

SePem®

SePem® 155

SePem® 01 Master



SePem® 155 Logger

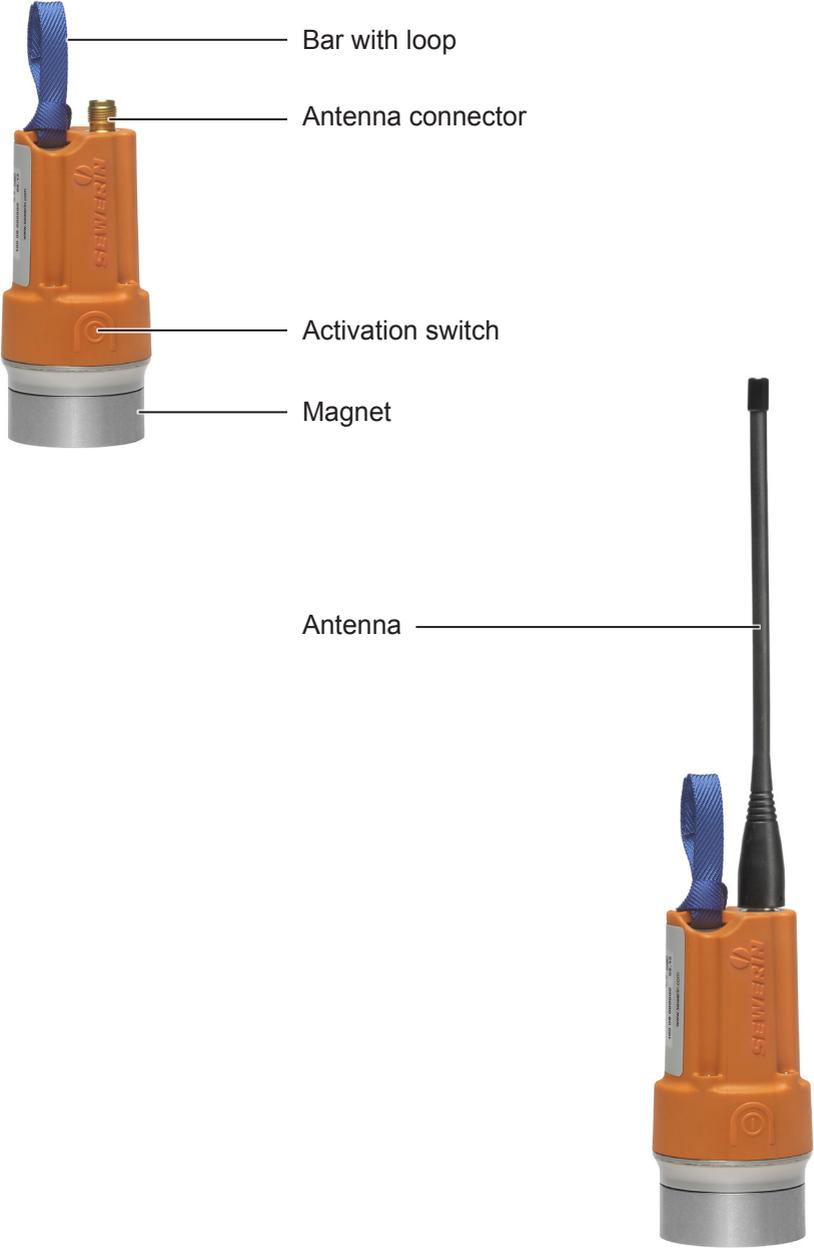


Fig. 1: **SePem 155** Logger without antenna (top) and with antenna (bottom)

SePem® 01 Master



Fig. 2: SePem 01 Master without antenna (top) and with antenna (bottom)

Information about this document

The warnings and notes in this document mean the following:



CAUTION!

Risk of personal injury. Could result in injury or health risk.

NOTICE!

Risk of damage to property.

Note:

Tips and important information.

Enumerated lists (numbers, letters) are used for:

- Instructions that must be followed in a certain order

Lists with bullet points (point, dash) are used for:

- Lists
- Instructions that only involve one step

Numbers enclosed by forward slashes /.../ refer to referenced documents.

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1 Introduction

The **SePem** system is used for the early detection of leaks in water pipe networks.

The **SePem 155** Logger is especially designed for stationary operation, i.e. for continuously monitoring water pipe networks at fixed measurement locations over long periods of time (several years).

The **SePem 01 Master** programming and read-out unit allows the system to be operated without the need for a computer.

SePem is a prelocation system. Indications that a leak is present must, therefore, always be verified using an appropriate method (e.g. correlation).

Note:

These operating instructions explain the **SePem** system. All descriptions refer to the device as delivered (factory settings). The manufacturer reserves the right to make changes.

2 General

2.1 Warranty

The following instructions must be complied with in order for any warranty to be applicable regarding functionality and safe operation of this equipment.

- Read these operating instructions prior to operating the product.
- Use the product only as intended.
- Repairs and maintenance must only be carried out by specialist technicians or other suitably trained personnel. Only spare parts approved by Hermann Sewerin GmbH may be used when performing repairs.
- Changes or modifications to this product may only be carried out with the approval of Hermann Sewerin GmbH.
- Use only Hermann Sewerin GmbH accessories for the product.

Hermann Sewerin GmbH shall not be liable for damages resulting from the non-observance of this information. The warranty conditions of the General Terms and Conditions (AGB) of Hermann Sewerin GmbH are not affected by this information.

In addition to the warnings and other information in these operating instructions, always observe the generally applicable safety and accident prevention regulations.

The manufacturer reserves the right to make technical changes.

2.2 Intended use

SePem is a measurement data recording and evaluation system. The system is designed for use in the stationary and mobile monitoring of water pipe networks. The system must only be operated by suitably qualified employees (skilled staff, specialists and technicians) of water supply companies.

This system is only suitable for use in industrial and commercial applications. All applicable safety and accident prevention regulations must be complied with when using the system.

Detailed information on appropriate operating conditions for the components of the system at the place of installation are provided in Section 7.1.

2.3 General safety information

This product was manufactured in accordance with all binding legal and safety regulations. It corresponds to the state of the art. The product is safe to operate when used in accordance with the instructions provided.

However, if you handle the product improperly or not as intended, the product may present a risk to persons and property. For this reason, always observe the following safety information.

- Do not modify the product.
- Never open the Logger housing.
- The Logger contains a powerful magnet. Keep the Logger away from magnetic storage media (e.g. hard drives, credit cards) and medical devices (e.g. pacemakers, insulin pumps).
- The batteries in the Logger may only be replaced by SEWERIN Service or by other suitably trained personnel.
- Ensure that no dirt or moisture gets into the connections on all the devices.
- Never carry a unit by its antenna.
- Never bend, kink or cut the antenna of the devices.
- Always observe the permitted operating and storage temperatures.
- Do not expose the **SePem 01 Master** to any source of moisture that could get into the device.

2.4 Notes on the radio operator's license

The **SePem** system may only be operated with a radio operator's license issued by the responsible authorities.

- Apply for a radio operator's license before starting up the system.
- Perform a frequency pairing with the assigned frequency (frequency pair) before starting up the system.

3 SePem system

3.1 System components

The **SePem** system (**SePem** for short) comprises:

- **SePem 155** Logger, for short: **Logger** (see Section 4)
for recording measurement data
- **SePem 01 Master**, for short: **Master** (see Section 5)
for programming Loggers and collecting and evaluating measuring results

A single **Master** can be used to manage up to 400 Loggers. A wide range of accessories is available for the Loggers and the **Master** (see Section 7.8).

3.2 Mobile operation as an alternative to stationary operation

The aim of stationary applications is to provide **permanent** monitoring over a large area, whereas mobile applications of the system are aimed at **regular** checks carried out over smaller areas.

Mobile operation represents a cost-effective alternative to stationary operation as only a limited number of Loggers are necessary. The Loggers will typically be installed for a few days to provide comprehensive coverage in the monitoring area. The measurement data that is recorded can then be read out and evaluated at regular intervals. Monitoring of the area is completed when any leaks detected are repaired. The Loggers can then be moved to the next monitoring area.

3.3 Operating principle

3.3.1 Monitoring procedure (overview)

The monitoring function is carried out as follows:

1. Prepare the Loggers (see Section 4.3)
2. Install the Logger at the measurement location (see Section 4.4.3)

The Loggers then work automatically, i.e. they record measurement data at the predefined times.

3. Read out the measuring results using the **Master** (see Section 5.5.2)

The Logger will transmit the measuring results at regular intervals within a prescribed period of time. The period of time is referred to as the radio time frame and is specified during programming.

The operator must transport the **Master** to within the transmission range of the Logger to read out the data. The measuring results will be transferred automatically from the Logger to the **Master** as soon as the user enters the radio transmission range.

It is also possible to display a graph of the measurement (Graphics) and the Logger data.

4. Evaluate the measuring results with the **Master** (see Section 5.5.2.2 - Section 5.5.2.4, Section 5.4.4)

3.3.2 Data transmission

The Master and Logger communicate with each other by bidirectional radio. The **Master** transmits and receives on a certain frequency, the Loggers transmit and receive on another frequency. Together, the two radio frequencies form a frequency pair. All the available frequency pairs are listed in Section 7.2.

