English

Instruction and operation manual

S 460

Ultrasonic Flow meter

Dear Customer,

Thank you for choosing our product.

Before starting up the device please read this manual in full and carefully observe instructions stated in this manual. The manufacturer cannot be held liable for any damage that occurs as a result of non-observance or non-compliance with this manual.

Should the device be tampered with in any manner other than a procedure that is described and specified in the manual, the warranty is cancelled and the manufacturer is exempt from liability.

The device is destined exclusively for the described application.

SUTO offers no guarantee for the suitability for any other purpose. SUTO is also not liable for consequential damage resulting from the delivery, capability or use of this device.

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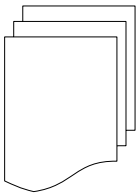
1 Safety instructions



Please check if this instruction manual accords to the product type.

Please observe all notes and instructions indicated in this manual. This manual contains essential information that must be observed before and during installation, operation and maintenance. Therefore this manual must be read carefully by the technician as well as by the responsible user or qualified personnel.

This instruction manual must be available at the operation site of the product at any time. In case of any obscurities or questions regarding this manual or the product, please contact the manufacturer.

WARNING!

Voltage used for supply!

Any contact with energized parts of the product, may lead to a electrical shock which can lead to serious injuries or even death!

- Consider all regulations for electrical installations.
- The system must be disconnected from any power supply during maintenance work.
- Any electrical work on the system is only allowed by authorized qualified personal.

WARNING!

Permitted operating parameters!

Observe the permitted operating parameters, any operation exceeding this parameters can lead to malfunctions and may lead to damage on the instrument or the system.

- Do not exceed the permitted operating parameters.
- Make sure the product is operated in its permitted limitations. Store and operate the product at the permitted temperature and pressure.
- The product must be maintained and calibrated frequently, at least annually.

General safety instructions

- It is not allowed to use the product in explosive areas.
- Please observe the national regulations before/during installation and operation.

Remarks

- It is not allowed to disassemble the product.
- Always use spanner to mount the product properly.

ATTENTION!

Measurement values can be affected by malfunction!

The product must be installed properly and frequently maintained, otherwise it may lead to wrong measurement values, which can lead to wrong results.

- Do not exceed the maximum operation temperature of the transducer.
- Avoid condensation on the transducer element as this will affect the accuracy enormously.

Storage and transportation

- Make sure that the transportation temperature of the device is between -30 °C... 70 °C.
- For transportation it is recommended to use the packaging which comes with the device.
- Please make sure that the storage temperature of the device is between -10 °C... 50 °C.
- Avoid direct UV and solar radiation during storage.
- For the storage the humidity has to be <90%, no condensation.

2 Applications

The S 460 is an ultrasonic flow meter which is designed to measure the flow and consumption of liquids within the permissible operating conditions. S 460 uses clamp-on transducers that can be mounted outside the pipe and brings you flow measurement with benefits including reduced installation costs, uninterrupted production, and no contact with internal liquid.

The liquids that S 460 can measure include the following:

- Chemical addition
- Cooling and heating water
- Drinking water
- Broad range of refined hydrocarbons
- Potable water
- De-ionized and de-mineralized water
- Sanitary liquid
- Purified water

The default units are: Velocity in m/s, Volume flow in m^3/h and Total Consumption in m^3. Other units are available by configurations through the optional display or the service kit.

The S 460 flow meter is mainly used in industrial environment. It is not developed to be used in explosive areas. To use it in explosive areas please contact the manufacturer.

3 Features

- Uses the proven clamp-on transit-time correlation technique.
- Easy to install for permanent and temporary installations.
- High accuracy.
- Configurable physical units.
- A wide range of pipe sizes from DN32 to DN6000.
- Plug and play for the display and data logger products from the same manufacturer.
- Data analysis via the S4M software.

4 Technical Data

4.1 General

CE	
Physical units	Standard flow unit: m^3/h Available flow units: m^3/min, l/min, l/s, cfm Standard velocity unit: m/s
Principle of measurement	Clamp-on transit-time correlation technique
Sensor	Transducer
Measuring medium	Different kinds of Liquid
Operating temperature	Transducer: -30 °C... 90 °C Controller: -20 °C... 60 °C
Housing material	Aluminum
Protection class	IP65
Dimensions	190 mm x 155 mm x 85 mm
Tube diameter	Depending on the transducers: TS-2: DN32 ... DN100 TM-1: DN100 ... DN700 TL-1: DN300 ... DN6000
Weight	2.55 kg

