Leaktesting by
measuring mass flow

SDT *LeakTESTER*

User Manual

V526

Third Edition, US English.

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.

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Contents

1. About this manual

1.1 AIM OF THE MANUAL

The *User Manual* is designed as a reference guide and tool for all those wishing to use the *SDT LeakTESTER* as part of their work.

This manual should be read carefully in its entirety before using the *SDT LeakTESTER*.

SDT produces this manual with the single and unique aim of providing the user with simple, accurate information. *SDT* cannot be held responsible for any incorrect interpretation of this manual. Despite our efforts to produce an error-free manual, there is nevertheless a possibility that it could inadvertently contain some technical inaccuracies. If in doubt, contact your local *SDT* distributor for further information.

Every effort has been made to put together an accurate and correct manual, updates and/or modifications may be added at any time without necessarily being added to this document

The owner of this manual is recommended to keep this manual for the entire life cycle of the appliance and is under obligation to pass it on to the buyer in the event of a resale.

This *User Manual* and its content are the inalienable property of *SDT International*.

2. Safety

2.1 SYMBOL

This symbol means:
Warning: consult the operating instructions before using the appliance.

In these operating instructions, all instructions preceded by this symbol, if not respected or carried out correctly, may lead to physical injury or damage to the appliance and the installations.

This appliance is manufactured and tested in accordance with CEI standards relating to Electromagnetic Compatibility. It has left the factory in perfect conditions of technical safety. In order to uphold these conditions and to guarantee safe use of the appliance, the user should follow the instructions and the icons in this manual. (CEM)

Before installation, check that the working voltage and the voltage of the power supply are the same.

When using the appliance in complete safety is not possible, the appliance must be switched off to ensure that no accidental usage may occur.

Safe usage of the appliance can no longer be guaranteed in the following cases:

- When the appliance is visibly damaged.
- The appliance no longer works.
- After a prolonged period of storage in unfavourable conditions.
- After serious damage sustained during transportation.

2.2 OPERATOR SAFETY

Read the following recommendations carefully before installing or using the appliance.

The appliance described in this manual is designed to be used exclusively by trained personnel. All maintenance operations should be carried out exclusively by qualified and authorised personnel. To ensure correct and safe usage for all maintenance operations, it is essential that the personnel follow normal safety procedures.

2.3 PRECAUTIONS IN THE EVENT OF FAULTS

When the appliance is suspected to be unsafe (for example because of damage sustained during transportation or use), it must be switched off. It is essential to ensure that it will not be used accidentally. The appliance will be sent to technicians authorised to carry out checks.

3. List of elements delivered

Rep.	Description	Quantity
1.	*SDT LeakTESTER*.	1
2.	Bracket and screw kit.	10
3.	Input-output 16-terminal connector.	2
4.	3-terminal power connector.	1
5.	Plug-ended Lemo 5 – Lemo 7 pin cord (*SDT LeakTESTER* sensor).	1 to 8
6.	MFL HP ±25 SCCM or -100/+1000 SCCM sensor.	1 to 8
7.	User manual.	1

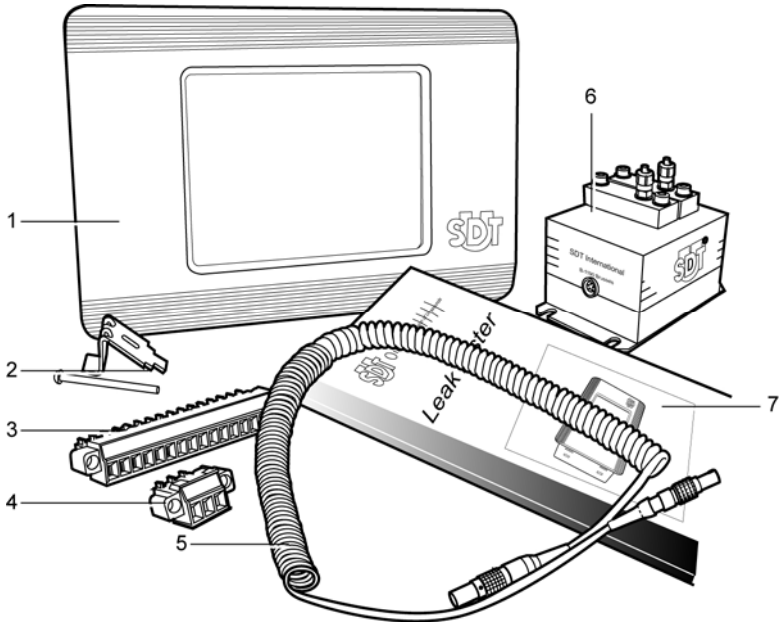


Figure 3-1 : The list of elements delivered.

4. General operating principles

For easier reading of this manual and subsequent easier use of the SDT LeakTESTER, this chapter presents the operating principles for the SDT LeakTESTER and its role in the production line. Details are given in the following chapters.

4.1 MEASUREMENT PRINCIPLE

The principle is based on the measurement of the flow rate between a reference volume (Vr) and the volume to be tested (Vt). Schematically, the principle is as follows (Figure 4-1).

Both volumes Vr and Vt, connected to each other but not necessarily equal, are simultaneously filled with air. After a stabilisation period, the pressure Pr of the reference volume Vr is equal to the pressure Pt of the volume to be tested Vt.

- If the piece to be tested Vt is airtight, the pressure Pr and Pt remain the same. The flow through the mass flow sensor is zero.
- If the piece to be tested is leaking, the pressure Pt reduces. The imbalance between the pressure Pr and Pt causes a flow through the flow rate sensor.

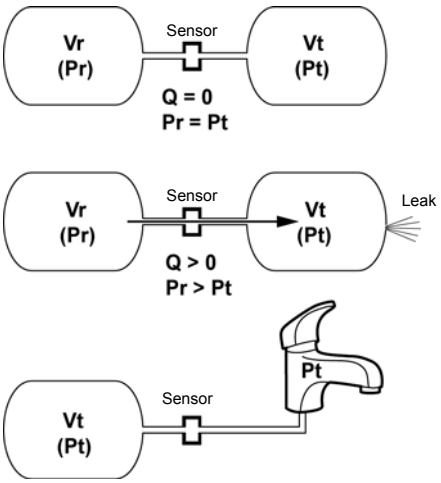


Figure 4-1: The two volumes are interconnected by solenoid valves (not pictured) and a mass flow sensor.

4.2 CONSTITUENT PARTS

4.2.1 The *SDT LeakTESTER*

- Adjusts all the parameters associated with the type of piece to be tested (rejection thresholds, measurement time, etc.).
- Simultaneously checks the tightness seal of 1 to 8 pieces to be tested using mass flow sensor(s).
- Commands the electropneumatic system(s) when the measurement cycle is launched.
- Has 8 logical command inputs and 8 logical command outputs.

4.2.2 The mass flow sensors

These sensors, type mass flow sensors (MFL), measure the flow of the leak in the piece to be tested in SCCM (Standard Cubic Centimetres per Minute).

4.2.3 The electropneumatic system

This does the following:

- Fills the reference volume and the piece to be tested.
- Serially connects the reference volume and the piece to be tested through an MFL sensor during the measure - stabilisation phase.
- Depressurises the piece to be tested at the end of the test.

4.2.4 The Output modules

These enable the number of *SDT LeakTESTER* outputs to be increased.

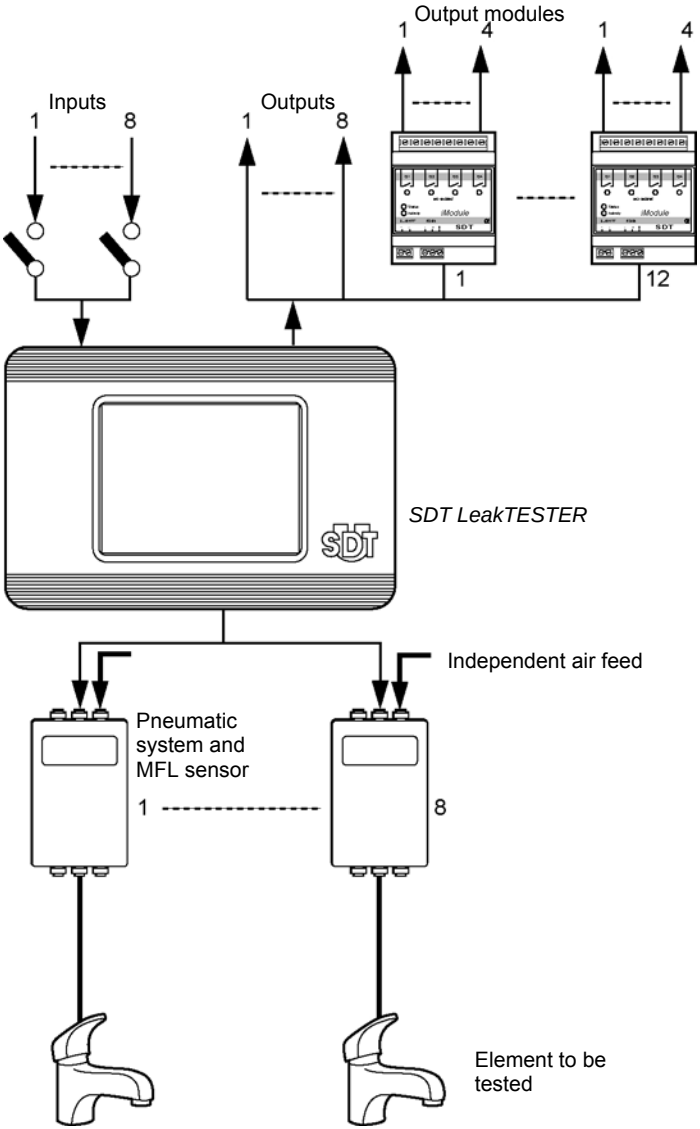


Figure 4-2: Diagram of elements in a leak detection system on domestic taps for example: up to 8 elements can be checked simultaneously.

5. Presentation of *SDT LeakTESTER*

5.1 FUNCTION

The *SDT LeakTESTER* is an electronic measurement unit equipped with mass flow sensors. It is used for either manually or automatically simultaneously checking the tightness of between one and eight elements - generally at the end of a production line - with rigid tightness criteria (taps, catheters, pouches, bottles, packaging, bottle, syringes, cartridges, cooling circuits, shock absorbers, etc.).

The measurement of tightness is carried out by measuring the rate of flow of gas (air, nitrogen, etc.) and not by the difference in pressure between the reference volume and the piece being tested. This measurement (SCCM) is carried out by passing the flow through a mass flow sensor.

The integration of the *SDT LeakTESTER* in the production line process involves the installation of a pneumatic system, and the opening and closing phases of the solenoid valves for this system are controlled by the *SDT LeakTESTER* itself.

The *SDT LeakTESTER* receives data about the flow rate from the mass flow sensor enabling it to validate or reject the products tested and controls the validation equipment in the testing chain (lights, relays, production data, etc.).

5.2 THE FRONT OF THE UNIT

It has a 256-colour touch screen with back-light, equipped with an automatic and adjustable shut-off device. The *SDT LeakTESTER* has no keypad; all the commands can be made by touching the icons on the screen. The display will be reactivated by touching the screen.

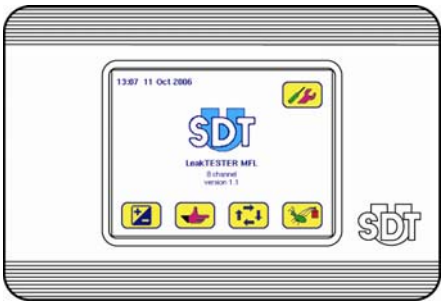
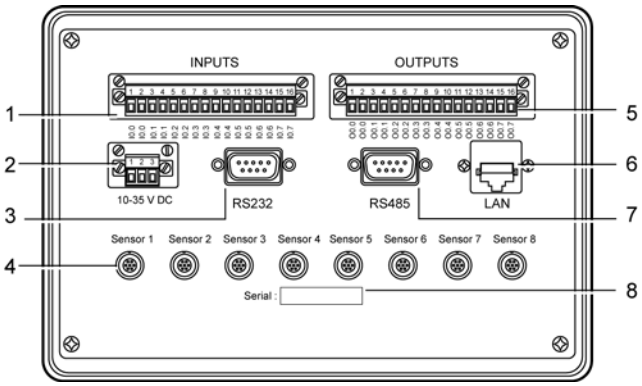


Figure 5-1: The front of the SDT LeakTESTER.

5.3 THE BACK OF THE UNIT

The various connectors for the *SDT LeakTESTER* and its serial number are found on the back of the unit.



1. Terminal for 8 digital inputs.
2. Power supply connector.
3. RS 232 connector.
4. Link connectors to MFL sensors 1 to 8.
5. Terminal for 8 digital outputs.
6. Ethernet connector.
7. Output modules connector (RS 485).
8. Serial number of the appliance.

Figure 5-2: The back of the unit.

5.3.1 Digital inputs connector

The *SDT LeakTESTER* has 8 independent optically isolated digital inputs. Each input numbered from I0.0 to I0.7 enables the *SDT LeakTESTER* to receive signals of exterior commands. The numbering for the inputs is identical on the back of the unit as on the settings screens.

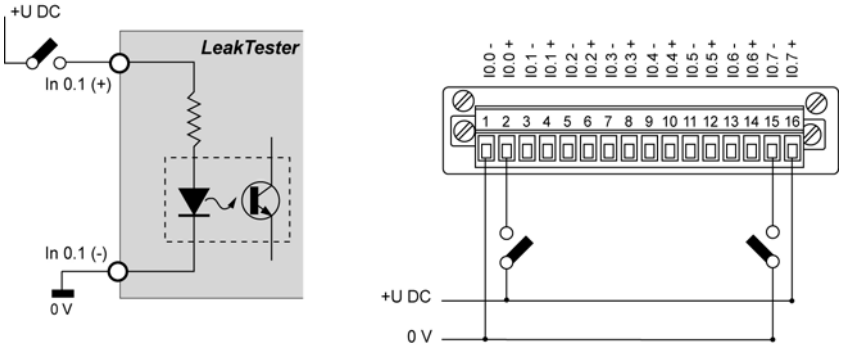


Figure 5-3: Example of wiring of a SDT LeakTESTER digital input.

5.3.2 Digital outputs connector

The *SDT LeakTESTER* has 8 independent digital outputs with optical isolation. Each output numbered O0.0 to O0.7 enables the *SDT LeakTESTER* to command a peripheral or to transmit information. The numbering of the outputs is identical on the back of the unit as on the settings screens.

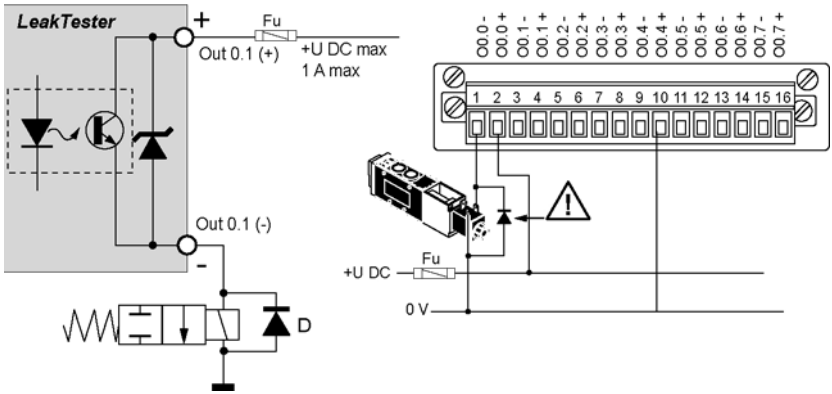


Figure 5-4: Example of wiring of a SDT LeakTESTER digital output.

Besides the fact that the European Standard CEM requires the installation of a protective diode known as a “freewheel” on the terminals of each solenoid valve, it is strongly recommended that this diode be installed in order to protect the internal circuits of the *SDT LeakTESTER* from high-voltage surges .

Fuse protection must be integrally fitted to the power supply cable for remotely controlled elements (relays, etc.).

5.3.3 Mass flow sensor (MFL) connector

Each mass flow sensor is connected to one of the 8 7-pin connectors (Figure 5-2, rep. 4) via a Lemo 5 - Lemo 7 cable.

To disconnect a male Lemo plug, never twist it. Simply slide the knurled ring sideways by pulling on the plug.

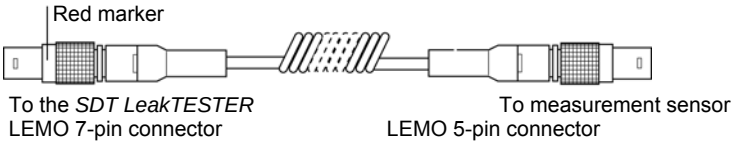


Figure 5-5: LEMO 7-pin cable (SDT LeakTESTER) to LEMO 5-pin cable (sensor).

