# OPERATING MANUAL

for

# *DPM 110*

***LOW AIR PRESSURE / VELOCITY SENSOR***


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# OPERATING MANUAL **DPM 110**

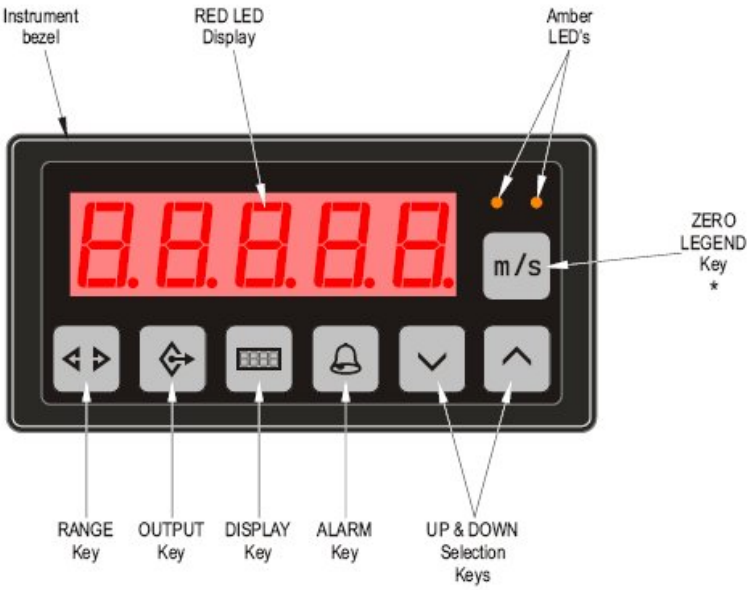
**CONTENTS**

## 1.1 DPM OVERVIEW FRONT PANEL LAYOUT

The DPM is a panel mount low air pressure / velocity sensor that provides an output signal of 0-10V and 4-20mA.

The integral 5 digit red LED display shows the actual pressure, velocity or volume in the selected units, dependant upon the settings. All necessary adjustments can be made from the front via the integral membrane keyboard, the layout of which is shown below.

**DPM**
**Front Panel Layout**




*NOTE

The ZERO key legend may vary depending on each instruments individual configuration. This a visual reference and does not affect the functionality of this key. Below are the variations available.

## 1.2 DIAGNOSTIC LEDs

The amber LEDs on the keyboard as well as the right hand decimal point on the display indicate various conditions as shown below.

| | |
|---|---|
| Both LEDs off. | Normal operation |
| One or both LEDs on steady | Alarm condition – see alarm section |
| Both LEDs flashing together | The display is temporarily showing an alternative value. |
| Left LED flashing Right LED off<br>Right LED flashing Left LED off | See 2.3 output scaling mode. |
| Right hand decimal point lit | The user has entered the correct password and the password is still active allowing parameters to be changed. |
| Right hand decimal point flashing twice per second | Calibration mode. |
| Right hand decimal point flashing rapidly | Calibration mode – span adjustment. The up and down keys can now be used to adjust the calibration of the sensor. |
| Display shows OLOAd or ULOAd | See section 2.2 Over pressure protection |
| Heartbeat LED<br>This GREEN led is visible through the hole in the case next to terminal 16 | Flashes at a rate of 5 times per second. |
| Communications LEDs<br>These Yellow leds are visible through the hole in the case next to terminal 16. | The LED nearest the rear flashes when the DPM is receiving data. The other LED flashes when the DPM is transmitting data. |

## 2.0 CONFIGURATION

## 2.1 ACCESSING MENUS

There are menus under the following keys:

 (Range)

 (Output)

 (Display)

 (Alarm)

To access a menu, hold down the key until the LED display changes (approx 1 second). The display will now show a parameter and its value. The same menu key is then used to step through all the available parameters within the menu. After the last parameter has been displayed the DPM will return to normal operation.

The  up and down keys are used to change the value of a parameter once selected.

To save the new value, simply step through to the next parameter.

To cancel the new value, press the  zero legend key.

A parameter is indicated by either a single letter or a group of letters. The following tables show how each parameter is displayed when the menu keys are pressed.

## 2.2 RANGE KEY PARAMETERS

*Note: A short press on this key will display the Full Scale Range of the sensor in the selected display units. Sensors with a -/+ range will show* Pn *indicating that the P and n parameters both need to be checked to see the range.*

| INDICATOR | PARAMETER | RANGE |
|---|---|---|
| S | Software Version | (e.g. 1.15) |
| Ad | Network Address | 1-254 |
| A2 | Auto-Zero | On or Off |
| P | Positive Range | |
| n | Negative Range | |
| OPP | Over-Pressure Protection | 1 (On) or 0 (Off) |
| F | Zero Offset | |
| t | Set Point | |
| Sn | MODBUS Smoothing | d or o |
| A2t | Auto-Zero Time | 1-99 hours |
| FF | MODBUS float format | 0 – 3 |
| rFt | Refill time | 0-99 seconds |

**Software Version**

This displays the current software version used. This manual relates to software version 3.73.

