



# SDT International

## *Ultrasonic multi-transmitter*

### Type SDT 8 and SDT 8 Multisetting

## User manual

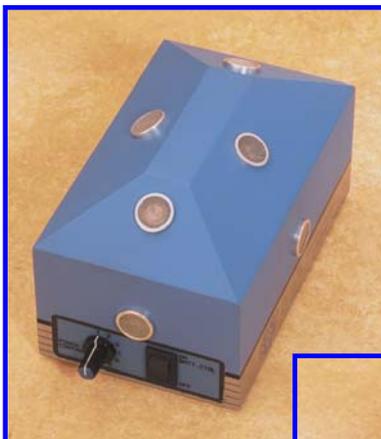
### Aim of the manual

This manual is directed to anybody who wishes to use an ultrasonic transmitter in the framework of ultrasonic inspection. This transmitter should work linked to an appropriate receiver, such as the SDT 150, the SDT 170 or the SDT Sherlog.

This manual contains information on:

- how to operate the equipment ;
- possible faults ;
- characteristics ;
- the principle of ultrasounds.

The information relating to the declaration of conformity of the European Community, to the guarantee, package, to areas of use and recommendations for use are also included.



### Contents

Declaration of conformity.....	2
Guarantee .....	2
Package .....	2
Using the multi-transmitter .....	2
Recommendations .....	3
<b>1. GENERAL PRESENTATION.....</b>	<b>4</b>
<b>2. IMPLEMENTATION .....</b>	<b>5</b>
The position of the multi-transmitter .....	5
Powering "ON" .....	5
Measurements .....	5
Powering "OFF" .....	5
Recharging the battery .....	5
<b>3. APPLICATIONS.....</b>	<b>7</b>
Navy.....	7
Aeronautics .....	7
Automobiles .....	7
Trains .....	7
Buildings.....	7
<b>4. SDT 8 MULTISETTING.....</b>	<b>8</b>
<b>5. OPERATIONAL PROBLEMS .....</b>	<b>9</b>
Ultrasonic sensor .....	9
Battery.....	9
Control fuse.....	9
<b>6. TECHNICAL CHARACTERISTICS .....</b>	<b>10</b>
Transmission characteristics .....	10
ON/OFF switch.....	10
Supply .....	10
Others .....	10
<b>7. ANNEXES .....</b>	<b>11</b>
The ultrasounds .....	11
Propagation laws of the ultrasounds .....	11
The bi-sonic mode.....	11
Detection of a leak by ultrasound in an enclosed space.....	12
The advantages of the SDT 8 .....	12

## Declaration of conformity for packaging in the European Union

### The manufacturer

SDT INTERNATIONAL S.A.  
Boulevard de l'Humanité 415  
B - 1190 BRUSSELS

declares that the product

### Ultrasonic multi-transmitter type SDT 8

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

The equipment carries the conformity label .

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

- the SDT 8 does not emit any electromagnetic waves (EMC);
- the SDT 8 is immunised against transmissions of external electromagnetic waves (EMI);
- the SDT 8 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, 2 January 1996.

The Manager.

## Guarantee

SDT International guarantees the SDT 8 against all manufacturing defects during a period of two (2) years from delivery, with the exception of the battery which is guaranteed for a period of six (6) months. The guarantee covers the whole of the equipment and consists of the free replacement of any defective parts, due to either material or constructional defects.

This guarantee is cancelled if the product is damaged by incorrect use or by accident, if the product is changed or altered in whatever manner or if attempts to repair or open the product are made without the permission of the SDT.

In the event of a defect, contact your SDT representative or the SDT International company itself.

