SENSORS

User Manual

Flow Meter – Thermal Mass (Inline)

Model: FLF

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Notices and Warnings

Notices

Please **read this manual** in full and carefully observe the notes and instructions before and during installation, operation and maintenance. 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 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.

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 authorised qualified personnel.

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, eg air, oxygen, nitrogen, carbon dioxide
- Sensor is used in clean, dry gas
- Gas flow rate is between: 0.1 to 250 Nm/s (0.3 to 820 ft/sec)
- Gas pressure is between: 0 to 16 bar (232 psi) or 0 to 40 bar (580 psi), depending on which model you purchased
- Gas temperature is between -40°C to +150°C (-40°F to +302°F)
- Power supply is between: 18 to 30 vDC
- The flow meter is not used in explosive areas.

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

The thermal mass flow meter measures standard flow, mass flow, consumption and temperature.

Thermal Mass Flow Meters

Thermal Mass flow sensors are perfectly suited for measuring clean, dry compressed air and inert gases, where accuracy on smaller pipe sizing is important. The streamlined sensor tip is designed to ensure minimal impact on gas flow while maintaining accuracy over a wide flow range.

CAA Sensors thermal mass flow meter measures standard flow, mass flow, consumption and temperature. It has full digital signal processing instead of traditional analog bridge design, making the flow meter more accurate and able to measure across a wider range.

Thermal mass flow meters are widely used in industrial processes, chemical, petrochemical, power engineering, etc. They are suitable for temporary or permanent installations.

Our thermal mass flow meters are available as insertion style or inline style.

- **insertion type sensors** which are easy to install under pressure through a 1/2" ball valve.
- **inline type sensors** are more suited to permanent installations or where shutting down the system to calibrate the sensor is not an issue.

Specifications

	Thermal Mass Flow Meter - Inline	
Technology	Thermal mass, Inline design	
Application	Manufacturing and Industry	
Gas	Air, Argon, Carbon Dioxide, Helium, Hydrogen, Natural Gas, Nitrogen, Nitrous Oxide, Oxygen	
Gas Quality	Clean and dry gas	
Accuracy	±(1.5% reading + 0.3% 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	0.1 to 250 Nm/sec	0.3 to 820 ft/sec
Pressure Measurement	0 to 16 bar (232 psi) or 0 to 40 bar (580 psi)	
Gas Temperature Measurement	-40°C to +150°C	-40°F to +302°F
	Outputs	
Output	Analog: 4 to 20mA / Pulse output Digital: RS485 Modbus / RTU	
Output Signals	Flow, mass flow, consumption and temperature	
	Power	
Power Supply	18 to 30VDC / 5W@24V	
Electrical Connection	2 x 5 pin M12, female	
EMC	According to IEC 61326-1	
	Display & Data Logger	
Display	2.8” LCD with touch panel	
Data Logger	10,000,000 samples	

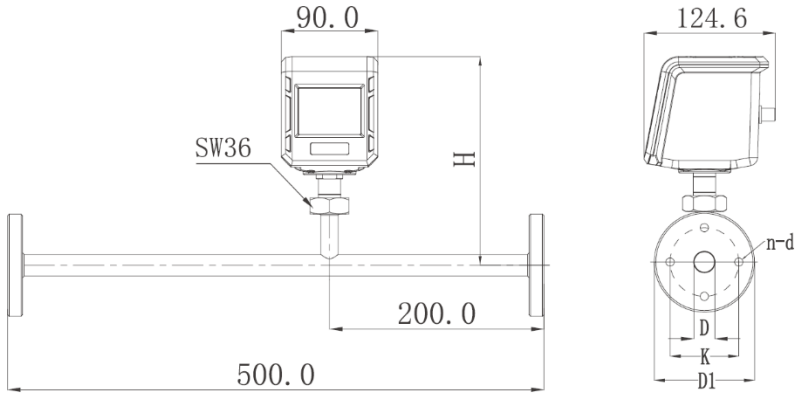
	Thermal Mass Flow Meter - Inline	
Sampling Rate	> 20 samples / second	
	Other Information	
Bi-directional	No	
Pipe Size	R-Thread: DN15 to DN50 | 0.5" to 2.0" Flange: DN15 to DN80 | 0.5" to 3.0"	
Process Connection	R thread (ISO-7-1) or Flange (ISO 7005 (DIN), PN16 and PN40)	
Ambient Temperature	-30°C to +70°C	-22°F to +172°F
Installation Type	Permanent or temporary installation	
Calibration Frequency	Every 2 years *provided the sensor is not exposed to relative humidity above 85%*	
Warranty Period	12 Months	
Reference Conditions	20°C, 1bar(a), ISO1217 (Programmable)	

