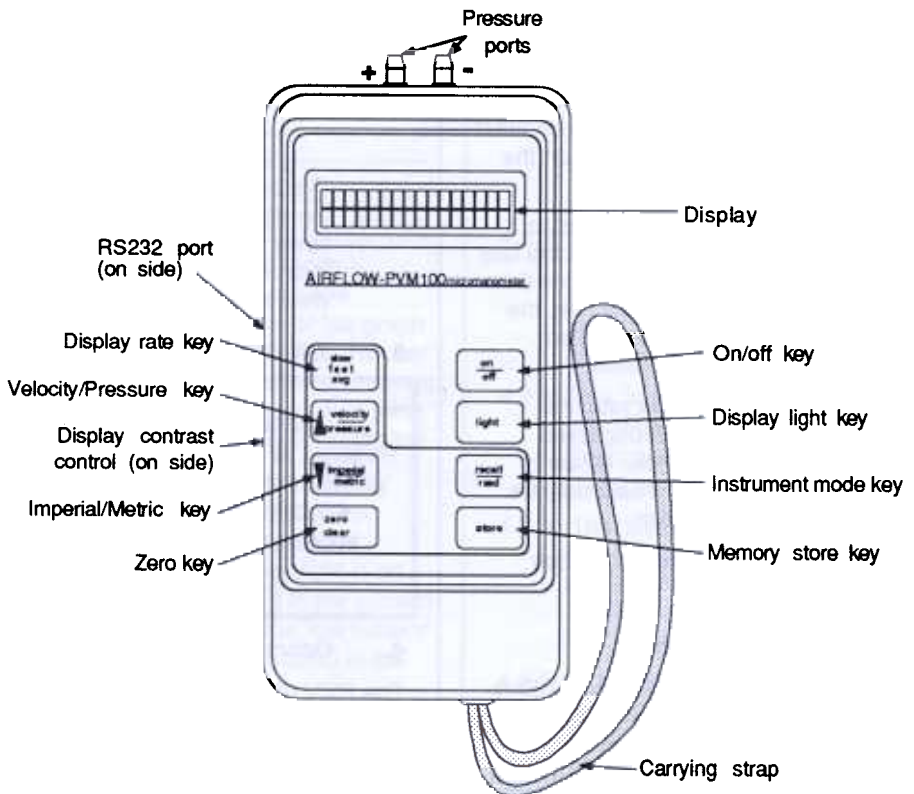


## PVM100 Micromanometer for Pressure and Velocity Measurement

### Operating Instructions



**Please read these instructions carefully before using the instrument.  
Shortform instructions are on the back of the instrument.**

## 1. Introduction

The PVM100 is designed to read positive or negative pressure up to 3500 Pa (14 ins. wg) or, with a standard ( $k=1$ ) pitot-static tube, to read velocities up to 76 m/s (15000 ft/min) in standard air conditions.

The PVM100 can function in two modes, 'read' and 'recall'. In 'read' mode, the instrument will display current readings of air pressure (or air velocity) incident at the pitot-static tube. In 'recall' mode, previously stored values can be displayed.

The display can be switched between imperial and metric units and a light is available so that it can be read under poor lighting conditions. Display contrast may be adjusted using a control on the side of the instrument.

The display may also be switched to operate at either of two rates. At the fast rate, the display is updated at more than once per second. At the slow rate, the value displayed is calculated as an average of four measurements.

In 'read' mode, at the slow rate, the instrument will output the displayed values to an RS232 device. When in 'recall' mode also, stored data may be output to an RS232 device.

Easy-to-use zero-set and calibration facilities are included.

## 2. Battery Information

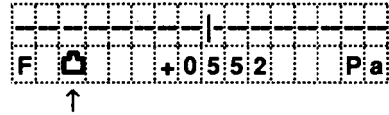
The PVM100 is supplied without battery cells. Four 1.5 volt AA size cells are required. 'Standard', Alkaline or rechargeable cells may be used, though 'standard' cells exhibit a relatively short life.