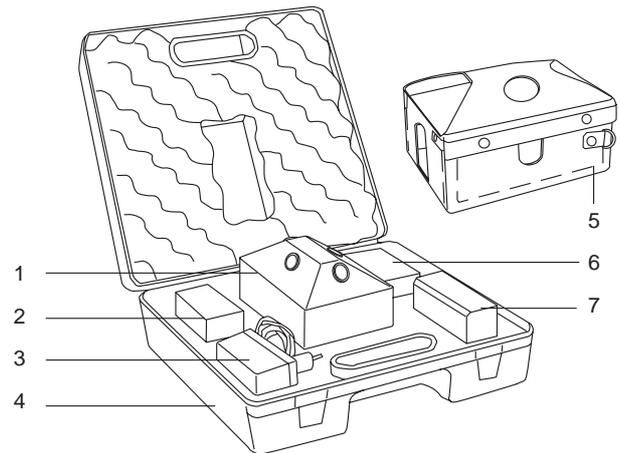
Under no circumstances can the SDT International company be held liable for any financial, material or time loss, any corporeal or other damage, resulting from loss of data, of any defect whatsoever of the SDT 8 equipment or of any connected equipment, even if it was informed of the possibility of damage.

Opening the unit without the permission of SDT International will result in the cancellation of the guarantee and service.

## Package

The package includes following items:

- 1 - a multi-transmitter type SDT 8;
- 2 - a first gel lead-acid 12V - 1.2 Ah battery;
- 3 - a 220 V - 0.3 Ah charger;
- 4 - a case;
- 5 - a leather bag;
- 6 - a second gel lead-acid 12 V - 1.2 Ah battery;
- 7 - an adapter;
- 8 - a screwdriver and a user manual (not shown).



*The set of elements supplied*

## Using the multi-transmitter

This ultrasonic multi-transmitter is designed for detecting openings in constructions or industrial products. It must work with an ultrasonic receiver such as the as the SDT 150, the SDT 170 or the SDT Sherlog by applying the "Transmission-Reception" method laid out in chapter 3 'Applications'. It must only be used for this function, to the exclusion of all others.

We advise you to read this manual very carefully and to implement the restrictions stated.

## Recommendations

This manual must be read attentively before the equipment is used and by any person likely to use it.

The box and the other internal components can be scrapped.

The local legal regulations take precedence over this text and must be respected scrupulously.

### The multi-transmitter

- must be used with an appropriate SDT receiver;
- must be used outside any classified zone, due to the absence of certificate for intrinsic and fireproof safety;
- must be used away from discharge of water and must never be immersed.  
It is important to prevent any foreign bodies entering the ultrasonic sensors, such as grease, dust, etc. The use of waterproof sensors is therefore obligatory;
- must be used within hygrometric and temperature limits stipulated in the technical characteristics;
- may be used with a connected battery charger. The operator must therefore respect the precautions linked to the use of live equipments (conformity of connectors, state of cables, authorisation, etc.).

### The battery

It is a sealed, lead-acid battery. Therefore:

- short circuit of the terminals is dangerous;
- the battery must not be discarded onto a flame;
- recharging in a sealed box is prohibited due to gas leaks (hydrogen);
- 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 the unused battery pack every three (3) months.

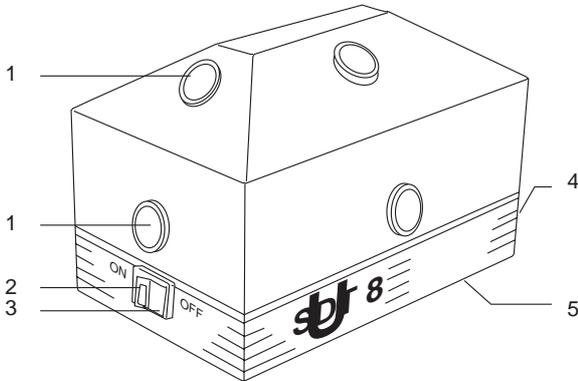
### Operator security

- there is no likelihood of direct consequences for the hearing capacities of the operator;
- the operator will take the necessary precautions when using the multi-transmitter in areas where risk of falling exists (open premises, working high-up, etc.);
- the operator will be particularly vigilant when entering or staying in confined zones (holds, silos) where risks of suffocation or lack of oxygen are possible.

### Destruction of the equipment

When the SDT 8 becomes obsolete, the internal battery must first be removed from the equipment. The battery will then be given to a company specialising in the destruction of this type of component.

# 1 - General presentation



*SDT 8 general view.*

The SDT 8 is an ultrasonic transmitter. It comes in the form of a box 160 x 100 x 95 mm. Equipped with a lead-acid battery, its weight is 1500 grams. The range of temperatures for use is from -10 C to +50 C.

