# INSTALLATION AND OPERATION MANUAL

# SUBJECT

## PSM SERIES 2200 MULTI-MINDER TANK MONITORS

### INDEX

## 1.0 INTRODUCTION

This document provides guidance on the installation, configuration, and operation of PSM Series 2200. The method of operating the unit and the menu structures employed are common to all units. What may vary is the packaging. This will depend upon the intended application, the operating environment, and the number of inputs & outputs to be processed. For example a simple 8 channel device may be mounted in a more compact enclosure than one processing 40 Analogue inputs as well as 16 relay outputs, and future options such as analogue retransmission and digital input monitoring. General arrangement and connection detail drawings will be issued as part of the supply documentation, for each contract and should be referred to.

## 2.0 GENERAL SPECIFICATION

Packaging : Mild steel epoxy coated wall mounting enclosure to IP 65
Display : 8 line x 30 character backlit LCD
User interface : 16 key multi-function keypad
Power supply : 230 V AC 50 Hz
Inputs : A maximum of 8 No 4-20mA inputs, or 40 if the 32 channel expander card is fitted. Channels are enabled during factory configuration depending upon the specific application requirements (2200 provides 24V Dc power supply).

## 3.0 INSTALLATION

Refer to the outline and connection drawings provided with this manual for guidance on mounting centres and connection arrangements for I/O signals and power supply.

## 4.0 CONFIGURATION OF OPERATING PARAMETERS

There are 2 levels of configuration:-

## 1) Factory level.
## 2) Application level.

Factory level configuration of all Multi-Minders is undertaken prior to despatch, and details are included for information only. Depending upon the purchase specification, the Application level configuration may also be covered by PSM. Where the unit is supplied unconfigured the following sections provide full information for entry of application specific parameters

Refer to the configuration sheet, **document ref. 031** which is despatched with each unit, for details of factory level and any application level parameters entered by PSM.
Part A of this form details factory configuration, and Part B is used to record the application details

### 4.1 Factory level

The parameters set during factory configuration define the hardware's functionality, i.e. the number of Digital and Analogue channels that are enabled. It also covers hardware level calibration against reference input signals and verifies the accuracy of all retransmission signals.

### 4.2 Application level

The application level parameters configure the for a particular duty. For example, these parameters include, Tank names, look up tables, Specific Gravity values, alarm and control settings, etc.

Configuration is menu driven and employs consistent keystroke conventions for moving around, entering and exiting menu options. For each screen the list of available operations together with the key to activate them is listed at the bottom of the page.
Where possible multiple choices have been used and the user simply scrolls to, or highlights, the appropriate value.
Free format fields such as names and measurement units are also entered by a combination of highlighting the character to change using the left & right arrow keys, scrolling through the list of available characters with the up & down arrow keys, and confirming with the enter key.
The menus are written in a simple to follow format. It is however, important to understand the terminology used, **"RESULTANT"**, or where space requires, **"RESULT"**, is the term used in both the menu structure and normal display mode to describe the actual displayed parameter. A resultant is

the final value once the unit has read the input signal, and applied zero, range factors, any maths functions, and corrected using the look up table and tank volume parameters.

**5.0 SET-UP MODE**
Note that when in set-up mode all input scanning is suspended, and the unit holds the last set of values prior to entry of set-up mode. Where Setpoint values are being changed this may mean alarm conditions could be unwittingly created or cancelled. It is therefore advised that all inputs are in a safe condition before entering set-up, and are likely to remain so whilst changes are being made. Also, the unit will automatically time out and return to run mode if no key is pressed for 1 minute.

Within the programmable parameters there are those which relate to the unit in general, e.g. its number of inputs and their basic scaling, and those which relate to each resultant in turn, e.g. name, tank capacity, sounding table, etc.
The first group of parameters are accessed under the general **CONFIGURATION** menu, and the latter via the **RESULTANTS** menu.

Set-up mode is entered via the normal run mode display. Power the unit and wait while it runs through its power up routine (see Section 6.0 Normal Operation). Once the normal display screen is present ( see sample display 23), press (ENTER) twice.
The following screen will be displayed

| TITLE | VALUE | UOM | SG= 1.0000 |
|-------|-------|-----|------------|
| TITLE | VALUE | UOM | SG= 1.0000 |
| TITLE | VALUE | UOM | SG= 1.0000 |
| TITLE | VALUE | UOM | SG= 1.0000 |

Resultants / Configuration

SAMPLE
DISPLAY 1

**5.1  Setting RESULTANT Parameters**
Highlight **Resultants** using the Left & Right arrows, hit (ENTER) to select, and the following screen will be displayed:-

| TITLE | VALUE | UOM | SG= 1.0000 |
|-------|-------|-----|------------|
| TITLE | VALUE | UOM | SG= 1.0000 |
| TITLE | VALUE | UOM | SG= 1.0000 |
| TITLE | VALUE | UOM | SG= 1.0000 |