Note:

Observe the information about the radio operator's licence in Section 2.4.

When installed in a pit, the Logger transmits its data out of that pit. The range of the radio signals is heavily dependent on the shielding effects of the shaft, especially the cover.

As a general rule, the radio signals can be expected to have a range of **30 – 70 m** (98 – 230 ft) from the installation position. The range can be extended to 100 - 200m (328 – 656 ft) with plastic covers.

3.3.3 Principles of leak detection

Various techniques are used for leak detection.

Note:

Leak alerts will not be issued if there is background noise (frequency 60 Hz or 120 Hz).

Please refer also to the information on interpreting measuring results and leak alerts in Section 5.5.2.3 - Section 5.5.2.5.

3.3.3.1 Leak detection in mobile operation

In order to determine whether or not the measurement data recorded by a Logger used as a mobile unit indicates a leak, an alarm threshold is specified in the **Master (absolute value)**. If the minimum noise level measured exceeds the specified threshold value then the operator will be alerted to a leak.

The level that is set for the alarm threshold will depend on the material of the pipe in the vicinity of the Loggers. It is therefore possible to set the alarm threshold in the **Master** for each individual Logger.

3.3.3.2 Leak detection in stationary operation

When the system is used as a stationary application, leak detection is based on a mathematical relationship that compares measurement values at different points in time (detection of **variations**). The following points must be taken into consideration when evaluating results:

- The water pipe network must be leak-free before setting up the system for stationary use.
- Only leaks that occur after the monitoring has been started will be detected.
- A leak alert will only be issued after three measurements have been taken since the first occurrence of the leak; this avoids false detection of leaks due to short-term fluctuations.
- It is possible that false leak alerts may be issued (e.g. as a result of prolonged heavy rain).

4 SePem 155 Logger

4.1 Function and setup

SePem 155 is a noise logger. It can acquire and save measurement data from water pipe networks. Data is exchanged with the **Master** by radio.

For an overview including the part names of the Logger, see the front cover flap (fig. 1).

Loop

A safety rope can be attached to the loop so that the Logger can be easily installed and removed at underground locations.

Mounting

The unit can be mounted on metal objects using magnets. If it is necessary to monitor a plastic pipe, then the Logger must be attached to the fittings.

Power supply

The power supply is provided by a permanently installed lithium battery that has a guaranteed lifetime of several years under normal operating conditions.

4.2 Specifying a device number (optional)

Every Logger is assigned an 11 digit serial number by the manufacturer before shipping. In order to simplify the job of managing the Loggers (in the **Master** software and at the measurement location), it is possible to assign each unit a device number. Any **number may be selected**, up to a **maximum of four digits**. This number could, for example, be the same as the last four digits of the serial number.

1. It is advisable to decide on a format that can be used as the device number for all Loggers.
2. Each Logger should be labelled with the device number.
3. The device numbers must be saved with the corresponding serial number in the **Master** (see Section 5.5.4.1).

4.3 Preparing the Logger for use

The preparatory work required for each Logger includes:

- Attaching the antenna to the Logger
- Pairing the radio frequencies
- Programming the Logger for the first time

4.3.1 Screwing on the antenna

The Logger and antenna are connected using a TNC connector. The antenna can be screwed directly into the threaded antenna connector.

1. Make sure that the contacts on the Logger and the antenna are dry and clean.
2. Screw the antenna onto the antenna connector.

Securely tighten the antenna by hand to ensure that the unit is sealed and to guarantee a good radio connection.

NOTICE! Risk of damage

The internal contacts of the TNC connector must not be subjected to mechanical load.

- Only tighten the antenna by hand.
 - Do not use tools.
-

4.3.2 Manually activating the Logger

Loggers can be activated manually to establish a radio connection to a specific **Master** .

Manual activation is required for the frequency pairing and programming for the first time etc.

- Move a magnet over the activation switch.
 - You can use, for example, the magnet from another Logger.
 - Fig. 3 shows the direction in which the magnet has to move.

Note:

The Logger will remain ready to receive information for one minute after activation. It can then be reactivated if necessary.



Fig. 3: Activating the Logger:
Relief of activation switch on housing (left)
Direction of movement of magnet (right)

4.3.3 Pairing the radio frequencies

To allow the **Master** and Logger to communicate successfully with each other, the radio frequencies have to be set to a frequency pair.

Note:

Observe the information about the radio operator's licence in Section 2.4.

1. Set the assigned frequency (**License frequency**) in the **Master** under **Master settings**.
2. Select **Frequency pairing** from the **Logger communication** menu in the **Master**.
3. Press **F1 Start Scan**.
4. Activate a Logger (see Section 4.3.2).

5. Wait until the **Master** has recognized the Logger and assigned it the new frequency. The Logger will then be listed under **SERIAL**.
 - The Logger will remain ready to receive information for one minute after activation. If the scan is not successfully completed within this time, you will need to reactivate the Logger again.
6. Activate another Logger. It will also appear in the list as soon as it has been recognized.

Repeat this step until all the Loggers have been paired.

4.3.4 Programming the Logger for the first time

Before installing the Logger at the measurement location it must be programmed, i.e. data relating to measurement times, measurement duration and the radio time frame etc. must be transmitted from the **Master** to the Logger.

1. Prepare the **Master** for programming the Loggers (see Section 5.5.3, in particular Section 5.5.3.1).
2. Activate the Logger (see Section 4.3.2).
3. Move the **Master** into the transmission range of the Logger. Transfer the data (see Section 5.5.3.3).

If a radio connection is not established between the **Master** and the Logger within the available time frame, then the Logger will automatically switch off again and may need to be reactivated.

Note:

If the device settings for the Logger are changed in the course of further work, then the radio time frame can be used to transfer the relevant data. The Logger, therefore, does not have to be activated manually every time.

4.4 Installing the Logger at the measurement location

4.4.1 Suitable installation locations

The Logger can be mounted on:

- Pipes
- Fittings
(slide gates, underground hydrants, above-ground hydrants)

Note:

Only attach the Logger to above-ground hydrants if it is possible to protect the device against theft and vandalism.

The units can be installed in water pipe networks constructed from both metal and **plastic piping**. Please note the following points relating to plastic water pipe networks:

- The Logger cannot be mounted directly on the pipe, instead it has to be attached to a fitting.
- Sound is not transmitted through plastic piping as well as through metal pipework systems.

4.4.2 Distance between two Loggers (recommended)

The following spacing is recommended between each Logger to allow systematic monitoring of an area:

Water pipe material	Logger location	Recommended distance between two Loggers
Metal	Fitting	300–500 m (984 – 1640 ft) (mobile)
		500 m (1640 ft) (stationary)
Plastic	Fitting	50–100 m (164 – 328 ft)

For highly intermeshed water pipe networks, the distance between Loggers may have to be reduced accordingly.

4.4.3 Installing the Logger

The Logger is fixed into position at the installation location using the magnet.

Note:

Please see Section 4.4.1 and Section 4.4.2!

NOTICE! Damage possible due to careless positioning

The Logger contains sensitive parts.

- Always position the Logger on the attachment point with care.
-

Installation instructions

- Use a safety rope if the attachment point is so far underground that you cannot position the Logger by hand. The safety rope is attached to the loop.

The safety rope is available to buy as an accessory.

- Ensure that a good metal-to-metal contact is formed between the Logger magnet and the attachment point.

It is important that structure-borne sound is not damped by dirt, mud or rust. Clean the attachment point if necessary before mounting the Logger magnet.

- The antenna of the **SePem 155** must not touch any metal parts at the installation location.
- The antenna of the **SePem 155** must remain straight after the shaft cover is closed and must not come into contact with the installation location. Allow the necessary clearance.

5 SePem 01 Master

5.1 Function and setup

The **Master** is the programming device and reader for the Loggers.

The following tasks can be performed using the **Master**:

- Program the Loggers
- Read out measuring results and device data from the Loggers
- Evaluate the measuring results (including chart)
- Change Logger data

An illustration of the **Master** with all parts labelled is provided on the inside front cover.

Antenna

The **Master** antenna guarantees a reliable bidirectional radio connection between the device and the Loggers. This is important because all measurement data, device data and programming data for the **Loggers** is transmitted using radio signals.

Supporting bracket

The supporting bracket can be used for carrying the unit and as a stand. The supporting bracket can be adjusted to different positions. With the bracket turned to the rear of the unit, the Master can be stood up safely in a convenient position for reading the display.

Display illumination

The duration for which the display is illuminated can be adjusted. The light will come on whenever a key is pressed or the jog dial is moved (except when battery is almost flat).

Memory

The **Master** saves the measuring results in a **ring memory**. This means that when the memory is full, i.e. when there is no more storage space available, the oldest data is automatically overwrit-

ten by the newest data. The unit will generate a warning to alert the user that memory is low.

5.2 Using the Master in vehicles

The most efficient way to program the Loggers and read out data is to drive slowly through the transmission range of the loggers in a vehicle with the **Master**. This is generally preferable to a foot patrol. It is important to ensure a stable radio connection between the **Master** and Loggers for the data transmission.

Note:

When programming the Loggers from a passing vehicle it is imperative to always maintain the radio connection.