**Network Address**

This is the Modbus network address assigned to the instrument.

**Auto-Zero**

When set to ON, the internal electronic air valve will remove air pressure from the sensor periodically, and the sensor will be zeroed. During this period the Output Signal, the Display and the Modbus registers will be held at their current values.

**Positive Range**

This is the Positive Range of the sensor and is displayed in Pascals (Pa). This range can be adjusted within certain limits (Consult CMR).

**Negative Range**

This is the Negative Range of the sensor and is displayed in Pascals (Pa). This range can be adjusted within certain limits (Consult CMR).

**Over-Pressure Protection**

When set to 1 (ON), the internal electronic air valve will remove air pressure from the sensor when an over-pressure condition is detected. After a 1 second delay the air valve will return to its normal operation. If the over-pressure condition is still present at this time the air valve will remove the air pressure once again. This routine will continue until the over-pressure condition is removed. If the over-pressure condition is positive, the display will show OLOAd, and the output will go to 10V. If the over-pressure condition is negative, the display will show ULOAd, and the output will go to 0V.

**Zero Offset**

A zero offset in Pa can be entered. This value is added to the sensor reading so that for example, if -5.0 is entered the sensor will now read -5.0Pa with no pressure applied to the instrument. For sensor ranges of less than 1000Pa an offset of +/-199.9Pa can be entered. For sensor ranges of 1000Pa or more an offset of +/-1999Pa can be entered.

**Set Point**

This parameter is to maintain compatibility with earlier versions of the software. For new projects use the PID setpoint.

**Modbus Smoothing**

Sets the smoothing of the values read over the Modbus network.
When set to ‘d’ (Display) the display smoothing value is used.
If set to ‘o’ (Output) the output smoothing value is used.

## Auto-Zero Time

Time in hours between auto-zero cycles.

Factory set to 1, but can be increased up to a maximum of 99.

## Float Format

Selects the format used to represent floating point values in the modbus registers. See DPM110 Modbus Protocol for exact details.

## Refill Time

Factory set to 0. If the instrument has been connected using small bore tubing (< 2mm diameter), the auto zero cycle may take longer to complete due to the resistance of the tubing. This can cause the sensor reading to drop briefly after an auto zero. The Refill Time parameter can be increased if required to stop this happening.

## 2.3 OUTPUT KEY PARAMETERS

*Note: Under normal operation a short press on this key will display either Lin or Root, indicating the output mode. If PID control mode is set then this key instead switches the display to show the current percentage value of the control output for a few seconds.*

| INDICATOR | PARAMETER | RANGE |
|---|---|---|
| So | Output Smoothing | 0-99 |
| L in root | Output Mode | |
| E | Output Scaling Mode | F or L or Fac |
| F | Mag Factor or K Factor (depends on E parameter setting) | 0-99.99 |
| - | Duct Width | 0-9999mm |
| I | Duct Height | 0-9999mm |
| d | Air Density | 0-9.999 kg/m$^3$ |
| r | Room Size | 0-999m$^3$ |
| S | Small Value Shut Off | 0.00 - 99.99% |
| o | Output Re-Scaling | |
| bFL | Bidirectional flow | 0 or 1 |

**Output Smoothing**

This will set the smoothing of the output signal and the Modbus registers. The value of between 0 and 99 represents a time constant of between 0 and 10 seconds.

**Output Mode**

This will set the Output Signal to be in either Linear (Pressure) or Square Root (Flow) mode.

**Output Scaling Mode**

The sensor can be set to measure air velocity or volume by using one of three different methods.

If set to ‘F’ (Mag Factor Method) then the sensor measures the differential pressure and uses the magnification factor and air density constant to calculate velocity. The volume is then calculated using the duct dimensions.

If set to Fac (K factor method) then the sensor measures the differential pressure and uses the K factor to directly calculate the volume. This method is used when a K factor has been supplied by, for example, a fan manufacturer.

If set to 'L' (Direct Entry Method), then the sensor uses a look up table to convert the differential pressure to velocity or volume. The look up table can have from 1 to 8 points. Each point consists of a pressure and an associated velocity or volume figure. If the look up table only has 1 point then the output from the sensor will be linear against square rooted pressure. For applications where the velocity or volume is not linear additional correction points maybe added.

