

## Instruction and Operation Manual

# S462

## Compact Ultrasonic Flow Meter for Liquids (Clamp-On)



Dear Customer,

Thank you for choosing our product.

Before you start 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 void and the manufacturer is exempt from liability.

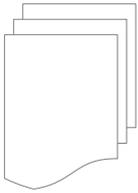
The device is destined exclusively for the described application.

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 matches 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.

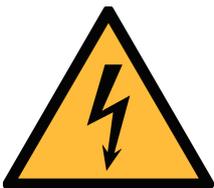


### **WARNING!**

#### **Voltage used for supply!**

**Any contact with energized parts of the product, may lead to 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.



### **ATTENTION!**

#### **Permitted operating parameters!**

**Observe the permitted operating parameters. Any operation exceeding this parameters can lead to malfunctions and might 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 might lead to wrong measurement values, which can lead to wrong results.**

- Do not exceed the maximum operating 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  $-30 \dots +70^{\circ}\text{C}$ .
- 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  $-30 \dots +70^{\circ}\text{C}$ .
- Avoid direct UV and solar radiation during storage.
- For the storage the humidity must be  $<95\%$  with no condensation.

## 2 Registered Trademarks

SUTO®	Registered trademark of SUTO iTEC
MODBUS®	Registered trademark of the Modbus Organization, Hopkinton, USA
HART®	Registered trademark of the HART Communication Foundation, Austin, USA
Android™, Google Play	Trademarks of Google LLC

### 3 Applications

The S462 is an ultrasonic flow meter that is designed to measure the flow and consumption of liquids within the permissible operating conditions. S462 is using clamp-on technology that can be mounted outside the pipe and brings flow measurement with benefits including reduced installation costs, uninterrupted production, and no contact with liquid to be measured.

The liquids that S462 can measure include the following:

- Cooling and heating water
- Drinking water
- Potable water
- De-ionized and de-mineralized water
- Sanitary liquid
- Purified water
- Other liquids on request

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

The S462 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.

### 4 Features

- Uses the proven clamp-on transit-time correlation technique.
- Easy to install for permanent and temporary installations.
- High accuracy.
- Configurable physical units.
- Available in DN20, DN25, DN32, and DN40.
- Connectable via Modbus/RTU to displays and data loggers from SUTO ITEC.

## 5 Technical Data

### 5.1 General

	
Dimensions	See dimensions for different models on page 10.
Weight	0.47...0.60 kg (depends on model)
Keypad	Four keys
Display	OLED, 128 x 64 pixel (31 x 16 mm)
Physical units	Metric and imperial units are available Consumption: m <sup>3</sup> , L, GAL Flow: m <sup>3</sup> /h, m <sup>3</sup> /min, GAL/min Velocity: m/s
Consumption counter	Daily, monthly, and yearly totalizers 6 digits
Liquids / Medium	Water, sea water, other liquids in request
Pipe material	PVC, carbon steel, steel, copper, PVDF, PFA, PTFE, PU, aluminum
Case Material	Housing: Aluminum alloy Sensor: PEI Display cover: PMMA Key pad: F150
Environment Temp.	0 °C ... 50 °C
Liquid Temp.	0 °C ... 50 °C
Environment Humidity	0 ... 95% relative humidity without condensation
IP Grade	IP65

