English

Instruction and operation manual

S401

Thermal mass flow sensor

Dear Customer,

Thank you for choosing our product.

Please read the operating instructions in full and carefully observe them before starting up the device. 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 designed exclusively for the described application.

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

Table of Contents

1 Safety instructions

Please check if this instruction manual matches the product type.

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

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

WARNING!

Compressed air!

Any contact with quickly escaping air or bursting parts of the compressed air system can lead to serious injuries or even death!

- Do not exceed the maximum permitted pressure range (see the sensors label).
- Only use the pressure-tight installation material.
- Avoid that persons get hit by escaped air or bursting parts of the instrument.
- The system must be pressure-less during maintenance work.

WARNING!

Voltage used for supply!

Any contact with energized parts of the product might lead to an 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.
- 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 these parameters can lead to malfunctions and might lead to damage to the instrument or the system.

- Do not exceed the permitted operating parameters.
- Make sure the product is operated in its permitted limitations.
- Do not exceed or undercut the permitted storage and operating temperature and pressure.
- The product should 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 a 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 a wrong result.

- Always observe the direction of the flow when installing the sensor. The direction is indicated on the housing.
- Do not exceed the maximum operating temperature at the sensor tip.
- Avoid condensation on the sensor element as this will affect accuracy enormously.

Storage and transportation

- Make sure that the transportation temperature of the sensor without the display is between -30 ... +70 °C and with the display between -10 ... +50 °C.
- For storage and transportation, it is recommended to use the packaging which comes with the sensor.
- Please make sure the storage temperature of the sensor is between -10 ... +50 °C.
- Avoid direct UV and solar radiation during storage.
- For the storage, the humidity must be <90%, with no condensation.

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MODBUS®

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Bluetooth® word mark and logos

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Android™, Google Play

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3 RF exposure information and statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device might not cause harmful interference, and (2) this device must accept any interference received, including interference that might cause undesired operation.

Remark: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

Remark: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, might cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help。
- This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

4 Application

The S401 is the insertion-type flow sensor that is designed to measure the consumption of compressed air and gases within the permissible operating parameters. (See chapter 6 Technical data on the next page.)

The S401 can measure the following values for the compressed air or gas:

- Volumetric flow (default unit: m^3/h).
- Total consumption (default unit: m^3).

Other units are configurable using the S4C-FS service app or the optional display.

The S401 flow sensor is mainly used in compressed air or gas systems in the industrial environments, and is not developed to be used in explosive areas. For the use in explosive areas please contact the manufacturer.

5 Features

- Insertion type flow sensor for easy installations under pressure through a ball valve.
- Thermal mass flow measurement, virtually independent of pressure and temperature changes.
- IP65 casing for robust protection in the industrial environment.
- Very fast response time.
- High accuracy and wide measuring ranges. Special ranges available on request.
- Tube diameters from 1/2” to 12”. Larger diameters available on request.
- Optional display on the sensor head, showing volumetric flow and consumption.
- Various options for signal outputs, such as Analog and pulse, Modbus RTU, Modbus TCP, or M-Bus.
- Optional Power over Ethernet (PoE) for the Modbus TCP output.

6 Technical data

6.1 General

FCC ID: 2ASK2-SUTO-001	
Parameters	Standard unit (flow): m^3/h Other units (flow): m^3/min, l/min, l/s, cfm, kg/h, kg/min, kg/s Units (Consumption): m^3, ft^3 , kg
Reference conditions	ISO1217 20 °C 1000 hPa (Standard-Unit) DIN1343 0°C 1013.25 hPa (Norm-Unit)
Principle of measurement	Thermal mass flow
Sensor	Glass-coated resistive sensor
Measuring medium	Air, gas (non corrosive gas)
Range versions	Standard range: 92.7 m/s Max range: 185 m/s High speed range: 220 m/s Low range: 1/3 of standard range Vacuum / Atmospheric range: 1/3 of standard range
Operating temperature	-30 ... +140 °C fluid temperature -30 ... +70 °C casing -10 ... +50 °C display (optional)
Humidity of the meas. medium	< 90%, no condensation
Operating pressure	Up to 5.0 MPa (> 1.6 MPa needs the installation device)
Housing material	PC + ABS
Material of the probe tube, probe tip (wetted parts)	Stainless steel 1.4404 (SUS 316L)
Protection class	IP65
Dimensions	See dimensional drawing on page 12.
Display (optional)	2.4” color graphics display with keypad

Tube diameter	1/2” to 12” (bigger diameters available on request)
Process connection	G1/2” (ISO 228/1)
Weight	0.9 kg (220 mm standard) 0.85 kg (160 mm), 0.95 kg (300 mm), 1.0 kg (400 mm)

6.2 Electrical data

Power supply	15 ... 30 VDC, 200 mA 44 ... 57 VDC, 120 mA (PoE)

6.3 Output signals

Analogue output	Signal: 4 ... 20 mA, isolated Scaling: 0 to max flow Max load: 250R
Pulse output	1 pulse per consumption unit, isolated switch, max. 30 VDC, 200 mA (pulse length: 10 ... 120 ms, depends on flow rate)
Modbus output	See section 10.3 on page 29.
M-Bus output	See section 10.4 on page 30.

6.4 Accuracy

Accuracy*	±(1.5% of reading + 0.3% FS) (optional 1% of reading) Temperature drift: < 0.05%/K
Stated accuracy at	Ambient/process temperature 23°C ±3°C Ambient/process humidity <90% Process pressure at 0.6 MPa
Repeatability	±0.25% of reading
*Specified accuracy is valid only within the minimum and maximum flow rates that are indicated in section 6.5 on the next page.	