***Single Point Example:***

*Sensor Range = 100Pa*

*It is known that for a duct volume of 1.000$m^3$/s the differential pressure is 25Pa.*

1. *Set the display units to $m^3$/s (See the key for description).*
2. *Hold the key to enter menu.*
3. *Press key and set the Lin / Root parameter to root.*
4. *Press key and set the E parameter to L.*
5. *With the display showing Lin 0, hold the key until the left hand amber LED flashes.*

*Use the keys to set the display to 25.0. Press the key when done.*

6. *With the display showing Lin 0, hold down the key until the right hand amber LED flashes.*

*Use the to set the display to 1.000. Press the key when done.*

7. *Press the zero legend key to exit the menu.*

*To find out the full scale range of the sensor in $m^3$/s press the key briefly.*

*In this example 2.000 $m^3$/s will be displayed.*

*When 100Pa is applied, 2.000 $m^3$/s is displayed, with a 10V and 20mA output.*

*When 25Pa is applied, 1.000 $m^3$/s is displayed with a 5V and 12mA output.*

***Multi Point Example***

*With the sensor set up as for the single point example, an applied pressure of 50Pa would display a volume of 1.414 $m^3$/s. If the application is not linear and has for example a volume of 1.700 $m^3$/s at 50Pa, then another Lin point can be added to correct for this error.*

1. *Follow the single point example until the display shows Lin.0 (Note that the decimal point in front of the 0 is lit, showing that Lin 0 is already set up).*
2. *The keys can be used to scroll from Lin 0 to Lin 7. If the decimal point in front of the Lin number is lit then this means that the Lin point has already been set up. A short press on the key or the key briefly shows the pressure or volume setting for the Lin point.*
3. *To set another point, select Lin 1. Hold the key until the left hand amber LED flashes and then set to 50.0 Pa. Press the key when done.*
4. *Hold the key until the right hand amber LED flashes and then set to 1.700 $m^3$/s. Press the key when done.*

   *Please note that Lin points do not have to be entered in order.*

   *Eg: If there are Lin points at 25, 50 and 75Pa, Lin.1 could be 75Pa, Lin.2 could be 25Pa and Lin.3 could be 50Pa.*

**Clearing a Lin Point**

If a Lin point has been set up, but is no longer required it can be cleared by holding down the Zero legend key, whilst changing its pressure or volume values.

**Using alternative units**

The Lin point volume values must be entered in $m^3$/s. The sensor can still be set to display $m^3$/h or l/s, but the volumes must be converted to $m^3$/s before setting the Lin points.

To use the sensor for measuring velocity the Lin point volume values can be entered directly as m/s.

**Mag Factor – (F parameter)**

*E parameter is set to F.*

This will set the desired Magnification Factor of the measurement device. Measured pessure (Pa) is divided by this value. Eg: Typically Oval Flowprobes = Mag 1.5 (150Pa / 1.5 = 100Pa)

**K Factor – (F parameter)**

*E parameter is set to Fac.*

The sensor can be set to display volume in cubic metres per second, cubic metres per hour, litres per second or as Air Changes per hour but the K factor must be set in $m^3/s$. If the K factor has been supplied in $m^3/h$ then divide the supplied value by 3600 to get $m^3/s$. If the K factor has been supplied in l/s then divide the supplied value by 1000 to get $m^3/s$.

**Duct Width**

This parameter will allow the Duct Width to be entered in millimetres (mm).

*Note. If the duct is circular this value represents the diameter (Not used for velocity).*

**Duct Height**

This parameter will allow the Duct Height to be entered in millimetres (mm).

*Note. If the duct is circular this value must be entered as zero (Not used for velocity).*

**Air Density**

The default value of $1.200kg/m^3$ can be used for the majority of applications. (*Please note that versions of software prior to V3.50 used Air Density Factor and should be set to 1.291)*

**Room Size**

The size of a room can be entered in cubic meters ($m^3$), if air change rate needs to be measured. If air change rate is not being measured then this value is not used.

**Small Value Shut Off**

This clamps the display and signal output to zero if the pressure reading is less than this setting which is in % of full scale pressure range.

**Output rescaling**

*Note that this function only works if the instrument is set to measure velocity or volume*

.

It is possible to rescale the output so that 10V and 20mA is equal to a different value. This is particularly useful when the output is connected to an external system (BMS / PLC / Chart Recorder) which already has input scaling set.

The output scaling can be changed by adjusting the **o** parameter on the menu. If this value is 0 then it is ignored, and the full scale output of the sensor will be the value shown when the key is pressed.