It should be noted that the unit will drain power from the vehicle battery when the engine is not running if this is used as an **external power source** for the **Master** (using the TG8 docking station and M4 vehicle cable). The **Master** should, therefore, always be switched off when not in use.

5.3 Power supply

5.3.1 Options

There are various power supply options available for the **Master**:

- Disposable batteries (x4)
- NiMH rechargeable batteries (x4)
- External, using mains or vehicle battery

Note:

The **Master** cannot be charged.

Switch off the device when not in use to prolong the life of the batteries.

5.3.2 Special features of rechargeable batteries



CAUTION! Risk of burning

Unsuitable rechargeable batteries can overheat in the event of a short-circuit.

- Only use rechargeable batteries listed by Underwriters Laboratories (UL).
-

Rechargeable batteries must be removed from the device for recharging and charged in an external charger.

5.3.3 Changing the batteries

A 2.5 mm Allen key (supplied) is required to open the battery compartment on the back of the device.

1. Loosen the two screws securing the battery compartment. Remove the screws by repeatedly turning them alternately a short way; this ensures that the cover does not jam.
2. Lift off the cover.
3. Remove the disposable/rechargeable batteries and insert new ones. Ensure that the batteries are inserted with the correct polarity.
4. Replace the cover so it fits neatly into place and attach firmly with the screws.

Note:

The date and time will need to be reset under **Master settings** if it takes longer than four minutes to replace the batteries (see Section 5.5.5).

5.3.4 External power supply

External power supply options:

Power source	Accessories required	Use power supply connection on...
Mains socket	M4 AC/DC adapter	Master
	TG8 docking station and M4 AC/DC adapter	TG8 docking station
Vehicle battery	TG8 docking station and M4 vehicle cable	TG8 docking station

The **M4 vehicle cable** is available in various models.

5.4 Operation

5.4.1 Keys and jog dial

The ON/OFF key is the only control on the device that does not change its function.

When switched on, the device is operated using the jog dial and function keys to navigate the display.

Control	Action	Function
ON/OFF key	Press	<ul style="list-style-type: none">• Switches the device on• Switches the device off
Function keys F1, F2, F3	Press	<ul style="list-style-type: none">• Variable• As indicated on the display at the bottom of the screen• Function keys may also have no function assigned in some cases
Jog dial	Turn	<ul style="list-style-type: none">• Select between vertically or horizontally adjacent functions, settings, measurement results, etc.• Modify values
	Press	<ul style="list-style-type: none">• Opens the next program level (e.g. menu item, function, measuring results, selectable values)• Confirm values

5.4.2 Standard functions

The following functions are frequently required to operate the **Master**:

Standard functions		
Back	F3	Return to previous program level
Accept	F2	Save a modified value
Delete Delete list	F2	Delete an individual value or a list

5.4.3 Warning prompts

Warning prompts may be displayed in connection with certain functions (e.g. **Delete**). The intention is to prevent the operator from accidentally performing actions that could lead to loss of data.

Every warning prompt is also accompanied by the following:

- **Visual signal:** Flashing signal light
- **Audible signal:** The buzzer will sound

The audible signal can be switched off in the **Master settings**.

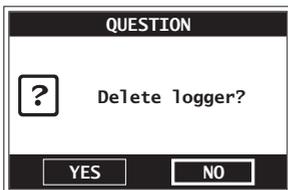


Fig. 4: Warning prompt

Use the jog dial to select **YES/NO** when prompted.

5.4.4 Enter text

You can save **comments** and the **location** for each Logger in the **LOGGER DATABASE**. The entry can be up to 20 characters long.

The window for entering text is called **EDIT TEXT**.

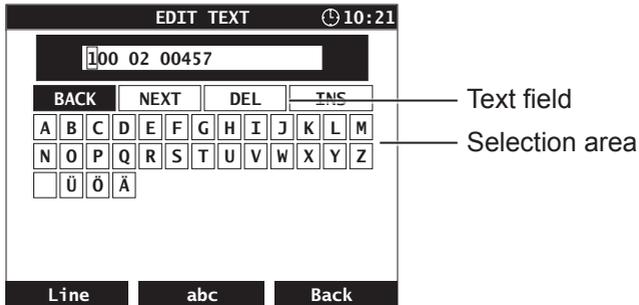


Fig. 5: Edit text

Text field

The text field always contains the last comment/location entered for the Logger. The previous entry is overwritten when you enter new text.

The cursor must be moved to each entry position for overwriting. This is done using the jog dial and the functions in the first line of the selection area (**BACK**, **NEXT**, **DEL**, **INS**).

The factory default setting for this field is the serial number.

Selection area

The selection area can be navigated as follows:

- Turn the jog dial forwards or backwards
- Use **F1 Line** to jump to the next line.

The functions in the first line of the selection area are used to select the cursor position in the text field.

Function	Effect in text field
BACK	Move cursor back one character
NEXT	Move cursor forward one character
DEL	Delete the character at the current cursor position
INS	Insert a character in front of the current cursor position.

Characters and functions in the first line must always be **confirmed** after selection by pressing the jog dial.

Function key assignment

Function keys		
Line	F1	Move to next line in selection area (only forwards)
abc 0-9 ABC	F2	Switch to next character set <ul style="list-style-type: none"> ● ABC Upper case ● abc Lower case ● 0-9 Numbers and special characters
Back	F3	Return to previous program level

5.4.5 Scrolling in charts

The **Master** can display data in charts. The corresponding windows are called **GRAPHICS** and **HIST. GRAPH**.

The charts always show all the data in one image. If there is a large amount of data, the values will be compressed in the chart.

If you want to study individual values in more detail, you can view the chart in scroll mode. Switch to scroll mode using **F2 Scroll**. Use **F2 No scroll** to exit scroll mode again.

Function key F2	
Scroll	Switch to scroll mode
No scroll	Exit scroll mode

Information on scroll mode

A cursor appears in the chart in scroll mode. This can be moved to the left and right by turning the jog dial.

Information relating to the respective cursor position (date and time, current noise level) is displayed above the chart.

If there is a large amount of data available for a measurement, i.e. when the values are compressed, there may be several values at one cursor position. In such cases, the highest and the lowest noise level at the cursor position are shown with the corresponding time.

5.5 Firmware menus and Master - Logger interaction

5.5.1 Main menu (overview)

The main menu is the central starting point for all tasks performed using the **Master**. It is the highest program level.

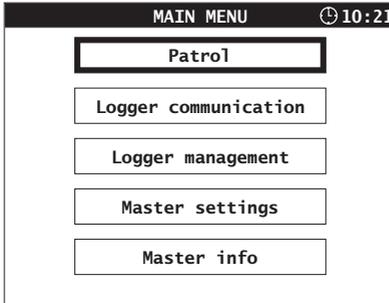


Fig. 6: Main menu

The main menu appears automatically when the unit is switched on, unless the Master settings specify that the program starts in patrol (see Section 5.5.5).

The five menu items in the main menu allow the following tasks to be carried out or information to be displayed:

MAIN MENU	
Patrol	<ul style="list-style-type: none">● Read out measuring results from the Loggers
Logger communication	<ul style="list-style-type: none">● Program the Loggers; transmit Logger data to the Loggers● Read out measuring results from individual Loggers● Online measurement● Frequency pairing
Logger management	<ul style="list-style-type: none">● Manage measuring results and Logger data
Master settings	<ul style="list-style-type: none">● Configure the Master
Master info	<ul style="list-style-type: none">● Information about the Master

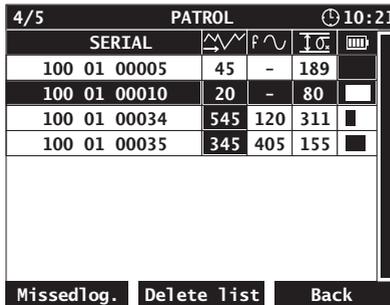
5.5.2 Patrol

Data saved in the Logger is read out (collected) by the **Master** during a patrol.

The **purpose** of a patrol is to

- keep track of the locations of leaks detected and
- collect measuring results for viewing and evaluation at a later point in time away from the location.

The **Patrol** window will appear as soon as **PATROL** is selected from the menu (and confirmed). This will display an overview list of the measuring results for all Loggers that have been read.



The screenshot shows a handheld device screen with a window titled 'PATROL'. The top left corner displays '4/5' and the top right corner displays '10:21'. The window contains a table with the following data:

SERIAL	45	-	189	
100 01 00005	45	-	189	
100 01 00010	20	-	80	
100 01 00034	545	120	311	
100 01 00035	345	405	155	

Below the table, there are three buttons: 'Missedlog.', 'Delete list', and 'Back'.

Fig. 7: Patrol - overview of Loggers from which data has been collected

Note:

The **Patrol** window only displays Loggers which have successfully completed a measurement (with the exception of **permanent** measurements, which do not have to be complete).

The number of Loggers read by and known to the **Master** (see Logger database) is shown in the top left-hand corner (in e.g. 4/5, i.e. 4 Loggers read, 5 Loggers known).

The overview will usually be empty at the start of a patrol because the list is automatically deleted from the overview and moved to the **Patrol lists** when the unit is switched off.

F1 Missed log. displays a list of all Loggers which have not yet been read out during the current patrol. The Loggers must be saved in the Logger database for this to happen.

