

## **SHARK MULTI-PARAMETER CONTROLLER & ANALYZER USER'S MANUAL**

Rev 3

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## ***Introduction***

The SHARK multi-parameter controller is a microprocessor based controller capable of measuring one of the following parameters, pH, ORP, conductivity or flow.

When shipped from the factory, the SHARK is not set to measure any one parameter. When the SHARK is powered up for the first time, it will display the meter selection screen where the meter type must be selected. (refer to section 4.6 Meter Selection)

This meter selection screen will only be displayed when the SHARK is powered up for the first time.

After the user selects a meter type the SHARK will remain set to that meter type until it is changed with the meter selection menu function in the Utilities menu.

To return the SHARK to its factory settings, the user must re-select the current meter type from the meter selection menu function. This will override all set-points and return all settings back to the factory settings.

The SHARK User's menu has been divided into five main categories

- Calibration, used to calibrate the SHARK with the selected sensor
- Utilities, Used to manually control or override the outputs.
- Setup, used to configure the SHARKs many options
- Diagnostics, used to troubleshoot any problems with the SHARK
- Outputs, used to configure the SHARK's outputs.

There are two displays on the SHARK. A bright LED numeric display with bar graph on the outside front panel, and a 2-line, 16-character LCD display on the inside. The LED readout on the outside panel can be seen several yards away. The distinctive, color-coded bar graph will immediately indicate if you are within the process parameters that you set (green), if the control relays are on (yellow) and if you are in alarm condition (red). This makes diagnosing pump and alarm malfunctions easy. All configuration and control functions are performed on the LCD menu on the inside front panel.

A universal mounting kit is included for surface, panel and pipe-mount applications. The 1/4 DIN enclosure makes panel-mount cutouts and engineering simple.

SHARK is packaged in a rugged NEMA 4X polycarbonate enclosure making it ideally suited for heavy-duty applications such as industrial wastewater neutralization, municipal water and wastewater, pulp and paper, and process control.



**Section I - Specifications**

	<b>pH</b>	<b>ORP</b>	<b>Conductivity</b>	<b>Flow</b>															
<b>Display</b>	Front Panel: 4 x 7 segment 1/2" LED display, 1 LED indicator On-line, 7 LED Bar Graph Inside Panel: 2 x 16 alpha-numeric LCD display																		
<b>Power Requirements</b>	120Vac (±10%) 50/60Hz (less than 12VA) or 240Vac (±10%) 50/60Hz (less than 12VA)																		
<b>Measuring Range</b>	pH: 0.01 to 14.00  Temp: 0 to 100°C or 32° to +212°F	ORP: -1999 to +1999mV (Dependent on sensor) Temp: 0 to 100°C or 32° to +212°F	<table border="1"> <tr> <td>MΩ/cm<sup>3</sup></td> <td>0 to 19.99</td> <td>0.01</td> </tr> <tr> <td rowspan="3">uS/cm<sup>3</sup></td> <td>0 to 2.000</td> <td>0.01</td> </tr> <tr> <td>0 to 200.0</td> <td>0.1</td> </tr> <tr> <td>0 to 2000</td> <td>1.0</td> </tr> <tr> <td rowspan="2">mS/cm<sup>3</sup></td> <td>0 to 20.00</td> <td>10</td> </tr> <tr> <td>0 to 200.0</td> <td>50</td> </tr> </table> Temp: 0 to 100°C or 32° to +212°F	MΩ/cm <sup>3</sup>	0 to 19.99	0.01	uS/cm <sup>3</sup>	0 to 2.000	0.01	0 to 200.0	0.1	0 to 2000	1.0	mS/cm <sup>3</sup>	0 to 20.00	10	0 to 200.0	50	Flow: 0 to 9999 with selectable flow rate units Volume: 0 to 9999 with Auto Range  Flow rate units: Gallons (GP), Cubic Feet (CF), Liters (LP), Cubic Meters (CM), custom by entering factor related to Gallons  Time units: Seconds (S), Minutes (M), Hours (H)
MΩ/cm <sup>3</sup>	0 to 19.99	0.01																	
uS/cm <sup>3</sup>	0 to 2.000	0.01																	
	0 to 200.0	0.1																	
	0 to 2000	1.0																	
mS/cm <sup>3</sup>	0 to 20.00	10																	
	0 to 200.0	50																	
<b>Temperature Compensation</b>	Automatic or Manual 0 to 100°C (32° to +212°F)	Not required	Automatic or Manual User selectable temperature compensation slope 0.0 to 10.0%/°C. 0 to 100°C (32° to +212°F)	Not required															
<b>Temperature Unit</b>	°C or °F			Not required															
<b>Temperature Sensor</b>	User selectable: 300Ω NTC Thermistor, 3000Ω NTC Thermistor or Pt. 1000 RTD			Not required															
<b>Calibration Modes</b>	Auto-Calibration Manual Calibration Temperature Calibration	Manual Calibration Temperature Calibration	Dry Calibration Sample Calibration Temperature Calibration	K factor Input															
<b>Ambient Conditions</b>	Temperature: -20°C to +60°C or -4°F to +140°F Humidity: 0 to 90% RH (non-condensing)																		
<b>Menu Access Front Panel</b>	Auto-Calibration, Manual Calibration, Temperature Display	Manual-Calibration, Temperature Display	Manual Calibration Temperature Display	Not available															
<b>Menu Access Inside Panel</b>	Full Access to all parameters of operations menu																		
<b>Sensor to SHARK Distance</b>	Differential Sensor: 3000 ft Combination Sensor: 10 ft		300 ft	2000 ft															
<b>Relay Outputs</b>	Two Control Relays, 10A / NO, 5A / NC @ 240VAC or 28VDC. Mode: Process control, Adjustable parameters: process direction, (rising or falling) on-set-point, off set-point, (0 to 100% of full scale), cycle timer (on / off, 0 to 600 seconds), failsafe (on / off). One Alarm Relay, 10A / NO, 5A / NC @ 240VAC or 28VDC. Mode: High / Low Alarm, Adjustable parameters: Low on / Low off set-point (0 to 100% of full scale, low on must be less than low off), High On / High Off set-point (0 to 100% of full scale, High on must be greater than High off).																		
<b>Analog Outputs</b>	4 to 20mA Channel 1 Isolated Output, Range expand 0 - 100% of full scale (min segment 10% of full scale), max. load 800Ω 4 to 20mA Channel 2 Isolated Output, Range expand 0 - 100% of full scale (min segment 10% of full scale), max. load 800Ω Can be set to track temperature if sensor is equipped with a temperature sensor																		
<b>Memory Back-up</b>	All user settings are retained indefinitely in memory (EEPROM)																		
<b>Mechanical</b>	Enclosure: NEMA 4X, 1/4 DIN, polycarbonate enclosure with four 1/2" conduit holes Mounting: Universal Mounting kit for surface, pipe and panel mount, is included																		
<b>Sensor Input</b>	Probe: -600 to +600mV Temp. Sensor: 0 to 9999Ω	Probe: -1999 to +1999mV Temp. Sensor: 0 to 9999Ω	Cell: 0 to 9999Ω Temp. Sensor: 0 to 9999Ω	Paddle: 0 to 2000Hz															
<b>Invalid Entries</b>	Invalid entries cannot be stored																		
<b>Manual Test Mode</b>	Process value can be simulated with arrow keys to verify correct setup of outputs																		
<b>Manual Relay Override</b>	Relays can be set to on / off / auto, to verify correct wiring of auxiliary devices, or to manually adjust process																		
<b>Output Hold</b>	All outputs are placed on hold when SHARK is in Menu mode																		
<b>Calibration Data</b>	Recall data from last calibration, calibration mode, 1st & 2nd accepted buffer value and probe mV output, calibration temperature, calibration slope, and probe efficiency		Recall data from last calibration, calibration buffer accepted value, and cell resistance, calibration temperature	Recall store K factor.															
<b>Auto Return</b>	User selectable auto return if SHARK is left in menu mode or if relays are left in manual override mode for more than 10 min.																		
<b>Display Damping</b>	User can select rate at which SHARK updates display. Enables display damping of unstable process																		
<b>Net Weight</b>	2.2lbs (1kg)																		
<b>Approvals</b>	ULC (pending)																		



## Section 2 - Installation

### 2.1 Unpacking

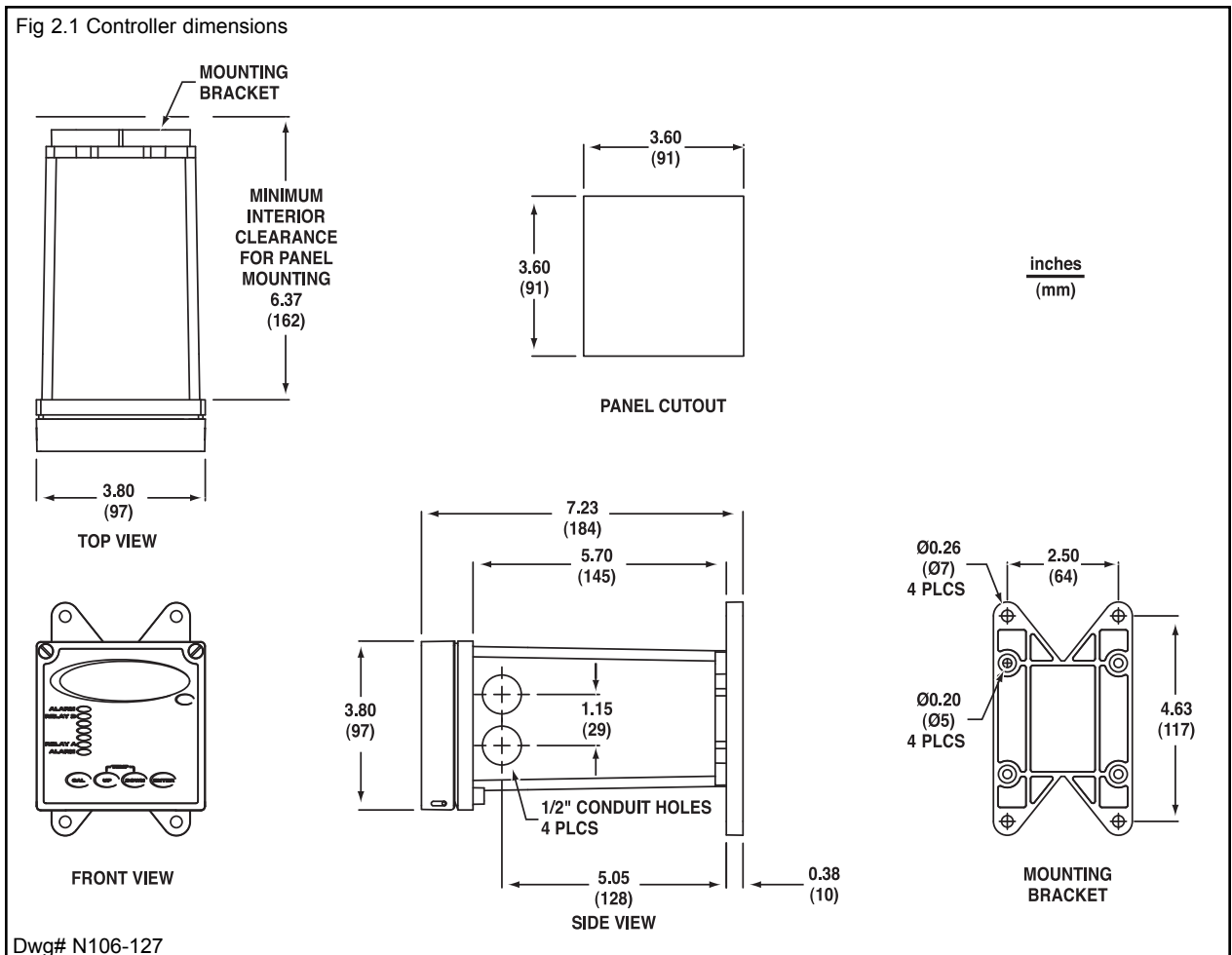
Save the shipping carton and packing material in case the instrument needs to be stored or returned. Inspect the instrument and packing material for shipping damage and report any problems immediately.

### 2.2 Location

Locate the controller/analyser close to the sensor. The list below gives typical maximum distances for various sensors. Refer to the sensor specifications for exact information.

- Aquamatrix Differential PH Probe 3000 ft (914 meters)
- Aquamatrix Combination PH Probe 10 ft (3 meters)
- Aquamatrix Conductivity Probe 300 ft (91 meters)
- Aquamatrix Flow sensor 2000 ft (610 meters)

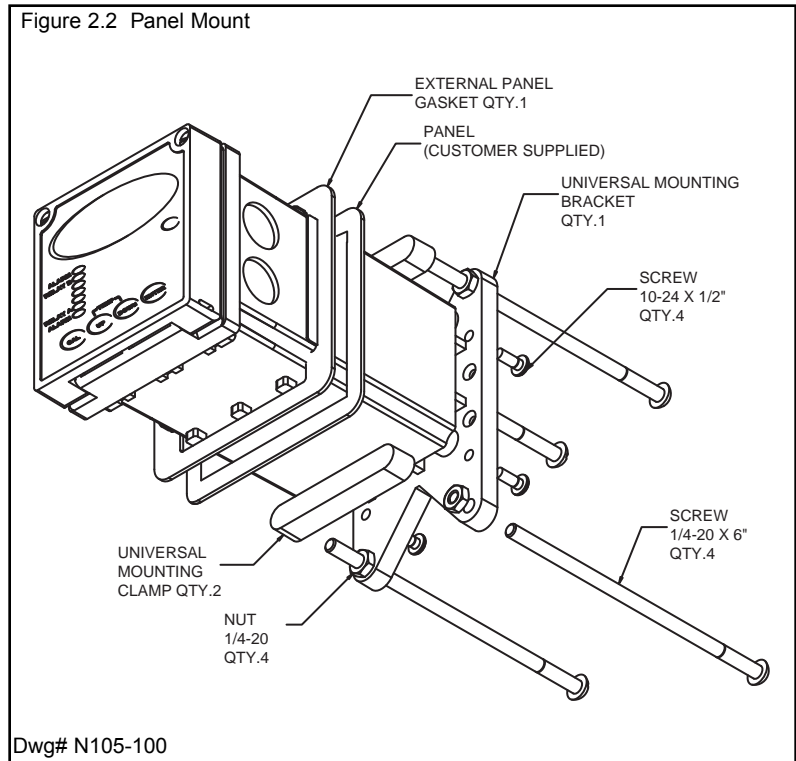
### 2.3 Mounting





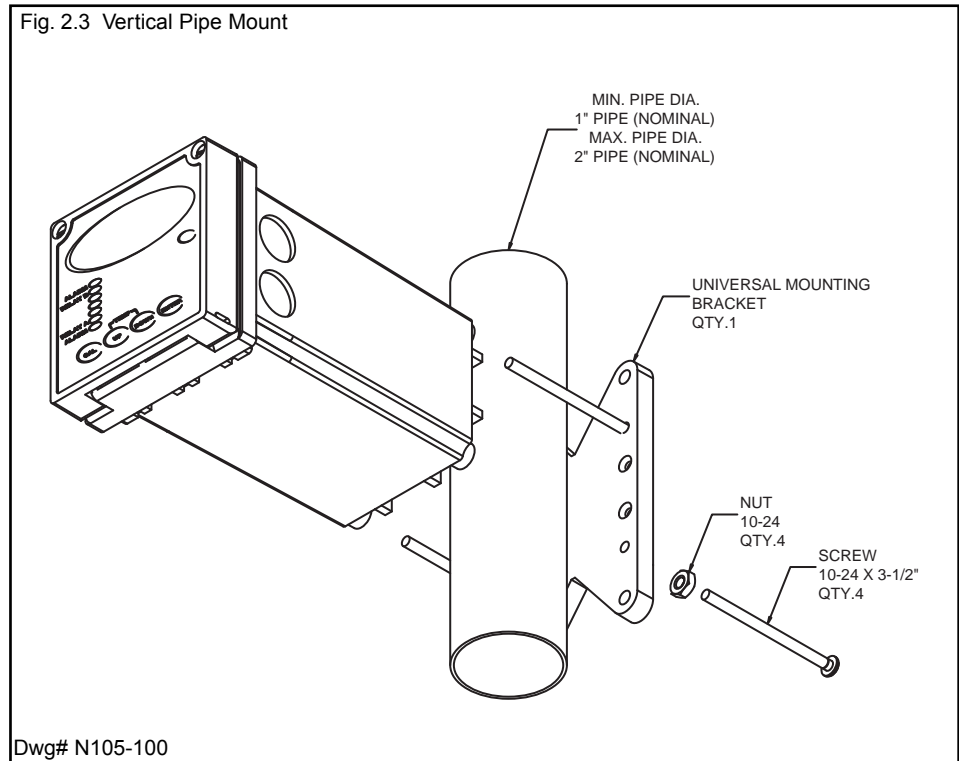
## Section 2 - Installation

Panel Mount – The Shark can be panel mounted to a panel using the hardware kit provided. The panel cutout dimensions are shown in fig. 2.1.



Pipe Mount – The Shark can also be mounted to a horizontal or vertical pipe with:

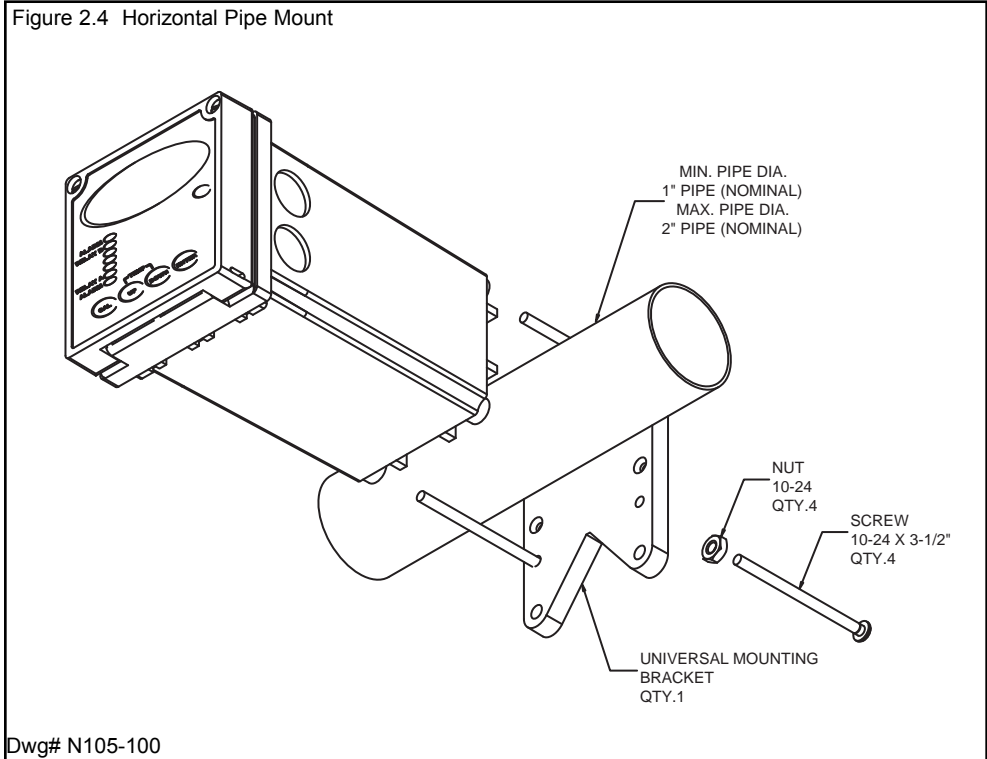
- a minimum outside diameter of 1.30" (33mm) (for example 1" CPVC pipe)
- and a maximum of 2.375" (60mm) (for example 2" CPVC pipe)





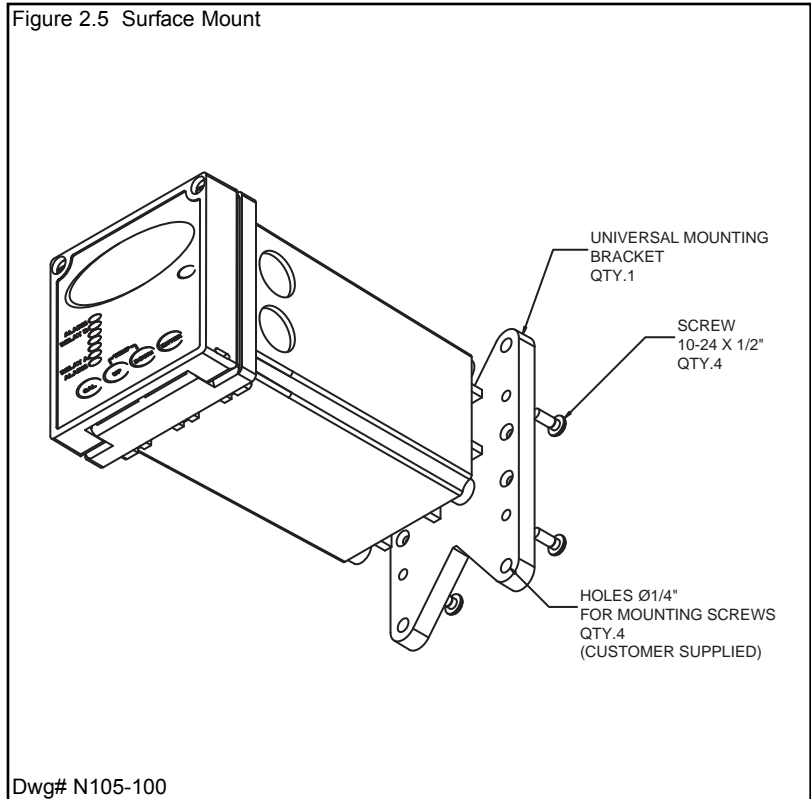
Section 2 - Installation

Figure 2.4 Horizontal Pipe Mount



Surface Mount – The Shark can be surface mounted using the hardware kit provided with the unit.

Figure 2.5 Surface Mount





### Section 3 - Electrical Connections and Setup

#### 3.1 Conduit Connections

The Shark has four 1/2" conduit holes, 2 on each side of the enclosure as shown on fig. 2.1. The unit is shipped with these holes plugged with liquid tight conduit seals. These must be left in unused holes to maintain the NEMA 4X integrity. Use approved conduit hubs to connect the conduit, connect these to the conduit before connecting to the enclosure.

Wire Specification: Size and fuse wire according to local electrical code. Maximum current not to exceed 10A when used to power auxiliary devices powered via internal connections.

#### 3.2 A.C. Power Connections

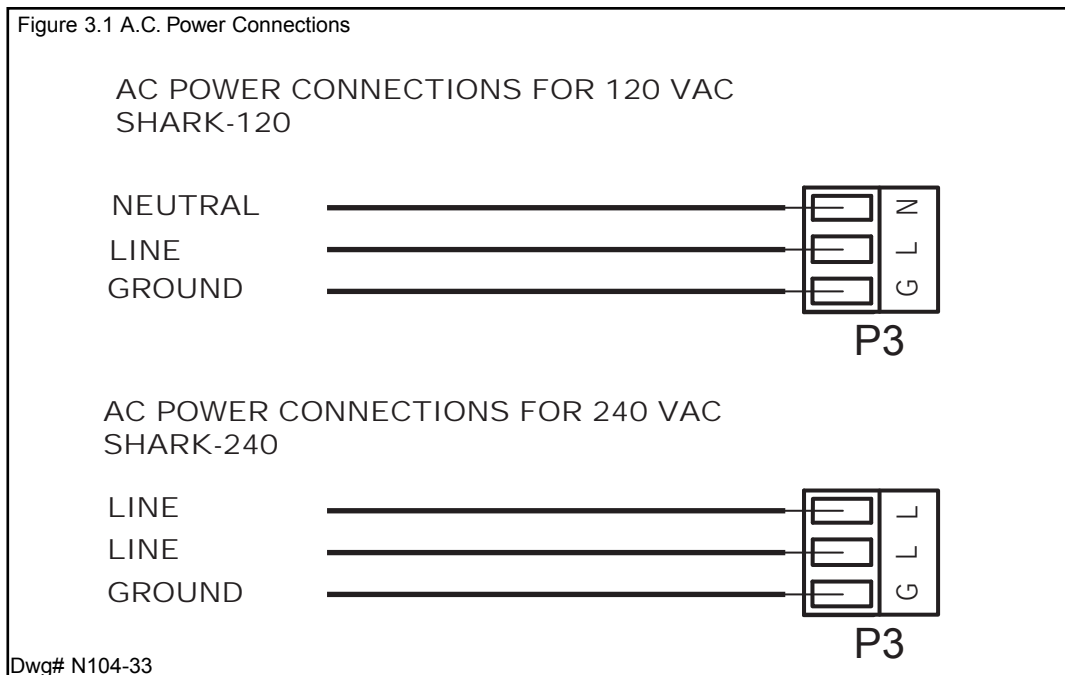
**Caution: This instrument uses 120 or 240 50/60 Hz AC power. Opening the enclosure door exposes you to potentially hazardous line power voltage which might be present on the terminals of plug P3 and P4. Always remove line power before working in this area. If the relay contacts on P4 are powered from a separate source from the line power on P3, be sure to disconnect that power before proceeding. The Shark flip out door contains only low voltage and is safe to handle.**

The Shark is available in two power models.

The Shark-240 is designed to operate at 240 VAC.

The Shark-120 is designed to operate at 120 VAC.

To connect power to the Shark, remove the terminal block plug P3 and connect the wiring as shown below.







**Section 3 - Electrical Connections and Setup**

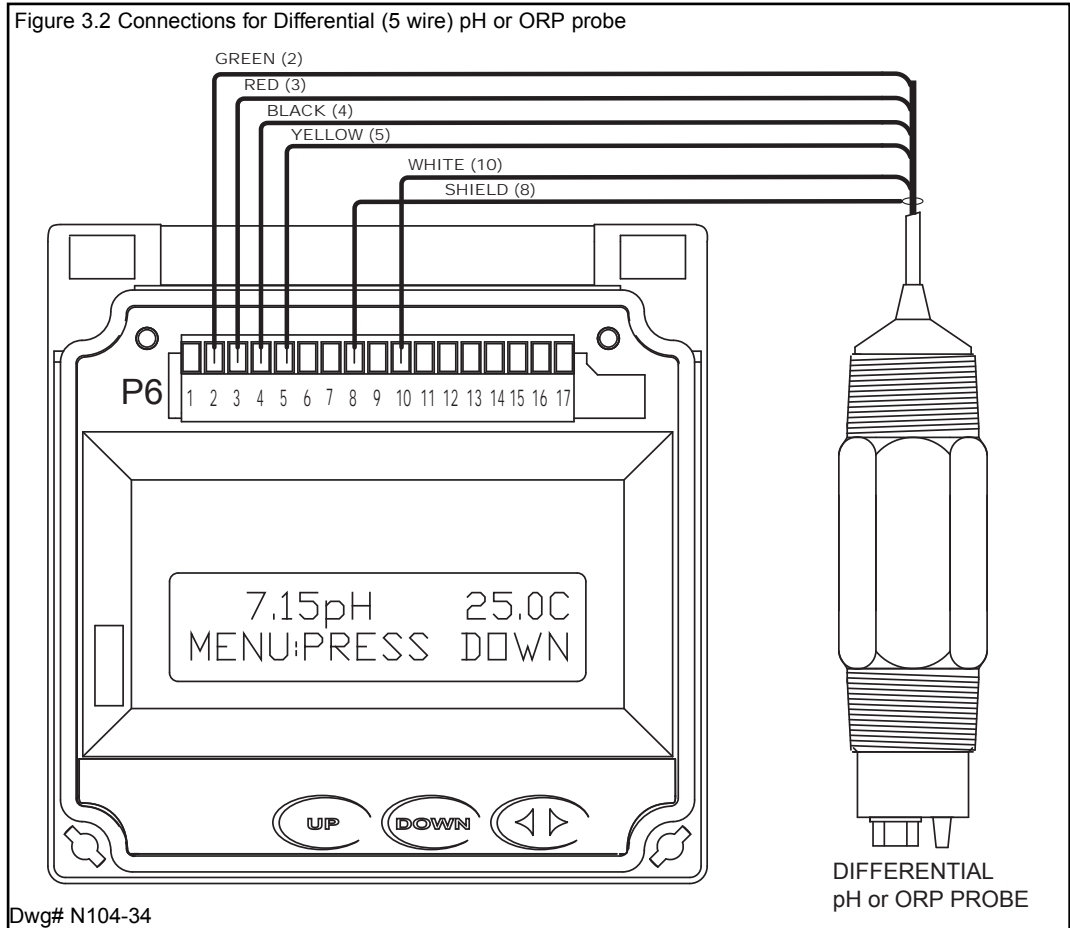
**3.3 pH and ORP Differential Probe connections and setup**

The drawing shows the connections for the Aquamatrix Differential (5 wire) probe. The cable should be run in a conduit separate from AC power wires, and via a separate conduit hole.

**Note:** Leave 4" to 6" slack for all wires connected to the terminals of P6. Slack required so that wires do not interfere with opening or closing of the front door.

If the cable of the differential probe is cut, the blue wire is not used.

**CAUTION:**  
Always remove line power before unplugging or plugging in the P6 connector



Once connected, step through the LCD menus to select the probe in the order shown. The first two steps may be skipped if the meter is already configured for pH or ORP and a Differential Probe. When using a pH probe, it is important to ensure that the Shark is reading the probe temperature correctly for accurate temperature compensation. The ORP probe does not require temperature compensation, although the Shark can display process temperature measured by the probe. The factory temperature calibration is usually accurate enough that no adjustments are necessary.

METER SELECTION	SELECT pH SEC. 4.6 or ORP SEC. 5.5 (IF NECESSARY)
PROBE SELECT	SELECT DIFFERENTIAL PROBE pH SEC. 4.7 or ORP SEC. 5.6 (IF NECESSARY)
MANUAL CAL PH	MANUAL CALIBRATE pH PROBE SEC. 4.1 or ORP PROBE SEC. 5.1
7.15pH 25.0C	RUN MODE



**Section 3 - Electrical Connections and Setup**

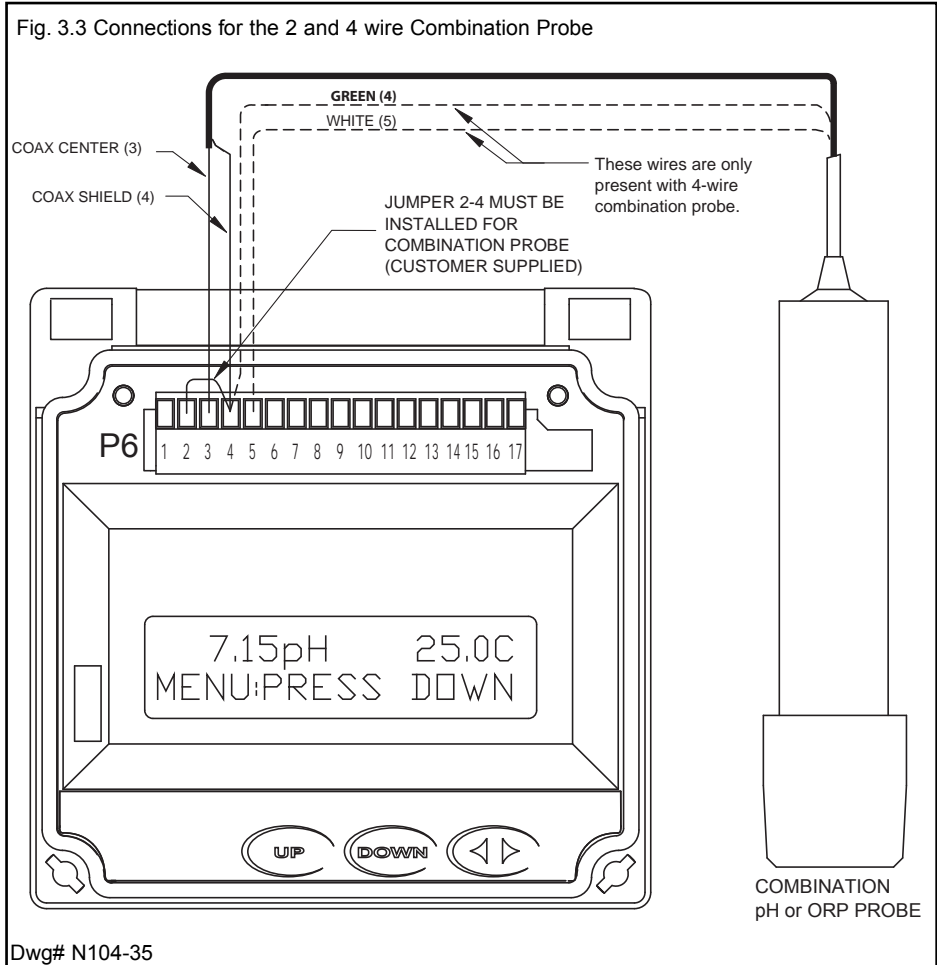
**3.4 pH or ORP Combination Probe connections and setup**

The drawing shows the connections for the Aquametrix Combination probe. The cable should be run in a conduit separate from AC power wires, and via a separate conduit hole. The cable length should not exceed 10 feet (3 meters).

The **2 wire** version has no temperature sensor and is connected via a coaxial wire. In a **pH meter**, the user should set the **T COMP OVERRIDE** menu to **ON** (Section 4.11) and adjust the temperature setting to the actual probe temperature. In an **ORP meter**, the user should set the **T.DISP OVERRIDE** to **ON** (Section 5.10) to blank the temperature reading on the display.

The **4 wire** version has two additional wires for the probe internal temperature sensor. Ensure that the **T COMP OVERRIDE** or **T.DISP OVERRIDE** is **OFF**.

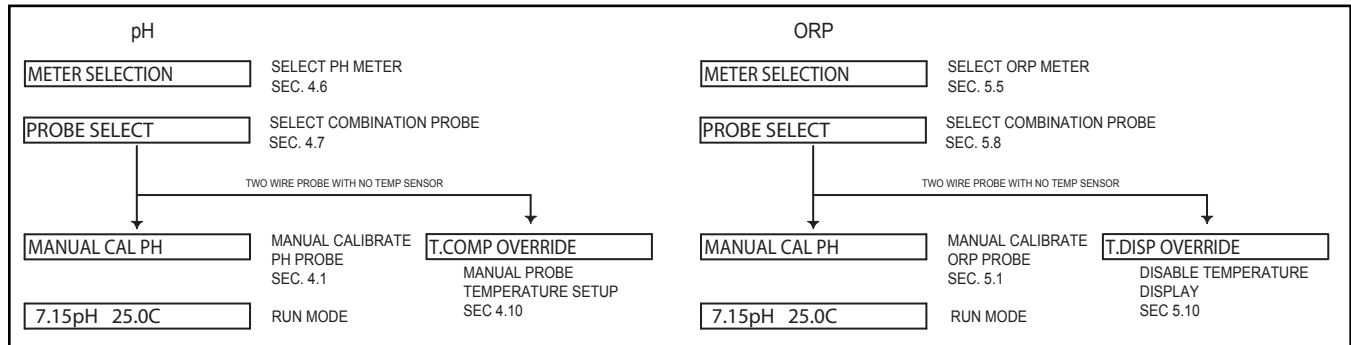
**Note:** Leave 4" to 6" slack for all wires connected to the terminals of P6. Slack required so wires do not interfere with opening/closing of front door.



Dwg# N104-35

**CAUTION:**  
Always remove line power before unplugging or plugging in the P6 connector

Once connected, step through the LCD menus to select the probe in the order shown. The first two steps may be skipped if the meter is already configured for a Combination Probe. If a two wire pH probe is used, which has no temperature sensor, ensure that the Temp. Comp. Override is set to same temperature as the buffer before calibrating. If a two wire ORP probe is used, you can blank the Temp display with the T DISP OVERRIDE menu.





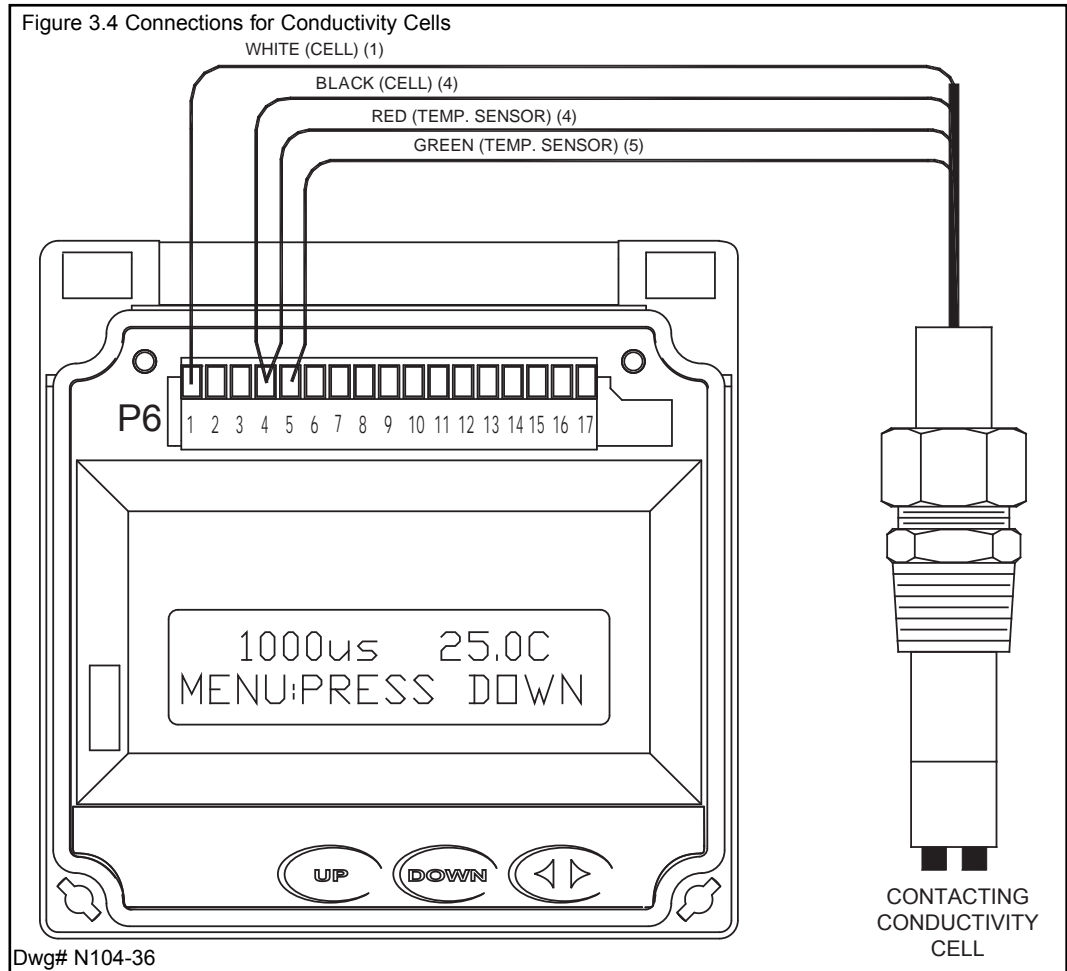
**Section 3 - Electrical Connections and Setup**

**3.5 Conductivity Cell (Contacting style) connections and setup**

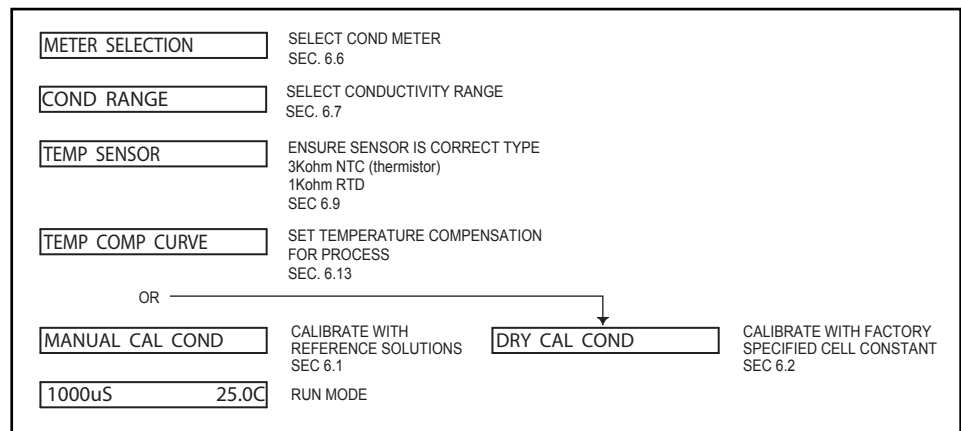
The drawing shows the connections for the Aquamatrix Conductivity Cells (Contacting style). The cable should be run in a conduit separate from the AC power wires, and via a separate conduit hole. The cell cable length should not exceed 300ft. (91 meters).

**Note:** Leave 4" to 6" slack for all wires connected to the terminals of P6. Slack required so that wires do not interfere with opening or closing of the front door.

**CAUTION:**  
Always remove line power before unplugging or plugging in the P6 connector



Once connected, step through the LCD menus to select the cell in the order shown. The TEMP COMP CURVE setup default is 1.8%/deg C. This is acceptable for most process applications. If your process is significantly different from this, change the setting in the TEMP COMP CURVE menu.



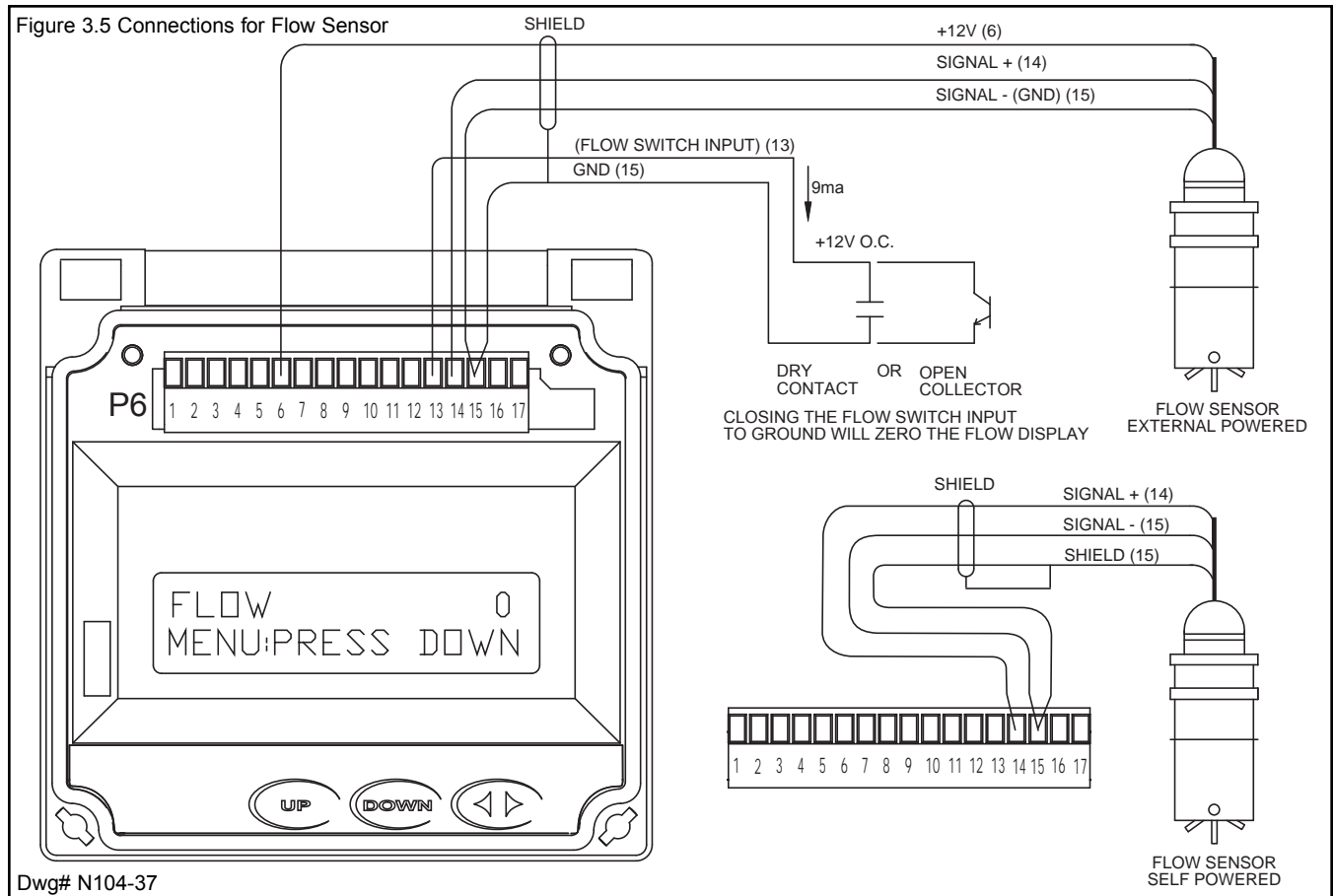


**Section 3 - Electrical Connections and Setup**

**3.6 Paddle Wheel Flow Sensor connections and setup**

The drawing shows the connections for a typical paddle wheel flow sensor. The cable to the sensor should not exceed 2000' (600 meters).

The Shark controller also supports the use of an external "flow switch". When the flow switch input is grounded, either through a dry contact or solid state input, the flow display will be held at zero. This is useful to ensure the flow reading remains locked at zero when conditions require it. The flow will start reading again when the input is opened. If the flow switch function is not desired, simply leave it disconnected and the flow meter will read as normal.



**Note:** Leave 4" to 6" slack for all wires connected to the terminals of P6. Slack required so that wires do not interfere with opening or closing of the front door.

**CAUTION:**  
Always remove line power before unplugging or plugging in the P6 connector

Once connected, step through the LCD menus to select the sensor in the order shown. The Sensor K factor (pulses per U.S. Gallon) is usually printed on the side of the sensor or on a label attached to the sensor cable.

METER SELECTION	SELECT FLOW METER SEC. 7.4
K FACTOR	ENTER FLOW SENSOR CALIBRATION FACTOR SEC. 7.1
UNITS OF VOLUME	SETUP OF UNITS OF VOLUME SEC. 7.5
UNITS OF TIME	SETUP OF UNITS OF TIME SEC. 7.6
TOTALIZER RESET	RESET TOTALIZER TO ZERO SEC. 7.0
TOTAL 0	RUN MODE



Section 3 - Electrical Connections and Setup

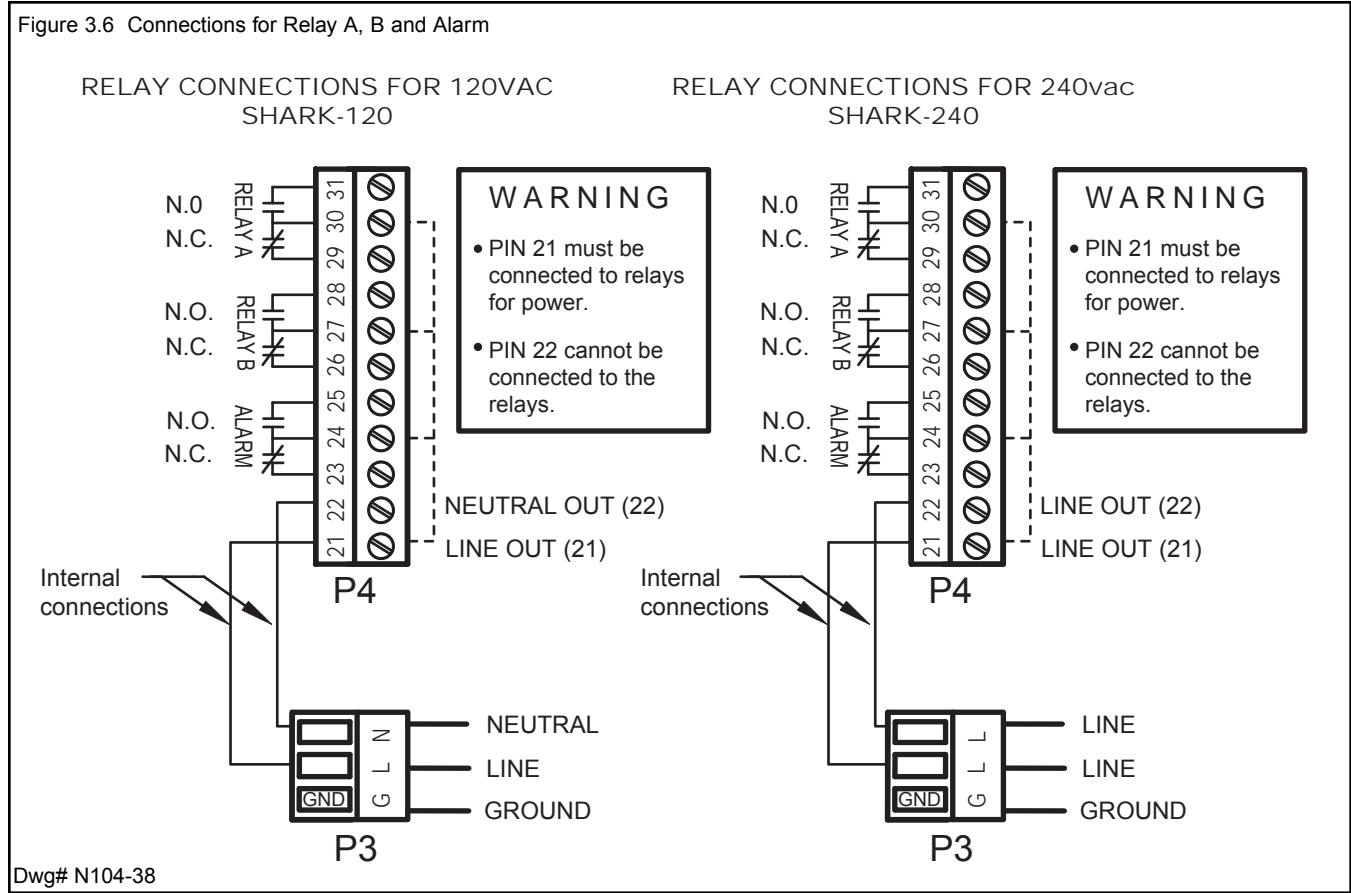
3.7 Relay connections

The Shark controller has three internal relays. Relays A and B are for control, the Alarm Relay can be configured for alarm functions or as an additional control relay.

The connections to the relays are shown in the drawing. Note that the AC power is internally connected to the relay terminal plug P4. This is used to provide 120V or 240V AC power for the relay contacts.

**WARNING**  
DISCONNECT POWER FROM CONTROLLER AND LOADS WHILE CONNECTING TO THE RELAY OUTPUT TERMINAL PLUG.

Wire Specification: Size and fuse wire according to local electrical code. Wire size not to exceed 14 AWG.



**Caution:**  
The contacts are rated at 10 amp N.O. and 5 amp N.C. Do not exceed this rating. When switching larger currents, use an auxillary relay switched by the controller relay to extend the controller relay life. If the relays are controlling an inductive load, use appropriate transient suppression at the load.



## **Section 3 - Electrical Connections and Setup**

### **3.8 RELAY A and B Setup**

(LCD MENU SECTIONS - pH: 4.18 & 4.19, ORP: 5.17 & 5.18, Conductivity: 6.18 & 6.19, Flow: 7.15 & 7.16)

Relay A & Relay B on the SHARK are SPDT dry contact relays. They are configurable to operate in response to rising or falling process values. Each relay has independently adjustable on and off set-points, cycle times, and fail-safe options.

The operator would use the control relays if the device to be controlled is a simple on/off device. For example a pump, solenoid valve, fan, or an indicating light.

The control relays have 6 user configurable settings:

**DIRECTION:** The relay can be set to control either a rising or falling process. If for example the relay is set to control a falling process, the ON set-point must be set lower than the OFF set-point. If the relay is set to control a rising process the SHARK will not allow the RELAY OFF set point to be set lower than the RELAY ON set-point. This rule will also apply to a rising process.

**RELAY ON set-point:** This is the process value at which the relay will energize. This value can be set anywhere between 0-100% of the range.

**RELAY OFF set-point:** This is the process value at which the relay will de-energize. Depending on the direction for which the relay is configured, the RELAY OFF set-point will only be settable in a limited range.

**CYCLE ON time:** To obtain a tighter process control, and limit over-shoot, the control relay can be set with the cycling feature. This feature, if enabled, will cause the control relay to cycle when the process is between the RELAY ON set-point and RELAY OFF set-point. The cycle on time is the amount of time in seconds that the relay will be energized. It can be set between 0 and 600 seconds.

**CYCLE OFF time:** The CYCLE OFF time is the amount of time in seconds that the relay will be de-energized, it can be set between 0 and 600 seconds. To disable the cycling feature set the cycle off time to 0.

**OVERFEED TIMER:** The overfeed timer is designed to help safeguard against a process or instrumentation error causing one of the control relays to remain energized for extended periods of time.

When enabled, the overfeed timer will time out if the control RELAY OFF set point is not reached inside the overfeed time out. The control relays will de-energize, the alarm relay will energize and an LED will flash at the front.

**FAILSAFE:** The FAILSAFE feature is designed to reverse the normal action of the control relay.

When the relay is set to FAILSAFE OFF the relay will operate as a normal relay. When the relay is de-energized the NO contacts are open and the NC contacts are closed. Thus the device connected via the NO contacts will be off. When the relay becomes energized the device will be on.

When the relay is set to FAILSAFE ON, the normal action of the relay is reversed. Thus the NO contacts act as the NC contact and the NC act as the NO. The device connected to the NC contacts will be energized when the RELAY ON set-point is reached. The relay will be de-energized but because it is acting in reverse the device will be energized. When the RELAY OFF set-point is reached the relay will energize and the device connected to the NC contact will de-energize.

The purpose of the Fail Safe option is to have the device turned on in the event of a power interruption.

**The factory default for FAILSAFE is OFF.**



**Section 3 - Electrical Connections and Setup**

**3.9 ALARM RELAY Setup**

(LCD MENU SECTIONS - pH: 4.20, ORP: 5.19, Conductivity: 6.20, Flow: 7.17)

The third relay (Relay C) is used as an alarm relay. The alarm relay on the SHARK is a SPDT dry contact relay.

This relay will respond to both a rising and falling process. The alarm relay will act as a low alarm (falling process) and a high alarm (rising process). Both relays will have independently adjustable on and off set-points. The ALARM ON set-points will always be set before the ALARM OFF set-points. The shark will not let the user input a value below the ALARM ON set-point. The same rule holds true for the high alarm.

The control relays have 5 user configurable settings:

ALARM LOW ON set-point: This is the low process value that will cause the relay to energize. This value can be set anywhere between 0-100% of the range.

ALARM LOW OFF set-point: This is the value that the process must reach in order to de-energize the alarm relay after it has dropped below the ALARM LOW ON set-point. This value must be higher than the ALARM LOW ON set-point.

ALARM HIGH ON set-point: This is the process value that will cause the relay to energize. This value can be set anywhere between 0-100% of the range.

ALARM HIGH OFF set-point: This is the value that the process must reach in order to de-energize the alarm relay after it has increased over the ALARM HIGH ON set-point. This value must be lower than the ALARM HIGH ON set-point.

FAILSAFE: This option can be turned on or off. It reverses the normal action of the relay. (see description under control relay)

ALARM SET-POINT ERROR: If the ALARM LOW ON set-point is set higher than the factory default ALARM LOW OFF set-point, when the user advances from the ALARM LOW ON set-point to the ALARM LOW OFF set-point the shark will adjust the ALARM LOW OFF set-point to be equal to the ALARM LOW ON set-point. If the user then tries to decrease the ALARM LOW OFF set-point the Shark will display the ALARM LOW ALARM setup error screen.

This screen will be displayed for 10 seconds, then return back to the setup screen that was previously displayed. If the user presses the down key again the error message will be displayed again for 10 seconds. The user must accept the LOW OFF set-point, equal to, or greater than the LOW ON set-point.

The same conditions apply to the ALARM HIGH set-points. Except the ALARM HIGH OFF set-point must be lower than the ALARM HIGH ON set-point. If the user tries to increase the ALARM HIGH OFF set-point higher than the ALARM HIGH ON set-point the High Alarm setup error screen will be displayed.

ALARM RELAY DISABLE: If the user sets the ALARM LOW ON set-point and the ALARM LOW OFF set-point equal to 0% of the range. It will disable the low alarm relay.

If the user sets the ALARM HIGH ON set-point and the ALARM HIGH OFF set-point equal to 100% of the range. It will disable the high alarm relay.



### **3.10 MANUAL TEST MODE**

(LCD MENU SECTIONS - pH: 4.4, ORP: 5.3, Conductivity: 6.4, Flow: 7.2)

Once the relays are configured, the setup can be tested using Manual Test Mode to simulate process changes.

MANUAL TEST MODE is used to simulate a process reading in order to verify the correct response of the outputs. When in the MANUAL TEST MODE, the relays and outputs are no longer placed on hold as they are when in the rest of the menu. The relays and outputs will react to the simulated change in process as if the Shark was in RUN MODE.

Note that when the user exits the MANUAL TEST MODE, the relays and outputs will remain in the MANUAL TEST MODE state until the user enters RUN MODE.