If for example the value shown when pressing the key is 2.000 $m^3/s$ and a value of 4.000$m^3/s$ for at 10V/20mA is preferred then the **o** parameter could be changed to 4.000. Pressing the key still shows 2.000 $m^3/s$ as this is still the maximum volume the sensor can measure, but 2.000 $m^3/s$ will now output 5V/12mA.

**Bidirectional Flow Enable**

Factory set to 0, bidirectional flow measurement disabled.

It is possible to measure airflow in both directions. To achieve this, the **bFL** parameter must be set to 1 and the Output Range (see section 6) must be set to 5-10V or 12-20mA. Zero flow will output 5V/12mA. Full scale forward flow will output 10V/20mA and full scale reverse flow will output 0V/4mA. The display will show a negative reading for a reverse flow.

When bidirectional flow is enabled, the small value shutoff will operate in a band either side of zero.

## 2.4 DISPLAY KEY PARAMETERS

*Note: A short press on this key will display the displayed units. These are shown as indicated below.*

| INDICATOR | PARAMETER | RANGE |
|---|---|---|
| Sd | Display Smoothing | 0-99 |
| | *Display Units:* | |
| PA | Pascals | |
| hPA | hecta Pascals | |
| 3PA | kilo Pascals | |
| nnPS | metres per second | |
| lPS | litres per second | |
| nn3S | cubic metres per second | |
| nn3h | cubic metres per hour | |
| Acr | Air changes per hour | |
| dP | Decimal point | 0-4 |
| PoS | Display polarity (+) | |
| nEG | Display polarity (-) | |
| LEd | Display Activation | 1 or t |
| brt | Display Brightness | L or H |
| L2b | Leading zero blanking | 1-4 |

### Display Smoothing

This will set the smoothing of the Display.

The value of between 0 and 99 represents a time constant of between 0 and 10 seconds.

### Decimal Point

The number of digits to be displayed after the decimal point.

### Display Polarity

This is normally set to positive.

If set to negative, the display will show a negative reading for the positive signal.

*For example:*

If a 0-1000Pa 0-10V sensor is used to measure a negative pressure by sucking on the negative nipple, the output signal will be between 0 and 10V for 0 to 1000Pa. The display can be made to read 0 to -1000Pa by setting the display polarity to negative.

If PID control is being used and the display polarity is set to negative then the setpoint is also negated internally. So for the above example, if it is required to control at –500Pa on the display, then the setpoint needs to be entered as –500Pa. Internally the sensor is measuring and controlling +500Pa but the display and setpoint both show –500Pa.

It is not recommended to set the display polarity to negative if the alarm function is required, as the alarm thresholds are not changed by the display polarity setting.

**Display Activation**

When set to ‘1’ the red LED display is always on.

If set to ‘t’ the red LED is switched on when a key is pressed and will automatically switch off after 2 minutes of keyboard inactivity.

**Display Brightness**

When set to ‘L’ the display has low brightness.

If set to ‘H’ the display has high brightness.

**Leading Zero Blanking**

This is the minimum number of digits that will be displayed. The table below shows how a value of 1 would be displayed depending on the number of decimal places and the L26 setting.

| L26 | Decimal places | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| 1 | 1 | 1.0 | 1.00 | 1.000 | 1.0000 |
| 2 | 01 | 01.0 | 01.00 | 1.000 | 1.0000 |
| 3 | 001 | 001.0 | 01.00 | 1.000 | 1.0000 |
| 4 | 0001 | 001.0 | 01.00 | 1.000 | 1.0000 |

## 2.5 ALARM KEY PARAMETERS

| INDICATOR | PARAMETER | RANGE |
|---|---|---|
| L | Low Alarm | |
| H | High Alarm | |
| t | Alarm Timer 1 | 0-999 seconds or 0-99.9 hours |
| t. | Alarm Timer 2 | |
| rL | Relay Energization | nE or nd |
| U | Units | dU or PEr (%) |
| AF | Alarm Function | 0 - 8 |
| Sr | Self Reset | 0 or 1 |
| Er | External Reset | A or r |
| bU | Buzzer Function | 0 1 P |
| rb | Remote buzzer | - 0 1 P |
| rA | Remote alarm indication | - 0 F LH |
| rt | Re-alarm timer | 0-999 minutes or 0-99.9 hours |
| tU | Timer units | S or h |

### Low Alarm

The low alarm threshold. See Units below.

If a low alarm is not required then it can be turned off by pressing the RANGE key while the Low threshold is being displayed. The display will then show L OFF.

### High Alarm

The high alarm threshold. See Units below.