5.5.2.1 Requirements for a successful patrol

- **Master** is switched on, **PATROL** window is open
- The operator and the **Master** are within the radio transmission range of the Logger
- The radio time frame of the Logger is open, i.e. the Logger is ready to send

Note:

The **Master** can only receive data when the **PATROL** window is open.

5.5.2.2 Patrol procedure (overview)

1. Operator

- Transports **Master** to within the radio transmission range of the Logger

2. Logger

- Ready-to-send (radio time frame open)

3. Master

- Receives the most recently stored measuring results - a new line appears in the **PATROL** window
- Synchronizes the Logger with the time of day stored in the Master (corresponds to **Master settings**)
- Sends an acknowledge signal to the Logger, indicating that the radio time frame is to be closed in **5 mins**

4. Operator

- Analyses the measuring results received (see Section 5.5.2.3)
- Continues from step 5 if the measuring results are to be analyzed in more detail
- Otherwise repeat from step 1 with the next Logger

5. Operator

- Moves the **Master** back into the radio transmission range of the Logger to allow the extended data set to be read out (remember there is only a 5 minute period in which to do this!)
- Chooses the required Logger in the **PATROL** window (select and confirm)

6. Logger

- Sends the extended data set for the chosen measurement

7. Master

- Displays the **SELECTED LOGGER** window

8. Operator

- Can analyze the extended data set (see Section 5.5.2.4 and Section 5.5.2.5)
- Can terminate communication with the Logger: Press **F3 Back**; **PATROL** window appears

5.5.2.3 Analysis of measuring result readings

The measuring results read out during the patrol (see Section 5.5.2.2, procedure to step 3) must always be analyzed and critically assessed.

The following values give information about the quality of the measurement and any leaks:

Value	Indication of	Description
Minimum noise level 	Possible presence of a leak	<ul style="list-style-type: none"> • Close to zero > no leak • Much greater than zero > possible leak
Characterizing frequency of measurement 	Fault	<ul style="list-style-type: none"> • 60 Hz or 120 Hz > background noise > usually no leak
	Location of leak	<ul style="list-style-type: none"> • Low > possible leak is some distance away • High > possible leak is not far away
Width 	Quality of measurement	<ul style="list-style-type: none"> • Small > low inference noise > good measurement • Large > high interference noise > bad measurement

Note:

In the factory settings the **Characterizing frequency of measurement** column is hidden. To display the column you will have to change the Master settings.

If graphics are required for analyzing the measuring results then the extended data set must be read out. In this case, the patrol should be carried out as per the procedure described in Section 5.5.2.2, step 5 onwards.

The following information is transmitted in addition to the measuring results when data is read out:

Note		Description of alert
Leak alert	Column 	<ul style="list-style-type: none"> • Numeric value inverted
	Signal light	<ul style="list-style-type: none"> • Visual signal: Lit for long period
	Buzzer	<ul style="list-style-type: none"> • Audible signal: Long signal
Remaining Logger battery power less than 10% (battery needs changing)	Column 	<ul style="list-style-type: none"> • Field is black • No segments can be seen

Please note: A **leak alert is not a guarantee that a leak is actually present.**

In cases where the analysis of the measuring results confirms that a leak may be present, this result should be checked using an appropriate method (e.g. correlation) before any excavation work is carried out.

5.5.2.4 Extended data set

The extended data set provides additional information on the following:

- A measurement (e.g. graphics),
- The transmitting Logger (e.g. radio times, last seven minimum noise levels recorded).

The extended data set allows the measurements to be analyzed in more detail and the Logger to be checked for correct functioning.

The extended data set for a measurement can be obtained by carrying out the patrol procedure in Section 5.5.2.2 as far as step 6.

Note:

The extended data set can only ever be read out for the most recent measurement carried out by a Logger or the measurement currently in progress.

Extended data set: Values in the patrol	
General	Battery capacity, device number, next device service, firmware version, errors (optional)
Radio times	Days, start, duration, patrol style, economy mode
Measurement times	Date, time, duration, interval, type, alarm level, status
Measuring results	Minimum level, characterizing frequency, width, measurement temperature, sensor
Last minimum noise level (optional)	Displays the last seven values (maximum)
Graphics	Displays the graphics

At the end of the patrol, part of the extended data set is saved in the **Logger database**.

Extended data set: Stored values in the Logger database (history)	
Measurement times	Date, time, duration
Measuring results	Minimum noise level, characterizing frequency, width, read-out time
Graphics	Displays the graphics
Last minimum noise level (optional)	Displays the last seven values (maximum)

5.5.2.5 Graphics

The graphics component of the extended data set (see Section 5.5.2.4) is particularly important for the thorough analysis of a measurement. The shape of the curve can give an indication that a leak may be present.

It is possible to view the graphics either during a patrol or at a later point in time.

Viewing the graphics during a patrol

1. Using the **PATROL** menu, select the appropriate Logger (and confirm). The **SELECTED LOGGER** window will appear.
2. Select **Data / Results** from the menu.
3. Turn the jog dial until the **Graphics** window appears (last window).

Viewing the graphics after completing a patrol

1. From the main menu select **Logger management** and then **Logger database**. The **LOGGER DATABASE** window will appear.
2. Choose the required Logger (select and confirm). The **HISTORY** window will appear.
3. Choose the required patrol (select and confirm). The **GRAPHICS** window will appear.

Analysis of the graphics

The x-axis corresponds to time, the y-axis is the measurement value scale (noise level).

A noise level that is continuously much higher than zero may indicate the presence of a leak (fig. 8).

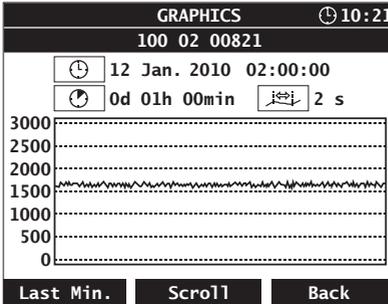


Fig. 8: Graphics showing a high probability of a leak

If the noise level is continuously close to zero then the probability of a leak is low (fig. 9). Short, high peaks (spikes) may indicate, for example, passing vehicles or water being withdrawn for a short period.

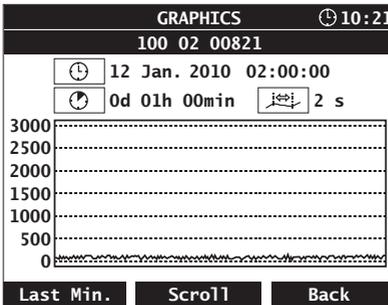


Fig. 9: Graphics showing a low probability of a leak

5.5.3 Logger communication

The **LOGGER COMMUNICATION** is used to control the exchange of data between the **Master** and the Logger. It uses different methods for data transmission to a single Logger and transmission to multiple Loggers (see Section 5.5.3.3).

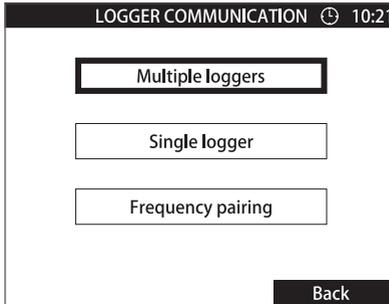


Fig. 10: Logger communication

LOGGER COMMUNICATION	
Multiple Loggers	<ul style="list-style-type: none"> • Configure and program as many Loggers as you wish
Single Logger	<ul style="list-style-type: none"> • Read out Logger data and measurement results • Online measurement • Configure and program a single Logger
Frequency pairing	<ul style="list-style-type: none"> • Set up the radio frequency of the Loggers depending on the radio frequency of the Master

Data includes both measuring results and Logger data.

Logger data features

Logger data is either:

- Specified in the **Master** (e.g. radio and measurement times) or
- Stored internally in the unit (e.g. next device service, firmware version).

Radio times and measurement times must be transmitted to the Logger, which results in the Logger being programmed.

For monitoring purposes, it is also possible to subsequently read out Logger data from a Logger using the **Master**.

LOGGER DATA	
General	Battery capacity, device number, next device service, firmware version
Radio times	Days, time, duration, patrol style, economy mode
Measurement times	Start of measurement ("Start in" or date), time, duration, interval, type, alarm level, status

Measuring results features

Measuring results are calculated from the measurement data collected by the Logger and can be read out using the **Master**. All measuring results are assigned to the appropriate Logger ID.

MEASURING RESULTS
Logger ID, minimum noise level, characterizing frequency, width Optional, depending on the program settings: Battery capacity, leak alert, measurement temperature, sensor

5.5.3.1 Multiple Loggers (Logger configuration)

The menu item **Multiple Loggers** takes you directly to **LOGGER CONFIGURATION**. This includes the options **Measurement times**, **Radio times** and **Miscellaneous**. Once entered, the settings can be sent to any desired number of Loggers (see Section 5.5.3.3).

Please note the following configuration tips:

- The windows **Meas. times**, **Radio times** and **Miscellaneous** are ordered one after the other (turn the jog dial).
- The magnitude of the values set has an influence on the lifetime of the Logger battery. Long radio times, short intervals, etc. reduce the lifetime.

- If values are chosen that are invalid or are not permitted then these cannot be transmitted. They will be automatically corrected.

Measurement times

The settings under **Meas. times** determine how and when a Logger records measurement data.

