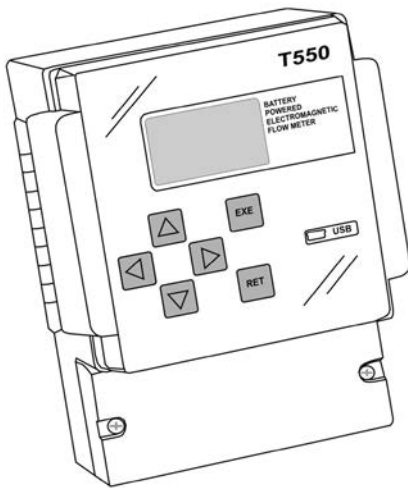
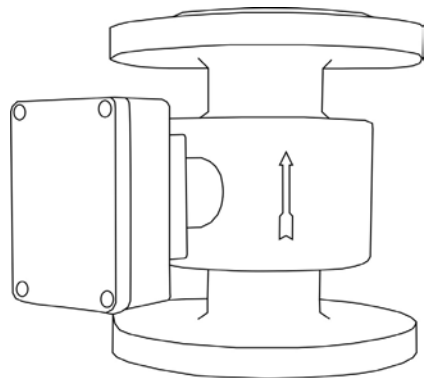


T550

Battery-operated magnetic
flowmeter



User's manual



NOTES :

toscano

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1 Basic information

1.1 Basic features

The inductive flow meter T550 is designed to measure, indicate and record the instantaneous and total flow of the conductive media flowing through the sensor. The flow meter records both forward and reverse flows.

As there are no moving parts in the flow profile the flow meter T550 can be used to measure extremely dirty liquids containing solids.

Range of applications. The inductive flow meter T550 is for use in the Chemical Industry, Paper Industry, Water and Wastewater Treatment Industry and most other process industries.

Features. The inductive flowmeter T550 is a highly accurate and stable device. The construction of T550 flowmeter uses components with long-term, time and temperature stability. Configuration data is backed up and can be recovered after a power failure. The back-up structure enables data recovery even if a partial loss of data occurs as a result of (e.g. high level electrostatic discharge or a noisy power supply). Internal CPU provides all functions usually built in electronic flow meters, incl. low flow rate correction, frequency response setting, bandwidth of sensitivity setting at low flow rates, etc.

Power supply. T550 is supplied from internal lithium battery and doesn't requires external power supply.

1.2 Standards and approvals

Electromagnetic flowmeter T550 is conformed to requirements for bearing CE mark.



- Electromagnetic flowmeter electronic unit, both remote and compact version meet safety requirements according to standard EN 61010-1 including amendment A2.
- Electromagnetic flowmeter electronic unit, both remote and compact version meets EMC requirements according to standard EN 61000-3, EN 61000-4, EN 61000-6
- Pipe with sensor meets requirements of Pressure Equipment Directive 97/23/EC.
- Both the pipe and electronic unit, meet the requirements of degree of protection provided by enclosure level IP67, according to EN 60529 (IEC 529).

1.3 Warranty

Within the manufacturers general supply conditions, all material and manufacturing faults are covered by that. It is up to us whether the warranty obligation includes a repair free of charge or corresponding replacement. Further claims on compensation, especially for loss of production or resultant damages, are strictly excluded.

Any defects caused by improper use are absolutely not included in the warranty. Excluded from warranty are also expendable items (as i.e. accumulators, batteries, pushbuttons after attained life time, ribbons, etc.)

In case of a warranty claim the user is asked to give detailed description of the defect and also of the application for which you use the product.

Warranty period for all types of electromagnetic flowmeter is 2 years.

The flowmeter should only be used according to the instructions described in this manual.

2 Preparing for start up

2.1 Inspecting contents of the package

Basic package includes the following items:

- Flanged sensor
- Electronic Transmitter (can be integral or remote)
- Operating manual.
- Calibration certificate
- USB A-B cable

The flowmeter is delivered ready for use after connecting to the power supply.

Please check that it has been correctly installed according to chapter "Installation".

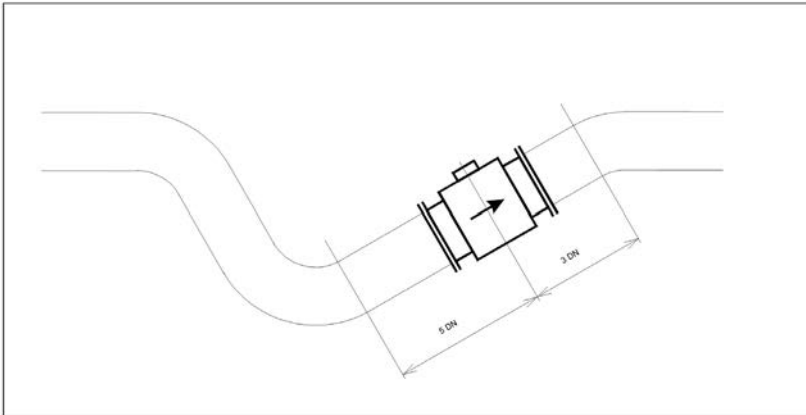
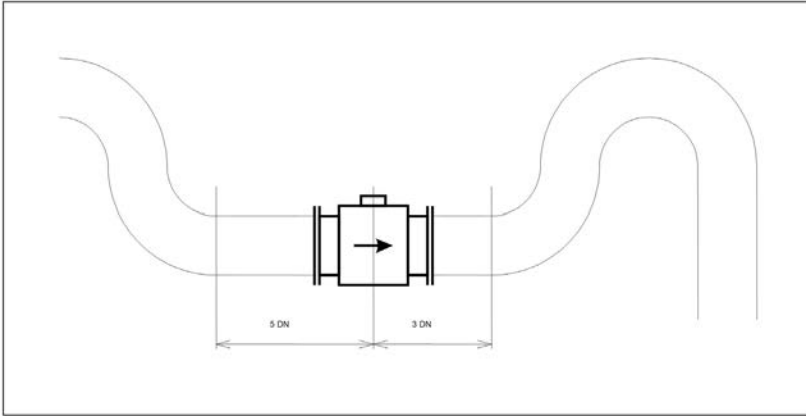
3 Installation

3.1 Sensor location

To avoid measuring errors due to gas/air entrainment or to a partly filled pipe, please observe the following:

Horizontal (standard) mounting

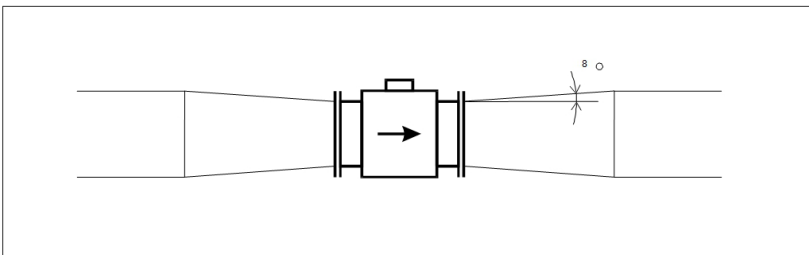
The sensor tube must always remain full. The best way to achieve this is to locate the sensor in a low section of pipe, see the following picture. It is recommended to install the sensor in a section of straight pipe with at least 5 times the pipe diameter before sensor and 3 times after sensor.