Resultants
View / Change

SAMPLE DISPLAY 2
Selecting VIEW displays the following screen enabling the current settings to be checked.

```
R01 : Tank No 5            SG : 0.8500   USER
Cap : 1000.0               UOM : Litres
Function : Single
IP1 : 01    IP2: N/A    IP3 : N/A        Scale : Detail
SP1 : XX%   SP2 : XX%   SP3 : XX%    SP4 : XX%
( UP ) PREV– Field        ( DOWN ) NEXT– Field
( LEFT ) PREV– Result   ( RIGHT ) NEXT– Result
( ENTER ) Edit Field      ( ESC ) Resume RUN MODE
```

SAMPLE DISPLAY 3
Note that this screen can also be displayed when a specific resultant is selected from the HELD screen in normal operation. (see sample display 14)
To change the resultants configuration hitting (ENTER) while the above screen is displayed will lead to a password entry screen as follows

```
R01 : Tank No 5            SG : 0.8500   USER
Cap : 1000.0               UOM : Litres
Function : Single
IP1 : 01    IP2: N/A    IP3 : N/A        Scale : Detail
SP1 : XX%   SP2 : XX%   SP3 : XX%    SP4 : XX%
            Enter level 2 Password
                    ????
```

SAMPLE DISPLAY 4

**N.B**. Choosing CHANGE at sample display 2 will directly display the above screen.
The level 2 Password is factory configured at **4321**.
Once this is keyed in and (ENTER) is pressed the following screen is displayed

```
R01 : Tank No 5            SG : 0.8500   USER
Cap : 1000.0               UOM : Litres
Function : Single
IP1 : 01    IP2: N/A    IP3 : N/A        Scale : Detail
SP1 : XX%   SP2 : XX%   SP3 : XX%    SP4 : XX%
( UP ) PREV– Field        ( DOWN ) NEXT– Field
( LEFT ) PREV– Result   ( RIGHT ) NEXT– Result
( ENTER ) Edit Field      ( ESC ) Resume RUN MODE
```

SAMPLE DISPLAY 5
To change parameters the Left & Right arrows are used to scroll through to a particular Resultant.
The Up & Down arrows move the cursor highlight, and (ENTER) selects the required field. The nec-

essary data is then scrolled & selected or directly typed in, and (ENTER) is used to save the changes & revert to RUN MODE.

The following fields may be changed :-

**R01 :** This field is used to enter the resultants name as it is to be displayed

**SG**: Where the value is followed by the word "USER" this field is used to key in the required correct value. Since it is possible to have an automatic or derived SG input (refer to section 5.1.1 dealing with  setting of the mathematical function) in some cases this is a read only field.

**Cap:** The total capacity of the tank is entered in this field. Maximum value is 99999999

**UOM** : This field is used to enter the units of measurement as they are to be displayed.

**Function:** The Multi-Minder has a number of inbuilt mathematical functions to meet the needs of various applications. In effect all functions achieve the same objective, which is to operate on the input signal in conjunction with the zero and span factors to provide a "normalised" signal of 0% for minimum level and 100% for maximum level. This normalised level signal is then used in the sounding  table from which an equivalent volume percentage is derived. The user entered full capacity of the tank is then multiplied by this volume percentage to give an actual volume figure for display. See section 5.1.1 for a full explanation of the various functions which can be selected

**IP1 to IP3**  These field defines the analogue input  channels the resultant is derived from. It is read only as these are actually selected under the **Function** option.

**Scale : Detail** - When this field is selected a further screen is displayed

```
Edit Resultant XX  Scale points
P01 Level :    0.00          Volume :       00.00
P02 Level :    05.00         Volume :       05.00
P03 Level :    10.00         Volume :       10.00
P04 Level :    15.00         Volume :       15.00
P05 Level :    20.00         Volume :       20.00
P06 Level :    25.00         Volume :       25.00
P07 Level :    30.00         Volume :       30.00
P08 Level :    35.00         Volume :       35.00
P09 Level :    40.00         Volume :       40.00
P10 Level :    45.00         Volume :       45.00
P11 Level :    50.00         Volume :       50.00
P12 Level :    55.00         Volume :       55.00
P13 Level :    60.00         Volume :       60.00
P14 Level :    65.00         Volume :       65.00
P15 Level :    70.00         Volume :       70.00
P16 Level :    75.00         Volume :       75.00
P17 Level :    80.00         Volume :       80.00
P18 Level :    85.00         Volume :       85.00
P19 Level :    90.00         Volume :       90.00
P20 Level :    95.00         Volume :       95.00
P21 Level :    100.00        Volume :       100.00


UOM Type : M/H
```

SAMPLE DISPLAY 6

This page is used to enter a look-up table for the Resultant. The input signal from the level transmitter is in liquid level terms, and where a tank is an irregular shape the percentage liquid **level** does not

relate directly to the percentage **volume**. The correlation between these actual parameters must be calculated and entered into this table

Use the arrow keys to move the cursor highlight and (ENTER) to select the parameter to be modified. Once modified hit (ENTER) to save the new value, and when all values are entered press (ESC).

The **UOM** field at the bottom of the page must be set depending upon the unit of measurement the Resultant is to be displayed in. If the unit is Mass or Head the field should be set as **M/H,** and if it is Volume or Level it must be set to **V/L**. The correct setting of this field is important as it affects the way the unit uses the SG value in calculation of both the displayed value and alarm and control Setpoints.

