ATS-X2000 Series

Dual Channel Controllers

User Instruction Manual

ATS-X2000 Series Process Controllers

Read this before using ATS-X2000 Series Controllers

Thank you for choosing ATS-X2000 Series controller.

ATS-X2000 Series are ARM processor-based dual channel controllers used for various industrial and commercial water applications. These controllers allow real-time monitoring and control of two same of different parameters including pH, conductivity and ORP and have set point values and relay for high and low signals.

This instruction manual contains information about the controller specifications, its optimal use and various anticipated applications. Inform and educate your personnel in proper operation of the controller. Installation and maintenance of the controller should only be performed by the trained personnel. In case of parts replacement, only use parts that are specified by the manufacturer or call at the provided number for assistance. Unauthorized parts or procedures can effect the controller's performance and place safe operation of the process at risk.

Making cable connections to controller and servicing this instrument requires access to shock hazard level voltages which can cause death or serious injury. Therefore disconnect all hazardous voltages before making connections to the controller. For safety and proper performance, the controller should be connected to a properly grounded three-wire power source.

ATS-X2000 Series controllers come with a 1-Year limited warranty. Warranty Terms & Conditions apply.

The information presented in this manual is subject to change in future without prior notice. AT Systems does not accept any responsibility for damage or malfunctioning of the unit due to improper usage and maintenance of the instrument.

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SECTION 1: PRODUCT OVERVIEW

1.1 INTRODUCTION

ATS-X2000 Series is series of dual-channel controllers that enables real-time monitoring and control of two same or different parameters including pH, conductivity and ORP in industrial and process control applications. Their isolated design provides superior noise control making them well suited for field application. Advanced control with industry-acceptable control loop and relay logic along with the functionality to monitor two parameters on a single screen makes them one of the most economical controllers in the market. The controllers also provides set point values and relay for High and Low digital control.

Enhanced user interface with easy-to-use 6-button keypad makes the controllers intuitive. The logging function saves parameter values on a dedicated microSD card at user-specified intervals. Password protection adds security to keep the process safe.

1.2 FEATURES

ATS-X2000 Series Controllers are designed to be a fully isolated instrument for two-wire DC applications.

- Automatic and manual temperature compensation via RTD (PT100/PT1000)
- Instrument supplied in a durable (IP65) enclosure (when installed in control panel)
- Built-in time, date and Logger function (available on request)
- Programmable high-low relay function
- Wi-Fi feature (available on customer request)
- Calibrated out of the box. If required, any standard calibration solution can be used
- 4~20mA customizable analog loop current outputs for plant operation
- Quick connection with sensors through connectors (requires tinned wires sensor)
- Built in password protection

1.3 SPECIFICATIONS

pH Channel	**Measuring Range**	**pH:** 0.00 - 14.00pH, Minimum resolution: 0.001, Accuracy: 0.5% **Temperature:** -50.0°C – 200.0°C, Resolution: 0.1°C, Linear Coefficient: ±1.0°C accuracy
	Units	pH, mV
	Calibration	**Auto Calibration:** 2 and 3-points calibration with slope indication. Compatible with all certified buffer solutions **Manual Calibration:** 2 and 3-points calibration with slop indication. Compatible with all certified buffer solutions. User may use any custom calibration solution for special purpose
	Temperature Compensation	Linear Temperature Compensation through-out the sensor range 2-wire PT100/PT1000 RTD

Conductivity Channel	**Measuring Range**	**Conductivity:** 0.000 µS/cm – 200 mS/cm, Minimum resolution: 0.001 µS/cm, Accuracy: ±0.5% **TDS:** 0.00 - 100 ppt, Minimum resolution: 0.001 ppm, Accuracy: ±0.5% **Resistivity:** 5.00Ω - 20MΩ, Minimum resolution: 0.001KΩ, Accuracy: ±0.5% **Temperature:** -50.0°C – 200.0°C, Resolution: 0.1°C resolution, Linear Coefficient: ±1.0°C accuracy
	Units	**Conductivity**: µS, mS **TDS**: ppm, ppt **Resistivity**: kΩ, MΩ
	Calibration	Easy single point calibration using any certified conductivity calibration solution. Option to set cell constant manually
	Cell Constant	2-pole Electrode: 0.01 – 10.0 /cm fixed, 0.01 – 10.0/cm freely selectable (user defined)
	Temperature Compensation	Linear Temperature Compensation through-out the sensor range 2-wire PT100/PT1000 RTD
ORP Channel	**Measuring Range**	**ORP:**-2000mv to +2000mV, Minimum resolution: 0.001, Accuracy: 0.5% **Temperature:** -50.0°C – 200.0°C, Resolution: 0.1°C resolution, Linear Coefficient ±1.0°C accuracy
	Units	mV (millivolts)
	Other Sensor Options	Ion-selective electrodes (ISE) are also compatible with the controller. Specify the electrode type before ordering
	Calibration	**Auto Calibration:** Single point calibration with +475mV standard calibration solution **Manual Calibration:** Single point calibration with any value with in the measuring range
Analog Output 1 & 2 (Isolated Outputs)		4~20mA corresponding to any selected parameter, ±0.001mA accuracy, 0.001mA resolution, maximum load 500Ω
Relays		1 (HI) – 24 VDC, 1A – On/Off Programmable 2 (LO) – 24 VDC, 1A – On/Off Programmable Relay function with customized dead band
Clock (Optional)		Internal Clock, 24 Hr format, ±1 min/month accuracy
SD Card (Optional)		Can save multiple values in SD Card, user can save values for up to 5 years with specific time interval Data logging on SD card at user-specified time interval. Save values for up to 5 years
Calibration History		Record keeping of previous calibration with date and time available only if internal clock and SD card options are opted

RS-485 Communication (Optional)	RS-485 Based communication with AT Systems software for microSD data retrieval MODBUS communication also available
Display	Graphical LCD (128px × 64px) with adjustable contrast and brightness
Mounting Type	Panel Mount
Panel Cutout Size	L x W (93mm x 93mm)
Dimensions	L × W × D (113.5mm × 113.5mm × 83mm)
Power Requirement	24 VDC (Maximum up to 35 VDC),2.5 Watts
Weight (Assembly)	≈ 255 grams
IP Class Protection	IP65 (In Panel Mount Installation)

1.4 MODEL SELECTION

Below is a guide to help choose correct model as required from the options available:

ATS-X2000-	A	N	2

Parameters	
A	pH/pH
B	Conductivity/Conductivity
C	ORP/ORP
D	pH/ORP
E	Conductivity/pH
F	Conductivity/ORP

RT Clock, SD Card & Modbus	
N	No
S	Yes

4~20mA Analog Outputs	
2	Two

Fig. 1: ATS-X2000 Series Model Selection

If a cond/pH dual controller is required with two 4~20mA analog outputs and no RT clock, modbus or SD card options included, the model will be ATS-X2000-EN2. This is illustrated below:

ATS-X2000-	**E**	**N**	**2**
	Cond/pH Dual Channel Controller	No RT Clock, SD card or Modbus	Two 4~20mA analog outputs

1.5 APPLICATIONS

ATS-X2000-A controller can be used for various industrial applications such as:

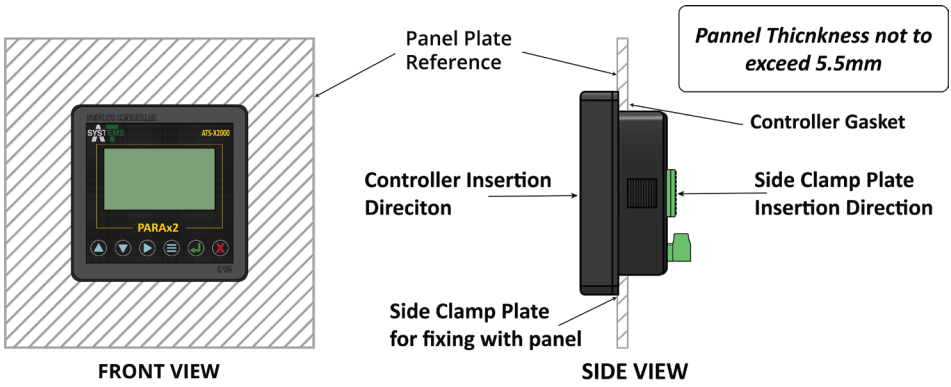
- Reverse Osmosis Plants
- Boiler Feed Water
- Cooling Water
- Closed Loop Systems
- Drinking Water
- Pharmaceutical Industry
- Textile Industry
- Waste Water industry
- Chemical Industry

SECTION 2: INSTALLATION

This section goes through the installation process of both the ATS-X2000 Series controller and sensor mounting. Read this section to avoid any unexpected inconvenience in the process of controller mounting and installation.

