User Manual
for
FRT303 FlowRate Totaliser

ManuFlo ™® Flow Measurement Products
A Division of Manu Electronics Pty Ltd
41 Carter Road,
Brookvale NSW 2100 Australia

1409/1

Table of Contents

List of Tables

List of Figures

1.   INTRODUCTION

The FRT303 Flowrate Totaliser is designed to operate with a wide range of pulse/signal output or coil output Flowmeters, providing an instantaneous flowrate reading, with a Grand Total display and a resetable Total display, for the measurement of liquids.

The LCD display can be programmed to show flowrate and totals in a number of different units. All functions are easily entered (via an internal keypad) through a programmable menu display.

The housing is a compact IP65 Polycarbonate enclosure with moulded mounts, which allows the FRT303 to be used in a wide range of field applications.

Any FRT303 unit ordered with a Manuflo Flowmeter will be pre-programmed to the Flowmeter's "K factor" and requested display preference. All other applications parameters will be entered, if supplied by the customer.

1.1.   Model Designations

Table 1 shows the available combinations of power sources, inputs and output options.

Product Code	Power Option	Coil	Reed Switch or Open Collector	Pulse/NAMUR	Pulse Output (isolated)	Pulse Output (non-isolated)	High/Low Flowrate indication	4-20mA current output (isolated)	4-20mA current output drive	Tradewaste 6-pin MIL spec plug
		Input to FRT from Flowmeter (1)			Outputs					
FRT303-B	Battery	Y	Y							
FRT303-B-P	Battery	Y	Y			Y				
FRT303-D	DC External power	Y	Y	Y						
FRT303-D-P	DC External power	Y	Y	Y	Y					
FRT303-D-E	DC External power	Y	Y	Y	Y		Y		Y	
FRT303-A-P	AC External power	Y	Y	Y	Y					
FRT303-A-E	AC External power	Y	Y	Y	Y		Y		Y	
FRT303-A-TW	AC External power	Y	Y	Y	Y		Y		Y	Y

Table 1. Model designations and their features
'Y' = is available on that model
Note (1): A flowmeter can be connected to the FRT via any input that is marked as available.

2.   TECHNICAL/ELECTRICAL SPECIFICATION

Display   LCD

FlowRate
- 6 digits, upto 3 decimal places.
- Litres, Kilolitres per second, minute, or hour.

Total (resetable)
- up to 7 digits, up to 3 decimal places.
- Litres, Kilolitres, Megalitres.

Grand Total
- Litres, Kilolitres, Megalitres

Power Options

Battery
- 3.6v Lithium battery (typical 5–10 year life).
- 10µA dormant state.
- automatic sleep mode to preserve battery power.

External Power
- +5 to +25 VDC option
- 240 vac option

Input
- will accept flowmeter input pulses from 0.2 to 2,000 Hz.
- Note: for steady flowrate calculations, need at least 2 Hz input.

Output Options   (all scalable via program)

Pulse Output
- NPN open collector 5-25 VDC.
- 100Hz maximum. 5ms fixed pulsewidth.
- 50% duty cycle @ 100 Hz.

Current Output
- 4 to 20 mA

High Flowrate O/P
- NPN open collector 5-25VDC
- contact output, opto isolated, 100mA@30V

Low Flowrate O/P
- NPN open collector 5-25VDC
- contact output, opto isolated, 100mA@30V

Enclosure

Dimensions (mm)
- 120 W, 95 H, 60 D

Rating
- IP65 (waterproof)
- Sealed Polycarbonate enclosure with hinged lid and screw lugs for mounting.

Access
- 4 Stainless Steel screws to access internal programming and for wire-up.

Electrical connection
- 1 or 2 IP67 cable gland entries, plug-in screw terminals.

2.1. Safety Considerations

The FRT 303 is not certified for intrinsically safe applications, and is not recommended for use in hazardous areas.

For the 240 vac versions: WARNING - DANGEROUS VOLTAGE. To prevent electric shock, DO NOT open the enclosure while 240 vac power is connected.

3.   PHYSICAL LAYOUT

The FRT is in a sealed polycarbonate enclosure with (as shown in Figure 1 below):
a.   a hinged cover to protect the Liquid Crystal Display (LCD) from UV light;
b.   two lugs (one each side) for mounting;
c.   cable entry;
d.   4 screws that secure the lid;
e.   lid;
f.   LCD;
g.   Selector button.
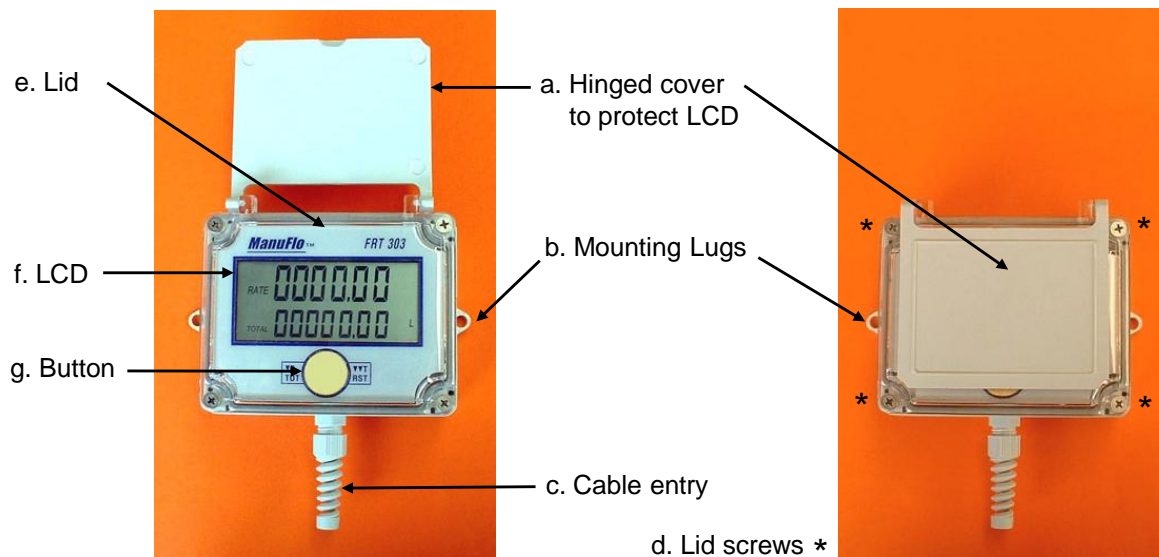
Figure 1. External view of FRT303.

