Operating instructions
# ORTOMAT-LC system

Release : SW Vers. 4.6.1 or higher
Last mod. : 01.02.10

# 1. System overview

## 1.1. ORTOMAT leak detection system

With their permanent leak monitoring system, ORTOMAT units are fitted to the water supply to enable the water main system (including the supply pipes) to be checked for leak sounds on a large-scale basis.

The aim is to analyse the sound structures of the period in which consumption is at its lowest level between 2 a.m. and 4 a.m. ORTOMAT dataloggers are fitted with a microprocessor and intelligent software, which decide whether there are any leaks immediately after a measuring period.

Leaks are thus immediately recognised and are available for the wireless readout of the water supply. With the new ORTOMAT system, battery requirements are arranged to permit a battery service life of 10 years.
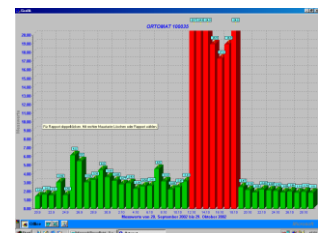
Wherever possible, ORTOMAT dataloggers are integrated into the water mains without any structural measures. Gate-valve operating spindles, gate-valve shafts, in-house installations or spot drilling are only a few of the ways they can be adapted.

The data recording of the sounds emanating from the different sections of the water mains is saved in the electronic memory of an ORTOMAT datalogger and is available for analysis during the programmable transmission periods. The water supply authority uses an ORTOMAT controller to collect the measurements saved (40 nights) by driving to the measurement locations individually. As soon as a measurement location is reached, the ORTOMAT controller beeps to indicate that data has been saved in the intelligent memory and an acoustic signal is emitted to indicate whether there is a leak or not. The data measurements can be displayed either numerically and/or graphically and viewed on the ORTOMAT controller's graphic display. Data is transferred to a PC for the purpose of storage.

Data measurements are either analysed using an ORTOMAT controller or a PC. For this purpose, one measurement is available to us per day and this is the lowest value measured. If there are no leaks, the lowest measurement is very low and amounts to a value in the region of 0dB. If the lowest measurement is high (e.g. higher than 10dB), exceptional sounds are present, which must be defined and located.

The ORTOMAT system offers convincing proof of the reliability of leak identification with several thousand dataloggers/measuring points already in operation. The system frequently identifies leaks that are still very minor in nature and thus prevents consequential damage whose extent we are probably not yet aware of. Leaks can be pinpointed for inclusion in daily work routines and repaired during normal working hours. Naturally, pipe bursts requiring immediate attention can occur even with this system. However, the number of night callouts in water supply districts using ORTOMAT systems has been substantially reduced.

## 1.2. ORTOMAT-LC datalogger

The ORTOMAT-LC datalogger is the central measuring unit of the monitoring system.

The unit has the following basic function: each night, it analyses the vibrations in the area it monitors and, when a measuring phase has been completed, it decides whether there is a leak or not.
During the day, it communicates these measurements by means of radio signals. However, these can also be exported from the unit directly via the LEDs (light-emitting diodes), or by a connection and importing via the PC software.



Radio module 433MHz
with integral aerial

Reed switch
(internal magnetic sensor)

RFID aerial for
communication with a PC

Status LED

GREEN = leak status
RED = leak status
YELLOW = radio status

Powerful
mini flat-magnet gripper

After the required parameters have been completed using ORTOMAT software, dataloggers work totally autonomously. A special lithium cell, which is designed to operate for approximately 5 years in normal operation, serves as an internal source of energy.

A difference is made between the following operating modes:

Transmission mode → In this operating mode, the logger transmits the data measured within a defined time window (e.g. every 2 seconds between 7 a.m. and 12 noon from Monday to Friday) by radio signal. This data can be received using an ORTOMAT controller within a limited radius.
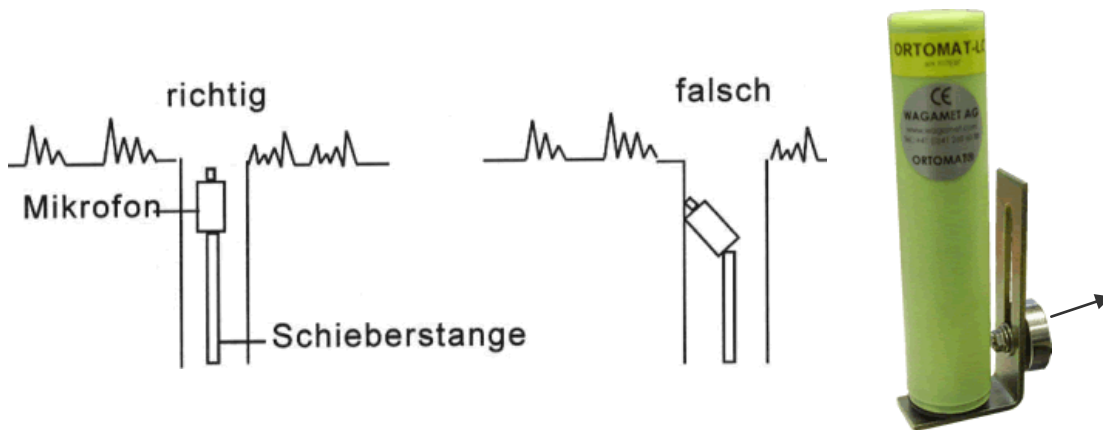
Measuring mode → In this operating mode, the logger analyses the vibrations measured by the sensor in the water mains during a defined time window. Measurement takes place once a day and should be done during the periods of lowest consumption and/or least noise (e.g. every day between 2 a.m. and 4 a.m.). As the logger takes several measurements in this phase and has an appropriate sound filter, brief disturbing sounds have no influence on the quality of leak identification.

Test mode → In this operating mode, the logger is put into online mode, in which the sounds measured are transmitted live straight to an ORTOMAT controller. The unit can be used similar to the way in which a vonRoll LeakPEN/LOG1A (listening unit) is used, but without acoustic signal transmission. On completion of programming, the logger is in this mode until the next measurement phase, after which it then switches to normal leak identification mode.

To ensure that the acoustic sound measurement process operates as reliably as possible in the field, it is important to have the best possible contact with the water main. The point of contact should be as clean as possible and the magnet must be resting on a flat area.

If the magnet contact point is poor or soiled, leak detection may be severely affected as the vibrations do not reach the sensor correctly.



Dependent on the installation situation, it is a good idea to work with a L-shaped bracket for best results.

