V-SENSOR  AIR PRESSURE  AIR VOLUME

- Ultra low pressure and volume measurement
- Traceable Calibration Certificate is included
- High accuracy and repeatability
- Linear pressure or air volume output
- Both measurement and PID control output
- Two modbus for monitoring and remote display
- One alarm relay, buzzer and LED indicators
- Auto Zero and overload protection is standard
- Operator keyboard display for all functions
- Two Modbus rtu, 0..10V and 4..20mA outputs
- IP65 enclosure with easy mount wall bracket
- 24 month warranty
- 30 Years field application experience

GENERAL
The V-Sensor is a wall mount ultra low pressure transmitter which provides 0..10V and 4..20mA as well as Modbus communication over the selected range. The display can be adjusted via the keyboard to show the measured value in Pa, hPa, kPa, m/s, l/s, m3/s, m3/h and ACR (air change rate).

A PID control output can be selected, but still having one output for monitoring the pressure or volume.

The pressure ranges can be adjusted via the keyboard, but the base range is factory calibrated and certified i.e. 10, 25, 50, 100, 250 and going up to 7500 Pa. All ranges can be adjusted to +/- ie. +/-25Pa.

Power supply 24Vdc/ac non-isolated or 24, 110 and 230Vac isolated are available as standard.

CMR TRANSDUCER
The transducer is manufactured by CMR with high precision engineered components. The principle is the measurement of the displacement of the diaphragm by means of a push and pull variable reluctance circuit which is not affected by humidity and hence it can be used in any industrial or commercial environment. There are no mechanical connections to any of the sensing coils and the diaphragm.

Extremely low pressures can be measured with excellent repeatability and minimal hysteresis. The diaphragm displacement is so small that no air volume is required to measure the air pressure which means measurement tubing can be connected in excess of 200m throughout the building without losing accuracy or measurement speed.

The zero drift is minimized by the measuring copper coils which are matched to provide excellent self compensation. One coil measures positive and the other negative drift and therefore balances any excessive drift between two tolerance limits in its life cycle. The CMR Transducer has a proven field track record of over 30 years. All CMR Sensors are temperature compensated in a computerised climate chamber.

CMR Climate Chamber

CMR Transducer

KEYBOARD DISPLAY
A combined keyboard and LED Display is fitted into the lid and is connected to the V-Sensor board with a plug-in ribbon cable. All parameters can be accessed via the key pad. The display can also be programmed to switch off after a time and by touching a key to light up again. Normally it is always on.

PARAMETER CONFIGURATION
The duct width and height can be entered as well as the density and (mf) magnification (K) factors to scale Fan Inlet Rings, Flowgrids, Veloprobos, Oval Flowprobes, Venturis or any other velocity pressure producing probes. The volume can be linearized over 8 points to provide extremely high accuracy in measurement.

The range can be changed from -10 Pa to 30 Pa or -20 to 120 Pa.

The output signals can be changed to i.e. 2..10V, 1..5V or 5..19mA.

One of the outputs can be configured to be a PID control to drive fan inverters or modulating dampers and the other can be used for the actual pressure or air volume measurement for the BMS or PLC system. The set point can be sent from the BMS via modbus.

The signals can be individually smoothed. The control output can be fast but the measurement output can be dampened.

A calibration mode can be selected so that all of the parameters remain the same as commissioned and only the base sensor shall be calibrated and displayed in Pa.

MODBUS rtu COMMUNICATION
The modbus communication can be used to read and write all parameters by the remote Host which can be the BMS, PLC or PC.

REMOTE ALARM DISPLAY
A remote display DIS110 without alarm or DIS125 with alarm and mute button can be connected via Modbus if the modbus is not used for the BMS. The alarm button has green and red Led light rings to show healthy or alarm status. A buzzer is also fitted. A separate power supply can be wired to the display.

Remote Display Plate
The above schematic shows a typical clean room. The room pressures are measured in cascades starting in Room 3 from a reference such as a plant room or any other stable location, then measuring across to room 2 and finally across to Room 1.