### 5.2 Electrical Data

Power supply	20 ... 28 VDC / 100 mA
Cable length	2 m

### 5.3 Output Signals

Analog output	4 ... 20mA, Maximum load: 600 Ω
Communication	RS-485, Modbus/RTU

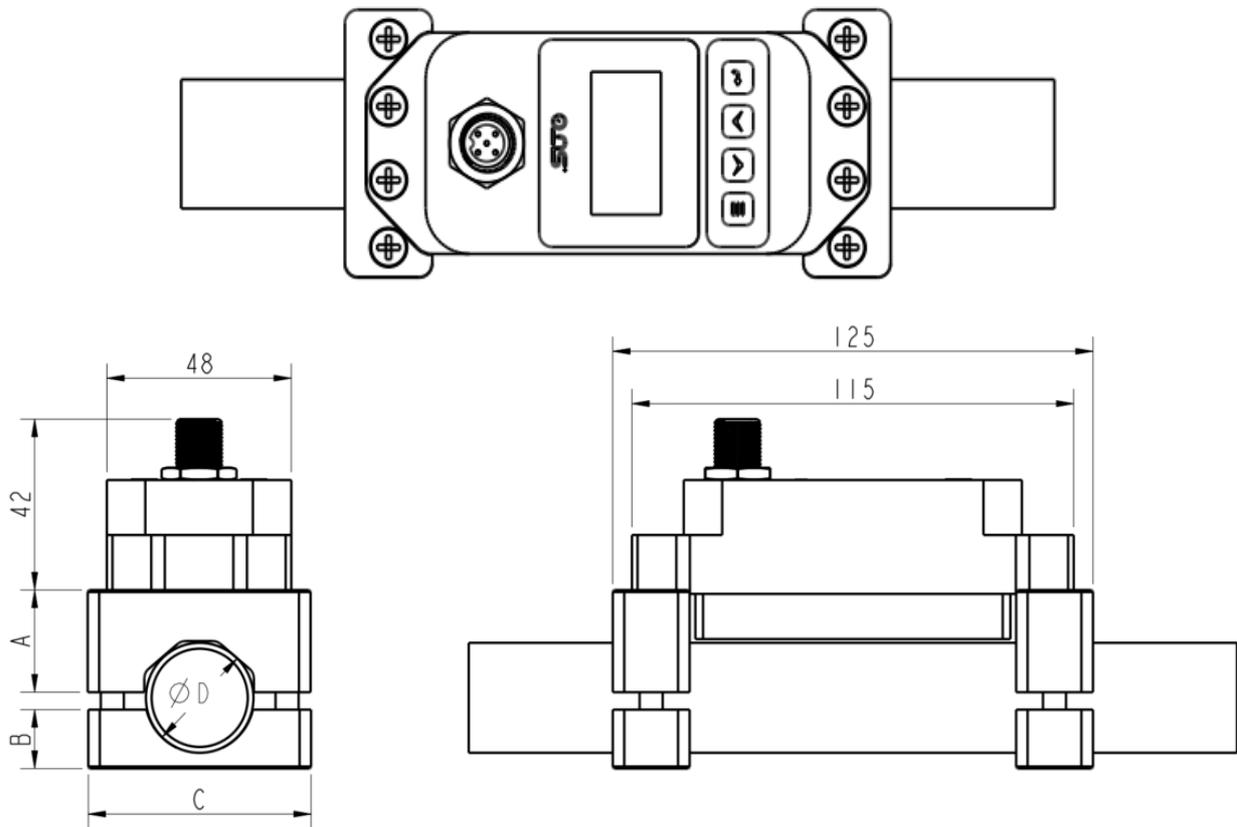
## 5.4 Accuracy

Measuring range	0.05 ... 5.0 m/s
Accuracy	1.5% o.RDG + 0.2% FS (0.5 ... 5.0 m/s)
Repeatability	0.80%
Response time	2 s

## 5.5 Flow Ranges

Model		DN20	DN25	DN32	DN40
Pipe size (mm)	Pipe OD	25...28	32...35	38...45	48...54
	Pipe ID	20	25	32	40
	NPS	3/4"	1"	1¼"	1½"
Flow Range (l/min)	0.05 m/s	0.9	1.5	2.4	3.8
	0.5 m/s	9.42	14.7	24.1	37.7
	5.0 m/s	94.2	147.2	241.2	377.0

## 6 Dimensions



Model size	A (mm)	B (mm)	C (mm)	D (mm)	
				Min	Max
DN20	26.5	15	58	25	28
DN25	30	18	58	32	35
DN32	33	22.5	68	38	45
DN40	38	27	78	48	54

