

# VPP VELOPROBE AIR VELOCITY SENSOR

- Ideal for average air volume measurement
- Multiple differential pressure sensing points
- Averaging impact pressure measurement
- Averaging static pressure measurement
- Ultra low velocity detection
- Ideal for installation in existing duct work
- Made to measure from 100 mm to 1500 mm
- Length manufactured in 50 mm increments
- Adjustable airtight flanges with 'O' ring seals
- Easy field positioning and installation
- Veloprobe is made of Polypropylene (PP)
- 35 years in service worldwide



VPP Veloprobe velocity pressure sensor

The CMR Veloprobes have been designed to measure air volume in ventilation ducts. They work in conjunction with the CMR P-Sensor as it provides a linear output signal in m<sup>3</sup>/s, m<sup>3</sup>/h, l/s or m/s. This means, the combination Veloprobes and P-Sensor provide an accurate and repeatable air volume measurement from 25-100% of the controlled air volume.

In order to read a velocity pressure, the Veloprobes are mounted either horizontally or vertically in the duct, using mounting flanges. The Veloprobe can be installed in various configurations but preferably in a straight duct with relatively little air turbulence.

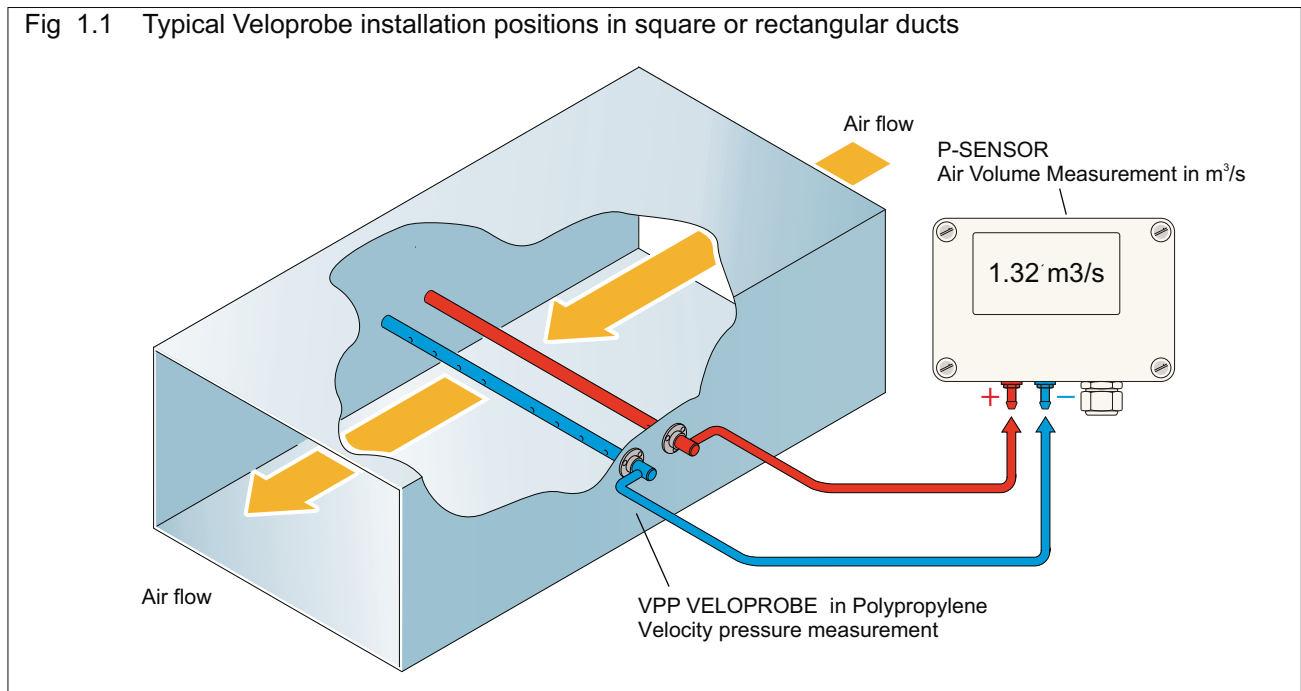
The installation is easy. Fit one Veloprobe facing (+) and one opposing (-) the airflow. The magnification factor, the duct height and width or diameter can be configured via the keyboard of the P-Sensor. Take a Pitot traverse reading and compare the actual volume with the displayed volume and simply re-adjust magnification factor on the P-Sensor to get the same results.