If a high alarm is not required then it can be turned off by pressing the RANGE key while the low threshold is being displayed. The display will then show H OFF.

### Alarm Timer 1 & 2

Alarm delays in seconds or hours. See Alarm Function and Timer Units below.

**Relay Energization**

nd The relays are normally de-energized and will energize when in alarm.

nE The relays are normally energized and will drop out when in alarm. The front panel LEDs are on when in alarm regardless of the relay energization.

**Self Reset**

If set to 0 then the alarm will not reset when the signal returns to normal. The Mute Input/Key resets the alarm. Non resetting alarms are only available for Alarm Modes 2, 4, 5 & 6.

**External Reset**

This feature only functions in Alarm Mode 2 with Sr set to 0.

A Clear Alarm. The external mute input resets Relay S2 and allows Relay S1 to reset when the fault has cleared.

r Clear Relay. The external mute input resets Relay S2. Relay S1 will not be reset until the key has been pressed and the fault has cleared.

**Internal Buzzer Function**

0 = The internal buzzer is disabled.

1= The internal buzzer sounds continuously when in alarm.

P= The internal buzzer pulses on and off when in alarm.

**Remote Buzzer Function & Remote Alarm Indiation**

See remote display section

**Re-alarm timer**

The re-alarm timer can be set between 1 and 999 minutes or 0.1 and 99.9 hours (see Timer Units below). If the re-alarm timer is set to zero then it is disabled. The re-alarm timer starts when the mute is operated. If the alarm condition is still present when the re-alarm timer expires, the buzzer and any muted relays are turned on again.

**Units**

dU The alarm thresholds are displayed in the same units as currently selected for display.

PEr The alarm thresholds are displayed as a percentage of the full scale range of the sensor.

**Timer Units**

S The alarm timers are in seconds and the re-alarm timer is in minutes.

h The alarm timers and re-alarm timer are in hours.

**Alarm Function**

0 NO ALARMS

1 SEPARATE LOW / HIGH ALARMS

Internal Relay S1 is a low alarm relay which operates when the signal has been below the low alarm threshold for longer than the timer 1 period.

Internal Relay S2 is a high alarm relay which operates when the signal has been above the high alarm threshold for longer than the timer 2 period.

Both relays will automatically reset when the signal returns to normal.

2 LAMP / BUZZER / MUTE

Both relays operate when the signal is outside either threshold for longer than the timer 1 period. Timer 2 is not used.

Relay S2 will return to normal if the alarm key  is pressed or if the mute input is activated but Relay S1 will stay in alarm.

Both relays reset when the signal returns to normal operation.

3 STAGE 1 / STAGE 2

Relay S1 operates when the alarm has been outside threshold for longer than timer1.

Timer 2 then starts and Relay S2 operates when timer 2 expires.

Both relays will automatically reset when the signal returns to normal.

4 ALARM + ZERO INDICATION

Relay 2 operates as a low/high alarm using timer 1.
Relay 1 energizes during a manual zero or auto zero cycle.

5 SEPARATE LOW / HIGH ALARMS WITH MUTE

Same as Mode 1 but mute input / key will reset whichever relay is in alarm.

6 SEPARATE LOW / HIGH ALARMS, TIMER 2 RESET DELAY WITH MUTE

Relay S1 is low alarm, Relay S2 is high alarm. Relay S1 or S2 will operate when the signal has been outside threshold for longer than the Timer 1 period. Relay S1 or S2 will reset when the signal has returned to normal for longer than Timer 2 period, or when the mute input / key is operated.

7 SEPARATE LOW / HIGH ALARMS, TIMER 2 RESET DELAY

Same as Mode 6 but no mute facility.

8 ALARM AND EXTERNAL CALIBRATION VALVE

*NOTE ! This mode can only be used when the external calibration valve assembly is fitted or if the DPM is fitted with calibration nipples.*

Relay 2 operates as a low/high alarm using timer 1.

If the external calibration valve assembly is fitted:-

Relay 1 operates during calibration mode to switch the external valves over to utilise the additional calibration nipples in lieu of the standard nipple connections.

If the DPM is fitted with calibration nipples:-

Relay 1 operates during calibration mode to signal that the instrument is in calibration mode.

## 2.51 ALARM FUNCTION 9

*To select alarm function 9, enter the alarm menu, step through to the AF parameter, change it to 9 and then press the alarm key to confirm, which will cause the menu to exit. Now when the alarm menu is entered the Alarm Function 9 menu will be entered as shown below.*

Alarm function 9 can only be used when the instrument is connected to a monitoring system via MODBUS communications. The alarm thresholds and delays can only be set via communications. The alarm thresholds are floating point values and are set in the same units as the display. The alarm timers can be set from 0 to 65534 seconds.