Care should be taken to position the unit as high as possible in the shaft to ensure the optimum export of the data by radio.
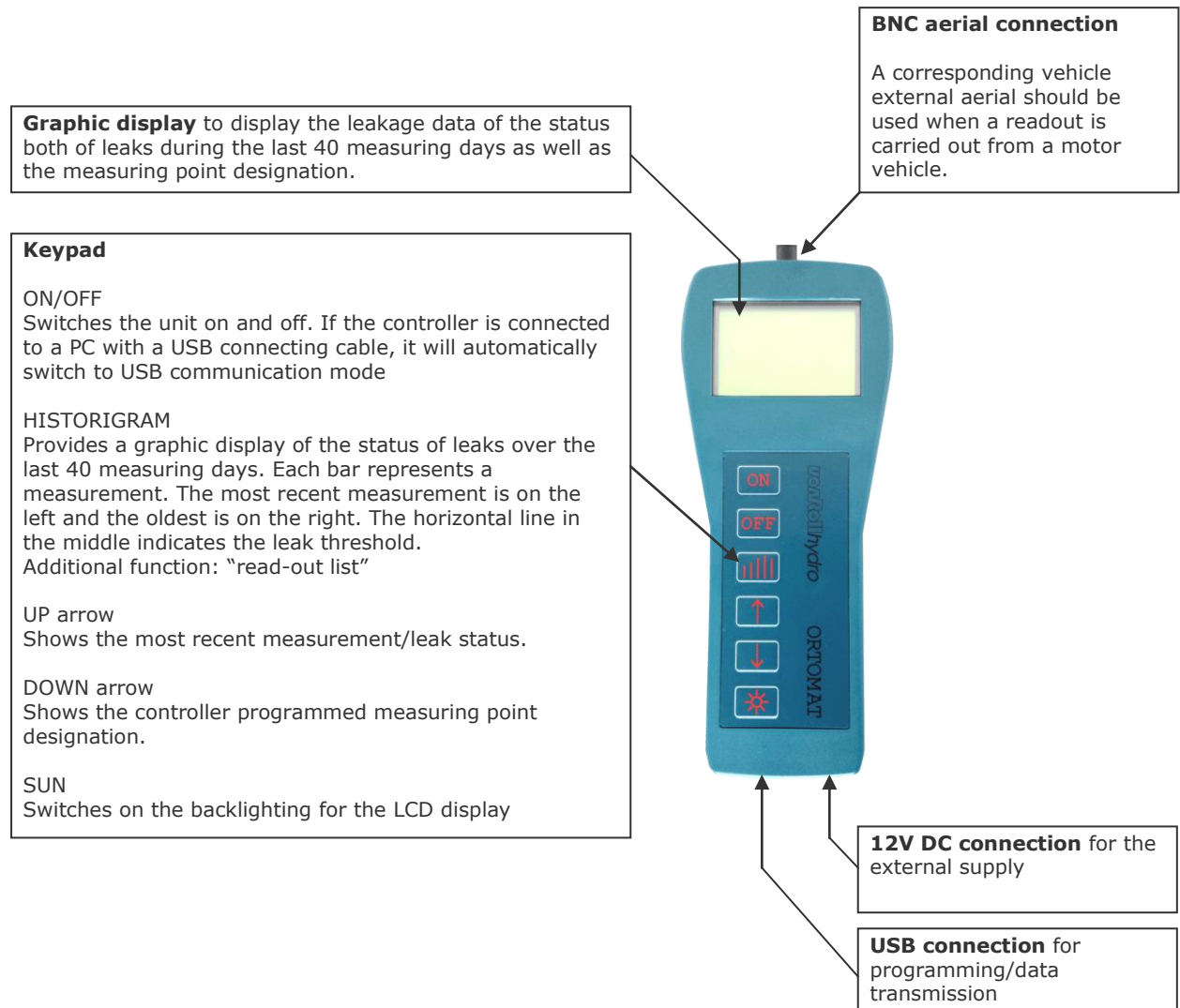
## 1.3. ORTOMAT controller

The purpose of the ORTOMAT controller is to export data remotely in the field.

However, this is only possible if the ORTOMAT-LC datalogger is within the radio reception radius and is listed in the ORTOMAT controller's logger list when data is exported in transmission mode.

Otherwise. no leak information is displayed or the controller reports "Serial number not found" → Check the serial number.

Standard commercial alkaline cells (LR6/1.5V) provide the energy required. Without backlighting, they are adequate for approximately 25 hours of operation. If backlighting were always switched on (which is not the case), operation would be limited to 4 hours. If backlighting is used sparingly, the unit should provide over 20 hours' operation.
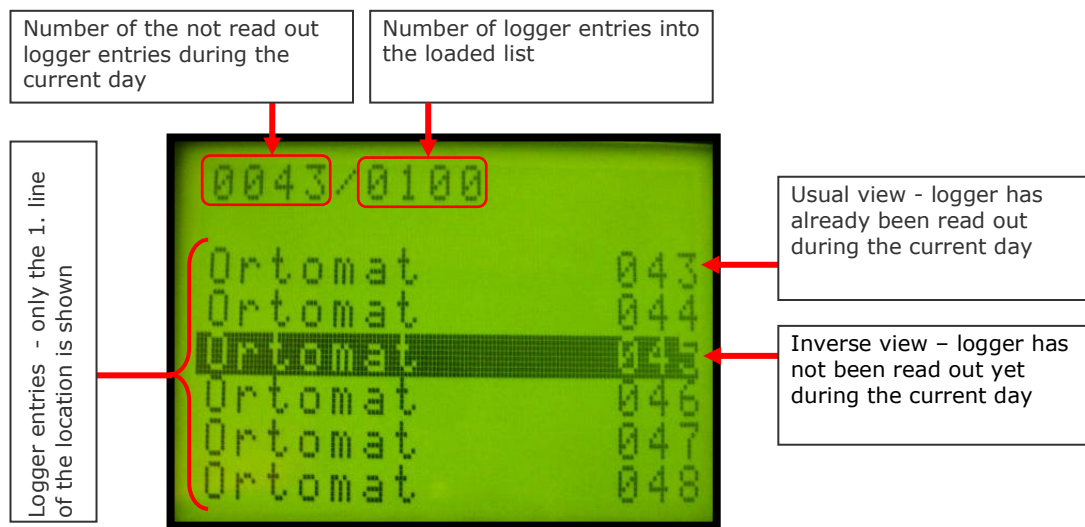
**BNC aerial connection**

A corresponding vehicle external aerial should be used when a readout is carried out from a motor vehicle.

**Graphic display** to display the leakage data of the status both of leaks during the last 40 measuring days as well as the measuring point designation.

**Keypad**

ON/OFF
Switches the unit on and off. If the controller is connected to a PC with a USB connecting cable, it will automatically switch to USB communication mode

HISTORIGRAM
Provides a graphic display of the status of leaks over the last 40 measuring days. Each bar represents a measurement. The most recent measurement is on the left and the oldest is on the right. The horizontal line in the middle indicates the leak threshold.
Additional function: "read-out list"

UP arrow
Shows the most recent measurement/leak status.

DOWN arrow
Shows the controller programmed measuring point designation.

SUN
Switches on the backlighting for the LCD display

**12V DC connection** for the external supply

**USB connection** for programming/data transmission

### 1.3.1. Menu „read-out list"

From software version 4.5.1 and higher, the ORTOMAT-controller is capable of generating a special read-out list. This list provides an overview of which logger list entries are / aren't read out on the current day.

Proceed:

*1. switch on the ORTOMAT-controller*

*2. push button "HISTORIGRAM"*

*3. hold the button "HISTORIGRAM" for approximately 5 seconds -> the new menu appears:*



Due to the fact, that only the first line of the location text is readable, it makes sense to choose a well considered text structure → see chapter 2.3 / ORTOMAT logger list . The entries are automatically arranged in alphabetical order and can be scrolled by pushing the button "arrow UP" and "arrow DOWN".

The List will be reset on the following day -> all entries are shown in inverse form. The same happens by reprogramming the logger list or reload the ORTOMAT-Controller software.

