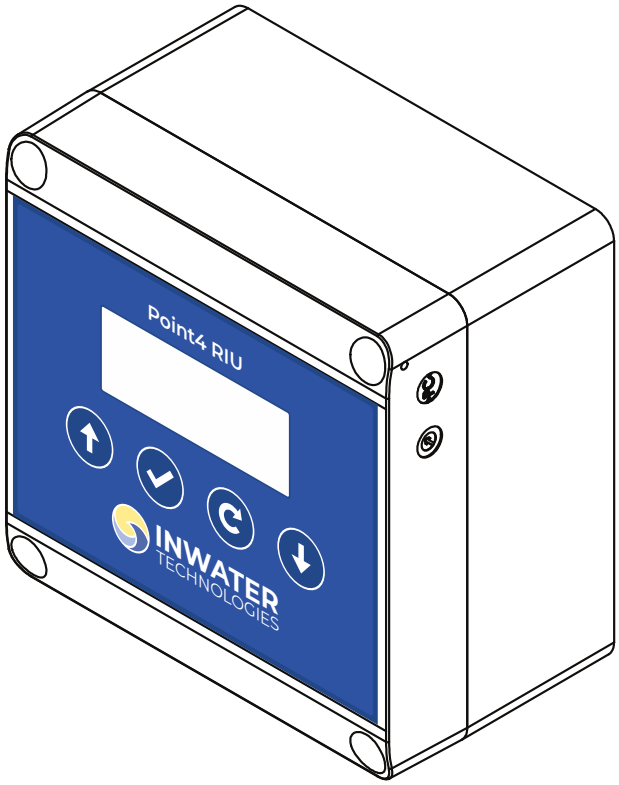
INWATER TECHNOLOGIES

RIU3
REMOTE MONITOR/CONTROLLER



INSTALLATION AND USER'S GUIDE

IMPORTANT SAFETY INSTRUCTIONS
READ AND FOLLOW ALL INSTRUCTIONS
SAVE THESE INSTRUCTIONS

CUSTOMER SERVICE / TECHNICAL SUPPORT

If you have questions about ordering InWater Technologies replacement parts, and products, please use the following contact information:

Phone: 250-850-0022

E-mail: info@inwatertech.com

Web site

Visit www.inwatertech.com to find information about InWater products.

TABLE OF CONTENTS

OVERVIEW

This manual is designed as a guide to assist users in becoming familiar with the various functions of the RIU3 (remote interface unit). Each section of this manual is set up to easily guide users through all stages of installation, setup and maintenance. Starting from unpacking and inspecting the box, this manual will explain all parts and functions of the system to allow users to get the most out of the RIU3 for all their system monitoring needs.

The PT4 RIU3 is a field mounted single sensor transmitter/controller. The unit is compatible with a variety of water quality probes such as dissolved oxygen, temperature and pH. For a full list of compatible probes, see Table1. The RIU3 is equipped with a large font 8 x 2 backlit display so the user can view the sensor readings . The unit contains two SPDT 10amp relays to be used for alarm and/or control outputs. The control blocks can be configured as described on page 19. Probe calibration can also be done via the RIU3 interface as described on page 21.

The RIU3 uses IP67-rated cable glands for the power, data and probe connections, sealing the unit for wet environments. Although the RIU will function as a standalone controller, multiple units may be daisy chained for a network connection. This allows the user to collect, manipulate and control all of the data via the PT4 LC Controller or using the PT4 Sync HMI Software (Windows Based).

Table 1: RIU3-compatible probes

Probe Description	Manufacturer	Parameters	Signal Type
Galvanic DO/Temp	OxyGuard	%Sat, mg/L, DegC	mV, Thermistor
Galvanic DO	OxyGuard	%Sat or mg/L	mV
Optical DO	In-Situ	%Sat, mg/L, DegC	RS485
pH	Sensorex	pH	4-20 mA
ORP	Sensorex	mV	4-20 mA
Salinity	OxyGuard	ppt	4-20 mA
Dissolved CO2 w/ transmitter	OxyGuard	mg/L	4-20 mA
Temperature	OxyGuard	DegC	4-20 mA
Level Switch	RHFS	Low/High Level	Dry Contact
Additional probes with 4-20 mA, 0-5V, or mV outputs may also be compatible with the RIU3. Contact InWater Technologies for more information.			

SYSTEM COMPONENTS

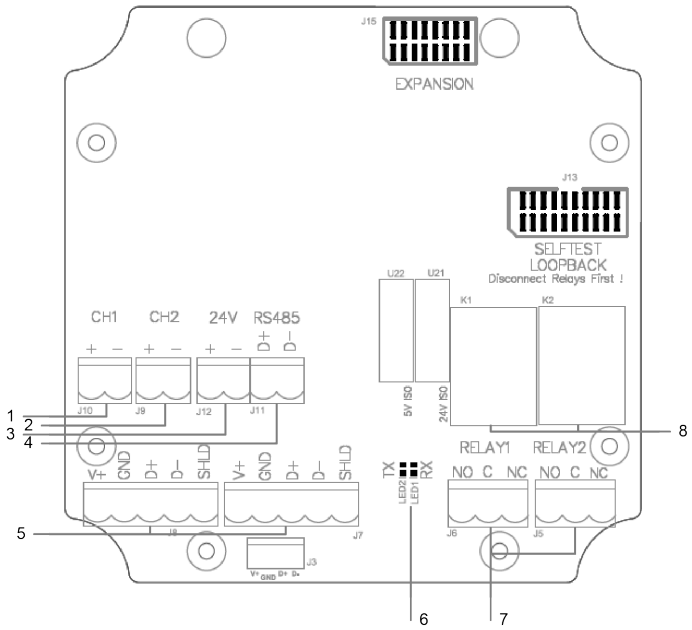
System Components

1) RIU LCD Display : 4 x 20 Backlit Alpha Numeric
2) 4-Button Foil Switch
3) PG9 Cable Gland for Probe Input
4) PG9 Cable Glands for Power and Data connections (x2)
5) PG7 Cable Glands for Relay Outputs (x2)
6) Optional Enclosure Mounting Feet (x4)

System Specifications

1) Power: 12-24 VDC, 180 mA max
2) Auxiliary power for loop-powered probes: Onboard isolated 24 VDC loop power supply
3) Input: Inputs are factory-configurable for probes listed in Table1. Additional probe types are available upon request
4) Outputs: Two SPDT 10 Amp relays – user configurable, RS-485 MODBUS communications
5) Environmental: IP67 water tight enclosure, sealed cable glands
6) Dimensions: 125x125x75 mm

SYSTEM WIRING

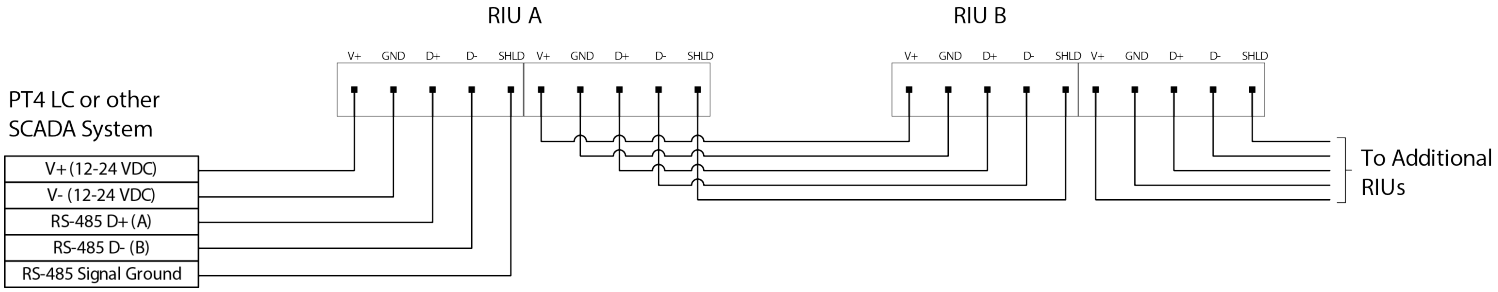


1	Ch 1 input connector
2	Ch 2 input connector
3	Auxiliary 24 VDC power output for probes
4	Auxiliary RS485 probe input
5	Power and RS485 input connectors
6	Data Tx & Rx status LEDs
7	Relay output connectors
8	SPDT Relays