Pipe reducers

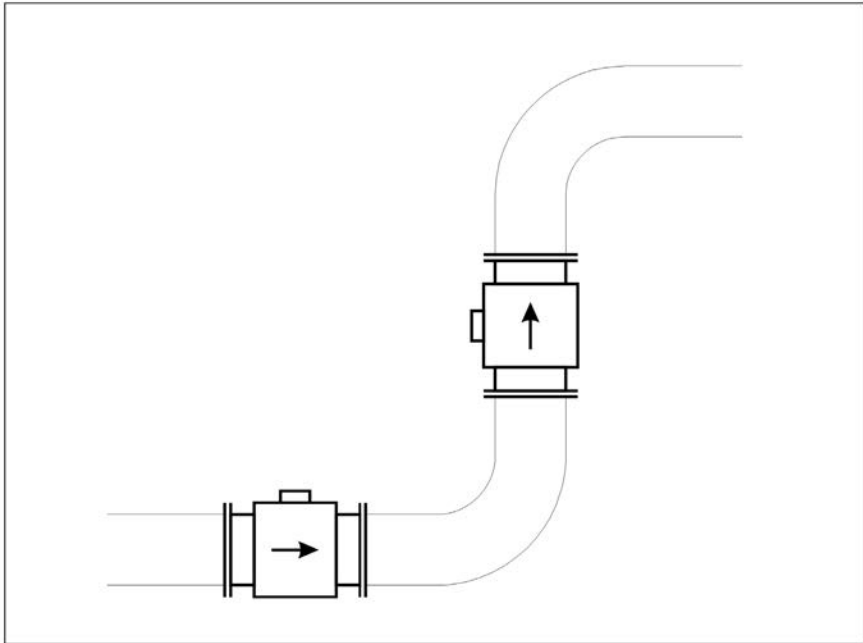
If the pipe diameter is not the same as the diameter of sensor, then pipe reducers can be used.

So as not to lose accuracy of the measurement, the slope of reducers should not exceed 8.



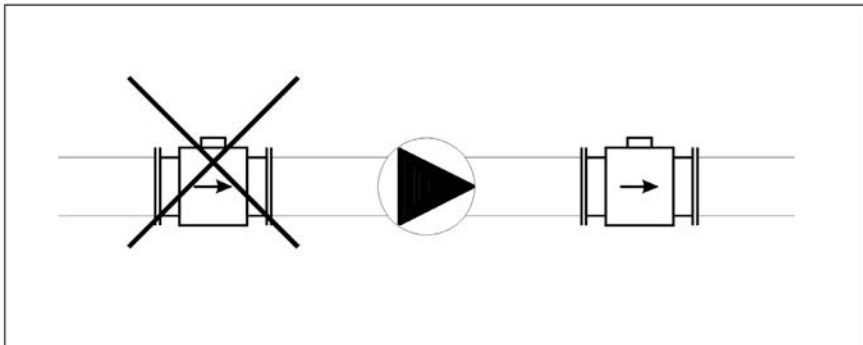
Vertical mounting

When the sensor is mounted on a vertical section of pipe, the flow direction must be upwards. In the case of a downward flow direction, air bubbles can collect in the sensor and the measurement could be unstable and inaccurate.



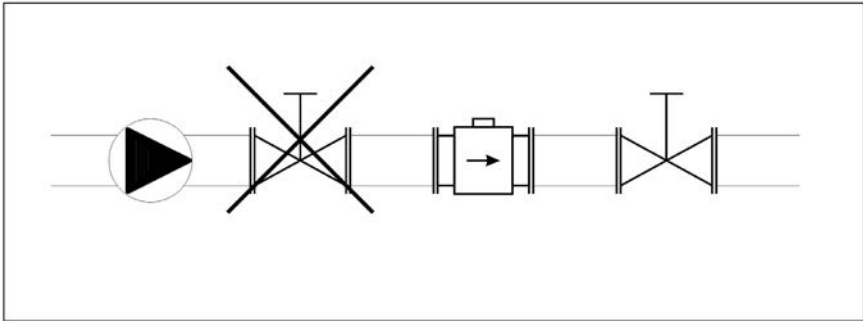
Pumps

Never install the sensor on the suction side of a pump or on a section of pipe where a vacuum is possible.



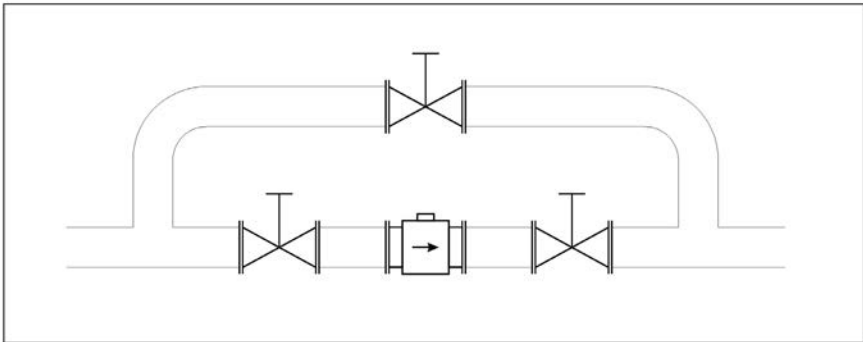
Valves

Suitable location of a shutoff valve is downstream of a sensor.



