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The *SDT Sherlog* S ultrasonic detector and multi-transmitter

Technical and User's Instruction Manual

Second Edition, July 2003.

The information herein is believed to be accurate to the best of our knowledge.

Due to continued research and development, specifications of this product can change without prior notice.

In this manual, *SDT International n.v. s.a.* is named SDT.

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Summary

First and foremost

1. Foreword

1.1 PURPOSE OF THE MANUAL

This Users Manual is designed as an educational guide and reference tool for anyone who wishes to use the *Sherlog* equipment for its intended purposes. Inside you will find information pertaining to:

- The description and functionality of the equipment.
- Its many uses.
- How to care for and maintain the equipment.

Recommendations relative to the declaration of compliance to the European Community's regulations, the guarantee and the different areas of application are included into this Users Manual.

SDT produces this Users Manual with the sole purpose of supplying simple and accurate information to the user. **SDT** shall not be held responsible for any misinterpretation of this Users Manual. Despite our efforts to provide an accurate manual, it may contain technical errors beyond our control. If in doubt, contact your local **SDT** distributor for clarification. While every effort was made to present a true and accurate text, modifications and/or improvements to the product described herein can be made at any time without corresponding changes being made to this Users Manual.

Please read this Users Manual carefully, and file it in a safe place for future reference. All requests and warnings of this Users Manual must be followed in order to maximize the value of your investment. This Users Manual and its contents remain the inalienable property of **SDT**. The information herein is believed to be accurate to the best of our knowledge.

1.2 OPERATOR SAFETY

The operator must take all necessary precautions when using the equipment in high risk areas (under high noise levels, high light and radiation levels, extreme temperature conditions, chemical corrosive elements, etc.).

The user must be particularly vigilant when entering enclosed zones (holds, silos) where a risk of asphyxiation or lack of oxygen is possible. There is no likelihood of direct consequences for the hearing capacities of the operator.

The instrument **MAY NOT** be used inside any classified zone requiring explosion proof equipment.

1.3 END OF LIFE DESTRUCTION OF THE EQUIPMENT

When the equipment becomes obsolete, the internal battery pack must be removed from the equipment, and must be disposed of in such a way that conforms to the environmental laws of the country where the equipment is located.

The outer casing and other internal components may be destroyed by the appropriate specialized organizations.

The mandatory stipulations of applicable law take precedence over the contents of this Users Manual.

2. Description of the *Sherlog S* set

The complete *Sherlog S* kit which contains:

Sherlog S detector assembly

- 1 x *Sherlog S* detector with rubber protection.
- 1 x Battery pack for *Sherlog S* detector.
- 1 x Battery loader for *Sherlog S* detector.
- 1 x Flexible sensor 820 mm for *Sherlog S* detector (tube + flex).
- 1 x extension accessories for *Sherlog S* detector (threaded tip, rubber tip and 2 plastic tubes).
- 1 x Noise isolating headphones 130 dB .
- 1 x Cable RS232 Stewart – Sub D9 female. Length 1.5 m.

SDT 8 Sherlog multi-transmitter

- 1 x *SDT 8 Sherlog* multi-transmitter with battery.
- 1 x Leather case for multi-transmitter.
- 1 x Battery loader for *Sherlog* multi-transmitter.
- 1 x Screwdriver for the *Sherlog* multi-transmitter battery cover.

Others

- 1 x Technical and instruction manual.
- 1 x Calibration certificate.

Optional

- 1 x Spare battery for *SDT 8 Sherlog*
- 1 x Battery loader adapter for *SDT 8 Sherlog*
- 1 x Y plug connector for second (optional) headphones

The *SDT Sherlog S* detector

3. Presentation

3.1 OPERATING PRINCIPLE OF THE SHERLOG

3.1.1 General

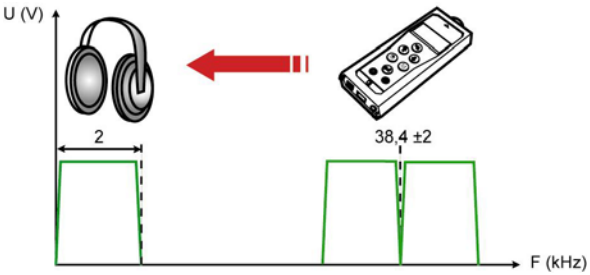
Ultrasonic waves are sound waves beyond the range of human hearing (>20 kHz). To be detected, we need to use an instrument like the *Sherlog*, with the capability to receive ultrasonic frequencies and convert them to corresponding audible sounds.

Ultrasonic waves travel through gases (air), liquids (water, fuel) and solids (bearing housings) in a very directional nature; unlike audible sounds which disperse in all directions. Ultrasounds are low energy sound waves, therefore they are quickly absorbed by the medium through which they travel. Ultrasonic waves are generated by:

- Naturally occurring mechanical phenomena (friction of rotating equipment), pressure or vacuum leaks (pneumatic, gas, steam) or arcing and corona (electrical problems).
- Artificially by means of a transmitter (like the *SDT 200 mW* or the *SDT 8 Multi-transmitter - 8 x 125 mW*) for tightness testing.

3.1.2 Applying ultrasonic waves on the Sherlog

The *Sherlog S* detects ultrasonic signals, converts them to audible frequencies, and amplifies them. The challenge is to transpose the received signal, using the heterodyne technology, into an interpretable audible signal. This solution extends the ability of the human ear beyond the simple audible range and into the ultrasonic one.



The main function of the Sherlog S is converting high frequency signals into audible. 002

3.2 SPECIFICATION OF THE *SHERLOG S*

They are summarized in this table.

- LDC display.
- Built-in (internal) ultrasonic sensor.
- Headphones output.
- Connector for charging unit.
- Connector for PC.
- Sensor connector for ultrasonic and non ultrasonic external sensors (see Chapters 18, 19 and 22).

3.2.1 Updating possibilities

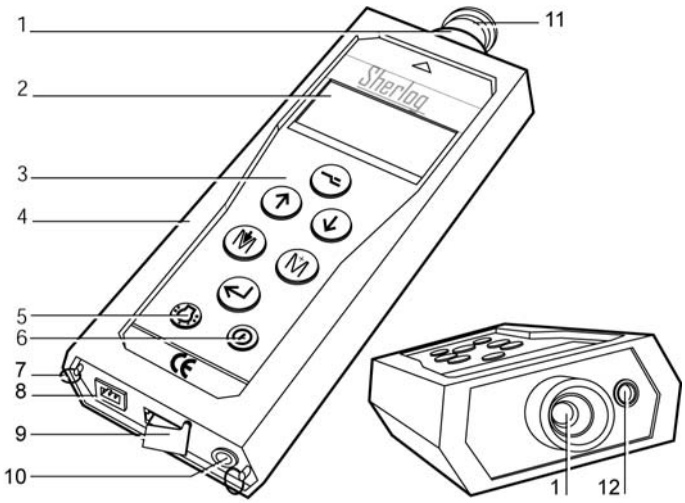
Regularly and for different reasons, the software version from the *Sherlog S* ultrasonic detector can be updated, the most common reason being a technical improvement in the core software.

This makes the *Sherlog S* the only Ultrasonic Multifunctional detector in the world that's always *up to date*.

Every owner of a *Sherlog S* detector can download this software update. The only things needed are a cable, an Internet connection and an unzip software.

3.3 FRONT AND BACK SIDE (FULL VIEW)

Presents itself as follows:



N°	Function	N°	Function
1.	Built-in ultrasonic sensor and cap.	7.	Carrying strap rings.
2.	LCD display.	8.	Battery charger connector.
3.	Keyboard.	9.	RS 232 connector and cap.
4.	Holster.	10.	Headphones connector.
5.	Backlight switch.	11.	Sensor protective cap.
6.	On/Off switch.	12.	External sensor connector.

The elements of the Sherlog S. *201*

3.4 THE KEYBOARD

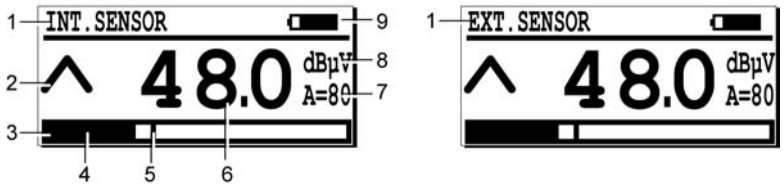
The keys correspond to the following functions:

Key	Function	Remarks
	First press: access to the menus and sub-menus.	See chapter “The main menu”.
	Second press: return to previous or basic screens.	
	Increase amplification level.	The **A** on screen is modified.
	Scroll up through menus.	
	Increment alphanumeric digits.	Used during the autopower down, backlight, contrast, time/date settings.
	Reduce amplification level.	The **A** on screen is modified.
	Scroll down through menus and sub-menus.	
	Decrement figures.	Used during the autopower down, backlight, contrast, time/date settings.
	Take the measurement	The measured value is displayed.
	Move the cursor to the right.	Used during the time/date settings.
	Non active for storing data. Move to the left.	
	Enter.	Used to validate and confirm a shown selection.
	Activate backlighting.	Press the key to switch on the backlight. Pressing the key again switches off the backlight. The backlighting switches off automatically if no buttons are used within a pre-defined period of time set by the user.
	On/Off switch.	First key press: switch on the unit. Second key press: switch off the unit. The unit switches off automatically if no buttons are touched on the keypad within pre-defined period of time set by the user.

3.5 THE DISPLAY

3.5.1 Basic screen

The following table summarizes the visible icons.

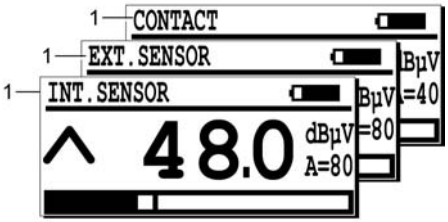


Primary icon locations on the display of the Sherlog. 202

N°	Function	Remarks
1	Type of sensor	Type of sensor used / connected.
2	Amplification indicator	Only for ultrasound (dBµV) measurements.
3	Bar graph.	Visual indications of the measured value.
4	Signal indicator.	This vertical line shows the actual level of the signal.
5	Peak and hold maximum signal indicator.	This indicator shows the maximum signal detected and resets itself after approximately 2 seconds.
6	Measurement value	The digital measured value (dBµV by default).
7	Amplification level	A = selected amplification level.
8	Unit of measurement.	Display of the measurement unit with the external connected sensor (dBµV, T°, dBA, RPM, etc.). dBµV is displayed when no sensor is connected.
9	Information	Display alternates between battery level indicator, time and date.
	Battery level indicator.	100% black corresponds to a fully charged battery.
	Time (Hour)	Current time.
	Date	Set date.

3.5.2 Type of sensor used

The type of sensor in use (rep. 1) is displayed at the upper left corner of the display. The system auto recognises externally connected sensors and switches automatically to the corresponding measurement unit.



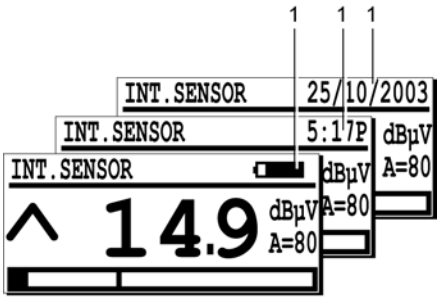
Primary icon locations on the display of the Sherlog. 263

3.5.3 Date / Autonomy / Time

This information (rep. 1) is cycling on the upper right corner of the screen.

The remaining capacity in the battery is expressed by an icon (the amount of blackening corresponds to the remaining capacity of the battery). The following table shows the icons used.

Icon	Signification
06/16/2003	Date in the local format.
	Estimated remaining capacity of the battery. A 100 % black icon indicates a fully charged battery.
5:17 P	Set time.

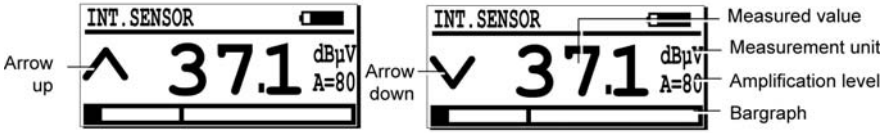


Example of revolving information icons 029 -130s

3.5.4 The measured data and its additional information

The display shows the measured data and its additional information described in the lower paragraphs, which are:

- Measured value.
- Measurement unit.
- Selected amplification level.
- Up and down arrows for adjusting the correct amplification level.
- Bargraph.



The main information relating to the measurement. 131

The measured value

The measured value is shown in the middle of the screen.

The measurement unit

The measurement unit is shown on the right side of the display, such as **dBµV by default**.

The amplification level

This function is only active when the *Sherlog* is used to detect and measure airborne ultrasounds.

The amplification level **A** varies on a scale from **10** to **80**.

Due to logarithmic characteristics, each and every time the **A** level is increased (decreased) by **10** (next or previous step), the gain is multiplied (divided) by approximately 3.

For example:

- **A = 40** -> Gain = **100**.
- **A = 50** -> Gain = **300**.

Understandably, when the ultrasonic level is high, little amplification is needed. When the ultrasonic level is very low (small leaks), the amplification required will be high.

When, in presence of a source of ultrasounds, the *Sherlog* must be adjusted to an optimal **A** level. *Sherlog* assists you on the screen by means of the ∧ and ∨ arrows at the left side of the screen.

- ∧ indicates that the amplification level is to low and that a higher amplification level should be selected.
- ∨ indicates that the amplification level is too high and that a lower amplification level should be selected.

The adjustment of the optimal **A** level is obtained by pressing ↑ to increase or by pressing ↓ to decrease.

Last but not least, it must also be understood that the amplification level determines the ***minimal*** dBµV measurement that the *Sherlog* will consider for a set level. For example, at **A = 40**, the instrument will display all measurements above 19 dBµV and will ***not*** display sounds lower than 19 dBµV.

The table below indicates the correlation between the different amplification levels, the gain and the correspondent minimal sound level in dBµV.

A	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**
Gain	3	10	30	100	300	1 000	3 000	10 000
Min (1)	49	39	29	19	9	-0.6	-4.1	-7

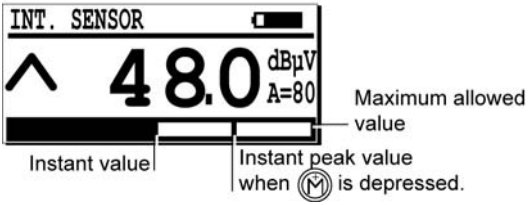
For the above mentioned reasons, one now understand why when measuring an Open Hatch Value (OHV), the *Sherlog* detects an important ultrasonic output volume generated by the multi-transmitter, which requires an adjustment of the optimal amplification level.

But when one is seeking for minor to very small leaks, the amplification level ***must*** be set at minimal **70** or **80**.

The scale here above shows that at those **A** levels, the *Sherlog* will display values of minimal **-4.1** (or **-7**) dBµV. No leak can then remain undetected.

The bargraphe

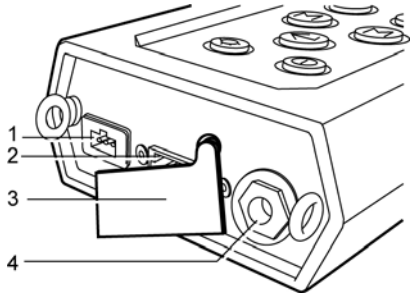
Situated on the lower side of the display, it graphically illustrates the amplitude of the detected signal. While measuring, an indicator line shows the peak value measured. Every two seconds, the peak and hold indicator is reset.



The bargraph and its peak and hold indicator. *132*

3.6 THE BOTTOM PLATE VIEW

This figure represents the location of the connectors at the bottom plate.



1. Battery charger connector.
2. RS232C connector.
3. Protective cap.
4. Headphones connector.

The rear connectors. *203*

3.6.1 The battery charger connector

This 3-pin connector is used to make the connection with the battery charger provided with the *Sherlog*. Due to the active interaction between the charger and the battery/equipment, only this charger can be used to charge the batteries.

Connecting another charger may cause serious damage to the equipment and void the warranty.

3.6.2 The PC communication connector

The 8 pin plug connects with a PC by means of a RS 232 C type connection. This port is also used to update new software to the *Sherlog*. The connector is protected against dust and moisture by a rubber protection cap.

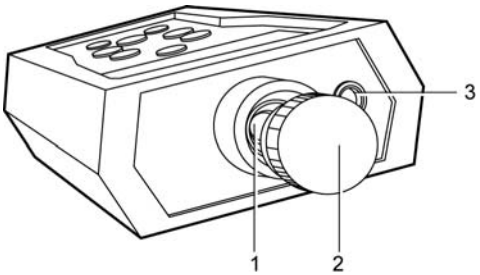
3.6.3 The headphones set connector

The supplied headphones set is connected to the *Sherlog* in order to listen to the converted ultrasounds. The Y plug is used to connect a second headphones set.

3.7 THE FRONT VIEW

The internal ultrasonic sensor

The detector has an internal sensor for detecting airborne ultrasounds and other ultrasonic phenomena such as compressed air leaks, vacuum leaks and corona discharge. It is directly connected to the internal components and protected by the sturdy extruded aluminium housing.