5.3.4 RS 232 link connector

This male 9-pin connector (Figure 5-2, rep. 3) connects the *SDT LeakTESTER* to the RS 232 communication input with additional equipment for the purpose of transferring two-way data. Contact SDT for any information on its use.

Due to its RS232 interface, the *SDT LeakTESTER* works as a DCT (DataComm Terminal) so that the PC linking must use a null modem cable.

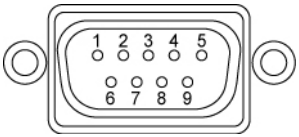


Figure 5-6: Wiring diagram for the RS 232 connector.

The numbers of the RS 232 connector terminals (Figure 5-2, rep. 3) correspond to the following functions:

N°	Abbreviation	Function
1	-	Not used
2	RXD	Received Data
3	TXD	Transmitted Data
4	-	Not used
5	SG	Mass signal
6	-	Not used
7	RTS	Request To Send
8	CTS	Clear To Send
9	-	Not used

Tableau 1: Pins of the RS 232 connector.

5.3.5 Output Modules connector

This male 9-pin connector (Figure 5-2, rep. 7) connects the *SDT LeakTESTER* to the Output modules via a RS 485 type connection.

5.3.6 Ethernet link connector

This 10-Lowere-T Ethernet connector (Figure 5-2, rep. 6) enables the *SDT LeakTESTER* to be linked to an Ethernet network. Contact *SDT* for any information on its use.

5.3.7 Serial number

The serial number of the *SDT LeakTESTER* is visible on the back of the terminal box (Figure 5-2, rep. 8).

6. The *Output Modules*

The basic version of the *SDT LeakTESTER* has 8 digital outputs (see paragraph 5.3.2, on page 13). In order to increase the number of available outputs, the *SDT LeakTESTER* can command 1 to 12 Output modules each equipped with 4 all-or-nothing outputs.

The *SDT LeakTESTER* can thus manage a maximum of 56 digital outputs.

Refer to the following paragraphs for the use of the Output Module:

Subject	See
Mechanical assembly	Paragraph 8.2.3, page 28.
Connecting the *SDT LeakTESTER*	Paragraph 8.3.4, page 30.
Electrical connections	Paragraph 8.3.2, page 29.

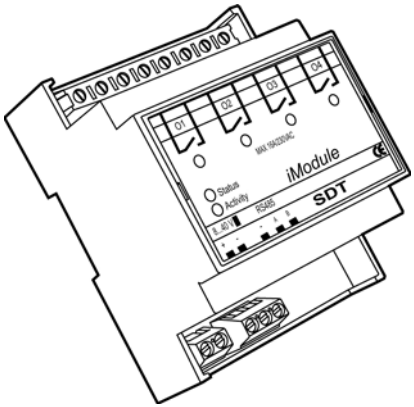


Figure 6-1: View of an Output Module.

7. The electropneumatic system

The quality and performances of the electropneumatic system directly influence the speed and reliability of the measures taken and consequently, the overall performance of the monitoring system. SDT International remains at your disposal to guide you in your choice of pneumatic equipment depending on your applications.

7.1 FUNCTION

Remotely-controlled by the *SDT LeakTESTER*, the electropneumatic system manages the pressurisation, measurement and depressurisation sequences for the pieces to be tested.

7.2 CONSTITUENT PARTS

An electropneumatic system is made up of the following parts (see figure on page 20):

Icon	Part	Function
P	Air feed	Clean and dry compressed air.
FR	Pressure regulator and filter	Adjustment of the test and air filtration pressure.
VR	Reference volume	Air reservoir.
VT	Piece to be tested	
MFL	Mass flow sensor	Measures the flow of air between the reference volume and the piece to be tested.
EV1	Pressure valve for air reservoir	Sets the air reservoir at test pressure.
EV2	Pressure valve for piece to be tested	Sets the piece to be tested at test pressure.
EV3	Measurement valve	Communicates the reference volume and the piece to be tested via the mass flow rate (MFL) sensor.
EV4	Depressurisation valve	Sets the piece to be tested at atmospheric pressure.

Tableau 2: Constituent parts of an electropneumatic system.

7.3 SCHEMATIC DIAGRAM

The constituent parts of an electropneumatic system are interconnected as follows:

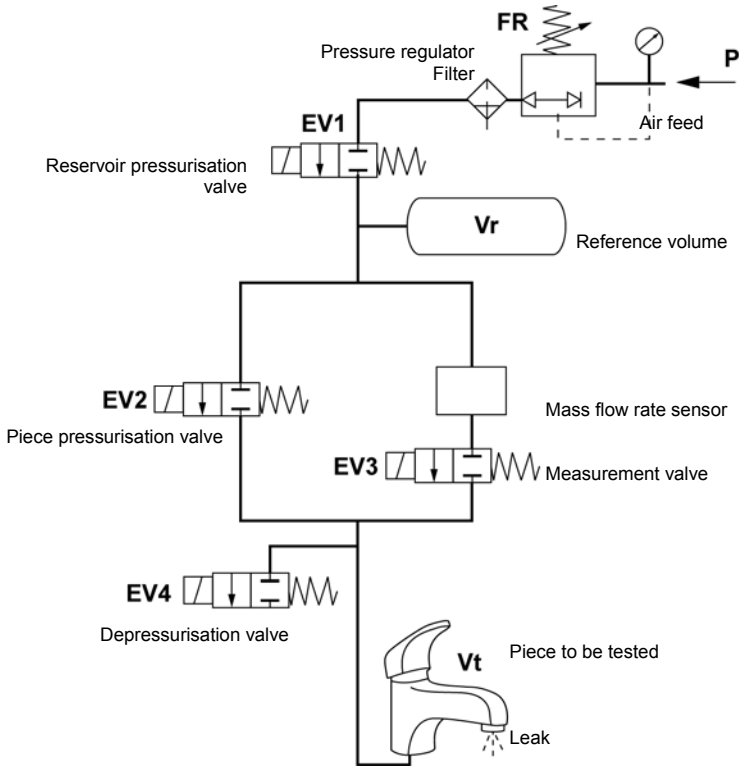


Figure 7-1: Loweric diagram of an electropneumatic system

7.4 PNEUMATIC SEQUENCES

The pneumatic sequences described below apply to the launch of a manual cycle and for solenoid valves that are normally closed.

- **Stage 1**: launch the test by pressing the start button.
- **Stage 2**: opening of the EVI solenoid valves (pressurisation of the reference volume) and EV2 (pressurisation of the piece to be tested).
- **Stage 3**: closure of the solenoid valves EV1 and EV2. Opening of the solenoid valve EV3 (communication of the reference volume and the piece to be tested via the mass flow sensor).
- **Stage 4**: thermodynamic stabilisation time and continuous measurement by the mass flow sensor.
- **Stage 5**: the measurement obtained at the end of the stabilisation time is the one retained in order to decide whether the piece is right or wrong, depending on the acceptability thresholds.
- **Stage 6**: closure of the solenoid EV3 valve (End of measurement) and opening of the EV4 solenoid valve (the piece to be tested is brought to atmospheric pressure.
- **Stage 7**: end of cycle and closure of EV4 solenoid valve. The *SDT LeakTESTER* is ready to start a new test cycle.

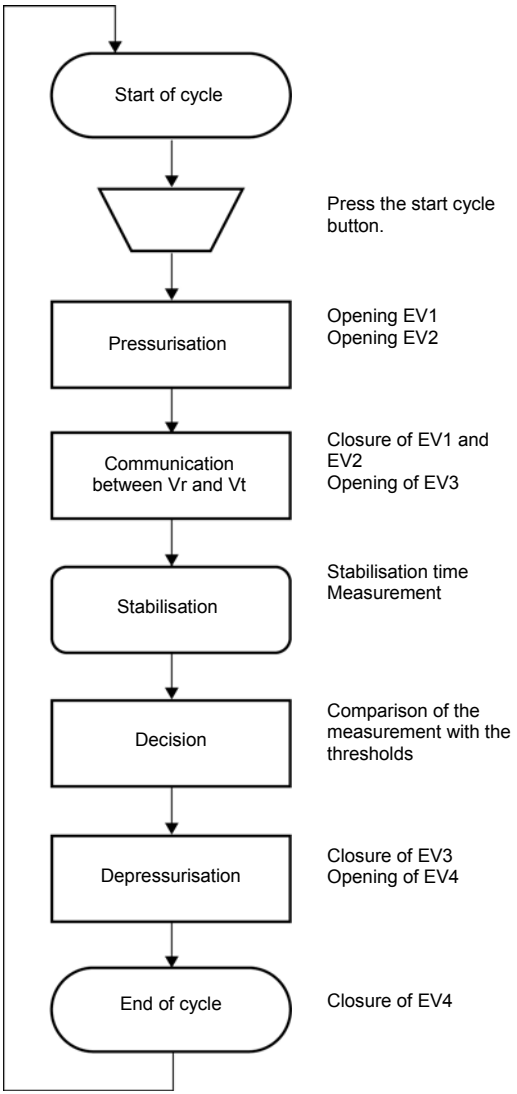


Figure 7-2: Flow chart of the test cycle.

7.4.1 Connection in *Mode 8*

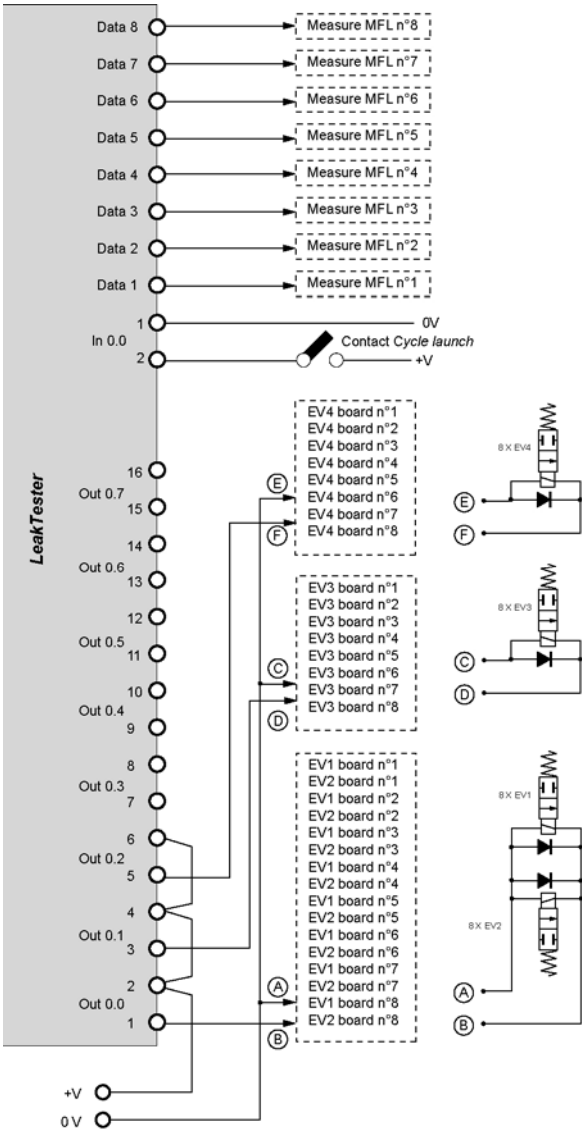


Figure 7-3: Example of connection diagram for equipment external to the LeakTESTER in mode 8.

Reminder: the wiring method is given as an example. It should be noted that the *SDT LeakTESTER* outputs can be set to command external elements (pneumatic solenoid valves, relays, indicator lights) depending on the settings.

The wiring method is as follows:

- There should be a single push button to launch the cycle.
- The EV1 and EV2 valves for each of the 8 electropneumatic circuit boards are connected in parallel. There must be a diode on the terminal of each solenoid valve.
- The EV3 valves for each of the 8 electropneumatic circuit boards are connected in parallel. There must be a diode on the terminal of each solenoid valve.
- The EV4 valves for each of the 8 electropneumatic circuit boards are connected in parallel. There must be a diode on the terminal of each solenoid valve.

Check the compliance between the power needed for the valves and the output interrupting capacity of the SDT LeakTESTER (paragraph 17.1, on page 83). Where necessary, use a suitable control relay.

7.4.2 Connection in *Mode 4/4*

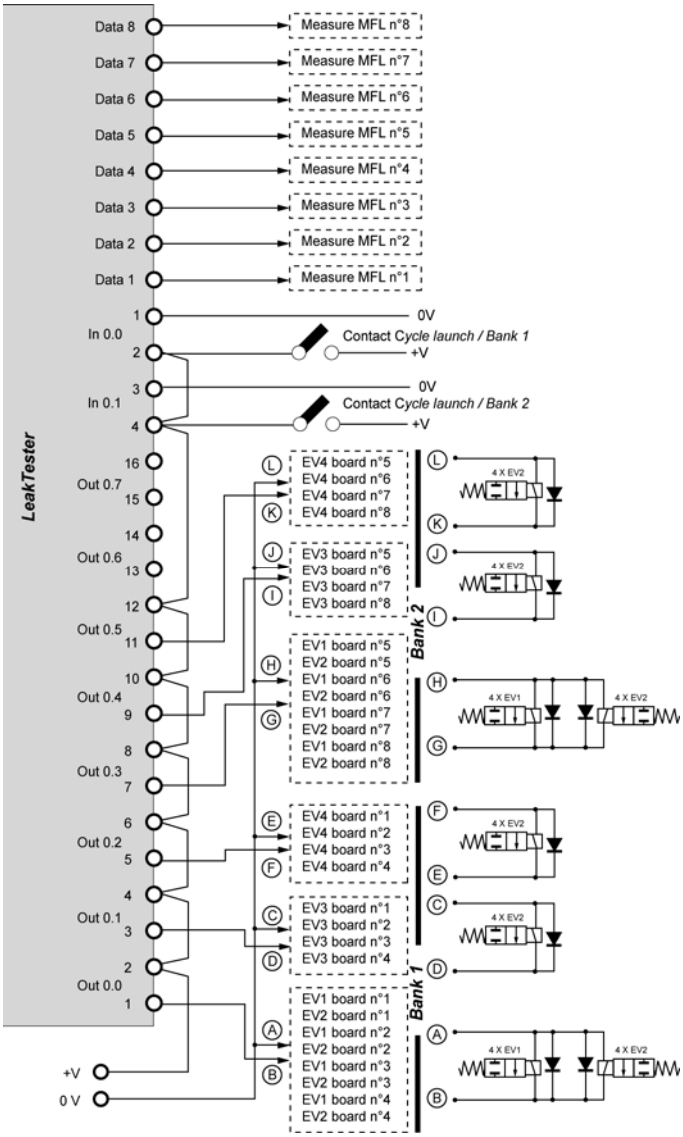


Figure 7-4: Example of a connection diagram for equipment external to the LeakTESTER in mode 4/4.

Reminder: the wiring method is given as an example only. You are reminded that the *SDT LeakTESTER* outputs can be set to command external elements (pneumatic solenoid valves, relays, indicator lights) depending on the settings selected.

The wiring method is as follows:

- There are two push buttons for independently launching the cycles; one for bank n°1 (boards 1 to 4) and the other for bank n°2 (boards 5 to 8).
- The three points below will be repeated twice, one for each bank.
  - The EV1 and EV2 valves for each of the 4 electropneumatic circuit boards are connected in parallel. A diode must be connected to the terminal of each solenoid valve.
  - The EV3 valves for each of the 4 electropneumatic circuit boards are connected in parallel. A diode must be connected to the terminal of each solenoid valve.
  - The EV4 valves for each of the 4 electropneumatic circuit boards are connected in parallel. A diode must be connected to the terminal of each solenoid valve.

Check the compliance between the power needed for the valves and the output interrupting capacity of the SDT LeakTESTER (paragraph 17.1, on page 83). Where necessary, use a suitable control relay.