LOGGER CONFIGURATION	
Measurement times	
Start in	d (days) <ul style="list-style-type: none"> • Number of days until start of measurement (0-30 d)
Time	hrs (hour: minutes) <ul style="list-style-type: none"> • Time of day at which the measurement should start
Duration	d h min (days: hours: minutes) <ul style="list-style-type: none"> • Duration of measurement (meas. type: single and repeat) • Recording time (meas. type: permanent)
Interval	s/min/h (seconds/minutes/hours) <ul style="list-style-type: none"> • Length of time between recording of two measurement values within one measurement period
Type	SINGLE > REPEAT > PERMANENT (meas. type) <ul style="list-style-type: none"> • Selection of measurement type (see Section 7.3)

Radio times

The settings under **Radio times** determine when and for how long a **Logger** is ready to exchange data with the **Master (Radio time frame)**. The length of time between two transmission pulses is specified under **Patrol style**.

LOGGER CONFIGURATION	
Radio times	
Days	<p>SU MO TU WE TH FR SA</p> <ul style="list-style-type: none"> • Days of the week on which the radio time frame will be open • The checks can be set or removed using the jog dial
Time	<p>hrs (hour: minutes)</p> <ul style="list-style-type: none"> • Time of day at which the radio time frame will be open
Duration	<p>h (hours)</p> <ul style="list-style-type: none"> • Duration of radio connection (1-23 hrs)
Patrol style	<p>DRIVE > SLOW DRIVE > WALK > STATIC</p> <ul style="list-style-type: none"> • Type of patrol • Specifies the length of time between two transmission pulses • DRIVE: Transmission pulse 5 s Equivalent to vehicle at approx. 30 km/h (18 mph) • SLOW DRIVE: Transmission pulse 10 s Equivalent to vehicle at less than 10 km/h (6 mph) or stop-and-go traffic • WALK: Transmission pulse 30 s Equivalent to foot patrol • STATIC: Transmission pulse 60 s

Miscellaneous

The settings available under **Miscellaneous** determine the way in which the **Master** operates. It is particularly important to set the correct **Alarm level**.

LOGGER CONFIGURATION	
Miscellaneous	
Alarm level	<p>MOBILE (mobile operation)</p> <ul style="list-style-type: none"> Requires a value to be set between 30 and 3000 (in increments of 30). A leak alert is then issued when this value is exceeded (see Section 3.3.3.1)
	<p>STATIC (stationary operation)</p> <ul style="list-style-type: none"> There is no alarm level for this mode as a different leak detection method is used (see Section 3.3.3.2)
Economy mode	<p>ON > OFF</p> <ul style="list-style-type: none"> ON: energy saving mode <ul style="list-style-type: none"> Logger can still send measuring results (within the radio time frame), but cannot receive data from the Master The Logger must be activated with a magnet for programming

5.5.3.2 Single Logger

Note:

A radio connection must always be established between the **Master** and **Logger** when working with single Loggers.

The **Master will switch to receive mode** as soon as **Single Logger** is selected from the menu (and confirmed). The **LOGGER SELECTION** options will appear. A selection window will be displayed (initially blank).

1. Establish radio connection to the required Logger by
 - activating the Logger with a magnetOR
 - moving the **Master** within the transmission range of the Logger (requires the radio time frame to be open).
2. Make sure that the **Master** and Logger are approx. 1 – 2 m (3.3 – 6.6 ft) apart.
3. Wait a moment. When the internal Logger search has been completed a list will be displayed in the selection window showing up to four Loggers to which there is a radio connection. (These are Loggers with an open radio time frame / manually activated Loggers.)

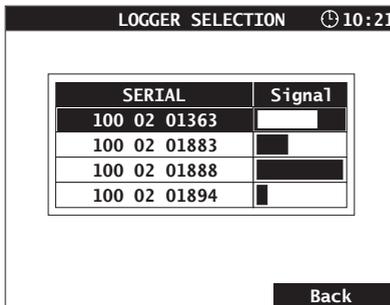


Fig. 11: Logger selection for single Loggers

4. Choose the required Logger (select and confirm).

Note:

Only select Loggers to which there is a radio connection with a good signal quality. These are Loggers for which the bar in the Signal column fills at least half of the field.

- The measurement and Logger data for the chosen Logger will be read out. The **SELECTED LOGGER** window will then appear.

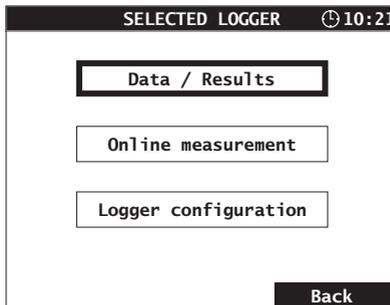


Fig. 12: Selected Logger

The three options in the **SELECTED LOGGER** menu allow the following actions to be performed/information to be displayed:

SELECTED LOGGER	
Data / Results	<ul style="list-style-type: none">• Display data for the selected Logger
Online measurement	<ul style="list-style-type: none">• Live recording of measurement data• Results can be viewed immediately on the Master in real time
Logger configuration	<ul style="list-style-type: none">• Specification of measurement and radio times for the selected Logger (same as Multiple Loggers, see Section 5.5.3.1)

Data/Results

Data / Results in the menu provides information from the Logger. The Logger data specified in Section 5.5.2.4 (first table) is listed. Please note that some values are only displayed if the Logger has saved corresponding measurements.

Any **Logger errors** detected during read-out will be shown under **General** in the last line. The error number given will be important for any contact with SEWERIN Service.

Online measurement

When online measurement is active, the measurement data recorded by the Logger can be viewed directly on the **Master** in real time.

Note:

Online measurements cannot be saved.

Online measurement is typically used during **mobile monitoring**. This is useful for providing feedback on the noise levels detected by the Logger immediately after installation. If the level is close to zero then it will not be necessary to monitor the installation location with a stationary unit. The Logger can be removed immediately and reinstalled at another location.

Usually, measurement values are calculated every second. All measurement values are immediately displayed in a chart. The **F2 Stop** key can be used to stop the measurement in order to view the graphics. (Note: The measurement **cannot** be subsequently restarted.) Pressing **F3 Back** will cause the online measurement to be stopped.

Please note the following points:

- The measurement interval (**Logger configuration > Meas. times > Interval**) specifies the length of time between each measurement that is recorded, and therefore determines the speed at which the graphics are updated.
- If an online measurement is running at the same time as a predefined measurement then the scale of the time axis will depend on the measurement interval.

5.5.3.3 Transferring data to the Loggers

To transfer the measurement time and radio time settings to the Loggers, always use the **F1 Transfer** option in the **Logger configuration**. It is imperative to note the following differences between transmission to multiple Loggers and transmission to a single Logger:

Data transmission to Multiple Loggers	
Radio connection	<ul style="list-style-type: none"> ● Must be established with each Logger separately: <ul style="list-style-type: none"> – Use a magnet to activate the Logger. Wait until the audible signal is heard. <p>Note: If multiple Loggers are active the system will automatically switch off all but one unit.</p> <p>OR</p> <ul style="list-style-type: none"> – Move the Master to within the radio transmission range of the Logger (requires the radio time frame to be open).
Start data transmission	<ul style="list-style-type: none"> ● After the radio connection has been established
Destination for transmitted data	<ul style="list-style-type: none"> ● Only the currently active/ready-to-receive Logger
Continue data transmission	<ul style="list-style-type: none"> ● Establish a radio connection to the next Logger
End of Master's ready-to-transmit state	<ul style="list-style-type: none"> ● Radio connection is terminated before the end of data transmission if <ul style="list-style-type: none"> – The measurement starts within the data transmission time period <p>OR</p> <ul style="list-style-type: none"> – The connection is terminated by pressing Back.
End data transmission	<ul style="list-style-type: none"> ● Ends when no new radio connection is established with a Logger

Data transmission to a single Logger	
Radio connection	<ul style="list-style-type: none"> • Already established
Start data transmission	<ul style="list-style-type: none"> • Starts as soon as F1 Transfer is pressed
Destination for transmitted data	<ul style="list-style-type: none"> • Only the selected Logger
End data transmission	<ul style="list-style-type: none"> • Radio connection will be terminated automatically • Return to main menu
Continue data transmission	<ul style="list-style-type: none"> • Not possible directly • Select next Logger using Logger communication - Single Logger (see also Section 5.5.3.2)

Data cannot be transmitted if any invalid entries were made in the **Logger configuration**. A prompt will be displayed to this effect; this must be acknowledged. The system will return to the **Logger configuration** window. The invalid values will be corrected automatically. (Values are adjusted to approximate the requested value wherever possible.) Corrected values are marked to assist with identification. You can **transfer** the data again immediately if you agree with the corrected values.

Note:

Any existing measurement data will be deleted when transmitting data to **multiple Loggers**. Please ensure therefore that all measurement results are read out before transmitting.

Loggers programmed (only with multiple Loggers)

After data has been transmitted to **multiple Loggers** the **LOGGERS PROGRAMMED** screen will be displayed.

5.5.3.4 Standard settings

The **Master** has a set of standard settings for the **LOGGER CONFIGURATION**. This set of values has been optimized to provide long battery life for the Loggers.

