TEX-BAR

PROCESS CONTROLLER + BAR GRAPH

TEX - BAR	TEX Range 4-20mA/0-10V bar graph process controller
- R2	2 x relay outputs
- R2A	2 x relay outputs, 1 x analogue output
- R2S	2 x relay outputs, 1 x serial output
- R2AS	2 x relay outputs, 1 x analogue output, 1 x serial output
- R4	4 x relay outputs
- R4A	4 x relay outputs, 1 x analogue output
- R4S	4 x relay outputs, 1 x serial output
- R4AS	4 x relay outputs, 1 x analogue output, 1 x serial output
- HV	85-265V AC / 95-370V DC power
- LV	15-48V AC / 10-72V DC power

1 INTRODUCTION

The TEX - BAR process controller interfaces smoothly with a wide range of PLC and monitoring systems. The key feature of this controller is its 0-100% front panel bar graph, which provides instant, efficient viewing of your selected variable.

This compact controller also includes a 5-digit LED display, 6 setpoints and 3 front panel buttons. Designed specifically for use in process applications, it accepts 0-20mA, 4-20mA, 0-2V or 0-10V inputs. Setup and calibration is simple, with on-screen, step-by-step instructions.

This controller is available in models with either 2 or 4 relay outputs. A serial port and/or an analogue output can also be added.

2 GENERAL INFORMATION

Input signal	Current (0-20mA, 4-20mA) **or** Voltage (0-2V, 0-10V)
Power supply	HV (85-265V AC/95-370V DC) **or** LV (15-48V AC/10-72V DC)
Relay output	Choose between 2 **or** 4 x 5A Form A relays
Excitation	24V DC (50mA MAX)
Sampling rate	10Hz
Resolution	16 bit
Accuracy	0.05% of reading
Temperature drift	50ppm/°C TYPICAL
Calibration	Factory calibrated for 4-20mA. Automatic or manual user recalibration available.
Security	Setup and setpoint functions have independent security code access. Setpoint functions are independently configurable, and accessible through the F2 key.

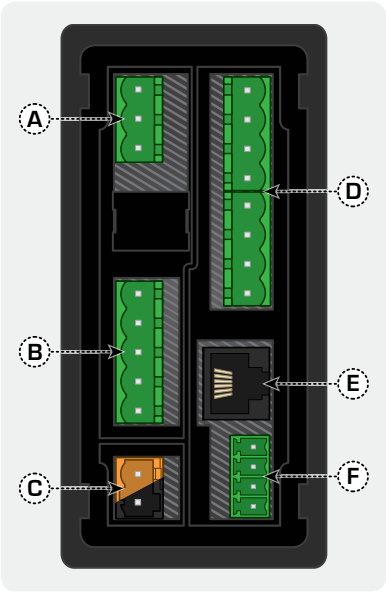
OPTIONAL FEATURES

Analogue output	Isolated 16-bit analogue output (fully scaleable). Can be wired for current (4-20mA) or voltage (0-10V). Window programmable over any range within the controller's full-scale range.
Serial port	Isolated RS232 or RS485 *Modes:* ASCII, Modbus RTU slave, Ranger A output *Data rates:* 300-38400 baud. *Parity:* Odd, even or none.

3 WIRING

3.1 Pinouts

- (A) **Analogue input** (see 3.3)
- (B) **Function pins** (see 3.7)
- (C) **Power supply** (see 3.8)
- (D) **Relay output** (see 3.4)
- (E) **Serial output** (see 3.6)
- (F) **Analogue output** (see 3.5)

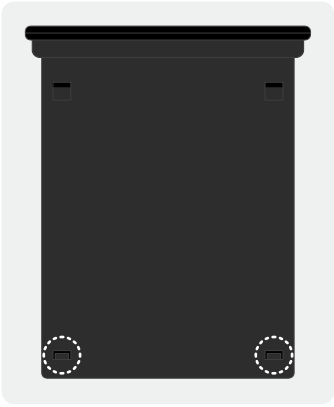


3.2 Position the input header

THE INPUT HEADER IS FACTORY POSITIONED FOR 0/4-20MA INPUT. MA INPUT USERS SKIP THIS STEP.