Each room has an air probe plate fitted to the ceiling. The air probes are connected to the V-Sensors with red and blue CMR PVC Tubing.

The CMR PVC tubing can be run up to 200m from the room to the P-Sensor without losing accuracy of the measurement.

Remote LED display plates are fitted for the operators to see the actual room pressure in Room 1 and 2. Room 2 has also a local illuminated alarm green and red led built as ring into the mute button and a buzzer. Room 3 has only a modbus alarm led indicator plate.

The V-Sensor is a true Low Differential Air Pressure Transmitter and can be used for static pressure, vacuum pressure and differential pressure measurements in positive or negative areas.

The operator keyboard with LED display is fitted into the lid as standard and shall display the actual pressure. All parameters can be adjusted without opening the lid.

The Pressure measurement can be transmitted via modbus rtu or analogue signals 0..10V or 4..20mA to the SCADA, BMS or industrial PLC systems for long term monitoring.

All future calibration can be done using the calibration mode. Calibration Certificates traceable to National and International Standards (UKAS) are supplied as standard with all V-Sensors.
The CMR V-Sensor is an ultra low high precision Velocity Pressure Transmitter which has been designed to accurately measure air volumes in Ventilation Ducts. The built in Square Root Extraction and Magnification Factor Scaling makes the V-Sensor an extremely versatile measurement instrument.

It can display the actual volume in m³/s. Other Units such as m³/h, litres/s or ACR (Air change rate) can be selected via the keyboard. Any imperial measurement units i.e. CFM are available on request.

The CMR PVC tubing can be run up to 200m from the sensing station to the V-Sensor without losing the accuracy of the measurement.

Calibration Certificates traceable to National and International Standards (UKAS) are supplied with all V-Sensors.

TYPICAL CMR AIR VOLUME MEASUREMENT APPLICATIONS
**V-SENSOR VELOPROBE MEASUREMENT**

**GENERAL**
The drawing shows a typical application for CMR Veloprobes and V-Sensors.

The supply air duct can either be fitted with one central Veloprobe or individual Veloprobes on each of its branches.

In many cases, the positions of the Veloprobes are very much dictated by the design of the building. The CMR Veloprobe can be fitted in almost any position in order to provide accurate measurements.

In a single supply and extract duct application, the V-Sensor measures the building’s actual total supply and return volumes. As both V-Sensors are calibrated to provide a linear air volume signal, tracking of supply and extract air is now made easy.

The duct height, width or diameter, density and magnification (‘K’ factors) can be entered in the V-Sensor via the keyboard very easily and only the measurement range for 0..10V or 4..20mA must be given to the BMS at final commissioning.

For multiple duct applications, the total supply and extract air volume is derived by adding all air volumes from the individual ducts.

---

**Example of Volume adding:**

\[ S = E \pm \text{an offset for positive or negative building pressure} \]

\[ S1 + S2 + S3 = E1 + E2 \pm \text{offset} \quad \text{or} \quad S = E1 + E2 \pm \text{offset} \]

---

**V-Sensor air volume measurement with Veloprobes in Duct**
V-SENSOR KEYBOARD FUNCTIONS

FUNCTIONS  (Use Operator Manual for full Instructions)
The V-Sensor LED-Keyboard has been designed to simplify installation and commissioning. The only time the lid must be opened is for wiring during installation. Thereafter every control function can be accessed via the keyboard, even the calibration can be carried out utilising this functionality.

ZERO KEY
When pressing the zero key for 1 seconds, the V-Sensor shall perform a zero which means the pressure is taken off the sensor internally and the diaphragm is relaxed to zero.

PASSWORD
The keyboard can be password protected so that only the display can be operated, but no adjustments can be made.

