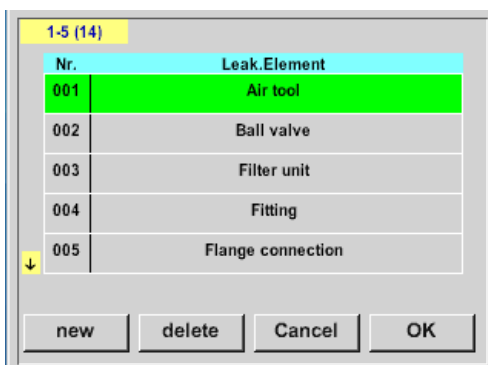
Afterwards it is possible to check the parameters (pressure and distance) and to precisely define the measurement place with company, building and location. It is also possible to enter a short error description (max. 32 characters).

The following error descriptions are available, which make it much easier to eliminate leakages later.
- Leakage element
- Measure
- Spare part
- Repair under pressure possible?

Some suggestions are stored by default to make the input easier for the user.
Entries made by the user are also stored in an internal database and can be used again and again.
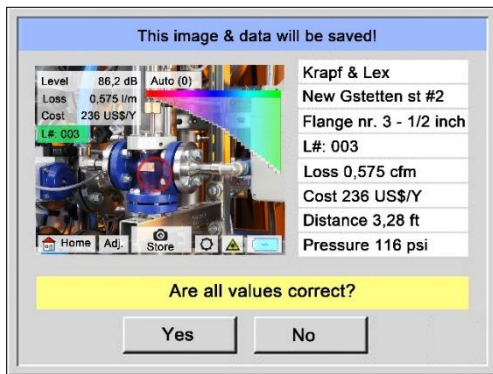
All relevant data of the leakage are shown in the image and a final check can be done again before saving. All leakages, including entries made, are saved to the journal file.

6.8 Exporting journal data

Once all leakages have been documented, the data must then be exported to a USB stick.
Here, the user has the option of selecting the start and end time of the exported leakages.

Attention: If the «DELETE leakage data» function is activated, **ALL** leakages in the memory will be irretrievably deleted.

Home → Export/Import → Export → Leakage Data → Change Start Time & Change End Time → Export
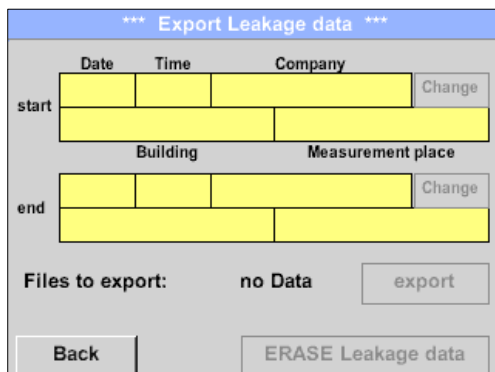
To continue with the leakage documentation, please go to section 7.4 *Data import*.

7. Using the CS Leak Reporter software

Main functions:
- Administration of companies/buildings/projects/measurements
- Documentation and reporting
-

Dashboard:
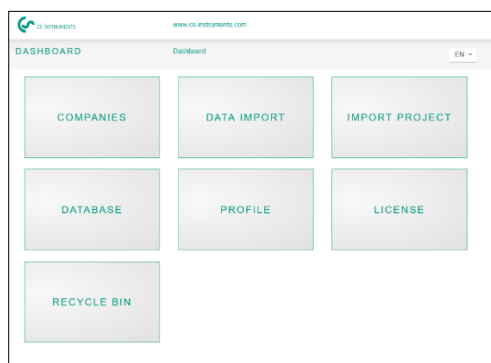
7.1 Installing the CS Leak Reporter software

The software is executed with the «Setup.exe» application. The file is located on the supplied USB stick or can be downloaded from the homepage at the following URL: https://www.cs-instruments.com/downloads/software/computer-evaluation-software

7.2 Software licensing

Path: Dashboard → Licence

Following installation, you will receive a 30-day trial access. For permanent use of the software, you need to purchase a licence key and register it along with your personal data. The licence key is printed on the invoice and the delivery note. Additionally, a digital copy of the licence can be found on the supplied USB stick and is also printed on the stick.

Note: One licence key allows for software activation on two devices. If the SW is subsequently installed on another laptop or computer, the licence on the old device must be deactivated. It can then be used again on the new device.

7.3 Saving your personal data and profile

Path: Dashboard → Profile

You can enter your contact details in the profile. These are printed on the cover page of the report.

7.4 Data import

Once you have saved the LD500 data on a USB stick, the leakage data must be read. The export function of the LD500 is described in section 5.8.
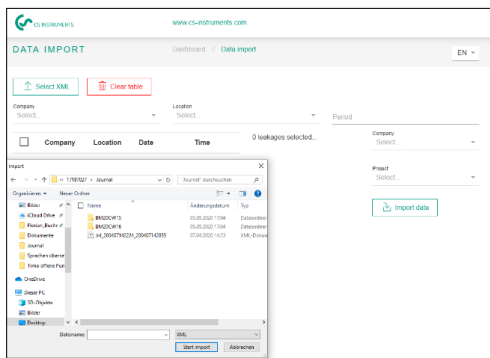
Path: Dashboard → Data import → Select XML

The name of the folder corresponds to the serial number of the LD500 in use.
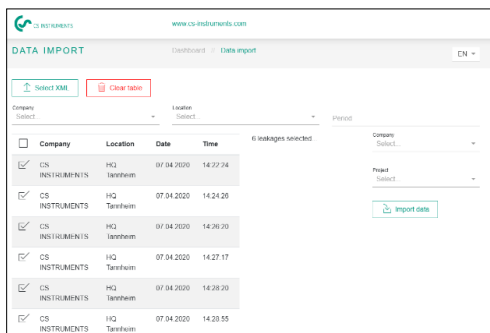
After selecting the relevant journal file, the following view will be displayed:
When you click on «Data import», the displayed companies will be created.
You can also sort by companies, building or a time range. Only the corresponding leakages will then be displayed and imported.