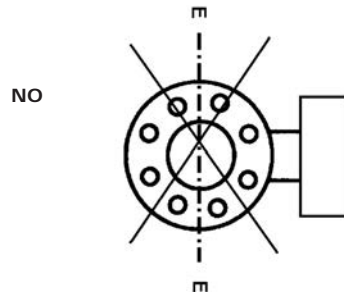
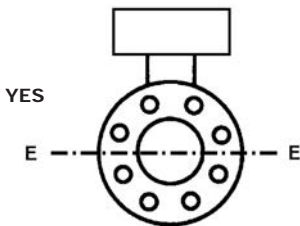
Removal during maintenance

If the application requires removal of the sensor for periodic maintenance, it is recommended to install a bypass section as the following drawing.



Position of electrodes

The axis of measuring electrodes must be approximately horizontal (see picture).



Vibration

To avoid mechanical damage protect both electronic unit and sensor against mechanical vibrations. When strong vibrations are possible, both the input and output pipe must be mechanically fixed or the remote version with a separate electronic unit should be used.

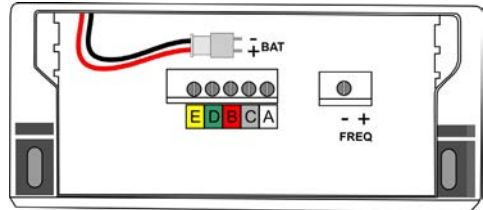
Overheating

To avoid overheating, the electronic unit should be protected against direct sunlight especially in areas with a warm climate with ambient temperatures over 30 °C. If necessary a sunshade has to be mounted over the electronic unit or a remote version with a separate electronic unit should be used.

3.2 Battery connection

The flowmeter is delivered with disconnected internal battery. Following procedure should be used to connect battery after installation the flowmeter:

- Unscrew and open the back cover.
- Get the white connector into the PCB connector marked as "BAT".
- Screw on the back cover.



3.3 Battery replacement

The battery life depends on the excitation time, unit settings and ambient temperature.

What shortens battery life:

- Short excitation time
- Using the USB connection
- Active display
- Active frequency output

If the battery is low, replace it by following these steps:

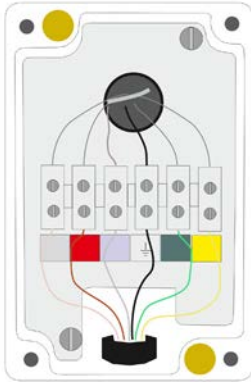
1. Type: MENU — SETUP — GENERAL — BATTERY — Change new (YES). You are prompted to connect the new battery.
2. Connect the new battery.
3. Check date and time.

3.4 Electric connection between converter and sensor

For remote version, converter and flanged sensor are connected with one 5-wire cable (2 unshielded wires and 3 shielded wires) cables. Standard cable length is 5 meters. It is recommended to mount the transmitter not too far from the flanged sensor. Use cables as short as possible.

Converter and flanged sensor have five screw terminal connectors. Wire colours are as follows:

- **White:** Electrode 1 (A)
- **Brown:** Electrode 2 (B)
- **Grey:** Earth (C)
- **Shielding**
- **Green:** Excitation 1 (D)
- **Yellow:** Excitation 2 (E)



Following procedure should be observed to connect sensor cable to the transmitter and sensor:

- Switch off transmitter power supply.
- Unmount top cover of sensor connection box. Four screws must be removed.
- Connect the 5-wire cable (grey, white, brown, green and yellow).
- Remove the 2 screws from transmitter terminal block cover. Connect the cable wires.
- Mount the transmitter cover back.
- Switch on transmitter power supply.

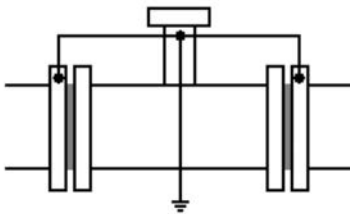
3.5 Sensor earthing

To ensure the correct operation of the flowmeter, an earthing connection between the sensor and pipeline must be made. The sensor is equipped with screw connection for an earthing wire. This screw has to be connected to the flange on the pipeline. Use a copper wire to connect between the flange and the earth screw on the sensor.

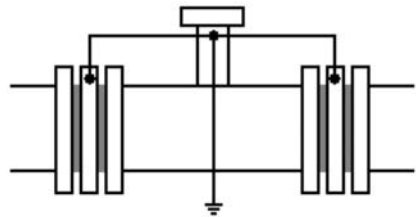
If the pipeline is manufactured from a non-electrically conductive material, or if the pipe is lined with a similar material, special earthing rings must be installed between flanges.

Note: The flowmeter must **not** be switched on, if the sensor is not connected /earthed to the rest of pipeline!

Sensor earthing without earthing rings

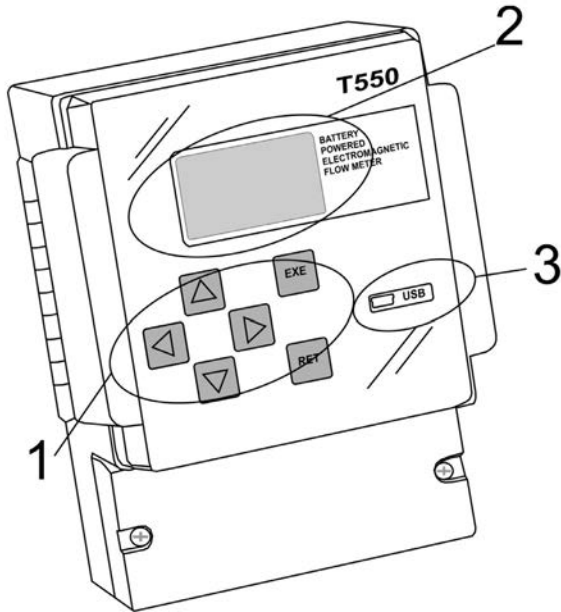


Sensor earthing with earthing rings



4 Electronic unit description

4.1 Front panel (display)



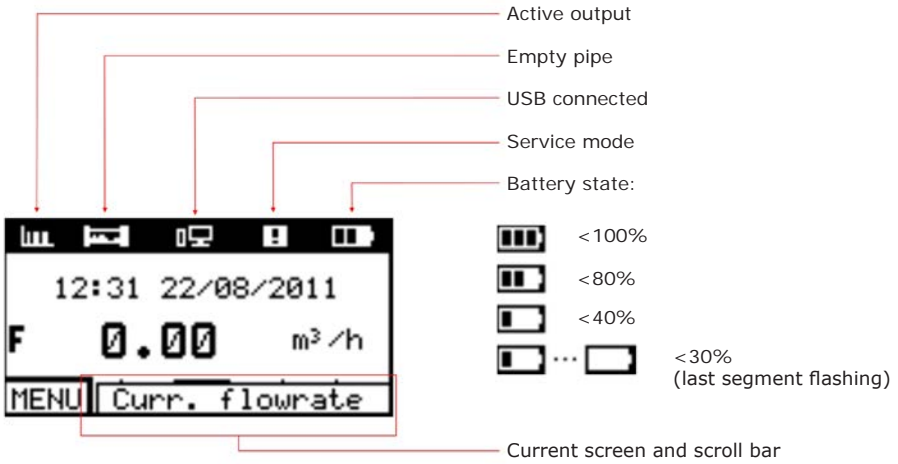
1 Keyboard

6 keys are used to act on flowmeter setting and calibration.