RANGE KEY
Pressing the range key very quickly once will display the sensor range i.e. if it shows 100, this means the range of the sensor has been configured to 0-100Pa for 10V/20mA output. By pressing the range key for 1 seconds it enters the configuration menu:

S  Software Version 1.5
Ad Network Address 1-254 (0 Denotes Modbus Display)
AZ Auto Zero on - off
P  Positive Range i.e. + 25
n  Negative Range i.e. - 25
Opp Over Pressure 1(on) 0(off)
F  Zero Offset
Z  Set Point
Sn  Modbus smoothing d or o
Adj Internal/External I or E
Azt Auto Zero time interval 1-99 h
FF  Modbus float format 0-3

OUTPUT KEY
Pressing the output key very quickly once will display the sensor output configuration i.e. lin or root, which means the sensor measures pressure or airflow. By pressing the output key for 1 seconds the configuration menu can be reached:

So  Output Smoothing 0-99
Lin Output mode linear pressure
root Output mode square root
e  Output scaling F, L orFac
F  Mag Factor 0-99.99
Duct width 0-9999mm
I  Duct height 0-9999mm
d  Air Density Factor 0-9.999kg/m3
r  Room Size 0-9999m3
s  Small Value Shut off 0-99.99%
o  Output Re-Scaling
bFl Bi-Directional Flow 0 or 1

DISPLAY KEY
Pressing the display key very quickly once will display the measurement units. i.e. Pa, hPa, kPa etc, and is the units the sensor has been configured to i.e. Pa. By pressing the display key for 1 seconds it enters the configuration menu:

Sd  Display Smoothing 0-99
Pa  Pascal
hpa hecta Pascal
3pa kPa
nmps metres per second
lps litres per second
mn3s cubic metres per second
mn3h cubic metres per hour
acr Air Change Rate per hour
dp  Decimal Place 0-4
pos Display polarity (+)
neg Display polarity (-)
Led Display Activation 0 or t
L2b Leading Zero Blanking 1-4

ALARM KEY
Pressing the alarm key quickly shall mute the alarm as the V-Sensor has an alarm buzzer built in. By pressing the alarm key for 1 seconds it enters the configuration menu:

L  Low Alarm
H  High Alarm
t  Alarm timer 1 0-999
at  Alarm timer 2 0-999
u.  Units dU (Display Units) or Per (%)
af  Alarm Function 0-2
Sr  Self Reset 0-1
rb  Remote Buzzer -, 0, 1 or P
ra  Remote Alarm Indication -, 0, F or LH
rt  Re-alarm timer 0-999 minutes
IU  Alarm timer units s or h

UP - DOWN KEY
The up and down keys are used to select the various parameters

OUTPUT SIGNAL
0-10V and 4-20mA are also available on J7.

V-SENSOR CIRCUIT BOARD
V-SENSOR

GENERAL
CMR manufactures the V-Sensors to suit many low pressure and volume measurement applications. Because of the variety of pressure ranges, output signals and power supplies it has been necessary to design an easy to use selection table for anybody to make up a V-Sensor specification to satisfy a requirement. On the V-Sensor Selection Table you will find all specifications available with the associated ordering code.

V-SENSOR BASE PART NUMBER
The V-Sensor Part Number starts with a base part number of the type of sensor. Code '24' which is a V-Sensor in a standard ABS enclosure.
The Part Number therefore starts with '24'.

V-SENSOR ISSUE No
The V-Sensor will have a version number to identify the model. The Code is ‘1 for version 1’. The Part Number extends to '241'.

TUBE CONNECTORS
6 mm barbed nipples to fit CMR PVC Tube are fitted as standard into the ABS box. They have the Code 'A'.
4 mm barbed nipples to suit the CMR Silicone Tube are also available as Code 'B'. The example has 6 mm barbed nipples which is standard. The Part Number therefore extends to '241A'.