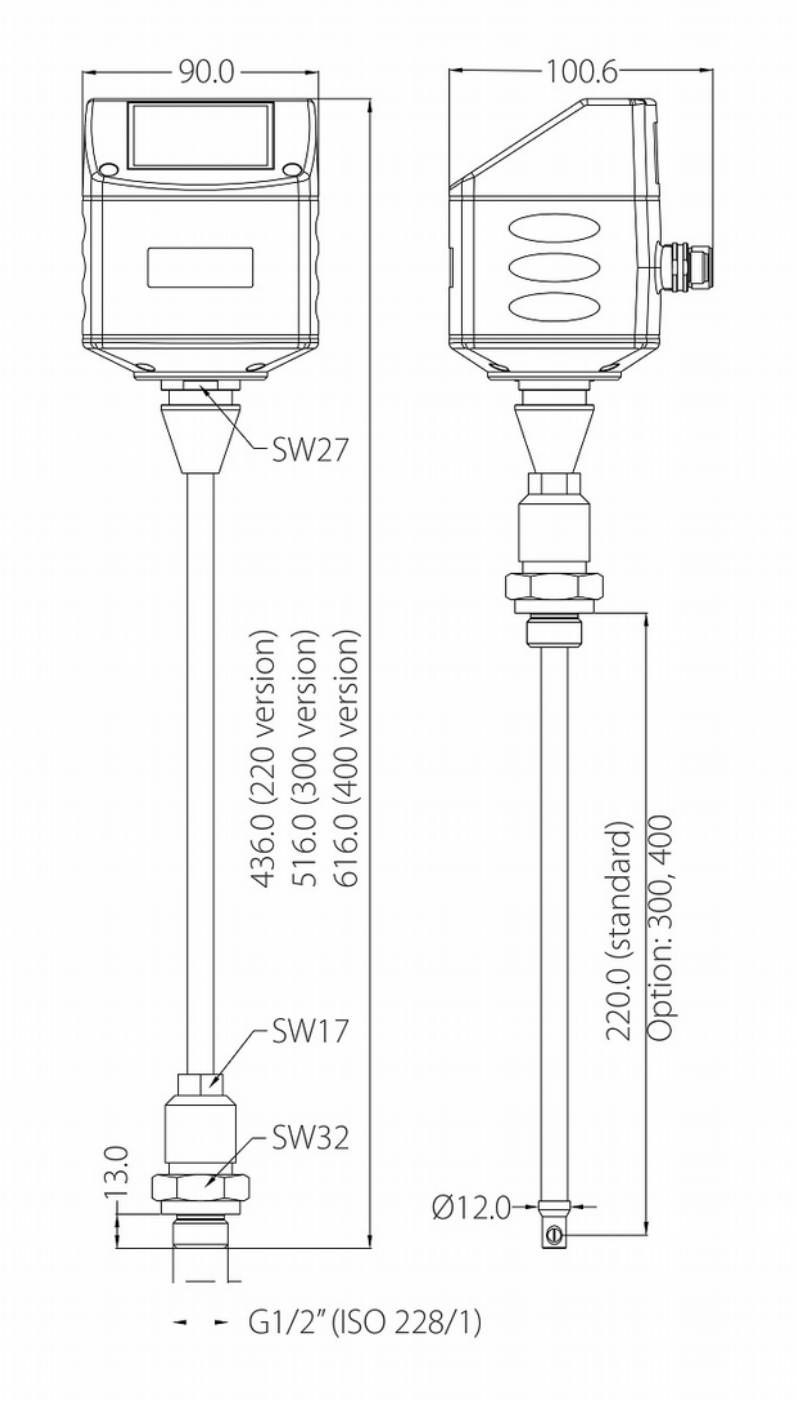
6.5 Volumetric flow ranges

Inch	DN	Di (mm)	S401-S (m³/h)	S401-M (m³/h)	S401-H (m³/h)
½"	DN15	-	-	-	-
¾"	DN20	-	-	-	-
1"	DN25	27.3	0.5 ... 147.7	0.6 ... 294.7	0.6 ... 356.9
1¼"	DN32	36.0	0.9 ... 266.3	1.2 ... 531.5	1.2 ... 643.5
1½"	DN40	41.9	1.2 ... 366.7	1.5 ... 731.9	1.5 ... 886.2
2"	DN50	53.1	2.0 ... 600.1	2.5 ... 1197.6	3 ... 1450.0
2½"	DN65	68.9	3.5 ... 1026.5	5.0 ... 2048.6	5 ... 2480.4
3"	DN80	80.9	5.0 ... 1424.4	7.0 ... 2842.7	7 ... 3441.9
4"	DN100	100.0	10 ... 2183.3	12 ... 4357.2	12 ... 5275.7
5"	DN125	125.0	13 ... 3419.6	18 ... 6824.4	18 ... 8263.1
6"	DN150	150.0	18 ... 4930.1	25 ... 9838.9	25 ... 11913.1
8"	DN200	200.0	26 ... 8785.6	33 ... 17533.3	42 ... 21229.5
10"	DN250	250.0	40 ... 13743.9	52 ... 27428.5	60 ... 33210.7
12"	DN300	300.0	60 ... 19814.8	80 ... 39544.1	100 ... 47880.4

Remarks:

- The measuring ranges are stated under following conditions:
  Standard flow in air
  Reference pressure: 1000 hPa
  Reference Temperature: +20°C
- To calculate flow ranges based on pipe sizes and reference conditions in your site, download and install the "Flow range calculator" tool for free from http://www.suto-itec.com.
- To fast access the tool download page, enter "flowrange" (without spaces) in the search field and click the search result.

7 Dimensional drawing



8 Determining the installation point

To maintain the accuracy stated in the technical data, the sensor must be inserted in the center of a straight pipe section with unhindered flow characteristics.
Unhindered flow characteristics are achieved if the section in front of the sensor (inlet) and behind the sensor (outlet) are sufficiently long, absolutely straight, and free of obstructions such as edges, seams, curves etc..
Please make sure that enough space exists at your site for an adequate installation as described in this manual.

ATTENTION!

Wrong measurement is possible if the sensor is not installed correctly.

Please note the following:

- Careful attention must be paid to the design of the inlet and outlet section. Obstructions can cause counter-flow turbulence as well as turbulence in the direction of the flow.
- The sensor is for indoor use only! At an outdoor installation, the sensor must be protected from solar radiation and rain.
- It is strongly recommend not to install S401 permanently in wet environment such as the place right after a compressor outlet.

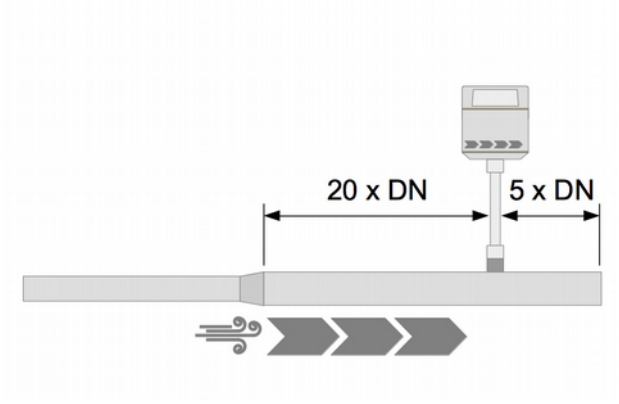
8.1 Reserving the required inlet and outlet sections

Because the thermal measuring principle is sensible to inlet and outlet conditions, we recommend the following minimum straight inlet and outlet sections be reserved to ensure an accurate measurement.

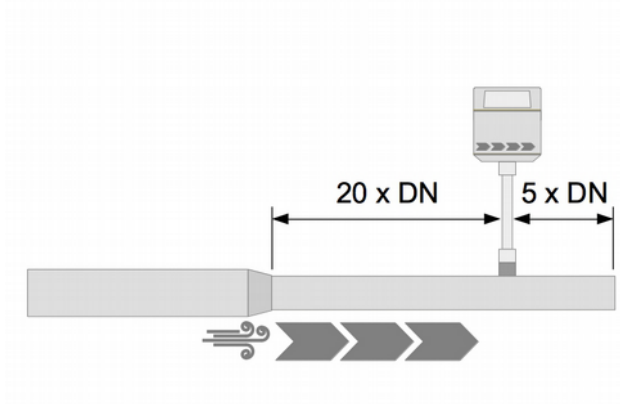
The S401 sensors should be always installed upstream from obstacles such as valves, filter, reductions etc. In common, sensors must be installed as far as possible away from any disturbances.

Remark: If there is any combination of the below situations, the longest straight inlet section must be maintained.