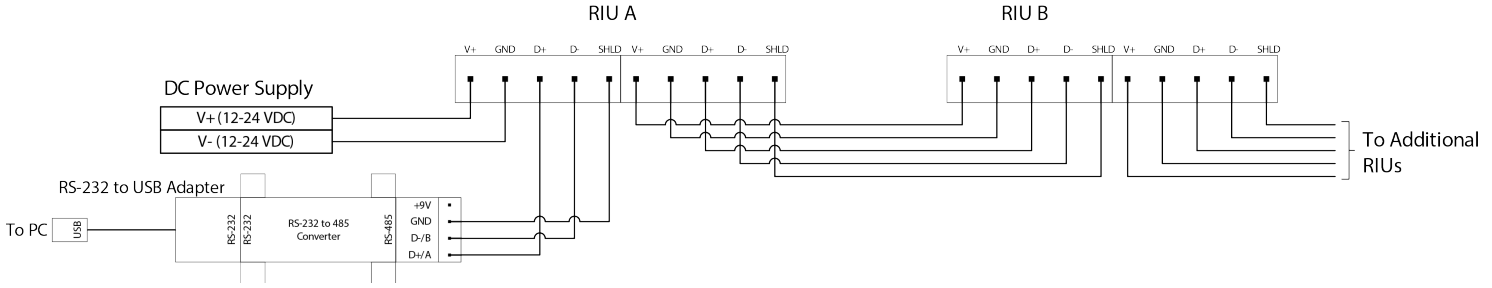
1. Ch1 input connector
   i. A 2 pin connector for the first channel for a probe input.
2. Ch2 input connector
   i. A 2 pin connector for the second channel for a probe input.
3. Isolated DC output for auxiliary probe power
   i. A 2 pin connector used to provide 24 VDC isolated auxiliary probe power.
4. Auxiliary RS485 input connector
   i. A 2 pin connector for RS485 probe inputs.
5. Power & RS485 inputs
   i. 5 pin connectors. Pins 1 and 2 are used to connect DC power to the RIU3. Pins 3 and 4 are used to connect the Modbus RS485 signal to the RIU3. Pin 5 is used to connect the shield of the cable to the RIU3 ground. See page 6 for wiring information.
6. Data Tx & Rx LEDs
   i. These LEDs indicate Modbus RS485 communications. The Rx LED will blink when a Modbus message is received by the RIU3 and the Tx LED will blink when a Modbus message is transmitted by the RIU3.
7. Relay output connectors
   i. 3 pin connectors used to connect the relay output to an external device. Normally open or normally closed configurations can be used. See page 6 for wiring information.
8. SPDT relays
   i. Single pole, double throw relays rated for up to 24 VDC , 10 A. The relay status is controlled by RIU3 control blocks, which can be configured through the Control menu using the 4-button foil switch. See page 19 for control block configuration information.

Typical RIU Wiring Configurations

1. Wiring for use with PT4 LC or other SCADA system



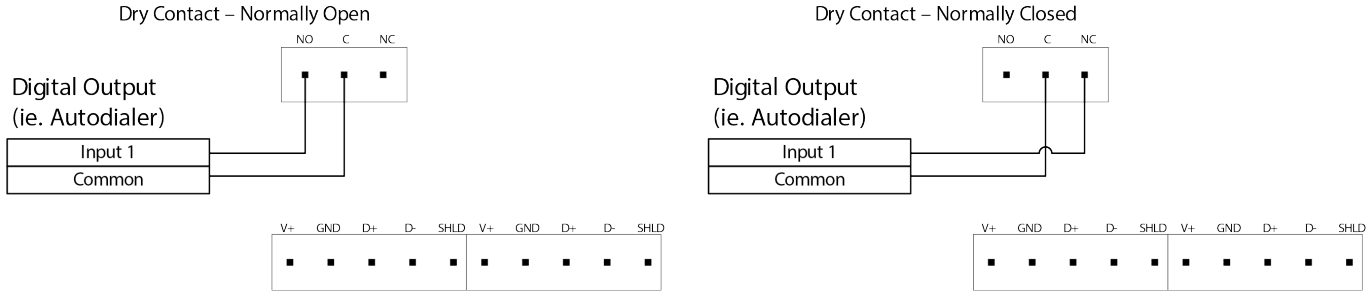
2. Wiring for use with a PC



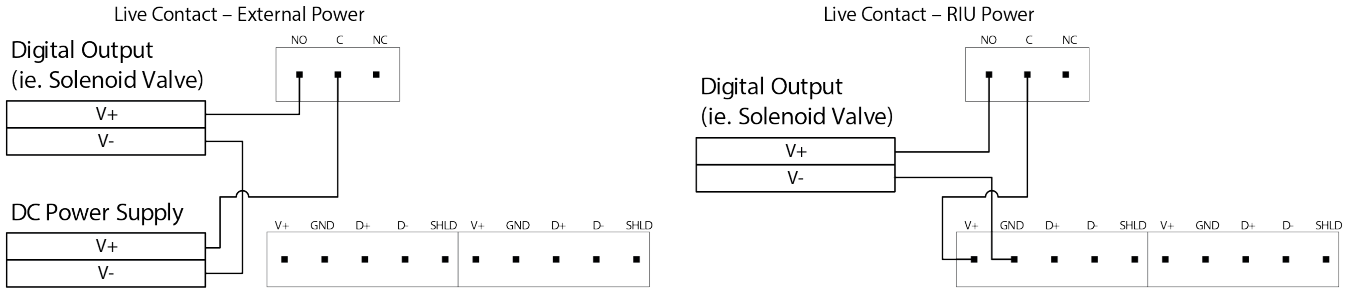
Warning: If the Data and Power wires are not connected to the appropriate terminals, damage to the RIU3 may occur. This will void the warranty. Please ensure all connections are correct before powering up the unit.