### 2.1 Low battery indication

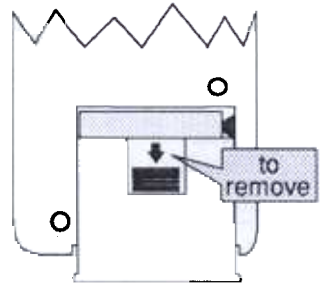
The low battery indicator (illustrated to the right) will appear



in the display, as shown below, if the batteries need replacing.



## 2.2 Replacing the batteries



The batteries are accessible through the slide and 'snap' cover in the underside of the instrument - shown above in a part view of the back of the instrument.

## 3. WARNING

**DAMAGE MAY RESULT IF THE PVM100 IS SUBJECTED TO AN INLET PRESSURE ON EITHER PORT IN EXCESS OF FIVE TIMES THE WORKING PRESSURE OF 3500 PASCALS**

## 4. Description of the instrument

The PVM100 is housed in a robust plastic case, with the following external features:

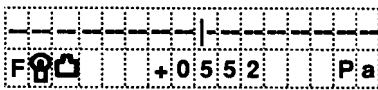
- 2 rows x 16 element dot matrix display
- Eight key keypad
- Two pressure ports
- RS232 port
- Display contrast control
- Battery compartment
- Carrying strap

Items supplied with the PVM100 but not forming part of the instrument itself are:

- Carrying case
- Mating RS232 connector (mini 8 pin plug, Airflow Part No. 9040180)
- 2.5mm to 5mm tube adaptors (for connecting to standard pitot-static tubes)
- 2.5mm I.D. x 2m lengths of red and blue plastic tubing
- 5mm I.D. x 150mm lengths of red and blue plastic tubing

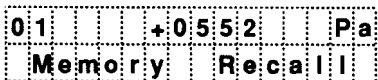
NOTE: Connect adaptors and tubing as shown in diagram in Section 7.1.

## 4.1 The Display



The display in 'read' mode is shown above. The top row provides a simple linear bar graph of the incoming pressure. The bar graph has a centre zero and shows positive values as a line extending to the right and negative to the left.

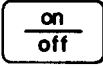
The bottom row shows Display rate ('F' or 'S') in the leftmost element, the 'light' symbol (whenever the display light is on - see paragraph 4.2.2) in the second element along and the 'low battery' symbol (when applicable) in the third element along.





In 'recall' mode, as illustrated above, the top row of the display is used to indicate each stored value and the bottom row the legend 'Memory Recall' or the average of the stored values, if so commanded (see paragraph 5.3).


## 4.2 Keypad functions


Keypad keys are marked in two colours. The white colour denotes commands which apply to the 'read' mode. The red colour denotes commands which apply to the 'recall' mode.

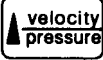
- 4.2.1 Press the 'on/off' key.  The display will come on within a second or so. On start-up, the instrument will enter 'read' mode with the display at the 'fast' rate (an 'F' appears in the bottom left corner of the display). The display units will be the same as those in use the last time the instrument was used. Pressing the key a second time will switch the instrument off.

- 4.2.2 When pressed, the 'Display light' key will  light the display for approximately 6 seconds. It is not necessary to hold the key down.

- 4.2.3 The 'instrument mode' key toggles the instrument between  'read' and 'recall' modes.

- 4.2.4 The 'Memory store' key, when pressed,  causes the data currently being displayed to be stored in memory.

- 4.2.5 In 'read' mode, the 'Display rate' key  toggles between 'slow' and 'fast' display rates. In 'recall' mode, the key causes the average of stored data to be displayed.

- 4.2.6 In 'read' mode, the 'velocity/pressure' key  toggles the display between velocity and pressure data. In 'recall' mode, the key

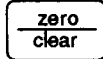
enables a sequence of stored data to be displayed in ascending order.