NB: in some cases, the equipment may be used down to a temperature of -25 C, as long as the equipment is not used for more than 15 hours at a time.

## 1. The ultrasonic sensors

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

## 2. Indicator

A red indicator integrated in the ON - OFF switch shows whether the equipment is switched on and the charge level of the battery according to the following code:

Indicator	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 - Battery charge insufficient.

## 3. The ON-OFF switch

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

## 4. The charge plug

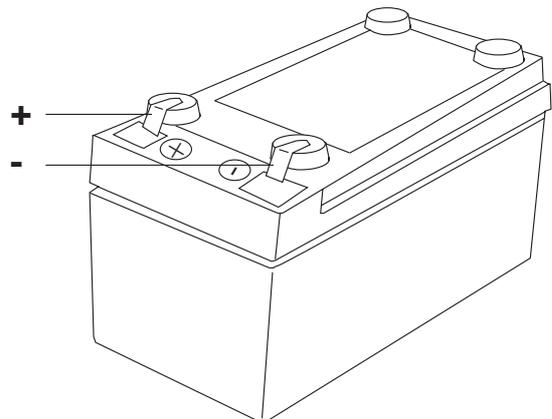
Marked LOAD (charged), it enables the internal lead battery to be recharged without taking the equipment apart. Overcharging is not possible if the charger delivered with the equipment is used.

## 5. The battery

Lead-acid type and sealed, the battery is accessible after the lower protection lid has been removed. The rated voltage is 12V and its capacity is 1.2 Ah at 20 C; the autonomy is 2.5 hours for a 6 hour charge.

The position of the battery is not important, when the lead terminals are directed to the inside of the multi-transmitter.

**Warning: if a battery of a different brand than that of the battery delivered must be fitted, it is essential to pay attention to the arrangement of polarity of the terminals. This must conform with the diagram below. There is no standardisation with regard to their arrangement.**



*The obligatory arrangement of the battery terminals*

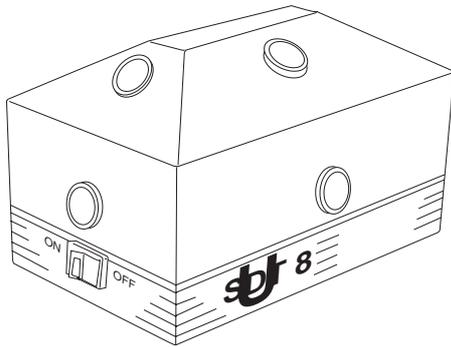
The battery terminals must conform with this layout. Moreover, the user must refer to the general recommendations of chapter 1 of this manual.

## 2 - Implementation

### The position of the multi-transmitter

The multi-transmitter will be placed on its base, at the centre of the volume to be inspected. Chapter 3 details the principle of applications.

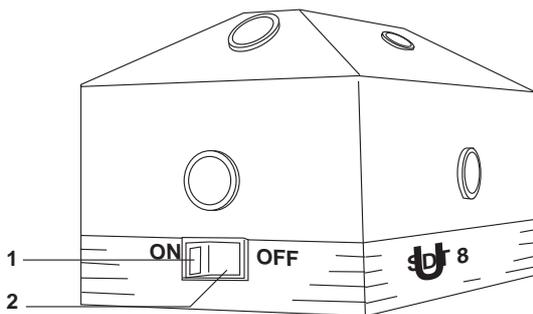
It must be noted that the SDT 8 may not be used in classified zones nor in environments exposed to discharges of water.



*The correct position of the multi-transmitter*

### Powering ON

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 5.



*The indicator of the multi-transmitter*

### Measurements

These will be carried out by complementary receiving equipment type SDT 150, SDT 170 or SDT Sherlog; the SDT 8 being the ultrasonic transmitter. The operator should refer to the receiver manual for the use of the equipments.

The multi-transmitter works in bi-sonic mode on frequencies stabilised at 39.2 and 39.6 kHz, with total transmission power also stabilised at 8 x 125 mW.

