SENSORS

User Manual

Flow Meter – Pitot Tube (Insertion)

Model: FLP

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Notices and Warnings

Notices

Please **read all of this manual** before you install, operate or maintain this product. Pay attention to notes, warnings and instructions. The manufacturer cannot be held liable for any damage which occurs as a result of noncompliance with this manual.

Do not tamper with device. Should the device be tampered with in any manner other than a procedure which is described and specified in this manual, the warranty is cancelled and the manufacturer is exempt from liability.

The product is designed exclusively for the described application. Use of this product in conditions not specified in this manual or, contrary to the instructions provided by the manufacturer, is considered improper handling / use of the product and will void your warranty. The manufacturer will not be held liable for any damages resulting from improper use of the product.

This manual should be read carefully by relevant personnel and the end user**.** This manual should be kept with the product and be made available as needed. **Once you install or use the product, you accept that you have read, understood and complied with this manual**.

CAA Sensors endeavours to make the content of this manual correct, but is not responsible for omissions or errors and the consequences caused. In case of any doubts or questions regarding this manual or the product, please contact CAA Sensors.

Warnings

Ignoring the warnings can lead to serious injury and/or cause damage!

When handling, operating or carrying out maintenance on this product, personnel must employ safe working practices and observe all local health & safety requirements and regulations.

Improper operation or maintenance of this product could be dangerous and result in an accident causing damage to machinery or injury or death.

The manufacturer cannot anticipate every possible circumstance which may represent a potential hazard. The warnings in this manual cover the most common potential hazards and are therefore not all-inclusive. If the user employs an operating procedure, an item of equipment or a method of working which is not specifically recommended by the manufacturer they must ensure that the product will not be damaged or made unsafe and that there is no risk to persons or property.

NEVER CHANGE ORIGINAL COMPONENTS WITH ALTERNATIVES.

Compressed Air Safety

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.
- Only use pressure rated installation materials and parts.
- Avoid getting hit by escaping air or bursting parts.
- The system must be pressure-less during maintenance work.

Electrical Safety

Any contact with energised parts of the product, may lead to an electrical shock which can lead to serious injuries or even death. The user shall take all measures necessary to protect against electrical shock.

Follow 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 authorised qualified personal.

Storage and transportation

- Make sure that the transportation temperature of the sensor is between -10°C to 60°C (14°F to 140°F).
- Please make sure that the storage temperature of the sensor is between -10°C to 50°C (14°F to 122°F) and the humidity is <90%, no condensation. Avoid direct UV and solar radiation during storage.

Cleaning

If you need to clean the sensor it is recommended to use a clean, dry cloth. For stubborn marks, use distilled water or isopropyl alcohol only.

Please note: contamination on the sensor tip will affect calibration and accuracy of the sensor. Removal of the contamination may not fix the issue.

Disposal

Electronic devices are recyclable material and do not belong in the household waste. The product, accessories and its packing material must be disposed according to local statutory requirements.

Introduction

About Flow Meters

Intended use

CAA Sensors flow meters are suitable for use in manufacturing, industrial and base building environments providing the sensor's specifications are met. This includes:

- Sensor is used in inert gases e.g. air, oxygen, nitrogen, carbon dioxide
- Gas flow rate is between: 5 to 300 Nm/s (17 to 984 ft/sec)
- Gas pressure is between: 0 to 17 bar (247 psi)
- Gas temperature is between -40°C to +150°C (-40°F to +302°F)
- Power supply is between: 18 to 30 vDC
- Sensor is not installed on the outlet of a compressor
- The flow meter is **not** used in explosive areas.

Refer to the *Specifications* section (next page) for full requirements.

The pitot tube flow meter measures flow, consumption, pressure and temperature.

Pitot Tube Flow Meters

Pitot tube flow meters are ideally suited to wet, dirty and high velocity gases.

The sensor measures upstream dynamic pressure and downstream static pressure. The pressure differential is a measure of gas velocity and flow rate.

CAA Sensors pitot tube flow meter has an extremely sensitive differential pressure measurement which allows the sensor to be used over a wide flow range. The patented anti condensation technology enables the sensor to be used in very wet gas. Our pitot tube flow meter will perform stable accurate measurements for years to come.

Thanks to the online auto-calibration technology, high reliability, long-term measurement and accuracy can be guaranteed.

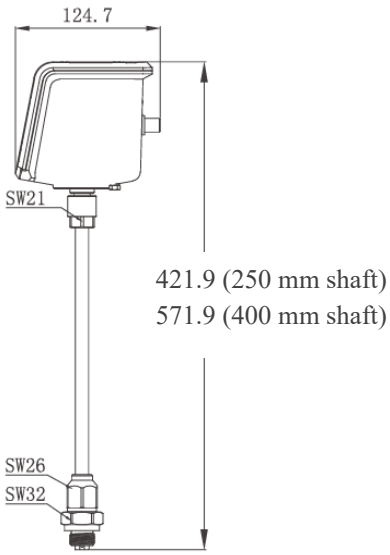
Pitot Tube flow meters are ideal for both temporary or permanent installations.

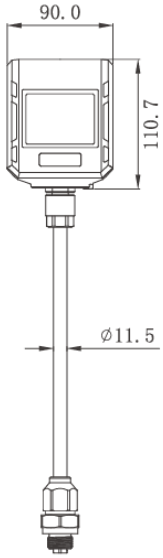
Specifications

Pitot Tube Flow Meter - Insertion		
Technology	Anti-condensation	
Application	Manufacturing and Industrial use	
Gas	Air, Argon, Carbon Dioxide, Helium, Hydrogen, Natural Gas, Nitrogen, Nitrous Oxide, Oxygen	
Gas Quality	Wet and dry gas, High velocities	
Accuracy	Flow: ±(1.5% reading + 0.3% full scale) Pressure: ±0.5% full scale *Accuracy is affected by the installation location, on-site conditions and contaminants such as oil, high humidity or other impurities*	
Measurement Ranges		
Flow Measurement	5 – 300 Nm/s	17 to 984 ft/sec
Pressure Measurement	0 to 17 bar (247 psi)	
Gas Temperature Measurement	-40°C to +150°C	40°F to +302°F
Outputs		
Output	Analogue: 4 to 20mA (4-wire, Isolated) / Pulse output Digital: RS485 Modbus / RTU	
Output Signals	Flow, consumption, pressure and temperature	
Power		
Power Supply	18 to 30VDC / 6.5W@24V	
Anti Condensate Power Up	18 to 30VDC / 24W@24V	
Electrical Connection	2 x 5 pin M12, female	
EMC	According to IEC 61326-1	

Anti Condensation Features		
Heating Function	Constant temperature control of flow meter head to prevent condensation build up inside the sensor when used in wet conditions	
Purge Function	Clicks will be heard when the intermittent tube cleaning system is operating.	
Display & Data Logger		
Display	2.8″ LCD with touch panel	
Data Logger	10,000,000 samples	
Sampling Rate	> 20 samples / second	
Other Information		
Bi-directional	Optional	
Pipe Size	DN25 to DN300	
Shaft Lengths	250 mm **or** 400 mm	9.8″ **or** 15.7″
Weight	FLP1 (shaft length = 250 mm or 9.8″) FLP2 (shaft length = 400 mm or 15.7″)	1.30 kg 1.40 kg
Dimensions	See next page	
Process Connection	ISO G1/2" thread	
Ambient Temperature	-20°C to +60°C	-4°F to +140°F
Installation Type	Permanent or temporary installation	
Calibration Frequency	Every 2 years *Annual calibration is required if the sensor is exposed to relative humidity above 85%.*	
Warranty Period	12 Months	

Dimensions (mm)





Flow Range

Pipe Size		Flow Range (Nm3/h)		Flow Range (cfm)	
DN	ID (Inches)	Min Flow	Max Flow	Min Flow	Max Flow
25	1″	8.8	530	5	312
32	1.25″	14.5	868	9	511
40	1.5	22.6	1,357	13	798
50	2″	35.3	2,120	21	1,247
65	2.5″	59.7	3,583	35	2,108
80	3″	90.5	5,428	53	3,193
100	4″	141.4	8,482	83	4,990
125	5″	220.9	13,253	130	7,797
150	6″	318.1	19,085	187	11,228
200	8″	565.5	33,929	333	19,962
250	10″	883.6	53,014	520	31,190
300	12″	1,272.3	76,340	749	44,913

CAA Sensors App

Flow Meter App - View data and edit settings on your phone

The CAA Sensors App allows you to view data and check / update settings on your phone.