In many applications, the ducts are short and have many branches and elbows, which means, the Veloprobes have to be calibrated to suit the duct flow characteristic as follows. Adjust the fan airflow to a fixed volume, preferably to 50% of the desired maximum volume. Turn the impact Veloprobe (+ red tube) so that the outside tube nipple, which is in line with the measurement holes, faces the anticipated air flow direction in order to get the maximum impact pressure.

Turn the static pressure Veloprobe (- blue tube) 180° away from the airflow and take a Pitot traverse reading to measure the actual air volume. If there are differences between the P-Sensor display and the Pitot tube reading, re-adjust the magnification factor in the P-Sensor until it is equal. Check the air volume reading at 25%, 75% and at 100%.

If there are differences, the P-Sensor can also linearize the measurements.

Fig 1.1 Typical Veloprobe installation positions in square or rectangular ducts

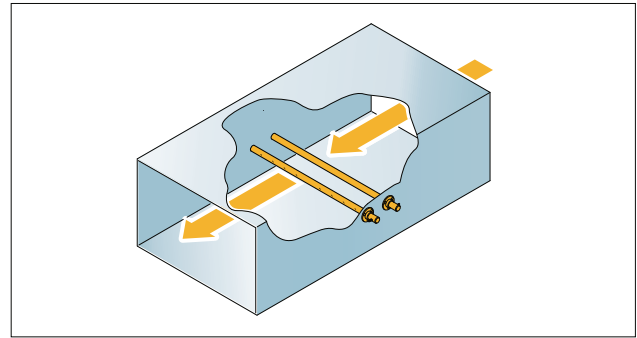


# VPP VELOPROBE APPLICATIONS

The VPP Veloprobe is best installed in a straight duct with a minimum length before and after the Veloprobe.

The Veloprobe does not work after a damper which moves. It can be installed vertically or horizontally but care must be taken that the tube connections are either on the side or at the top. Never at the bottom, as condensation might block the measurement tubes.

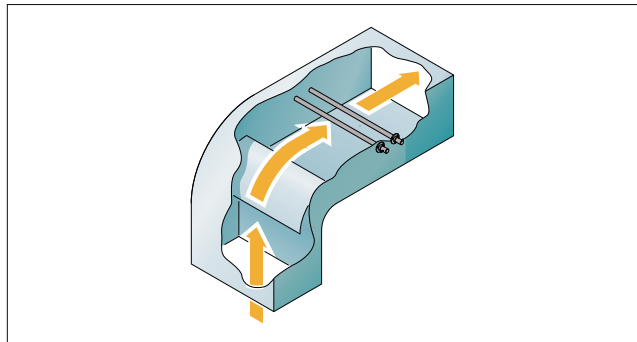
I



VPP Veloprobe in a straight duct section

The VPP Veloprobe can be installed after an elbow as shown on the right.

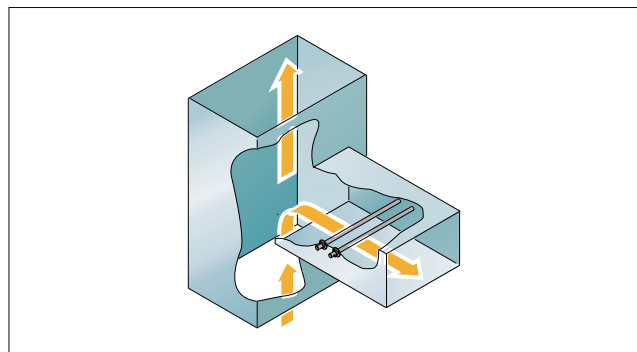
If it has to be installed within the elbow due to very short duct runs, then the Veloprobes can be turned in their flanges to face the air flow to get the maximum impact pressure. The Static probe can then be adjusted to be opposed.



VPP Veloprobe after an Elbow

The VPP Veloprobe can be installed after a T-Section shown on the right. The probes must be installed further into the T so that is not at the beginning of the T.