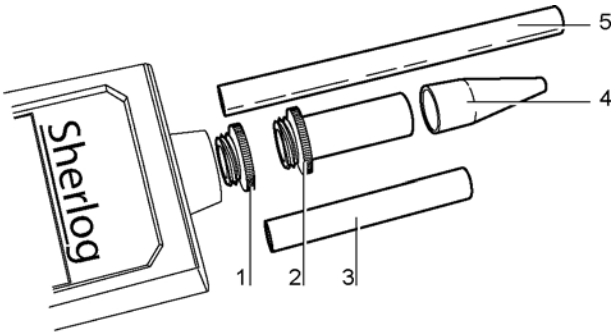
1. Ultrasonic sensor.
2. Protection cap.
3. Connector for external sensor.

Elements located on the top of the Sherlog S. *204*

This sensor is not waterproof. Precautions must be taken to protect the sensor from humidity and projections of liquids. For that purpose, the internal sensor is protected by a metal cap, which has to be fitted if the sensor is not in use.

Warning: when using the internal sensor, do not forget to remove the protection cap (rep. 2 – picture here above).

Several extension accessories are supplied with the unit which permits to focus and pin point the ultrasonic source. They are to be connected as follows:



1. Protection cap to be removed before any measurement.
2. Threaded tip for current leak detection.
3. Extension to be fitted on 2.
4. Rubber precision cone to be fitted on items 2, for functionality tests.
5. Plastic extension to be fitted on 2.

Precision accessories to be mounted on the sensor of the Sherlog. 072

The connector for external sensors

It is used to connect the external flexible sensor as well as all other ultrasonic or non ultrasonic sensors. The internal airborne ultrasound sensor is automatically disconnected when an external sensor is connected.

3.8 THE BACK SIDE

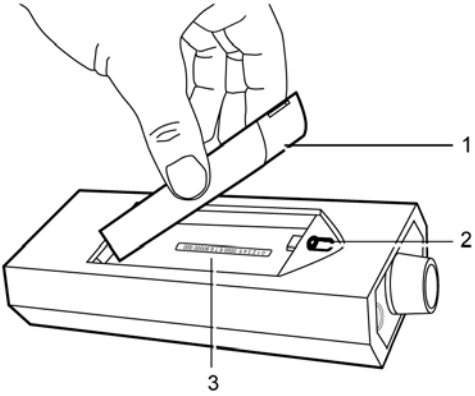
It permits the access to the battery pack.

3.8.1 The battery

The battery is a NiMH type (Nickel Metal Hydrate; operating voltage 7.2 V). It is specific to the equipment. Chapter 12 presents the general characteristics of the battery pack as well as how to recharge it.

3.8.2 The serial number of the Sherlog

The serial number of the *Sherlog* is visible in the battery compartment, on the back side of the unit (rep. 3, illustration hereafter).



1. Battery pack
2. Locking catch of the battery pack
3. Serial number bar code.

The battery pack, the battery pack locking catch and the serial number of the detector. 205

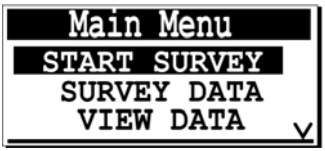
4. The *Main menu*

4.1 ACCESS TO THE *MAIN MENU*

- Switch on the equipment by pressing the ⏻ key.
- Once the equipment switched on, the self-test is started and takes about two seconds to finish. If no problem or fault is detected during this test, the unit will place itself into the measurement mode.
- Once the basic screen is shown, press ⏦ to access the **`Main menu`**.

Display of the basic screen. *210*

- The main screen is displayed as follows.



The main menu. *211*

4.2 THE *MAIN MENU* SCREEN

4.2.1 Presentation

When the basic screen is shown, press ⏦ to access the **`Main menu`**.

The main menu. 211S

The active keys are:

Key	Function
⏦	Access to the **`Main menu`** or return to the previous menu when in a sub-menu.
↑	Select one of the menu lines by moving the inverted line upwards.
↓	Select one of the menu lines by moving the inverted line downwards.
↵	Enter, validates the choice (the inverted line).
💡	Activates the backlight. This key is available at any time.
⏻	Switch of the equipment. This key is available at any time.

The accessible menus and sub-menus

They are:

- '**`SETTINGS…`**' : use this menu to select :
  - '**`SENSOR OPTIONS`**': only displayed when an external sensor is connected. Defines the sensor options. The unit of measurement relative to temperature and frequency range are only available when a contact probe is attached to the equipment.
  - '**`CLOCK/DATE`**': adjust time and date of the internal real time clock.
  - '**`CONTRAST`**': set the LCD display's contrast.
  - '**`BACK LIGHT`**': defines the displays backlighting timer.
  - '**`AUTO PWR DWN`**': defines the auto power down timer.

- '**ISO/IMPERIAL**': defines the type of measurement system.

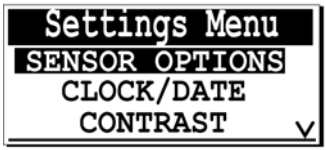
- '**SYSTEM INFO**': display's complementary equipment information on the display: serial number, software version, serial number, type of battery, number of times the battery has been recharged.

5. Settings Menu

This menu allows the configuration setting of the detector, such as date and internal clock, contrast of the display, duration of the backlighting, delay of the auto power down, etc.

5.1 ACCESS TO THE FUNCTION

Select the **`Settings`** line from the **`Main menu`**. The menu is displayed as per the figure.



The "Settings" menu. *220*

5.2 THE ENTRIES OF THE *SETTINGS* MENU

The sub-menus are as follows:

- Sensor options (only displayed when an external sensor is connected).
- Clock/Date.
- Contrast.
- Back light.
- Auto power down.
- Iso/Imperial.

They are displayed, by using the ↑ or ↓ keys. Each of them, entered by pressing the key ↵, is fully described below.

5.3 SENSOR OPTIONS

This function is displayed or not, according to the type of sensor connected. The sensors allowing a configuration through the **`Sensor options`** menu are:

- Internal ultrasonic sensor.
- External sensors :
  - Flexible sensor (dBµV).
  - Ultrasonic parabolic sensor (dBµV).
  - Contact probe (dBµV).
  - Sound level meter (dBA).
  - Non-contact infrared temperature sensor (°C, °F, °K, °R).
  - Thermocouple interface (°C, °F, °K, °R).

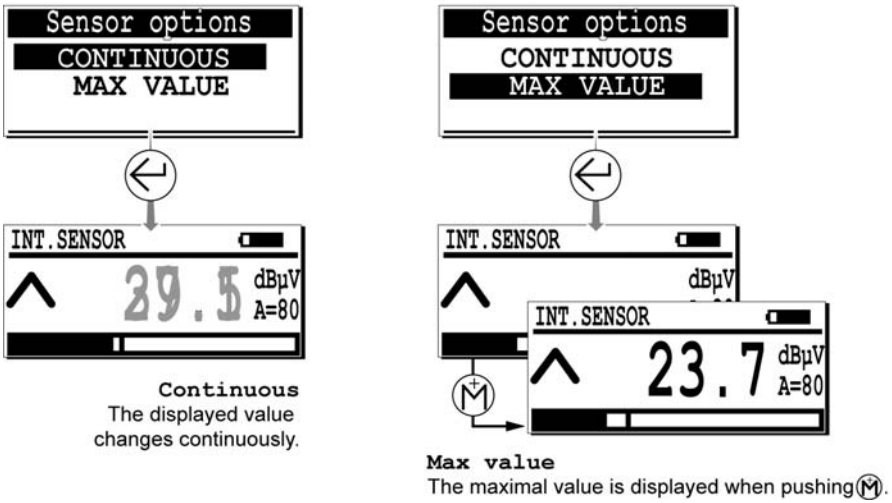
As far as the use of these sensors is concerned, please refer to the part *Sensors and options*.

5.3.1 Internal and all other airborne US sensors

The screen displays:

- **`Continuous`** : the bar graph and the display show a measure which varies continuously, according to the signal measured.
- **`Max value`** : the bar graph shows the instant level which varies continuously but the display shows the measure only when the  is depressed. If necessary, the maximal measurement can be stored. Only the **`Max value`** mode ***must*** always be selected for a hatch cover tightness survey.

The next picture shows the influence of **`Continuous`** or **`Max value`** choice.



Influence on the display when using "Continuous" or "Max value". 227

5.3.2 Contact probe

This application is only activated and accessible when the contact probe is connected and recognized by the unit. The user can select one out of three operating modes, depending on the application:

- **SLOW MEC** : Slow mechanical movements (most sensitive).
- **MEC** : Normal mechanical movements.
- **US** : Fast mechanical movements.

Example of screen when selecting the measuring frequency band for the contact probe. 228

5.3.3 Sound level meter (dBA)

The following menu is displayed.

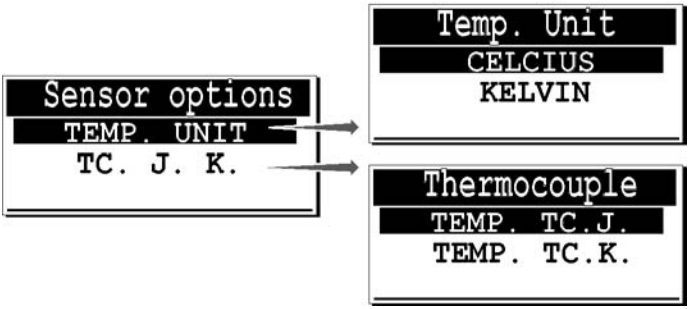
The Sensor options menu with a sound level meter. 048

The selection acts as follows:

- **Slow**: slow reaction to sound peaks.
- **Fast**: fast reaction to sound peaks.

5.3.4 Thermometer (infrared or thermocouple)

The following menu is displayed.



The Sensor options menu with interface pyrometer. 025

- **Temp. Unit**: defines the scale used for temperature measurement.

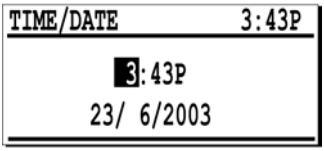
  This selection is done in combination with the ISO/Imperial selection, see paragraph 5.8.

  - **CELCIUS** or **KELVIN**: in the ISO/METRIC system, one of both scales can be used.
  - **FAHRENHEIT** or **RANKINE**: in the English Imperial system, one of both scales can be used.

- **`TC J. K`**: this function defines the type of temperature probe used for temperature measurement.
  - **`TEMP. TC. J.`**: -40 °C to +750°C.
  - **`TEMP. TC.K`**: -40°C to +1500 °C.

5.4 CLOCK/DATE

This sets the internal clock (date and time). Regularly check that set date and time are correct, particularly if you travel from one time zone to another or when you switch to either summer or winter time. The display is as follows:



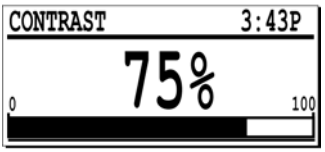
Display showing the set time and date of the Sherlog internal clock. *221*

The active keys are:

Key	Function
	Returns to the `Settings` Menu, without taking into account eventual changes.
	Increments the inverted field. Hold key for auto increment.
	Decrements the inverted field. Hold key for auto decrement.
	Moves the cursor to the next field to be modified.
	Enters, validates set values and returns to the `Settings` menu.

5.5 CONTRAST

This function modifies the screen displays contrast ratio. The display will show a screen similar to the one below:



Screen example when changing the displays contrast ratio. *222*

A contrast ratio of 75 % is ideal in normal conditions

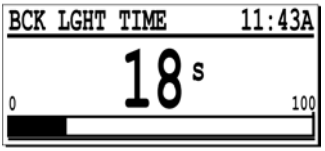
The active keys are:

Key	Function
	Returns to the `Settings` menu, without taking into account eventual changes.
	Increases the contrast ratio. Hold key for auto increment.
	Decreases the contrast ratio. Hold key for auto decrement.
	Enters, validates the adjusted contrast ratio, and returns to the `Settings` menu.

5.6 BACKLIGHT

This function adjusts the time before the instrument switches off the backlight. It is an energy saver for the battery.

The range of the timer is adjustable between 1 and 100 seconds.



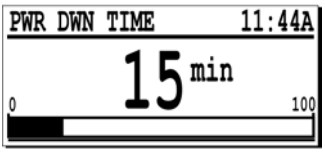
Example of a setting of the backlight timer. *223*

The active keys are:

Key	Function
	Returns to the **Settings** menu, without taking into account eventual changes.
	Increases the backlighting timer. Hold key for auto increment.
	Decreases the backlighting timer. Hold key for auto decrement.
	Enters, validates the adjusted backlighting timer's value, and returns to the **Settings** menu.

5.7 AUTO PWR DWN

This function sets the time for the instrument to switch off power automatically to save the battery power. This function is activated when the instrument is not in use and that no key is hit during the pre-programmed time. The timer is adjustable between 1 and 100 minutes.



Example of a setting of the auto power down timer. *224*

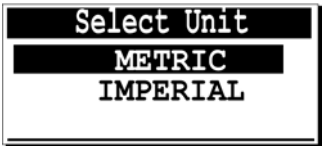
The active keys are:

Key	Function
	Returns to the **Settings** menu, without taking into account eventual changes.
	Increases the auto power down timer. Hold key for auto increment.
	Decreases the auto power down timer. Hold key for auto decrement.
	Enters, validates the adjusted auto power down timer's value, and returns to the **Settings** menu.

5.8 ISO/IMPERIAL…

Defines the unit system that is used for the measurements:

- **METRIC**: the measurements will be displayed in the ISO (METRIC) system. The mass flow sensor will read in SCCM (Standard Cubic Centimetre per Minute). Temperatures will read in degrees Celsius or in degrees Kelvin depending on the setting.
- **IMPERIAL**: the measurements will display the English imperial measurement system. The mass flow sensor will read in SCFM (Standard Cubic Foot Minute). Temperature will read in degrees Fahrenheit or in degrees Rankine depending upon the setting.



Screen to select the measurement unit system. 225

The active keys are:

Key	Function
	Returns to the **Settings** menu, without taking into account eventual changes.
	Moves up the inverted measurement system selector.
	Moves down the inverted measurement system selector.
	Enters, validates the measurement system, and returns to the **Settings** menu.

6. *System Info* Menu

This function gives information about the instrument in a sequence of four consecutive screens.

6.1 ACCESS TO THE FUNCTION

Select the **`System info`** line from the **`Main menu`**.

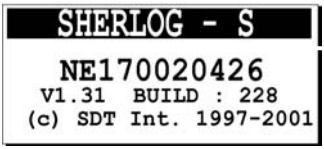
The "System info" menu. *251s*

6.2 THE SCREENS

6.2.1 Screen 1/5

It consists of information relative to the:

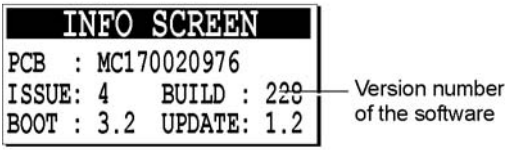
- Type of equipment. (**S**: Standard, **TA**: Type approved).
- Serial number of the *Sherlog* detector.
- Software version of the instrument.
- Copyright message.



The first screen 1/5. *234S*

6.2.2 Screen 2/5 (electronic information)

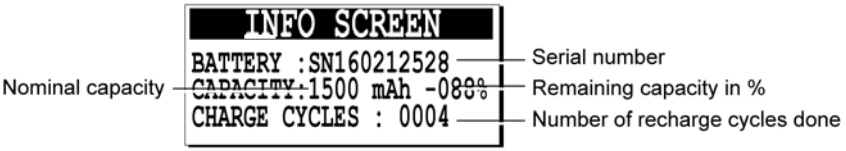
Starting from the previous display, press the ↵ key. The display shows information relative to the internal electronics and system software. This information is only useful to a service engineer for detailed identification.



Example of the complementary information of the screen 2/5. 235

6.2.3 Screen 3/5 (battery information)

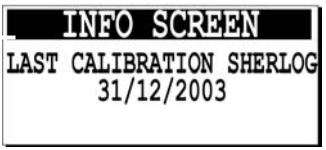
From the previous display, press the ↵ key. The display shows information relative to the serial number, the type of battery, the amount of capacity left in the battery pack, as well as the number of battery recharge cycles done.



Example of the complementary information of the screen 3/5. 236

6.2.4 Screen 4/5 (last calibration date)

From the previous display, press the ↵ key. The display shows the last calibration date (format DD/MM/YYYY). Press again to return to the basic screen.



Example of the complementary information of the screen 4/5. 237

6.2.5 Screen 5/5 (connected sensor)

Starting from the previous display, press the ↵ key. The display shows the type of the connected sensor, as well as its serial number.

Example of the complementary information of the screen 5/5. *027E*

After this fifth screen, the measurement screen is displayed.

For all the screens, the active keys are ⇆ or ↵.