**SP1 to SP4** Show the percentage value of the alarm set-points. Hitting (ENTER) once a particular SP is highlighted brings up a further screen where the setpoint parameters may be configured. This is covered in detail in section 6.0 Normal Operation.

### 5.1.1 Setting the MATHEMATICAL function
The Multi-Minder has a number of inbuilt mathematical functions to meet various applications. These different functions are selected as required for each resultant from the resultant set-up page (see sample display 5). In effect all functions achieve the same objective, which is to manipulate the active input signal apply corrections to it, and provide a "normalised" signal of 0% for minimum level and 100% for maximum level. This normalised level signal is then used in the look-up table (see section 5.1 Scale – Detail) from which an equivalent volume percentage is derived. The full capacity of the tank is then multiplied by this volume percentage to give an actual volume figure for display.
To select, when **function** is highlighted press (ENTER), and using the up and down arrows choose the required **function**. As it is changed the applicable fields are also changed.
Note that since an input can be used for more than one resultant, to avoid scaling errors, the input zero and range factors are actually set up in the CONFIGURATION menu structure (refer to section 5.2). This ensures the input has the same effect from one resultant to the next. The range & zero factors for the inputs being used are shown as read-only values.

Following is a sample of each of the function screens with examples of their use.

```
R : XX          TANK No 5          Function : Monitor


Input : XX
Zero : XXX.XX                      Range : XXX.XX


( UP ) PREV– Field          ( DOWN ) NEXT– Field
( LEFT ) PREV–Function ( RIGHT ) NEXT– Function
( ENTER ) Edit Field        ( ESC ) to Results page
```

SAMPLE DISPLAY 7

**Monitor**
The Monitor function is used for inputs other than liquid level from a hydrostatic transmitter where SG correction is not needed. Examples include Ultrasonic level measurement, top pressure

measurement, and temperature measurement.
The formula applied is:-

**I/P XX** **+ ZF XX**
**RF XX**

Where :-
**XX** is the number of the input channel selected. To select the input number highlight the field and use the up & down arrows, press (ENTER) when the required input number is displayed.
**I/P** is an active value between 0 and 100.00 % dependant upon the value of the 4 to 20mA input signal. 4mA is 0 and 20mA is 100.00.
**ZF** is the Zero Factor programmed for the input selected. This will automatically be displayed as the input number is selected
**RF** is the Range Factor programmed for the input selected. This will automatically be displayed as the input number is selected

```
R : XX          TANK No 5              Function : Single


Input : XX
Zero : XXX.XX                          Range : XXX.XX


( UP ) PREV– Field        ( DOWN ) NEXT– Field
( LEFT ) PREV–Function ( RIGHT ) NEXT– Function
( ENTER ) Edit Field        ( ESC ) to Results page
```

SAMPLE DISPLAY 8

**Single**
The single function is used for a vented tank with a single hydrostatic level transmitter. The formula is as for monitor with the additional element of SG correction since the output from a hydrostatic transmitter is also effected by this
The formula applied is:-

**I/P XX** **+ ZF XX**
**SG x RF XX**

Where SG is the USER entered value for the resultant (see section 6.0)

```
R : XX          TANK No 5          Function : Top pressure


Level I/P : XX                    Pressure I/P : XX
Zero : XXX.XX                      Zero : XXX.XX
Range : XXX.XX                     Range : XXX.XX
( UP ) PREV– Field        ( DOWN ) NEXT– Field
( LEFT ) PREV–Function( RIGHT ) NEXT– Function
( ENTER ) Edit Field        ( ESC ) to Results page
```

SAMPLE DISPLAY 9

**Top Pressure**

The top pressure function is for pressurised tanks and uses a hydrostatic transmitter for level as in Single and adds a second input from a pressure transmitter measuring the tank pressure.
The formula applied is:-

$$\frac{\text{I/P XX} - [(\text{I/P YY} \times \text{RATIO})\ \text{ZF YY}]}{\text{SG} \quad \times \quad \text{RF XX}} + \text{ZF XX}$$

Where:-
**I/P XX** is the input from the hydrostatic level transmitter
**I/P YY** is the input from the pressure transmitter

**RATIO** is a factor which scales the input signal from the pressure transmitter so that it has the same effective sensitivity in the formula as the level transmitters' signal. The value for ratio must be keyed in and is calculated as:-

$$\text{RATIO} = \frac{\text{The calibrated range of the pressure transmitter}}{\text{The calibrated range of the level transmitter}}$$

```
R : XX          TANK No 5      Function : SG
Min SG : X.XXXX                Max SG : X.XXXX
Level I/P : XX                 SG I/P : XX
Zero : XXX.XX                  Zero : XXX.XX
Range : XXX.XX                 Range : XXX.XX
( UP ) PREV– Field        ( DOWN ) NEXT– Field
( LEFT ) PREV–Function ( RIGHT ) NEXT– Function
( ENTER ) Edit Field      ( ESC ) to Results page
```