4. LIQUID CRYSTAL DISPLAY (LCD) - in Normal Mode

4.1.   Display Elements
The LCD can be in:
- Normal Mode (to display flowrate and total), or
- Calibration Mode (to calibrate the FRT303).

For the LCD in Calibration Mode, see section 9 on page 11.

Figure 2 on page 4 shows the general elements that can be displayed on the LCD in Normal Mode. Note that not all elements are displayed at all times.
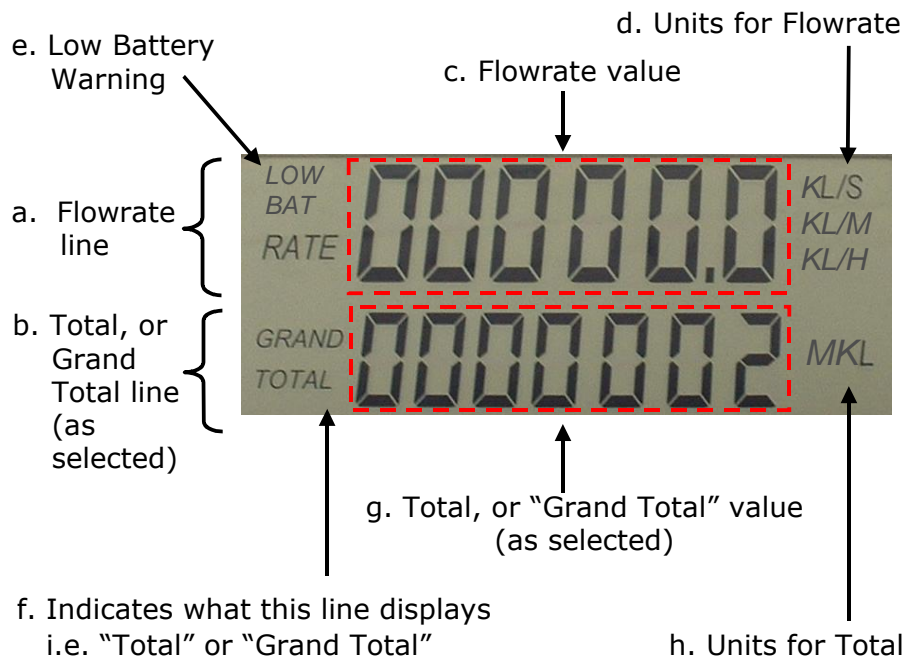
Figure 2. Elements of the LCD Display.

4.2. Upper line – Flowrate

The upper line of the LCD is used primarily to display the flowrate. The flowrate is displayed using 6 digits. The number of decimal places is configurable (see section 10.0 on page 14).

The units for the flowrate are displayed in the top right of the LCD:
- The flowrate units for volume can be:
  - Litres (millimeters being to the right of the decimal point), or
  - KiloLitres.

  The volume units are configurable as explained in section 10.0 on page 14;
- the flowrate units for time can be
  - per Second,
  - per Minute, or
  - per Hour.

  The time units are configurable as explained in section 10.4 on page 17.

The top left of the LCD may display the Low Battery warning, when a low battery situation occurs.

4.3. Lower Line - Totals

The lower line of the LCD displays either the "Grand Total" or the "Total", as selected via the front panel button (see section 4.5 on page 5).

The "Total" is the liquid being delivered in the current batch. The "Total" is reset by pushing the round Selector Button twice within a second (as described in section 4.6 on page 5).

The "Grand Total" is the accumulated total of all the liquid delivered by all batches. The Grand Total is reset according to section 10.12 on page 20.

The totals are displayed using up to 7 digits. The number of decimal places is configurable (see section 10.1 on page 15).

The units for the totals are displayed in the bottom right of the LCD. The units for volume can be:
Litres (L), KiloLitres (KL), or MegaLitres (ML).
The units are configurable as explained in section 10.1 on page 15.

4.4. Dormancy

If the FRT303 is a battery powered version, to conserve battery power, the FRT303 will become dormant, and the LCD will go blank, after a period of no activity (no pulses received, and the selector button has not been pressed).

The period of inactivity required before dormancy occurs is configurable (see section 10.11 on page 19).

The FRT303 is awakened from its dormant state, and the LCD display comes back on, once the FRT303 receives pulses from a flowmeter, or if the selector button is pushed.

Note: if the FRT303 is not a battery powered version, then the LCD always displays data.

4.5. Toggle Between Totals

The selector button on the lid of the FRT303 (Figure 3 below) when pushed once - will toggle the display on the lower line of the LCD (Figure 2-b on page 4), between the "Grand Total" and the "Total" values.
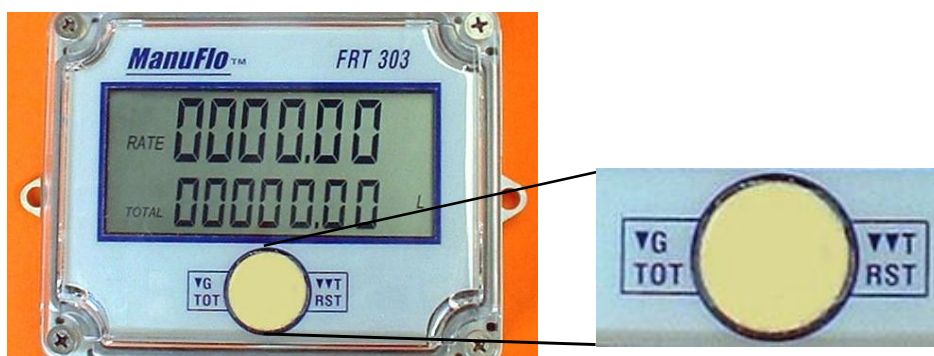
Figure 3. Selector Button.

The button should be pushed only momentarily but firmly. The graphic to the left of the button is a reminder to push the button once, to see the "Grand Total".

4.6. Reset Total

The "Total" value can be reset via the selector button (the "Grand Total" can be reset as described in section 10.12 on page 20).

When the "Total" is displayed on the lower line of the LCD, if the selector button is pushed twice, then the "Total" will reset. The two pushes of the button must occur within about 1 second of each other.

> Note that the "Total" can only be reset when the "Total" is being displayed on the lower line of the LCD.
>
> If the "Grand Total" is being displayed, then pushing the selector button twice will have no effect and the "Total" will not be reset.