2.1 PANEL MOUNTING

The controllers can be mounted on control panel plate for different industrial applications. Fig. 2 below shows the controller with panel cutout dimensions in mm. Panel cutout sticker is also provided in package for reference cutting.



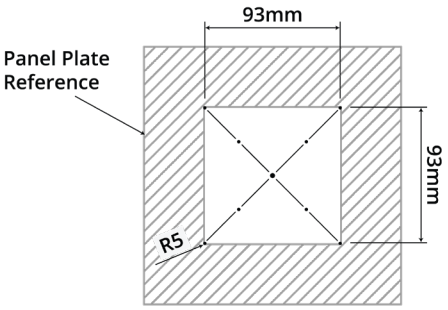


Fig. 2: ATS-X2000-A Panel Mounting

2.2 SENSOR MOUNTING

It is recommended to install the sensors in a line which does not run dry. Sensors can be installed within the cable length (5 meters cable length included with the sensor). If the distance to the installation point from the controller is more than the cable length of sensor, then an off-line housing is required for sensor installation (available on demand

from AT Systems). It is recommended to install the sensor away from pumps, frequency drive systems or other high frequency sources to avoid fluctuations in sensor readings due to electrical noise.
For detailed instructions on the installation of a sensor, refer to the installation manual of that sensor.

SECTION 3: CONNECTIONS

3.1 ELECTRICAL CONNECTIONS

ATS-X2000 Series controllers require a regulated 16- 24 VDC (max. 35 VDC) connection from an external supply (not included in the package) to work.

Warning!
Don't connect AC power cables to the ATS-X2000 Series controllers.

IMPORTANT NOTES:

- All electrical installations must be supervised by a qualified and responsible electrician
- Use wiring practices that conform to all national, international and local electrical codes
- Isolate sensor cables from AC power wires to prevent interference in controller signals

The controllers have power polarity protection which provides protection against malfunctioning if +ve terminal of the power supply is connected to the -ve terminal of controller or vice versa, by keeping it from turning on. Make sure that input DC power is stable, noise free and non-fluctuating. To power on the controller insert a regulated 16-24VDC power into the back of the controller.

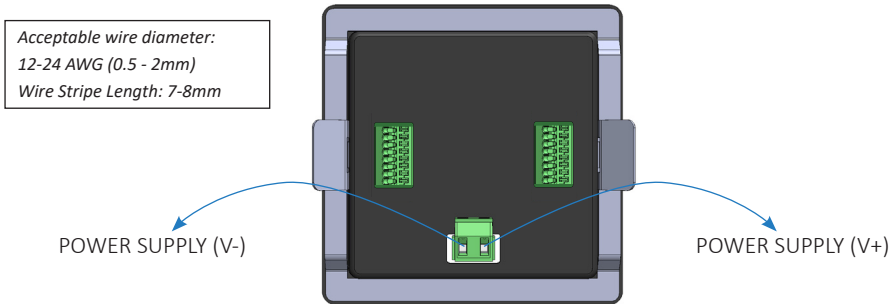


Fig. 3: ATS-X2000 Series VDC Connections

3.2 SENSOR CONNECTIONS

Depending on the controller model, connection description for the sensors is given below:

3.2.1 ATS-X2000-A (PH/PH CONTROLLER)

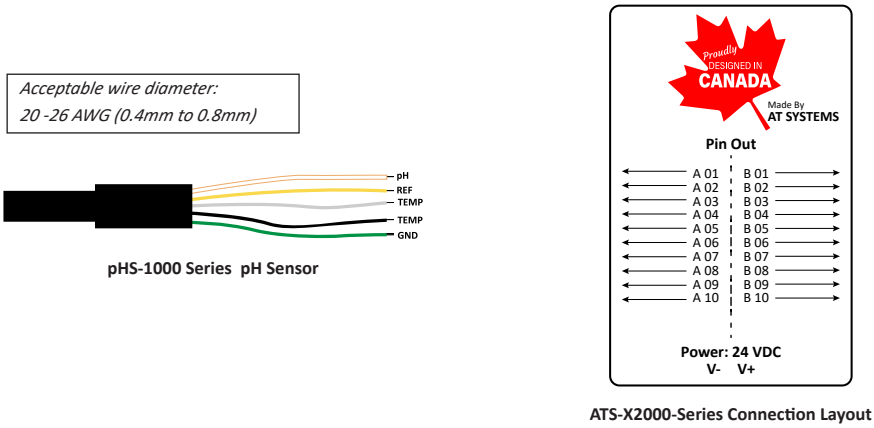


Fig. 4: ATS-X2000-A Sensor Connections

Fig. 4 shows the sensor connection description for the pH sensors. Detail of the connections is given below:

- A01 is used for pH contact
- A02 is used for reference wire
- A03 and A04 are used for temperature contacts
- A05 is used for ground
- A06 is used for pH contact
- A07 is used for reference wire
- A08 and A09 are used for temperature contacts
- A10 is used for ground

3.2.2 ATS-X2000-B (COND/COND CONTROLLER)

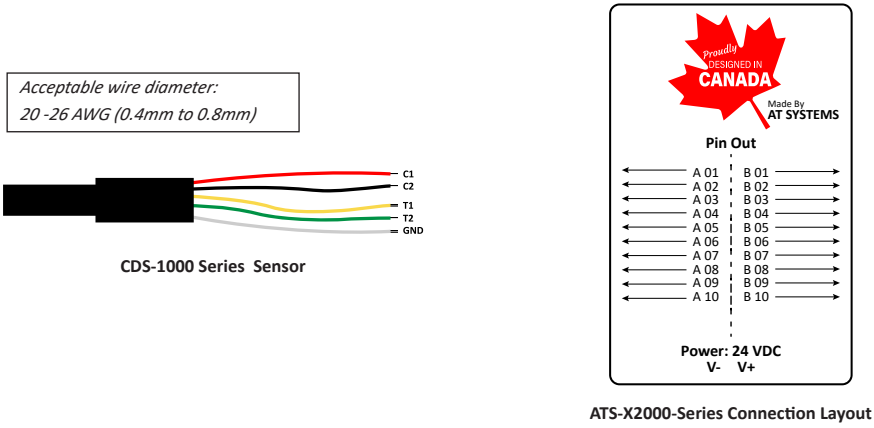


Fig. 5: ATS-X2000-A Sensor Connections

Fig. 5 shows the sensor connection description for the Conductivity sensors. Detail of the connections is given below:

For Channel 1:

- Connect C1 (Red wire) with A01 connection of Controller
- Connect C2 (Black wire) with A02 connection of controller
- Connect T1 (Yellow wire) with A03 connection of controller
- Connect T2 (Green wire) with A04 connection of controller
- Connect GND (Bare wire) with A05 connection of controller

For Channel 2:

- Connect C1 (Red wire) with A06 connection of Controller
- Connect C2 (Black wire) with A07 connection of controller
- Connect T1 (Yellow wire) with A08 connection of controller
- Connect T2 (Green wire) with A09 connection of controller
- Connect GND (Bare wire) with A10 connection of controller