Flow Range

Pipe Size		Flow Range (Nm3/h)		Flow Range (cfm)	
DN	ID (inches)	Min Flow	Max Flow	Min Flow	Max Flow
15	1/2"	0.06	158	0.04	93
20	3/4"	0.1	282	0.06	166
25	1"	0.2	441	0.12	259
32	1.25"	0.3	723	0.18	425
40	1.5	0.5	1,131	0.29	665
50	2"	0.7	1,767	0.41	1,040
65	2.5"	1.2	2,986	0.71	1,757
80	3"	1.8	4,523	1.06	2,662

Flange Details - ISO 7005 (DIN), PN16 and PN40

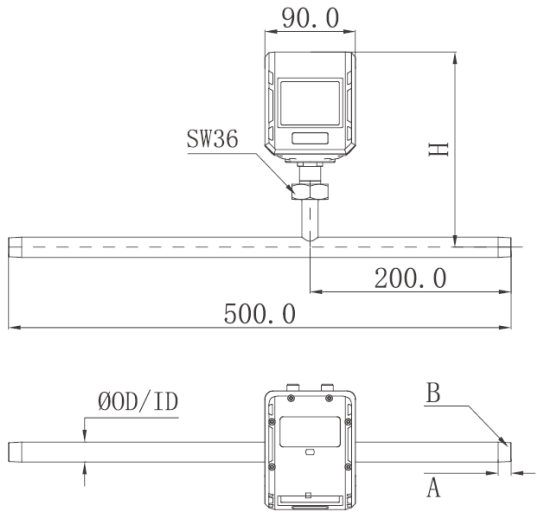
Dimensions in mm



Pipe Size		Dimensions (mm)						
DN	Inches	D Inner pipe diameter	D1 Flange outer diameter	K Screw hole, centre distance	H From pipe centre to top of case	N Number of bolt holes	D Bolt hole diameter	Bolt Size
15	1/2"	15	95	65	177	4	14	M12
20	3/4"	20	105	75	176	4	14	M12
25	1”	25	115	85	175	4	14	M14
32	1.25”	32	140	100	177	4	18	M16
40	1.5”	40	150	110	177	4	18	M16
50	2”	50	165	125	177	4	18	M16
65	2.5”	65	185	145	177	4 (PN16) 8 (PN40)	18	M16
80	3”	80	200	160	177	8	18	M16

R-Thread Details - ISO ISO-7-1

Dimensions in mm



Pipe Size		Dimensions (mm)		
DN	Inches	A Thread Length	B External Thread	H From pipe center to top of case
15	1/2"	≥13.2	R1/2”	177
20	3/4"	≥14.5	R3/4”	176
25	1”	≥16.8	R1”	175
32	1.25”	≥19.1	R1.25”	177
40	1.5”	≥19.1	R1.5”	177
50	2”	≥23.4	R2”	177

Flow Meter Pack

Each flow meter pack comes with:

- ✓ 1 x Thermal Mass Flow Meter – Inline style, configured for your gas type, pipe connection type (R Thread or Flange) and pressure range

Inline style Flow Meter
R Thread connection

OR

Inline style Flow Meter
Flange connection

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 dustrubutor for more information.