Pressing the **F2 standard** key will cause all values to be overwritten with the standard settings. No additional warning is provided.

Standard settings for configuration of Loggers	
Measurement times	
Start in	1 d
Time	02 : 00 hrs
Duration	00 d 01 h 00 min
Interval	2 s
Type	REPEAT
Radio times	
Days	TU
Time	08 : 00 hrs
Duration	8 h
Patrol style	DRIVE
Miscellaneous	
Alarm level	STATIC
Economy mode	OFF

Note:

The life of the Logger battery is approx. 40% longer in economy mode (ON).

5.5.3.5 Frequency pairing

Note:

Observe the information about the radio operator's licence in Section 2.4.

Selecting **Frequency pairing** from the menu opens a window of the same name (fig. 14) in which the radio frequencies of the **Master** and Loggers are paired. The frequency pair used is shown on the top right (2nd row).

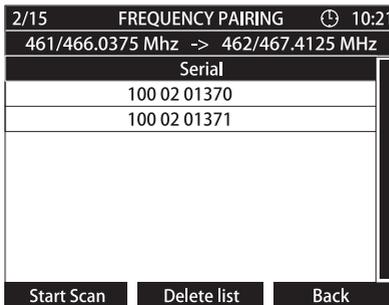


Fig. 14: Frequency pairing

Pairing is carried out by way of scan. The **Master** will continuously change its receiving frequency until it can receive the signals from an active Logger, which uses any frequency for transmission. The **Master** will then assign the new frequency to the Logger.

All the paired Loggers are listed. In the top left corner is a counter showing the number of paired Loggers and the number of Loggers recognized by the **Master** ("2/15" in the example means that 2 Loggers have been paired and the Master has recognized 15 Loggers).

Further information about the frequency pairs can be found in Section 3.3.2 and Section 7.2.

Detailed information about the pairing procedure can be found in Section 4.3.3.

5.5.4 Logger management

Logger management is used for the following:

- Displaying all stored measuring results and Logger data
- Editing Logger data

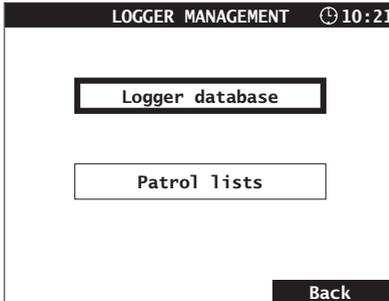
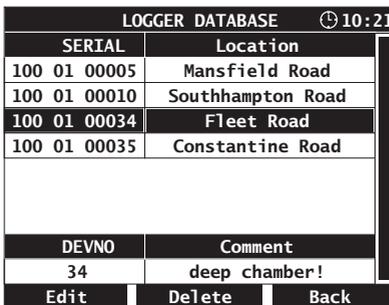


Fig. 15: Logger management

5.5.4.1 Logger database

The **LOGGER DATABASE** displays a list of all Loggers stored. A Logger will be identified and saved by the **Master** as soon as there is a radio connection between the two. No distinction is made here between intentional radio connections and those that were established by chance.



SERIAL	Location
100 01 00005	Mansfield Road
100 01 00010	Southampton Road
100 01 00034	Fleet Road
100 01 00035	Constantine Road

DEVNO	Comment
34	deep chamber!

Edit Delete Back

Fig. 16: Logger database

The top section of the window displays a list of Loggers sorted by **SERIAL** number alongside their **location**.

The bottom section of the window shows additional Logger data (**DEVNO**, **Comment**) for the Logger selected in the list above.

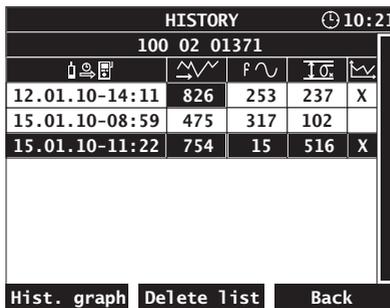
Note:

All associated Logger data will be also deleted when a Logger is deleted from the Logger database.

History

A **history** is saved for each Logger. This contains the measuring results for all measurement readings (time of reading, minimum noise level, width, characterizing frequency). If the extended data set was read out too, then this will also be saved (indicated by an 'x' in the last column; see also Section 5.5.2.4, second table).

1. Select a Logger from the **Logger database**.
2. Press the jog dial. The **HISTORY** window will appear.



The screenshot shows a handheld device screen with a 'HISTORY' window. At the top right, the time is 10:21. Below the title, the device ID '100 02 01371' is displayed. The table has five columns: a time column, a minimum noise level column (826, 475, 754), a width column (253, 317, 15), a characterizing frequency column (237, 102, 516), and a status column (X, empty, X). The status column contains 'X' for the first and third rows. At the bottom, there are three buttons: 'Hist. graph', 'Delete list', and 'Back'.

HISTORY					🕒 10:21
100 02 01371					
🕒	📊	📏	📡	📄	
12.01.10-14:11	826	253	237	X	
15.01.10-08:59	475	317	102		
15.01.10-11:22	754	15	516	X	

📄 | 🗑️ | ⏪

Fig. 17: History

3. Optional: **View the graphics**

Select a measuring result that includes an extended data set (and confirm). The **GRAPHICS** window will appear.

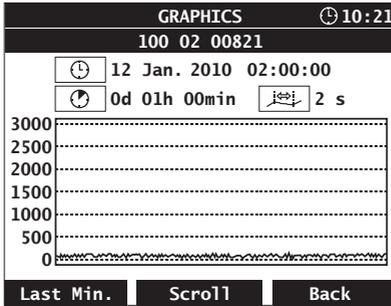


Fig. 18: Graphics in a saved patrol

Pressing **F1 Hist. graph** (in the **History** window) will create a chart plotting the **minimum noise level of all the saved measurements**.

Note:

The history will be deleted automatically for all Loggers if the **Master** memory is deleted.

Edit

Pressing **F1 Edit** allows you to edit the Logger data saved in the **LOGGER DATABASE**.

EDIT LOGGER	
SERIAL	• Not editable
Device number	• Any number between 0 and 9999 (see Section 4.2)
Location	• Text entry possible (see Section 5.4.4)
Comment	• Factory default setting for this field is the serial number

5.5.4.2 Patrol lists

During a **PATROL**, all measuring results received will be saved automatically to the **Patrol lists** (see Section 5.5.2.2). Whenever

- the **Delete** option is selected in the **PATROL** window
- the **Master** is switched off

the existing data will be saved.

The **Patrol lists** provide the following information:

- Dates of the last four patrols
- The Loggers read during those patrols
- Associated measurement results

As soon as you select **Patrol lists** from the menu (and confirm) the **Date / Time** selection window will appear. This will list up to four patrols.



Fig. 19: Selecting patrols

Note:

The **Date / Time** window will not list any patrols the first time the **Master** is used, or when all existing patrol lists have been deleted, or the memory has been erased. A patrol must be carried out in order for a patrol to be recorded! Reading out data from a Logger that has been activated manually is not treated as a patrol.

Once a patrol has been selected, a list containing the corresponding measurements will appear (**SAVED PATROL**).

SAVED PATROL				10:21	
15 Jan. 2010 11:08:01					
SERIAL	📶	📶	📶	📶	📶
100 02 01286	122	-	110	█	
100 03 03534	155	31	113	█	
100 02 00821	630	15	169	█	
100 02 01119	608	190	150	█	
100 02 01370	2697	206	225	█	
100 03 01893	1005	285	182	█	
100 02 01122	1075	396	244	█	
100 02 01121	1647	238	319	█	
					Back

Fig. 20: Saved patrol

The measurements are listed with the Logger ID information (e.g. **SERIAL**), minimum noise level, characterizing frequency, width and remaining Logger battery capacity.

Leak alerts and low Logger battery alerts are indicated using an inverse representation, as described in the **PATROL** section.

It is also possible to access the history for saved patrols (see Section 5.5.4.1).

5.5.5 Master settings

The **MASTER SETTINGS** are used to configure the **Master**. The settings will be stored until they are next changed (unless the **memory is deleted**). If it takes longer than four minutes to change the batteries, then the date and time must be reset.

MASTER SETTINGS	
Date	(day : month : year) ● Current date
Time	hrs (hour: minutes) ● Current time
DST	YES > NO ● YES: Change to daylight saving time (for details see Section 7.6)
Language	deutsch > english > francais > ... ● Language selection

Illumi- nation	<p>OFF > 10 s > 30 s > 1 min > 5 min > ON</p> <ul style="list-style-type: none"> ● Illumination of display ● ON: Light permanently on ● Note: Long on-times will reduce the lifetime of the batteries.
Buzzer	<p>ON > OFF</p> <ul style="list-style-type: none"> ● Switches audible signal off/on
Delete memory	<p>YES > NO</p> <ul style="list-style-type: none"> ● YES: Delete Master memory ● Affects all data relating to Logger management (Logger data in the Logger database, measuring results in the Patrol lists) ● PIN code: 7314
Contrast	<ul style="list-style-type: none"> ● Sets the contrast of the display
Log. identi- fication	<p>SERIAL > DEVNO > LOCATION</p> <ul style="list-style-type: none"> ● Logger ID ● Master detects Loggers either by the serial number (SERIAL), device number (DEVNO) or the location (LOC)
Auto power off	<p>OFF > 5min > 10min > 30min</p> <ul style="list-style-type: none"> ● Automatic shut down ● Time after which the Master switches off if it has not been used ● OFF: Auto power off disabled
Multiple antennas	<p>YES > NO</p> <ul style="list-style-type: none"> ● YES: Master receives the Logger data from several antennas. ● Note: If YES is selected the Master will only be able to receive data, but not send any. LOGGER COMMUNICATION is blocked.
Start with patrol	<p>YES > NO</p> <ul style="list-style-type: none"> ● YES: When the Master is switched on, the PATROL window will appear instead of the MAIN MENU window.