The graphic to the right of the button (Figure 3) is a reminder to push the button twice to reset the "Total".

5. INTERNAL VIEW

Figure 4 below shows the FRT303 with the lid removed. Note the position of connectors TB1 (AC version only), X1 (non-AC versions only), X2 and X4 which are for power, input and output connections.
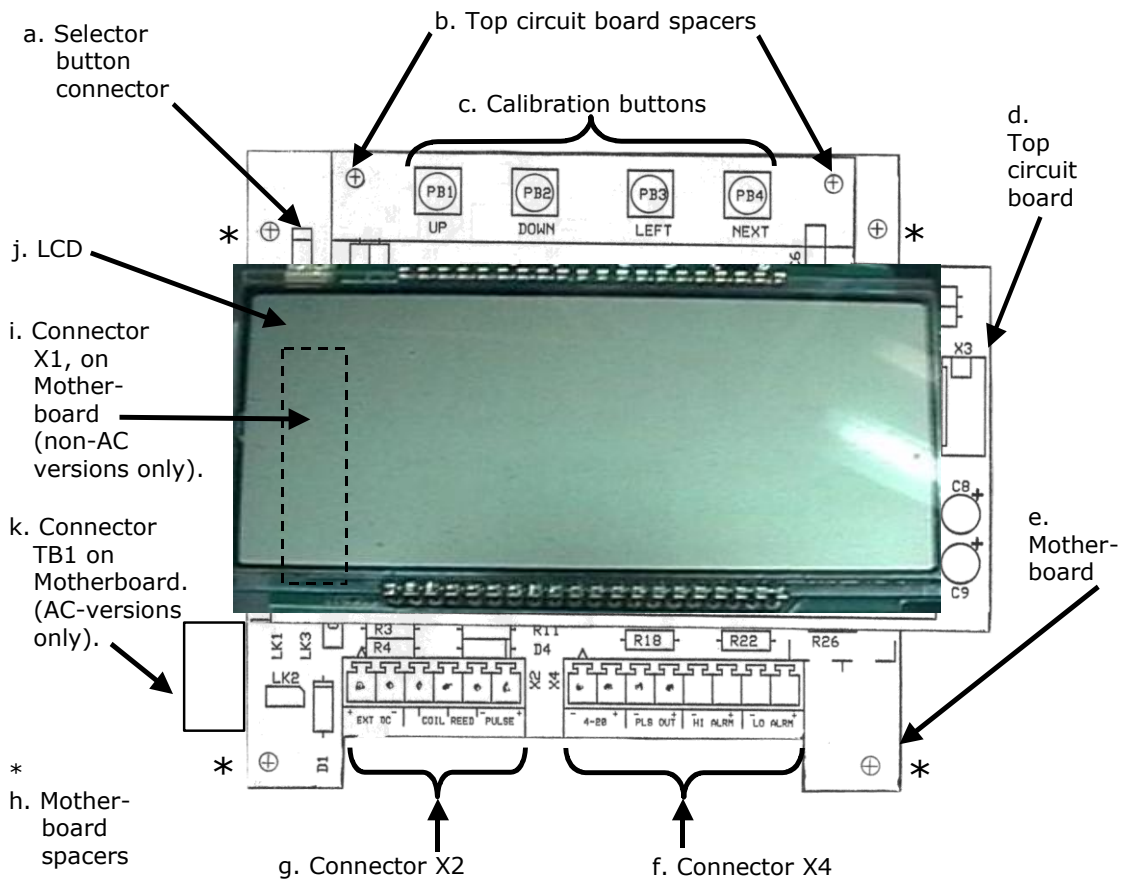
Figure 4. FRT303 Internal view of FRT303.

6. CONNECTING POWER SUPPLY

6.1. Internal Battery

The FRT303 issupplied with an internal battery. which:
- is attached to the underside of the lower circuit board;
- is a 3.6 v AA Lithium battery.

> Battery life is at least 5 years from the date of battery installation, and may be up to 10 years depending on usage.

6

If the FRT303 is a version that is solely battery powered version (see Table 1 on page 1), then only reed switch and coil inputs are suitable because they are low current devices that will not cause excessive battery drain.

Where the FRT303 is solely battery powered, and battery power becomes low:
• a Low Battery indication will appear on the top left of the LCD (see Figure 1-f on page 3).
• the battery must be replaced as soon as possible.

Where the FRT303 is solely battery powered, if battery power is lost then all calibration settings will be retained but any pulse counts stored in the FRT303 will be lost.

The internal battery can be replaced by:
• returning the FRT303 to Manu Electronics (see cover page for address); or
• opening the FRT303, and soldering a replacement battery to the motherboard.
    o Any commercially available 3.6 v AA Lithium battery is suitable;
    o Ensure the replacement battery is positioned with correct polarity;
    o Dispose of the old Lithium battery, noting the caution below.

CAUTION
Do not attempt to recharge, disassemble, heat above 100 C or incinerate a Lithium battery, or expose its contents to water.

6.2. Connecting External 240 vac Power Supply

If the FRT303 is a version requiring external AC power (see Product Id in Table 1 on page 1), then the external power supply is connected via Motherboard connector TB1, as shown in Figure 5 below. A 2 metre 240 vac Australian power cord is supplied with the FRT303.

The location of connector TB1 is shown at Figure 4-k on page 6.
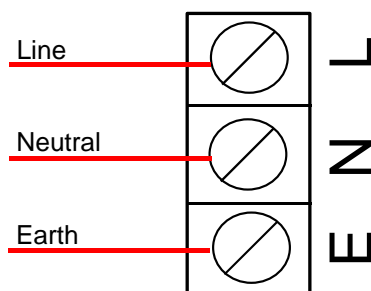
Figure 5. External AC Power via Connector TB1

(AC versions only)

6.3. Connecting External 5-25 VDC Power Supply

If the FRT303 is a version requiring external DC power (see Product Id in Table 1 on page 1), then connect the external power supply via Motherboard connector X2, as shown in Figure 6 below.

The location of connector X2 is shown at Figure 4-g on page 6.
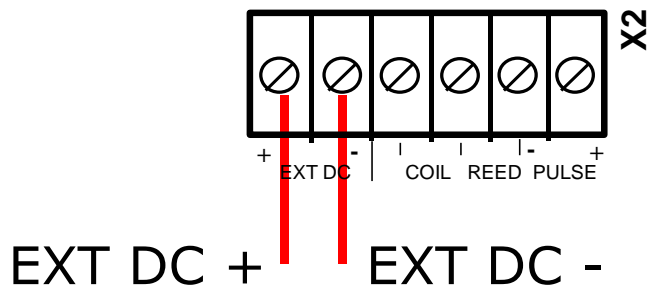
Figure 6. External DC Power via Connector X2.

