V-SENSOR LOW AIR VELOCITY SENSOR

- Ultra low velocity pressure measurement
- Traceable Calibration Certificate
- Excellent repeatability
- Self compensating zero
- Climate chamber compensated
- Long term span stability
- Ultra low hysteresis
- Unaffected by humidity
- Factory logged burn in time
- Transducer and PCB is made by CMR
- After Sales Service is provided by CMR
- 24 month warranty
- 20 Years field application experience

GENERAL DESCRIPTION
The V-Sensor is a wall mount Velocity Pressure transmitter which provides an output signal of 0…10V and 4…20mA. The LCD connector always provides 0…10V and the Output Terminals have dual output 0…10V and 4…20mA. Other signal outputs can be supplied on special request. An optional LCD display can show the actual velocity or volume in m/s or m³/s.

The 4…20mA is produced by the V-Sensor and could drive a number of devices. There are many Velocity Pressure ranges available from 0..6.45 m/s (0..25 Pa) up to 0..28.85 m/s (0..500 Pa). The maximum range is 129.10 m/s.

Power supplies in DC or AC are standard.

THE TRANSUDER
The transducer is manufactured by CMR and consists of precision engineered components, high quality metals and SMD electronics. The principle of the transducer is the measurement of the displacement of the linear diaphragm by means of a push and pull variable reluctance transducer which is not affected by Humidity, hence it can be used in many Industrial and Chemical applications even using high concentration of Formaldehyde.

There are no mechanical connections to any of the sensing coils and the diaphragm, hence extreme low pressures can be measured at excellent repeatability and minimal hysteresis.

The movement of the diaphragm is so small that no air volume is required to measure the air pressures over a distance of 200m.

The zero drift is uniquely minimized by the measuring coils which 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 track record of over 20 years. Finally, all CMR V-Sensors are temperature compensated in a computerised climate chamber and go through an ageing burn in cycle.

LCD DISPLAY
An Optional LCD Display indicates the actual Velocity in m/s or Volume in m³/s. The LCD is factory calibrated but the user can adjust the zero and span to suit other scales. The LCD display is fitted to the front lid and is for internal wall mount use.

REMOTE DISPLAY
A remote LCD or LED can be connected to display the information locally.

LED DISPLAY
An Optional LED Display either 3 1/2 or 4 1/2 digit can be supplied which indicates the actual Velocity in m/s or Volume in m³/s. The LED display is fitted into the front lid. It shall provide IP65 protection and is intended for wall mount use.

DISPLAY AND SIGNAL DAMPENING
The displays can be smoothed by means of a switch (LCD) or a jumper (LED) on the rear independently of the output signal of the sensor. The output signal can be smoothed by means of the ‘Slow’ adjustment on the PCB of the V-Sensor. This damping acts on the 0..10V, 4…20mA and the Display simultaneously.

MAGNIFICATION FACTOR SCALING
The display’s zero and span has been factory scaled during manufacture. The magnification Factor can be adjusted on the PCB Scaler to suit the CMR Flow Probes, Velo Probes and Velo Grids or any other velocity measurement devices.

ALUMINIUM ENCLOSURE
The V-Sensor can be supplied in an IP65 Aluminium Enclosure with 6mm or 1/4” ferule compression fittings and stainless Cable Gland.

An optional IP65 LED display either 3 1/2 or 4 1/2 Digit is mounted into the Lid.

Stainless Steel Transducers can be supplied on request but then the Aluminium Enclosure shall always be supplied.

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Issue GB 2 - 2 2000

V-Sensor Page 1
The CMR V-Sensor is a true Velocity Pressure Transmitter which has been designed to measure air volumes in Ventilation Ducts accurately. The built in Square Root Extraction and Magnification Factor Scaling makes the V-Sensor the most versatile instrument. It can display in m/s or m³/s. Other displays such as m³/h, litres/s, litres/min or any imperial measurement units are available on request.