NB: Follow these instructions ONLY if you are switching the input from current ⇆ voltage.

Remove the backing plate by inserting a screwdriver into the indents (indicated on the diagram). Then gently slide the input module from the case (see 3.1A to identify the input module).

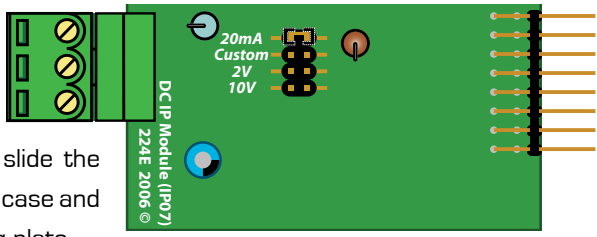


INPUT HEADER

20mA	**Factory default** For 0-20mA & 4-20mA inputs	**Custom**	**Not used for this model** Custom input
2V	For 0-2V input	**10V**	For 0-10V input

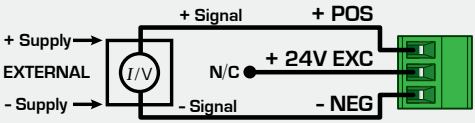
Reposition the header on the input module to suit your application.

When you have finished, slide the input module back into the case and replace the plastic backing plate.

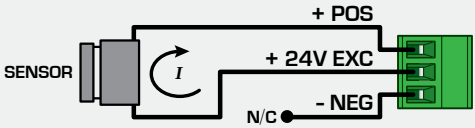


3.3 Wire the analogue input module (see 3.1A)

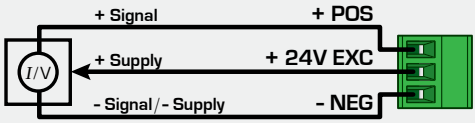
2-wire current/voltage input
External excitation used



2-wire current/voltage input
Loop powered sensor



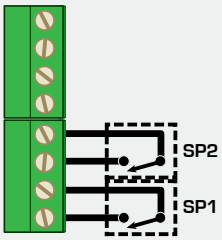
3-wire current/voltage input
Controller supplied excitation



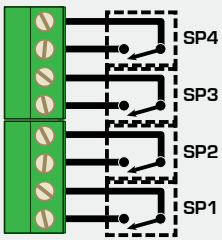
3.4 Wire the relay outputs (see 3.1D)

Wire your relays as per the appropriate diagram below, depending on how many relay outputs you have installed. Relays are individually programmable.

R2 (2 relays)



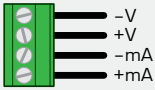
R4 (4 relays)



3.5 Wire the analogue output (if fitted) (see 3.1F)

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

If there is no analogue output fitted, skip this step.

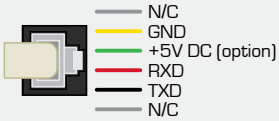


3.6 Serial port (if fitted) (see 3.1E)

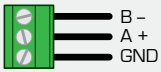
If your controller has a serial port fitted, wire it as shown.

If there is no serial port fitted, skip this step.

RS232 (RJ11)



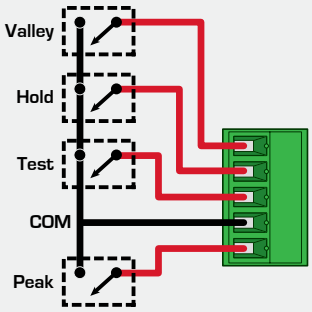
RS485
(Screw terminal)



3.7 Wire the function pins (see 3.1B)

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

Valley Clears the valley reading
Hold Holds the current display value
Test Resets the meter
Peak Clears the peak reading



3.8 Wire the power supply (see 3.1C)

Determine whether your meter is configured for low or high voltage power supply. Check the label on the unit against the colour of the connector:

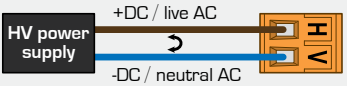
- Orange = high voltage (85-265V AC, 95-370V DC)
- **Black** = low voltage (15-48V AC, 10-72V DC).