If an existing company was selected for «Company» or «Project», the data is exported to this company and the

selected project.

7.5 Data preparation
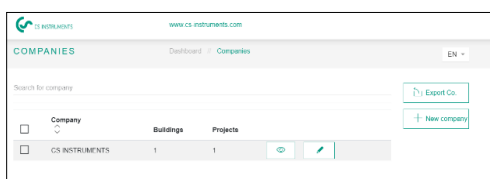
Path: Dashboard → Companies (eye of the corresponding company)
The data import from section 7.4 corresponds to a project. This can then be further processed by clicking on the eye. Specific information for a company can be added under the company and this is where the data imports are located as

separate projects.

7.6 Selecting projects

Path: Dashboard → Companies→ Project (eye of the corresponding project)
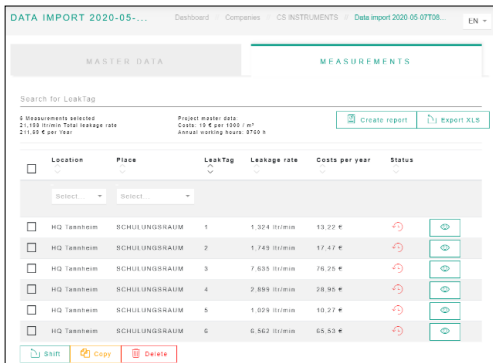
Each «Data import» corresponds to a project. Here, the desired project of the company in question must now be selected.
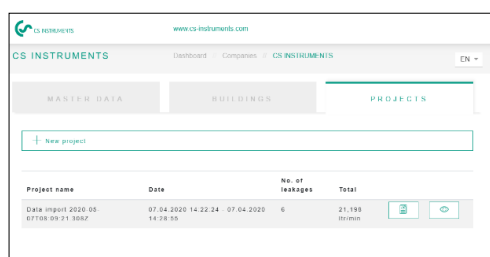
The leakage overview for the project will then be displayed.

7.7 Leakage overview

This list now contains all imported leakages from the data import. The relevant parameters of each individual leakage are displayed and can be sorted by header (e.g. Leak tag).

It is also possible to «copy» or «move» leakages to other projects or «delete» them.

7.8 Editing individual leakages

Using the eye, a detail view of each individual leakage can now be opened and then edited.
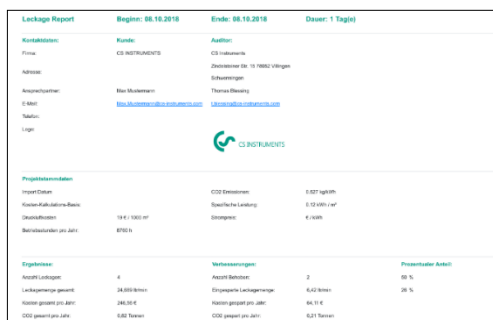

Path: Dashboard → Companies→ Project →(eye of the corresponding leakage)

In this menu, you can:
- upload an additional image
- add/change a comment
- define the priority
- add/edit details on leakage elimination
- set the status

7.9 Creating reports

Path: Dashboard → Companies→ Project → «PDF» or «XLS»

After editing leakages, an automatic report can be created by pressing the «PDF» or «XLS» buttons in the leakage overview. The report follows the selection of building or place and the sorting of the relevant column. Sorting can be done by LeakTag, leakage rate, costs per year or status.
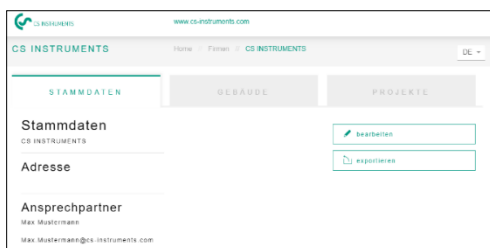

The first page of the «PDF report» shows a cover page including contact information, project master data and the results of the leakage scan.

The following pages list the individual leakages:

7.10 **Modifying company master data (customer)**
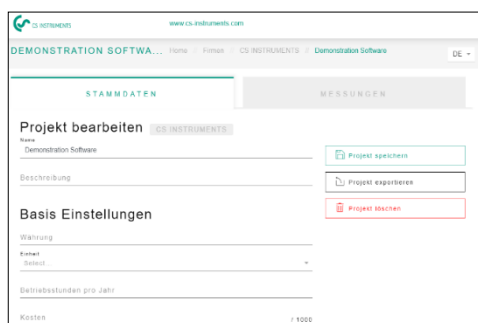
Path: Dashboard → Companies→ Master data

In this screen the contact details of the customer, which will be printed in the report, can be entered.

7.11 **Modifying project master data**

Path: Dashboard → Companies→ Project → Master data

In this screen, the parameters of the project can be adapted if the configuration of the LD500 was faulty or in-complete. The entries made there are then used for all leakages in the project.

Further explanations and details can be found under:

Instruction manual: https://www.cs-instruments.com/downloads/instruction-manuals

LD500: https://www.cs-instruments.com/products/d/leak-detection/leak-tester-ld500-to-detect-and-calculate-leakages