### **3.11 RELAY OVERRIDE**

(LCD MENU SECTION - pH: 4.5, ORP: 5.4, Conductivity: 6.5, Flow: 7.3)

Relay Override is used to manually override the state of the relays. The user is able to set the operating mode of the relay as AUTO/ON/OFF (the default and RUN MODE states are AUTO).

This feature can be used to energize or de-energize the relays to manually correct the process, or to shut down an ancillary device to perform maintenance. When in the RELAY OVERRIDE mode, the relays are no longer placed on hold as they are when in the other menus.

Note that if the RELAY AUTO RETURN is set to "ON", the controller will place all the relay settings back to AUTO 10 minutes after the Shark returns to the run mode..





### Section 3 - Electrical Connections and Setup

#### 3.12 4-20 mA Isolated Outputs Channel 1 and Channel 2

(LCD MENU SECTIONS - pH: 4.21 & 4.22, ORP: 5.20 & 5.21, Conductivity: 6.21 & 6.22, Flow: 7.18 & 7.19)

The Shark Controller has two 4 to 20mA outputs, electrically isolated from each other and ground. Either output can source current into a maximum of 800 ohms.

Channel 1 (the primary output) is located on the flip out door, terminal plug P6. Channel 1 is dedicated to track the process and has fully independent and fully adjustable 4 & 20 mA output setpoints. This will enable the operator to span the output over the desired range.

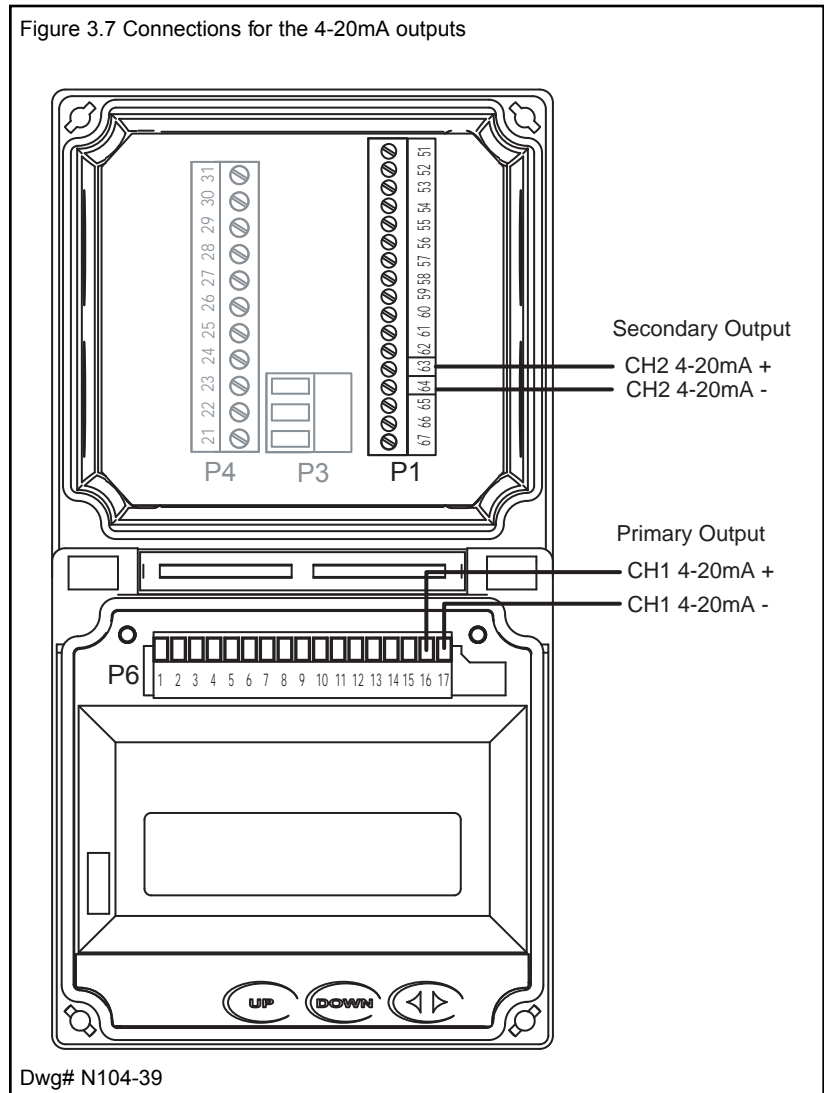
Channel 2 (the secondary output) is located in the enclosure terminal plug P1. Channel 2 can be selected to track the process value or temperature and has fully independent and adjustable 4 & 20 mA output setpoints.

Both Channel 1 and 2 can be precisely trimmed through the LCD menu for precision applications.

The drawing shows the connections for both outputs.

Wire Specification: 22 AWG 7/30, insulation 0.010"

Figure 3.7 Connections for the 4-20mA outputs



Dwg# N104-39

**Note:** Leave 4" to 6" slack for all wires connected to the terminals of P6. Slack required so that wires do not interfere with opening or closing of the front door.

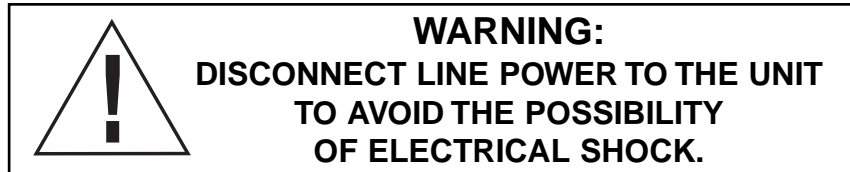


**Section 3 - Electrical Connections and Setup**

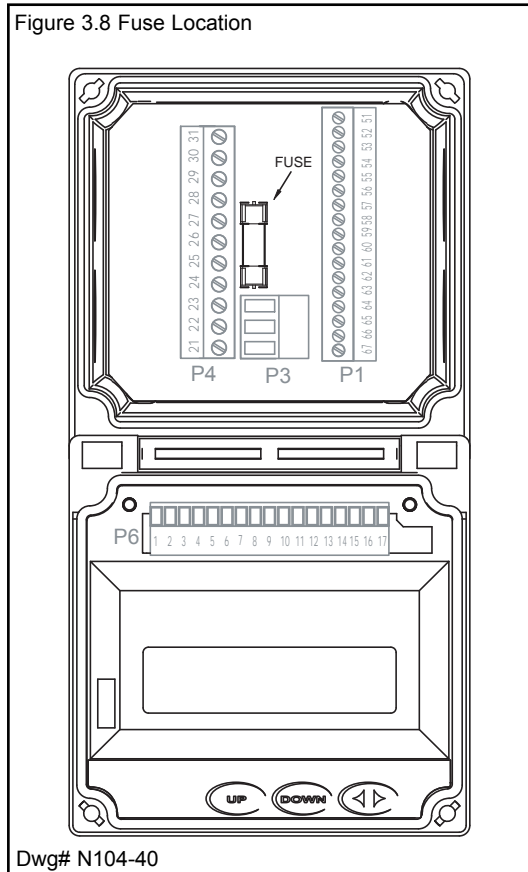
**3.13 Service**

**SHARK SERVICE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY.**

**3.14 Fuse Replacement**



1. Proceed **after** disconnecting line power from the instrument.
2. Open the front panel by rotating the quarter-turn fasteners, using a flat blade screwdriver, to expose the relay board.
3. The fuse, F1, is located in the middle of the relay board, directly above the three terminal connectors.
4. Remove the open fuse and replace it only with a fuse of the same type and rating. REFER TO THE FUSE RATING TABLES BELOW.
5. Close the front panel and secure using the quarter-turn fasteners.
6. Restore power to the unit.



Fuse Rating Table for **120** volt operation

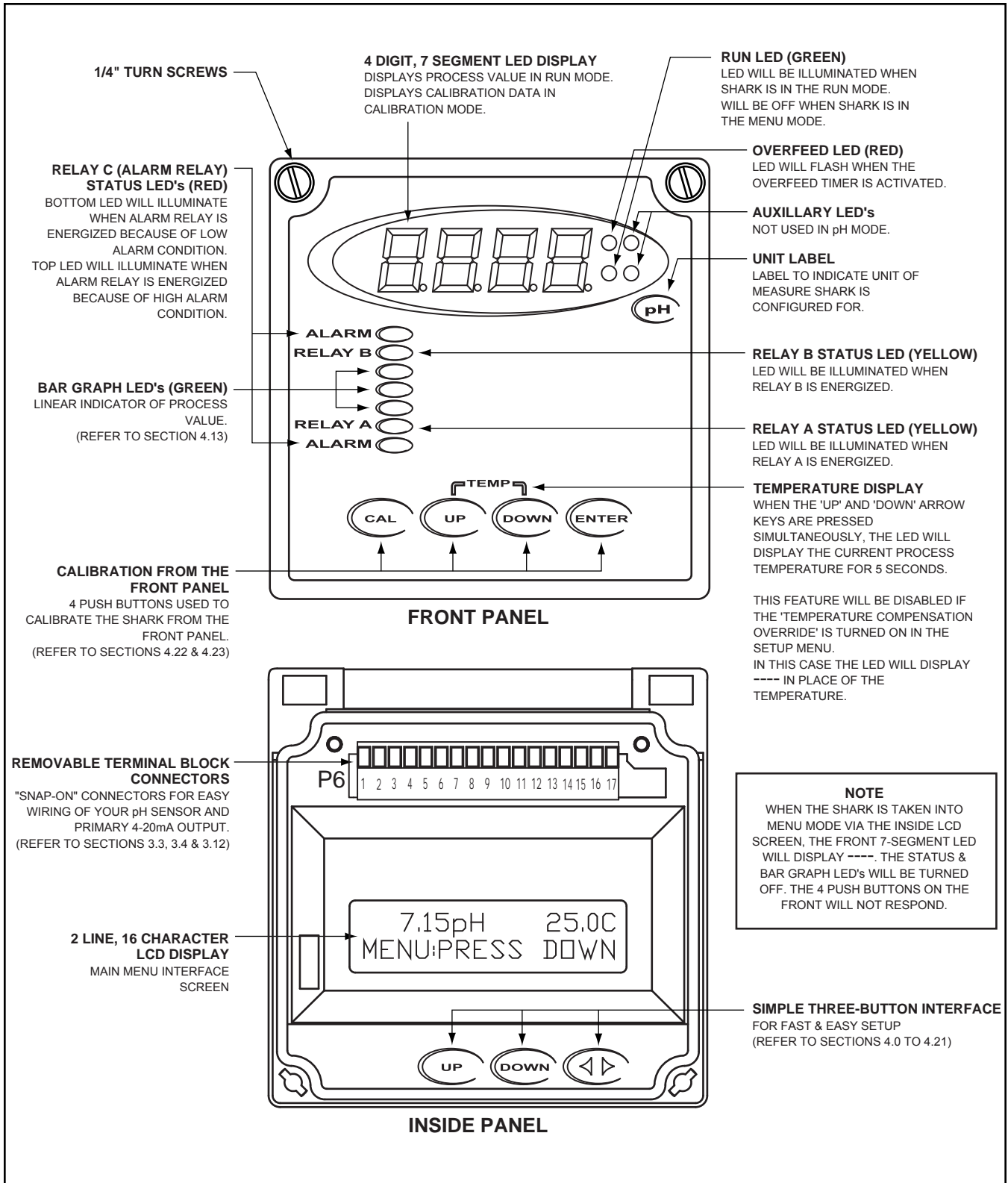
Fuse Type: Slo-Blo fuse 5 x 20mm	Fuse Ratings: 250 VAC, 100mA
----------------------------------	------------------------------

Fuse Rating Table for **240** volt operation

Fuse Type: Slo-Blo fuse 5 x 20mm	Fuse Ratings: 250 VAC, 50mA
----------------------------------	-----------------------------

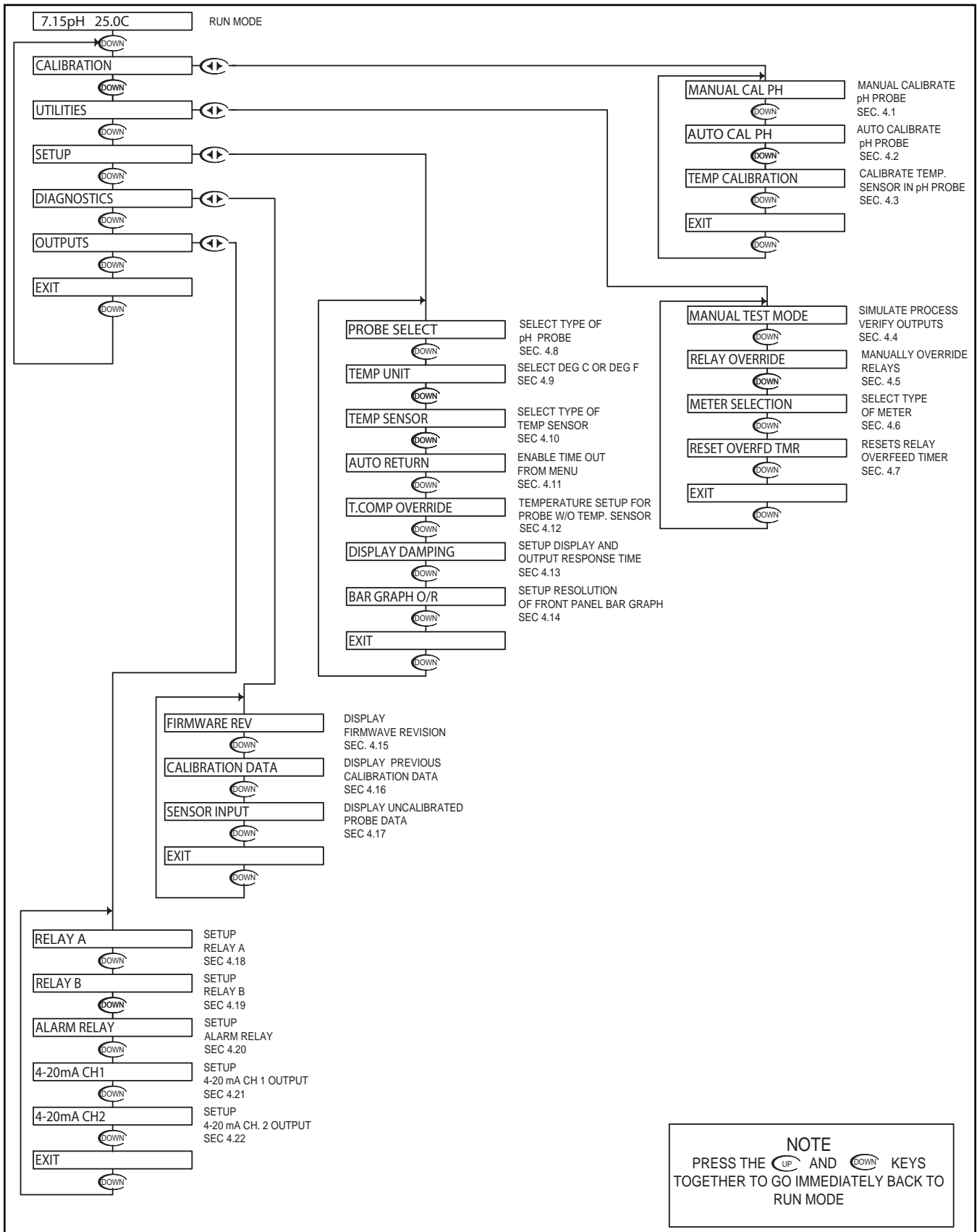


**Section 4 - Using the SHARK in pH Mode**





**pH - Menu Overview 4.0**





pH - Calibration Menu - Manual Calibrate 4.1

7.15pH 25.0C RUN MODE

CALIBRATION

MANUAL CAL PH

IF BUFFER1 READY  
PRESS 'DOWN'

Place the probe in the first buffer solution, be sure to clean and rinse the Probe first with D.I. water and then insert it in the 7.00 buffer.

Press DOWN

RUNNING MANU CAL  
BUFFER1 WAIT...

The controller will read the pH value, averaging a number of results to get a stable calibration value.

Please wait for the controller to complete the measurement

MANUAL CAL PH  
BUFFER1 7.35>

When complete, the controller will report the measured value

Use the UP and DOWN keys to adjust the reading until it agrees with the actual buffer pH value

MANUAL CAL PH  
BUFFER1 7.00>

Then press LEFT-ARROW to move the cursor to the RH position

MANUAL CAL PH  
BUFFER1 7.00>

Then press DOWN to store the value and move to BUFFER2

IF BUFFER2 READY  
PRESS 'DOWN'

Place the probe in the second buffer. Be sure to clean and rinse the Probe first with D.I. water and then insert it in the 4.00 buffer.

Press DOWN

RUNNING MANU CAL  
BUFFER2 WAIT...

The controller will read the pH value, averaging a number of results to get a stable calibration value.

Please wait for the controller to complete the measurement

MANUAL CAL PH  
BUFFER2 4.40>

When complete, the controller will report the measured value

Use the UP and DOWN keys to adjust the reading until it agrees with the actual buffer pH value

MANUAL CAL PH  
BUFFER2 4.00>

Then press LEFT-ARROW to move the cursor to the RH position

MANUAL CAL PH  
BUFFER2 4.00>

Then press DOWN to store the value and complete the Manual Calibration

SLOPE 61.22MV/PH  
EFF 95% 24.8C

After 5 seconds, the controller will compute the slope of the calibration, the estimated probe efficiency and the probe temperature.

If the calibration is OK, use the LEFT-ARROW key to move the cursor over the Y text and press the down key.

MANUAL CAL PH  
STORE? Y N

If the calibration did not appear to be correct, press the DOWN key which will return back to the Manual Cal menu.

MANUAL CAL PH  
STORE? Y N

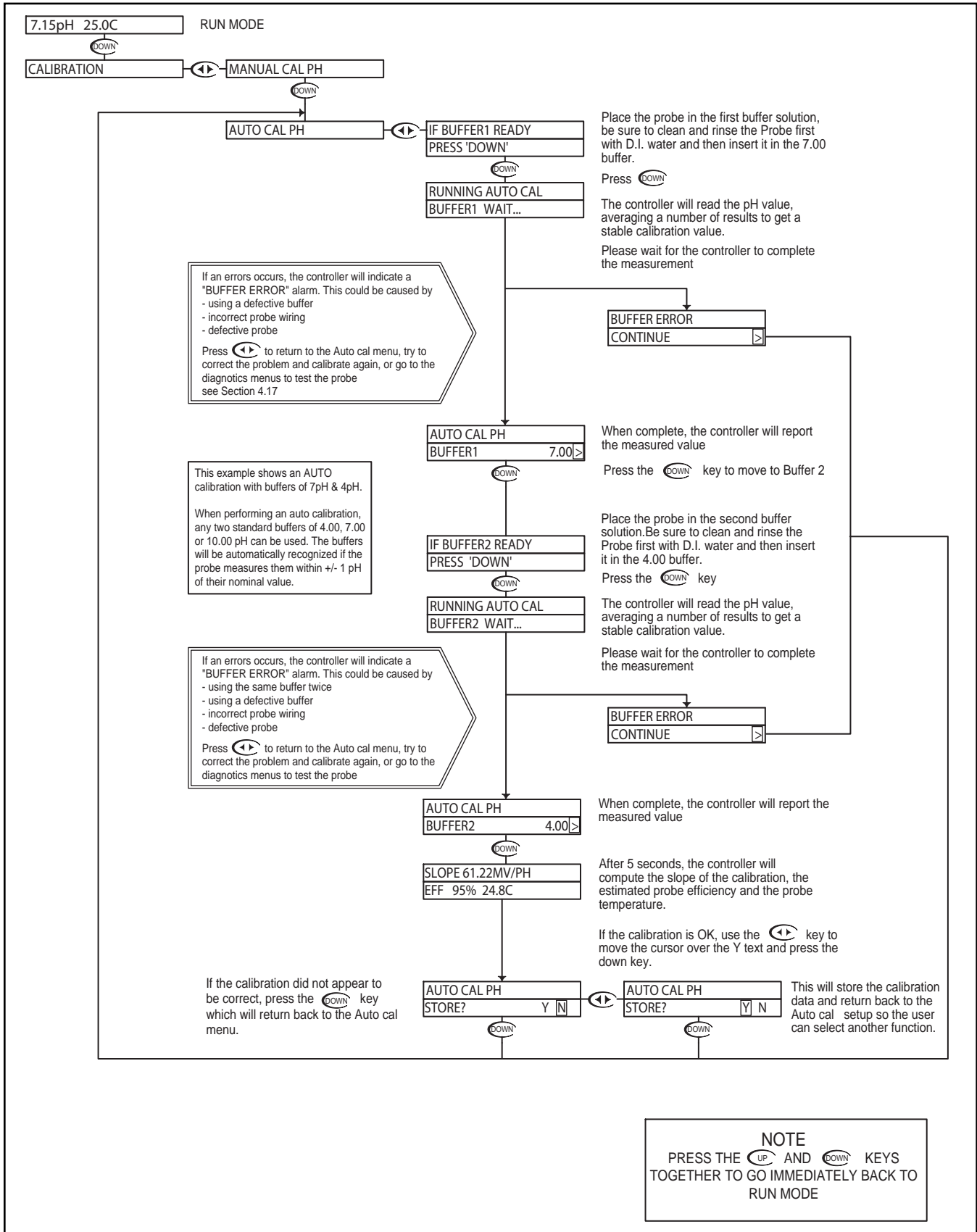
Press DOWN to store the calibration data and return back to the Manual Cal menu so the user can select another function.

This example shows a MANUAL calibration with buffers of 7pH & 4pH. When performing a manual calibration, any two known buffer solutions can be used.

NOTE  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

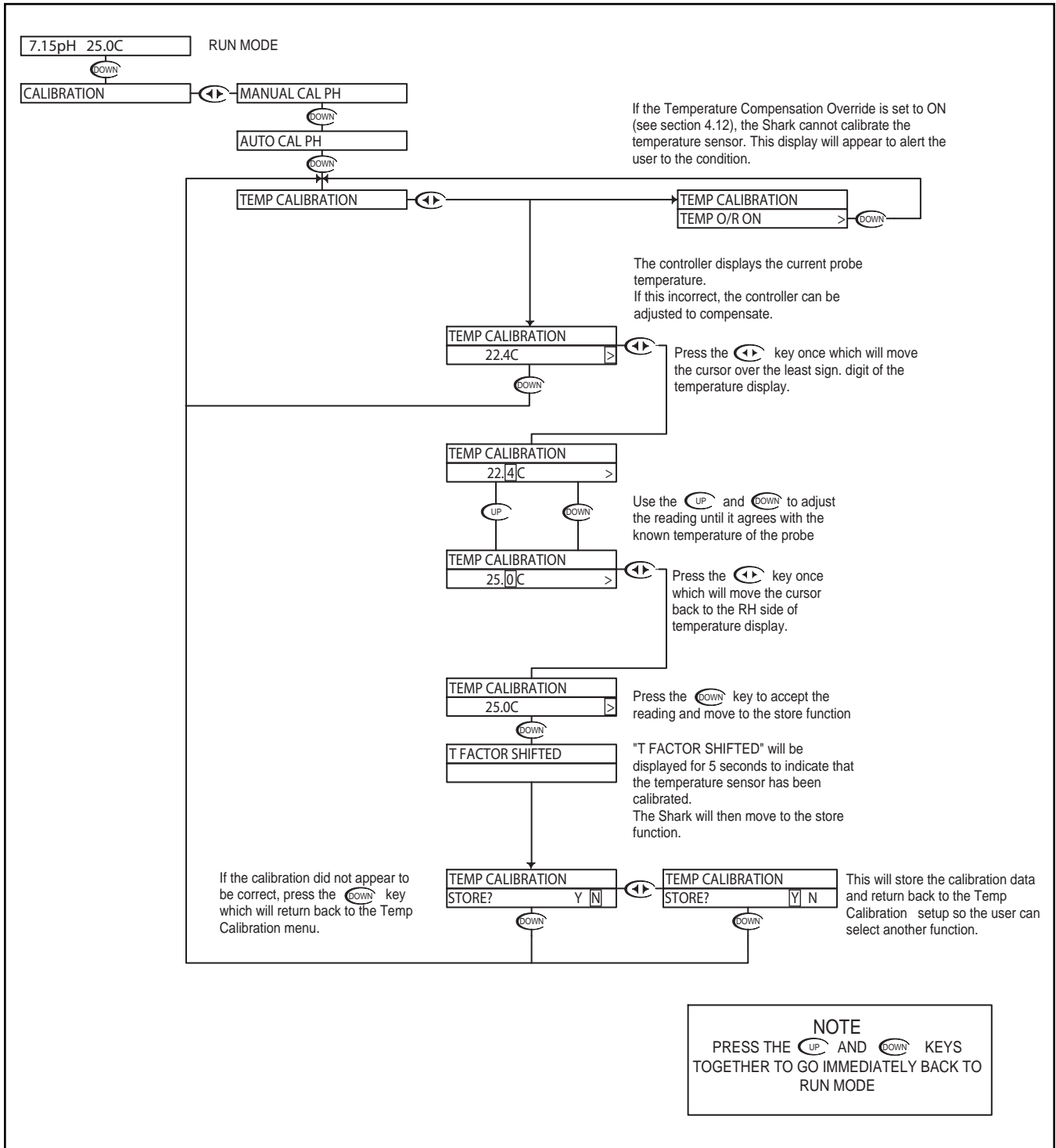


**pH - Calibration Menu - Auto Calibrate 4.2**



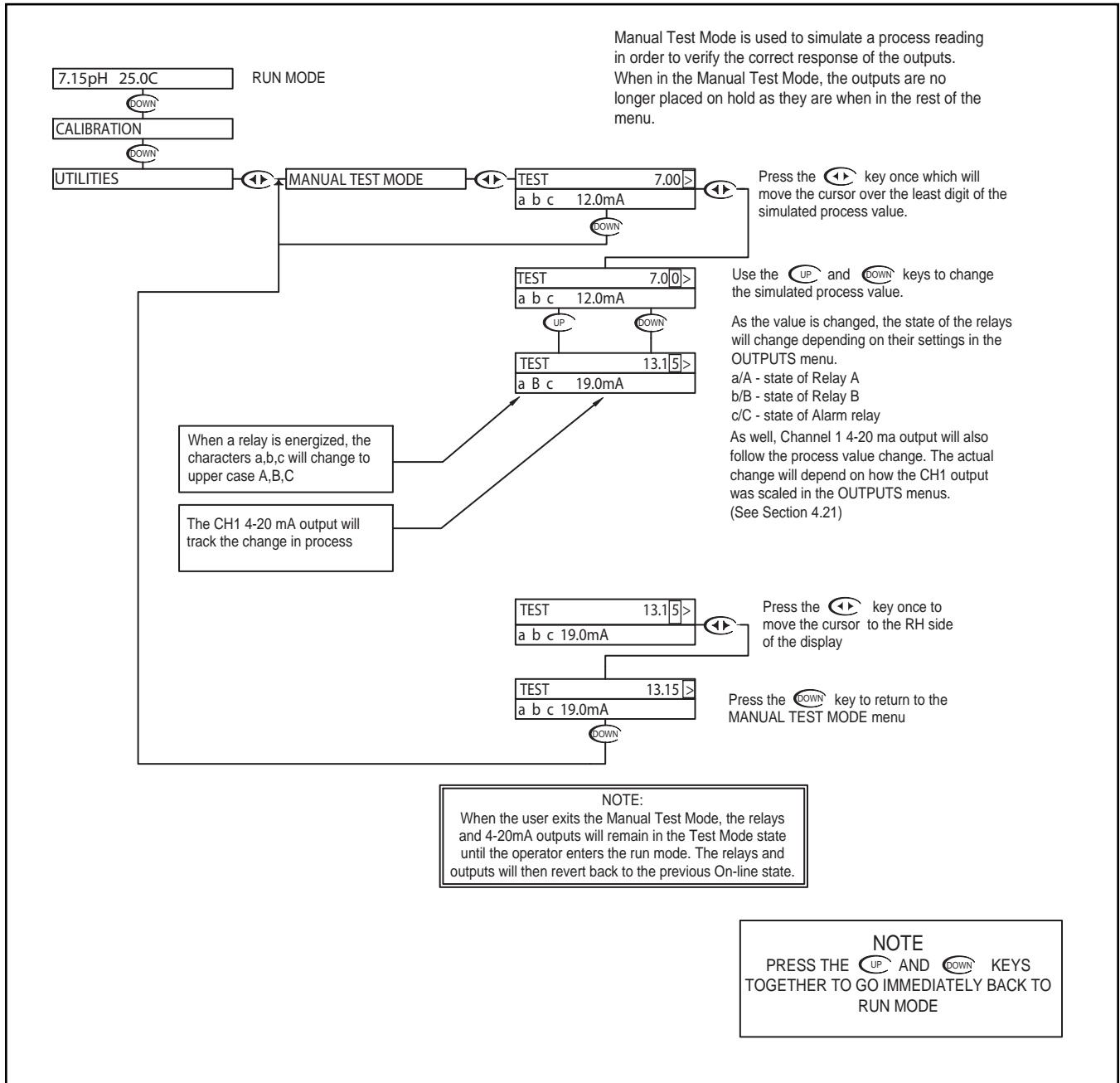


**pH - Calibration Menu - Temperature Calibration 4.3**





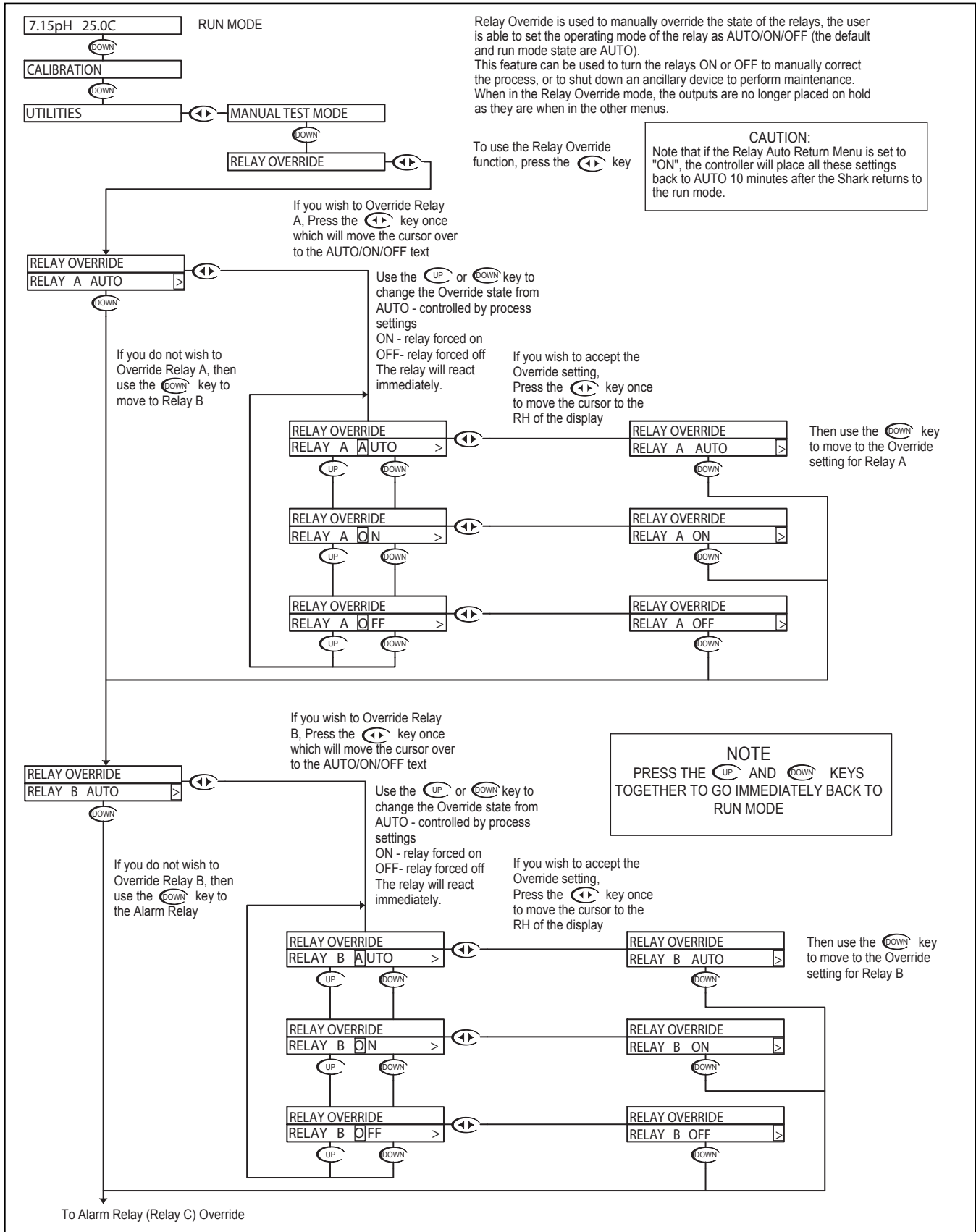
pH - Utilities Menu - Manual Test Mode 4.4





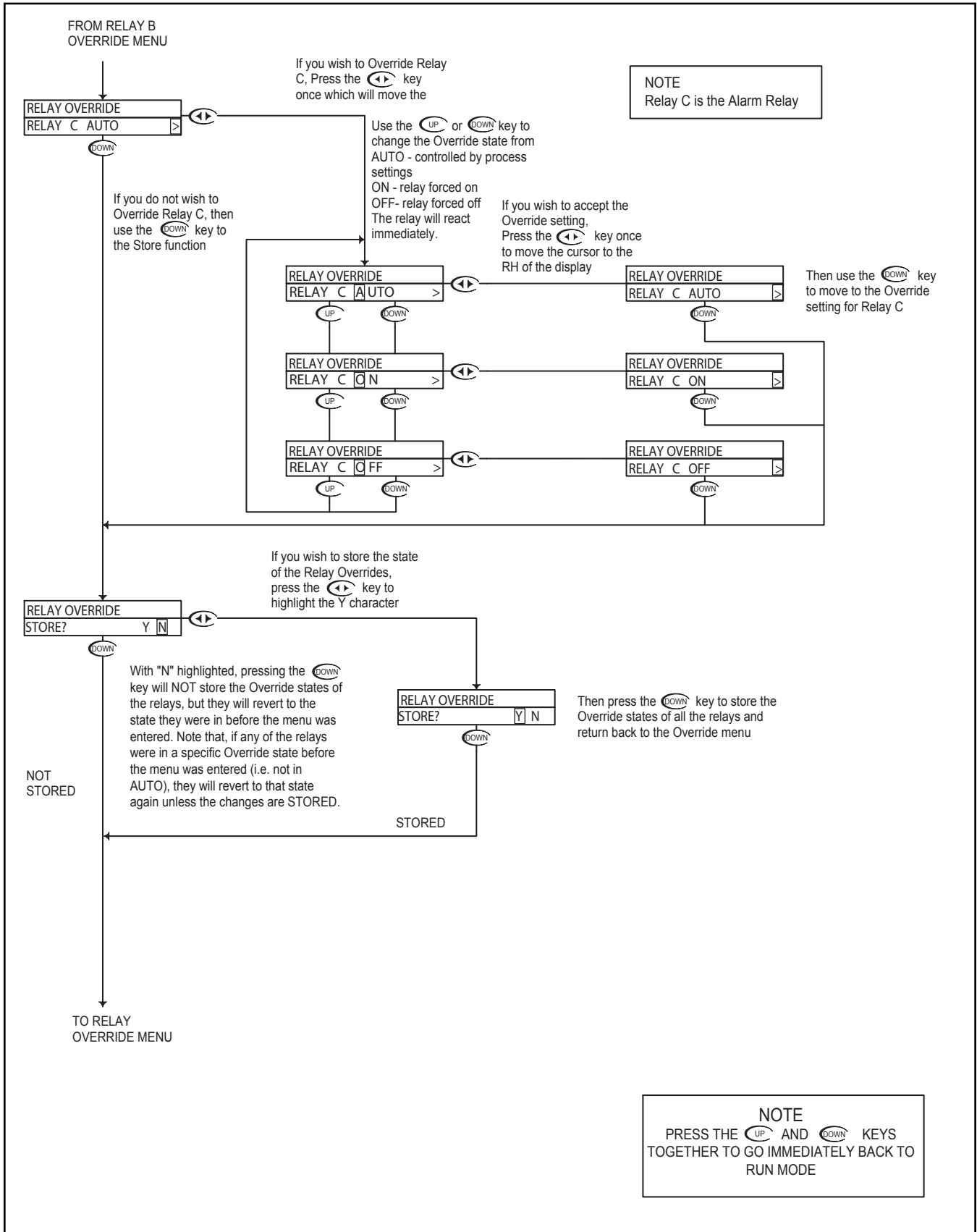


pH - Utilities Menu - Relay Override 4.5



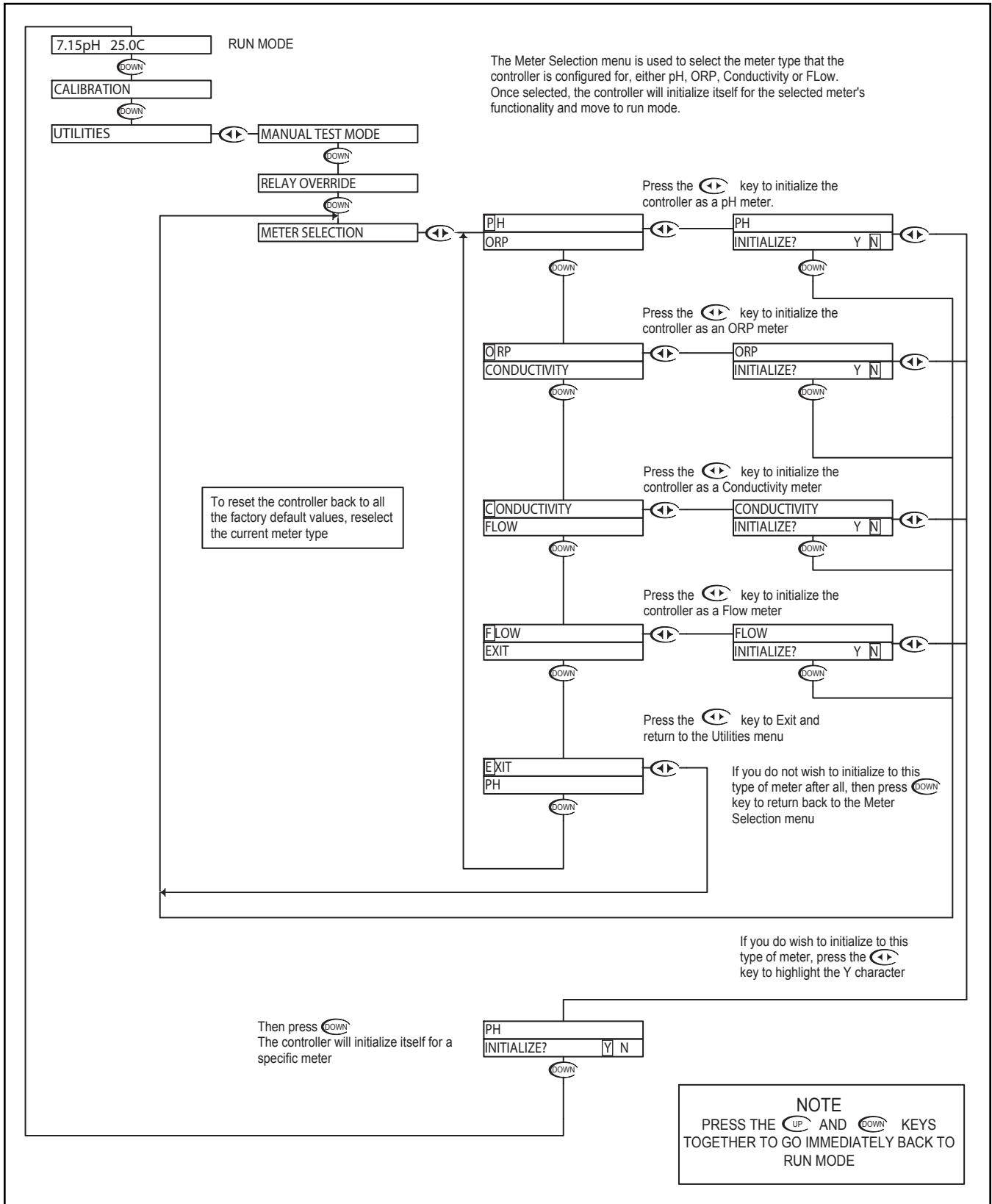


pH - Utilities Menu - Relay Override 4.5





pH - Utilities Menu - Meter Selection 4.6





pH - Utilities Menu - Overfeed Timer Reset 4.7

7.15pH 25.0C RUN MODE

DOWN  
CALIBRATION

DOWN  
UTILITIES

MANUAL TEST MODE

DOWN  
RELAY OVERRIDE

DOWN  
METER SELECTION

DOWN  
RESET OVERFD TMR

If the control relay overfeed timer has been enabled, the relay will "time out" after the specified overfeed time. When the relay times out, it must be manually reset. The time out will be signaled by the time out LED flashing on the front panel.

The reset overfeed timer will reset the timers for both relay A & relay B at the same time.

Press the key to choose between Y or N.

RESET OVERFD TMR RESET OVERFD TMR RESET OVERFD TMR Y N

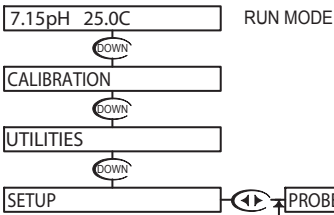
If you wish to reset the overfeed timer, then press the key to proceed and return back to the Utilities menu.

If you do not wish to reset the overfeed timer after all, press the key to highlight the N character and press the key to return back to the Utilities menu.

**NOTE**  
PRESS THE AND KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



pH - Setup Menu - Probe Select 4.8



PROBE SELECT will allow the user to select whether the probe is a 2 or 4 wire combination probe, or a 5 wire differential probe.

Press the **←→** key once which will move the cursor over the first character of the probe type.

**Note:**  
 If using the 2 wire Combination Probe (which doesn't have a temperature sensor), T COMP OVERRIDE must be set to ON, and the actual probe temperature set through the T COMP OVERRIDE menu. (see sec. 4.12)

Use the **↑** or **↓** keys to scroll through the probe types available. In this case, the user can select - the 2 or 4 wire combination probe - the 5 wire differential probe

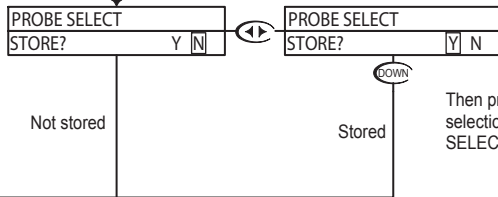
Once the correct probe type is selected, move to the store function to save the selection

Press the **←→** key once which will move the cursor back to the RH side of the display.

Press the **↓** key to accept the setting and move to the store function

With "N" selected, pressing the **↓** key will NOT store the selection, but simply return to the PROBE SELECT Menu. This function is useful if you wish to view the current selection without making any changes.

Or press the **←→** key to highlight the Y character.



Then press the **↓** key to store the selection and return to the PROBE SELECT Menu.

Note: Refer to Appendix A - Probe Configuration Table

**NOTE**  
 PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



pH - Setup Menu -Temp Unit 4.9

7.15pH 25.0C RUN MODE

CALIBRATION

UTILITIES

SETUP

PROBE SELECT

TEMP UNIT DEGREE C

Press the key once which will move the cursor over the unit type, C or F.

TEMP UNIT DEGREE C

Use the UP or DOWN to select C or F

TEMP UNIT DEGREE F

Press the key once which will move the cursor back to the RH side of the display.

TEMP UNIT DEGREE F

Press the DOWN key to accept the change and move to the store function

TEMP UNIT STORE? Y N

With "N" selected, pressing the key will NOT store the selection, but simply return to the TEMP UNIT Selection Menu. This function is useful if you wish to view the current selection without making any changes.

Not stored

Or press the key to highlight the Y character.

TEMP UNIT STORE? Y N

Stored

Then press the key to store the selection and return to the TEMP UNIT Selection Menu.

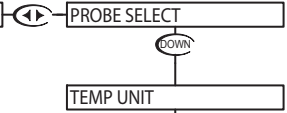
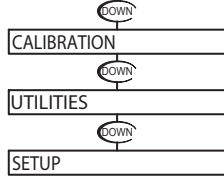
TEMP UNIT allows the user to select either Degrees Centigrade or Fahrenheit units for display

NOTE PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



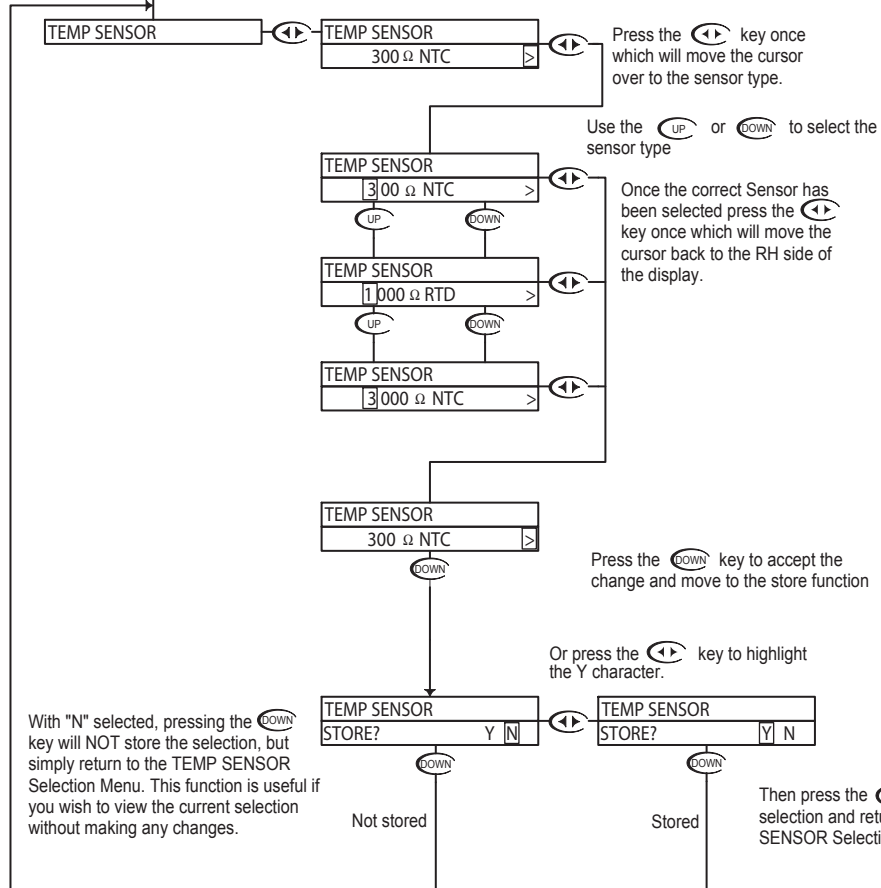
pH - Setup Menu - Temp. Sensor 4.10

7.15pH 25.0C RUN MODE



TEMP SENSOR allows the user to select the type of temperature sensor used in the probe.

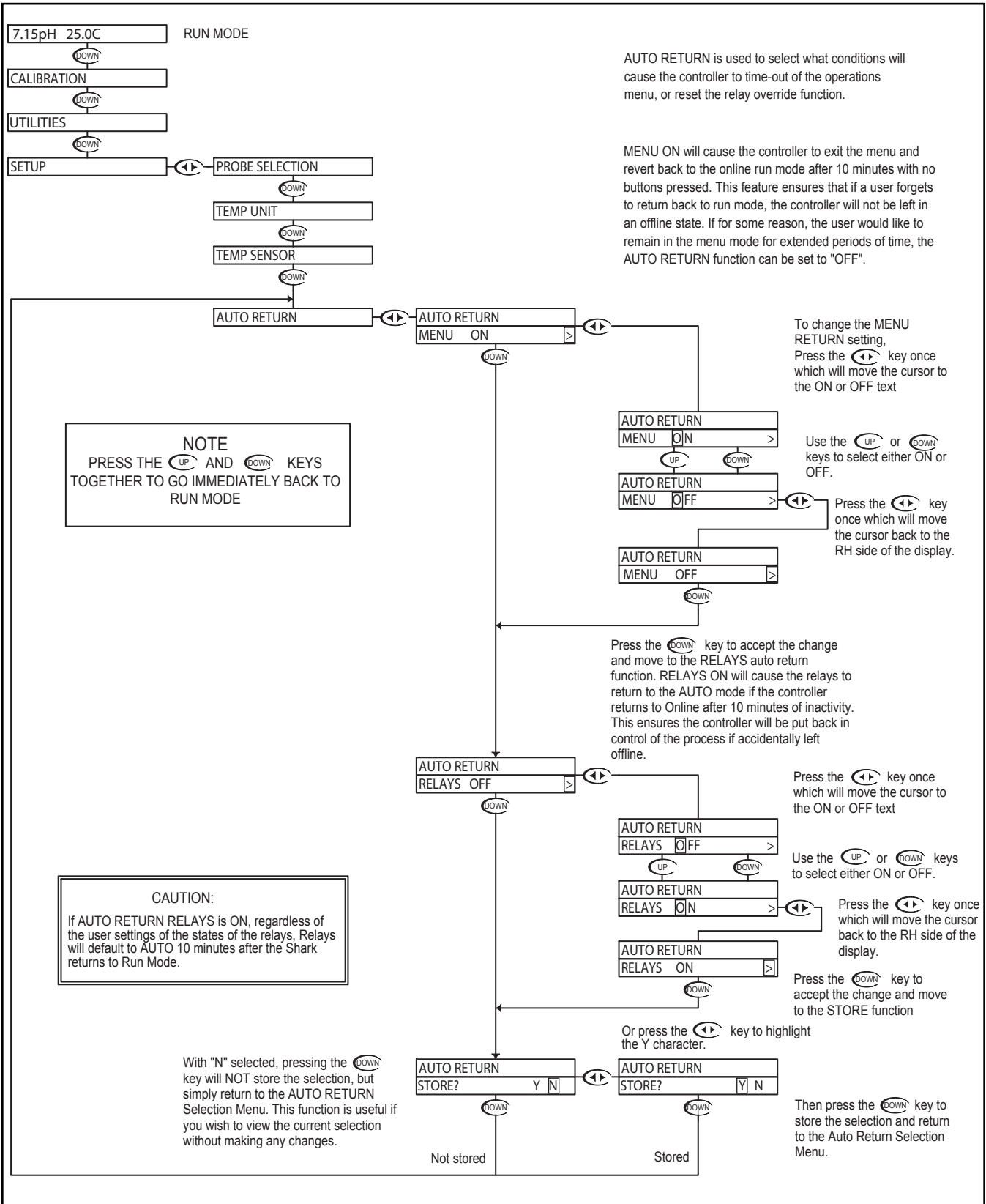
The factory default for pH is a 300Ω NTC Thermistor. The user can also select a 3000Ω NTC Thermistor or a 1000Ω RTD.



**NOTE**  
 PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



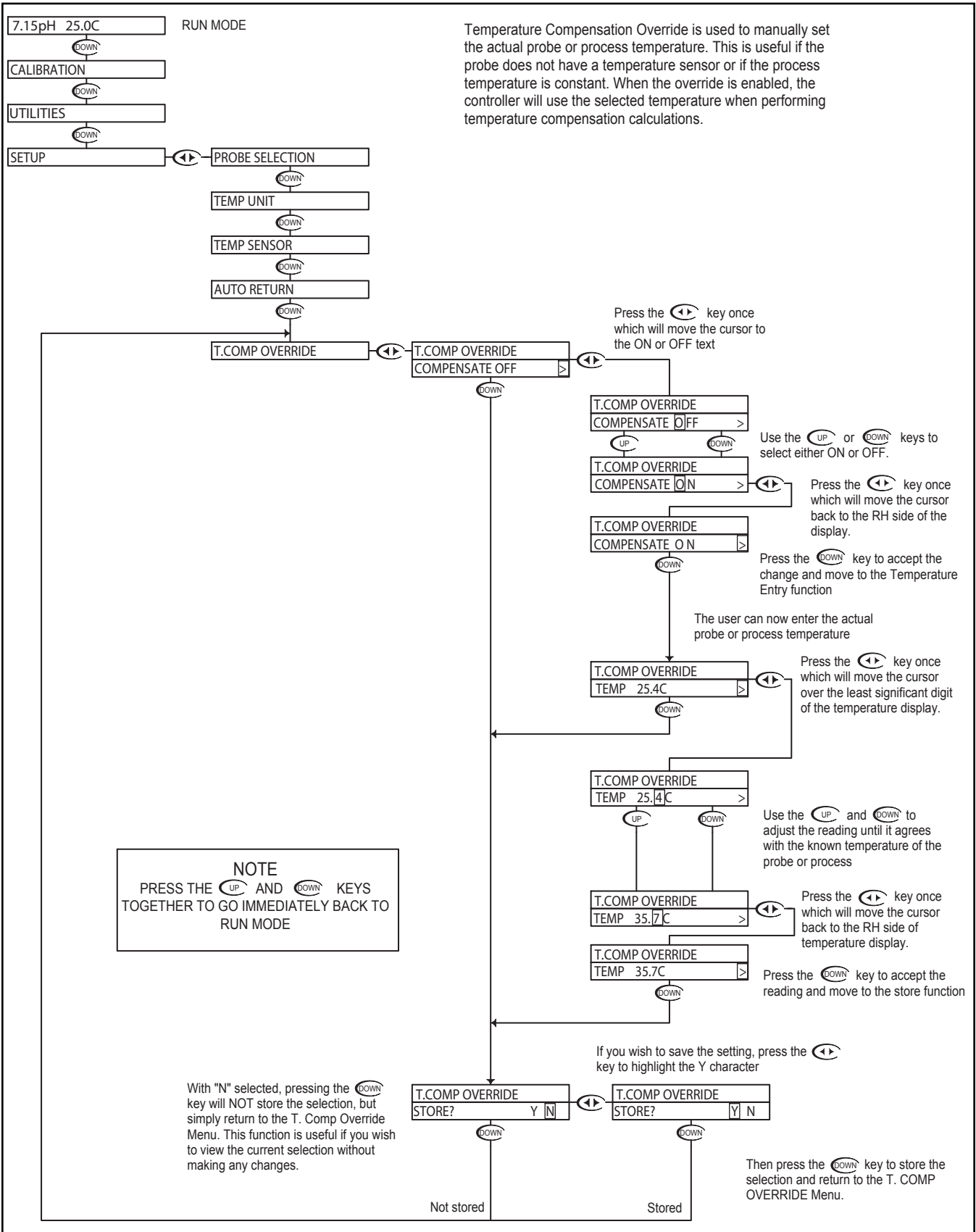
pH - Setup Menu - Auto Return 4.11







pH - Setup Menu - T.Comp Override 4.12





pH - Setup Menu - Display Damping 4.13

7.15pH 25.0C RUN MODE

CALIBRATION

UTILITIES

SETUP

PROBE SELECTION

TEMP UNIT

TEMP SENSOR

AUTO RETURN

T.COMP OVERRIDE

DISPLAY DAMPING

DISPLAY DAMPING  
UPDATE 0SEC

The Display Damping menu allows the user to adjust the rate at which the display and all outputs are updated. This allows the user to dampen out unstable process readings. The damping can be set from 0 seconds to 10 seconds. (default value is 0 sec.)

Press the **←→** key once which will move the cursor over the seconds digit

DISPLAY DAMPING  
UPDATE 10SEC

Use the **↑** and **↓** to adjust the damping time, the default setting is 0 seconds. The setting can be adjusted from 0 to 10 seconds.

Press the **←→** key once which will move the cursor back to the RH side of the display.

DISPLAY DAMPING  
UPDATE 10SEC

Press the **↓** key to accept the setting and move to the store function

DISPLAY DAMPING  
STORE? Y N

If you wish to save the setting, press the **←→** key to highlight the Y character

DISPLAY DAMPING  
STORE? Y N

Then press the **↓** key to store the selection and return to the Display Damping Menu.

With "N" selected, pressing the **↓** key will NOT store the selection, but simply return to the Display Damping Menu. This function is useful if you wish to view the current selection without making any changes.

Not stored

Stored

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



pH - Setup Menu - Bar Graph O/R 4.14

7.15pH 25.0C RUN MODE

CALIBRATION

UTILITIES

SETUP

PROBE SELECTION

TEMP UNIT

TEMP SENSOR

AUTO RETURN

T.COMP OVERRIDE

DISPLAY DAMPING

BAR GRAPH O/R

The BAR GRAPH O/R menu allows the user control over the resolution of the bar graph on the front panel of the Shark. The factory default for this function is "OFF" which means the 3 green LEDs are set to operate between the ON set points of Relay A and B. This may not always be acceptable, and this function allows the user to override these settings.

Press the **←** key once which will move the cursor over the first character

BAR GRAPH O/R  
OVERRIDE OFF >

Use the **↑** and **↓** to select the override either ON or OFF.