Relay Wiring Examples

1. Dry Contact – Normally Open or Normally Closed

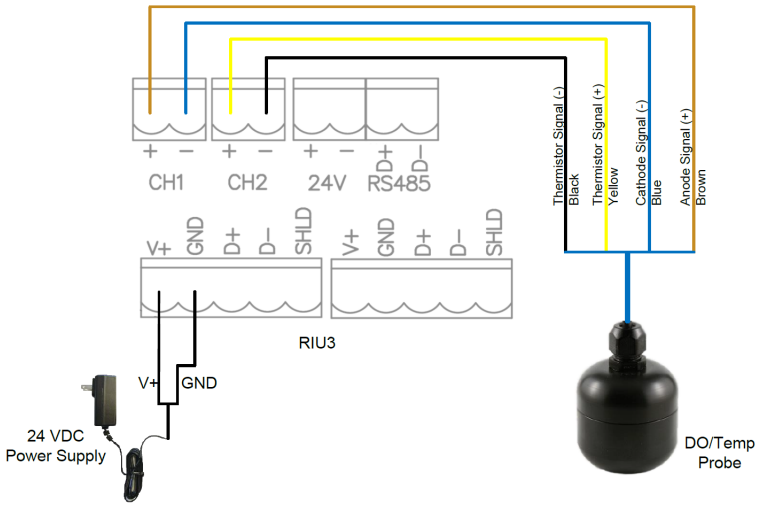


2. Live Contact – RIU or External Power

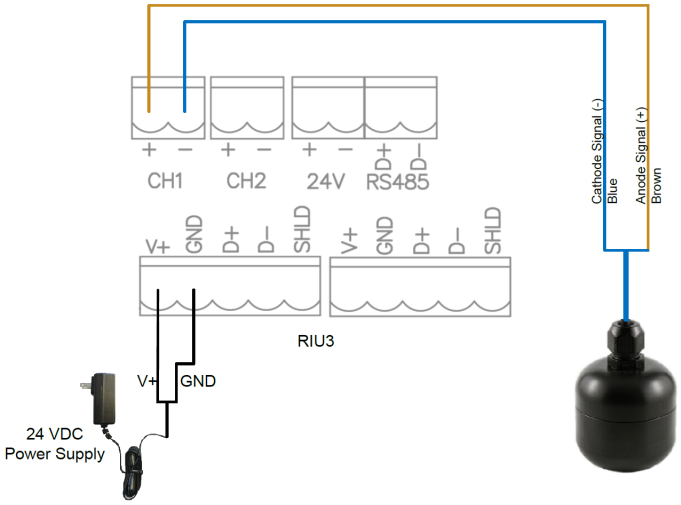


Typical Probe Wiring Configurations

1. OxyGuard DO/Temp Probe

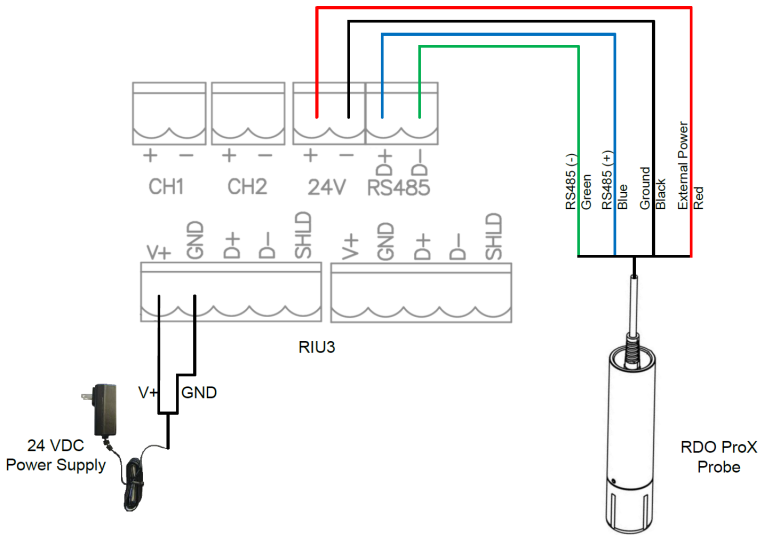


2. OxyGuard DO Probe

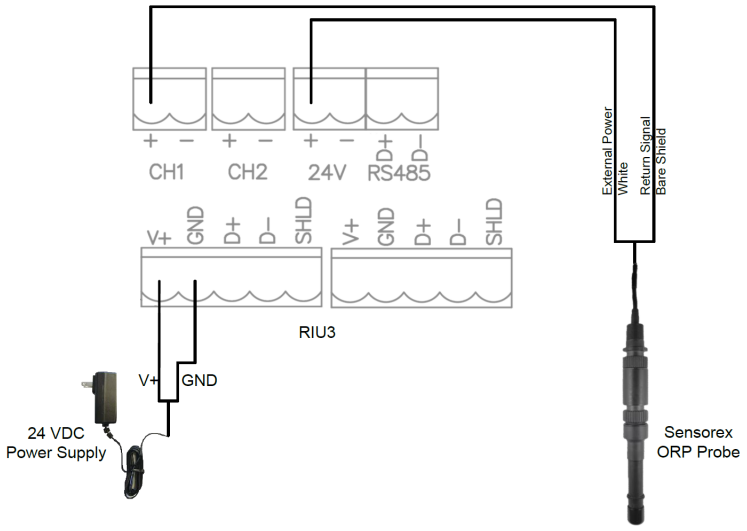


Typical Probe Wiring Configurations

3. InSitu RDO Optical DO Probe

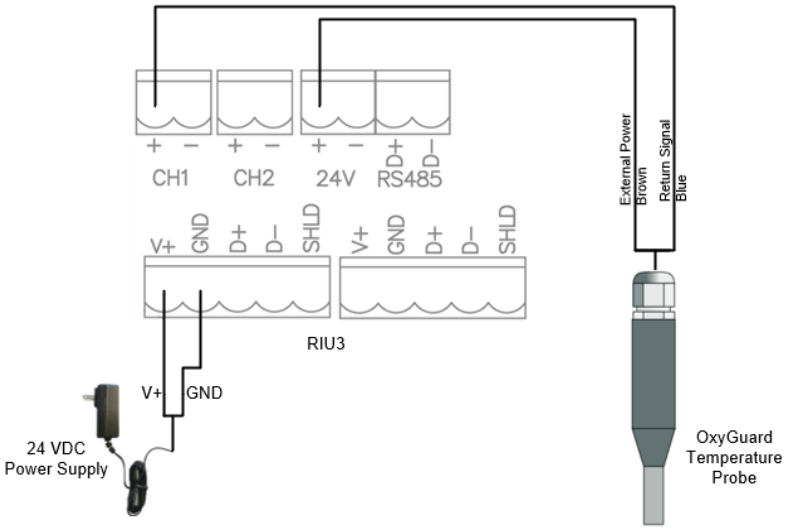


4. Sensorex ORP or pH Probe

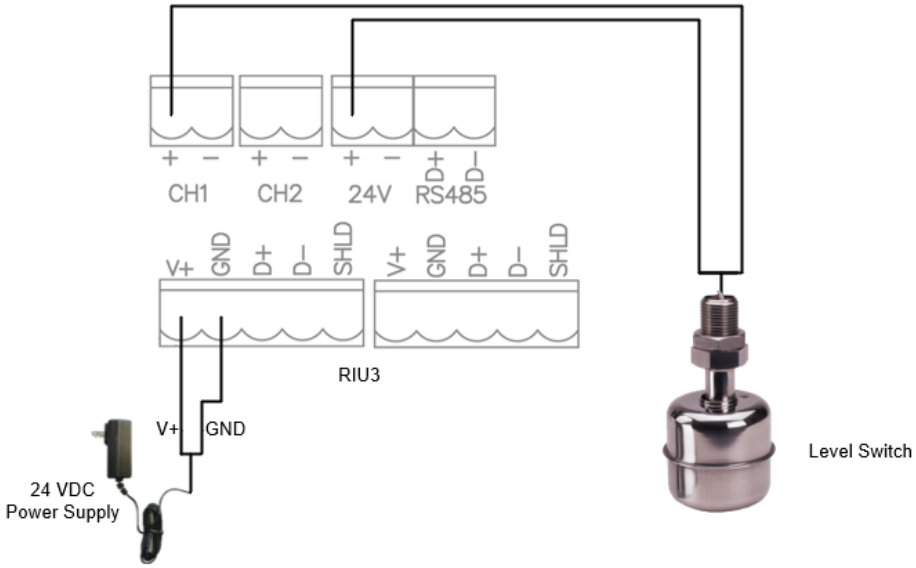


Typical Probe Wiring Configurations

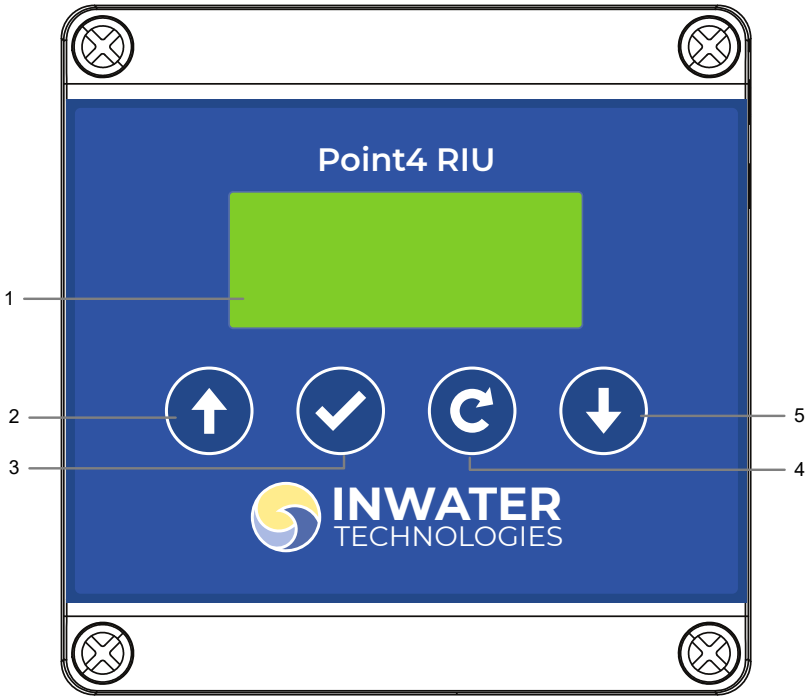
5. OxyGuard Temperature Probe



6. Level Switch



RIU3 FRONT PANEL



1	Backlit LCD Display
2	Up button
3	Enter button
4	Return button
5	Down button

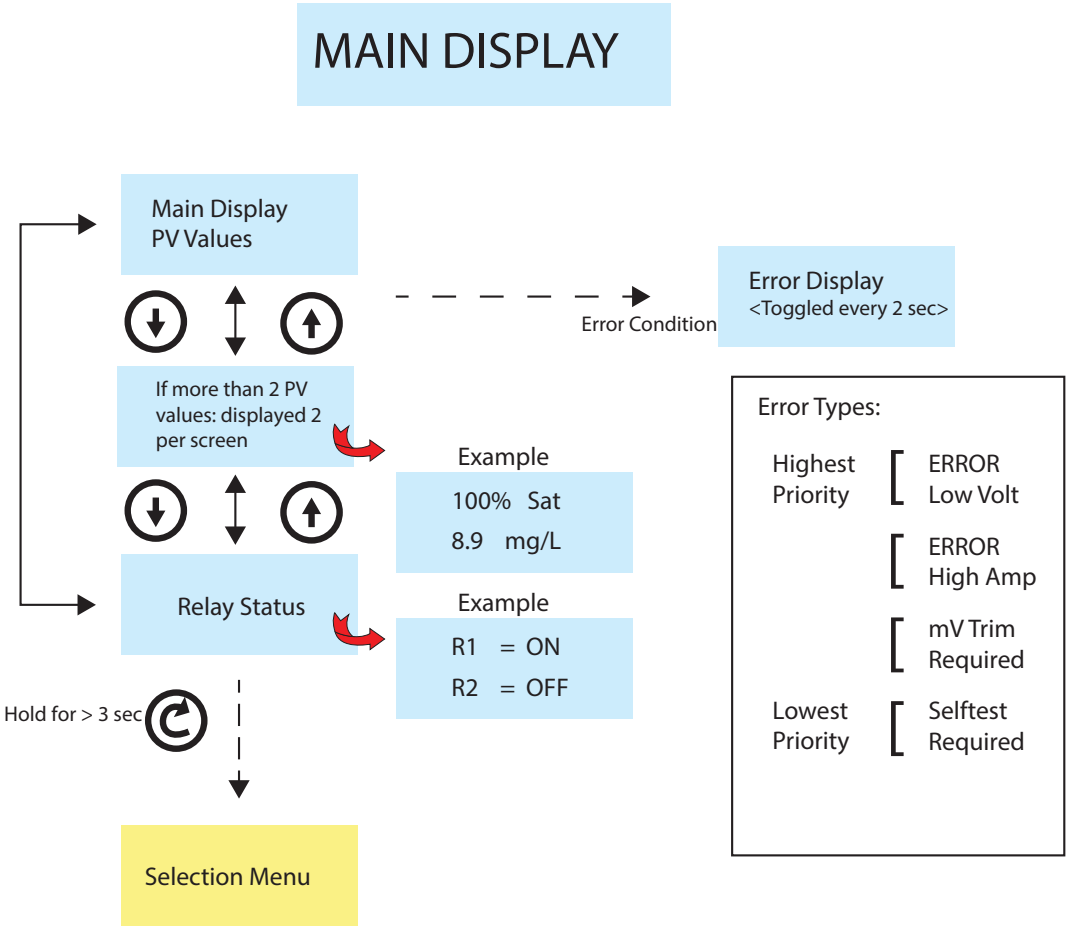
1. LCD Display
   i. A 2x8 Backlit LCD display.
2. "Up" Button