2 Display

Graphic LCD is used to display the total volume, instantaneous flowrate, current keyboard function and auxiliary information.

The decimal point position and type of units can be changed in the flowmeter "Setup Menu" (see chapter "Flowmeter configuration").



3 USB connector

USB for connecting the flowmeter to the computer. USB is electrically isolated from the flowmeter electronics.

The connector is located on the front panel, next to keyboard.

USB enables to connect the flowmeter to a personal computer. It can be used for flowmeter's configuration and calibration, but it's not suitable for online communication during operation.

- Communication rate: 9600 Bd
- Data bits: 8
- Stop bit: 1
- Parity: none



To connect the flowmeter to the PC a standard mini USB A-B cable is used. Follow this procedure:

- Unscrew the transparent front cover.
- Plug the one end of the cable onto the USB connector in the flowmeter.
- Connect the opposite end to the USB port in the PC.
- Use the application software (FlowAssistant) to enter new calibration data or to change settings of the flowmeter.
- Disconnect USB cable and replace the cover.



4.2 Frequency output

The frequency output is NPN type to transistor with galvanic isolation. The voltage drop when the pulse is active is 1V. The maximum voltage is 50V and the maximum current is 100 mA. The frequency range is from 10Hz to 12kHz.

When the frequency output is active, it is switched off after 60 minutes, in order to prolong battery life.

4.3 Main menu

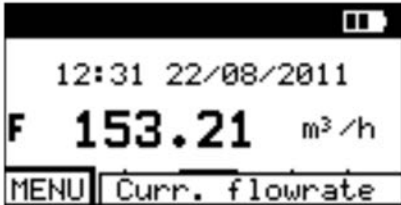
The flowmeter is in Main Menu after switching on. This entire menu can be operated with keyboard without opening the housing.

The following information can be displayed in the Main Menu.



Total Volume

On basic display (after power on), time and date are displayed on the first line. Total volume is displayed on the second line. Flow in the forward direction is added to this volume, while flow in the reverse direction is subtracted.



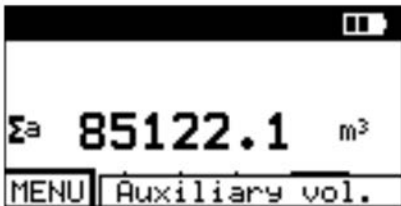
Current Flowrate

From the "Total volume" screen, by pressing the right arrow key, we turn to the screen "Current Flow".



Positive and Negative Volume

From the "Current Flow" screen, by pressing the right arrow key, we turn to the "Pos / Neg Volume" screen. The positive cumulative volume is displayed in the first line and the negative is shown on the second line.



Auxiliary Volume

From the "Current Flow" screen, by pressing the right arrow, we turn to "Auxiliary Volume". This is a partial volume counter, which can be reset by pressing the EXE key for 3 seconds. This counter is selected in the "Settings" menu.



Datalogger (periodical flow rate record)

From the "Auxiliary Volume" screen, by pressing the right arrow key, we turn to "Datalogger". Each memory register can be viewed individually by pressing the down arrow key. Each displayed value is accompanied by date and time. Press right arrow to exit this display mode.

Datalogger capacity: 100,000 records.

4.4 Internal backup

Each hour the following data is saved in the internal memory: date, time, total volume, positive and negative volume. If necessary, replace the battery (see chapter "Battery replacement". The settings for menu, datalogger, etc. are saved immediately.

4.5 Menu - Basic rules (MENU)

All the flowmeter parameters can be changed by using the Setup menu. Menu is organized in a tree type structure. Meaning of keys is:

- "↑", "→", "↓", "←": parameter selection
- "EXE": confirmation of selected parameter
- "RET": return one level back

The folder names are written in capital letters, individual items are written small letters.

4.6 Setup menu (SETUP)

Access the "Settings" menu by pressing the "EXE" button in the main menu. Such access is protected by password ("00000" by default).



The password is entered by using the arrow keys and confirm with "EXE".

You can return to the main menu with the "RET" key.

After entering the correct password, the flowmeter shows four levels of access:

1. FLOWMETER - password "00000"
2. CALIBRATION - password "10000". Allows to change configuration and calibration
3. GENERAL - password "00000". To change user settings.
4. SERVICE - only for the service engineer.

Flowmeter configuration (FLOWMETER)

At the main menu press the "EXE" button, enter the password "00000" and select "FLOWMETER".

Flowrate parameters (FLOW)

Function enables to set flowrate unit, resolution and other flowrate parameters.

- Flowrate units (Unit): This item allows to set flowrate units. Available units are:
 1. l/s: litres per second
 2. m³/h: cubic metres per hour
 3. UG/m: US gallons per minute
 4. IG/m: imperial gallons per minute
 5. User: user-defined unit, factory-set is "l/h" (litres per hour). User defined unit can be changed by computer only.
- User unit name (User unit): This item allows to set the name of user unit. Maximal length is five letters.
- User unit conversion constant (User constant): This item allows to set the conversion constant for user unit. This constant is calculated as the ratio between flowrate in [l/s] and flowrate in [user unit]. CALIBRATION access is required.
- Flowrate direction (Direction): This item allows to switch between "Positive" and "Negative" flow direction (change the sign in flowrate value).

Note: Flowmeters are working in both flow directions. However standard calibration is made for positive direction only.

- Low-flow cutoff (Low-fl.off): This item allows to set limit for suppressing low flowrates. Available range is according to the nominal diameter.

Note: All flowrates below this value will be displayed as 0.00. This setting is valid for display and all outputs.