Then wire your power supply as shown below.

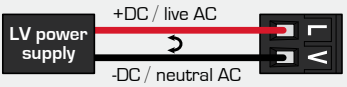
NEVER ATTEMPT TO WIRE YOUR CONTROLLER WHILE THE POWER IS ON.

NEVER CONNECT YOUR LOW VOLTAGE CONTROLLER TO MAINS POWER.

High voltage (HV)



Low voltage (LV)



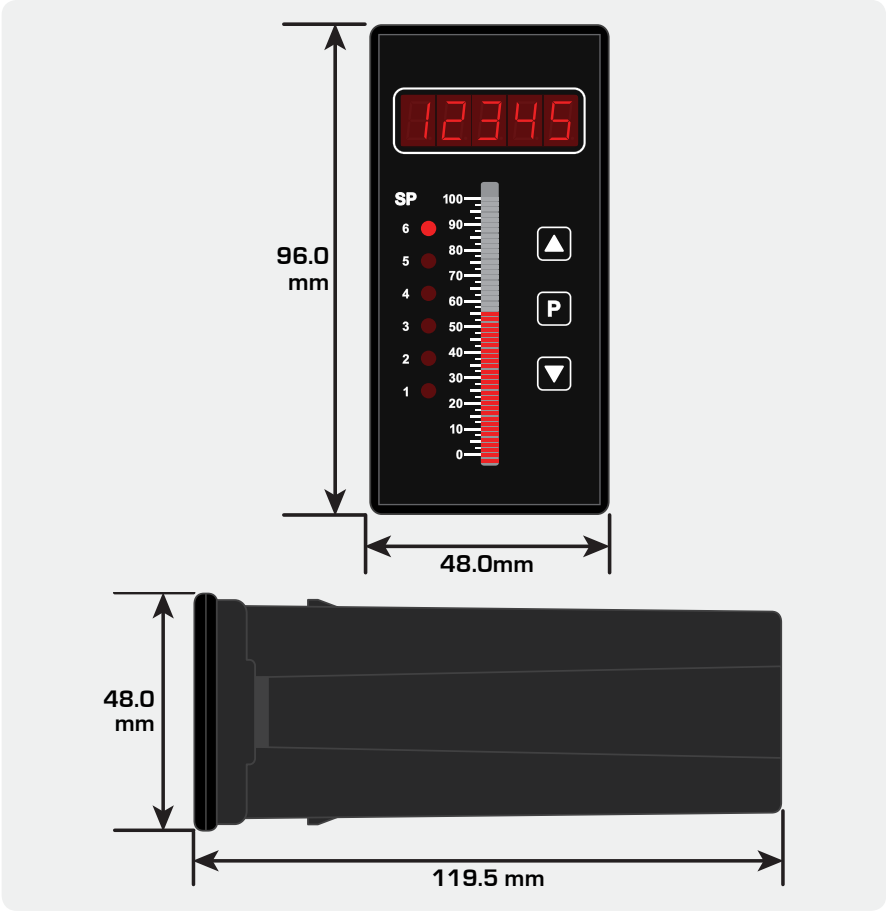
Once you have completed the wiring process it is safe to switch on your power supply. Ensure that your display is functioning before you proceed.

4 CASING & DISPLAY

4.1 Case dimensions

Dimensions 96 x 48 x 119.5mm (H x W x D)

Panel cutout 92.5mm x 45.5 (H x W)