BAR GRAPH O/R  
OVERRIDE OFF >

Press the **←** key once which will move the cursor back to the RH side of the display.

BAR GRAPH O/R  
OVERRIDE ON >

Press the **↓** key to adjust the resolution setting. If OFF was selected, the menu will move to the store function directly.

BAR GRAPH O/R  
OVERRIDE ON >

Press the **←** key once which will move the cursor over the least sign. digit.

BAR GRAPH O/R  
LOW GRN 0.00 >

Use the **↑** and **↓** to adjust the setting for the Low Green Led.

BAR GRAPH O/R  
LOW GRN 0.00 >

Press the **←** key once which will move the cursor back to the RH side.

BAR GRAPH O/R  
LOW GRN 2.50 >

Press the **↓** key to accept the reading and move to the High Green Led setting.

BAR GRAPH O/R  
LOW GRN 2.50 >

The controller displays the current setting for the highest green Led of the bar graph.

BAR GRAPH O/R  
HIGH GRN 14.00 >

Press the **←** key once which will move the cursor over the least sign. digit.

BAR GRAPH O/R  
HIGH GRN 14.00 >

Use the **↑** and **↓** to adjust the setting for the High Green Led.

BAR GRAPH O/R  
HIGH GRN 14.00 >

Press the **←** key once which will move the cursor back to the RH side.

BAR GRAPH O/R  
HIGH GRN 10.80 >

Press the **↓** key to accept the reading and move to the store function.

BAR GRAPH O/R  
HIGH GRN 10.80 >

If you wish to save the setting, press the **←** key to highlight the Y character

BAR GRAPH O/R  
STORE? Y N

BAR GRAPH O/R  
STORE? Y N

Then press the **↓** key to store the selection and return to the Bar Graph O/R Menu.

Not stored

Stored

The controller displays the current setting for the lowest green led of the bar graph.

Press the **↓** key skip the setting for the Low Green Led and move to the setting for the High Green Led.

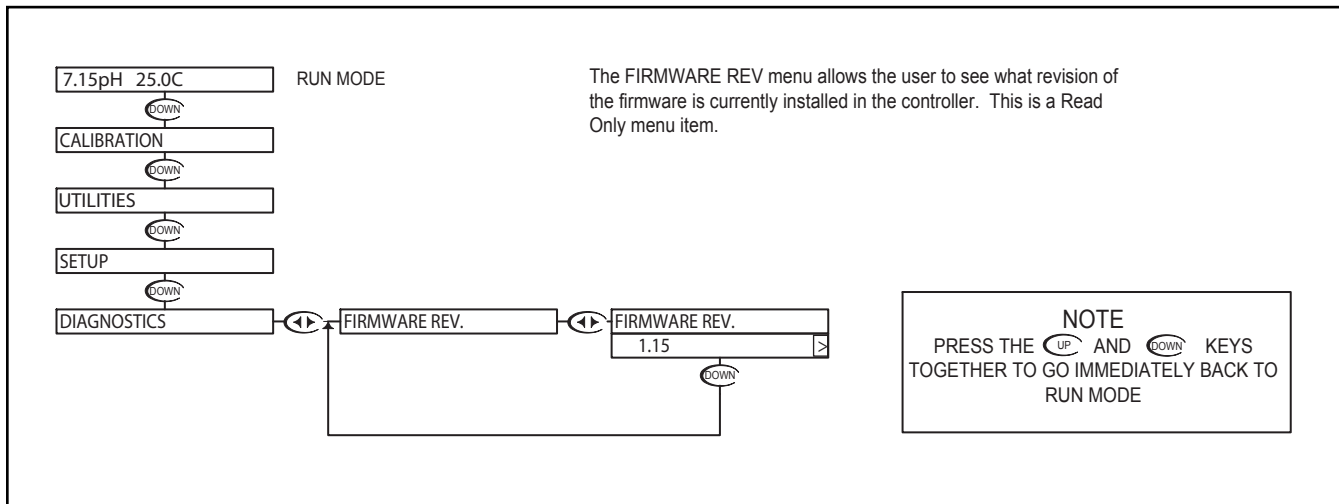
Press the **↓** key skip the setting for the High Green Led and move to store function.

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

With "N" selected, pressing the **↓** key will NOT store the selection, but simply return to the Bar Graph O/R Menu. This function is useful if you wish to view the current selection without making any changes.

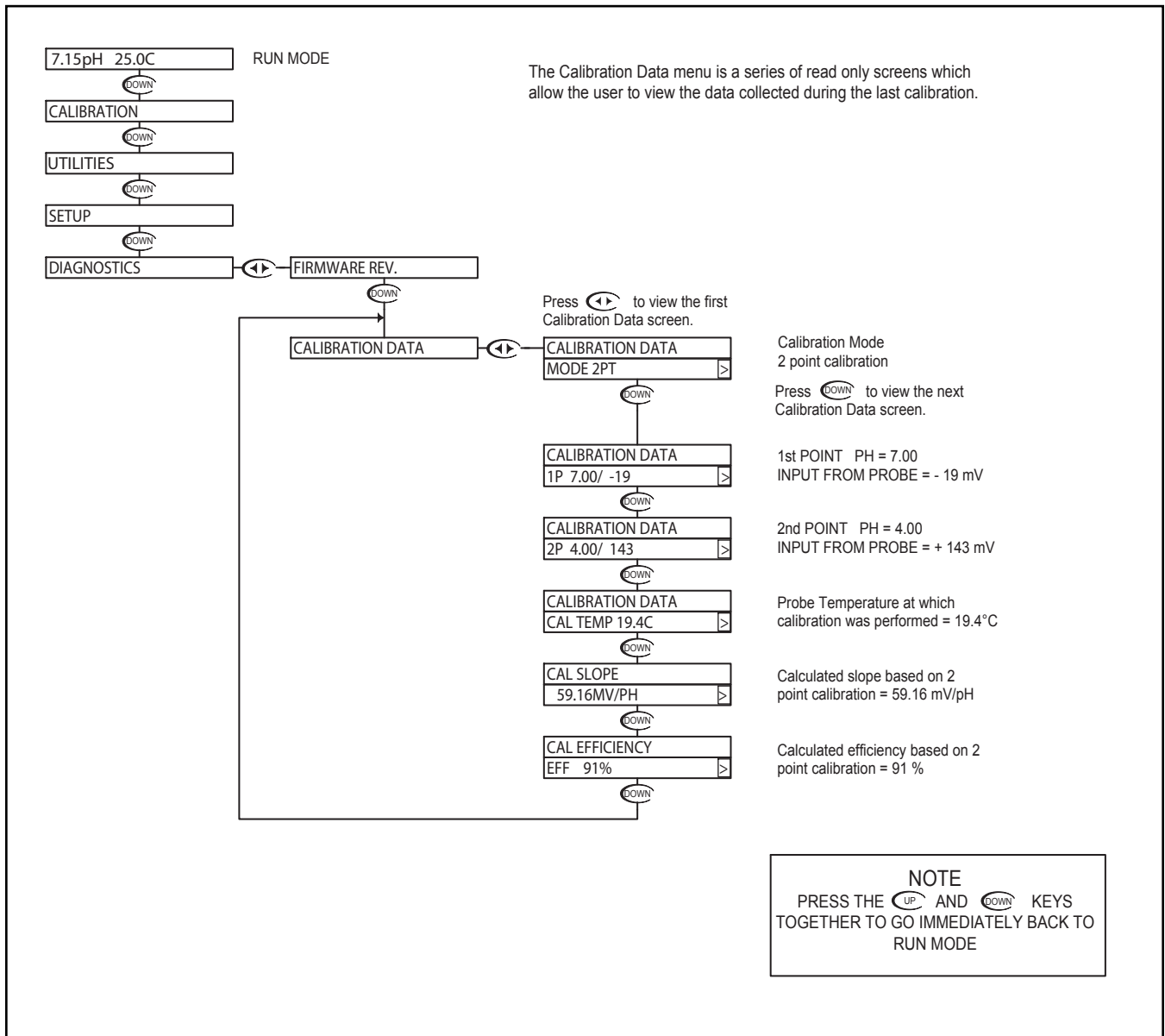


pH - Diagnostics Menu - Firmware Rev 4.15



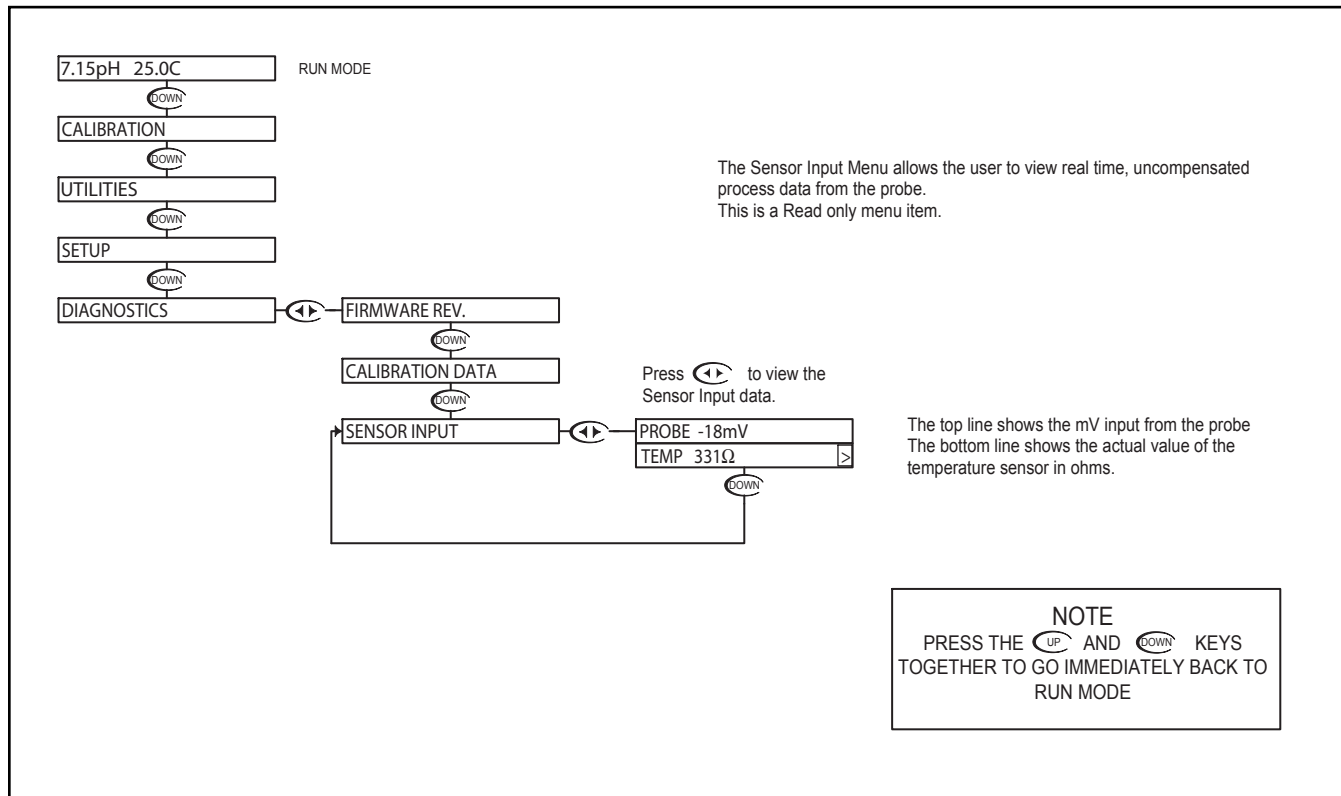


pH - Diagnostics Menu - Calibration Data 4.16





## pH - Diagnostics Menu - Sensor Input 4.17



### Troubleshooting a pH probe using the sensor input

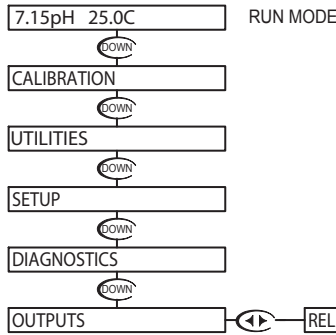
Sensor input displays the uncompensated sensor input data. The pH probe values are displayed in mV (millivolts). The temperature sensor value is displayed in Ω (ohm).

Connect the pH probe as per Probe Configuration Table in Appendix A.

1. Place the probe in buffer 7pH (allow temperature to stabilize)
  - Probe should read 0mV [±50mV]
  - Temperature should read 300Ω [±50Ω] @ 25°C
  - Record both of these numbers.
2. Place the probe in buffer 4pH
  - Probe should read +160mV more than probe value at 7pH
  - Temperature should read the same as in 7pH
3. Place the probe in buffer 10pH
  - Probe should read -160mV less than probe value at 7pH
  - Temperature should read the same as in 7pH



pH - Outputs Menu - Relay A 4.18



Relay A can be configured for the following operations

- Response to rising or falling process values
- Adjustable on and off set-points
- Cycle on and off times
- Failsafe operation

The relay can be set to control either a RISING or FALLING process.

In a FALLING process, the control relay will energize when the process falls below a set value. In this case, the ON set-point must be set lower than the OFF set-point.

In a RISING process, the control relay will energize when the process rises above a set value. In this case, the ON set-point must be set higher than the OFF set-point.

The RELAY ON setting is the process value at which the relay will energize. It may be set anywhere between 0-100% of the range.

The RELAY OFF setting is the process value at which the relay will de-energize. The setting must be rationalized against the On setting. For example, in a falling process, the Off setting must be higher than the On setting.

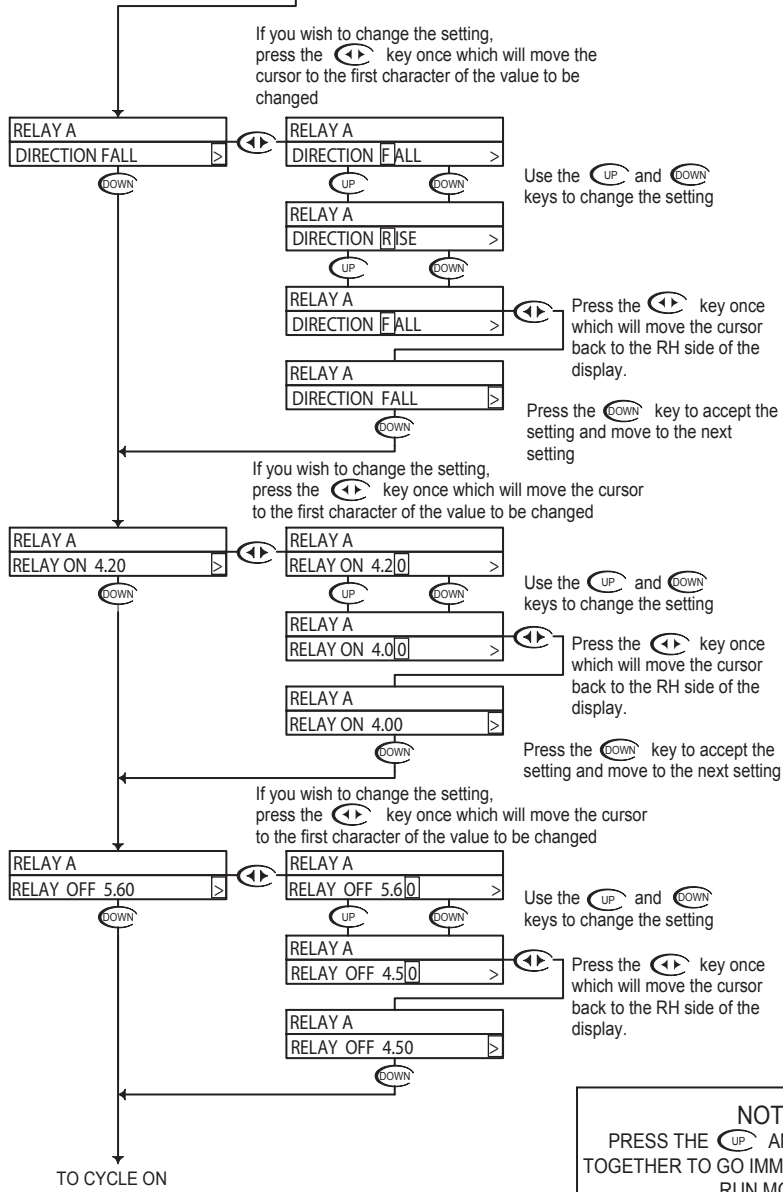
The controller will not allow you to select the RELAY OFF value on the wrong side of the RELAY ON value for the selected direction. If the user tries to set the RELAY OFF on the wrong side, the following errors will be displayed:

FALLING PROCESS  
ON SPT < OFF SPT

Error when trying to set OFF point lower than ON point when set to falling.

RISING PROCESS  
ON SPT > OFF SPT

Error when trying to set OFF point higher than ON point when set to rising.



**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



pH - Outputs Menu - Relay A 4.18

The relay can be set to CYCLE when the process is between the RELAY ON setting and the RELAY OFF setting. This is meant to help eliminate overshoot.

The CYCLE ON time is the amount of time in seconds that the relay will be on. The value can be set between 0 and 600 seconds. The default ON time is 5 seconds.

**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

The CYCLE OFF time is the amount of time in seconds that the relay will be off for, it can be set between 0 - 600 seconds.

To disable the cycling feature set the cycle off time to 0.

The Default OFF time is 0 seconds.

The OVERFEED TIMER is designed to help safeguard against a process or instrumentation error causing one of the control relays to remain energized for extended periods of time.

When enabled, the user must select the desired overfeed timeout time (1-999 min.)

If the overfeed timer times out:

- Alarm relay will energize.
- Control (A&B) will de-energize
- LED on front will flash

Must be reset via Utilities Menu or Power reset.

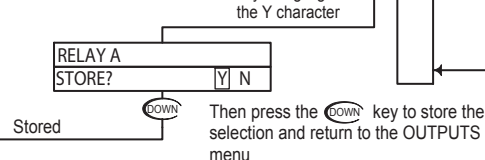
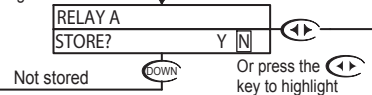
The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

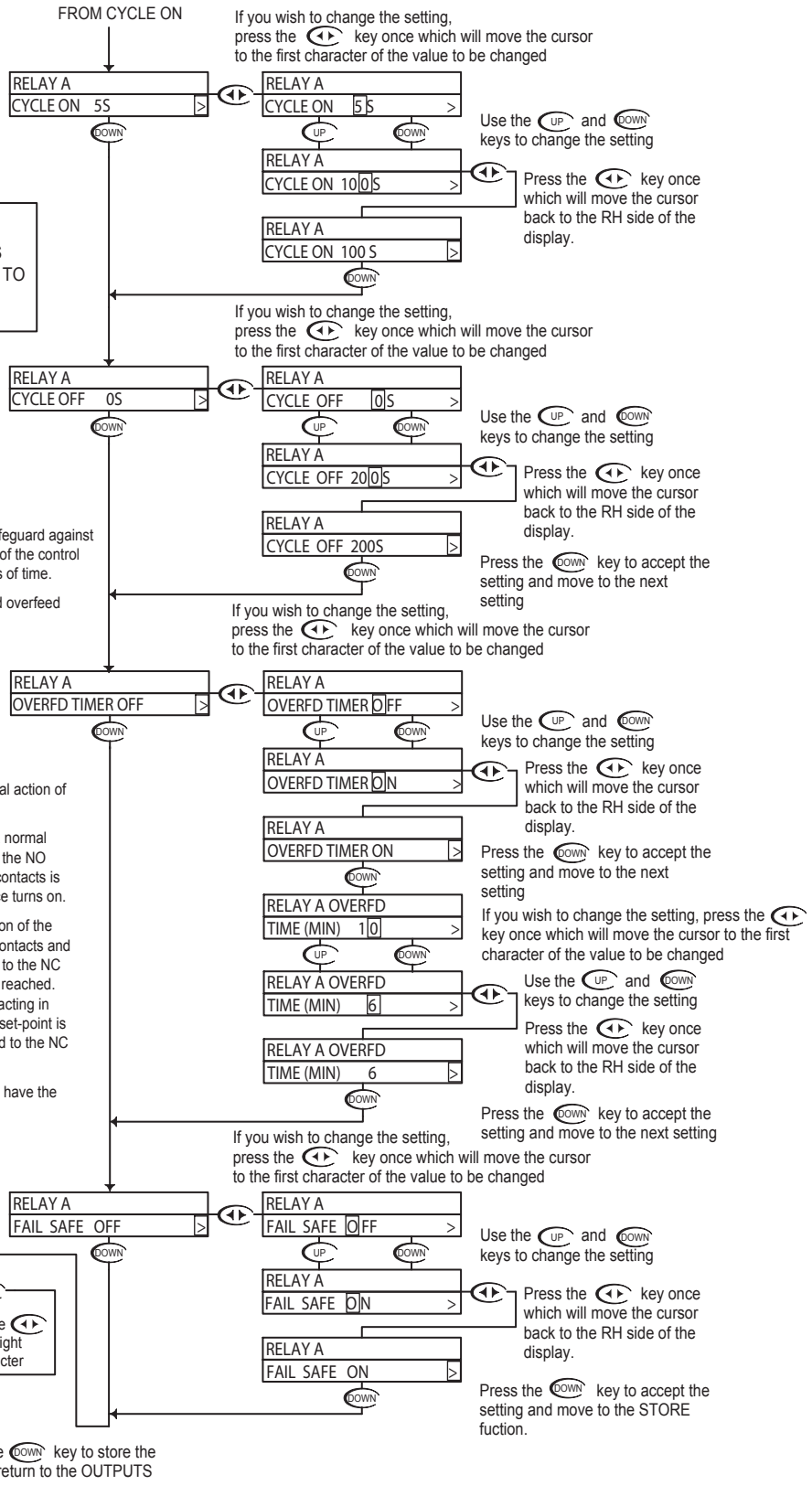
When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption.

With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



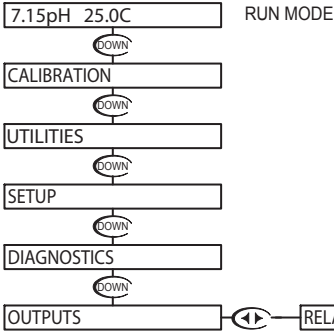
TO OUTPUTS MENU







pH - Outputs Menu - Relay B 4.19



Relay B can be configured for the following operations

- Response to rising or falling process values
- Adjustable on and off set-points
- Cycle on and off times
- Failsafe operation

Each function will be explained below

The relay can be set to control either a RISING or FALLING process.

In a RISING process, the control relay will energize when the process rises above a set value. In this case, the ON set-point must be set higher than the OFF set-point.

In a FALLING process, the control relay will energize when the process falls below a set value. In this case, the ON set-point must be set lower than the OFF set-point.

The RELAY ON setting is the process value at which the relay will energize. It may be set anywhere between 0-100% of the range.

The RELAY OFF setting is the process value at which the relay will de-energize. The setting must be rationalized against the On setting. For example, in a falling process, the Off setting must be higher than the ON setting.

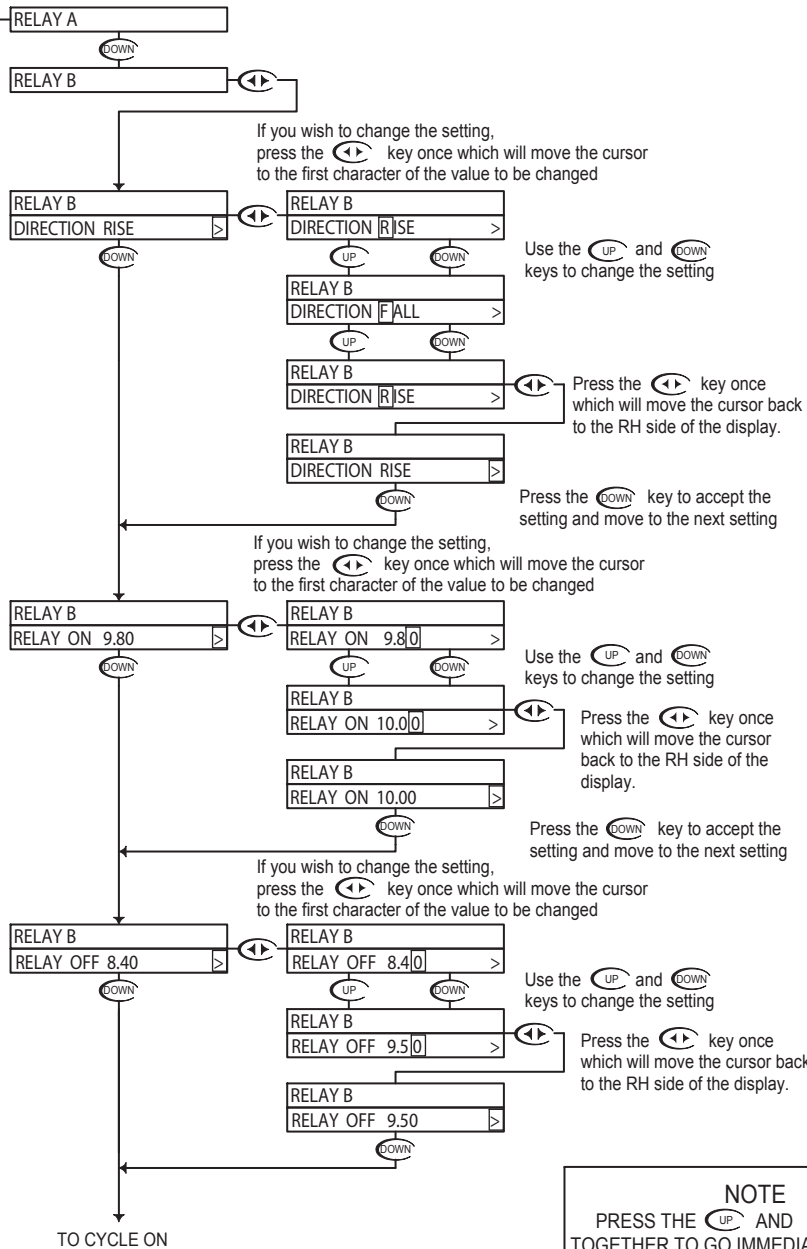
The controller will not allow you to select the RELAY OFF value on the wrong side of the RELAY ON value for the selected direction. If the user tries to set the RELAY OFF on the wrong side, the following errors will be displayed:

FALLING PROCESS  
ON SPT < OFF SPT

Error when trying to set OFF point lower than ON point when set to falling.

RISING PROCESS  
ON SPT > OFF SPT

Error when trying to set OFF point higher than ON point when set to rising.



**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



pH - Outputs Menu - Relay B 4.19

The relay can be set to CYCLE when the process is between the RELAY ON setting and the RELAY OFF setting. This is meant to help eliminate overshoot.

The CYCLE ON time is the amount of time in seconds that the relay will be on. The value can be set between 0 and 600 seconds. The default ON time is 5 seconds.

**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

The CYCLE OFF time is the amount of time in seconds that the relay will be off for, it can be set between 0 - 600 seconds.

To disable the cycling feature set the cycle off time to 0.

The Default OFF time is 0 seconds.

The OVERFEED TIMER is designed to help safeguard against a process or instrumentation error causing one of the control relays to remain energized for extended periods of time.

When enabled, the user must select the desired overfeed timeout time (1-999 min.)

If the overfeed timer times out:

- Alarm relay will energize.
- Control (A&B) will de-energize
- LED on front will flash

Must be reset via Utilities Menu or Power reset.

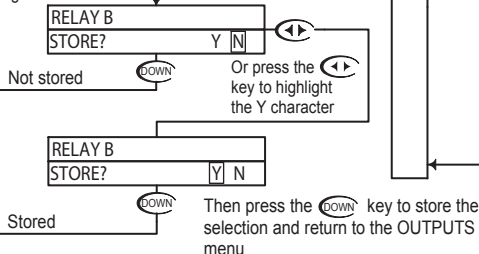
The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

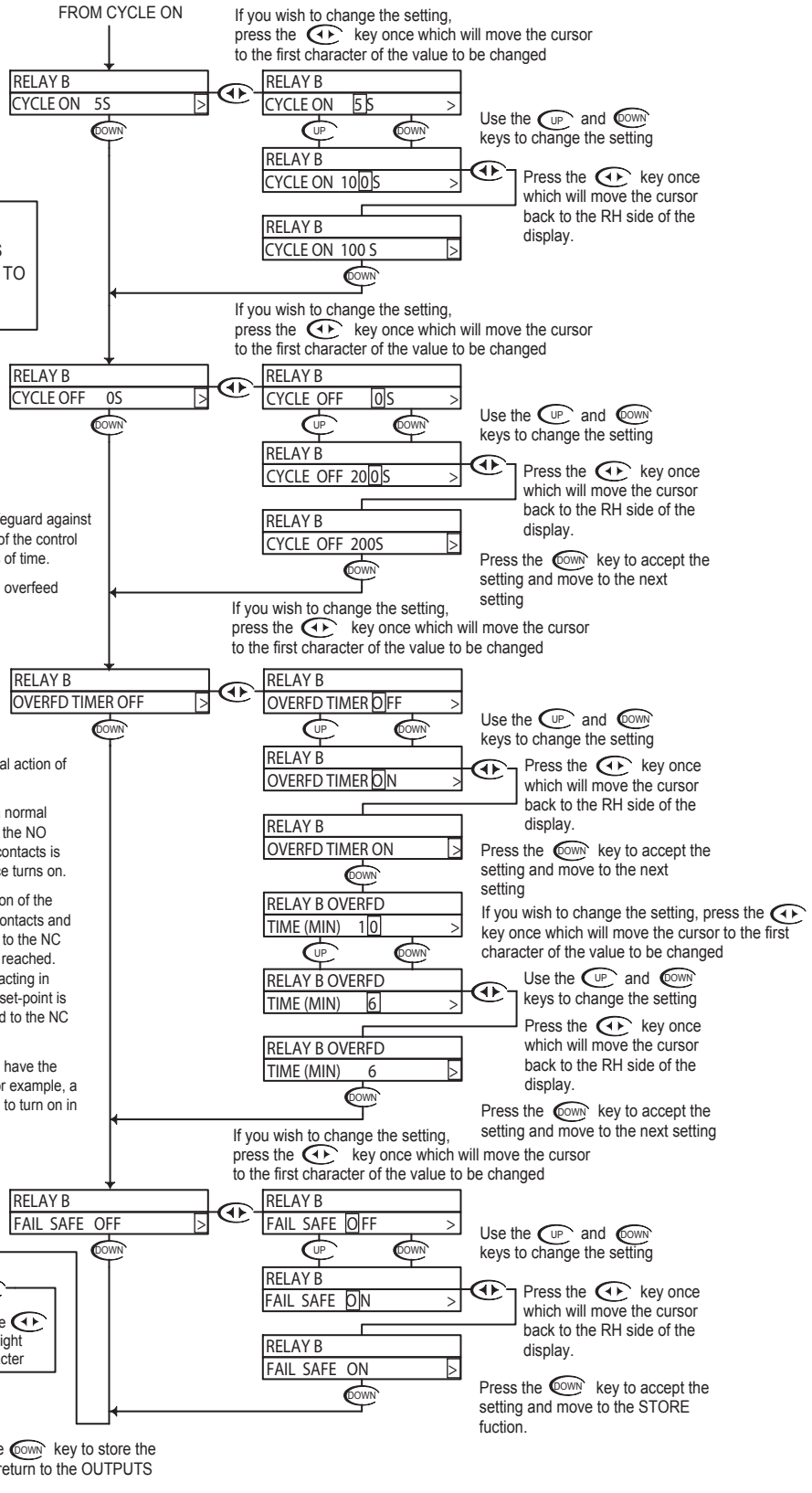
When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption. For example, a process that needs a constant feed, would want a pump to turn on in the event of a controller power failure.

With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



TO OUTPUTS MENU





pH - Outputs Menu - Alarm Relay 4.20

7.15pH 25.0C RUN MODE

CALIBRATION

UTILITIES

SETUP

DIAGNOSTICS

OUTPUTS

RELAY A

RELAY B

ALARM RELAY

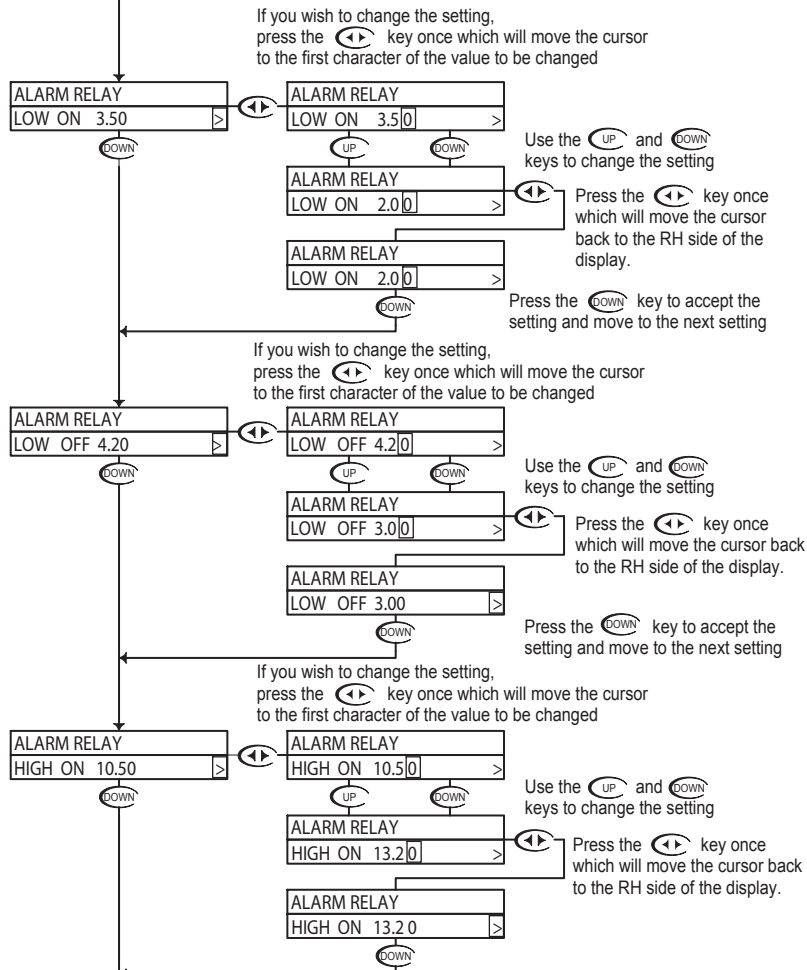
The ALARM RELAY will respond to both a rising and falling process. The ALARM RELAY will act as a low alarm (falling process) and a high alarm (rising process). Both relay bands will have independently adjustable on and off set-points. If a low alarm set-point is set at a value 3.00pH for example, the off set-point must be set higher. The controller will not let the user input a value below 3.00pH. The same rule holds true for the high alarm.

- The Alarm Relay can be configured for the following operations
- LOW ON Set-point
  - LOW OFF Set-point
  - HIGH ON Set-point
  - HIGH OFF Set-point
  - Failsafe

The LOW ON set point is the low process value that will cause the relay to energize. This value can be set anywhere 0-100% of Full Scale.

The LOW OFF set point is the value that the process must reach in order to de-energize the alarm relay after it has tripped the LOW ON set-point. This value must be higher than the LOW ON Set-point.

The HIGH ON set-point is the high process value that will cause the relay to energize. This value can be set anywhere 0-100% of Full Scale.



TO HIGH OFF

**NOTE**  
 PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



pH - Outputs Menu - Alarm Relay 4.20

The HIGH OFF set-point is the value that the must reach in order to de-energize the alarm relay after it has increased over and tripped the HIGH ON set-point. This value must be lower than the HIGH ON Set-point.

The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption.

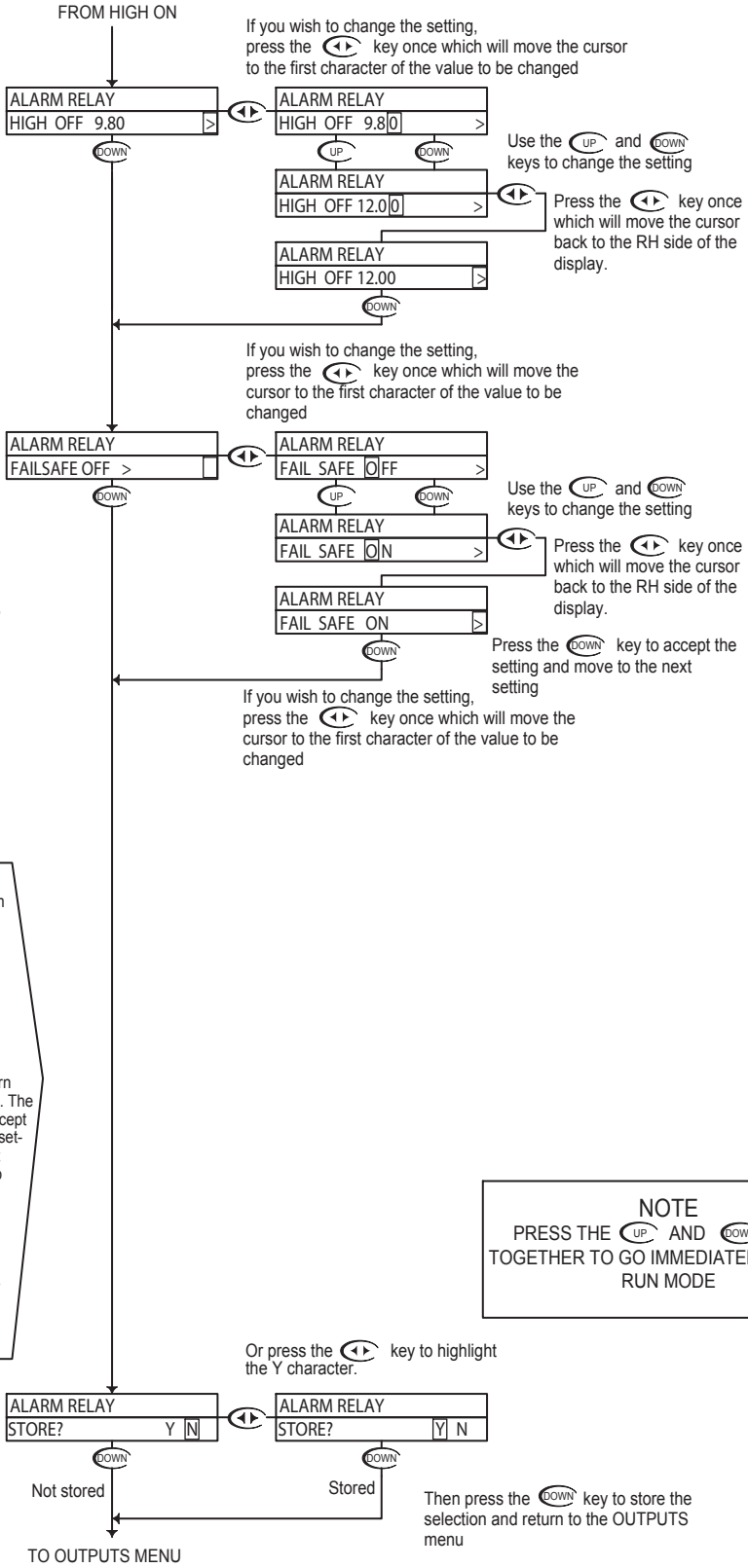
If the Low On set-point is set higher than the factory default Low Off set-point, when the user advances from the low on set-point to the Low Off set-point the shark will adjust the Low Off set-point to be equal to the Low On set-point. If the user then tries to decrease the Low Off set-point the Controller will display the Low Alarm setup error screen.

LOW ALARM  
ON SPT < OFF SPT

This screen will be displayed for 10 seconds, then return back to the setup screen that was previously displayed. The same conditions apply to the High alarm set-points. Except the High Off set-point must be lower than the High On set-point. If the user tries to increase the High Off set-point higher than the High On set-point the High Alarm setup error screen will be displayed.

HIGH ALARM  
ON SPT > OFF SPT

If the user sets the low on set-point and the low off set-point equal to 0, it will disable the Low Alarm relay. Similarly, setting the High On set-point and the HIGH OFF set-point to 0 will disable the High Alarm.



**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



pH - Outputs Menu - 4-20mA CH1 Output 4.21

7.15pH 25.0C RUN MODE

CALIBRATION

UTILITIES

SETUP

DIAGNOSTICS

OUTPUTS

RELAY A

RELAY B

ALARM RELAY

4-20mA CH1

The Controller has 2 4-20mA outputs, electrically isolated from each other and ground. Either output can source current into a maximum of 800 ohms. See Section 3.12 for wiring diagram. Channel 1 (the primary output) is located on the flip out door, terminal plug P6. Channel 1 is dedicated to track the process and has fully independent and fully adjustable 4 & 20 mA output adjustments. This will enable the operator to span the output over the desired range.

The example below shows the 4-20 mA set to 4mA = 7.00pH and 20mA = 14pH. The output would then span 4 to 20 mA for a pH swing of 7.0 to 14.0. Note that the span can be reversed, in that 4 mA can be set to a high pH value, and 20 mA can be set to a low pH value, effectively reversing the control direction.

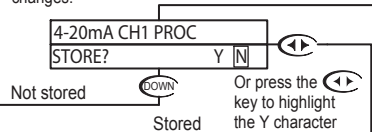
**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

The TUNE function allows the user to precisely adjust the 4-20 mA output to compensate for any errors in the output circuitry. Normally, fine tuning the 4-20mA output is not necessary.

To make the adjustment, place an accurate current meter in series with the 4-20 mA output, with the appropriate loads connected. When the TUNE menu is selected, the controller puts 20 mA out the terminals. Use the UP or DOWN keys to adjust the 20mA output to get exactly 20.

The TUNE value can be adjusted over the range from 0 to 1000, these are unitless numbers used for tuning purposes only.

With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



4-20mA CH1 PROC  
STORE? Y N

Then press the DOWN key to store the selection and return to the OUTPUTS menu

4-20mA CH1 PROC  
4mA OUT 0.00

If you wish to change the setting, press the LEFT key once which will move the cursor to the first character of the value to be changed

4-20mA CH1 PROC  
4mA OUT 0.0|0

Use the UP and DOWN keys to change the setting

4-20mA CH1 PROC  
4mA OUT 7.0|0

Press the LEFT key once which will move the cursor back to the RH side of the display.

4-20mA CH1 PROC  
4mA OUT 7.00

Press the DOWN key to accept the setting and move to the next setting

4-20mA CH1 PROC  
20mA OUT 14.00

If you wish to change the setting, press the LEFT key once which will move the cursor to the first character of the value to be changed

4-20mA CH1 PROC  
20mA OUT 14.0|0

Use the UP and DOWN keys to change the setting

4-20mA CH1 PROC  
20mA OUT 14.0|0

Press the LEFT key once which will move the cursor back to the RH side of the display.

4-20mA CH1 PROC  
20mA OUT 14.00

Press the DOWN key to accept the setting and move to the next setting

4-20mA CH1 PROC  
20mA TUNE 512

If you wish to change the setting, press the LEFT key once which will move the cursor to the first character of the value to be changed

4-20mA CH1 PROC  
20mA TUNE 51|2

Use the UP and DOWN keys to change the setting

4-20mA CH1 PROC  
20mA TUNE 54|0

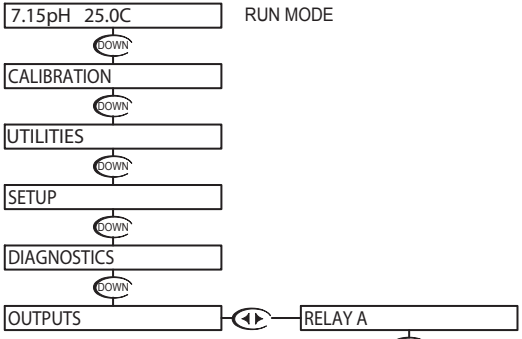
Press the LEFT key once which will move the cursor back to the RH side of the display.

4-20mA CH1 PROC  
20mA TUNE 54.0

Press the DOWN key to accept the setting and move to the next setting



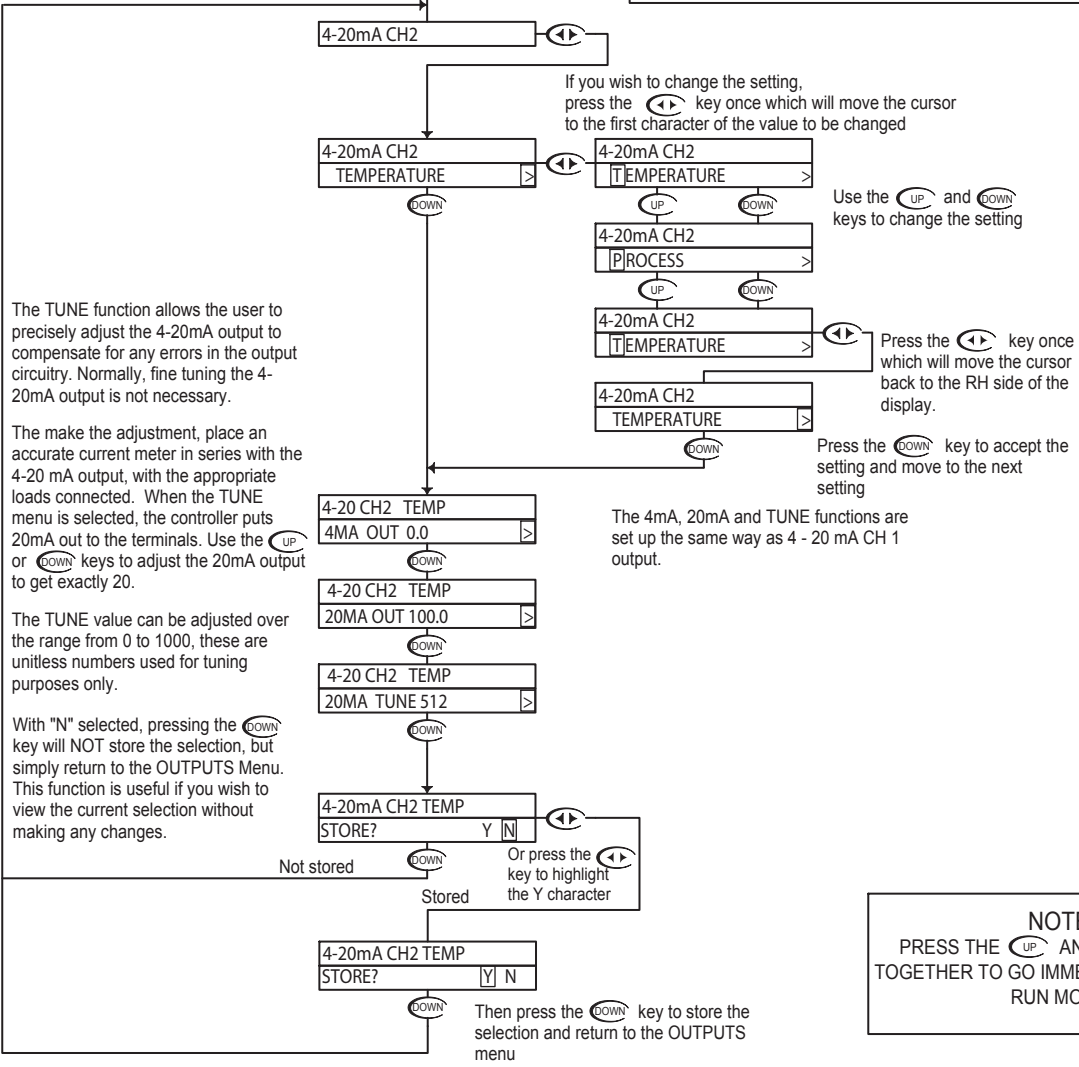
pH - Outputs Menu - 4-20mA CH2 Output 4.22



The Controller has 2 4-20mA outputs, electrically isolated from each other and ground. Either output can source current into a maximum of 800 ohms.  
 Channel 2 can be selected to track the process or temperature.  
 Channel 2 has fully independent and fully adjustable 4 & 20 mA output adjustments. This will enable the operator to span the output over the desired range.

Note that if the T COMP OVERRIDE is ON and Channel 2 output is set to track temperature, the output will not change, but hold at a value representing the temperature set in the T COMP OVERRIDE.

The example below shows the 4-20 mA set to 4mA = 0°C and 20mA = 100°C  
 The output would then span 4 to 20 mA for a temperature swing of 0°C to 100°C.  
 Note that the span can be reversed, in that 4 mA can be set to a high process value, and 20 mA can be set to a low process value, effectively reversing the control direction.



The TUNE function allows the user to precisely adjust the 4-20mA output to compensate for any errors in the output circuitry. Normally, fine tuning the 4-20mA output is not necessary.

The make the adjustment, place an accurate current meter in series with the 4-20 mA output, with the appropriate loads connected. When the TUNE menu is selected, the controller puts 20mA out to the terminals. Use the UP or DOWN keys to adjust the 20mA output to get exactly 20.

The TUNE value can be adjusted over the range from 0 to 1000, these are unitless numbers used for tuning purposes only.

With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.

If you wish to change the setting, press the LEFT key once which will move the cursor to the first character of the value to be changed

Use the UP and DOWN keys to change the setting

Press the LEFT key once which will move the cursor back to the RH side of the display.

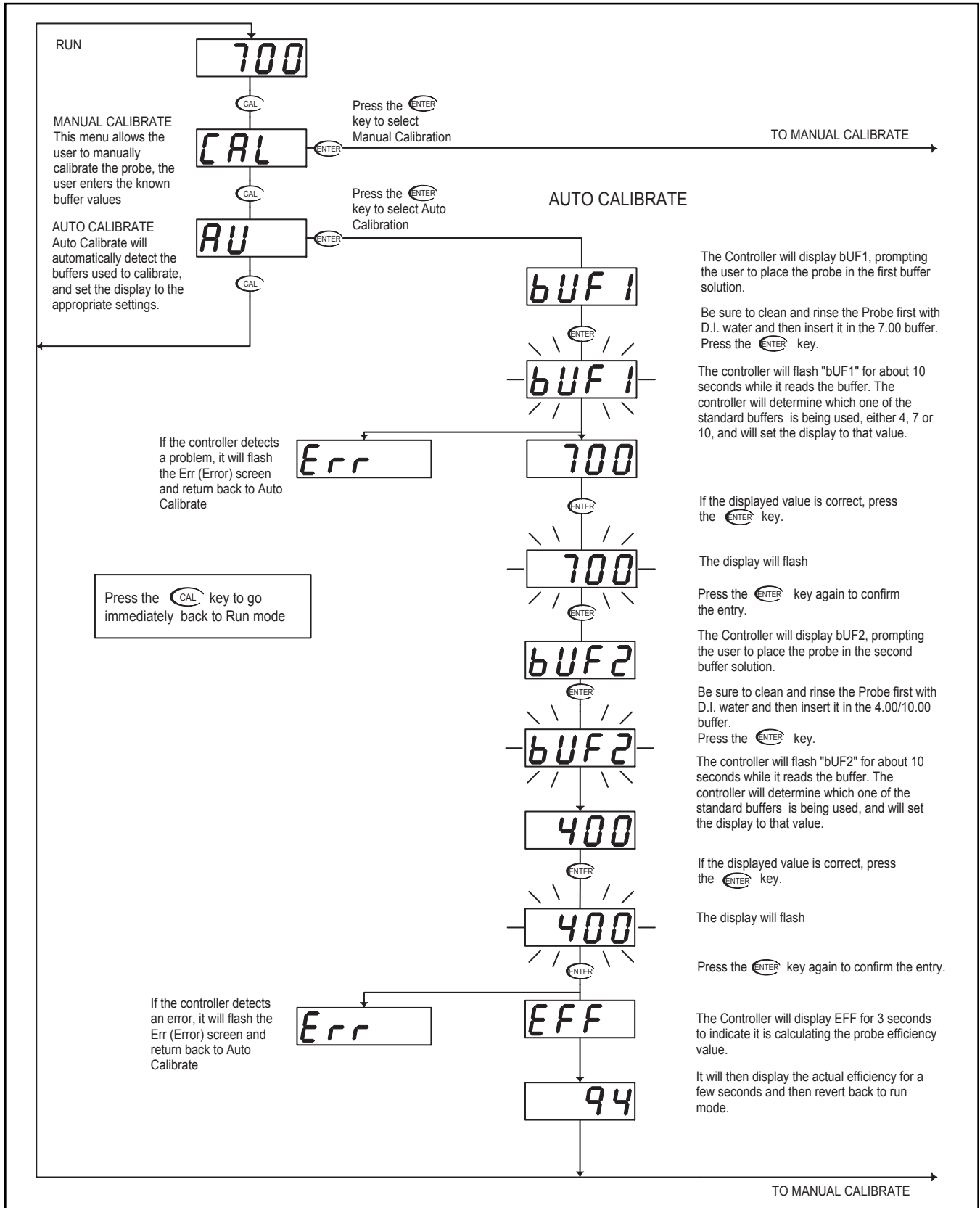
Press the DOWN key to accept the setting and move to the next setting

The 4mA, 20mA and TUNE functions are set up the same way as 4 - 20 mA CH 1 output.

**NOTE**  
 PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



pH - LED Display Menu - pH Auto Calibrate 4.23





MANUAL CALIBRATE

← TO AUTO CALIBRATE

6UF1

ENTER

6UF1

672

UP DOWN

700

ENTER

700

ENTER

6UF2

ENTER

6UF2

385

UP DOWN

400

ENTER

400

ENTER

Err

EFF

94

← TO AUTO CALIBRATE

The Controller will display bUF1, prompting the user to place the probe in the first buffer solution.

Be sure to clean and rinse the Probe first with D.I. water and then insert it in the 7.00 buffer. Press the ENTER key.

The controller will flash "bUF1" for about 10 seconds while is reads the buffer. It will then display the pH value based on an ideal theoretical pH slope.

Use the UP and DOWN keys to adjust the display until it reads the correct value of the buffer.

Press the ENTER key to accept the setting.

The display will flash

Press the ENTER key again to confirm the change in calibration value.

The Controller will display bUF2, prompting the user to place the probe in the second buffer solution.

Be sure to clean and rinse the Probe first with D.I. water and then insert it in the 4.00/10.00 buffer. Press the ENTER key.

The controller will flash "bUF2" for about 10 seconds while is reads the buffer. It will then display the pH value based on an ideal theoretical pH slope.

Use the UP and DOWN keys to adjust the display until it reads the correct value of the buffer.

Press the ENTER key to accept the setting. The display will flash.

Press the ENTER key again to confirm the change in calibration value.

The Controller will display EFF for 3 seconds to indicate it is calculating the probe efficiency value.

It will then display the actual efficiency for a few seconds and then revert back to run mode.