The V-Sensor is ideal for wall or plant room panel mount applications. The CMR PVC tubing can be run up to 200m without losing accuracy of the measurement.

TYPICAL CMR AIR VOLUME MEASUREMENT APPLICATIONS

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V-SENSOR AHU APPLICATIONS

TYPICAL AIR HANDLING UNIT VOLUME AND VELOCITY MEASUREMENTS WITH CMR V-SENSORS

The above schematic shows a practical application in Supply and Extract Air-Handling Unit Control Systems, where Supply and Extract Duct Volumes must be measured.

CMR Multi Point Flow Probe

CMR Oval Flow Probe

CMR Fan Inlet Probe

CMR Velo Grid

The V-Sensor is ideal for Fan Tracking, Fresh Air, Re-circulation Air control and monitoring. The CMR V-Sensors are maintenance free and long term accurate.

TYPICAL EXTRACT AIR VOLUME MEASUREMENT APPLICATIONS

Extract Velo Probe Sensor

Extract Velo Grid Sensor

Extract Attenuator Flow Probe

Extract Orifice Plate Sensor

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V-Sensor Page 3
GENERAL

The drawing shows a typical application for CMR velocity Velo Probes and V-Sensors.

The supply air duct can either be fitted with one central Velo Probe or individual Velo Probes on each of its branches.

In many cases, the positions of the Velo Probes are very much dictated by the design of the building. The CMR Velo Probe can be fitted in almost any position in order to provide the necessary results.

In a single supply and single 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 made simple.

The Velo probes are easily adjusted by the commissioning engineer during final commissioning. For multiple duct applications, the total supply air volume is derived by adding measurements from individual ducts.

The same applies to the return air where the following formulae is specified as mentioned under the schematic on the right.

V-SENSOR SCALING BY ADJUSTING THE VELO PROBES

Adjust the Impact Veloprobe to face the Airflow and and adjust the Static Veloprobe to approx. 40° away from the airflow.

Scaling the BMS in m/s

Look at the V-Sensor label and scale BMS to 0V = 0 m/s and 10V = V-Sensor range i.e. 12.91 m/s. Take a Pitot reading in the duct and if this is 5.00 m/s adjust the Static Veloprobe by turning it towards or away from the airflow until the BMS Screen shows 5.0 m/s.

Scaling the BMS in m3/s

Multiply the V-Sensor range i.e. 12.91 m/s by the duct area i.e 1m x 1m = 1m2. The Sensor range is now 10V=12.91 m3/s. Scale the BMS to 12.91 m3/s and work out the Pitot readings in m3/s. If the Volume is 5.00 m3/s, turn the Static Veloprobe until the Screen shows 5.0 m3/s.

V-SENSOR SCALING BY ADJUSTING THE ‘SCALER’

Adjust the Impact Veloprobe to face the Airflow and and adjust the Static Veloprobe to approx. 180° away from the airflow.

Scaling the BMS in m/s

Look at the V-Sensor label and scale BMS to 0V = 0 m/s and 10V = V-Sensor range i.e. 12.91 m/s. Take a Pilots reading and if this is 5.00 m/s adjust the V-Sensor ‘Scaler’ Potentiometer until the BMS Screen shows 5.0 m/s.

Scaling the BMS in m3/s

Multiply the V-Sensor range i.e. 12.91 m/s by the duct area i.e 1m x 1m = 1m2. The Sensor range is now 10V=12.91 m3/s. Scale the BMS to 12.91 m3/s and work out the Pitot readings in m3/s. If the Volume is 5.00 m3/s, turn the V-Sensor ‘Scaler’ Potentiometer until the Screen shows 5.0 m3/s.