7. CONNECTING INPUTS

7.1. Coil

A coil input is connected to via Motherboard Connector X2, as shown in Figure 7 below.
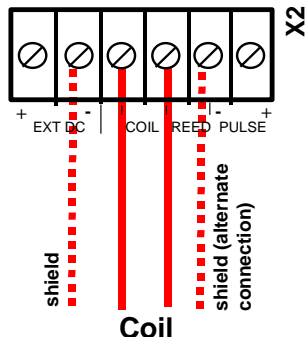
Figure 7. Connection of Coil Input via Connector X2.

7.2. Reed switch

A reed switch input is connected via Motherboard Connector X2, as shown in Figure 8 below.
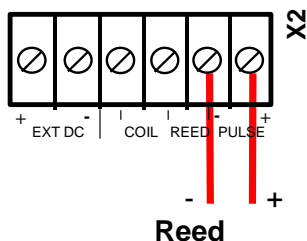
Figure 8. Connection of Reed Input via Connector X2.

7.3. Pulse(NAMUR) sensor

A pulse (NAMUR) sensor is connected via Motherboard Connector X2, as shown in Figure 9 below.
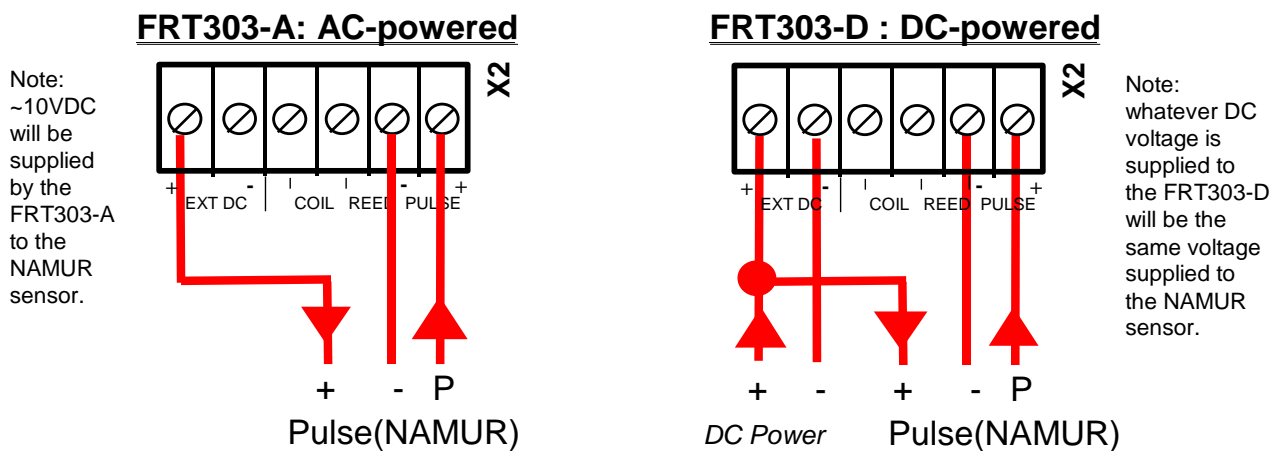
Figure 9. Connection of Pulse Input via Connector X2.

Note: for the NAMUR sensor to function, it must be provided with a DC supply as shown.

9

8. CONNECTING OUTPUTS

Outputs are connected via Motherboard Connector X4:

- 4-20mA output is connected as shown in Figure 10-a below.
- Pulse Output is connected as shown in Figure 10-b below.
- High Alarm is connected as shown in Figure 10-c below. See Figure 11 below for example output circuit.
- Low Alarm is connected as shown in Figure 10-d below. See Figure 11 below for example output circuit.
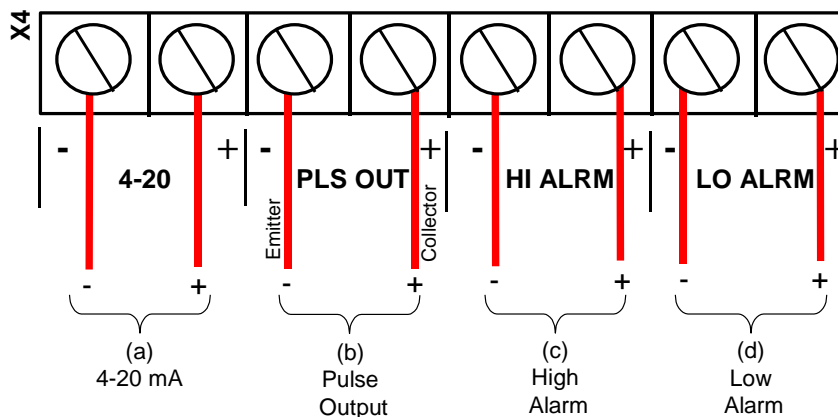
Figure 10. Connection of 4-20mA, Pulse and Hi/Lo Alarm Outputs via Connector X4.
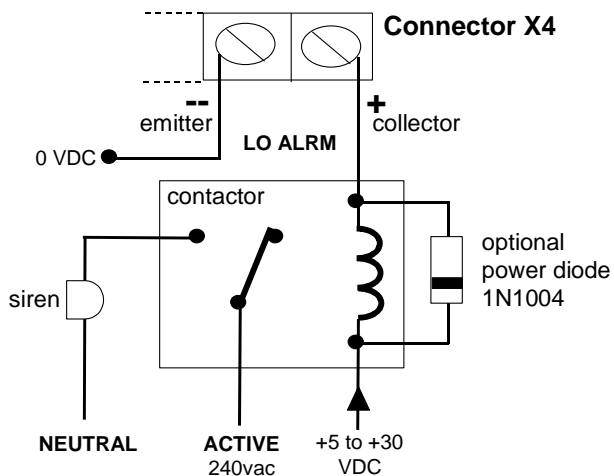
Figure 11. Example alarm output circuit.

9. CALIBRATION MODE

Manu Electronics will supply the FRT303 already configured for your needs, taking into account the flowmeter used with the FRT303.

Table 2 below is a list of the calibration settings for the FRT303.