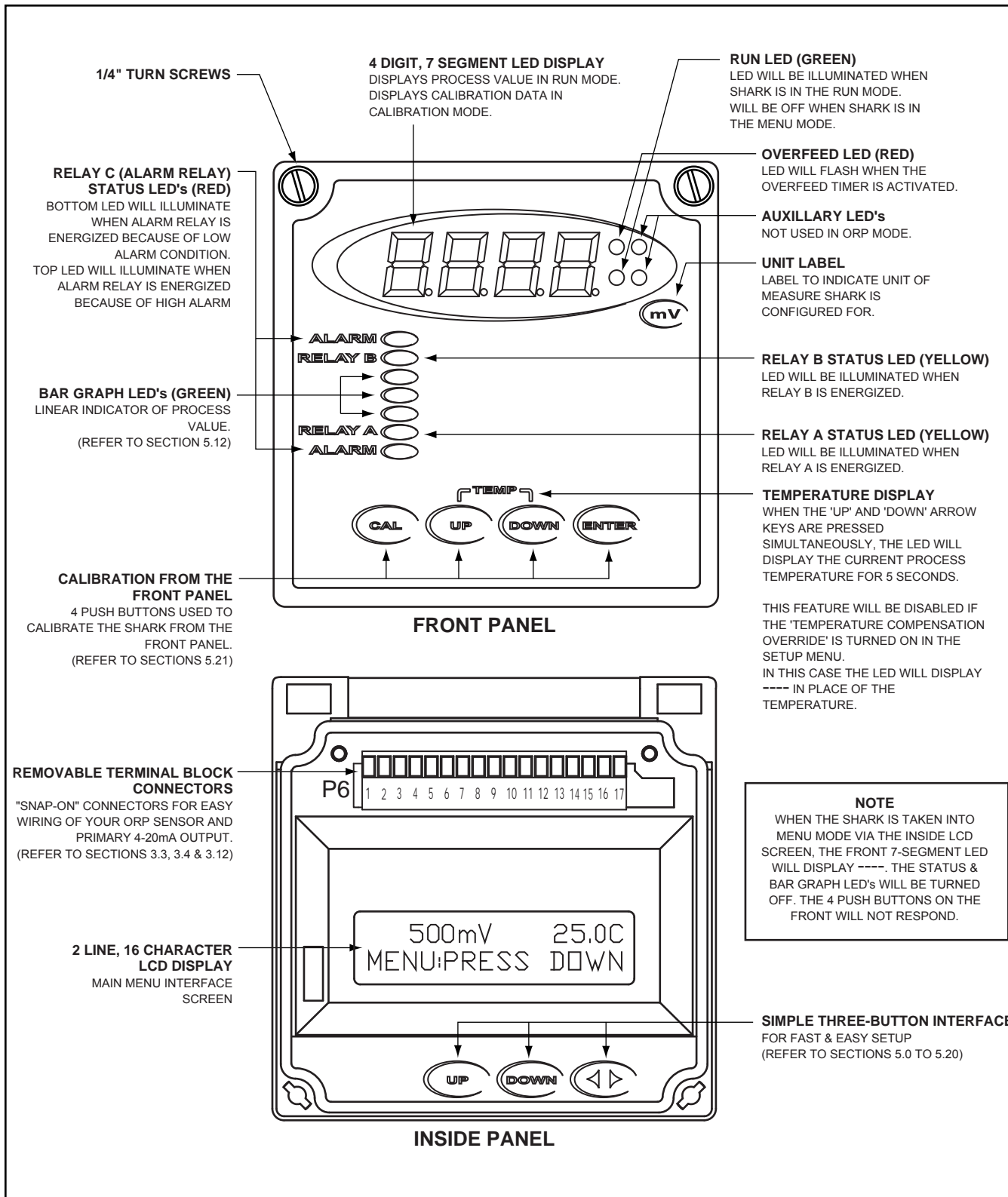
Press the CAL key to go immediately back to Run mode

If the controller detects an error, it will flash the Err (Error) screen and return back to Manual



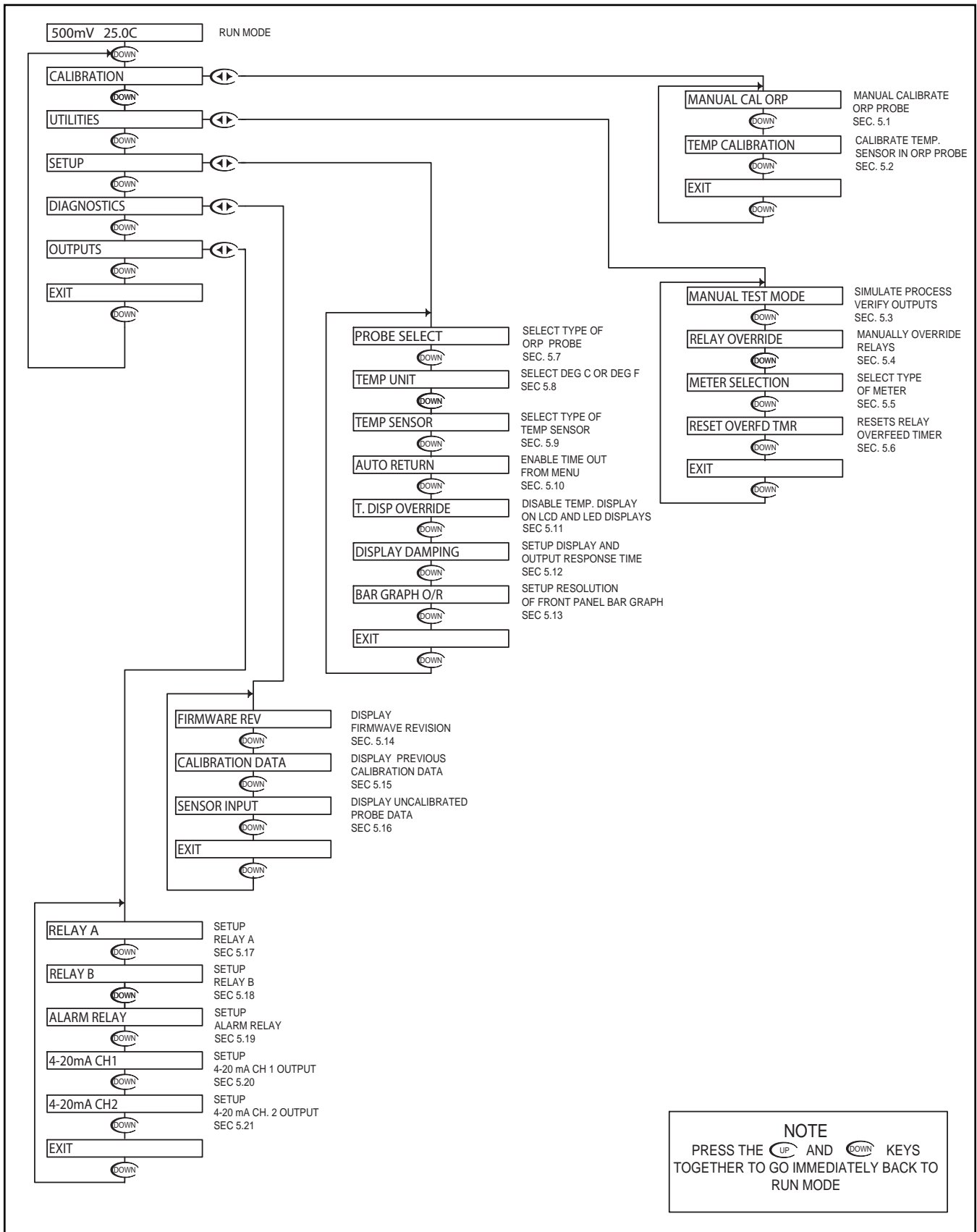


**Section 5 - Using the SHARK in ORP Mode**



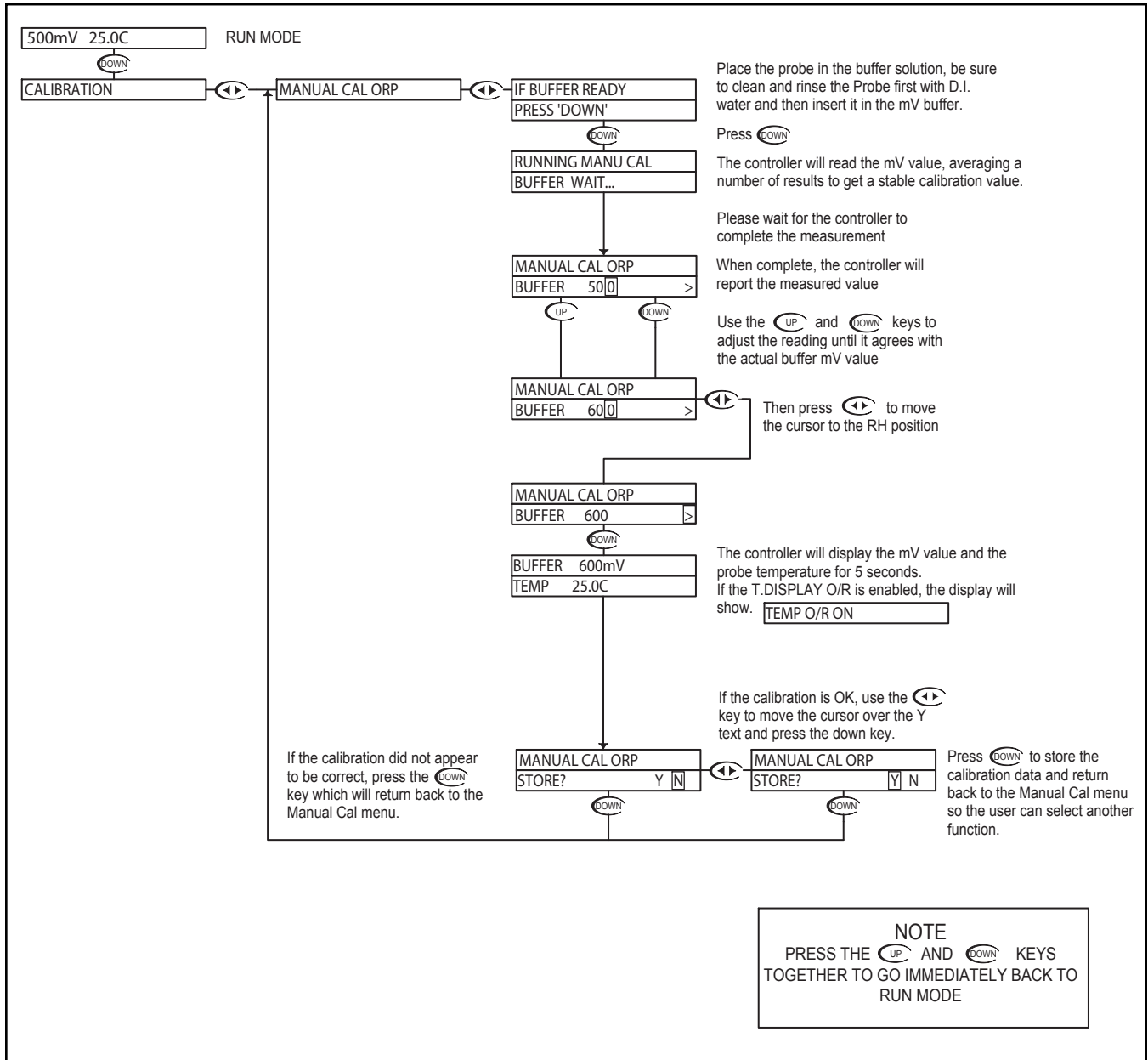


**ORP - Menu Overview 5.0**



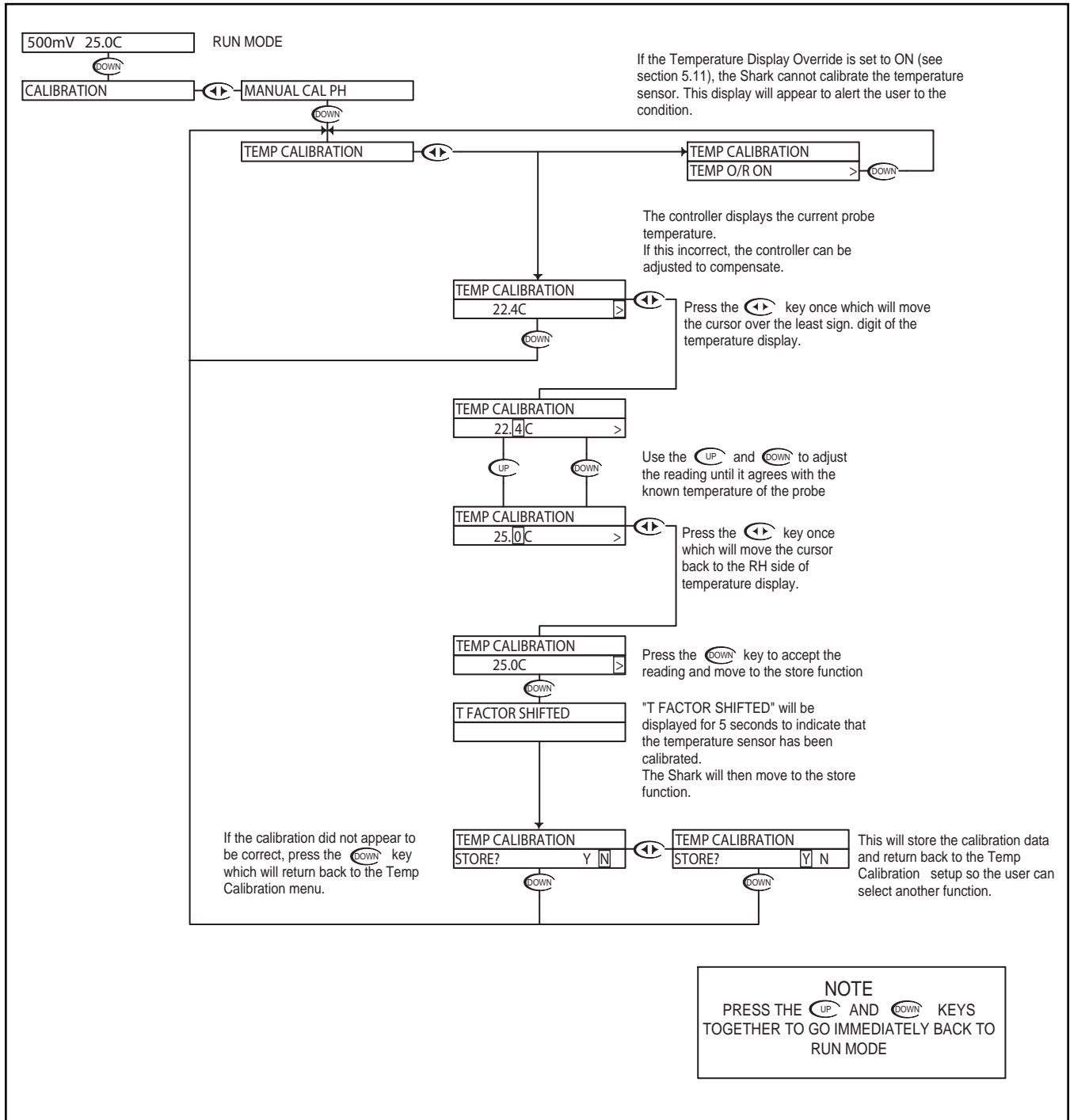


ORP - Calibration Menu - Manual Calibrate 5.1



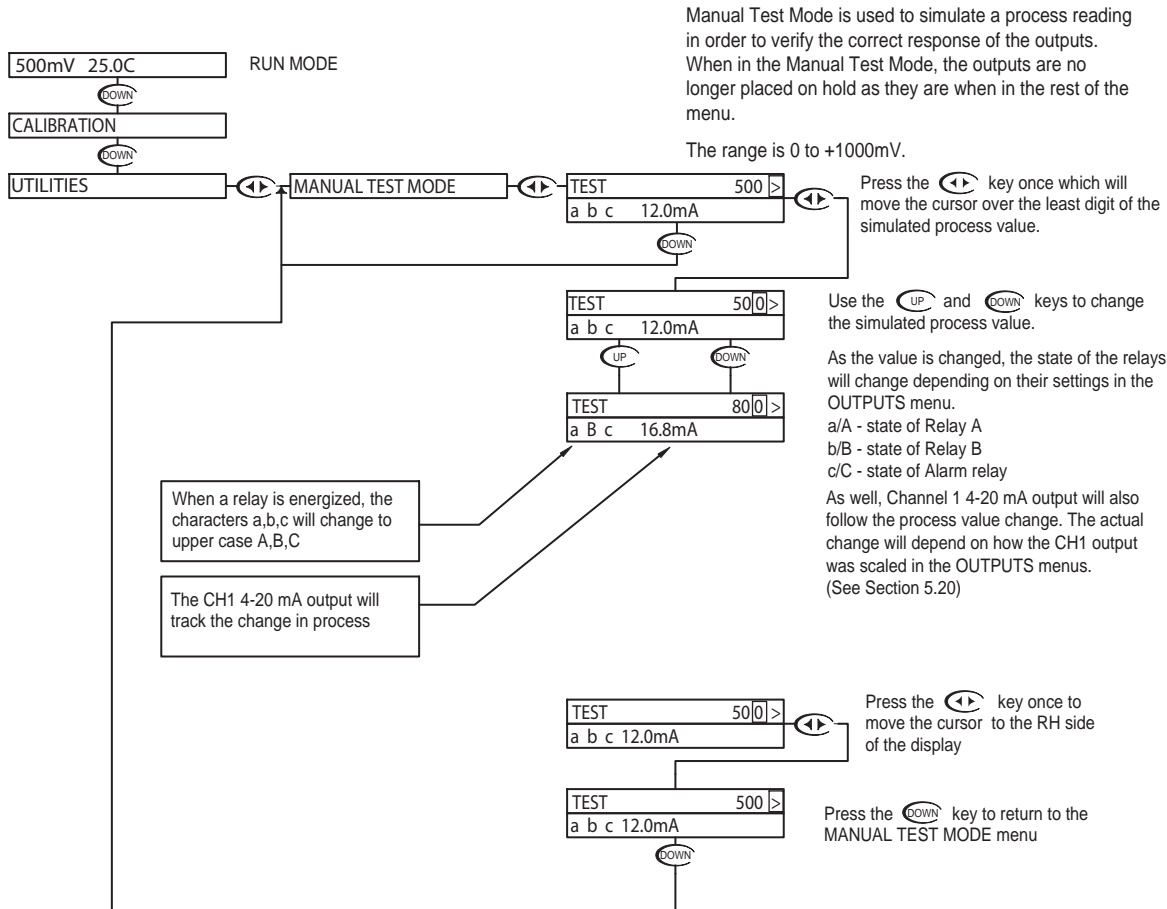


ORP - Calibration Menu - Temp. Calibration 5.2





ORP - Utilities Menu - Manual Test Mode 5.3



**NOTE:**  
 When the user exits the Manual Test Mode, the relays and 4-20mA outputs will remain in the Test Mode state until the operator enters the run mode. The relays and outputs will then revert back to the previous On-line state.

**NOTE**  
 PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



ORP - Utilities Menu - Relay Override 5.4

500mV 25.0C RUN MODE

CALIBRATION

UTILITIES

MANUAL TEST MODE

RELAY OVERRIDE

Relay Override is used to manually override the state of the relays, the user is able to set the operating mode of the relay as AUTO/ON/OFF (the default and run mode state are AUTO). This feature can be used to turn the relays ON or OFF to manually correct the process, or to shut down an ancillary device to perform maintenance. When in the Relay Override mode, the outputs are no longer placed on hold as they are when in the other menus.

To use the Relay Override function, press the **←** key

**CAUTION:**  
Note that if the Relay Auto Return Menu is set to "ON", the controller will place all these settings back to AUTO if the controller is put back in run mode, and there is no button activity for 10 minutes.

RELAY OVERRIDE  
RELAY A AUTO

If you wish to Override Relay A, Press the **←** key once which will move the cursor over to the AUTO/ON/OFF text

Use the **↑** or **↓** key to change the Override state from AUTO - controlled by process settings  
ON - relay forced on  
OFF - relay forced off  
The relay will react immediately.

If you wish to accept the Override setting, Press the **←** key once to move the cursor to the RH of the display

If you do not wish to Override Relay A, then use the **↓** key to move to Relay B

Then use the **↓** key to move to the Override setting for Relay A

RELAY OVERRIDE  
RELAY A AUTO

RELAY OVERRIDE  
RELAY A AUTO

RELAY OVERRIDE  
RELAY A ON

RELAY OVERRIDE  
RELAY A ON

RELAY OVERRIDE  
RELAY A OFF

RELAY OVERRIDE  
RELAY A OFF

RELAY OVERRIDE  
RELAY B AUTO

If you wish to Override Relay B, Press the **←** key once which will move the cursor over to the AUTO/ON/OFF text

Use the **↑** or **↓** key to change the Override state from AUTO - controlled by process settings  
ON - relay forced on  
OFF - relay forced off  
The relay will react immediately.

If you wish to accept the Override setting, Press the **←** key once to move the cursor to the RH of the display

If you do not wish to Override Relay B, then use the **↓** key to move to the Alarm Relay

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

Then use the **↓** key to move to the Override setting for Relay B

RELAY OVERRIDE  
RELAY B AUTO

RELAY OVERRIDE  
RELAY B AUTO

RELAY OVERRIDE  
RELAY B ON

RELAY OVERRIDE  
RELAY B ON

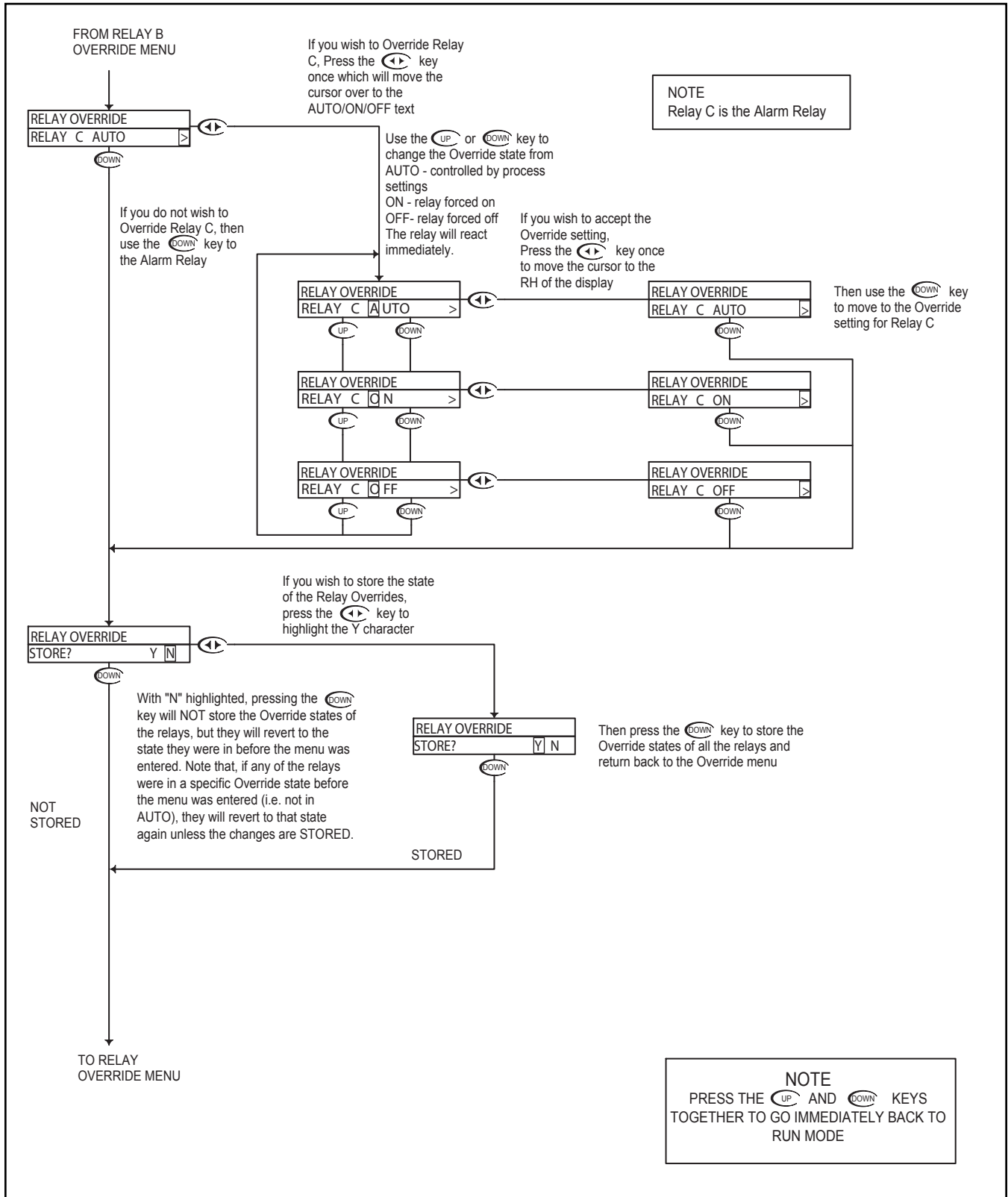
RELAY OVERRIDE  
RELAY B OFF

RELAY OVERRIDE  
RELAY B OFF

To Alarm Relay (Relay C) Override

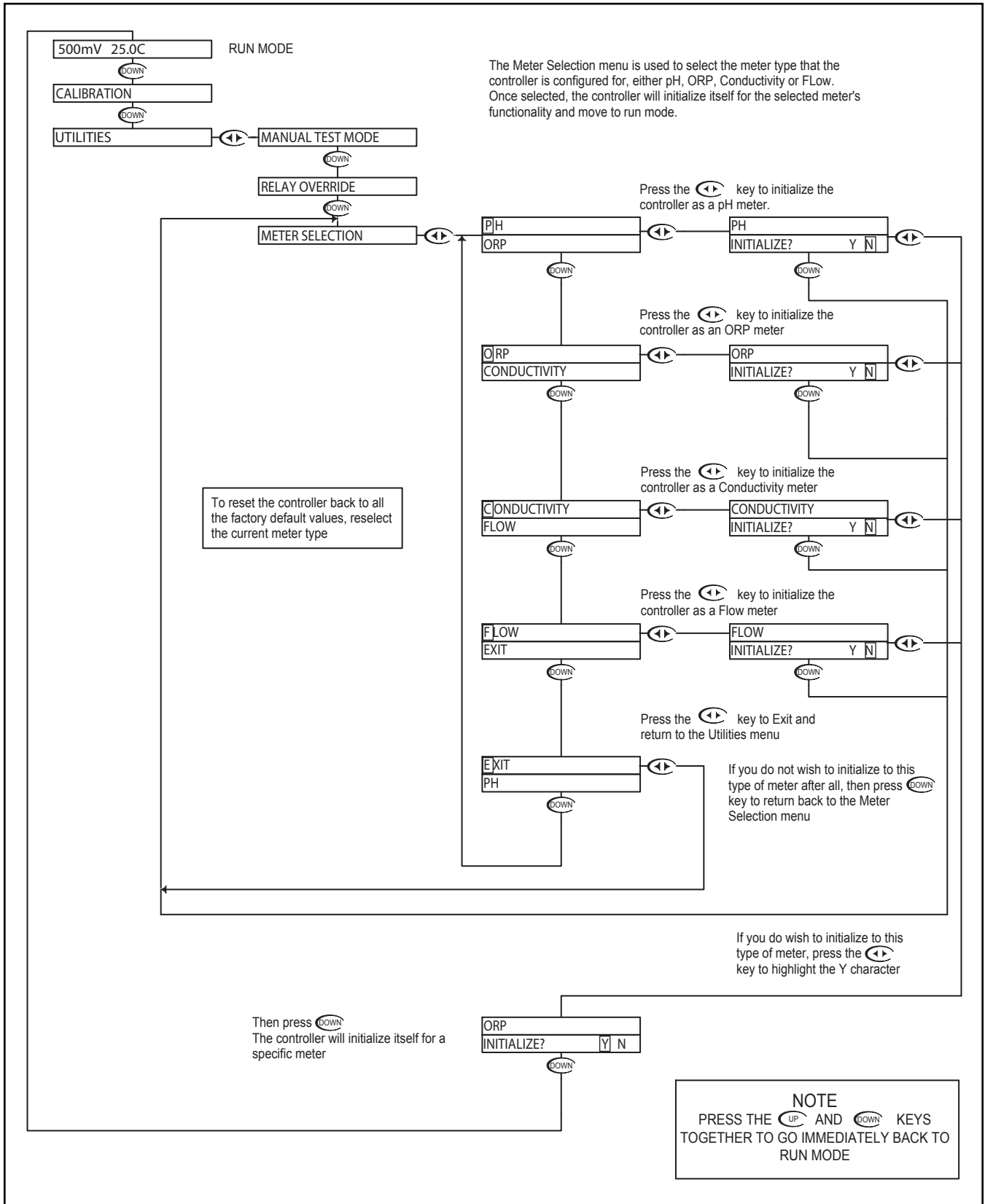


ORP - Utilities Menu - Relay Override 5.4





ORP - Utilities Menu - Meter Selection 5.5







ORP - Utilities Menu - Overfeed Timer Reset 5.6

500mV 25.0C RUN MODE



CALIBRATION



UTILITIES

MANUAL TEST MODE



RELAY OVERRIDE



METER SELECTION



RESET OVERFD TMR

If the control relay overfeed timer has been enabled, the relay will "time out" after the specified overfeed time. When the relay times out, it must be manually reset. The time out will be signaled by the time out LED flashing on the front panel.

The reset overfeed timer will reset the timers for both relay A & relay B at the same time.

Press the key to choose between Y or N.

RESET OVERFD TMR Y N

RESET OVERFD TMR Y N

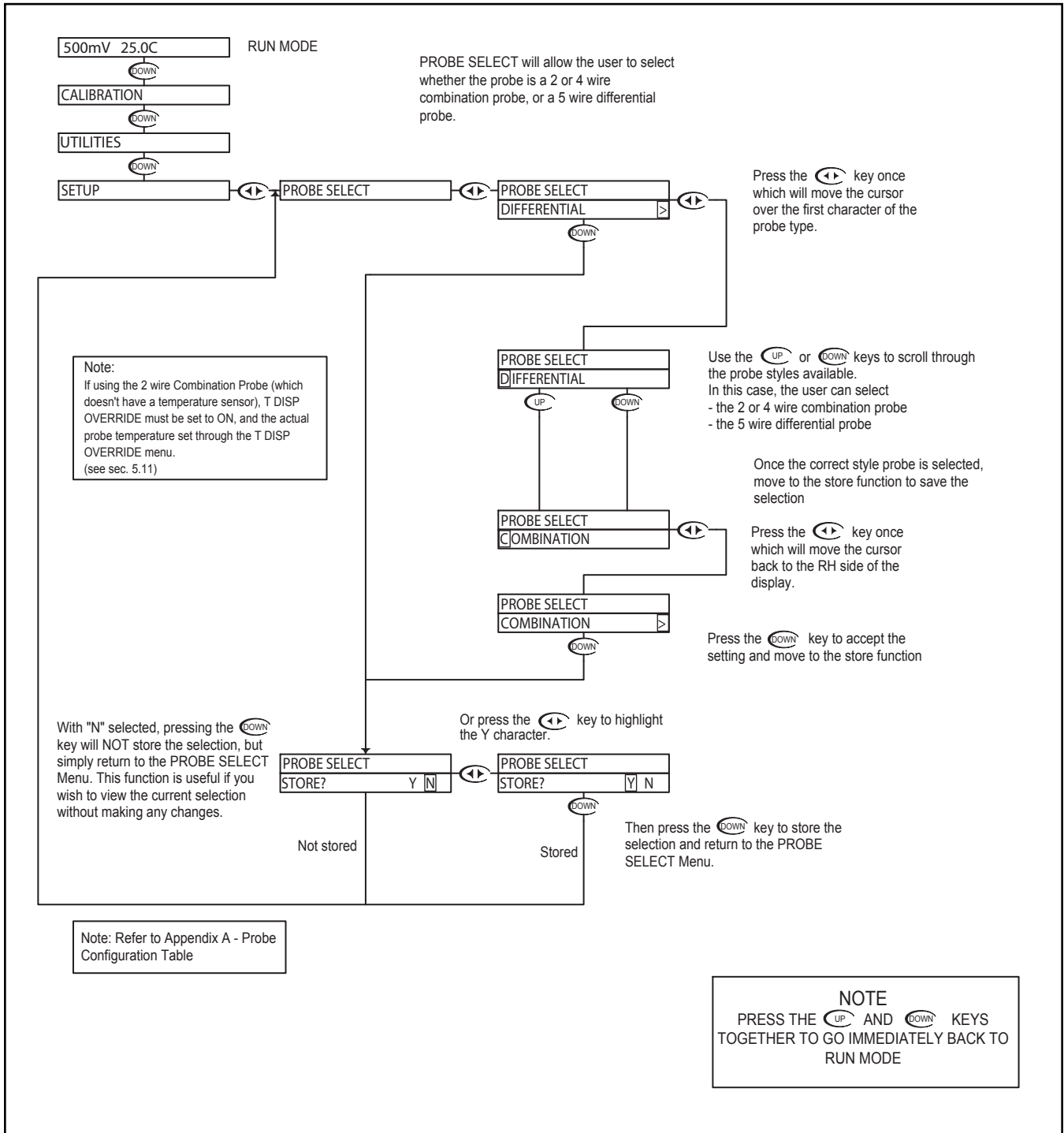
If you wish to reset the overfeed timer, then press the key to proceed and return back to the Utilities menu.

If you do not wish to reset the overfeed timer after all, press the key to highlight the N character and press the key to return back to the Utilities menu.

**NOTE**  
PRESS THE AND KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

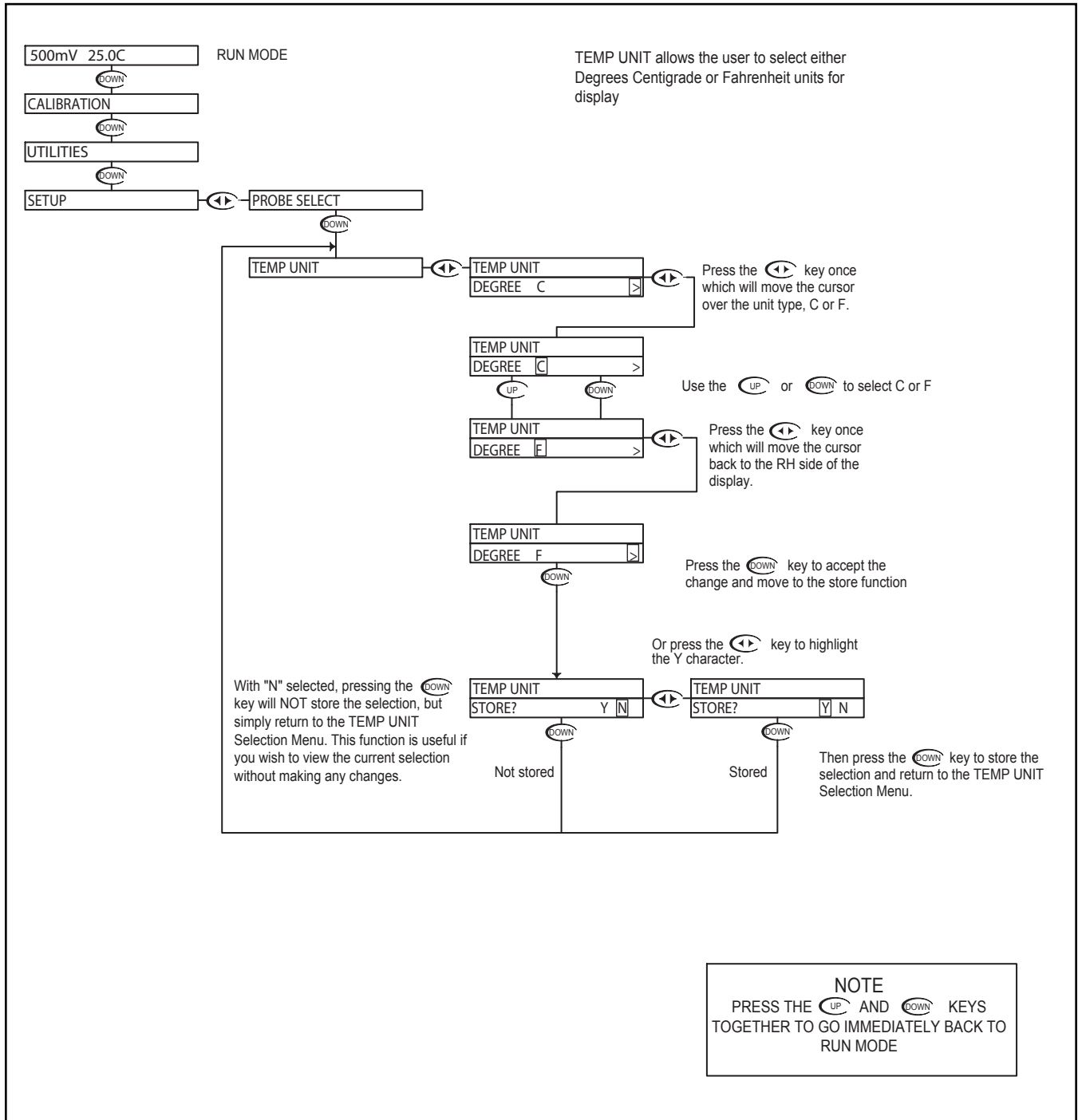


ORP - Setup Menu - Probe Select 5.7





ORP - Setup Menu - Temp. Unit 5.8





ORP - Setup Menu - Temp. Sensor 5.9

500mV 25.0C RUN MODE

DOWN

CALIBRATION

DOWN

UTILITIES

DOWN

SETUP

PROBE SELECT

DOWN

TEMP UNIT

TEMP SENSOR

TEMP SENSOR  
300 NTC

Press the **←→** key once which will move the cursor over to the sensor type.

Use the **↑** or **↓** to select the sensor type

TEMP SENSOR  
300 Ω NTC

Once the correct Sensor has been selected press the **←→** key once which will move the cursor back to the RH side of the display.

UP DOWN

TEMP SENSOR  
1000 Ω RTD

TEMP SENSOR  
3000 Ω NTC

TEMP SENSOR  
300 NTC

Press the **DOWN** key to accept the change and move to the store function

Or press the **←→** key to highlight the Y character.

TEMP SENSOR  
STORE? Y N

TEMP SENSOR  
STORE? Y N

With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the TEMP SENSOR Selection Menu. This function is useful if you wish to view the current selection without making any changes.

Not stored

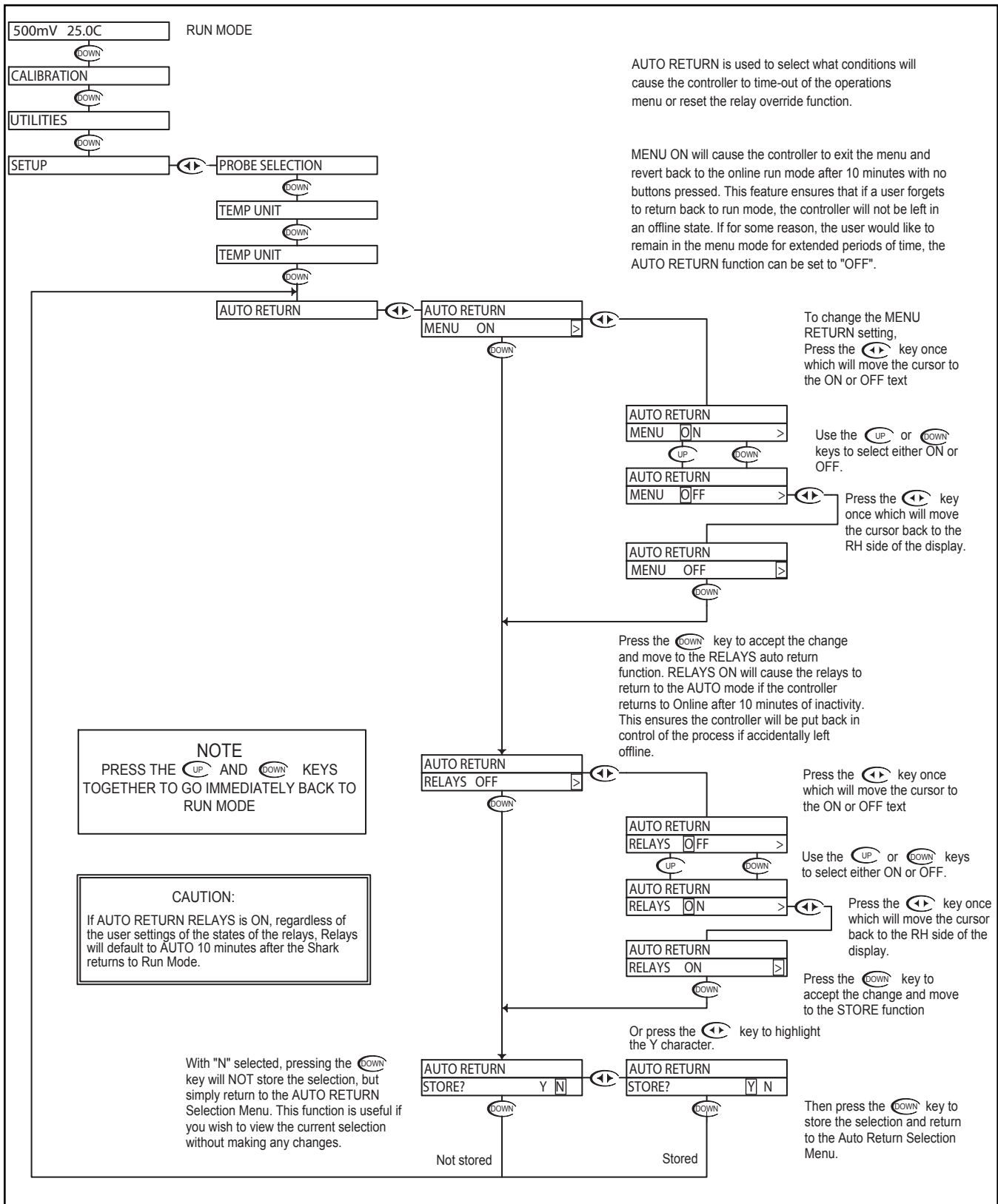
Stored

Then press the **DOWN** key to store the selection and return to the TEMP SENSOR Selection Menu.

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



ORP - Setup Menu - Auto Return 5.10





ORP - Setup Menu - Temp. Display Override 5.11

500mV 25.0C RUN MODE

CALIBRATION

UTILITIES

SETUP

PROBE SELECTION

TEMP UNIT

TEMP SENSOR

AUTO RETURN

T. DISP OVERRIDE

T. Display Override is used to blank the Temperature Display on the LCD menu and place 4 dots on the LED menu when Temp display is requested. This is to ensure the user isn't shown a temperature value that isn't valid.

T. DISP OVERRIDE  
OVERRIDE OFF

Press the key once which will move the cursor to the ON or OFF text

T. DISP OVERRIDE  
OVERRIDE OFF

Use the or keys to select either ON or OFF.

T. DISP OVERRIDE  
OVERRIDE ON

Press the key once which will move the cursor back to the RH side of the display.

T. DISP OVERRIDE  
OVERRIDE ON

Press the key to accept the change and move to the store function

T. DISP OVERRIDE  
STORE? Y N

T. DISP OVERRIDE  
STORE? Y N

If you wish to save the setting, press the key to highlight the Y character

With "N" selected, pressing the key will NOT store the selection, but simply return to the T. Disp. Override Menu. This function is useful if you wish to view the current selection without making any changes.

Not stored

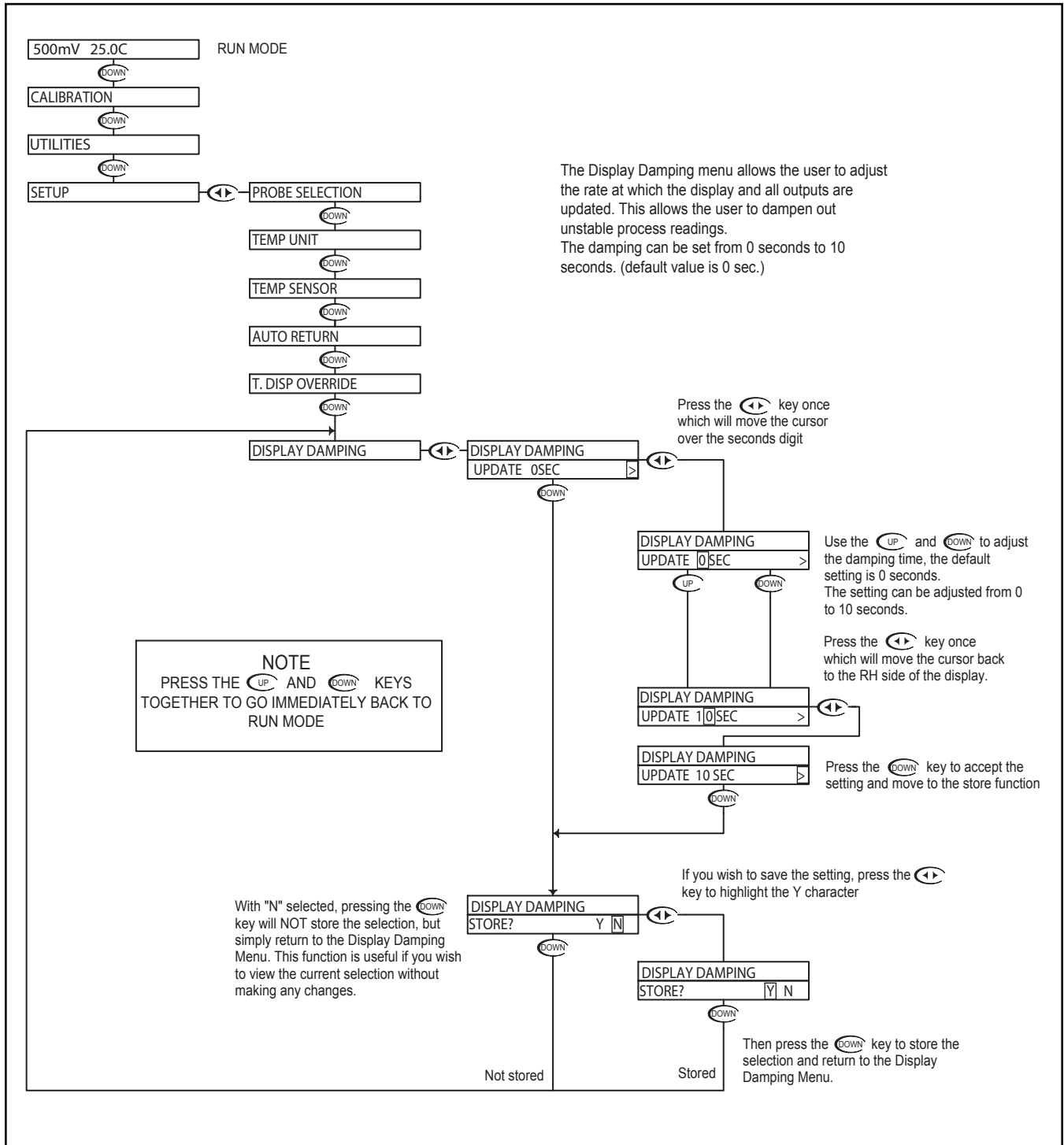
Stored

Then press the key to store the selection and return to the T. DISP OVERRIDE Menu.

**NOTE**  
PRESS THE AND KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

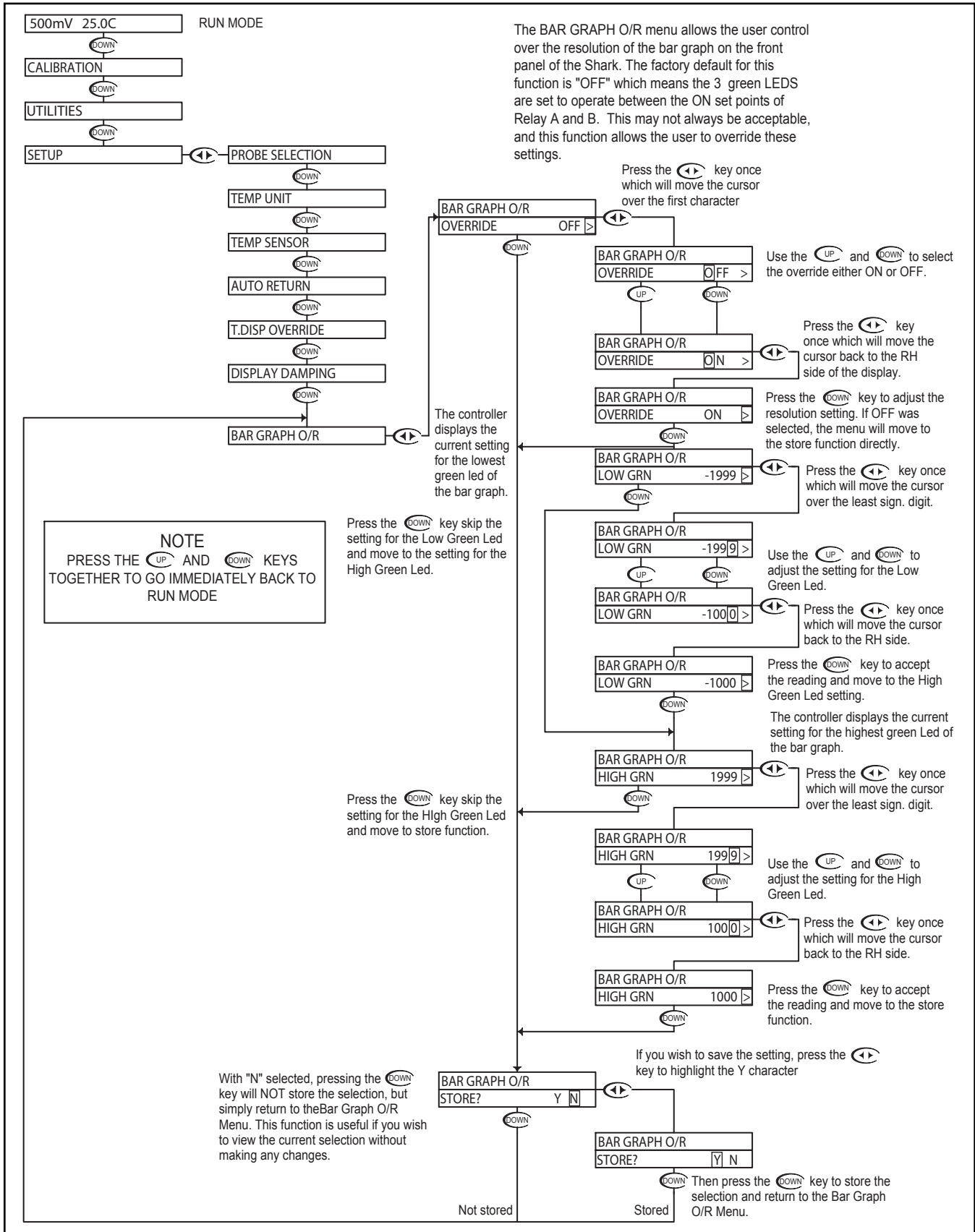


ORP - Setup Menu - Display Damping 5.12





ORP - Setup Menu - Bar Graph O/R 5.13



The BAR GRAPH O/R menu allows the user control over the resolution of the bar graph on the front panel of the Shark. The factory default for this function is "OFF" which means the 3 green LEDs are set to operate between the ON set points of Relay A and B. This may not always be acceptable, and this function allows the user to override these settings.

Press the **LEFT** key once which will move the cursor over the first character

Use the **UP** and **DOWN** to select the override either ON or OFF.

Press the **LEFT** key once which will move the cursor back to the RH side of the display.

Press the **DOWN** key to adjust the resolution setting. If OFF was selected, the menu will move to the store function directly.

Press the **LEFT** key once which will move the cursor over the least sign. digit.

Use the **UP** and **DOWN** to adjust the setting for the Low Green Led.

Press the **LEFT** key once which will move the cursor back to the RH side.

Press the **DOWN** key to accept the reading and move to the High Green Led setting.

The controller displays the current setting for the highest green Led of the bar graph.

Press the **LEFT** key once which will move the cursor over the least sign. digit.

Use the **UP** and **DOWN** to adjust the setting for the High Green Led.

Press the **LEFT** key once which will move the cursor back to the RH side.

Press the **DOWN** key to accept the reading and move to the store function.

If you wish to save the setting, press the **LEFT** key to highlight the Y character

With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the Bar Graph O/R Menu. This function is useful if you wish to view the current selection without making any changes.

Not stored

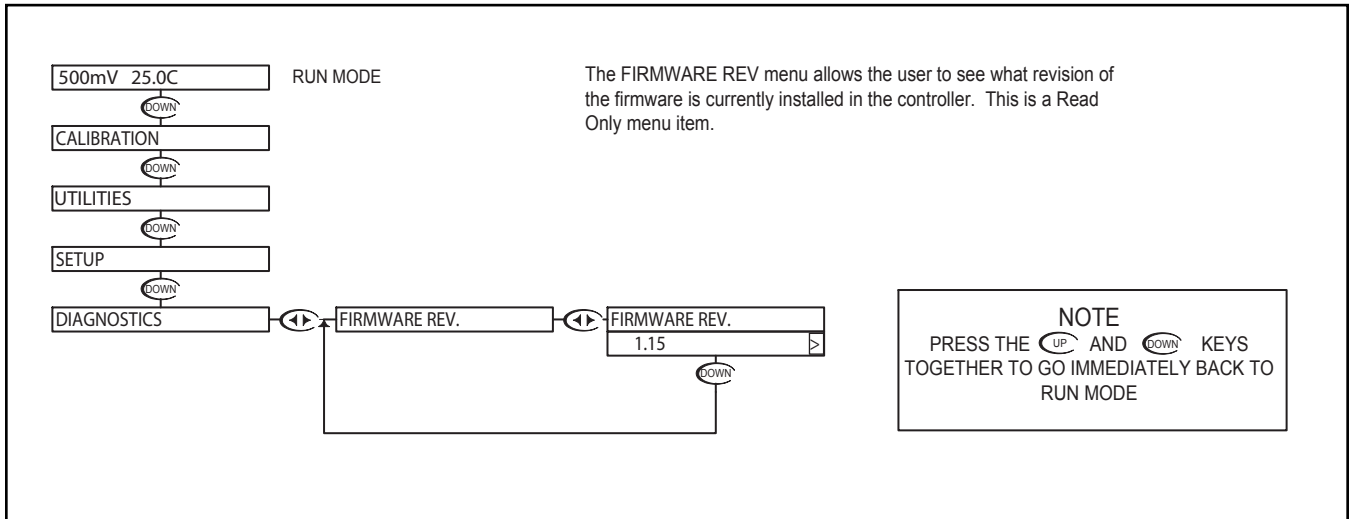
Stored

Then press the **DOWN** key to store the selection and return to the Bar Graph O/R Menu.



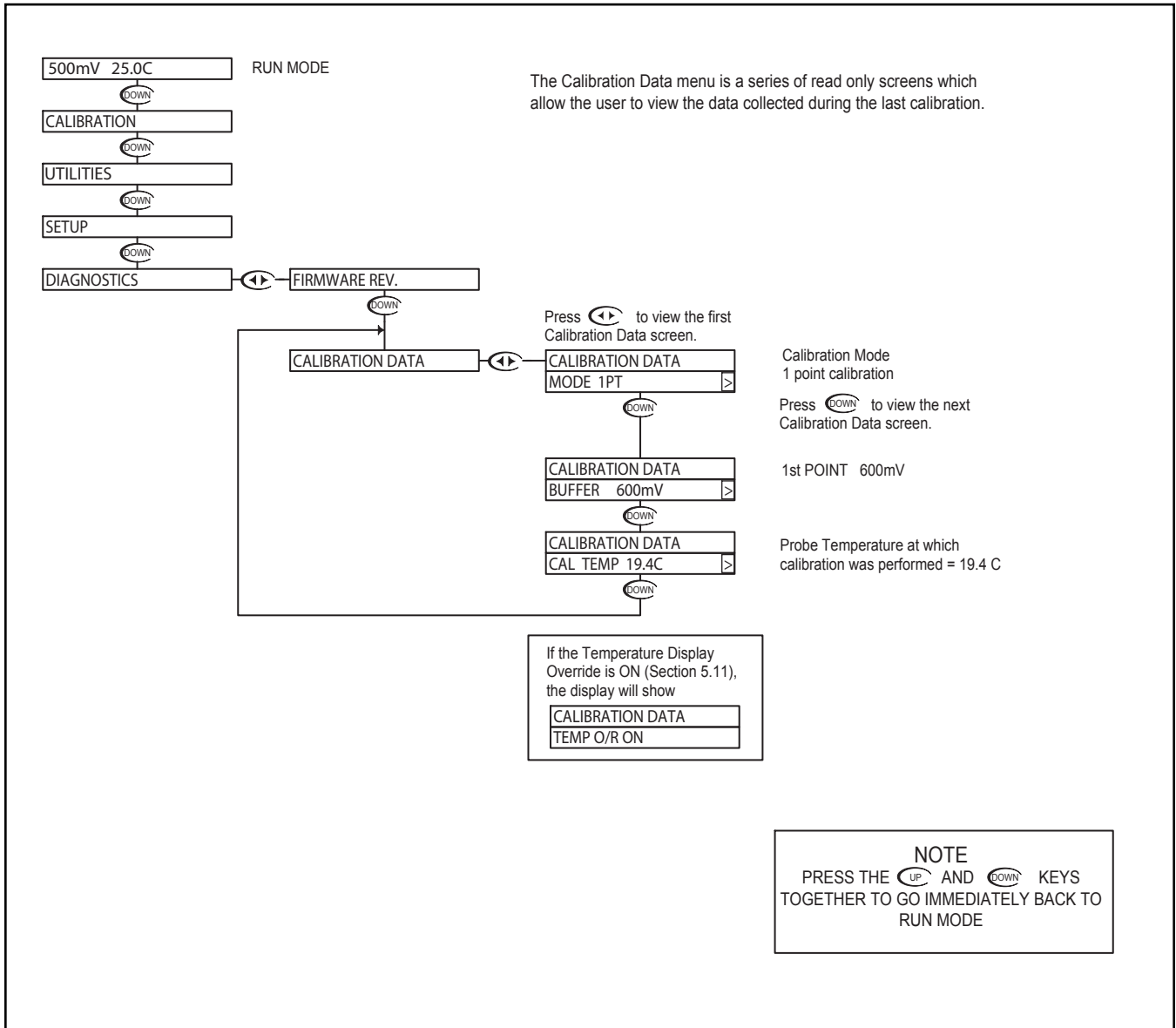


ORP - Diagnostics Menu - Firmware Rev 5.14





ORP - Diagnostics Menu - Calibration Data 5.15





# ORP - Diagnostics Menu - Sensor Input 5.16

500mV 25.0C RUN MODE



CALIBRATION



UTILITIES



SETUP



DIAGNOSTICS

FIRMWARE REV.



CALIBRATION DATA



SENSOR INPUT

PROBE 500mV  
TEMP 331Ω

The Sensor Input Menu allows the user to view real time, uncompensated process data from the probe. This is a Read only menu item.