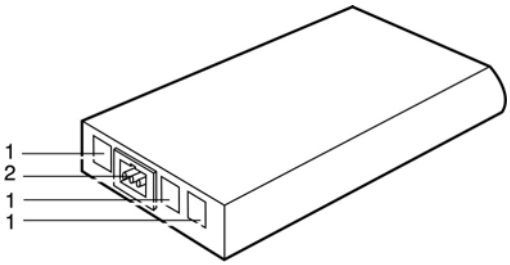
7. The battery pack and the charger

7.1 THE BATTERY PACK

The battery packs are charged in the factory for test purpose, but are discharged before being dispatched, because of international air transport regulations. At reception, the battery packs should be reloaded during at least five hours. Optimal functioning will be obtained after several (3 minimum) full reloads.

7.1.1 General

The battery pack is represented as follows.



1. Battery contact pads. Do not short circuit.
2. Battery charger connector.

Contacts and connector of the battery pack. *052*

7.1.2 Recommendations

- Never short-circuit the contact pads, nor use with inverted polarity, nor incinerate or disassemble the battery pack or the battery cells. The components used in the battery are corrosive and may be dangerous for skin and eyes. In case of any harm, contact a doctor as soon as possible.
- Always drain the battery before recharging to maximize the number of cycles, charge the battery pack completely and store the battery pack charged in a cool dry place.
- After a long period without use, it is advised to charge/discharge again the battery 3 times to regain optimal battery capacity.
- Contains NiMH type batteries (Nickel Metal Hydrate, operating voltage 7.2 V). Short circuit of the battery pack's connections can be dangerous.

- Must not be thrown into a flame or fire.
- Must be protected from any mechanical shock that can lead to a rupture of the battery pack's outer casing that can compromise the life of the batteries.
- Must be recharged when not used for more than 3 weeks.

7.2 THE BATTERY CHARGER

Do not recharge the battery on board of a ship (240 / 60 Hz) if your battery charger is a 110 V AC / 60 Hz model (North America mainly).

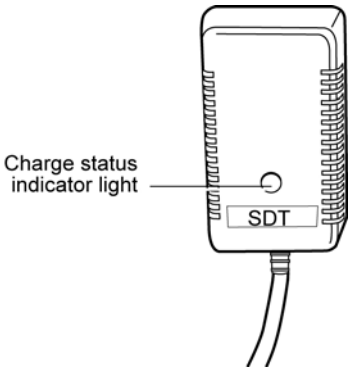
7.2.1 General

The mains supply voltage depends on the model used (110 or 220 VAC). The output voltage of the battery charger can be either 7.2V or 9V depending on its operating mode (charger connected directly to the battery pack, or charger connected to the *Sherlog S*, the unit being switched on or off). The maximum output current is about 500 mA.

The charger **must be unplugged** from the mains before recharging a new battery, in order to reset the charger internal timer.

While charging the battery pack the following criteria are permanently monitored:

1. The battery cannot be overcharged
2. End of battery charging cycle detection by means of the ΔU method.
3. End of the battery charging cycle detection by means of excessive change in the battery pack's temperature.
4. Detection of temperature overload.
5. End of charging cycle by means of timeout timer.



View of the battery charger and its charge status indicator light. 050

7.2.2 The status indicator light

When the battery charger is connected to the power supply, it informs the user of its charging status by means of the status light, as follows:

Status of the light	Meaning
No light	Battery charged.
Green / Fix	Slow charging mode (12 to 14 hours). Power supply to the *Sherlog S* unit.
Green / Flashing	Fast charging (5 to 6 hours), only with direct connection to the battery pack.
Red / Fix	Problem with charging.

7.2.3 Recommendations

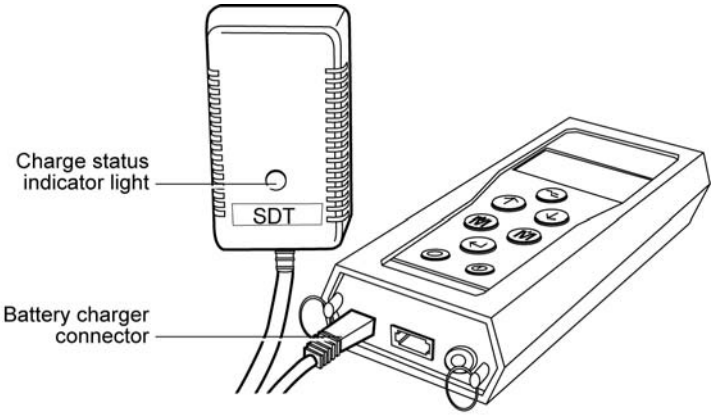
- Contains no user serviceable parts and must not be opened by the user.
- Must not be subjected to water or used in humid environments.
- Always keep and use the battery charger in a dry indoor place.
- Never short-circuit the pins of the charger connector, nor use a battery charger to charge the battery pack, other than the one supplied with your kit.
- The charging of the battery pack must always be done in a cool place, for example, room temperature (out of the sun or away from any heating system).

7.3 RECHARGING THE BATTERY PACK

7.3.1 Recharging the battery in the instrument

The battery pack can be charged while still in the unit. Charging will be done transparently to the operation of the unit. The advantage is the possibility to charge the battery pack while the unit is in use. The disadvantage is that the charging time is longer when the equipment is switched on (due to power consumption restrictions of the charger).

Never use this method (charger connected to the mains and detector) in a hazardous area.



The connection of the charger to the unit. 052

Operation

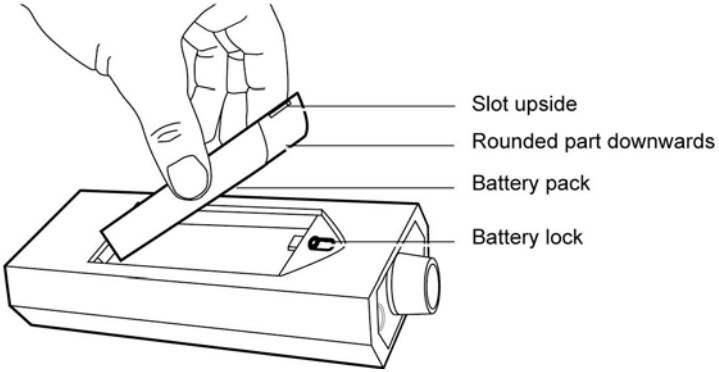
1. **Unplug the charger from the mains before recharging a new battery, in order to reset the internal timer.**
2. **Connect the charger connector to the unit and plug the charger into the mains power socket.**
   The charging will be done in about 5 to 6 hours when the unit is switched off, or 12 to 14 hours when the equipment is in use.
3. **The charging is completed when the charger light goes out.**

7.3.2 Recharging the battery removed from the instrument

The battery pack can always be charged in fast mode, which is the ideal solution. The *Sherlog* can be used with a spare battery (optional) while charging the empty one.

Operation

1. **Remove the battery pack at the back of the instrument.**
   Maintain the battery lock in upward position. Place your hand under the battery pack and gently tap the instrument against your hand. The battery pack will then release easily.

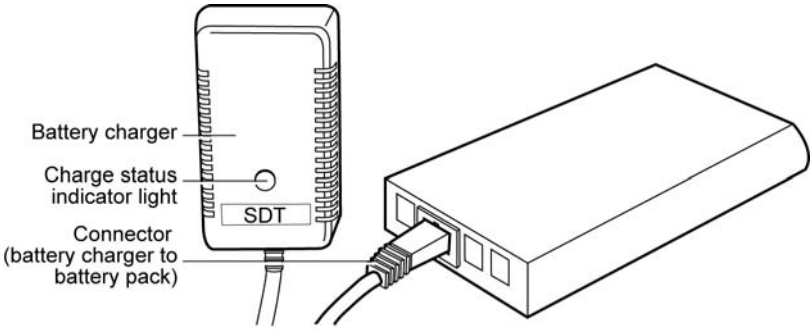


Removing of the battery. *053*

2. **Connect battery charger onto the battery pack connector.**

3. **Plug the battery charger in the mains socket.**
   The charging cycle will take about 5 to 6 hours. Charging is completed when the charger light goes out. Please refer to paragraph 7.2.2 *The status indicator light* for more information on the status light of the battery charger.

4. **Once charging is completed, replace the battery pack in the Sherlog.**



Connection of the battery charger onto the battery pack. *054*

8. Troubleshooting

8.1 MESSAGES ON THE LCD DISPLAY

8.1.1 Battery charge too low

When this message flashes on the screen, immediately change the battery pack and/or recharge the empty pack as previously indicated.

The battery packs are charged in the factory for test purpose but the battery pack is discharged before being dispatched, because of international air transport regulations. At reception, the battery packs should be reloaded during at least five hours. Optimal functioning will be obtained after several (3 minimum) full reloads.

A battery will not be charged if the charger is not unplugged **from the mains** between two charges preventing the internal timer to reset.

It is advisable to reload a battery that remained unused for more than 3 weeks.

8.1.2 Other messages

These appear when a serious internal error occurs. In most cases this is due by an electronic failure of the unit. The user must return the equipment to the distributor for repair. There are no internal parts on the *Sherlog S*, that are serviceable by the end user. Only qualified technicians should attempt repairs.

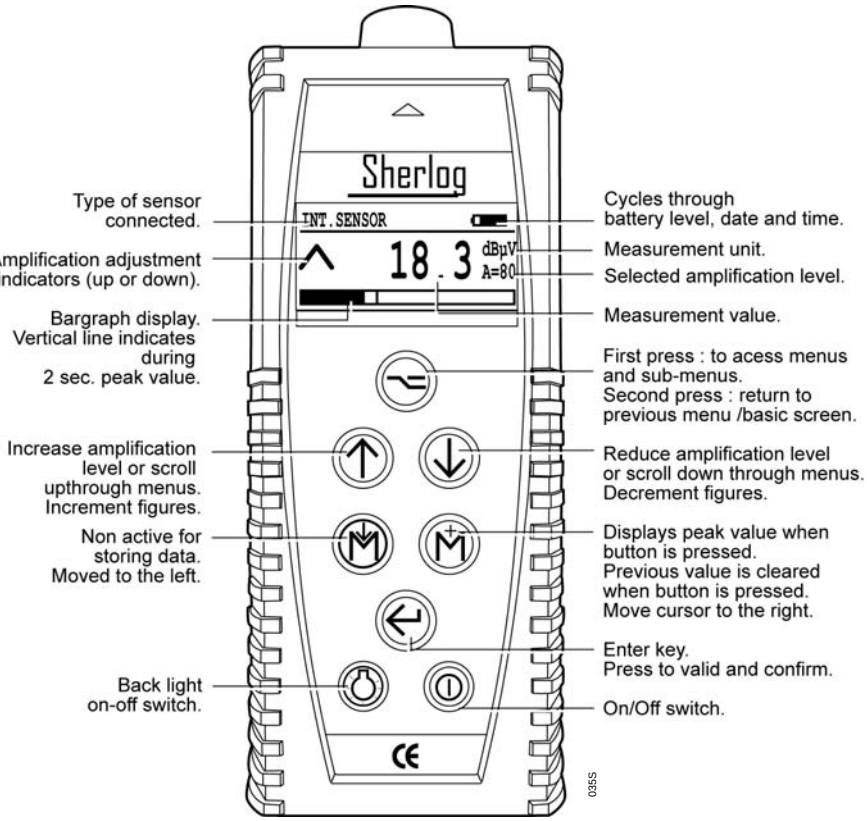
8.2 ULTRASONIC SENSOR

The ultrasonic internal or external sensor may be defective following:

- In case of mechanical shock, return the equipment to your distributor for replacement of the sensor;
- In case of water ingress inside the sensor, leave it to dry and check and start again.
- In case of ingress of dust, small debris or grease, gently try to remove it with a clean dry cloth or a pencil.

In all cases the reception of ultrasonic signals will be either interrupted or significantly impaired.

9. *Sherlog S* quick reference guide



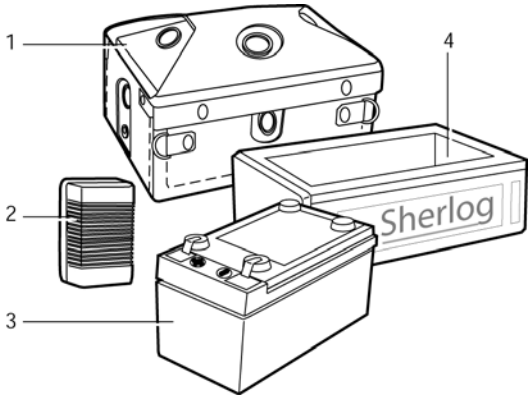
The *SDT 8 Sherlog* multi-transmitter

10. Description

This section is directed to anyone who needs to use an ultrasonic transmitter for tightness inspections (e.g. hatch covers, water tight doors, ramp covers, windows, bulkheads, etc). The *SDT 8 Sherlog* multi-transmitter is to be operated in combination with the *Sherlog* detector. This section contains information on how to operate the equipment, possible faults and characteristics.

10.1 PACKAGE

The *SDT 8 Sherlog* multi-transmitter and its related components:

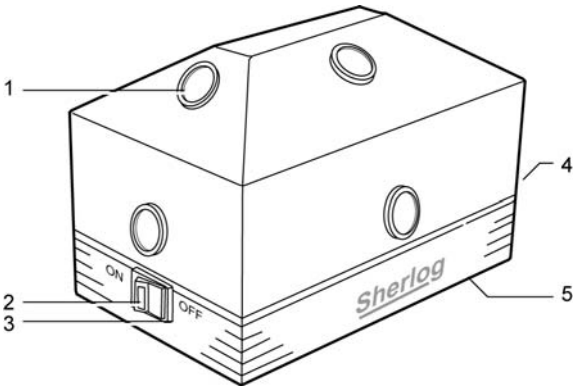


1. Multi-transmitter, a leather bag and a shoulder strap.
2. 220 V - 0.3 Ah charger.
3. One sealed lead-acid gel 12V - 1.2 Ah battery.
4. Adapter for battery charging (optional) and screwdriver (not shown).

The multi-transmitter with its main dedicated components 101

10.2 PRESENTATION

The box-shaped multi -transmitter (160 x 100 x 95 mm) is operated with a sealed lead-acid gel battery and weights 1500 grams. The instrument can be used in temperatures ranging from -20 C to +50 °C.



1. Ultrasonic transducer.
2. Red light on/off indicator.
3. ON-OFF switch.
4. On-Off switch.
5. Battery (underneath at the bottom).

General view of the multi-transmitter. *612*

The ultrasonic transducers

Eight transducers (1) are laid out in the equipment in such a way that they transmit in the volume of a hemisphere. Each ultrasonic transducer has a power of 125 mW and is frequency and power stabilized. The ultrasonic transmission frequency is 39.2 and 39.6 kHz (bi-sonic mode).

The red light indicator

A red light indicator (2), integrated in the On/Off switch, shows whether the equipment is switched on as well as whether the battery is still charged. Refer to Chapter 12 *Recharging the multi-transmitter battery pack* for further information.

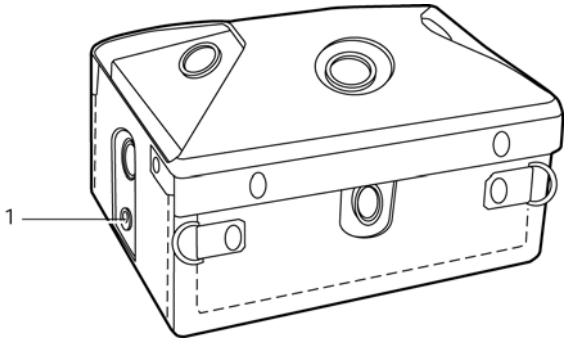
The on-off switch

Located at the base, this switch (3) enables the equipment to be switched on (ON position) or off (OFF position).

The charge connector

Marked LOAD, the charge connector enables to re-load the internal battery without removing it. Overcharging is not possible when used with the SDT charger provided.

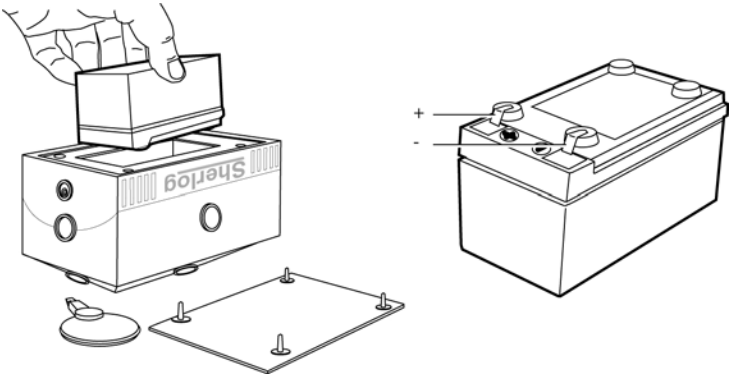
Do not recharge the battery on board of a ship (240 / 60 Hz) if your battery charger is a 110 V AC / 60 Hz model (North America mainly).



The charge connector is located on the side of the multi-transmitter. *103*

The battery

The sealed lead-acid gel type battery is accessible after having removed the bottom protection plate. The rated voltage is 12V and its capacity is 1.2Ah at 20 °C; the autonomy is 2.5 a 3.5 hour for a full charge. The position of the battery in its compartment is of no importance for polarity sake.