- Coils excitation time (Excitation): Defines the time between a measurement and the next. This time is directly related to battery life. Relationship between the excitation pulse and battery life:
 1. 1 s: battery life 5 months
 2. 5 s: battery life 30 months
 3. 15 s: battery life 5 years
 4. 30 s: battery life 7 years
- Moving average time constant (Time const.): This item allows to change the time for moving average calculating. Available range is between 4 and 20 s.
- Rated flow range (Range): Change the interval of the nominal flow. This value makes setting the outputs of the flowmeter. Does not affect the accuracy of the equipment.

Volume parameters (VOLUME)

This item allows to set volume unit, resolution and other volume parameters.

- Volume units (Unit): This item allows to set volume units. Available units are:
 1. m3: cubic metres
 2. l: litres
 3. UG: US gallons
 4. IG: imperial gallons
 5. User: user-defined unit, factory-set is "l" (litres). User defined unit can be changed by computer only.
- User unit name (User unit): This item allows to set the name of user unit. Maximal length is four letters.
- User unit conversion constant (User constant): This item allows to set the conversion constant for user unit. This constant is calculated as the ratio between volume in [l] and volume in [user unit]. CALIBRATION access is required.
- Resetting Volume counters (CLEAR VOLUME): This item allows to clear volume counters.
 1. "Auxiliary volume": clears auxiliary volume counter.
 2. "Total volume" clears total volume counter (CALIBRATION access is required).
 3. "Pos/Neg volume" clears positive and negative volume counter (CALIBRATION access is required).

Datalogger parameters (DATALOGGER)

This item allows to set the datalogger.

- Datalogger sampling interval (Interval): This item allows to set sample interval for internal datalogger. You can select one of following intervals in minutes: Off, 5, 10, 15, 30, 45, 60, 120, 180 and 240. Flowrate value written into the datalogger is calculated as average value in the selected interval.
- Datalogger filling (Filling): This item displays datalogger filling in %. Datalogger capacity is over 100 000 samples.
- Datalogger clear(Clear): This item allows to clear the datalogger memory.

Output configuration (OUTPUT)

This item allows to set the outputs.

- Output modes (Mode):
 1. Off: output off, not active (off state).
 2. Freq: frequency $1000 * \text{Flow} / \text{QF}$ [Hz] according to the flow.

The frequency output is to transistor, galvanically isolated and NPN polarity. Voltage drop across the transistor is 1V. Maximum voltage 50 V. Maximum current 100 mA. Frequency range from 10 Hz to 12 kHz. The frequency output runs continuously for 60 minutes and then turn off automatically to save battery.

- Flow corresponding to 1 kHz (QF): allows setting the QF constant, that represents the corresponding flow to a frequency of 1 kHz. It can be adjusted completely independent from the nominal diameter of the flowmeter. QF value range is proportional to the flowmeter range.

Calibration configuration (CALIBRATION)

This item serves for the flowmeter calibration.

**Setting any new value in calibration menu changes calibration data!
Calibration should be performed in an appropriate equipped laboratory.**

**We recommend to use FlowAssistant software for easy calibration.
Its "calibration wizard" can prevent flowmeter from incorrect calibration.**

You can change calibration values only if the correct calibration password has been entered. Default factory setting is "10000".

Note: Flowmeter T550 enables calibration at 2, 3 or 4 points.

Each calibration point contains 2 values. User sets nominal value of calibration point between +/- QMAX (for maximum flowrates see table 1: T550 flowrates). It is expressed in flowrate units. A calibration constant is attached to each nominal value (calibration constant doesn't have a unit).

During the calibration process, you may change this calibration constant to reach similarity between standard flowmeter and the calibrated flowmeter. Higher calibration constant means lower displayed value.

Calibration constants must be different. In the case of two equal calibration constants, the measured values could be wrong.

- Number of Calibration Points (Num.of cal.point): This item allows to enter number of calibration points in range between 2 and 4.

Note: Standard number of calibration points is 2. More calibration points are used for special applications when higher accuracy is expected (negative flowrate, low flowrates etc.).

- Calibration point 1 (CAL.POINT 1): This item allows to change nominal and calibration value of Calibration point 1.
 1. Flowrate nominal value setting (Flowrate): Flowrate nominal value can be changed in the range +/- QMAX (see the table 1: T550 flowrates). This value is flowrate that is calibrated.
 2. Calibration constant (Constant): Value presents calibration constant in above defined calibration point. Higher calibration constant means lower displayed value.
- Calibration point 2 (CAL.POINT 2): This item allows to change nominal and calibration value of Calibration point 2. For detail description see Calibration point 1.
- Calibration point 3 (CAL.POINT 3): This item allows to change nominal and calibration value of Calibration point 3. For detail description see Calibration point 1.
- Calibration point 4 (CAL.POINT 4): This item allows to change nominal and calibration value of Calibration point 4. For detail description see Calibration point 1.
- Factory setting calibration (Orig. Cal. Settings): Restores the original factory calibration (number of points, 1.4 calibration point range and low flow cut).

General settings (GENERAL)

This item serves for flowmeter general settings.

- Interface parameters (USB-RS232): This item allows to change USB (virtual RS232) parameters.
 1. Bus mode (Mode): Following modes are available:
 - Normal
 - Modbus ASCII
 - Modbus RTU
 2. Modbus parity (Modbus parity): Following parity setting is available:
 - None
 - Even
 - Odd
 3. Modbus address (Modbus address): Available range for modbus addresses is 1 to 247.
- Display parameters (DISPLAY): This item allows to change display parameters.
 1. Language (Language): This item allows to set the language. You can select one of following items: (English, Spanish).
 2. Display contrast (Contrast): This item allows to set the display contrast in range 30 to 70 %.
 3. Message display time (Message time): This item allows to set the message display time. You can select one of following items: (Short, Normal, Long).
- Real time setting (DATE/TIME): This item allows to correct time of internal Real time clock and select required date format.
 1. Time setting (Time set): This item allows to set the actual time. Range is 00:00 to 23:59.
 2. Date setting (Date set): This item allows to set the actual date. Range is 01.01.2009 to 31.12.2099.
 3. Date format setting (Date format): This item allows to set required date format. You can select one of following items: ("D/M/Y", "D.M.Y", "D-M-Y", "Y/M/D", "Y.M.D", "M/D/Y", "M-D-Y").
- Password setting (USER ACCESS): This item allows to set user passwords.
 1. Basic access password (Basic password): This item allows to set five digits password for access level "BASIC".
 2. Calibration access password (Calibr. password): This item allows to set five digits password for access level "CALIBRATION".
 3. Clear on main screen (Clear. on screen): This item allows to clear auxiliary volume and min./max. flowrates without password direct from the Main menu. If item is enabled the password is not required.
- Battery status (BATTERY): Let you know the battery status.
 1. Size Battery (Type): Allows to select between 2 or 4 cells batteries.
 2. Change battery: Function to use when you want to replace the battery. After selecting and confirming, the protocol for substitution is active.