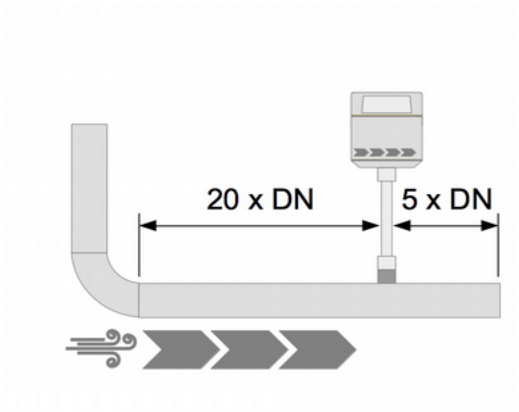
- Expansion



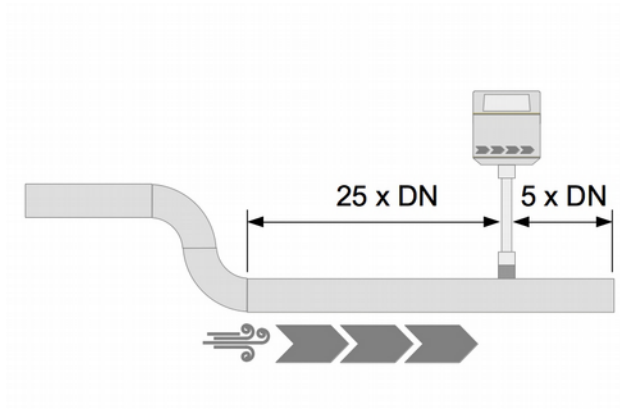
- Reduction



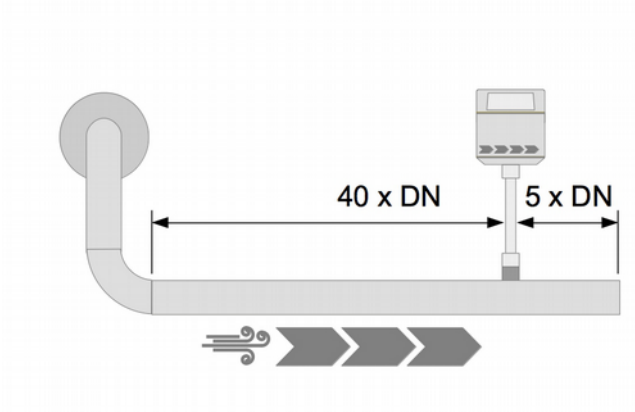
- 90° Bend



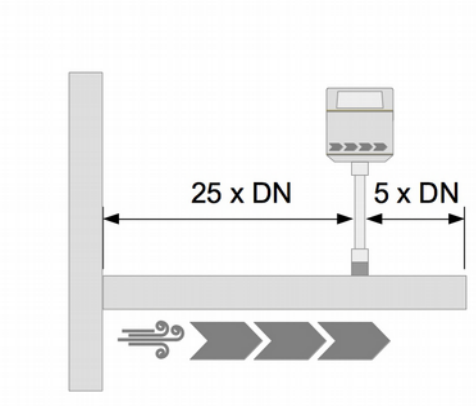
- 2 x 90° Bend



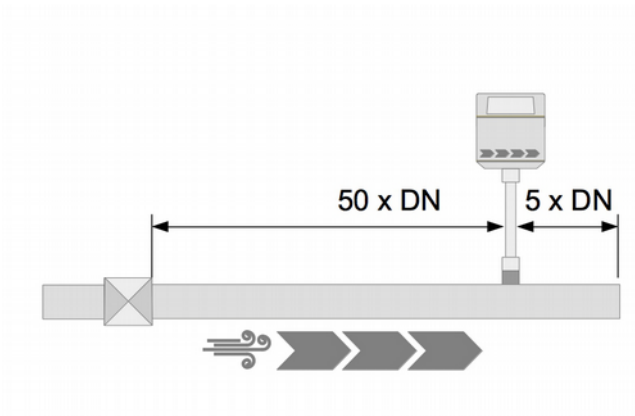
- 3 dimensional Bend



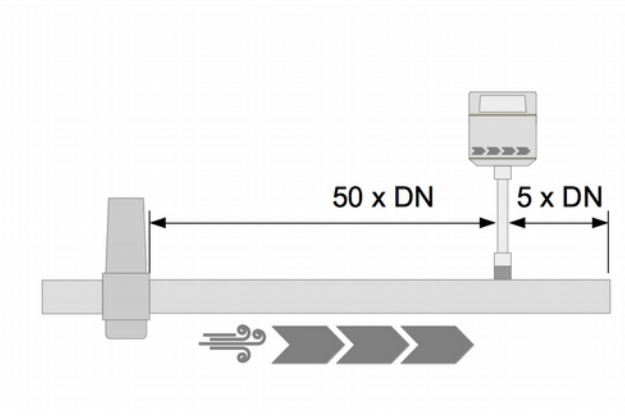
- T-piece



- Shut-off valve



- Filter or similar (unknown objects)



9 Installation

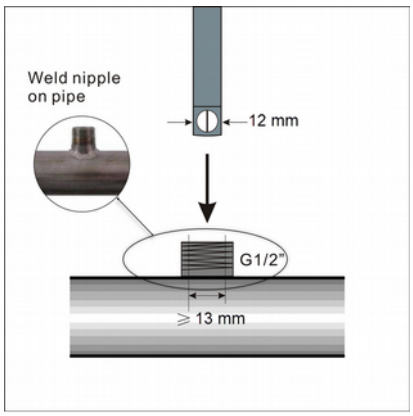
Before installing the sensor, please make sure that all components listed below are included in your package.

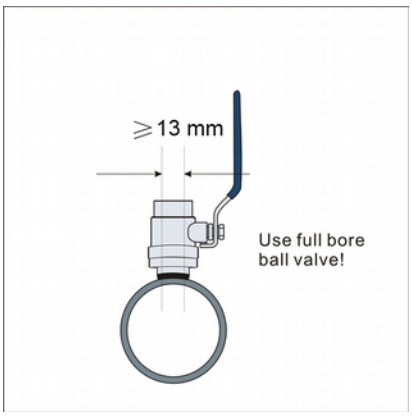
Qty	Description	Item no.
1	Sensor	S695 4100 S695 4101 S695 4102 S695 4103
1	Sealing ring	NA
1	Alignment key	NA
2	Depending on orders: M12 plug or M12 cable	Plug: C219 0059 Cable: A553 0104/A553 0105/A553 0146
1	Instruction manual	NA
1	Calibration certificate	NA

9.1 Installation requirements

To install the sensor, a ball valve and a nozzle are needed:

- The inner thread must be G 1/2”.
- The diameter of the nozzle must be ≥ 13 mm. Otherwise the shaft can not be inserted in.





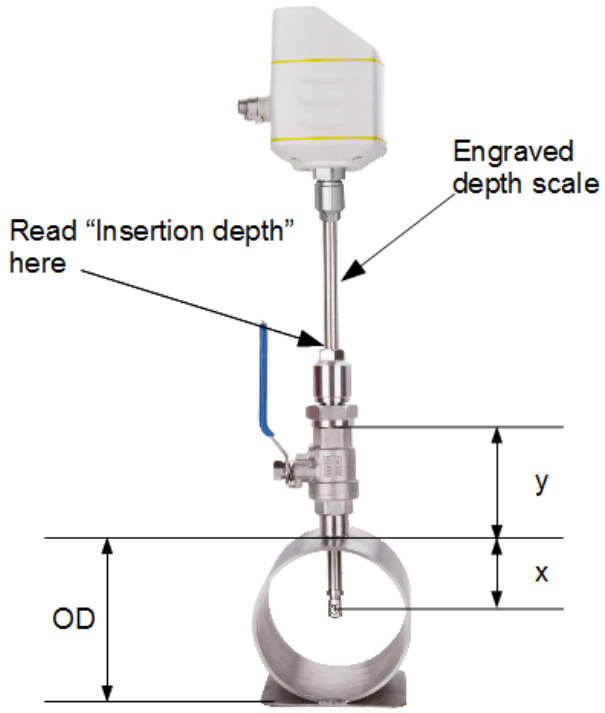
9.2 Installation procedure

The following steps explain the procedure of an appropriate installation.

9.2.1 Calculating the installation depth

Center installation is the default and recommended installation method.

The sensor tip must be placed in the center of the pipe. The sensor shaft has a scale engraved. To determine the right position, please calculate the insertion depth as described below.



Insertion depth $= x + y$

$x = \frac{OD}{2}$; OD is Outer Diameter of the pipe

y = length of the ball valve

Calculation example:

A 2″-diameter pipe and an 87 mm-length ball valve:

$OD = 60.3\,\text{mm}$

$x = \frac{OD}{2} = \frac{60.3\,\text{mm}}{2} = 30.15\,\text{mm}$

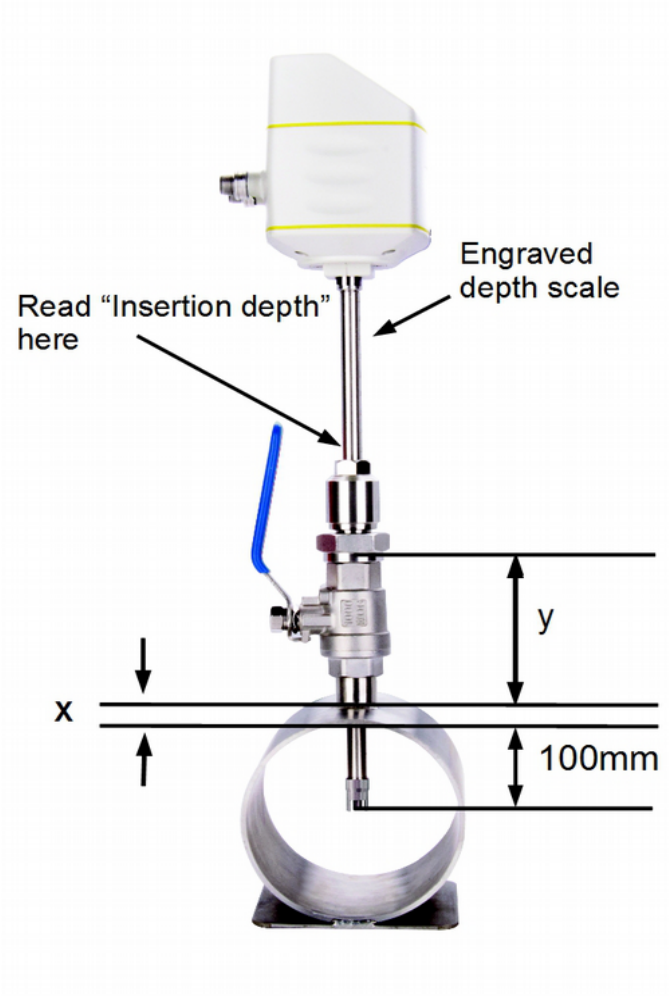
$y = 87\,\text{mm}$;

Insertion depth

$= 30.15\,\text{mm} + 87\,\text{mm} = 117.15\,\text{mm}$

For bigger pipe diameters (> 200 mm), the sensor can be installed with only a 100 mm insertion depth as the alternative. This allows one sensor to be used for all pipe sizes.

Remark: To enable the 100 mm installation method, remember to change the installation method setting accordingly, using the S4C-FS service app or the optional sensor display.