Installation

Installation Overview

Mechanical Installation

Step 1 – Find a suitable section of pipe

- The sensor must be installed vertically or horizontally, in clean, dry gas
- The sensor must be installed away from bends, edges, seams, changes in pipe size and other obstructions
- Do NOT install the sensor in wet gas

Step 2 – Cut pipe to suit flow meter pipe section and install pipe unions or flanges

Step 3 – Fit flow meter

Electrical Installation

Step 4 – Wire the sensor for 24vDC power and communication

Sensor Configuration

Step 5 – Set sensor settings:

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

Step 6 (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

Thread Tape / Sealant

Installation – Mechanical

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

Notes

- **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.
- The flow meter is **not** bidirectional. When installing and using the flow meter, please pay attention to the direction of gas flow and the alignment of the sensor. The direction is indicated on the housing.
- Avoid condensation on the sensor element as this will affect the accuracy enormously.
- 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.
- This product must be installed properly and calibrated regularly, otherwise it may lead to inaccurate measurements.

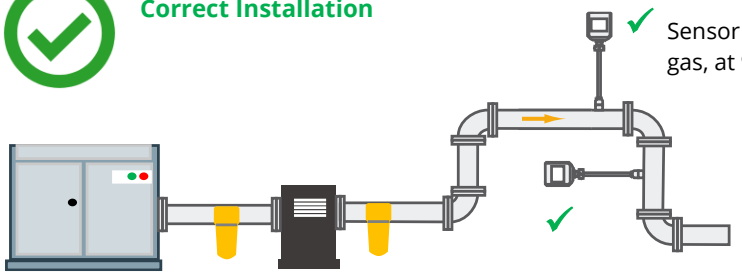
Step 1 – Find a suitable section of pipe

The sensor **must** be installed:

- ✓ Vertically or horizontally,
- ✓ away from bends, edges, seams, changes in pipe size and other obstructions,
- ✓ in dry gas (gas humidity should be less than 80% relative humidity (RH)).
- ✓ in clean gas (the sensor should be installed after filters and dryers)

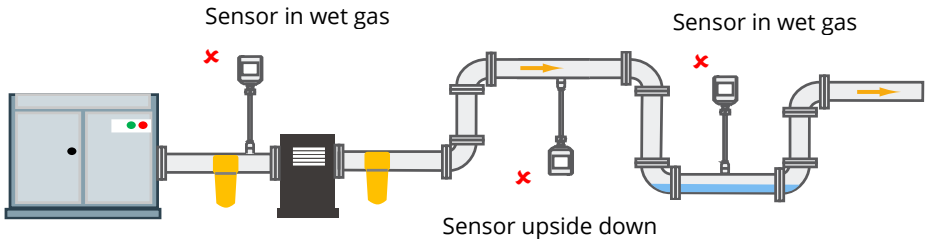
Make sure the insertion location has enough room around the pipe to install the sensor.

Correct Installation



Incorrect Installation

Do **NOT** install the sensor before a dryer or in gases with a relative humidity above 80%.
Do **NOT** install the sensor upside down.



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 (eg 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.