8. Mechanical and electrical assembly

8.1 ELEMENTS TO BE ASSEMBLED

Ref.	Description	Quantity
1.	*SDT LeakTESTER*.	1
2.	Bracket and fixing screw.	10
3.	Input-output 16-way connector.	2
4.	3-way power connector.	1
5.	Connector cable(s) for the SDT LeakTESTER – MFL sensor.	1 to 8
6.	Output Module(s) (option).	1 to 12
7.	MFL HP ±25 SCCM sensors(s) or ±100 SCCM.	1 to 8

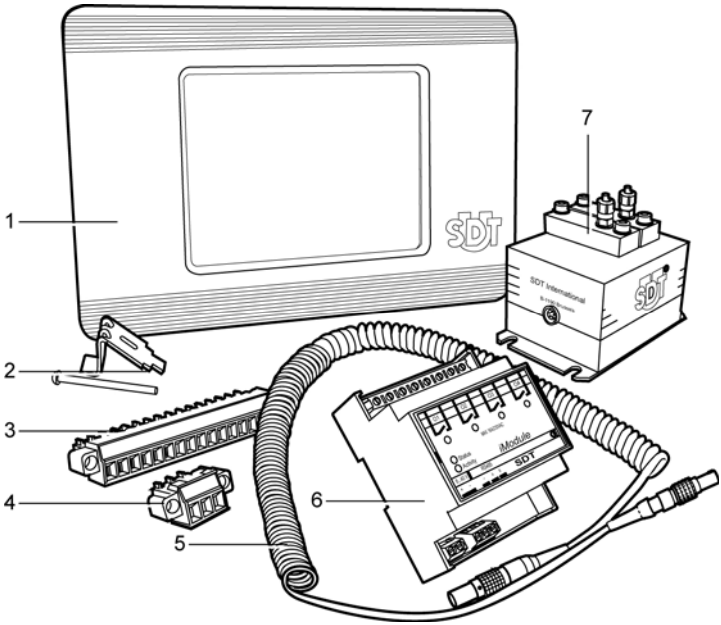


Figure 8-1: Elements to be assembled.

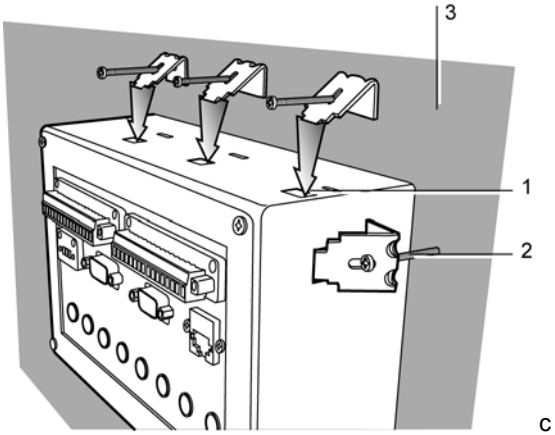
8.2 MECHANICAL ASSEMBLY

8.2.1 Template for the testing bay

The *SDT LeakTESTER* is designed to be mounted on a support (testing bay, box, etc.). Its dimensions will be 205 mm wide (8’.1’’) by 132 mm high (5.2’’).

8.2.2 Assembly of the *SDT LeakTESTER*

Manually assemble the *SDT LeakTESTER* as indicated below. Use the fastenings provided (legs and screw). Position each leg (rep. 2) in the holes provided (rep. 1) on the *SDT LeakTESTER*. Then position the screw and tighten to fix the *SDT LeakTESTER* to its supporting surface.



1. Hole for support leg.
2. Support leg and fixing screws.
3. Supporting surface (testing bay, electrical box).

Figure 8-2: The SDT LeakTESTER is delivered with a fixing kit. 049

8.2.3 Assembly of Output modules

Each Output Module will be fixed to a DIN rail.

8.3 ELECTRICAL CONNECTIONS

8.3.1 Electrical power supply to the *LeakTESTER*

The three-pin connector for the *LeakTESTER* is connected to the electrical power supply (12 to 36 V DC, 1,5 A max); the maximum consumption is 12 W (consumption of *LeakTESTER*), plus 1 W per MFL sensor connected.

The connection is protected against all voltage reversal. However, the application of excessive voltage can lead to irreversible damage to the *SDT LeakTESTER*. The power supply to the unit must be protected by a suitable fuse adapted to the total consumption of the *SDT LeakTESTER* and the MFL sensors.

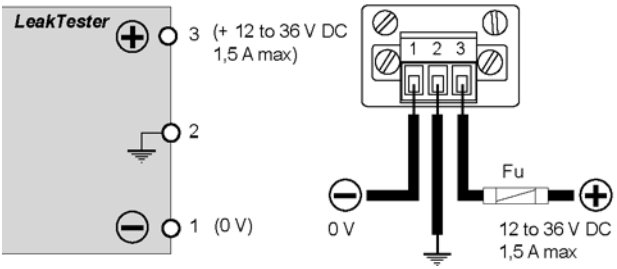


Figure 8-3: Diagram of the power supply connections for the SDT LeakTESTER.

8.3.2 Electrical power supply to the Output modules

Each Output Module will be powered by electricity (12-36V DC) via its two-pin terminal. The maximum consumption is 2.5 W per Output Module.

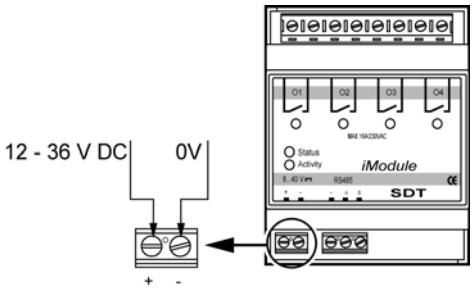


Figure 8-4: Connection of the Output Module to the external power supply.

8.3.3 MFL sensors to the *SDT LeakTESTER*

Refer to paragraph 5.3.3, on page 14.

8.3.4 Output Modules to the *SDT LeakTESTER*

The *Output Modules* are assembled in parallel mode on a RS 485 line connected to the DB9 (RS 485) connector of the *SDT LeakTESTER* using a bunched and protected 1 pair cable. The line must be a maximum length of 1.2 metre. The connection to the first module should be carried out as follows:

- Connect the first conductor to terminal A of the *Output Module* and to pin 2 of the DB9 (RS 485) connector of the *SDT LeakTESTER*.
- Connect the second conductor to terminal B of the *Output Module* and to pin 3 of the DB9 (RS 485) connector of the *SDT LeakTESTER*.
- Connect the protection to the earth terminal of the *Output Module* and to pin 5 of the DB9 connector (RS 485) of the *SDT LeakTESTER*.

The wiring for a new *Output Module* will be carried out by branching off the previous one.

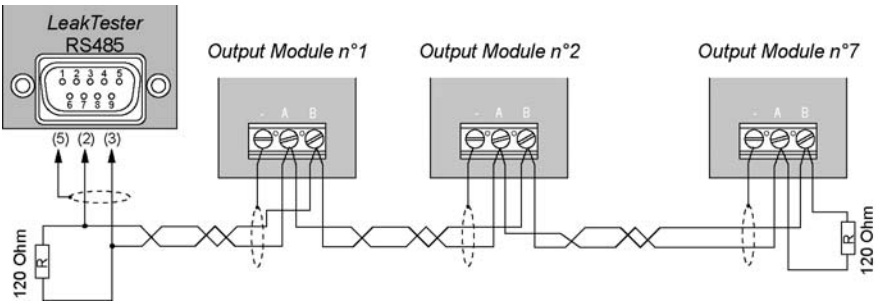


Figure 8-5: Connection of Output Modules to the SDT LeakTESTER and branching of the DB9 (RS 485) connector of the SDT LeakTESTER.

The loop will be made by fitting a 120 Ω resistor between terminals A and B of the last Output Module and between pins 2 and 3 of the DB9 (RS 485) connector of the *SDT LeakTESTER*. The modules will later be declared to the *SDT LeakTESTER* (see paragraph 11.8, on page 52).

9. General structure of menus

9.1 GENERAL POINTS

The *SDT LeakTESTER* is equipped with a touch screen. To access a menu or confirm a function the corresponding icon on the screen is pressed.

9.2 FUNCTION KEYS

The functions keys are described below. They are identical on all the menus.

Key	Function
	Select a field and move to the next field. A selected field will be highlighted in red or in bold.
	Increases the value of the selected field.
	Decreases the value of the selected field.
	Confirms and returns to the previous menu.
	Saves the modified data.

9.3 STARTUP SCREEN

After switching the *SDT LeakTESTER* on, the screen remains switched off for around 15 seconds, while the operating system loads. The main menu is displayed around 50 seconds after the appliance is switched on.

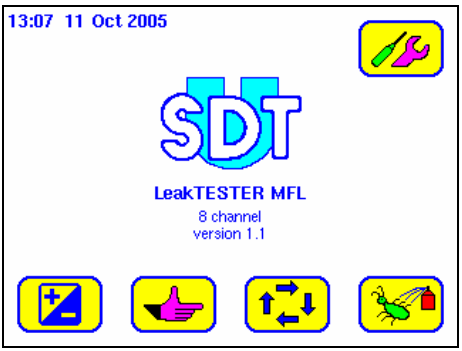


Figure 9-1: The main menu.

Note: if an automatic shut-off has been programmed, the screen will automatically switch off after a period of inactivity. Touch the screen to re-activate it.

9.4 THE MENUS

The menus accessible from the startup screen are:

Key	Menu	Function	See
	Internal settings	Adjusts the automatic shut-off period for the screen backlighting, the system date and the loudspeaker.	Page 35
	Parameters	Sets the inputs/outputs, the Output modules, the cycle time, the alarm thresholds, the profiles. Modifies the access codes and screen settings.	Page 37
	Manual command	Manually activates the various stages of a test cycle.	Page 65
	Automatic mode	Activates an automatic mode, consults and resets the “good/bad pieces” counters, cycle reports and measurement graphs.	Page 67
	Debug	Displays the status of inputs, display and manually activates the *SDT LeakTESTER* outputs and *Output* modules.	Page 75

9.5 BLOCK DIAGRAM OF MENUS AND SUB-MENUS

The figure below presents the diagram of menus and sub-menus of the *SDT LeakTESTER* accessible from the main menu and links to corresponding pages.

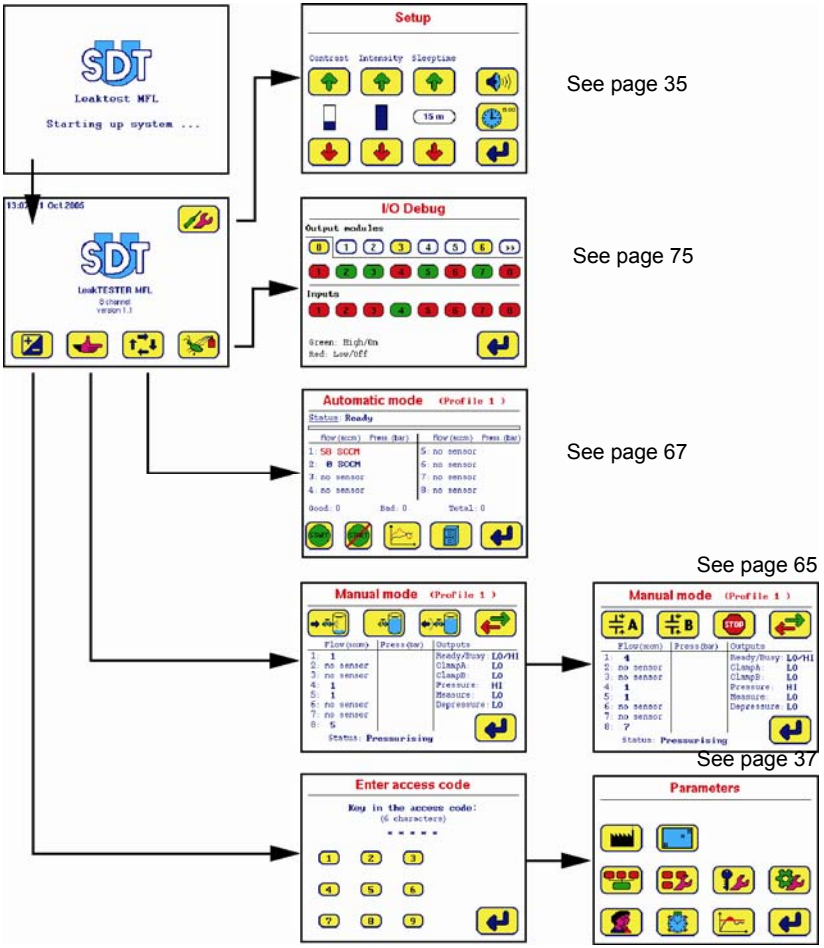


Figure 9-2: Tree structure of menus available from the main menu.

10. *Internal settings* menu

10.1 ACCESSING THE *INTERNAL SETTINGS* MENU

The access path is: Main screen / .

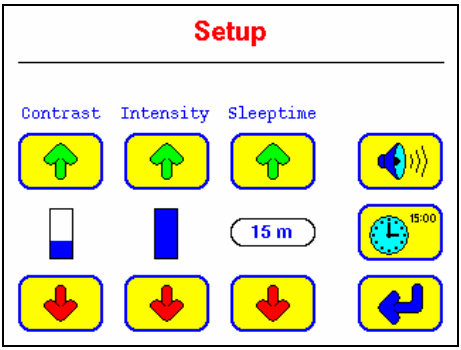


Figure 10-1: The [Setup] (Internal settings) menu.

10.2 DESCRIPTION OF *INTERNAL SETTINGS*

Function	Description
Contrast	Increases or decreases the contrast of the display.
Intensity	Increases or decreases the intensity of the display backlighting.
Sleeptime	Increases or decreases the interval before the screen backlighting switches off
	Switching on or off of a beeping sound when the screen icons are touched.
	Accesses the sub-menu for setting the system date and time. See paragraph 10.3.
	Back to previous menu.

10.3 SUB-MENU FOR SETTING THE SYSTEM DATE AND TIME

The access path is: Main screen /  /  .

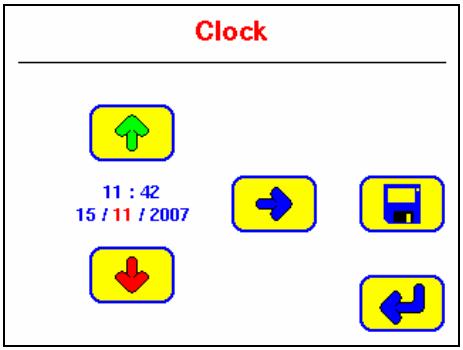


Figure 10-2: The [Clock] menu

Key	Function
	Select the following field.
	Increase the selected field (in red).
	Decrease the selected field (in red).
	Save the data and return to the *Internal settings* menu ().
	Return to the *Internal settings* menu () without saving the changes.

.

11. The *Parameters* menu

11.1 ACCESSING THE *PARAMETERS* MENU

The access path is: Main screen / .

11.2 USERS' ACCESS CODE

A password is requested for accessing the *Parameters* menu. The access code for the appliance by default on delivery is **147369**.

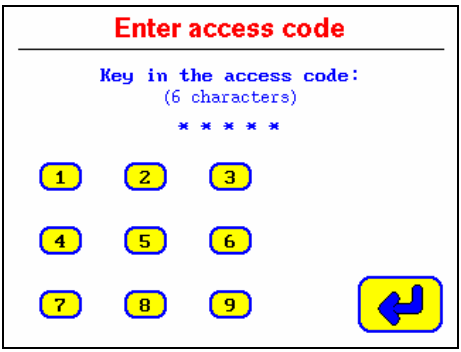


Figure 11-1: The [Enter access code] menu requires an access code to be entered for access to the parameters menus.

Proceed as follows:

- Enter the 6 characters of the code by pressing the numbered zones.
  - **If the code is correct**: the **`Parameters`** menu is displayed (see paragraph 11.3, page 38) immediately after the sixth number is entered.
  - **If the code is incorrect**: a screen is displayed indicating that the access code is incorrect (see Figure 11-2); the keys are de-activated for around 20 seconds. The system then returns automatically to the main menu (paragraph 9.5, page 33).

Figure 11-2: If the code entered is incorrect, a warning screen is displayed.

11.3 SUB-MENUS OF THE *PARAMETERS* MENU

Key	Sub-menu	Function	See
	Reset	Loads the factory settings for the *SDT LeakTESTER*.	§ 11.5, page 42
	Screen settings	Adjusts the size of the screen.	§ 11.6, page 44
	I/O assignment	Assigns logical inputs / outputs.	§ 11.7, page 44
	Assignment of Output Modules	Configures and declares an Output Module to the *SDT LeakTESTER*	§ 11.8, page 52
	Access code:	Modifies the user access code.	§ 11.9, page 54
	General profile settings	Select mode 8 or 4/4, to launch a measurement by operator or by external command, select the metric or imperial system, set the alarms by cycle and by sequence, load a test profile by external command.	§ 11.10, page 55
	Designation / Selection of profiles	Naming and selection of a test profile.	§ 11.11, page 59
	Adjustments to cycle time	Adjusts the duration of each stage of the cycle.	§ 11.12, page 61
	Threshold settings	Adjusts the upper and lower alarm thresholds.	§ 11.13, page 63

11.4 *PARAMETERS* MENU DIAGRAMS

11.4.1 Diagram 1/3

The figure below presents the first diagram of menus accessible from the **`Parameters`** menu and links to the corresponding pages.