3.2.3 ATS-X2000-C (ORP/ORP CONTROLLER)

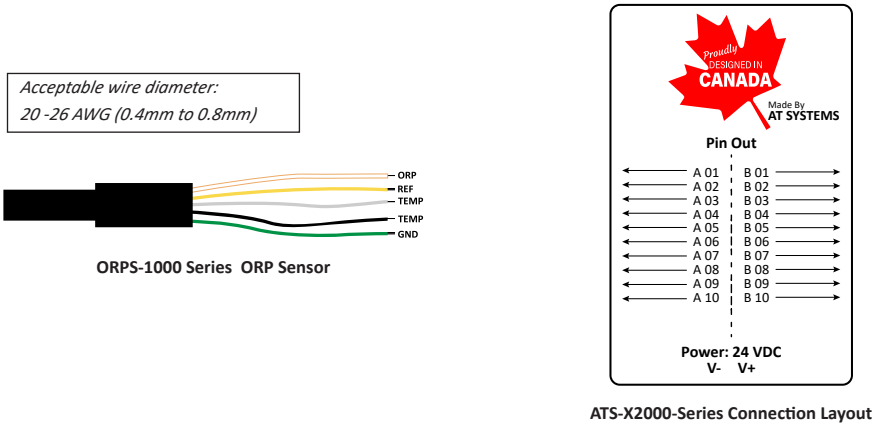


Fig. 6: ATS-X2000-C Sensor Connections

Fig. 6 shows the sensor connection description for the ORP sensors. Detail of the connections is given below:

- A01 is used for ORP contact
- A02 is used for reference wire
- A03 and A04 are used for temperature contacts
- A05 is used for ground
- A06 is used for ORP contact
- A07 is used for reference wire
- A08 and A09 are used for temperature contacts
- A10 is used for ground

3.2.4 ATS-X2000-D (PH/ORP CONTROLLER)

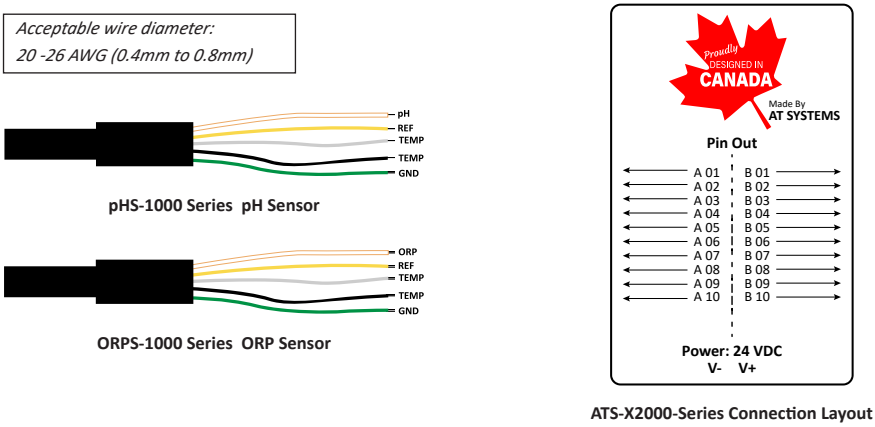


Fig. 7: ATS-X2000-D Sensor Connections

Fig. 7 shows the sensor connection description for the pH and ORP sensors. Detail of the connections is given below:

- A01 is used for pH contact
- A02 is used for reference wire
- A03 and A04 are used for temperature contacts
- A05 is used for ground
- A06 is used for ORP contact
- A07 is used for reference wire
- A08 and A09 are used for temperature contacts
- A10 is used for ground

3.2.5 ATS-X2000-E (COND/PH CONTROLLER)

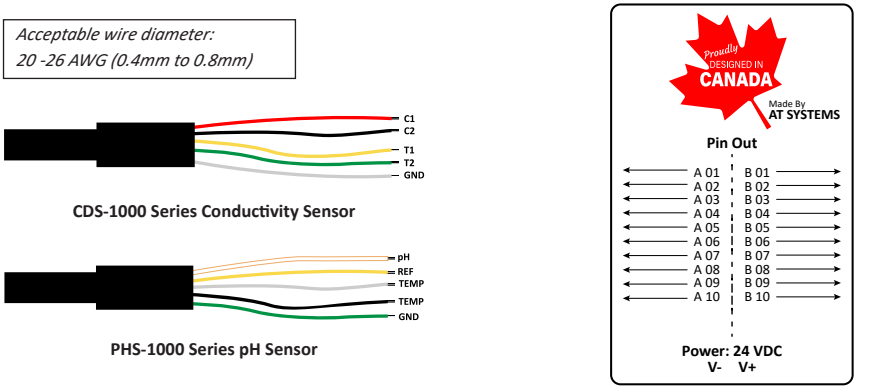


Fig. 8: ATS-X2000-E Sensor Connections

Fig. 8 shows the sensor connection description for the Conductivity and pH sensors. Detail of the connections is given below:

For Channel 1:

- Connect C1 (Red wire) with A01 connection of Controller
- Connect C2 (Black wire) with A02 connection of controller
- Connect T1 (Yellow wire) with A03 connection of controller
- Connect T2 (Green wire) with A04 connection of controller
- Connect GND (Bare wire) with A05 connection of controller

For Channel 2:

- A06 is used for pH contact
- A07 is used for reference wire
- A08 and A09 are used for temperature contacts
- A10 is used for ground

3.2.6 ATS-X2000-F (COND/ORP CONTROLLER)

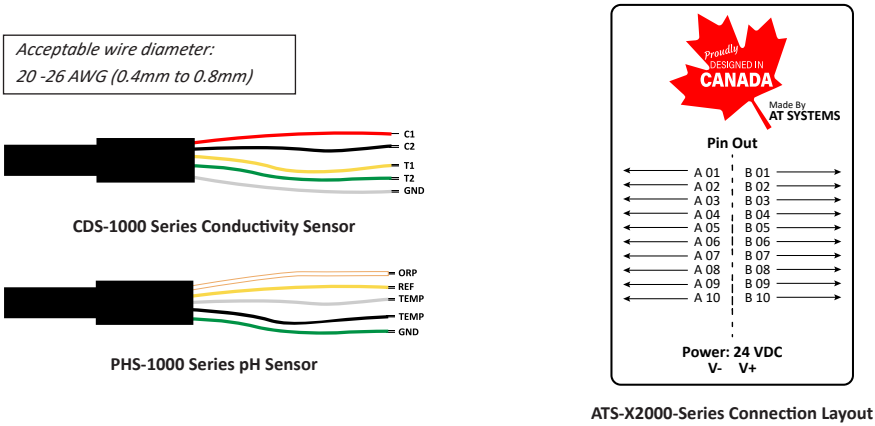


Fig. 9: ATS-X2000-F Sensor Connections

Fig. 9 shows the sensor connection description for the conductivity and ORP sensors. Detail of the connections is given below:

For Channel 1:

- Connect C1 (Red wire) with A01 connection of Controller
- Connect C2 (Black wire) with A02 connection of controller
- Connect T1 (Yellow wire) with A03 connection of controller
- Connect T2 (Green wire) with A04 connection of controller
- Connect GND (Bare wire) with A05 connection of controller

For Channel 2:

- A06 is used for ORP contact
- A07 is used for reference wire
- A08 and A09 are used for temperature contacts
- A10 is used for ground

3.3 PLC/ANALOG OUTPUT & COMMUNICATION CONNECTIONS

Communication connections description is illustrated in fig. 10 below.