Table 2. Calibration Settings.

Cal. No.	Description	Valid Range
00	Flow Rate Units	0 – 6
01	Total units	0 – 9
02	Grand Total units	0 – 9
03	K factor	1 – 999999
04	Flow rate timebase	0 – 2
05	Flow rate filter	1 - 99
06	Output pulse rate	1 – 999999
07	Low flow limit	0 – 999999
08	High flow limit	0 – 999999
09	Low (4mA) flow rate	0 – 999999
10	High (20mA) flow rate	1 – 999999
11	Delay to dormancy	1 – 9999
12	Reset the Grand Total	Not Applicable
13	Software Version	Not Applicable

If necessary, the user can change one or more calibration settings, through the calibration mode of the FRT303.

> **Using the buttons (see Figure 12 and Table 3 on page 12) on the top circuit board internal to the FRT303 (Figure 4-c on page 6):**
>
> - **calibration mode is entered by pressing the NEXT button;**
>
> - **calibration settings are changed using the LEFT, UP or DOWN buttons.**

(b) LEFT: Move focus to the digit to the left (the digit will flash)

(c) DOWN: Decrease the value of the flashing digit

(a) NEXT:
* first press enters Calibration Mode.
* lock in new value.
* Step to the next calibration setting.

(d) UP: Increase the value of the flashing digit
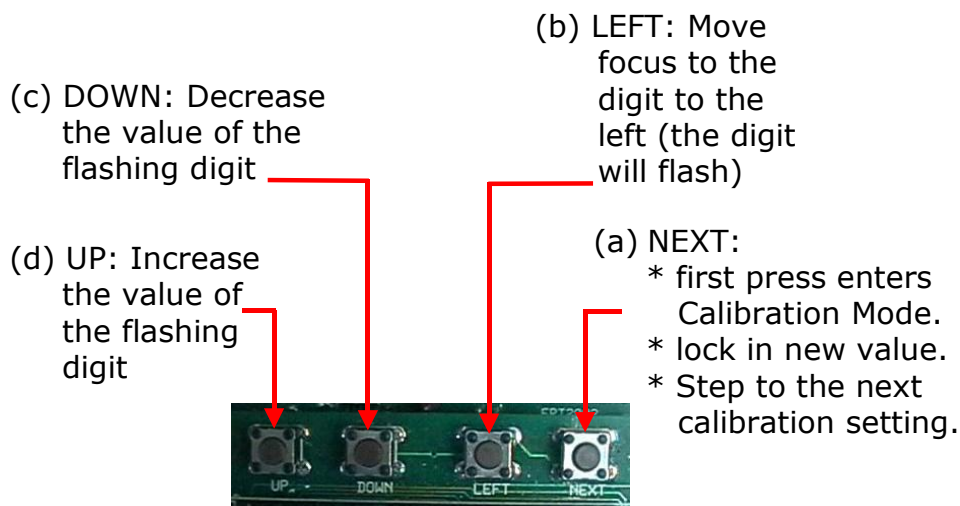
Figure 12. Internal Buttons to change calibration settings.

Table 3. Functions of the Calibration buttons.

Note: (1) For CAL 13, the button is not applicable and does not have any effect.

Calibration Button	Function
NEXT (Figure 12–a)	• Steps through the calibration settings, as shown in Figure 13 on page 13. On first press, enters Calibration Mode. • Locks in the value after a calibration setting has been modified (there will no longer be a digit blinking).
LEFT *(1)* (Figure 12–b)	• Selects the digit to change in a calibration value, by cycling right to left through the digits. • Moves focus to the digit to the left and causes the selected digit to blink (on first press, causes the right most digit of the calibration value to blink).
DOWN *(1)* (Figure 12–c)	• Decreases the value of the selected digit (the digit that is blinking).
UP *(1)* (Figure 12–d)	• Increases the value of the selected digit (the digit that is blinking).

Figure 13 below shows how successive presses of the NEXT button will cycle through the calibration settings.
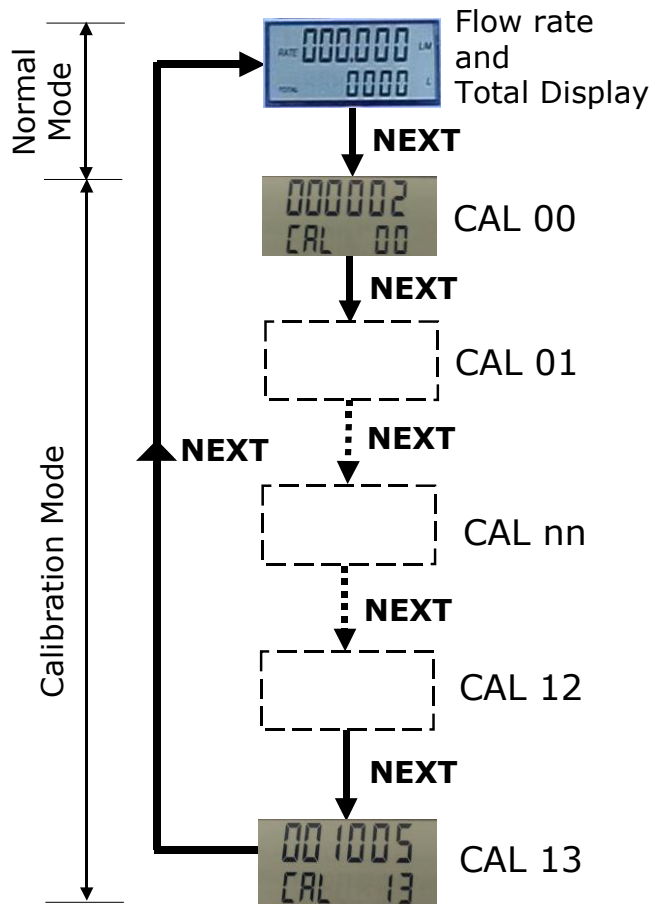
Figure 13. NEXT button cycles through the calibration settings.

Calibration mode is exited by pressing the NEXT button repeatedly until, after CAL 13, the LCD returns to the Normal Mode (i.e. displays flowrate and total).

When in calibration mode, the LCD display is as shown in Figure 14 below.

The value for the setting.
CAL 02 has value '3'.

Identifies the setting.
CAL 02 is for Grand Total Units.