Attention: while this menu is active, no radio signals can be received

*4. leave the menu by bushing the button "HISTORIGRAM"*

## 1.4. PC software

ORTOMAT PC software is used for the central administration of all the measuring points used in the system. In addition, the measurements read out can be displayed and archived using the software. All commonly used Microsoft operating systems (from WIN95 to VISTA) are supported.

All the measurement points used are recorded in the ORTOMAT-logger list (*.ort file).



ORTOMAT software can communicate with the datalogger and the controller via a USB interface. Parameters can be redefined and data measured and exported in the field can be re-imported into the logger list.

# 2. ORTOMAT PC software

## 2.1. Installing and restarting the software

To install the software, insert the ORTOMAT software CD in the CD drive of the PC workstation. Installation will start automatically → please follow the instructions.



### 2.1.1. Device drivers

The ORTOMAT controller and the RFID interface are connected to the PC via a USB interface and therefore need a device driver.

#### 2.1.1.1. RFID interface

This is automatically installed when the software is installed.

#### 2.1.1.2. ORTOMAT controller

The USB device driver for the ORTOMAT controller must be manually installed when initial connection is made. The installation assistant can differ slightly in appearance according to the operating system in use.

1. Connect the ORTOMAT controller to your PC workstation using the USB connecting cable

2. The operating system (WIN XP) will recognise the new device and start the assistant automatically

3. Following the installation of the ORTOMAT software, the device drivers required are placed in the programme folder



4. At the Windows logo test, select "Continue with Installation"



5. The USB device driver has been correctly installed



For an installation on Windows 7 operating system, a special connection assistant will be started. Follow this assistant step by step.

## 2.2. Starting the software

Start the ORTOMAT software by double-clicking the icon that is automatically created on the Windows Desktop.



### 2.2.1. Opening a logger list



The ORTOMAT software will ask for a logger list when first opened.

At this point, either the logger list for the system supplied on the CD can be used or a new list must be compiled.

The most recently opened list is automatically opened again after a restart.

### 2.2.2. User interface

## 2.3. ORTOMAT logger list

The ORTOMAT logger list is used for the central administration and description of all the measuring points used. It is saved as an "*.ort" file.
Normal ORTOMAT dataloggers and ORTOMAT-LC dataloggers can be mixed in a logger list. List entries are marked indicate the type.

IMPORTANT: An ORTOMAT controller can only export the dataloggers in the field that are included in its list. This list corresponds to the ORTOMAT logger list that is administered in the software.

All important pieces of system information are linked to the ORTOMAT logger list:

- Number of measuring points used
- Location designations of the individual measurement points
- Serial numbers of the individual measurement points
- Entries in the note area of the individual measurement points
- All the measurements read out since the list was created
- Most recently altered general logger settings

If a logger list (*.ort file) is therefore copied and opened at another workplace with the ORTOMAT software installed, all the information on the leak monitoring system is available.

### 2.3.1. Entries/displays in the logger list
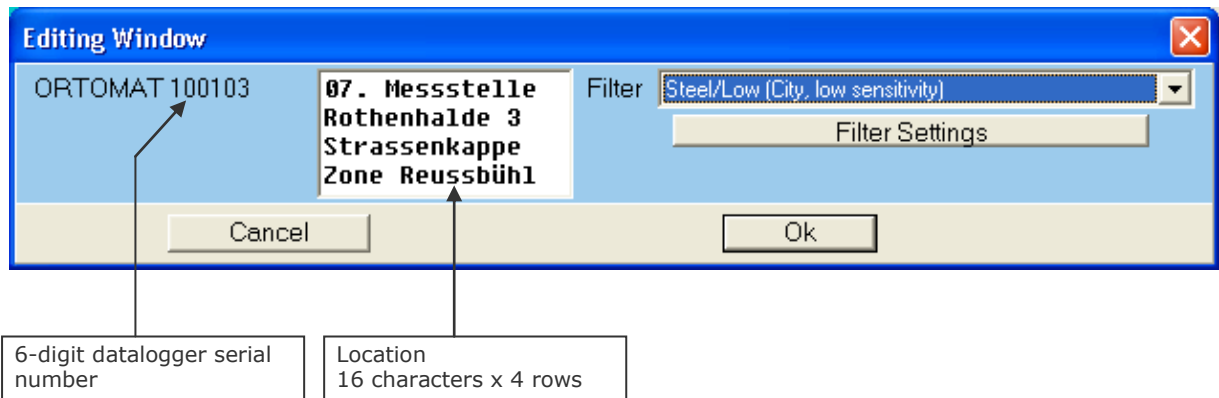
### 2.3.2. Registering new dataloggers on the list

There are two ways to register a datalogger in an existing list:

1. Connect the new datalogger directly to the PC software and carry out the instructions that follow.
2. Register the new datalogger according to the section File -> Insert Logger without Establishing Connection (see page 14)

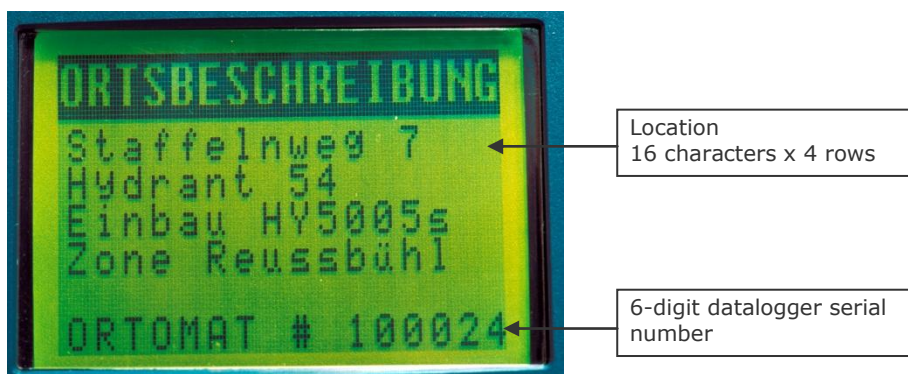### 2.3.3. Formatting logger entries/location

A processing window for the corresponding measuring point can be opened by clicking the right-hand mouse button on a logger entry in the logger list. This function is mainly used to format the location text.

The filter setting can also be modified here → see the section Leak threshold/filters on page 26



6-digit datalogger serial number

Location
16 characters x 4 rows

It is important to know that the location need not be programmed into the datalogger. The logger identifies itself via the 6-digit serial number (in the example: 100,024).

The location and/or the entire logger list must, however, be programmed into the ORTOMAT controller (see the section Programming the ORTOMAT controller on page 29) to allow it to display the correct location text for the corresponding serial number of the datalogger during data export in the field.



Location
16 characters x 4 rows

6-digit datalogger serial number

## 2.4. Main menu



→ File        → Display        → Sorting        → Settings

The logger list can be opened from the menu.

### 2.4.1. File -> Open

Apart from 'Find', the menu item 'Open' also has a list of the 6 most recently opened files. As the same files are often frequently opened in normal use, the desired file is probably already listed.

### 2.4.2. File -> New

Creates an empty logger list in which loggers can be included.

### 2.4.3. File -> Save a Backup

Allows the open logger list to be saved under a new name.

### 2.4.4. File -> Insert Logger without Establishing Connection

Allows new units of the existing logger list to be added without having to connect them directly to a PC. To do this, it is necessary to know the 6-digit serial number of the units to be inserted.