This feature is great for viewing flow readings when your flow meter is installed in high locations.

Contact CAA Sensors or your local dealer for more information.

Flow Meter Pack

Each flow meter pack comes with:

- ✓ 1 x Pitot Tube Flow Meter – Insertion style, configured for your gas type.
- ✓ 1 x O-Ring
- ✓ 1 x Adjustment tool (used to align flow meter correctly)
- ✓ 1 x USB C to USB A adapter (used to download data to a USB)
- ✓ **Connector Options** - 2 x M12 female connectors **or** 2 x 5 meter data cables with M12 connector on one end
- ✓ Calibration Certificate

Flow Meter Pack

Flow Meter

O-Ring

USB C to USB A adapter

Adjustment tool

Connector Options

2 x M12 female connectors

OR

2 x 5 meter cable with M12 connector on one end

Installation

Installation Overview

Mechanical Installation

Step 1 – Find a suitable section of pipe

- The sensor must be installed vertically or horizontally (on pipe with upward gas flow)
- The sensor must be installed away from bends, edges, seams, changes in pipe size and other obstructions
- Do **NOT** install the sensor upside down

Step 2 – Install connection point, eg ball valve or nipple

Step 3 – Fit flow meter

Step 4 – Align sensor with direction of gas flow

Electrical Installation

Step 5 – Wire the sensor for 24vDC power and communication

Sensor Configuration

Step 6 – Set sensor settings:

- Inner Pipe Diameter
- Unit of Measurement
- Communication settings (RS485 or Analog)
- Optional – Confirm other sensor settings

Step 7 (optional) – Connect the sensor to your SCADA or energy management system

Tools and Equipment needed for installation

(not included with Flow Meter Pack)

Wrench / Spanner

Screw Driver

Ball Valve (optional)

Thread Tape / Sealant

Installation – Mechanical

WARNING! Incorrect installation can damage the sensor or cause it to work incorrectly.

Notes

- **You need to maintain a minimum flow velocity of 5 Nm/s (17 ft/sec)** for the pitot tube to work correctly. Below this minimum velocity, the flow meter reading will be zero.
- **Before installing the sensor, make sure it is rated for your system** (refer to the "Specifications" section).
    - Use of the product outside specified ranges or operating parameters can lead to malfunctions and may damage the product or system.
- Do not use this product in explosive areas.
- Pay attention to the installation location and gas contamination levels to ensure accuracy is maintained.
- When installing and using the flow meter, please pay attention to the direction of air flow and the alignment of the sensor. The direction is indicated on the housing.
- The sensor is for indoor use only. If installed in an outdoor installation, the sensor must be protected from sun and rain.
- Only use pressure rated materials and parts when installing and maintaining the product.
- Do not disassemble the product.
- Please follow local and national regulations before/during installation and operation.
- The product must be installed properly and calibrated regularly, otherwise it may lead to inaccurate measurements.

Step 1 – Find a suitable section of pipe

The sensor **must** be installed

- ✓ at 90° to the pipe, +/- 15° (ie within 75° to 105° of vertical).
- ✓ Vertically or horizontally on pipe with upward gas flow
- ✓ away from bends, edges, seams, changes in pipe size and other obstructions,

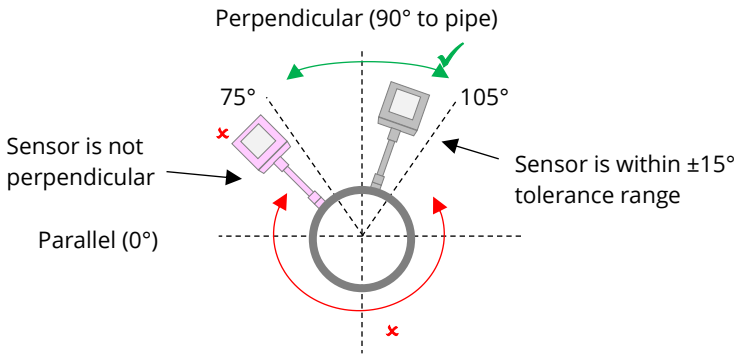
Make sure the insertion location has enough room around the pipe to install the sensor.

Note: the pitot tube flow meter can be installed in wet gas however it can't be installed on the outlet of a compressor. If you would like to install the pitot tube flow meter near a compressor outlet, you must have some form of water separation between the compressor and flow meter.

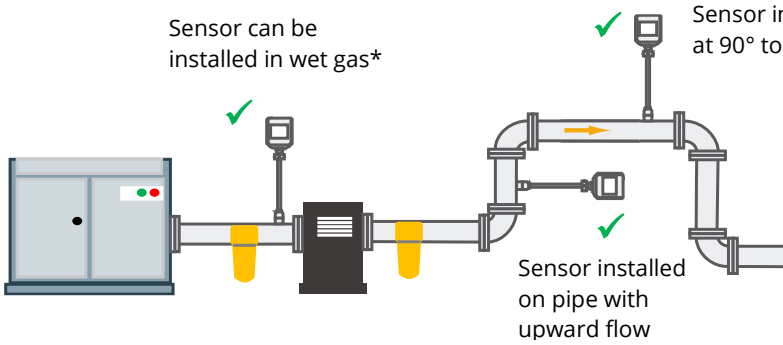
Do **NOT** install the flow meter:

- **x** upside down
- **x** at too much of an angle
- **x** on pipe with downward gas flow
- **x** on the outlet of a compressor
- **x** in saturated gas or liquids

Install 90° (perpendicular) to pipe

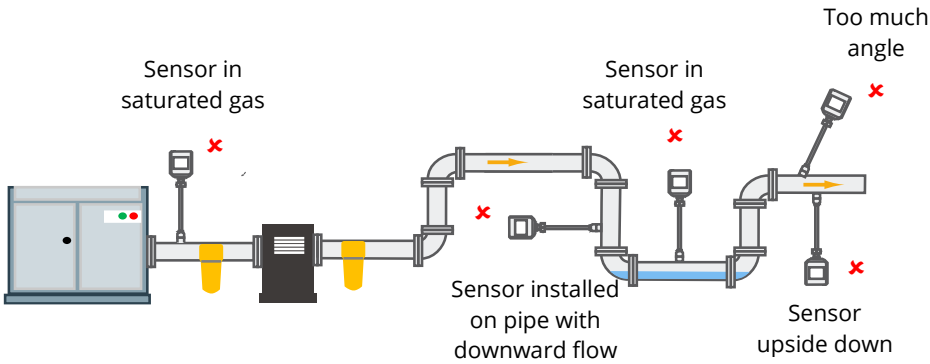


Correct Installation



* If you would like to install the pitot tube flow meter near a compressor outlet, you must have some form of water separation between the compressor and flow meter.

Incorrect Installation



Choose insertion location, away from obstacles

To achieve and maintain the accuracy stated in the specifications, the sensor must be inserted away from bends, edges, seams, curve, changes in pipe size, control valves, etc.

For best results, choose a long, absolutely straight, section of pipe that is free of obstructions.

Pipe obstructions (e.g. bends, edges, seams, curves, changes in pipe size, control valves, etc) change the velocity of compressed air / gasses and/or create turbulence near the obstruction. Placing the sensor too close to the obstruction will result in inaccurate readings.