Insertion depth $= x + y + 100$
x is the wall thickness of pipe
y = length of the ball valve

Calculation example:

A 12”-diameter pipe with the wall thickness of 9 mm and a 87 mm-length ball valve.

$x = 9\,\text{mm}\,;\ y = 87\,\text{mm}$
Insertion depth
$= 9\,\text{mm} + 87\,\text{mm} + 100\,\text{mm} = 196\,\text{mm}$

9.2.2 Installing the sensor

First please observe the flow direction indicated on the housing or on the shaft. It must match the flow direction of the compressed air or gas.

1. Close the ball valve.

2. Make sure that he probe tip is completely covered by the connection head (see the photo on the left).

3. Underlay the "O-ring" at the thread of the connection head.

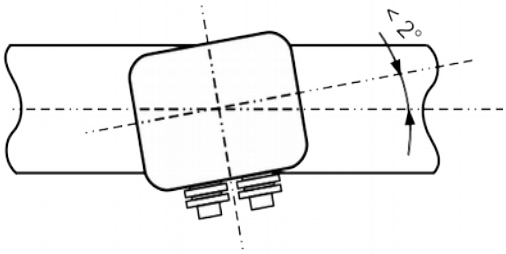
4. Screw the connection head tightly to the ball valve and align flow sensor to flow direction.

5. Open the ball valve.

6. Move the shaft slightly to the determined insertion depth by means of the scale on the shaft.

7. Tighten the locking nut to the extent that the flow sensor can no longer be moved by the pressure in the pipe but can be moved manually.

8. With the aid of the alignment key, make sure that the actual flow direction is same as the arrow shows. (The angle deviation should not be larger than ±2°.)



9. Double check the installation depth because the shaft might be pushed away from its original position by the compressed gas.

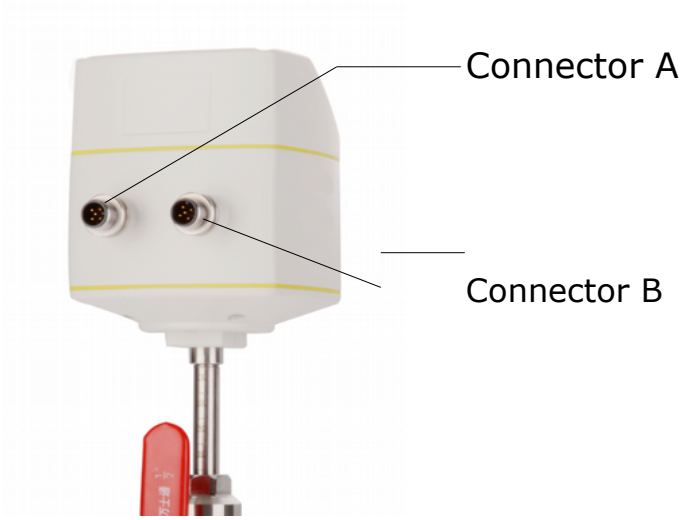
10. Tighten the locking nut with clamping torque 20 … 30 Nm.

9.2.3 Removing the sensor

1. Hold the flow sensor firmly.
2. Release the locking nut.
3. Pull out the shaft slowly until the value “10” can be read at the scale.
4. Close the ball valve.
5. Release the connection head and pull the flow sensor out of the pipe.

9.3 Electrical connection

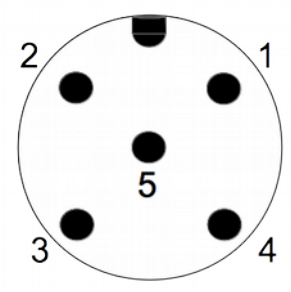
The flow sensor comes with connectors "A" and "B" through which the sensor is connected with external control devices such as PLC.



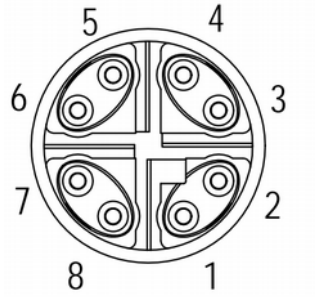
9.3.1 M12 connection pins

The following table lists the type of the M12 connector based on the output option.

P/N	Output option	Connector type
A1410	4 ... 20 mA + Pulse	A = M12 (5-pin); B = M12 (5-pin)
A1411	Modbus RTU	A = M12 (5-pin); B = M12 (5-pin)
A1412	M-Bus output	A = M12 (5-pin); B = M12 (5-pin)
A1413	4 ... 20 mA + Pulse compatible to S400	A = M12 (5-pin); B = M12 (5-pin)
A1424	Modbus TCP	A = M12 (5-pin); B = M12 (8-pin X-coded)



General connection pins, male
(View onto the sensor connector)



Ethernet connection pins, male
(View onto the sensor connector)

M12 pin assignment

Output Type	Connector	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
4 ... 20 mA plus pulse (P/N: A1410)	A	SDI	-VB	+VB	DIR	DIR
	B	NA	SW	SW	+I	-I
Modbus RTU (P/N: A1411)	A	SDI	-VB	+VB	DIR	DIR
	B	GND	-VB	+VB	D+	D-
M-Bus (P/N: A1412)	A	SDI	-VB	+VB	N/A	N/A
	B	N/A	-VB	+VB	M-Bus	M-Bus
4 ... 20 mA plus pulse, compatible to S400 (P/N: A1413)	A	SDI	-VB	+VB	+I	+P
	B	NA	-VB	DIR	SW	SW
Modbus TCP (P/N: A1424)	A	SDI	-VB	+VB	DIR	DIR
	B	See section 9.3.2 on the next page.				
	/	brown	white	blue	black	grey

Legend to pin assignment

GND:	Ground for Modbus RTU
SDI:	Digital signal (internal use)
-VB:	Negative supply voltage
+VB:	Positive supply voltage
+I:	Positive 4 ... 20 mA signal
-I:	Negative 4 ... 20 mA signal
+P:	Pulse output

SW:	Isolated pulse output
DIR	Flow direction input
D+:	Modbus RTU data +
D-:	Modbus RTU data -
M-Bus:	M-Bus data
NA:	Not applicable

ATTENTION!

Do not screw the M12 connector using force.
Otherwise it might damage the connecting pins.

9.3.2 Ethernet connection

The sensor can be powered by the following ways:

- Using the connector A
- Using the PoE (Power over Ethernet) function, which is integrated into the Ethernet connection on connector B.

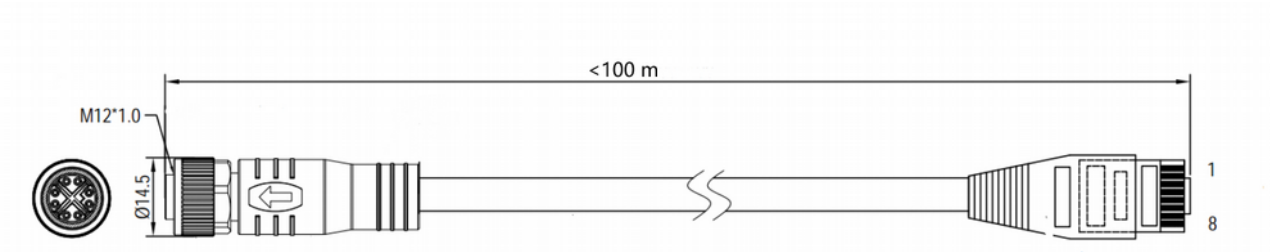
To power the unit via PoE, a network switch that supports PoE is needed. PoE comes into two standards:

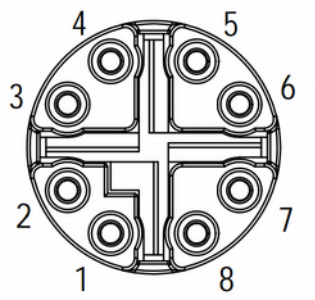
- Type A: The PoE switch powers the device via Pair 2 (Pin 1 and Pin 2) and Pair 3 (Pin 3 and Pin 6)
- Type B: The PoE switch powers the device via Pair 1 (Pin 4 and Pin 5) and Pair4 (Pin 7 and Pin 8)

This sensor supports both types.

Connection cable – M12 X-coded to RJ45

When Modbus TCP is chosen as the sensor output, a 5 m 8-pore cable is supplied in the delivery package. The has the M12 and RJ45 plugs on the ends. RJ45 is used to connect the sensor to a PoE switch.





Front view of the M12 plug, female

The 8-position pin/pair assignment on the RJ45 side must comply with the T568B wiring method. The sensor does not support the T568A wiring method.