SAMPLE DISPLAY 10

**SG Input**
This function is for use on vented tanks with a hydrostatic level transmitter and a second input representing the Specific Gravity of the liquid in the tank. The formula is as for the Single function except that the manually entered SG value is replaced by an actively calculated one.
The active SG value varies between the limits which are entered in the set-up screen and is calculated by:-

$$\textbf{ACTIVE SG} = \frac{\textbf{I/P YY}}{\textbf{RF YY}} + \textbf{ZF YY}$$

Where I/P YY is the input from the SG transmitter
When this equation evaluated to 0 the SG is at the minimum entered value, and when it evaluates to 100 the SG is at the maximum entered value.

```
R : XX          TANK No 5      Function : Derived SG
Match : XXX.XXX              Dist : XXX.XXX
Level I/P : XX              Comp I/P : XX
Zero : XXX.XX              Zero : XXX.XX
Range : XXX.XX              Range : XXX.XX
( UP ) PREV– Field      ( DOWN ) NEXT– Field
( LEFT ) PREV–Function ( RIGHT ) NEXT– Function
( ENTER ) Edit Field      ( ESC ) to Results page
```

SAMPLE DISPLAY 11

**Derived SG**
This function is for use on vented tanks where two hydrostatic transmitters are fitted, one at a known and fixed distance above the other. Using the difference in output between the two transmitters the formula calculates the SG of the liquid in the tank and uses this value in correcting the hydrostatic signal from the lower transmitter
The basic formula is as the Single function except that the manually entered SG value is replaced by an actively calculated one.
The active SG value is calculated by:-

**I/P XX - [(I/P YY  x  MATCH) + ZF YY]**
                    **DIST**
Where:-
I/P XX is the signal from the lower level transmitter
I/P YY is the signal from the upper level transmitter

MATCH ensures that the signals from both level transmitters are of the same sensitivity in the equation given by:-

MATCH = Calibrated range of upper transmitter   x  100
             Calibrated range of lower transmitter

DIST defines the distance between the two transmitters
Given by:-

DIST = Level distance between lower & upper sensor
             Calibrated range of lower transmitter

MATCH & DIST factors are entered in the set-up screen in the normal way.

```
R : XX          TANK No 5      Function : SG & Pressure
Min SG: X.XXXX  Max SG: X.XXXX  Ratio: XXX.XX
Level I/P : XX     Pressure I/P : XX     SG I/P : XX
Zero : XXX.XX   Zero : XXX.XX      Zero : XXX.XX
Range:XXX.XX   Range:XXX.XX      Range:XXX.XX
( UP ) PREV– Field         ( DOWN ) NEXT– Field
( LEFT ) PREV–Function ( RIGHT ) NEXT– Function
( ENTER ) Edit Field       ( ESC ) to Results page
```

SAMPLE DISPLAY 12

**Top Pressure & SG Input**
This function is a combination of the Top Pressure and SG Input functions. It is used for pressurised tanks with an active SG input signal. As such it uses 3 inputs per resultant
The formula is:-

**I/P XX [(I/P YY x RATIO) + ZF YY]   + ZFA**
  **(I/P ZZ +ZF ZZ)    +   RF XX**
  **(RF ZZ          )**

Where:-
I/P XX is the signal from the level transmitter
I/P YY is the signal from the pressure transmitter
I/P ZZ is the signal from the SG transmitter
Min SG, Max SG, and RATIO must all be calculated & entered in the same manner as described for the Top Pressure and SG functions above.


**5.2 Setting CONFIGURATION Parameters**
The Configuration parameters are those that define the Global facilities of the unit. These may be viewed or edited by selecting the Configuration option at sample display 1.
If View is selected the following screen will appear

```
VIEW UNIT CONFIGURATION
Unit ID                 : 01
Unit Serial No          : 123456789 — Read only
Level1 Password         : ****
Level2 Password         : ****
Master Password         : ******
No of RESULTS           : XX
No of An. Inputs        : XX
No of An. Outputs       : XX
No of Dig Inputs        : XX
No of Dig Outputs       : XX
SP Edit in RUNMODE      : ENABLED
SG Edit in RUNMODE      : DISABLED
An. Input Details       : Read only
Calibrate An. Inputs    : N/A
( UP ) PREV– Field      ( DOWN ) NEXT– Field
( LEFT ) PREV– SP       ( RIGHT ) NEXT– SP
( ENTER ) Edit Field    ( ESC ) to Results page
```

SAMPLE DISPLAY 13

This Screen is a read only display of the unit configuration. Note that the display actually shows 5 parameter lines at any time, the Up & Down arrow keys allow the user to scroll the actual display.
If Change configuration is selected a password prompt screen will be displayed.

```
            Change Unit Configuration

                Enter Password

                    ??????
```

SAMPLE DISPLAY 14

In this case the Master password is required. This has 6 digits and is factory set as **511111**. Since this may be altered during configuration make careful note of any changes.
On entry of the correct Password the following screen appears

```
EDIT UNIT CONFIGURATION
Unit ID                : 01
Unit Serial No         : 123456789 — Read only
Level1 Password        : 1234
Level2 Password        : 4321
Master Password        : 511111
No of RESULTS          : XX
No of An. Inputs       : XX Read — only
No of An. Outputs      : XX Read — only
No of Dig Inputs       : XX Read — only
No of Dig Outputs      : XX Read — only
SP Edit in RUNMODE     : DISABLED
SG Edit in RUNMODE     : ENABLED
An. Input Details      :
Calibrate An. Inputs   :
( UP ) PREV– Field        ( DOWN ) NEXT– Field
( LEFT ) PREV– SP         ( RIGHT ) NEXT– SP
( ENTER ) Edit Field      ( ESC ) to Results page
```