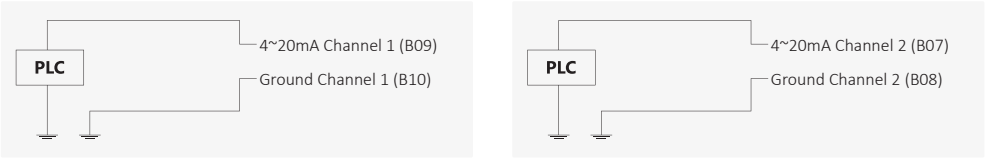


Fig. 11: ATS-X2000 Series Communication Connections

3.4 RELAY HIGH/LOW CONNECTIONS

Two channel relays (high and low) cables can be connected to the ATS-X2000 Series controller terminal strip by inserting the wires for Relay channel 1 (B01, B02) , Relay channel 2 (B03, B04) connections. (Marked in Blue and Yellow)

- B01 and B02 are used for high and low relay function for channel 1. Connect top (blue and yellow) with Relay 1,2 Channel 1 terminals
- B03 and B04 are used for high and low relay function for channel 2. Connect top (blue and yellow) with Relay 1,2 Channel 2 terminals

Connections are illustrated in fig. 11 below:

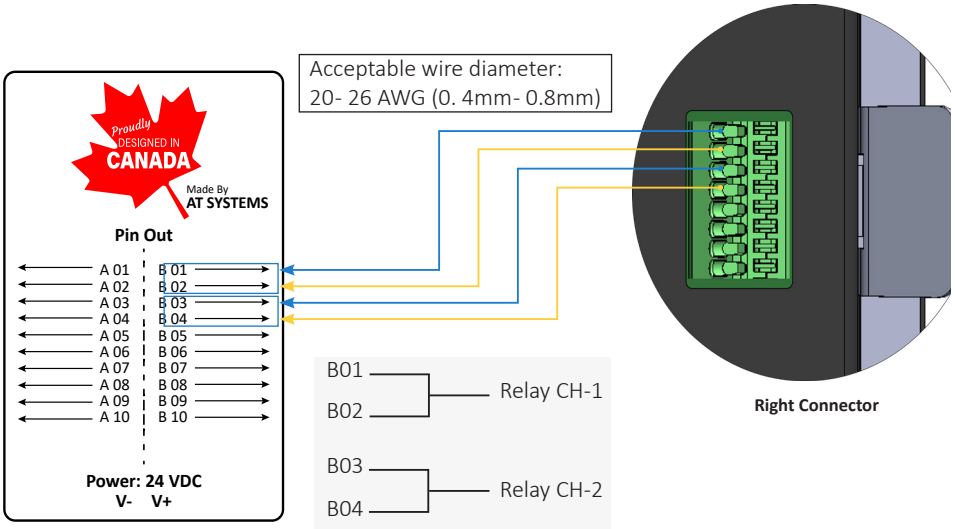


Fig. 10: Relay High/Low Connections

3.5 RELAY CONNECTIONS

Caution
Read this before connecting an ATS-X2000 Series controller to any external relays

ATS-X2000 Series controllers come with built in relays which can be connected to external relays for control function.
Make sure to use Fly Back Diode across External Relay Coil while connecting to an **ATS-X2000 Series** controller as shown in the figure below.

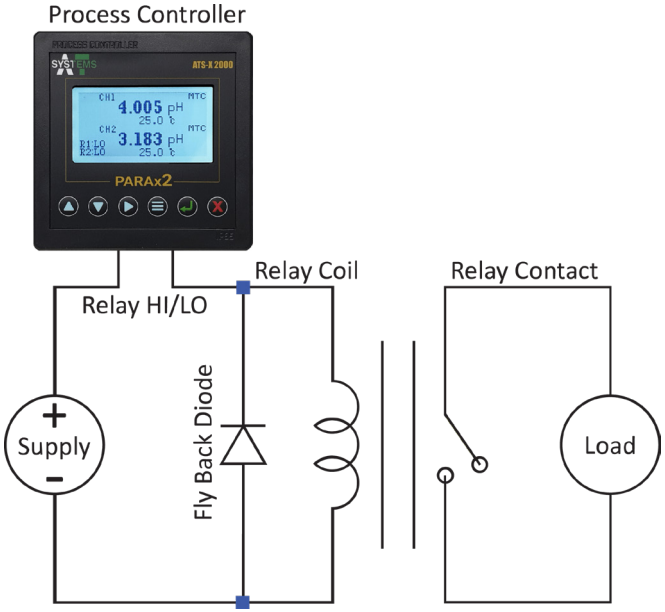


Fig. 12: Fly Back Diode Circuit Diagram

SECTION 4: GENERAL OPERATION

ATS-X2000 Series controllers have a 6 button layout with a 128px x 64px LCD to display information. Figure below shows front layout of the controller.

1	Up
2	Down
3	Right / Forward
4	Menu
5	Accept / Confirm / Enter
6	Escape / Previous / Back
7	LCD Display (128px x 64px)

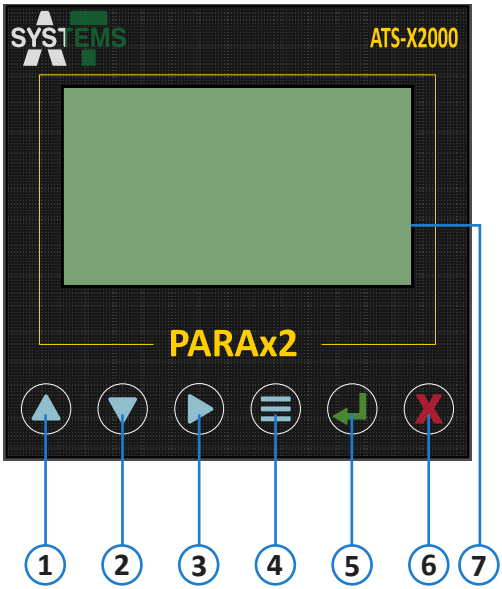


Fig. 13: ATS-X2000 Series Layout

4.1 START UP

Before Startup, ensure proper transmitter wire connections and the clamping of the controller with panel plate. To start the controller, connect the power connector to the back of instrument. Fig. 14 shows the main LCD display and the information it displays.

1	Parameter value with unit (Channel 1)
2	Parameter value with unit (Channel 2)
3	Relay 1 & 2 status (high or low)
4	Temperature with unit (Channel 1)
5	Temperature with unit (Channel 2)
6	Temperature compensation (Channel 2)
7	Temperature compensation (Channel 1)

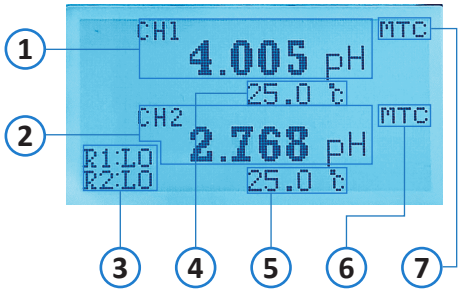


Fig. 14: Main Screen

4.2 OPERATING THE CONTROLLER

4.2.1 MENU NAVIGATION

To access the menu screen, press the menu button. Main menu screen is shown in fig. 15.

Caution

If password protection is on, pressing the menu button will take the user to password screen. Enter the password and press confirm button to enter the menu. For details please refer to section 8.

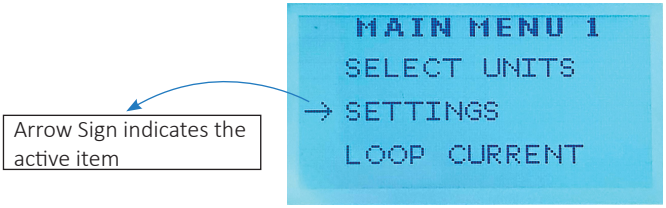


Fig. 15: Main Menu

Through main menu user can setup the controller as per operation's needs. **Up** and **down** buttons can be used to navigate between the menu items. A right arrow sign before a menu item name indicates that it is the item in focus. To see items/options under a selected menu item, press **enter** button.

4.2.2 SELECT OR TOGGLE AN OPTION ON OR OFF

To select or toggle an option on and off, navigate to that option and press **enter** button. A check sign next to it will indicate that an option is selected or turned on. **Up** and **down** buttons can be used to navigate between the available options, and **enter** button is used to selected/deselect or turn on/off the option.

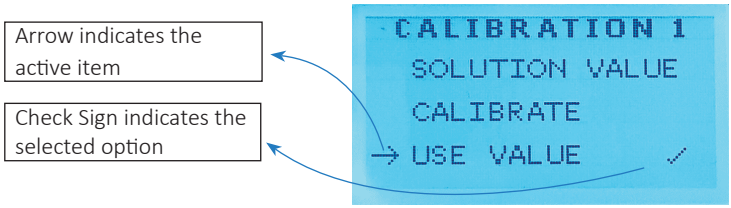


Fig. 16: Select or Turn on/off an option

4.2.3 SET A VALUE

To set a value, for example, to set value of a calibration solution, **right** button can be used to navigate between the digits. An line under a digit indicates that it is the focused digit. **Up** and **down** buttons are used to change the value. Once the desired value is set, press **enter** button to save the value.

