PRO-FLO200

Flow Rate Totalizer

E2180

This sophisticated panel mount controller is the ideal solution for a variety of flow rate applications, and is designed for simple setup and operation.

It features a customizable dual display, user programmable input functions, and simple calibration using K factor entry, or pulses per unit of measurement.

Advanced setpoint modes are available, including timed or latched types, and the totalizer features batch counting and volumetric pulse.

Order Codes

PRO-FLO200

-HV	85-265V AC / 95-370V DC
-LV	15-48V AC / 10-72V DC

Options

-R2	2 x relay outputs
-R4	4 x relay outputs
-R6	6 x relay outputs (5 active)
-A	1 x mA/V analog output
-S2R	1 x RS232 (RJ11 terminal)
-S4S	1 x RS485 (screw terminal)

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1 SPECIFICATIONS

General Specifications

Sensor type NPN (open collector), PNP, Mag (20mV to 30V), TTL, digital, closed contact or namur

Input 0–24V DC, 0–30V AC

Power supply
HV: 85–265V AC/95–370V DC **OR**
LV: 15–48V AC/10–72V DC

Sensor calibration using direct K factor entry or pulses per unit of measurement

K factor ranges 3 ranges for K factors, from 0.1 to 99.9999, 999.999 or 9999.99

Flow rate /sec, /min or /hour; use multiplier (x0.0001–1000) to display required units

Totalizer resolution x1, $x10^3$, $x10^6$

Volumetric pulse with adjustable pulse width from 0.1 to 10.0 seconds

Frequency 2Hz to 10KHz

Excitation 24V DC (50mA max) provided by controller

Accuracy 0.005%

Temperature drift Typically 2ppm/°C

Relay Output *OPTIONAL*

Number of relay outputs
None, 2, 4 or 6
Note that the first relay (SP 1/BCH SP) is reserved for batching functions
SP 6 is disabled and cannot be used, even when 6 relay outputs are installed

Relay output type 5A form A (3A 240V AC max or 3A 30V DC max)

Analog Output *OPTIONAL*

Number of analog outputs None or 1

Analog output type Isolated 16 bit 4–20mA/0–10V
Wire for either current or voltage. Fully scalable. Window programmable over any range within the controller's full-scale range.

Comm Port *OPTIONAL*

Number of comm ports None or 1

Comm port options
S2R= Isolated RS232, RJ terminal, or
S4S= Isolated RS485, screw terminal

Serial output Custom ASCII, Modbus RTU slave or Ranger A

Data rate 1200–115k2 baud

Parity Odd, even or none

Programming

Front panel buttons Up, Down, P (Prog/Enter), plus 2 Menu buttons (F)

Security Input and setpoint setups are independently accessible and PIN protected

Display

Display type 14 segment alphanumeric LED display, 5 buttons

Digits 2 x 6 digits, 0.4" (10mm)

LED indicators 6 setpoint LED's (5 active)

Construction

Casing Panel mount case

Ingress protection rating IP65 dust/ splash proof (face only)

Dimensions (H x W x D) 1.89 x 3.78 x 4.72" (48 x 96 x 120mm)

Panel cutout 1.77 x 3.62" (45 x 92mm)

2 FEATURES

2.1 - Advanced Setpoint Types

There are three setpoint types available for this model:

- A **normal** setpoint will activate and deactivate using alarm or control logic (see 8.2J) regulated within a hysteresis band (see 8.2K).
- A **timed** setpoint will activate as normal, and remain active for a user defined time period (see 8.2O), after which it will deactivate automatically.
- A **latched** setpoint will activate as normal, and remain active until it is unlatched either by setpoint logic (see 8.2Q), or manually using a user shortcut pin/key (see 7.6).

2.2 - Batching

This function allows the Total count to be maintained, as well as the current batch value. This allows the user to maintain the total in the background, while still allowing set batch amounts to be measured. The batching feature uses the calculation: **Batch = Total – Batch Tare**.

Batch Tare is reset to the *Total* value when a reset batch function is triggered via setpoint logic (see 8.2Q) or a user shortcut pin/key (see 7.6).

Batch Count allows the user to count how many completed batches have been processed. The *Batch Count Modifier* (see 8.2U) value (usually 1 or -1) is added to the *Batch Count* register each time the *Batch Setpoint* is activated, as per the selected *Reset Edge* (see 8.2S).

2.3 - Input Signal Averaging

Input signal averaging reduces noise and optimizes stable measurement.

If your input signal contains large noise spikes, you can increase the size of the averaging window to ensure that these are still averaged. If the change in input exceeds the averaging window value it will not average, ensuring fast response when there are large differences between readings. Increasing the window size too far will reduce the ability of the controller to respond quickly to real changes in input signal.

2.4 - Startup Inhibit

This feature can be used with setpoints which may be active initially at power up. It will cause a relay to remain off (de-energized) at power up until it has first reached its inactive state, after which it will function normally.

2.5 - Volumetric Pulse

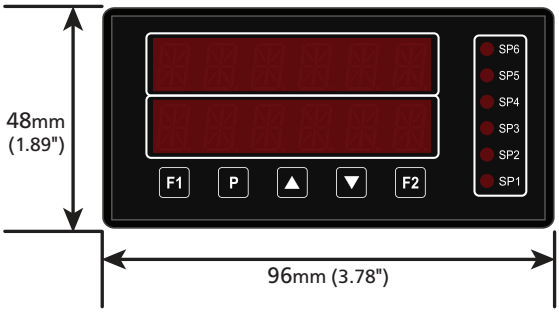
This function is ideal for feeding volume information to other equipment. It outputs a pulse on the relay when Total ≥ Setpoint Value, causing the relay to activate for a

specified length of time (see 8.2G), which can be adjusted to suit the requirements of externally connected devices.

When a setpoint is activated in volumetric pulse mode, the totalizer will reset using the calculation: **Total = Total – Setpoint Value**, and then resume totalizing.

3 FRONT PANEL & DISPLAY

3.1 - Front panel



SPX The SP LED's are used to indicate active setpoints. **SP1** is used to indicate the **BCH SP**. **SP6** is permanently disabled.

F1 Used to access the **Input Setup & Calibration** menu (Section 7).

P Used to save your settings and advance to the next step. It can also be configured to perform a user-selected custom function after a long press (> 2secs) from the main display (see 7.6B).

▲ Typically used to scroll through options or increase values in the setup menu. Pressing this button from the main display will show the current values for Rate, Batch and Peak (see 3.3).

▼ Typically used to scroll through options or decrease values in the setup menu. Pressing this button from the main display will show the current values for Total, Batch Count, Inflight Correction and Valley (see 3.3).

F2 Used to access the **Setpoint Setup** menu (Section 8) and the **Setpoint Direct Access** menu (Section 9).

3.2 - Display brightness

To adjust the display brightness, press the [P] and [▲] buttons together from the main display. **BRI** appears and toggles with the current setting. Use the [▲] and [▼] buttons to adjust the LED backlight, and then press [P] to return to the normal operating mode.

3.3 - Up and down button shortcuts

Pressing the [▲] and [▼] buttons from the main operational display allows instant access to a number of values held in the controller's memory. These variables will appear in the order shown in the table below, and will cycle continuously at each press of the [▲] or [▼] button.

Press [P] at any time to return to normal operating mode. The **PEAK**, **VALLEY**, **TOTAL** and **BT CNT** values may be reset to zero by pressing the [▲] and [▼] buttons **at the same time** while the variable is being displayed.