NEGATIVE PRESSURE RANGE
The Negative Range is specified as (-). If the application requires to measure a negative pressure against a reference, i.e. a room has to be at negative pressure compared with the corridor then the room has to be connected to the Red or (+) nipple. The blue (-) nipple shall be connected to the reference in this case the corridor.
The negative room pressure shall suck on the red (+) nipple and the V-Sensor produces an output signal equivalent of the negative pressure measured.
In the Example we have chosen -25 which has the Code '0025'. The Part Number extends to '241A0025'.
If the V-Sensor must only measure in the positive Range i.e 0-25 then the Negative Range will always be selected as 0 and the Code is always '0000'.

PRESSURE UNITS
The negative pressure and the positive pressure range must be expressed in units i.e. Pa or kPa. The CMR transducers are in Pascals (Pa) as standard.
In the example Pa was selected with Code ‘P’. The Part Number extends '241A0025P'.

POSITIVE PRESSURE RANGE
To measure Positive Pressure against a reference it is necessary to select a positive range i.e. +25. The Code is '0025'. This means the V-Sensor selected above can measure from -25 Pa to 0 Pa and from 0 to +25 Pa. The output Voltage would therefore be 5V or 12mA at 0 Pa.
The Part Number extends to '241A0025P0025'

ORDER DESCRIPTION

LABEL UNITS
As the V-Sensor has a fixed label next to the LED display, i.e. Pa, kPa, hPa, mB etc. It is necessary to specify the label when selecting the part number as this is all part of the validation of the instrument.
In the example Code 'P' for Pa was selected.
The Part Number extends to '241A0025P0025P'.

OUTPUT SIGNAL
The Industry Standards for Output Signals are 0-10V or 4-20mA, but other signals can be adjusted via the keyboard by the operator.
If 0-10V is the Output Signal for -25 Pa to +25 Pa then 5 V is 0 Pa. From 5V to 0V the V-Sensor measures from 0 Pa to -25 Pa i.e.(-)12.5 Pa would be 2.5V.
From 5V to 10V the V-Sensor would measure positive Pressure from 0 Pa to +25 Pa i.e. +12.5 Pa would be 7.5V.
It is standard to use equal ranges -25 Pa to +25 Pa rather than -25 Pa to +50 Pa but the V-Sensor can be adjusted via the keyboard to provide this off-set.
In the Example, we have selected Dual (0-10V & 4-20mA) which has the Code '1'. The Part Number extends to '241A0025P0025P1'.

POWER SUPPLY
CMR can supply 24Vdc/24Vac Non-Isolated which does not have an isolation transformer, and is also suitable for 3-Wire connection. Most common is the 24Vac Isolated. 110Vac and 230Vac are less used, but also selectable. In the example we have selected 24Vac isolated which has the Code '3'. The Part Number extends to '241A0025P0025P13'.

FINAL PART NUMBER
The Part Number to order is '241A0025P0025P13'.

Now try and select your own V-Sensor using the V-Sensor Order Selection Table.
V-SENSOR ORDER SELECTION TABLE

The Selection Table has been prepared to make ordering easy. Each column contains a number of different options which are available and a Part Number can be established by you depending on a specific requirement.

The Example Part Number 241A0025P0025P13 which is printed above the Selection Table and identified as being a V-Sensor with ABS enclosure, having an LED Display and Keyboard, with an issue No 1, with 6mm barbed tube connectors, a Negative Pressure Range of -25, Range Units in Pa (Pascals) and a Positive Range of +25, labelled in Pa (Pascals) with Dual Output Signals of 0-10V & 4-20mA, which would mean in this case 0 Pa is 5V & 12mA. The Power Supply is 24Vac.

The V-Sensor would be supplied with a 5 digit LED-Keyboard / Display mounted internally into the Lid and the Measured Units are Pa (Pascals). The Decimal Point is user adjusted to 1 on the keyboard which indicates from -25.0 Pa to +25.0 Pa. It comes with a traceable Calibration Certificate to national and international Standards (UKAS).