- 4.2.7 In 'read' mode, the 'imperial/metric' key toggles the display between imperial and metric units.



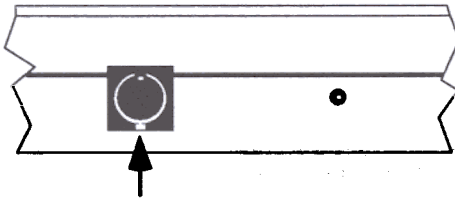
In 'recall' mode, the key enables a sequence of stored data to be displayed in descending order.

- 4.2.8 In 'read' mode, the 'Zero' key enables the instrument to set its own offset to zero, with no differential pressure applied to the instrument. It is not necessary to hold the key down.



In 'recall' mode, the key causes the memory to be cleared.

### 4.3 The RS232 Port



RS232 PORT

Located on the side of the instrument, the RS232 port is a mini 8 pin DIN female socket.

It may be used to connect the instrument to any RS232 compatible device such as a printer or data-logger.

The RS232 interface is suitable for driving a SEIKO Model No. DPU201GS (obtainable through Airflow Ltd) or any other RS232 compatible printer.

Connection details and data format are given in Section 10 at the end of this booklet.

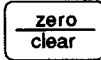
### 4.4 The Display Contrast Control



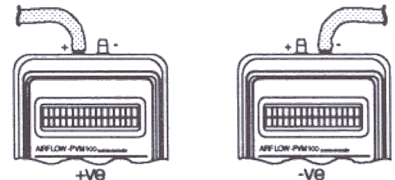
Also located on the side of the instrument, this control may be used to vary the display contrast. This control should not normally need any adjustment but if the display contrast is not optimum for any reason, a small screwdriver may be used to make an adjustment.

### 5. Operation

Before making any pressure connections it is wise to press the 'zero' key to reset the instrument's offsets.



Connect the instrument to a remote pressure source. Positive pressure readings will be obtained if the pressure (relative to atmospheric pressure) connection is made to the left-hand port on the top of the instrument, negative to the right-hand port - see illustration which follows.



If measuring a differential pressure, connect as shown in Section 7.1.

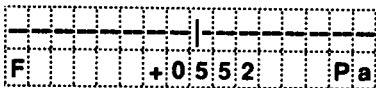
### 5.1 Switch On

Press the 'on/off' key. The display will show the current computed velocity or pressure value.



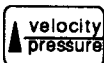
## 5.2 'Read' Mode Measurements

5.2.1 The instrument will enter 'fast' mode automatically on switch-on and will display either velocity or pressure values - depending on which mode it was in when last used.



In the above example, the top row is the linear bar graph of the pressure as described earlier, the 'F' confirms that the instrument is in 'fast' mode and the current reading is a pressure of 552 Pa.

Press the 'velocity/pressure' key to toggle between 'velocity' and 'pressure' values.



Press the 'imperial/metric' key to toggle between imperial or metric units on the display.



5.2.2 With the instrument set to display at the 'fast' rate, the display will be updated at a rate slightly higher than once per second (and will display an 'F' in the lower left corner of the display).

If the 'display rate' key is pressed, the display will show an average of four readings, updated approximately once every three seconds (and will display an 'S' in the lower left corner of the display).



In the 'slow' mode, the data being displayed is output to the RS232 port.

5.2.3 At any time while readings are being taken, it is possible to store any reading (currently showing in the display) in the instrument's memory. To do this, press the

'store' key. The display will change (for four seconds) to show the value being stored, as follows:



Up to 60 values may be stored.

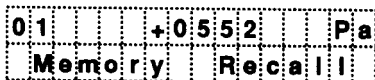
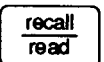
Note that the reading is stored as a velocity or pressure value in the units currently in use. Thus, when storing a series of readings, it is important that neither the velocity/pressure nor the imperial/metric keys should be pressed. If such a change is made immediately prior to recalling the stored data, all stored values will be displayed in the new units (rather than the units in which they were originally recorded).