If local regulations allow it, the multi-transmitter may be supplied by the charger during the measurements. The operator will

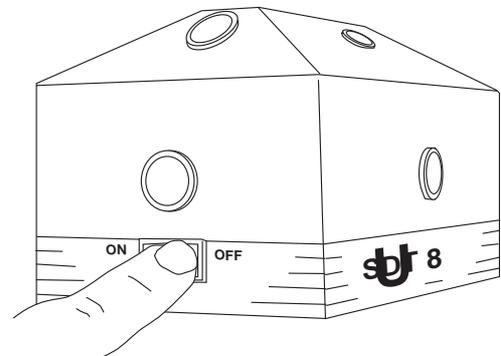
respect the safety measures for use in relation to electric shocks caused by the use of equipments supplied by the mains.

The autonomy of the multi-transmitter will therefore no longer be limited.

NB: the battery will not be recharged in this case.

### Powering OFF

This is carried out by pushing the switch to the OFF position. The operating light will be off.



*Stopping of the multi-transmitter*

### Recharging the battery

This 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:

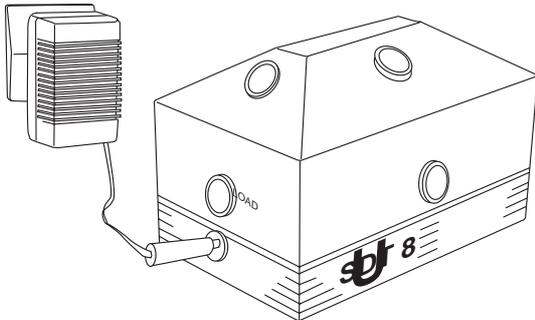
Indicator	Equipment
On	- Equipment switched on. - Battery charge correct.
Flashing	- Equipment switched on. - Battery charge incorrect. The speed of the flashing increases as the charge decreases.
Off	- Equipment switched off or - Battery charge insufficient.

Reminder: if local regulations permit, the multi-transmitter may be supplied by the charger during the measurements. The autonomy of the multi-transmitter be therefore no longer be limited. The battery does not require recharging in this case.

**Without removing the battery**

Proceed as follows:

- 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.

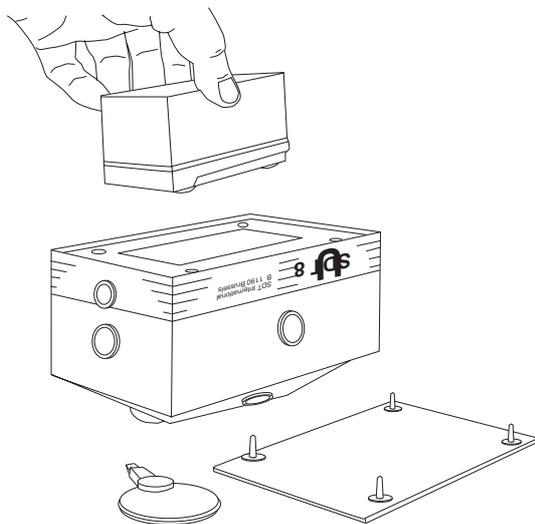


*Recharging a battery without removing.*

**When removing the battery**

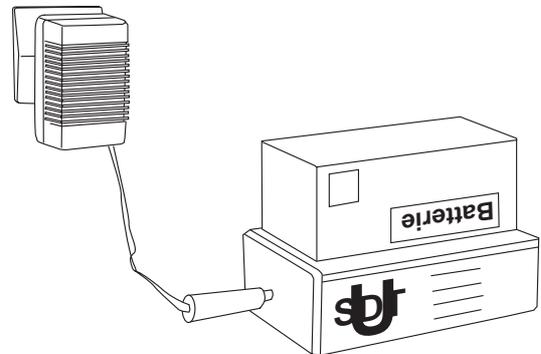
Proceed as follows:

- remove the lid at the base of the multi-transmitter by means of the screwdriver provided and remove the battery;



*Removing the battery.*

- 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.