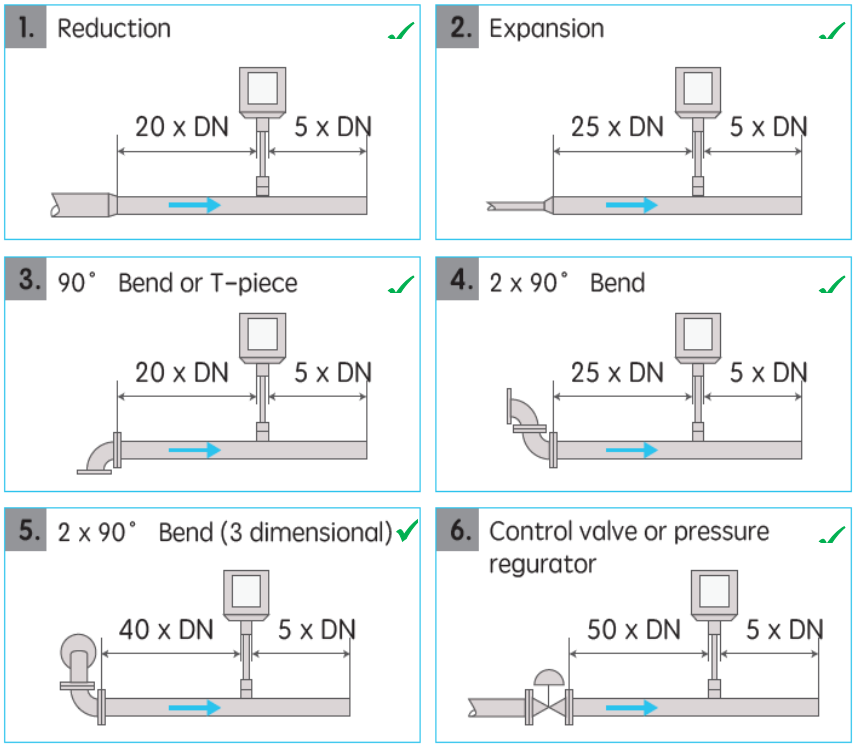
Notes

- Pay attention to the distance between the sensor's inlet and outlet sections and points of turbulence (e.g. bends, valves, etc).
- Make sure that the insertion location has enough straight pipe on either side of the sensor, as shown in the diagrams below.
- Obstructions can cause counter-flow turbulence as well as turbulence in the direction of the flow. Turbulence will reduce the accuracy of flow readings and result in inaccurate data.

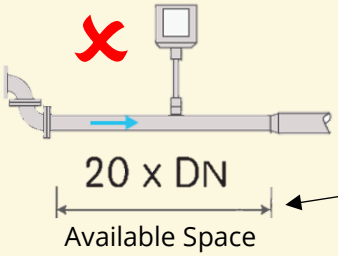
Correct Installation

The diagram below shows the **minimum** allowable distance between the sensor and any bends, changes in pipe size or other obstructions. Distances are shown in multiples of pipe diameters (DNs). For best results, choose a long, absolutely straight, section of pipe that is free of obstructions.

DN = Pipe Diameter



Examples



- To install a flow meter near 2 x 90° bends, you need at least 30 DN of space (25 DN on the inlet side + 5 DN on the outlet side, see diagram 4 on previous page)
- Only 20 DN is available.
- Therefore the sensor should **not** be installed in this location

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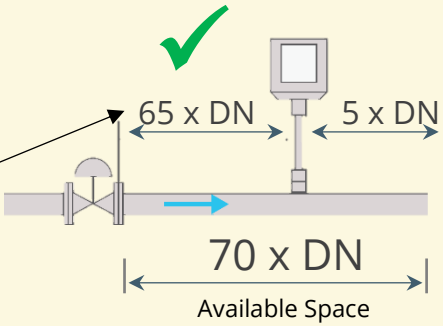
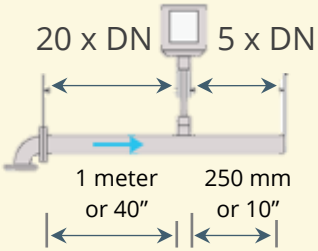
- To install a flow meter near a control valve or pressure regulator, you need at least 55 DN (50 DN on inlet side and 5 DN on outlet side, see diagram 6 on previous page)
- This section of pipe has 65 DN on the inlet side and 5 DN on the outlet side
- Therefore the sensor **can** be installed in this location





Minimum spacing on inlet and outlet sides for DN 50

A flow sensor will be installed on a section of pipe, just after a bend (as shown in the diagram on the left). The pipe has a DN of 50 (ie, it’s a 2 inch or 50 mm pipe).

Therefore the sensor must be installed:

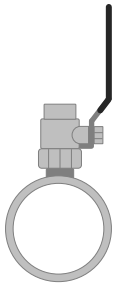
- Inlet side: 20 x DN from the bend
  = 20 x 2” = 40” or
  = 20 x 50mm = 1,000mm = 1 meter
- Outlet side: 5 x DN from any other obstruction
  = 5 x 2” = 10” or
  = 5 x 50mm = 250mm

Step 2 – Install connection point

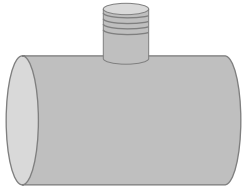
To install the sensor, you need a connection point to the pipe e.g. a ball valve or a nozzle or nipple. The thread must be G 1/2".

Use of a ball valve is optional - You do not need to use a valve to install the sensor. However, using a valve will make removing the sensor easier (e.g. when you need to remove the sensor for calibration).

If installing a ball valve, you can use a hot tap drill and clamp to create a connection point on pressurized or unpressurised pipes. See the CAA Sensors website for information on hot tap drills and clamps.

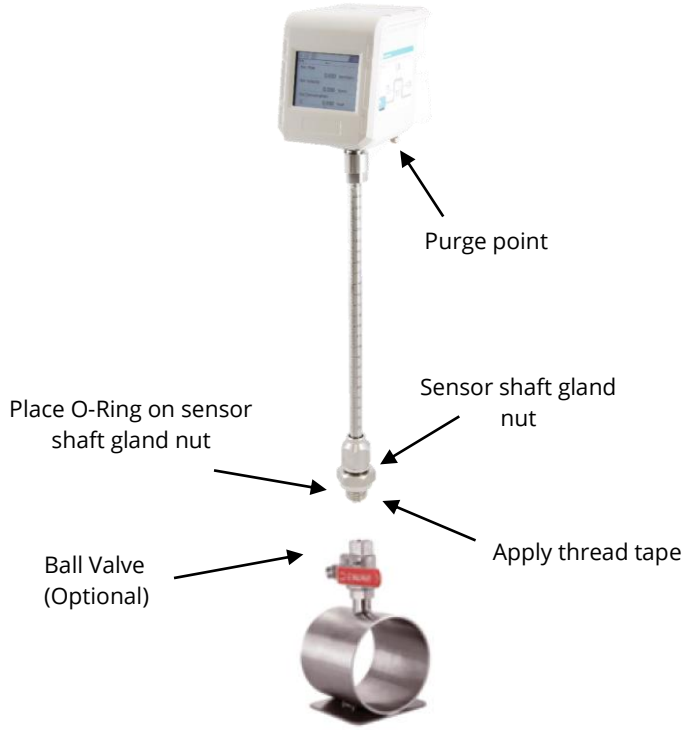


Ball Valve **OR** Welded nipple on pipe



Step 3 - Fit Flow meter

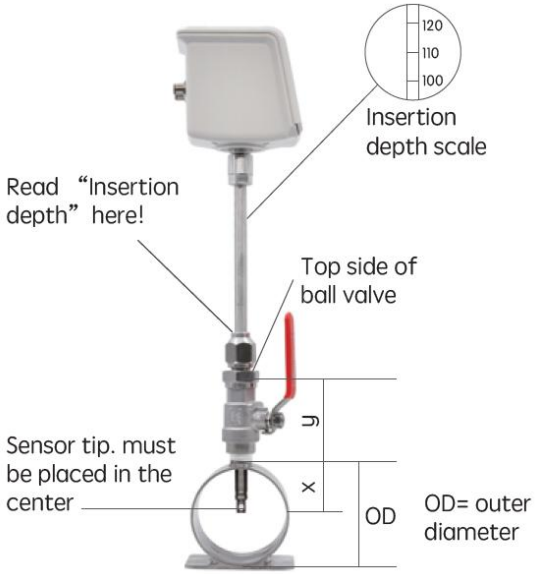
- Place O-Ring on sensor shaft gland nut.
- Wrap thread tape / sealant tape around sensor thread. Do not let tape enter pipe.
- Screw the sensor into the connection point.
- If using a ball valve, open the valve.