Calibrating by adjusting the Velo Probes

Calibrating by adjusting the V-Sensor scaler
**V-SENSOR OPERATING INSTRUCTIONS**

**CALIBRATION**

The V-Sensor’s electronic is accessible by removing the Lid. Connect a Voltmeter to the Terminals 1 and 2 or use a molex connector on the LCD Display connector J7. The output signal on the LCD connector is always 0...10V. Connect a mA Meter to the Terminals 3 and 4. It is important to know that the V-Sensor’s base calibration is based on 0...10V, which means, all calibrations must be carried out in 0...10V first. The 4...20mA circuit is simply a convertor of the 0...10V and is factory set. It is therefore recommended never to touch P6 and P5 unless they have been tampered with. To calibrate the 4...20mA circuit it is necessary to have a Voltmeter and a mA Meter connected to obtain overall accuracy.

To check the Scaler, first pump up the sensor to its range i.e. 100 Pa and note down the voltage output in Linear Mode. If the output is i.e 5V then the scaler has been set to calibrate the duct velocity.

**ZERO ADJUSTMENT**

Switch Slide Switch to UP position which is the linear Pressure Signal Output on the J2 Terminals. Turn Scaler fully clockwise with no scaling.

P1 scales the Zero of the Sensor. Turn the ‘SLOW’ P8 Potentiometer completely anti clockwise to remove any dampening. Remove all Tubes and let the Sensor settle.

If the Voltmeter is connected to 1 and 2, adjust P1 until 0.00V is achieved.

If the mA Meter is connected to 3 and 4, adjust P1 until 4.00mA is achieved.

If the Voltmeter, which is connected to the LCD connector or Terminal 1 and 2, displays 0.00V but the mA Meter connected to 3 and 4 is not at 4.00mA only then adjust P6 to achieve 4.00 mA.

**SPAN ADJUSTMENT**

Check the Zero Adjustment above first. P2 scales the Span of the V-Sensor. Use any CMR Calibrator and pump up the positive nipple of the V-Sensor to 75% of Full Scale as indicated on the label of the V-Sensor i.e. a 100Pa Sensor would be pumped up to 75.0 Pa.

If the Voltmeter is connected to 1 and 2, adjust P2 until 7.50V is achieved.

If the mA Meter is connected to 3 and 4, adjust P2 until 16mA is achieved.

If the Voltmeter, which is connected to the LCD connector or Terminal 1 and 2, displays 7.50V but the mA Meter connected to 3 and 4 is not at 16.00mA only then adjust P5 to achieve 16.00 mA.

**LINEARITY CHECK**

Use any CMR Calibrator and pump up the positive nipple of the V-Sensor to 25% of Full Scale as indicated on the label of the V-Sensor i.e. a 100Pa Sensor would be pumped up to 25.0Pa.

25% = 25Pa or 2.50V  -  8.00mA
50% = 50Pa or 5.00V  -  12.00mA.
100% = 100Pa or 10.00V  -  20.00mA

The Linearity is the accuracy of the Sensor less any Calibrator deviation. See the following Example:

Zero of Sensor = 0.00 V  Zero of Calibrator = 0.0Pa
Span of Sensor = 7.55 V  Span of Calibrator = 75.5Pa

The Sensor is 100% linear compared with the Calibrator. Repeat the Zero and Span Adjustments a few times.

**SQUARE ROOT CHECK**

The Square Root circuit is factory adjusted. In order to check its accuracy use any of the CMR Calibrators and pump up the positive nipple of the V-Sensor to 20% of Full Scale as indicated on the label of the V-Sensor i.e. a 100Pa Sensor would be pumped up to 20.0Pa. To check the Square Rooter switch the slide switch to DOWN position during measurement. The Results would be as follows:

20%  =  20 Pa is 2.00V/ 7.20mA in Linear Mode
20% =  20 Pa is 4.47V/11.15mA in Square Root Mode
50% =  50 Pa is 5.00V/12.00mA in Linear Mode
50% =  50 Pa is 7.07V/15.31mA in Square Root Mode

**SLOW OR DAMPENING OF OUTPUT SIGNAL**

Adjust ‘SLOW’ P8 clockwise for signal output dampening. This adjustment is useful in monitoring applications where the output signal must be smoothed to eliminate fluctuations in the digital data input channels of Scada Monitoring or BMS Computer Systems. During Calibration of the V-Sensor set P8 fully anti-clockwise.