4.2 Electrical Data

Power supply	230 VAC or 24 VDC

4.3 Output-Signals

Analogue output	4... 20 mA
Pulse output	1 pulse per consumption unit Pulse width selectable (6 ... 1000 ms)
Interface	Modbus RTU

4.4 Accuracy

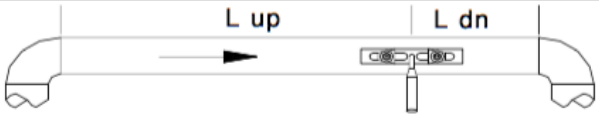
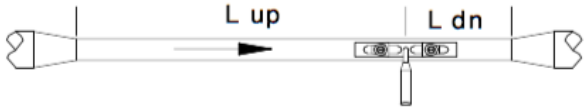
Accuracy	2% (0.03 … 2.00 m/s) 1% (2.00 … 7.00 m/s)
Repeatability	0.20%

5 Determination of installation point

To maintain the accuracy stated in the technical data, the ultrasonic transducers must be clamped on a straight pipe with unhindered flow characteristics. The pipe can be in vertical or horizontal position.

Unhindered flow characteristics are achieved if the section in front of the transducer (upstream) and behind the transducer (downstream) are sufficiently long, absolutely straight and free of obstructions such as edges, seams, curves, and so on.

The following table shows examples of optimum installation locations.

Piping Configuration and Transducer Position	Upstream Dimension L up x Diameters	Downstream Dimension L dn x Diameters
	10D	5D
	10D	5D
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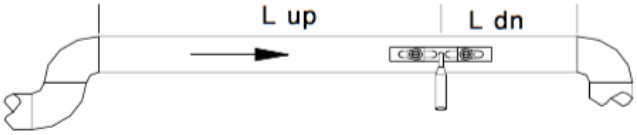
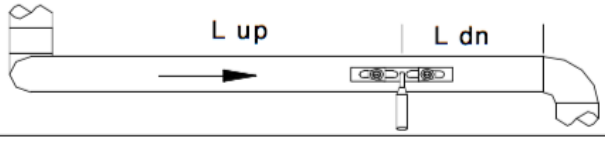
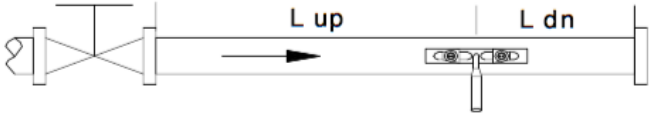
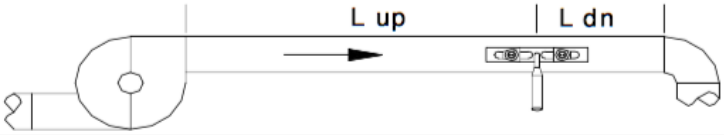
	12D	5D
	20D	5D
	20D	5D
	30D	5D

Principles to select an optimum location:

- Install the transducers on a long straight pipe. The longer the better and make sure that the pipe is completely full of liquid.
- Make sure that the temperature on the location does not exceed the permitted temperature range for the transducers. Generally, the closer to the room temperature the better.
- Take the pipe fouling into consideration. Select a straight and relatively new pipe. If the condition is not satisfying, consider the fouling thickness as part of the liner for a more accurate result.

Remarks

Some pipes have a kind of plastic liner. Between the outer pipe and the liner there may be a certain thickness difference that will prevent the ultrasonic waves from direct travelling. Such conditions will make the measurement impossible. Try to avoid this kind of pipes whenever possible. If that is impossible, plug-in transducers are necessary that are installed permanently on the pipe by drilling holes on the pipe while liquid is running inside.

ATTENTION!

Wrong measurement may occur if the transducers are not installed correctly.

- The flow meter is for indoor use only! At an outdoor installation, the device must be protected from solar radiation and rain.
- It is strongly recommended not to install S 460 permanently in wet environment.

6 Installation

Make sure that all components listed below are included in your package.