- Use the depth scale on the sensor shaft to place the tip of the sensor in the middle of the pipe.
- Once the tip is in the centre of the pipe, tighten the gland nut to hold the sensor in place.

$$\text{The Insertion Depth} = x + y = \frac{OD}{2} + y.$$

Where OD = outer diameter of pipe and Y = ball valve or nipple height.

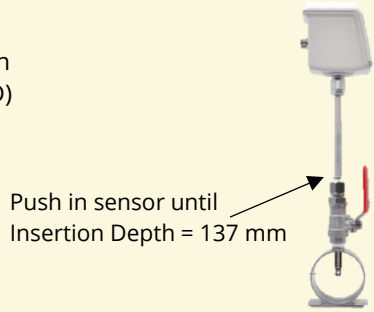


Example

A flow meter is being installed in a cooper tube with a DN of 100. This equates to an outer diameter (OD) of 100 mm. The ball valve is 87 mm high.

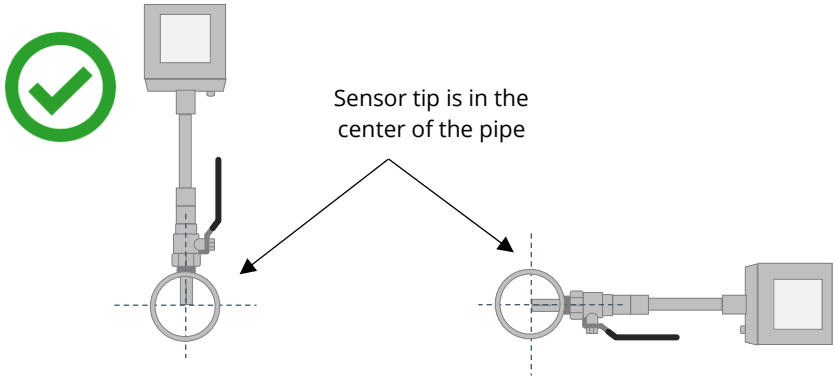
The Insertion Depth = OD/2 + y
where y = height of the ball valve.

Therefore, the Insertion Depth =
100 mm / 2 + 87 mm = 50 mm + 87 mm = 137 mm.



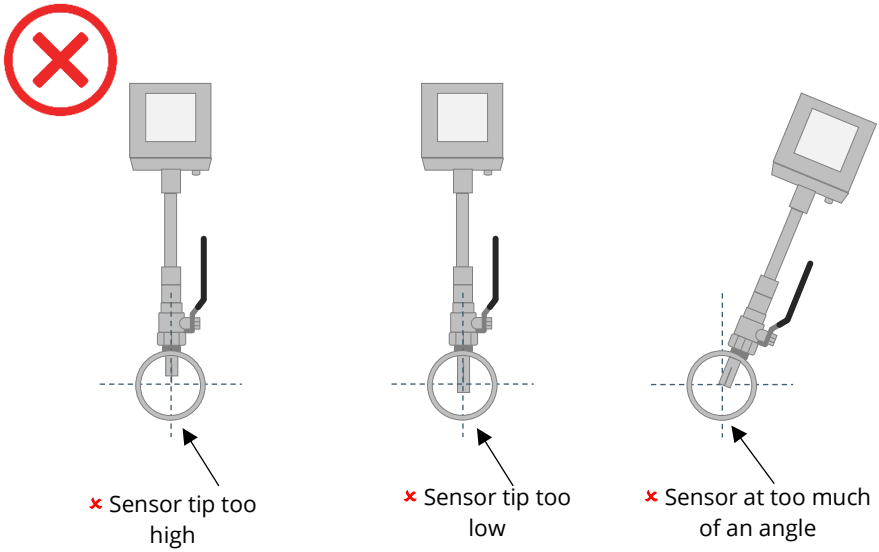
Correct Installation

The sensor tip must be in the center of the pipe / tube.



Incorrect Installation

Note: Inaccurate measurement may occur if the sensor is installed incorrectly.

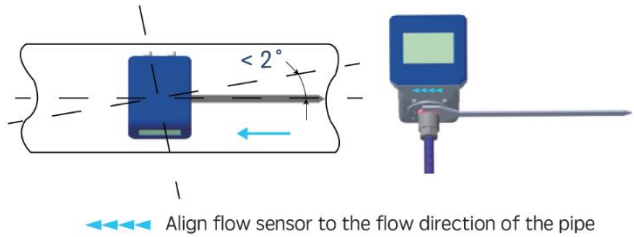


Step 4 – Align sensor with the direction of flow

When installing and using the flow meter, please pay attention to the direction of air flow and the alignment of the sensor.

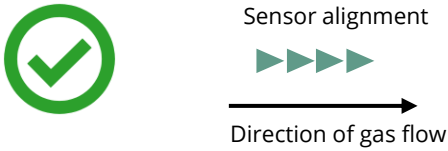
The direction is flow is marked by 4 green arrows on the back of the sensor and underneath the sensor.

Use the alignment tool to align the sensor with the pipe. Ensure the arrows on the sensor match the direction of flow.



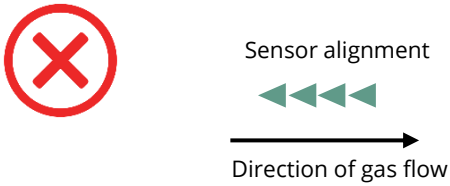
Correct Installation

The sensor is aligned in the same direction as the gas flow.



Incorrect Installation

The sensor is aligned in the opposite direction to the gas flow.



Installation – Electrical

WARNING! Incorrect wiring can damage the sensor or cause it to work incorrectly.

Notes:

- Do **not** screw the M12 connector using force, otherwise it may damage the connection pins.
- Always check the M12 connectors to make sure they are wired correctly.
- Follow all local and national safety requirements and regulations for electrical installations.
- **The system must be disconnected from any power supply during installation and maintenance work.**
- Any electrical work on the system is only allowed by authorised and qualified personal.

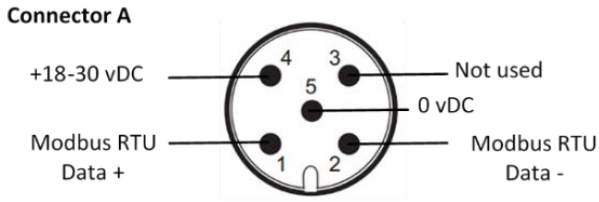
Step 5 – Wire the Sensor for Power and Communication

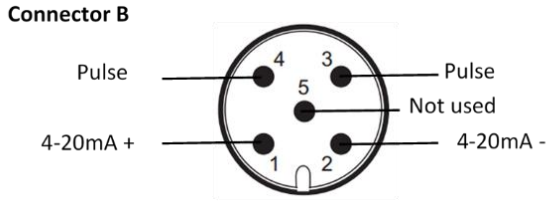
The flow sensor has two x 5 pin M12 connector plugs - “A” and “B”. Cables are connected to the sensor through the M12 connector plugs.

- Connector **A** is used for power and Modbus
- Connector **B** is used for 4-20mA and pulse

If you ordered a cable with the sensor, the cables will be coloured coded as shown in the table below.