Frequen- cy Hide	YES > NO <ul style="list-style-type: none"> ● The Characterizing frequency of measurement column is set to hidden in the factory settings ● Column can be displayed ● Refers to the PATROL, SAVED PATROL and HISTORY WINDOWS ● YES: Column is hidden
License frequen- cy	... MHz <ul style="list-style-type: none"> ● Selection of radio frequency (frequency pair) ● Note: Observe the information about the radio operator's licence in Section 2.4.

Delete memory

The memory can only be deleted if the correct PIN code is entered. This is intended to prevent accidental deletion of the contents of the memory.

1. Select **DELETE MEMORY** from the **Master settings** menu (and confirm).
2. Select **YES** and press the jog dial.
3. Press **F2 Accept**.
4. Answer **YES** to the warning prompt.
5. Enter the **PIN code 7314**. A message will appear as soon as the last digit has been confirmed informing you that the memory has been deleted. The unit will then return to the main menu.

5.5.6 Master info

The Master info is solely for information purposes. It is not possible to modify any settings.

MASTER INFO	
	<ul style="list-style-type: none">• Serial number
	<ul style="list-style-type: none">• Date and time as set in Master settings
	<ul style="list-style-type: none">• Remaining battery capacity
	<ul style="list-style-type: none">• Memory used
	<ul style="list-style-type: none">• Hardware and firmware version
	<ul style="list-style-type: none">• Temperature

6 Troubleshooting

6.1 Problems with the Logger

Problem/symptom	Solution
Logger cannot be activated	<ul style="list-style-type: none">• Flat battery > send Logger to SEWERIN Service

6.2 Problems with the Master

Problem/symptom	Solution
No radio connection (error message e.g. "Connection to Logger terminated!")	<ul style="list-style-type: none">• Check radio connection (see Section 6.3.1)
Logger 'forgotten' when reading out data	<ul style="list-style-type: none">• In future, check under Patrol using F1 Unprogrammed that all Loggers have been read.
History does not contain any entries	<ul style="list-style-type: none">• Memory was deleted OR• Logger is new and no measurements have been read out yet
Not possible to communicate with the Logger	<ul style="list-style-type: none">• Economy mode ON selected? > If so, then bidirectional radio connection is switched off: Logger continues to send measuring results, but Master cannot establish contact to Logger during the patrol

6.3 Problems with the Master - Logger radio connection

The most common reason for problems with exchanging data between the **Master** and Logger is the quality of the radio connection. It is rare for problems to be caused by a device malfunction.

Problem / symptom	Solution
Logger is activated, but the Master does not recognize it	<ul style="list-style-type: none">● Check radio connection (see Section 6.3.1)● Improve radio connection (see Section 6.3.2)
Master does not receive data	<ul style="list-style-type: none">● Check radio connection (see Section 6.3.1)● Check Master: Antenna on device?● Improve radio connection (see Section 6.3.2)
No data received when in vehicle	<ul style="list-style-type: none">● Check radio connection (see Section 6.3.1)● Improve radio connection (see Section 6.3.2, Changing the antenna)

6.3.1 Checking the radio connection

Check the following points first if there are problems with radio communication between the Logger and **Master**:

- Are the radio frequencies of the Logger and **Master** paired with each other?
- Are all antenna connections clean and dry (Logger, **Master**)? Moisture will reduce the quality of the radio connection.
- Are the Logger and **Master** approx. 1 – 2 m (3.3 – 6.6 ft) apart?
- Are there any other devices nearby that may transmit in the same transmission range (461.0375 – 469.5625 MHz), e.g. correlators or radio masts?

Either remove the other transmitting device (e.g. correlator) or select a new installation location (e.g. away from fixed radio mast).

If the interference is not due to one of the causes mentioned above then it will be necessary to establish if the interference to the radio signal is permanent or intermittent. To do this, test the radio connection with at least two Loggers in succession.

1. Test the radio communication between the **Master** and a **Logger** (first **Logger**) somewhere far away from the original installation location.

Result:

– Radio communication
OK

– Interference with radio
communication

Conclusion:

Original installation location
unsuitable, e.g. due to strong
shielding effects or another
transmitting device in the area
Master, Master antenna, first
Logger or Logger antenna
faulty

2. Test the radio communication between the **Master** and another **Logger** (second **Logger**) at the same place as under point 1.

Result:

– Radio communication
OK

– Interference with radio
communication

Conclusion:

First **Logger** or **Logger** antenna
faulty
Master or Master antenna faulty

6.3.2 Improving the radio connection

There are a number of ways to improve the radio connection between the **Logger** and **Master**:

- Align the Logger and Master antennas in parallel
- Replace metal valve box covers with plastic valve box covers
- When using the **Master** in vehicles: Use the magnetic antenna attachment for installation on roof of vehicle (instead of standard Master antenna)

6.4 Other problems

Problem/symptom	Solution
The Master issued a leak alert, but no leak could be found	SePem is a prelocation system. Leak alerts must always be verified using an appropriate method (e.g. correlation) before carrying out excavation work.

7 Appendix

7.1 Specifications and permitted operating conditions

7.1.1 SePem 155 Logger

Device data

Dimensions (Ø × H)	54 × 114 mm (2.13 × 4.49 in) (without magnet and aerial)
Weight	775 g (1.71 lb)

Certificate

Certificate	FCC
-------------	-----

Device elements

Interface	radio data
Memory	64 kB
Processor	16-bit processor
Operation	magnetic activation via reed contact

Operating conditions

Operating temperature	-15 °C – +55 °C (5 °F – 131 °F)
Storage temperature	-20 °C – +70 °C (-4 °F – 158 °F)
Humidity	100 % r.h.
Atmospheric pressure	900 – 1180 hPa
Protection rating	IP68
Permitted operating environments	outdoors submersible to 1 m (3.3 ft)
Non-permitted operating environments	in liquids other than water in aggressive media in potentially explosive areas

Power supply

Power supply	lithium metal battery [1355-0017]
Lithium mass per battery	2.37 g
Operating time, typical	5 years (if standard settings are used)

Measurement

Sampling rate	adjustable 1 s – 1 h
---------------	----------------------

Data transmission

Transmission frequency	461.0375 – 469.5625 MHz
Communication	bi-directional radio data
Power	20 mW

Additional data

Attachment option	magnetic at measuring point
Shipping instructions	UN 3091: lithium metal batteries contained in equipment or lithium metal batteries packed with equipment net weight of battery/batteries: 0.043 kg

Assignment

For use with	SePem 01 Master safety rope
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7.1.2 SePem 01 Master

Device data

Dimensions (W x D x H)	158 × 57 × 205 mm (6.22 × 2.24 × 8.07 in) with supporting bracket: 158 × 57 × 253 mm (6.22 × 2.24 × 9.96 in)
Weight	approx. 850 g (1.87 lb) (with antenna)

Certificates

Certificate	FCC
-------------	-----

Device elements

Display	320 × 240 dots, monochromatic
Buzzer	for audible signals in operation
Signal light	LED
Interface	USB/radio data
Memory	8 MB
Processor	AMR7 Core LPC 2294
Operation	membrane keypad with 4 keys, jog dial

Operating conditions

Operating temperature	-15 °C – +45 °C (5 °F – 113 °F) (depends on battery type)
Storage temperature	-30 °C – +80 °C (22 °F – 176 °F) (without disposable batteries)
Humidity	95%, non-condensing
Protection rating	IP54
Permitted operating environments	outdoors in vehicle
Non-permitted operating environments	in water or other liquids in aggressive media in potentially explosive areas

Power supply

Power supply	external 12 V= OR internal, using 4 replaceable AA-size batteries, disposable or rechargeable (LR6, AA, AM3), either: – Alkali-manganese disposable cells – Zinc-carbon disposable cells – NiMH rechargeable batteries (all 4 cells must be the same type)
Operating time, minimum	10 h
Operating voltage	6 V

Data transmission

Transmission frequency	461.0375 – 469.5625 MHz
Radio range	> 50 m (164 ft)
Communication	bi-directional radio data
Power	20 mW