The monitoring system can lock the DPM110 so that its parameters can only be modified if the monitoring system first unlocks the instrument. This means that it is not necessary to set a password in the DPM110.

Relay1 and relay 2 each have their own low and high alarm thresholds and each threshold has a separate timer. Each relay can be made to operate on either or both of its thresholds and can be independently configured to be normally energised or normally de-energised. All four alarms can be read by the monitoring system. The monitoring system can override either or both of the relays to their non alarmed state for maintenance or calibration.

All the alarms are self resetting. The on board buzzer and the remote display alarm operate on the Relay1 and Relay2 thresholds. The mute key or the external mute input can be used to mute the buzzer.

The left hand LED on the keyboard will be on if the Relay1 alarm is on and the right hand LED will be on if the Relay 2 alarm is on. If the buzzer is enabled and is buzzing then the appropriate LED will flash until the buzzer is muted.

Alarm function 9 has a different alarm key menu as detailed below.

| ALARM KEY MENU – ALARM FUNCTION 9 | | |
|---|---|---|
| **INDICATOR** | **PARAMETER** | **RANGE** |
| r 1 | Relay1 threshold configuration | L H LH |
| r2 | Relay2 threshold configuration | L H LH |
| r 1. | Relay1 Energization | nE or nd |
| r2. | Relay2 Energization | nE or nd |
| hY | Hysteresis | 0.0 - 99.0% |
| bU | Buzzer Function | 0 1 P |
| rb | Remote buzzer | - 0 1 P |
| rA | Remote alarm ndication | - 0 F LH |
| Zon | Zone | 0-7 |
| AF | Alarm Function | 0 – 9 |

**Relay Threshold Configuration**

L=Relay operates on the low threshold only.

H= Relay operates on the high threshold only.

LH=Relay operates on both thresholds.

**Relay Energization**

nd The relay is normally de-energized and will energize when in alarm.

nE The relay is normally energized and will drop out when in alarm.

**Hysteresis**

The hysteresis value is common to all the alarm thresholds. The value is set as a percentage of the full scale range of the sensor. If the sensor has a positive and a negative range, e.g. a +/-100Pa sensor, then the full scale range is the total range so in this example a hysteresis value of 1.0% would give a hysteresis value of 2Pa.

**Internal Buzzer Function**

0 = The internal buzzer is disabled.

1= The internal buzzer sounds continuously when in alarm.

P= The internal buzzer pulses on and off when in alarm.

**Remote Buzzer Function & Remote Alarm Indiation**

See remote display section

**Zone**

The zone parameter can be set from 0 to 7.

The monitoring system can override the relays to the non alarmed state for maintenance purposes. It is possible to group the instruments into zones so that a broadcast command can be used to override all the instruments in a particular zone.

## 3.0 ALARM TEST MODE

*Note that the Alarm Test Mode does not function when alarm function 9 has been selected.*

To activate the Alarm Test Mode, hold down both the Range key and Alarm key simultaneously until the display reads test.

The internal relays (S1 & S2) will be switched ON and OFF at 1 second intervals until the Alarm key is pressed.

If this test mode is not manually cancelled by pressing the Alarm key it will automatically stop after a period of 15 minutes.

The DPM will continue to otherwise operate normally during this test mode.

## 4.0 MANUAL ZERO

To perform a Manual Zero, hold down the Zero key ZERO KEY until the display reads 2Ero.

The internal electronic air valve will be switched to remove the air pressure from the sensor allowing the sensor zero to be measured and then adjusted if necessary.

The pressure tubes do not have to be removed during this procedure, as the internal valve will operate to remove the air pressure.

## 5.0 PASSWORD OPERATION

When originally supplied the DPM has no password entered, and all functions are accessible.

Once a password has been entered, all settings can only be viewed.
The Up/Down keys will not have any effect on the values unless the password has been entered.

### PASSWORD ENTRY

Hold down both the Range Key and Down Key simultaneously for 1 second.

The display will read _ _ _ _ , enter the 4 digit password. If the password is accepted, the display will read **Good**. The right hand decimal point will now be lit to show that a password is active.

The password will timeout after a period of 3 minutes with no keyboard activity.

### NEW PASSWORD ENTRY

*If a password already exists, this will have to be entered before a new password can be entered. See PASSWORD ENTRY above.*

Hold down both the Range Key and Up Key simultaneously for 1 second.

The display will read 1_ _ _ _ , enter a 4 digit password.
The display will read 2_ _ _ _ , enter the same 4 digit password.