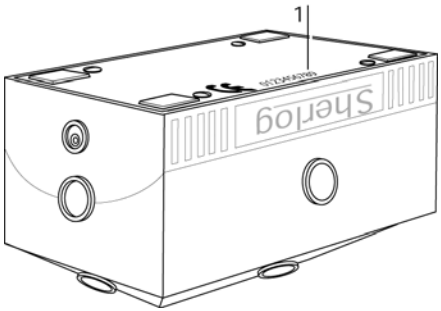


The battery is accessible from the bottom and the obligatory arrangement of the battery. 104

Warning: if a battery of a different brand than the one provided by SDT is used, it is essential to respect the polarity arrangement of the terminals as shown in the diagram above. Failing to do so can cause serious damage and impair the good functioning of the multi-transmitter**.**

The multi-transmitter serial number

It is located at the bottom, on the removable plate.



Localisation of the serial number of the multi-transmitter. 106

11. Using the multi-transmitter

11.1 RECOMMENDATIONS

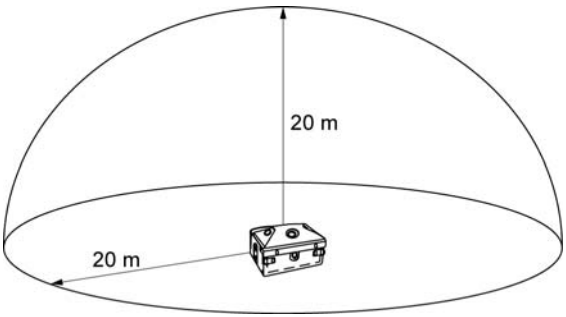
The multi-transmitter must be used:

- In combination with a *Sherlog* detector;
- Outside any classified zone requiring intrinsic and fireproof safety.
- Away from discharge of water and must never be immersed. It is important to prevent any foreign bodies entering the ultrasonic transducers, such as grease, dust, etc.
- Within hygrometric and temperature limits stipulated in the technical characteristics.

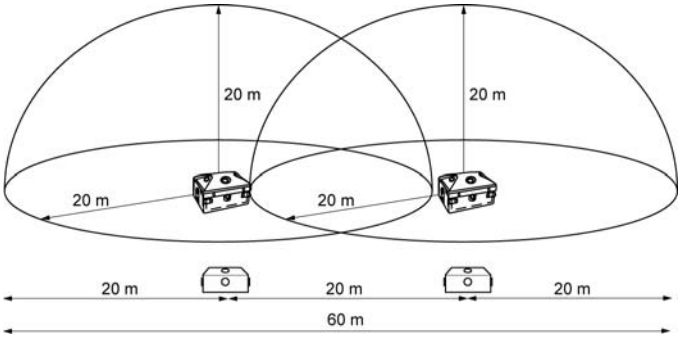
11.2 WORKING POSITION

When preparing for testing the tightness of hatch covers and determining the OHV (Open Hatch Value), the multi-transmitter should be placed, ideally, in the centre of the tanktop.

The multi-transmitter covers an operational spherical volume of 20 meters (60 ft) around its position. For larger volumes, the multi-transmitter should be moved several times; it is then requested to carry out a new OHV (Open Hatch Value) measurement after each moving.

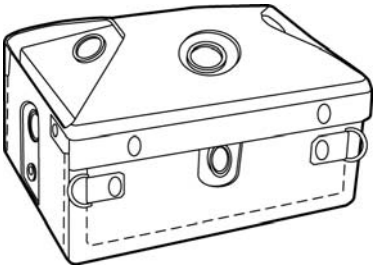


The volume covered by one multi-transmitter. 111



The zone covered by the multi-transmitter when set to various points. 112

If the hold is not empty, the multi-transmitter can be placed on top of the cargo.

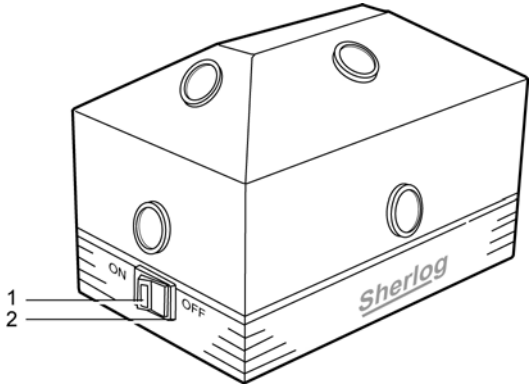


The correct position of the multi-transmitter. 114

11.3 POWERING ON

Note: The battery packs are charged in our factory for test purpose but the battery packs are discharged before being dispatched, because of international air transport legislation. At reception, the battery packs should so be charged.

This is done by pushing the switch to the ON position (1). The operating light (2) should be lit. If this is not the case then refer to *Chapter 13 The multi-transmitter operational problems*.



The on-off switch (1) and battery control indicator (2). *613*

11.4 MEASUREMENTS

The 8 transducers of the multi-transmitter work in bi-sonic mode on frequencies stabilized at 39.2 and 39.6 kHz, with total transmission power also stabilized at 8 x 125 mW. The measurements will be carried out by the *Sherlog* detector (see *Chapters 14 and 17* for the use of the equipment).

11.5 POWERING OFF

Set the switch to the Off position (1). The operating light should switch off.

12. Charging the multi-transmitter battery pack

Do not recharge the battery on board of a ship (240 / 60 Hz) **if your battery charger is a 110 V AC / 60 Hz model (North America mainly).**

12.1 RECHARGING THE BATTERY

The battery packs are charged in our factory for test purpose but the battery packs are discharged before being dispatched, because of international air transport regulations. At reception, the battery packs should be recharged.

12.1.1 Recommendations

The battery is a sealed lead-acid gel battery. Therefore:

- Short circuit of the contacts is dangerous.
- The battery must not be discarded onto a flame.
- Recharging in a sealed box is prohibited (gas leaks).
- All mechanical shocks able to break the box may adversely affect the life of the battery.
- In the case of electrolyte coming into contact with the skin, rinse the contaminated area immediately with water.
- **Recharge an unused battery pack every three (3) weeks.**

12.1.2 Generalities on charging

Charging will be carried out:

- Either to maintain the charge of the battery. A continuous charge is not harmful to the life of the battery, as long as the charger provided with the multi-transmitter is used.
- Or after the flashing of the indicator of the battery.

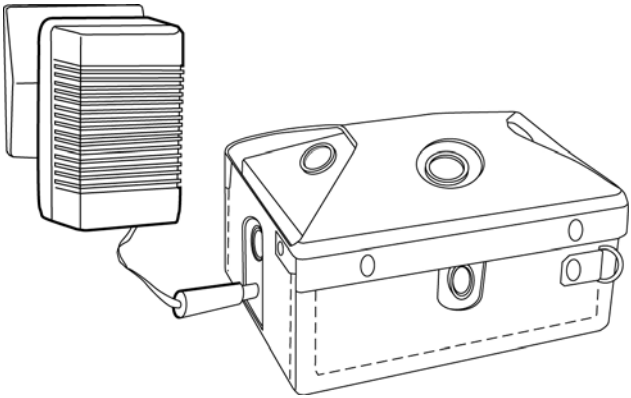
The following table details the state of battery charge in relation to the information provided by the indicator:

Indicator light	Equipment
On	Equipment switched on. Battery charge correct.
Flashing	Equipment switched on. Battery charge incorrect. The speed of the flashing increases as the charge decreases.
Off	Equipment switched off or, with switch in ON position, indicates insufficient charge.

12.1.3 Without removing the battery

Proceed as follows:

- Before every recharging operation, unplug the battery charger from the mains and replug it, in order to reset the internal timer.
- Connect the plug to the socket marked LOAD on the multi-transmitter.
- Connect the charger to the mains.
- Leave it on charge for 6 hours for a completely flat battery. There is no maximum charge indicator.

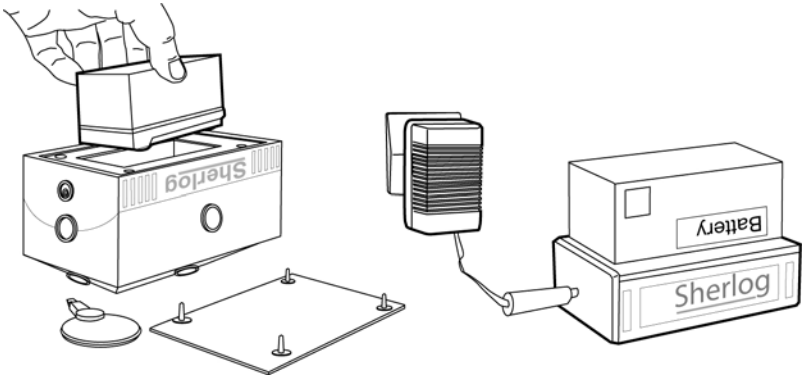


Recharging a battery without removing it. 108

12.1.4 When removing the battery

If you have a spare battery and its battery adapter (optional in the Sherlog S kit) proceed as follows:

- Remove the lid at the base of the multi-transmitter by means of the screwdriver provided and remove the battery.
- Before every recharging operation, unplug the battery charger from the mains and replug it, in order to reset the internal timer.
- Connect the charger to the mains.
- Connect the plug to the battery's support socket.
- Place the battery in the support, contacts inside. There is no preferential direction for the battery.
- Leave the battery on charge for 6 hours for a completely flat battery. There is no indicator for a maximum charge.
- Batteries should be discharged from time to time to avoid build-up effect.



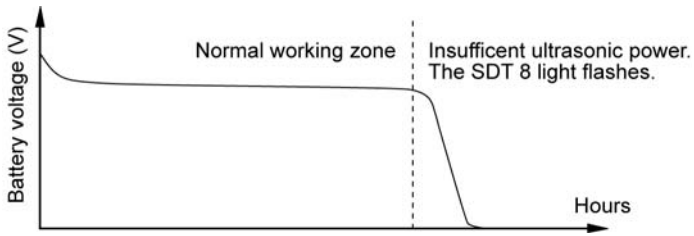
Removing the battery and connecting to the charger. 109

13. The multi-transmitter operational problems

13.1 ULTRASONIC TRANSDUCER

13.1.1 Decreasing ultrasonic signal

The main reason, when an unstable signal is red on the *Sherlog S*, is that the battery is not fully charged. Although the discharge curve of the battery is constant on a long period, the voltage decrease suddenly when the initial charge is too low, occurring an unstable signal.



The battery voltage decrease suddenly, giving that way an decreasing ultrasonic signal. 115

13.1.2 Low but constant level ultrasonic signal

If the signal measured from a transducer during the functionality test is significantly lower than 85 dBµV and however remains constant, this indicates that the functioning of the transducer is impaired by some clogging . In this case, clean the transducer(s).

13.1.3 Defective transducers

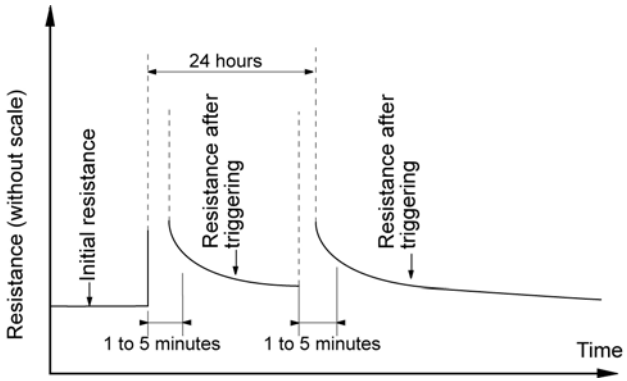
One or more sensors may be defective following:

- A mechanical shock: return the equipment to your distributor for a change of one or more transducers.
- Water in the transducers: leave to dry and check that there is no water left, etc.
- Dust, debris and grease.
- In both cases the transmission power is significantly limited or even non-existent, as the receiver will confirm.

Note: But for large volumes, the failure of one or two transducers will not prevent a correct tightness test. The remaining total output will be sufficient in most cases.

13.2 CONTROL FUSE

Despite an apparently correctly charged battery, the transmitter, in good working order, does not produce any ultrasonic signal. This failure may be due to the triggering of a chemical control fuse located in the internal electronics as well as in the battery support unit. *Contrary to a standard type, such a fuse contains a progressive reset time corresponding to the following curve.*



Automatic reset curve of the chemical fuse. 110

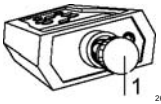
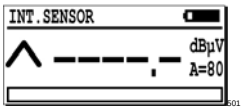
Never replace the chemical fuse with a different type. Successive occurrences of triggering are caused by a failure in the equipment. It is therefore advisable to return the equipment to the distributor for repairs.

Using the *SDT Sherlog S* for ultrasonic and non-ultrasonic applications

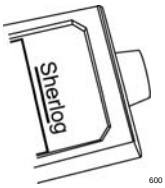
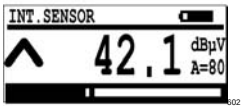
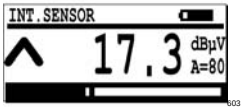
14. Operating procedure

This chapter describes how to use the Sherlog detector for the ultrasonic and non ultrasonic applications.

14.1 PREPARING THE DETECTOR

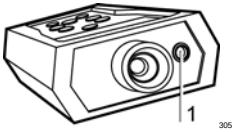
Step	Screen	Key	Action
1			Unscrew the protective cap (rep. 1) on top of the nozzle of the *Sherlog* detector.
2		⏻	Switch on the *Sherlog* detector
3			The basic screen is displayed.

14.2 TAKING A MEASUREMENT

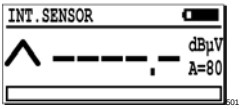
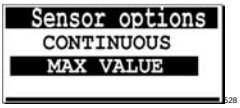
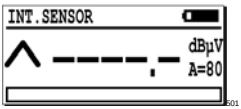
Step	Screen	Key	Action
1			Direct the sensor towards the point or area to be controlled.
2		M	To visualize the signal level, depress the key M. When the M key is released, the *Sherlog* stops measuring. The display shows the highest value recorded while the key was pressed.
		M	To make a new measurement and erase the previous maximum value, just press the key again. If needed, store the measured value. Refer to next paragraph.

14.3 USING ULTRASONIC SENSORS

14.3.1 Connecting an external sensor

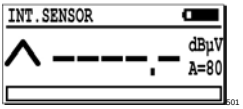
Step	Screen	Key	Action
1			Connect the external sensor on to the connector (rep. 1). For the displays, refer to chapters 19 and 22. The following paragraphs only refer to the use of the internal sensor.

14.3.2 Selecting the *Continuous* or *Max value* function

Step	Screen	Key	Action
1			Switch on the *Sherlog* detector.
2			The basic screen is displayed.
3			Depress this key to display the **`Main menu`**.
4			With the arrows key, select **`Sensor options`** and validate with the return key.
5			Select **`Max value`** or **`Continuous`** and validate with the return key : - **`Continuous`** : the bar graph and the display show a measure which varies continuously, according to the signal measured. - **`Max value`** : the bar graph shows the instant level which varies continuously but the display shows the measure only when the  is depressed. If necessary, the maximal measurement can be stored.
6			The basic screen is displayed.

14.3.3 Selecting the amplification level

Proceed as follows:

Step	Screen	Key	Action
1			Check the arrows to optimize the amplification level and use these two these buttons to modify the value **A** at the bottom of the screen. - When the *Sherlog S* receives ultrasonic sounds from a source, set the appropriate amplification (up and down arrows disappear from the screen) - When no ultrasonic signal is present, set the amplification to **A = 80**.

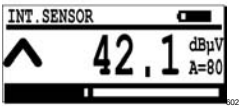
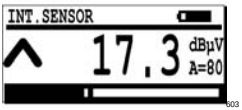
14.3.4 Measuring with the *Continuous* function

Proceed as follows:

Step	Screen	Key	Action
1			Direct the sensor towards the point or area to be controlled.
2			Read the signal level on the display. The signal changes continuously. Measurement is to be performed while listening with the headphones.

14.3.5 Measuring with the *Max value* function

Proceed as follows:

Step	Screen	Key	Action
1			Direct the sensor towards the point or area to be controlled.
2			To visualize the signal level depress: The maximum (peak value) is displayed for as long as the key is pressed. When the  key is released, the *Sherlog* stops measuring. The display shows the highest value recorded while the key was pressed.
			To make a new measurement and erase the previous maximum value, just press the key again.

14.4 USING NON ULTRASONIC SENSORS

Please refer to *Chapter 22* for the detail relating to each sensor used.

14.5 SWITCHING OFF THE EQUIPMENT

Step	Screen	Key	Action
1			Press to switch off the *Sherlog* detector. The instrument will also automatically switch off after a pre-programmed period. This auto power down timer can be adjusted in the 'Auto power off' menu.

Using the *SDT Sherlog S* for an ultrasonic hatch cover tigthness procedure

Complies with the DNV Approval Program n°403,
survey procedure approved by IACS in July 1997

15. Main questions and answers relating to ultrasonic tests

15.1 WHAT IS AN ULTRASONIC TEST ?

An ultrasonic test is aimed at detecting a source of ultrasounds generated either naturally (e.g. air compressed leaks) or by means of an ultrasonic transmitter. It indicates with pin-point accuracy the area of leak (gas or liquid).