## 7 Scope of Delivery

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

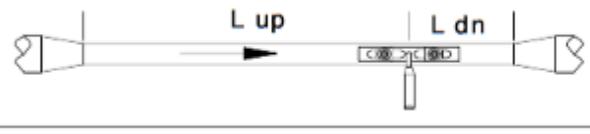
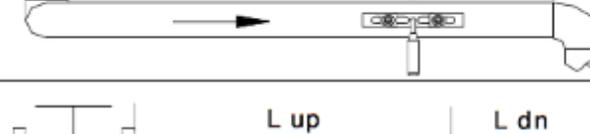
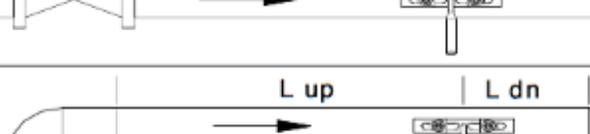
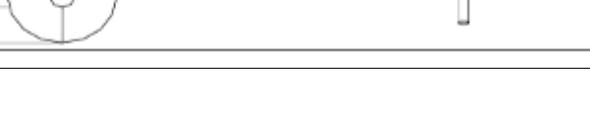
<b>Qty</b>	<b>Description</b>	<b>Item no.</b>
1	S462 Compact Ultrasonic Flow Meter for Liquids, including upper brackets and lower brackets	S695 4621 (DN20) S695 4622 (DN25) S695 4623 (DN32) S695 4624 (DN40)
1	2 m cable with an M12 connector included	NA
4	Coupling pads	A695 4620
1	Instruction manual	NA
1	Calibration certificate	NA

### 8 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	Downstream dimension
	Lup x diameter	Ldn x diameter
	10D	5D
	10D	5D
	10D	5D
	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!**

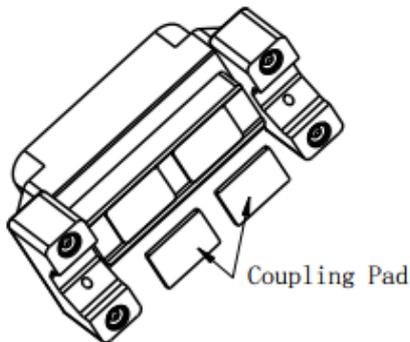
**Wrong measurement may occur if the transducers are not installed correctly.**

- 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 S460 permanently in wet environment.

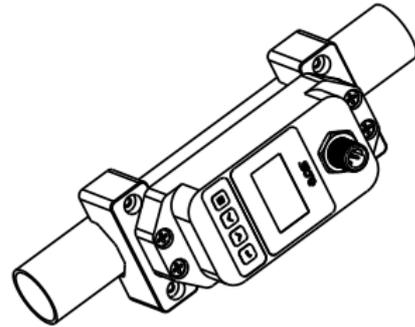
## 9 Installation and Connection

Follow the instructions below to install the flow meter onto the pipe.

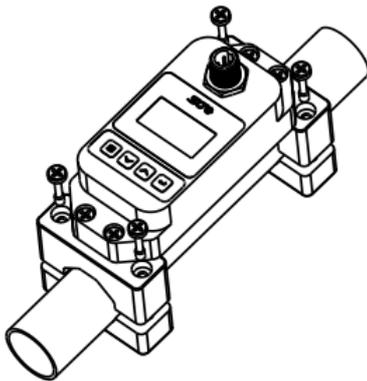
**Step 1.** Clean the pipe to make sure no dirt, paint, or any stains on its surface. Add the coupling pads onto the sensor surface.