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- Service information (INFO): This item displays internal measured values. These values can be used for diagnostic.
 1. Serial number (Serial number): This item displays flowmeter serial number as "xxxxxx" (six digits).
 2. Firmware version (Version SW): This item displays internal firmware version as "FW x.xx".
 3. Hardware version (Version HW): This item displays internal hardware version as "HW x.xx".
 4. Nominal sensor diameter DN (Diameter): This item displays nominal sensor diameter in mm. Diameter can be changed with access level "SERVICE".
 5. Internal temperature (Int. temp): This item measures internal temperature. Optimal range is -20° to 75° C.
 6. Battery voltage (Volt.battery): This item measures battery voltage. Optimal range is 2.8 to 3.7 V.
 7. CPU voltage (Volt. CPU): This item measures CPU voltage. Optimal range is 2.8 to 3.2 V.
 8. Internal voltage +5 V (Volt. high): This item measures internal power supply +5 V. Optimal range is 4.7 to 5.1 V.
 9. Internal voltage +3.6 V (Volt. +symm): This item measures internal power supply +3.6 V. Optimal range is 3.5 to 3.7 V.
 10. Internal voltage -3.6 V (Volt. -symm): This item measures internal power supply -3.6 V. Optimal range is -3.5 to -3.7 V.
 11. Reference voltage +2,5 V (Volt. ref): This item measures internal reference. Optimal range is 2.4 to 2.6 V.
 12. Coil excitation current (Coil excit): This item measures coil excitation current. Optimal range is 19 to 22 mA.

4.7 Nominal values (standard factory setting)

FLOWMETER

FLOW

UNIT	m ³ /h
USER UNIT	l/h
USER CONSTANT	3600
DIRECTION	Positive
EXCIT. FREQ	1/15 Hz
L.F.CUTOFF	flowrate Q1%/2
TIME CONSTANT	10s
RANGE	flow Q _n (nominal flow)

VOLUME

UNIT	m ³
USER UNIT	l
USER CONSTANT	1.0

DATALOGGER

INTERVAL	Off
----------	-----

CALIBRATION

NUMBER OF CAL.P	2
CAL. POINT 1	
FLOWRATE CONSTANT	5 ... 10 % of required Q _n is assigned according to the calibration
CAL. POINT 2	
FLOWRATE CONSTANT	40 ... 70 % of required Q _n is assigned according to the calibration
CAL. POINT 3	Not used
CAL. POINT 4	Not used

GENERAL**INTERFACE**

USB-RS232 MODE	Normal
BAUDRATE	9600
MODBUS PARITY	Even
MODBUS ADDRESS	10

DISPLAY

LANGUAGE	English
CONTRAST	50 %
MESSAGE TIME	Normal

DATE/TIME

ACTUAL TIME	actual time (GMT + 1)
ACTUAL DATE	actual date (GMT + 1)
DATE FORMAT	D/M/Y

USER ACCESS

BASIC PASSWORD	00000
CAL. PASSWORD	10000
CLEAR ON SCREEN	Enabled

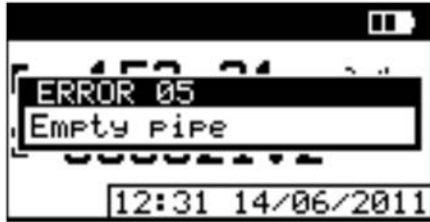
INFO

DIAMETER	according to the sensor DN
----------	----------------------------

5 Error messages

When any error occurs, the T550 flowmeter will display an error message. Errors can arise because of:

- Incorrect control, i.e. faulty connection to the flowmeter, earthing, etc.,
- Flowmeter internal failure.



In case of any error, the error message is displayed on the display for approx. 1 to 5 seconds. The same error message can be read by computer (command IER?).

After switching on, an internal test of the hardware is performed. If there were any error during the power on test, the flowmeter displays the appropriate error message.

Types of errors and methods of troubleshooting (if available) are in following table.

No.	Error	Meaning	Troubleshooting
110	Flashing	Error in internal memory.	Internal error. Turn T550 off and, after 5 s, turn it on again. If the error recurs, contact the manufacturer.
120	Temperature error	Room temperature.	Check that the ambient temperature is within the permitted range.
121	Int. Voltage	Internal voltage error.	Internal error. Turn T550 off and, after 5 s, turn it on again. If the error recurs, contact the manufacturer.
122	Excitation open	Resistance of excitation coils is higher than 250 Ohm.	The strength of the magnet coils is too high (open circuit). Check the sensor connection.
125	Empty pipe	No fluid in the pipe.	Fill the pipe. If there is fluid in the pipe, clean the electrodes and check the wiring between the sensor and electronics.
130	Datalogger full	Memory of datalogger is full.	Empty datalogger memory.

Except the errors mentioned above, the flowmeter reports even the errors caused by incorrect communication with the computer. These errors are described in the chapter "Remote control".

6 Maintenance

T550 flowmeter is an electronic device with circuits protected with built-in electronic fuses. They protect the instrument against damage caused by the user.

6.1 Advice for correct operation

The following principles should be considered during installation:

- Protect the flowmeter and the internal lining of the sensor pipe from mechanical damage, especially during installation or cleaning.
- Protect the flowmeter from direct sunlight. Fit a sunshade if necessary.
- Do not expose the flowmeter to intense vibration.

6.2 Periodical maintenance

T550 flowmeter does not require any special maintenance. Once a year, remove the sensor from the pipe and clean the liner. Method of cleaning consists of removing mechanical dirt and any non-conductive coating (like oil film) from the liner. A very dirty liner could cause inaccuracy of the measurement. Check mechanical state of the liner.

6.3 What to do in case of failure

If the screen turn off during operation, the flowmeter must be switched off immediately.

- Remove the cover from the transmitter.
- Disconnect the power supply battery (see chapter Battery connection).
- Connect power supply again.
- Replace the cover.

It is not advisable that users try to repair by their means.

Hidden faults can cause different symptoms. Usually, they cause instability of some parameters.

They are likely caused by interferences, fault isolation, proper installation, improper voltage network, poor earthing, or the presence of strong electromagnetic or electrostatic fields. In this case contact distributor.