15.2 FOR THAT PURPOSE ?

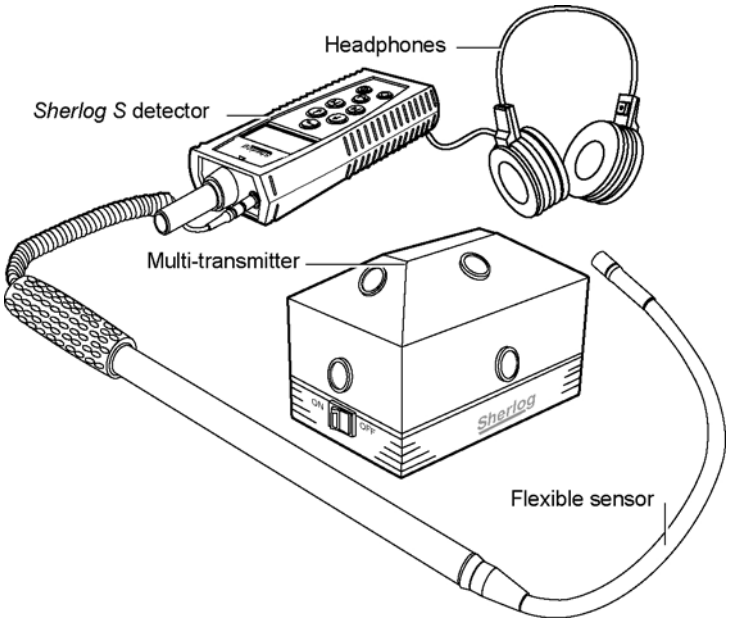
Ultrasonic tests allow tightness testing of hatch covers, Ro-Ro bow, stern and inner doors, ramps and ramp covers, water tight doors, bulkheads, windows, tanks, pipes, air compressed systems, etc.

15.3 WHAT EQUIPEMENT TO USE ?

The tests are carried out by means of a transmitter (the *Sherlog* Multi-transmitter) that emits ultrasonic waves. In case of leaks, the ultrasounds will pass trough the openings and be detected by a receiver (the *Sherlog* detector). In many case the use of an external flexible sensor will allow to access remote places to inspect.

For statutory and Class hatch cover surveys, a Typed approved equipment is required as the *Sherlog TA*.

The ultrasonic tightness tests are to be carried out by trained, skilled and certified operators.



The complete testing equipment: detector, flexible sensor, multi-transmitter, headphones. 266

16. Some reminders

16.1 DEALING WITH THE SHIP'S STAF

16.1.1 Importance of explaining your mission

- Advise the Master about the purpose for your visit and who appointed you.
- Explain the ultrasonic test method.
- Inform the Master that you are a qualified operator (Certificate of Qualification).
- Invite the Master to witness the test.

16.1.2 During the test

- Be flexible and patient.
- Comment both on good and bad items.
- Advise the Master about the exact position of leaks to allow crew to carry out appropriate corrective action.

16.2 PREPARING FOR SURVEY

16.2.1 Importance of planning

- Time is money.
- Good organization and proper planning will reduce costly idle time, allow optimal use of time available for survey and reinforce the professional perception.

16.2.2 Items to consider when planning a survey

- Loading and discharge operation, size, number of holds and duration of tests.
- Type of ship, number and type of hatches to be tested.
- Time of survey: day, night, during cargo operation (noise level), fatigue (crew, operator).

- Place of survey (alongside, at anchorage - heavy rolling - shipyard (background noises), etc.
- Persons to be advised of the operator's survey (agents, ship's staff, other surveyors, etc.).
- Equipment required for test (1 or 2 transmitters, a flexible extension, a dual plug for headphones, spare batteries, operator certificates, calibration certificate, performance record, camera, chalk, marker, flashlight, yardstick).
- Review of hatch cover history, if records and details are available.
- Hatch cover checklist (for hatch type).
- Test report (draft form).
- Deficiency list (draft form).
- Consulting hatch patentees if necessary, when unfamiliar with type of hatch covers to be inspected.

16.3 USING ULTRASONIC TESTING MATERIAL

16.3.1 Checks prior to testing

- Ship's draft (hog, sag).
- Ship empty or loaded.
- High or low density cargo on board (deflection of coamings possible with high density cargoes).

16.3.2 Perusal of hatch patentee manual

- Manual should be on board.
- Check details and specific features of the hatch covers to be tested.

16.3.3 Functional testing of the equipment

- Prior to commencement and after test (see paragraph 17.1).
- Signal output of each transducer must be checked (about 90 dB), as well as the *Sherlog S* internal sensor, the external flexible sensors and the headphones.

16.3.4 Open hatch value (OHV)

- Place the transmitter down on the tanktop, possibly in central position or on top of cargo.

Some reminders

- The ultrasonic signal measured with open hatch covers, around the hatch coaming is usually around 40-45 dBµV and is called the OHV (Open Hatch Value).
- If the hatch cover is already closed, measure the OHV in way of access/booby hatch. The measured OHV will probably be less than the OHV measured with an open hatch.
- If the volume is too important (very deep holds) or the hold is very long (more than 25 m) refer to the procedure indicated in paragraph 11.2 (Working position).
- Never forget to measure a new OHV every time you change the position of the multi-transmitter in the hold.

16.3.5 Ship's condition

- Leaks are the result from:
- Damages or deficiencies of the hatch covers and/or their sealing arrangements
- Ship's condition.
- About hatch covers, remember that they:
  - Are not parts of the ship's structure.
  - Are a ship's fitting and will not move in unison with the hatchway when it is distorted as a result from stresses.
- Conditions such as hogging, sagging, twisting might adversely affect the tightness status because they cause the structure to develop a deformation of the ship. This one cannot be compensated for by the resilience of the sealing arrangement anymore (e.g. contained feeder vessels that in empty condition and equipped with large/heavy pontoons).
- With high density cargoes, the hatch coaming tend to become slightly deformed up to such and extend that leakage might appear.

16.3.6 Resonance of the hatch plating

- Positive reading with the detector above the hatch top plating is the result from resonance of the hatch plating under the influence of the continuous bombing with ultrasounds and not the result of a leak.
- Resonance is generally not found on double skin type hatch cover.
- Resonance mainly occurs in locations just above the transmitter (shortest distance) and when the transmitter is positioned high up in the ship's hold.

16.3.7 Background noises

- Background noises might render detection of small leaks difficult or even impossible.
- Headphones should therefore always be used.
- Most common background noises likely to be experienced during testing are motor of hydraulic power packs for hatch covers or cranes, chipping, compressed air leaks, welding, rain, gale force winds, shore cranes, etc. If the adverse source cannot be eliminated or shielded away, the test might have to be temporarily interrupted.

16.3.8 Batteries

- Batteries should be properly charged.
- A spare battery is often useful.

16.3.9 Calibration of the equipment

- Check whether your calibration certificate is still valid. The *Sherlog* detector must be re-calibrated every **two years** as required by Class.

16.3.10 Maintenance of the equipment

- Accessories should be maintained as per manufacturer instructions.
- Special attention and care should be given to the flexible extension (check for presence of dirt on the sensor) and possible clogging on the transducers of the multi-transmitter (use gunny bag).

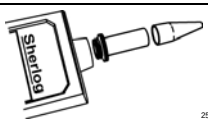
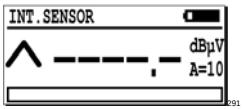
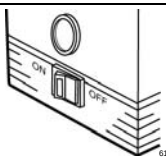
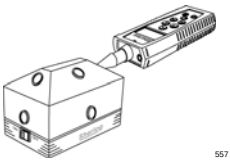
17. The Class required hatch cover ultrasonic tightness survey procedure

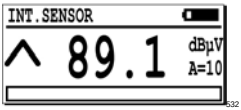
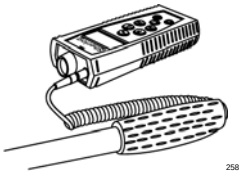
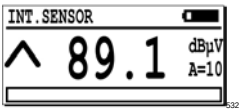
This chapter describes a complete survey procedure.

17.1 CARRYING OUT AN ON-SITE FUNCTIONAL TEST

It is mandatory to proceed to an on-site test in order to check the full functionalities of the measuring chain (multi-transmitter, detector, headphones and external sensor).

Proceed as follows:

Step	Screen	Key	Action
1			Unscrew the protective cap and connect the rubber tip on top of the nozzle of the *Sherlog* detector.
2			Switch on the *Sherlog* detector
3			On the *Sherlog* detector, set amplitude level at 10 (with the down arrow key). **This step is very important.**
4			Switch on the *Sherlog* multi-transmitter.
5			On the *Sherlog* multi-transmitter, place the rubber nozzle in right angle position respectively in the center of each of the eight transducers.

6			Measure individually the ultrasonic emitting output value of all the transducers by depressing the M+ key. The measured value should be around 90 dBµV (not lower than 85 dB).
7			Connect the flexible sensor to the *Sherlog* detector.
8			Bring the flexible sensor close to any of the eight transducers and measure the dBµV value, which should not be lower than 85 dBµV (depress the M+). If the signal is lower than 80 dBµV: • The transducer has a failure • Possible presence of dust, debris or grease in the transducer. • The battery is unloaded.

17.2 POSITIONING THE MULTI-TRANSMITTER

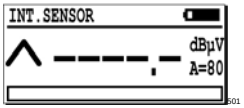
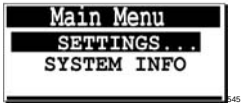
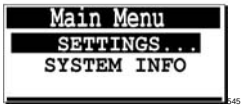
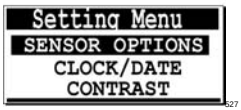
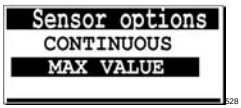
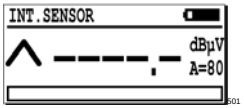
The multi-transmitter should be placed according to *paragraph 11.2*.

17.3 STARTING A SURVEY PROCEDURE

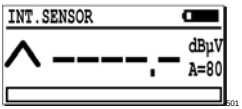
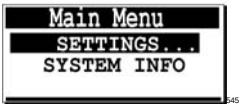
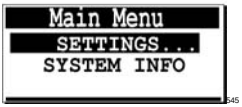
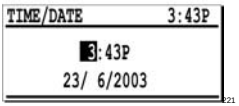
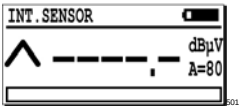
17.3.1 Checking the appropriate settings

See chapter 5.

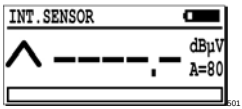
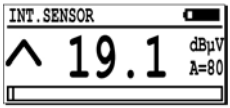
17.3.2 Choosing the *Max value* function

Step	Screen	Key	Action
1			Switch on the *Sherlog* detector
2			The basic screen is displayed.
3			Depress this key to display the **`Main menu`**.
4			With the arrows key, select **`Settings`** and validate with the return key.
5			With the arrows key, select **`Sensor options`** and validate with the return key.
6			Select **`Max value`** and validate with the return key.
7			The basic screen is displayed.

17.3.3 Checking the time and date

Step	Screen	Key	Action
1			Switch on the *Sherlog* detector.
2			The screen is displayed. Depress this key to display the **Main menu**.
3			Depress this key to display the **Main menu**.
4			With the arrows key, select **Settings** and validate with the return key.
5			With the arrows key, select **Clock/Date** and validate with the return key.
6			Check and/or set the date and time. A : 00H00 to 12H00 P : 12H00 to 24H00
			Increase the selected figure.
			Decrease the selected figure.
			Moves the cursor to the next position.
			Validate with the return key and return to the **Settings** menu
7			The basic screen is displayed.

17.3.4 Making a measurement

Step	Screen	Key	Action
1	515		Connect the headphones.
2	 501		**Set the amplification to A=70 or A=80.** *Not doing this adjustment may cause to miss small leaks!*
3			Place the internal or external sensor close and directed to the seal.
4			Listen to possible ultrasounds with the headphones.
5	 544		Depress the key to freeze the measured value.

Sensors and options

18. The whole range of sensors

This list shows the whole range of sensors and options available witch can be connected to the *Sherlog S*.

Internal ultrasonic sensor (*) (1)

External ultrasonic sensors

- Flexible sensors (*)
- Parabolic sensor
- Contact probe
- Magnetic sensor
- Threaded sensor
- Open sensors

Adaptator for ultrasonic sensor

- Lube adapter

External non ultrasonic sensors

- Sound level meter
- Tachometer
- Thermocouple interface
- Non-contact temperature sensor
- Mass airflow sensor

Cables for external sensors

- BNC to LEMO 7 pin cable (*)
- LEMO 5 pin to LEMO 7 pin cable

(*) included in the *Sherlog S* set.

(1) See *Chapter 14* or *Chapter 17* as far as the use of this sensor is concerned.

19. External ultrasonic sensors

It is to be reminded that the detector will recognize the presence of the sensor and will automatically change to the appropriate settings, scales and units.

19.1 FLEXIBLE SENSORS

Three models are available: 550 and 820 mm long with a 20 mm external diameter and the delivered flexible sensor with the *Sherlog* kit: 820 mm long and a 13 mm external diameter.

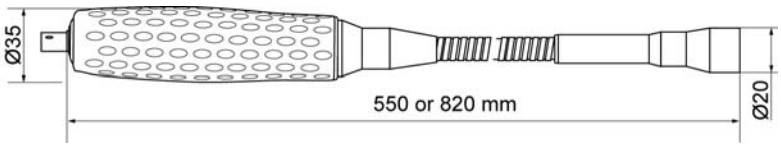
19.1.1 Main field of application

They are:

- Leak detection.
- Tightness testing with an ultrasonic transmitter.
- Control of mechanical units and predictive maintenance.
- Control of the aligning of mechanical coupling.
- Electrical arcing and corona detection.

19.1.2 Description

Each of these sensors is supplied with a BNC type connector and a coiled cable equipped with BNC and 7-pin LEMO connectors. The coiled cable can be stretched to about 2 m (6.6 ft).



View of a flexible sensor. *043*

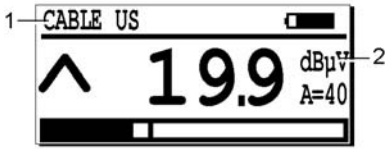
19.1.3 Technical data

Item	Data
Bandwdith	1,2 kHz at -6 dB
Frequency	40 kHz ± 1 KHz
Sensitivity	-65 dB/V/µbar kHz at 40 kHz
Length	550 mm or 820 mm (without cable)
Diameter	20 mm external 16 mm internal
Cable length	Coiled 0,5 m to 2 m

19.1.4 How to read the displayed data

The LCD display indicates:

1. That a cable for ultrasonic sensor is connected between the sensor and the detector.
2. The measured value expressed in dBµV.



The icon with a flexible sensor. *091*

19.2 PARABOLIC SENSOR

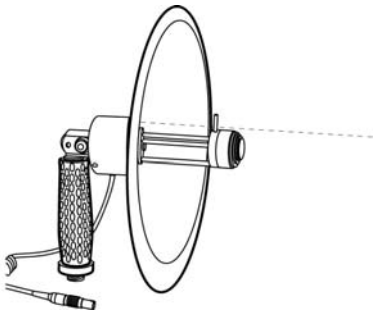
19.2.1 Main field of application

This typical waveform concentrator equipped with a laser pointer is used to detect ultrasonic phenomena, at short or large distances, with a high pin-point accuracy. The main applications are:

- Tightness testing of windows
- Tightness testing of bulkheads
- Tightness testing of RoRo bow, stern and visor doors
- Leak detection in remote air compressed systems,
- Electrical arcing and corona effects detection.

19.2.2 Description

This sensor allows is an exceptional highly unidirectional ultrasonic measurement tool that minimizes background noises and detects distant leaks, corona discharges and electrical arcing at remote distances.



View of the parabolic sensor and the laser beam (artist's representation). *074*

The dish is transparent to easy visualize the object while measuring. For this same purpose of "pin pointing the object to measure" this parabolic concentrator has two sights: a "rifle-sight-shaped" sight and a very effective laser pointer sight.

In some cases (corona detection) the *Sherlog* is used with the special SDT loudspeaker instead of using the normal headphones.

19.2.3 How to read the displayed data

The LCD display indicates:

1. **`Parabolic`**: means that a parabolic sensor is connected.
2. The measured value expressed in dBµV.