<table>
<thead>
<tr>
<th>24</th>
<th>1</th>
<th>A</th>
<th>0025</th>
<th>P</th>
<th>0025</th>
<th>P</th>
<th>1</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>V-Sensor</td>
<td>Issue</td>
<td>Nipple</td>
<td>Size</td>
<td>Negative Range (Pa)</td>
<td>Positive Range (Pa)</td>
<td>Label</td>
<td>Output Signal</td>
<td>Power Supply</td>
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<td>Base = 24</td>
<td>Issue = 1</td>
<td>6mm = A</td>
<td>0000</td>
<td>Pa = P</td>
<td>0000</td>
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<td>Dual = 1</td>
<td>24Vdc = 2</td>
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<td>4mm = B</td>
<td>0010</td>
<td>0010</td>
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<td>24 Vac = 3</td>
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<td>0025</td>
<td>0025</td>
<td>mB = B</td>
<td>110 Vac = 4</td>
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<td>0030</td>
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<td>hPa = H</td>
<td>230 Vac = 5</td>
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<td>0050</td>
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<td>m/s = V</td>
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</tr>
</tbody>
</table>

HOW TO ORDER

EXAMPLE

A wall mount pressure transmitter is required of the Type V-Sensor
An LED complete with Keyboard is required as standard with an issue No 1.
The tube connections must be 6mm for CMR PVC Tube
The negative pressure range must be -100 Pa
The positive pressure range must be +100Pa
The measured units must be in Pascals (Pa)
The units on the LED display must be in Pa as well as on the Product label.
The output signal must be Dual (0-10V & 4-20mA)
The power supply must be 24Vdc non-isolated

Call CMR for assistance at any time

The part Number for this V-Sensor is 24 1 A 0100 P 0100 P 1 2
### V-SENSOR TECHNICAL SPECIFICATION

<table>
<thead>
<tr>
<th><strong>Measurement Range</strong></th>
<th>Any Range from 0-25Pa or /-+25Pa up to 0-7500Pa or /-+7500Pa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overload Capacity</strong></td>
<td>Ranges 25Pa - 150Pa up to max 1200Pa if over pressure protection is off. Ranges from 200Pa - 7500Pa up to max 10 times of range if over pressure protection is off.</td>
</tr>
<tr>
<td><strong>Media</strong></td>
<td>Non corrosive gases such as Air, N2, O2, Co2, N2O and inert gases</td>
</tr>
<tr>
<td><strong>Diaphragm Unit</strong></td>
<td>Beryllium Copper suitable for high concentration of Formaldehyde - Stainless Steel on request.</td>
</tr>
<tr>
<td><strong>AC Power Supplies</strong></td>
<td>24 Vac 50/60Hz 198mA. Internal Fuse 300mA Auto-Reset. 110Vac 50/60Hz 40mA. Fuse 315mA Wickmann. 230Vac 50/60Hz 20mA. Fuse 315mA Wickmann.</td>
</tr>
<tr>
<td><strong>DC Power Supplies</strong></td>
<td>24 Vdc (19 to 31Vdc) smoothed 118mA Internal Fuse 300mA Auto-Reset.</td>
</tr>
<tr>
<td><strong>Voltage Output Signal</strong></td>
<td>0-10V (0 to 100% of Range) RL = 5kOhm min. Other output signals (e.g. 2-10V) or PID loop control is programmable via the keyboard.</td>
</tr>
<tr>
<td><strong>Current Output Signal</strong></td>
<td>4-20mA (0 to 100% of Range) RL = 500 Ohm max. (0-20mA) or PID control is programmable via keyboard One Alarm changer over volt free contact is user programmable</td>
</tr>
<tr>
<td><strong>Relay Output 1A 24Vdc</strong></td>
<td>2 x Output Signal, Alarm Status, Alarm Thresholds and Alarm Timers are all readable as Modbus rtu Commands. Modbus register assignments to read and write are available in user manual.</td>
</tr>
<tr>
<td><strong>Hysteresis/Repeatability</strong></td>
<td>0.1% Typical of Full Scale.</td>
</tr>
<tr>
<td><strong>Linearity (Accuracy)</strong></td>
<td>+/- 0.25% of Full scale &gt; 100 Pa and 0.25Pa &lt; 100Pa.</td>
</tr>
<tr>
<td><strong>Zero Drift</strong></td>
<td>0.05%K (+10°C to +50°C) - Automatically corrected to 0.0 if Auto-Zero function is enabled.</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>-10°C to +70°C.</td>
</tr>
<tr>
<td><strong>Mounting Position</strong></td>
<td>Vertical.</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>0.6 kg in ABS Housing.</td>
</tr>
<tr>
<td><strong>Electrical Connections</strong></td>
<td>ABS Housing: 1 x M20 Gland and 1 x M12 Gland and internal removable Screw Terminals.</td>
</tr>
<tr>
<td><strong>Air Tube Connections</strong></td>
<td>ABS Housing: Positive and Negative Pressure Barbed Nipple 6mm OD x 15mm long for CMR PVC Tube Alternatively Barbed Nipple 4mm OD x 15mm long for silicone tube on special request.</td>
</tr>
<tr>
<td><strong>Enclosure</strong></td>
<td>Plastic (ABS) Light Grey (RAL7035) - Protection IP65. EN61326-1 EMC - EN61010-1 SAFETY.</td>
</tr>
<tr>
<td><strong>Calibration Certificate</strong></td>
<td>Supplied with Certificate traceable to national and international Standards (UKAS).</td>
</tr>
</tbody>
</table>