SAMPLE DISPLAY 15

The following parameters may be amended:-

**Unit ID** - This is a unique Ident code for use where there is more than one Multiminder connected together via an RS485 data loop. It ensures that data packets are correctly labeled and received only by the intended unit. RS485 communication is covered by a supplement to this manual which is included only if required.
**Unit Serial No**. - A read only information parameter that is set during factory configuration.
**Level 1, Level 2, and Master Passwords**. - These may all be amended. Caution is advised before making changes and any that are made should be safely recorded.
**No. of Results** - This field defines the total number of resultants which will be displayed. The maximum value is 40.
**No of Analogue Inputs -** Factory set. This field is for information only.
**No of Analogue Outputs** – Factory set. This field is for information only. **
**No of Digital Inputs -** Factory set. This field is for information only.**
**No of Digital Outputs -** Factory set. This field is for information only.
** These features are not available at date of issue of this manual.

**SP Edit in RUNMODE** - This either allows or prevents an operator from making changes to the Setpoint parameters while the unit is in normal operational mode. The options are :-
Enabled.
Enabled plus entry of Level 1 password required.
Disabled.
**SG Edit in RUNMODE** - This either allows or prevents an operator from making changes to the SG values in run mode. The options are as described for SP edit above.
**Analogue input details** - Selecting this option leads to a further screen :-

```
EDIT PARAMETERS          Analog Input : XX
Status : ON
Zero :        XXX.XX       Range :         XXX.XX
CurVal :      XXXX(0000h)


( UP ) PREV– Field        ( DOWN ) NEXT– Field
( LEFT ) PREV– An IP     ( RIGHT ) NEXT– An IP
( ENTER ) Edit Field      ( ESC ) To Config page
```

SAMPLE DISPLAY 16

**Analog Input XX =** The input channel being displayed
**Status** : Use this field to switch the input ON or OFF.  If an Attempt is made to switch off an input that is currently in use, the following screen will appear:-

```
                        WARNING

          Analog input XX is currently in use

           (ENTER) to view usage details

          (ESC) to return to VIEW/EDIT MENU
```

SAMPLE DSPLAY 17

If, as indicated, the user presses (ENTER) at this point a summary screen appears which identifies all the displayed resultants that use this particular input channel

```
Input XX Used by :
R01:Y   R02:N   R03:N   R04:N   R05:N   R06:N
R07:Y   R08:N   R09:N   R10:N   R11:N   R12:N
R13:Y   R14:N   R15:N   R16:N   R17:N   R18:N
R19:Y   R20:N   R21:N   R22:N   R23:N   R24:N
R25:Y   R26:N   R27:N   R28:N   R29:N   R30:N
R31:Y   R32:N   R33:N   R34:N   R35:N   R36:N
R37:Y   R38:N   R39:N   R40:N
```

SAMPLE DISPLAY 18
Use (ESC) to return to sample screen 16

**Zero, & Range. -** These are parameters employed in scaling the 4-20mA analogue input such that it provides a value of 0 to 100% over the required span (normally the tank depth). This scaled value is then used within the **function** selected for each resultant. The following formula illustrates how these parameters are applied.

$$\frac{\text{Input Value}}{\text{Range Factor}} + \text{Zero Factor} = \text{Scaled input value}$$

Where **Input value** is the actual value of the input signal expressed as
0= 4mA and 100.00 = 20mA.

The **Range Factor** is calculated by

$$\frac{\text{Total Tank Depth}}{\text{Transmitter calibrated range}} \times 100$$
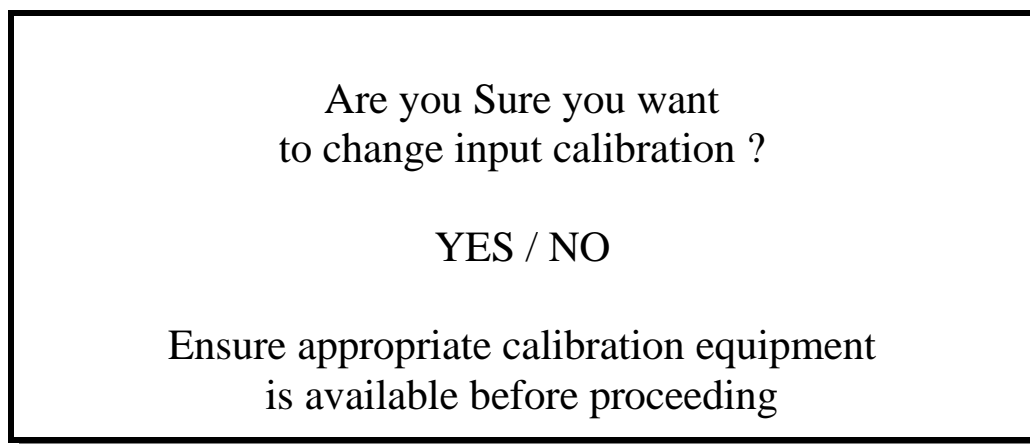
The **Zero Factor** is calculated by:-

$$\frac{\text{Transmitter fitting Height}}{\text{Total Tank depth}} \times 100$$

The **Scaled input value** resulting from these corrections is used by the **function** to calculate the value of the resultant.