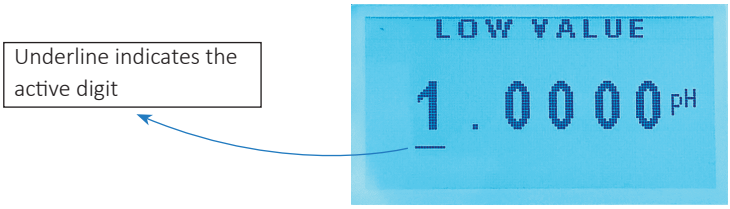


Fig. 17: Set a Value

Once the confirm button is pressed, a screen saying "VALUE SAVED" will appear for 3 seconds and then disappear showing that the value is accepted and stored.

Fig. 18: Value Saved

SECTION 5: PH CHANNEL CONFIGURATION

ATS-X2000 Series controllers offer monitoring and control of any two parameters including pH, conductivity, and ORP. This section discusses the configuration options for pH channel as required for a specific process. These configuration options are discussed in detail in sections 5.2 through 5.6.

5.1 MENU TREE

The menu tree below gives an overview of all the options available for the pH channel.

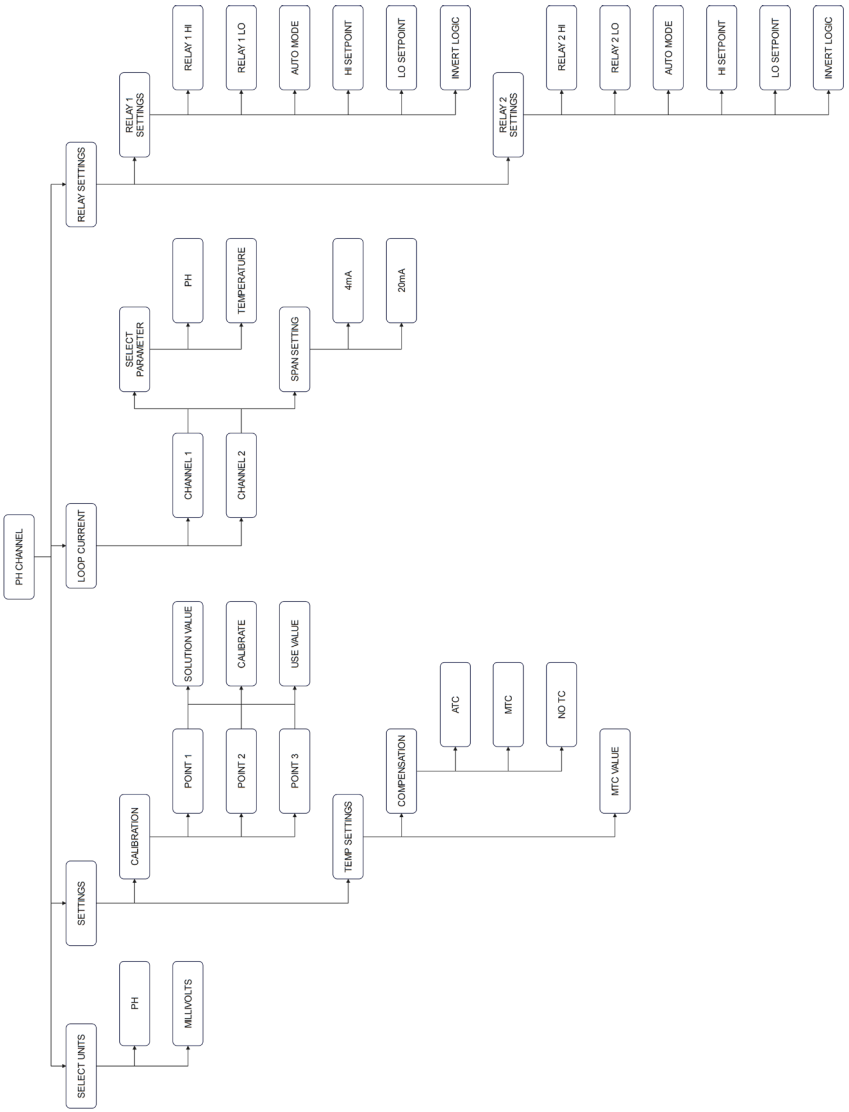


Fig. 19: Menu Tree for pH Channel

5.2 UNIT SELECTION

In the pH channel menu, navigate **SELECT UNITS** to choose desired units for pH. Unit selection screen for pH channel is shown is fig. 20.

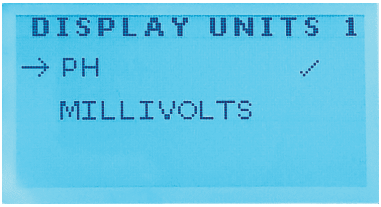


Fig. 20: Display Units

Choose from the two available units **PH** and **MILLIVOLTS** and press **enter** button set it as active unit.

5.3 CALIBRATION

ATS-X2000 Series controllers offer three point calibration for pH channel. For calibration, navigate to **SETTINGS > CALIBRATION**. The calibration menu is shown in fig. 21 below.

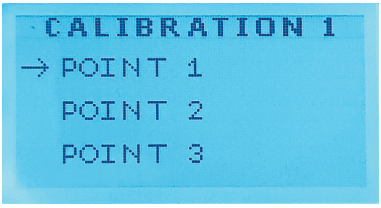


Fig. 21: Calibration Menu

5.3.1 PROCEDURE

Controller offers three point calibration and any certified pH calibration solution can be used for the calibration process.

IMPORTANT:
Following points are to be kept in mind for correct calibration process:

1. Rinse the pH electrode thoroughly with distilled water before calibration.
2. During the calibration process, constantly stir the pH electrode in calibration solution for at least a minute before pressing the calibrate button. If this step is missed, pH reading may be inaccurate.
3. Point 1 calibration must be performed with a calibration solution of lowest pH value. Point 2 calibration must be performed with a calibration solution of pH value higher than Point 1 but lower than Point 3. And point 3 calibration must be performed with a solution of highest pH value. If this step is missed, pH curve formation will

be inaccurate and pH readings will be inaccurate.

In **CALIBRATION** menu, choose **POINT 1**.

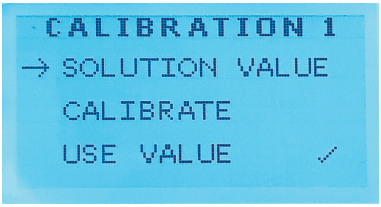


Fig. 22: POINT 1 Calibration

Choose **SOLUTION VALUE** and enter the value of pH calibration solution. Press **enter** button to save the value. Remember to choose the calibration solution of lowest pH value for point 1.

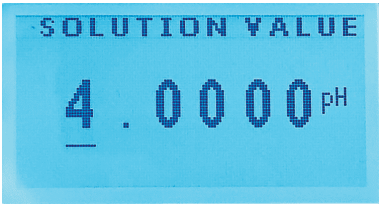


Fig. 23: Solution Value

Stir the electrode thoroughly in calibration solution for at least a minute. Then navigate to the **CALIBRATE** option and press the **enter** button to start calibration process. A screen **CALIB IN PROGRESS** will appear for 30 seconds followed by a **CALIBRATION COMPLETE** screen which indicates that the calibration process was successful.

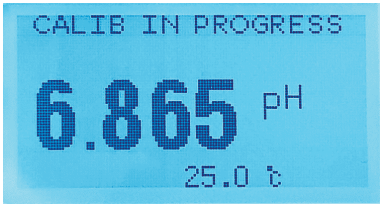


Fig. 24: Calibration in Progress

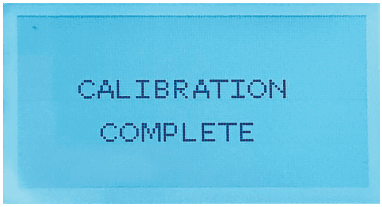


Fig. 25: Calibration Complete

Once the calibration is complete, navigate to **USE VALUE** (fig. 22)option and check it so that POINT 1 is used in calibration curve. It is important that the **USE VALUE** option is checked so this point is used in calibration curve or else it can cause deviations in pH readings.