Connector A (Power & Modbus)		**Cable Colour**	Connector B (Pulse & Analogue)	
Pin 1	RS845, Data + (A)	Brown	Pin 1	4-20mA +
Pin 2	RS845, Data - (B)	White	Pin 2	4-20mA -
Pin 3	N/A - Not Used	Blue	Pin 3	Pulse
Pin 4	+18-30 vDC	Black	Pin 4	Pulse
Pin 5	0 vDC (Ground for Modbus)	Grey	Pin 5	N/A - Not Used





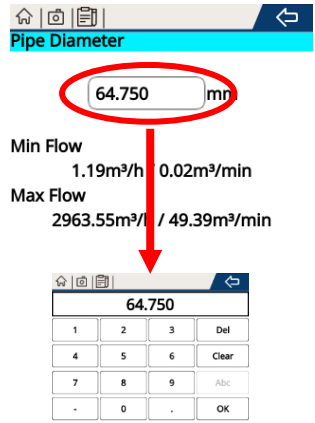
Configuring the Sensor

Step 6 - Configure the Flow Meter

You must configure the flow meter to make sure it is reading accurately.

- You **must** set the (inner) pipe diameter.
- You should check / adjust the gas type, units of measure, communication settings (4-20mA and/or Modbus) and screen rotation.

Mandatory Configuration - Pipe Diameter



Pipe diameter refers to Inner Pipe diameter. **Not** the outer diameter.

To set the inner pipe diameter**:**

- Go to **Settings** ( ) > **Pipe Diameter**.
  - If the **lock screen symbol** is present (on the bottom left of the screen), press the symbol, hold and drag it to the right of the screen. The screen is set to lock after 60 seconds.
- Press the diameter size, in millimeters (mm)
- Enter new **inner** diameter of the pipe
- Press OK

Press the arrow ( ) to save your settings and return to the previous screen.

Optional configuration

We recommend you check the following settings on the flow meter. See the next section - “Using the Display” for instructions on checking / updating settings.

- Gas type
- Unit of Measurement
- Communication settings (RS485 or Analog)
- Screen Rotation

Using the Flow Meter

Operating the Flow Meter

WARNING!

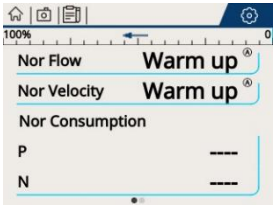
- Make sure the sensor is installed and wired correctly before powering up the sensor. Only use 24vDC to power the sensor.
- The flow meter head will get hot. This is normal and is the tube cleaning system / purge system working.

Turning On

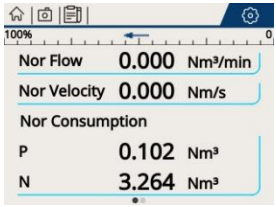
Connect the flow meter to 24vDC power. The sensor will start powering up automatically. There is no on/off switch on the sensor.

On powering up:

- The CAA Sensors logo will appear on the screen.
- You will hear some clicks. These clicks are normal and are the scleaning system / purge system working.
- After a few seconds, the Warm Up screen will appear (see image below, left). During warm up the current draw will be higher than normal as the flow meter head is brough up to temperature.
- After a minute you will see flow meter home screen. The flow meter is now ready to configure (see image below, right).

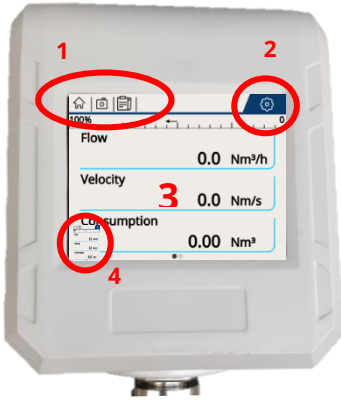


Warm up screen when Flow Meter powered on



Flow Meter home screen. The sensor is ready to configure

Using the Display



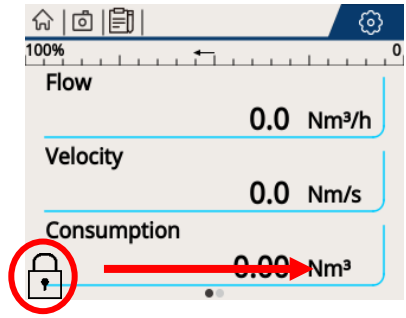
The flow meter has a touch screen interface.

1. Menu options
2. Settings
3. Data / Measurement Readings
4. Locked screen icon

To navigate the interface:

- scroll up and down (↑ and ↓) to see other options
- scroll left and right (← and →) to see other screens
- Press an item to access that feature

Unlock the screen

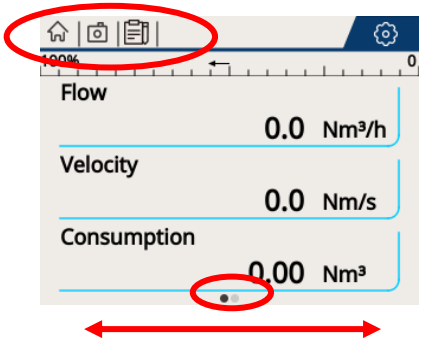


The screen is set to automatically lock after 60 seconds.

If the **lock screen symbol**  is present, press the symbol, hold and drag it to the right of the screen.

You can change the timing for the lock screen in the “Screen Settings” menu (Settings > System Settings > Screen Settings).

Home Screen



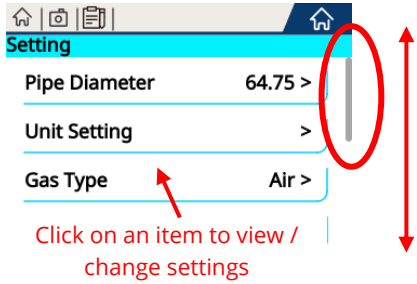
Scroll left or right to see other screens

The home screen has two pages, as shown by the two dots (..) at the bottom of the screen. Move the screen left or right to move between screens.

When you press the **Menu** icon ( ) a pop up screen appears. Press:

- ✓ The **Home** icon ( ) to return to the home screen
- ✓ The **Camera** icon ( ) to take a screen shot of that screen
  - To access screen shots, go to the Settings Menu ( ) > Screen Shot.
- ✓ The **Notepad** icon ( ) to access the Data Logging information
- ✓ If you have a USB installed, press the **USB icon** ( ) to safely remove the USB.

Settings Menu



Press the **settings** icon ( ) in the top right corner of the screen to access the settings screen.

In the Settings Menu you can view / change:

- ✓ Pipe diameter
- ✓ Units of measurement
- ✓ Gas type
- ✓ Data logging
- ✓ Screen Shots
- ✓ RS485 settings
- ✓ Analog output
- ✓ Pressure Calibration
- ✓ Normalisation
- ✓ System settings and
- ✓ Advanced Settings.

Menu Options

Menu	Sub Menus	Options / Comments
Pipe Diameter	-	Set inner pipe diameter. **This must be set when you install the flow meter** Pipe diameter refers to inner Pipe diameter. **Not** the outer diameter
Unit Settings	Flow Unit	m^3/h l/min Kg/h m^3/min l/s Kg/min m^3/s cfm Kg/s
	Velocity Unit	m/s ft/s
	Consumption Unit	m^3 ft^3 kg
	Temperature Unit	°C °F
	Pressure Unit	Pa kPa Bar hPa Mpa PSI Mbar
Gas Type	-	Air Argon (Ar) Butane (C4H10) Carbon dioxide (CO2) Carbon monoxide (CO) Ethane (C2H6) Helium (He) Hydrogen (H2) Methane (CH4) Natural Gas Nitrogen (N2) Nitrous oxide (N2O) Oxygen (O2) Propane (C3H8) Sulfur Hexafluoride (SF6)
	Note: The flow meter is calibrated in air. If you select another gas type, the flow meter will automatically adjust its readings to match the gas selected. If you require calibration in real gas, contact CAA Sensors or your local distributor	
Data Logging	Logging	Set, start / Stop data logging