000003
CAL 02
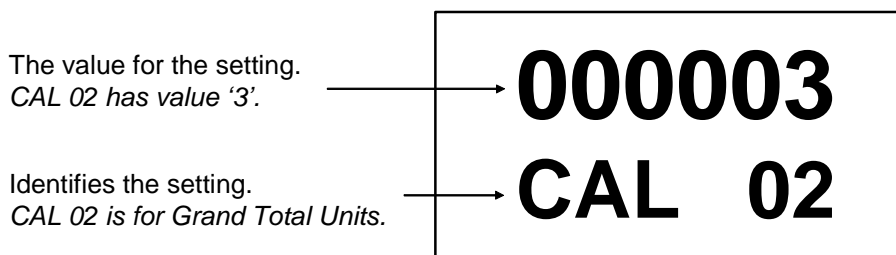
Figure 14. LCD in Calibration Mode.

This example shows that CAL 02 (the units for the Grand Total) has value '3', which means (from Table 6 on page 15) that the Grand Total will be displayed as Litres with no decimal point.

10.   CALIBRATION SETTINGS

NOTE: If the user enters a value for a calibration setting that is less than the allowed minimum, or greater than the allowed maximum, for that setting, then once the NEXT button is pressed the value will automatically change to the minimum or maximum allowed respectively.

10.0.   CAL 00 - Flow Rate units of volume

Calibration 00 sets the units of flow rate volume, which can be:
- Litres; or
- KiloLitres.

Also, various numbers of decimal places can be selected according to the resolution of the flowmeter used.

The possible values for Calibration 00 are shown in Table 4 below. The range of allowed values is 0 to 6 inclusive.

Note that the selection for flow rate units also decides the representation of the K Factor (which is further discussed in section 10.3 on page 16) i.e. whatever row is selected in Table 4 for CAL 00 (Flow Rate Units), the same row applies for the format of CAL 03 (K-Factor).

Table 4. Flow Rate units and K-Factor.

CAL 00 value	CAL 00 - Flow Rate Units		Format of K-Factor (the value of the K-Factor is stored in CAL 03)	
0	x x x ● x x x	Litres/?	x x x x ● x x	pulses/Litre
1	x x x x ● x x	Litres/?	x x x ● x x x	pulses/Litre
► 2	x x x x x ● x	Litres/?	x x ● x x x x	pulses/Litre ◄
3	x x x x x x x	Litres/?	x ● x x x x x	pulses/Litre
4	x x x x ● x x	KiloLitres/?	x x x ● x x x	pulses/KiloLitre
5	x x x x x ● x	KiloLitres/?	x x ● x x x x	pulses/KiloLitre
6	x x x x x x x	KiloLitres/?	x x x x ● x x	pulses/KiloLitre

For example, if Calibration 00 is set to a value of '2', then from Table 4:
- (see the row indicated by symbol '►') the units of flow rate are set to Litres, and the flow rate value will be shown to 1 decimal place on the LCD; and
- (in the same row, right side of the table at symbol '◄') the format of the K Factor is in pulses/Litre with 4 decimal places. Note that the value of the K-Factor is stored in CAL 03 and, in this example, cannot exceed 99.9999 pulses/Litre.

10.1. CAL 01 - Total Units

Calibration 01 sets the units of the Total. The Total is the amount of liquid delivered in a batch.

The units of the Total can be Litres, KiloLitres; or MegaLitres. Also, various numbers of decimal places can be selected according to the resolution of the flowmeter used. The possible entries for Calibration 01 are shown in Table 5 below. The range of allowed values is 0 to 9 inclusive.

Table 5. Total units.

CAL 01 value	Total units								
0	x	x	x	x	•	x	x	x	L
1	x	x	x	x	x	•	x	x	L
2	x	x	x	x	x	x	•	x	L
3	x	x	x	x	x	x	x	x	L
► 4	x	x	x	x	x	•	x	x	KL
5	x	x	x	x	x	x	•	x	KL
6	x	x	x	x	•	x	x	x	ML
7	x	x	x	x	x	•	x	x	ML
8	x	x	x	x	x	x	•	x	ML
9	x	x	x	x	x	x	x	x	ML

For example, if Calibration 01 is set to a value of '4' then, from Table 5 (see the row indicated by symbol '►'), the units of the Total are set to KiloLitres and the Total value will be shown to 2 decimal places on the LCD. If the Total is to be shown in KiloLitres with 1 decimal place, then CAL 01 must be set to '5'.

10.2. CAL 02 - Grand Total Units

Calibration 02 sets the units of the Grand Total, which is the accumulated total of all the liquid delivered by all batches since the Grand Total was last reset.
The units of the Grand Total can be Litres, KiloLitres, or MegaLitres. Also, various numbers of decimal places can be selected according to the resolution of the flowmeter used. The possible entries for Calibration 02 are shown in Table 6 below. The allowed value range is 0 to 9 inclusive.

Table 6. Grand Total units.

CAL02 value	Grand Total units								
0	x	x	x	x	•	x	x	x	L
1	x	x	x	x	x	•	x	x	L
2	x	x	x	x	x	x	•	x	L
3	x	x	x	x	x	x	x	x	L
4	x	x	x	x	x	•	x	x	KL
5	x	x	x	x	x	x	•	x	KL
► 6	x	x	x	x	•	x	x	x	ML
7	x	x	x	x	x	•	x	x	ML
8	x	x	x	x	x	x	•	x	ML
9	x	x	x	x	x	x	x	x	ML

For example, if Calibration 02 is set to a value of '6', then from Table 6 (see the row indicated by symbol '►') the units of the Total are set to MegaLitres and the Total value will be shown to 3 decimal places on the LCD.

10.3.   CAL 03 - K factor

Calibration 03 sets the K Factor, which is the number of pulses (output by a flowmeter) per volume of liquid delivered. The value depends on the flowmeter being used with the FRT303.

The units and representation (location of the decimal point) of the K Factor are determined by the selection of flow rate units in CAL 00 (as described in section 10.0 on page 14).

CAL 03 is used to enter the <u>value</u> of the K-factor (Note that the decimal point is not actually displayed when the value for CAL 03 is being entered, so the user has to be aware of where the decimal point is).

The range allowed in CAL 03 is 1 to 999999 inclusive.