### V-SENSOR DIMENSIONS AND CONNECTIONS

![V-SENSOR Dimensions and Connections Diagram](image)

**V-Sensor in ABS Enclosure**
- **TUBE CONNECTIONS**
  - 2 x 6mm Barbed x 15mm for PVC or
  - **CABLE ENTRY**
    - 1 x M20 Gland for ABS Enclosure
    - 1 x M12 Gland for ABS Enclosure

**Air Tube Connections**
- **Transformer Isolated**
  - 24 Vac 50/60Hz 198mA. Internal Fuse 300mA Auto-Reset.
  - 110Vac 50/60Hz 40mA. Fuse 315mA Wickmann.
  - 230Vac 50/60Hz 20mA. Fuse 315mA Wickmann.

**AC Power Supplies**
- 24 Vdc (19 to 31Vdc) smoothed 118mA Internal Fuse 300mA Auto-Reset.

**Current Output Signal**
- 0-10V (0 to 100% of Range) RL = 5kOhm min.
- Other output signals (e.g. 2-10V) or PID loop control is programmable via the keyboard.

**Voltage Output Signal**
- 4-20mA (0 to 100% of Range) RL = 500 Ohm max. (0-20mA) or PID control is programmable via keyboard
- One Alarm changer over volt free contact is user programmable

**Relay Output 1A 24Vdc**
- 2 x Output Signal, Alarm Status, Alarm Thresholds and Alarm Timers are all readable as Modbus rtu Commands. Modbus register assignments to read and write are available in user manual.

**Hysteresis/Repeatability**
- 0.1% Typical of Full Scale.

**Linearity (Accuracy)**
- +/- 0.25% of Full scale > 100 Pa and 0.25Pa < 100Pa.

**Zero Drift**
- 0.05%K (+10°C to +50°C) - Automatically corrected to 0.0 if Auto-Zero function is enabled.

**Operating Temperature**
- -10°C to +70°C.

**Mounting Position**
- Vertical.

**Weight**
- 0.6 kg in ABS Housing.

**Electrical Connections**
- ABS Housing: 1 x M20 Gland and 1 x M12 Gland and internal removable Screw Terminals.

**Air Tube Connections**
- ABS Housing: Positive and Negative Pressure Barbed Nipple 6mm OD x 15mm long for CMR PVC Tube Alternatively Barbed Nipple 4mm OD x 15mm long for silicone tube on special request.

**Enclosure**
- Plastic (ABS) Light Grey (RAL7035) - Protection IP65.

**Calibration Certificate**
- Supplied with Certificate traceable to national and international Standards (UKAS).