   i. Scrolls up through menu options or input characters, or in the main menu, toggles between display parameters.
3. "Enter" Button
   i. This button is used while in the configuration menu to confirm a selection or user input. See page 11 for more information about navigating the RIU3 menu.
4. "Return" Button
   i. This button can be held for 3 seconds to enter into the RIU3 configuration menu. While in the configuration, this can be pressed to return to the previous menu page.
5. "Down" Button
   i. Scrolls up through menu options or input characters, or in the main menu, toggles between display parameters.

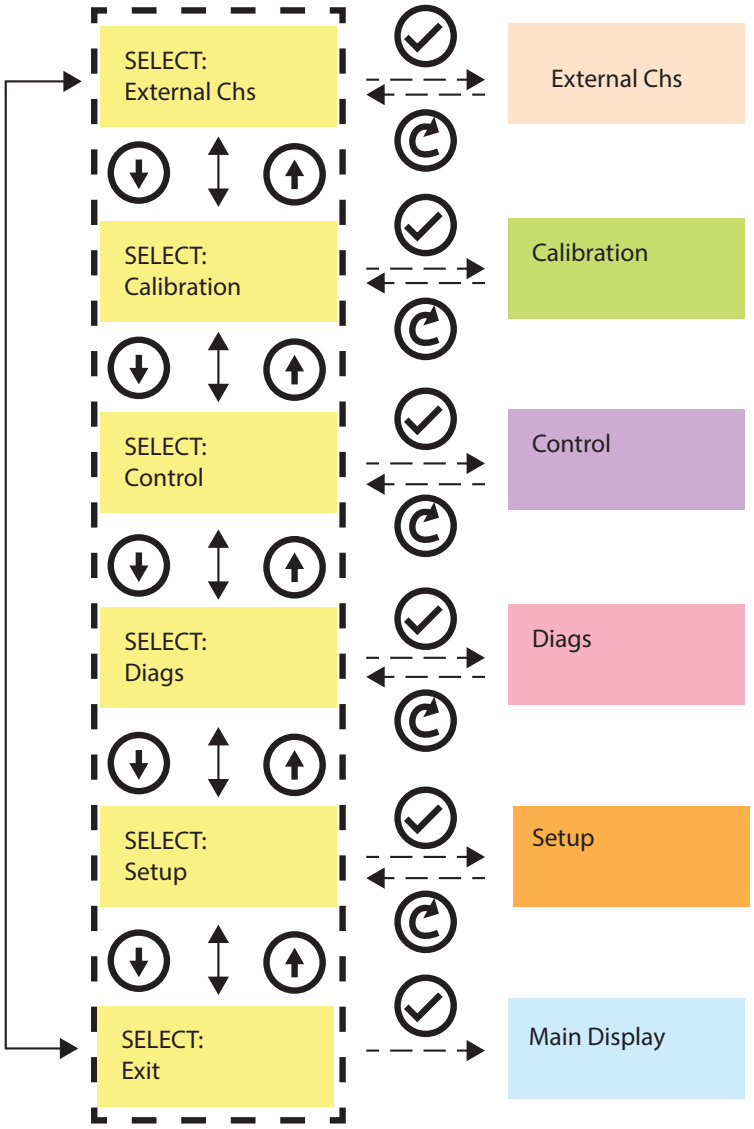
RIU3 OPERATION

The main screen of the RIU3 displays the current values read from the probe.
Using the up and down keys toggles between additional probe values and shows the status of the relays either being on or off.
Warnings conditions are also displayed on the Main screen