M12 X-coded	RJ45	Signal	Color code	Pair designation
1	1	Tx+ / +Vb / -Vb	White-Orange (W-O)	Pair 2
2	2	Tx- / +Vb / -Vb	Orange (O)	
3	3	Rx+ / -Vb / +Vb	White-Green (W-G)	Pair 3
4	6	Rx- / -Vb / +Vb	Green (G)	
5	7	NA / -Vb	White-Brown (W-BR)	Pair 4
6	8	NA / -Vb	Brown (BR)	
7	5	NA/ +Vb	White-Blue (W-BL)	Pair 1
8	4	NA/ +Vb	Blue (BL)	

10 Sensor signal outputs

10.1 Analog output

The sensor has an analog output of 4 ... 20 mA. This output can be scaled to match the desired measuring range. Standard scaling is from 0 to max flow.

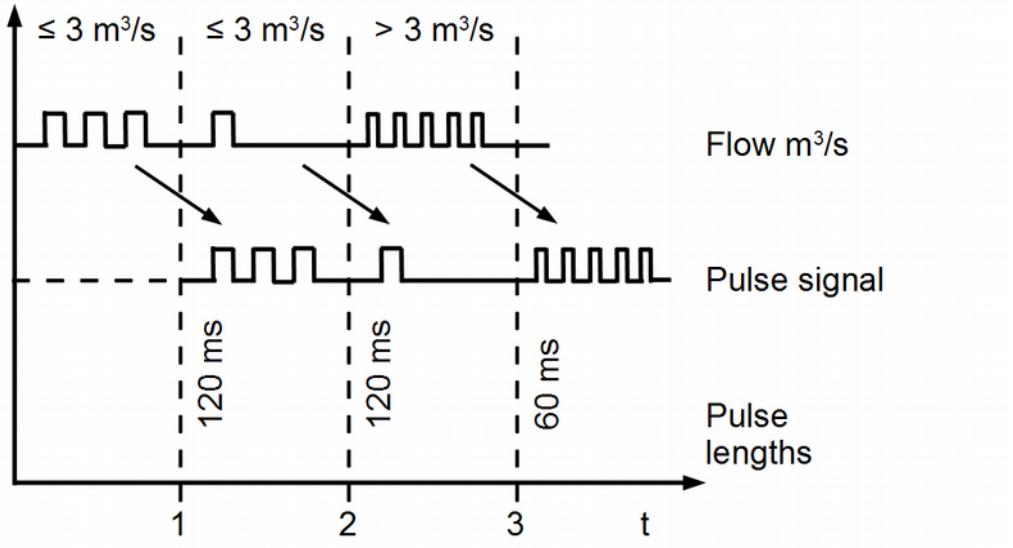
The S401 can be ordered with the bi-directional calibration. In such case, the correspondence between the analog output and standard scaling is as follows:

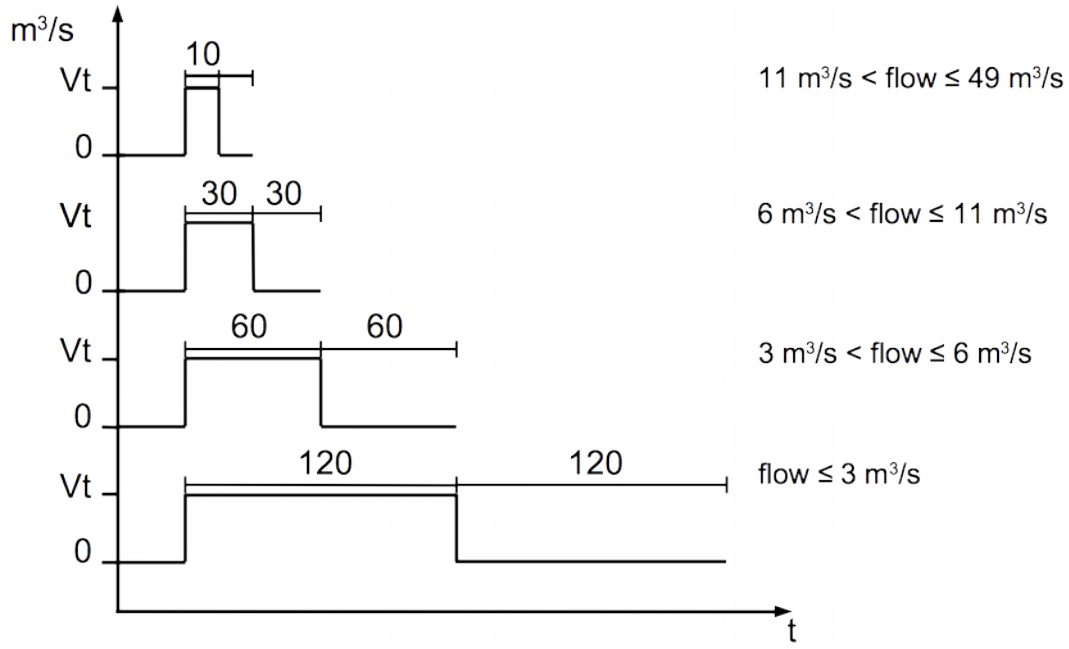
Analog output	Standard scaling
4 mA	Maximum flow reverse
12 mA	Zero flow
20 mA	Maximum flow forward

The corresponding flow rates to different pipe sizes can be calculated using the free "Flow range calculator" tool available in http://www.suto-itec.com. For more information, see section 6.5 on page 11.

10.2 Pulse output

The sensor outputs one pulse per a consumption unit. This pulse output can be connected to an external pulse counter to count the total consumption. The number of m^3 per second are summed up and indicated after one second. Pulse length depends on the flow rate.





In case that the flow rate is too high, the S401 cannot output the pulses with default settings (one pulse per consumption unit). In this case, you can set the pulse to 1 pulse per 10 consumption units or 1 pulse per 100 consumption units, using the S4C-FS service app or a connected display.

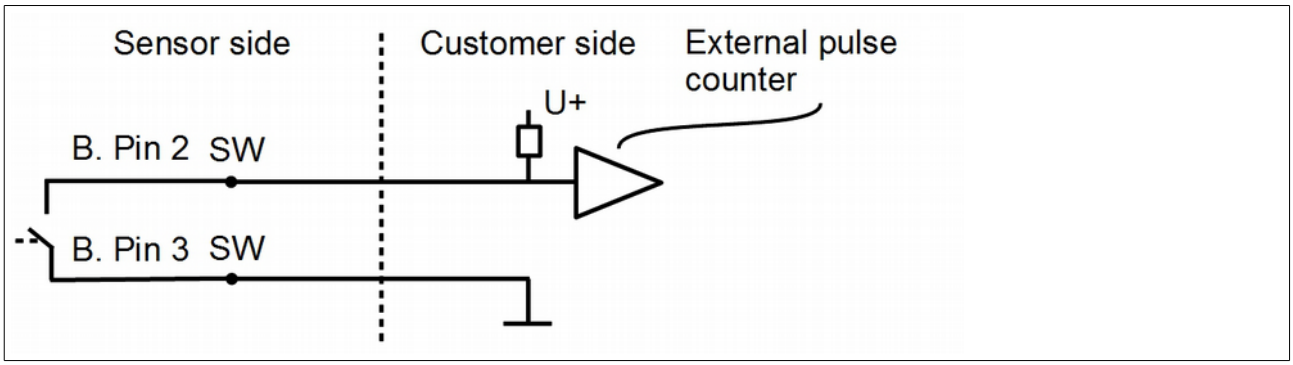
Example: With the setting of 1 pulse per 10 m^3, the sensor sends one pulse each 10 m^3.