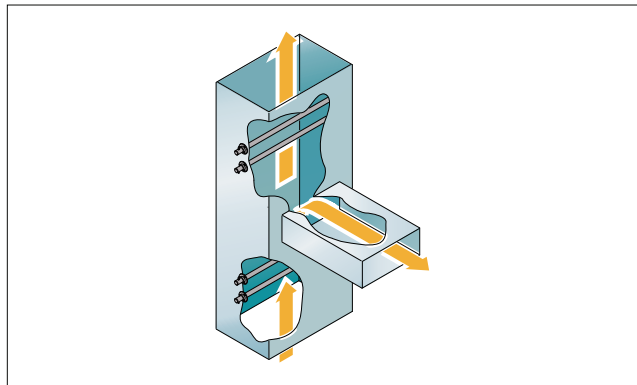
The Veloprobes can be turned in their flanges to face the air flow to get the maximum impact pressure. The Static probe can then be adjusted to be opposed.



VPP Veloprobe after T- Section

If the duct on the right cannot be fitted with a Veloprobe then the bottom Veloprobe measures the total volume and the top Veloprobe measures what is left over. The difference is the volume which passes through the duct on the right hand side.

The Veloprobes can be turned in their flanges to face the air flow to get the maximum impact pressure. The Static probe can then be adjusted to be opposed.



VPP Veloprobe before and after T- Section

Send a drawing or hand sketch to CMR to provide a selection and full dimensional specification and a recommendation how to measure the air volume accurately.

# VPP VELOPROBE

# SPECIFICATIONS

## Selection of Veloprobes

It is essential to determine the air volume during the design stage. Normally there is a minimum and a maximum volume which has to be measured. The duct area should be calculated so that the velocity is approximately 2.5 m/s at the minimum volume and preferably 5 m/s at the operating point if possible. If the velocity is more than 5 m/s at the maximum volume then the noise level criteria needs to be considered of the whole installation. The maximum velocity should not exceed 9 m/s as the duct resistance shall increase and the overall energy consumption shall go up. Use selection Table 1 on page 6.

## Installation

The CMR Veloprobes are made in increments of 50mm length, which means the correct length of Veloprobe can be ordered to suit the duct width or height. It is very important, that the length is chosen correctly, so that it can be insulated and lagged to avoid thermal transfer and condensation on the outside of the duct in the plant room. Also, it guarantees that the measurement holes are in the correct duct area to produce the best results. The mounting flanges are adjustable with an allen key and a tolerance of +/- 50mm adjustment can be done on site. A VPP-A-1000 is designed for a duct width of L=1000 mm - the overall length of the probe is L3 = 1100 mm. If the duct on site is 1040 mm then the flanges can be adjusted to L=1040 mm. The VPP Veloprobe can be installed horizontally or vertically but the tube connections should be on the side or on top. It works best if it has a reasonable length of duct so that the air flow is laminar when approaching the VPP Veloprobe. If a reasonable length is not available then the magnification factor (mf) can be adjusted on the P-SENSOR and it can be linearized over 10 points for unusual measuring positions. This is easily achieved by measuring the air volume with a Pitot Tube at a different location of the duct and adjusting the P-Sensor via the keyboard accordingly.

## Accuracy

The VPP Veloprobe can achieve an accuracy of 5% between 20 and 100% of the design volume if it is used with a P-SENSOR and the linearisation function. If a higher accuracy is to be achieved over the whole range it is better to use the CMR Flowgrids.

## Maintenance

The VPP Veloprobe is maintenance free and when used in conjunction with the P-SENSOR there is no air flow going through the Veloprobes and therefore no dust particles can enter the measuring holes as they are pressurised and any particles would be deflected from the Veloprobes.

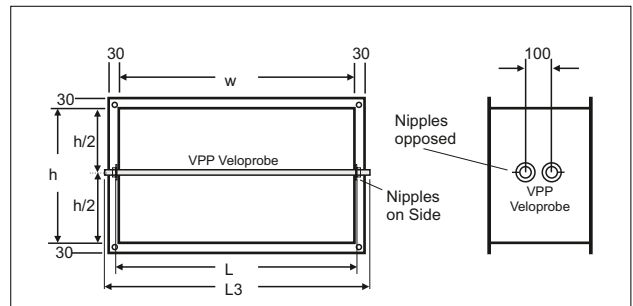
## Materials

Veloprobes	- Polypropylene 25.0 mm Ø
Flanges	- Stainless Steel 304 57.0 mm Ø
Gasket	- Neoprene
'O' Rings	- Neoprene
Tube Nipples	- Polypropylene 6.0 mm Ø
Mounting Screws	- Stainless Steel Size 6