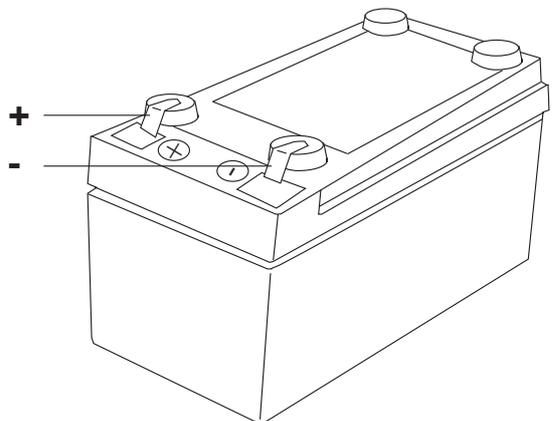


*The battery connected to the charging pack.*

- leave the battery on charge for 6 hours for a completely flat battery. There is no indicator for a maximum charge.

It is advisable to recharge when the battery has not been used for two weeks.

**Warning:** if a battery of a different manufacturer than that of the battery delivered must be fitted, it is essential to pay attention to the arrangement of the terminals polarity. This must conform with the diagram below. There is no standardisation with regard to their arrangement.



*The battery terminals must be placed in this arrangement.*

# 3 - Applications

This chapter describes some of the principle applications of the multi-transmitter SDT 8. They do not cover all areas as each user may use the equipment for his own personal needs.

## Navy

One of the principal applications for the SDT 8 in the navy is to monitor the untightness of the hatchcover joints of the holds. The holds of liners must be protected against the entry of water from the sea in the context of transporting perishable products (wheat, sugar, steel, etc.).

The usual method, consisting of unloading the boat and watering the hatches by means of a water hose to monitor the joints, becomes redundant with the use of the SDT 8. This can merely be placed on the cargo.

NB: see the comments regarding the safety of the operator on page 3 'Recommendations'.

## Aeronautics

### *Joints of the doors*

Detecting leaks from the joints of the doors, portholes and the cockpit is simplified. Functioning in bi-sonic mode (see annex) enables the elimination of dead zones.

### *Leaks in the fuselage*

The SDT 8 will be located at the centre of the volume to be controlled. A localisation probe used with the SDT detector for example will ensure precise detection.

### *Other monitoring possibilities*

The SDT 8 may also be used to monitor the bulkhead, compartments, windows, etc.



Monitoring in aeronautics is particularly appreciated

## Automobiles

The SDT 8 may be used in the context of manufacturing applications in order to detect wind noises and infiltrations of water. Therefore, for many automobile manufacturers, the ultrasonic technology is already replacing monitoring using water.

The multi-transmitter located inside the vehicle enables the windscreen, doors and windows joints to be checked.

## Trains

The SDT 8 has enough power to fill the volume of a refrigeration carriage for example with ultrasounds. It would therefore be easy to detect leaks from the external joints and locks.

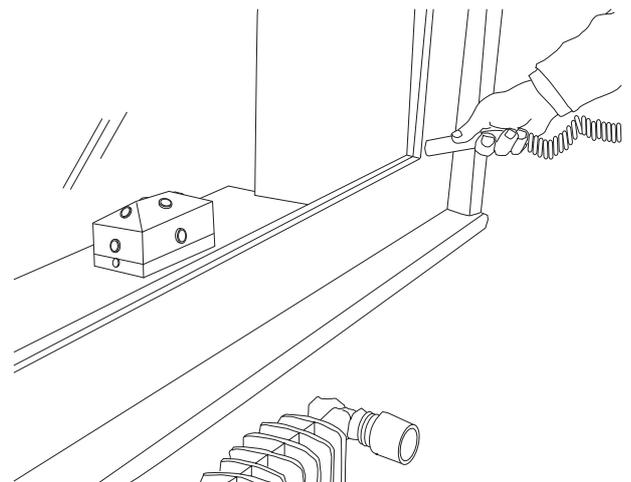
## Buildings

Numerous checks may be carried out with the ultrasonic sound, such as for roof and wall leaks, etc.

### *Window joints*

The SDT 8 would be located **outside**, on scaffolding for example, on the one hand to ensure the safety of the operator, and on the other hand to eliminate outside noise.

While checking windows, some vibrations tend to pass via the centre of the window. This place must be ignored. Concentrate on checking the edges where the risk of leaks is greatest. The level of the signals is more significant there.



Checking the tightness of a window.

# 4 - SDT 8 Multisetting

## 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 volumes which cannot be pressurized or depressurized.

## Description

This equipment is an adjustable (six positions) ultrasonic transmitter used in combination with an *SDT Ultrasonic Detector*. Eight (8) oriented ultrasonic transducers are localized all around the unit, for a variable 8x 125 mW ultrasonic power.