Volumetric flow [m^3/s]	**Volumetric flow [m^3/h]**	**Pulse length [ms]**	**Max. pulse output per hour**
≦ 3	≦ 10800	120	1080
> 3	> 10800	60	2880
> 6	> 21600	30	3960

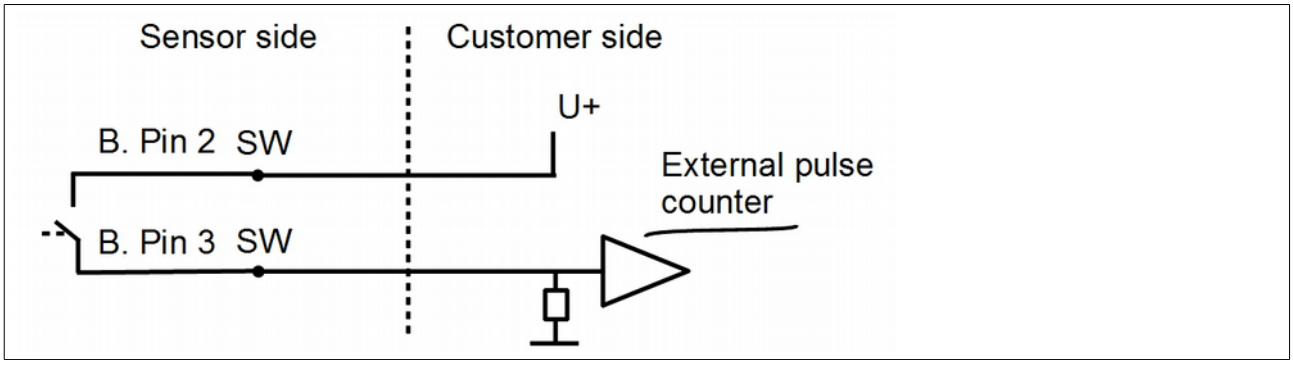
10.2.1 Pulse connection diagrams (A1410)

Using the isolated pulse switch (Connector B, Pin 2 and 3)

Variant 1:



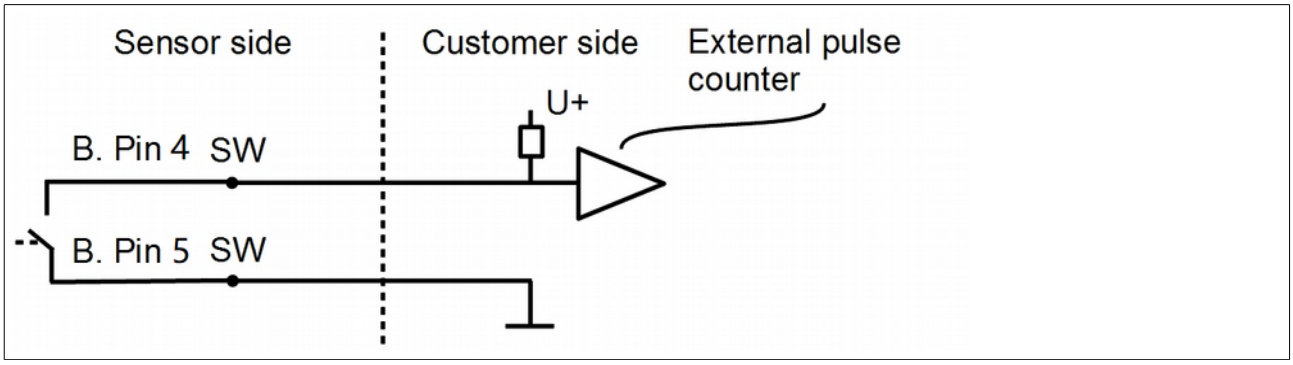
Variant 2:



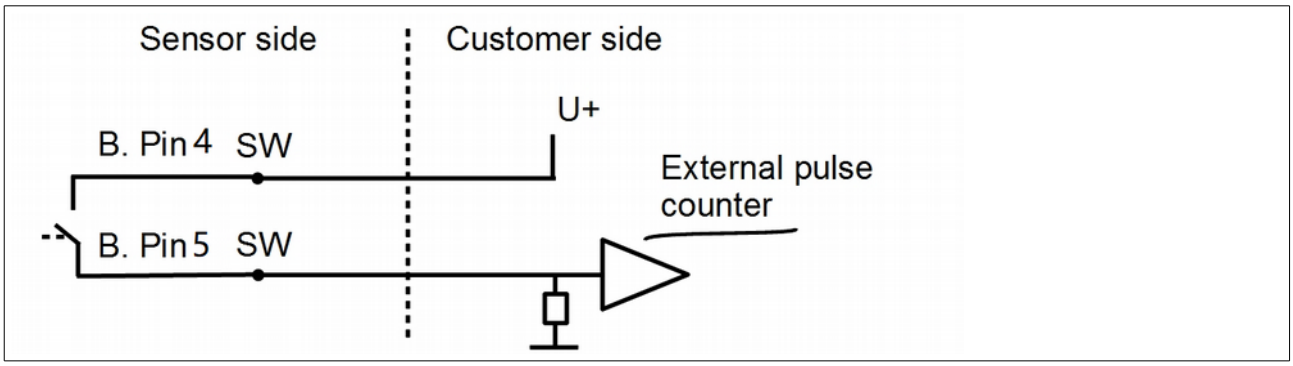
10.2.2 Pulse connection diagrams (A1413)

Using the isolated pulse switch (Connector B, Pin 4 and 5)

Variant 1:

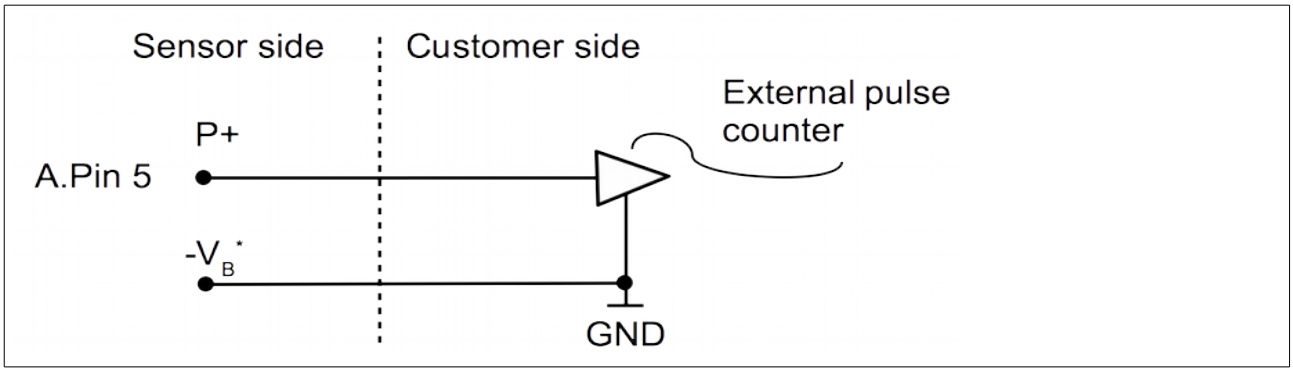


Variant 2:

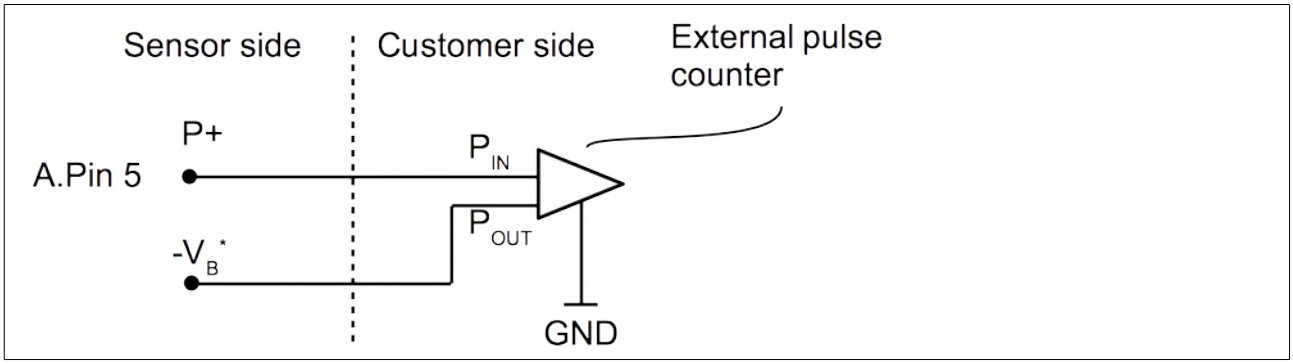


Using the pulse output P+ (Connector A, Pin 5)

Variant 1:



Variant 2:



*GND of the external pulse counter might be connected to $-V_B$ of the sensor.

10.3 Modbus output

Communication parameters (Modbus RTU)

Baud rate	:	19200
Device address	:	Last digits of serial number
Framing / parity / stop bit	:	8, N, 1
Response time	:	1 second
Response delay	:	0 ms
Inter-frame spacing	:	7 char

Communication parameters (Modbus TCP)

DHCP	:	Yes
MAC	:	Set ex-factory
IP address	:	Dynamic or Static
Subnet	:	Dynamic or Static
Gateway	:	Dynamic or Static
Timeout	:	>= 200 ms

Remarks:

- Modbus output settings can be changed using S4C-FS service app or the optional sensor display.
- In the Modbus TCP mode, a slave device does not support concurrent connections because it can response to only one polling message at a time.