Assignment

For use with	SePem 01
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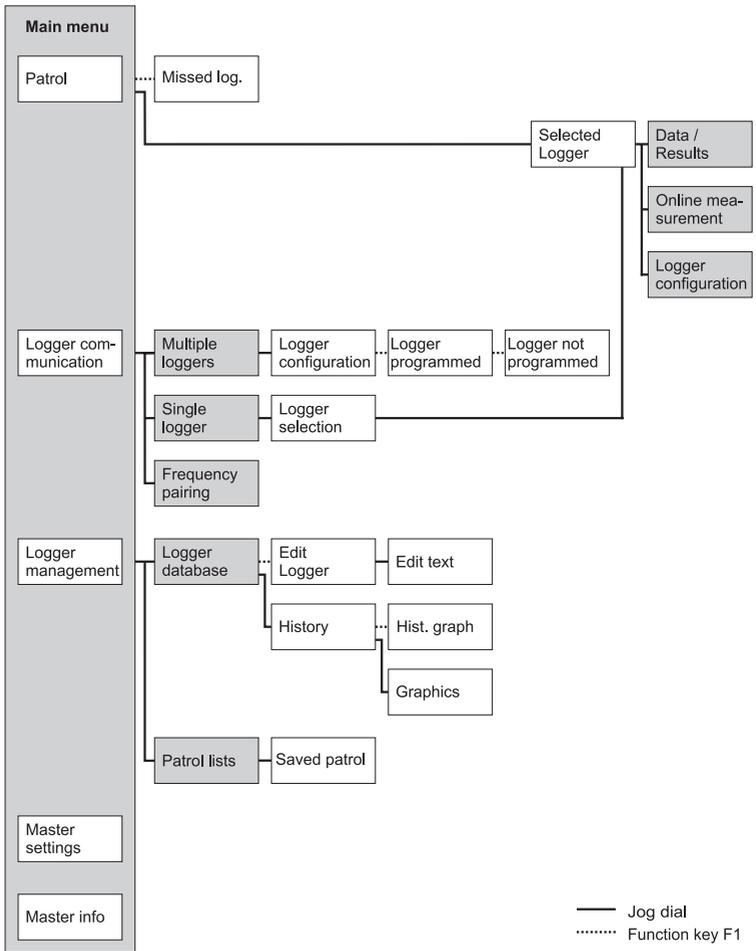
7.2 Radio frequencies

Frequency pairs [MHz]		
SePem 155	SePem 01 Master	Notation in the Master settings
461.0375	466.0375	461/466.0375
461.0625	466.0625	461/466.0625
461.0875	466.0875	461/466.0875
461.1125	466.1125	461/466.1125
461.1375	466.1375	461/466.1375
461.1625	466.1625	461/466.1625
461.1875	466.1875	461/466.1875
461.2125	466.2125	461/466.2125
461.2375	466.2375	461/466.2375
461.2625	466.2625	461/466.2625
461.2875	466.2875	461/466.2875
461.3125	466.3125	461/466.3125
461.3375	466.3375	461/466.3375
461.3625	466.3625	461/466.3625
462.2125	467.2125	462/467.2125
462.2375	467.2375	462/467.2375
462.2625	467.2625	462/467.2625
462.2875	467.2875	462/467.2875
462.3125	467.3125	462/467.3125
462.3375	467.3375	462/467.3375
462.3625	467.3625	462/467.3625
462.3875	467.3875	462/467.3875
462.4125	467.4125	462/467.4125
462.4375	467.4375	462/467.4375
462.8625	467.8625	462/467.8625
462.8875	467.8875	462/467.8875
462.9125	467.9125	462/467.9125
464.4875	469.4875	464/469.4875
464.5125	469.5125	464/469.5125
464.5375	469.5375	464/469.5375
464.5625	469.5625	464/469.5625

7.3 Measurement types (overview)

Measurement type	Features
<p>Single measurement</p> <p>Abbr.: Single</p>	<ul style="list-style-type: none"> ● Records a single measurement, with a specified duration, at a specified point in time ● Any previous measurement data stored in the Logger will be completely deleted before recording starts.
<p>Permanent measurement</p> <p>Abbr.: Permanent</p>	<ul style="list-style-type: none"> ● Records an ongoing measurement ● Measurement time is 24 hrs or a multiple thereof ● Always starts at 0:00 hrs. ● Any previous measurement data stored in the Logger will be overwritten ● The first measuring results can be read out after 24 hrs.
<p>Repeat measurement</p> <p>Abbr.: Repeat</p>	<ul style="list-style-type: none"> ● Records a repeated measurement every 24 hrs. ● Any previous measurement data stored in the Logger will be completely deleted before recording starts.

7.4 Menu structure



7.5 Display symbols (Master)

Notes

	Wait
	PIN code protected area
	Error
	Warning
	Question
	Information

Measurement

	Number of measurements
	Graphics
	Maximum noise level
	Minimum noise level
	Width
	Characterizing frequency of measurement
	Current noise level (online measurement)
	Interval
	Scale for time axis (graphics)
	Evaluation

General information

	Date, time (time of day, measurement time)
	Duration
	Radio time
	Read out time
	Logger
	SERIAL
	Remaining Logger battery capacity
	Remaining Master battery capacity
	Memory for Master
	Hardware and firmware version
	Temperature

7.6 Terminology and general abbreviations

AF	<ul style="list-style-type: none"> ● Width across flat
Attachment point	<ul style="list-style-type: none"> ● Point at which the Logger is attached to the pipe or fitting i.e. where it makes physical contact with the water pipe network
Background noise	<ul style="list-style-type: none"> ● Unwanted electromagnetic radiation from various sources (e.g. street lamps)
Character set	<ul style="list-style-type: none"> ● Specifies the character type (upper case, lower case, numbers) for entering text
DST	<ul style="list-style-type: none"> ● Daylight Saving Time ● Adjusts the time on the last Sunday in March (time moved forward by 1 hour; Summer Time) and the last Sunday in October (time moved back by 1 hour; Winter Time) ● Applies to all member countries of the European Union
Extended data set	<ul style="list-style-type: none"> ● Can be read out during a patrol in addition to the measuring results ● Provides further information about the measurement (e.g. graphics)
Firmware	<ul style="list-style-type: none"> ● Term used to refer to software in electronic devices (e.g. Logger, Master) ● to distinguish it from PC software
Graphics	<ul style="list-style-type: none"> ● Chart of the noise level of a measurement plotted against time
Hist. graph	<ul style="list-style-type: none"> ● Chart of the history of a Logger ● Shows a chart of minimum noise levels for all saved measurements
History	<ul style="list-style-type: none"> ● Contains all measuring results read out from each Logger: Time of reading, minimum noise level, width, characterizing frequency, graphics (if read out) ● Can be displayed as a chart (hist. graph)

Installation location	<ul style="list-style-type: none"> • Location in the water pipe network where a Logger is installed for the acquisition of measurement data
Logger data	<ul style="list-style-type: none"> • Data that identifies a Logger • A distinction is made between: General data (battery capacity, device number, next device service due, firmware version), radio times (days, start, duration, patrol type, economy mode) and measurement times (date, time, duration, interval, type, alarm threshold, status)
Measurement data	<ul style="list-style-type: none"> • Data that is collected and stored by a Logger during a measurement
Measurement location	<ul style="list-style-type: none"> • Same meaning as installation location
Measuring results	<ul style="list-style-type: none"> • Calculated from the measurement data • Includes: Minimum noise level, characterizing frequency, width, battery capacity, leak alert • To avoid data being incorrectly assigned, the Logger serial number is also issued with the measuring results.
Online measurement	<ul style="list-style-type: none"> • A measurement type that allows data measured by the Logger to be followed directly on the Master in real time (live recording)
Patrol	<ul style="list-style-type: none"> • Derived from the French verb patrouiller • Reading out of data recorded by the Logger • The operator must transport the Master to within the transmission range of the Logger
Radio time frame	<ul style="list-style-type: none"> • Period of time during which the Logger is in the correct mode for data transfer with the Master
Reading	<ul style="list-style-type: none"> • Transmit data from Logger to the Master

Width	<ul style="list-style-type: none"> • Standard deviation of measurement data
--------------	--

7.7 Abbreviations in the firmware

DEL	Delete
DEVNO	Device number
DST	Daylight Saving Time
Hist. graph	History graph
INS	Insert
Last Min.	Last minimum
LAST MIN. NOISE LEVELS	Last minimum noise levels
LOC	Location
Log.identification	Logger identification
Meas. results	Measurement results
Meas. temperature	Measurement temperature
Meas. times	Measurement times
Min. noise level	Minimum noise level
Missed log.	Missed Logger
PERM.	Permanent
Updat. Log	Updated Logger

7.8 Accessories

Accessories

Part	Order number
SePem carrying case	ZD28-10000
SePem US transport box	ZD30-10002
US safety rope	SF01-Z0305
"Vario" carrying system	3209-0012
Docking station TG8	LP11-10001
US M4 AC/DC adapter	LD10-10100
Vehicle cable M4, 12 V= portable	ZL07-10100
Vehicle cable M4, 12 V= installed	ZL07-10000
Vehicle cable M4, 24 V= portable	ZL09-10000

Other accessories are available for the product. Please contact our SEWERIN sales department for further information.

7.9 FCC/IC Compliance Statements

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This Class B digital apparatus complies with Canadian ICES-003.

7.10 Advice on disposal

The European Waste Catalog (EWC) governs the disposal of appliances and accessories.

Description of waste	Allocated EWC waste code
Device	16 02 13
Disposable battery, rechargeable battery	16 06 05

End-of-life equipment

Used equipment can be returned to Hermann Sewerin GmbH. We will arrange for the equipment to be disposed of appropriately by certified specialist contractors free of charge.

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