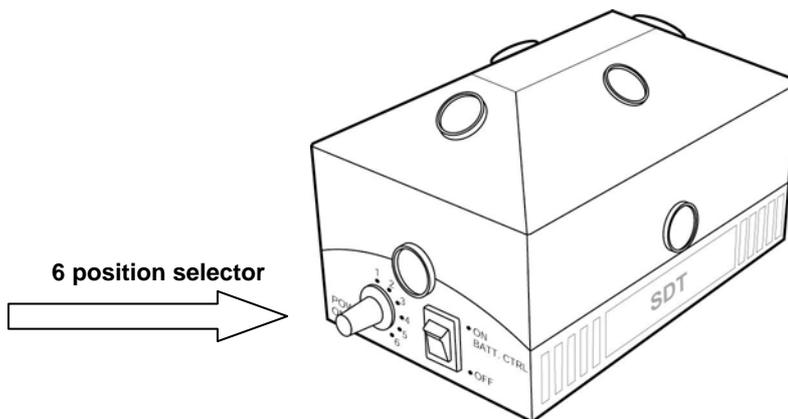
A 6 position selector allows the choice of the ultrasonic power.

## Transmission power

Power control in 6 levels:

Typical value from 1 to 6: -20dB, -15dB, -9dB, -6dB, -2dB, Max

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



View of the ultrasonic type SDT 8 multisetting transmitter.

# 5 - Operational problems

This chapter focuses on the principal operational defects.

## Ultrasonic sensor

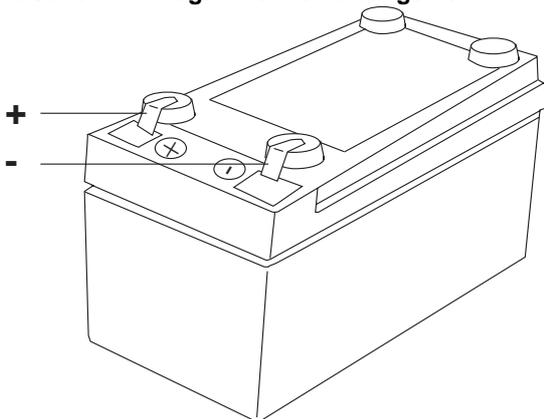
One or more sensors may be defective following:

- a mechanical shock: return the equipment to your distributor for a change of one or more sensors;
- water in the sensors: leave to dry and check that there is no water left, etc.

In both cases the transmission power is significantly limited or even non-existent, as the receiver will confirm.

## Battery

**Warning: if a battery of a different manufacturer than that of the battery delivered must be fitted, it is essential to pay attention to the arrangement of the terminals polarity. This must conform with the diagram below. There is no standardisation with regard to their arrangement.**



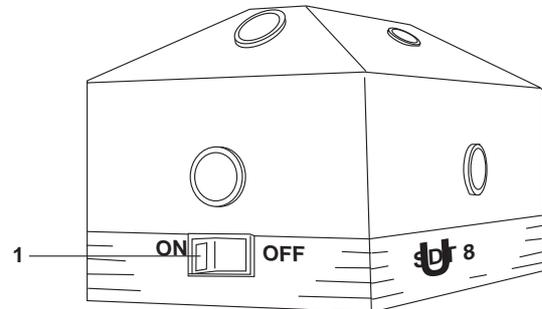
The battery terminal spade tags must be conform to this layout.

A flat or defective battery prevents the correct functioning of the multi-transmitter. The characteristics of the battery are:

- a gelled lead-acid battery
- normal voltage: 12V
- capacity: 1.2 Ah
- charge current: 0.4 A max.

As a method of control, an indicator enables the condition of the battery charge to be determined quickly. It has the following codes:

Indicator	Equipment
On	- Equipment switched on. - Battery charge correct.
Flashing	- Equipment switched on. - Battery charge incorrect. The speed of flashing increases as the charge decreases.
Off	- Equipment switched off or - Battery charge insufficient.