The specific icon with an ultrasonic parabolic sensor. *096*

19.2.4 Technical data

Item	Data
Function	Ultrasonic transparent parabolic waveform concentrator
Measurement Gain	± 25 dBµV
Transducer type	Air Ultrasonic Ceramic Transducer diameter 16 mm
Measuring range	-10 dBµV to 120 dBµV
Accuracy	± 0.5 dBµV
Measuring resolution	0.1 dBµV
Signal to noise ratio	–5 dBµV typical
Bandwidth (-6 dB)	2 kHz
Central Frequency range	40 kHz ±1 kHz
Laser Power	≤ 2.5 mW activated by push button
Laser Spot size	± 6 mm at 5m
Operating temperature	+10°C to +40°C
Material Parabola	Transparent Plexiglas (polymethacrylate)
Material Handgrip	Aluminum covered with antiskid grip
Weight	Approx. 0.8 kg.
Parabola Max. Ext. Diameter	275mm
Parabola Nominal Diameter	250mm
Parabola length	193,5mm (with handgrip 90°angled)
Fitting	As separate unit or fitted on the *Sherlog S* with knurled nut
Handle position	Angle from –90 to + 90 versus pointing direction

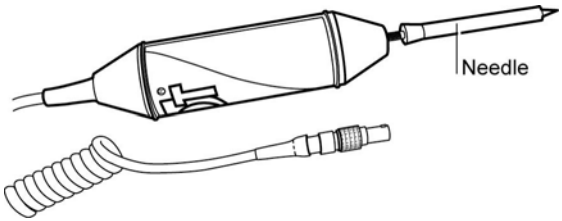
19.3 CONTACT PROBE

19.3.1 Main field of application

Use the contact probe for detecting and localizing bearing defects, gear meshes problems, pump cavitations, steam trap failures, valve and reciprocating compressor checks, and lubrication trending of rotating equipment.

19.3.2 Description

When plugged into the sensor input of the *Sherlog S* the equipment switches to “contact measurement” mode. It is supplied with a spiral cable with its appropriate connector.



The contact probe. *064*

19.3.3 Technical Data

Item	Data
Bandwidth	1 kHz at -6 dB
Frequency	40 kHz ± 1 kHz
Sensitivity (40 kHz)	-60 db/V/µbar
Length	260 mm (without cable nor needle)
Diameter	36 mm
Cable length	Coiled cable 0.5 m to 2 m

19.3.4 Operating method

To determine the status of the bearing, two operating methods are possible:

- Trending the evolution: periodical measurements are recorded for further analysis with PC software or by consultation of the stored data in the internal memory of the *Sherlog TA*. Any signal increase higher than 10 dBµV needs to be watched.
- By comparison: any significant difference (several dBµV) between the measurements take on the bearings evolving under similar operating conditions is to be watched.

19.3.5 Operating mode

When the contact probe is connected to the *Sherlog S*, select **`Settings`**, **`Sensor options`**, **`Select freq`** and choose from three operating modes. These modes are pre-programmed frequency bands that are common to the application being tested. There are three different designations:

- **`SLOW MEC`** to listen and to measure bearings with a rotation speed lower than 300 RPM.
- **`MEC`** to listen and to measure the bearings with a rotation speed higher than 300 RPM.

- **US** to listen and to measure the bearings of turbines and bearings with a speed higher than 10.000 RPM. This mode is also most convenient for finding internal leaks (hydraulic systems, fluids).

The menu with a contact probe. *026*

The active keys are:

Key	Function
	Return to the parameter menu, without taking in to account eventual changes.
	Move up the inverted contact probe frequency band selector.
	Move down the inverted contact probe frequency band selector.
	Enter, validate the selected contact probe frequency band, and return to the **`Settings`** menu.

19.3.6 Rules to respect

In most circumstances, the contact probe is the best sensor to monitor a bearing.

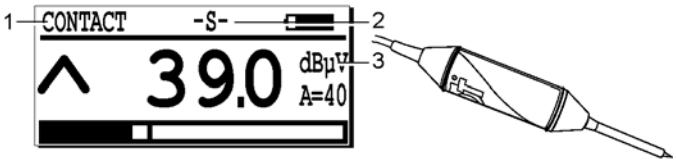
To ensure the repeatability of the measurements taken with the contact probe, it is imperative to follow the next rules.

- Attach the needle correctly and connect the contact probe to the unit.
- Always take a measurement by applying the top of the needle on the same spot (possible marking with the awl to dimple the housing).
- Maintain the contact on the vertical plane (perpendicular) of the measurement point. Any oblique position should be avoided.
- Apply about the same holding pressure on the probe.
- Hold the button down for 3 to 4 seconds until stabilization of the measurement is achieved.
- Make sure that the appropriate functioning mode has been selected (Slow mec, Mec or US).
- Ideally, take the measurement when no arrow is displayed (∧ or ∨).

19.3.7 How to read the displayed data

The LCD display indicates:

1. The type of sensor connected (here, a contact probe).
2. The selected mode (S, M or US).
3. The measured value expressed in dBµV.



The specific icon with an ultrasonic contact probe. *055*

19.4 MAGNETIC SENSOR

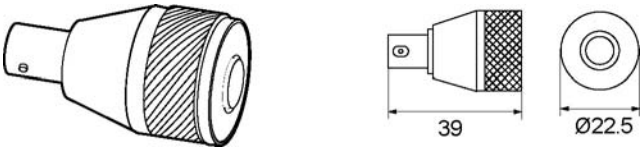
19.4.1 Main field of application

Fitted with a magnet, this sensor allows the localization of anomalies and irregularities. The main applications are:

- Control of mechanical units and predictive maintenance.
- Control of bush, motor, pumps, valve, steam trap, condensate purge.

19.4.2 Description

The sensor is supplied with a spiral cable, equipped with the appropriate connectors on both sides.



View of the magnetic sensor. *042*

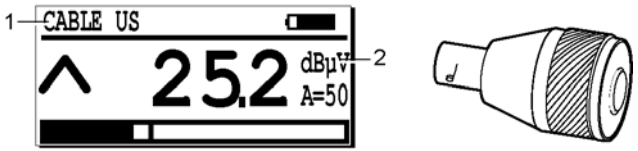
19.4.3 Technical Data

Item	Data
Bandwidth	1,5 kHz at -6 dB
Frequency	40 kHz ± 3 kHz
Sensitivity	-80 dB/V/µbar at 40 kHz
Temperature	-20°C to +80°C
Weight	35 g
Diameter	22,5 mm
Cable length	Coiled 0,5 m to 2 m
Tractive power	4 kg

19.4.4 How to read the displayed data

The LCD indicates:

1. **`Cable US`**: a cable for ultrasonic sensor is connected between the sensor and the detector.
2. The measured value expressed in dBµV.



The icon with an ultrasonic external magnetic sensor. *057*

19.5 THREADED SENSOR

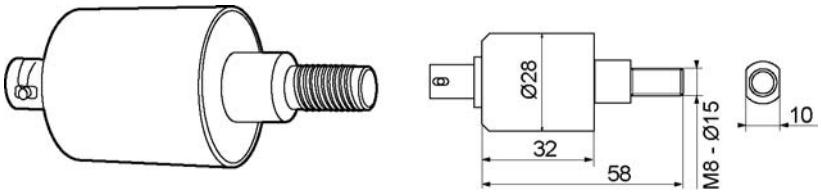
19.5.1 Main field of application

They are:

- Permanent control of mechanical units and predictive maintenance.
- Control of bush, motor, pumps, valve, steam trap, condensate purge.

19.5.2 Description

The sensor is equipped with a thread (M8) and a NBC connector.



View of the threaded sensor. *044*

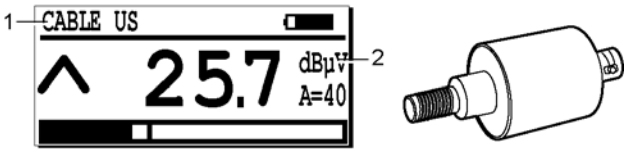
19.5.3 Technical Data

Item	Data
Bandwidth	2 kHz at -6 dB
Frequency	40 kHz ± 3 kHz
Sensitivity	-73dB/V/µbar at 40 kHz
Temperature	-20°C to +150°C
Weight	90 g
Diameter	28 mm
Cable length	Coiled 0,5 m to 2 m
Thread	M8 x 15

19.5.4 How to read the displayed data

The LCD display indicates:

1. **`Cable US`**: a cable for ultrasonic sensor is connected between the sensor and the detector.
2. The measured value expressed in dBµV.



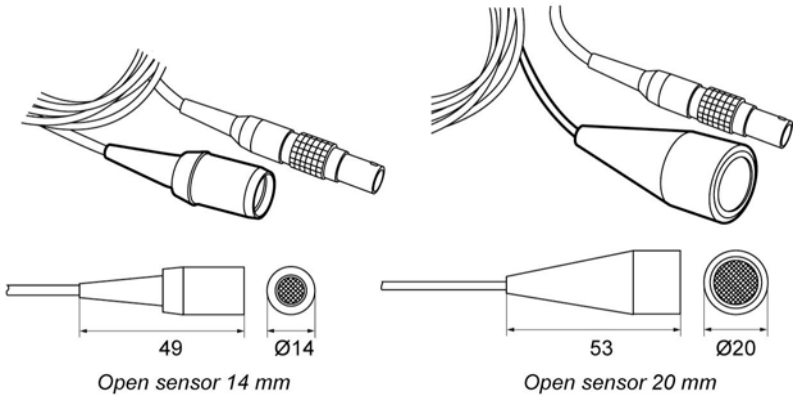
The icon with an ultrasonic external threaded sensor. 093

19.6 OPEN SENSORS

Open sensor is a non waterproof sensor. Two models are available: diameter 14 and 20 mm.

19.6.1 Description

Each of these sensors is supplied with a 2.5 m / 8.2 ft cable, equipped with a 7 pin LEMO connector.



View of the open sensors diameter 14 and 20 mm. 040

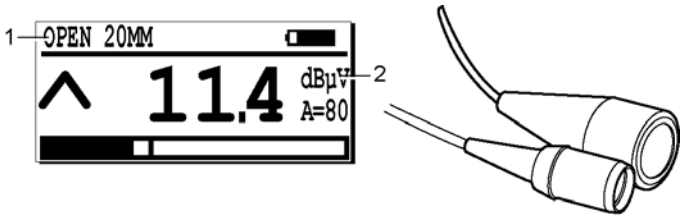
19.6.2 Technical data

Item	Data
Bandwidth (-6 dB)	3 kHz at -6 dB
Frequency	40 kHz ± 1 kHz
Sensitivity	-70 dB/V/µbar (14 mm) and -65 dB/V/µbar (20 mm) at 40 kHz
Length	50 mm (without cable)
Diameter	14 mm or 20 mm external
Cable length	2,5 m

19.6.3 How to read the displayed data

The LCD display indicates:

1. The type of sensor connected. The information depends of the sensor: open sensor 14 mm, open sensor 20 mm.
2. The measured value expressed in dBµV.



The specific icon with an ultrasonic external open sensor. *089*

20. Adaptator for ultrasonic sensors

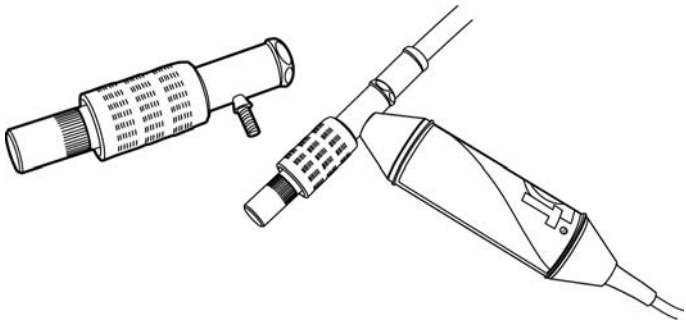
20.1 LUBE ADAPTER

20.1.1 Main field of application

- Adaptator for greasing control of mechanical unities and predictive maintenance.
- Listening to bearing, bush.

20.1.2 Description

Connected to the contact probe and fixed on the top of the pump flexible to grease, this adapter allows controlling the efficiency level of greasing in real time.



View of the lube adapter. *097*

21. Ultrasonic transmitters

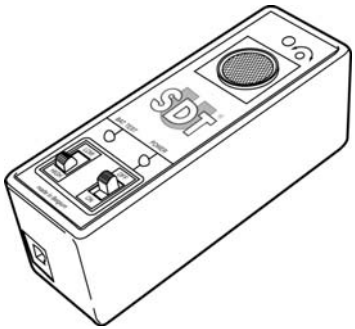
21.1 SDT 200 mW TRANSMITTER

21.1.1 Main field of application

It is the tightness control of small volumes which cannot be pressurized or depressurized.

21.1.2 Description

This is a small portable ultrasonic transmitter, equipped with one transducer and an internal rechargeable Ni-Cd battery. The transmitter is available in directional and bi-sonic modes. The user can select between two power positions.



View of the ultrasonic transmitter type SDT 200 mW. *071*

Its main characteristics are as follows:

Item	Data
Transmitter frequency	Bisonic : 39.2 and 39.6 kHz
Transmitter power	200 mW
Transmitter angle	60 °
Internal battery	9.6 V, 110 mAh Ni-Cd
Autonomy	±4 hours
Dimensions	108 x 35 x 40 mm (4.25 x 1.37 x 1.57 inches) L x W x H)
Weight	230 g (8.11 oz)

21.2 SDT 8 (8 X 125 mW) MULTI-TRANSMITTER

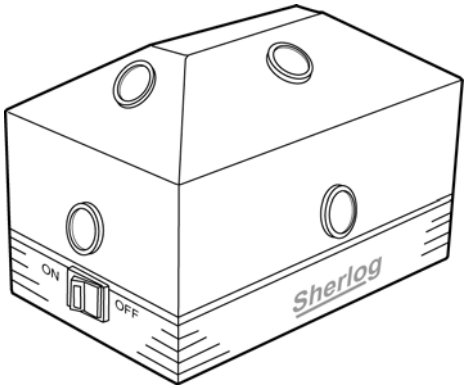
This equipment is delivered in the *Sherlog S* set.

21.2.1 Main field of application

It is the tightness control of large volumes which cannot be pressurized or depressurized, without control of the emitting ultrasonic power.

21.2.2 Description

This is a small portable fixed power multihead ultrasonic transmitter. Eight (8) oriented ultrasonic transducers are localized all around the unit, for a 8 x 125 mW ultrasonic power. The *SDT 8* uses the bi-sonic mode and is equipped with a removable rechargeable lead-acid gel battery pack.



View of the ultrasonic transmitter type SDT 8. 061

Its main characteristics are detailed on *Chapter 25*.

21.3 SDT 8 (8 X 125 mW) MULTI-TRANSMITTER MULTISETTING

This equipment is delivered in the *Sherlog TA* set.

21.3.1 Main field of application

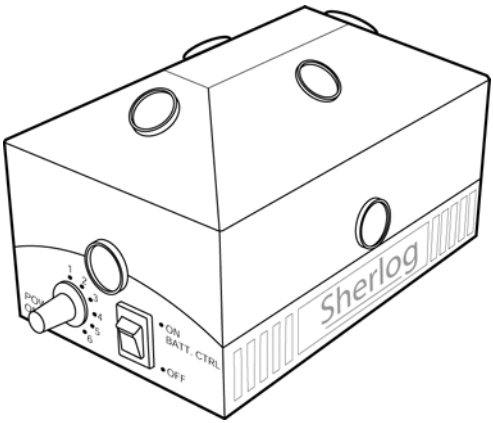
It is used in situations where the emitted ultrasonic power must be adjustable to the volume that has to be controlled, mainly in the tightness control of large volume which cannot be pressurized or depressurized.

21.3.2 Description

This six position ultrasonic transmitter used in combination with an *Sherlog* detector. Eight (8) oriented ultrasonic transducers are localized all around the unit, for a variable 8 x 125 mW ultrasonic power.

A six position selector allows the choice of the ultrasonic power.

This combination is an accurate and reliable tool for testing the tightness of every kind of object or volume.



View of the SDT 8 multi-transmitter multisetting. *100*

Its main characteristics are:

Item	Data
Function	Ultrasonic multi-transmitter
Frequencies	Stabilized at 39.2 and 39.6 kHz (bi-sonic mode).
Nbr of transducers	8
Transmission power	Power control in 6 levels
	Typical values form 1 to 6 : -20dB, -15dB, -9dB, -6dB, -2dB, max.
Maw trans. Power	8 x 125 mW
Dispersion	240 °
Voltage/capacity	12V DC/1.2 Ah.
Battery	Sealed lead-acid gel type rechargeable.
Recharge	By means of an external charger and integrated connector (without removing the battery) or by using a charge adapter (removing the battery).
Autonomy	2.5 hours at 20 °C.
Charging time	6 hours.
Safety	Chemical control fuse with automatic reset.
Command	By On/Off switch
Visual indication	On/Off/Battery charge control indicator. Flashes when undercharged.
Temperature range	-20° C to +50° C (°F)
Dimensions :	160 x 100 x 95 mm (L x W x H)
Weight	1.5 kg

22. External non ultrasonic sensors

It is to be reminded that the detector will sense the presence of the sensor and will automatically change to the appropriate settings, scales and measurement units.

Measurements can be time-dated and logged inside the memory of the *Sherlog S*.

22.1 SOUND LEVEL METER

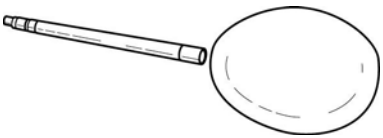
22.1.1 Main applications

Designed for the sound measure (dBA), this equipment allows the measure of the ambient noise and the determination of the level of the hearing protection (safety, ergonomics).