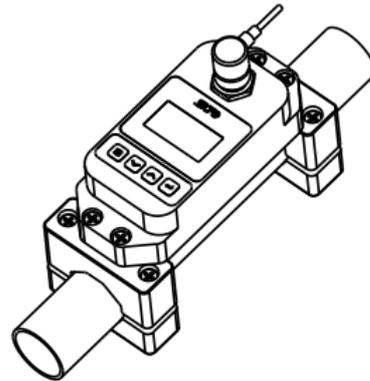
**Step 2.** Place the flow meter with the upper brackets (installed together ex-works) on the pipe. Install the meter on the side of the pipe instead of the top to avoid bubbles effecting the measurement.



**Step 3.** Place the two base brackets directly under the upper brackets across the pipe. Finally, tighten the screws on both ends.



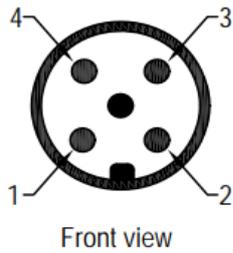
**Step 4.** Connect the cable to the M12 connector and then tighten them up.



## 10 Electrical Connection and Output

### 10.1 Electrical Connection

#### M12 connection pins



	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
Signal	+I <sub>a</sub>	-V <sub>B</sub>	+V <sub>B</sub>	D+	D-
Color	Brown	White	Blue	Black	Gray

#### Legend to pin assignment

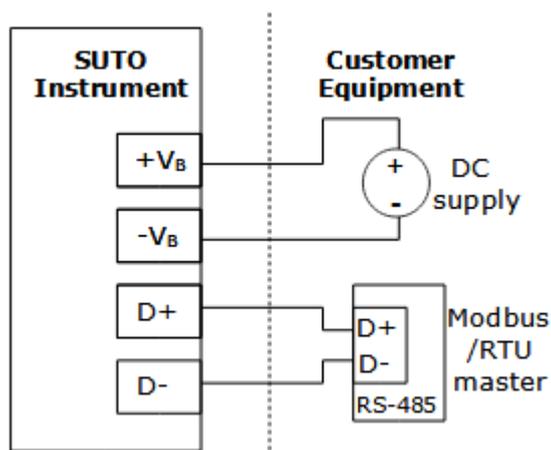
+I <sub>a</sub>	Positive 4 ... 20 mA signal
-V <sub>B</sub>	Negative supply voltage
+V <sub>B</sub>	Positive supply voltage
D+	Modbus/RTU data +
D-	Modbus/RTU data -

### 10.2 Connection between S462 Outputs and Customer Equipment

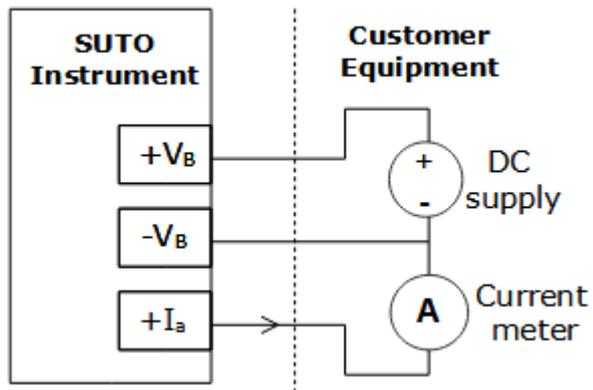
This section provides figures to show how outputs supported by the S461 connect with the customer equipment.

In the following figures, the SUTO instrument indicates the S462.