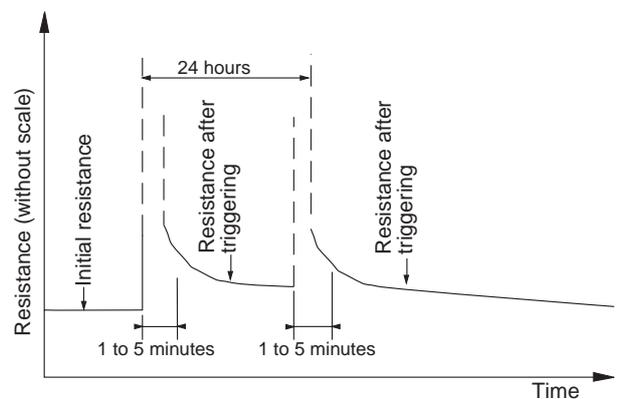


Position of the battery charge indicator

## Control fuse

Despite the presence of a correctly charged battery, the receiver, in good working order, does not receive any ultrasonic signal. This fault may be due to the triggering of a chemical control fuse of the internal electronics.

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

The general causes of the triggering are:

- fault in the internal electronics;
- battery polarity is incorrect.

NB:

- never replace the chemical fuse with a different type;
- successive occurrences of triggering are caused by a fault in the equipment.

It is therefore advisable to return the equipment to the distributor for repairs.

# 6 - Technical characteristics

## Transmission characteristics

**Function:** Ultrasonic multi-transmitter.

**Number of sensors:** Eight (8).

**Frequencies:** Stabilised at 39.2 and 39.6 kHz (bi-sonic mode).

**Transmission power:** Stabilised at 8x125 mW.

**Dispersion:** 8x60° .

## ON/OFF switch

**Command:** By ON-OFF switch.

**Visual indication:** ON - OFF/battery charge control indicator.

## Supply

**Voltage/capacity:** 12V DC/1,2 Ah.

**Battery:** Gelled lead-acid 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.

## Others

**Temperature range:** -10° C to +50° C(\*)

**Measurements:**

**Length:** 160 mm

**Width:** 100 mm

**Height:** 95 mm

**Weight:** 1.5 kg

**Guarantee:** SDT International guarantees the SDT 8 against all manufacturing defects during a period of two (2) years from delivery, with the exception of the battery which is guaranteed for a period of six (6) months. The guarantee covers the whole of the equipment and consists of the free replacement of any defective parts, due to either material or constructional defects.

See also the guarantee paragraph on page 2.

(\*): in some cases the equipment may be used down to a temperature of -25° C on condition that the equipment is not used for more than 15 hours at a time.

# 7 - Annexes

## The ultrasounds

They occur above the audible range of the human ear, i.e. over 20kHz. Only a specialised detection equipment can detect their presence.

The ultrasounds created by the SDT 8 are generated by transmitters made out of piezoelectric quartz crystals. These work like ultrasonic loud speakers. They transmit a frequency around 40 kHz.

## The propagation laws of the ultrasounds

In order to achieve improved use of an ultrasonic transmitter/receiver set, it is important to know the laws governing the propagation of ultrasounds.

### Main properties of the ultrasonic sensors

Due to the fact that its frequency approaches 40 kHz, ultrasounds are very directional. With their short wavelength, ultrasounds cannot spread as quickly as the broad waves of the audible sound.

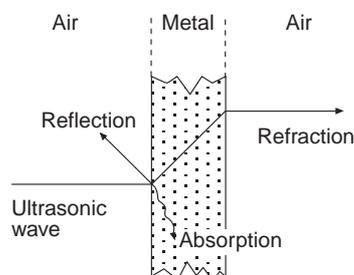
In order to compensate for the ultra-directional directivity of ultrasound, the multi-transmitter uses 8 transmission sensors set out in such a way as to cover a volume comparable to that of a hemisphere.

Each sensor of the SDT 8 transmits at a solid angle of  $60^\circ$ . Due to their arrangement on the SDT 8's box, the ultrasonic rays cross over each other to ensure a sufficient sound density for the optimal detection of leaks.

### Ultrasounds and solid materials

When an ultrasonic wave meets another material, there is:

- reflection on the first material;
- refraction in the second material;
- absorption in the second material.