Qty	Description	Part no.
1	Ultrasonic flow meter controller	D554 0074
1	Ultrasonic transducer pair	S694 4604, S694 4607, or S694 4608 depending on the pipe size.
2	5 m connection cable to transducers	A553 0127
1	Metal strap	A554 0077
1	Coupling agent	A554 0078
1	Instruction manual	N/A

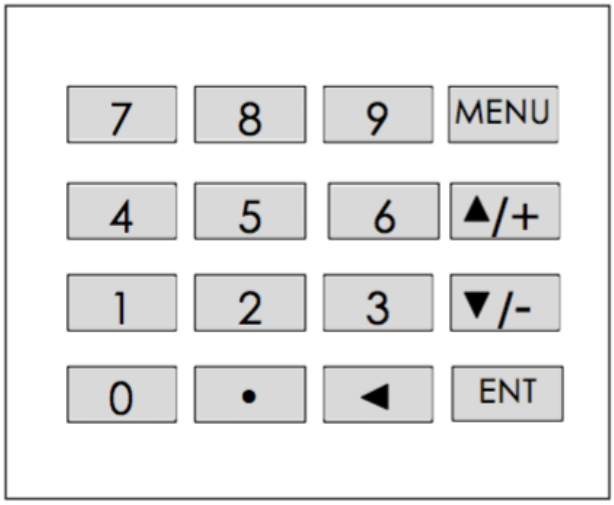
6.1 Configuration

Before installing transducers, configure the transducer parameters using the keypad in front of the meter controller.

Note: The S 460 keypad does not support all settings but most of them. Instead the software S4C-Display does. You can download S4C-Display from our Website at www.suto-itec.com.

6.1.1 Usage of keypad

The S 460 has a keypad available for you to configure and view parameter values.



Key “MENU” – Pressed followed by 2-digit numbers to enter the corresponding menu window.

Key “▲/+” – To scroll up the menu window. It also works as the “+” key when entering numbers.

Key “▼/+” – To scroll down the menu window. It also works as the “+” key when entering numbers.

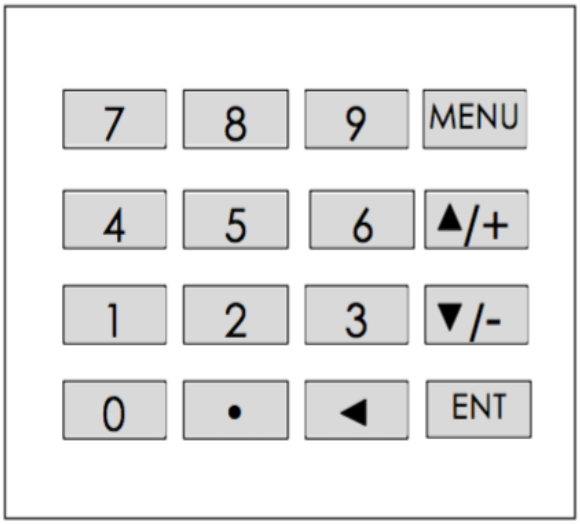
Key "◂" – To scroll left or go backspace.

Key "ENT" – To confirm changes.

6.1.2 Configuring the transducer parameters

The S 460 keypad provides about 100 different menus for configuring the transducers parameters.

Configure parameters using the following steps:



1. Press "Menu" and enter a menu number as needed.
2. In the menu window, enter a desired value or select an option by pressing the UP and DOWN keys.
3. Press "ENT" to confirm the change.

For more information about required parameters and the corresponding menu numbers, see the following table.

6.1.3 Description for the parameter settings

The following table lists parameters that you must configure before starting measurement.

Parameter	Description	Menu No.
Pipe outer diameter	Enter a value in mm.	11
Pipe wall thickness	Enter a value in mm.	12
Pipe inner diameter	Enter a value in mm.	13
Pipe material	Select a material from the selection list.	14
Fluid type	Select the proper fluid from the selection list. For non-standard fluids, the sound speed and viscosity of the fluid are also needed.	20
Transducer type	Select the type based on the pipe size:	23

	TS-2: DN32 … DN100 TM-1: DN100 … DN700 TL-1: DN300 … DN6000	
Installation method	Select V-method or Z-method. For description of these two methods, see section 6.2.1 .	24
US transmitter space	Enter the distance between the two transducers in mm.	25
Flow unit	Enter the desired flow unit, e.g. m^3/h.	31
Consumption unit	Enter the desired consumption unit, e.g. m^3.	32

6.2 Installation procedure

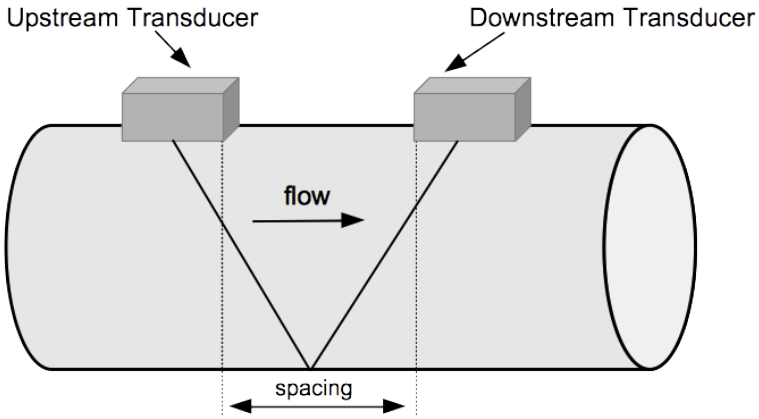
This section describes procedures for installing and removing transducers.