Holding register (Modbus RTU and Modbus TCP)

Channel description	Resolution	Format	Length	Register address
Flow	0.1	FLOAT	4-Byte	6
Consumption	1	UNIT32	4-Byte	8
Reverse consumption	1	UNIT32	4-Byte	14
Flow Direction Indication*	1	UNIT32	4-Byte	42

* Value 0 identifies same direction and 1 identifies reverse direction.

Response message

In the response message that the device returns to the master:

- Function code: 03
- Byte order (32-bit data): MID-LITTLE-ENDIAN.

  Remarks: To properly decode the 4-byte float and unsigned integer data in the response message, the master must change the byte order from MID-LITTLE-ENDIAN to the order that it is using (LITTLE-ENDIAN or BIG-ENDIAN).

Byte sequencing

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

10.4 M-Bus output

Communication parameters

Primary Address	:	1
Secondary Address	:	8-digit serial number of the sensor
Manufacturer Code	:	0x15C4
M-Bus version	:	1
Baud rate	:	2400
Response delay (ms)	:	7
Response timeout (ms)	:	100
Receive timeout (ms)	:	500

Value register

M-Bus Addr.	Description	Data bytes
1	Total consumption	4-byte
2	Flow	4-byte
3	M-Bus status	4-byte

11 Configuration

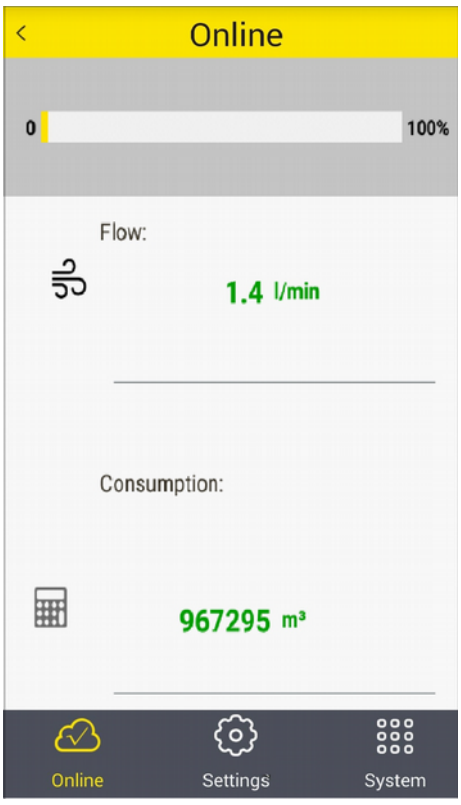
After the installation is completed, change the sensor settings if needed using one of the following tools:

- S4C-FS service app, most convenient
- Sensor display (optional)

11.1 Using the service app S4C-FS

S4C-FS is an Android-based app that enables you to view online measurements and change settings for SUTO flow meters wirelessly.

Download S4C-FS from Google Play Store or SUTO website, and install it as you do for any apps on your Android devices.



For more information about description of the sensor settings, see the *S4C-FS Instruction and Operation Manual, which you can download from our website (Download > Search: S4C-FS).*

ATTENTION!

Improper changes on the settings might lead to wrong measurement results! Contact the manufacturer if you are not familiar with the settings.

11.2 Using the sensor display (optional)

The Sensor display enables you to do the following:

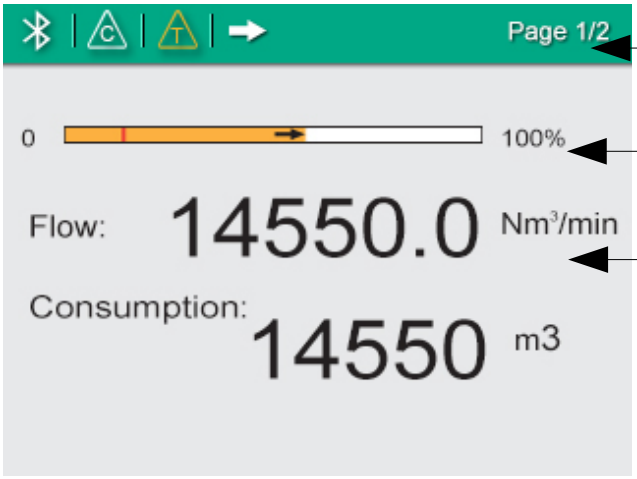
- View the online flow and consumption values
- View error messages
- Change the sensor settings.

	Enter key	Press for >3 seconds to enter the configuration mode. Press to confirm your selection.
	Up key	Press to choose a parameter item, entry box, or to adjust the value.
	Down key	

11.2.1 Start-up

After powered up, the display starts an initialization procedure. During the next eight seconds, the display will show the current software version and set up the connection with the sensor. After it is completed, the display enters the standard mode, showing the online values as below.

Home page



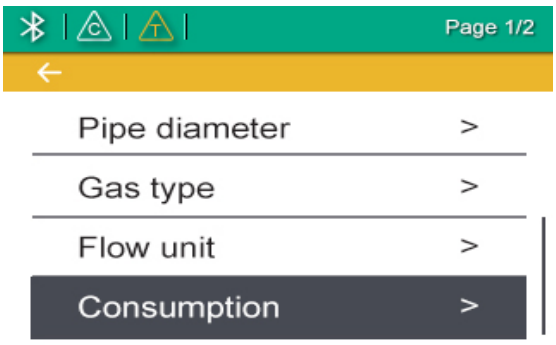
- Status bar
- Moving bar to indicate flow value
- Measuring values

Icons shown in the status bar

Indicate status or warnings for the sensor in service.

Icon	Description	Icon	Description
	Calibration expired		Pressure sensor damaged
	Temperature over operating range		Temperature sensor damaged
	Flow over measuring range		Flow direction
	Pressure over operating range		