*The three phenomena observed when ultrasound passes through a material*

Hence, each time an ultrasonic wave passes from one material to another, these phenomena occur in different proportions.

### Ultrasounds and liquid materials

When ultrasounds pass through the air and into a liquid, most of the energy is reflected.

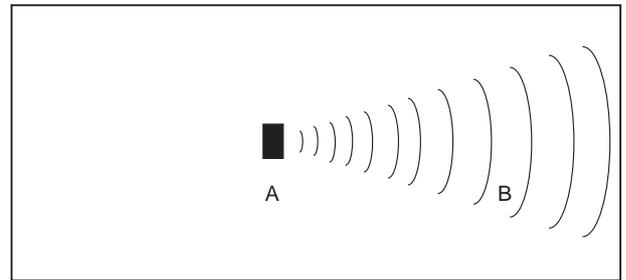
When the ultrasounds pass through a liquid and then meets air, most of the energy is refracted or passes into the air with a slight change of direction.

When the ultrasounds pass through a continuous environment such as air or water and encounters a second material such as foam, a large part of the energy is absorbed.

## The bi-sonic mode

### The necessity of the bi-sonic mode

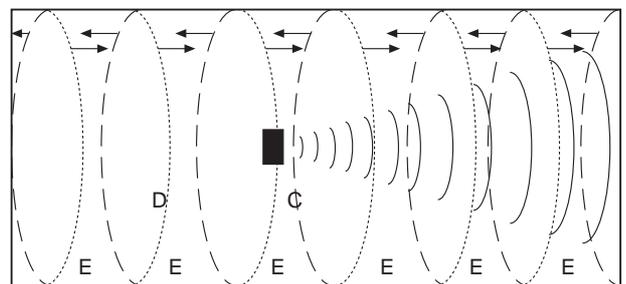
An ultrasonic source (A) placed in an enclosed environment, initially emits a first wave (B).



*The ultrasonic source (A) and the first wave (B).*

This first wave is then reflected a first time (C) and a second time (D). C and D are called secondary waves.

These secondary waves react in such a way as to produce interference patterns which create null points or 'dead zones' (E) in the inspection areas.



*The initial reflection (C), the second (D) and the dead zones (E)*

Where a null ultrasonic activity occurs, the probability of detecting a leak is greatly reduced. This is why the elimination of the permanent waves is important to ensure effective detection in an enclosed environment. This elimination of the permanent waves is carried out by using the bi-sonic mode.

### The operation of the bi-sonic mode

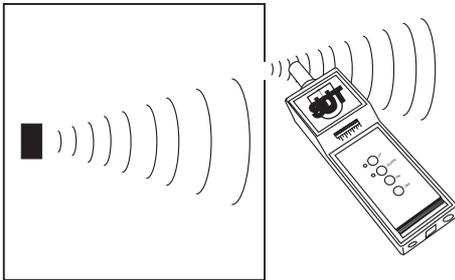
The bi-sonic mode uses two ultrasonic frequencies of 39.2 and 39.6 kHz commutated 9 times a second. Although each frequency has its own pattern of permanent waves, the automatic cycle commutation leads the movement of the null points at the same rhythm (9 times a second). This technique also eliminates the problem of the permanent waves.

Two other advantages are drawn directly from this bi-sonic technique:

- the commutation between these two ultrasonic frequencies produces a sound (beating) recognisable by the human ear, which facilitates the detection of leaks;
- the increase of about 20% in the ultrasonic density in the zone to be inspected compared with any other current technique.

### Detection of a leak by ultrasound in an enclosed space

The ultrasonic transmitter is placed in the volume or the zone to be tested. From the other side of the wall, by means of an appropriate receiver, the possible presence of ultrasonic waves can be detected. These use any crack or lack of matter as their route.



*The detection of a leak by means of an ultrasonic transmitter-receiver set.*

### The advantages of the SDT 8

The SDT 8 thus enables significant volumes (125,000 m<sup>3</sup>) to be filled perfectly with ultrasonic waves. An opening of a few micrometres or more hardly offers any resistance to the 40kHz ultrasounds. It is then possible to fill with ultrasounds, a cavity, a room, a vehicle, etc. and to detect the leak exactly by means of a receiver placed on the other side of the wall.





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