Holding down the return arrow for three seconds brings you into the settings menu.
The settings menu allows you configure multiple values and parameters such as alarm conditions, relay control type, probe calibration, backlight set up and system diagnostics.

The following chapter will discuss the basic operational features and menu structure of the RIU3.
Additional chapters in this manual will explain advanced features such as configuring relay control types, two point calibration, and troubleshooting.





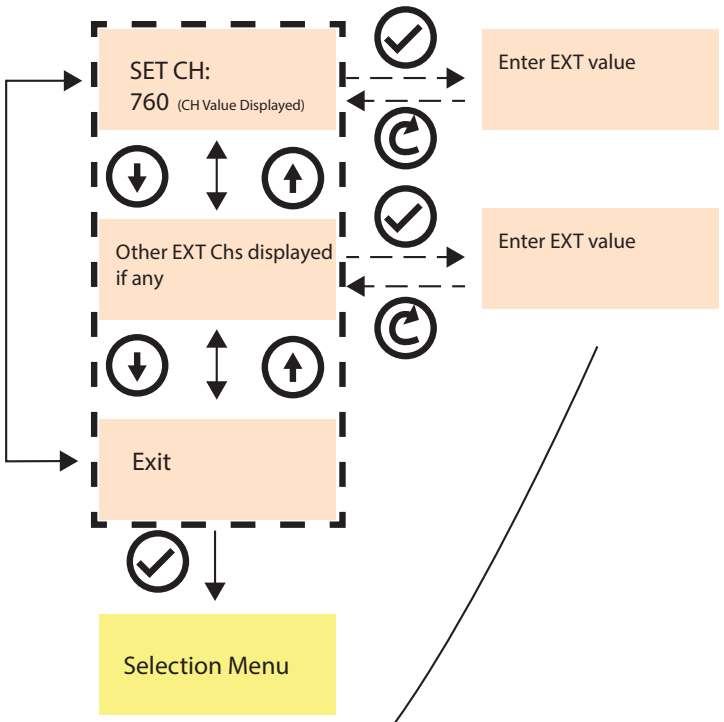
IF YOU DO NOT TOUCH ANY KEYS AFTER 60SEC THE UNIT WILL REVERT TO THE MAIN DISPLAY

PRESS THE RETURN BUTTON FROM ANY SCREEN WITHIN THE DASHED LINE TO REVERT TO THE MAIN DISPLAY

EXTERNAL CH MENU

External channels are values required by the RIU3 that it does not produce.

Example: BP is a required input value for an RIU3 *configured for DO readings*



Changing the Values

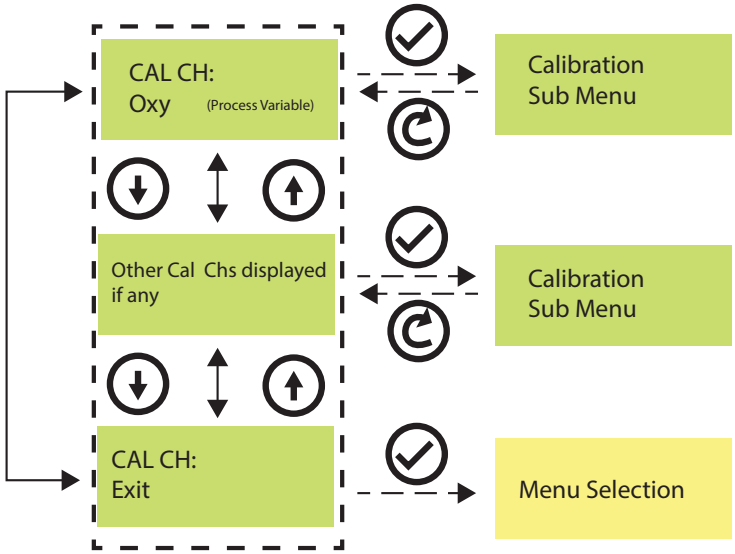
Example Ext XXX CH:
BPT - Default Value 760
TEMP - Default Value 20
SAL - Default Value 0

Press the up or down arrow to change the value (0-9)
Press the check to go to the next digit
Press the return key to go to the previous digit.
Pressing the return key from the 1st digit returns to the menu.

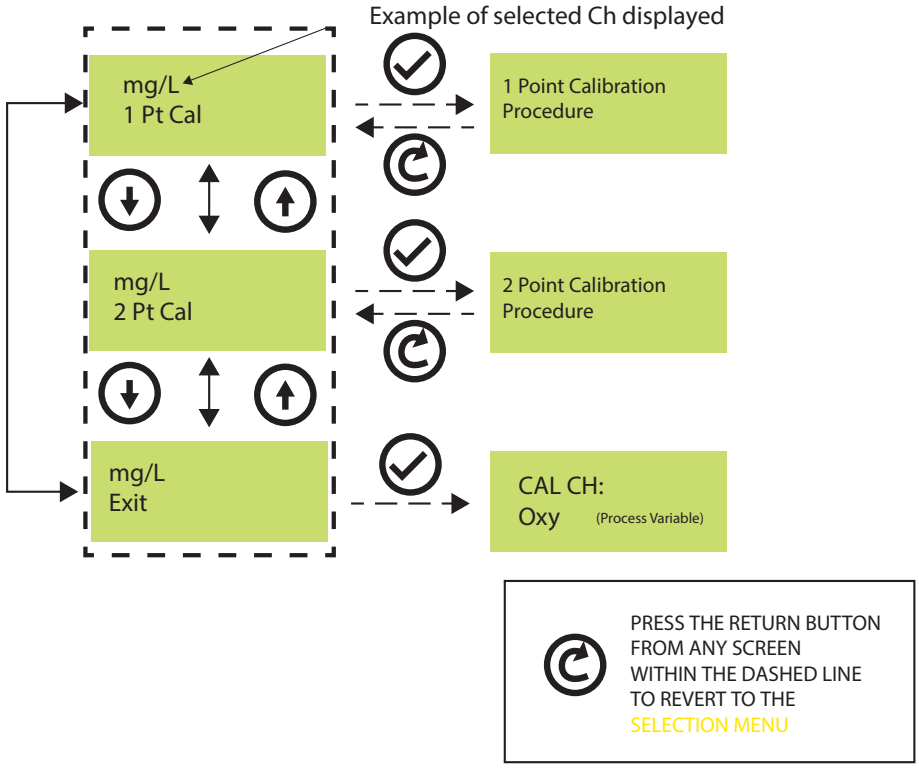
IF YOU DO NOT TOUCH ANY KEYS AFTER 60SEC THE UNIT WILL REVERT TO THE MAIN DISPLAY