Repeat the procedure for **POINT 2** and **POINT 3**. As stated earlier, remember to choose a pH calibration solution of value higher than point 1 but lower than point 3 for point 2, and the pH calibration of highest pH value for point 3.
Also make sure that the **USE VALUE** option is checked for all three points to get accurate pH readings.

5.4 TEMPERATURE SETTINGS

In ORP channel menu, navigate to **SETTINGS > TEMP SETTINGS** to configure temperature settings for ORP channel. The temperature settings menu is shown in figure below.

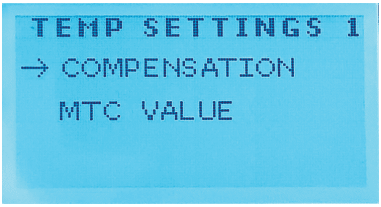


Fig. 26: Temperature Settings Menu

5.4.1 TEMPERATURE COMPENSATION

In **TEMP SETTINGS** choose **COMPENSATION** to set temperature compensation to automatic (**ATC**), manual (**MTC**), or no temperature compensation (**NO TC**). Choose the desired option and press **enter** button to confirm choice.

Fig. 27: Temperature Compensation

5.4.2 MTC VALUE

In **TEMP SETTINGS** menu (fig. 25), select **MTC VALUE** to set the reference temperature value which will be used if temperature compensation is set to manual temperature compensation. Set desired value and press **enter** button to save the value.

Fig. 28: MTC Value

5.5 LOOP CURRENT

Navigate to **LOOP CURRENT** in pH channel menu to configure loop current settings. Loop current menu is shown in fig. 28.

Fig. 29: Loop Current Menu

5.5.1 CHANNEL 1

In **LOOP CURRENT** menu, navigate to **CHANNEL 1** option to access loop current settings for channel 1 analog output.

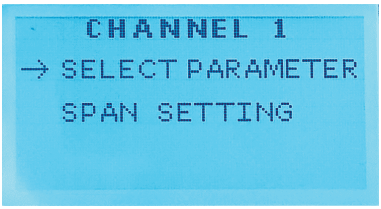


Fig. 30: Channel 1 Loop Current Settings

5.5.1.1 PARAMETER SELECTION

Select **SELECT PARAMETER** option to select between **PH** or **TEMPERATURE** parameter for channel 1 analog output. Select the desired parameter and press **enter** button to confirm changes.

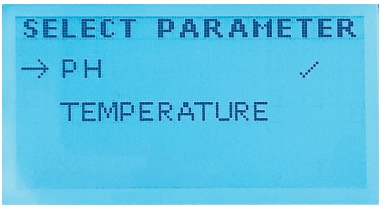


Fig. 31: Select Parameter

5.5.1.2 SPAN SETTINGS

In **LOOP CURRENT** menu, navigate to **SPAN SETTING** option to access span settings for channel 1 analog output.

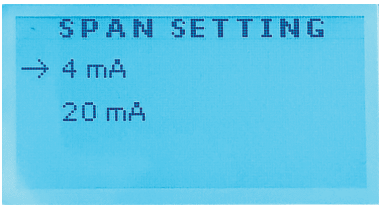


Fig. 32: Span Settings

Choose **4mA** option to set low value and **20mA** option set high value for span adjustment of channel 1 analog output.

Fig. 33: Span Setting - Low Value

Fig. 34: Span Setting - High Value

5.5.2 CHANNEL 2

Navigate to **CHANNEL 2** in **LOOP CURRENT** menu for loop current settings of channel 2 analog output. Options are the same as **CHANNEL 1** (Refer to section 5.5.1).

5.6 RELAY SETTINGS

Navigate to **RELAY SETTINGS** in pH channel menu to configure relay settings. Relay settings menu is shown in fig. 34 below.

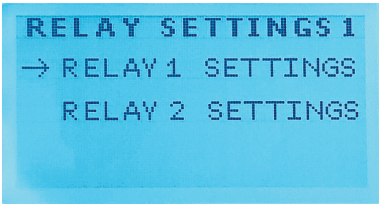


Fig. 35: Relay Settings Menu

5.6.1 RELAY 1 SETTINGS

Select **RELAY 1 SETTINGS** in **RELAY SETTINGS** menu to configure relay 1 settings. Relay 1 settings menu is shown in fig. 35.

Fig. 36: Relay 1 Settings

ATS-X2000 Series offer both automatic and manual relay operation both of which are described below.

5.6.1.1 MANUAL RELAY 1 OPERATION

Relay 1 can be manually turned on or off. Select **RELAY 1 HI** option to turn relay 1 on or **RELAY 1 LO** option to turn relay 1 off (fig. 35).

5.6.1.2 AUTOMATIC RELAY 1 OPERATION

Selecting **AUTO MODE** will turn relay 1 on and off based on high and low set point values. The relay will turn off when the value rises above high set point and will turn off when the value falls below the low set point. There is no change in the state of relay when the value is in between the high and low set point value.

High Set Point & Low Set Point Values for Relay Auto Mode

For auto operation of relay 1 operation, high set point and low point can be set by selecting **HI SETPOINT** and **LO SETPOINT** option. Enter the desired value for the set points and press **enter** button to save the values. High set point and low set point screens are shown in fig. 36 and fig. 37.

Fig. 37: Relay 1 high set-point

Fig. 38: Relay 2 high set-point

Invert Logic for Relay Auto Mode

Select **INVERT LOGIC** option in **RELAY 1 SETTINGS** to invert the logic for auto mode of relay 1 operation. If this option is checked, the relay will turn off if the value falls below the low set point and will turn on if the value rises above the high set point. There will be no change in the state of relay when the value is in between the high set point and low set point values.

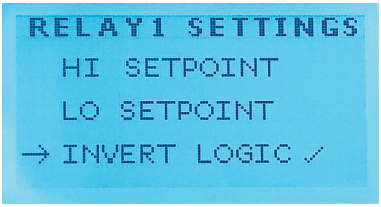


Fig. 39: Invert Logic

5.6.2 RELAY 2 SETTINGS

Select **RELAY 2 SETTINGS** in **RELAY SETTINGS** menu of pH channel to change relay 2 settings (fig. 34). The options are same as described in section 5.6.1.

SECTION 6: CONDUCTIVITY CHANNEL CONFIGURATION

This section discusses in detail the configuration options for conductivity channel in ATS-X2000 Series controllers. The menu tree below gives an overview of all the options available for the conductivity channel. These options are discussed in detail through section 6.1 to section 6.6.