The second and third diagrams are presented on the following pages.

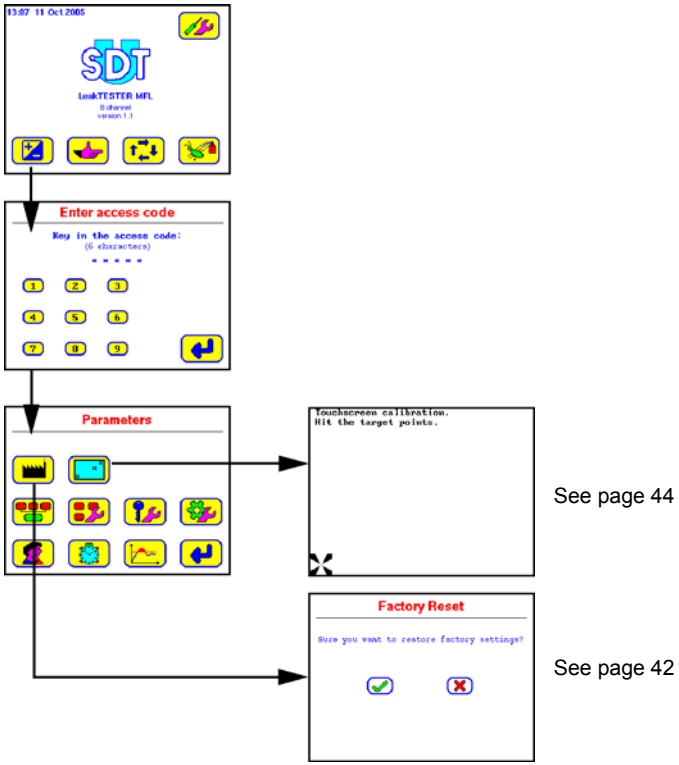
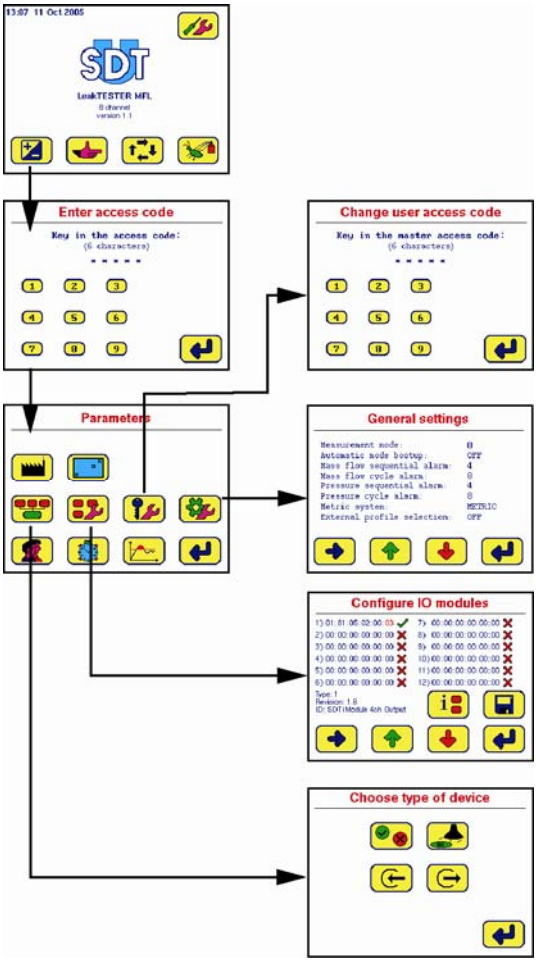


Figure 11-3: Tree structure for the Parameters menu (1/3) – continued on page 40.

11.4.2 Diagram 2/3

The figure below presents the second diagram of the menus accessible from the **`Parameters`** menu and links to the corresponding pages.

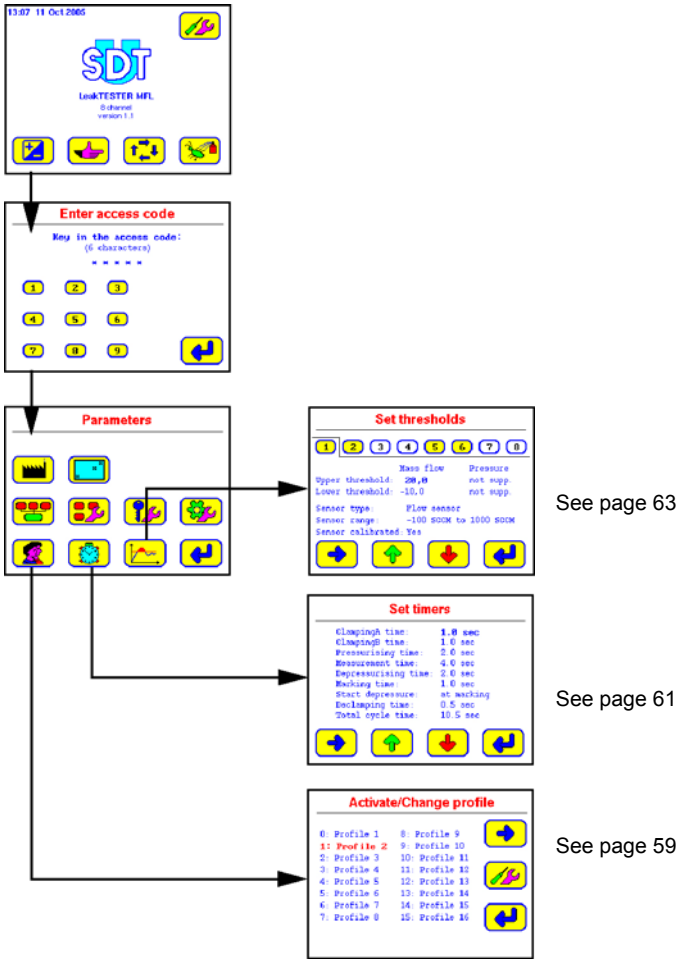


See page 54
See page 55
See page 52
See page 44

Figure 11-4: Tree structure for the Parameters menu (2/3) – see also page 39.

11.4.3 Diagram 3/3

The figure below presents the third and final diagram of the menus accessible from the **`Parameters`** menu and links to the corresponding pages.



See page 63

See page 61

See page 59

Figure 11-5: Tree structure for the Parameters menu (3/3) – see also page 39.

11.5 *FACTORY RESET* MENU

11.5.1 Accessing the menu

Access path: Main screen / / Enter the access code /.

This screen immediately resets the appliance to the predefined factory settings.

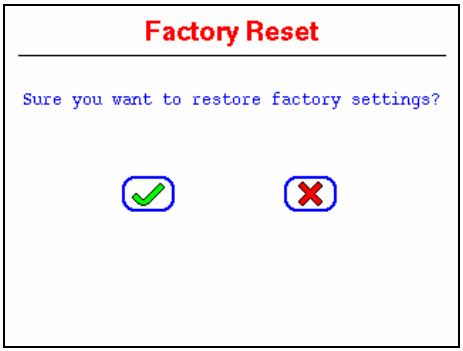


Figure 11-6: The "Factory reset" screen [Reset factory settings].

11.5.2 The keys

Key	Description
	When this key is pressed, and after 2 seconds of inactivity, the factory settings are re-loaded to the *SDT LeakTESTER*. The system then returns to the **Parameters** menu. All settings previously entered by the user will be lost.
	When this key is pressed the window is closed without modification to the current *SDT LeakTESTER* settings.

11.5.3 Factory settings

For the SDT LeakTESTER

Name	Default value
User code:	147369
Inputs:	unassigned
Outputs:	unassigned
MAC addresses	00:00:00:00:00:00
Measurement mode	8
Mass flow sequential alarm	5
Mass flow cycle alarm	10
Pressure sequential alarm	5
Pressure cycle alarm	10
Measurement unit	Metric
External profile selection	Off
Default selected profile	Profile 1
Profile names	Profile 1, … , Profile 16

For each of the 16 profiles (Profile 1 to Profile 16)

Name	Default value
Upper flow threshold	20 SCCM
Lower flow threshold	-10 SCCM
Clamping A time	1.0 sec
Clamping B time	1.0 sec
Pressurising time	2.0 sec
Measurement time	4.0 sec
Depressurising time	2.0 sec
Marking time	1.0 sec
Start depressure	at marking
Declamping time	0.5 sec

11.6 *SCREEN SETTINGS* MENU

11.6.1 Accessing the menu

Access path: Main screen / / Entry of access code / .

11.6.2 Settings

This menu enables the size of the display compared with the useable surface of the screen to be adjusted. Follow the instructions given. The procedure of adjusting the screen ends with one of the following messages:

- The message '`Touchscreen calibration succeeded!`' should be displayed. Touch the screen to return to the **`Parameters`** screen.
- '`Touchscreen calibration failed!`'. Touch the screen to return to the **`Parameters`** screen. Repeat the procedure.

11.7 *ASSIGNMENT OF I/O*

11.7.1 Accessing the menu

Access path: Main screen / / Enter access code / .

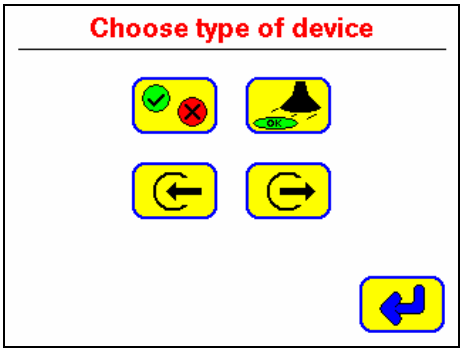


Figure 11-7: The "Choose type of device" screen [Assignment of I/O].

11.7.2 The sub- menus

Key	Menu	Description	See
	Assignment of outputs for good/bad pieces	Assignment of an output (*) for good piece and an output for bad piece, for each measuring channel.	§ 11.7.3, page 45
	Assignment of marking outputs	Assignment of a marking output (*) for good piece, for each measuring channel.	§ 11.7.4, page 47
	Assignment of inputs	Assignment of an input for receiving an external command by the *SDT LeakTESTER* for the launch of a measurement cycle. Assignment of inputs for loading and use of one of the 16 profiles for the next measuring cycle by the *SDT LeakTESTER*.	§ 11.7.5, page 47
	Assignment of outputs	Assignment of an output (*) for the transmission of “ready” information and an output for “busy” information. Assignment of an output for launching the Clamping A and Clamping B stages. Assignment of an output for launching the pressurisation stage, the measurement stage and the depressurization stage.	§ 11.7.6, page 50
	Back	Back to the  menu.	

(*) the programmer can randomly select an output on the SDT LeakTESTER or an output on the declared and connected Output Module. Only outputs not yet used will appear as available choices.

11.7.3 Assignment of outputs for Good/Bad pieces

Access path: Main screen/  / Enter access code/  /  .

This menu assigns an output (and therefore commands an element or transmits information) for a “Good Piece”, or a “Bad piece”, separately for each measuring channel.

- A piece is declared “Good“ if the mass flow rate measurement is higher than the lower alarm threshold and lower than the upper alarm threshold programmed **AND** if the pressure measurement is higher than the lower alarm threshold and lower than the upper alarm threshold programmed. Both conditions must be fulfilled in this case.
- Inversely, a piece is declared “Bad" if the mass flow rate measurement is outside the range of the programmed thresholds OR the pressure measurement is outside the range of the programmed thresholds. Only one of these 2 conditions must be fulfilled.

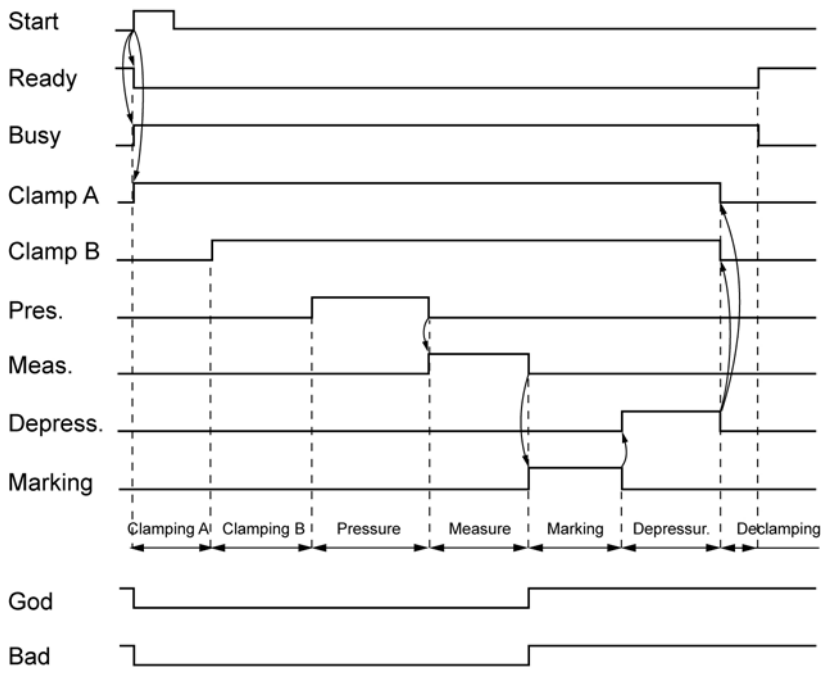


Figure 11-8: The time diagram.

Key	Description
	Selects the following field. The following field appears in bold.
	Increases the selected field.
	Decreases the selected field.
	Back to the *Assignment of I/Os* () menu.

11.7.4 Assignment of outputs for marking

Access path: Main screen/ / Enter access code/ / .

This menu assigns an output (*SDT LeakTESTER* or Output module) for marking pieces for each of the 8 measuring channels.

The function of each key is described in the previous table.

The start of the marking function can be programmed in two different ways by modifying the **`Start depressure`** setting (see paragraph 11.12, on page 61).

- In sequential mode (**`Start depressure after marking`**).

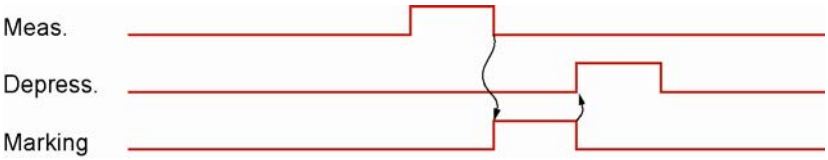


Figure 11-9: Extract from time diagram during a pressurisation with marking. 049

- In parallel mode (**`Start depressure at marking`**).

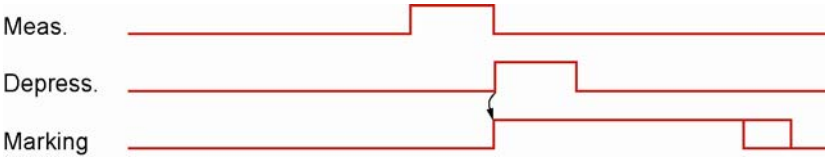


Figure 11-10: Extract of time diagram during a depressurisation with marking. 050

If the parameter is set to 255 (maximal value), the signal will remain active until next cycle.

11.7.5 Assignment of inputs

Access path: Main screen/ / Enter access code/ / .

This menu launches a measurement cycle when the *SDT LeakTESTER* receives an external all-or-nothing command and forces it to choose one of the 16 profiles for this measuring cycle.

Comment: two different screens are available depending on whether the user is working in mode 8 or in mode 4/4 (see paragraph 11.10 – General profile adjustment menu, on page 55).

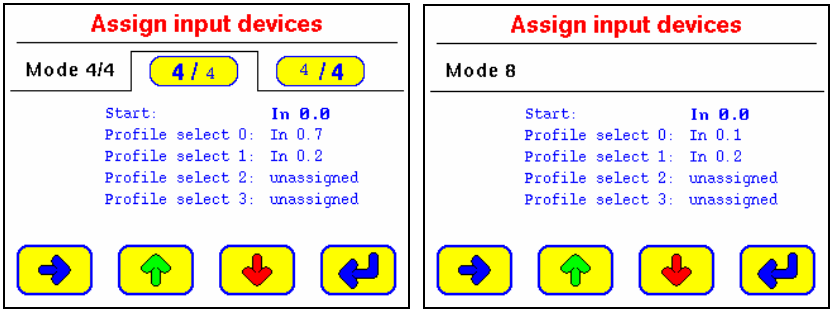


Figure 11-11: The screen in mode 4/4 (left) and mode 8 (right).

Assignment of an input for launching a cycle in automatic mode

Choose an available input for the **`Start`** field. When a tab opens for the selected input, the *SDT LeakTESTER* will automatically launch a measuring cycle, on condition that it is in **`Ready`** status.