Press to view the Sensor Input data.

The top line shows the mV input from the probe  
The bottom line shows the actual value of the temperature sensor in ohms.

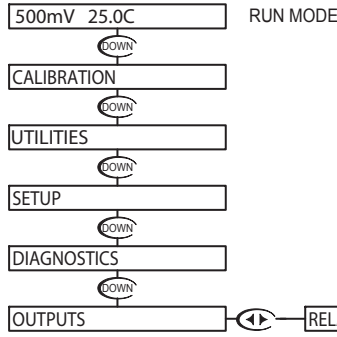
If the Probe is not equipped with a Temperature Sensing Device, and Temperature Display Override is ON (Section 5.11), the display will show

PROBE 500mV
TEMP O/R ON

**NOTE**  
PRESS THE AND KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



ORP - Outputs Menu - Relay A 5.17



- Relay A can be configured for the following operations
- Response to rising or falling process values
  - Adjustable on and off set-points
  - Cycle on and off times
  - Failsafe operation

The relay can be set to control either a RISING or FALLING process.

In a FALLING process, the control relay will energize when the process falls below a set value. In this case, the ON set-point must be set lower than the OFF set-point.

In a RISING process, the control relay will energize when the process rises above a set value. In this case, the ON set-point must be set higher than the OFF set-point.

The RELAY ON setting is the process value at which the relay will energize. It may be set anywhere between 0-100% of the range.

The RELAY OFF setting is the process value at which the relay will de-energize. The setting must be rationalized against the On setting. For example, in a falling process, the Off setting must be higher than the On setting.

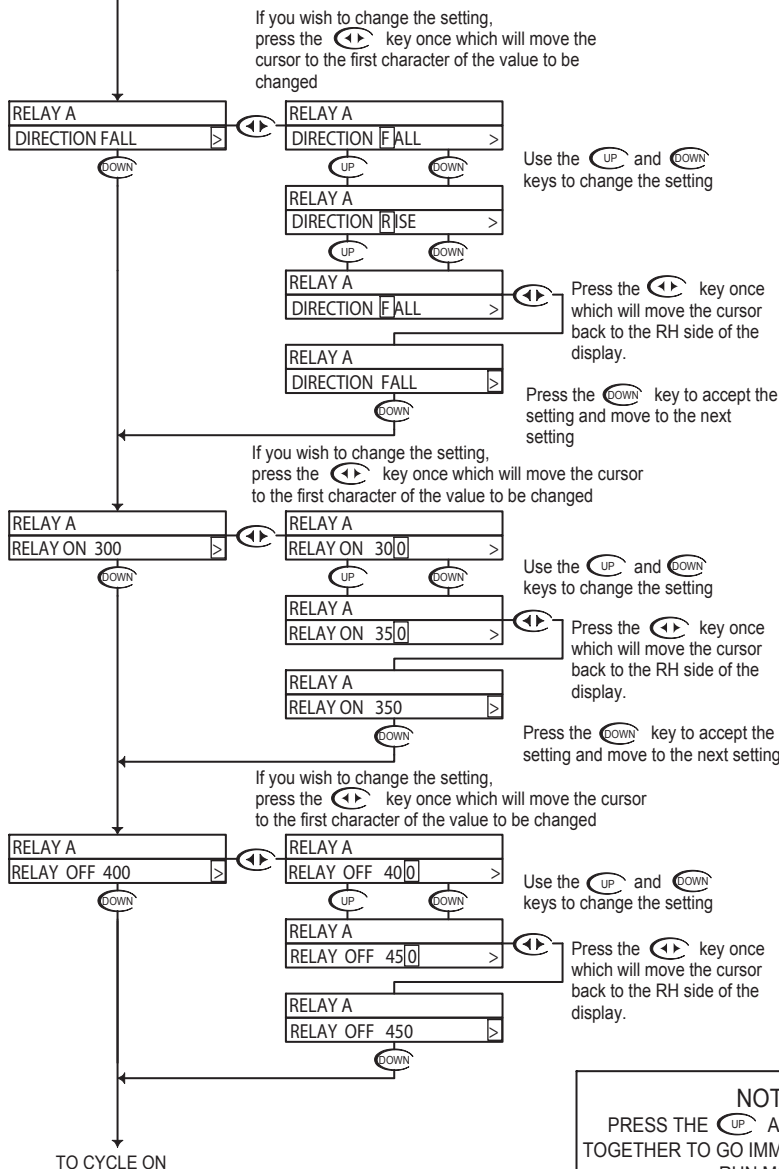
The controller will not allow you to select the RELAY OFF value on the wrong side of the RELAY ON value for the selected direction. If the user tries to set the RELAY OFF on the wrong side, the following errors will be displayed:

FALLING PROCESS  
ON SPT < OFF SPT

Error when trying to set OFF point lower than ON point when set to falling.

RISING PROCESS  
ON SPT > OFF SPT

Error when trying to set OFF point higher than ON point when set to rising.



**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



ORP - Outputs Menu - Relay A 5.17

The relay can be set to CYCLE when the process is between the RELAY ON setting and the RELAY OFF setting. This is meant to help eliminate overshoot.

The CYCLE ON time is the amount of time in seconds that the relay will be on. The value can be set between 0 and 600 seconds. The default ON time is 5 seconds.

NOTE
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

The CYCLE OFF time is the amount of time in seconds that the relay will be off for, it can be set between 0 - 600 seconds.

To disable the cycling feature set the cycle off time to 0.

The Default OFF time is 0 seconds.

The OVERFEED TIMER is designed to help safeguard against a process or instrumentation error causing one of the control relays to remain energized for extended periods of time.

When enabled, the user must select the desired overfeed timeout time (1-999 min.)

If the overfeed timer times out:

- Alarm relay will energize.
Control (A&B) will de-energize
LED on front will flash

Must be reset via Utilities Menu or Power reset.

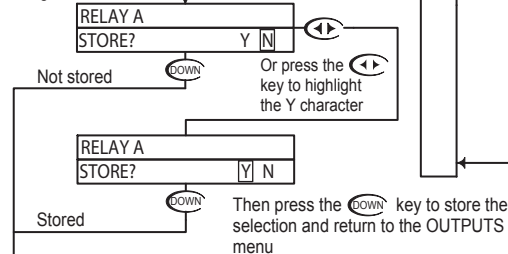
The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

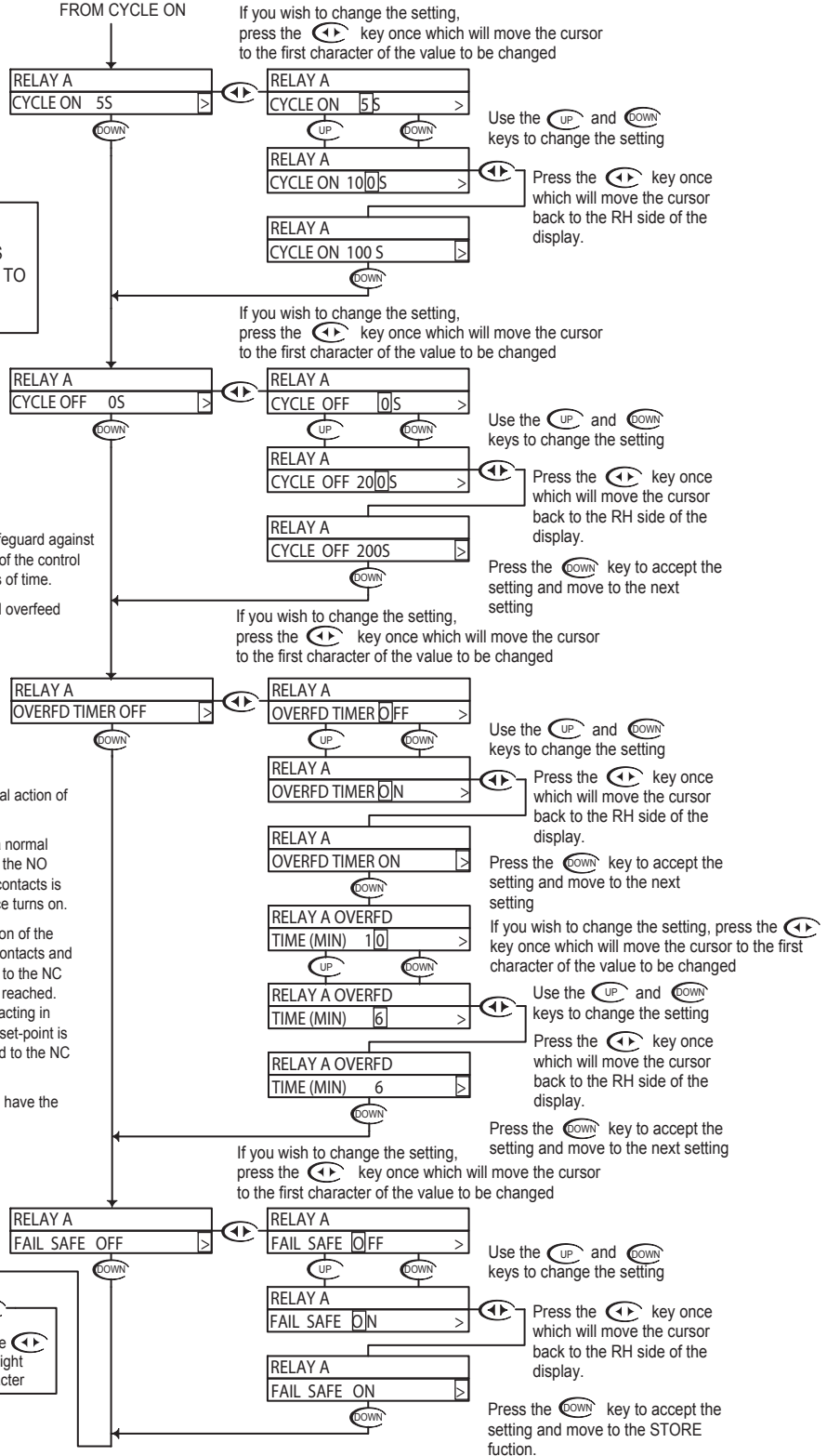
When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption.

With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



TO OUTPUTS MENU





ORP - Outputs Menu - Relay B 5.18

500mV 25.0C RUN MODE

CALIBRATION

UTILITIES

SETUP

DIAGNOSTICS

OUTPUTS

RELAY A

RELAY B

RELAY B  
DIRECTION RISE

Relay B can be configured for the following operations

- Response to rising or falling process values
- Adjustable on and off set-points
- Cycle on and off times
- Failsafe operation

Each function will be explained below

The relay can be set to control either a RISING or FALLING process.

In a RISING process, the control relay will energize when the process rises above a set value. In this case, the ON set-point must be set higher than the OFF set-point.

In a FALLING process, the control relay will energize when the process falls below a set value. In this case, the ON set-point must be set lower than the OFF set-point.

The RELAY ON setting is the process value at which the relay will energize. It may be set anywhere between 0-100% of the range.

The RELAY OFF setting is the process value at which the relay will de-energize. The setting must be rationalized against the On setting. For example, in a falling process, the Off setting must be higher than the ON setting.

The controller will not allow you to select the RELAY OFF value on the wrong side of the RELAY ON value for the selected direction. If the user tries to set the RELAY OFF on the wrong side, the following errors will be displayed:

FALLING PROCESS  
ON SPT < OFF SPT

Error when trying to set OFF point lower than ON point when set to falling.

RISING PROCESS  
ON SPT > OFF SPT

Error when trying to set OFF point higher than ON point when set to rising.

If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed

RELAY B  
DIRECTION RISE

RELAY B  
DIRECTION RISE

Use the **↑** and **↓** keys to change the setting

RELAY B  
DIRECTION FALL

RELAY B  
DIRECTION RISE

Press the **←→** key once which will move the cursor back to the RH side of the display.

RELAY B  
DIRECTION RISE

RELAY B  
DIRECTION RISE

Press the **↓** key to accept the setting and move to the next setting

If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed

RELAY B  
RELAY ON 700

RELAY B  
RELAY ON 700

Use the **↑** and **↓** keys to change the setting

RELAY B  
RELAY ON 800

RELAY B  
RELAY ON 800

Press the **←→** key once which will move the cursor back to the RH side of the display.

RELAY B  
RELAY ON 800

RELAY B  
RELAY ON 800

Press the **↓** key to accept the setting and move to the next setting

If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed

RELAY B  
RELAY OFF 600

RELAY B  
RELAY OFF 600

Use the **↑** and **↓** keys to change the setting

RELAY B  
RELAY OFF 750

RELAY B  
RELAY OFF 750

Press the **←→** key once which will move the cursor back to the RH side of the display.

RELAY B  
RELAY OFF 750

RELAY B  
RELAY OFF 750

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

TO CYCLE ON



ORP - Outputs Menu - Relay B 5.18

The relay can be set to CYCLE when the process is between the RELAY ON setting and the RELAY OFF setting. This is meant to help eliminate overshoot.

The CYCLE ON time is the amount of time in seconds that the relay will be on. The value can be set between 0 and 600 seconds. The default ON time is 5 seconds.

NOTE
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

The CYCLE OFF time is the amount of time in seconds that the relay will be off for, it can be set between 0 - 600 seconds.

To disable the cycling feature set the cycle off time to 0.

The Default OFF time is 0 seconds.

The OVERFEED TIMER is designed to help safeguard against a process or instrumentation error causing one of the control relays to remain energized for extended periods of time.

When enabled, the user must select the desired overfeed timeout time (1-999 min.)

If the overfeed timer times out:

- Alarm relay will energize.
Control (A&B) will de-energize
LED on front will flash

Must be reset via Utilities Menu or Power reset.

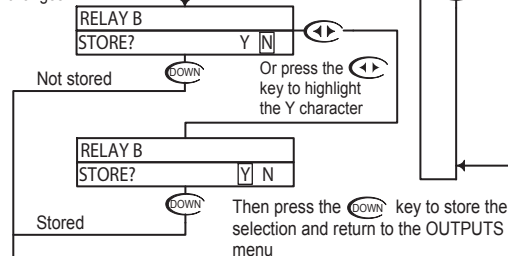
The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

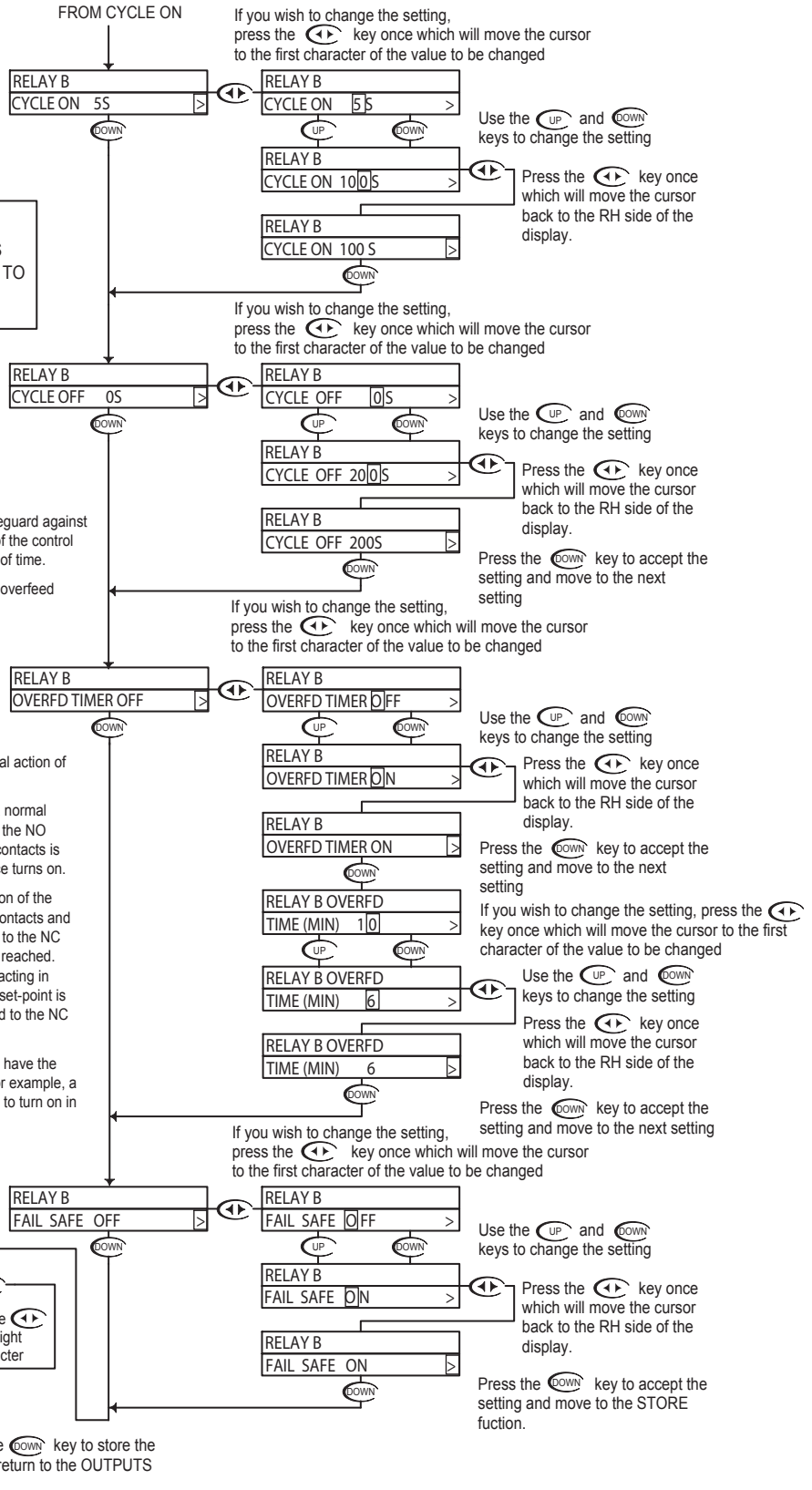
When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption. For example, a process that needs a constant feed, would want a pump to turn on in the event of a controller power failure.

With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.

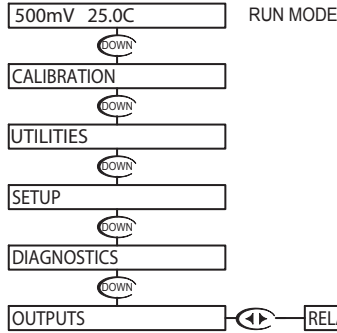


TO OUTPUTS MENU





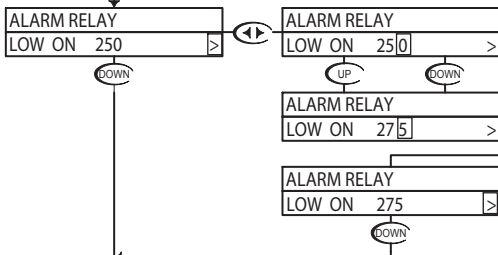
ORP - Outputs Menu - Alarm Relay 5.19



The ALARM RELAY will respond to both a rising and falling process. The ALARM RELAY will act as a low alarm (falling process) and a high alarm (rising process). Both relay bands will have independently adjustable on and off set-points. If a low alarm set-point is set at a value 800mV for example, the off set-point must be set higher. The controller will not let the user input a value below 800mV. The same rule holds true for the high alarm.

- The Alarm Relay can be configured for the following operations
- LOW ON Set-point
  - LOW OFF Set-point
  - HIGH ON Set-point
  - HIGH OFF Set-point
  - Failsafe

The LOW ON set point is the low process value that will cause the relay to energize. This value can be set anywhere 0-100% of Full Scale.



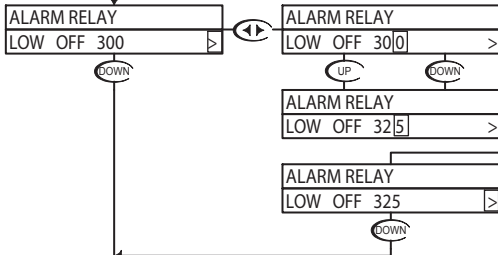
If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed

Use the **↑** and **↓** keys to change the setting

Press the **←→** key once which will move the cursor back to the RH side of the display.

Press the **↓** key to accept the setting and move to the next setting

The LOW OFF set point is the value that the process must reach in order to de-energize the alarm relay after it has dropped below and tripped the LOW ON set-point. This value must be higher than the LOW ON Set-point.



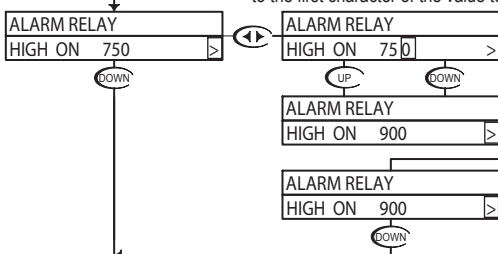
If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed

Use the **↑** and **↓** keys to change the setting

Press the **←→** key once which will move the cursor back to the RH side of the display.

Press the **↓** key to accept the setting and move to the next setting

The HIGH ON set-point is the high process value that will cause the relay to energize. This value can be set anywhere 0-100% of Full Scale.



If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed

Use the **↑** and **↓** keys to change the setting

Press the **←→** key once which will move the cursor back to the RH side of the display.

TO HIGH OFF

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE





ORP - Outputs Menu - Alarm Relay 5.19

The HIGH OFF set-point is the value that the must reach in order to de-energize the alarm relay after it has increased over and tripped the HIGH ON set-point. This value must be lower than the HIGH ON Set-point.

The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption.

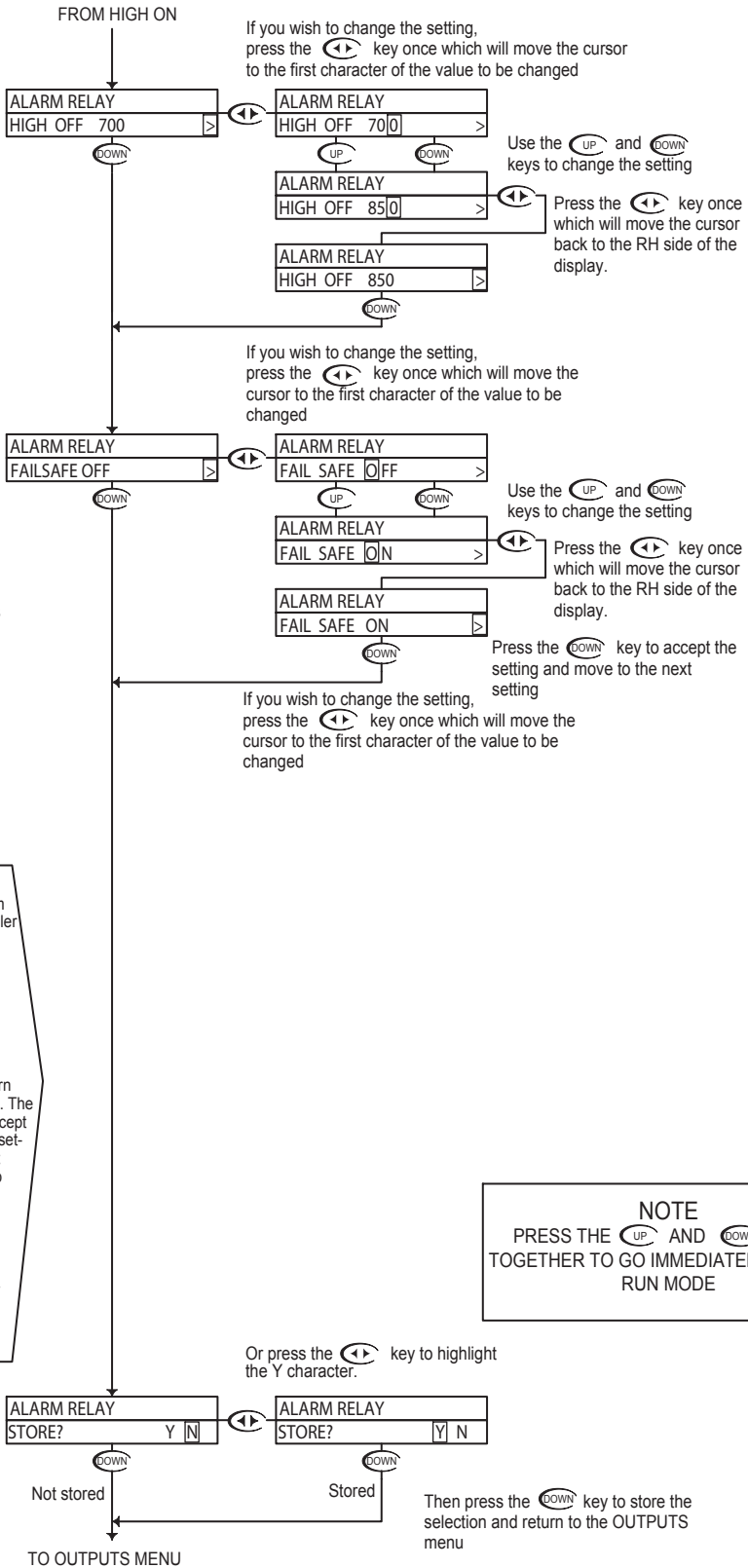
If the Low On set-point is set higher than the factory default Low Off set-point, when the user advances from the low on set-point to the Low Off set-point the controller will adjust the Low Off set-point to be equal to the Low On set-point. If the user then tries to decrease the Low Off set-point the Controller will display the Low Alarm setup error screen.

LOW ALARM  
ON SPT < OFF SPT

This screen will be displayed for 10 seconds, then return back to the setup screen that was previously displayed. The same conditions apply to the High alarm set-points. Except the High Off set-point must be lower than the High On set-point. If the user tries to increase the High Off set-point higher than the High On set-point the High Alarm setup error screen will be displayed.

HIGH ALARM  
ON SPT > OFF SPT

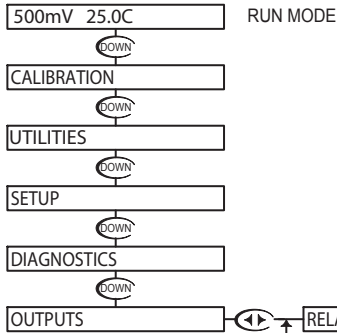
If the user sets the low on set-point and the low off set-point equal to 0, it will disable the Low Alarm relay. Similarly, setting the High On set-point and the HIGH OFF set-point to 0 will disable the High Alarm.



**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



ORP - Outputs Menu - 4-20mA CH1 Output 5.20



The Controller has 2 4-20mA outputs, electrically isolated from each other and ground. Either output can source current into a maximum of 800 ohms. See Section 3.12 for wiring diagram. Channel 1 (the primary output) is located on the flip out door, terminal plug P6. Channel 1 is dedicated to track the process and has fully independent and fully adjustable 4 & 20 mA output adjustments. This will enable the operator to span the output over the desired range.

The example below shows the 4-20 mA set to 4mA =200mV and 20mA = 800mV. The output would then span 4 to 20 mA for a mV swing of 200mV to 800mV. Note that the span can be reversed, in that 4 mA can be set to a high mV value, and 20 mA can be set to a low mV value, effectively reversing the control direction.

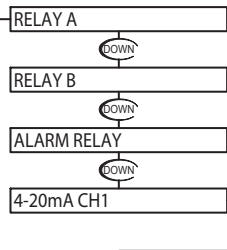
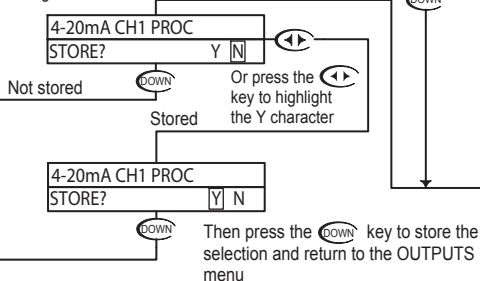
**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

The TUNE function allows the user to precisely adjust the 4-20 mA output to compensate for any errors in the output circuitry. Normally, fine tuning the 4-20mA output is not necessary.

To make the adjustment, place an accurate current meter in series with the 4-20 mA output, with the appropriate loads connected. When the TUNE menu is selected, the controller puts 20 mA out the terminals. Use the **UP** or **DOWN** keys to adjust the 20mA output to get exactly 20.

The TUNE value can be adjusted over the range from 0 to 1000, these are unitless numbers used for tuning purposes only.

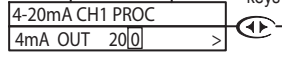
With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



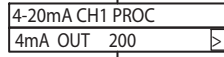
If you wish to change the setting, press the **LEFT** key once which will move the cursor to the first character of the value to be changed



Use the **UP** and **DOWN** keys to change the setting



Press the **LEFT** key once which will move the cursor back to the RH side of the display.

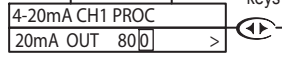


Press the **DOWN** key to accept the setting and move to the next setting

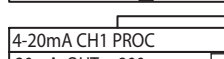
If you wish to change the setting, press the **LEFT** key once which will move the cursor to the first character of the value to be changed



Use the **UP** and **DOWN** keys to change the setting



Press the **LEFT** key once which will move the cursor back to the RH side of the display.

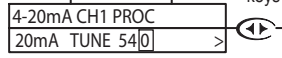


Press the **DOWN** key to accept the setting and move to the next setting

If you wish to change the setting, press the **LEFT** key once which will move the cursor to the first character of the value to be changed



Use the **UP** and **DOWN** keys to change the setting



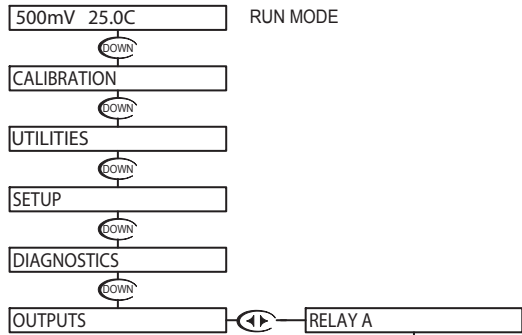
Press the **LEFT** key once which will move the cursor back to the RH side of the display.



Press the **DOWN** key to accept the setting and move to the next setting



ORP - Outputs Menu - 4-20mA CH2 Output 5.21



The Controller has 2 4-20mA outputs, electrically isolated from each other and ground. Either output can source current into a maximum of 800 ohms.

Channel 2 can be selected to track the process or temperature.

Channel 2 has fully independent and fully adjustable 4 & 20 mA output adjustments. This will enable the operator to span the output over the desired range.

Note that if the T DISP OVERRIDE is ON and Channel 2 output is set to track temperature, the output will not change, but hold at a value representing the temperature set in the T DISP OVERRIDE.

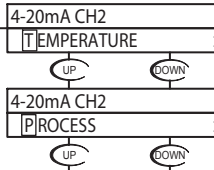
The example below shows the 4-20 mA set to 4mA = 0°C and 20mA = 100°C

The output would then span 4 to 20 mA for a temperature swing of 0°C to 100°C.

Note that the span can be reversed, in that 4 mA can be set to a high process value, and 20 mA can be set to a low process value, effectively reversing the control direction.



If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed



Use the **UP** and **DOWN** keys to change the setting

Press the **←→** key once which will move the cursor back to the RH side of the display.

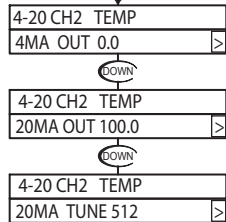
Press the **DOWN** key to accept the setting and move to the next setting

The TUNE function allows the user to precisely adjust the 4-20mA output to compensate for any errors in the output circuitry. Normally, fine tuning the 4-20mA output is not necessary.

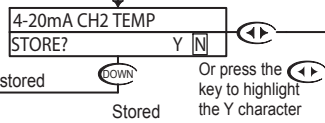
To make the adjustment, place an accurate current meter in series with the 4-20mA output, with the appropriate loads connected. When the TUNE menu is selected, the controller puts 20mA out to the terminals. Use the **UP** or **DOWN** keys to adjust the 20mA output to get exactly 20.

The TUNE value can be adjusted over the range from 0 to 1000, these are unitless numbers used for tuning purposes only.

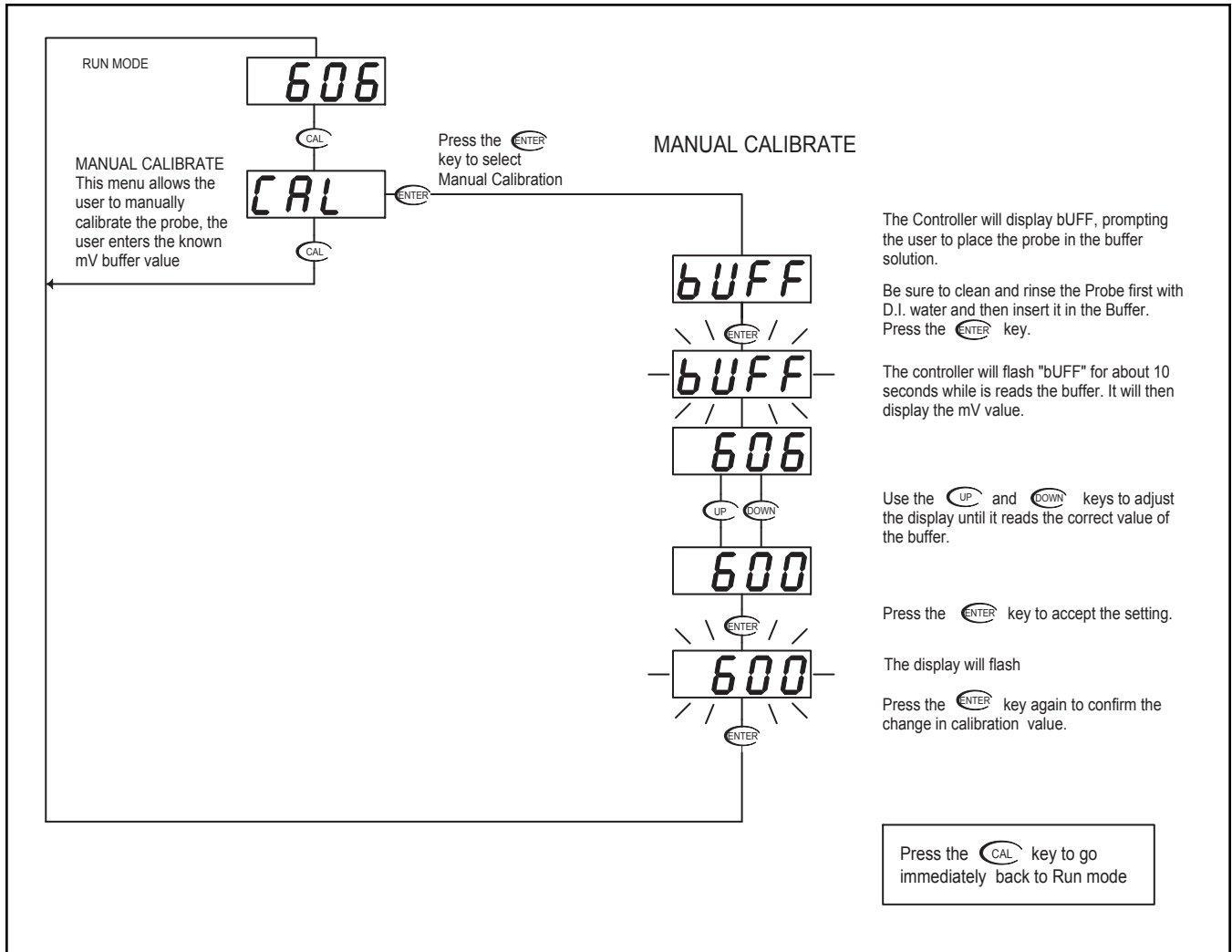
With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



The 4mA, 20mA and TUNE functions are set up the same way as 4 - 20 mA CH 1 output.

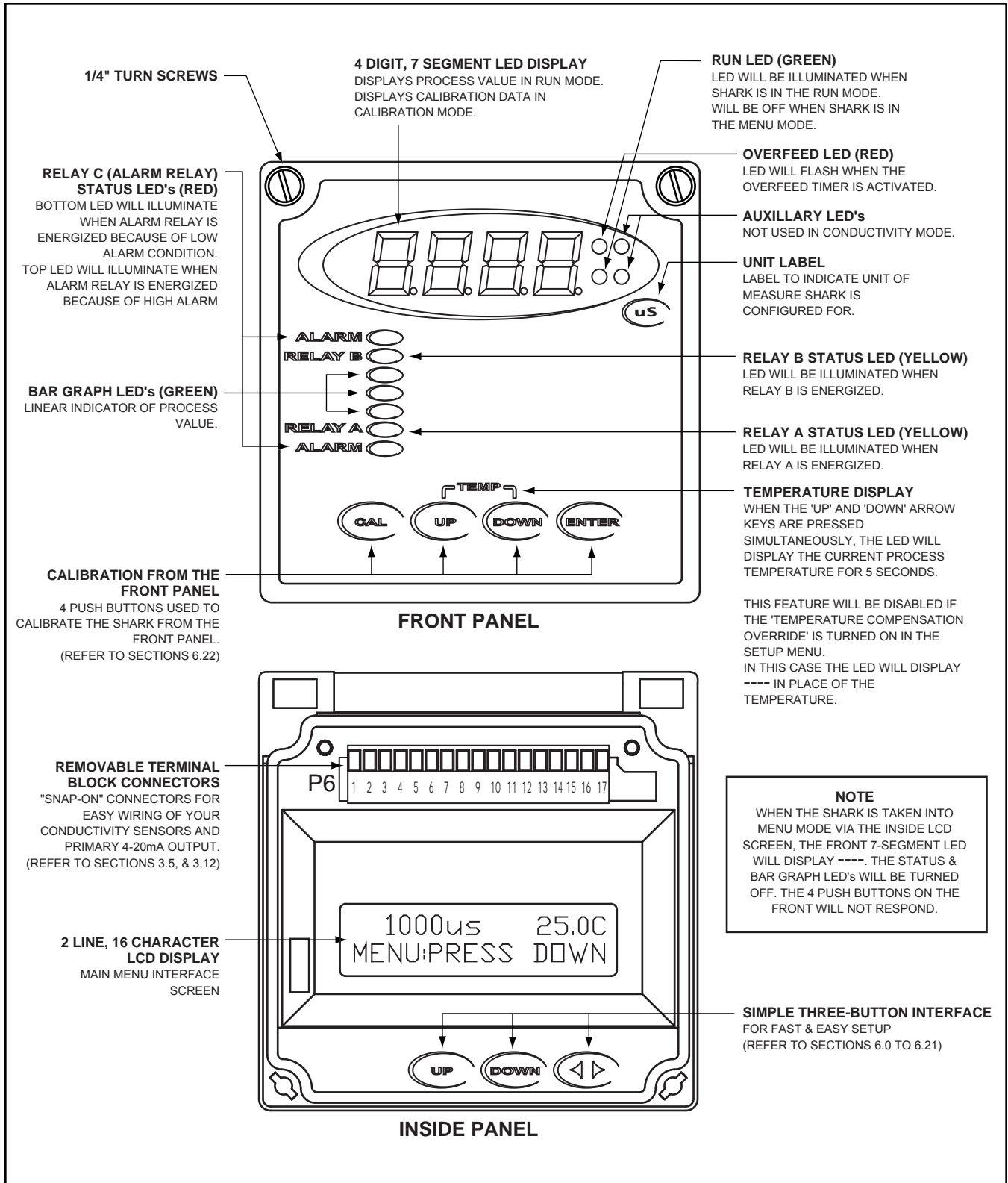


**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



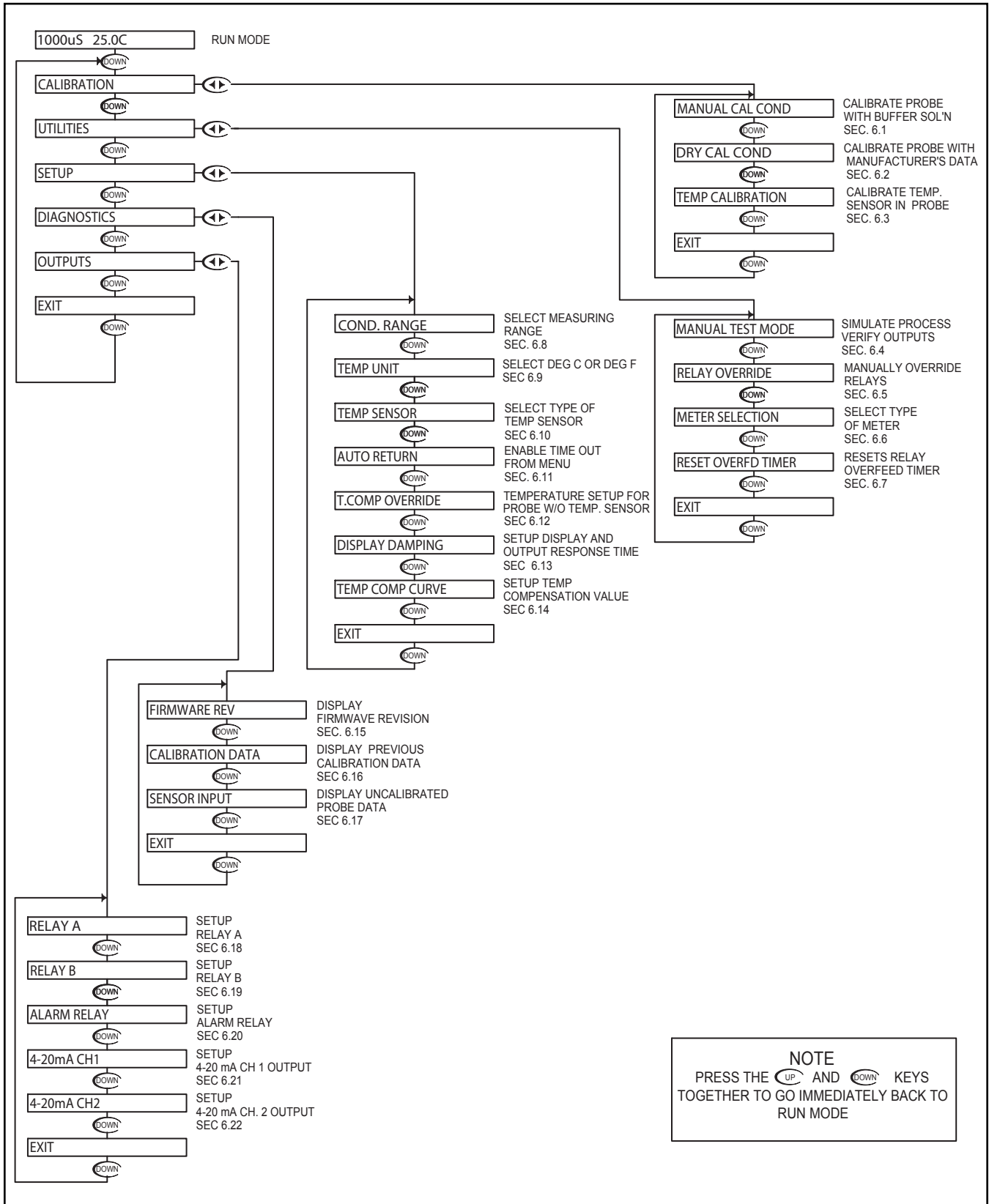


**Section 6 - Using the SHARK in Conductivity Mode**





Conductivity - Menu Overview 6.0



**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Conductivity - Calibration Menu - Manual Calibrate 6.1

Manual Calibration is used to "wet calibrate the cell". This can be done with the cell installed in the process, or with the cell suspended in a known buffer solution.

When calibrated "In Process", the actual conductivity is determined with a grab sample or a hand held meter, and the value entered in the display.

When calibrated with buffers, the cell is placed in a known buffer solution, and the value of the buffer entered on the display.

In both cases, make sure the cell has time to stabilize both in temperature and conductivity before entering any data.

Place the cell in the buffer solution  
The controller will read the Conductivity value, averaging a number of results to get a stable calibration value.

Press the key once which will move the cursor over the least sign. digit of the display.

Use the and keys to adjust the reading until it agrees with the actual buffer conductivity value

Then press to move the cursor to the RH position

If the calibration is OK, use the key to move the cursor over the Y text and press the down key.

Press to store the calibration data and return back to the Manual Cal Cond menu so the user can select another function.

If the calibration did not appear to be correct, press the key which will return back to the Manual Cal Cond menu.

1000uS 25.0C RUN MODE

CALIBRATION

MANUAL CAL COND

MANUAL CAL COND  
967 uS

MANUAL CAL COND  
967 uS

MANUAL CAL COND

MANUAL CAL COND  
1000 uS

MANUAL CAL COND  
1000 uS

MANUAL CAL COND  
STORE? Y N

MANUAL CAL COND  
STORE? Y N

**NOTE**  
PRESS THE AND KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Conductivity - Calibration Menu - Dry Cal Cond 6.2

Dry Calibration eliminates the need for conductivity reference solutions, the user inputs the Cell K factor supplied by the factory.

If the conductivity cell has a tag attached to it, specifying the exact cell constant, the user is prompted to enter this value.

1000uS 25.0C RUN MODE

CALIBRATION MANUAL CAL COND

DRY CAL COND

DRY CALIBRATION K FACTOR 1.0000

Press the [LEFT] key once which will move the cursor over the least sign. digit of the display.

DRY CALIBRATION K FACTOR 1.0000

Use the [UP] and [DOWN] keys to adjust the value to the K factor specified on the probe tag

DRY CALIBRATION K FACTOR 10.000

Then press [LEFT] to move the cursor to the RH position

DRY CALIBRATION K FACTOR 10.000

If the setting is OK, use the [LEFT] key to move the cursor over the Y text and press the down key.

DRY CALIBRATION STORE? Y N

If the calibration did not appear to be correct, press the [DOWN] key which will return back to the Manual Cal Cond menu.

DRY CALIBRATION STORE? Y N

Press [DOWN] to store the calibration data and return back to the Dry Cal Cond menu so the user can select another function.

NOTE: ACCELERATOR KEYS Pressing the [UP] or [DOWN] key once will change the value by the smallest digit. Holding the key down will cause the value to change at an increasing rate until the key is released. Pressing the key again will cause the value to start changing at it's slowest rate again. This allows the user to get to the new multiplier value quickly.

NOTE PRESS THE [UP] AND [DOWN] KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE





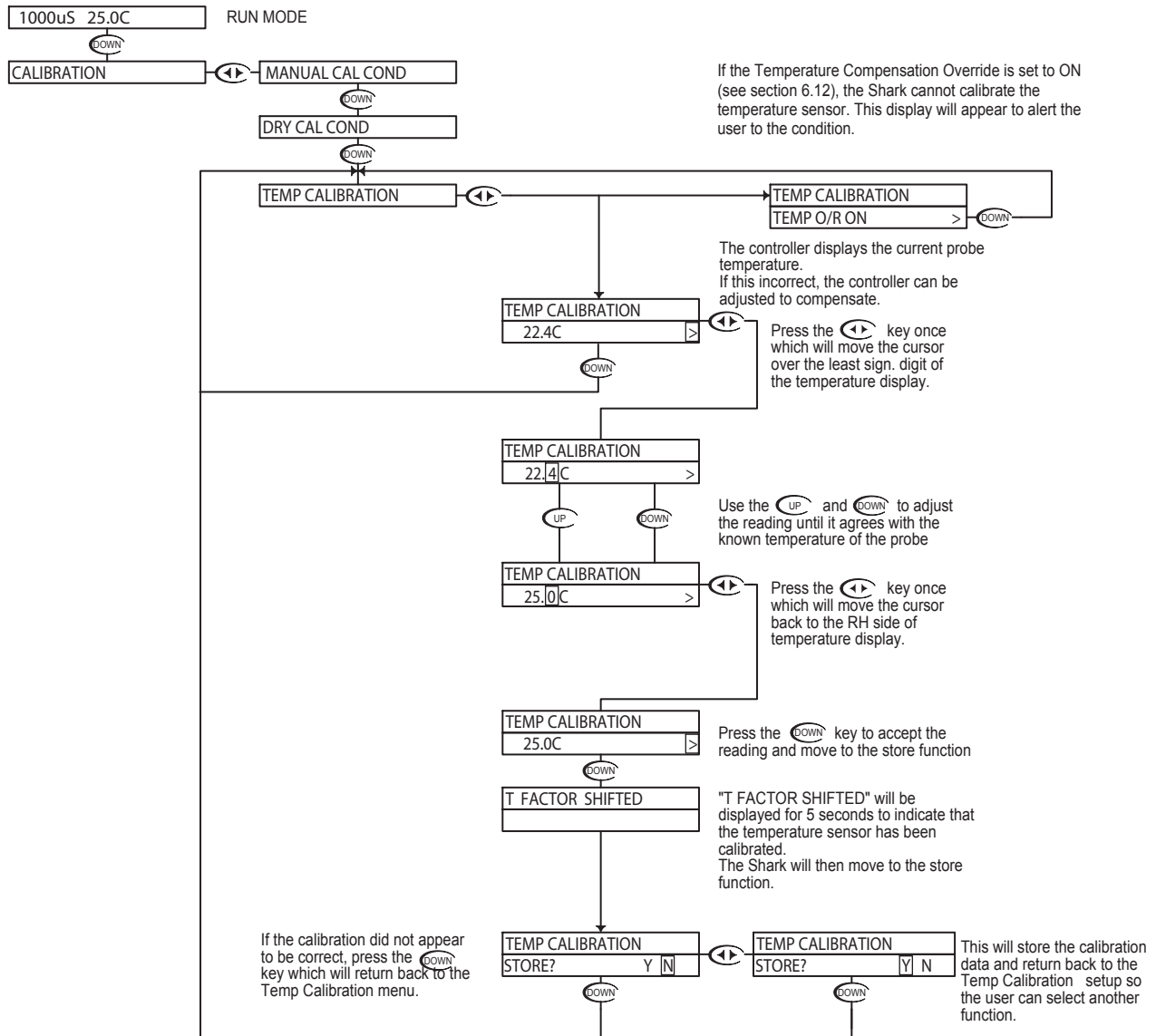
**Conductivity - Calibration Menu - Temp. Calibration 6.3**

**Temperature Calibration**

In most cases, the factor temperature calibration is accurate enough to ensure correct temperature readings. However, in some circumstances, the user may wish to ensure the temperature sensor is calibrated accurately, especially when operating at the extreme end of the conductivity cell temperature operating range, or where the temperature compensation is critical to correct process readings. This menu allows to user to calibrate the temperature anywhere within it's range.

Be aware, that the conductivity reading is affected by the temperature reading (due to the temperature compensation) so accurate temperature calibration is vital to obtaining accurate conductivity readings. If the user is unsure of the calibration test fixture, then it would be best to leave the temperature calibration at it's factory setting.

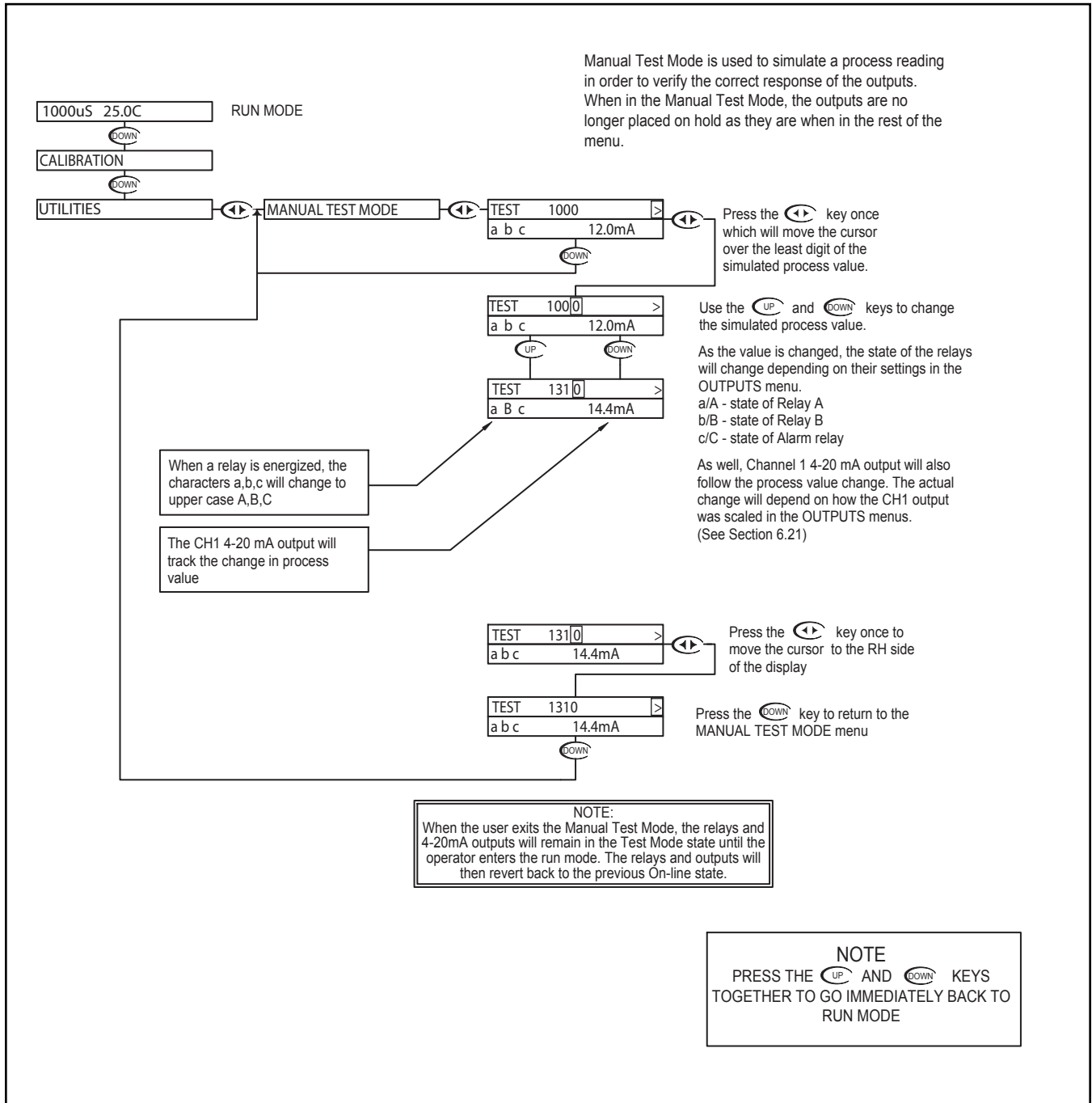
Be sure to allow the temperature of the cell to stabilize before attempting to calibrate the temperature sensor, this may take a significant amount of time as the sensor is buried behind a protective layer of epoxy which will cause some delay.