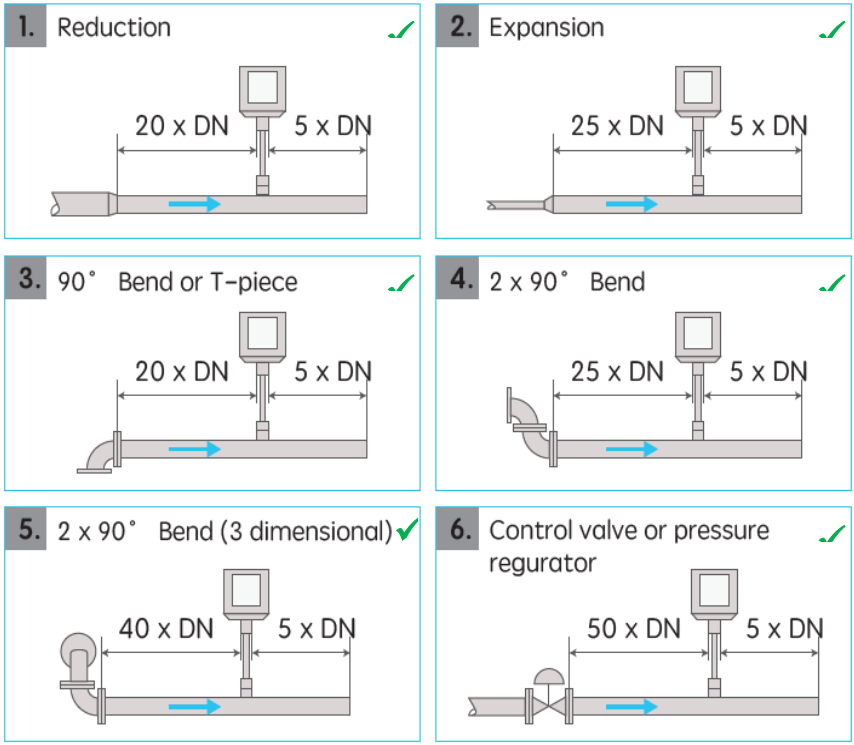
Notes

- Pay attention to the distance between the sensor's inlet and outlet sections and points of turbulence (eg bends, valves, etc).
- Make sure that the insertion location has enough straight pipe on either side of the sensor, as shown in the diagrams on the next page.
- 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.
- Do not increase or decrease the pipe diameter immediately before or after the flow meter pipe section.

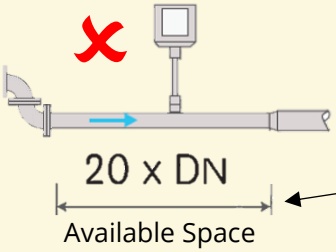
Correct Installation

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

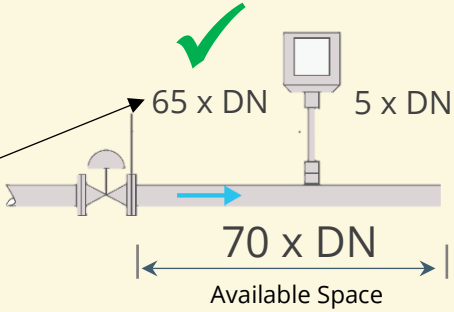


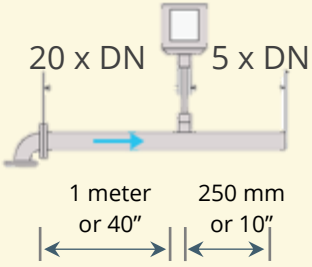
Examples



- 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 **not** be installed in this location

- 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 (i.e., 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

Step 2 - Cut pipe and install pipe unions

This step will depend on the pipe material and available fittings. Match the thread of the pipe to the flow meter and install pipe unions on both ends.

Do **not** increase or decrease the pipe diameter immediately before or after the flow meter pipe section.

Step 3 – Fit Flow meter

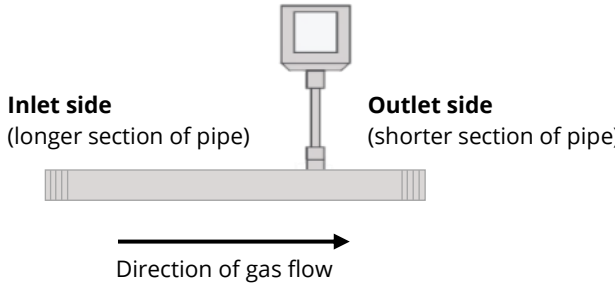
The flow meter is **not** bidirectional. When installing and using the flow meter, please pay attention to the direction of air flow and the alignment of the sensor.

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

Direction of gas flow

Correct Installation

The sensor is aligned in the same direction as 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 personnel.

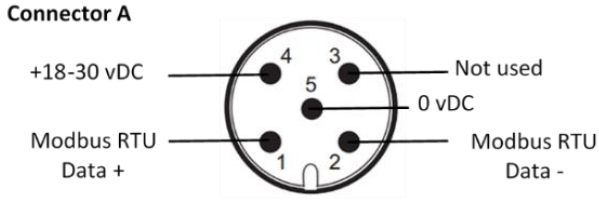
Step 4 – Wire the sensor for power and communication

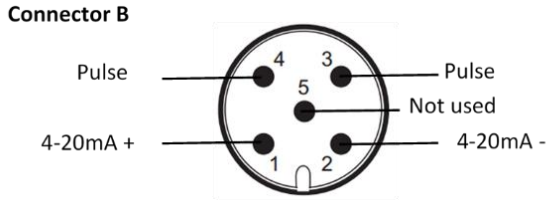
The flow sensor has two x 5 pin M12 connector plugs - “A” and “B”. Cables are connected to the sensor through the M12 connector plugs.