### 2.4.5. File -> Insert Logger from Another File

Existing loggers or complete logger lists can be combined here.

### 2.4.6. File -> Page Setup

Allows the margins to be set on the paper.

### 2.4.7. File -> Print

Prints out the logger list; larger lists may cover several pages.

### 2.4.8. Displays



Normally all the loggers are displayed in the logger list. To make lengthy lists easy to understand, the scope of display can, however, be restricted.

**For example:** I only want to show the exported dataloggers of a part-export from this week → *Only display the data imported from the last 1 day*

**For example:** I will check whether I have recorded all the dataloggers during the data exports in the last week → *Only display the data NOT imported in the last 7 days*

The information bar at the top of the list shows whether entries have been suppressed or not:



GREEN bar = All entries are displayed

In this example, the complete list is displayed with a total of 202 entries.



YELLOW bar = Not all the entries are displayed → the list has been partially suppressed.

In this example, only the entries that have been imported within the last 10 days are displayed.

### 2.4.9. Sorting



To gain a good overview of the logger-list entries, these can be sorted by the text rows of the location description. Sorting is done alphabetically, empty spaces are ignored and numbers are correctly aligned.

It is therefore a good idea to develop the entries in a logger list logically to allow the rows to be sorted alphabetically.

Examples:

### 2.4.10. Settings

The Settings menu is used for the basic definition of certain displays in software, logger and controller operating modes.

### 2.4.10.1. ORTOMAT settings



The desired language can be selected here. The program (but not the computer) must be restarted whenever the language is changed. If a GSM list is active, the SMS language setting is also displayed.

Define the PC interfaces→ USB

Comm Port should only be used for old systems that have an RS232 interface

Basic controller settings

The illustration shows the standard setting for normal operation.

Technician functions: may only be used if agreed to by a technician.

### 2.4.10.2. GSM settings

Can only be selected if GSM loggers are in use and the logger list has been correspondingly defined.
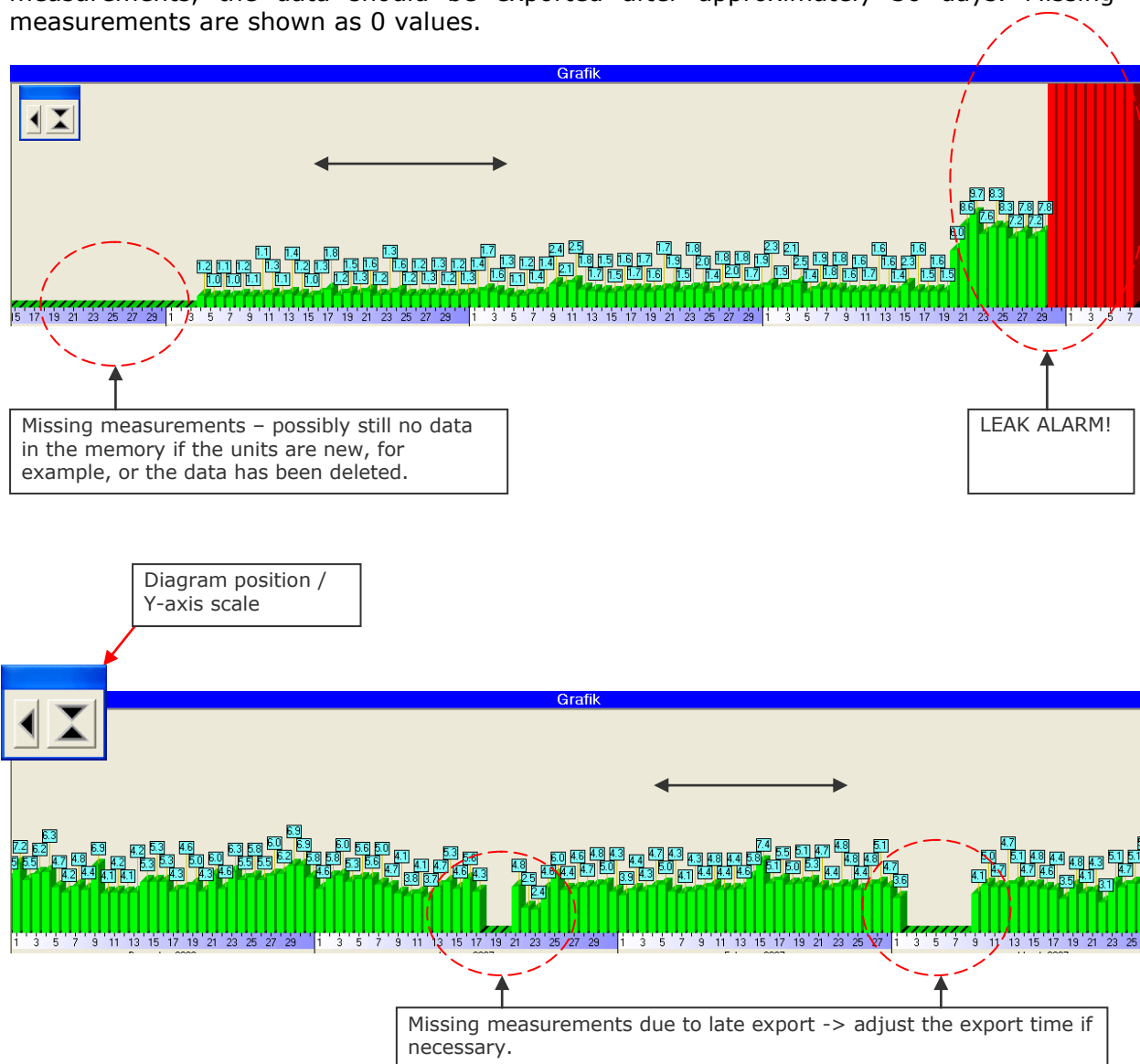
### 2.4.11. [X]

Closes the software and shuts down the software window. When the software is restarted, the logger list last opened is automatically displayed again.

## 2.5. Measurement graphics

The measurement graphics display the leak data of the measurement point selected in the logger list. The chart shown is always the one for the measuring point that is selected in the logger list (click the list entry with the left mouse button).
If the data in the dataloggers has been exported using ORTOMAT controllers in the field, the leak information can then be re-imported into the software → see section Importing the measurements on page 29.

Approximately 500 measurements can be displayed in a chart. This can be dragged back and forth with the mouse button. As the datalogger only has space in the field for 40 measurements, the data should be exported after approximately 30 days. Missing measurements are shown as 0 values.



Missing measurements – possibly still no data in the memory if the units are new, for example, or the data has been deleted.

LEAK ALARM!

Diagram position / Y-axis scale



Missing measurements due to late export -> adjust the export time if necessary.

### 2.5.1. Deleting measurements

Click the right mouse button on the measurement chart -> "*Delete All Data*"

However, measurements can only be deleted when the corresponding datalogger is connected to the software.