**NOTE**  
 PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

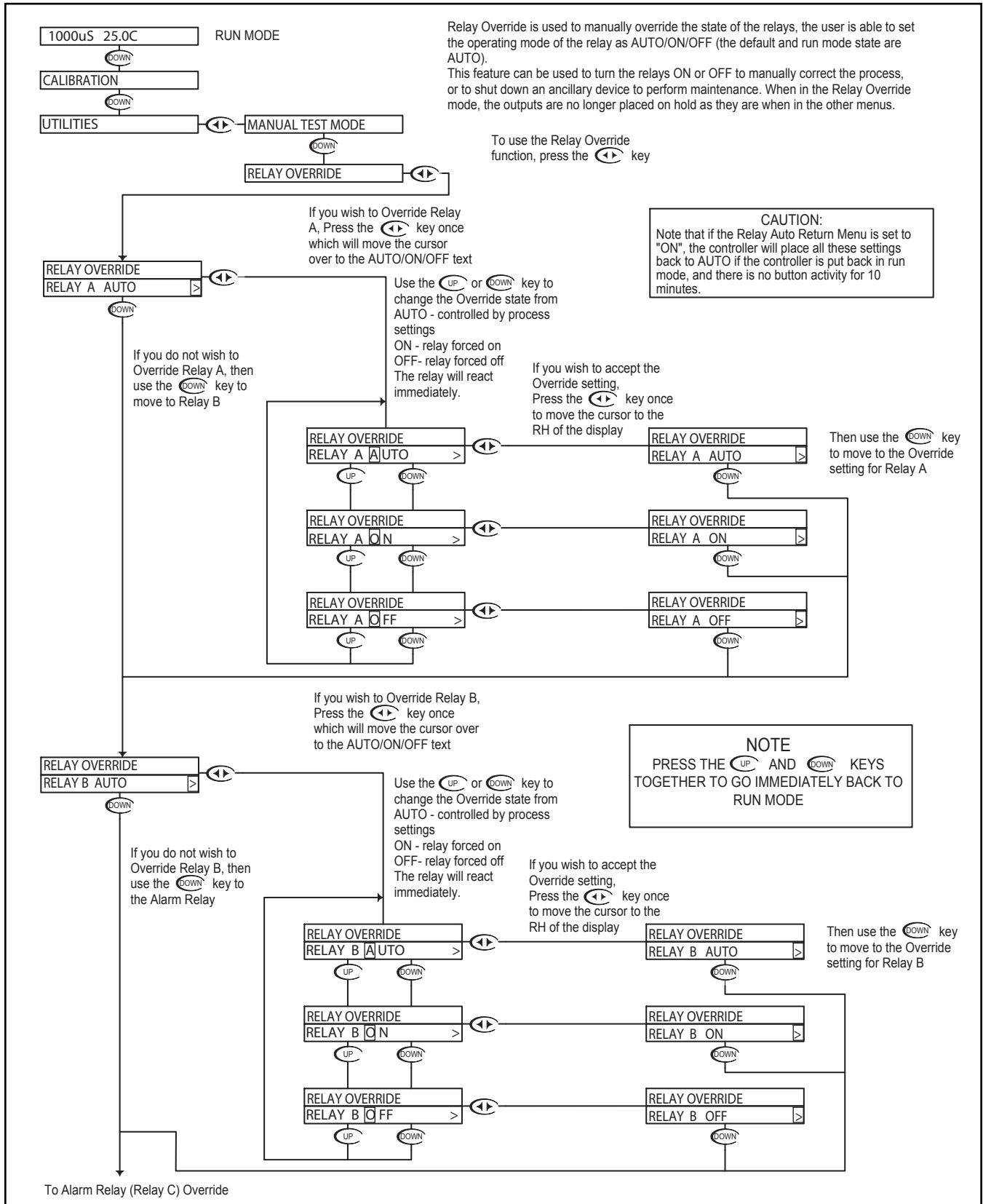


Conductivity - Utilities Menu - Manual Test Mode 6.4



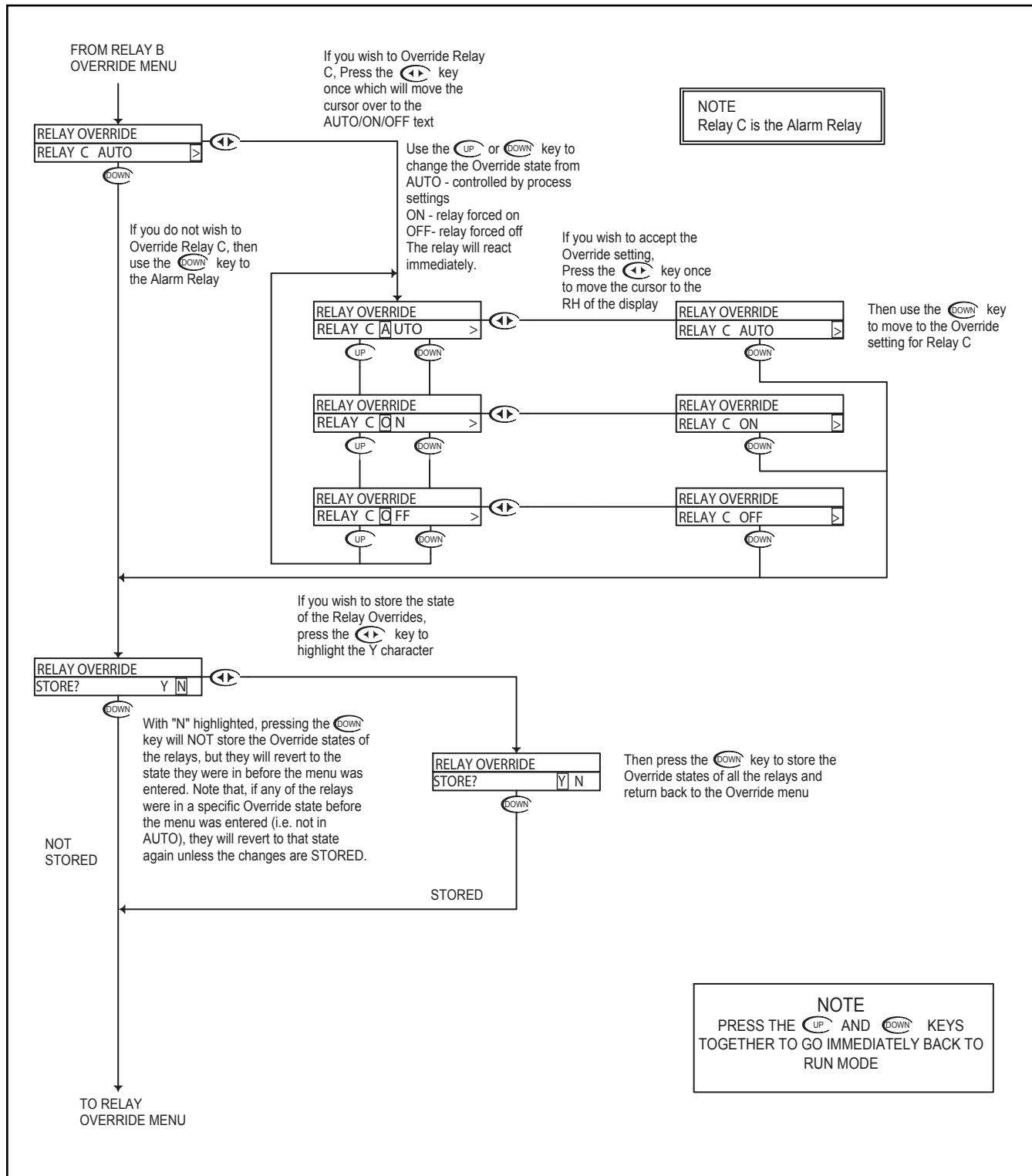


# Conductivity - Utilities Menu - Relay Override 6.5



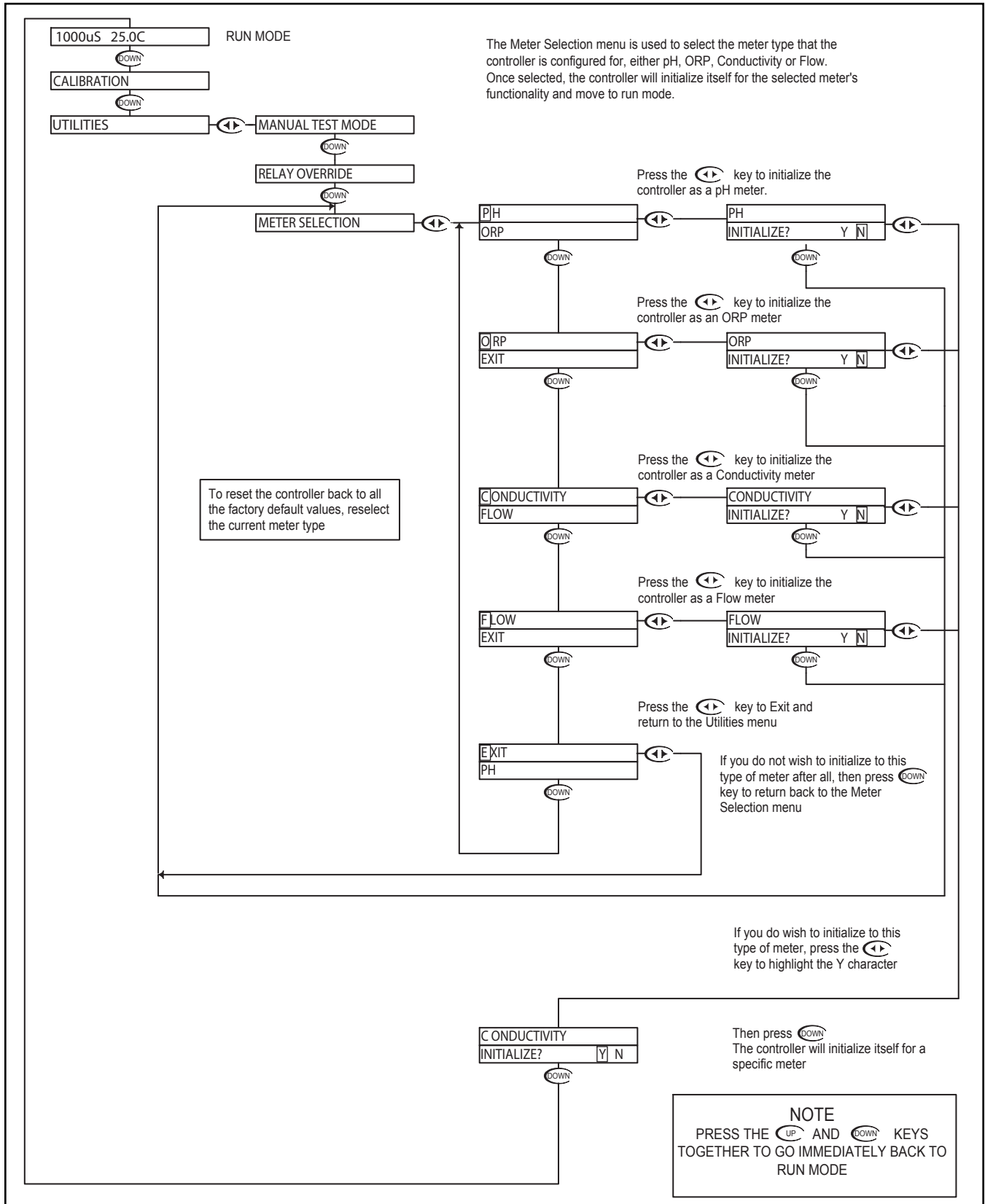


Conductivity - Utilities Menu - Relay Override 6.5





Conductivity - Utilities Menu - Meter Selection 6.6





# Conductivity - Utilities Menu - Overfeed Timer Reset 6.7

1000uS 25.0C RUN MODE

DOWN

CALIBRATION

DOWN

UTILITIES

MANUAL TEST MODE

DOWN

RELAY OVERRIDE

DOWN

METER SELECTION

DOWN

RESET OVERFD TMR

If the control relay overfeed timer has been enabled, the relay will "time out" after the specified overfeed time. When the relay times out, it must be manually reset. The time out will be signaled by the time out LED flashing on the front panel.

The reset overfeed timer will reset the timers for both relay A & relay B at the same time.

Press the key to choose between Y or N.

RESET OVERFD TMR Y N

RESET OVERFD TMR Y N

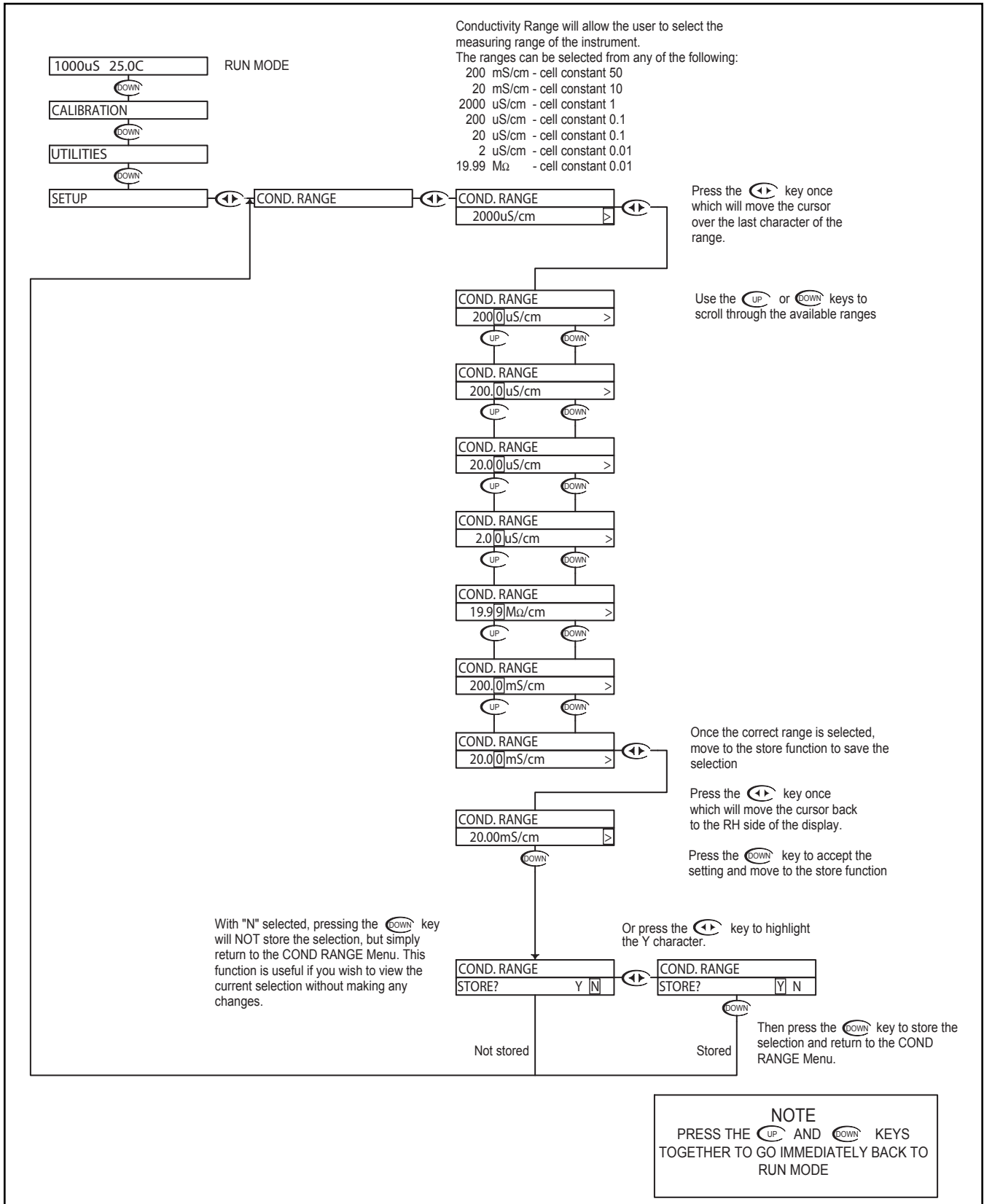
If you wish to reset the overfeed timer, then press the key to proceed and return back to the Utilities menu.

If you do not wish to reset the overfeed timer after all, press the key to highlight the N character and press the key to return back to the Utilities menu.

**NOTE**  
PRESS THE AND KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

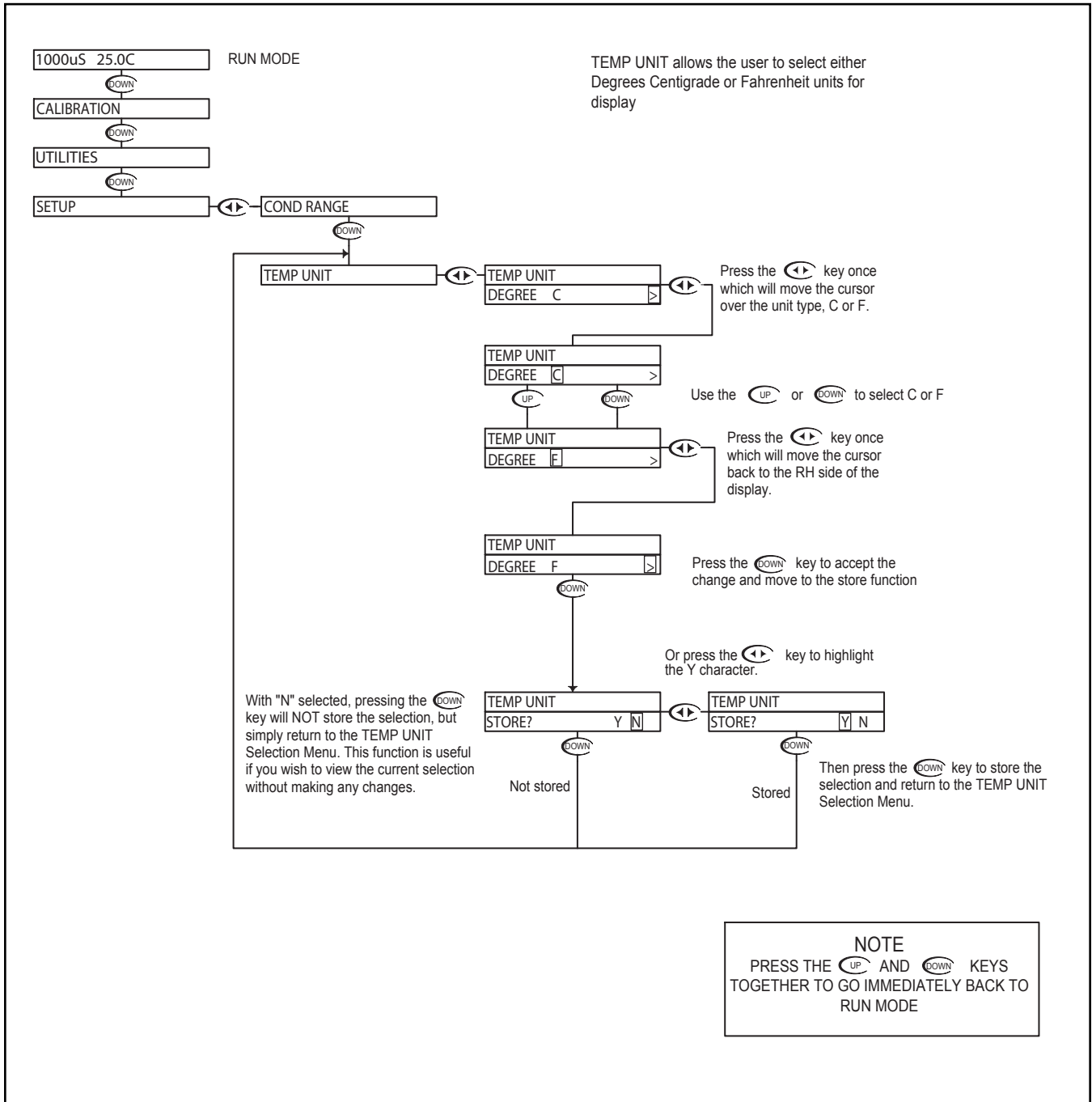


Conductivity - Setup Menu - Conductivity Range 6.8





# Conductivity - Setup Menu - Temp. Unit 6.9







# Conductivity - Setup Menu - Temp. Sensor 6.10

1000uS 25.0C RUN MODE

CALIBRATION

UTILITIES

SETUP

COND RANGE

TEMP UNIT

TEMP SENSOR

TEMP SENSOR  
3000 Ω NTC

TEMP SENSOR  
3000 Ω NTC

TEMP SENSOR  
300 Ω NTC

TEMP SENSOR  
1000 Ω RTD

TEMP SENSOR  
3000 Ω NTC

TEMP SENSOR  
STORE? Y N

Press the **RIGHT** key once which will move the cursor over to the sensor type.

Use the **UP** or **DOWN** to select the sensor type

Once the correct Sensor has been selected press the **RIGHT** key once which will move the cursor back to the RH side of the display.

Press the **DOWN** key to accept the change and move to the store function

Or press the **RIGHT** key to highlight the Y character.

With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the TEMP SENSOR Selection Menu. This function is useful if you wish to view the current selection without making any changes.

Not stored

Stored

Then press the **DOWN** key to store the selection and return to the TEMP SENSOR Selection Menu.

**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



# Conductivity - Setup Menu - Auto Return 6.11

1000uS 25.0C RUN MODE

CALIBRATION

UTILITIES

SETUP

COND RANGE

TEMP UNIT

TEMP SENSOR

AUTO RETURN

AUTO RETURN  
MENU ON

AUTO RETURN is used to select what conditions will cause the controller to time-out of the operations menu, or reset the relay override function.

MENU ON will cause the controller to exit the menu and revert back to the online run mode after 10 minutes with no buttons pressed. This feature ensures that if a user forgets to return back to run mode, the controller will not be left in an offline state. If for some reason, the user would like to remain in the menu mode for extended periods of time, the AUTO RETURN function can be set to "OFF".

To change the MENU RETURN setting, Press the **←** key once which will move the cursor to the ON or OFF text

Use the **↑** or **↓** keys to select either ON or OFF.

Press the **→** key once which will move the cursor back to the RH side of the display.

Press the **↓** key to accept the change and move to the RELAYS auto return function. RELAYS ON will cause the relays to return to the AUTO mode if the controller returns to Online after 10 minutes of inactivity. This ensures the controller will be put back in control of the process if accidentally left offline.

Press the **←** key once which will move the cursor to the ON or OFF text

Use the **↑** or **↓** keys to select either ON or OFF.

Press the **→** key once which will move the cursor back to the RH side of the display.

Press the **↓** key to accept the change and move to the STORE function

Or press the **→** key to highlight the Y character.

AUTO RETURN  
STORE? Y N

AUTO RETURN  
STORE? Y N

Not stored

Stored

Then press the **↓** key to store the selection and return to the Auto Return Selection Menu.

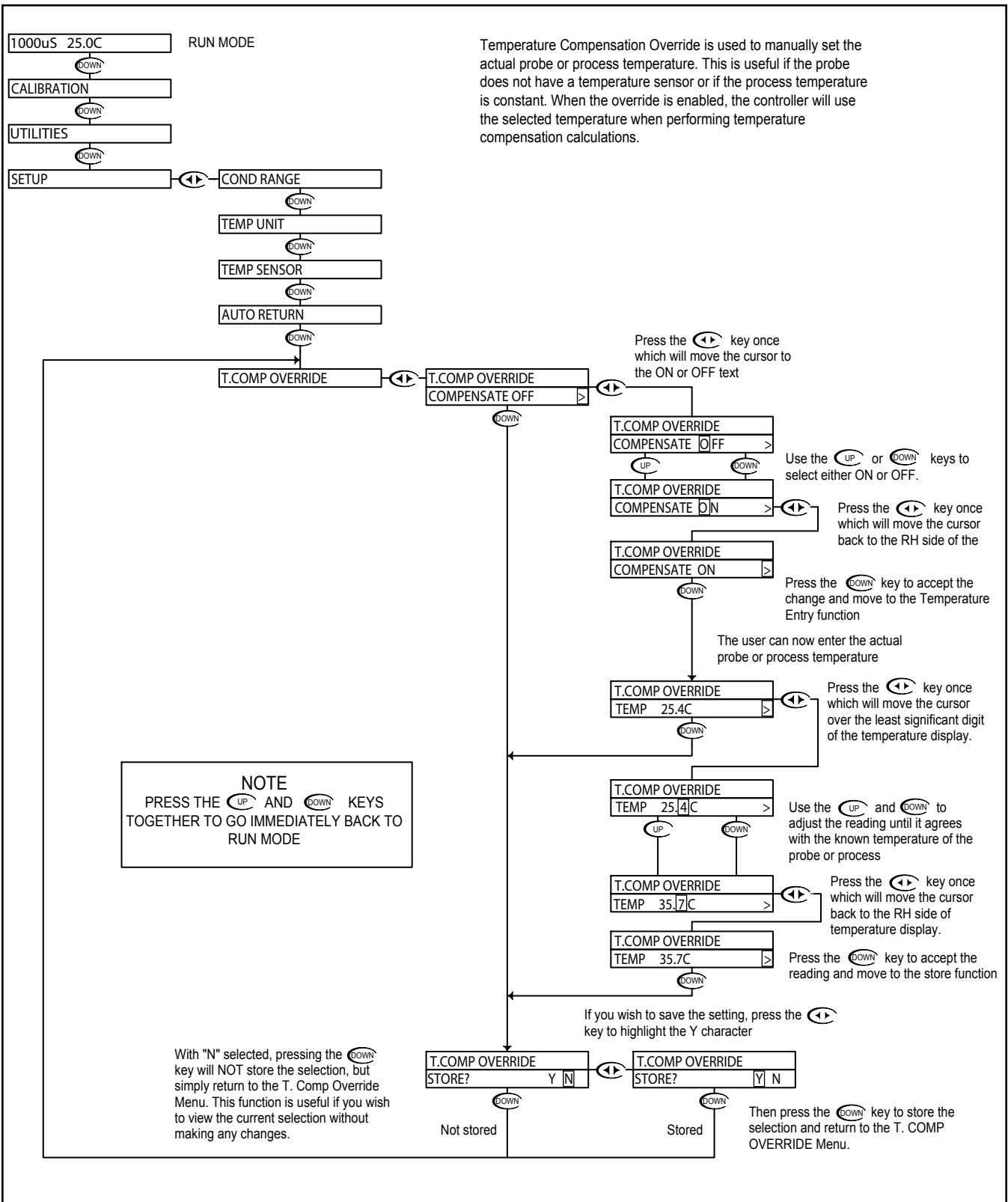
**CAUTION:**  
If AUTO RETURN RELAYS is ON, regardless of the user settings of the states of the relays, Relays will default to AUTO 10 minutes after the Shark returns to Run Mode.

With "N" selected, pressing the **↓** key will NOT store the selection, but simply return to the AUTO RETURN Selection Menu. This function is useful if you wish to view the current selection without making any changes.

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

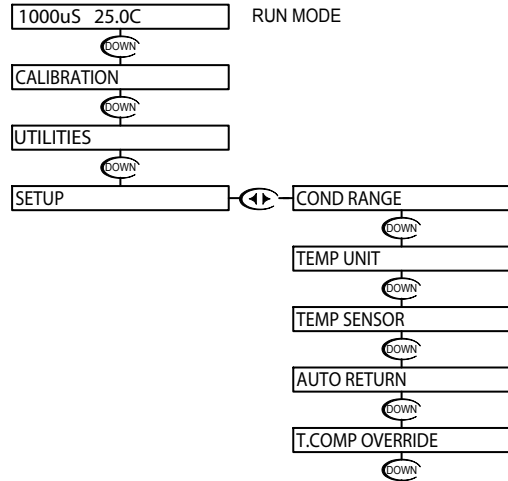


Conductivity - Setup Menu - T. Comp Override 6.12



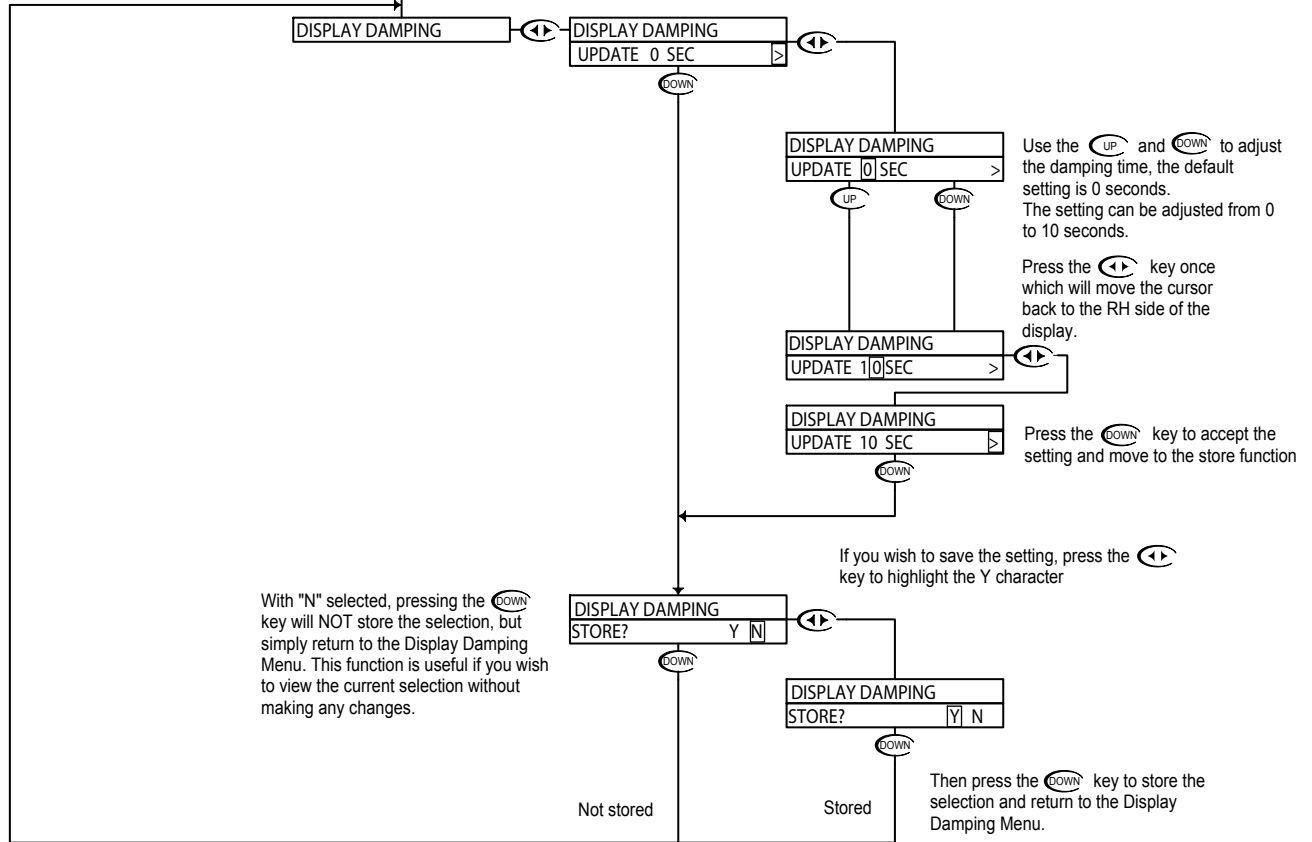


Conductivity - Setup Menu - Display Damping 6.13



The Display Damping menu allows the user to adjust the rate at which the display and all outputs are updated. This allows the user to dampen out unstable process readings. The damping can be set from 0 seconds to 10 seconds. (default value is 0 sec.)

Press the **←** key once which will move the cursor over the seconds digit



With "N" selected, pressing the **↓** key will NOT store the selection, but simply return to the Display Damping Menu. This function is useful if you wish to view the current selection without making any changes.

Use the **↑** and **↓** to adjust the damping time, the default setting is 0 seconds. The setting can be adjusted from 0 to 10 seconds.

Press the **←** key once which will move the cursor back to the RH side of the display.

Press the **↓** key to accept the setting and move to the store function

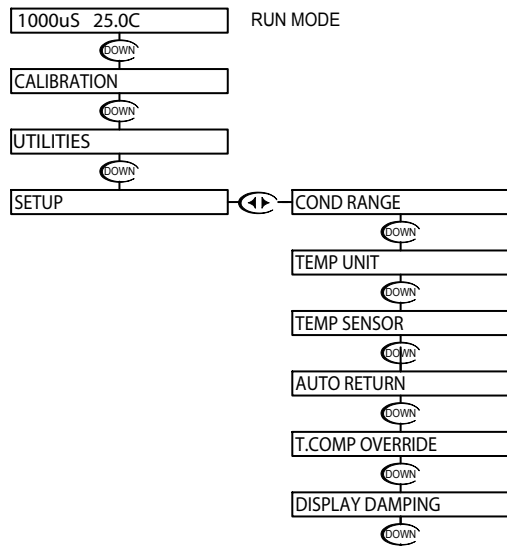
If you wish to save the setting, press the **←** key to highlight the Y character

Then press the **↓** key to store the selection and return to the Display Damping Menu.

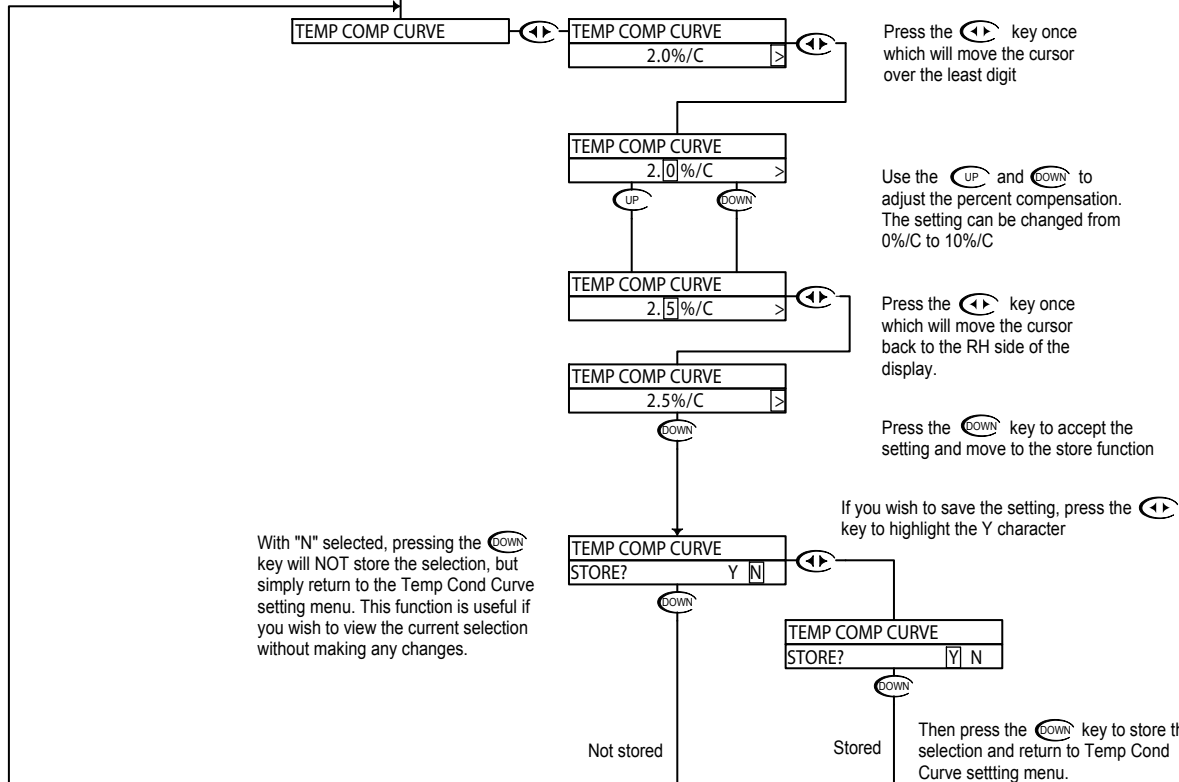
**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Conductivity - Setup Menu - Temp. Comp. Curve 6.14

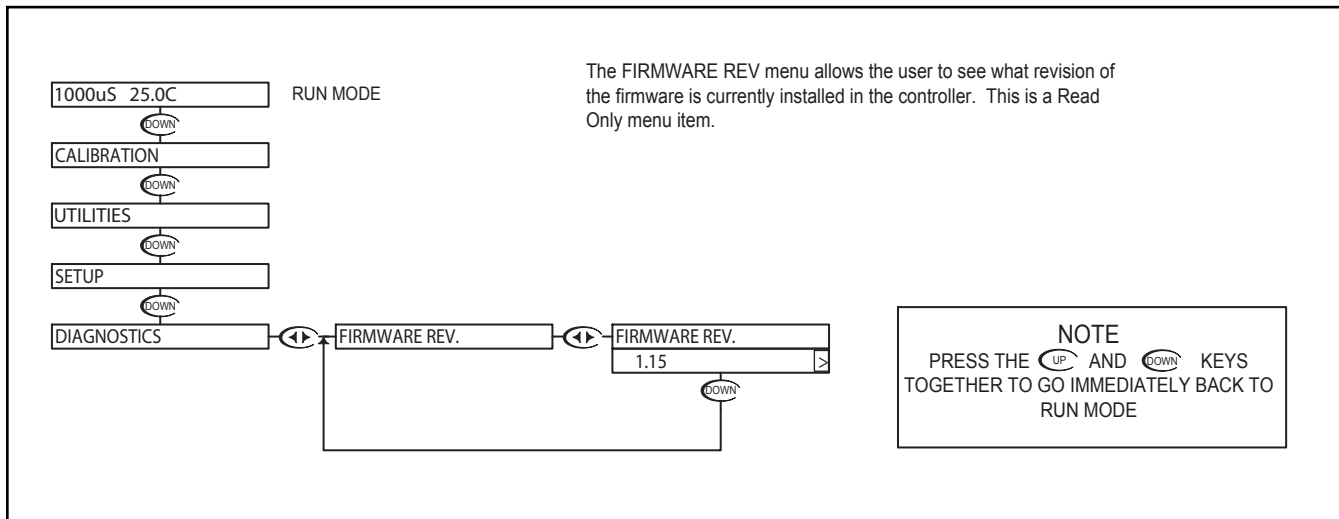


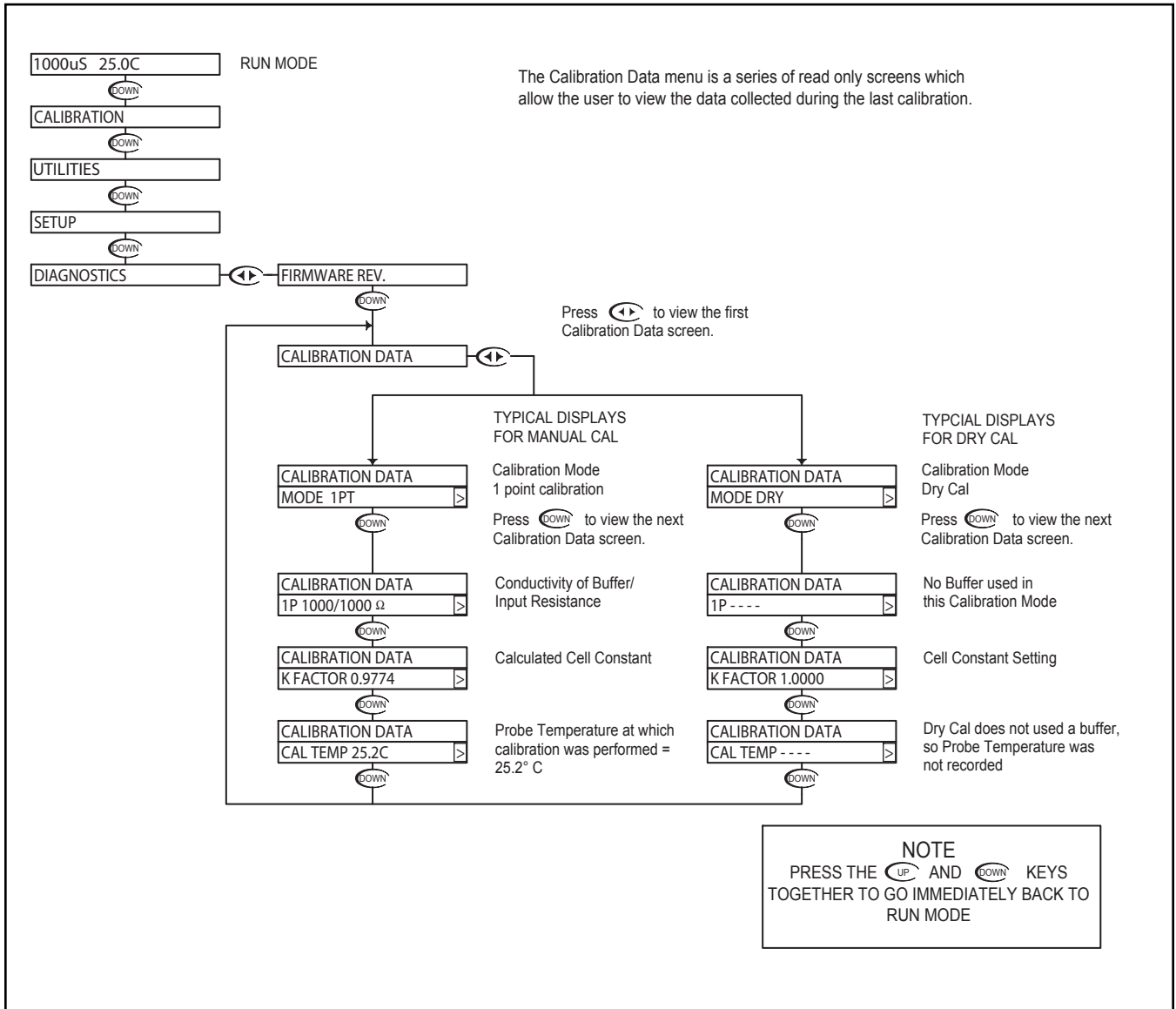
The Temperature Compensation Curve setting allows the user to select the temperature compensation to match a specific process. The variation of Conductivity versus Temperature is dependent on the type of solids and liquids in water, so no fixed compensation value will accurately compensate every process. This setting allows the user to fine tune the compensation to their specific process. Estimates of the correct compensation for certain chemicals are available and can be preset via this menu, otherwise the user will need to set the compensation to 0%/C, measure the effect of temperature for a specific process, calculate the actual compensation required and enter it through this menu. The Compensation can be varied from 0%/C to 10%/C.



With "N" selected, pressing the **↓** key will NOT store the selection, but simply return to the Temp Cond Curve setting menu. This function is useful if you wish to view the current selection without making any changes.

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE







Conductivity - Diagnostics Menu - Sensor Input 6.17

1000uS 25.0C RUN MODE

DOWN  
CALIBRATION

DOWN  
UTILITIES

DOWN  
SETUP

DOWN  
DIAGNOSTICS

LEFT/RIGHT  
FIRMWARE REV.

DOWN  
CALIBRATION DATA

DOWN  
SENSOR INPUT

The Sensor Input Menu allows the user to view real time, uncompensated process data from the conductivity cell. This is a Read only menu item. This "Live Data" screen is useful for trouble shooting purposes when diagnosing cell or process problems.

Press LEFT/RIGHT to view the Sensor Input data.

LEFT/RIGHT  
CELL 966 Ω  
TEMP 2953 Ω

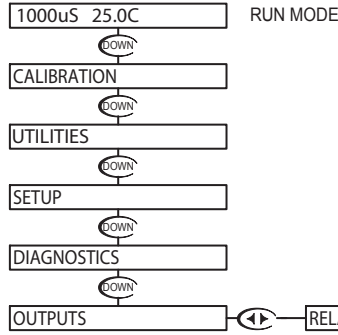
The top line shows the resistance of the cell, The bottom line shows the actual value of the temperature sensor in ohms.

**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE





# Conductivity - Outputs Menu - Relay A 6.18



Relay A can be configured for the following operations

- Response to rising or falling process values
- Adjustable on and off set-points
- Cycle on and off times
- Failsafe operation

The relay can be set to control either a RISING or FALLING process. In a FALLING process, the control relay will energize when the process falls below a set value. In this case, the ON set-point must be set lower than the OFF set-point. In a RISING process, the control relay will energize when the process rises above a set value. In this case, the ON set-point must be set higher than the OFF set-point.

The RELAY ON setting is the process value at which the relay will energize. It may be set anywhere in the normal range of the sensor.

The RELAY OFF setting is the process value at which the relay will de-energize. The setting must be rationalized against the On setting. For example, in a falling process, the Off setting must be higher than the ON setting.

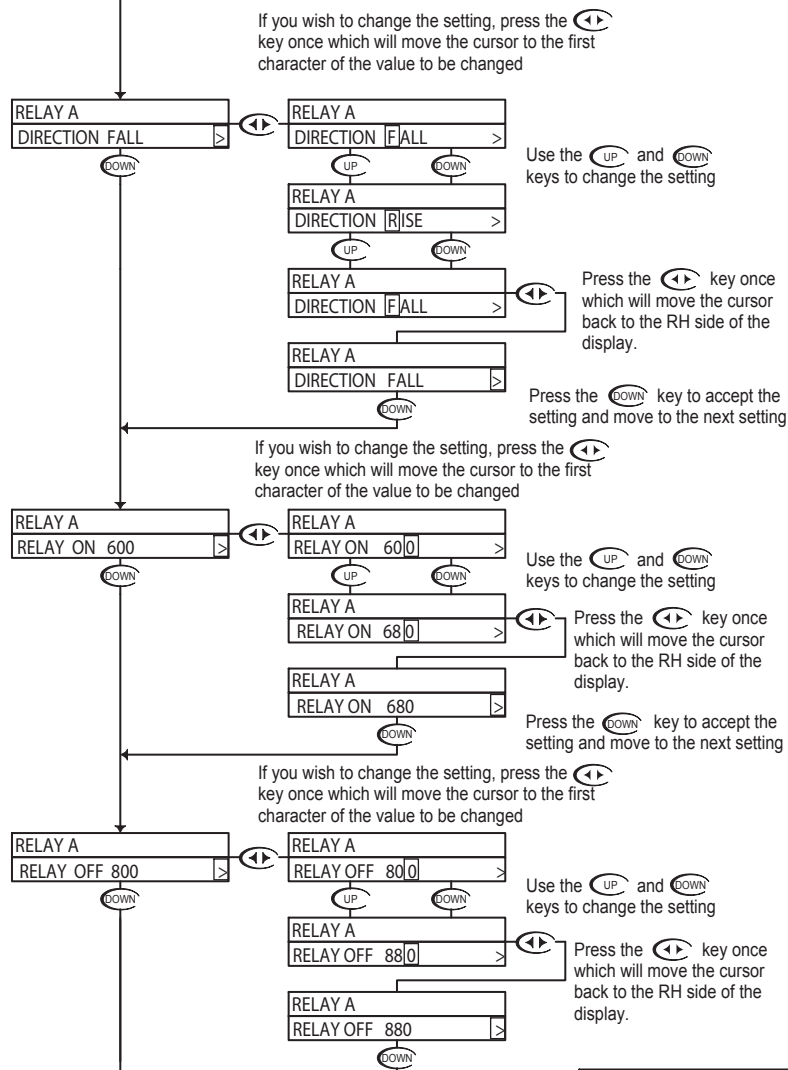
The controller will not allow you to select the RELAY OFF value on the wrong side of the RELAY ON value for the selected direction. If the user tries to set the RELAY OFF on the wrong side, the following errors will be displayed:

FALLING PROCESS  
ON SPT < OFF SPT

Error when trying to set OFF point lower than ON point when set to falling.

RISING PROCESS  
ON SPT > OFF SPT

Error when trying to set OFF point higher than ON point when set to rising.



**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

TO CYCLE ON



# Conductivity - Outputs Menu - Relay A 6.18

The relay can be set to CYCLE when the process is between the RELAY ON setting and the RELAY OFF setting. This is meant to help eliminate overshoot.

The CYCLE ON time is the amount of time in seconds that the relay will be on. The value can be set between 0 and 600 seconds. The default ON time is 5 seconds.

**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

The CYCLE OFF time is the amount of time in seconds that the relay will be off for, it can be set between 0 - 600 seconds.

To disable the cycling feature set the cycle off time to 0.

The Default OFF time is 0 seconds.

The OVERFEED TIMER is designed to help safeguard against a process or instrumentation error causing one of the control relays to remain energized for extended periods of time.

When enabled, the user must select the desired overfeed timeout time (1-999 min.)

If the overfeed timer times out:

- Alarm relay will energize.
- Control (A&B) will de-energize
- LED on front will flash

Must be reset via Utilities Menu or Power reset.

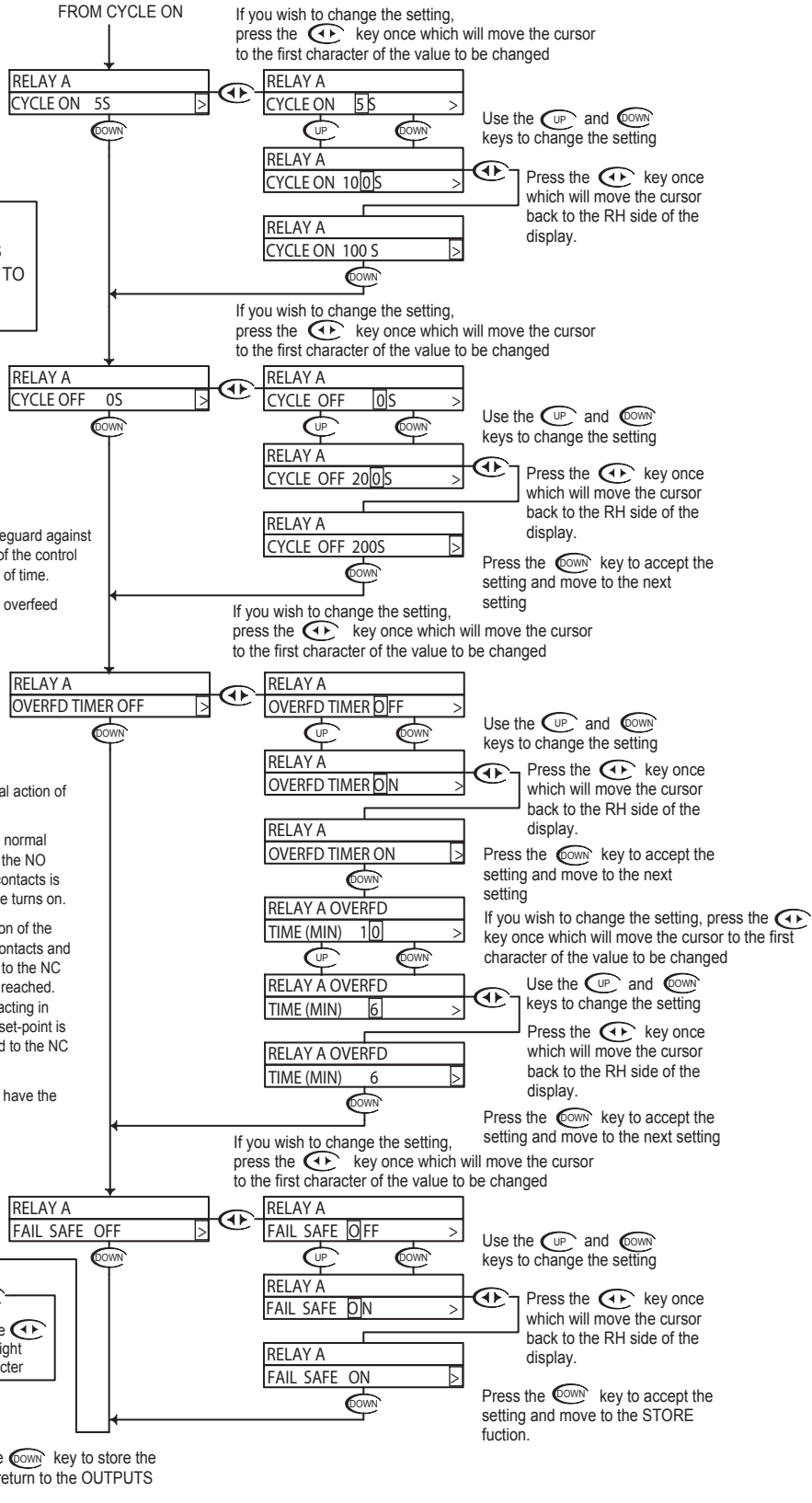
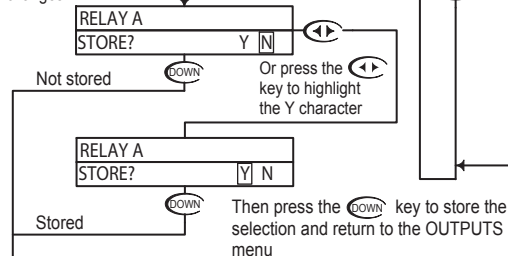
The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

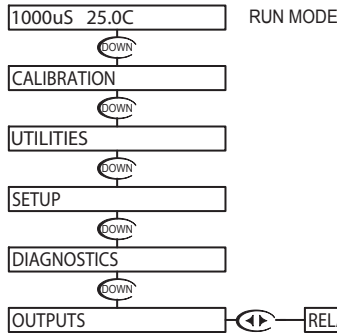
The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption.

With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.





# Conductivity - Outputs Menu - Relay B 6.19



Relay B can be configured for the following operations

- Response to rising or falling process values
- Adjustable on and off set-points
- Cycle on and off times
- Failsafe operation

Each function will be explained below

The relay can be set to control either a RISING or FALLING process. In a RISING process, the control relay will energize when the process rises above a set value. In this case, the ON set-point must be set higher than the OFF set-point. In a FALLING process, the control relay will energize when the process falls below a set value. In this case, the ON set-point must be set lower than the OFF set-point.

The RELAY ON setting is the process value at which the relay will energize. It may be set anywhere in the normal range of the sensor.

The RELAY OFF setting is the process value at which the relay will de-energize. The setting must be rationalized against the On setting. For example, in a falling process, the Off setting must be higher than the ON setting.

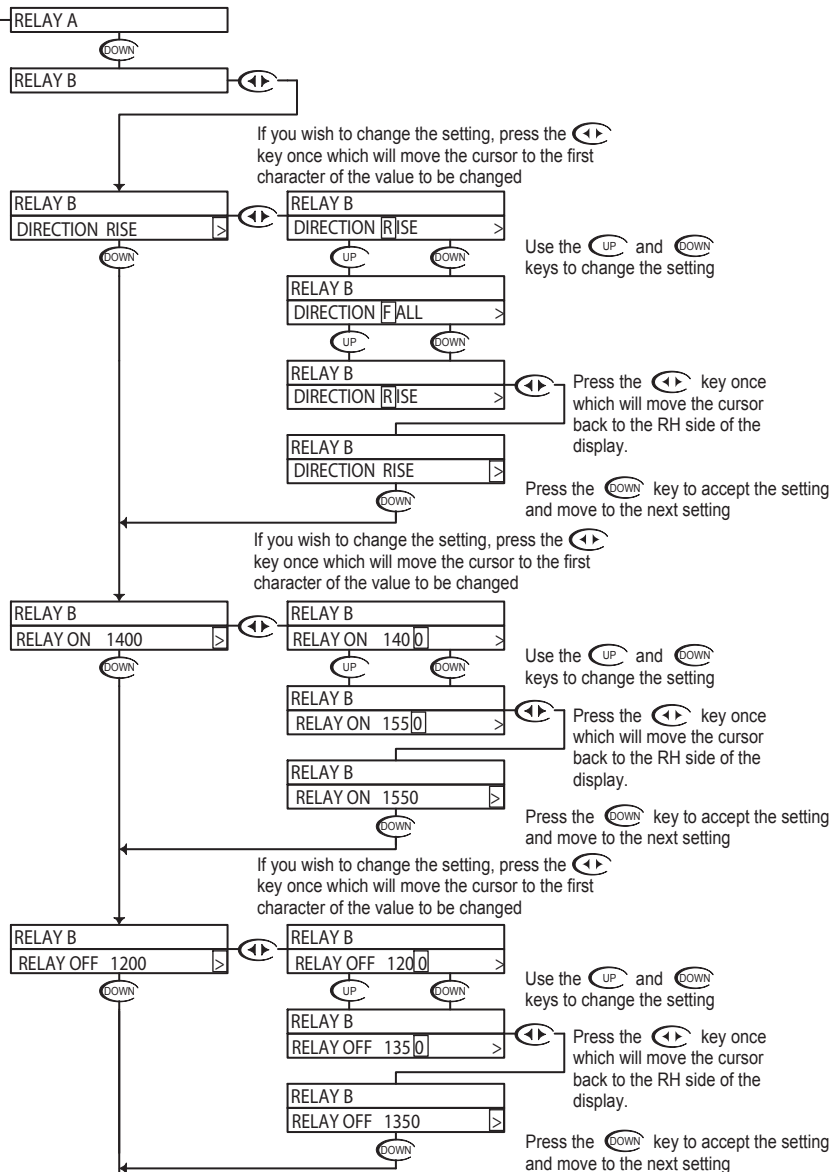
The controller will not allow you to select the RELAY OFF value on the wrong side of the RELAY ON value for the selected direction. If the user tries to set the RELAY OFF on the wrong side, the following errors will be displayed:

FALLING PROCESS  
ON SPT < OFF SPT

Error when trying to set OFF point lower than ON point when set to falling.

RISING PROCESS  
ON SPT > OFF SPT

Error when trying to set OFF point higher than ON point when set to rising.



**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



# Conductivity - Outputs Menu - Relay B 6.19

The relay can be set to CYCLE when the process is between the RELAY ON setting and the RELAY OFF setting. This is meant to help eliminate overshoot.

The CYCLE ON time is the amount of time in seconds that the relay will be on. The value can be set between 0 and 600 seconds. The default ON time is 5 seconds.

**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

The CYCLE OFF time is the amount of time in seconds that the relay will be off for, it can be set between 0 - 600 seconds.

To disable the cycling feature set the cycle off time to 0.

The Default OFF time is 0 seconds.

The OVERFEED TIMER is designed to help safeguard against a process or instrumentation error causing one of the control relays to remain energized for extended periods of time.

When enabled, the user must select the desired overfeed timeout time (1-999 min.)

- If the overfeed timer times out:
- Alarm relay will energize.
  - Control (A&B) will de-energize
  - LED on front will flash

Must be reset via Utilities Menu or Power reset.