**SM SMALL VALUE SHUT OFF**

The output signal at very low pressures is extremely high when square rooted. In order to force the signal to have 0V output when there is no airflow, turn the SM Potentiometer clockwise until the signal shows 0V. During calibration turn the SM Potentiometer fully anti clockwise otherwise the zero adjustment is not correct.

**MAGNIFICATION FACTOR SCALING**

Make sure to re-adjust the ‘Scaler’ after calibration to its original figures to show the correct velocity or volume on the BMS screen. If the original position of the scaler can be adjusted by pumping up the V-Sensor to its commissioning figures i.e. the V-Sensor Range is 0-100 Pa or 12.91m/s. The scaler has been adjusted to half position which means the output voltage would be 5V in linear mode or 7.07V in square root mode if pumped up to 100 Pa.

Note: the maximum sensor range i.e. 100 Pa must never be exceeded otherwise the sensor is out of range.

If the scaling factor has been lost, new Pitot readings must be taken to re-commission the system.

---

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V-SENSOR ORDER DESCRIPTION

GENERAL
CMR manufactures a large range of V-Sensors to suit many Velocity or Volume measurement applications. Because of the variety of velocity 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 PART NUMBER
The V-Sensor Part Number starts with the selection of the enclosure which depends on the Tube connections. In the Example we have chosen Code '24A' which is a standard ABS V-Sensor enclosure with 6 mm barbed nipples to fit CMR PVC Tube.

NEGATIVE PRESSURE RANGE
The Negative Range is not available with V-Sensors as negative velocity pressures are never measured and cannot be square rooted. The Code '000' always applies to any V-Sensors.

VELOCITY PRESSURE RANGE
It is important to determine the duct velocity pressure. Normally, this information is supplied by the Designer of the Ventilation System. On the V-Sensor Selection Table are a number of standard velocity pressures listed.

OUTPUT SIGNAL
The Industry Standard for Output Signals is 0...10V and 4...20mA, but other signals can be supplied by CMR on request and are listed in the Selection Table. The V-Sensor has a dual output as standard.

POWER SUPPLY
The Industry Standard is 24VDC or 24VAC. 110VAC and 230VAC displays in 3 1/2 or 4 1/2 digits must be used. The legends are not available on these glasses.

INTERNAL LCD OR LED BUILT INTO LID
A 3 1/2 digit LCD Display can be supplied as an optional extra to be mounted into the Lid of the V-Sensor. The LCD is a Liquid Crystal Display without illumination. The Protection is IP44 and is only suitable for indoor applications. This LCD is the most popular display as it incorporates the Engineering Units as legends i.e. m/s or m3/s.

VELOCITY or VOLUME measurement applications. Because of the variety of velocity 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.

NEGATIVE PRESSURE RANGE
The Negative Range is not available with V-Sensors as negative velocity pressures are never measured and cannot be square rooted. The Code '000' always applies to any V-Sensors.

VELOCITY PRESSURE RANGE
It is important to determine the duct velocity pressure. Normally, this information is supplied by the Designer of the Ventilation System. On the V-Sensor Selection Table are a number of standard velocity pressures listed.

Output Signal
The Industry Standard for Output Signals is 0...10V and 4...20mA, but other signals can be supplied by CMR on request and are listed in the Selection Table. The V-Sensor has a dual output as standard.

Power Supply
The Industry Standard is 24VDC or 24VAC. 110VAC and 230VAC are less used today for safety and EMC protection reasons. The 15VDC versions are seldom used.

In the Example we have chosen 24VDC which has the Code '2'. The Part Number extends to '24A 000 025 A 2'.

DECIMAL POINTS
One decimal point has the Code 'B'.

LINEARITY
The V-Sensor is available in two Linearity Grades, 0.5% and 1.0% in Linear Mode which is 1% or 2% in Square Root Mode.

In the Example, we have used 0.5% which has the Code 'A'. The Part Number extends to '24A 000 025 A 2 A 1'.