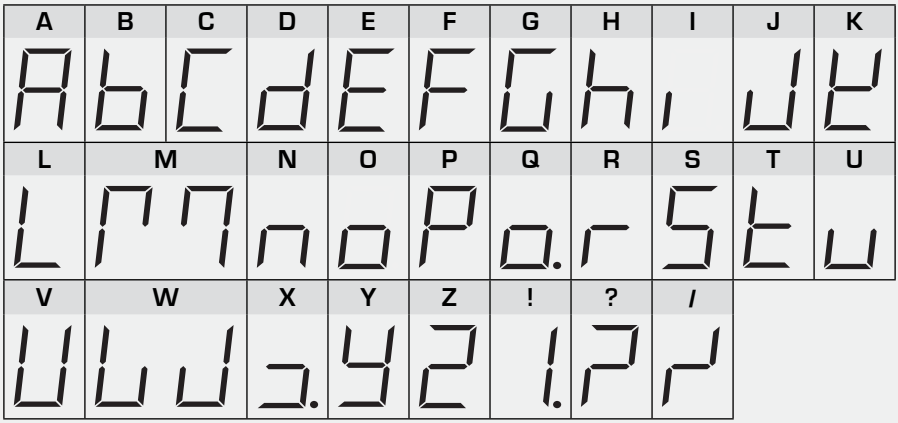
4.2 Front panel

▲ This button is used to access the **Input Setup & Calibration** menu (see section 5), and to scroll through options or increase values in the setup menu.

P This button is used to save your settings and advance to the next step.

▼ This button is used to access the **Setpoint Setup** menu (see section 6) and the **Setpoint Open Access** menu (see section 7). It is also used to scroll through options or decrease values in the setup menu.

7-SEGMENT ALPHA DISPLAY CHARACTERS



4.3 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.

5 INPUT SETUP & CALIBRATION

5.1 Enter calibration PIN

YOU WILL HAVE THE OPPORTUNITY TO CHANGE YOUR PIN NUMBER AT THE END OF THIS SECTION (5.8). IF YOU HAVE FORGOTTEN YOUR PIN NUMBER, SEE SECTION 8.

A Enter the calibration mode by pressing the ▲ button.

_ _ _ ENTER CAL PIN NUMBER scrolls across the display and toggles with **0**. 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 5.2.

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

5.2 Input setup

INPUT DEFAULTS ARE SET TO 4-20MA, 50HZ, NO DECIMAL AND NO ROUNDING.

A **_ _ _ INPUT SETUP** scrolls across the display and toggles with **SKIP**. Press P to skip to 5.3, or the ▲ button and then P to **ENTER** input setup.

B **_ _ _ MAINS FREQUENCY** scrolls across the display and toggles with the current selection. Use the ▲ and ▼ buttons to select **50HZ** or **60HZ**, and then press P to accept.

C **_ _ _ INPUT MODE** scrolls across the display and toggles with the currently selected input mode. Using the ▲ and ▼ buttons, select: **4-20** (4-20mA), **0-20** (0-20mA), **2V** (0-2V) or **10V** (0-10V). Then press P.

If you opt to change the input mode in this section then the header plug on the input module may also need to be changed. See 3.2 for more information.

D **_ _ _ DECIMAL POINT POSITION** scrolls across the display and toggles with the currently selected decimal point position. Use the ▲ and ▼ buttons to choose between: **NO DP**, **0.1**, **0.12**, **0.123**, or **0.1234**, and then press P.

E **_ _ _ DISPLAY ROUNDING** scrolls across the display and toggles with the currently selected display rounding. 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 5.3mA, 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**).*

5.3 Calibration

WHEN CALIBRATION IS COMPLETE, YOU WILL BE DIRECTED BACK TO THE OPERATIONAL DISPLAY. TO PROCEED TO 5.4, YOU MUST SELECT SKIP AT 5.3A. THIS UNIT HAS BEEN FACTORY CALIBRATED FOR 4-20MA.

A **_ _ _ CALIBRATION TECHNIQUE** scrolls across the display and toggles with **SKIP**. Press P to skip to 5.4, or use the ▲ and ▼ buttons select either **AUTO**, **MAN** (manual) or **S.G.** (specific gravity), and then press P.

***AUTO -** The automatic (key-in) 2-point calibration procedure uses zero and span values to calculate the scale and offset. This is the most accurate calibration method, but requires known low and high input signals (or the use of a calibrator).*

***MAN -** The manual calibration procedure uses low and high display values, and is intended for a pre-calibrated sensor with a known output range. (For example 4mA=0 and 20mA=1000.) It does not require any input signals to be applied to the controller during calibration.*

S.G. -** The specific gravity calibration procedure allows the user to enter a scale factor which is used to compensate for changes in the specific gravity of different substances. **This does not constitute a full calibration and assumes that either an automatic or manual calibration has been applied previously with the S.G. value set to 1.0.