7 Application information

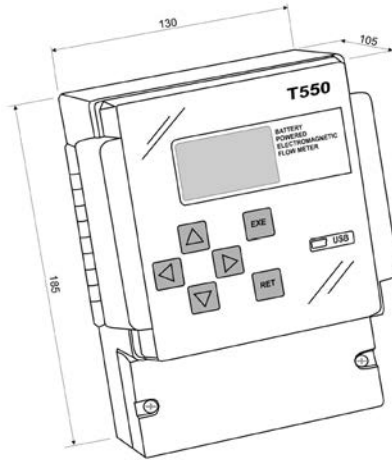
7.1 Weight and dimensions

Flowmeter weight and dimensions depend mostly on the diameter of the pipe.

Electronic unit

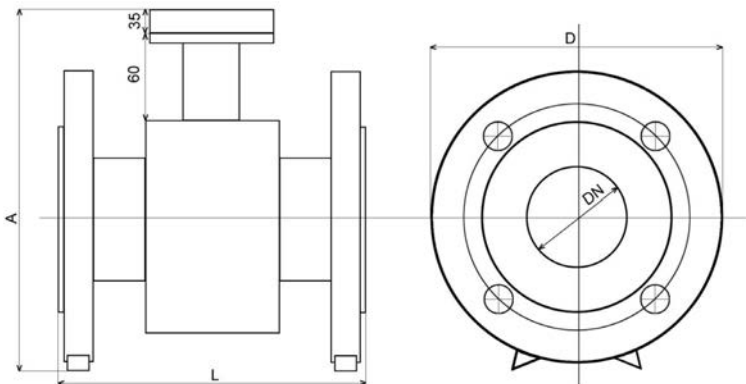
Weight: 0.85 kg

Dimensions in mm:



Sensor

In the table below are the dimensions of the different sensor sizes.



DN (mm)	L (mm)	A (mm)	D (mm)	Peso (kg)
10	150	140	90	1.8
15	150	145	95	1.9
20	150	150	105	2.0
25	150	155	115	3.0
32	150	220	140	4.0
40	150	230	150	6.5
50	200	240	165	7.5
65	200	260	185	11.7
80	200	275	200	12.0
100	250	300	220	16.5
125	250	335	250	23.5
150	300	360	285	27.0
200	350	430	340	39.0
250	400	480	405	59.0
300	500	488	460	92.0

7.2 Materials

T550 electromagnetic flowmeter is made from materials that meet the international standards and conventions.

Liner: Hard rubber (as standard)
Teflon – PTFE / Teflon E-CTFE

Electrodes: CrNi (stainless) steel 1.4571 (as standard)
Hastelloy C276
Titanium

Sensor tube: Stainless steel 1.4201 (dimensions according to DIN 17457)

Flange: Steel 1.0402 or higher dimensions according to EN1092, DIN2501(=BS 4504), ANSI B16.5, Sanitary DIN11851, flangeless wafer style

7.3 Flowrate versus diameter

The choice of flowrate for an electromagnetic flowmeter depends on the diameter of the sensor. The higher pipe diameter, the higher flowrate can be measured. A determining parameter for flowrates is maximum velocity of the liquid. Maximum velocity is the speed, where the flow of liquid inside pipe is still laminar. For T550 it is limited to 10m/s (with 125% overload). Speed over 10 m/s is usually too high for industrial applications. Such pipe diameter is usually selected, where expected flowrate is between Q5% and Q50%.

In the table below, applicable flowrates for various diameters are displayed in l/s and m³/h:

T550 - Battery-operated magnetic flowmeter

DN	Flowrates [l/s]						Flowrates [m3/h]					
	Q _{1%}	Q _{5%}	Q _N	Q _{50%}	Q _{100%}	Q _{MAX}	Q _{1%}	Q _{5%}	Q _N	Q _{50%}	Q _{100%}	Q _{MAX}
10	0,01	0,04	0,2	0,39	0,79	0,98	0,03	0,14	0,8	1,41	2,83	3,53
15	0,02	0,09	0,5	0,88	1,77	2,21	0,06	0,32	2	3,18	6,36	7,95
20	0,03	0,16	0,9	1,57	3,14	3,93	0,11	0,57	3,2	5,65	11,31	14,14
25	0,05	0,25	1,4	2,45	4,91	6,14	0,18	0,88	5	8,84	17,67	22,09
32	0,08	0,4	2,2	4,02	8,04	10,05	0,3	1,5	8	14,5	29	36,2
40	0,1	0,6	4	6,3	12,6	15,7	0,5	2,3	13	22,6	45,2	56,6
50	0,2	1	6	9,8	19,6	24,5	0,7	3,5	20	35,3	70,7	88,4
65	0,3	1,7	9	16,6	33,2	41,5	1,2	6	35	59,7	119,5	149,3
80	0,5	2,5	14	25,1	50,3	62,8	1,8	9	50	90,5	181	226,2
100	0,8	3,9	20	39,3	78,5	98,2	3	14	80	141	283	353
125	1	6	30	61	123	153	4	22	150	221	442	552
150	2	9	50	88	177	221	6	32	200	318	636	795
200	3	16	100	157	314	393	11	57	300	565	1131	1414
250	5	25	150	245	491	614	18	88	500	884	1767	2209

- Q_{1%} - minimum applicable flowrate (minimum flowrate with guaranteed accuracy)
- Q_{5%} - recommended minimum flowrate (minimum flowrate with best accuracy)
- Q_N - recommended nominal flowrate (expected working flowrate)
- Q_{50%} - recommended maximum flowrate (maximum flowrate for industrial use)
- Q_{100%} - maximum applicable flowrate (maximum flowrate with guaranteed accuracy)
- Q_{MAX} - maximum applicable overload (Q_{125%}) (flowmeter is still measuring)

A sensor diameter should be chosen to keep real flowrate between Q_{5%} and Q_{50%}, because in this range the flowmeter has the best accuracy.