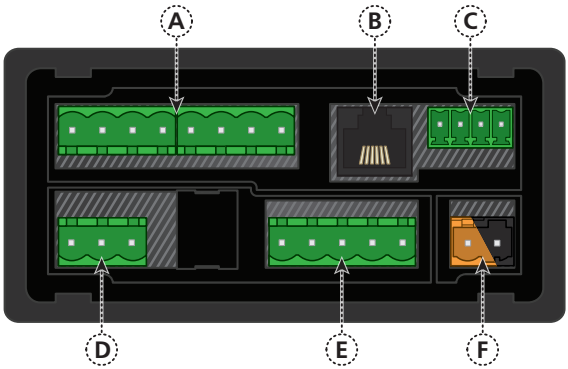
Up and down button shortcuts

[▲]	**RATE**	The current flow rate input
	BATCH	The batch value
	PEAK	The maximum measured flow rate input since the instrument was turned on or reset
[▼]	**TOTAL**	The totalizer value
	BT CNT	The number of batches that have been processed (batch count)
	INFLIT	Inflight correction offset: This value is calculated by the controller based on the batch error (the difference between the batch setpoint value and the final batch value) averaged over the last three batches, and the Inflight Adjustment Delay time (selected in 8.2W)
	VALLEY	The minimum measured flow rate input since the instrument was turned on or reset

4 WIRING

BEFORE YOU BEGIN WIRING, ensure that the unit is switched off and the power supply is disconnected.

4.1 - Pinouts



Key

4.1A Relay Output (See 4.3)

4.1B Serial Port (See 4.5)

4.1C Analog Output (See 4.4)

4.1D Analog Input (See 4.2)

4.1E Function Pins (See 4.6)

4.1F Power Supply (See 4.7)

4.2 - Wire the Analog Input Module

See 4.1D

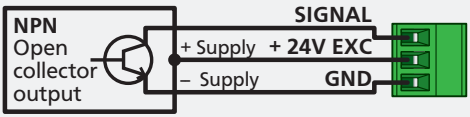
IMPORTANT: The input module for this unit has four headers which are factory configured to suit your application. The unit is configured for an NPN type sensor by default.

- If you are using an **NPN** type sensor, you don't need to change anything.
- If you are using **PNP**, **TTL**, **Namur**, **Tacho**, or a **Pushbutton switch**, please review your header configuration before continuing, referring to Section 6.

Then wire your input as required, referring to the diagrams on the following page.

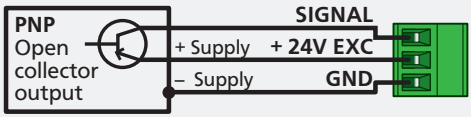
NPN open collector output with proximity switch

- Active sensor signal: 0V
- Inactive sensor signal: +24V



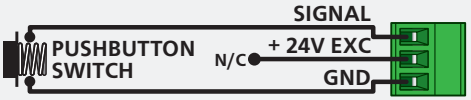
PNP open collector output with proximity switch

- Active sensor signal: +24V
- Inactive sensor signal: 0V

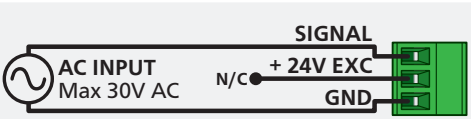


Push button switch

- Open signal: +24V
- Closed signal: 0V

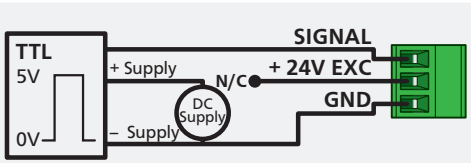


Tacho generator sensor



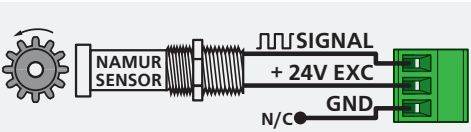
TTL input

- In this example the TTL logic has a separate +5V power supply



Namur sensor

- Active sensor signal: 0.3–1.0mA
- Inactive sensor signal: 1.7–3.0mA



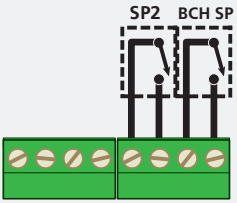
4.3 - Wire the Relay Outputs

See 4.1A

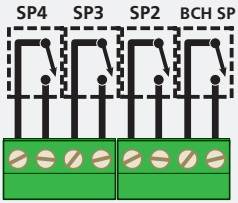
If your controller has relay outputs fitted, wire them as shown below. Please note:

- **SP 1** is always treated as a Batch Setpoint (**BCH SP**)
- **SP 6** is used by the controller for internal calculations. It does not appear in the setpoint menu, and its relay output functionality has been deactivated.

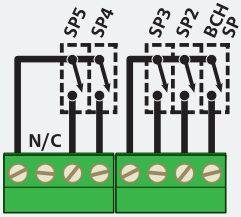
-R2



-R4



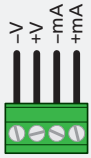
-R6



4.4 - Wire the Analog Output

See 4.1C

If your controller has analog output fitted, wire it as shown for either voltage (0–10V) or current (4–20mA).



4.5 - Wire the Serial Port

See 4.1B

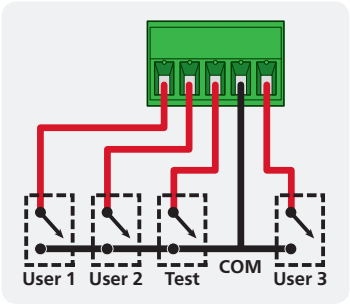
If your controller has serial port fitted, wire it as shown in the applicable diagram. (S2R: RS232, RJ11 terminal, S4S: RS485, screw terminal).

-S2R

-S4S

4.6 - Wire the Function Pins

See 4.1E



Connect external switches to enable a function to be executed when its switch is activated.

- **User 1–3:** Activating one of these function pins will execute its user-defined function (as specified in 7.6C–E)
- **Test:** Activating this pin resets the unit

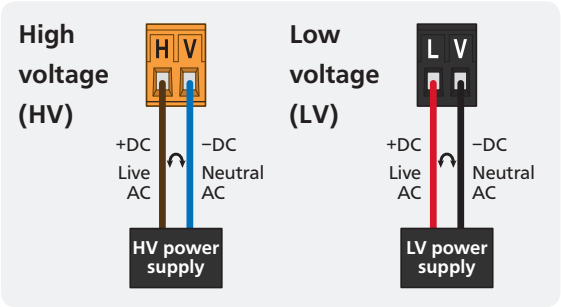
4.7 - Wire the Power Supply

See 4.1F

DO NOT attempt to wire your controller while the power is on. NEVER connect your low voltage controller to mains power.

Wire your controller for low or high voltage power supply, as show in the diagrams below. Check the label on the unit against the color of the connector:

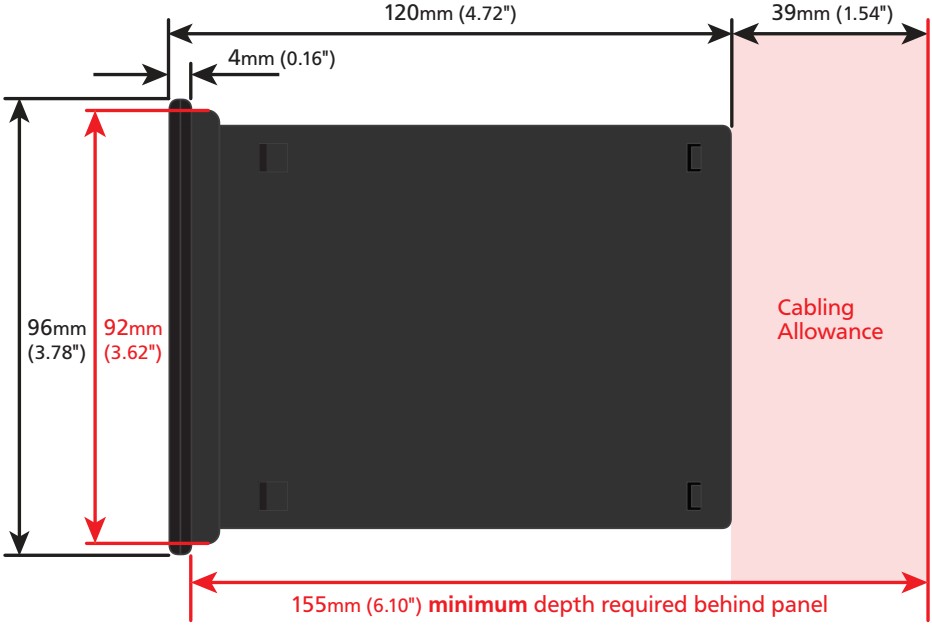
- **Orange =**
  High voltage (85–265V AC, 95–370V DC)
- **Black =**
  Low voltage (15–48V AC, 10–72V DC)