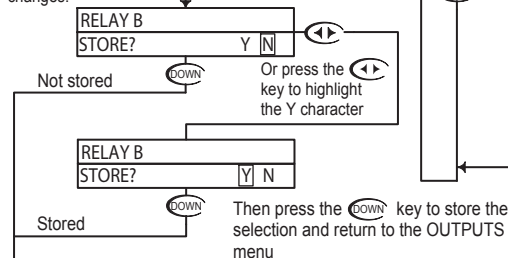
The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

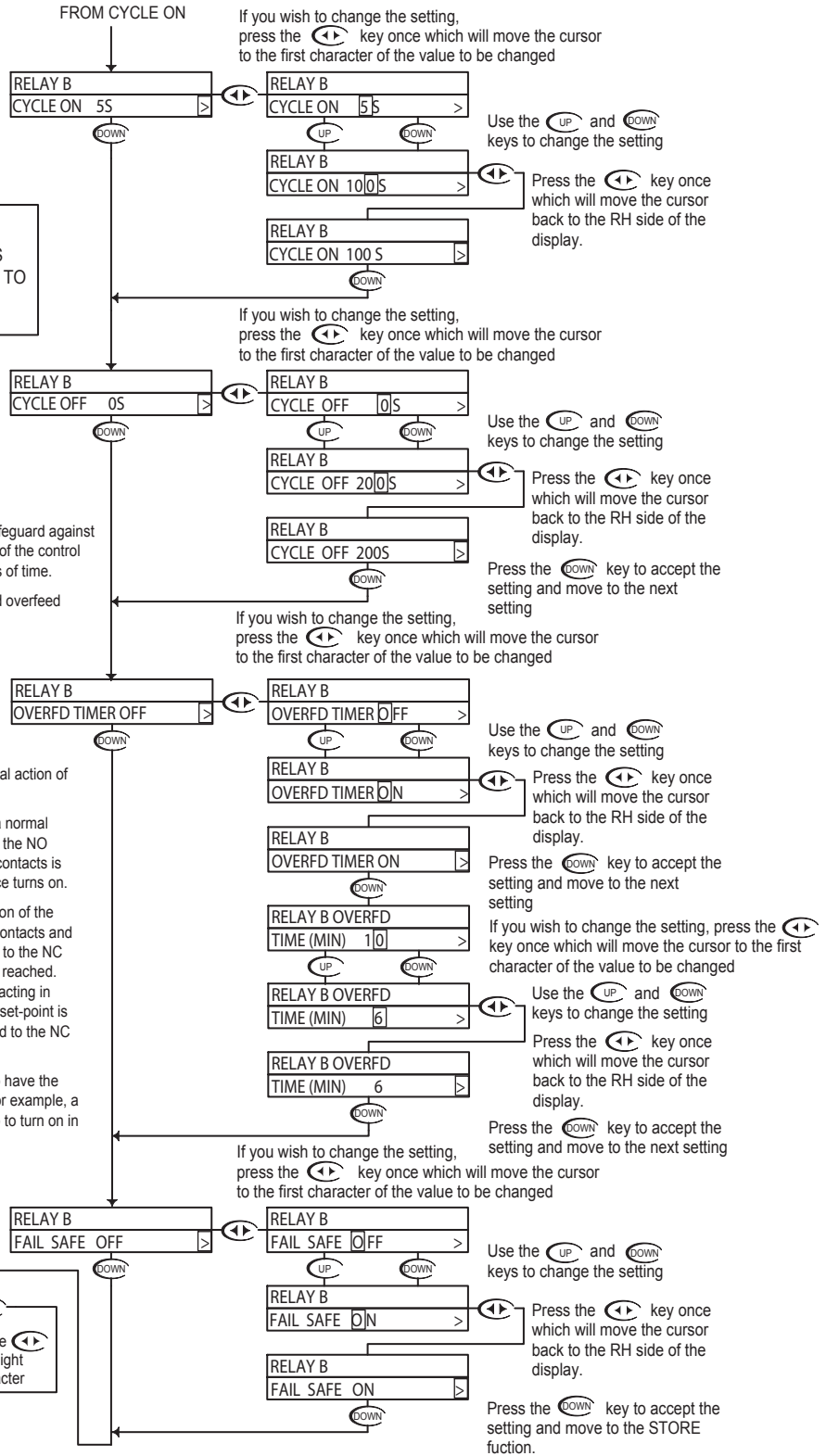
When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption. For example, a process that needs a constant feed, would want a pump to turn on in the event of a controller power failure.

With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.

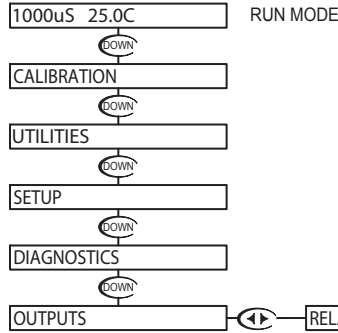


TO OUTPUTS MENU





# Conductivity - Outputs Menu - Alarm Relay 6.20



The ALARM RELAY will respond to both a rising and falling process. The ALARM RELAY will act as a low alarm (falling process) and a high alarm (rising process). Both relay bands will have independently adjustable on and off set-points. If a low alarm on set-point is set at a value 800uS for example, the off set-point must be set higher. The controller will not let the user input a value below the low alarm on. The same rule holds true for the high alarm.

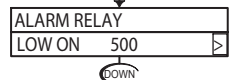
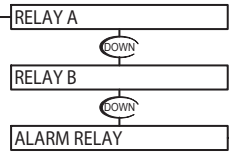
The Alarm Relay can be configured for the following operations

- LOW ON Set-point
- LOW OFF Set-point
- HIGH ON Set-point
- HIGH OFF Set-point
- Failsafe

The LOW ON set point is the low process value that will cause the relay to energize. This value can be set anywhere 0-100% of Full Scale.

The LOW OFF set point is the value that the process must reach in order to de-energize the alarm relay after it has dropped below and tripped the LOW ON set-point. This value must be higher than the LOW ON Set-point.

The HIGH ON set-point is the high process value that will cause the relay to energize. This value can be set anywhere 0-100% of Full Scale.



If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed



Use the **↑** and **↓** keys to change the setting



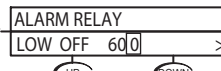
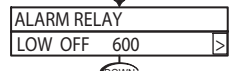
Press the **←→** key once which will move the cursor back to the RH side of the display.



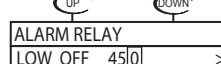
Press the **↓** key to accept the setting and move to the next setting



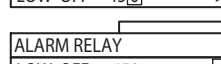
If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed



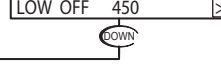
Use the **↑** and **↓** keys to change the setting



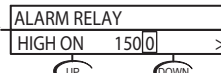
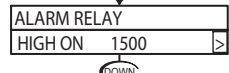
Press the **←→** key once which will move the cursor back to the RH side of the display.



Press the **↓** key to accept the setting and move to the next setting



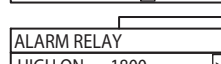
If you wish to change the setting, press the **←→** key once which will move the cursor to the first character of the value to be changed



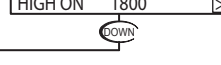
Use the **↑** and **↓** keys to change the setting



Press the **←→** key once which will move the cursor back to the RH side of the display.



Press the **↓** key to accept the setting and move to the next setting



TO HIGH OFF

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Conductivity - Outputs Menu - Alarm Relay 6.20

The HIGH OFF set-point is the value that the most reach in order to de-energize the alarm relay after it has increased over and tripped the HIGH ON set-point. This value must be lower than the HIGH ON Set-point.

The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption.

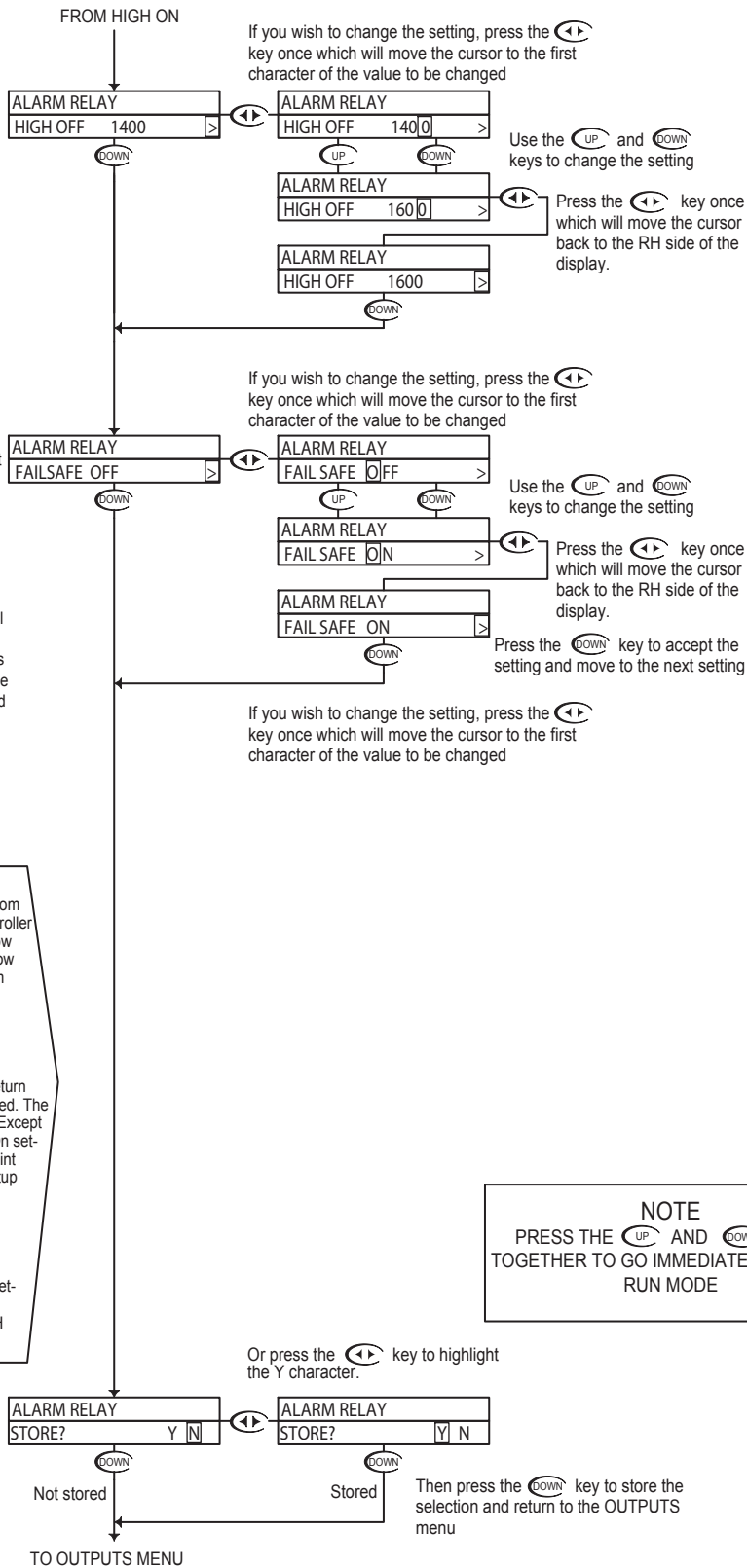
If the Low On set-point is set higher than the factory default Low Off set-point, when the user advances from the low on set-point to the Low Off set-point the controller will adjust the Low Off set-point to be equal to the Low On set-point. If the user then tries to decrease the Low Off set-point the Controller will display the Low Alarm setup error screen.

LOW ALARM  
ON SPT < OFF SPT

This screen will be displayed for 10 seconds, then return back to the setup screen that was previously displayed. The same conditions apply to the High alarm set-points. Except the High Off set-point must be lower than the High On set-point. If the user tries to increase the High Off set-point higher than the High On set-point the High Alarm setup error screen will be displayed.

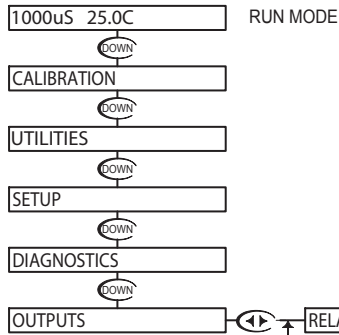
HIGH ALARM  
ON SPT > OFF SPT

If the user sets the low on set-point and the low off set-point equal to 0, it will disable the Low Alarm relay. Similarly, setting the High On set-point and the HIGH OFF set-point to 0 will disable the High Alarm.





Conductivity - Outputs Menu - 4-20mA CH1 Output 6.21



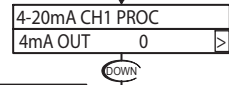
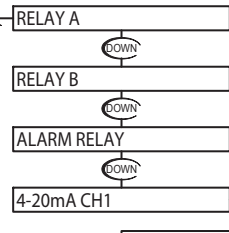
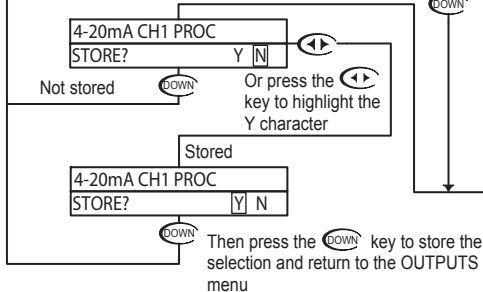
The Controller has 2 4-20mA outputs, electrically isolated from each other and ground. Either output can source current into a maximum of 800 ohms. See Section 3.12 for wiring diagram. Channel 1 (the primary output) is located on the flip out door, terminal plug P6. Channel 1 is dedicated to track the process and has fully independent and fully adjustable 4 & 20 mA output adjustments. This will enable the operator to span the output over the desired range.

The example below shows the 4-20 mA set to 4mA =400uS and 20mA = 1800uS. The output would then span 4 to 20 mA for a conductivity swing of 400 to 1800. Note that the span can be reversed, in that 4 mA can be set to a high conductivity value, and 20 mA can be set to a low conductivity value, effectively reversing the control direction.

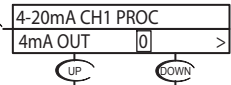
**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

The TUNE function allows the user to precisely adjust the 4-20 mA output to compensate for any errors in the output circuitry. Normally, find turning the 4-20mA output is not necessary. To make the adjustment, place an accurate current meter in series with the 4-20 mA output, with the appropriate loads connected. When the TUNE menu is selected, the controller puts 20 mA out the terminals. Use the UP or DOWN keys to adjust the 20mA output to get exactly 20. The TUNE value can be adjusted over the range from 0 to 1000, these are unitless

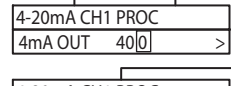
With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



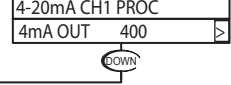
If you wish to change the setting, press the LEFT key once which will move the cursor to the first character of the value to be changed



Use the UP and DOWN keys to change the setting



Press the LEFT key once which will move the cursor back to the RH side of the display.



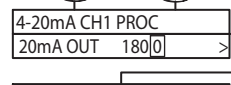
Press the DOWN key to accept the setting and move to the next setting



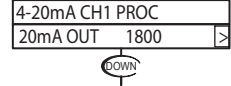
If you wish to change the setting, press the LEFT key once which will move the cursor to the first character of the value to be changed



Use the UP and DOWN keys to change the setting



Press the LEFT key once which will move the cursor back to the RH side of the display.



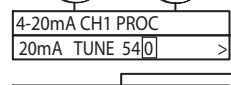
Press the DOWN key to accept the setting and move to the next setting



If you wish to change the setting, press the LEFT key once which will move the cursor to the first character of the value to be changed



Use the UP and DOWN keys to change the setting



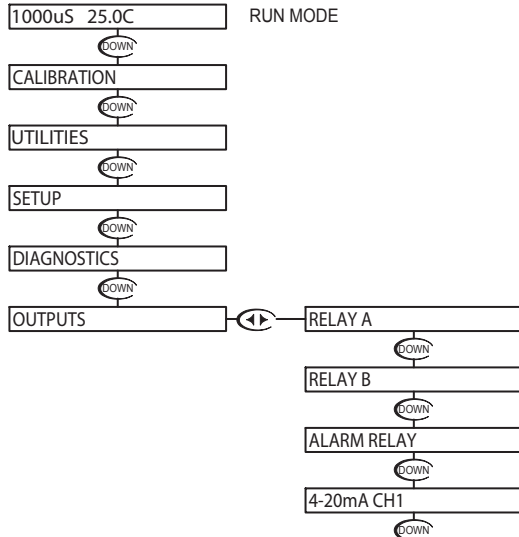
Press the LEFT key once which will move the cursor back to the RH side of the display.



Press the DOWN key to accept the setting and move to the next setting



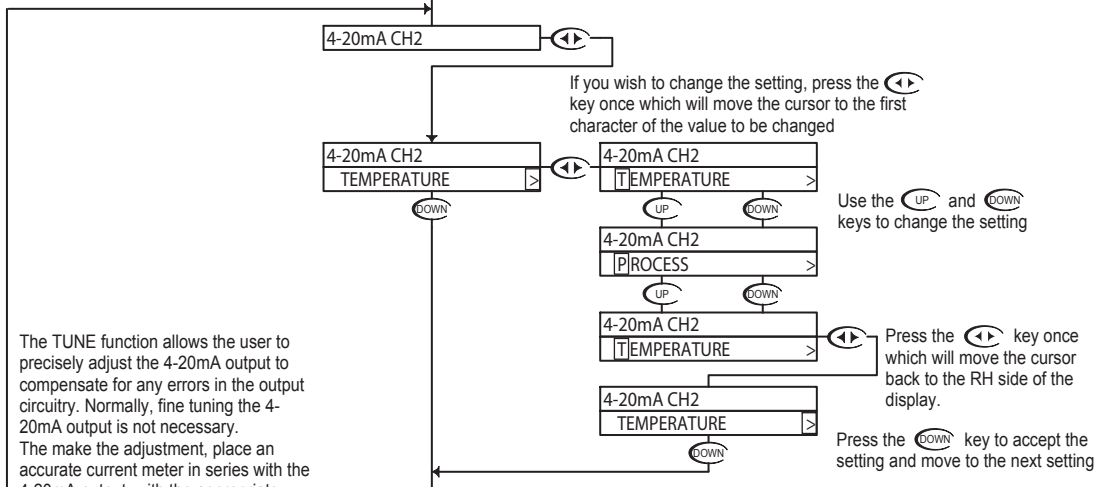
Conductivity - Outputs Menu - 4-20mA CH2 Output 6.22



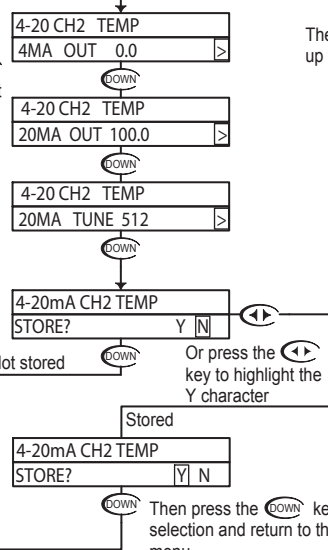
The Controller has 2 4-20mA outputs, electrically isolated from each other and ground. Either output can source current into a maximum of 800 ohms. Channel 2 can be selected to track the process or temperature. Channel 2 has fully independent and fully adjustable 4 & 20 mA output adjustments. This will enable the operator to span the output over the desired range.

Note that if the T COMP OVERRIDE is ON and Channel 2 output is set to track temperature, the output will not change, but hold at a value representing the temperature set in the T COMP OVERRIDE.

The example below shows the 4-20 mA set to 4mA = 0 C° and 20mA = 100 C°. The output would then span 4 to 20 mA for a temperature swing of 0 C° to 100 C°. Note that the span can be reversed, in that 4 mA can be set to a high process value, and 20 mA can be set to a low process value, effectively reversing the control direction.



The TUNE function allows the user to precisely adjust the 4-20mA output to compensate for any errors in the output circuitry. Normally, fine tuning the 4-20mA output is not necessary. To make the adjustment, place an accurate current meter in series with the 4-20mA output, with the appropriate loads connected. When the TUNE menu is selected, the controller puts 20mA out to the terminals. Use the UP or DOWN keys to adjust the 20mA output to get exactly 20. The TUNE value can be adjusted over the range from 0 to 1000, these are unitless numbers used for tuning purposes only. With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



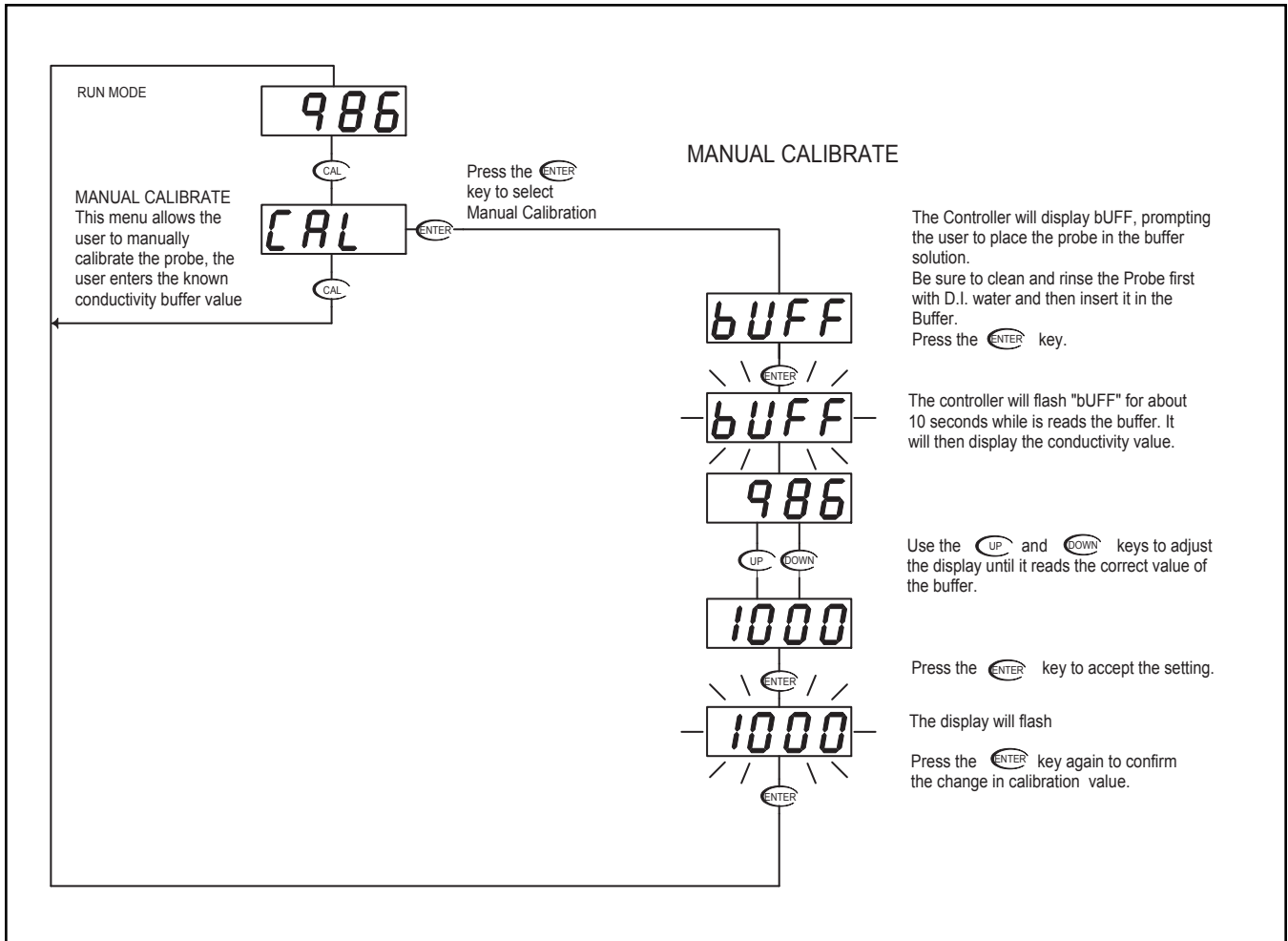
The 4mA, 20mA and TUNE functions are set up the same way as 4 - 20 mA CH 1 output.

**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



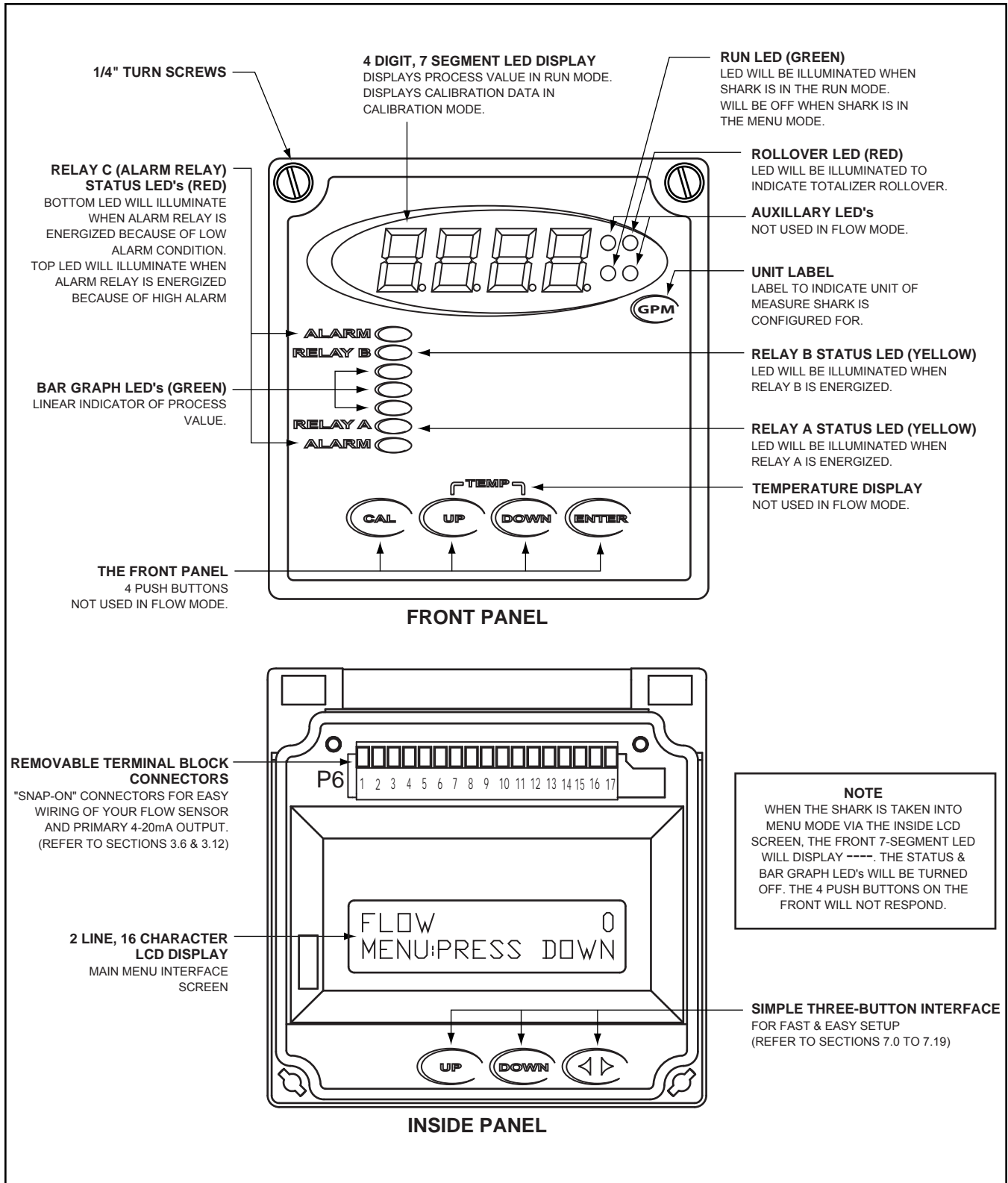


# Conductivity - LED Display Menu - Conductivity Manual Calibrate 6.23



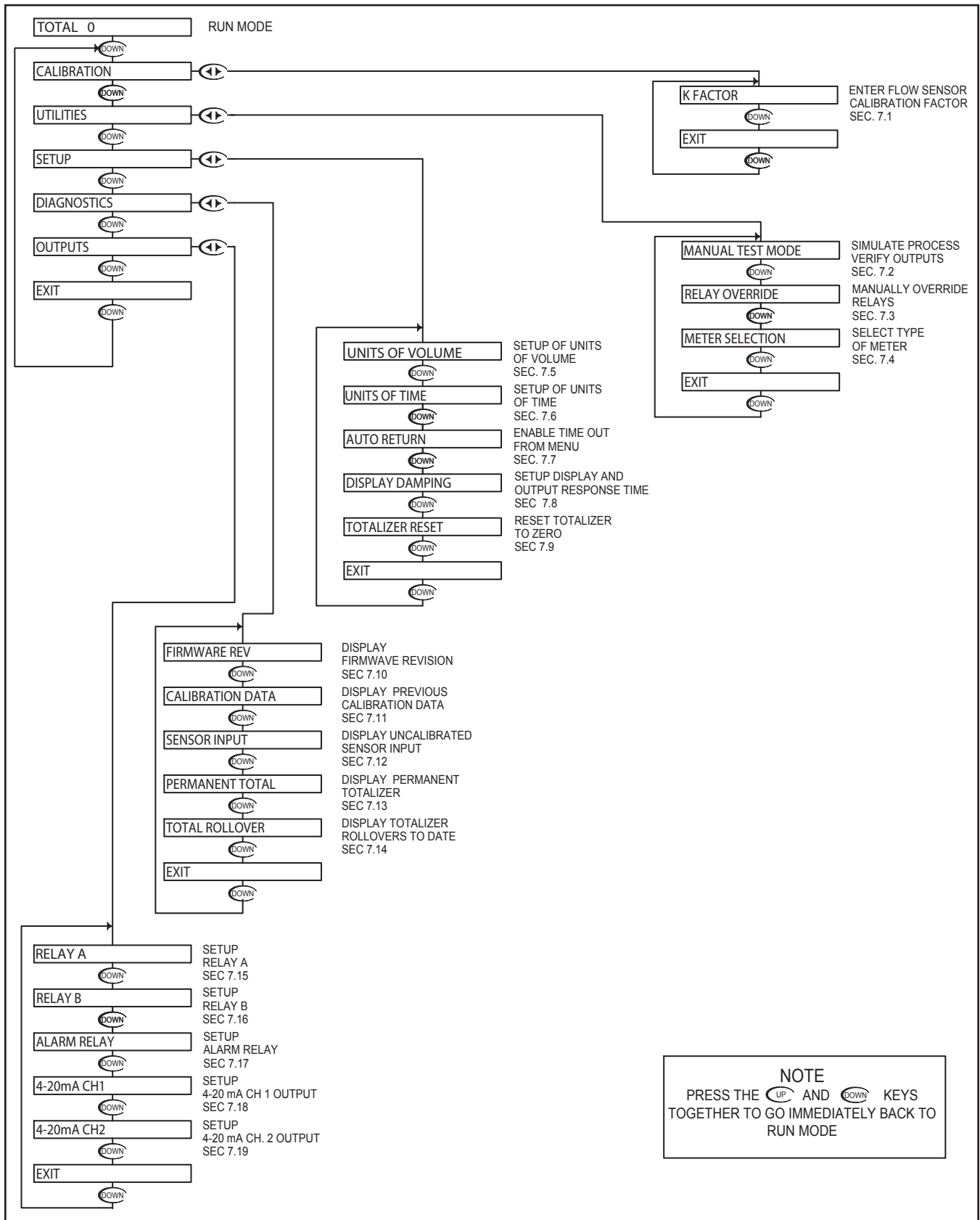


**Section 7 - Using the SHARK in Flow Mode**





**Flow - Menu Overview 7.0**





Flow - Calibration Menu - K Factor 7.1

The K Factor menu is used to enter the flow sensor calibration factor. The K Factor represents the number of pulses per U.S. Gallon, generated by the combination of sensor and flow fitting. It is normally stamped on the flow fitting or attached to a tag on the cable. Typical K factors range between 0.5000 to 1500.0.

TOTAL 0 RUN MODE

CALIBRATION

K FACTOR

K FACTOR 100.00

K FACTOR 100.00

K FACTOR 125.00

K FACTOR 125.00

K FACTOR STORE? Y N

K FACTOR STORE? Y N

NOTE: ACCELERATOR KEYS Pressing the UP or DOWN key once will change the value by the smallest digit. Holding the key down will cause the value to change at an increasing rate until the key is released. Pressing the key again will cause the value to start changing at it's slowest rate again. This allows the user to get to the new K Factor value quickly. The K Factor can be set anywhere from 0.5000 pulses per U.S. Gallon to 1500.0 pulses per U.S. Gallon

To enter the K factor, use the DOWN key to enter the Calibration menu and then the LEFT key to select the K Factor menu.

Press the LEFT key once which will move the cursor over the least sign. digit of the display.

If you just wish to view the current K Factor without changing it, press the DOWN key which will move to the store function

Use the UP and DOWN keys to adjust the reading until it agrees with the actual K Factor as specified on the sensor

Then press the RIGHT key to move the cursor to the RH position

Press the DOWN key to accept the change and move to the store function

If the K Factor setting is OK, use the LEFT key to move the cursor over the Y text and press the down key.

If the calibration did not appear to be correct, press the DOWN key which will return back to the K Factor menu without storing the value.

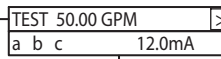
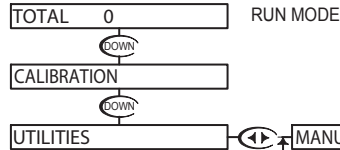
Press DOWN to store the calibration data and return back to the menu so the user can select another function.

NOTE PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Flow - Utilities Menu - Manual Test Mode 7.2

Manual Test Mode is used to simulate a process reading in order to verify the correct response of the outputs. When in the Manual Test Mode, the outputs are no longer placed on hold as they are when in the rest of the menu.



Press the **←** key once which will move the cursor over the least digit of the simulated process value.

Use the **↑** and **↓** keys to change the simulated process value.

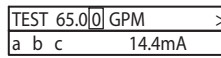
As the value is changed, the state of the relays will change depending on their settings in the OUTPUTS menu.

- a/A - state of Relay A
- b/B - state of Relay B
- c/C - state of Alarm relay

As well, Channel 1 4-20 ma output will also follow the process value change. The actual change will depend on how the CH1 output was scaled in the OUTPUTS menus. (See Section 4.18)

When a relay is energized, the characters a,b,c will change to upper case A,B,C

The CH1 4-20 mA output will track the change in process



Press the **←** key once to move the cursor to the RH side of the display

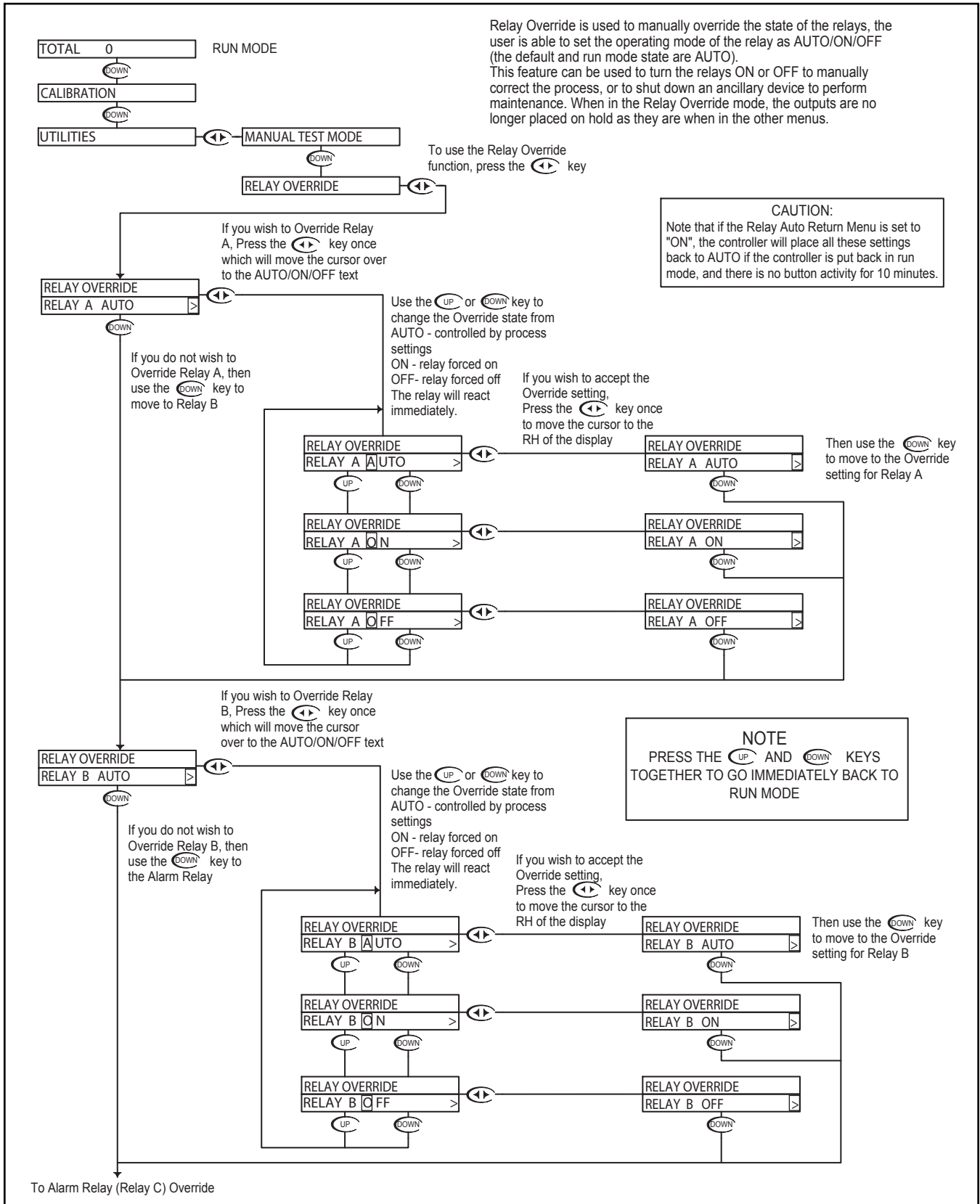
Press the **↓** key to return to the MANUAL TEST MODE menu

**NOTE:**  
When the user exits the Manual Test Mode, the relays and 4-20mA outputs will remain in the Test Mode state until the operator enters the run mode. The relays and outputs will then revert back to the previous On-line state.

**NOTE**  
PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

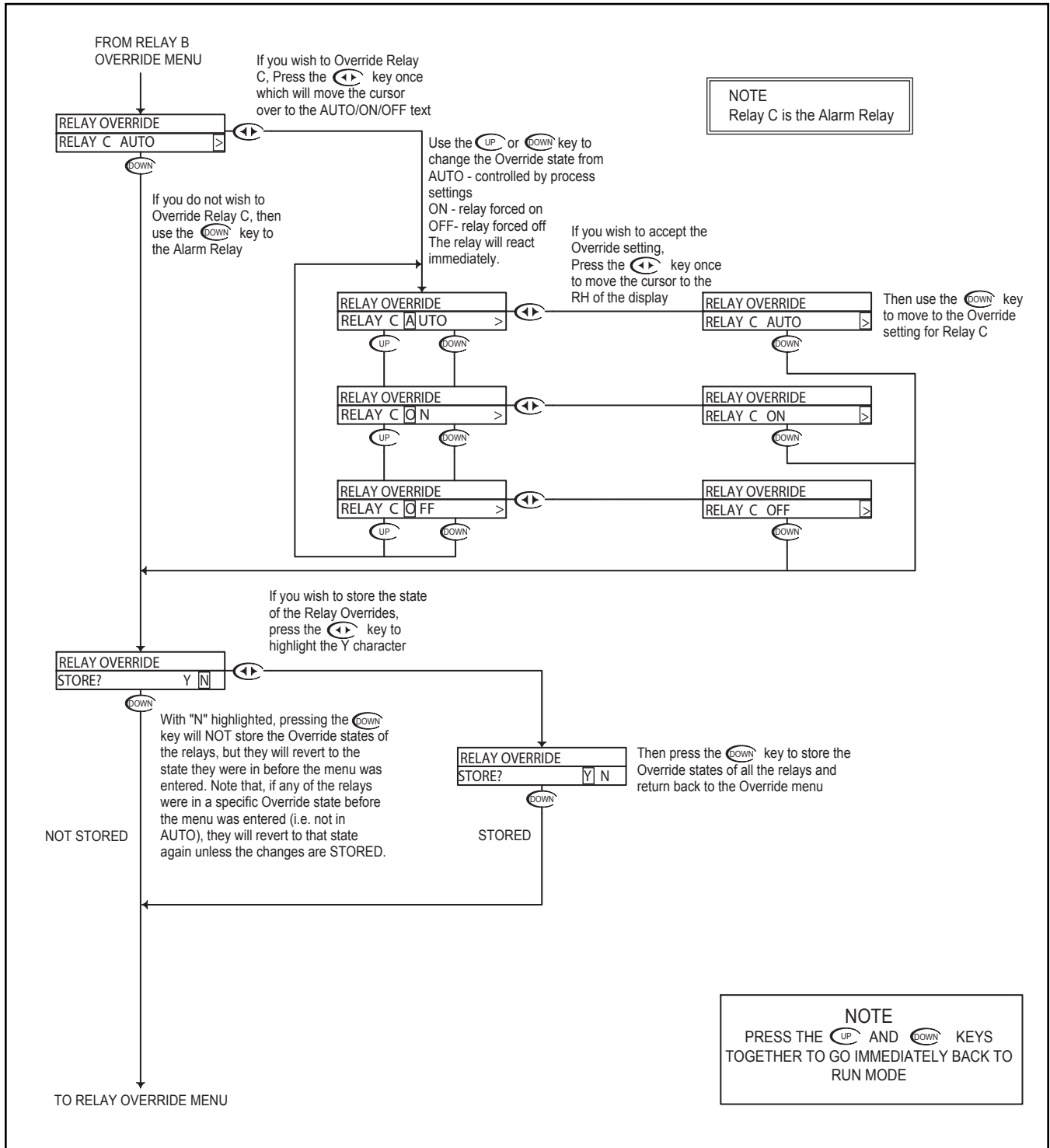


Flow - Utilities Menu - Relay Override 7.3





Flow - Utilities Menu - Relay Override 7.3









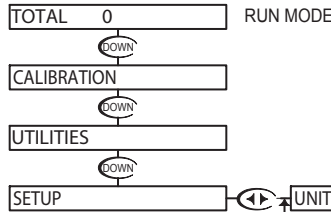
Flow - Setup Menu - Units of Volume 7.5

The Units of Measurement is broken into two variables, UNITS OF VOLUME and UNITS OF TIME. The two variables are then combined to display the desired units of measure. For example, if units of Volume is to set Cubic Meters (CM) and Units of Time is set for Seconds (S), the the controller will display flow as Cubic Meters per Second on the front LED display.

UNITS OF VOLUME

The user can select from four predefined units of Volume, or create their own custom value. The four predefined units are US Gallons GP, Cubic Feet CF, Liters LP, Cubic Meters CM

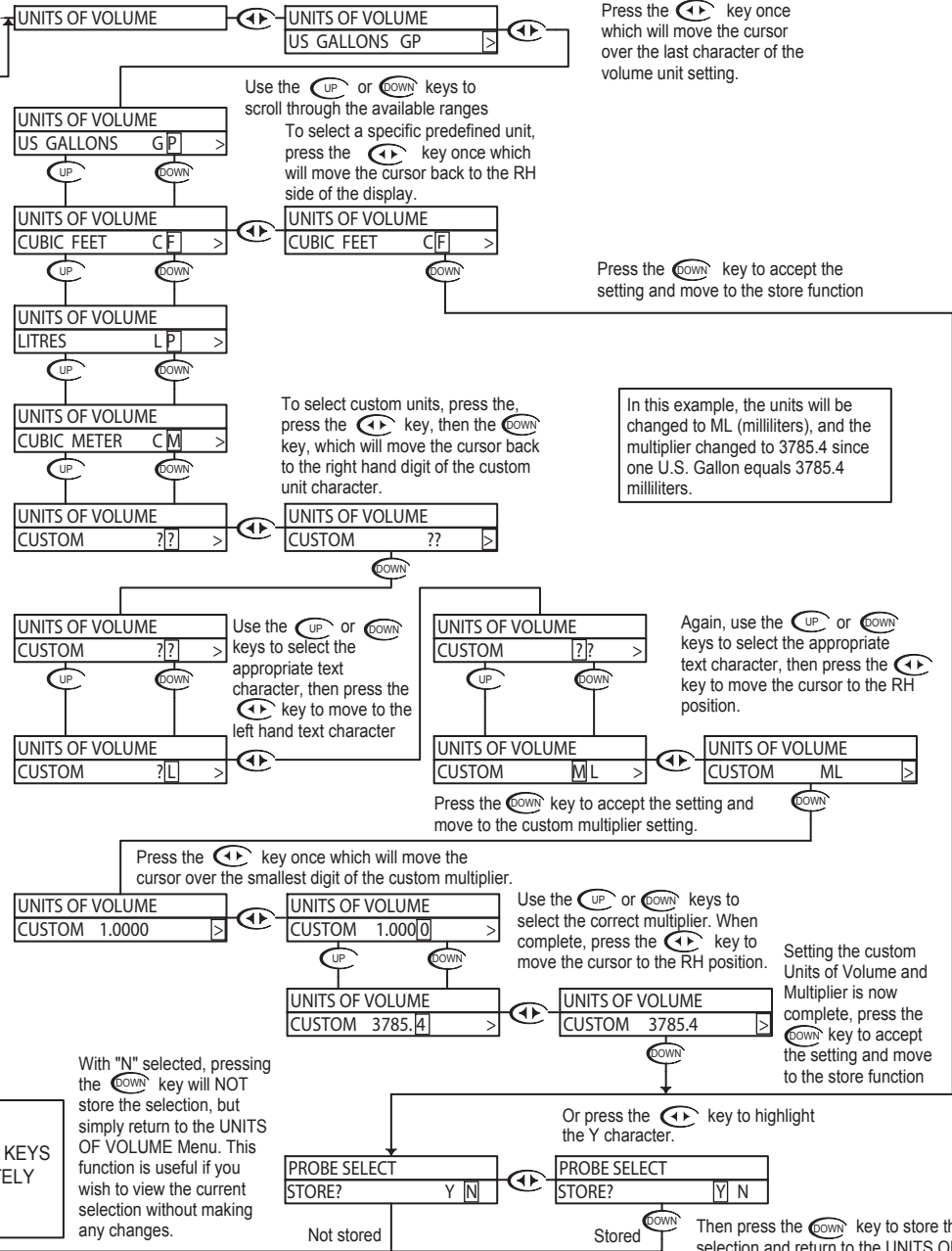
The user can also select any custom two characters to represents units from AA to ZZ and an input multiplier which will numerically relate the custom unit of measure to US Gallons. The input multiplier can be set at any value between 0.0001 and 10000.



WARNING: Changing the units of Volume with an accumulated flow total will reset the flow total to zero. Example: If the controller has been running in GPM mode and has a totalized flow, changing from GPM to another unit will reset the totalizer to zero.

NOTE: ACCELERATOR KEYS: Pressing the UP or DOWN key once will change the value by the smallest digit. Holding the key down will cause the value to change at an increasing rate until the key is released. Pressing the key again will cause the value to start changing at it's slowest rate again. This allows the user to get to the new multiplier value quickly.

NOTE: PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Press the key once which will move the cursor over the last character of the volume unit setting.

Use the UP or DOWN keys to scroll through the available ranges. To select a specific predefined unit, press the key once which will move the cursor back to the RH side of the display.

Press the DOWN key to accept the setting and move to the store function

In this example, the units will be changed to ML (milliliters), and the multiplier changed to 3785.4 since one U.S. Gallon equals 3785.4 milliliters.

To select custom units, press the key, then the DOWN key, which will move the cursor back to the right hand digit of the custom unit character.

Again, use the UP or DOWN keys to select the appropriate text character, then press the key to move the cursor to the RH position.

Press the DOWN key to accept the setting and move to the custom multiplier setting.

Press the key once which will move the cursor over the smallest digit of the custom multiplier.

Use the UP or DOWN keys to select the correct multiplier. When complete, press the key to move the cursor to the RH position.

Setting the custom Units of Volume and Multiplier is now complete, press the DOWN key to accept the setting and move to the store function

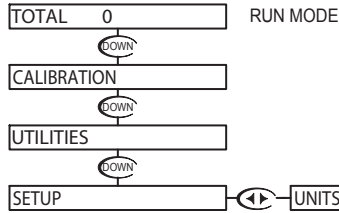
With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the UNITS OF VOLUME Menu. This function is useful if you wish to view the current selection without making any changes.

Or press the key to highlight the Y character.

Then press the DOWN key to store the selection and return to the UNITS OF VOLUME menu.



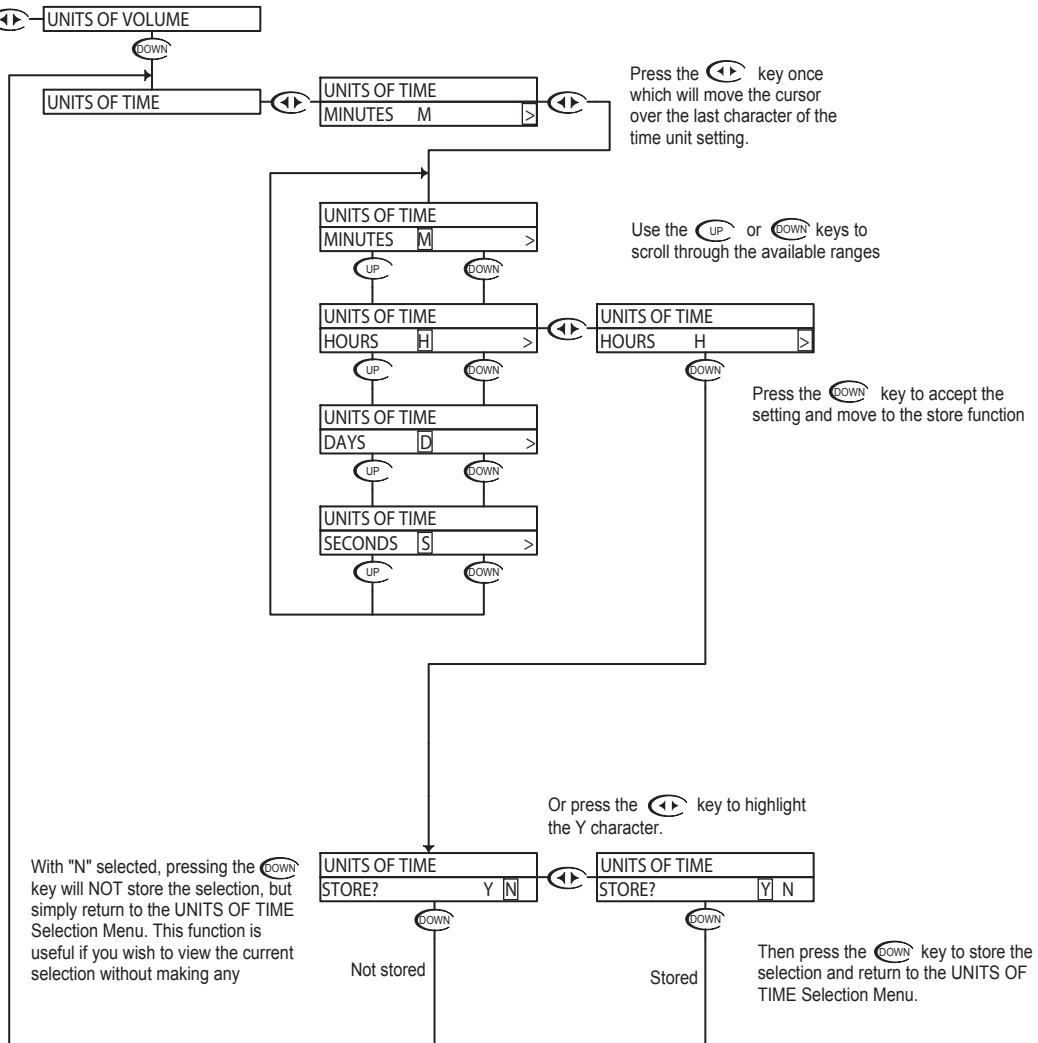
Flow - Setup Menu - Units of Time 7.6



RUN MODE

The Units of Measurement is broken into two variables, UNITS OF VOLUME and UNITS OF TIME. The two variables are then combined to display the desired units of measure. For example, if units of Volume is to set Cubic Meters (CM) and Units of Time is set for Seconds (S), the controller will display flow as Cubic Meters per Second on the front LED display.

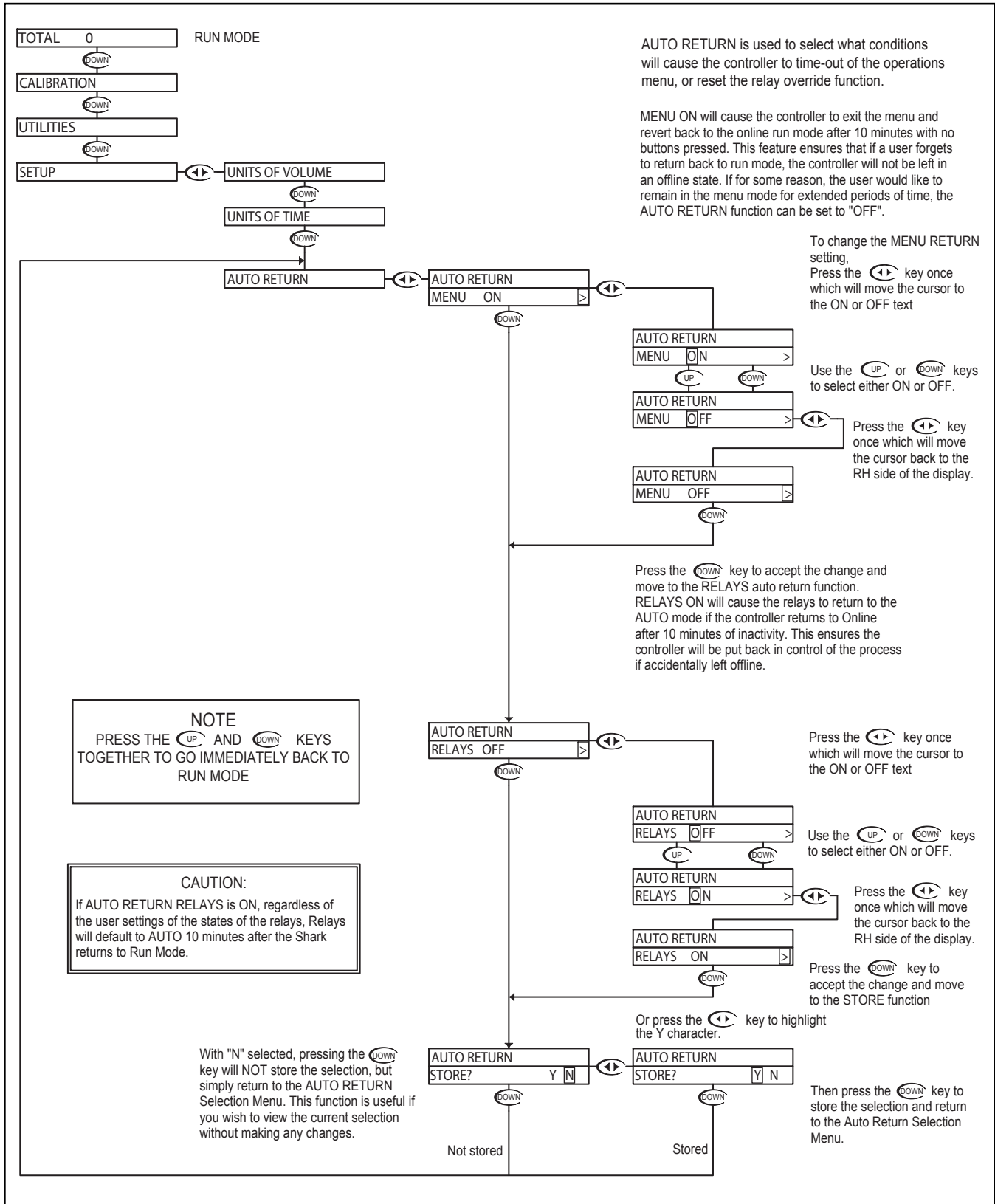
UNITS OF TIME  
 The user can select from four predefined Units of Time, Seconds, Minutes, Hours, Days.