**CurVal** - This is a "live" field providing both a bit count, and (in brackets) the hexadecimal representation of the inputs current value. Used in conjunction with the details recorded in the configuration record for each channel it can be interpreted to provide a Virtual MA meter for diagnostic purposes. For this reason this screen does not time out, the user must press escape to exit.

The final option shown on sample display 9 is **Calibrate Analogue inputs**. This leads to a further "Caution" screen

---

Are you Sure you want
to change input calibration ?

YES / NO

Ensure appropriate calibration equipment
is available before proceeding

---

SAMPLE

DISPLAY 19
Since this process is undertaken at the factory prior to despatch it will not normally need to be repeated unless, for example, a PCB has been substituted.
Choose **NO** to exit or **YES** to proceed.

```
Analog Input Calibration

AI = 01 4mA cal point -  0 (0000h)




Set AIP 01 to 4mA          (ENTER) to record
(UP/DOWN) Prev / Next Chan.     (ESC) cancel
```

SAMPLE DISPLAY 20
This screen is used for software calibration of the analogue inputs. Actual calibration involves inject-
ing both 4.00 then 20.00 mA signals - from a traceable source, at each point the unit samples the sig-
nal 10 times and takes the average of the A to D bit count which it records in its memory. It also dis-
plays the averaged bit count and its equivalent hexadecimal value for the calibration engineer to re-
cord on the units' configuration record. When 4.00mA is input (ENTER) is pressed, and when the unit
finishes averaging the following screen is displayed

```
Analog Input Calibration

AI = 01 4mA cal point -  XXX (????h)
Calibration set



Set AIP 01 to 20mA          (ENTER) to record
(UP/DOWN) Prev / Next Chan.     (ESC) cancel
```

SAMPLE DISPLAY 21A
20.00 mA is then input and (ENTER) again pressed to average & save value.

```
Analog Input Calibration

AI = 01 4mA cal point     - XXXX (????h)
         20mA cal point   - XXXX (????h)
Calibration set

Set AIP 01 to 20mA          (ENTER) to record
(UP/DOWN) Prev / Next Chan.     (ESC) cancel
```

SAMPLE DISPLAY 21B
The Calibration engineer will sequentially step through each of the analogue inputs which have been
enabled , and upon reaching the last will be prompted to enter his initials and  date.
**6.0 NORMAL OPERATION**

On initial start up a display similar to the following should be observed.

```
              PSM Instruments
Multichannel Minder          Version X.XX © 1999
Loading Config ………….……OK
Loading Results ……………….…OK
Loading AnInputs……………...OK
32 Channel ADC Card…………Installed
16 Channel Relay Card………...Installed
8 Channel DAC Card…………..Not Installed
```

SAMPLE DISPLAY 22
This screen sequentially indicates the various stages of the units power up routine and confirms the presence of any expander cards.
Following this the unit will enter run mode, and display the following screen.

```
TITLE        VALUE      UOM        Any Messages
TITLE        VALUE      UOM        Any Messages
TITLE        VALUE      UOM        Any Messages
TITLE        VALUE      UOM        Any Messages
Channels 1 to 4
ACTIVE ALARMS :
Press (ENTER) to HOLD
```

SAMPLE DISPLAY 23
The **TITLE** field will be replaced by the name of the parameter being displayed e.g. FOREPEAK.
The **VALUE** field will show the tanks current content, in the units of measure indicated in the **UOM** field..
The **"Any Messages"** field will normally display the currently set specific gravity value but will change to an alarm active, control action, or error message should a setpoint be triggered or an input go out of limits.
Messages which may be shown against the resultant are :-
CNTL ACTIVE. Indicates a control setpoint is operational
ALARM—N.ACK. Indicates an active alarm which has not been acknowledged
ALARM—ACK. Indicates an active alarm which has been acknowledged by the operator.
Input LOW. This message indicates that the input signal on a channel used by this resultant has a problem in that it is below 4mA but above approximately 2mA This may also result in the display showing EMPTY in the content field.
Input HIGH. This message indicates that the input signal on a channel used by this resultant is high, i.e. above 20mA. This may also result in the display showing FULL in the content field.
Note that alarm messages take priority over signal warning messages.

Active alarm conditions are also summarised on line 6 of the display, which is otherwise clear.. The message "**ACTIVE ALARMS**" is shown followed by a list of all resultants which have an alarm condition. If more than 6 alarm conditions exist the first 6 will be shown on line 6 followed by a "+" sign indicating there are more. As the display updates it will scroll through all active alarms.