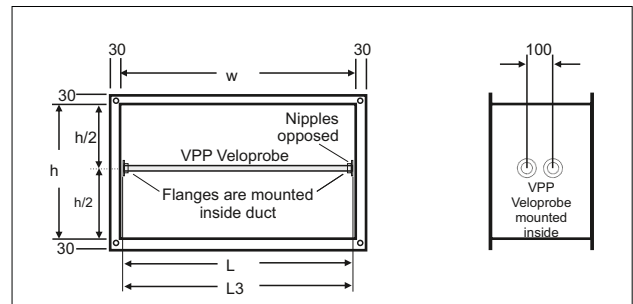
## Specifications

Recommended minimum air velocity is	2.5 m/s
Recommended operating air velocity is	5.0 m/s
Recommended maximum air velocity is	9.0 m/s

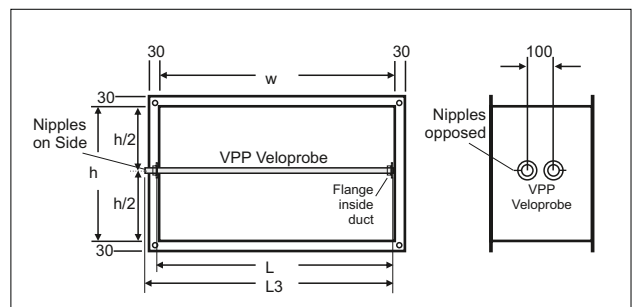
Humidity 10% to 90% non condensing.  
 Operating Temperature (dry condition) -20 to 70°C  
 Air density factor must be considered and can also be adjusted in the P-Sensor.



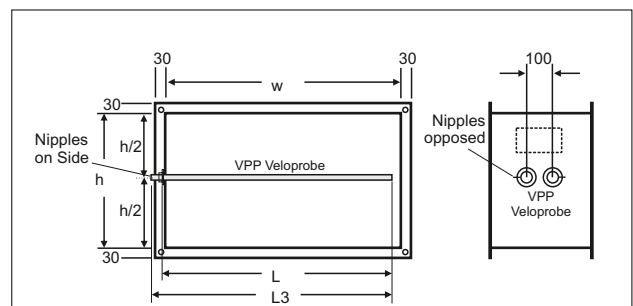
Type 'A' VPP Veloprobe mounted with flanges on outside duct



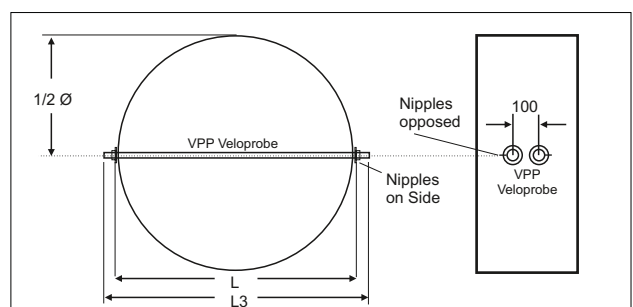
Type 'B' VPP Veloprobe mounted with flanges on inside duct



Type 'C' VPP Veloprobe mounted with flanges inside and outside

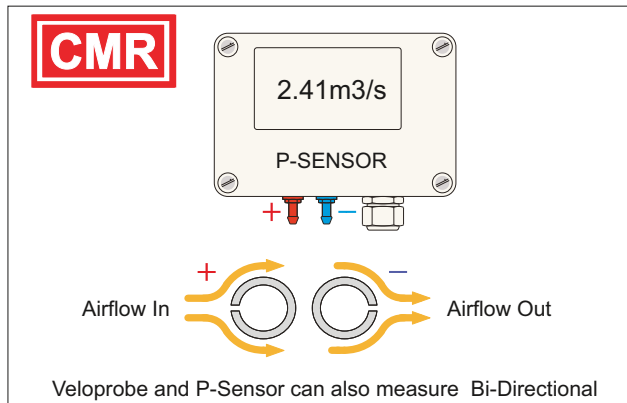


Type 'D' VPP Veloprobe mounted with one flange only on outside



Type 'A' VPP Veloprobe with flanges on outside duct

# VPP VELOPROBE VELOCITY PRESSURES



## VPP Veloprobe and P-Sensor tube connections

The velocity pressure is measured by the Veloprobes mounted in the duct and the total impact pressure is measured on the positive (+red) and the static pressure is measured on the negative (- blue) Veloprobe. The P-Sensor shall be connected to the corresponding (+) and (-) port using CMR red and blue tube.