Table 7. Units and representation of K-Factor

CAL 00 value	CAL 00 - Flow Rate Units		Format of K-Factor (the value of the K-Factor is stored in CAL 03)	
0	x x x • x x x	Litres/?	x x x x • x x	pulses/Litre
1	x x x x • x x	Litres/?	x x x • x x x	pulses/Litre
2 ▶	x x x x x • x	Litres/?	x x • x x x x	pulses/Litre ◀
3	x x x x x x x	Litres/?	x • x x x x x	pulses/Litre
4	x x x x • x x	KiloLitres/?	x x x • x x x	pulses/KiloLitre
5	x x x x x • x	KiloLitres/?	x x • x x x x	pulses/KiloLitre
6	x x x x x x x	KiloLitres/?	x x x x • x x	pulses/KiloLitre

For example, if Calibration 00 is set to a value of '2' (see the row indicated by symbol '▶'), then from Table 7 (in the same row, right side of the table at symbol '◀') the value in CAL 03 is the value of the K-Factor in pulses/Litre to 4 decimal places.

Although the FRT303 is factory wet test calibrated to your matching flowmeter, a final calibration adjustment may be required on site. <u>To recalibrate</u>, fill a calibrated vessel or load cell. Compare the quantity collected against the totaliser display reading. If the amount collected is less than is shown on the LCD display total, then increase the K-factor value by the same percentage difference. If the amount collected is more than is shown on the LCD display total, then decrease the K-factor value by the same percentage difference.

For example, if:
- CAL 00 is '2'; and
- CAL 03 is '100000'; and
- you want to increase the K-Factor by 1%

then the K-factor is in pulses/Litre to 4 decimal places, so '100000' is 10.0000 pulses/Litre. A 1% increase is 0.1 pulses/Litre, so use the buttons shown in Figure 12 on page 12 to change CAL 03 to '101000' to represent 10.1000 pulses/Litre.

10.4. CAL 04 - Flow Rate Timebase

Calibration 04 sets the timebase to be used for the flowrate. The timebase can be:
- Seconds;
- Minutes; or
- Hours.

The possible entries for Calibration 04 are shown in Table 8. The range of allowed values is 0 to 2 inclusive.

Table 8. Flow Rate timebase.

CAL 04 value	Timebase
0	Seconds
► 1	Minutes
2	Hours

For example, if Calibration 04 is set to a value of '1' (see the row indicated by symbol '►'), then from Table 8, the flow rate timebase is in Minutes (i.e. Flowrate is displayed as a volume per minute).

NOTE: If the user enters a value for CAL 04 that is greater than the maximum allowed (i.e. greater than 2), then once the NEXT button is pressed, the value will automatically change to the maximum allowed (i.e. to '2').

10.5. CAL 05 - Flow rate filter

Calibration 05 sets the flow rate filter, which is a factor that can be adjusted depending on the application and the amount of fluctuation of the input from the flowmeter, to average out fluctuations and enable accurate readings.

The range of allowed values is 1 to 99 inclusive. The default is 1 (no filtering). Filtering can be increased to obtain steady readings if necessary.

10.6. CAL 06 - Output pulse rate

Calibration 06 sets the output pulse rate, which sets the amount of liquid dispensed that is represented by each output pulse.

The range of allowed values is 1 to 999999 inclusive. The value for CAL 06 has the same number of decimal places and the same units as selected by the value in CAL 01, as shown in Table 9.

Table 9. No. of decimal places and units for CAL 06.

CAL 01 value	No. of decimal places and units for CAL 06								
0	x	x	x	x	●	x	x	x	L
1	x	x	x	x	x	●	x	x	L
2	x	x	x	x	x	x	●	x	L
3	x	x	x	x	x	x	x	x	L
4	x	x	x	x	x	●	x	x	KL
5	x	x	x	x	x	x	●	x	KL
6	x	x	x	x	●	x	x	x	ML
7	x	x	x	x	x	●	x	x	ML
8	x	x	x	x	x	x	●	x	ML
9	x	x	x	x	x	x	x	x	ML

(Row 2 indicated by symbol '►')

For example, if CAL 01 is set to '2' (see the row in Table 9 indicated by symbol '►'), then the value in CAL 06 is in Litres with 1 decimal place). If CAL 06 is set to say '000015', then each output pulse represents 1.5 Litres dispensed.

17

10.7. CAL 07 - Low flow limit

Calibration 07 sets the value of the low flow limit. The range of allowed values is 0 to 999999 inclusive.

When the flowrate falls below the low flow limit, the FRT303 will indicate this situation by giving an output on the Low Alarm output (see Figure 10-d on page 10).

The units and timebase of the low flow limit are:
- the units and number of decimal places as set for the flowrate by CAL 00, and
- the timebase as set for the flowrate by CAL 04.

CAL 00 value	Units and No. of decimal places							
0	x	x	x	●	x	x	x	Litres/?
1	x	x	x	x	●	x	x	Litres/?
2	x	x	x	x	x	●	x	Litres/?
3	x	x	x	x	x	x	x	Litres/?
4	x	x	x	x	●	x	x	KiloLitres/?
5	x	x	x	x	x	●	x	KiloLitres/?
6	x	x	x	x	x	x	x	KiloLitres/?

(row 2 indicated by ►)

CAL 04 value	Timebase
0	Seconds
1	Minutes
2	Hours

(row 1 indicated by ►)

For example, if:
- CAL 00 is set to '000002' (Litres, with 1 decimal place), and CAL 04 is set to '000001' (Minutes),
  (see the rows in the tables above indicated by symbol '►'); and
- CAL 07 has a value of say '000185'

then the low flow limit is 18.5 Litres per Minute.

10.8. CAL 08 - High flow limit

Calibration 07 sets the value of the high flow limit. The range of allowed values is 0 to 999999 inclusive.

When the flowrate rises above the high flow limit, the FRT303 will indicate this situation by giving an output on the High Alarm output (see Figure 10-c on page 10).

The units, timebase and number of decimal points for CAL 09 follow the same principles described for CAL 07 on page 18.

For example, if:
- CAL 00 is set to '000002' (Litres to 1 decimal place), and
- CAL 04 is set to '000001' (Minutes), and
- CAL 08 has value '001705'

then the high flow limit is 170.5 Litres per Minute.

10.9. CAL 09 - Low (4 mA) flow rate

Calibration 09 sets the flow rate that corresponds to the lowest value (4 mA) of the 4-20 mA current loop output.

The range of allowed values is 0 to 999999 inclusive.

The units, timebase and number of decimal points for CAL 09 follow the same principles described for CAL 07 on page 18.