5.2.4 Note that due to the high sensitivity of the instrument, low pressure fluctuations such as noise, are filtered out. Hence, for inputs below the levels specified in the following table, the display will show zero:

Parameter	Metric mode	Imperial mode
Pressure	1 Pa	0.003 in.wg
Velocity	1.3 m/s	220 ft/min

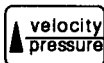
## 5.3 Recalling Stored Data

Press the 'Instrument mode' key to switch to the 'recall' mode. The display will change to show the first item of stored data on the top row with the legend 'Memory Recall' on the bottom row - as shown in the following illustration:



- 5.3.1 The whole set of stored data may be examined as follows.

Pressing the red arrow up key causes the display to show the next stored value in ascending order. If this process is continued until the last stored value is reached, the cycle will automatically return to 01, ready to cycle through again.



Similarly, pressing the red arrow down key causes the display to show the next stored value in descending order.

The stored values will be displayed in whichever units were in use at the time of entering 'recall' mode.

The average of all stored values may be displayed by pressing the red 'avg' key. This causes the display to change to the following:

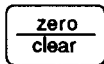


		32	Readings		
Avg		+0405	Pa		

In this example, the average of all stored values is 405 Pa.

Having noted this average value it is possible to continue stepping through the stored values by simply pressing either of the red arrow keys.

The contents of the memory may be cleared while in 'recall' mode by pressing the red 'clear' key. The display will change to show:

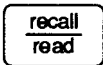


Memory	Cleared
Memory	Recall

This display will be held for approximately two seconds and will be replaced by the normal

'read' mode display. [It is not possible to remain in or enter 'recall' mode if there is no data stored in memory.]

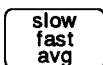
- 5.3.4 When finished in 'recall' mode, press the 'instrument mode' key to return to 'read' mode.



## 5.4 Downloading Data

- 5.4.1 In 'read' mode, with the 'slow' display mode set, the instrument will download the currently displayed value to the RS232 port immediately after each fresh calculation is made of the average value of four readings (see 5.2.2).
- 5.4.2 In 'recall' mode the whole set of stored data (including an average value) may be output to an RS232 device. The following procedure describes how to do this.

Connect an RS232 device to the RS232 port on the side of the instrument. Press the red 'Avg' key. After a short wait, the display will change to show the following set-up panel:



Print	from	01	
	to	04	

The 'from' index may be altered by repeatedly pressing the red up arrow key until the desired start index is showing. Similarly, the 'to' index may be altered using the red down arrow key.



Pressing the red 'Avg' key at this point will cause the average of the selected range of 'from/to' values to be calculated.

Press 'store' to cause all selected values,



plus the average of these values, to be output to the RS232 device. Once the output sequence is complete, the display will return to the normal 'Memory Recall' one.

## 6. Calibration

Given that a calibrated pressure source (with a range of zero to 3500 Pa minimum) is available, re-calibration of the PVM100 using its built-in calibration facility is a very simple process.

To ensure accuracy, the pressure source should be traceable to a National Standard.

**WARNING:** Altering the calibration will INVALIDATE Airflow's warranty. Note that the PVM100 will monitor each time the calibration is affected.

If the calibration routine is INADVERTENTLY entered then SWITCH OFF immediately and re-start.

### 6.1 Set-up

- 6.1.1 Connect the positive port of the PVM100 to the pressure source.
- 6.1.2 Switch on the PVM100, whilst holding down any other key on the keypad. The display should show:

	V	e	r	s	i	o	n	:	N	.	N	
X	X											

where N.N is the current software issue, and XX is the value of the calibration counter (for Airflow use only).

If the display does not show this, switch off and repeat the switch-on step again.