Assignment of inputs for changing a profile

This function enables a dynamic change of the production range by external command transmitted to the *SDT LeakTESTER*. The *Assignment of inputs for automatically changing a profile* menu can be used if the **`External profile selection`** field is **`On`** in the *Profile setting* field (paragraph 11.11, on page 59).

The loading of a profile among 16, by external command, requires the use of 4 distinct all-or-nothing inputs. The **`Profile select 0`** field corresponds to the smallest bit and the **`Profile select 3`** field corresponds to the largest bit. This binary coding on 4 bits enables a profile to be selected from 16.

Example:

- 1st entry: **`Profile select bit 0`**.
- 2nd entry: **`Profile select bit 1`**.
- 3rd entry: **`Profile select bit 2`**.
- 4th entry: **`Profile select bit 3`**.

The following table summarises the possibilities:

Profile selection				
3	**2**	**1**	**0**	Profile loaded by the *LeakTESTER*
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	5
0	1	0	1	6
0	1	1	0	7
0	1	1	1	8
1	0	0	0	9
1	0	0	1	10
1	0	1	0	11
1	0	1	1	12
1	1	0	0	13
1	1	0	1	14
1	1	1	0	15
1	1	1	1	16

For example, when the *SDT LeakTESTER* receives an analogue signal in continuous voltage (V DC) on its input 1 and its input 2, it will use profile 7 during its next measurement cycle.

Comment: you must inform the *SDT LeakTESTER* of the choice of profile, followed by the information on the automatic cycle launch, as represented in the following figure.

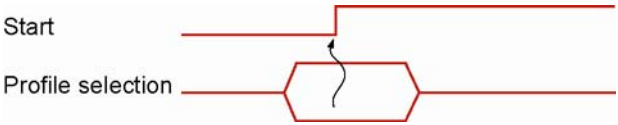


Figure 11-12: In the time diagram, the profile must have already been defined before the Start input moves to the high logical level. 047

11.7.6 Assignment of outputs

Access path: Main screen/  / Enter access code/  /  .

This menu is used to attribute the *SDT LeakTESTER* outputs or a connected and declared Output module. The fields described below can be **`unassigned`** or have as a value an available output of **`Out 0.0`** to **`Out 12.4`**.

Comment

This paragraph describes the convention of designating *SDT LeakTESTER* outputs.

An output is made up of a code with 3 elements (for example **`Out 0.0`**).

- **`Out`** designates an output.
- The first figure indicates an output of a *SDT LeakTESTER* output (**`0`**) or an Output module (**`1`** to **`12`**).
- The second figure indicates the position of the output for the *SDT LeakTESTER* (**`0`** to **`7`**) or for an Output Module (**`0`** to **`3`**).

The other information represents:

- **`Ready`** indicates that the equipment is ready to launch a cycle.
- **`Busy`** indicates that the last measurement cycle is not yet finished.
- **`Clamp A`** designates the output used for clamping A of the piece to be tested.
- **`Clamp B`** designates the output used for clamping B of the piece to be tested.
- **`Pressure`** designates the output used for the command of EV1 and EV2 (*).
- **`Measure`** designates the output used for the command of EV3 (*).
- **`Depressure`** designates the output used for the command of EV4 (*).
- **`Alarm`** designates the output used to indicate that a programmed value for the alarm cycle or alarm sequence has been exceeded. This function is active if at least one pressure or mass flow rate alarm, either in cycle or in sequence, is programmed in the *General profile settings menu* (see paragraph 11.10, on page 55).

(*) For detail concerning EV1, EV2, EV3 and EV4, see the loweric scheme of the electropneumatic system (Figure 7-1, page 20).

Two different screens are proposed depending on whether the user is working in Mode 4/4 or in Mode 8.

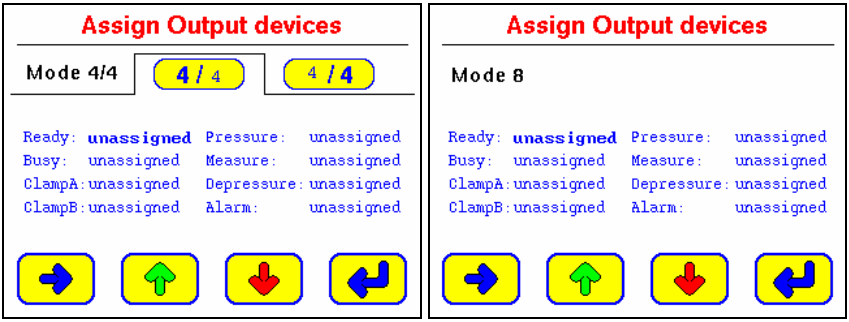


Figure 11-13: The "Assign Output devices" screen in mode 4/4 (left) and in mode 8 (right).[953 - 955]

Key	Description
	Selects the following field. The following field appears in bold.
	Increases the selected field.
	Decreases the selected field.
	Returns to the *Assignment of I/O* () menu.

11.8 *ASSIGNMENT OF OUTPUT MODULES* MENU

Access path: Main screen/ / Enter access code/ / .

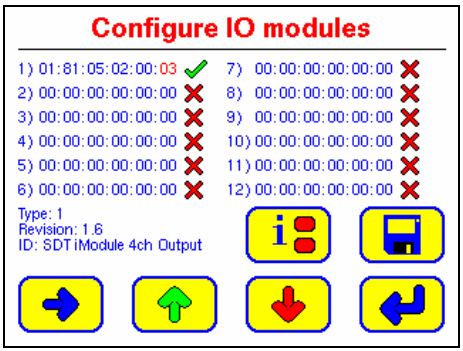


Figure 11-14: The "Configure IO modules" screen.

This menu declares to the *SDT LeakTESTER* the modules that are connected via the RS 485 line.

Each field comprises:

- A chronological number (1 to 12).
- The hexadecimal address on 6 bytes of the module. The address that will be encoded in this zone is the MAC address indicated on the side of the Output Module box.

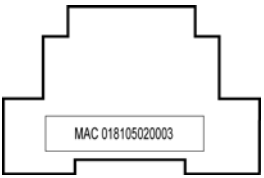


Figure 11-15 Each Output Module has a unique MAC address on the side of the box.

Icon	Description
	Indicates that the module is connected and recognised.
	Indicates that the module is not connected, either because not recognised, or because faulty.
?	Icon displayed whilst locating the RS 485 line.
	Identify the selected Output Module.
	Saves the data.
	Selects the following field. The following field appears in red.
	Increases the selected field.
	Decreases the selected field.
	Back to the *Assignment of I/O* () menu.

11.9 *USER'S ACCESS CODE* MENU

Access path: Main screen/ / Enter access code/ .

This menu enables the user to modify the user's access code.

The access code by default when the appliance is delivered is **147369**.

To modify the user's access code, first the current code must be manually entered "**Key in the master code**", then the new code must be entered "**Key in the new user access code**". The new code is confirmed by asking the user to key in the new code once again "**Verify the new access code**".

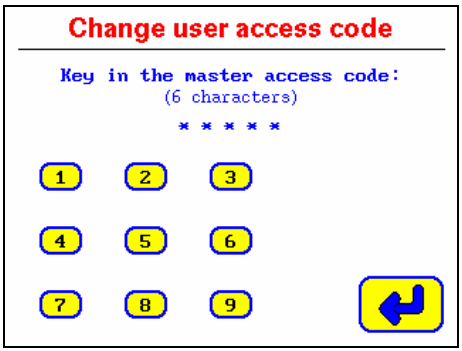


Figure 11-16: The screen for modifying the user access code. 910

To be noted:

- A code should always contain 6 figures.
- If an incorrect code is entered during one of the stages described above, the *SDT LeakTESTER* will display a screen for 10 seconds indicating that the access code is incorrect and will then automatically return to the main screen.

11.10 *GENERAL PROFILE SETTINGS* MENU

Access path: Main screen/ / Enter access code/ .

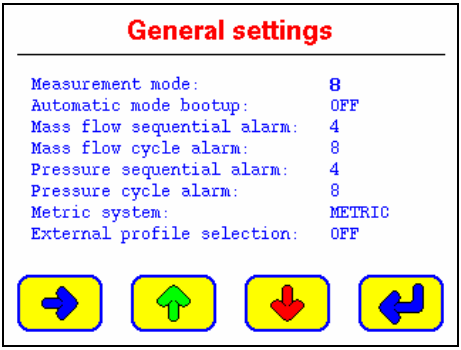


Figure 11-17: General settings screen. 942

Name	Subject	See page
Measurement mode	Selects *Mode 8* or *Mode 4/4*.	56
Automatic mode bootup	Immediate starting in automatic mode.	58
Mass flow sequential alarm	Selection of the alarm level for the flow measurements out of criterion, for all measurement channels.	58
Mass flow cycle alarm	Selection of the alarm level for consecutive flow measurements out of criterion, for each measurement channel.	58
Pressure sequential alarm	Selection of the alarm level for pressure measurements out of criterion, for all measurement channels.	58
Pressure cycle alarm	Selection of the alarm level for consecutive pressure measurements out of criterion, for each measurement channel.	58
Measurement unit	Selects the measurement units.	58
External profile selection	Validates or invalidates the possibility to select a profile via an external command.	58

The information displayed for consultation or possible modification is the subject of the following pages.

11.10.1 Measurement mode

Mode 8

In mode 8, the air filling, measuring and air purge cycles are carried out simultaneously on 1 to 8 elements to be tested.

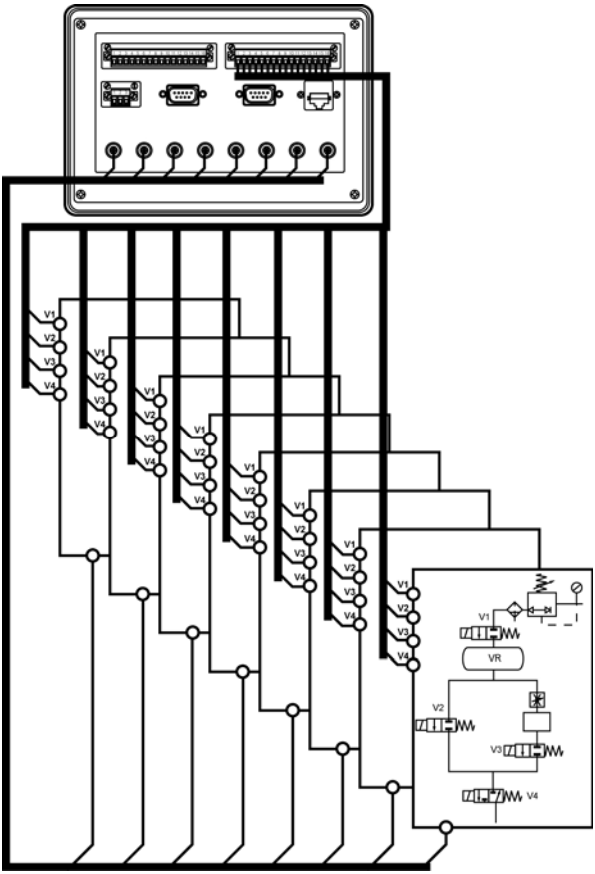


Figure 11-18: In mode 8, 1 to 8 elements are tested at the same time. Warning: this illustration shows the principle and not the actual wiring. 021

Mode 4/4

In mode 4/4, the testing cycle is carried out on 2 independent groups from 1 to 4 measurement channels.

The selected profile (defining the cycle time, the thresholds, and the meters) is used for testing the pieces in group 1 and group 2. However, the profile used for group 1 can be different from the profile for group 2, by using an external command.

The launch (manual or by external command) of the start of the measuring cycle for group 1 is independent from the launch of the start of the measuring cycle for group 2. This mode is used to enable the operator to work on more than one cycle simultaneously.

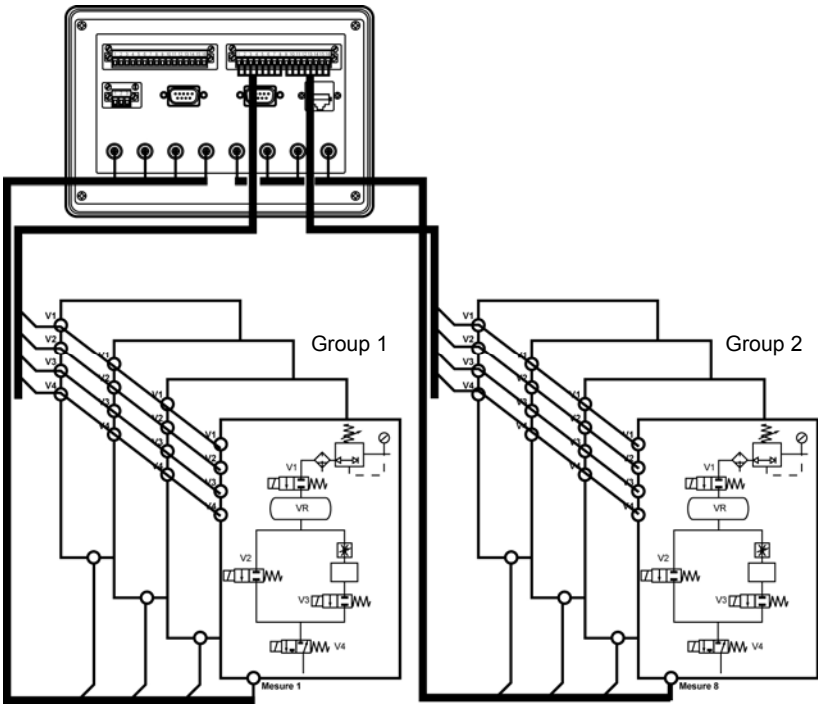


Figure 11-19: In mode 4/4, a group of 1 to 4 elements is in test phase, whilst the operator is loading or unloading the pieces for the other group. Warning: this illustration shows the principle and not the actual wiring required.

11.10.2 Automatic bootup mode

This setting selects the screen to be displayed when the *SDT LeakTESTER* is switched on.

- Positioned to **On**, the **Automatic mode** screen (page 69) is displayed after powering up the *SDT LeakTESTER*.
- Positioned to **Off**, the startup screen (page 32) is displayed after powering up the *SDT LeakTESTER*.

11.10.3 Mass flow sequential alarm

This parameter defines the number of measurements (consecutive or not) for flow out of criterion, added up during the 10 last measurement cycles on all the measuring channels.

11.10.4 Mass flow cycle alarm

This parameter defines the number of consecutive measurements for flow out of criterion, for each measuring channel.

11.10.5 Pressure sequential alarm

This parameter defines the number of measurements (consecutive or not) for pressure out of criterion, added up during the 10 last measurement cycles on all the measuring channels.

11.10.6 Pressure cycle alarm

This parameter defines the number of consecutive measurements for pressure out of criterion, for each measuring channel.

11.10.7 Measurement unit

This parameter sets the units of measurement displayed by the measurement screens. The choice is either **Metric** or **Imperial**,.

11.10.8 External profile selection

This parameter sets the option of externally selecting a profile to be used by an external programmable logic controller (PLC).

- **OFF**: selection unauthorised.
- **ON**: selection authorised.

11.11 *ALLOCATING/SELECTING A PROFILE* MENU

Access path: Main screen/ / Enter access code/ .

Important note

A profile corresponds to a type of piece to be tested, within the production range. Each type of piece has its own characteristics (in terms of volume and rejection criteria) and a set of specific parameters associated with it.

- Pressurisation time (See paragraph 11.12) ;
- Stabilisation/measuring time (see paragraph 11.12) ;
- Depressurisation time (see paragraph 11.12) ;
- The rejection thresholds for flow rate and pressure (see paragraph 11.13) ;
- Where relevant the clamping/unclamping time and marking time (see paragraph 11.13) ;
- Working in Mode 8 or Mode 4/4 (see paragraph 11.10.1) during the launch of a test cycle.

During the launch of a cycle of tests, the *SDT LeakTESTER* uses the set of parameters for the previously selected active profile.

The *Allocating/Selecting a profile* menu has 2 functions:

- To set the name for one of the 16 test profiles.
- To select the profile (and its set of parameters) that will be active during the following series of tests (see § 15.3.1 *Selecting a test profile* on page 77).

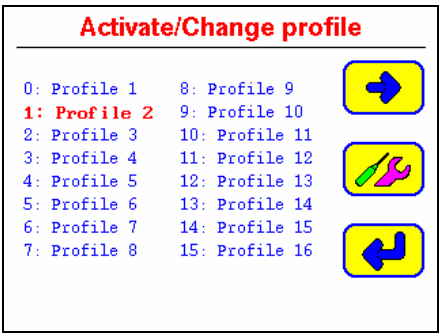


Figure 11-20: The [Active/Change profile] (Allocating/Selecting a profile) screen.

Icon	Description
	Selects the following field. The following field appears in red.
	Enables the active field to be renamed and opens the screen below.
	Returns to previous menu.