See the section Deleting measurements in the logger on page 22

### 2.5.2. Creating reports

Click the right mouse button on the measurement chart -> "*Create Report*"

A reporting tool is provided for this. Open reports can be saved and printed out.
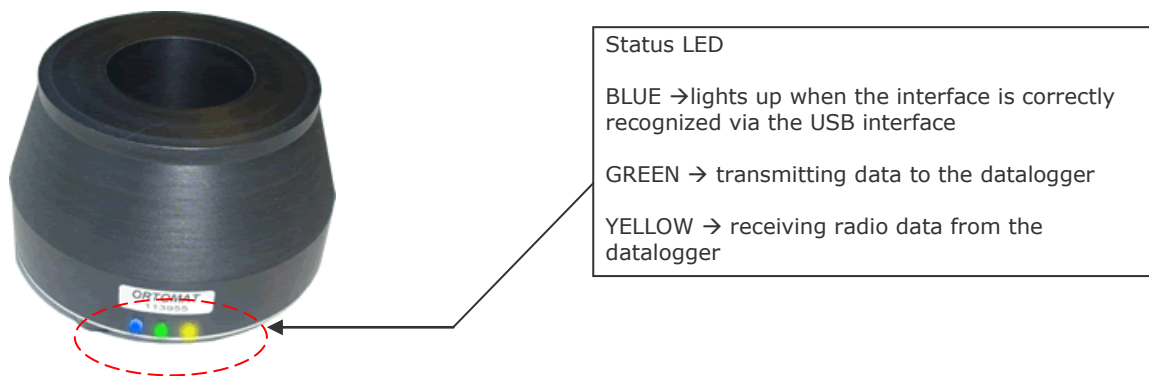
# 3. Programming the ORTOMAT datalogger

## 3.1. RFID interface

An RFID interface is required to connect an ORTOMAT-LC datalogger to a PC. This is a special readout adapter that can communicate with the unit over a short distance (approximately 2 cm). The datalogger need not therefore be opened to communicate with a PC.

The RFID interface is connected to a PC with a USB interface. The USB device driver required for this module is installed together with the installation of the ORTOMAT software.



Status LED

BLUE →lights up when the interface is correctly recognized via the USB interface

GREEN → transmitting data to the datalogger

YELLOW → receiving radio data from the datalogger

## 3.2. Connecting the datalogger



To connect a datalogger to the RFID interface, it must be inserted into the interface upside down.
Connection with the unit can now be established by clicking on the logger/controller connection terminal.
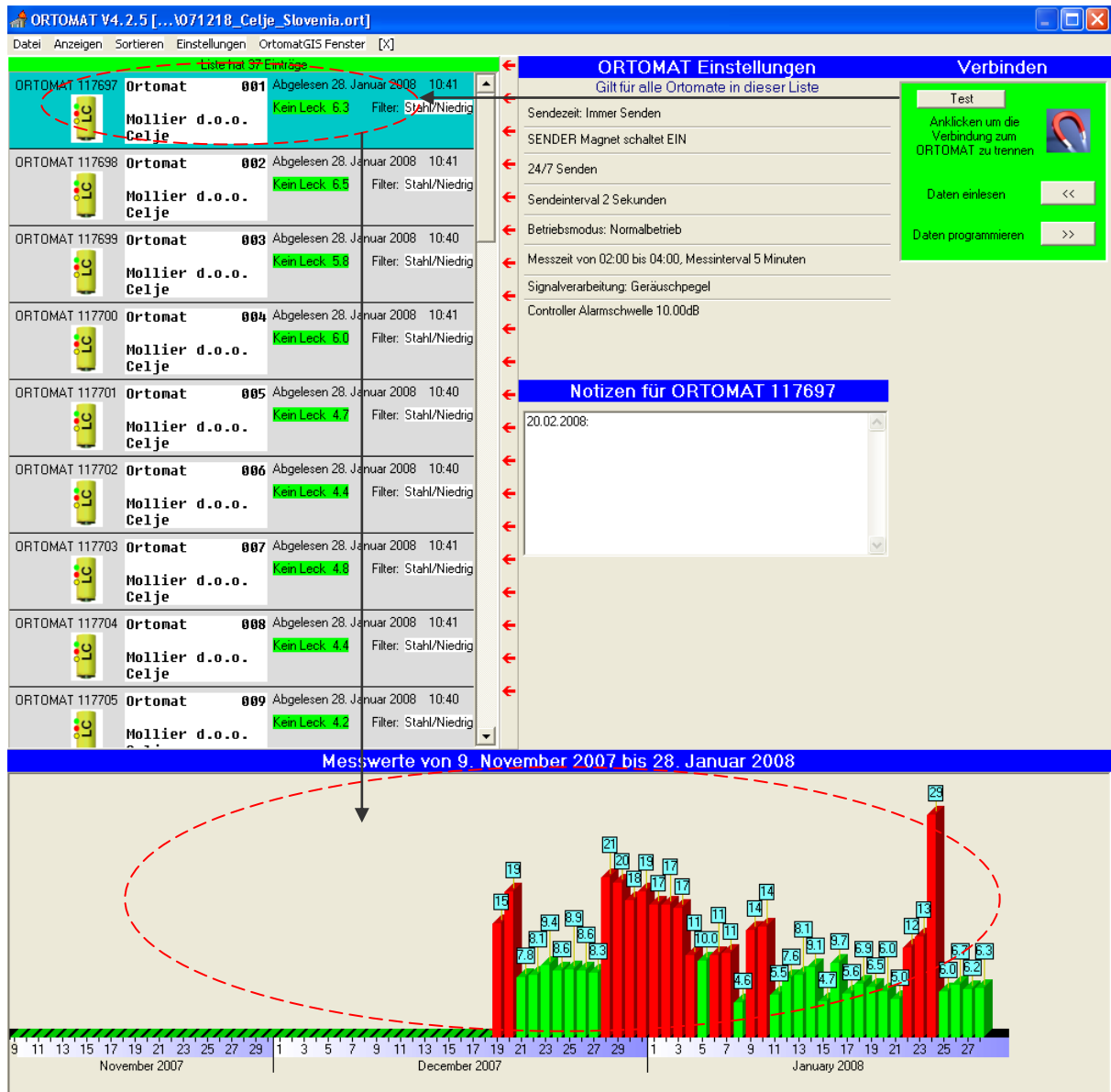
It will take approximately 3 seconds to establish the connection. If this is done correctly, the opened connection terminal is now highlighted in green. The status of the transmitter is imported directly and displayed in the window -> see the section Symbols in the connection terminal on page 25.

Otherwise, a corresponding error message is displayed in red.

## 3.3. Importing the measurements

After establishing connection, the datalogger connected is highlighted in green in the logger list on the left and the leak graphic that goes with the measuring point is displayed in the lower part.
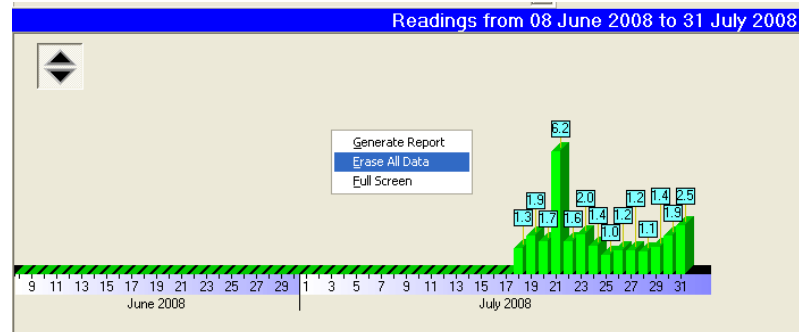
Clicking on the button "Import Data" transfers the most recent measurements from the datalogger straight to the software and displays it. Then entry "Read on ..." in the logger list is updated.
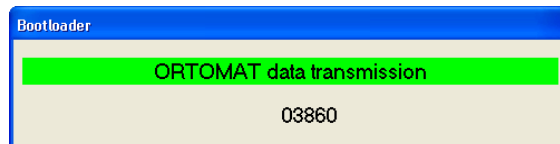
### 3.3.1. Deleting measurements in the logger

The measurements saved in the logger can only be deleted when it is connected to a PC.