PRESS THE RETURN BUTTON FROM ANY SCREEN WITHIN THE DASHED LINE TO REVERT TO THE SELECTION MENU

CALIBRATION MENU

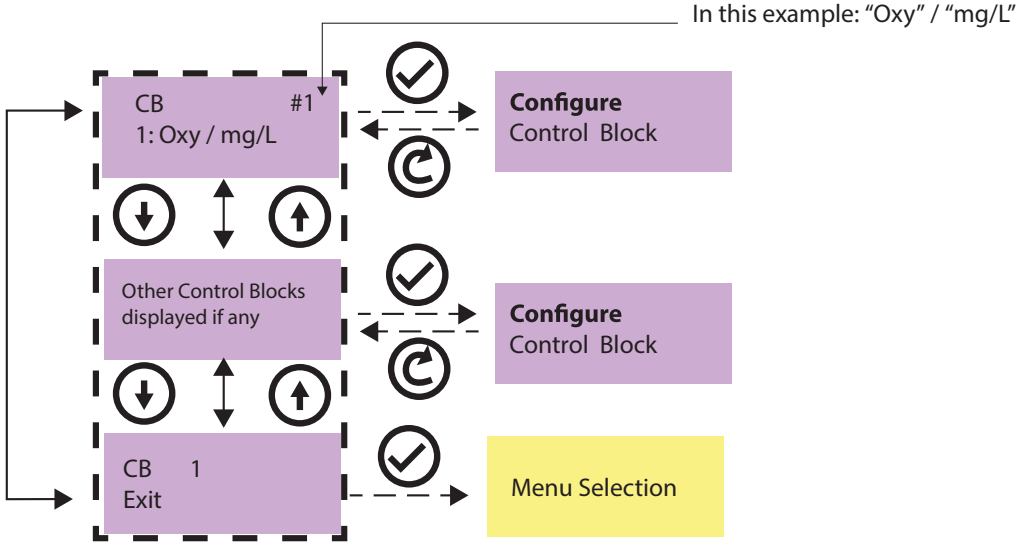


Calibration Sub Menu:



CONTROL MENU

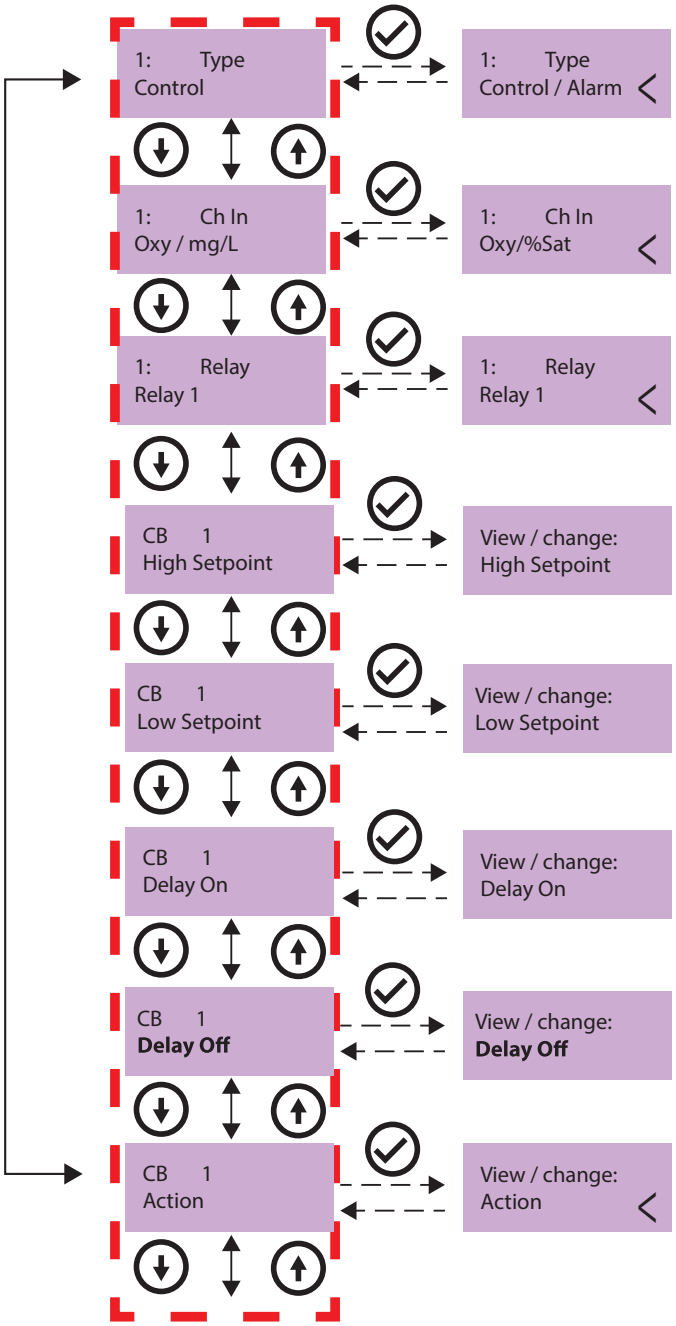
Select Control Block:



PRESS THE RETURN BUTTON
FROM ANY SCREEN
WITHIN THE BLACK
DASHED LINE
TO REVERT TO THE
SELECTION MENU

CONTROL MENU

Configure Control Block:



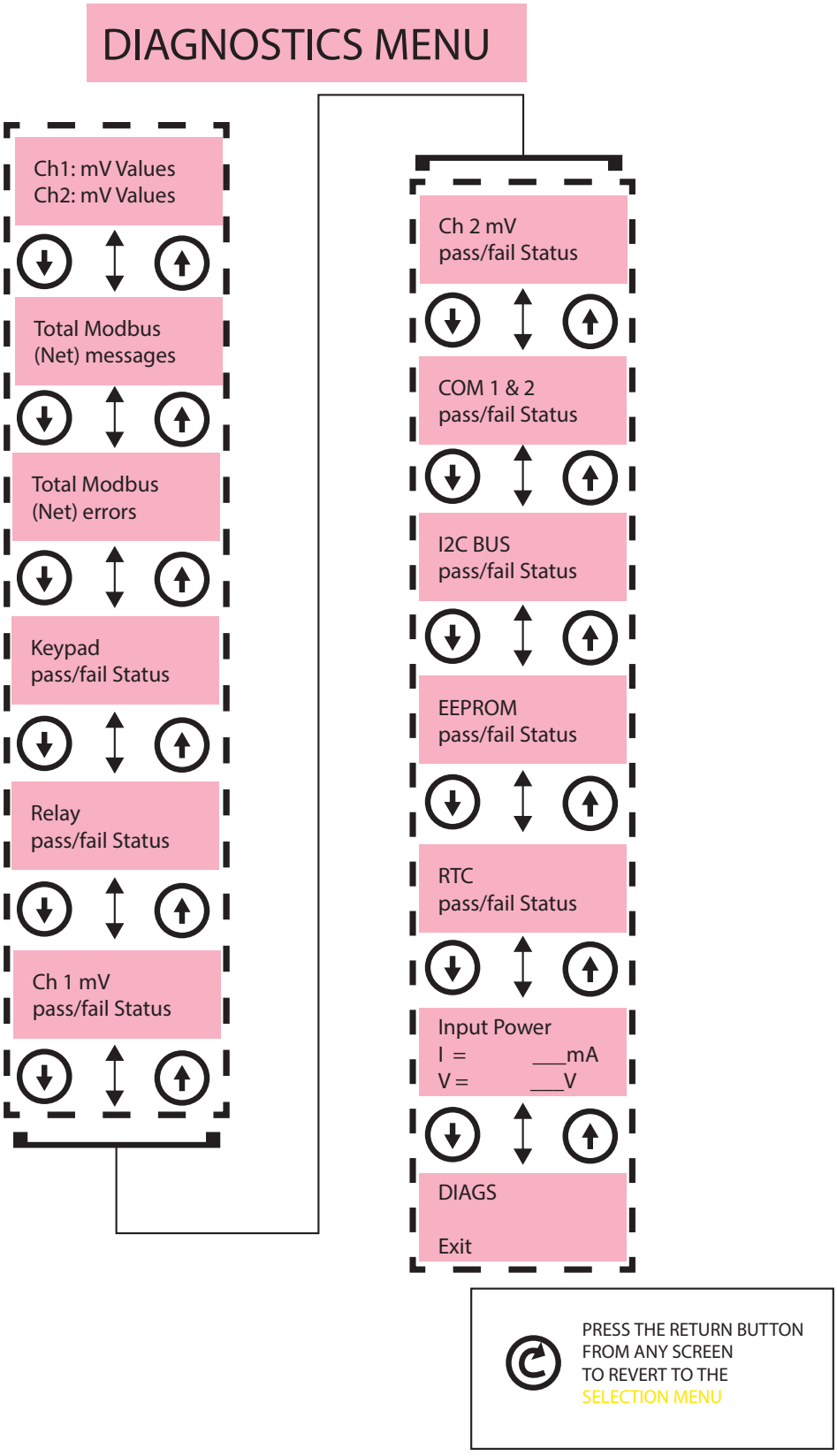
Changing the Values

1: Hi SP

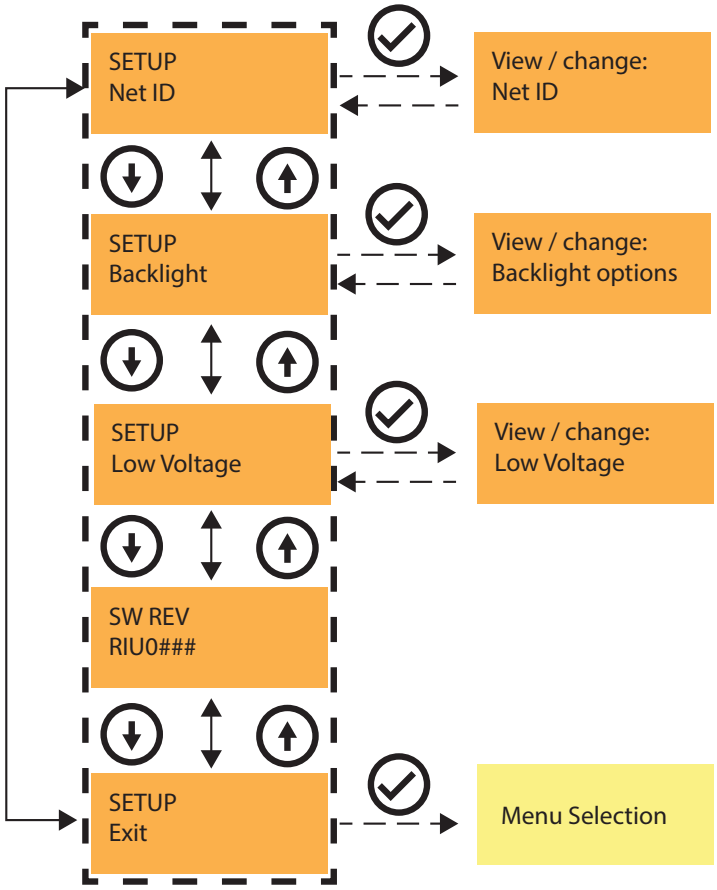
##ay2

Press the up or down arrow to change the value (0-9)
Press the check to go to the next digit
Press the return key to go to the previous digit.
Pressing the return key twice from the 1st digit returns to the menu.

PRESS THE RETURN BUTTON FROM ANY SCREEN WITHIN THE RED DASHED LINE TO REVERT TO THE CONTROL MENU ABOVE


DIAGNOSTICS MENU
Ch1: mV Values
Ch2: mV Values
Total Modbus
(Net) messages
Total Modbus
(Net) errors
Keypad
pass/fail Status
Relay
pass/fail Status
Ch 1 mV
pass/fail Status
Ch 2 mV
pass/fail Status
COM 1 & 2
pass/fail Status
I2C BUS
pass/fail Status
EEPROM
pass/fail Status
RTC
pass/fail Status
Input Power
I = ___mA
V = ___V
DIAGS
Exit
PRESS THE RETURN BUTTON
FROM ANY SCREEN
TO REVERT TO THE
SELECTION MENU

SETUP MENU



PRESS THE RETURN BUTTON
FROM ANY SCREEN
WITHIN THE DASHED LINE
TO REVERT TO THE
SELECTION MENU

CONTROL BLOCK OPERATION

The RIU3 control blocks take inputs from the probe parameters and control the state of the relays according to some user-selected set points. The user can configure the input parameters, control type, set points, delays and output relays for each control block. The user-selectable parameters are described in more detail below.

User-Selectable Control Block Parameters

1) Type

The Type can be set either to Control or Alarm. In alarm mode, the relay output behaves as described in Figure 1. In control mode, the relay output behaves as described in Figure 2

If the process value (PV) is within the user defined high and low set points the system condition is normal. If the process value (PV) fluctuates out of the alarm bandwidth (above the high set point or below the low set point) the system will go into alarm.

This is indicated on the bottom left corner of the home screen by flashing the word "ALARM". This is also indicated on each individual channel by the alarm symbol.

A delay time can be added to the setpoint. (E.G. A fish/plant touches the probe, sending the conditions out of the normal bandwidth, resulting in false alarm conditions. The delay time allows the conditions to return to within the normal bandwidth.

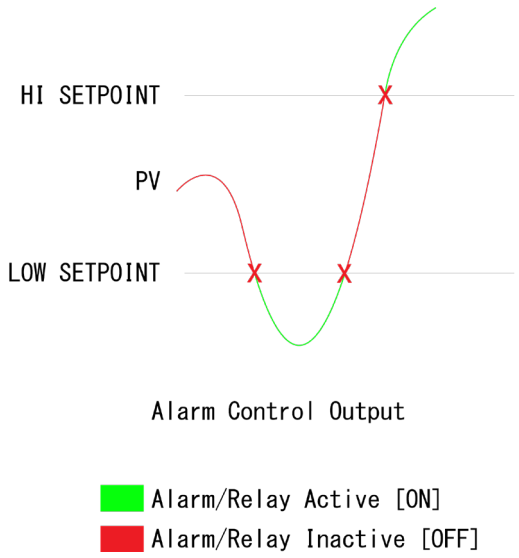


Figure 1: Alarm Mode operation

If the process value (PV) is within the user defined high and low set points the system condition is normal. If the process value (PV) fluctuates below the low set point the system will go into a control situation. This turns on (or off depending on normal conditions) a relay. The relay will remain on until the process value (PV) reaches the high set point at which point it will switch off.

The process can be reversed so that a relay turns on when the process value (PV) fluctuates above the high setpoint, depending on the customers needs.

This is indicated on each individual channel by the orange RLY ON indicator.

A delay time can be added to the setpoint. (E.G. A fish/plant touches the probe, sending the conditions out of the normal bandwidth, resulting in false control conditions. The delay time allows the conditions to return to within the normal bandwidth. A delay can also be added to the high setpoint which allows the system overdose, which may be applicable in some cases.