This screen is the normal operational default. It automatically cycles through the resultants at 5 sec-

ond intervals displaying 4 at a time. At any time pressing (ENTER) will hold the display on a group of particular interest. A HELD display is as follows.

```
TITLE          VALUE       UOM          Any Messages
TITLE          VALUE       UOM          Any Messages
TITLE          VALUE       UOM          Any Messages
TITLE          VALUE       UOM          Any Messages
Channels 1 to 4   - HELD


(UP / DOWN) Select Resultant
(ENTER) View Details          (ESC) Release HOLD
```

SAMPLE DISPLAY 24

Using the Left & Right arrows the user is able to step through all of the display pages.
Using the Up & Down arrows the user can position a cursor highlight against a particular Resultant.
By then pressing (ENTER) the following detailed information screen is displayed.

```
R01 : Tank No 5            SG : 0.8500  USER
Cap : 1000.0               UOM : Litres
Function : Single          Ratio : N/A
IP1 : 01      IP2: N/A      IP3 : N/A
SP1 : XX%   SP2 : XX%   SP3 : XX%     SP4 : XX%


(LEFT ) PREV - Result       ( RIGHT ) NEXT - Result
( ENTER ) To Change         (ESC) Resume Run Mode
```

SAMPLE DISPLAY 25

This screen provides a detailed overview of the settings for a particular resultant, where:-
**SG**: Is the currently used Specific Gravity for the resultant. Following the SG value is a field which shows the SG type . This may either be USER,  NOT APPLIC., DERIVED, or INPUT. The differences in these are detailed in the following section.
**Cap:** Is the full capacity of the tank
**UOM**: Units of measure
**Function :** This is a function which defines the type of Resultant being displayed. Refer to section 5.1.1 for explanation.
Ratio : This will only appear depending upon the function in use.
**IP1, IP2, IP3,** : These fields show the channel number of the analogue inputs the resultant are derived from.

 Pressing (ENTER) from the above screen will bring up the following display.

```
R01 : Tank No 5                 SG : 0.8500  USER
Cap : 1000.0                    UOM : Litres
Function : Single
IP1 : 01       IP2: N/A         IP3 : N/A
SP1 : XX%   SP2 : XX%   SP3 : XX%     SP4 : XX%
                Enter level 2 Password
                       ????
```

SAMPLE DISPLAY 26

Following entry of the correct password the unit will enter configuration mode. The facilities within this mode are covered earlier in this manual.

The **FC** key toggles the display between normal and free capacity display
A free capacity display is indicated by the words **FREE CAPACITY** in the "Messages" field. Note that this is replaced by any alarm messages that may occur.

From the normal or held display screens the user may also press the **SG** button to bring up the following screen. Note that access to this screen can be disabled within the configuration, or it may require that the level 1 password is entered when prompted.

```
Edit SG Values
R01 : Tank No 1        SG : 0.8350 - USER    V/L
R02 : Tank No 2        SG : 0.8350 - USER    V/L
R03 : Tank No 3        SG : 0.8350 - USER    V/L
R04 : Tank No 4        SG : 0.8350 - USER    V/L


(UP/DOWN) to Select Resultant
( ENTER ) Edit SG          ( ESC ) Resume RUN MODE
```

SAMPLE DISPLAY 27

Where the SG type is "USER"  it may be changed, all other types (i.e. , NOT APPLIC. INPUT or DERIVED) are automatically calculated by the unit.  Use the up & down arrows to highlight the resultant to be changed and press (ENTER).
Key in the new value and press (ENTER) to store it.

Once all values have been changed as required press (ESCAPE) to save the new values and return to normal operation
Note that the valid range of SG values is limited to 0.5000 to 3.0000.
If no change is made to the SG values the unit will time out and revert to normal display after 1 minute.
The screen also indicates if the resultant is set to display in Volume or Level (V/L) units or in Mass or Head (M/H) units. This option is set in the configuration mode (refer to section 5.2) . This field is for information only since it's setting affects the way that SG is used in calculating the tank content.

Pressing SP from the normal or held run mode display will access the Setpoints summary and edit

screen, provided that access has been enabled in configuration mode (as detailed above for SG screen entry). Screen is as follows :-

```
Edit SP Details
R01:  Tank Name  SP1:ALM  2:CTL  3:OFF   4:OFF
R02:  Tank Name  SP1:ALM  2:OFF  3:OFF   4:OFF
R03:  Tank Name  SP1:ALM  2:OFF  3:OFF   4:OFF
R04:  Tank Name  SP1:ALM  2:OFF  3:OFF   4:OFF
R05:  Tank Name  SP1:ALM  2:OFF  3:OFF   4:OFF
UP/DOWN> to select Resultant
( ENTER ) Edit SP          ( ESC ) Resume Run Mode
```

SAMPLE DISPLAY 28


This screen details the current setting of all Setpoints. Each resultant has 4 Setpoints which may be set as either ALM—alarm, CTL— control, or OFF— switched off.
To view the details of a particular resultants setpoints use the up/down arrows to scroll and highlight it, the following screen will then be displayed:-

```
R:XX          SP: XX          Dig OP : XX
ACTION : MOR                  FAILSAFE : NE
TYPE : Alarm
Setpt : XX.XX                  Hyst : XX.XX
Dbnc: XX Sec        Status : CLEAR
( UP ) PREV– Field      ( DOWN ) NEXT– Field
( LEFT ) PREV– SP      ( RIGHT ) NEXT– SP
( ENTER ) Edit Field      ( ESC ) to Results page
```