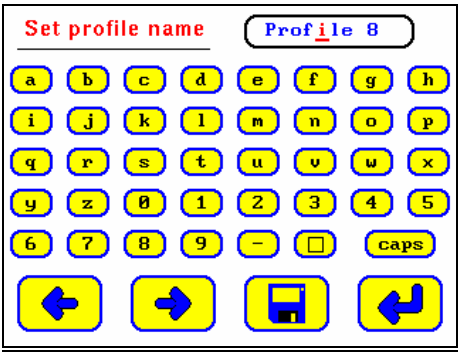


Figure 11-21: This screen sets the profile name.

Icon	Description
	Alphanumeric keypad.
	Switches between upper/lower case mode.
	Space.
	Selects the previous letter.
	Selects the following letter.
	Saves the modifications.
	Returns to the previous menu without saving the changes.

11.12 *CYCLE TIME SETTINGS* MENU

Access path: Main screen/ / Enter access code/ .

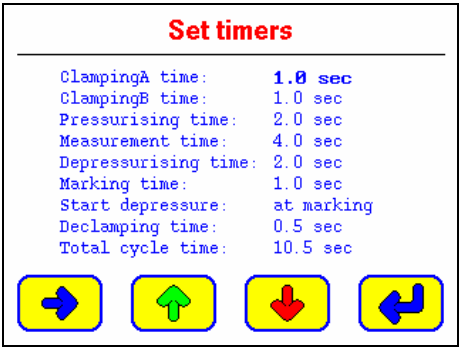


Figure 11-22: The [Set timers] (cycle time settings) screen.

Icon	Description
	Selects the following field. The selected field appears in **bold**.
	Increases the selected field.
	Decreases the selected field.
	Returns to the *Settings* menu ( ).

If a stage is not used (for example **`Clamping B`** time or **`Marking`**), the corresponding field will be reset to 0 (seconds). The **`Depressurization time`** field will not be overridden to zero.

Clamping A time

This value sets the duration of the Clamping A stage.

Clamping B time

This value sets the duration of the Clamping B stage.

Pressurising time

This value sets the duration of the pressurisation of the volume to be tested and of the reference volume, that is, the time during which the EV1 and EV2 solenoid valves are in use.

The value will be optimised by successive attempts using the **`Graphical representation`** menu (see paragraph 13.3.7, on page 71).

Measurement time

This value sets the duration of the stabilisation / measurement stage, this is the time during which the EV3 solenoid valve (measuring valve) is in use; the mass flow sensor therefore measures the rate of flow of any leakage.

This value may be optimised by successive tests using the **`Graphical representation`** menu (see paragraph 13.3.7, on page 71).

Depressurising time

This value sets the duration of the depressurisation of the volume to be tested, this is the time during which the EV3 solenoid valve is open.

Marking time

This value sets the duration of marking for a good or bad piece. If the parameter is set to 255 (maximal value), the signal will remain active until next cycle

Start depressure

There are two possible choices:

- **`At marking`**: the depressurisation of the piece starts simultaneously with the marking of said piece.
- **`After marking`**: the depressurisation of the piece starts after the end of marking of the piece.

Declamping time

This value sets the duration of un-clamping A and B of the piece to be tested.

Total cycle time

This value is automatically calculated by the *SDT LeakTESTER*; it corresponds to the total time shown on the **`Set timers`** screen, if the marking is done in sequential mode.

11.13 *THRESHOLDS SETTINGS* MENU

Access path: Main screen/ / Enter access code/ .

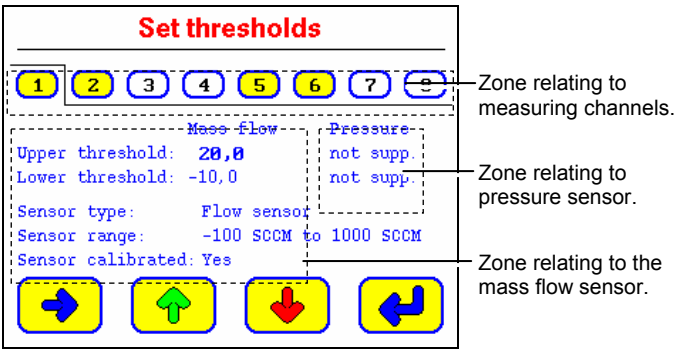


Figure 11-23: [Set thresholds] (Setting of alarm thresholds) screen

Icon	Description
	Selects the following field. The selected field appears in **bold**.
	Increases the selected field.
	Decreases the selected field.
	Returns to the *Settings* ( ) menu.

Sensors are checked during the boot of the system by entering this menu. So, they are not hot-pluggable.

11.13.1 Zone relating to measurement channels

Each channel is represented by a tab number (1 ... 8). The colours indicate the channels as follows:

- **White** tab for the channels with no mass flow sensor connected.
- **Yellow** tab for the channels with a mass flow sensor connected.

11.13.2 Zone relating to the mass flow sensor

Icon	Description
`Upper threshold`	Upper rejection threshold.
`Lower threshold`	Lower rejection threshold.
`Sensor type`	The *SDT LeakTESTER* automatically recognises the type of sensor connected and enters the associated field.
`Sensor range`	The *SDT LeakTESTER* automatically indicates the scope of the measure of the sensor connected.

11.13.3 Zone relating to the pressure sensor

This zone is currently not used.

11.13.4 Rejection criteria for a piece tested

- **Piece declared "bad"**: a piece will be declared "bad" if the value measured (of flow rate and pressure) is inferior to the lower threshold (`Lower threshold`) OR superior to the upper threshold (`Upper threshold`).
- **Piece declared "good"**: a piece will be declared "good" if the value measured (of flow rate and pressure) is anywhere between the lower threshold (`Lower threshold`) AND the upper threshold (`Upper threshold`), with the threshold values included.

12. The *Manual mode* menu

12.1 ACCESSING THE *MANUAL MODE* MENU

The access path is: Main screen / .

12.2 THE SCREEN

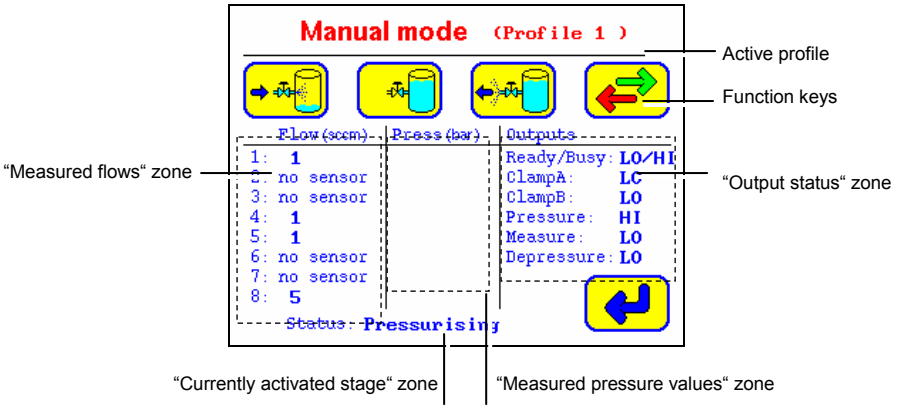


Figure 12-1: Screen n°1 of the manual mode.

12.3 "CURRENTLY ACTIVATED STAGE" ZONE

This zone indicates the stage currently activated. A stage remains activated until the operator:

- Activates another stage.
- Or presses the key.
- Or quits the *Manual mode* menu by pressing the key.

12.4 "MEASURED FLOWS" ZONE

This zone indicates for each of the 8 measuring channels:

- "**No sensor**" when there is no mass flow sensor connected to the corresponding measuring channel.
- The measurement value in real time when the `Measure` function is active.
- The last measurement value recorded when the Measure function is not active.

12.5 "MEASURED PRESSURE VALUES" ZONE

This zone is not currently used.

12.6 "OUTPUT STATUS" ZONE

Each field indicates the status of the corresponding output:

- "**Lo**" indicates that the output is inactive.
- " **H**" indicates that the output is active.

12.7 THE FUNCTION KEYS

Key	Function	Description
	Pressurisation.	Pressurisation of the reference reservoir and piece to be tested.
	Measurement.	The *SDT LeakTESTER* measures in SCCM the flow of the leak between the reference reservoir and the piece to be tested.
	Depressurisation.	The piece to be tested is brought to atmospheric pressure.
	Clamping A.	Clamping A of the piece.
	Clamping B.	Clamping B of the piece.
	Stop	Stoppage of process in progress.
	Next / previous.	Displays the next or previous screen.
	Back.	Returns to the main menu.

13. The *Automatic mode* menu 

13.1 ACCESSING THE *AUTOMATIC MODE* MENU

The access path is: Main screen /  .

This mode:

- Launches a measurement cycle with the active profile, according to its set of parameters.
- Displays the total number of pieces tested and the counters for good/bad pieces.
- Displays a summary of results obtained on a measuring channel over the course of the last 10 cycles.
- Graphically represents the measurement values in relation of time for a maximum of 4 measuring channels.

13.2 DIAGRAM OF THE *AUTOMATIC MODE* MENU

This figure presents the diagram of menus accessible from the **`Automatic mode`** menu and links to the corresponding pages.

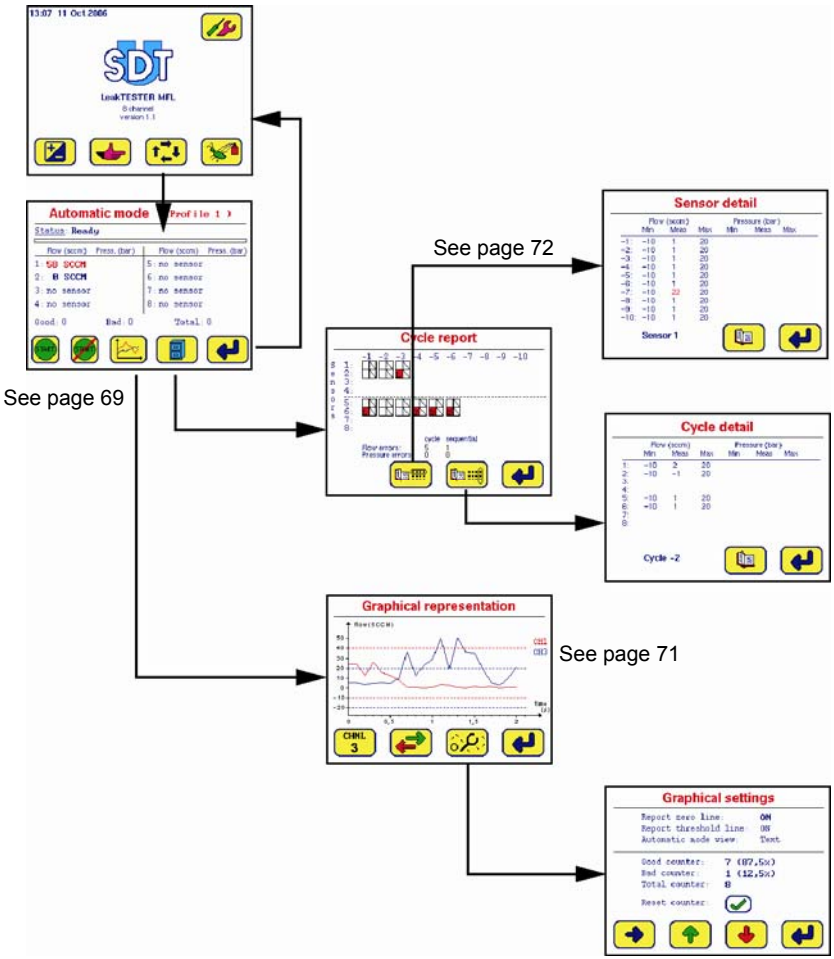


Figure 13-1: Tree structure of menu [Automatic mode]. 031

13.3 THE *AUTOMATIC MODE* SCREEN

When displayed, the *Automatic Mode* menu is presented as follows:

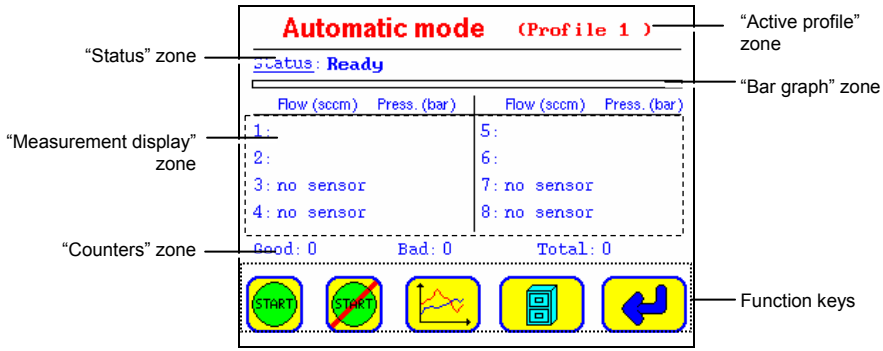


Figure 13-2: The [Automatic mode] menu.

13.3.1 "Active profile" zone

This zone shows the profile which will be used. The profile to be used is selected using the **`Select profile`** menu.

13.3.2 "Status" zone

This zone indicates the active stage in the sequence of stages forming the measurement cycle or indicates **Ready** when the last test cycle is finished.

13.3.3 "Bar graph" cycle

The bar graph indicates in real time the progress of the measurement cycle. The zone in green displays the proportion of cycle time already run.

13.3.4 "Measurement display" zone

This zone displays:

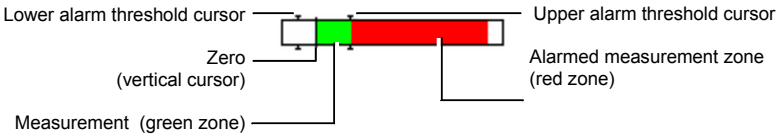
- **The leak flow in text mode** (*). The measurement is therefore displayed as a digital value, in SCCM, highlighted in blue (measurement within the alarm thresholds) or highlighted in red (measurement outside the alarm thresholds).

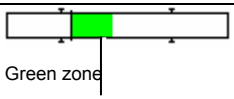
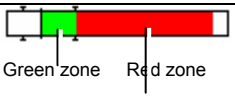
  *(*) the choice of display mode (text or graphic mode) is activated from the **`Graphical settings`** screen (see paragraph 13.3.8, on page 71).*

- **The leak flow in graphic mode** (*).

  (*) the choice of display mode (text or graphic mode) is activated from the ***Graphical settings*** *screen (see paragraph 13.3.8, on page 71).*

  The bar graph should be read as follows:



View	Comment
	Green zone ***without*** red zone: good piece. The length of the green zone is proportional to the leak flow.
	Green zone ***and*** red zone: bad piece. The red zone starts after the threshold (upper or lower). The length of the red zone is proportional to the leak flow after the upper or lower alarm threshold).

- **The value of the pressure measured** in bars. This function is not currently used.

13.3.5 "Counters" zone

The **Good**, **Bad** and **Total** values summarise the number of pieces tested and found to be good or bad and the **Total** number of pieces tested since the last reset of the counters .

13.3.6 Function keys zone

The keys have the following functions:

Key	Function	See
	Manual launch of a measurement cycle on a group of pieces to be tested in mode 8., on sensors 1 to 4.	
	Manual launch of a measurement cycle on the 2nd group of pieces to be tested in mode 4/4, on sensors 5 to 8.	
	Display of a leak flow graph on the screen.	§ 13.3.7, page 71
	Display of measurements performed during the last 10 cycles.	§ 13.3.9, page 72
	Closes the window and returns to the main menu.	§ 9.5, page 33

13.3.7 Graphical representation of leak flows function

Access path: Main screen/  /  (see § 13.3.6, on page 71).

This function displays the curve of leak flows over a given timescale. It is particularly useful for optimising the cycle because it allows minute adjustments to the duration of the **`Pressurising`** and **`Measurement`** stages. It is possible to superpose a maximum of 4 measurement channels at any one time.

13.3.8 Settings menu for graphical representations

Access path: Main screen/  /  /  (see § 13.3.6, on page 71).

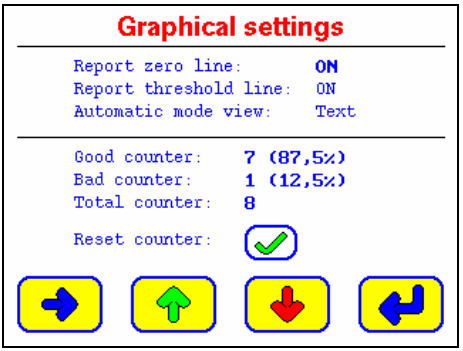


Figure 13-3: The [Graphical settings] (graphical representations) menu

The displayed information is:

- **`Report zero line`**: add (**`On`**) or remove (**`Off`**) the **`0 SCCM`** line from the graph.
- **`Report threshold line`**: add (**`On`**) or remove (**`Off`**) the lines corresponding to the upper and lower thresholds from the graph.
- **`Automatic view`**: display the measurement in text format (**`Text`**) or in bargraph format.
- **`Good counter`**: indicates the number of pieces tested and found to be good and their percentage compared to the total number of pieces tested.
- **`Bad counter`**: indicates the number of pieces tested and found to be bad and their percentage compared to the total number of pieces tested.
- **`Total counter`**: totalises the number of pieces tested.
- **`Reset counter`**: resets the counters to zero.