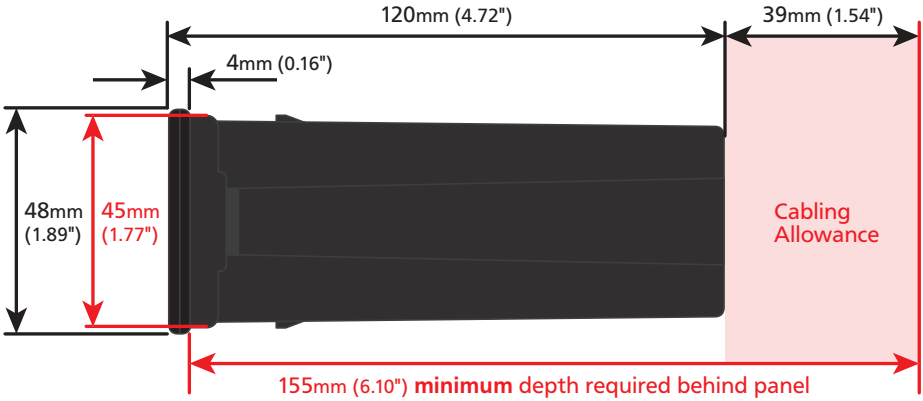


Once you have completed the wiring process it is safe to switch on your power supply. Ensure that your display is functioning before you proceed.

5 DIMENSIONS & INSTALLATION

5.1 - Case Dimensions

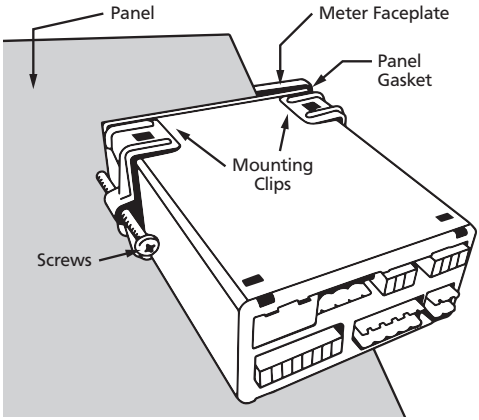




5.2 - Installation Instructions

A Prepare the **Panel Cutout** to 3.62 x 1.77" ±.02 (92 x 45mm ±.5), as shown below.
Allow at least 6.10" (155mm) depth behind the panel to accommodate the meter body, protruding connectors and cabling.

B Remove the **Mounting Clips** from the meter back.

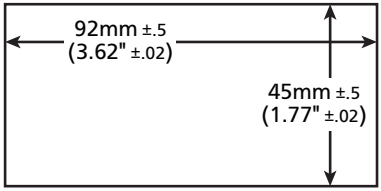


C Slide the **Panel Gasket** over the rear of the unit to the back of the **Meter Faceplate**.

D From the front of the panel, insert the meter into the P**anel Cutout**. Holding the unit in place, engage the **Mounting Clips** so that the tabs snap into place over the notches on the case.

E To achieve a proper seal, tighten the **Screws** evenly until the unit sits firmly against the panel. Do not over-tighten the screws.

Panel Cutout



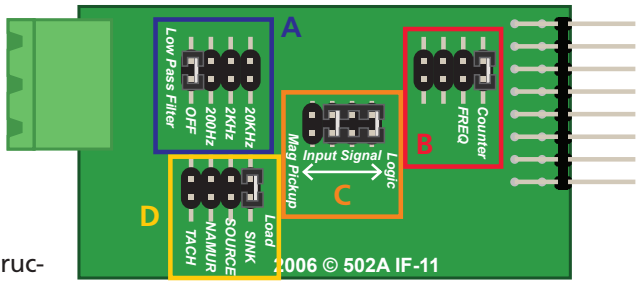
6 INPUT HEADER ADJUSTMENT

We recommend that you specify your sensor type when you place your order, to avoid unnecessary removal of the input module.

6.1 - Input Header Settings

The analog input board for the PRO-FLO200 has four headers which affect the Low Pass Filter (A), Mode (B), Input Signal (C) and Load (D). Of these, headers A, C and D should be adjusted as required for your sensor type.

Refer to the tables below to determine whether the default header positions (highlighted black) are suitable for your application.



If required, follow the instructions in 6.2 to remove the analog input board from the meter case and adjust the header positions as needed.

Low Pass Filter Header (A)

OFF	Ideal for high-speed counting
200Hz	Ideal for mechanical contacts
2KHz	Suitable for a noisy signal
20KHz	Suitable for a noisy signal

Mode Header (B) - **Do not adjust!**

Counter	Always use this setting
FREQ	Not used for PRO-FLO200

Input Signal Header (C)

Logic	NPN, PNP, Namur, TTL & Pushbuttons
Mag Pickup	Tacho

Load Header (D)

SINK	NPN, TTL & Pushbuttons
SOURCE	PNP
NAMUR	Namur
TACH	Tacho

6.2 - How to Remove the Input Module

A If the meter is already installed, remove it from the panel, and unplug all plugs from the back of the unit.

B Using a small screwdriver or similar implement, press downward into one of the slots at the rear of the case. This will disengage one of the tabs which holds the back plate on, allowing it to be gently levered away at one corner.

C Holding the loosened corner open with one hand, disengage the lever on the opposite slot (Fig 1).

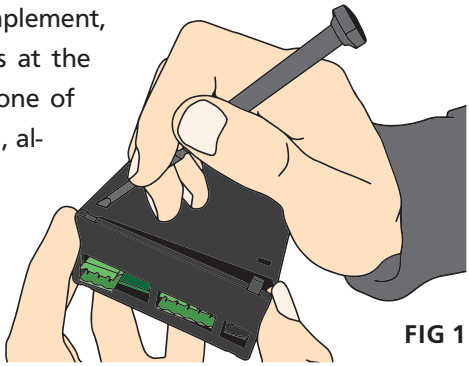


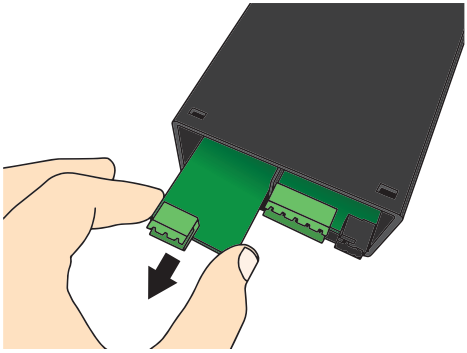
FIG 1

D You should now be able to remove the back plate. If it does not unclip easily, you may need to disengage the two remaining tabs by repeating steps 6.2B–C on the other side of the meter.

E Slide the analog input module out of the meter case (Fig 2). (See 4.1D to identify the input module.)

F Position the headers on the input module as required for your sensor type, referring to 6.1.

G Slide the input module back into the meter case.