For example, if:
- CAL 00 is set to '000002' (Litres to 1 decimal place), and
- CAL 04 is set to '000001' (Minutes), and
- CAL 09 has value '000105'
then 4 mA represents the flowrate of 10.5 Litres per Minute.

10.10. CAL 10 - High (20mA) flow rate

Calibration 10 sets the value of the flow rate that corresponds to the highest value (20 mA) of the 4-20 mA current loop output.

The range of allowed values is 1 to 999999 inclusive.

The units, timebase and number of decimal points for CAL 09 follow the same principles described for CAL 07 on page 18.

For example, if:
CAL 00 is set to '000002' (Litres to 1 decimal place), and
CAL 04 is set to '000001' (Minutes), and
CAL 10 has value '001800'
then 20 mA represents the flowrate of 180.0 Litres per Minute.

10.11. CAL 11 - Delay to dormancy

If the FRT303 is solely battery powered then, to conserve battery power, the FRT303 will become dormant, and the LCD will go blank, after a period of no activity (no pulses received, and the selector button has not been pressed).

Calibration 11 sets the period of inactivity required before dormancy occurs.

Each unit of this value represents one-hundredth of an hour (36 seconds) e.g.
000001 = 36 seconds
000002 = 72 seconds
000003 = 108 seconds, etc

The range of allowed values is 1 to 9999 inclusive.

10.12. CAL 12 - Reset the Grand Total

The Grand Total is the accumulated total of all the liquid delivered by all batches. The Grand Total can be reset using Calibration 12:

- press the NEXT button repeatedly until CAL 12 is displayed;
- press the LEFT button to cause a digit to flash;
- press the NEXT button and the Grand Total will reset;
- press the NEXT button repeatedly until the LCD is in Normal Mode (flowrate and total is displayed).

If a digit is not flashing whilst in CAL 12, then when the NEXT button is pressed the Grand Total will not be reset i.e. can "pass through" CAL 12 without causing the Grand Total to reset.

10.13. CAL 13 - Software Version

Calibration 13 displays the version of the software that is loaded in the FRT303. The software version can be viewed using Calibration 13:

- press the NEXT button repeatedly until CAL 13 is displayed;
- the value displayed is the software version in format "XXX.XXX"
  e.g. a value of "001100" in CAL 13 represents software version 001.100 ;
- press the NEXT button repeatedly until the LCD is in Normal Mode (flowrate and total is displayed).

Note that the UP, DOWN and LEFT buttons are not applicable for CAL 13, and so have no effect when in CAL 13.

11. TROUBLESHOOTING

Symptom	Solution
LCD displays Low Battery warning.	Replace battery (see section 6.1 on page 6).
On a battery powered FRT303, the LCD is blank.	The FRT303 may be in dormant mode because it is not receiving input pulses (note that this is normal operation and is not a fault). Touch the selector button (Figure 3) to activate the LCD.
On a battery powered FRT303 connected to an RMS Magnetic Flowmeter, the display is counting even when there is no flow.	• Ensure that the minus (shield) pulse wire of the RMS Magnetic Flowmeter is connected to an earth post, otherwise the pulse circuit may be acting as an antenna and picking up 50Hz hum. • Ensure that the RMS Magnetic Flowmeter earthing rings are connected to the earth post.
When on external DC power, LCD is faint.	Ensure that the external power is not under 4V.
When on external DC power, the FRT303 doesn't count.	Ensure that the external power is not under 4V.

12. EXAMPLE

Given an FRT303 that accepts pulses from an MES20 flowmeter, to calibrate the FRT303 for the situation listed below:

Flowmeter	MES20
K-Factor	1000 pulses per Litre
Pipe Size	20 mm
Maximum Flow Rate	65 Litres per Minute
Flow Rate	display in Litres per Minute, to 3 decimal places
Total	display in Litres, to 1 decimal place
Grand Total	display in Litres, no decimal place
Flow Rate filter	5
Output Pule Rate	1 pulse = 1 L
4mA represents	0 Litres per Second flowrate
20mA represents	65 Litres per Minute flowrate
Low flow limit	6.5 Litres per Minute (10% of maximum)
High flow limit	58.5 Litres per Minute (90% of maximum)
Delay to LCD Dormancy	3 minutes (0.05 hours)

the calibration settings are shown on the next page.

21

ManuFlo™ ®			a division of	**MANU ELECTRONICS PTY LTD**		
Flow Measurement Products				**41 Carter Road Brookvale**		
Email: sales@manuelectronics.com.au				**Sydney NSW 2100 Australia**		
Web: www.manuelectronics.com.au				**Ph: +61 2 9938 1425, +61 2 9905 4324**		
			ABN: 47-002-946-303	**Fax: +61 2 9938 5852**		

	FRT 303 - PROGRAM DATA SHEET				0309/1
Customer: Example			**Date: 28-Oct-03**		
Flowmeter: MES			**Flowmeter Part No: MES20**		
Min Flow Rate (L / min): 1.5			**Pipe Diameter (mm): 20**		
Max. Flow Rate (L / min): 65			**FRT Product Code: FRT303-D-P**		
Serial No.:			**Set up by:**		

Calibration		Setting		Meaning			
000000							
CAL 00		**Flow Rate Units**		**XXX-XXX** Litres		*per*	*Minute*
000002							
CAL 01		**Total Units**		**XXXXXX-X** L			
000003							
CAL 02		**Grand Total Units**		**XXXXXXX** L			
100000				**XXXX-XX**			
CAL 03		**Input K Factor**		**1000** p/L			
000001							
CAL 04		**Flow Rate Timebase**		**per** Minute			
000005							
CAL 05		**Flow Rate Filter**		**5**			
000010							
CAL 06	#	**Output Pulse Rate**		**1** L		per pulse	
006500							
CAL 07	#	**Low flow limit**		**6.5** Litres		per Minute	
058500							
CAL 08	#	**High flow limit**		**58.5** Litres		per Minute	
000000							
CAL 09	#	**Low (4mA) flow rate**		**0** Litres		per Minute	
065000							
CAL 10	#	**High (20mA) flow rate**		**65** Litres		per Minute	
000100				**1** hours		or	
CAL 11		**Delay to LCD Dormancy**		**60** min		or	
				3600 sec			
XXXXXX							
CAL 12		**Reset Grand Total**		*(Not Part of Factory Calibration)*			
XXXXXX							
CAL 13		**Software Version**		*(Not adjustable)*			
	#	= is only relevant if this output option is provided.					