22.1.2 Description

Its main characteristics are as follows:

Item	Data
Function	Sound (pressure) level meter
Measuring ranges	45 to + 130 dBA
Precision	± 2 dB at full scale
Resolution	0.1 dB over the whole range
Type of filter	'A' weighted, compliant with IEC 651A
Measuring unit	dBA



External view of the sound level meter and its wind bonnet. 066

22.1.3 How to configure the display

Proceed as follows:

- From the basic menu, push the ≂ key.
- Select **Settings…** and **Sensor options** and push ↵.
- The screen displays:

The Sensor options menu with sound pressure measurement microphone. 048

The selection acts as follows:

- **Slow**: slow reaction to sound peaks.
- **Fast**: fast reaction to sound peaks.

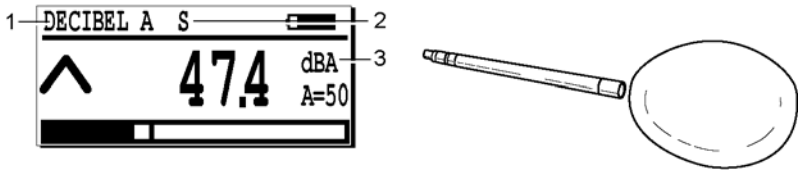
The active keys are:

Key	Function
≂	Return to the parameter menu, without taking into account eventual changes.
↑	Move up to the *Slow* mode.
↓	Move down to the *Fast* mode.
↵	Enter, validate choice and return to the measurement display.

22.1.4 How to read the displayed data

The LCD display indicates:

1. **Decibel A**: measure of the dBA.
2. **S** or **F**: Indicates the selected mode (Slow or Fast).
3. The measured value expressed in dBA.



The specific icon with a sound level meter. *049*

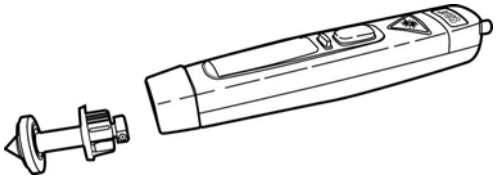
22.2 TACHOMETER

22.2.1 Main applications

All linear or rotation measurements with or without contact of a mechanical or electrical system, mainly for the control of mechanical units and predictive maintenance.

22.2.2 Description

The SDT laser tachometer can be used separately as an individual unit or in combination with the *Sherlog S*.



External view of the tachometer. *070*

The SDT tachometer is an extremely versatile fully featured sensor, with a wide selection of practical functions including revolutions per minute (rpm) and revolutions per second (rps) both optically with a laser pointer and by contact method, contact linear speeds, in feet, yards or meters per minute and per second.

Special memory functions include maximum, minimum reading capture, employing a unique dual time base for high speed data grabbing. Truly average speed measurement mode is also standard, with time interval measurement for reciprocal speeds and cycle timing, other features include revolution count and length count in meters, yards or feet, with last reading hold and auto-memory retention of last selection function mode.

22.2.3 Technical data

Display tachometer

Item	Data
Display tacho	Inverting LCD vertical 5 digit display
Display functions tacho	180° inverting
On target indicator	Yes, on LCD
Low battery indicator	Yes, on LCD
Function icons	Comprehensive selection of ranges shown in display

Controls - 3 push buttons

Item	Data
On/Off normal mode	Dual action rocker type touch button (UP ARROW)
On/Off inverted mode	As above but for inverted operation (DOWN ARROW)
Program control	Selects program mode in conjunction with up/down switches

Optical system

Item	Data
Optical range	50mm - 2000mm
Minimum optical angle	Incidence +/- 45° regarding the reflecting zone
Light source	Red Spot Laser Class II

Measurement range

Item	Data
Measurement modes	rpm & rps optically (also count & time)rpm & rps, meters, yards, feet, per min.& sec. Via contact adaptor count total revs, meters, feet, yards, measure time interval in seconds between pulses (reciprocal rate)speed capture feature - max, min, or average rate

Speed range

Item	Data
Optical mode	3 - 99.999 rpm (or equivalent in rps)
Contact mode	Max 50.000 rpm for 10 sec. (or equivalent in rps)
Linear speeds maximum	0.3 - 1500 meters/min (or equivalents)

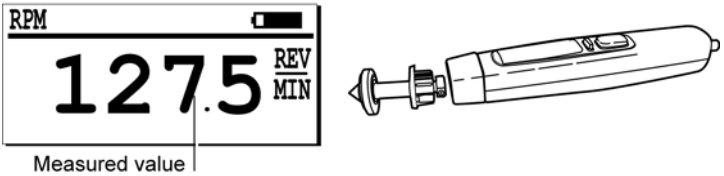
Other

Item	Data
Resolution range features	Fully auto ranging, up to 0.001 digit or +/- 1 digit fixed
Accuracy speed modes	0.01% +/- 1 digit
Count mode	Resolution +/- 0.1 meters (or equivalent in all ranges)
Time interval mode	0 - 99999 seconds autoranging only (max. 0.001 resolution)
Time base standard	0.8 sec. Or time between pulses, whichever is longest
Time base fast mode	0.1 sec. Auto-selection in max. or min. capture mode
Memory features	Last reading held for 1 minute, Auto switch off. Program settings retained in memory after power down.
Contact adapter	Included complete with rpm cone & metric wheel assembly
Power requirements	4 x AAA alkaline cells
Operating temp.	0°C to 60°C / 32°F to 140°F
Operating humidity	0 % to 90 % R.H. when temperature is less than 35°C/95°F
	0 % to 70 % R.H. when temperature is above 35°C/95°F

22.2.4 How to read the displayed data

The LCD display indicates:

1. **RPM** : the connection of a rotation sensor
2. The measured value expressed in revolutions per minute.



The Sensor options menu with the tachometer. *060*

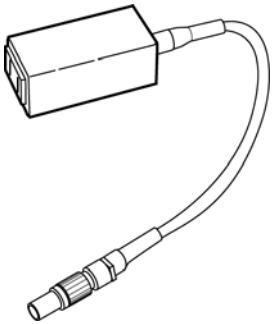
22.3 THERMOCOUPLE INTERFACE

22.3.1 Use

It is used to check any kind of temperature that can be measured with a thermocouple. Its main applications are for the control of mechanical units and maintenance.

22.3.2 Description

This "Digital Thermocouple Interface" allows any 'J' or 'K'-type thermocouple to be connected via its plug to the *Sherlog S*. The temperature can be read out in degrees Celsius, Kelvin, Fahrenheit and Rankine. Designed for usage in an industrial environment, the interface is made out of a rugged metal casing, and has a miniature thermocouple connector. The interface has on board digital cold junction compensation and is equipped with a wire brake or thermocouple not present detector.



External view of the thermocouple interface. 045

22.3.3 Technical Data

Thermocouples types:	"J" and "K" (user selectable, not automatic)
Connector	With a standard miniature thermocouple connector, 7.9 mm or 0.312 inch, center to center.
Interface dimensions	108 x 73 x 23 mm / 4.3 x 2.9 x 0.9 inch
Interface weight	106 gram / 0.36 lb
Cable to the *Sherlog*	Included
Thermocouple	Not included

*Accuracy and measuring ranges for 'J' thermocouples **

	Range	Resolution	Accuracy (2)
Celsius	-210 to +1200°C	0.1°C /1°C (1)	0.3 % of lecture bol'± 1.2°C (3)
Kelvin	+63.1 to +1473°K	0.1°K /1°K (1)	0.3 % of lecture bol'± 1.2°K (3)
Fahrenheit	-346.0 to +2192°F	0.1°F /1°F (1)	0.3 % of lecture bol'± 2.16°F (3)
Rankine	+113.6 to +2651°R	0.1°R /1°R (1)	0.3 % of lecture bol'± 2.16°R (3)

(1) the measuring resolution 0.1° up to 999.9° from 1000° onwards resolution is 1°.
(2) with the interface at +18°C to +28°C / 64°F to 82°F.
(3) whichever is greater.
* : typical ranges. The measuring ranges depend of the thermocouple used.

*Accuracy and measuring ranges for 'K' thermocouples **

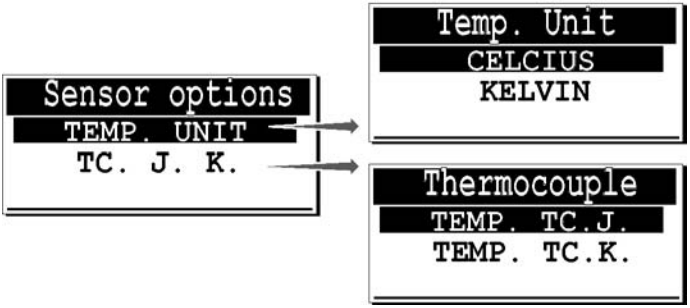
	Range	Resolution	Accuracy (2)
Celsius	-200 to +1372°C	0.1°C /1°C (1)	0.3 % of lecture bol'± 1.2°C (***)
Kelvin	+73.1 to +1645°K	0.1°K /1°K (1)	0.3 % of lecture bol'± 1.2°K (***)
Fahrenheit	-328.0 to +2501°F	0.1°F /1°F (1)	0.3 % of lecture bol'± 2.16°F (***)
Rankine	+131.6 to +2961°R	0.1°R /1°R (1)	0.3 % of lecture bol'± 2.16°R (***)

(1) the measuring resolution 0.1° up to 999.9° from 1000° onwards resolution is 1°.
(2) with the interface at +18°C to +28°C / 64°F to 82°F.
(3) whichever is greater.
* : typical ranges. The measuring ranges depend of the thermocouple used.

22.3.4 How to configure the display

Proceed as follows:

- From the basic menu, push the ⏦ key.
- Select **`Settings…`** and **`Sensor options`** and push ↵.
- The screen displays:



The Sensor options menu with thermocouple interface. *025*

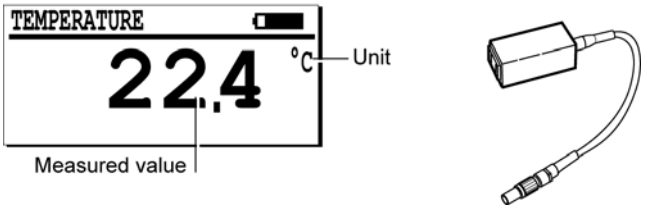
- **Temp. Unit**: defines the measurement system used for temperature measurement. A normal temperature scale or a temperature relative to absolute zero can be used. This selection is done in combination with the ISO/Imperial selection, see paragraph 5.8.
  - **CELCIUS** or **KELVIN**: in the ISO/METRIC system, one of both scales can be used.
  - **FAHRENHEIT** or **RANKINE**: in the English Imperial system, one of both scales can be used.
- **TC J. K**: this function defines the type of temperature probe used for temperature measurement.
  - **TEMP. TC. J.**: -40 °C to +750°C.
  - **TEMP. TC.K**: -40°C to +1500 °C.

The active keys are:

Key	Function
	Return to the parameter menu, without taking into account eventual changes.
	Move up to the upper selection.
	Move down to lower selection.
	Enter, validate choice and return to the previous menu.

22.3.5 How to read the displayed data

The LCD display indicates:



The Sensor options menu with a thermocouple interface. *056*

- The word **TEMPERATURE** indicated that a thermocouple interface is connected.
- The units are °C or °F and °F or °R. The unit depends of the setting made in the **Settings** menu.
- The thermocouples types are “J” and “K”, selectable by the user in the **Settings** menu.
- The data represents the actual temperature applied on the sensor. **Open** displayed means that the sensing unit is out of order or not connected.

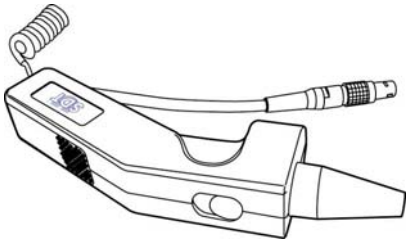
22.4 NON CONTACT INFRARED TEMPERATURE SENSOR

Main applications

This non-contact infrared thermometer allows the temperature measurement in °C, °K, °F, °R without contact, from -18°C up to 260°C. The main applications are the control of mechanical and electrical units as well as the predictive maintenance.

Description

The probe has a temperature range of -18°C to 260°C (0°F to 500°F), with a basic accuracy of 5% of reading and an output of 1 mV DC per °C of °F.



External view of the non-contact infrared temperature sensor. *067*

Pointing the probe at the surface to be measured and reading the temperature on the *Sherlog S* display is sufficient to measure temperature.

22.4.1 Technical data

Item	Data
Function	Temperature sensor (infrared temperature probe)
Measuring ranges	-18 to 260 °C (0 to 500 °F)
Temp. range	0 to 63 °C (ambient temperature range)
Accuracy	±5% of reading or ±3 °C, whichever is greater @ 18 to 28 °C (64 to 82 °F) ambient operating temperature (accuracy for one year).
Temperature coef.	±0.2 % of reading or ± 0.2 °C (± 0.3 °F) whichever is greater, change in accuracy per °C in ambient operating temperature above 28 °C (82 °F) or below 18 °C (64 °F).
Response time	1 second
Spectral response	8 to 14 microns nominal
Emissivity	Preset 0.95
Output	1 mV / °C or °F
Power	Through the *Sherlog S* connection
Dimensions	180 x 30 x 50 mm (7.1 x 1.2 x 2 inches) (L x W x H)
Resolution	±1 % (depending of the sensor type)
Weight	180 g (6.4 oz)

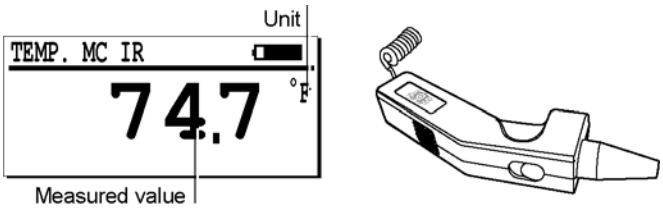
22.4.2 Taking a measurement

Note: see also the paragraph *Additional considerations* below.

1. **Plug the Infrared Temperature Probe connector (Lemo) in the *Sherlog S* sensor connector.**
2. **Slide the probe switch forward to the « ON » position.**
   The *Sherlog S* needs 5 seconds to calibrate. While calibrating the message “OFF” is displayed.
3. **Point the tip of the probe as close as possible to the object being measured without touching the object.**
3. **Read the temperature on the *Sherlog S* display.**
   Measurements can be time-dated and logged inside the memory of the *Sherlog S*.

22.4.3 How to read the displayed data

The display indicates (above left) the connection of a temperature infrared sensor. The display is as follows.

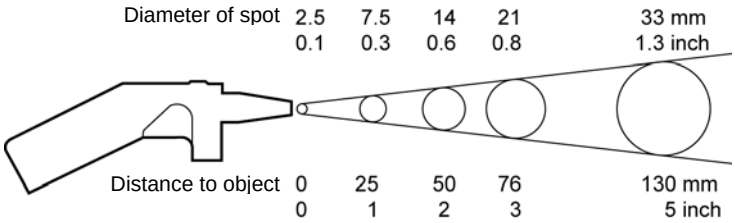


The Sensor options menu with the non-contact infrared temperature sensor. *059*

- The displayed data indicated (**`TEMP MC IR`**) that a temperature infrared sensor is connected.
- The unit depends of the setting made in the **`Settings`** menu.
- The data is as usual (see above paragraphs). **`Open`** displayed means that the sensing unit is out of order or no connected.

22.4.4 Additional considerations

- After 10 minutes of use the probe will automatically shift to Sleep mode (the display will show 0°C or 0°F). It can be restarted by sliding the switch to « OFF » and then to « ON ».
- Sleep mode extends battery life. However, for maximum battery live, switch the probe to the « OFF » position.
- The distance to spot size ratio (or field of view) refers to the diameter of the spot that the probe is sensing at a given distance. The closer your are to the object (or target), the smaller area (or spot) the probe is sensing. For example, with the probe held at 50 mm (2 in.) distance from the target, the spot size is approximately 13 mm (1/2 in.) Hot spots can be missed if too large an area is included in the field of view, so get as close as possible.



The spot size increases with distance from the probe tip, as shown. *068*

22.5 MASS AIR FLOW SENSOR

22.5.1 Main applications

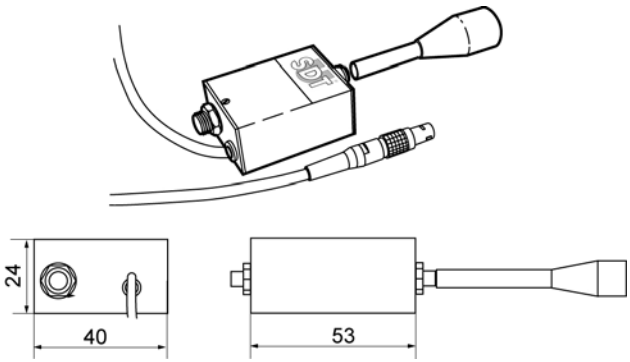
Fitted with a tip made of flexible rubber, this sensor allows to measure the flow (sccm/scfm) of a compressed air leak. For a accurate measurement, the nozzle must be set so that all the air leakage goes trough the sensor. Two models are available:

- Very small leaks: from -25 till +200 SCCM ($0.8x10^{-3}$ to $7x10^{-3}$ SCFM).
- Small leaks: from -75 till +1000 SCCM ($2.5x10^{-3}$ to $3.5x10^{-3}$ SCFM).