13.3.9 The summary menu

Access path: Main screen/ / / (see § 13.3.6, on page 71).

This menu displays the results of the measures of leak flows and pressure for the last ten cycles, either for a measuring channel in particular, or for all measuring channels. It also contains a counter for pieces declared bad (compared to the flow thresholds and/or compared to the pressure thresholds) either consecutively or not.

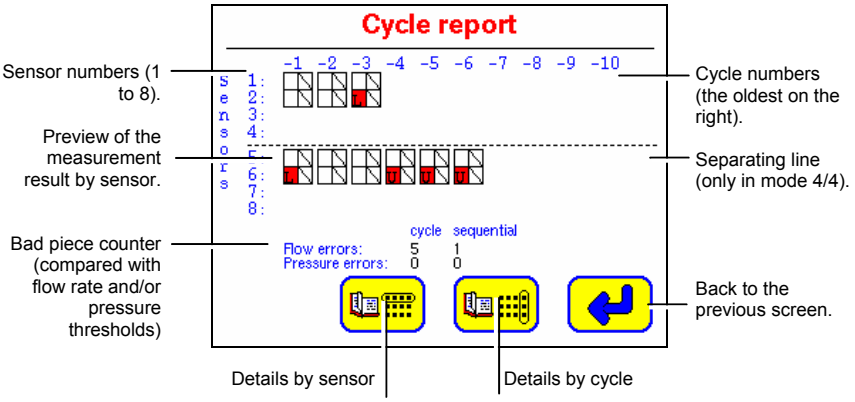


Figure 13-4: Example of display of the Cycle report [Details of the cycle] menu. 949

For each sensor, the information should be read as follows:

The cycle numbers

The number "`-1`" corresponds to the last measuring cycle. The number "`-10`" corresponds to the 10th last measuring cycle.

The measurement results

Each result is displayed in the form of an icon with 2 boxes (). The left hand box represents the measurement of the leak flow, whereas the right hand box represents the pressure measurement. The meaning of the icons is as follows:

Icon	Box	Meaning
	Empty	Measurement between the lower and upper alarm thresholds.
	Crossed	No measurement (of flow in left hand column, of pressure in right hand column) for the channel.
	Red with **L**	Measurement inferior to the lower alarm threshold.
	Red with **U**	Measurement superior to the upper alarm threshold.

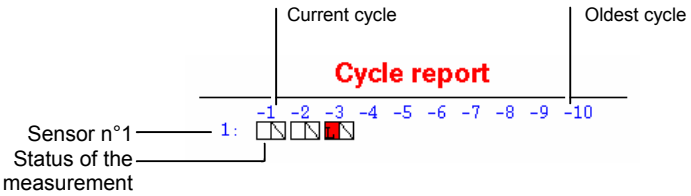


Figure 13-5: Detail of an information line. 947

Defect counters

The information is as follows:

- **`Flow errors`**: totalises the pieces declared bad compared with flow thresholds over the last 10 measuring cycles.
- **`Pressure errors`**: totalises the pieces declared bad compared with pressure thresholds over the last 10 measuring cycles.
- **`Cycle`**: totalises the pieces declared bad over the last 10 measuring cycles.
- **`Sequential`**: totalises the pieces consecutively declared bad over the last 10 measuring cycles.

Details by sensor function

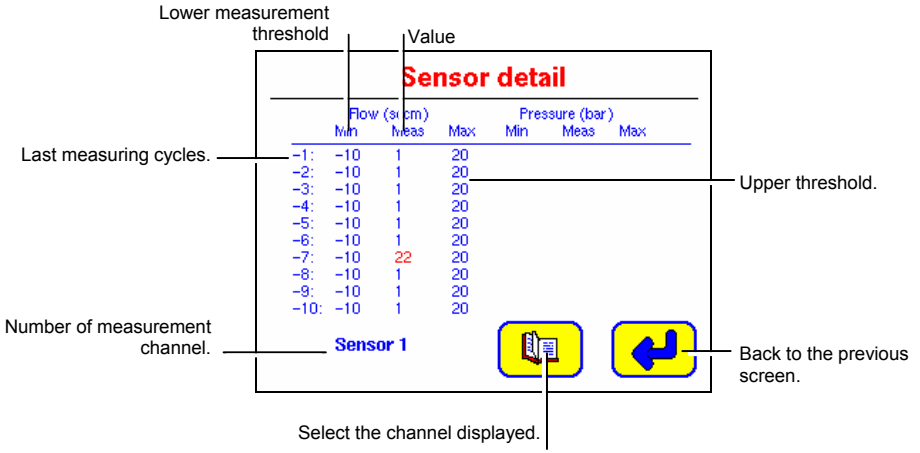


Figure 13-6: Sensor details [Details by sensor] menu.

Details by cycle function

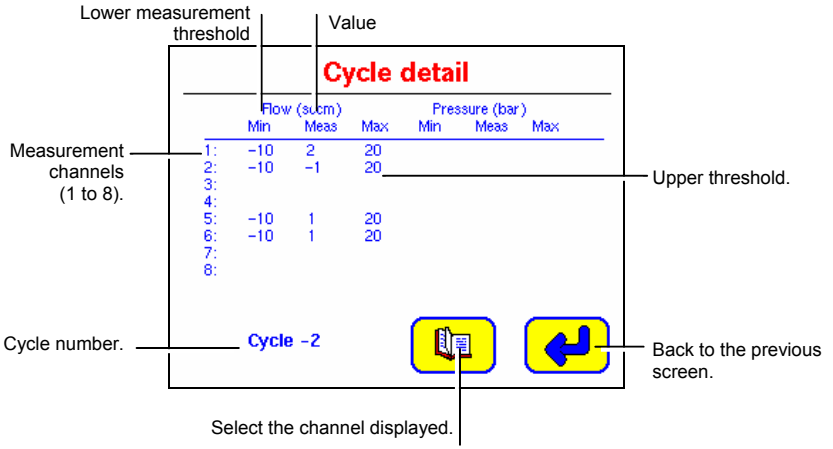


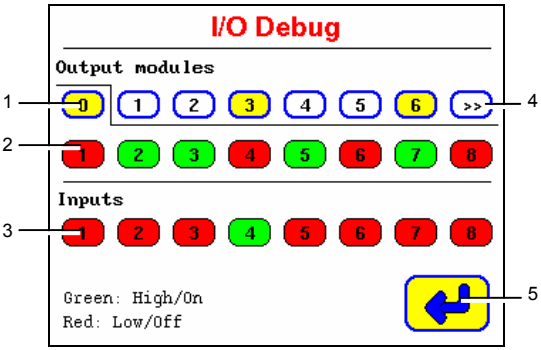
Figure 13-7: Cycle details [Details by cycle] menu.

14. The *Debug* menu

Access path: Main screen / .

This menu accesses:

- The individual and manual activation of each *SDT LeakTESTER* output and its *Output* modules in order to check that the peripherals are working correctly.
- The display of the status of the *SDT LeakTESTER's* logical inputs in order to check that they are working correctly.



1. Selection of *SDT LeakTESTER* outputs (tab 0 and Output modules (tabs 1 to 12).
   Yellow background: modules connected to the *SDT LeakTESTER*.

   White background: no module connected.
2. Logical status of outputs.

   Red background = low output (OFF or logical 0).

   Green background = high output (ON logical 1).
3. Logical status of inputs.
   Red background = low output (OFF or logical 0).

   Green background = high output (ON logical 1).
4. Move to the next modules.
5. Back to the main menu.

Figure 14-1: The I/O Debug screen displays the SDT LeakTESTER outputs (the 0 tab is selected here).

See the note on the following page.

When this screen is called up the *SDT LeakTESTER* scans the status of the inputs and the outputs for a few secondes and displays the message `Checking states`. During this interval, the  icon becomes inactive. The scanning time needed depends on the number of *Output* modules connected to the *SDT LeakTESTER*.

15. Use

15.1 USING THE *SDT LEAKTESTER*

1. The screen remains black for 15 seconds after switching on (the appliance has no *stop/start* button; the message **`Starting up system`** is then displayed).
2. Wait 35 more seconds until the main menu is displayed.

15.2 GENERAL SETTINGS FOR THE *SDT LEAKTESTER*

This configuration has been set in accordance with chapter 11, on page 37; refer to this chapter if necessary.

15.3 LAUNCHING A CONTROL CYCLE

Proceed as follows:

15.3.1 Selecting a test profile

Before launching the tightness cycle on the pieces, it is essential to select the test profile to be used. It is recommended that at least one test profile should be defined. Once the test profile for the pieces to be tested has been selected, this is the one that will be used by the *SDT LeakTESTER*, in automatic mode. To select and use a previously selected test profile, proceed as follows:

1. In the main menu, press the  key and enter the password.
2. When the **`Parameters`** screen is displayed, press the  key to display the **`Select profiles`** screen.
3. Select one of the set profiles using the  key. The selected profile is the one whose name is highlighted in bold type.
4. Press twice on the  key to return to the **`Main Menu`**.

15.3.2 Accessing the Automatic Mode screen

Access the **`Automatic mode`** menu from the **`Main menu`** (§ 9.5, page 33), by pressing the icon. The name of the profile used is indicated on the right of the title **`Automatic mode`**.

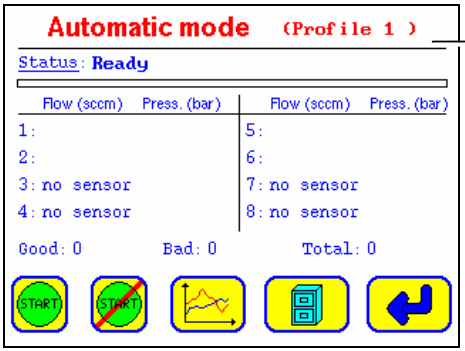


Figure 15-1: The profile used is indicated to the right of the of the screen title. 905

15.3.3 Possible reset of piece counters

1. When the **`Automatic mode`** screen is displayed, press the icon and then the icon.

2. In the **`Graphical settings`** screen, press the icon to access the **`Reset counters`** screen.

   - Press the icon to reset the counters to zero and to return to the `Graphical settings` screen.

   - or press the icon to return to the `Graphical settings` screen without resetting the counters to zero.

15.3.4 Choice of display mode for measurements

1. When the **`Graphical settings`** screen is displayed, select with the icon the chosen presentation of graphics (**`Report zero line`**, **`Report threshold line`**) and measurements (**`Automatic mode view`**).

2. Return to the **`Automatic mode`** screen by pressing the icon.

15.3.5 Launching measurements

Use the manual launch method or the automatic launch using an automaton.

Manual launch

When the **Automatic mode** screen is displayed, the first button 

launches the test cycle on boards 1 to 4 in mode 4/4 and on the 8 boards in mode 8.

The second button 

launches the test cycle on boards 5 to 8 in mode 4/4.

Automatic launch from an automaton

The test cycle is launched as soon as there is a positive voltage sent by an automaton to the logical input programmed as the **Start** input (see Figure 11-11, on page 48).

15.3.6 Display of graphs

When the **Automatic mode** screen is displayed, press the  key to display the graph of flow rates.

15.3.7 Results of measurements

When the **Automatic mode** screen is displayed (Figure 13-2, page 69), each of the lines **1** to **8** indicates the flow rate and pressure values.

The piece tested is **correct** (good) when the values measured falls between the minimum and maximum flow rate and pressure (*) values as defined in the **Set threshold** screen, with the threshold values included. The values will in this case be displayed in **blue**.

The piece tested is **incorrect** when the value measured does not fall between the minimum and maximum values for flow rate and pressure (*) as defined in the **Set threshold** screen. The values will in this case be displayed in **red**.

When the **Automatic mode** screen is displayed (Figure 13-2, page 69), each of the lines **1** to **7** indicates information representing the pressure and flow rate values. The part tested on the sensor concerned is incorrect when the value is highlighted in red: the value is in this case outside the minimum and maximum flow rate and pressure (*) limits as define in the **Set threshold** screen.

(*) the measurement of the pressure is not yet implemented.

15.3.8 Display of statistics

When the **Automatic mode** screen is displayed (Figure 13-2, page 69), press the  icon to view the report for the last 10 cycles. Use the 2 keys at the bottom of the screen to view the details by sensor or by cycle.

15.4 END OF A TEST CYCLE

The **Status** line of the **Automatic mode** screen displays **Ready** (Figure 13-2, page 69).

If a logical output corresponding to the information **Ready** has been configured in the **Assign Output devices** screen, it is activated at this point.

16. Stopping the *SDT LeakTESTER*

16.1 EMERGENCY STOP OF A TEST CYCLE

In accordance with regulations, the *SDT LeakTESTER* cannot control an emergency stop of the pneumatic system, the clamping system, or the piece marking system.

16.2 COMPLETE STOPPAGE OF THE *SDT LEAKTESTER*

Complete stoppage of the *SDT LeakTESTER* may be carried out by switching off the power supply to the appliance.

17. Technical specifications

17.1 SDT *LEAKTESTER*

Function	Main characteristics
Display	Graphic colour display, 320 x 240 pixels, 6,5''.
Keypad	Touchscreen.
Screen	Touchscreen colour LCD 320 x 240 pixels.
Power	12 to 36 V DC.
Maximum consumption	Loweric: 12 W. 1 additional W per sensor connected.
Measurements	Sensor: mass flow sensor. Range of measure: up to 1 000 SCCM (depending on sensor). Resolution: up to 0.1 SCCM (depending on sensor). Alarm level: 2 high and low thresholds, independently adjustable. Profiles: 16 independent profiles.
Sensor inputs	8 measuring inputs for mass flow sensors.
Logical inputs	8 digital inputs with optical isolation (8 to 30 V DC).
Logical outputs	8 digital outputs, 8 to 30 V DC, 1 A max on resistive charge, optical isolation.
RS 232 Interface	Serial interface for specific application. Contact SDT.
RS 485 Interface	Interface for link (2 cables + earth) with a maximum of 12 *Output Modules* (modules with 4 all-or-nothing contact outputs).
Ethernet Interface	Standard 10-BASE-T interface for specific application. Contact SDT.
Environment	Operating temperature: +10 °C to +45 °C (50 °F to 113 °F) Storage temperature: 0 °C to +60 °C (32 °F to 140 °F) Relative operational humidity: 20 to 80 % non-condensed. Relative storage humidity: 10 to 90 % non-condensed.

Table continued on following page.

Function	Main characteristics
Weight	Approx. 2 kg (70,54 oz)
Cross section	205 x 132 mm (8.10 x 5.20 inches)(L x H).
Casing	Front: solid aluminium. Back terminal box: electrogalvanized steel. Installation into control panel. Tightness seal standards after installation: IP65
Dimensions	See figure below.

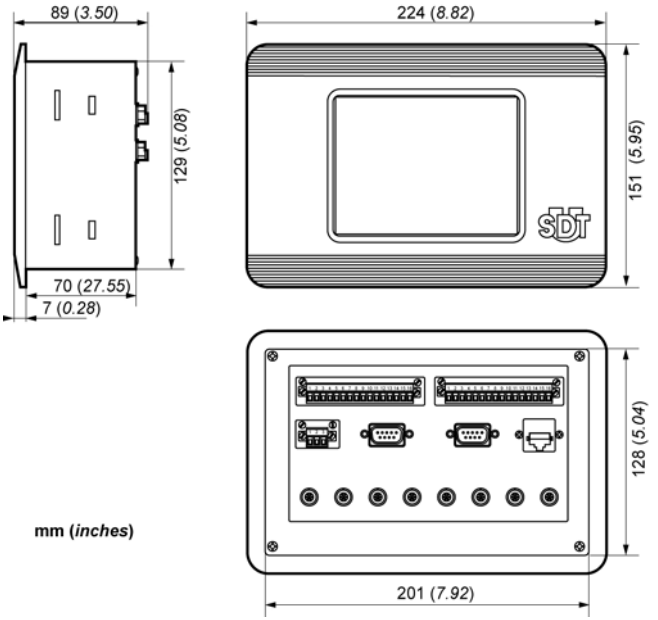


Figure 17-1: Dimensional characteristics of the SDT LeakTESTER.