If the P-Sensor is ordered with the VPP Veloprobe then it is pre-adjusted at the factory - i.e. duct width and height, density and VPP Veloprobe Magnification Factor (mf) and the range is in l/s, m³/s, m³/h. It is ready for connection to the control or monitoring system.

If the P-Sensor was ordered separately and it was not factory adjusted then it is quite simple to adjust the parameters on site.

The P-Sensor has a keyboard and the duct height and width must be entered. The magnification factor of the VPP Veloprobe must be entered which is normally 2.00, if it is installed in a straight duct.

If the volume indicated on the P-Sensor display is deviating from the actual measurements, then the magnification factor can be adjusted to suit the installation abnormalities via the P-Sensor keyboard.

Adjust the fan to a constant volume – start with 50% of the minimum and maximum operating volume and take a pitot travers reading with an independent instrument. Once the average volume has been established and it is not the same as displayed on the P-Sensor, then adjust the Magnification Factor (mf) until the same display is achieved. For higher accuracy try this at 25%, 75% and 100% volume set point The P-Sensor has parameters to linearize the measurements for more precise applications.

Useful VPP Veloprobe scaling formula:

$$\text{velocity m/s} = \sqrt{\frac{2 \times (\Delta P \text{ in Pa} / \text{mag factor})}{1.2 \text{ Density}}}$$

Example:

$$2 \times (50\text{Pa on the VPP} / 2.0 \text{ mf}) = 50.0 / 1.2 = 41.666$$

$$\sqrt{41.666} = 6.454 \text{ m/s}$$

$$6.454 \text{ m/s} \times (\text{duct height 'h' x duct width 'w'}) = \dots \text{ m}^3/\text{s} \times 3600 = \text{m}^3/\text{h}$$

Conversion Table - Velocity in m/s at standard density to Velocity Pressure in Pa

m/s	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.01	0.02	0.05	0.10	0.15	0.22	0.29	0.38	0.49
1	0.60	0.73	0.86	1.01	1.18	1.35	1.54	1.73	1.94	2.17
2	2.40	2.65	2.90	3.17	3.46	3.75	4.06	4.37	4.70	5.05
3	5.40	5.77	6.14	6.53	6.94	7.35	7.78	8.21	8.66	9.13
4	9.60	10.09	10.58	11.09	11.62	12.15	12.70	13.25	13.82	14.41
5	15.00	15.61	16.22	16.85	17.50	18.15	18.82	19.49	20.18	20.89
6	21.60	22.33	23.06	23.81	24.58	25.35	26.14	26.93	27.74	28.57
7	29.40	30.25	31.10	31.97	32.86	33.75	34.66	35.57	36.50	37.45
8	38.40	39.37	40.34	41.33	42.34	43.35	44.38	45.41	46.46	47.53
9	48.60	49.69	50.78	51.89	53.02	54.15	55.30	56.45	57.62	58.81
10	60.00	61.21	62.43	63.65	64.90	66.15	67.42	68.69	69.98	71.29
11	72.60	73.93	75.26	76.61	77.98	79.35	80.74	82.13	83.54	84.97
12	86.40	87.85	89.30	90.77	92.26	93.75	95.26	96.77	98.30	99.85
13	101.40	102.97	104.54	106.23	107.74	109.35	110.98	112.61	114.26	115.93
14	117.60	119.29	120.98	122.69	124.42	126.15	127.90	129.65	131.42	133.21
15	135.00	136.81	138.62	140.45	142.30	144.15	146.02	147.89	149.78	151.69
16	153.60	155.53	157.46	159.41	161.38	163.35	165.34	167.33	169.34	171.35
17	173.40	175.45	177.50	179.57	181.66	183.75	185.86	187.97	190.10	192.25
18	194.40	196.57	198.74	200.93	203.14	205.35	207.58	209.81	212.06	214.33
19	216.60	218.89	221.18	223.49	225.82	228.15	230.50	232.85	235.22	237.61
20	240.00	242.41	244.82	247.25	249.70	252.15	254.62	257.09	259.58	262.09
21	264.60	267.13	269.66	272.21	274.78	277.35	279.94	282.53	285.14	287.77
22	290.40	293.05	295.70	298.37	301.06	303.75	306.46	309.17	311.90	314.65
23	317.40	320.17	322.94	325.73	328.54	331.35	334.18	337.01	339.86	342.73
24	345.60	348.49	351.38	354.29	357.22	360.15	363.10	366.05	369.02	372.01
25	375.00	378.01	381.02	384.05	387.10	390.15	393.22	396.29	399.38	402.49