TRACEABLE CALIBRATION CERTIFICATE
The V-Sensor can be supplied with a Calibration Certificate traceable to National Standard which has the Code 'T'.

In the Example we have to chose Code 'T'.

FINAL PART NUMBER
The Part Number to order is 24A000025A2A1BAT.

Now try and select your own V-Sensor using the 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 depending on a specific requirement. The Example Part Number 24A 000 025 A 2 A 1 B A T which is printed above the Selection Table can be identified as being a V-Sensor Velocity Pressure Sensor having 6mm barbed tube connectors with a Negative Range of 0 Pa and a Positive Range of 100 Pa (12.91m/s), with a dual Output Signal of 0-10V and 4-20mA. The power Supply is 24VDC. The Sensor would be supplied with a 3 1/2 digit LCD Display mounted internally. The display is scaled in m/s. The Decimal Points are adjusted to 1 which indicates 0 -12.9 m/s. The Linearity is 0.5% in Linear Mode and it comes with a traceable Calibration Certificate to National Standards.

**EXAMPLE PART NUMBER SELECTION**  (The code after the (=) sign is used i.e. 6mm = 24A)

<table>
<thead>
<tr>
<th>24A</th>
<th>000</th>
<th>025</th>
<th>A</th>
<th>2</th>
<th>A</th>
<th>1</th>
<th>B</th>
<th>A</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-SENSOR</td>
<td>Negative</td>
<td>Positive</td>
<td>Output</td>
<td>Power</td>
<td>Internal</td>
<td>Scaled</td>
<td>Decimal</td>
<td>Linearity</td>
<td>Certificate</td>
</tr>
<tr>
<td>Part No.</td>
<td>Range</td>
<td>Range</td>
<td>Signal</td>
<td>Supply</td>
<td>Units</td>
<td>Points</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6mm = 24A</td>
<td>0 Pa = 000</td>
<td>25Pa (6.45m/s) = 010</td>
<td>Dual = A</td>
<td>15 VDC = 1</td>
<td>NONE = N</td>
<td>m/s = 1</td>
<td>N/A = N</td>
<td>0.5% = A</td>
<td>Trace = T</td>
</tr>
<tr>
<td>3mm = 24B</td>
<td>50Pa (9.12m/s) = 015</td>
<td>0..20mA = B</td>
<td>24 VDC = 2</td>
<td>LCD 3 1/2 = A</td>
<td>Pa = 2</td>
<td>000 = A</td>
<td>1.0% = B</td>
<td>None = N</td>
<td></td>
</tr>
<tr>
<td>6cp = 24C</td>
<td>60Pa (10.00m/s) = 020</td>
<td>5..19mA = C</td>
<td>24 VAC = 3</td>
<td>LED 3 1/2 = B</td>
<td>m3/s = 3</td>
<td>00.0 = B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/4cp = 24D</td>
<td>100Pa (12.91m/s) = 025</td>
<td>110 VAC = 4</td>
<td>LED 4 1/2 = C</td>
<td>m3/h = 4</td>
<td>0.00 = C</td>
<td></td>
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<tr>
<td></td>
<td>125Pa (14.43m/s) = 030</td>
<td>230 VAC = 5</td>
<td></td>
<td>l/s = 5</td>
<td>000 = D</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>150Pa (15.81m/s) = 035</td>
<td></td>
<td></td>
<td>ACR = 6</td>
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</tr>
</tbody>
</table>

Stainless  
6cp = 24E  
1/4cp = 24F  

**HOW TO ORDER**

Make up your own V-Sensor selection below using the empty cells

**EXAMPLE**

A wall mount pressure transmitter is required of the Type V-Sensor.  
The tube connections must be 6mm for CMR PVC Tube  
The negative pressure range must be 0 Pa (no others can be supplied)  
The positive pressure range must be +25Pa (6.45 m/s)  
The output signal must be dual 0-10V and 4-20mA.  
The power supply must be 24V AC isolated  
The internal LCD Display must be a 3 1/2 digit LCD with legends.  
The scaled units must be in metres/second (m/s).  
The indication must be 6.45 with two decimal points  
The linearity must be 1% of full scale  
The Certificate must be traceable to National Standards  