Click the right-hand mouse button on the datalogger graphic and select *"Delete All Data".*



When deleting the measurements, the parameters defined in the "*ORTOMAT settings*" window are also retransmitted → an additional "*Bootloader*" window is displayed.



## 3.4. Programming parameters into the datalogger

Clicking on one of the entries in the "*ORTOMAT Settings*" window causes a new processing window "*Settings*" to be displayed. All the parameters required for the ORTOMAT datalogger can be defined here.
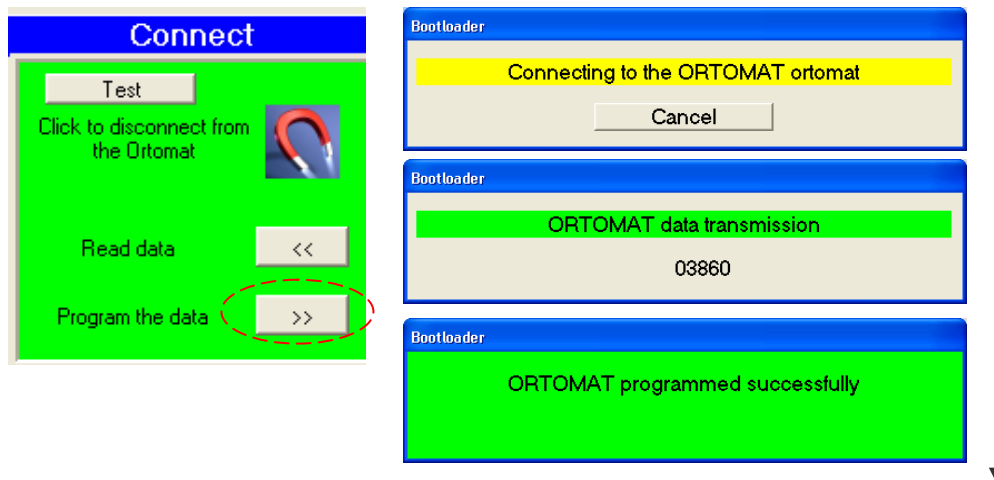
The operating mode defined here for the ORTOMAT datalogger is written to the logger when the button "*Programme Data*" is clicked.

→ an additional "*Bootloader*" window is displayed.



If data transmission is not successfully concluded, the corresponding error message will be displayed in a red window.
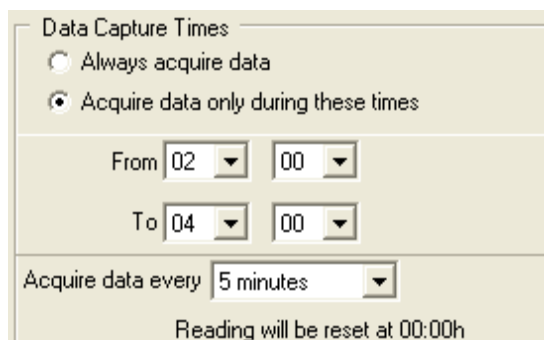
Before programming, it is important to make sure that the settings in the "*ORTOMAT Settings*" window are chosen correctly. During a programming session, these are all rewritten into the datalogger – a wrong setting might therefore distort operation in the field.

### 3.4.1. Measuring time

This is where we define in which time window and at what interval the datalogger is to carry out the leak identification process.

This measuring phase should be carried out in the period during the day that has the lowest consumption or the lowest sounds.

The illustration shows the standard setting for a permanently installed system.

### 3.4.2. Transmission time

This is where we define when and how the logger switches on the transmitter for the radio data readout.

The transmitter can only be switched on for a limited time so as not to put too great a strain on the internal battery of the logger.

The illustration shows the standard setting for a permanently installed system.

In the field "After programming" you can define if the transmitter is switched ON or OFF after the programming. Normally choose ON! If you choose OFF, the you have the

### 3.4.3. Transmission setting

Dependent on how it is to be used, different functions can be defined to switch the transmitter ON or OFF.

The relevant operating mode is always coupled to the transmission times defined.

The mode is activated as soon as the settings are programmed into the logger.

In the field "After programming" you can define if the transmitter is switched ON or OFF after the programming. Normally choose ON!

*Always OFF*:
The transmitter is inactive. -> can be activated if a magnet is held on top

*Always ON*:
The transmitter is active within the programmed transmission time.

### 3.4.4. Magnet control function

The radio transmission mode can be influenced, if a magnet is held on top.
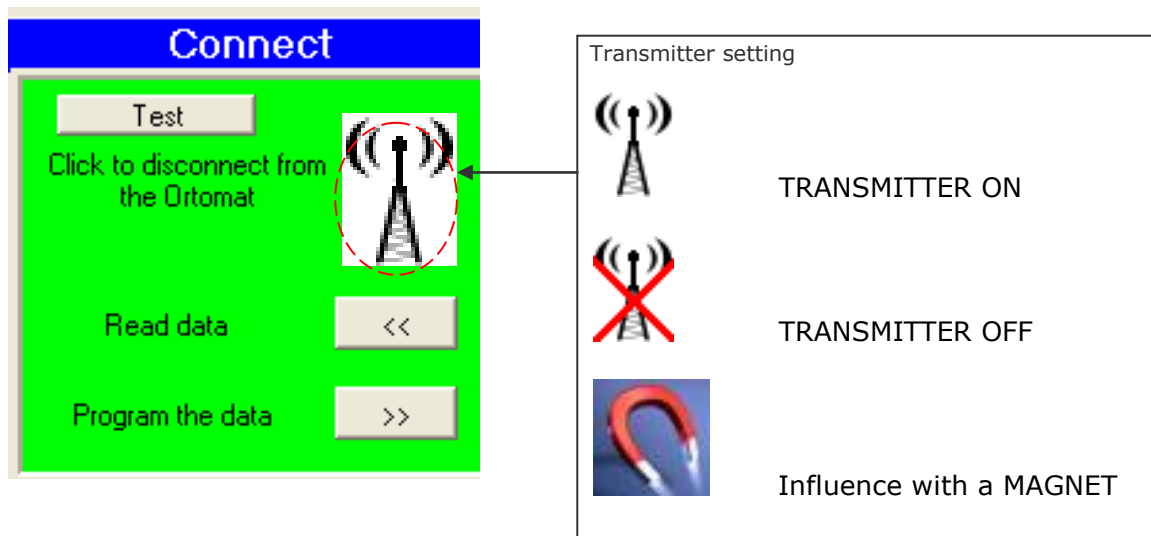
The transmitter can be switched in different modes:

*time (magnet held on top)*

| 0 | 10 Sek | 20 Sek | 30 Sek |
|---|--------|--------|--------|

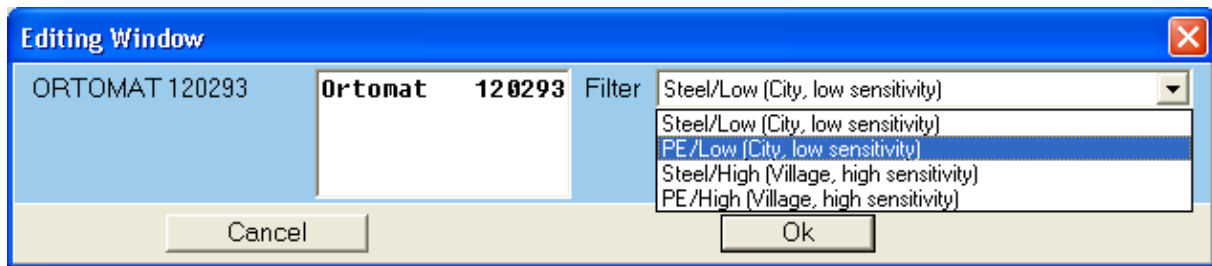| During the first 10 seconds, the ORTOMAT transmits the stored LEAK information.<br><br>If the magnet is removed during this 10 sec., the transmitter remains in the same mode as before.<br>. | During the next 20 seconds, the OROMAT switches into the „LIVE" mode. The current noise level from the sensor will be displayed.<br><br>If the magnet is removed during this 20 sec., the "LIVE" mode remains until midnight.<br><br>On the next day, the ORTOMAT will be in its normal transmission mode according the programmed "transmission time". | The radio signal is switched OFF |
|---|---|---|

### 3.4.5. Symbols in the connection terminal

The selected transmitter setting is shown in the connection terminal after a connection has been established with the ORTOMAT datalogger. The operating mode can thus be recognised immediately.

However, this must always be seen in connection with the transmission time defined. For example, if the "TRANSMITTER ON" symbol is displayed when connection is established, it is possible that the datalogger is outside the programmed transmission time and thus cannot be received by the ORTOMAT controller.

### 3.4.6. Leak threshold/filters/zero level



The datalogger can be operated with 2 different filter settings, each of which has two threshold values.

1st filter set at **Steel** *(300Hz - 5kHz)*     - low sensitivity     (e.g. leak threshold at 20)
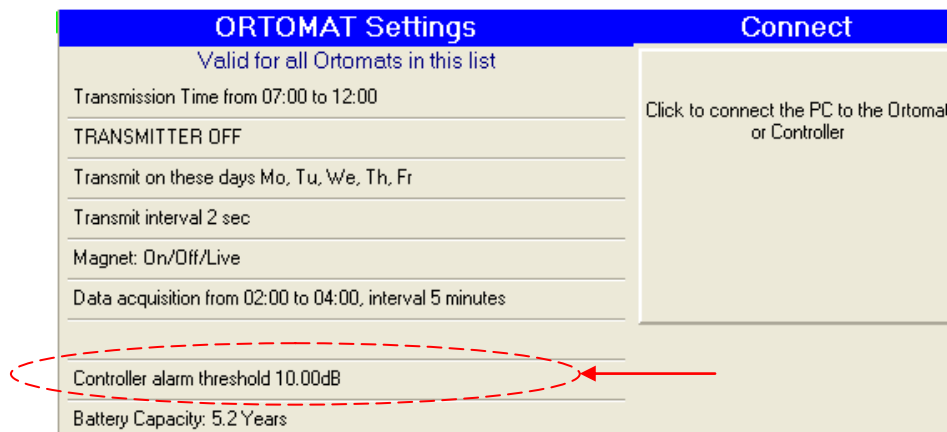                                           - high sensitivity    (e.g. leak threshold at 10)

The filter setting "*Steel*" is used as standard. Since leaks in plastic pipe sections can also be recognised with this setting, it is used as a universal filter setting.

2nd filter set at **PE** *(10Hz – 5kHz)*       - low sensitivity     (e.g. leak threshold at 20)
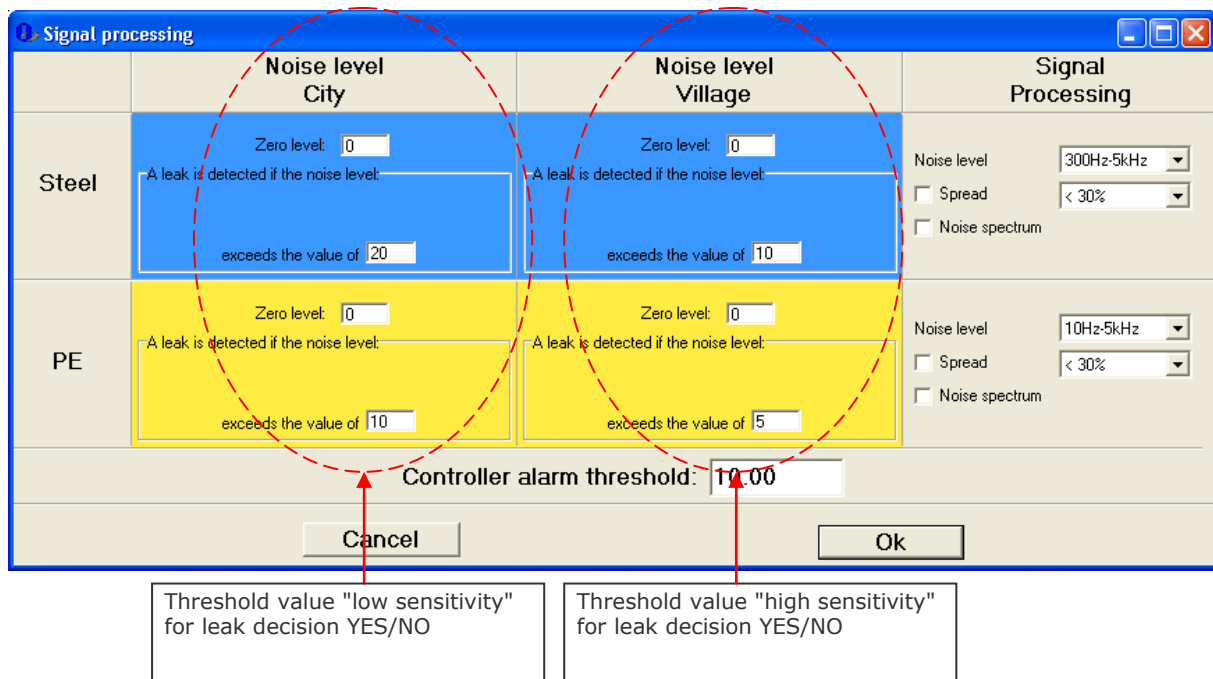                                           - high sensitivity    (e.g. leak threshold at 10)

Since the PE filter setting (compared with the steel filter setting) also takes measurements in the low frequency waveband (below 300Hz), it is more suitable for leak identification with plastic but, as a result, it is also much more susceptible to low-frequency malfunctions resulting from road traffic or industry, for example.

While the filter setting (steel/PE) has to be programmed into the datalogger, the sensitivity setting is only required (high/low) for the software. The decision on a leak display YES/NO is thus taken by the ORTOMAT controller and the software.