**NOTE**  
 PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

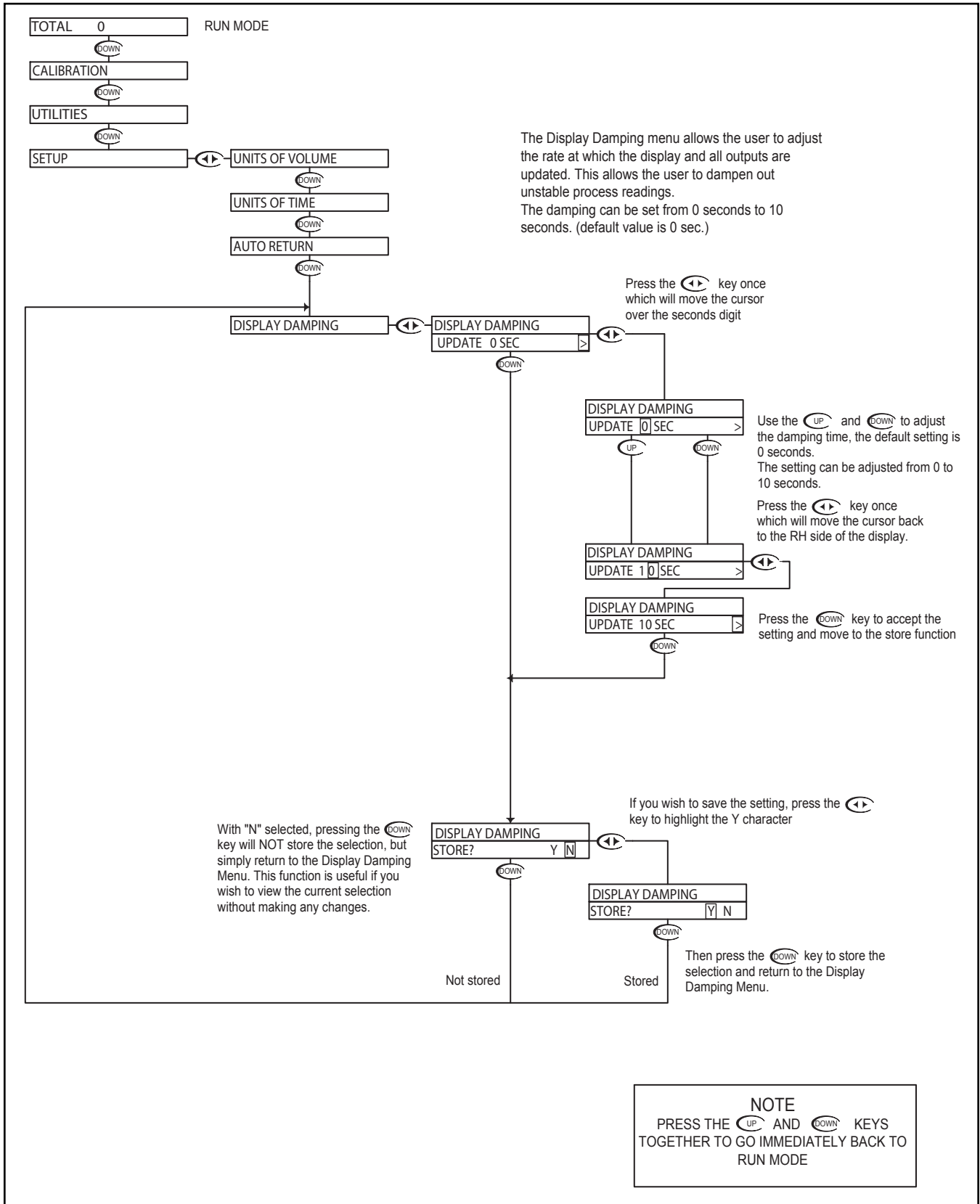


Flow - Setup Menu - Auto Return 7.7



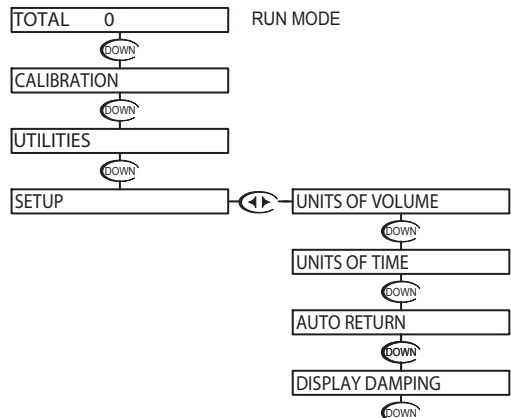


Flow - Setup Menu - Display Damping 7.8





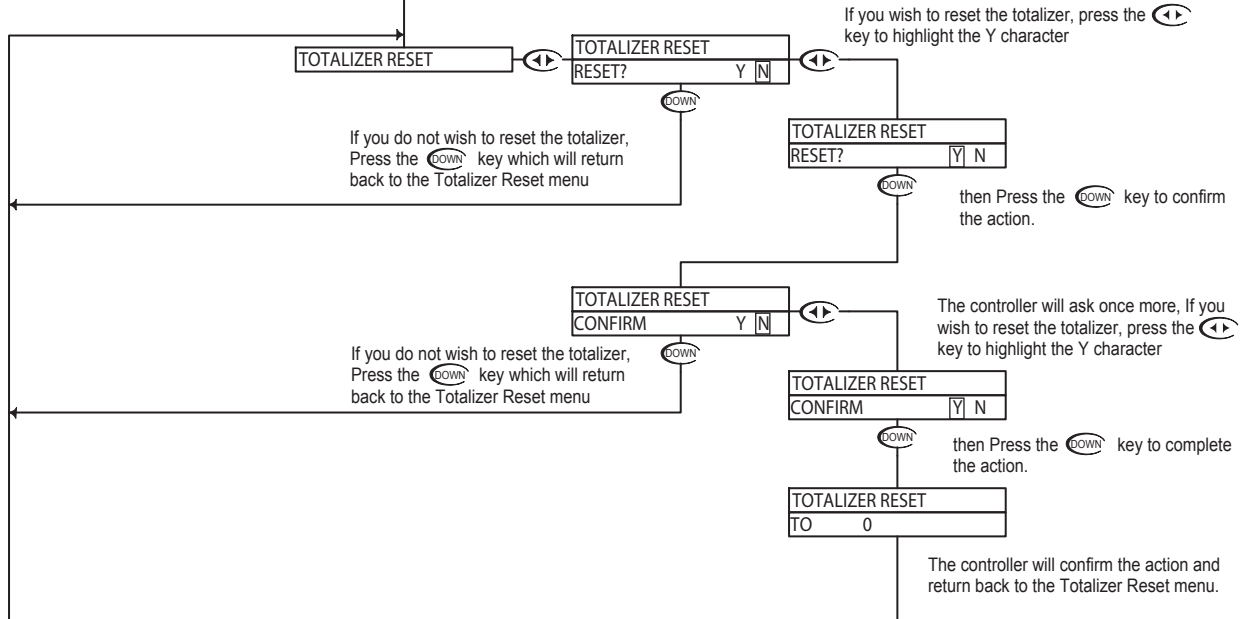
# Flow - Setup Menu - Totalizer Reset 7.9



Totalizer Reset is used to reset the Flow totalizer to zero.

Note that this once complete, this action cannot be reversed, the accumulated total will be erased permanently.

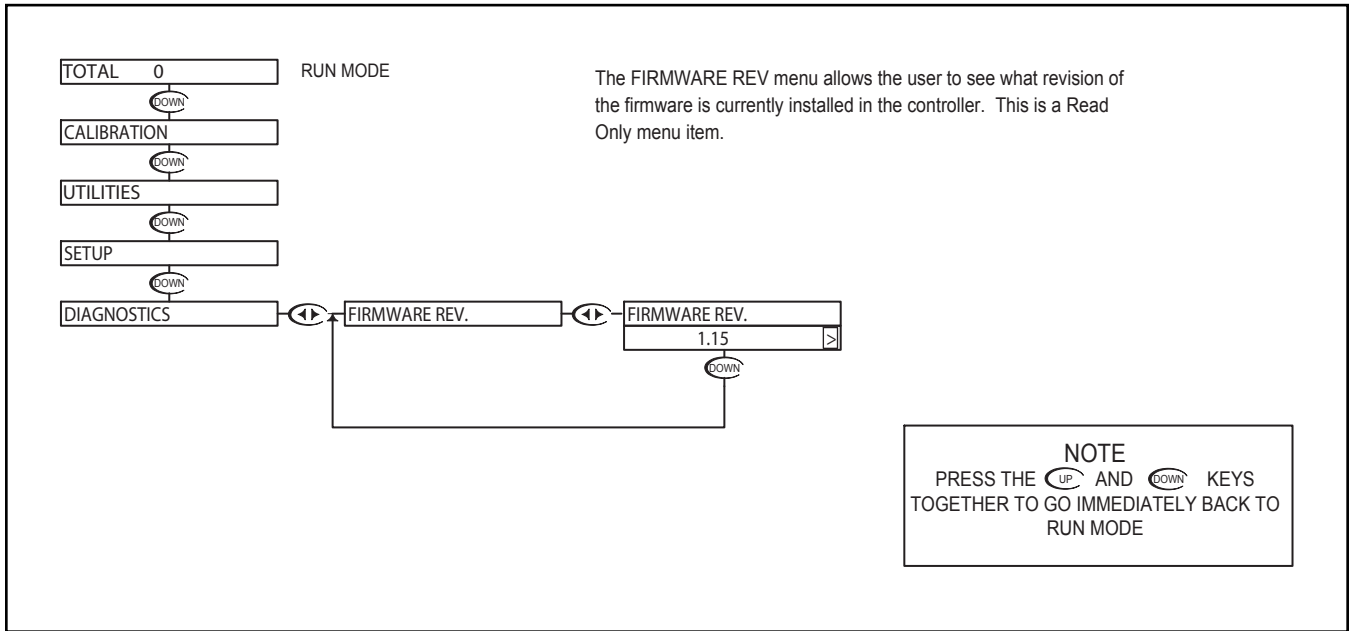
When the totalizer "roles over", an auxillary LED will light up the front panel.



**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

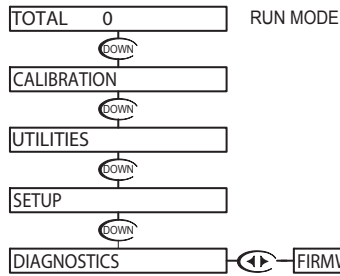


Flow - Diagnostics Menu - Firmware Rev 7.10





Flow - Diagnostics Menu - Calibration Data 7.11



The Calibration Data menu is a read only screen which allow the user to view the K factor entered during the last calibration.

Press **←→** to view the first Calibration Data screen.

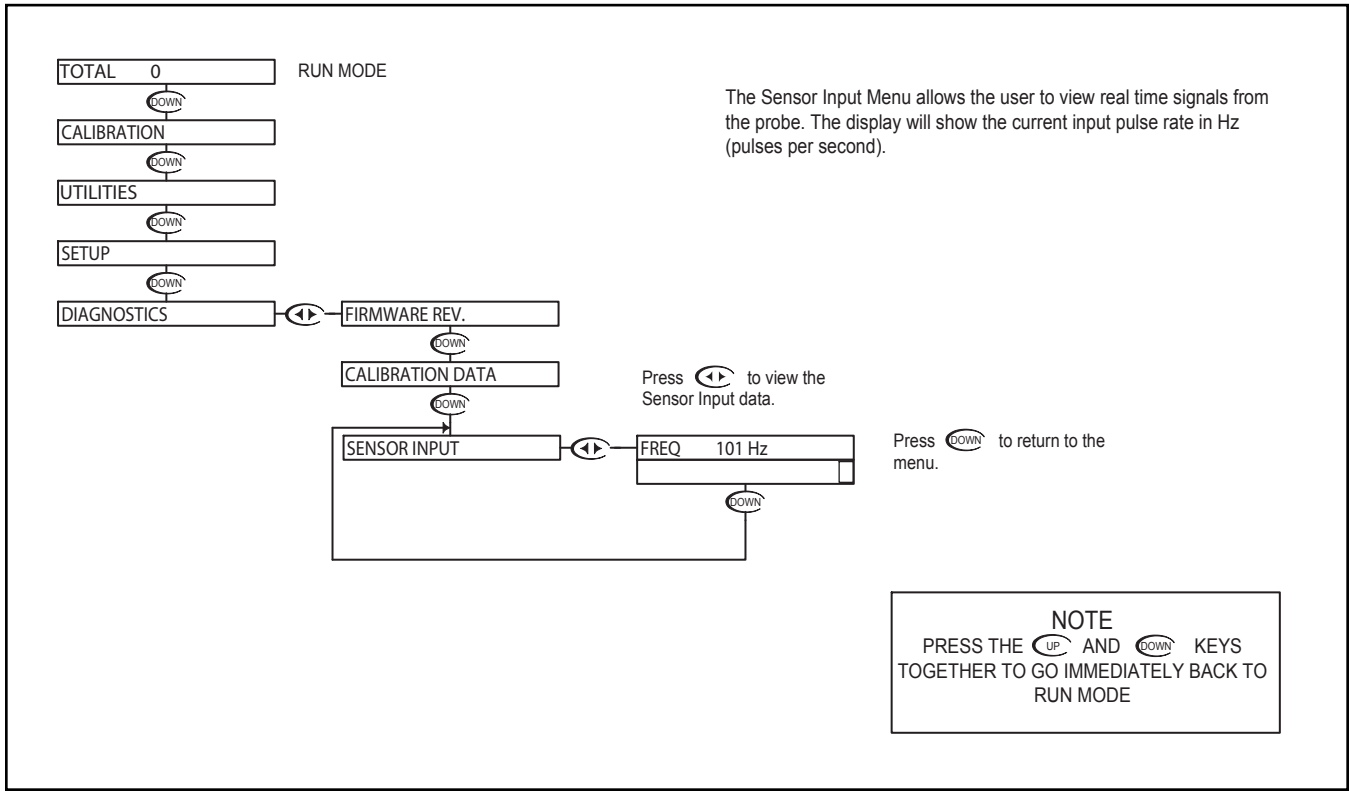
This screen shows the K factor entered during calibration.

Press **DOWN** to return to the Calibration Data menu.

**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Flow - Diagnostics Menu - Sensor Input 7.12







Flow - Diagnostics Menu - Permanent Total 7.13

TOTAL 0 RUN MODE

DOWN  
CALIBRATION

DOWN  
UTILITIES

DOWN  
SETUP

DOWN  
DIAGNOSTICS

◀▶ FIRMWARE REV.

DOWN  
CALIBRATION DATA

DOWN  
SENSOR INPUT

DOWN  
PERMANENT TOTAL

Press ◀▶ to view the Total Life Flow to date.

▶ TOTAL LIFE FLOW  
7421413

Press DOWN to return to the menu.



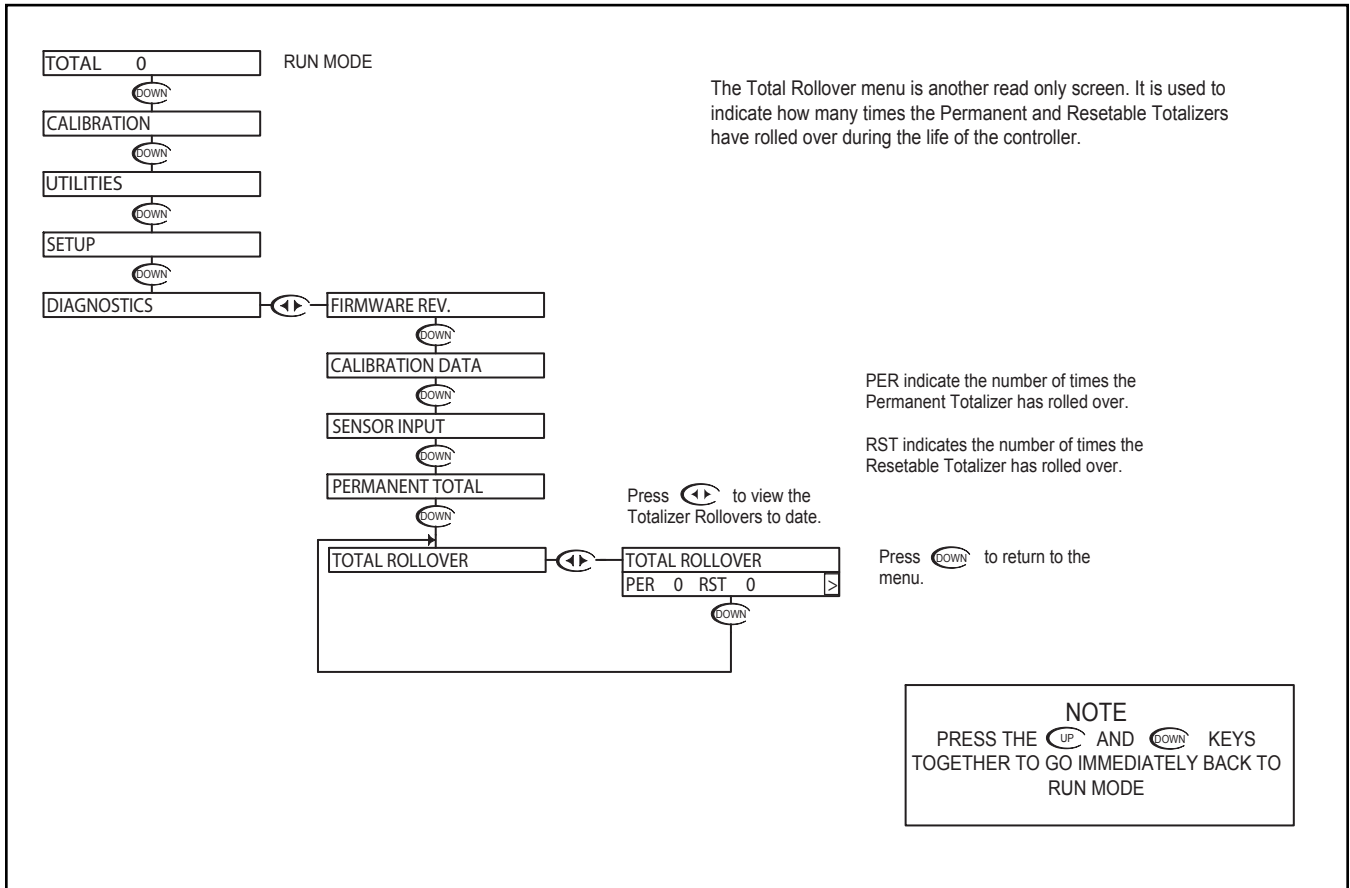
The Permanent Total is a running total off all the volume units that have been accumulated by the controller. It starts at zero when new, and can only be set to zero at the factory.

This is a read only screen.

**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

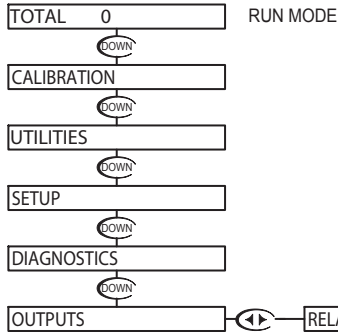


Flow - Diagnostics Menu - Total Rollover 7.14





Flow - Outputs Menu - Relay A 7.15



Relay B can be configured for the following operations  
 - Response to rising or falling process values  
 - Adjustable on and off set-points  
 - Cycle on and off times  
 - Failsafe operation  
 Each function will be explained below

The relay can be set to control either a RISING or FALLING process.  
 In a RISING process, the control relay will energize when the process rises above a set value. In this case, the ON set-point must be set higher than the OFF set-point.  
 In a FALLING process, the control relay will energize when the process falls below a set value. In this case, the ON set-point must be set lower than the OFF set-point.

The RELAY ON setting is the process value at which the relay will energize. It may be set anywhere in the normal range of the sensor.

The RELAY OFF setting is the process value at which the relay will de-energize. The setting must be rationalized against the On setting. For example, in a falling process, the Off setting must be higher than the ON setting.

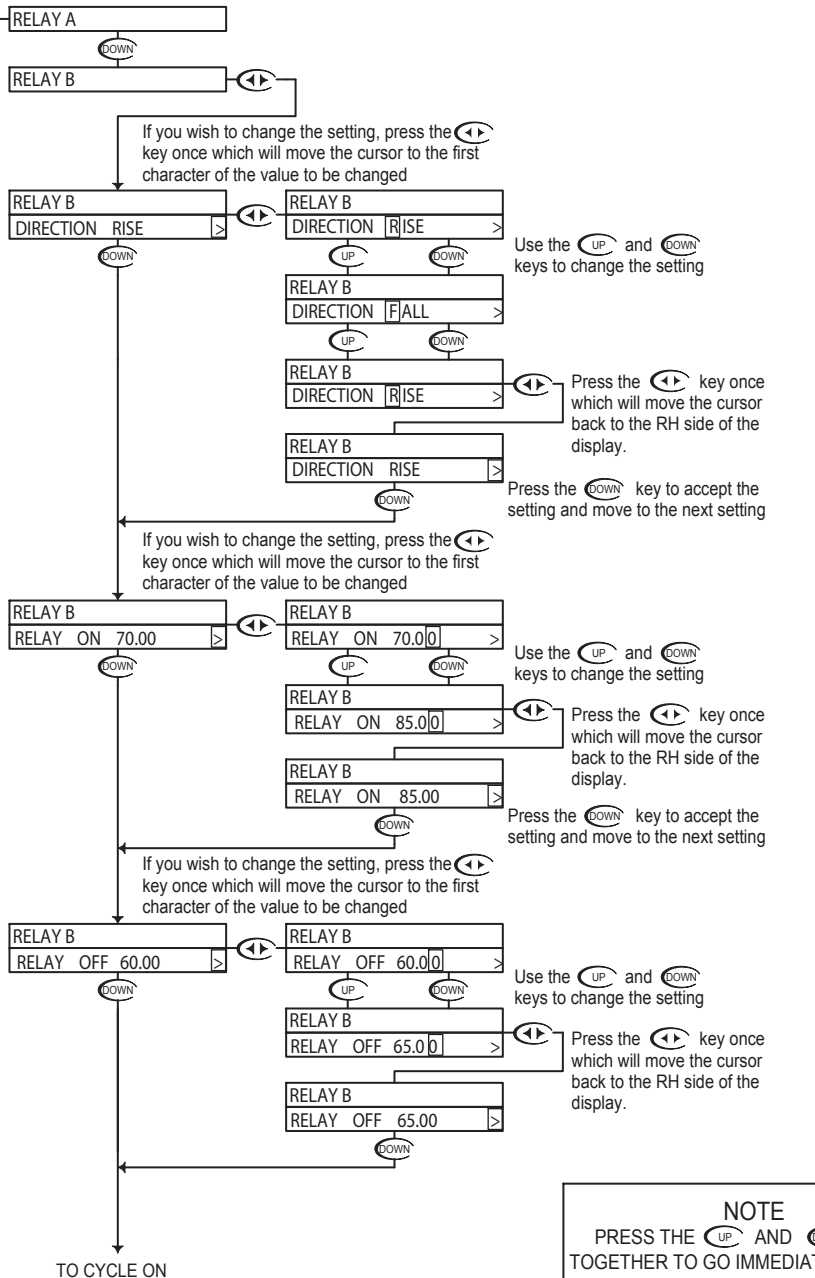
The controller will not allow you to select the RELAY OFF value on the wrong side of the RELAY ON value for the selected direction. If the user tries to set the RELAY OFF on the wrong side, the following errors will be displayed:

FALLING PROCESS  
 ON SPT < OFF SPT

Error when trying to set OFF point lower than ON point when set to falling.

RISING PROCESS  
 ON SPT > OFF SPT

Error when trying to set OFF point higher than ON point when set to rising.



**NOTE**  
 PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Flow - Outputs Menu - Relay A 7.15

The relay can be set to CYCLE when the process is between the RELAY ON setting and the RELAY OFF setting. This is meant to help eliminate overshoot.

The CYCLE ON time is the amount of time in seconds that the relay will be on. The value can be set between 0 and 600 seconds. The default ON time is 5 seconds.

The CYCLE OFF time is the amount of time in seconds that the relay will be off for, it can be set between 0 - 600 seconds.

To disable the cycling feature set the cycle off time to 0. The Default OFF time is 0 seconds.

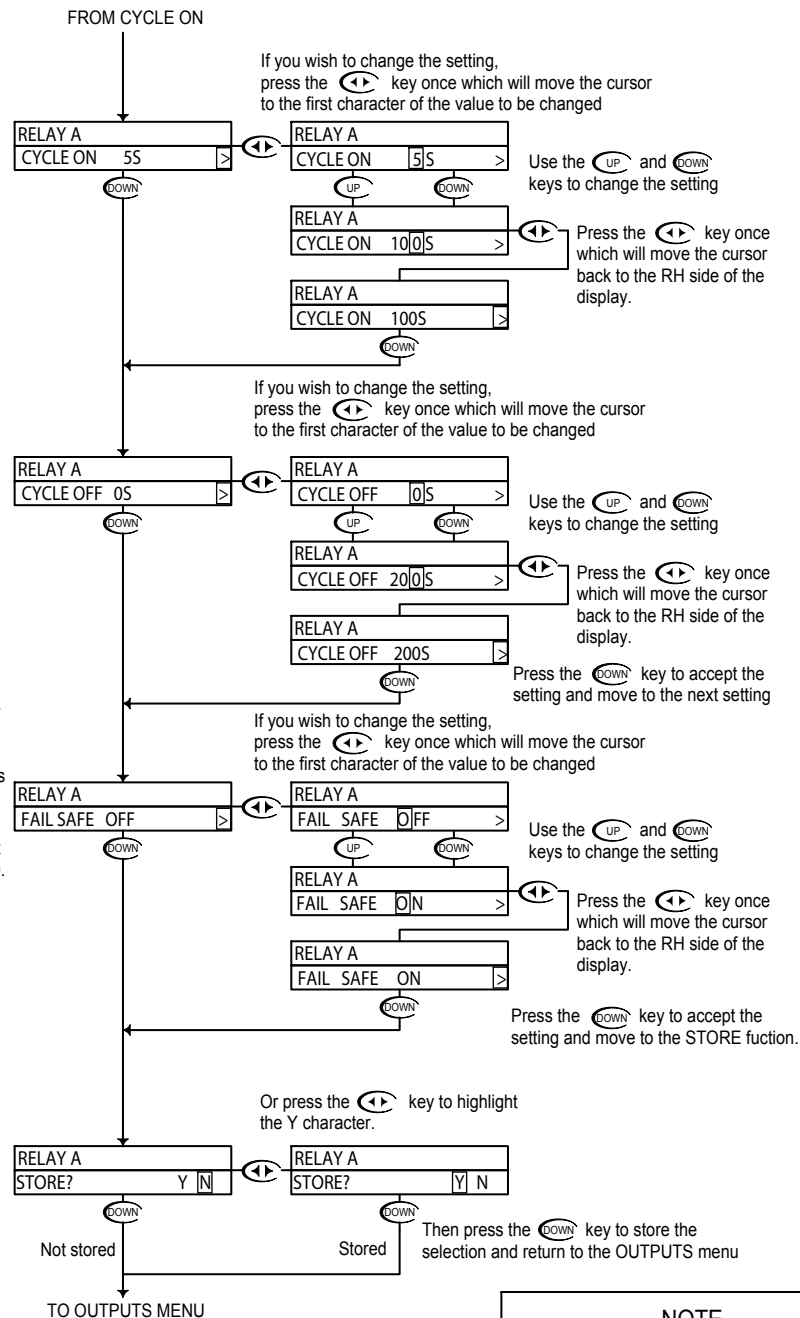
The FAIL SAFE feature is designed to reverse the normal action of the relay.

When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption.

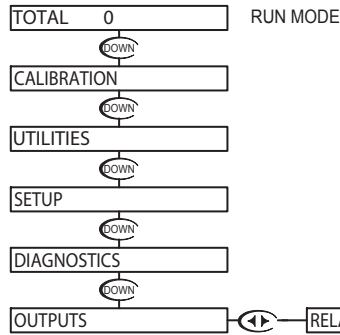
With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Flow - Outputs Menu - Relay B 7.16



Relay B can be configured for the following operations  
 - Response to rising or falling process values  
 - Adjustable on and off set-points  
 - Cycle on and off times  
 - Failsafe operation  
 Each function will be explained below

The relay can be set to control either a RISING or FALLING process.  
 In a RISING process, the control relay will energize when the process rises above a set value. In this case, the ON set-point must be set higher than the OFF set-point.  
 In a FALLING process, the control relay will energize when the process falls below a set value. In this case, the ON set-point must be set lower than the OFF set-point.

The RELAY ON setting is the process value at which the relay will energize. It may be set anywhere in the normal range of the sensor.

The RELAY OFF setting is the process value at which the relay will de-energize. The setting must be rationalized against the On setting. For example, in a falling process, the Off setting must be higher than the ON setting.

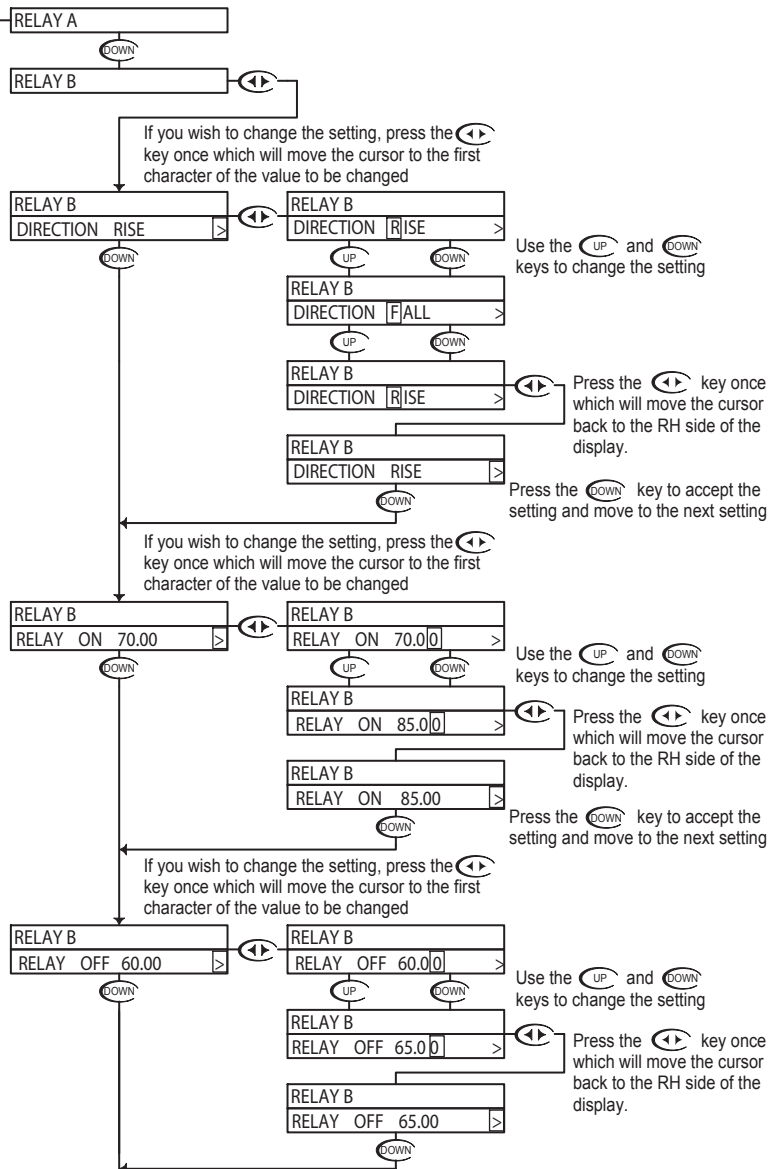
The controller will not allow you to select the RELAY OFF value on the wrong side of the RELAY ON value for the selected direction. If the user tries to set the RELAY OFF on the wrong side, the following errors will be displayed:

FALLING PROCESS  
 ON SPT < OFF SPT

Error when trying to set OFF point lower than ON point when set to falling.

RISING PROCESS  
 ON SPT > OFF SPT

Error when trying to set OFF point higher than ON point when set to rising.



TO CYCLE ON

**NOTE**  
 PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Flow - Outputs Menu - Relay B 7.16

The relay can be set to CYCLE when the process is between the RELAY ON setting and the RELAY OFF setting. This is meant to help eliminate overshoot.

The CYCLE ON time is the amount of time in seconds that the relay will be on. The value can be set between 0 and 600 seconds. The default ON time is 5 seconds.

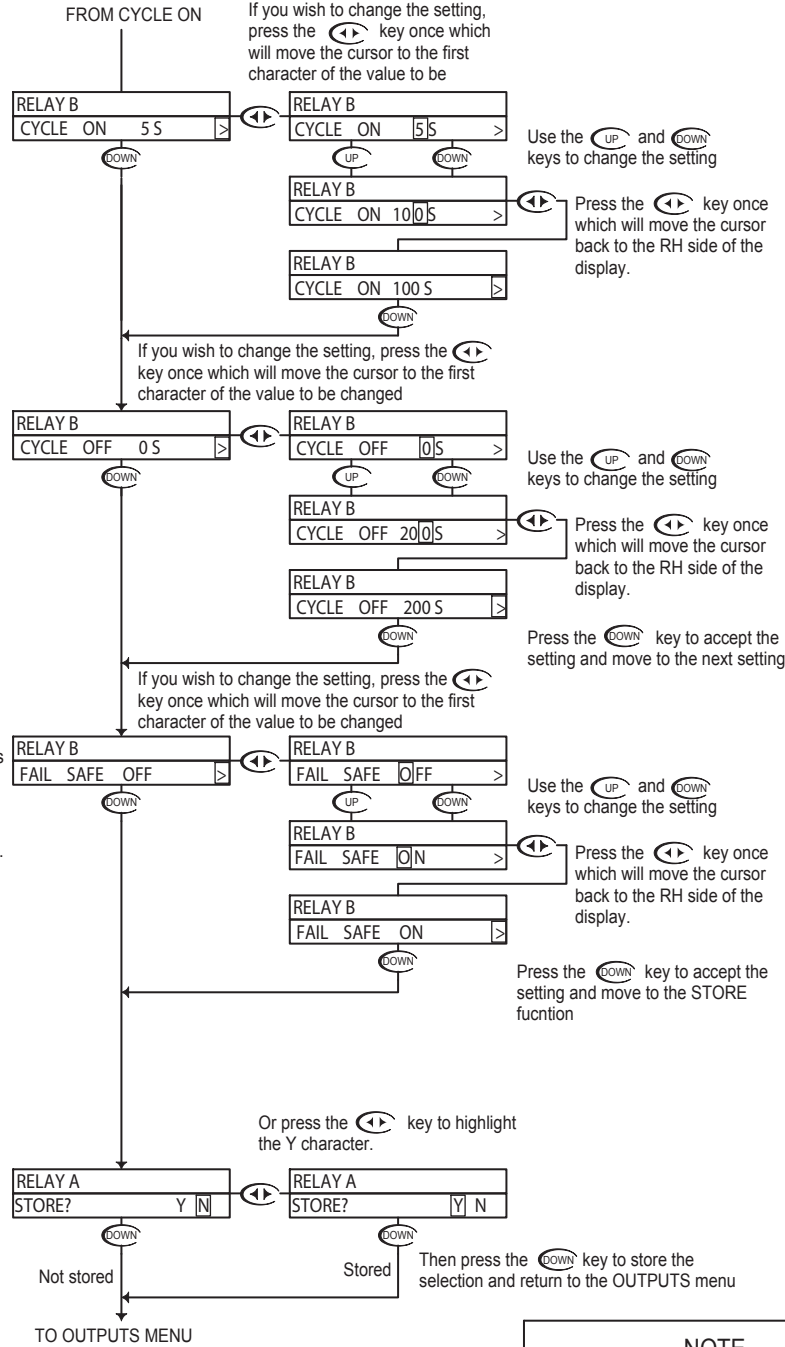
The CYCLE OFF time is the amount of time in seconds that the relay will be off for, it can be set between 0 - 600 seconds. To disable the cycling feature set the cycle off time to 0. The default OFF time is 0 seconds.

The FAIL SAFE feature is designed to reverse the normal action of the relay. When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on.

When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off.

The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption. For example, a process that needs a constant feed, would want a pump to turn on in the event of a controller power failure.

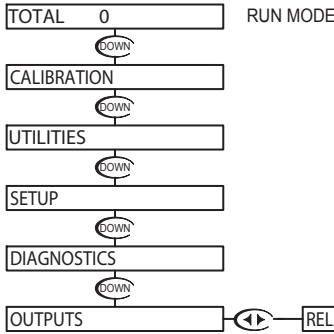
With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.



**NOTE**  
PRESS THE UP AND DOWN KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Flow - Outputs Menu - Alarm Relay 7.17



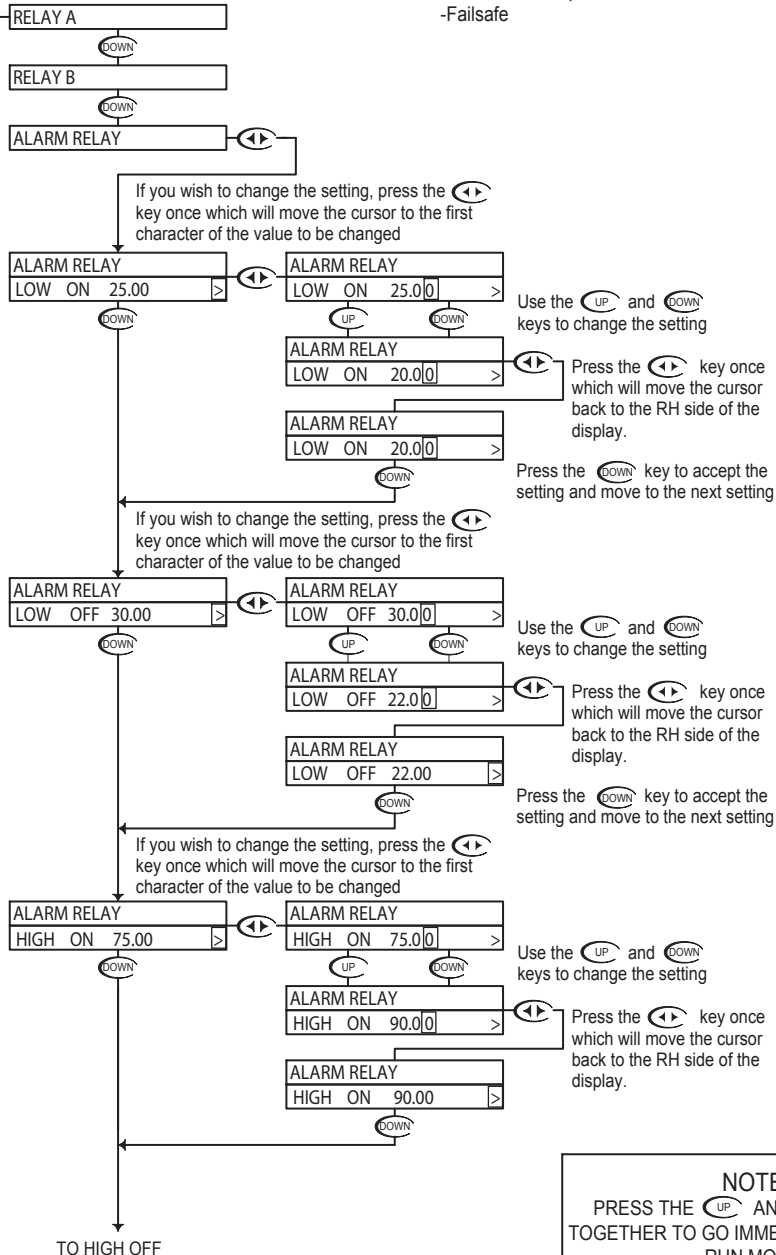
The ALARM RELAY will respond to both a rising and falling process. The ALARM RELAY will act as a low alarm (falling process) and a high alarm (rising process). Both relay bands will have independently adjustable on and off set-points. If a low alarm set-point is set at a value 20 for example, the off set-point must be set higher. The controller will not let the user input a value below 20. The same rule holds true for the high alarm. The Alarm Relay can be configured for the following operations

- LOW ON Set-point
- LOW OFF Set-point
- HIGH ON Set-point
- HIGH OFF Set-point
- Failsafe

The LOW ON set point is the low process value that will cause the relay to energize. This value can be set anywhere 0-100% of Full Scale.

The LOW OFF set point is the value that the process must reach in order to de-energize the alarm relay after it has dropped below and tripped the LOW ON set-point. This value must be higher than the LOW ON Set-point.

The HIGH ON set-point is the high process value that will cause the relay to energize. This value can be set anywhere 0-100% of Full Scale.



**NOTE**  
 PRESS THE **↑** AND **↓** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



Flow - Outputs Menu - Alarm Relay 7.17

The HIGH OFF set-point is the value that the must reach in order to de-energize the alarm relay after it has increased over and tripped the HIGH ON set-point. This value must be lower than the HIGH ON Set-point.

The FAIL SAFE feature is designed to reverse the normal action of the relay. When set to FAIL SAFE OFF, the relay will operate as a normal relay, which means that when the relay is not energized the NO contacts are open, and a device connected via the NO contacts is turned off. When the relay becomes energized the device turns on. When the relay is set to FAIL SAFE ON, the normal action of the relay is reversed. Thus the NO contact acts as the NC contacts and the NC acts as the NO. Therefore the device connected to the NC contacts will be turned on when the relay on set-point is reached. Actually the relay will be de-energized but because it is acting in reverse the device will be turned on. When the relay off set-point is reached the relay will energize and the device connected to the NC contact will turn off. The reason that the Fail Safe option would be used is to have the device turned on in the event of a power interruption.

If the Low On set-point is set higher than the factory default Low Off set-point, when the user advances from the low on set-point to the Low Off set-point the controller will adjust the Low Off set-point to be equal to the Low On set-point. If the user then tries to decrease the Low Off set-point the Controller will display the Low Alarm setup error screen.

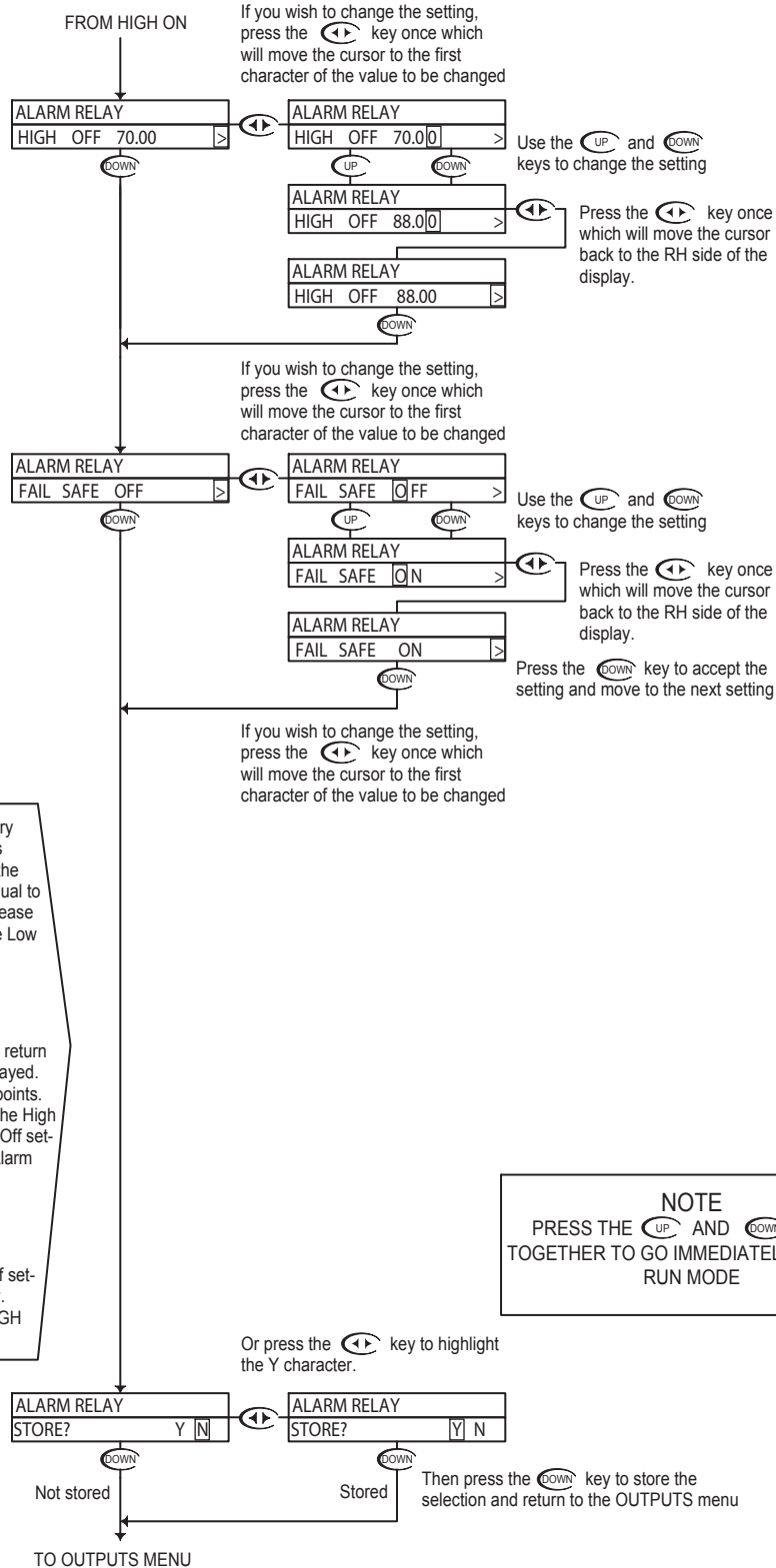
LOW ALARM  
ON SPT < OFF SPT

This screen will be displayed for 10 seconds, then return back to the setup screen that was previously displayed. The same conditions apply to the High alarm set-points. Except the High Off set-point must be lower than the High On set-point. If the user tries to increase the High Off set-point higher than the High On set-point the High Alarm setup error screen will be displayed.

HIGH ALARM  
ON SPT > OFF SPT

If the user sets the low on set-point and the low off set-point equal to 0, it will disable the Low Alarm relay. Similarly, setting the High On set-point and the HIGH OFF set-point to 0 will disable the High Alarm.

With "N" selected, pressing the DOWN key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without making any changes.

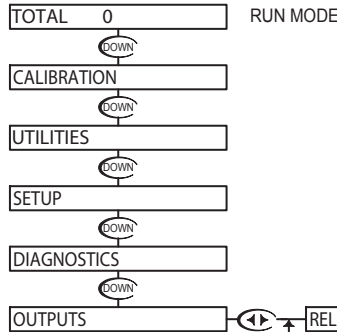


**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE





Flow - Outputs Menu - 4-20mA CH1 Output 7.18



The Controller has 2 4-20mA outputs, electrically isolated from each other and ground. Either output can source current into a maximum of 800 ohms. See Section 3.12 for wiring diagram. Channel 1 (the primary output) is located on the flip out door, terminal plug P6. Channel 1 is dedicated to track the process and has fully independent and fully adjustable 4 & 20 mA output adjustments. This will enable the operator to span the output over the desired range.

The example below shows the 4-20 mA set to 4mA = 20 and 20mA = 90. The output would then span 4 to 20 mA for a flow swing of 20 to 90. Note that the span can be reversed, in that 4 mA can be set to a high flow value and 20 mA can be set to a low flow value, effectively reversing the control direction.

**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE

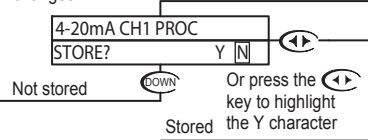
The TUNE function allows the user to precisely adjust the 4-20 mA output to compensate for any errors in the output circuitry. Normally, fine tuning the 4-20mA output is not necessary.

To make the adjustment, place an accurate current meter in series with the 4-20 mA output, with the appropriate loads connected. When the TUNE menu is selected, the controller puts 20 mA out the terminals. Use the **UP** or **DOWN** keys to adjust the 20mA output to get exactly 20.

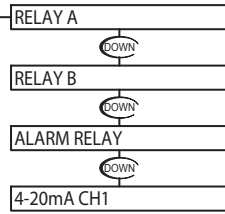
The TUNE value can be adjusted over the range from 0 to 1000, these are unitless numbers used for tuning purposes only.

With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the OUTPUTS Menu.

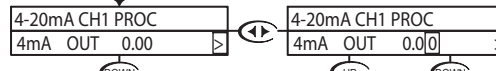
This function is useful if you wish to view the current selection without making any changes.



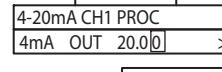
Then press the **DOWN** key to store the selection and return to the OUTPUTS menu



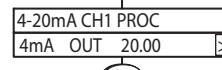
If you wish to change the setting, press the **LEFT** key once which will move the cursor to the first character of the value to be changed



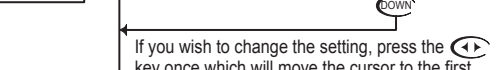
Use the **UP** and **DOWN** keys to change the setting



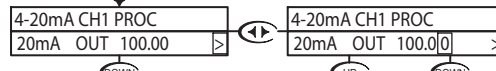
Press the **LEFT** key once which will move the cursor back to the RH side of the display.



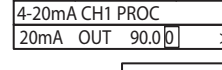
Press the **DOWN** key to accept the setting and move to the next setting



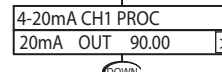
If you wish to change the setting, press the **LEFT** key once which will move the cursor to the first character of the value to be changed



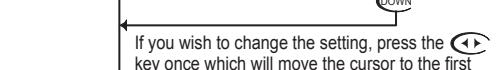
Use the **UP** and **DOWN** keys to change the setting



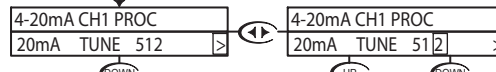
Press the **LEFT** key once which will move the cursor back to the RH side of the display.



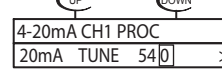
Press the **DOWN** key to accept the setting and move to the next setting



If you wish to change the setting, press the **LEFT** key once which will move the cursor to the first character of the value to be changed



Use the **UP** and **DOWN** keys to change the setting



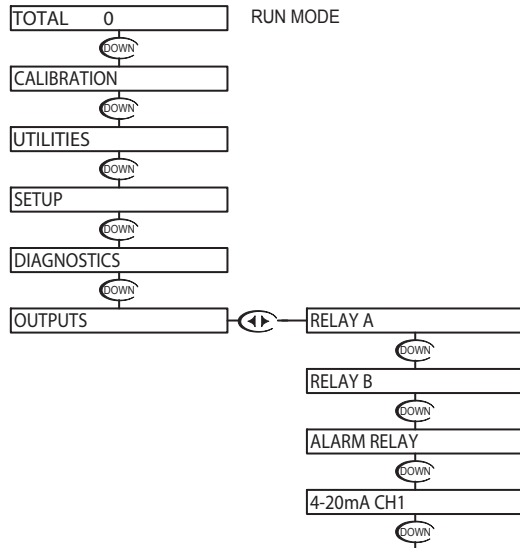
Press the **LEFT** key once which will move the cursor back to the RH side of the display.



Press the **DOWN** key to accept the setting and move to the next setting



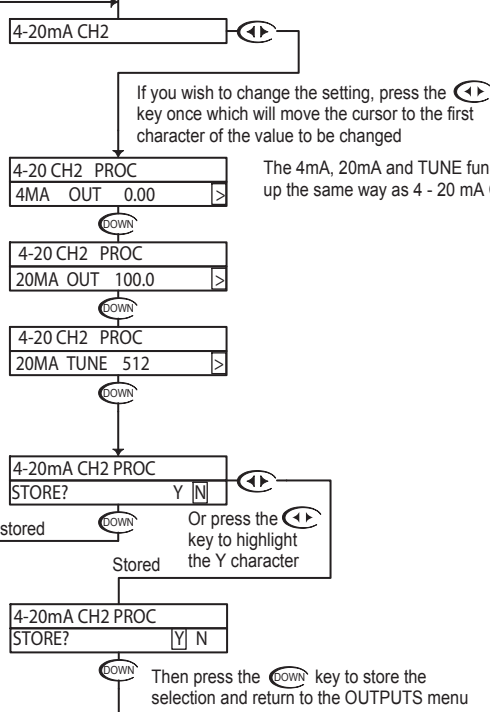
Flow - Outputs Menu - 4-20mA CH2 Output 7.19



The Controller has 2 4-20mA outputs, electrically isolated from each other and ground. Either output can source current into a maximum of 800 ohms. Channel 2 has fully independent and fully adjustable 4 & 20 mA output adjustments. This will enable the operator to span the output over the desired range.

The TUNE function allows the user to precisely adjust the 4-20mA output to compensate for any errors in the output circuitry. Normally, fine tuning the 4-20mA output is not necessary. To make the adjustment, place an accurate current meter in series with the 4-20mA output, with the appropriate loads connected. When the TUNE menu is selected, the controller puts 20mA out to the terminals. Use the **UP** or **DOWN** keys to adjust the 20mA output to get exactly 20. The TUNE value can be adjusted over the range from 0 to 1000, these are unitless numbers used for tuning purposes only.

With "N" selected, pressing the **DOWN** key will NOT store the selection, but simply return to the OUTPUTS Menu. This function is useful if you wish to view the current selection without



The 4mA, 20mA and TUNE functions are set up the same way as 4 - 20 mA CH 1 output.

Then press the **DOWN** key to store the selection and return to the OUTPUTS menu

**NOTE**  
PRESS THE **UP** AND **DOWN** KEYS TOGETHER TO GO IMMEDIATELY BACK TO RUN MODE



**Appendix A - Probe Configuration Table**

Model#	Probe Select	Temp. Sensor	Model#	Probe Select	Temp. Sensor
P60C-4	DIFFERENTIAL	300Ω	R60C-4	DIFFERENTIAL	300Ω
P60C-4-A	DIFFERENTIAL	300Ω	R60C-4-H	DIFFERENTIAL	300Ω
P60C-4-H	DIFFERENTIAL	300Ω	R60C-4-G	DIFFERENTIAL	300Ω
P60C-6	DIFFERENTIAL	300Ω	R60C-6	DIFFERENTIAL	300Ω
P60C-6-H	DIFFERENTIAL	300Ω	R60C-6-H	DIFFERENTIAL	300Ω
P60C-6-F	DIFFERENTIAL	300Ω	R60C-6-G	DIFFERENTIAL	300Ω
P60C-7	DIFFERENTIAL	300Ω	R60C-7	DIFFERENTIAL	300Ω
P60C-7-H	DIFFERENTIAL	300Ω	R60C-7-H	DIFFERENTIAL	300Ω
P60C-7-F	DIFFERENTIAL	300Ω	R60C-7-G	DIFFERENTIAL	300Ω
P60C-8	DIFFERENTIAL	300Ω	R60C-8	DIFFERENTIAL	300Ω
P60C-8-A	DIFFERENTIAL	300Ω	R60C-8-H	DIFFERENTIAL	300Ω
P60C-8-H	DIFFERENTIAL	300Ω	R60C-8-G	DIFFERENTIAL	300Ω
P60C-S	DIFFERENTIAL	300Ω	R60C-S	DIFFERENTIAL	300Ω
P60C-S-F	DIFFERENTIAL	300Ω	R60C-S-F	DIFFERENTIAL	300Ω
AM6010-PO	DIFFERENTIAL	300Ω	AM2010-RO	DIFFERENTIAL	300Ω
AM6070-PO	DIFFERENTIAL	300Ω	AM2070-RO	DIFFERENTIAL	300Ω
P525	COMBINATION	no. temp. sensor	AM2010-R1	DIFFERENTIAL	300Ω
P525-BNC	COMBINATION	no. temp. sensor	AM2070-R1	DIFFERENTIAL	300Ω
P575	COMBINATION	no. temp. sensor	R525	COMBINATION	no. temp. sensor
P575K-1	COMBINATION	Pt. 1000 RTD	R525-BNC	COMBINATION	no. temp. sensor
P575K-2	COMBINATION	300Ω	R575	COMBINATION	no. temp. sensor
P575-BNC	COMBINATION	no. temp. sensor	R575-BNC	COMBINATION	no. temp. sensor
P585	COMBINATION	no. temp. sensor	R585	COMBINATION	no. temp. sensor
P585K-1	COMBINATION	Pt. 1000 RTD	R585-BNC	COMBINATION	no. temp. sensor
P585K-2	COMBINATION	300Ω	R565	COMBINATION	no. temp. sensor
P585-BNC	COMBINATION	no. temp. sensor	R565L	COMBINATION	no. temp. sensor
P565	COMBINATION	no. temp. sensor			
P565L	COMBINATION	no. temp. sensor			



***Return Policy & Warranty Plan***

**AQUAMETRIX, INC. RETURN POLICY**

1. Contact Aquamatrix for a "Return Material Authorization" (RMA) form & number. This RMA number is required for all returns or they will not be accepted.
2. The RMA number must be written on the outside of the box for proper identification.
3. A copy of the RMA form along with a description of the problem, model & serial number must be attached with the returning item(s).
4. All C.O.D. & freight collect shipments will be refused unless authorized by AquaMetric.
5. Shipping documents must indicate "RETURNING FOR REPAIR ONLY, NO COMMERCIAL VALUE".

**12-MONTH AQUAMETRIX WARRANTY REPLACEMENT PLAN**

AquaMetric, Inc. will replace or repair any AquaMetric SHARK controller that fails due to defects in material or workmanship for a period of up to 12 months from the date of shipment from our facility.

A warranty claim will not be honored if defects are not reported within the warranty period, or if AquaMetric determines that defects or damages are due to normal wear, misapplication, lack of maintenance, abuse, improper installation, alteration, or abnormal conditions. AquaMetric's obligation under this warranty shall be limited to, at its option, replacement or repair of this product. The product must be returned to AquaMetric Inc, freight prepaid, for examination. The product must be accompanied with an MSDS for all the process chemicals used, must be thoroughly cleaned and any process chemicals removed before it will be accepted for replacement or repair. AquaMetric liability shall not exceed the cost of the product. Under no circumstances will AquaMetric be liable for any incidental or consequential damages, whether to person or property. AquaMetric will not be liable for any other loss, damage or expense of any kind, including loss of profits, resulting from the installation, use, or inability to use this product.