B

! What did you select in 5.3A?

SKIP	Proceed to 5.4	**AUTO**	Complete steps 5.3C-E
MAN	Complete steps 5.3F-H	**S.G.**	Complete step 5.3I

▸▸ AUTO CALIBRATION METHOD ▸▸

C **_ _ _ APPLY LOW INPUT SIGNAL – – – –ENTER LOW DISPLAY VALUE** scrolls across the display, and the currently selected low display value appears. Apply the required low level input signal to the meter, and wait a moment for the signal to stabilise. Then use the ▲ and ▼ buttons to set the required low level display value, and press P to accept.

D **_ _ _ APPLY HIGH INPUT SIGNAL – – – –ENTER HIGH DISPLAY VALUE** scrolls across the display, and the currently selected high display value appears. Apply the required high level input signal to the meter, and wait a moment for the signal to stabilise. Then use the ▲ and ▼ buttons to set the required high level display value, and press P to accept.

E If **AUTO** calibration was successful, you will be directed back to the operational display. (To enter step 5.4, you must select **SKIP** at 5.3A.)

If calibration fails, **_ _ _ CALIBRATION FAILED** will scroll across the display, and then you will be directed back to the operational display.

The most likely cause of this message is that the controller has not detected any change in input signal during the calibration process. Check your signal and connections, and then repeat the calibration procedure.

▸▸ MANUAL CALIBRATION METHOD ▸▸

F **_ _ _ ENTER DISPLAY VALUE FOR [LOW]** scrolls across the display, and the currently selected low display value appears. Use the ▲ and ▼ buttons to set the display value for the low level input signal. Press P to accept.

*The text string for **[LOW]** will differ depending on your input range (selected in 5.2C): **0MA** (for 0-20mA), **4MA** (for 4-20mA) or **0V** (for 0-2V/0-10V).*

G **_ _ _ ENTER DISPLAY VALUE FOR [HIGH]** scrolls across the display, and the currently selected high display value appears. Use the ▲ and ▼ buttons to set

the display value for the high level input signal. Press P to accept.

*The text string for **[HIGH]** will differ depending on your input range (selected in 5.2C): **20MA** (for 0-20mA/4-20mA), **2V** (for 0-2V) or **10V** (for 0-10V).*

H You will be directed back to the operational display. (To enter step 5.4, you must select **SKIP** at 5.3A.

▸▸ SPECIFIC GRAVITY SCALE FACTOR ▸▸

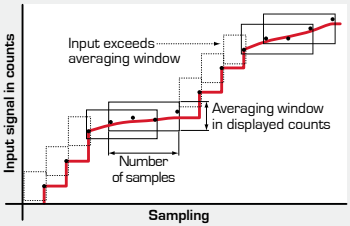
I _ _ _ **SPECIFIC GRAVITY** scrolls across and toggles with the current specific gravity scale factor. Adjust this value using the ▲ and ▼ buttons, and then press P to accept and return to the operational display.

5.4 Averaging setup

▸▸ 5.4 ACCESS FROM MAIN MODE ▸▸ Press ▲. Use ▲ & ▼ to enter PIN. Press P 3 times.

AVERAGING - Your controller has input signal averaging, optimising 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.



A _ _ _ **AVERAGING PARAMETERS** scrolls across the display and toggles with **SKIP**. Press P to skip to 5.5, or the ▲ button and then P to **ENTER** setup.

B _ _ _ **AVE SAMPLES** scrolls across the display and toggles with the currently selected averaging. Using the ▲ and ▼ buttons, alter the number of input samples that the controller will average, and then press P.

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

C **_ _ _ AVE WINDOW** scrolls across the display and toggles with the currently selected averaging window value. 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 the of 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.*

5.5 Analogue output setup

PLEASE SKIP THIS SECTION IF YOU DO NOT HAVE ANALOGUE OUTPUT INSTALLED.