Menu	Sub Menus	Options / Comments	
	History	Download data as a CSV file Delete records	
RS485 Settings	Device Address	**Options** 1 to 247	**Default Settings** 1
	Baud Rate	1200 2400 4800 9600 14400 19200 38400 56000 57600 115200	9600
	Parity	None Odd Even	None
	Stop Bits	1 2	1
	Response Delay	0 to 999 ms	0
Analog output	4-20mA Channel	**Options** Flow Velocity Pressure Temperature Normal Flow Normal Velocity	**Default Settings** Velocity
	4-20mA Scaling - Low	±0 to ±9999999.99	0.00 Nm/s
	4-20mA Scaling - High	±0 to ±9999999.99	300.00 Nm/s
	Cubic Meter / Pulse	$1m^3$/Pulse	$1m^3$/Pulse

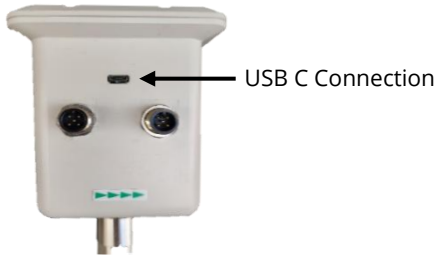
Menu	Sub Menus	Options / Comments
		5m^3/Pulse 10m^3/Pulse
Screen Shot		View and download screenshots
Pressure Calibration		Do a zero calibration of the gauge pressure
Normalisation	Temperature Pressure	The Normalization screen lets you change the reference conditions of the flow meter. The Flow Meter will readjust is calculations to suit the new normalization valves. The normalization setting should only be changed if the flow meter is installed under conditions that differ from the standard calibration (20°C, 1 bar, 0% relative humidity). Default Values: • Flow Unit Prefix: Normal • Temperature = 20°C • Pressure = 100.00kPa
System Settings	Screen Settings	View / change: • Screen rotation – rotate the screen by 90 degrees • Screen brightness • Timing for screen lock - The screen is set to automatically lock after 60 seconds
	Language Setting	Change language – English or Chinese
	System information	• **Boot Count**: Number of times the sensor has been disconnected and reconnected to power • **Sensor Information**: Serial Number, hardware version and software version • **Display Information**: Serial Number, hardware version and software version
	System Update	Update the firmware.

Menu	Sub Menus	Options / Comments
		If a new version of the firmware is released, your local distributor will send the software to you. To update the firmware: • Copy the firmware to a USB • Plug the USB drive into the back of the sensor • On the Flow Sensor's touch screen, go to the **Settings Menu > System Setting > System Update** • Follow the prompts

Advanced Settings		These settings are password protected. They should not be changed as they will affect the flow meter readings and accuracy.
		
		Advanced settings let you change:
		• Velocity Offset Ratio
		• Velocity Filter Grad
		• Consumption
		• Anti-condensation heating function
		  ○ The Anti-condensation heating function should be left on when using the flow meter in wet gas. Turning the Anti-condensation heating function off when the sensor is used in wet air can damage or destroy the sensor
		• Constant Temperature
		  ○ This is the temperature of the Anti-condensation heating function. The default temperature is 65°C. If the Anti-condensation heating function is turned off, you can not access this feature.
		• Actual Channel

Menu	Sub Menus	Options / Comments
		• Cut Off Velocity ○ This is the minimum velocity the flow meter can detect. If the flow is less than the cut off velocity, the flow meter will read '0'. The flow meter is not calibrated for velocities less than 0.1m/s. • Change Password

Data Logging



You can record data to a USB and download data as a CSV file. The USB connection is on the back of the flow meter head.

Alternatively, you can connect the flow meter to CAA Sensors CALMS system (a cloud based compressed air and energy management system) or your own SCADA.

How much data will the flow meter record?

The flow meter will record a maximum of 10,000,000 samples.

Example: Recording flow, consumption and temperature at 1 second increments will record three (3) samples (flow, consumption, temperature) per second. Therefore 3 samples x 60 seconds = 180 samples per minute. 180 samples/min x 60 minutes = 10,800 samples per hour. 10,800 samples/hour x 24 hours = 259,200 per day. So 10,000,000 / 259,200 samples per day = 38 days of data recording.

Example: Recording only one measurement (eg flow) will record one (1) sample. If you record flow at 10 second increments you can record: 1 sample x 6 = 6 samples per min x 60 min = 360 samples / hour x 24 hours = 8,640 samples per day x 365 days per year = 3,153,600 per year.

How can I download data from the flow meter?

To download data, you need to connect a USB drive to the flow meter and export the data as a CSV file. Alternatively, you can connect the flow meter to to CAA Sensors DAS system (a cloud based compressed air and energy management system) or your own SCADA.

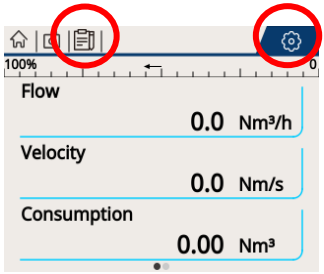
If the flow meter losses power, will the data logger restart automatically?

No. If you lose power to the flow meter, you must manually restart the data logging function. You can do this via the flow meter screen or the CAA Sensors App (see below).

How do I access the data logger?

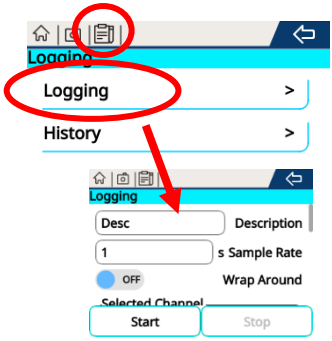
To set up data logging, view data logging history and start or stop data logging go to the "**Logging**" menu. You can access the data logging menu via:

- ✓ Notebook icon ( ) on the top left of the screen, or
- ✓ Via the Settings menu ( ) on the top right of the screen (Settings > Logging).



Before you remove the USB card, press the **USB icon** ( ) on the top left of the screen to safely remove the USB.

Set up Data Logging



To set up data logging:

- Enter a Descriptive Name for the data
- Enter the sample rate, in seconds
- Turn on / off "Wrap Around"
  - If you turn **on** "Wrap Around" the data will write over old records when the memory card is full
  - If you turn **off** "Wrap Around", the data will stop recording when the memory card is full
- Select which channels you want to log. You can select one or more from the list below:
  - Flow, velocity, consumption and/or temperature
- Enter the system date and time
- If you want the data logging to start at a specific time, enter the START date and time
- If you want the data logging to stop at a specific time, enter the STOP date and time
- Press the arrow ( ) to save settings and return to the previous screen

Start / Stop Logging

- Press the Notebook icon ( ) on the top left of the screen
- To start data logging (without changing any of the settings) press Start icon Start
- To stop data logging (without changing any of the settings), press the Stop icon Stop
- When data logging is active, the pencil on the notebook icon ( ) will move.

Download Data

To download data as a CSV file

- Press the History option.
- Select the data to download
- Insert a USB into the back of the flow sensor
- Press Export
- Press the arrow ( ) to save settings and return to the previous screen

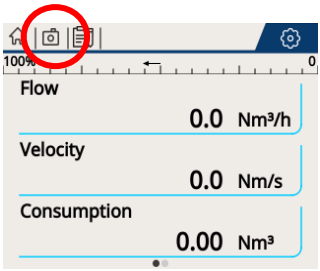
Delete Data

To delete historical data records

- Press the History option.
- Select the data to delete
- Press Delete

Screen Shot

You can take a screen shot of any screen by pressing the camera icon ( ) on the top left of the screen.



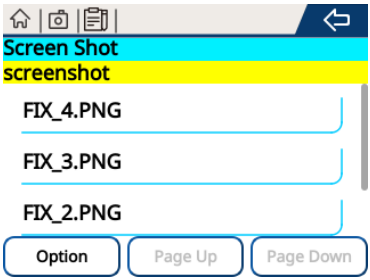
To access the screen shots, go to the **Settings Menu ( ) > Screen Shots**.

Here you can:

- ✓ View the picture
- ✓ Export the picture to a USB
- ✓ Delete pictures

View a picture

Press the picture name to view the picture.