8 Technical data

Nominal size	DN10 to DN300
Nominal pressure	PN10 to PN40 (depending on nominal size)
Flow range	0.1 to 12 m/s (0.01 to 600 l/s) / (0.03 to 2100 m ³ /h)
Accuracy	0.5% (0.5 to 12 m/s) of reading value
	1% (0.1 to 0.5 m/s)
Maximum media temperature	0° to 80° C (32° to 176° F) for rubber liner
	0° to 150° C (32° to 302° F) for PTFE liner
	0° to 130° C (32° to 266° F) for E-CTFE liner
Minimum electrical conductivity	≥ 5 μS / cm
Ambient temperature	-20° to 60° C (-4° to 140° F)
Excitation coils temperature	-20° to 150° C (-4° to 302° F)
Power supply	Internal battery
Liner	hard rubber
	E-CTFE
	PTFE
Electrodes	CrNi (stainless) steel 1.4571
	Hastelloy C276
	Titanium
Measuring tube	Stainless steel 1.4201, dimensions according to DIN 17457
Flange	Steel 1.0402 or higher Dimensions according to EN1092, DIN2501 (BS 4504), ANSI B16.5, Sanitary DIN11851, flangeless wafer style
Protection category	Sensor: IP68
	Converter: IP65 (optionally IP67)
Communication	USB (Modbus)
Displayed values	Flowrate (m ³ /h, l/s, US.Gal/min, Imperial.Gal/min, user)
	Volume (m ³ , l, US.Gal, Imperial.Gal, user)
	Positive, total, negative and auxiliary (clearable, daily) volume
Control	Keyboard
	USB
Other features	Test of: excitation coils, sensor, electronic unit
	Internal temperature and power supply diagnostic
	Real time clock
	Empty pipe indication
	Datalogger 100000 records (programmable sample rate)
	Registration of min. and max. flowrate including date and time

9 Terminology

Special symbols and terms.

Flowrates:

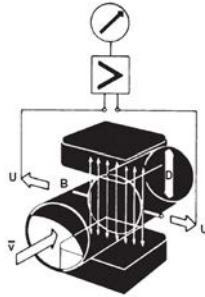
- Q1%** minimum applicable flowrate (the least flowrate which has guaranteed measuring accuracy – depends on diameter – see table 2 T550 flowrates).
- Q5%** recommended minimum flowrate (least flowrate which has the best measuring accuracy – depends on diameter – see table 2 T550 flowrates).
- QN** recommended nominal flowrate (nominal flowrate in which is flowmeter usually calibrated – depends on diameter – see table 2 T550 flowrates). You can predetermine this nominal flowrate in your order.
- Q50%** recommended maximum flowrate (maximum flowrate which is usually used in industrial applications – depends on diameter – see table 2 T550 flowrates).
- Q100%** maximum applicable flowrate (flowrate limit which has guaranteed measuring accuracy – depends on diameter – see table 2 T550 flowrates).
- QMAX** maximum applicable overload (Q125%) (maximum flowrate which can be still measured – depends on diameter – see table 2 T550 flowrates).

Abbreviations:

- QP** impulse output constant. It represents volume for 1 impulse.
- Auxiliary volume counter** second Total Volume counter. Can be cleared by pushing “→” key. It is usually used for measuring volume during day, month etc.
- USB** universal serial bus. It enables remote control of instruments by a computer.

Appendix A Measuring principle

T550 flowmeter is designed for electrically conductive fluids. Measurement is based on Faraday's law of induction, according to which a voltage is induced in an electrically conductive body, which passes through a magnetic field. The following expression is applicable to the voltage:



$$U = K \times B \times v \times D$$

where:

- U = induced voltage
- K = an instrument constant
- B = magnetic field strength
- v = mean velocity
- D = pipe diameter

Thus the induced voltage is proportional to the mean flow velocity, when the field strength is constant.

Inside the electromagnetic flowmeter, the fluid passes through a magnetic field applied perpendicular to the direction of flow. An electric voltage is induced by the movement of the fluid (which must have a minimum electrical conductivity). This is proportional to the mean flow velocity and thus to the volume of flow. The induced voltage signal is picked up by two electrodes, which are in conductive contact with the fluid and transmitted to a signal converter for a standardized output signal. This method of measurement offers the following advantages:

- No pressure loss through pipe constriction or protruding parts.
- Since the magnetic field passes through the entire flow area, the signal represents a mean value over the pipe cross-section; therefore, only relatively short straight inlet pipes x DN from the electrode axis are required upstream of the primary head.
- Only the tube liner and the electrodes are in contact with the fluid.
- Already the original signal produced is an electrical voltage, which is an exact linear function of the mean flow velocity.
- Measurement is independent of the flow profile and other properties of the fluid.

The magnetic field of the primary head is generated by a square wave current fed from the signal converter to the field coils. This field current alternates between positive and negative values. Alternate positive and negative flowrate-proportional signal voltages are generated at the same frequency by the effect of the magnetic field, which is proportional to the current. The positive and negative voltages at the primary head electrodes are subtracted from one another in the signal converter. Subtraction always takes place when the field current has reached its stationary value, so that constant interference voltages or external or fault voltages changing slowly in relation to the measuring cycle are suppressed. Power line interference voltages coupled in the primary head or in the connecting cables are similarly suppressed.

Appendix B T550 menu structure

T550 has three access levels for parameter's setting:

- Basic (user access)
- Calibration (calibration laboratory)
- Service (service organization)

Every parameter has minimal access level which allows you to change it. Access to parameters is enabled after pushing the key "ENTER" from the Main menu and after entering the password. Access level is defined by used password.

Setup menu has following folders:

- FLOWMETER
- CALIBRATION
- GENERAL
- SERVICE

FLOWMETER	FLOW	Unit		
		User unit		
		User constant		
		Direction		
		Low-fl. off		
		Exc. freq		
		Time const.		
		Range		
	VOLUME	Unit		
		User unit		
		Constant		
		CLEAR VOLUME	Auxiliary volume	
			Total volume	
	Pos/Neg volume			
	DATALOGGER	Interval		
		Filling		
		Clear		
	EXIT	Mode		
		QF		
CALIBRATION	Num. of cal. point			
	CAL. POINT 1	Flowrate		
		Constant		
	CAL. POINT 2	Flowrate		
		Constant		
	CAL. POINT 3	Flowrate		
		Constant		
	CAL. POINT 4	Flowrate		
Constant				

GENERAL	USB-RS232	Mode	
		Baudrate	
		Modbus parity	
		Modbus address	
	DISPLAY	Language	
		Contrast	
		Message time	
	DATE/TIME	Time set	
		Date set	
		Date format	
	USER ACCESS	Basic password	
		Calibr. password	
		Clear. on screen	
	INFO	Serial number	
		Version SW	
		Version HW	
		Diameter	
		Int. temp	
		Volt. battery	
		Volt. CPU	
Volt high			
Volt. +symm			
Volt. -symm			
Vol. ref			
Coil excit			
SERVICE			

T550 - Battery-operated magnetic flowmeter

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