A **_ _ _ ANALOG OUTPUT SETUP** scrolls across and toggles with **SKIP**. Press P now to skip to 5.6, or the ▲ button and then P to **ENTER** analogue output setup.

B **_ _ _ LOW SCALE VALUE FOR ANALOG OUTPUT** scrolls across the display and toggles with the currently selected low scale value. Use the ▲ and ▼ buttons to enter your cal low position, and then press P.

This sets the display value for cal low (as at 5.5F).

C **_ _ _ HIGH SCALE VALUE FOR ANALOG OUTPUT** scrolls across the display and toggles with the currently selected high scale value. Use the ▲ and ▼ buttons to enter your cal high position, and then press P.

This sets the display value for cal high (as at 5.5G).

D **_ _ _ CALIBRATE ANALOG OUTPUT?** scrolls across and toggles with **SKIP**. Press P now to skip analogue output calibration, or the ▲ button and then P to **ENTER**.

E

!	What did you select in 5.5D?		
SKIP	Skip to step 5.6A	**ENTER**	Continue to 5.5F

F **_ _ _ CAL LOW ANALOG OUTPUT** scrolls across the display and toggles with a calibration number. **Before proceeding, connect a mA or volt meter across the analogue output connector (see 3.5).** Then use the ▲ and ▼ buttons to calibrate your low analogue output as required, and press P to accept.

The display value is shown in internal units (mA or V).

G **_ _ _ CAL HIGH ANALOG OUTPUT** scrolls across the display and toggles with a calibration number. Using the ▲ and ▼ buttons, calibrate your high analogue output as required. Then press P.

The display value is shown in internal units (mA or V).

5.6 Serial setup

PLEASE SKIP THIS SECTION IF YOU DO NOT HAVE A SERIAL PORT INSTALLED. CONFIGURING THE SERIAL PORT WILL ALLOW YOU TO CONNECT TO A PC OR ANOTHER DEVICE.

A **_ _ _ SERIAL SETUP** scrolls across the display and toggles with **SKIP**. Press P to skip to 5.7, or the ▲ button and then P to **ENTER** serial port setup.

B **_ _ _ SERIAL MODE** scrolls across the display and toggles with the currently selected serial mode. Using the ▲ and ▼ buttons, choose one of: **ASCII** (custom), **MDBS** (Modbus/RTU) or **RNGRA** (Ranger A). Then press P.

See Appendix A for more information on serial modes.

C **_ _ _ BAUD RATE** scrolls across the display and toggles with the current selection. Use the ▲ and ▼ buttons to select one of: **300**, **600**, **1200**, **2400**, **4800**, **9600**, **19200** or **38400**. Then press P.

D **_ _ _ PARITY** scrolls across the display and toggles with the currently selected parity. Using the ▲ and ▼ buttons, select: **NONE**, **ODD** or **EVEN**. Press P.

E **_ _ _ SERIAL ADDRESS** scrolls across the display and toggles with the currently selected serial address. 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.

5.7 Bar graph setup

A **_ _ _ BAR GRAPH SETUP** scrolls across the display and toggles with **SKIP**. Press P to skip to 5.8, or the ▲ button and then P to **ENTER** bar graph setup.

B **_ _ _ LOW SCALE VALUE FOR BAR GRAPH** scrolls across the display and toggles with the current low scale bar graph setting. Use the ▲ and ▼ buttons to enter the low scale value (in display counts), and then press P.

C **_ _ _ HIGH SCALE VALUE FOR BAR GRAPH** scrolls across the display and toggles with the current high scale bar graph setting. Use the ▲ and ▼ buttons to enter the high scale value (in display counts), and then press P.

5.8 Edit calibration PIN

A **_ _ _ EDIT CAL PIN NUMBER** scrolls across the display and toggles with **SKIP**. 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 CAL PIN NUMBER** scrolls across the display and toggles with the current PIN (default 1). Using the ▲ and ▼ buttons, enter your new calibration PIN number. Then press P to exit to the operational display.