Make sure that it is sitting in the tracks on the left and right. Press firmly until the input module is fully inserted and sits flush with the other boards that are visible from the back of the meter.

H Replace the back plate.

Begin by inserting the two lower tabs into the slots, and then position the upper tabs so that they will not catch on the top lip of the meter case. Apply firm pressure until the back plate clicks into place.

I Reconnect the plugs and return the meter to the panel installation.

7 INPUT SETUP & CALIBRATION

7.1 - Enter F1 PIN Number

A Enter the calibration mode by pressing the [F1] button.

_ _ _ ENTER F1 PIN NUMBER scrolls across the bottom row and **0** appears in the top row. Use the [▲] and [▼] buttons to enter your security code (factory default 1). Then press [P]. If the correct PIN is entered, setup is started at 7.2.

If an incorrect PIN number is entered, **_ _ _ INCORRECT PIN NUMBER – ACCESS DENIED** scrolls across the display and it returns to normal operating mode.

You will have the opportunity to change your PIN number at the end of this section (7.9). If you have forgotten your PIN number, see Section 10.

7.2 - Flow Rate Setup

A **_ _ _ FLOW RATE SETUP** scrolls across the bottom row and **SKIP** appears in the top row. Press [P] to skip to 7.3, or the [▲] button and then [P] to **ENTER** flow rate setup.

B **_ _ _ DECIMAL POINT POSITION** scrolls across the bottom row and the current selection appears in the top row. Use the [▲] and [▼] buttons to select **NO DP**, **0.1**, **0.12**, **0.123**, **0.1234** or **0.12345**, and then press [P] to accept and continue.

C **_ _ _ CALIBRATION METHOD** scrolls across the bottom row and the currently selected calibration method appears in the top row. Use the [▲] and [▼] buttons to choose between **K FCTR** (K Factor) or **PULSES**, and then press [P].

- ➡ If you selected **K FCTR**, complete steps 7.2D–E, and then continue to 7.2H.
- ➡ If you selected **PULSES**, complete steps 7.2F–G, and then continue to 7.2H.

K FCTR *is ideal for fast, accurate calibration using the sensor manufacturer's K factor value.*

PULSES *is for applications where the flow sensor's K factor value is not known. It is also a more accurate calibration method in rare situations where the known K factor is less than 1.*

K Factor Calibration

D **_ _ _ K FACTOR RANGE** scrolls across the bottom row and the current selection appears in the top row. Use the ⬆ and ⬇ buttons to select from: **99.9999**, **999.999** or **9999.99**, and then press P.

E **_ _ _ K FACTOR** scrolls across the bottom row and the current value appears in the top row. Use the ⬆ and ⬇ buttons to enter the K factor from your flow transducer manufacturer's specifications. Then press P.

➡ Please skip to 7.2H now.

Pulses Calibration

F **_ _ _ PULSES PER UNIT OF MEASUREMENT** scrolls across the bottom row and the current number of pulses appears in the top row. Adjust this value using the ⬆ and ⬇ buttons, and then press P.

*For example, if a flow sensor outputs 50 pulses/unit of flow, set this value to **50**. (Where 'unit of flow' is your selected engineering unit i.e. Liters, Gallons etc.)*

G **_ _ _ ENTER DISPLAY VALUE FOR X PULSES** (where 'X' is the number of pulses selected above) scrolls across the bottom row. The current display value appears in the top row. Adjust this value using the ⬆ and ⬇ buttons, and press P.

➡ Please continue to 7.2H now.

*If you selected 50 pulses above, and 50 pulses = 1 unit of flow, then enter **1** here. ('Unit of flow' is your selected engineering unit i.e. Liters, Gallons etc.) The controller will automatically calculate the correct scale factor for you.*

H **_ _ _ TIME PERIOD FOR RATE DISPLAY** scrolls across the bottom row and the current selection appears in the top row. Use the ⬆ and ⬇ buttons to select: **SECS**, **MINS** or **HOURS**, and then press P.

E.g. If the measurement units are liters, then rate can be viewed in L/sec, L/min or L/hr.

I **_ _ _ RATE MULTIPLIER** scrolls across the bottom row and the current multiplication factor appears in the top row. This option adds a scale factor, to display the rate in the required units. Use the ⬆ and ⬇ buttons to select: **X0.0001**, **X0.001**, **X0.01**, **X0.1**, **X1**, **X10**, **X100** or **X1000**. Then press P.

J **_ _ _ ROUNDING** scrolls across the bottom row and the current display rounding appears in the top row. Using the ⬆ and ⬇ buttons, select: **NONE**, **2**, **5** or **10**, and then press P.

*Rounding is quoted in display counts and is not influenced by decimal point position. For example, if your input signal is 5.3, the display will show: 5.3 (for rounding=**NONE**), 5.4 (for rounding=**2**), 5.5 (for rounding=**5**) or 5.0 (for rounding=**10**).*

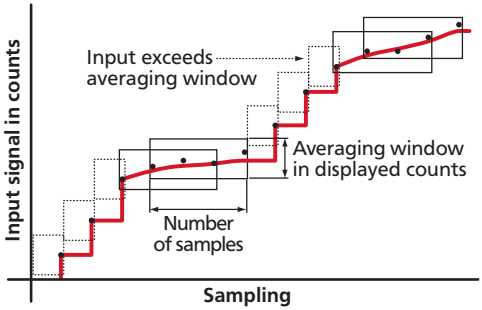
K **_ _ _ DISPLAY ZERO TIME** scrolls across the bottom row and the current selection appears in the top row. This value controls how quickly the rate display changes to zero. Use the ⬆ and ⬇ buttons to select either: **0.5SEC** (for inputs with >2 pulses/sec) or **100SEC** (for slow inputs). Then press P.

L **_ _ _ AVE SAMPLES** scrolls across the bottom row, and the currently selected averaging appears in the top row. Using the ⬆ and ⬇ buttons, alter the number of input samples that the controller will average, and then press P.

Your controller has input signal averaging, optimizing stable measurement.

If the change in input exceeds the averaging window value it will not average, ensuring fast response when there are large differences between readings.

*Increasing the number of **AVE SAMPLES** will stabilise measurement, but it will also slow down response rates.*



M **_ _ _ AVE WINDOW** scrolls across the bottom row, and the currently selected averaging window value appears in the top row. Using the ⬆ and ⬇ buttons, alter the signal averaging window. Then press P.

*If your input signal contains large noise spikes, you can increase the size of the averaging window to ensure that these are still averaged. However, increasing the window size too far will reduce the ability of the controller to respond quickly to real changes in input signal. Setting **AVE WINDOW** to **0** will give continuous averaging as per the selected averaging samples.*

7.3 - Totalizer Setup

A **_ _ _ TOTALIZER SETUP** scrolls across the bottom row and **SKIP** appears in the top row. Press [P] to skip to 7.4, or the [⬆] button and then [P] to **ENTER**.

B **_ _ _ DECIMAL POINT POSITION** scrolls across the bottom row and the current selection appears in the top row. Use the [⬆] and [⬇] buttons to select **NO DP**, **0.1**, **0.12**, **0.123**, **0.1234** or **0.12345**, and then press [P].

C **_ _ _ RESOLUTION** scrolls across the bottom row and the currently selected totalizer resolution appears in the top row. Use the [⬆] and [⬇] buttons to select: **X1**, **10^3** (10^3), or **10^6** (10^6), and then press [P].

D **_ _ _ RESET AT POWER UP** scrolls across the bottom row and the current setting appears in the top row. Use the [⬆] and [⬇] buttons to select: **NO** (retain previous totalizer value at power up), **ZERO** (reset totalizer to zero at power up), or **LD VAL** (reset totalizer to custom load value (see 7.3E) at power up). Press [P].