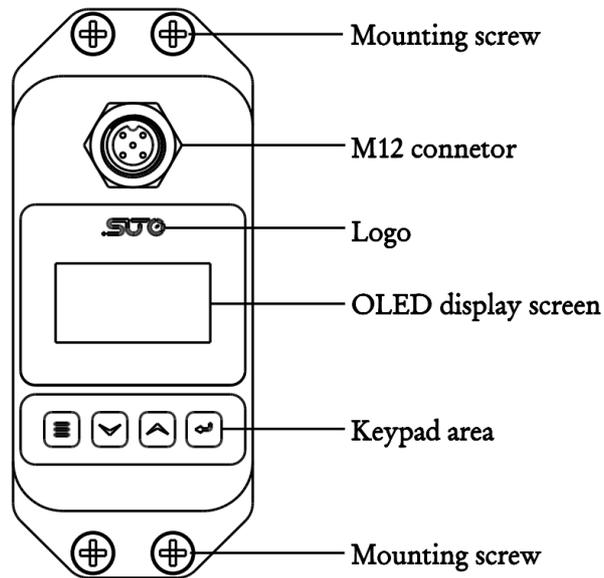
#### Modbus/RTU output



4 ... 20 mA analog output



## 11 Panel Function



## 12 Powering On

After the flow meter is powered on, the self-diagnosis program starts to run. The display will show the last selected main screen.

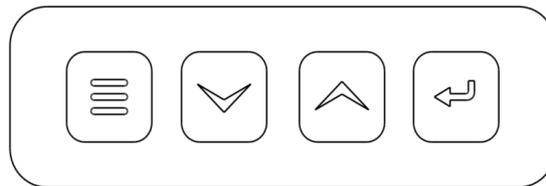
SQ 88	12:30:29
Vel	1.035 m/s
Flow	3.32 m <sup>3</sup> /h
NET	723.58 m <sup>3</sup>

### Signal Quality (SQ value)

Indicates the level of the signal detected using the number from 0 ... 99. 0 represents the minimum signal detected and 99 represents the maximum signal. For a reliable measurement a SQ value of >70 is required.

Adjust the transducer position repeatedly and check the coupling pad frequently until the signal quality detected is as strong as possible.

## 13 Keypad Functions



To switch between the Setting and the Display modes.  
To return to the previous menu when in the Setting mode.



To scroll up and down the menu list.

When entering digits, press  to move to the next digit.

Press  to scroll the number from 0 to 9.



To confirm a selection.

## 14 Menu Operations

### 14.1 Display Menu

19-06-22	12:30
<b>1.035</b> m/s	
NET	723.58 m <sup>3</sup>

This main screen shows Date, Time, Velocity and Net Totalizer.

SQ 88	12:30:29
<b>3.32</b> m <sup>3</sup> /h	
NET	723.58 m <sup>3</sup>

This main screen shows Signal Quality (SQ), Time, Flow and Net Totalizer.

SQ 88	12:30:29
Vel	1.035 m/s
Flow	3.32 m <sup>3</sup> /h
NET	723.58 m <sup>3</sup>

This main screen shows Signal Quality (SQ), Time, Velocity, Flow and Net Totalizer.

Runtime	216h
Day	79.63 m <sup>3</sup>
Mth.	2380.3 m <sup>3</sup>
Year	28984 m <sup>3</sup>

This main screen shows the Run Time of the instrument in hours and the current Daily, Monthly and Yearly Consumption.

SQ 88	12:30:29
<b>-0.241</b> m <sup>3</sup> /h	
S. TOT	-0.000 m <sup>3</sup>

This main screen shows the Signal Quality, Time, Flow and the Consumption since last power on.

## 14.2 Setup Menu

Setup menu
0. Pipe parameter
1. System setting
2. Calibration

The Setup menu is used to do the configuration of S462 after installation. These parameters are important for proper operation of the instrument.

Following options are available:

- 0. Pipe parameter**
- 1. System setting**
- 2. Calibration**
- 3. Output setting**

### 14.2.1 Setup Menu – Pipe Parameter

Every installation requires pipe settings and fluid settings at least.

Pipe parameter
0. Outer diameter
1. Wall thickness
2. Material

Following settings are done here:

- **0: Outer diameter of pipe**
- **1: Wall thickness of pipe**
- **2: Material** (PVC, carbon steel, steel, copper, PVDF, PFA, PTFE, PU, aluminum)
- **3: Fluid type** (Water, Sea Water, others).  
For others the sonic velocity of the fluid to be measured needs to be entered.