- 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





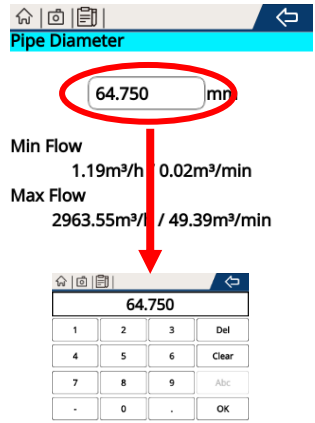
Configuring the Flow Meter

Step 5 - Set sensor settings

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

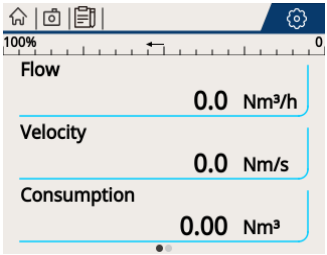
WARNING! Make sure the sensor is installed and wired correctly before powering up the sensor. Only use 24vDC to power the sensor.

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.

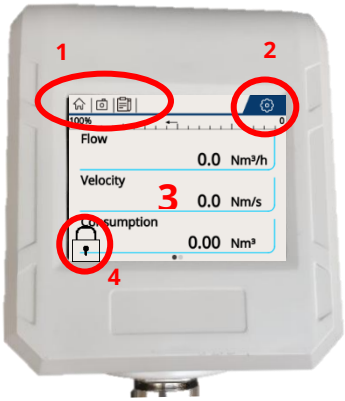
On powering up:

- The CAA Sensors logo will appear on the screen.
- After a few seconds, you will see flow meter home screen. The flow meter is now ready to configure (see next page).



Flow Meter home screen. The sensor is ready to configure

Using the Display



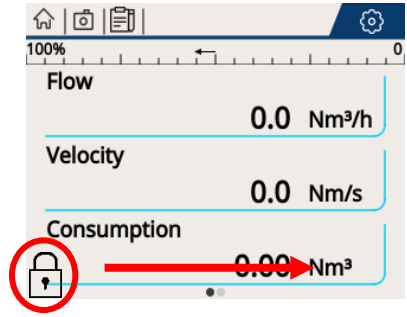
The flow meter has a touch screen interface.

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

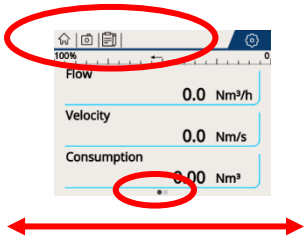


The screen is set to automatically lock after 60 seconds.

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



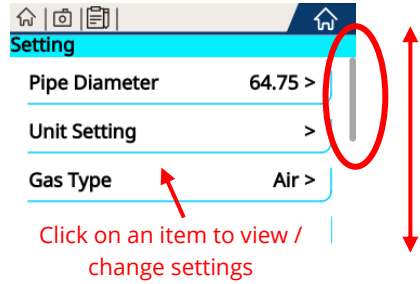
Scroll left or right to see other screens

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 ( ) > System Setting.
- ✓ The **Notepad** icon ( ) to access the Data Logging information
- ✓ If you have a USB drive 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 change / set up:

- ✓ Pipe diameter
- ✓ Units of measurement
- ✓ Gas type
- ✓ Data logging
- ✓ RS485 settings
- ✓ Analog output
- ✓ Screen shots
- ✓ Normalisation and
- ✓ System settings.

Menu Options

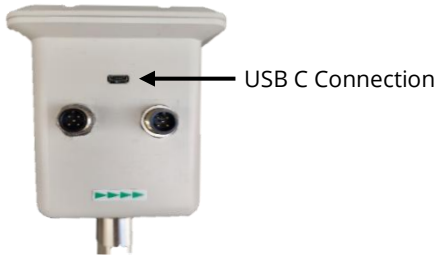
Menu	Sub Menus	Options / Comments		
Pipe Diameter	-	Set inner pipe diameter. **This must be set when you install the flow meter** Pipe diameter refers to inner Pipe diameter. **Not** the outer diameter		
Unit Settings	Flow Unit	m^3/h m^3/min m^3/s	l/min l/s cfm	Kg/h Kg/min Kg/s
	Velocity Unit	m/s	ft/s	
	Consumption Unit	m^3	ft^3	kg
	Temperature Unit	°C	°F	
Gas Type	-	Air Argon (Ar) Carbon dioxide (CO2) Helium (He) Hydrogen (H2)	Natural Gas Nitrogen (N2) Nitrous oxide (N2O) Oxygen (O2)	
	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		
	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	