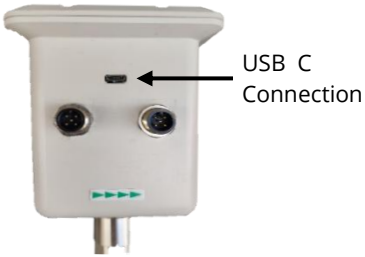
Delete Pictures

To delete pictures:

- Press the Option icon

  Option
- Select the images you want to delete
- Press the **Delete** icon

Export / Download Pictures



To export pictures:

- Insert a USB into the back of the flow sensor
- Press the Option icon

  Option
- Select the images you want to download
- Press the **Export** icon

Modbus Registers

Default Modbus Communication settings

Modbus settings can be changed to suit system requirements

Default Modbus RTU (RS485) Settings					
Address	Baud Rate	Frame / Parity / Stop Bit	Response Time	Response Delay	Frame Spacing
1	9600	8 / N / 1	1 Sec	0 Milliseconds	7 Characters

Holding Register Definition

Logical channels, data and related holding registers

- Modbus read command: 0x03
- Modbus write command: 0x06 for single register, 0x10 for multiple register
- Coil registers write command: 0x05

Process Data Format: supports two data types: IEEE 754 float data and unsigned int data.

Byte Order = Little Endian Byte Swap.

- 32bit: CD AB
- 64 Bit: GH EF CD AB

Modbus Registers

Holding Register	Data Type	Byte Length	Description	Comments	Read / Write
Process Data					
0	FLOAT L	4	Standard Flow		Read
2	FLOAT L	4	Standard Velocity		Read

Holding Register	Data Type	Byte Length	Description	Comments	Read / Write
4	DOUBLE L	8	Standard Consumption	Write “0” to clear value	Read / Write
8	FLOAT L	4	Temperature		Read
10	FLOAT L	4	Gage Pressure		Read
12	FLOAT L	4	Actual Flow		Read
14	FLOAT L	4	Actual Velocity		Read
16	FLOAT L	4	Actual Consumption		Read
20	FLOAT L	4	Density		Read
22	UNSIGNED LONG	4	Standard Consumption (4 byte value type)	Write “0” to clear value	Read / Write
24	UNSIGNED LONG	4	Act Consumption (4 byte value type)	Write “0” to clear value	Read / Write
26	UNSIGNED INT	2	Gas Type	0: Air (**Default**) 1 Oxygen (O2) 2: Nitrogen (N2) 3: Hydrogen (H2) 4: Carbon Monoxide (CO) 5: Carbon Dioxide (CO2) 6: Sulfur Hexafluoride (SF6) 7: Argon (Ar) 8: Helium (He) 9: Nitrous Oxide (N2O) 10: Methane (CH4) 11: Ethan (C2H6) 12: Propane (C3H8) 13: Butane (C4H19)	Read / Write
27	UNSIGNED INT	2	Flow Unit	0: m^3/h (Nm^3/h) 1: m^3/min (Nm^3/min) (**default**) 2: m^3/s (Nm^3/s) 3: l/min (Nl/min) 4: l/s (Nl/s)	Read / Write

Holding Register	Data Type	Byte Length	Description	Comments	Read / Write
				5: cfm (Ncfm) 6: kg/h 7: kg/min 8: kg/s	
28	UNSIGNED INT	2	Velocity Unit	0: m/s (Nm/s) (**Default**) 1: ft/s (Nft/s)	Read / Write
29	UNSIGNED INT	2	Consumption Unit	0: m^3 (Nm^3) (**default**) 1: ft^3 (Nft^3) 2: kg	Read / Write
30	UNSIGNED INT	2	Temperature Unit	0: °C (**default**) 1: °F	Read / Write
31	UNSIGNED INT	2	Pressure Unit	0: Pa 1: hPa 2: kPa (**Default**) 3: MPa 4: mbar 5: bar 6: PSI	Read / Write
32	FLOAT L	4	Pipe Inner Diameter	Measured in millimeters	Read / Write
34	FLOAT L	4	Normal Temperature	Measured in °C **Default** = 20°C	Read / Write
36	FLOAT L	4	Normal Pressure	Measured in kPa **Default** = 100kPa	Read / Write
38	UNSIGNED INT	2	Filter Grade	1 to 255 **Default** = 5	Read / Write
39	FLOAT L	4	Flow Factor	Value must be > 0 **Default = 1**	Read / Write
Flow factor is used to compensate the flow value. Flow shown on Sensor's Display = Measured Flow x Flow Factor Example: Measured flow = 50 Nm^3/min. Flow Factor = 0.8. Then the flow shown on the sensor's display = 50 x 0.8 = 40 Nm^3/min					
41	FLOAT L	4	Atmosphere Pressure	Used to compensate gauge pressure	Read / Write

Holding Register	Data Type	Byte Length	Description	Comments	Read / Write
				Default 100 kPa	
43	UNSIGNED INT	2	Anti condensation	0: OFF 1: ON (**Default**)	Read / Write
56	DOUBLE_L	8	Reverse Direction Nor. Consumption	Write “0” to clear value	Read / Write
60	DOUBLE_L	8	Reverse Direction Act. Consumption	Write “0” to clear value	Read / Write
64	UNSIGNED LONG	4	Reverse Direction Nor. Consumption (4 byte value type)	Write “0” to clear value	Read / Write
66	UNSIGNED LONG	4	Reverse Direction Act. Consumption (4 byte value type)	Write “0” to clear value	Read / Write
70	FLOAT L	2	Velocity Cutoff	Value must be > 0 **Default** = 0.1 m/s	Read / Write
101	UNSIGNED INT	2	Software Version		Read
102	UNSIGNED INT	2	Hardware Version		Read
103	DOUBLE L	8	Serial Number		Read
Modbus Communication					
Note: The Modbus Communication settings will take effect after writing a “1” to the holding register address 50. Then the Modbus master must change communication settings accordingly in order to communicate with the slave.					
50	UNSIGNED INT	2	Restart device Write “1” to restart device		Write
51	UNSIGNED INT	2	Device address	1-247 **Default** = 1	Read / Write
52	UNSIGNED INT	2	Baud Rate (bps)	12 = 1200 bps 24 = 2400 bps 48 = 4800 bps 96 = 9600 bps (**default**)	Read / Write

Holding Register	Data Type	Byte Length	Description	Comments	Read / Write
				144 = 14400 bps 192 = 19200 bps 384 = 38400 bps 560 = 56000 bps 576 = 57600 bps 1152 = 115200 bps	
53	UNSIGNED INT	2	Parity	0 = None (**default**) 1 = Odd 2 = Even	Read / Write
54	UNSIGNED INT	2	Stop Bit	1 = 1 bit (**default**) 2 = 2 bit	Read / Write
55	UNSIGNED INT	2	Response Time Out	0 – 255 ms 1ms/step **Default** = 0m/s	Read / Write
Coil Register Table					
0	UNSIGNED INT	2	Restart Modbus Communication	Read: Always 0 Write: 0x0000 = Do Nothing Write: 0xff00 = Restart	Read / Write

Trouble Shooting

FAQ

Why is the flow meter head warm / hot?

During normal operation, the Pitot Tube Flow Meter head will be warm (approximately 65°C inside the flow meter head). This is normal and is the tube cleaning system / purge system working.

If you are using the Pitot Tube Flow Meter in dry gas (ie, after a dryer), you can turn the warming function off via the 'Advanced Settings' menu.

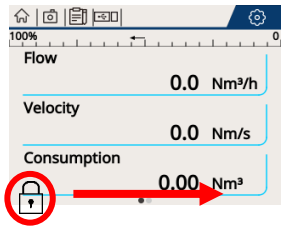
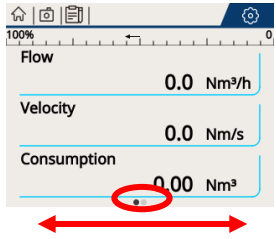
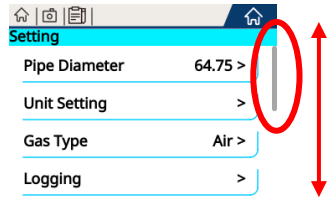
Why is the flow meter head clicking?