**Note:** The above four settings are crucial for an accurate measurement.

### 14.2.2 Setup Menu – System Setting

System setting 0. System Unit 1. Flow rate unit 2. Total unit
--

The system settings have following options:

**0. System Unit:** Metric or Imperial units

**1. Flow rate unit:** m<sup>3</sup>/h, LPM, or GPM

**2. Total unit:** m<sup>3</sup>, L, or GAL

**3. Totalizer RESET:** To clear the consumption counters to zero

**4. Time set:** To set the time. Generally, it is unnecessary to modify date and time because the system comes with a highly reliable perpetual calendar chip.

**5. System lock:** To lock or unlock S462. Once the system is locked, any modifications to the system are prohibited, but parameters are readable. You can “unlock” the system by entering your password. If you forget your password, contact the manufacturer.

**6. System INFO:** To display system information consisting of the Serial number (SN) of the electronics system. This S/N differs from the S/N printed outside the instrument on the label. Both S/N can be used for tracking.

**7. Display Direction:** Depending on the installation it may required to swap the display direction.

**8. Damping:** A damping factor can be entered to stabilize the reading. Default is 3.

### 14.2.3 Setup Menu – Calibration

Calibration  
 0. Scale factor  
 1. 4-20mA CAL  
 2. Set zero

The system settings have following options:

**0. Scale factor:** Refers to the ratio between “actual value” and “reading value”. *For example*, when the actual value is 2.00, and the meter displays 1.98 on the screen, the scale factor reading is 2/1.98. The default scale factor is factory calibrated and close 1.000.

4mA Calibrate  
 4200

**1. 4-20mA CAL:** Can be used to calibrate / adjust the 4-20 mA output. Pressing the <Enter> selects between 4 mA and 20 mA output. By using an amp-meter the accuracy can be checked. If the reading is not accurate it can be adjusted with the <arrow> keys.

Set zero  
 Ent To set zero  
 Reset zero

**2. Set zero:** Is used to make a zero flow calibration or to reset the last calibration and bring it back to factory setting. In order to make a zero calibration there must not be any flow in the pipe!

Use the <arrow> keys to select between the 2 choices and press <Enter> to activate. The calibration process may take a few seconds.

Set zero  
 Waitting...  
 SQ 88  
 Vel 0.035 m/s

**3. Low flow cut:** When the flow rate falls below the low flow cutoff value, the flow indication is set to zero. This function can prevent the flow meter from reading the flow rate after a pump is shut down but there is still liquid movement in the pipe, which will result in totalization error.

Generally, 0.03m/s is recommended to enter as the low flow cutoff point. The low flow cutoff value has no relation to the measurement results once the velocity increases over the low flow cutoff value.

Calibration  
 2. Set zero  
 3. Lowflow cut  
 4. Manual zero

**4. Manual zero:** When the zero point cannot be set due to on-site working conditions, a zero point can be manually set to force the zero point to be achieved (this function is not commonly used).

### 14.2.4 Setup Menu – Output

Output setting  
 0. RS485 Setup  
 1. 4-20mA range  
 2. Alarm value

#### 0. RS485 Setup:

**0. Network addr:** Is the device address within the RS-485 network. Default is 001.

**1. RS485 Baudrate:** Available baudrates: 2400, 4800, 9600, 19200. Other parameters are fixed at 8 data bits, no parity, 1 stop bit.

**1. 4-20 mA range:** Is used to set the scaling of the analog output to the desired flow rate in the selected flow unit.