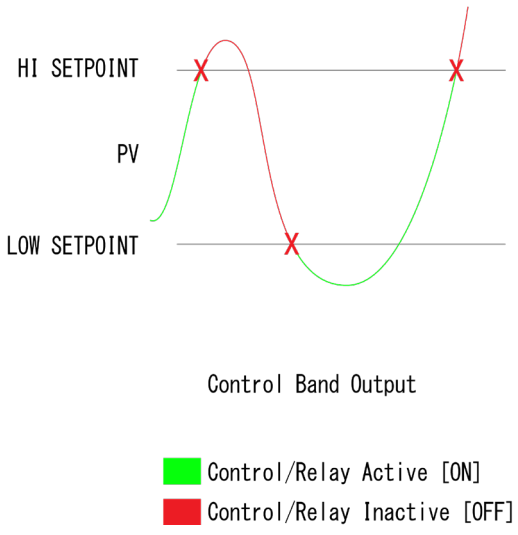


Figure 2: Control Mode operation

2) Ch In

This is the input parameter for the control block. The user will have the option to select from all available parameters for the specific probe being used.

3) Relay

This is the output relay for the control block. The user will have the option to select between Relay 1 and Relay 2.

4) Hi SP

This is the high set point as described in SectionAbove.

5) Lo SP

This is the low set point as described in SectionAbove.

6) Delay On

The delay on defines how long in seconds the control block will be in Alarm or Control status before the relay output is activated.

7) Delay Off

The delay off defines how long in seconds the control block will be out of Alarm or Control status before the relay output is deactivated.

8) Action

The user will have the option to select between High and Low. When set to low action, the control block will behave as described on page 19. When in set to high action, the control block will behave inversely to what is described on page 19.

PROBE CALIBRATION

The calibration procedure will vary depending on the type of probe being used. In general, either 1-point or 2-point calibrations can be done. Depending on the probe type, 1 or 2 –point calibrations may be recommended.

PV=(V_raw-Offset)×Slope

PV : Process variable – this is the value that is displayed on the main screen with the appropriate engineering units.
Vraw : Raw voltage input – this is the raw voltage value measured by the RIU3 from the probe.
Offset : The offset value is calculated by the RIU3 during calibration.
Slope: The slope value is calculated by the RIU3 during calibration.

To perform a typical 1-point calibration, the user places the probe in an environment with a known value for the measured parameter. The user then enters the known value into the RIU3 and completes the calibration. The RIU3 will then calculate the Offset value so the PV matches the value that the user entered for the 1-point calibration.

To perform a typical 2-point calibration, the user places the probe in an environment with a known value for the measured parameter. The user then enters the known value into the RIU3 and captures the first calibration point. Next, the user places the probe in a different environment with a different known value for the measured parameter. The user enters the know value into the RIU3 again and captures this value. The calibration then completes by calculating both the Slope and the Offset so the PV matches user entered values with the captured raw voltage inputs.

The calibration procedure is slightly different for galvanic dissolved oxygen probes. Since these probes have a true zero, the Offset is always zero. In this case, it is never necessary to complete a 2-point calibration. During a 1-point calibration, the Offset will not be modified – it will remain at zero – and instead, the Slope will be calculated so the PV matches the value the user entered for the 1-point calibration.

Calibrating Specific Probe Types

1) OxyGuard Commander Dissolved Oxygen (DO)/Temperature Probe

a. DO Calibration

With this probe type, the RIU3 will have 2 process variables corresponding to DO. The engineering units for these PVs are %Sat (percent saturation) and mg/L. In order to calibration the DO, only the %Sat PV must be calibrated. The mg/L PV will then be calculated based on the %Sat and the Temperature readings.
A 1-point calibration should be done with the %Sat PV since these probes have a true zero, meaning the Offset will always be zero, and only the Slope needs to be calculated.

To complete a 1-point DO calibration for this probe, do the following.

i. Place the probe in air. Allow the probe readings to stabilize for 30 minutes.
ii. On the RIU3, press and hold the Return button for 3 seconds to enter the configuration menu.
iii. Using the Down button, scroll down to the Cal menu and click the Enter button.
iv. Scroll to "Oxy" and click the Enter button.
v. Scroll to "1-point" and click the Enter button.
vi. The current value of the %Sat PV will be displayed. You will want to change this to read 100 %Sat since the probe is currently in the air. Use the Up and Down buttons and the Enter button to do this.
vii. Once you have entered 100 and clicked the Enter button once more, the RIU3 will attempt to capture the calibration point and calculate the Slope. If the probe reading is stable and within reasonable limits, the calibration point will be captured and a Cal OK message will be displayed.
viii. Use the Return button to return back to the main display. The %Sat PV should now read 100 %Sat.
ix. The probe can now be returned to use. You will have to allow another 30 minutes for the probe temperature to stabilize. After this, the probe will now be reading accurately.

b. Temperature Calibration

The temperature channel is factory calibrated and in general, should never need to be re-calibrated. A 1-point calibration may be completed to ensure consistent readings between different probes. A 2-point calibration may also be completed; however, this can be time consuming and will typically not be as accurate as the existing factory calibration.

To complete a 1-point temperature calibration for this probe, do the following:

i. Ensure the probe temperature has stabilized in the measurement sample for at least 30 minutes. Also ensure the reading of a reference temperature sensor in the same sample has stabilized.
ii. On the RIU3, press and hold the Return button for 3 seconds to enter the configuration menu.
iii. Using the Down button, scroll down to the Cal menu and click the Enter button.
iv. Scroll to "Temp" and click the Enter button.
v. Scroll to "1-point" and click the Enter button.
vi. The current value of the degC PV will be displayed. You will want to change this to match the value of the reference temperature sensor. Use the Up and Down buttons and the Enter button to do this.
vii. Once you have entered the temperature value and clicked the Enter button once more, the RIU3 will attempt to capture the calibration point and calculate the Offset. If the probe reading is stable and within reasonable limits, the calibration point will be captured and a Cal OK message will be displayed.
viii. Use the Return button to return back to the main display. The degC PV should now read the same as the reference temperature sensor.

To complete a 2-point temperature calibration for this probe, do the following:

i. Choose 2 calibration temperatures that cover the expected range of measurement temperatures. For example, if the sample temperature is expected to vary between 5 and 15 °C, choose calibration points 5 and 15 °C. 0 and 20 °C would also work.
ii. Create a sample with water at the temperature of the first calibration point. For example, if the first calibration point is 0 °C, an ice bath can be used. Place the probe in the sample and allow the temperature to stabilize for at least 30 minutes.
iii. On the RIU3, press and hold the Return button for 3 seconds to enter the configuration menu.
iv. Using the Down button, scroll down to the Cal menu and click the Enter button.
v. Scroll to "Temp" and click the Enter button.
vi. Scroll to "2-point" and click the Enter button.
vii. The current value of the degC PV will be displayed. You will want to change this to match the value of the first calibration sample. Use the Up and Down buttons and the Enter button to do this.
viii. Once you have entered the temperature value and clicked the Enter button once more, the RIU3 will attempt to capture the calibration. If the probe reading is stable and within reasonable limits, the calibration point will be captured.
ix. Create a sample with water at the temperature of the second calibration point. For example, if your second calibration point must be around 20 °C, room temperature water can be used with a reference temperature sensor to measure the actual water temperature. Place the probe in the sample and allow the temperature to stabilize for at least 30 minutes.
x. On the RIU3, the second calibration point should be displayed. You will want to change this to match the value of the second calibration sample. Use the Up and Down buttons and the Enter button to do this.
xi. Once you have entered the temperature value and clicked the Enter button once more, the RIU3 will attempt to capture the calibration. If the probe reading is stable and within reasonable limits, the calibration point will be captured. The new Slope and Offset values will be calculated and a Cal OK message will be displayed.
xii. Use the Return button to return back to the main display. The degC PV should now read the same as the reference temperature sensor.