6 SETPOINT SETUP

6.1 Enter setpoint PIN

IF NO RELAYS ARE INSTALLED, SECTION 6 WILL BE DISABLED AND THE ▼ BUTTON WILL NOT RESPOND TO A 3 SECOND PRESS. YOU CAN EDIT YOUR PIN NUMBER AT THE END OF THIS SECTION (6.3). IF YOU HAVE FORGOTTEN YOUR PIN, SEE SECTION 8.

A Enter the setpoint setup mode by pressing the ▼ button for 3 seconds.

_ _ _ ENTER SP PIN NUMBER scrolls across the display and toggles with **0**. 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 6.2.

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

6.2 Edit setpoints

A **_ _ _ EDIT SETPOINT** scrolls across the display and toggles with **SKIP**. Press P to skip to 6.3, or use the ▲ and ▼ buttons to select a setpoint to edit, and then press P.

B **_ _ _ SP VALUE** scrolls across the display and toggles with the last setpoint value entered. Using the ▲ and ▼ buttons, adjust the display value at which the selected setpoint will activate. Then press P.

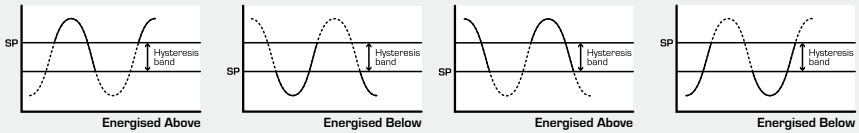
C **_ _ _ SP ACTIVATION** scrolls across the display and toggles with the last selected setpoint activation. Using the ▲ and ▼ buttons, select the relay activation to operate **ABOVE** or **BELW** (below) the setpoint value, and then press P.

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

D _ _ _ **SETPOINT TYPE** scrolls across the display and toggles with the current selection. Use the ▲ and ▼ buttons to select **ALRM** (alarm) or **CNTRL** (control), and then press P.

ALRM - 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.



E _ _ _ **HYSTERESIS VALUE** scrolls across the display and toggles with the current selection. Use the ▲ and ▼ buttons to adjust this value if required. Press P.

*The **HYSTERESIS VALUE** defines the separation band between setpoint activation and deactivation, and will operate as per the **SETPOINT TYPE** selected in 6.2D.*

F _ _ _ **MAKE DELAY** scrolls across the display and toggles with the current selection. Use the ▲ and ▼ buttons to adjust the make delay value (in tenths of a second) as required, and then press P.

The make delay value defines the delay between setpoint activation and when the relay turns on.

G _ _ _ **OPEN ACCESS TO SP VALUE** scrolls across the display and toggles with the current direct access setting for the selected setpoint. Use the ▲ and ▼ buttons to select **NO** or **YES**, and then press P.

*Choosing **YES** will allow the selected setpoint to be quick-edited via the ▼ button without entering a PIN (see section 7). Open access can be independently configured for each setpoint.*

H

! **What did you select in 6.2A?**

SP 1 Skip to step 6.2J **Other** Continue to step 6.2I

I **_ _ _ TRAIL SP1** scrolls across the display and toggles with the current selection. Use the ▲ and ▼ buttons to select **OFF** or **ON**, and then press P.

*If you choose **ON**, the selected setpoint will track the setpoint value of **SP 1**, with the setpoint value of the tracking setpoint becoming an offset value.*

J **_ _ _ SHOW SP ON BAR** scrolls across the display and toggles with the current display setting. Use the ▲ and ▼ buttons to select **NO** or **YES**, and then press P.

*If you choose **YES**, the setpoint value will be marked on the graph by a single bar. Multiple setpoints may have this option enabled.*

K **_ _ _ EDIT SETPOINT** scrolls across the display and toggles with **SKIP**. You are now back at 6.2A. To edit another setpoint, follow the instructions from 6.2A-J again. If you do not wish to edit another setpoint, press P now to **SKIP** to 6.3.

6.3 Edit setpoint PIN

A **_ _ _ EDIT SP PIN NUMBER** scrolls across the display and toggles with **SKIP**. 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 SP PIN NUMBER** scrolls across the display and toggles with the current PIN (default 1). Using the ▲ and ▼ buttons, enter your new setpoint entry PIN number. Then press P to exit to the operational display.