6.2.1 Installing the transducers

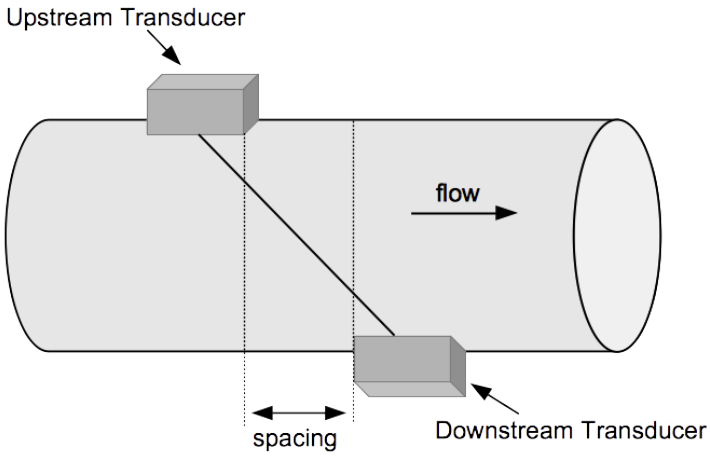
Ultrasonic measurement is realized by measuring the travelling time difference of ultrasonic signals. That is why the alignment and the spacing of the transducers are critical factors for the measurement accuracy and the system performance.

Follow the steps for a proper installation:

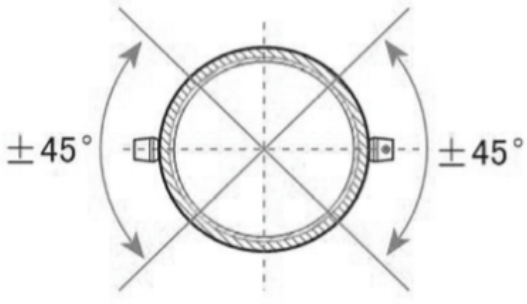
1. Locate an optimum position where the straight pipe length is sufficient and the pipe is in a good condition. For example, a relatively new pipe with no rust and easy to operate.
2. Clean any dust and rust on the pipe surface.
3. Choose one of the two installation methods based on the pipe diameters.



V-Method:
The transducers are mounted on the same side of the pipe and the sound crosses the pipe twice.
It is commonly used when the pipe inner diameter ranging from 15 mm to 200 mm.



Z-Method:
The transducers are mounted on opposite sides of the pipe and the sound crosses the pipe once.
It is commonly used when the pipe inner diameter is above 200 mm.



If the Z-Method is used, make sure that the transducers are mounted on a pipe within a valid angle range, as shown in the left picture.

4. Grease the underside of the transducers with the coupling agent.
5. Use the metal strap to attach a transducer on the pipe and leave no gap between the pipe surface and the transducer.

ATTENTION!

The strap is under tension. Please open it carefully!

6. Install the other transducer on the pipe as described in steps 4 and 5. Make sure that the distance between the two transducers is as close as possible to the “US transmitter space” value configured through the menu number 25.

6.2.2 Removing a transducer

Remove a transducer as described below.

1. Hold the transducer.
2. Release the metal strap.
3. Remove the coupling agent from the underside of the transducer.

6.2.3 Installing the housing (Optional)

The housing can be mounted at a wall. To do so, follow the steps below:

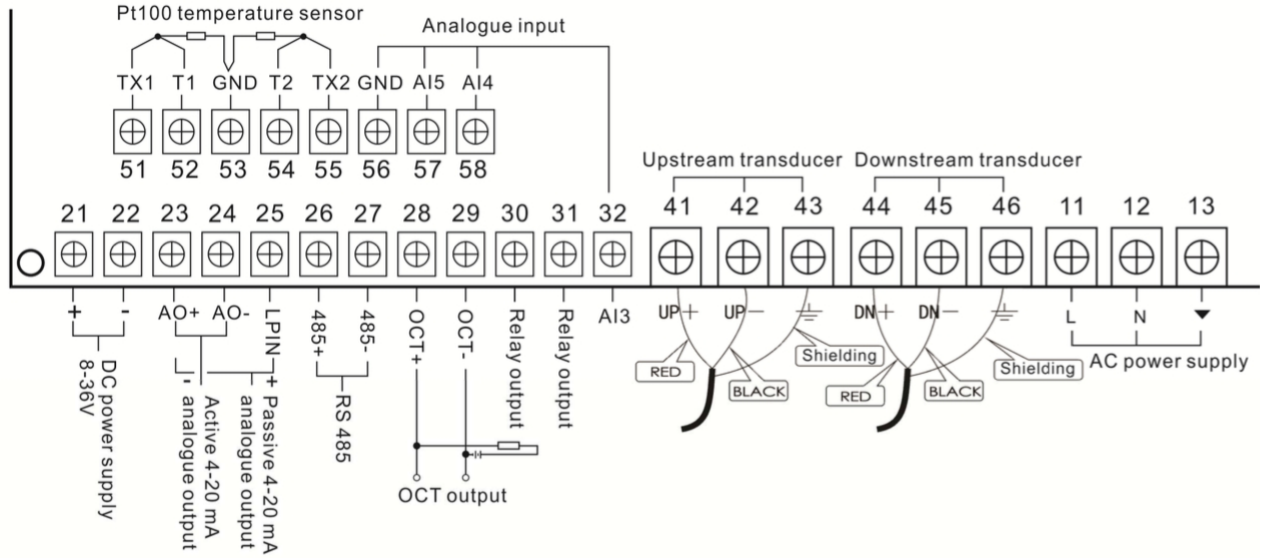
1. Release the wall mounting brackets on the backside of the housing.
2. Mount the housing near the transducer so that the cables are not under the tension.

6.3 Electrical connection

The S 460 is shipped with ex-work electrical connection.

To make any changes, please refer to the following wiring diagram.

Wiring diagram



6.4 Final check

After you complete installation and configuration, perform an installation check to ensure that the signal strength and signal quality of the transducers are in a valid range.

Use the following menu numbers to perform the check.

Parameters	Menu No.	Valid range
Signal strength	90	60.0 ... 99.9
Signal quality	90	60.0 ... 90.0
Transit time ratio	91	97 ... 103

If an error appears in the window, please contact the manufacturer and provide the error code.

If the signal strength is not in the valid range, do the following:

- Relocate the transducers to a better position.
- Try to apply more coupler or clean the surface.
- Adjust position of the transducers vertically and horizontally while checking the varying signal strength and stop at the position of the highest signal strength. Please remember to change the setting for the distance between the two transducers through the menu number 25.
- Check the transducers spacing to make sure the transducers spacing is the same as the setting on the menu number of 25.

If the signal quality is not in the valid range, do the following:

- Avoid interferences from other instruments and devices such as a powerful working converter nearby. Try to relocate the flow meter to a new place where there is littler interference.
- Avoid bad sonic coupling for the transducers with the pipe. Try to apply more couplers or clean the surface.
- Relocate the transducers to a better position.

If the transmit time ratio is not in the valid range, check the following to ensure:

- The pipe parameters are correctly entered.
- The actual spacing of the transducers is correctly placed and the same as displayed in the menu number 25.
- The transducers are installed properly in the right directions.

- The mounting location is good and the pipe is not changed in shape or there is not too much fouling inside the pipes.

7 Troubleshooting

This chapter provides common errors and their countermeasures.

7.1 Power-on errors and countermeasures

The ultrasonic flow meter provides an automatic online diagnosis for the hardware problems. When any message in the following table appears, countermeasures should be taken.

Error message	Causes	Actions
ROM Testing error	Software problem.	1. Power off and on again. 2. Contact the manufacturer.
Segment Test error		
Stored data error	The parameters entered by the user lose integration.	Press “ENT” and reset all the configuration.
Timer slow error	Problem with the timer-keeper or the crystal oscillator.	1. Power off and on again 2. Contact the manufacturer
Timer fast error		
Date time error	Number errors with the calender	Initialize the calender by menu number 60
Reboot repetitively	Hardware problems	Contact the manufacturer

7.2 Error codes and countermeasures

The ultrasonic flow meter shows error codes in the lower right corner of the screen with a single letter like I, R, on the menu window M00, M01, M02, M03, M90 and M08. When any abnormal error code shows, countermeasures should be taken.