These clicks are normal and are the tube cleaning system / purge system working. You can't turn off the purge system / clicking noise.

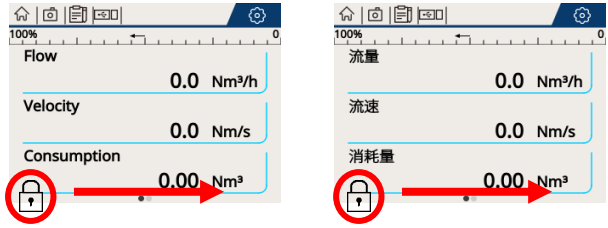
Trouble Shooting

Problem	Possible Causes	Suggested Action
The flow meter head is warm / hot	This is normal operation. During normal operation, the Pitot Tube Flow Meter head will be warm (approximately 65°C inside the flow meter head). This is normal and is the tube cleaning system / purge system working.	
There is a clicking noise coming from the flow meter	These clicks are normal and are the tube cleaning system / purge system working. You can't turn off the purge system / clicking noise.	
Readings are different than expected	Flow meter installed incorrectly	Check installation • Is the flow meter at 90° to pipe • Is flow meter upside down? • Is flow meter too close to bends, obstructions, etc?

Problem	Possible Causes	Suggested Action
		• Is the sensor tip in the centre of the pipe? • Do the arrows on the flow meter head match the direction of gas flow?
	Flow meter is wired incorrectly	Check Wiring Check wire colours match pins
	Flow meter not configured for system	Check / update the following settings: • Inner Pipe diameter (not outer diameter) • Unit of Measurement • Gas Type • Communication settings (RS485 or Analog)
	Gas is off	Turn gas on Open isolation valves
	Communication settings incorrect	Check and update 4-20mA and/or Modbus RS485 settings
	Normalization data has changed	Reset normalisation to factory default: • Flow Unit Prefix = Normal • Temperature = 20°C • Pressure = 100 kPa.
	Flow meter is due for calibration	Calibrate sensor. CAA Sensors can help with calibration
	Incorrect flow meter for your system	Check that the sensor's specifications are suitable for your system.
The touch screen isn't working	You are using hard objects to operate the display, eg fingernails, pens	Use the fleshy part of your finger to touch the screen. The touch

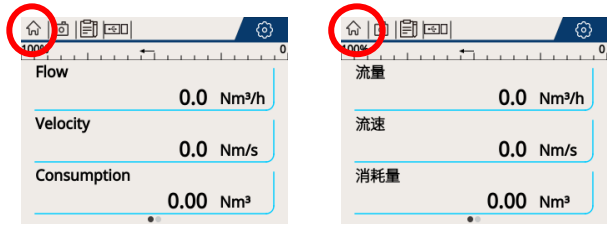
Problem	Possible Causes	Suggested Action
		screen does not work if you use fingernails or pens.
	Screen is locked	The screen automatically locks when not in use. To unlock the screen, slide the lock symbol ( ) to the right. 
I can't access the CAA App	Trying to use App on iPhone	The CAA App only works on Android phones.
	Update needed	Contact your local distributor or CAA to get the latest version of the CAA App
I can't see all menu items	On some menus, you will need to scroll up and down (or left and right) to see all items.  	
The screen is in the wrong language	**Step 1 – Unlock Screen** Slide the lock symbol ( ) to the right.	

Problem	Possible Causes	Suggested Action



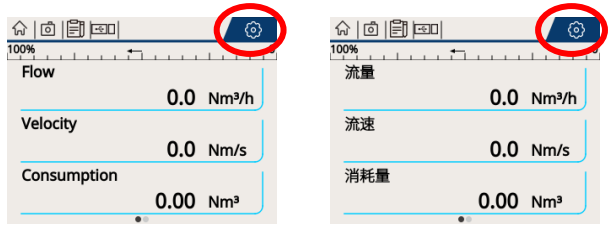
Step 2 – Go to the home page.

Click on the Menu icon on the top left of the screen, then click on the home icon. If you are already on the home page, you can skip this step.



Step 3 – Go to Settings

Click on the Settings icon on the top right of the home page.



Step 4 – Go to System Setting

Problem	Possible Causes	Suggested Action

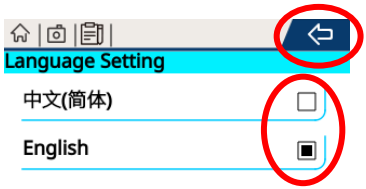
Scroll to the bottom of the settings screen. Press the “System Setting” menu – **2nd menu from bottom**

Step 5 – Go to Language Setting

Scroll to the top of the System Settings screen. Press the “Language Setting” menu – **2nd menu from top**

Step 6 – Select desired language

Select the desired language. Press the arrow button to save your selection and return to the previous screen



Default / Factory Settings

To reset the flow meter to factory settings or default settings, you will need to manually adjust the following settings:

Setting	Default Value / comments
Settings	
Pipe Diameter	64.75
Unit Setting	Flow Unit = Nm^3/min Velocity Unit = Nm/sec Consumption Unit = Nm^3 Pressure Unit = Bar Temperature Unit = °C
Gas Type	Air
Normalisation	Flow Unit Prefix = Normal Default Temperature = 20°C Default Pressure = 100kPA
RS485 Setting	Baud Rate = 9600 Parity = None Stop Bits = 1 Response Delay = 0 Device Address = 1
Analog Setting	4-20mA Channel = Nor Velocity 4-20mA Scaling = 0 – 300 Pulse Out Mode = 1 Cubic Meter/Pulse = 5
Pressure Calibration	Only perform this function if advised
System Settings	Screen Setting > Screen Timeout = 60s

Warranty

CAA Sensors provides a 12-month warranty for all sensors. The warranty covers materials and workmanship under the stated operating conditions from the date of delivery. Please report any findings immediately and within the warranty time.

If faults occur during the warranty period CAA Sensors will repair or replace the defective unit, without charge for repair labour and material costs but there is a charge for other services such as labour to remove or reinstall the instrument, transport and packing. Warranty repairs do not extend the period of warranty.

The following damage is excluded from this warranty:

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

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

- The user opens the measurement instrument without a direct request written in this manual.
- Repairs or modifications are undertaken by third parties or unauthorised persons.
- The serial number has been changed, damaged or removed.

Other claims, especially damage occurring on the outside of the instrument (e.g. dents, marks), are not included unless responsibility is legally binding.

Calibration

The sensor is calibrated before delivery. The calibration date is printed on the certificate which is shipped with the sensor.

Flow Meters require calibration to remain accurate. The frequency of calibration depends greatly on the level of contamination within your system.

We recommend you calibrate the sensor every 2 years (provided the sensor is not exposed to relative humidity above 80%). Calibration is excluded from the product warranty.

For more information, contact CAA Sensors:

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- WhatsApp: +61 494095632
- E-mail: sales@caasensors.com

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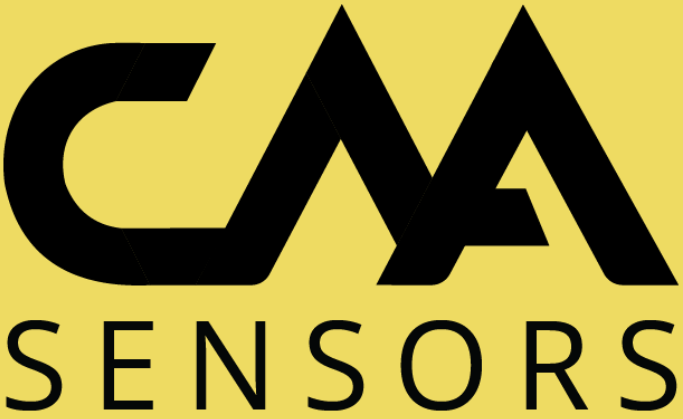

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