E **_ _ _ LOAD VALUE** scrolls across the bottom row and the current totalizer load value appears in the top row. Use the [⬆] and [⬇] buttons to adjust this value if required, and then press [P].

*This value will be loaded into the totalizer at power up, if **LD VAL** is selected in 7.3D above. It will also be loaded into the totalizer if either **TOT=LV** or **T&B=LV** is executed via a user programmable input function (see 7.6).*

7.4 - Batching Setup

A **_ _ _ BATCHING SETUP** scrolls across the bottom row and **SKIP** appears in the top row. Press [P] to skip to 7.5, or the [⬆] button and then [P] to **ENTER**.

B **_ _ _ RESET AT POWER UP** scrolls across the bottom row and the current setting appears in the top row. Use the [⬆] and [⬇] buttons to select: **NO** (retain previous batch value at power up), **ZERO** (reset batch value to zero at power up), or **LD VAL** (reset batch to custom load value (see 7.4C) at power up). Then press [P].

C **_ _ _ LOAD VALUE** scrolls across the bottom row and the currently selected batch load value appears in the top row. Use the ⬆ and ⬇ buttons to adjust this value if required, and then press P.

*This value will be loaded into the batch register at power up, if **LD VAL** is selected in 7.4B above. It will also be loaded into the batch register if either **BCH=LV** or **T&B=LV** is executed via a user programmable input function (see 7.6).*

7.5 - Display Setup

A **_ _ _ DISPLAY SETUP** scrolls across the bottom row and **SKIP** appears in the top row. Press P to skip to 7.6, or the ⬆ button and then P to **ENTER** setup.

B **_ _ _ LINE 1 DISPLAY SOURCE** scrolls across the bottom row and the currently selected line 1 (top row) display source appears in the top row. Use the ⬆ and ⬇ buttons to select: **NONE**, **RATE**, **TOTAL**, **BATCH**, **BCHCNT**, or **BCH SP**, and then press P.

C **_ _ _ LINE 2 DISPLAY SOURCE** scrolls across the bottom row and the currently selected line 2 (bottom row) display source appears in the top row. Use the ⬆ and ⬇ buttons to select: **NONE**, **RATE**, **TOTAL**, **BATCH**, **BCHCNT**, or **BCH SP**, and then press P.

7.6 - User Programmable Input Functions

This section allows you to assign a custom function to the front panel P button, or the rear user input pins (see 4.6). The following functions are available:

NONE	No action
TOT=0	Reset totalizer to zero
TOT=LV	Reset totalizer to totalizer load value (defined in 7.3E)
BCH=0	Reset batch value to zero
BCH=LV	Reset batch value to batch load value (defined in 7.4C)
T&B=0	Reset totalizer & batch to zero
T&B=LV	Reset totalizer & batch to load values (defined in 7.3E & 7.4C)
BCNT=0	Reset batch count to zero

HALT B	Halt the batch in progress (not available on User Input 2)
HOLD	Hold all counts (available on User Input 2 only) In this mode, activating User Input 2 will stop the batch process (turn the batching relay off), and will hold the current total and batch values until the pin is deactivated. Any pulses on the input will be ignored while the User Input 2 pin is activated. Deactivating User Input 2 will restart the batching process (turn the batching relay on again), and the total and batch values will continue counting from the previously held values.
CONT B	Continue with the current batch (not available on User Input 2)
HOLD B	Hold the batch count (available on User Input 2 only) In this mode, activating User Input 2 will stop the batch process (turn the batching relay off), and will hold the current batch value until the pin is deactivated. While User Input 2 is activated, the total value will continue to count input pulses, but the batch value will be held. Deactivating User Input 2 will restart the batching process (turn the batching relay on again), and the batch value will continue counting from its previously held value.
UNLTCH	Unlatch all setpoints (see 2.1 and 8.2I for information on latched setpoints)
UNLT B	Unlatch **BCH SP** (see 2.1 and 8.2I for information on latched setpoints)
UNLT 2/3/4/5	Unlatch **SP 2/3/4/5** (see 2.1 and 8.2I for information on latched setpoints)

A **_ _ _ USER PROGRAMMABLE INPUT FUNCTIONS** scrolls across the bottom row and **SKIP** appears in the top row. Press [P] to skip to 7.7, or the [⬆] button and then [P] to **ENTER** input functions setup.

B **_ _ _ PROGRAM BUTTON** scrolls across the bottom row and the current function appears in the top row. This specifies the operation to be executed when the [P] button is pressed (for more than 2 seconds) from the main display. Referring to the table above, use the [⬆] and [⬇] buttons to select a function, and then press [P].

C **_ _ _ USER INPUT 1** scrolls across the bottom row and the current function appears in the top row. This specifies the operation to be executed when the User 1 pin is activated from the rear of the unit (see 4.6). Referring to the table above, use the [⬆] and [⬇] buttons to select a function, and then press [P].

D **_ _ _ USER INPUT 2** scrolls across the bottom row and the current function appears in the top row. This specifies the operation to be executed when the User 2 pin is activated from the rear of the unit (see 4.6). Referring to the table above, use the [⬆] and [⬇] buttons to select a function, and then press [P].

*Note that User Input 2 has unique additional options, including **HOLD** (Hold all counts) and **HOLD B** (Hold batch count). See the table above for more information.*

E **_ _ _ USER INPUT 3** scrolls across the bottom row and the current function appears in the top row. This specifies the operation to be executed when the User 3 pin is activated from the rear of the unit (see 4.6). Referring to the table above, use the ⬆ and ⬇ buttons to select a function, and then press P.

7.7 - Analog Output Setup

*N.B. All new units are calibrated before shipping. Recalibration is **only** necessary if settings are wiped or the unit's accuracy requires verification after a long period of use. e.g. 1 year.*

A **_ _ _ ANALOG OUTPUT SETUP** scrolls across the bottom row and **SKIP** appears in the top row. If your controller does not have analog output installed, (or you do not wish to configure your analog output now), press P to skip to 7.8.

Otherwise, press the ⬆ button and then P to **ENTER** analog output setup.

B **_ _ _ DATA SOURCE FOR ANALOG OUTPUT** scrolls across the bottom row and the current analog output data source appears in the top row. Use the ⬆ and ⬇ buttons to select an option from: **NONE**, **RATE**, **TOTAL**, **BATCH** or **BCHCNT**, and then press P.

C **_ _ _ LOW SCALE VALUE FOR ANALOG OUTPUT** scrolls across the bottom row and the currently selected low scale value appears in the top row. Use the ⬆ and ⬇ buttons to enter your cal low position, and then press P.

*This sets the display value for **CAL LOW** (as in 7.7F, below).*

D **_ _ _ HIGH SCALE VALUE FOR ANALOG OUTPUT** scrolls across the bottom row and the currently selected high scale value appears in the top row. Use the ⬆ and ⬇ buttons to enter your cal high position, and then press P.

*This sets the display value for **CAL HIGH** (as in 7.7G, below).*

E **_ _ _ CALIBRATE ANALOG OUTPUT?** scrolls across the bottom row and **SKIP** appears in the top row. If you do not wish to calibrate your analog output then press P now to skip to 7.8.

Factory analog output calibration is precisely set before shipping this instrument, and should not be adjusted unless advised by the manufacturer.

To calibrate your analog output now, connect a mA or volt meter across the analog output connector (see 4.4). Then press the ⬆ button, followed by P, to **ENTER** analog output calibration mode.

F **_ _ _ CAL LOW ANALOG OUTPUT** scrolls across the display and toggles with a calibration number shown in internal units (around -16000). Press the ⬆ or ⬇ buttons until the multimeter displays your target low output, then press P.

G **_ _ _ CAL HIGH ANALOG OUTPUT** scrolls across the display and toggles with a calibration number shown in internal units (around 30000). Press the ⬆ or ⬇ buttons until the multimeter displays your target high output, then press P.