17.2 OUTPUT MODULE

Data	Main characteristics
Power	12 to 36 V DC.
Consumption	2.5 W per module.
Input	Controlled by the *SDT LeakTESTER*.
Outputs	4 independent outputs remotely-controlled by the *SDT LeakTESTER*. Each output is made up of an independent NO type relay contact (normally open). Interruption capacity of each contact: 230 V AC – 16 A
Weight	165 g 5.82 oz).
Dimensions	See figure below.
Casing	DIN module.
Environment	Operating temperature: +10 °C to +45 °C (50 °F to 113 °F). Storage temperature: 0°C to +60 °C (32 °F to 140 °F). Relative operating humidity: 20 to 80 % non-condensed. Relative storage humidity: 10 to 90 % non-condensed.

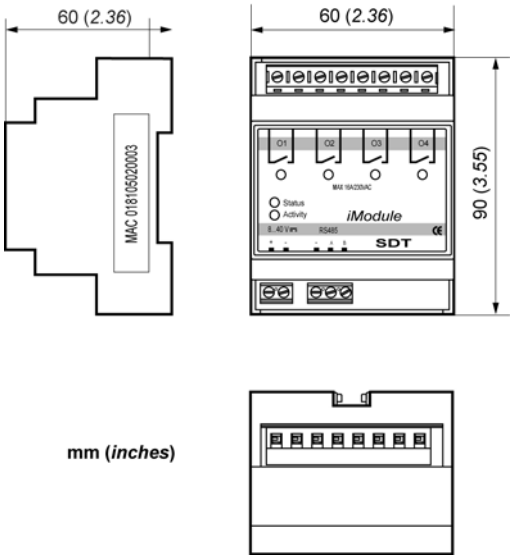


Figure 17-2: Dimensional characteristics of the Output Module.

17.3 MASS FLOW SENSOR

Data	MFLHP 25	MFLHP 1000
Scope of measurement	-25 to + 25 SCCM	-100 to + 1000 SCCM
Resolution	0.1 SCCM	1 SCCM
Accuracy	± 5% of full scale	± 5% of full scale
Repeatability	± 1% of full scale	± 1% of full scale
Operating strain	10 bars maximum	10 bars maximum
Breaking strain	15 bars	15 bars
Consumption	1 W	1 W

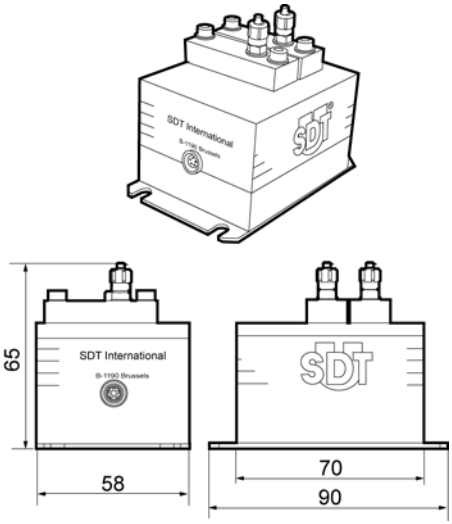


Figure 17-3: View of mass flow sensor.

Conditions for use:

- Do not exceed the maximum operating pressure of 10 bars.
- Respect the ISO 8573-1 standard relating to the quality of air to be used.

18. Measuring methods

This appendix provides basic information on the description, characteristics and applications of mass flow sensors used with the *SDT LeakTESTER* for testing the tightness of volumes.

18.1 THE TIGHTNESS OF A VOLUME

The measure of the tightness of a volume is the measure of the quantity of fluid or gas entering or exiting the volume to be tested when there is a difference of pressure between the exterior and the interior of this volume. One of these two pressures can be equal to atmospheric pressure.

18.2 LOWERIC NOTIONS

18.2.1 Pressure

A gaseous state can be characterised by a set of molecules or atoms (in the case of inert gases or metallic gases) whose dimensions are miniscule compared with the distances which separate them. These particles are almost unaffected by intermolecular linking forces, giving them a large degree of mobility and consequently, enabling them to occupy all of the space in which they find themselves. This mobility is characterised by movement at great speed in rectilinear patterns that lead to collisions between the particles themselves or between the particles and the walls of whatever is containing them.

The particles of the earth's atmosphere are therefore in perpetual movement, colliding a great many times per second, changing direction and following a path of several million zigzags per second. These strongly violent movements take place at great speeds. The gases in the earth's atmosphere can thus be compared to a relentless vibration of molecules that are travelling at 0.5 kilometres per second or 1,800 kilometres per hour, a speed comparable to a bullet exiting a gun (0.75 km/s).

It is curious to compare the speed of these moving molecules each moving independently with the overall movement of a gaseous mass of wind during a hurricane of 5, 10 or even 20 metres per second which would be considered as a gust!

In normal conditions such as the earth's atmosphere, collisions between molecules take place for the most part against other molecules. However, some of them hit the surfaces of the solid objects surrounding them. All these collisions make up what we call pressure.

The pressure of a gas can be expressed as a kind of average effect of all collisions produced between the molecules. On an object in the gas, this effect is characterised by a pressure or more exactly a force.

18.2.2 Pressure units

The unit used to represent this effect is made up of two other units: force and surface. It is expressed in force per unit of the surface subjected to the effect of molecules:

1 Newton /m² = 1 Pascal

At ground level, pressure is around 105 Pascal. Many different units have been used to measure pressure. Certain units are compared in the following table:

	Pascal	Bar	mm.CE	Kg/cm²	Atm.	PSI
1 Pascal	1	10^{-5}	0,102	$1,02.10^{-5}$	$9,87.10^{-6}$	145.10^{-6}
1 bar	10^{5}	1	$1,02.10^{4}$	1,02	0,987	14,5
1 mm.CE	9,81	$9,81.10^{-5}$	1	10^{-4}	$9,68.10^{-5}$	$1,42.10^{-3}$
1 kg/cm²	$9,81.10^{4}$	0,981	10^{4}	1	0,968	14,22
1 Atm	$1,013.10^{5}$	1,013	$1,033.10^{4}$	1,033	1	14,69
1 PSI	6895	$68,95.10^{-3}$	703,1	$70,31.10^{-3}$	$68,05.10^{-3}$	1

18.2.3 The rate of leakage

Definition

In tightness seal testing, leakage flow and leakage rate are imprecise terms. For gases, the criteria for tightness sealing should be expressed in the legal unit that is, the leakage flow measured in Pascal – metres cubed per second: Pa.m3.s-1. The gaseous flows represent a volumic flow rate of gas that is rounded up to the unitary pressure, per time unit.

If V is the volume of gas travelling through the section per unit of time and P is the pressure in this exact area, it is possible to write:

Qgaseous flow = P.V.

This equation can also be expressed as:

Qgaseous flow = kNT

With

K = Boltzman constant

T = Thermodynamic temperature

N = Number of real molecules travelling through the section per unit of time

We can see in this expression that the leakage flow expresses the number of individual elements that make up the gas travelling through the leakage point for a given temperature. It is important to note that this definition does not account for the nature of the gas.

The various units

Many different units have been used to describe gaseous flows to the present day. The following table compares some of them:

	$Pa.m^3.s^{-1}$	**$Mbar.l.s^{-1}$**	**SCCM**	**SCFM**
$Pa.m^3.s^{-1}$	1	10	592	$20{,}91.10^{-3}$
$Mbar.l.s^{-1}$	0,1	1	59,2	$2{,}091.10^{-3}$
SCCM	$1{,}69.10^{-3}$	$16{,}9.10^{-3}$	1	$35{,}32.10^{-6}$
SCFM	47,84	478,4	$28{,}31.10^{3}$	1

The unit used by the mass flow sensor of the *SDT LeakTESTER* is the SCCM - Standard Cubic Centimeter per Minute.

The standard cubic centimeter is a volume of 1 centimeter cubed of gas taken at atmospheric pressure and at a temperature of 0°C (32 °F).

Note on orders of magnitude

Practically speaking, a gaseous flow of 1 Pa.m3.s-1 corresponds to a leak that accumulates a cubed meter of gas at a pressure of one pascal in one second.

Leaks traditionally measured at between 10^{-2} and 10^{-10} Pa.m3.s-1 correspond to the time needed to accumulate 1 cm^3 of gas at atmospheric pressure as follows:

1 cm^3	**$Pa.m^3.s^{-1}$**	**Time**
	10^{-2}	10 seconds
	10^{-3}	1 to 2 minutes
	10^{-4}	1/3 hour
	10^{-6}	1.2 day
	10^{-8}	3.8 month
	10^{-10}	33 years
	10^{-13}	330 centuries

18.3 OPERATION OF THE MASS FLOW SENSOR (OR MFL)

The principle of the mass flow sensor is based on the transfer of heat created by the flow rate of gas passing over the surface of the sensitive element. The sensor is made up of a heating resistor (HR) and two thermonsensitive resistors (RT1 and RT2) mounted inside a tube through which the gas passes (see Figure 18-1) (There is also a third temperature sensitive element to regulate the heating resistor).

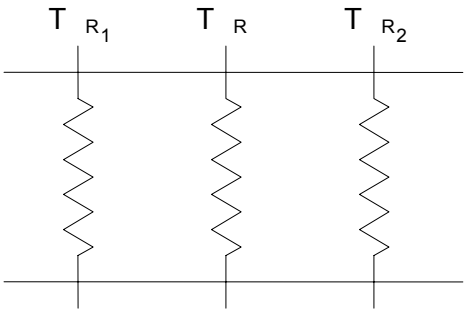


Figure 18-1: Loweric construction of a mass flow sensor. xxxx

In the absence of a rate of gas flow, the two thermosensitive resistors are heated in the same way; the difference in temperature between these two resistors is therefore nil (see Figure 18-2).

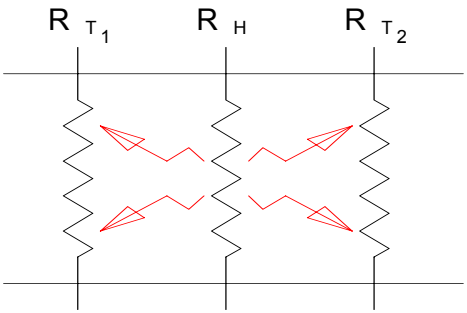


Figure 18-2: Dispersion of heat without gas flow. xxxx

In the presence of a flow of gas, The T1 resistor is cooled whereas the temperature of the resistor T2 increases (see Figure 18-3). A difference in temperature proportional to the flow of gas though the sensor is observed between the two thermosensitive resistors. The higher the flow rate of the gas, the

greater the difference in temperature. Moreover, the positioning of the resistors (one heating resistor between two thermosensitive resistors) determines the direction of the flow of gas.

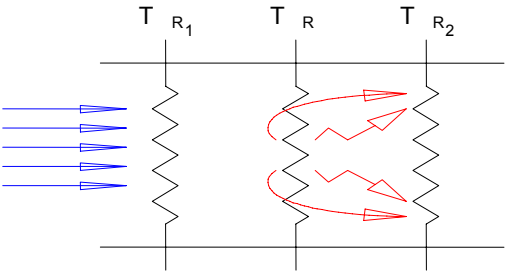


Figure 18-3: Heat dispersion with gas flow.

This phenomenon can be represented by the Figure 18-4 and calculated using the following equation: $\Delta T = k.C_p.\rho.\phi_v$, with:

ΔT = *T2-T1 in Kelvin or Celsius*

C_p = *specific heat*

ρ = *volumic mass*

ϕ_v = *volumic flow rate*

ϕ_m = *mass flow rate*

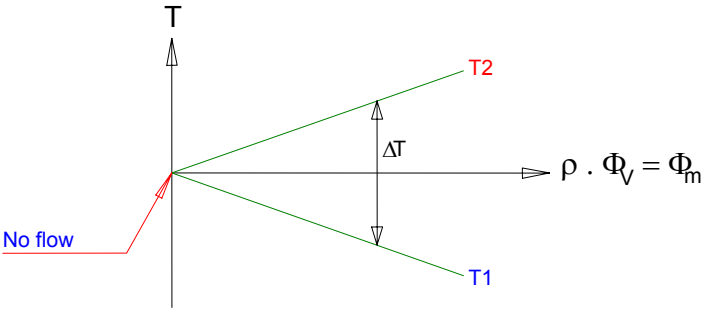


Figure 18-4: Graph of mass flow rate according to temperatures T1 and T2.

The previous formula shows that the gas mass passing through the sensor is measured by observing the temperature difference between the two sensitive resistors. The mass flow sensor is calibrated by modifying the value of the constant “k”. Moreover, a conversion factor can be applied depending on the type of gas (modification of the density and specific heat).

In practice, the resolution and speed of the measurement depends strongly on the thermal mass of the heating resistor and the thermosensitive resistors. These characteristics depend on the construction of the sensor. The smaller the sensor, the smaller the quantity of gas needed to create the difference in temperature. Modern progress made in micro-electronics and micro-mechanics has led to great improvements in such types of sensors.

18.4 REFERENCE RESERVOIR VOLUME

The volume of the reference reservoir (see Figure 7-1, page 20) will be selected depending on the volume to be tested and on the value of the flow of the leak to be measured. It is better to have a reference volume tank greater than the volume of the piece to be controlled. The simplified diagram is as follows:

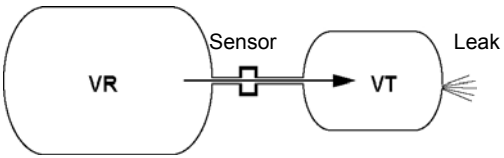


Figure 18-5: The reference volume (VR) and the volume to be tested (VT).

In the case of a pressure test, the leak reduces the pressure of the volume to be tested VT. Through the principle of communicating vessels, the reference volume VR will free a quantity of gas through the flow sensor, and a uniform pressure will tend to return to both volumes.

For a VR reservoir with a capacity equal to the volume tested, the flow measured by the sensor will be equal to half the leakage flow.

In fact, if the leak lets a quantity of gas equal to 4 cm^3 escape, to retain pressure balance, 2 cm^3 will come from the VR volume and 2 cm^3 will come from the VT volume.

The table below summarises the proportion of the flow measured compared with the leak flow, depending on the relation between the volume to be tested VT and the volume of the reference reservoir VR.

$$\frac{\text{Q measured}}{\text{VR}} = \frac{\text{Q leak}}{\text{VR + VT}}$$

VR	VT	Leak flow	Measured flow	Real leak flow
1	1	1	0.50	2.00
2	1	1	0.67	1.50
3	1	1	0.75	1.33
4	1	1	0.80	1.25
5	1	1	0.83	1.20
6	1	1	0.86	1.17
7	1	1	0.88	1.14
8	1	1	0.89	1.13
9	1	1	0.90	1.11
10	1	1	0.91	1.10

The equation used for calculating these reports is:

Q measured = Q leak x VR / (VR+VT)

19. Declaration of European Union compliance

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

Declares that the

***SDT LeakTESTER* type leak detector**

Subject of this declaration, is compliant with the fundamental description relating to safety described in the CEM 89/336/CEE directive.

The equipment features the logo CE indicating that it is compliant with current EC regulations.

In order to operate adequately and as indicated in the directive, it has been manufactured according to the following standards:

- The *SDT LeakTESTER* does not emit electromagnetic waves (CEM).
- The *SDT LeakTESTER* is immunised against external electromagnetic waves (EMI).
- The *SDT LeakTESTER* is protected against electrostatic shocks (ESD).

Brussels, January 2006.

The Director

20. Guarantee and responsibilities

20.1 GUARANTEE

SDT International guarantees the *SDT LeakTESTER* appliance and the *Output module* against all manufacturing defects for a period of two (2) years, with the exception of the MFL pressure sensor, which is guaranteed for a period of six (6) months, provided that that the conditions for use have been followed. The guarantee covers all the material delivered and includes the free replacement of all pieces presenting manufacturing defects.

The guarantee period starts on the day of delivery of the product to the end user. In the event of faults or defects, the date of dispatch will be the reference date.

The guarantee will be null and void in the event of incorrect use or damage to the product, or if the product has been modified, or if non-authorised repairs have been carried out by a third party, or if the product is opened without written authorisation from *SDT International*.

In the event of a fault or defect, contact your local *SDT* representative or *SDT International*.

20.2 LIMIT OF LIABILITY

SDT International, including all of its associated companies, will under no circumstances be held responsible for any damages, including and without limitation; manufacturing losses, interruptions to manufacturing or production, loss of information, defects in the *SDT LeakTESTER* or its accessories, personal injury, loss of time, financial or material losses or any indirect or direct consequences of such losses occurring following the use of, or inability to use the product, even in the event that *SDT* has been informed of such damages.

21. Index

SDT *LeakTESTER*

Leaktesting by measuring mass flow

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