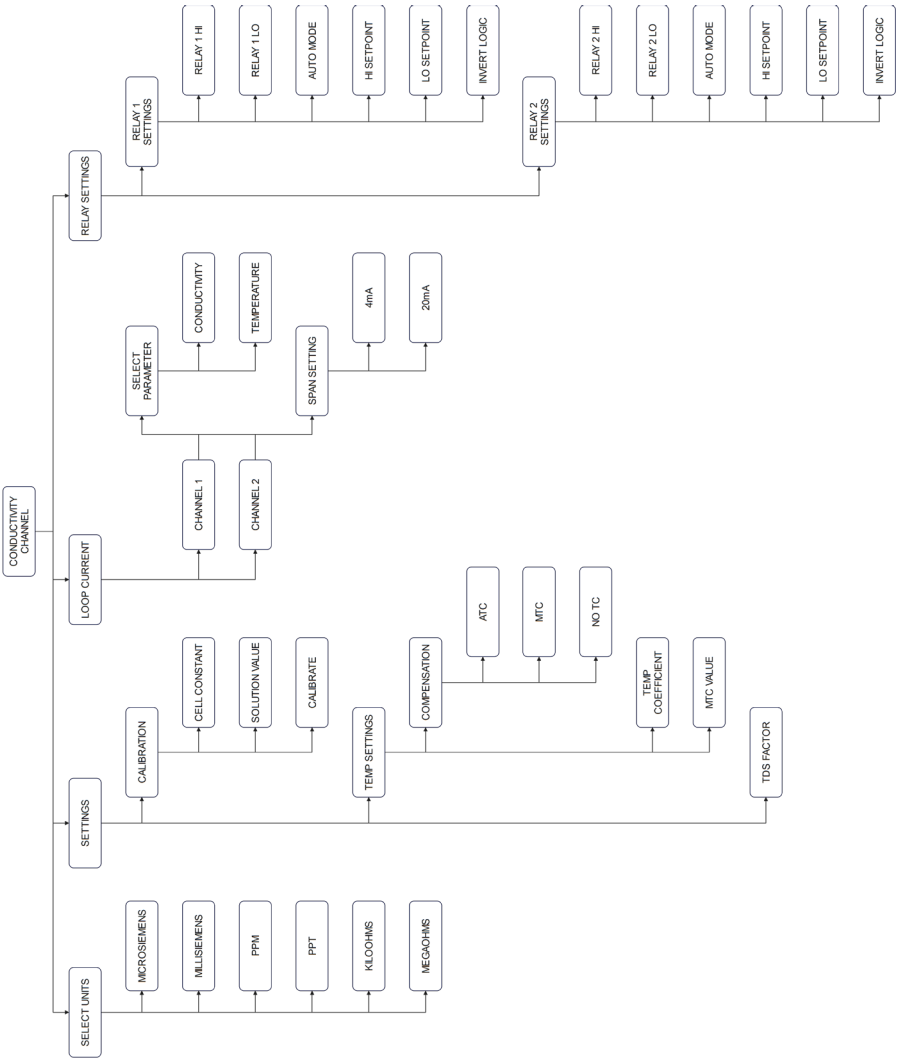


Fig. 40: Menu Tree for Conductivity Channel

6.1 UNITE SELECTION

In Conductivity channel menu, navigate to **SELECT UNITS** to choose desired units for conductivity measurement. Unit selection screen is shown figure below.

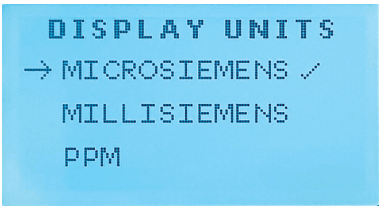


Fig. 41: Display Units

Available units are shown in below table. Navigate to the desired unit and press enter button to set it as active unit for conductivity channel.

Units	Conductivity	TDS	Resistivity
	µS	ppm	kΩ
	mS	ppt	MΩ

6.2 CALIBRATION

For calibration, navigate to **SETTINGS > CALIBRATION** in conductivity channel menu. The calibration menu is shown in figure below.

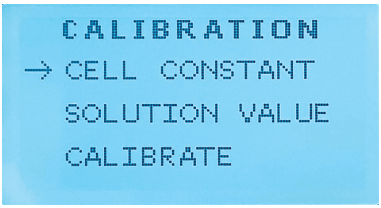


Fig. 42: Calibration Menu

6.2.1 MANUAL CELL CONSTANT ADJUSTMENT

ATS-X2000 Series controllers offer the option to manually enter the cell constant for conductivity calibration purposes. In the **CALIBRATION** menu of conductivity channel, select **CELL CONSTANT** option to set a desired cell constant value ranging from 0.01 to 1.00 1/cm. Enter the desired value and press the **enter** button to confirm the changes.

Fig. 43: Cell Constant Adjustment

6.2.2 CALIBRATION PROCEDURE

ATS-X2000 Series controllers offer easy single point calibration for conductivity channel using any certified conductivity calibration solution. Before calibration thoroughly wash the conductivity sensor electrode with DEMIN water and dry it.

In the **CALIBRATION** menu, select the **SOLUTION VALUE** option and enter the conductivity value of the conductivity calibration solution. Press enter button to save the value.

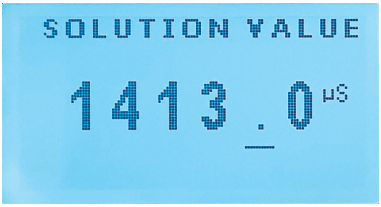


Fig. 44: Solution Value for Calibration

Once the value of calibration solution is set, navigate to the **CALIBRATE** option and press **enter** button to start the calibration process. Screen saying **CALIB IN PROGRESS** will appear indicating that calibration is in progress followed by a **CALIBRATION COMPLETE** screen which shows that the calibration is complete.

Fig. 45: Calibration in Progress

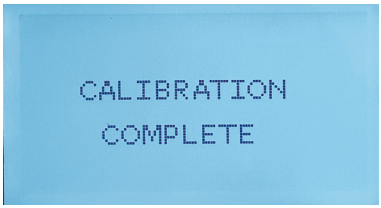


Fig. 46: Calibration Complete Message

6.3 TEMPERATURE SETTINGS

Navigate to TEMP SETTINGS in conductivity channel menu to configure temperature settings. The TEMP SETTINGS menu is shown in figure below.

Fig. 47: Temperature Settings Menu

6.3.1 TEMPERATURE COMPENSATION

In **TEMP SETTINGS** choose **COMPENSATION** to set temperature compensation to automatic temperature compensation (ATC), manual temperature compensation (MTC), or no temperature compensation (NO TC). Choose the desired option and press **enter** button to set it as active option.

Fig. 48: Temperature Compensation

6.3.2 TEMPERATURE COEFFICIENT

In **TEMP SETTINGS** menu, choose **TEMP COEFFICIENT** option to set the temperature coefficient value. Once the desired value is entered, press **enter** button to save the temperature coefficient value.

Fig. 49: Temperature Coefficient

Temperature coefficient range for different solutions is given in below table.

SOLUTION	Temperature Coefficient Range (%/°C)
Acids	1.0 - 1.6
Bases	1.8 - 2.2
Salts	2.2 - 3.0
Drinking/Raw Water	2.0
Permeate/Pure Water	5.2

6.3.3 MTC VALUE

Choose **MTC VALUE** in **TEMP SETTINGS** menu to set the reference temperature value which will be used if temperature compensation is set to manual temperature compensation. Set desired value and press **enter** button to set MTC value.

Fig. 50: MTC Value

6.4 TDS FACTOR

TDS factor is the factor that is used to convert conductivity reading into TDS (total dissolved solids). For example, with a TDS factor of 0.63, a conductivity solution of 1000µS/cm will result in TDS reading of 630ppm.
Select **TDS FACTOR** option in **SETTINGS** menu of conductivity channel to set the desired TDS factor. Enter the desired TDS factor and press **enter** button to confirm the changes.

Fig. 51: TDS Factor

6.5 LOOP CURRENT

Navigate to **LOOP CURRENT** in conductivity channel menu to configure loop current settings for channel 1 and channel 2. Loop current menu is shown in figure below.

Fig. 52: Loop Current Menu

6.5.1 CHANNEL 1

Navigate to **CHANNEL 1** In **LOOP CURRENT** menu of conductivity channel to access loop current settings for channel 1 analog output.

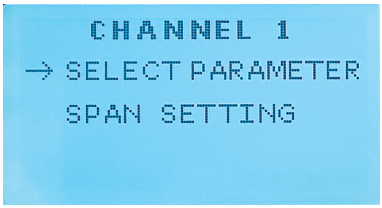


Fig. 53: Loop Current Settings for Channel 1

6.5.1.1 PARAMETER SELECTION

Select **SELECT PARAMETER** option to select between CONDUCTIVITY or TEMPERATURE parameter for channel 1 analog output.

Fig. 54: Select Parameter

6.5.1.2 SPAN SETTINGS

In **LOOP CURRENT** menu for channel 1 (fig. 52), navigate to **SPAN SETTING** option to access span settings for channel 1 analog output. Span settings menu is shown in figure below.