7.8 - Serial Setup

A **_ _ _ SERIAL SETUP** scrolls across the bottom row and **SKIP** appears in the top row. If your controller does not have a serial port installed, (or you do not wish to configure your serial options now), please press P to skip to 7.9.

Otherwise, press the ⬆ button and then P to **ENTER** serial setup.

B **_ _ _ SERIAL MODE** scrolls across the bottom row and the currently selected serial mode appears in the top row. Using the ⬆ and ⬇ buttons, choose either: **ASCII** (custom), **MODBUS** (RTU) or **RNGR A** (Ranger A), and then press P.

See Appendix A for more information about the available serial modes.

- ➡ If you selected **ASCII** or **MODBUS**, skip to 7.8D now.
- ➡ If you selected **RANGER A**, continue to 7.8C now.

C **_ _ _ SERIAL DATA SOURCE** scrolls across the bottom row and the current Ranger A serial data source appears in the top row. Use the ⬆ and ⬇ buttons to select an option from: **RATE**, **TOTAL**, **BATCH** or **BCHCNT**, and then press P.

D **_ _ _ BAUD RATE** scrolls across the bottom row and the current selection appears in the top row. Use the ⬆ and ⬇ buttons to select one of: **1200**, **2400**, **4800**, **9600**, **19200**, **38400**, **57600** or **115200** Then press P.

E **_ _ _ PARITY** scrolls across the bottom row and the currently selected parity appears in the top row. Using the ⬆ and ⬇ buttons, select: **NONE**, **ODD** or **EVEN**, and then press P.

F **_ _ _ SERIAL ADDRESS** scrolls across the bottom row and the currently selected serial address appears in the top row. Use the ⬆ and ⬇ buttons to alter the serial address, and then press P.

*The serial address parameter is used to identify a particular device when it is used with other devices in a system. (It applies particularly to **MODBUS** mode when used on an RS485 serial network.) The serial address of the controller must be set to match the serial address defined in the master device.*

Refer to Appendix A for more information on serial modes and registers.

7.9 - Edit F1 PIN Number

A **_ _ _ EDIT F1 PIN NUMBER** scrolls across the bottom row and **SKIP** appears in the top row. Press P to skip and return to the operational display, or the ⬆ button and then P to **ENTER** and change your PIN number.

B **_ _ _ ENTER NEW F1 PIN NUMBER** scrolls across the bottom row and the current PIN (default 1) appears in the top row. Using the ⬆ and ⬇ buttons, enter your new F1 PIN number. Then press P to exit to the operational display.

8 SETPOINT SETUP

The software in your controller will allow you to configure 1 batch setpoint (SP 1/ BCH SP) and up to 4 standard setpoints (SP 2–5). SP 6 is permanently deactivated. For the first 5 setpoints, full functionality is only supported when relay output hardware installed.

(Setpoints with no corresponding relay output hardware may be used as simple LED indicators, if desired. In this case, features requiring relay output functionality will continue to appear in the setup menu, but will be ignored by the controller.)

8.1 - Enter F2 PIN Number

A Enter setpoint setup mode by pressing and holding the F2 button for 3 seconds.

_ _ _ ENTER F2 PIN NUMBER scrolls across the bottom row and **0** appears in the top row. Use the ⬆ and ⬇ buttons to enter your security code (factory default 1). Then press P. If the correct PIN is entered, setup is started at 8.2.

If an incorrect PIN number is entered, **_ _ _ INCORRECT PIN NUMBER – ACCESS DENIED** scrolls across the display and it returns to normal operating mode.

You will have the opportunity to change your PIN number at the end of this section (8.3). If you have forgotten your PIN number, see Section 10.

8.2 - Setpoint Setup

A **_ _ _ EDIT SETPOINT** scrolls across the bottom row and **SKIP** appears in the top row. Press [P] now to skip to 8.3, or use the [⬆] and [⬇] buttons to select a setpoint to edit: **BCH SP** (batch setpoint/SP 1), **SP 2**, **SP 3**, **SP 4**, or **SP 5**. Then press [P].

B **_ _ _ SP VALUE** scrolls across the bottom row, and the current value for the selected setpoint appears in the top row. Using the [⬆] and [⬇] buttons, adjust the display value at which the selected setpoint will activate, and then press [P].

C The step that you proceed to now will depend on which setpoint you are editing (selected in 8.2A):

- If you are currently editing **BCH SP**, skip to 8.2E now.
- If you are currently editing **SP 2-5**, continue to 8.2D now.

D **_ _ _ TRACK BATCH SP** scrolls across the bottom row, and the tracking setting for the selected setpoint appears in the top row. Using the [⬆] and [⬇] buttons, select **OFF** or **ON**, and then press [P].

- If you selected **OFF**, continue to 8.2E now.
- If you selected **ON**, the step that you proceed to now will depend on the Setpoint Source (8.2E) previously configured for your Batch Setpoint:
  - **BCH SP** source = **TOTAL**: Skip to 8.2F now.
  - **BCH SP** source = **RATE**, **BATCH**, or **BCHCNT**: Skip to 8.2H now.

*A setpoint with **TRACK BATCH SP** enabled will track the setpoint value of **BCH SP**, with the setpoint value of the tracking setpoint becoming an offset value.*

E **_ _ _ SETPOINT SOURCE** scrolls across the bottom row and the activation source for the selected setpoint appears in the top row. Use the ⬆ and ⬇ buttons to choose **RATE**, **TOTAL**, **BATCH**, or **BCHCNT** and then press P.

- ➡ If you selected **RATE**, **BATCH**, or **BCHCNT**, skip to 8.2H now.
- ➡ If you selected **TOTAL**, continue to 8.2F now.

F **_ _ _ VOLUMETRIC PULSE** scrolls across the bottom row and the current selection appears in the top row. Use the ⬆ and ⬇ buttons to select **OFF** or **ON**, and then press P.

- ➡ If you selected **OFF**, skip to 8.2H now.
- ➡ If you selected **ON**, continue to 8.2G now.

*This function outputs a pulse on the relay when **Total ≥ Setpoint Value**. This will activate the selected relay for a specified length of time (see 8.2G), which can be adjusted in 0.1 second increments to suit the requirements of externally connected devices. This function is useful for feeding volume information to other equipment.*

*When the selected setpoint is activated in volumetric pulse mode, the totalizer will reset using the calculation: **Total = Total – Setpoint Value**, and then resume totalizing.*

G **_ _ _ PULSE TIME** scrolls across the bottom row and current selection appears in the top row. Pulse reset requires a minimum of 0.1 seconds. Use the ⬆ and ⬇ buttons to select your pulse time (up to 10.0 seconds), and then press P.

- ➡ All remaining setpoint parameters will be configured automatically by the controller. Please skip to 8.2X now.

A combination of high input rates and low setpoint values may exceed this limitation, resulting in missed output pulses.

H **_ _ _ SP ACTIVATION** scrolls across the bottom row, and the current activation for the selected setpoint appears in the top row. Using the ⬆ and ⬇ buttons, select the relay activation to operate **ABOVE** or **BELOW** the setpoint value, and then press P.

***ABOVE**: Relay turns on above the setpoint value and off below it. **BELOW**: Relay turns on below the setpoint value and off above it.*

I **_ _ _ SETPOINT TYPE** scrolls across the bottom row, and the setpoint type for the selected setpoint appears in the top row. Using the ⬆ and ⬇ buttons, select: **NORMAL**, **TIMED** or **LATCHD** (latched), and then press P.

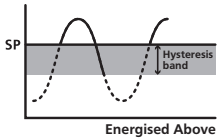
➡ If you selected **TIMED** or **LATCHD**, skip to 8.2L now.