To get the range of the P-Sensor use the keyboard and display the range . This is the sensor range in l/s, m³/s or m³/h at 10V / 20mA.

Enter this range into your control system. No further calculations are necessary. If you want to use the table above, use the range of the transmitter in Pa and divide it by the (mf) of the VPP. Look up the velocity above. i.e. 100 Pa / 2.0 (mf) = 50.0 Pa.

Look up above ~ 50.0 Pa and read on side and top ~ 9.12 m/s then multiply with duct area in m² to get m³/s and multiply by 3600 to get m³/h.

# VPP VELOPROBE AIR MEASUREMENT

## GENERAL

The drawing shows a typical application for CMR Veloprobes.

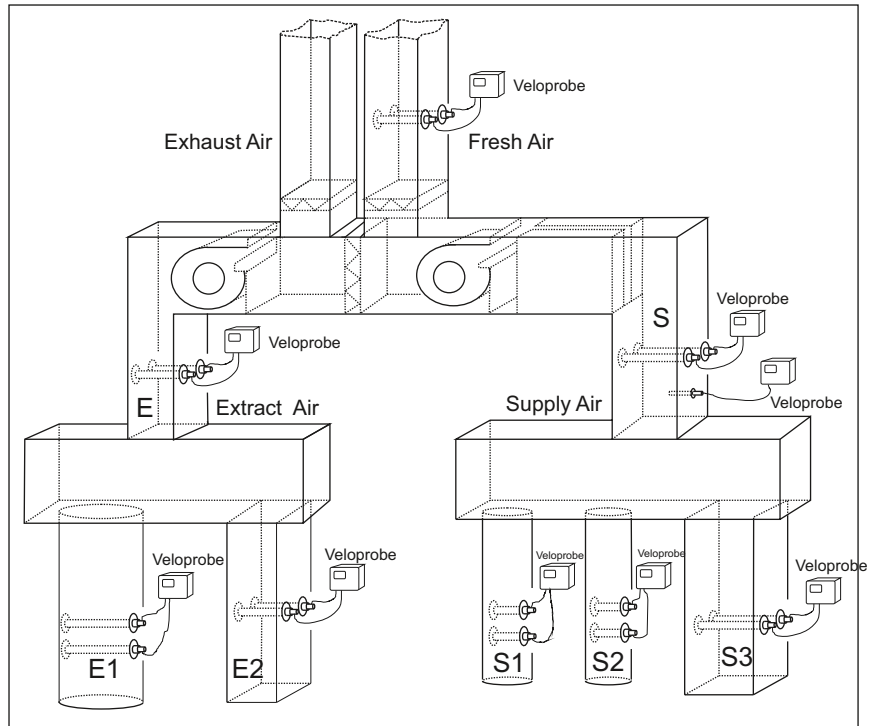
The supply air duct can either be fitted with one central Veloprobe or individual Veloprobes on each of its branches.

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 Veloprobe measures the building's actual total supply and return volumes. As both Veloprobes are calibrated to provide a linear air volume, tracking of supply and extract air is now made easy.