In the window "*ORTOMAT Settings*", click on the entry "*Controller Alarm Threshold*" in order to format these display thresholds for "LEAK YES/NO".
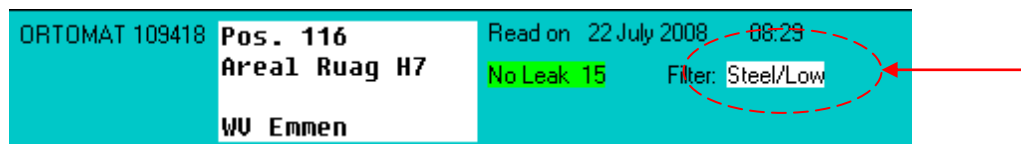
A new "*Signal processing*" window is opened.



Threshold value "low sensitivity" for leak decision YES/NO

Threshold value "high sensitivity" for leak decision YES/NO
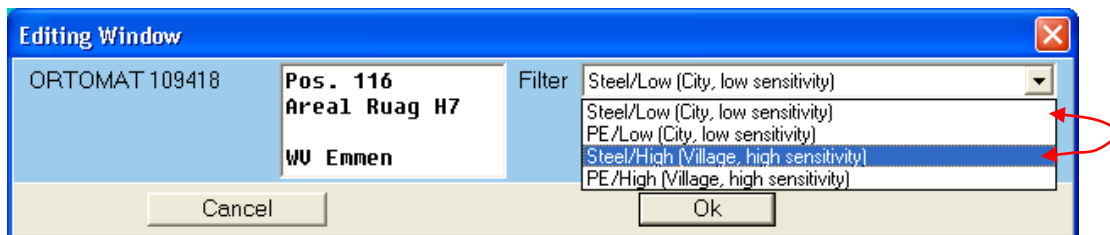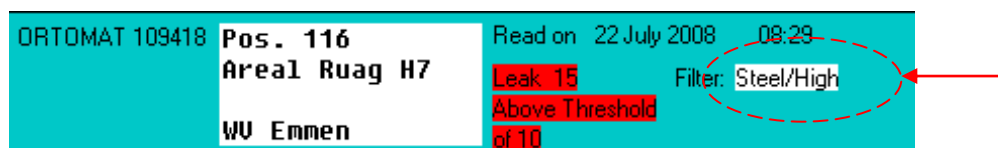
Example:

The measuring point shown is programmed with a steel/low filter. This means that according to the settings above, it will switch to LEAK from a level of 20.



A threshold value of 10 is used if you switch over in the "*Processing Window*" (right mouse button on logger entry-> Processing) from "*Low Freq.*" to "*High Freq.*".



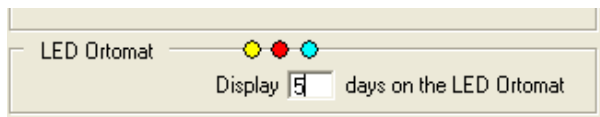The entry is now displayed with a leak alarm.

An offset can be defined in the "*Zero Level*" field. This value is deducted in the logger from the measurement. The purpose of this is to eliminate background noises and to set the logger measurement value to zero or close to zero if no leak is present.

Changing the "*Zero Level*" must be programmed into the datalogger if it is to be effective. N.B.: Altering the zero level distorts the measurement and must be correspondingly documented for the particular datalogger.
The "*Controller Alarm Threshold*" field defines the measurement from which the controller is to emit an acoustic warning signal when reading values in the field. A typical value selected for this is the same as the display threshold for "Low sensitivity".

### 3.4.7. LED settings

ORTOMAT-LC dataloggers provide the opportunity for communicating their leak data not only via the 433 MHz radio signal, but also for flashing the leak data using integral LEDs in a simplified form of data export.



In the example, the last 5 measurements finish flashing as LEAK (red LED) or NO LEAK (green LED).
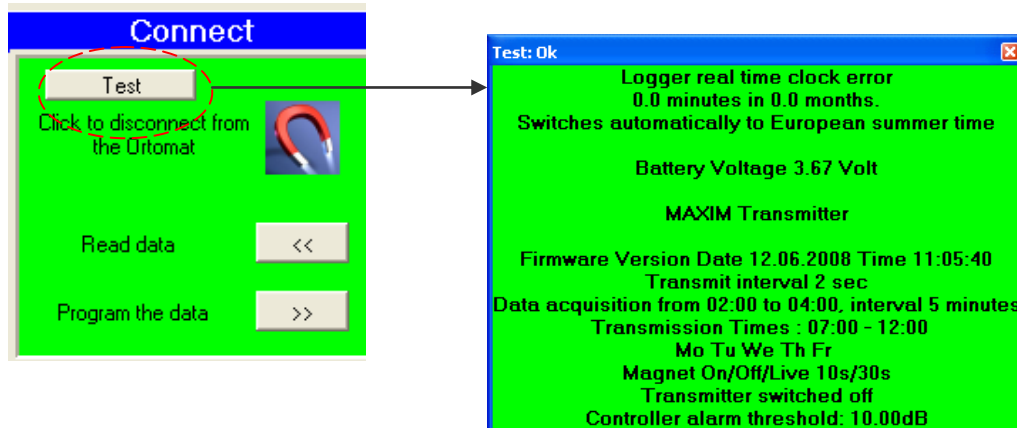
The flashing process always starts with the most recent leak value.

The LED display is triggered off by applying a magnetic field at the upper end of the unit. By removing the magnet the LEDs light up.

## 3.5. Logger function test

This key in the connection terminal permits a brief, but meaningful function test of the ORTOMAT datalogger. All the datalogger settings are displayed. The user is given a corresponding warning here if anything is wrong with the unit.
The sensitivity of the microphone is not tested. To do this, the unit can be put into test mode to check the microphone measurement live.

# 4. Programming the ORTOMAT controller

## 4.1. Connecting the controller

Prior to connecting an ORTOMAT controller for the first time, the corresponding device driver must be installed → see the section on Device drivers on page 9.

If the controller is connected to a PC using a USB connecting cable, this can be set by pressing the ON button in communication mode. The letters "USB" will appear on the controller display.
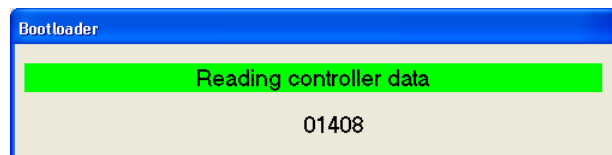
It is now possible to establish a connection to the unit by clicking on the logger/controller connection terminal in the open ORTOMAT software. Establishing a connection takes approximately 3 seconds. If this is done correctly, the open connection terminal is now highlighted in green.



## 4.2. Importing the measurements

Press the button "*Import Data*" to import the datalogger measurements received in the field into the logger list.

This can take several seconds/minutes depending on the size of the list.



Wait until the process has been successfully concluded.

## 4.3. Programming parameters into the controller

The ORTOMAT controller must be reprogrammed to change the following two things:

### 4.3.1. Loading a changed or new logger list

The ORTOMAT controller can only receive the datalogger that has been included in its list.

If a new measuring point is therefore added to the system, it must first be inserted into the existing logger list (see the section on Registering new dataloggers on the list on page 13) and this must then be programmed into the controller.

The controller may also have to be used to export a different ORTOMAT system.
The corresponding logger list must be programmed first in order to do this. Only one list can be loaded onto the controller at any one time.

### 4.3.2. Basic controller settings

Certain basic settings are also reset when data is transmitted to an ORTOMAT controller. These are documented in the menu "*Settings-> ORTOMAT Settings*".



The illustration shows a standard setting for an ORTOMAT controller.