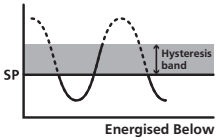
➡ If you selected **NORMAL**, continue to 8.2J now.

***NORMAL**: A normal setpoint will activate and deactivate using alarm or control logic regulated within a hysteresis band (8.2J–K). **TIMED**: A timed setpoint will activate as normal, and remain active for a user defined time period (8.2O), after which it will deactivate automatically. **LATCHD**: A latched setpoint will activate as normal, and remain active until it is unlatched either by setpoint logic (8.2Q), or manually using a user programmable shortcut (7.6).*

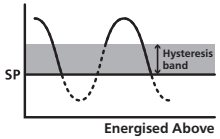
J **_ _ _ HYSTERESIS TYPE** scrolls across the bottom row, and the hysteresis type for the selected setpoint appears in the top row. Using the ⬆ and ⬇ buttons, select either **ALARM** or **CNTRL** (control), and then press P.

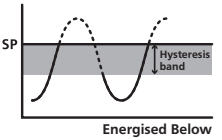
***ALARM** - **SETPOINT VALUE** controls setpoint activation point. **HYSTERESIS VALUE** controls setpoint deactivation point.*





***CNTRL** - **SETPOINT VALUE** controls setpoint deactivation point. **HYSTERESIS VALUE** controls setpoint reactivation point.*





K **_ _ _ HYSTERESIS VALUE** scrolls across the bottom row, and the hysteresis value for the selected setpoint appears in the top row. Use the ⬆ and ⬇ buttons to adjust this value if required, and then press P.

*The **HYSTERESIS VALUE** defines the separation band between setpoint activation and deactivation, and will operate as per the **HYSTERESIS TYPE** setting selected in 8.2J.*

L **_ _ _ MAKE DELAY** scrolls across the bottom row, and the current make delay time for the selected setpoint appears in the top row. This is the time delay between setpoint activation, and when the relay turns on. Adjust this value in 0.1 second increments using the ⬆ and ⬇ buttons, and then press P.

M The step that you proceed to now will depend on the Setpoint Type that you selected in 8.2I:

➡ If your Setpoint Type = **NORMAL**, proceed to 8.2N now.

➡ If your Setpoint Type = **TIMED**, skip to 8.2O now.

➡ If your Setpoint Type = **LATCHD**, skip to 8.2P now.

N **_ _ _ BREAK DELAY** scrolls across the bottom row, and the current break delay value for the selected setpoint appears in the top row. This is the time delay

between setpoint de-activation, and when the relay turns off. Adjust this value in 0.1 second increments using the ⬆ and ⬇ buttons, and then press P.

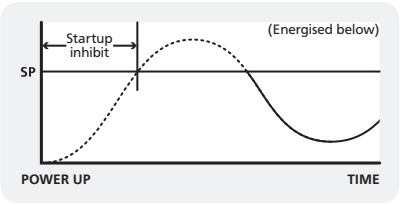
➡ Please skip to 8.2P now.

O **_ _ _ ON TIME** scrolls across the bottom row, and the current selection appears in the top row. This defines the time that a Timed relay (see 8.2I) remains energized. Adjust this value in 0.1 second increments using the ⬆ and ⬇ buttons, and then press P.

P **_ _ _ STARTUP INHIBIT** scrolls across the bottom row, and the current selection appears in the top row. Use the ⬆ and ⬇ buttons to select either **NO** or **YES**, and then press P.

This option can be used with setpoints which may be active initially at power up.

*Setting **STARTUP INHIBIT** to **YES** will cause a relay to remain off (de-energized) at power up until it has first reached its inactive state. It will then function normally.*



Q **_ _ _ RESET ACTION** scrolls across the bottom row, and the current selection appears in the top row. This parameter specifies the action to be executed when the Reset Edge (8.2S) occurs. Use the ⬆ and ⬇ buttons to select: **NONE**, **RS TOT** (reset total), **RS BAT** (reset batch), **RS BCT** (reset batch count) or **UNLTCH** (unlatch all setpoints). Then press P to accept.

➡ If you selected **NONE**, then the step that you proceed to now will depend on which setpoint you are editing (your selection in 8.2A):
- **BCH SP** = Skip to 8.2S now.
- **SP2–5** = Skip to 8.2X now.

➡ If you selected **RS TOT** or **RS BCT**, continue to 8.2R now.

➡ If you selected **RS BAT** or **UNLTCH**, skip to 8.2S now.

R **_ _ _ RESET VALUE** scrolls across the bottom row, and the current reset value appears in the top row. Use the ⬆ and ⬇ buttons to adjust the value which will be loaded into the destination register selected in 8.2Q (Reset Action) when the selected Reset Edge (8.2S) occurs. Then press P to accept.

S **_ _ _ RESET EDGE** scrolls across the bottom row, and the current selection appears in the top row. The defines the reset edge which must occur in order to trigger the Reset Action selected in 8.2Q. Use the ⬆ and ⬇ buttons to select: **NONE**, **MAKE** (make edge, relay energizes), **BREAK** (break edge, relay de-energizes) or **BOTH** (make and break edges). Then press P to accept and continue.

T The step that you proceed to now will depend on which setpoint you are editing (selected in 8.2A):

- ➡ If you are currently editing **BCH SP**, continue to 8.2U now.
- ➡ If you are currently editing **SP 2–5**, skip to 8.2X now.

U **_ _ _ BATCH COUNT MODIFIER** scrolls across the bottom row and the current value appears in the top row. Use the ⬆ and ⬇ buttons to adjust this value if desired, and then press P.

A positive number will cause the batch count register to be incremented by that amount each time the selected reset edge is triggered. Likewise, a negative number will cause the batch count register to be decremented. Setting this value to zero will disable this feature.

V **_ _ _ INFLIGHT CORRECTION** scrolls across the bottom row and the current option appears in the top row. This function is used to correct for overrun errors caused by pipes/valves etc. Use the ⬆ and ⬇ buttons to turn this feature **ON** or **OFF**, and then press P.

- ➡ If you selected **ON**, continue to 8.2W now.
- ➡ If you selected **OFF**, skip to 8.2X now.

*When **INFLIGHT CORRECTION** is turned **ON**, the batch error (the difference between the batch setpoint value and the final batch value) is averaged over the last 3 batches. When a batch has finished, the controller waits for the **INFLIGHT ADJUSTMENT DELAY** time (see 8.2W), and then calculates a new inflight correction offset for the next batch.*

*During the next batch, the effective **BCH SP** value is modified to include the calculated Correction Offset value, in an attempt to compensate for errors. (Correction Offset cannot be greater than 50% of the setpoint value).*

W **_ _ _ INFLIGHT ADJUSTMENT DELAY IN SECONDS?** scrolls across the bottom row, and the current value appears in the top row. This function is used to specify the time delay (in seconds) between the batching relay turning off, and the inflight correction calculation being made (see 8.2V). Use the ⬆ and ⬇ to adjust the inflight delay time, and then press P.

X **_ _ _ USER ACCESS?** scrolls across the bottom row, and the direct access permission setting for the selected setpoint appears in the top row. Use the ⬆ and ⬇ to select either **OFF** or **ON**, and then press P.

When enabled, this option allows the selected setpoint's value to be edited directly after pressing the F2 button, without needing to enter a PIN number or go through all of the other options. Each setpoint can individually have this option enabled or disabled. See Section 9.

Y **_ _ _ EDIT SETPOINT** scrolls across the bottom row and **SKIP** appears in the top row. You are now back at 8.2A. To edit another setpoint, follow the instructions from 8.2A–Y again. If you do not wish to edit another setpoint, press P now to skip to 8.3.