If both the 4 digit passwords match then the display will read **Good** and the new password has been accepted. If the passwords did not match, the display will read **bAd** indicating that the new password was not accepted.

### REMOVING PASSWORD

Enter the existing password as described in 'PASSWORD ENTRY'. Now start to enter a new password, when the display shows 1_ _ _ _ hold down the ZERO key (ZERO KEY) until the display shows **CLEAr**.

## 6.0 CALIBRATION MODE

*Note: If a password has been set then this will need to be entered before the calibration mode can be accessed.*

To enter the calibration mode hold down both the Range key  and Zero key 

simultaneously until the display goes BLANK and then release. The right hand decimal point will now flash to indicate that the calibration mode is active.

In calibration mode the display and output smoothing values are temporarily set to zero. If the DPM has calibration nipples fitted, the internal valves will switch over so that the instrument measures the pressure applied to these nipples.

The calibration mode can be cancelled by holding down the same two keys again until the display goes BLANK and then release.

## 6.1 OUTPUT RANGE CONFIGURATION

 Output key - Calibration Mode

| INDICATOR | PARAMETER | RANGE |
|---|---|---|
| u_ | Minimum Output Voltage (e.g.0V) | 0-10 |
| u¯ | Maximum Output Voltage (e.g.10V) | 0-10 |
| I_ | Minimum Output Current (e.g.4mA) | 0-20 |
| I¯ | Maximum Output Current (e.g.20mA) | 0-20 |
| OPF | Calibration mode output freeze | 0 or 1 |

*Note: Calibration mode will exit automatically when this menu is exited.*

## 6.2 SENSOR SPAN CALIBRATION

Range key - Calibration Mode

| INDICATOR | |
|---|---|
| CAL_P | (Positive) See Procedure below |
| CAL_n | (Negative) See Procedure below |

Manually Zero the sensor.

Connect a calibrator to the positive (+) nipple and apply full scale positive pressure.

Enter the calibration mode, as described previously.

Hold down the Range key . The display will briefly show CAL_P then show the pressure reading with the right hand decimal point flashing quickly, this indicates Span Calibration Mode.

The Up/Down keys can be used to alter the display, making the values the same for both the DPM and the calibrator.

If there is no negative range to calibrate, the next procedure can be bypassed.

Press the Range key . The display will briefly show CAL_n then show the pressure reading with the right hand decimal point flashing quickly. Apply pressure to the negative (-) nipple and use the Up/Down keys to alter the display, making the values the same for both the DPM and the calibrator.

Press the Range key to finish. The DPM will return to its normal operation ending the calibration mode. The right hand decimal point will stop flashing.

## 6.3 CALIBRATION MODE OUTPUT FREEZE

If the OPF parameter is set to 1, the voltage and current outputs will be held at their values prior to entering calibration mode. The outputs will return to normal when calibration mode exits. Values read by the MODBUS network are not affected by this parameter

## 7.0 PID CONTROL MODE

The PID menu is accessed by holding down the → key and the ZERO KEY key.

| INDICATOR | PARAMETER | RANGE |
|---|---|---|
| PId | Pid mode | 0 A H |
| H | Hand setpoint | 0.00 – 99.9 |
| t | Auto setpoint | |
| P | Proportional gain* | 0.00 - 999 |
| I | Integral gain* | 0.00 - 999 |
| d | Derivative* | 0.00 - 999 |
| b | Dead band | 0.00 – 99.9 % |
| r | Ramp speed* | 0.00 – 999 sec |
| Co | Control output | U I UI |
| SF | Smoothing factor | 00-99 |
| dt | Door timer | 00 – 255 secs |
| dI | Door input | 0 nC no |
| dir | Control direction | P or n |

*When changing these values, the control loop is updated with the new value as soon as the UP or DOWN key is released. This allows adjustment of the parameter in real time. To store the change in value the OUTPUT must be pressed to move to the next parameter. If ZERO KEY is pressed the change is not saved.

**PID MODE**

O = Off. PID mode is disabled. The voltage and current outputs revert to being sensor outputs.

A = Auto. PID automatic mode. The output selected for PID control is controlled to maintain the pressure at the automatic setpoint. A brief press on the key will change the display to show the control output temporarily. After 15 seconds the display reverts to normal operation.

H = Hand. The control output is fixed at the hand setpoint.

**HAND SETPOINT**

In hand mode, the control output will be fixed at this value. The value is between 0.0 and 99.9% of full scale output. e.g. with a 50.0% setpoint the output will be 5V on the 0-10V voltage output or 12mA on the 4-20mA output.

The keys are used to change the setpoint. The control output will change immediately.