Error code	Message displayed on M08	Causes	Actions
R	System normal	No error.	NA
I	Detect no signal	1. No signal detected.	1. Relocate

Error code	Message displayed on M08	Causes	Actions
		2. Transducers installed improperly. 3. Too much fouling. 4. The pipe liners are too thick. 5. The transducer cords are not properly connected.	measuring location. 2. Clean the spot. 3. Check the cords.
J	Hardware error	Hardware problem.	Contact the manufacturer.
H	Poor Sig detected	1. Poor signal detected. 2. The transducers installed improperly. 3. Too much fouling. 4. The pipe liners are too thick. 5. Problem with transducer.	1. Relocate measuring location. 2. Clean the spot. 3. Check the cords. 4. Check the coupler.

Error code	Message displayed on M08	Causes	Actions
Q	Frequ. Output over	The actual frequency for the frequency output is out of the range set by the user.	Check the value entered at M66, M67, M68 and M69 and try to enter a larger value in M69.
F	System RAM error Date time error CPU or IRQ error ROM parity error	1. Temporary problems with RAM, RCT. 2. Permanent problems with hardware.	1. Power on again. 2. Contact the manufacturer.
G	Adjust gain	The instrument is in the progress of adjusting the gain for the signal and the number indicates the progressive steps.	NA
K	Empty pipe	No liquid inside the pipe or setting error.	Relocate where the pipe is full of liquid. Or enter 0 on M29 if there is liquid inside.

7.3 Other problems and solutions

The following table lists other common problems and their solutions.

Problem	Action
The display shows 0.0000 for the flow rate while the flow inside the pipe is not zero.	Use the “Reset Zero” function on menu M43 to solve the problem.
The display shows a much higher or lower flow rate than the actual one.	1. Check if the problem results from an offset value wrongly entered by the user through the M44 menu “Setup a flow bias”, and enter “0” in M44 to fix the problem. 2. Check if the transducer is correctly installed.

Problem	Action
	3. Zero calibrate the instrument by using M42 menu “Zero calibration” and make sure that the flow inside the pipe is zero.

8 Signal outputs

8.1 Analog / Pulse output

The flow meter has an analog output range of 4... 20 mA. This output can be scaled to match a desired measuring range.

The flow meter generates one pulse per a consumption unit. This pulse output can be connected to an external pulse counter to counter the total consumption.

8.2 Interface

The data can be transmitted via RS-485 Modbus to a data collection system or software.

9 Calibration

In certain installations the display will show a non-zero flow even if there is absolutely no flow. In this case, a zero point calibration is recommended. Make sure that there is zero flow in the pipe before activating this function in the sensor menu.

The sensor is calibrated ex work. The exact calibration date is printed on the certificate which is supplied together with the sensor. The accuracy of the sensor is regulated by the on site conditions, parameters like oil, high humidity or other impurities can affect the calibration and furthermore the accuracy. However we recommend to calibrate the instrument at least once per year. The calibration is excluded from the instruments warranty.For this please contact the manufacturer.

10 Maintenance

To clean the flow meter and its accessories it is recommended to use moist cloth only.

ATTENTION!

Do not use isopropyl alcohol to clean the display!

11 Disposal or waste

Electronic devices are recyclable material and do not belong in the household waste.
The device, the accessories and its packings must be disposed according to your local statutory requirements.
The dispose can also be carried by the manufacturer of the product. Please contact the manufacturer for details.

12 Warranty

SUTO provides a warranty for this product of 24 months covering the material and workmanship under the stated operating conditions from the date of delivery. Please report any findings immediately and within the warranty time. If faults occurring during the warranty time SUTO will repair or replace the defective unit, without charge for labour and material costs but there is a charge for other service such as transport and packing costs.
Excluded from this warranty is:

- Damage caused by:
  - Improper use and non-adherence to the instruction manual.
  - Use of unsuitable accessories.
  - External influences (e.g. damage caused by vibration, damage during transportation, excess heat or moisture).

The warranty is cancelled when one of the following situations occurs:

- The user opens the measurement instrument without a direct request written in this instruction manual.
- Repairs or modifications are undertaken by third parties or unauthorised persons.

- The serial number has been changed, damaged or removed.

Other claims, especially those for damage occurring outside the instrument are not included unless responsibility is legally binding.

Warranty repairs do not extend the period of warranty.

ATTENTION!

Batteries have a reduced warranty time of 12 months.

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