7 SETPOINT OPEN ACCESS

OPEN ACCESS IS CONFIGURED INDIVIDUALLY FOR EACH SETPOINT (SEE 6.2G). IF NONE OF THE SETPOINTS HAVE OPEN ACCESS ENABLED, THIS FEATURE WILL BE DISABLED AND THE ▼ BUTTON WILL NOT RESPOND TO A SHORT BUTTON PRESS.

A Begin by pressing the ▼ button for half a second. The name of the first access-enabled setpoint will appear on the display and toggle with the current value for that setpoint. Using the ▲ and ▼ buttons, adjust the selected value. Then press P to accept the new value and progress to the next access-enabled setpoint.

B If any other setpoints have the direct access option enabled then the same process is repeated for the next setpoint. Pressing P for the last enabled setpoint will exit and return to the operational display.

8 RESET PIN NUMBERS

IF YOU HAVE FORGOTTEN YOUR PIN NUMBER(S), FOLLOW THE PROCEDURE BELOW TO RESET BOTH THE CALIBRATION AND SETPOINT SETUP PIN NUMBERS TO THEIR FACTORY DEFAULT OF 1.

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 When successful, a factory identification text will scroll across the display, followed by: **_ _ _ ALL PIN NUMBERS RESET TO 1**.

C Reset the default PIN numbers if required by following the instructions in 5.8 (for input setup and calibration) and 6.3 (for setpoint setup), entering '1' whenever you are prompted for your current PIN.

A APPENDIX A
Serial Modes

A.1 Custom ASCII

Custom ASCII is a simple, custom protocol that allows connection to various PC configuration tools. (Please note that the 'Custom ASCII' protocol 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 - This 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

16-BIT UNSIGNED	
Address	**Function**
1	Alarm status (Bit 0=SP1, Bit 1= SP2, Bit 2=SP3, Bit 3=SP4 etc.)
65	Hysteresis SP1
66	Hysteresis SP2
67	Hysteresis SP3
68	Hysteresis SP4
69	Hysteresis SP5
70	Hysteresis SP6
71	Make delay SP1
72	Make delay SP2
73	Make delay SP3
74	Make delay SP4
75	Make delay SP5
76	Make delay SP6

32-BIT SIGNED	
Address	**Function**
2	Process display
12	Peak
13	Valley
6	Setpoint 1
7	Setpoint 2
8	Setpoint 3
9	Setpoint 4
10	Setpoint 5
11	Setpoint 6
34	D/A scale low value
36	D/A scale high value

NB: Setpoint registers only active for models with relay outputs installed.

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)

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™ 6-digit addressing format. i.e. Register 65=400065 (subtract 1 for direct addressing).

MODBUS (RTU) REGISTERS

16-BIT UNSIGNED	
Address	**Function**
40001	Alarm status (Bit 0=SP1, Bit 1= SP2, Bit 2 =SP3, Bit 3=SP4 etc.)
40065	Hysteresis SP1
40066	Hysteresis SP2
40067	Hysteresis SP3
40068	Hysteresis SP4
40069	Hysteresis SP5
40070	Hysteresis SP6
40071	Make delay SP1
40072	Make delay SP2
40073	Make delay SP3
40074	Make delay SP4
40075	Make delay SP5
40076	Make delay SP6

32-BIT SIGNED (2x16-bit)		
LSW	**MSW**	**Function**
40513	(40514)	Process display
40525	(40526)	Peak
40527	(40528)	Valley
40535	(40536)	Setpoint 1
40537	(40538)	Setpoint 2
40539	(40540)	Setpoint 3
40541	(40542)	Setpoint 4
40543	(40544)	Setpoint 5
40545	(40546)	Setpoint 6
40587	(40588)	D/A scale low value
40591	(40592)	D/A scale high value

NB: Setpoint registers only active for models with relay output installed.

A.3 Ranger A

Ranger A is a continuous output, used to drive remote displays and other instruments in the Rinstrum™ range. (Ranger is a tradename 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)

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