There is a bumpless transfer of control when switching between auto and hand modes. When switching from auto to hand operation the hand setpoint will be changed to be the same as the current output. When switching from hand to auto the output will initially start controlling at the hand setpoint.

**AUTOMATIC SETPOINT**

The automatic setpoint is set in the same units as the sensor is displaying. In normal operation, a brief press on the key displays the setpoint for a few seconds.

**P**

PID – Proportional Gain

**I**

PID – Integral Gain

**D**

Derivative

**DEADBAND**

The control output will be frozen if the input signal is within the deadband. The deadband is set as a percentage of the full scale range of the sensor. The full scale range can be viewed by briefly pressing the RANGE button.

**RAMP SPEED**

This sets the rate at which the output changes in seconds.

**CONTROL OUTPUT**

U=Voltage output is control output. Current output is sensor output.

I = Current output is control output. Voltage output is sensor output.

UI =Both outputs are control outputs.

*Note that in calibration mode, the control output remains fixed at it's value prior to calibration mode being started. The output starts controlling again when calibration mode exits.*

See calibration mode if it is required to change the output range, e.g. from 4-20mA to 0-20mA.

**SMOOTHING FACTOR**

The signal to the PID control loop may be smoothed by setting a smoothing factor. 00=no smoothing. 99=maximum smoothing.

**DOOR TIMER (DPM & APM only)**

See door input.

**DOOR INPUT (DPM & APM only)**

The Mute input on terminal 13 may be reconfigured as a door switch input. If enabled, the control output is frozen while the door is open. When the door closes there is a delay in seconds, set by the door timer before control starts again.

0=Door input is disabled.

nc=Door input is enabled. Door switch contact is closed when the door is closed.

no=Door input is enabled. Door switch contact is open when the door is closed.

**DIRECTION**

P=The output voltage increases if the input is below setpoint.

n= The output voltage decreases if the input is below setpoint.

## 8.0 REMOTE DISPLAY

A remote display can be connected to the side connector on the DPM. The remote display replicates the value shown on the instrument display when the instrument is in normal operation.
When the instrument keyboard is being operated and its display is showing a parameter, this value is not sent to the remote display. The remote display value will be frozen until the instrument reverts to normal operation.

The remote display has a mute button which does exactly the same function as pressing the key on the instrument. Pressing the on the instrument or the remote mute will mute the internal buzzer and the remote buzzer.

The remote display has its own parameters. To access the parameters the plate must be removed to access the two buttons on the rear of the circuit board. Hold down both buttons until the first parameter is shown and then release. The top key will now increment the setting and the bottom key will decrement the setting. To move to the next parameter hold both keys down. Holding both keys on the final parameter will go back to normal operation.

| INDICATOR | PARAMETER | RANGE | FACTORY SETTING |
|---|---|---|---|
| S | Software version | | |
| o | Operating mode | SEn AnI dPC | SEn |
| Ad | Address | 1 2 | 1 |
| bU | Buzzer * | 0 1 P | 1 |
| AL | Display alarm indication * | 0 F LH | LH |
| * These settings can be overridden by parameters in the DPM. See Buzzer and Alarm Indication below | | | |

## OPERATING MODE

This must be set to SEn to use the sensor with the DPM instrument.

## ADDRESS

The DPM is capable of powering one remote display but two can be connected if at least one of them is powered by a separate power supply. If two displays are connected then they must be set to different addresses. If only one display is connected then this setting can be ignored.

## BUZZER & ALARM INDICATION

The buzzer and alarm indication functions on the remote display can be set on the DPM or they can be set on the remote display. If the rb or rA parameter on the DPM is set to show a dash then the setting on the remote display is used otherwise the setting on the DPM is used.

### BUZZER

0 = Off. The buzzer will not sound.

1 = On. The buzzer will sound continuously when in alarm until muted.

P = Pulsed. The buzzer will pulse on and off when in alarm until muted.

### ALARM

0 = No display alarm indication.

F = The display will flash when in alarm.

LH = The display will flash LO when in low alarm or HI when in high alarm.

## FAULT DISPLAY

If communications to the display fails for more than 30 seconds, or if the number to be displayed is outside the range of the display, then ----- is displayed.

## 9.0 PASSWORD OPERATIONS CMR USE ONLY

CMR PASSWORD = 


### PASSWORD ENTRY

Hold down both the Range Key and Down Key  simultaneously for 1 second.

The display will read _ _ _ _ , enter the 4 digit CMR password (shown above). If the password is accepted, the display will read **Good**. The right hand decimal point will now be lit to show that a password is active.

The password will timeout after a period of 3 minutes with no keyboard activity.