22.5.2 Description

This is a thermal based Mass Flow Sensor fitted with an incorporated conditioning and temperature compensation electronics.

The flow rate can be readout in either SCCM (Standard Cubic Centimeters per Minute) or in SCFM (Standard Cubic Feet per Minute).



External view of the mass air flow sensor. 046

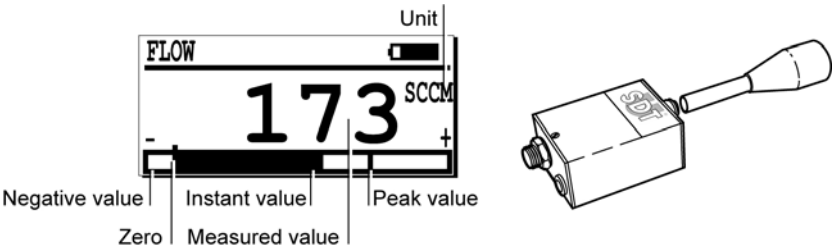
22.5.3 Technical data

Item	Data
Function	Leak flow rate
Operating pressure	1 Bar max (common mode)
Measuring ranges	-25 till +200 SCCM or -75 till +1000 SCCM (depending of the sensor)
Resolution	1 SCCM
Measuring unit	- SCCM: Standard Cubic Centimeter Minute - SCFM: Standard Cubic Feet Minute

22.5.4 How to read the displayed data

The display indicates:

- Unit: SCFM or SCCM according to the unit chosen (**`Settings`** menu).
- Negative value: when a vacuum (depressure) is measured.
- Zero: any pressure/depressure applied.



The Sensor options menu with mass air flow sensor. *047*

23. Cable for external sensors

23.1 BNC TO LEMO 7 PINS CABLE

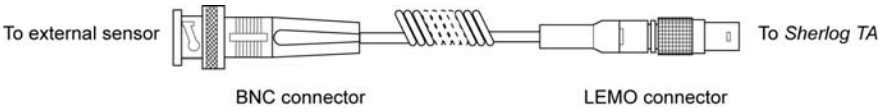
23.1.1 Use

This cable is used to connect, to the *Sherlog S*, the following ultrasonic devices:

- Flexible sensors.
- Magnetic sensor.
- Threaded sensor.

23.1.2 Description

This is a 0.5 to 2 m coiled cable fitted with a BNC connector and a LEMO connector.



View of the BNC to LEMO 7-pin cable. *078*

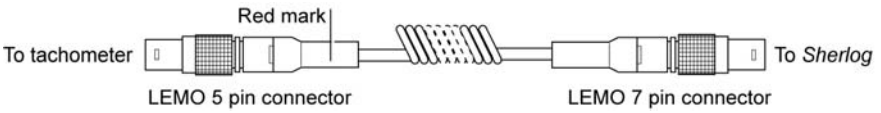
23.2 LEMO 7 PIN TO LEMO 5 PIN CABLE

23.2.1 Use

This cable is used to connect the *Sherlog S* with the tachometer.

23.2.2 Description

This is a 0.5 to 2 m coiled cable fitted with a LEMO 5 pin connector and a LEMO 7 pin connector.



View of the LEMO 5 pin to LEMO 7 pin cable. *079*

Technical specifications

24. Sherlog S

24.1 MEASUREMENT INSTRUMENT

Function	Multifunction detector.
Display	Graphic LCD with backlighting.
Keyboard	8 function keys.
Ultrasonic sensor	Built-in.
External sensors	Through specific connector (Lemo 7 pins).
Communication	RS 232 C communication interface (19,2 kB) for update purpose.
Battery pack	Rechargeable NiMH (Nickel Metal Hydrate). Autonomy of 8 to 10 hours without backlighting. Recharge time: 5 to 6 hours. Nominal Capacity: 1.5 Ah. Life span: 500 to 1,000 charge/discharge cycles. Recharge only with appropriate SDT charger.
Auto power down	Auto power down after preset time.
Operating temperature	-15 °C to +60 °C / 14 °F to 140 °F.
Housing	Extruded aluminium.
Weight	750 g / 26.45 oz. (with battery and holster included).
Dimensions	225 x 90 x 40 mm / 8.86 x 3.54 x 1.57inches (L x W x H).
Holster	Rubber resistant to hydrocarbons (fluor silicone).
Headphones	130 dB, noise isolating.

24.2 INTERNAL ULTRASONIC SENSOR

Function / type	Open type ultrasonic sensor
Bandwidth (-6 dB)	±2 kHz
Frequency	40 kHz ± 1 kHz
Sensitivity (40 kHz)	-65 dB/V/µBar
Total beam angle	55° typical at -6 dB

24.3 FLEXIBLE SENSOR

Bandwidth (-6 dB)	±3 kHz
Frequency	40 kHz ± 1 kHz
Sensitivity (40 kHz)	-70 dB/V/µBar
Length	820 mm without cable
Diameter	13 mm external, 10 mm internal
Cable length	Coiled 0.5 to 2.0 m

The sensor is supplied with BNC connector and a coiled cable equipped with BNC and 7 pin LEMO connectors. The coiled cable can be stretched to approximately 2 m (6.6 ft).

24.4 BATTERY PACK

For optimum performance, this battery pack is equipped with an electronic management system (includes digital serial number, capacity and temperature management).

Battery type	6 cell, 7.2 V, 1500 mAh, NiMH battery pack.
Dimensions	106 x 52 x 18 mm / 4.17 x 2 x 0.71 inches (L x W x H).
Protections	Short-circuit, reverse polarity and temperature protected.
Weight	190 g / 6.7 oz.
Housing	Glass fibre reinforced polyamide / FR4 Epoxy (contact area).

24.5 BATTERY CHARGER

For optimum performance, this charger is microprocessor controlled.

Charger type	Specific for *Sherlog S*, NiMH battery pack.
Power supply	230 (110 VAC on request) +15% / -10% - 50/60 Hz.
Output voltage	7.2 or 9.0 V DC (depending on the operating mode).
Current	500 mA max.
Recharge time	5 to 6 hours typical in fast mode. 12 to 14 hours typical in slow mode.
Protections	Temperature limitation at 60 °C / 140 °F.
Status indicator	Two color LED type.
Isolation	Double isolation.
Weight	425 g. / 15 oz.
Housing	PPE.

25. SDT 8 Sherlog multi-transmitter

25.1 MAIN CHARACTERISTICS

Item	Data
Transmitter frequency	Bisonic : 39.2 and 39.6 kHz
Transmitter power	8 x 125 mW
Transmitter angle	240 °
Internal battery	12 V, 1.2 Ah sealed lead-acid gel battery
Autonomy	2.5 hours
Dimensions	160 x 100 x 95 mm (6.29 x 4 x 3.75 inches) L x W x H)
Weight	1.5 kg (3.3 lb)
Operating temp.	-10 to +50 °C (14 to 122 °F)

Appendixes

26. Declaration of conformity in the European Union

Manufacturer
SDT International n.v. s.a.
Boulevard de l'Humanité 415
B - 1190 BRUSSELS
BELGIUM

declares that, under the generic name "SDT 170 Multifunction Detector", the

***Sherlog S* Multifunction Detector**

making the object of this declaration, is conform to the fundamental description concerning security stipulated in de EMC 89/336/CEE directive.

The equipment contains the CE logo of being compliant to the current CE regulations.

To be able to operate by state of the art rules, as stipulated in the directive, it has been designed by the following rules:

- The *Sherlog S* does not radiate electromagnetic waves (EMC);
- The *Sherlog S* is immunized against external electromagnetic radiation (EMI);
- The *Sherlog S* is protected against electrostatic discharges (ESD).

Note: the owner is obliged to preserve the present users manual with the obligation to pass it on to future users, or been resold to an other user.

Brussels, January 2003.
The Manager.

27. Declaration of conformity in the European Union

Manufacturer
SDT International n.v. s.a.
Boulevard de l'Humanité 415
B - 1190 BRUSSELS
BELGIUM

declares that, under the generic name "SDT 8 Ultrasone multi-transmitter", the

***Sherlog* Ultrasonic multi-transmitter**

being the object of the declaration, conforms to the fundamental descriptions with regard to safety stipulated in the CEM 89/336/EEC directive.

The equipment carries the conformity label CE.

To implement the safety prescriptions stipulated in the Directive as well as possible, the following standards were taken into consideration. So, the transmitter:

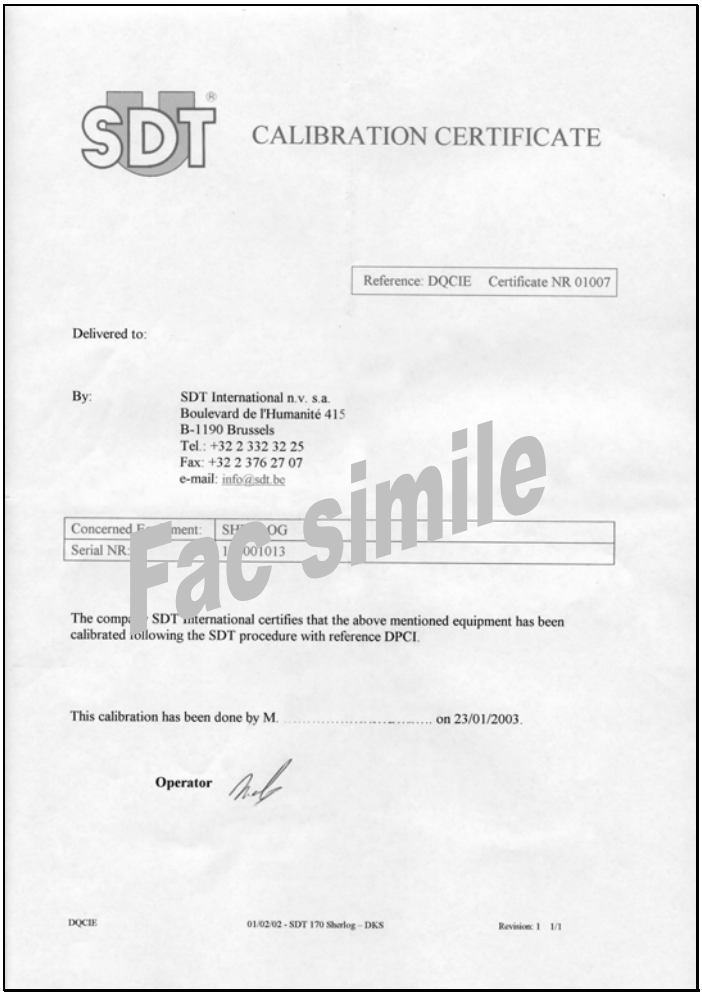
- Does not emit any electromagnetic waves (EMC) ;
- Is immunised against transmissions of external electromagnetic waves (EMI) ;
- Is protected against electrostatic discharges (ESD).

Note: the owner of the equipment is obliged to keep this manual throughout the entire life of the device and to pass it on to the new buyer if it is resold.

Brussels, March 2003.
The Manager

28. Copies of certificates

As required by Class, the *Sherlog S* detector must be recalibrated every two years.



SDT

CALIBRATION CERTIFICATE

Reference: DQCIE Certificate NR 01007

Delivered to:

By: SDT International n.v. s.a.
Boulevard de l'Humanité 415
B-1190 Brussels
Tel.: +32 2 332 32 25
Fax: +32 2 376 27 07
e-mail: info@sdt.be

Concerned Equipment:	SH OG
Serial NR:	1 001013

Fac simile

The company SDT international certifies that the above mentioned equipment has been calibrated following the SDT procedure with reference DPCI.

This calibration has been done by M. ..... on 23/01/2003.

Operator

DQCIE 01/02/02 - SDT 170 Sherlog - DKS Revision: 1 1/1

Copy of a Calibration Certificate. 539

The Certificate of Qualification is obtained after having successfully passed the theoretical and practical on- board training program. Class has limited its validity to three years.

SDT International sa-nv

Certificate of Qualification

This is to certify that

has, in accordance with Classification Societies Requirements i.e.

- DNV - Certification Notes N° 2.9 – June 1997
  Approval Programme – Service Suppliers N°403 (by IACS approved in November 1997)
- IACS U.R. Z.17 Procedural Requirements for Service Suppliers Rev. 2 – Nov. 1999.

attended the following modules of the SDT training course at their premises in Brussels on Tuesday 25th & Wednesday 26th May 2002.

Module	***C... ted***
Theoretical training on hatch covers & closing applian... s	✓
Theoretical training on Ro-Ro access equipment & securing de...	✓
Theoretical training on Ultrasounds and SDT Sherlog	✓
Practical training on SDT Sherlog TA	✓
On Board traini... tutor Jacqu... Lausn... ith a... pe... pi... ed D... Sherlog TA de... in c... nat... n a She... m... i-... ns... tter and used with external ... xible s... so... (M.V. ... 8... 06 in ... Harbour of Antwerp - Berth n' 344 -Belgi...	✓

Fac simile

On completion ... the training course, **Walter W.J. Vervloesem** has successfully passed the written examination and has therefore been certified as "**Certified Operator qualified for ultrasonic tightness testing**" of hatch covers, bow- stern- side- and inner doors & ramps, watertight doors in superstructures and deck houses, bulkhead doors, bull eyes and windows as well as similar appliances required to be weather tight by the Load Line Convention.
This statement is valid for a period of 3 years and expires on July 1st 2005.

Issued at Brussels on June 28th 2002 and carries the n' **SDT 02050145**

For SDT International
André Degraeve
Managing Director

For the tutors
Jacques de Lausnay
Manager Maritime Affairs

SDT — IMCS

Bd de l'Humanité 415 ▪ B-1190 Brussels (Belgium) ▪ Tel: ++32-(0)2-332.32.25 ▪ Fax: ++32-(0)2-376.27.07 ▪ e-mail: info@sdt.be ▪ www.sdt.be
Bankers: KBC 436-4131111-37 ▪ Fortis 293-0345531-72 ▪ CEE VAT : BE 418.020.213 ▪ T.R. Brussels : 410.561

Copy of the Certificate of Qualification. 540

29. Warranty and responsibility limits

29.1.1 Guarantee

Subject as hereinafter set out, **SDT** undertakes to remedy any defect of the equipment resulting from faulty materials or workmanship. The guarantee undertaking includes measures for repairing or replacing the equipment. This liability is limited to defects, which appear:

- For the battery and accessories (such as charger, headphones, sensors, …) within six (6) months from the delivery of the equipment to the customer,
- For the Sherlog detector and multi-transmitter within twenty-four (24) months from the delivery of the equipment to the customer.

On receipt of the customer's written notification falling within this guarantee **SDT** shall remedy the defect forthwith and at its own expense. The customer shall return to **SDT** the equipment, in which a defect covered by this guarantee has appeared, for repair or replacement by **SDT**, and the delivery to the customer of the equipment properly repaired or replaced shall be deemed to be a fulfillment by **SDT** of its obligations and a sole and exclusive remedy under this guarantee in respect of such defective equipment.

The customer shall bear the cost and risk of packing and transport of the defective equipment and of the repaired or replaced equipment between the place where the equipment is situated and **SDT** closest office.

SDT's liability shall apply only to defects that appear under the conditions of operation provided for by this Users Manual and in proper use. It does not cover defects due to causes arising after delivery. In particular it does not cover defects arising from the customer's faulty maintenance, installation, handling, service or inspection or non-compliance with **SDT**'s instructions in this Users Manual, in **SDT**'s Technical Specifications or given otherwise or from repairs, alterations or adjustments carried out without **SDT** prior written consent or from repairs, alterations or adjustments carried out improperly by the customer or arising from an accident, nor does it cover normal deterioration, wear and tear.

29.1.2 Limitation of liability

If the customer fails to give notice of a defect that falls within this guarantee during the above stated guarantee period, **SDT** shall be under no liability even in respect of defects due to causes existing before the expiry of the above stated guarantee period.

SDT liability under this guarantee shall in all cases be limited to fifteen per cent (15%) of the purchase price of the equipment. In addition, it is expressly agreed that the customer shall have no claim in respect of personal injury or of damage to property arising before, during or after the above stated guarantee period nor for loss of profit, loss of use or any other indirect, consequential, punitive, special or incidental damages of any kind, whether or not **SDT** has been advised of the possibility of such loss or damage.

29.2 RESPONSIBILITY LIMITS

Neither the company *SDT International*, nor any related company, will in any circumstances be liable for any damages, including, without limitation, damages for loss of business, business interruption, loss of information, defect of the *Sherlog* equipment unit or its accessories, bodily harm, loss of time, financial or material loss or any other indirect or consequential loss arising out of the use, or inability to use this product, even when it has been warned of possible damages.

30. Index

31. Contents

First and foremost

The SDT 8 multi-transmitter

Sensors and options

Technical data

Appendix

Index and contents

Your *Sherlog S* detector