Menu	Sub Menus	Options / Comments	
		9600 14400 19200 38400 56000 57600 115200	
	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	250.00 Nm/s
	Cubic Meter / Pulse	$1m^3$/Pulse $5m^3$/Pulse $10m^3$/Pulse	$1m^3$/Pulse
Screen Shot		View and download screenshots	
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.	

Menu	Sub Menus	Options / Comments
		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. 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

Menu	Sub Menus	Options / Comments
		• 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 • Consumption • 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. • Velocity Filter Grade • Change Password

Data Logging



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

Alternatively, you can connect the flow meter to CAA Sensors GEMS 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.

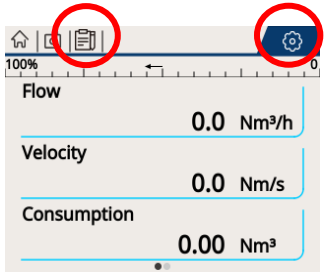
If the flow meter losses power, will the data logger restart automatically?

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?

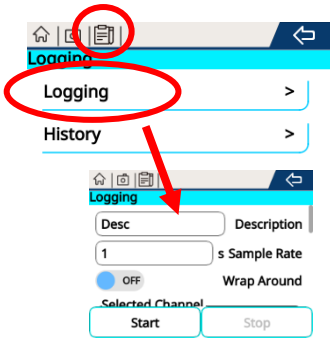
To set up data logging, view data logging history and start or stop data logging go to the "**Logging**" menu. You can access the data logging menu via:

- ✓ 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 drive, 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 record
- 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 drive into the back of the flow sensor
- Press Export
- Press the arrow ( ) to save settings and return to the previous screen

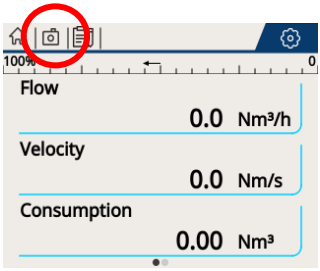
Delete Data

To delete historical data records

- Press the History option.
- Select the data to delete and click delete

Screen Shot

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



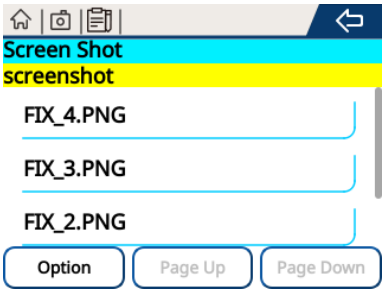
To access the screen shots, go to the **Settings Menu ( ) > Screen Shots**.

Here you can:

- ✓ View the picture
- ✓ Export the picture to a micro 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 Micro 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
4	DOUBLE L	8	Standard Consumption	Write “0” to clear value	Read / Write

Holding Register	Data Type	Byte Length	Description	Comments	Read / Write
8	FLOAT L	4	Temperature		Read
22	UNSIGNED LONG	4	Standard 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) 5: cfm (Ncfm) 6: kg/h 7: kg/min 8: kg/s	Read / Write
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

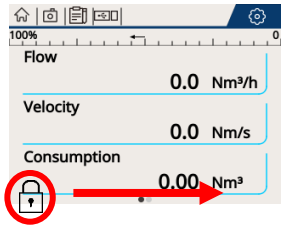
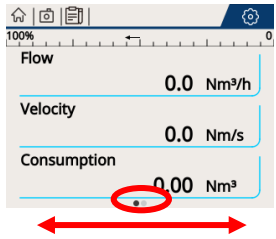
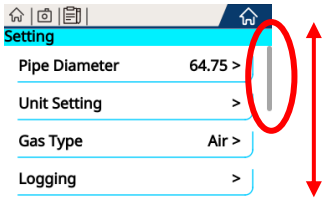
Holding Register	Data Type	Byte Length	Description	Comments	Read / Write
32	FLOAT L	4	Pipe Inner Diameter	Measured in millimeters	Read / Write
34	FLOAT L	4	Normal Temperature	Measured in °C **Default** = 20°C	Read / Write
36	FLOAT L	4	Normal Pressure	Measured in kPa **Default** = 100kPa	Read / Write
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					
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	Read / Write