The duct height, width or diameter, density and magnification(mf) or ('K' factors) can be entered in the P-Sensor via the keyboard very easily and only the measurement range for 0-10 V or 4-20 mA 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:  $S = E \pm \text{an offset for positive or negative building pressure}$   
 $S1 + S2 + S3 = E1 + E2 \pm \text{offset}$  or  $S = E1 + E2 \pm \text{offset}$  - etc

## Veloprobe - scaling in m<sup>3</sup>/s - m<sup>3</sup>/h - l/s - ACR air change rate

Adjust the Impact Veloprobe (red +) to face the airflow and adjust the Static Veloprobe (blue -) to approx. 180° away from the airflow.

Use the keyboard and enter the duct height and width or enter the width of a round duct and adjust the height to '0'. Adjust the magnification factor (mf) to 2.000. Use the display and select m<sup>3</sup>/s, m<sup>3</sup>/h, l/s or ACR (Air Change Rate) and adjust the decimal places.

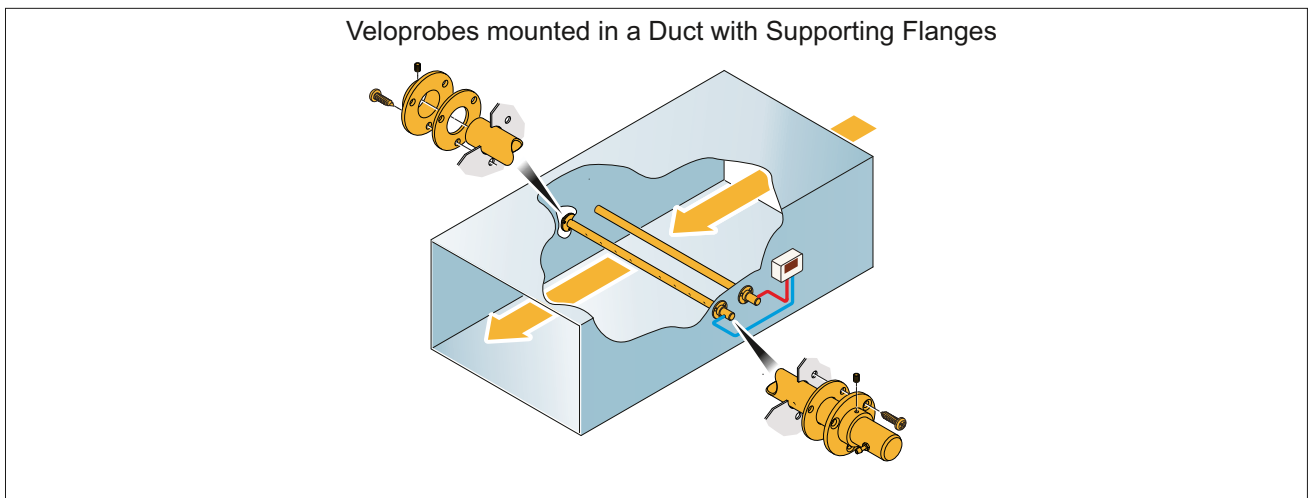
Take a Pitot Tube reading in the duct and if the volume is not equal to the display then adjust the magnification factor {mf} until it is equal.

## P-Sensor - scaling in m/s only.

Adjust the Impact Veloprobe (red +) to face the airflow and adjust the Static Veloprobe (blue -) to approx. 180° away from the airflow.

The scaling of the duct height and width is done in the BMS. Use the keyboard and adjust the display to m/s. Adjust the height and width to 1 and adjust the (mf) to 2.000. If the range of the sensor is 50 Pa then it should display 9.128 m/s.

Take a Pitot Tube reading in the duct and if the velocity is not equal to the display then adjust the magnification factor until it is equal.



# VPP VELOPROBE

# ORDER SELECTION

## HOW TO ORDER

Call sales at CMR and provide the duct dimension such as height and width or diameter, the minimum and maximum air volume in l/s, m3/s or m3/h and how it is to be mounted in the duct.

You can however configure the part number yourself by using the table below. The selection table has been prepared to make ordering easy. Each column contains a number of different options which can be selected to configure a part number using the mounting type and duct dimensions.