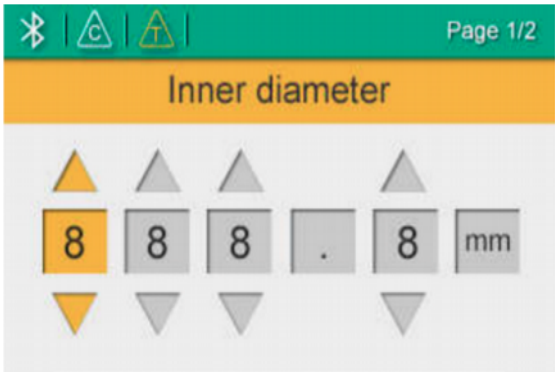
11.2.2 Operations



1. Press the “Enter” key for more than 3 seconds to enter the configuration mode.

2. Enter the unlock code: 12 using the “Up” and “Down” keys, and then press the “Enter” key to confirm.

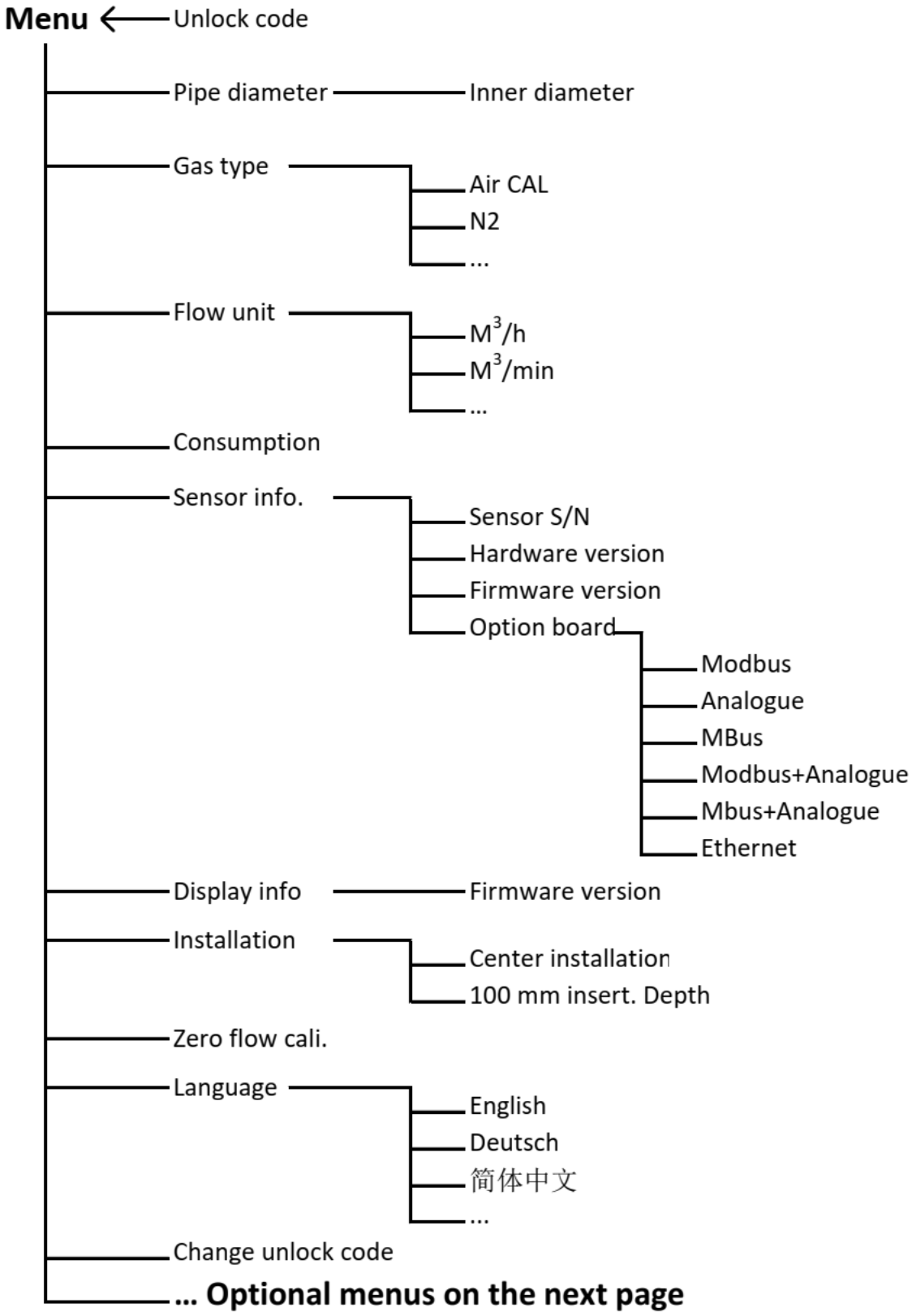
3. Use the “Up” and “Down” keys to choose a setting that needs to be changed.



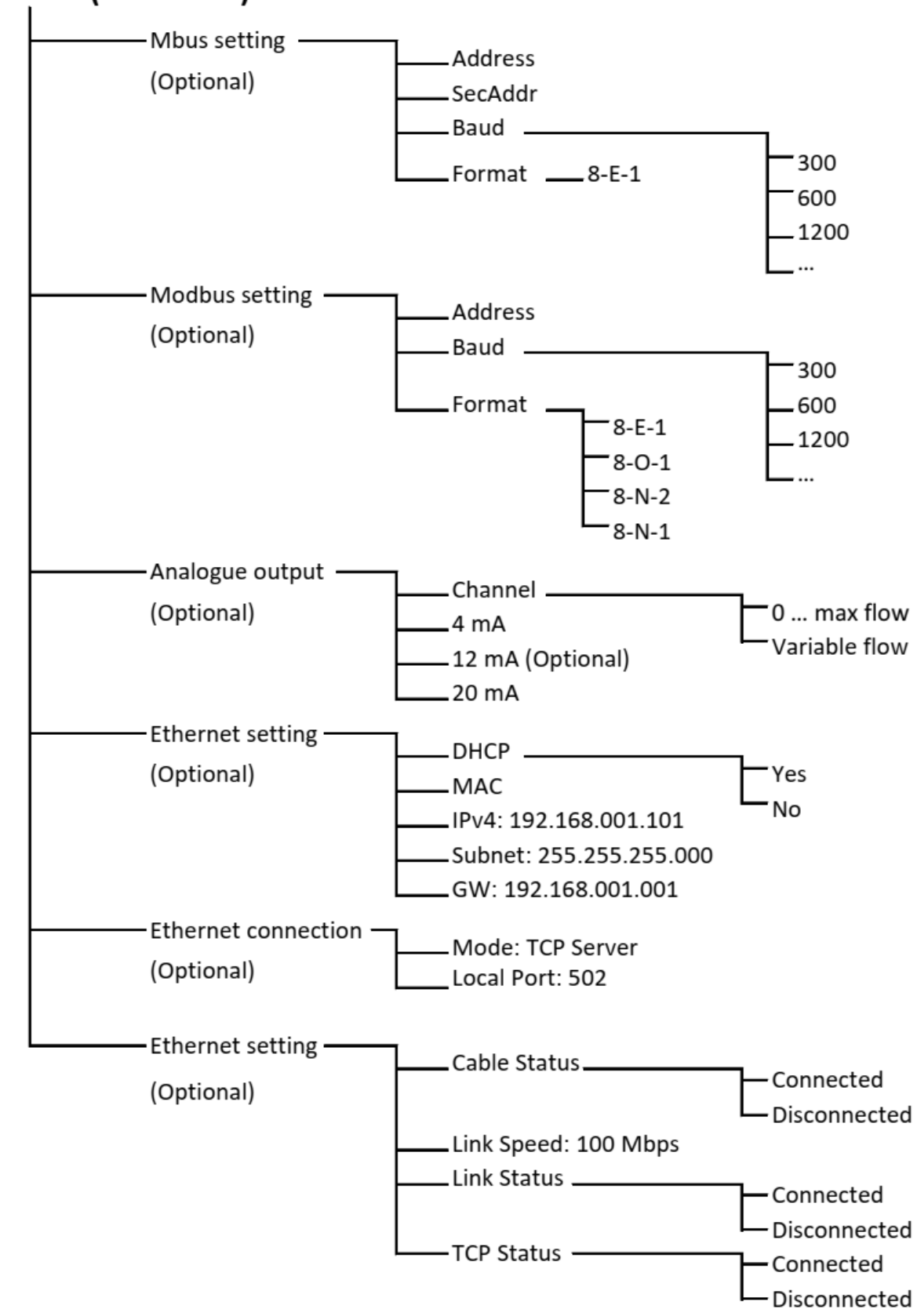
4. Use the “Up” and “Down” keys to select a desired setting and adjust its value.

5. Press the “Enter” key to confirm the changes.

11.2.3 Menu map



Menu (Continued)



12 Calibration

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 onsite conditions, and parameters such as oil, high humidity, or other impurities can affect the calibration and furthermore the accuracy.

We recommend the instrument to be calibrated at least once per year. The calibration is excluded from the instruments warranty. For more information about the calibration service, please contact the manufacturer.

13 Maintenance

To clean the sensor, we recommend you use distilled water or isopropyl alcohol only.

ATTENTION!

Do not touch the surface of the sensor plate.

Avoid mechanical impact on the sensor (e.g with a sponge or a brush).

If the contamination cannot be removed, the sensor must be inspected and maintained by the manufacturer.

14 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.

15 Appendix A - Modbus communication example

03 (0x03) Read holding register

Request		Response	
Slave address	1 byte	Slave address	1 byte
Function code	1 byte	Function code	1 byte
Starting address Hi	1 byte	Byte count	1 byte
Starting address Lo	1 byte	Register Hi	1 byte
No. of points Hi	1 byte	Register Lo	1 byte
No. of points Lo	1 byte	:	:
CRC	2 bytes	Register Hi	1 byte
		Register Lo	1 byte
		CRC	2 bytes

05 (0x05) Write single coil

Request		Response	
Slave address	1 byte	Slave address	1 byte
Function code	1 byte	Function code	1 byte
Coil address Hi	1 byte	Coil address Hi	1 byte
Coil address Lo	1 byte	Coil address Lo	1 byte
Data Hi	1 byte	Data Hi	1 byte
Data Lo	1 byte	Data L	1 byte
CRC	2 bytes	CRC	2 bytes

16 (0x10) Write multiple registers

Request		Response	
Slave address	1 byte	Slave address	1 byte
Function code	1 byte	Function code	1 byte
Starting address Hi	1 byte	Starting address Hi	1 byte
Starting address Lo	1 byte	Starting address Lo	1 byte
No. of registers Hi	1 byte	No. of registers Hi	1 byte
No. of registers Lo	1 byte	No. of registers Lo	1 byte
Byte count	1 byte	CRC	2 bytes
Data Hi	1 byte		
Data Lo	1 byte		
:	:		
Data Hi	1 byte		
Data Lo	1 byte		
CRC	2 bytes		

17 (0x11) Report slave ID

Request		Response	
Slave address	1 byte	Slave address	1 byte
Function code	1 byte	Function code	1 byte
CRC	2 bytes	Byte count	1 byte
		Slave ID	2 bytes
		Device run indicator	2 bytes
		Product code	2 bytes
		Product name	20 bytes
		CRC	2 bytes

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