8.3 - Edit F2 PIN Number

A **_ _ _ EDIT F2 PIN NUMBER** scrolls across the bottom row and **SKIP** appears in the top row. Press P to skip and return to the operational display, or the ⬆ button and then P to **ENTER** and change your PIN number.

B **_ _ _ ENTER NEW F2 PIN** scrolls across the bottom row, and the current PIN (default 1) appears in the top row. Using the ⬆ and ⬇ buttons, enter your new F2 PIN number. Then press P to exit to the operational display.

9 SETPOINT DIRECT ACCESS

If none of the setpoints have their direct access option enabled then this feature will be disabled and the F2 button will not respond to a short button press. (See 8.2X.)

A Begin by pressing the F2 button for less than 3 seconds.

B The name of the first access-enabled setpoint will appear in the bottom row and the current value for that setpoint will appear in the top row. Using the ⬆ and ⬇ buttons, adjust the selected value. Then press P to accept and continue.

C The name of the next access-enabled setpoint will appear on the display, along with its setpoint value. Repeat step 9B. The direct access menu will proceed through all access-enabled setpoints in this fashion. Pressing P for the last enabled setpoint will exit and return to the operational display.

10 RESET PIN NUMBERS / VIEW FIRMWARE VERSION

If you have forgotten your PIN number(s), follow the procedure below to reset both the F1 and F2 PINs to their factory default of 1.

This procedure will also allow you to view the current software installed on your device, which may be required for support purposes.

A Press ⬆, ⬇ and P at the same time. (This key combination can be difficult to execute and you may need several tries to get it right.)

B A message will appear on the display, with details of the unit's current software configuration (Product name, Firmware Version, Macro Version etc.). At the end, you will see – **PIN NUMBERS RESET TO 1**

C Both the F1 PIN number and the F2 PIN number have now been reset to '1'.You can change this, if required, by following the instructions in 7.9 (for F1) and 8.3 (for F2), using '1' to enter each memnu initially.

A APPENDIX A - SERIAL MODES

A.1 - Custom ASCII Mode

Custom ASCII is a simple, custom protocol that allows connection to various PC configuration tools. ('Custom ASCII' differs from the 'Modbus (ASCII)' protocol used by some devices.) Custom ASCII command strings must be constructed in this order:

<Start> <Controller Address> <Read/Write Command> <Register Address> <Separator Character> <Data Value> <Message Terminator>

Start - Use '**S**' for the start character of a command string (not case sensitive). This must be the first character in the string.

Controller Address - Use an ASCII number from '**1**' to '**255**' for the controller address. If the character following the start character is not an ASCII number, then address '**0**' is assumed. All controllers respond to address '**0**'.

Read/Write Command - Use ASCII '**R**' for read, '**U**' for unformatted read, or '**W**' for write (not case sensitive). Any other character aborts the operation.

*In Custom ASCII mode, data is normally read as formatted data (which includes decimals and any text characters that may be selected to show units). However it is also possible to read unformatted data by using a '**U**' in the read command. There is no unformatted write command, as when writing to fixed point registers, any decimal point and text characters are ignored.*

Register Address - The register address for the read/write operation will be an ASCII number from '**1**' to '**65535**'. This character must be specified for a write command, but may be omitted for a read command, (in which case the controller will respond with the data value currently on the display).

Separator Character - The separator character can be either a space or a comma, and is used to separate the register address from the data value.

Data Value - Must be an ASCII number. The absolute limits for this number are **-1000000** to **1000000**, but please note that not all registers will accept this range.

Message Terminator - This is the last character, and must be either a '**$**' (dollar) or an '*****' (asterisk). Neither of these characters should be used elsewhere in the

message string. If '**$**' is used, a 50ms minimum delay is inserted before a reply is sent. If '*****' is used, a 2ms minimum delay is inserted before a reply is sent.

Custom ASCII Read/Write Examples

Example	Description
SR$	Read display value from all controllers, 50ms delay.
S15R$	Read display value from controller address 15, 50ms delay.
S3U40*	Read unformatted data in channel 4 from controller address 3, 2ms delay.
S2W2 -10000$	Write -10000 to the display register of controller address 2, 50ms delay.
SWT CHAN_1$	Write ASCII text string Chan_1 to channel 1 text register, 50ms delay.

Custom ASCII Registers

8 Bit Unsigned

48207	Baud rate
48211	Serial address
48215	Serial mode

16 Bit Unsigned

65	Hysteresis BCH SP (SP 1)
66–69	Hysteresis SP 2–5
71	Make delay BCH SP (SP 1)
72–75	Make delay SP 2–5
4213	Break delay BCH SP (SP 1)
4214-4217	Break delay SP 2–5
5173	Batch count increment

24 Bit Signed (2 x 16 Bit)

2509	Load value (Total)
2511	Load value (Batch)

32 Bit Signed (2 x 16 Bit)

9	Rate
11	Total
13	Batch result
15	Batch count
81	Batch tare
57	Peak
59	Valley
6	Batch setpoint (SP 1)
7	Setpoint 2
8	Setpoint 3
9	Setpoint 4
10	Setpoint 5
239	Alarm status

Controller Response - After the controller has completed a read or write instruction, it responds by sending a carriage return/line feed (CR/LF) back to the host. If

the instruction was a read command, the CR/LF follows the last character in the ASCII string. If it was a write command, CR/LF is the only response sent back. The host must wait for this before sending further commands to the controller. If the controller encounters an error, it will respond with a null (0x00) CR/LF.

A.2 - Modbus RTU Mode

Modbus RTU is an industry standard RTU slave mode that allows connection to a wide range of devices. Modbus registers are all holding registers, and should be accessed via function codes 3 and 6.

Register addresses are displayed in the Modicon™ 5-digit addressing format. I.e. Register 65=40065 (subtract 1 for direct addressing).

Modbus (RTU) Registers

8 Bit Unsigned

48207	Baud rate
48211	Serial address
48215	Serial mode

16 Bit Unsigned

44181	Hysteresis BCH SP (SP 1)
44182–44185	Hysteresis SP 2–5
44197	Make delay BCH SP (SP 1)
44198–44201	Make delay SP 2–5
44213	Break delay BCH SP (SP 1)
44214–44217	Break delay SP 2–5
45173	Batch count increment

24 Bit Signed (2 x 16 Bit)

42509	Load value (Total)
42511	Load value (Batch)

32 Bit Signed (2 x 16 Bit)

40009	Rate
40011	Total
40013	Batch result
40015	Batch count
40081	Batch tare
40057	Peak
40059	Valley
40111	Batch setpoint (SP 1)
40113	Setpoint 2
40115	Setpoint 3
40117	Setpoint 4
40119	Setpoint 5
40239	Alarm status

A.3 - Ranger A Mode

Ranger A is a continuous output, used to drive remote displays and other instruments in the Rinstrum™ range. (Ranger is a trade name belonging to Rinstrum Pty Ltd.) Ranger A output strings are constructed as shown:

<Start> <Sign> <Output Value> <Status> <End>

Start - STX character (ASCII 02)

Sign - Output value sign (space for + and dash for -)

Output Value - Seven character ASCII string containing the current output value and decimal point. (If there is no decimal point, then the first character is a space. Leading zero blanking applies.)

Status - Single character output value status. '**U**'=Under, '**O**'=Over, '**E**'=Error.

End - ETX character (ASCII 03)

Define Instruments

New Zealand (Head Office)

10B Vega Place, Rosedale,
Auckland 0632, New Zealand

PO Box 245 Westpark Village,
Auckland 0661, New Zealand

Ph: +64 (9) 835 1550
Fax: +64 (9) 835 1250

sales@defineinstruments.co.nz

www.defineinstruments.com

United States (Dallas, TX)

Ph: (214) 926 4950

sales@defineinstruments.com

www.defineinstruments.com