- 6.1.3 Press the keys listed in the following (and in the order listed) to enter the calibration routine code:

'slow/fast/avg'  
'zero/clear'

'velocity/pressure'  
'imperial/metric'

Each correct entry will be indicated by a '+' on the display.

If there is an incorrect entry, the PVM100 will start-up again but in the normal 'read' mode. If this happens, press the 'on/off' key and start again from switch on as described in paragraph 6.1.2.

Once the code is entered correctly, the display will show:

A	r	e	Y	o	u	S	u	r	e	?
Y	=	z	e	r	o	N	=	l	i	g

zero
clear

Press 'zero' to continue or 'light' to quit.

light
-------

### 6.2 Calibration Procedure

Calibration of the PVM100 is highly simplified and involves no internal adjustments. The procedure merely requires the user to select the correct pressure and proceed through a series of instructions displayed on the PVM100's display.

The PVM100 is calibrated by selecting four different pressure points, firstly on the positive pressure port and secondly on the negative pressure port. The calibration instructions are prompted by the PVM100 at each step, as follows:

#### 6.2.1 Prompt:

S	e	t	P	r	e	s	s	=	0	0	0	P	a
T	h	e	n	P	u	s	h	Z	e	r	o		

With the positive pressure port connected to the pressure source, set the pressure to 0000 Pa. Press the 'zero' key on the PVM100's keypad.





Measure the cross-sectional area of the duct (using metres or feet units as appropriate to the velocity units used).

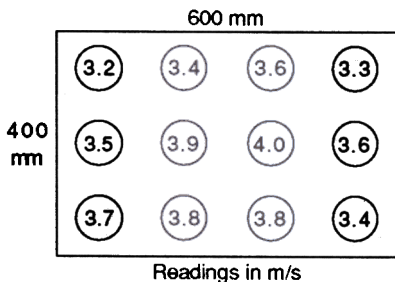
Calculate the volume flow rate as:

$$\text{Flow rate} = (\text{Avg vel}) \times (\text{area})$$

The units for the flow rate answer will be either  $\text{m}^3/\text{sec}$  or  $\text{ft}^3/\text{min}$ , depending on whether metric or imperial units were used.

### EXAMPLE

Air velocity has been measured in a 600mm x 400mm rectangular duct at 12 different positions as shown in the diagram which follows:



The readings have been recorded in memory and the average obtained as described earlier. In this example, the average velocity is 3.6 m/s.

After finding the average velocity find the duct cross-sectional area :-

$$0.6 \times 0.4 = 0.24 \text{ metres}^2.$$

Therefore the volume flow rate is:-

$$0.24 \times 3.6 = 0.864 \text{ m}^3/\text{sec}$$

$$\text{or, } 0.864 \times 3600 = 3110.4 \text{ m}^3/\text{hr}$$

$$\text{or, } 0.864 \times 1000 = 864 \text{ litres/s}$$

## 7.2 Air Filter Pressure Loss

In a similar manner, the instrument may be used in 'pressure' mode to measure the static pressure either side of an air filter in a duct.

In this case, a single measurement only is required on the upstream and downstream sides of the filter. The difference between the two pressure readings is an indication of the state of the filter.

## 8. Possible Sources of Error

One common source of error arises from the taking of measurements in a duct too close to a source of turbulence (e.g. a bend). If possible, the pitot-static tube should be inserted into the duct at least 6 duct diameters or widths downstream of any source of turbulence.

In the particular case of measuring air flow from a grille, the air issuing from a grille is invariably very disturbed and results obtained by deploying the pitot-static tube near to the grille surface are sure to be unreliable. Instead, make up a short length of test ducting which is just larger than the overall dimensions of the grille.

This test duct can be of any convenient rigid material (e.g. stiff cardboard) and should have a length at least twice the diagonal measurement of the grille. The test duct should be placed over the grille, and sealed to the wall with adhesive tape. The pitot-static tube can now be deployed at the open end of the test duct. The cross-sectional area of the test duct (not the grille) should be used in any volume flow calculations.