Holding Register	Data Type	Byte Length	Description	Comments	Read / Write
				48 = 4800 bps 96 = 9600 bps (**default**) 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

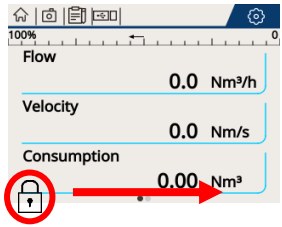
Trouble Shooting

Trouble Shooting

Problem	Possible Causes	Suggested Action
Readings are different than expected	Flow meter installed incorrectly, eg upside down, too close to bends	Check installation • Is flow meter upside down? • Is flow meter too close to bends, obstructions, etc? • 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
	Normalization data has changed	Reset normalisation to factory default: • 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.

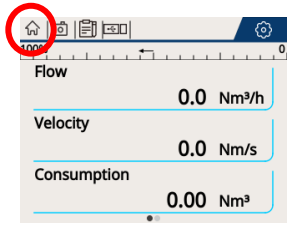
Problem	Possible Causes	Suggested Action
The touch screen isn't working	You are using hard objects to operate the display, eg fingernails, pens	Use the fleshy part of your finger to touch the screen. The touch screen does not work if you use fingernails or pens.
	Screen is locked	The screen automatically locks when not in use. To unlock the screen, slide the lock symbol ( ) to the right. 
I can't see all menu items	On some menus, you will need to scroll up and down (or left and right) to see all items.  	
I can't access the CAA Sensors App	Trying to use App on iPhone	The CAA Sensors App only works on Android phones.
	Update needed	Contact your local distributor or CAA Sensors to get the latest version of the CAA Sensors App

Problem	Possible Causes	Suggested Action
The screen is in the wrong language		**Step 1 – Unlock Screen** Slide the lock symbol ( ) to the right.



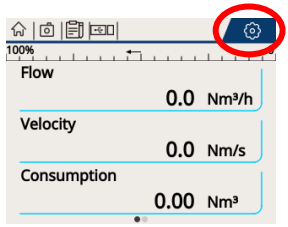
Step 2 – Go to the home page.

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.



Problem	Possible Causes	Suggested Action

Step 4 – Go to System Setting

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

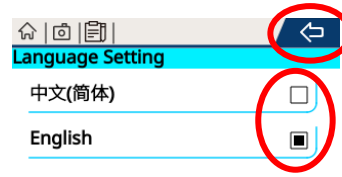
Step 5 – Go to Language Setting

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/s
	Consumption Unit	Nm^3
	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	Velocity
	4-20mA Scaling – Low	0
	4-20mA Scaling – High	250
	Cubic Meter/Pulse	5
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 (eg 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:

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

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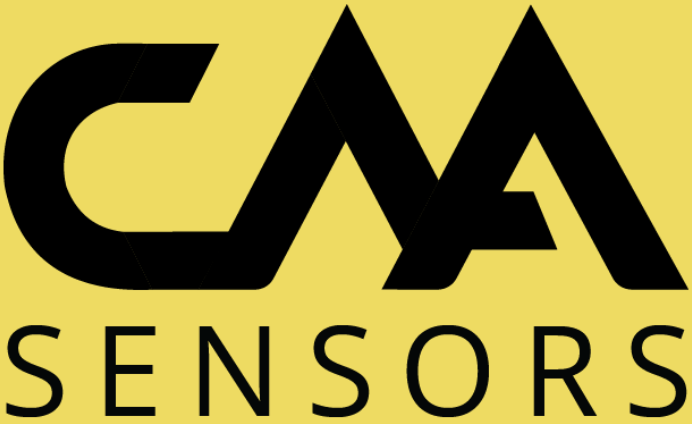

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