**2. Alarm value:** (not supported)

**3. OCT output:** (not supported)

**4. OCT multiplier:** (not supported)

### 14.2.5 Setup Menu – History Data

History data  
 0. By Day  
 1. By Month  
 2. By Year

**0. By Day:** lists the daily consumption of the past 63 days.

**1. By Month:** lists the daily consumption of the past 63 months.

**2. By Year:** lists the daily consumption of the past 9 years.

## 15 Modbus Communication Protocol

Request from master:

Contents	Slave address	Function code	Register address	Number of registers	Check code
Size (bytes)	1	1	2	2	2
Data Range	0x01...0xF9	0x03 (read) 0x06 (write)	0x0000...0xFFFF	0x00...0x7D	CRC

Response from slave:

Contents	Slave address	Function code	Data size	Data	Check code
Size (bytes)	1	1	1	2 x N <sup>1)</sup>	2
Data Range	0x01...0xF9	0x03 (read) 0x06 (write)	2 x N <sup>1)</sup>	---	CRC <sup>2)</sup>

**Remarks:**

- 1) N = number of registers requested
- 2) The CRC check code of this instrument is obtained by CRC-16-IBM (polynomial  $X^{16} + X^{15} + X^2 + 1$ , mask word 0xA001) cyclic redundancy algorithm. The low byte of the check code is first, and the high byte is after.

Type of byte order: **MID-LITTLE-ENDIAN:**

Type of byte order	Byte sequencing (HEX)	Example
MID-LITTLE-ENDIAN	C D A B	0x 0A 11 42 C5
LITTLE-ENDIAN	D C B A	0x 11 0A C5 42
BIG-ENDIAN	A B C D	0x 42 C5 0A 11

Table 1 Read-only register address list (read with 0x03 function code)

Channel description	Format	Length	Register address	Description
Velocity	FLOAT	4-byte	0x0000	Unit: m/s
Flow	FLOAT	4-byte	0x0002	Unit: as programmed in m <sup>3</sup> /h, l/min or GAL
Totalizer (float)	FLOAT	4-byte	0x0004	Unit: as programmed in m <sup>3</sup> , liter or GAL
Totalizer (integer part)	UINT32	4-byte	0x0006	
Totalizer (decimal part)	FLOAT	4-byte	0x0008	
Daily totalizer (integer part)	UINT32	4-byte	0x000A	
Daily totalizer	FLOAT	4-byte	0x000C	
Monthly totalizer	FLOAT	4-byte	0x000E	
Yearly totalizer	FLOAT	4-byte	0x0010	
4-20mA output	FLOAT	4-byte	0x0012	Unit: mA
Running time	UINT32	4-byte	0x0014	Unit: sec
Meter serial number	String	8-byte	0x0016	N/A
Date and time	String	6-byte	0x001A	Year, month, day, hour, minute, second
Signal Quality Q	UINT	2-byte	0x001D	0 ... 99
Running status	UINT	2-byte	0x001E	0 = normal 1 = abnormal
Meter Address	UINT	2-byte	0x001F	Slave address 1 ... 249
Communication baud rate*	UINT	2-byte	0x0020	0 = 2400, 1 = 4800, 2 = 9600, 3 = 19200
Velocity unit	STRING	4-byte	0x0021	"m/s" or "f/s"
Flow unit	STRING	4-byte	0x0023	0x30 = m <sup>3</sup> /h 0x31 = LPM 0x32 = GPM
Totalizer unit	STRING	4-byte	0x0025	0x30 = m <sup>3</sup> 0x31 = L 0x32 = GAL

Table 2: Single write register address list (write with 0x06 function code)

Channel description	Format	Length	Register address	Description
Meter address	UNIT	2-byte	0x1003	1...249
Communication baud rate	UNIT	2-byte	0x1004	0 = 2400, 1 = 4800, 2 = 9600, 3 = 19200
Flow unit	UNIT	2-byte	0x1005	0x30 = m <sup>3</sup> /h 0x31 = LPM 0x32 = GPM
Totalizer unit	UNIT	2-byte	0x1006	0x30 = m <sup>3</sup> 0x31 = L 0x32 = GAL

**Remarks:**

- When changing the address or communication baud rate of the instrument, the instrument will work at the new address or communication baud rate immediately after the instrument returns a response at the original address or communication baud rate.

## 16 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.

## 17 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!**

## 18 Disposal or Waste



Electronic devices are recyclable material and do not belong in the household waste.

The sensor, 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, for this please contact the manufacturer.



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