### Example Part Number configuration

The code after the [=] sign is used to form the number

VPP- Veloprobe Part No.	A- Mounting Type	25- Probe Diameter mm	0500 Duct width or height in mm Length 'L'
Base = VPP	Type = A	Ø = 25	L = 0200
	Both flanges on outside of duct		L = 0250 L = 0300 L = 0350 L = 0400
	Type = B		L = 0450
	Both flanges in inside of duct		L = 0500 L = 0550 L = 0600 L = 0650
	Type = C		L = 0700
	One flange on outside of duct		L = 0750 L = 0800
	one flange on inside of duct		L = 0850 L = 0900 L = 0950 L = 1000
	Type = D		L = 1050
	One flange on outside of duct		L = 1200 L = 1250
	from 200mm to 450mm only		L = 1300 L = 1350 L = 1400 L = 1450 to 1500

## HOW TO ORDER

### EXAMPLE

A duct mounted Polypropylene (PPs) Veloprobe is required  
The Veloprobe must have 2 flanges mounted on the outside of the duct  
The Veloprobe should have a tube diameter of 25mm Ø.  
The internal duct dimension 'L' must be 1400mm

The part number for this Veloprobe is **VPP-A-25-1400**

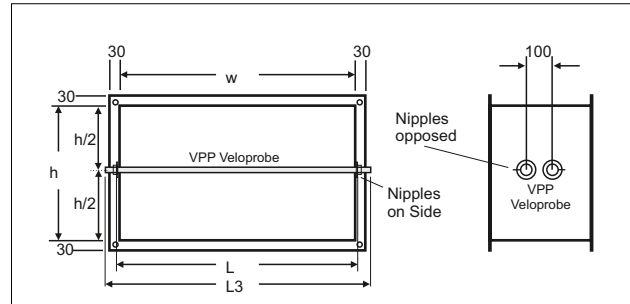
Now try to select your Veloprobe for your installation

VPP - x - xx - xxxx

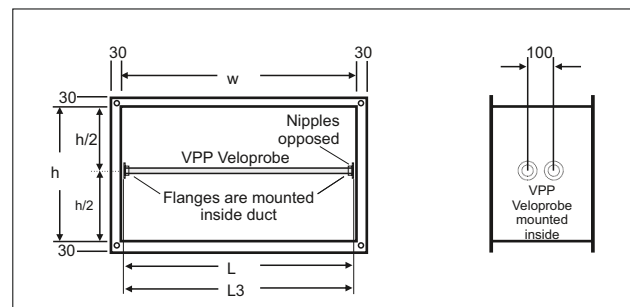
Call CMR for free assistance at any time.

The example part number VPP-A-25-0500 which is printed above the selection table can be used to try to configure a Part Number to be used in your new application.

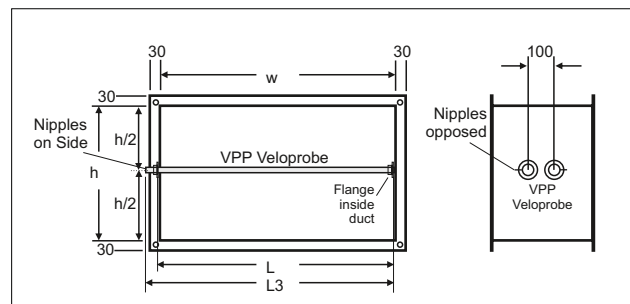
The sample shows it is a Veloprobe, having a base part Number of VPP - the mounting of the supporting flanges are according to Type 'A' - the Veloprobe tube diameter is 25 mm Ø O/D - the Duct Dimension where the probes are to be mounted is 'L' = 500 mm.



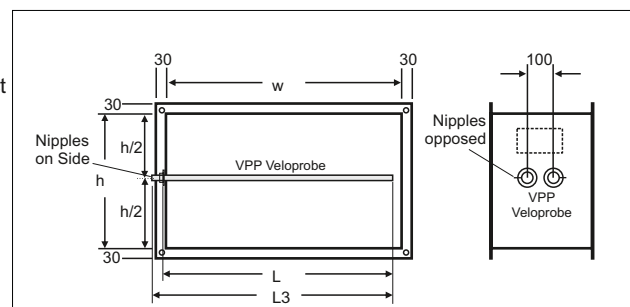
Type 'A' VPP Veloprobe mounted with flanges on outside duct



Type 'B' VPP Veloprobe mounted with flanges on inside duct



Type 'C' VPP Veloprobe mounted with flanges inside and outside



Type 'D' VPP Veloprobe mounted with one flange only on outside

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