SAMPLE DISPLAY 29

**R : –** Resultant Number. Read only.

**IP : –** Set-point Number. Read only. Use the Left & Right arrows to scroll through the SP's.

**Dig OP : -** Use this field to select which output relay the set-point will trigger. Since it is possible to have a particular relay controlled by set-points from more than one Resultant, for example as a common high level alarm, great care must be taken to avoid differing functions to the same relay. For instance if Dig OP 01 has been set as a MOR ALARM which is Normally De-energised for SP1 of Resultant 1, any other Resultant which also uses Dig OP 01 must also use these settings. It is permissible for the actual setpoint value, the hysteresis, and the debounce settings to vary, but the user must be aware that if alarms from more than one resultant are set to activate a single digital output it will be necessary for all active alarms to be acknowledged before the digital output is reset.
**ACTION :** – Choices are :-
**M**ake **O**n **R**ise, the digital output triggers when a Resultant **rises** to the trigger value of a set-point assigned to it.
**M**ake **O**n **F**all, the digital output triggers when a Resultant **falls** to the trigger value of a set-point assigned to it.
**Dev**iation, the digital output triggers when a Resultant deviates above or below the set-point by a cer-

tain value.

**FAILSAFE :** This determines the Digital outputs Normal state. If **N**ormally **E**nergised (**NE**) is selected then the relay will be held powered under normal conditions. If **N**ormally **D**e-energised (**ND**) is selected the relay will only power when a set-point condition is met. For failsafe operation **NE** is the preferred setting. If for example there is a power failure to the unit the relay will change state by de-energising, as well as it being controlled by the set-points. Note that when connecting the relay outputs to external devices, the terminal markings, i.e., NO Com & NC apply to the relay in its un-powered state.

**Type :** This defines the setpoint action as one of the following:
ALARM, which causes the relay to operate and can then be acknowledged by the operator causing the relay to reset. (The display will still indicate the presence of an active acknowledged alarm whilst the condition exists).
CONTROL, The relay will operate in the background, setting and resetting automatically based on the parameters entered. Operator intervention is not possible.
OFF, Disables the setpoint.

**Setpt :** This field sets the switching point and is entered as a percentage of the actual tank content display. For instance, if the content display is in liquid volume terms the setpoint is a percentage of this, if it is in liquid head terms then the setpoint also operates based on a percentage of head pressure.

**Hyst :** This field sets the Hysteresis of the Set-point. I.e. the difference between the trigger point and the reset point expressed as a percentage of the contents display. For example a relay with a MOR action and a 50% setpoint and 10% hysteresis will operate on the signal rising above 50% and reset when it drops below 40%.

Note that when the alarm type is set as deviation this field changes to "Band" and is used to define the maximum deviation from a setpoint before the relay triggers. For example a setpoint of 50% and a band of 10% would mean the setpoint operated if the content display went above 60% or below 40%.

**Dbnc :** This field sets the Debounce for the set-point, i.e. the delay in seconds that the set-point conditions must be met before it is considered as valid.

Status : This field shows the current condition of the setpoint. If it is a Control the possibilities are CLEAR or ACTIVE. For an alarm the status may be either CLEAR, ACTIVE (unacknowledged) or ACTIV-ACK. (acknowledged).

**Acknowledging alarms**
If there are active alarm conditions which have not been acknowledged, the detailed page showing the SP information for the resultant will look as follows

```
R:XX            SP: XX              Dig OP : XX
ACTION : MOR                        FAILSAFE : NE
TYPE : Alarm
Setpt : XX.XX                       Hyst : XX.XX
Dbnc: XX Sec             Status : Active-not Ack
( UP ) PREV– Field       ( DOWN ) NEXT– Field
( LEFT ) PREV– SP        ( RIGHT ) NEXT– SP
( ACK) clear alarms      ( ESC ) to Results page
```

SAMPLE DISPLAY 30

If, as indicated, the ACK button (button 0) is pressed the alarm condition is acknowledged and the display status changes to "Active— Ack". Provided there are no other unacknowledged Setpoints holding it on, the relay will also reset.

It is also possible to acknowledge alarm conditions from the detailed Resultant page (screen sample XX). From the normal scrolling display press enter to hold it and use left & right arrows to select the page with the resultant of interest. Using the up & down arrows highlight the particular resultant and press Enter. The following screen is displayed :-

```
R01 : Tank No 5              SG : 0.8500  USER
Cap : 1000.0                 UOM : Litres
Function : Single            Ratio : N/A
IP1 : 01      IP2: N/A       IP3 : N/A
SP1 : XX%   SP2 : XX%   SP3 : XX%     SP4 : XX%
Alarm SP1                    Active — not ack
(LEFT ) PREV - Result    ( RIGHT ) NEXT - Result
( ACK ) clear alarms     (ESC) Resume Run Mode
```

SAMPLE DISPLAY 31

Again pressing the ACK key (button 0) will acknowledge the alarm condition.

**END OF DOCUMENT**

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