The part number for this V-Sensor is 24A 000 010 A 3 A 1 C B T
V-SENSOR TECHNICAL SPECIFICATION

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>See Order Selection Table V-Sensor</td>
<td>Any Range from 25Pa (6.45m/s) up to 10 000Pa (129.10m/s)</td>
<td>Ranges 25Pa - 150Pa up to max 1400Pa. Ranges from 200 - 10000Pa 10 times of range</td>
<td>Non Corrosive Gases such as Air,N2,O2,CO2,N2 O, inert Gases</td>
<td>Bronze Beryllium Copper suitable for high concentration of Formaldehyde - All Stainless on request.</td>
<td>24 VAC 50/60Hz 140mA Fuse 300mA Auto Reset 110VAC 50/60Hz 32mA Fuse 315mA Wickmann 230VAC 50/60Hz 10mA Fuse 315mA Wickmann</td>
<td>15 VDC (19 to 31VDC) smoothed. Sensor with remote LCD and mA output only. ( 50mA ) 24 VDC (19 to 31VDC) smoothed. Sensor with remote LCD and mA output ( 80 mA )</td>
<td></td>
<td></td>
<td>0.1% Typical of Full Scale</td>
<td>+/- 0.5% or 1.0% of Full Scale in Pressure Mode</td>
<td></td>
<td></td>
<td>Vertical</td>
<td>0.7 kg</td>
<td>1 x PG13 Gland Internal Plugs with Screw Connections (Other Gland Sizes on request)</td>
<td>Positive and Negative Pressure Barbed Nipple 6.5mm O/D x 15mm long or Positive and Negative Pressure Straight Nipple 3.0mm O/D x 15mm long</td>
<td>ABS Grey Protection IP65 without LCD. With CMR LCD IP44 and ABS or ALU with/without LED IP65</td>
<td>EN61326-1 EMC EN61010-1 SAFETY</td>
<td>Supplied with Certificate traceable to National Standards</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions and Connections</th>
<th>TUBE CONNECTIONS</th>
<th>CABLE ENTRY GLANDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD 122 mm 80mm ABS ENCLOSURE</td>
<td>ABS 2 x 8mm for PVC or 3mm for Silicone Tube</td>
<td>1 x PG13 Gland for ABS Enclosure</td>
</tr>
<tr>
<td>LED 122 mm 83mm ALU ENCLOSURE</td>
<td>ALU 2 x Compression Fittings for 6mm or 1/4&quot; O/D</td>
<td>1 x PG13 Metal Gland for Aluminium Enclosure</td>
</tr>
</tbody>
</table>

24VAC 50/60Hz Isolated 110VAC 50/60Hz Isolated 24VDC Non Isolated 230VAC 50/60Hz Isolated

<table>
<thead>
<tr>
<th>0-10V 4-20mA</th>
<th>0-10V GND 4-20mA</th>
<th>0-10V GND 4-20mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10V</td>
<td>4-20mA</td>
<td>0-10V</td>
</tr>
<tr>
<td>4-20mA</td>
<td>GND</td>
<td>0-10V</td>
</tr>
<tr>
<td>111 13</td>
<td>J5</td>
<td>111 13</td>
</tr>
<tr>
<td>11</td>
<td>13 J5</td>
<td>11</td>
</tr>
</tbody>
</table>

The output voltage is the result of square rooting the linear pressure i.e 100 Pa. 100 Pa square rooted = 10 m/s. Multiply the 10 m/s by the density of air x 1.291 = 12.91m/s The mA circuit is a direct conversion of the 0..10V and therefore all calculations should be made in 0..10V. The 4.20mA is linear from 0...12.91m/s.

83 mm

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V-Sensor Page 8