## 9. Repair and Calibration

If an instrument's calibration becomes suspect (after having ensured that it is correctly zeroed), it should be returned to

Airflow Developments for recalibration to original standards. In any event, it is good practice to have the instrument checked at least once a year.

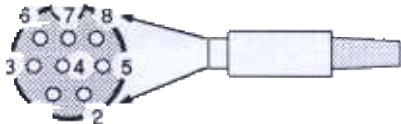
If an instrument is not working correctly, or requires recalibration, contact your nearest Airflow Agent or UK Service Department on (01494) 525252.

In the UK, Airflow Ventilation Supplies (AVS) operates an instrument hire service for the convenience of customers having equipment repaired or recalibrated. To use this facility, contact AVS, telephone (01494) 463490, facsimile (01494) 471507, to make arrangements prior to returning your instrument.

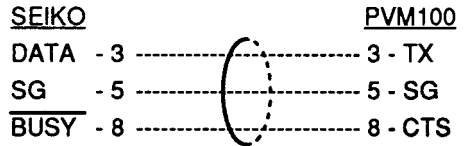
### 10. RS232 Connections

A mating RS232 connector (mini DIN 8 pin plug, Airflow Part No. 9040180 is supplied with the PVM100. The pin identification for this plug is shown in the illustration which follows:

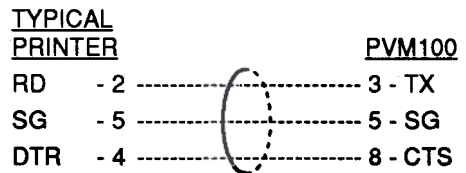
EXTERNAL VIEW



Wiring details for the SEIKO printer (Model No. DPU201 GS) are shown in the following illustration:



Wiring details for other typical printers with an RS232 port (on a 9 pin D-type connector) are shown in the following illustration:



As indicated, in both cases multicore cable should be used.

The data format for the RS232 output from the PVM100 is as follows:

BAUD	1200
PARITY	NONE
DATA BITS	8
STOP BIT	1

## 11. Specification

Parameter	Metric mode	Imperial mode
Velocity range†	0 - 76 m/s	0 - 15000 ft/min
Pressure range†	0 - 3500 Pa	0 - 14 in wg
Pressure resolution	1 Pa	0.001 in wg
Storage temperature	-10°C to +50°C	14°F to 122°F
Operating temperature	-5°C to +50°C	23°F to 122°F
Accuracy at 20°C	±1 % of reading ± 1 digit in +ve and -ve mode	
Output	RS232 (1200,N,8,1)	
Max. overload pressure	17.5 kPa	70 in wg
Memory size	60 concurrent velocity or pressure readings	
Instrument dimensions	185 x 92 x 30mm	7.28 x 3.62 x 1.18ins
Instrument weight (less battery cells)	290 gms	10.3 oz
Battery cells	Four type AA 1.5 volt cells, Rechargeable, Alkaline or Standard (zinc carbon)	
Battery life	Approximately 35 hours using Alkaline battery cells (in 'read' mode with no backlight or RS232 output)	

† Velocity and pressure ranges quoted apply to measurements made on air at a density of 1.2Kg/m<sup>3</sup> and using an ellipsoidal nose pitot-static tube to ISO 3966 - 1977 (BS1042 Section 2.1)

## 12. Spares List

Description	Airflow Pt. No.	Description	Airflow Pt. No.
Keypad & Panel	51993601	Display	9020129
6 fasteners for above	9020195	Service pack comprising:-	72310901
Transducer	9040130	Battery holder & connector,	
Eprom	71968801	2 port manifold, screws &	
RS232 socket	9040131	spacers, red/blue tubing for	
RS232 plug	9040180	transducer, spindle & sleeve	

# AIRFLOW™

QUALITY ASSURED TO ISO 9001

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