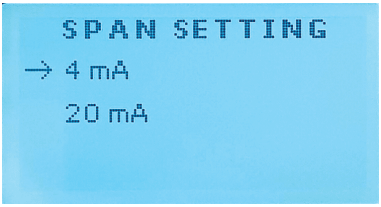


Fig. 55: Span Settings

Choose **4mA** option to set low value and **20mA** option to set high value for span adjustment of channel 1 analog output.

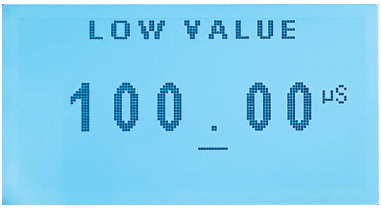


Fig. 56: Span Setting - Low Value

Fig. 57: Span Setting - High Value

Unit of low and high value depends on the selected parameter for channel 1 (section 6.5.1.1).

6.5.2 CHANNEL 2

For loop current settings for channel 2, navigate to **CHANNEL 2** in loop current menu of conductivity channel. Options are the same as described in section5.2.5.1.

6.6 RELAY SETTINGS

Navigate to **RELAY SETTINGS** in conductivity channel menu to configure relay settings for channel 1 or channel 2. Relay settings menu is shown in fig. 58 below.

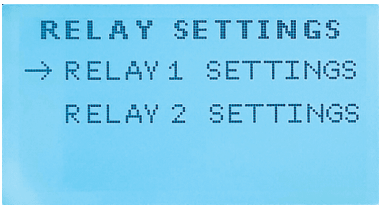


Fig. 58: Relay Settings Menu

6.6.1 RELAY 1 SETTINGS

Relays can be operated both automatically based on low and high set points and manually. Select **RELAY 1 SETTINGS** in **RELAY SETTINGS** menu to configure relay 1 settings. Relay 1

settings menu is shown in figure below.

Fig. 59: Relay 1 Manual Operation

ATS-X2000 Series offer both automatic and manual relay operation both of which are described below.

6.6.1.1 MANUAL RELAY OPERATION

To manually turn relay 1 on, under relay 1 settings menu, select **RELAY 1 HI** option and to manually turn relay 1 off, select **RELAY 1 LO** option.

6.6.1.1 AUTOMATIC RELAY OPERATION

ATS-X2000 Series offers option for automatic relay operation. Selecting **AUTO MODE** will turn relay 1 on and off based on high and low set point values (described under the heading, "High and Low Set Point Values"). The relay will turn off when the value rises above high set point and will turn off when the value falls below the low set point. There is no change in the state of relay when the value is in between the high and low set point value.

High and Low Set Point Values

To set high and low set points for auto operation of relay 1, navigate to **HI SETPOINT** and **LO SETPOINT** option respectively in relay 1 settings menu. Enter the desired value for the set points and press **enter** button to save the values.

Fig. 60: Relay 1 High Set Point

Fig. 61: Relay 1 Low Set Point

Invert Logic for Relay Auto Operation

This option inverts the logic for relay auto operation. If this option is active, relay will turn on when the value falls below the low set point and will turn on when the value rises above the high set point. Select **INVERT LOGIC** option in **RELAY 1 SETTINGS** to

invert the logic for auto mode of relay 1 operation. There will be no change in the state of relay when the value is in between the high set point and low set point values.

Fig. 62: Invert Logic

6.6.2 RELAY 2 SETTINGS

Select **RELAY 2 SETTINGS** in **RELAY SETTINGS** menu (fig. 58) in conductivity channel menu. The options are same as relay 1 and are described in section 6.6.1.

SECTION 7: ORP CHANNEL CONFIGURATION

This section discusses the configuration options for ORP channel as required for a specific process. These configuration options are discussed in detail in sections 7.2 through 7.6.

7.1 MENU TREE

The menu tree below gives an overview of all the options available for the ORP channel.

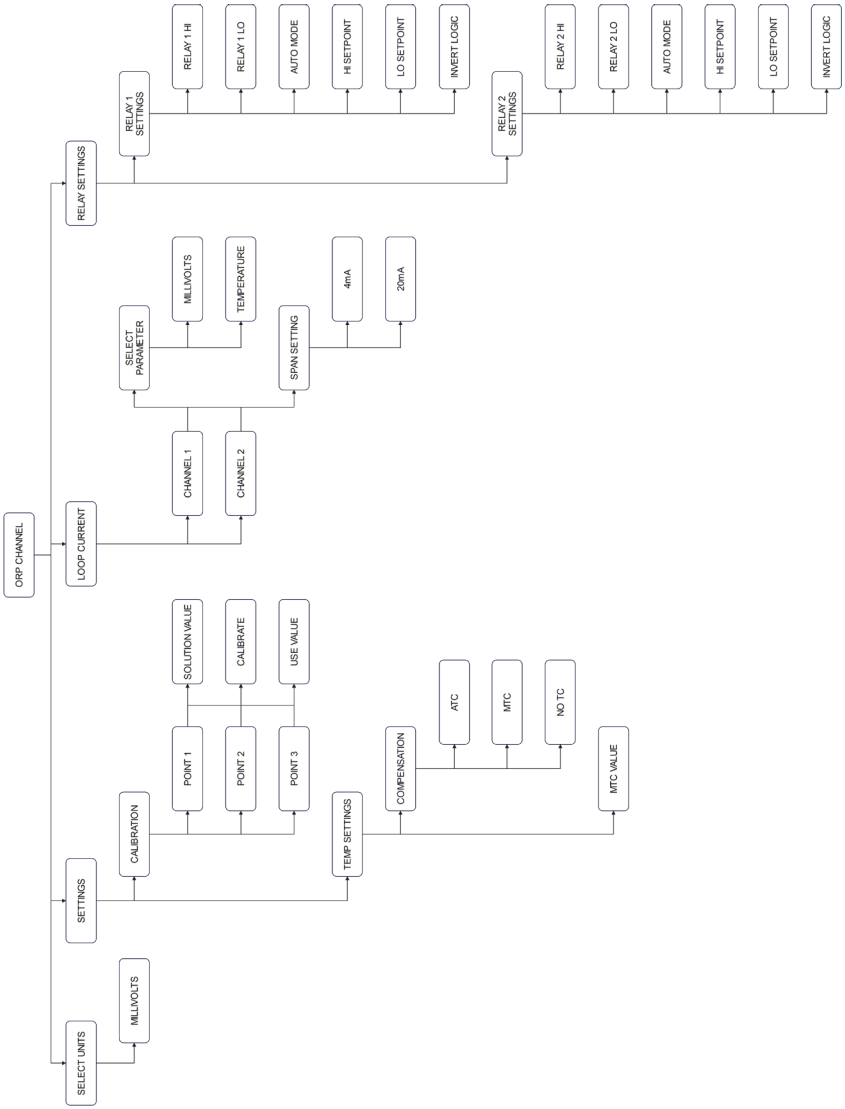


Fig. 63: Menu Tree for ORP Channel

7.2 DISPLAY UNIT

ATS-X2000 Series controllers offer millivolts unit for ORP channel. In the pH channel menu, navigate to **SELECT UNITS** to see display unit for ORP.

Fig. 64: Display Units

7.3 CALIBRATION

ATS-X2000 Series controllers offer three point calibration for ORP channel. For calibration, navigate to **SETTINGS > CALIBRATION** under ORP channel menu. The calibration menu for ORP channel is shown below.

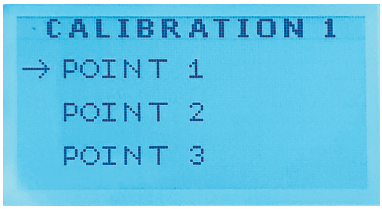


Fig. 65: Calibration Menu

7.3.1 PROCEDURE

Controller offers three point calibration and any certified ORP calibration solution can be used for the calibration process.

IMPORTANT:

Following points are to be kept in mind for correct calibration process:

1. Rinse the ORP electrode thoroughly with distilled water before calibration.
2. During the calibration process, constantly stir the ORP electrode in calibration solution for at least a minute before pressing the calibrate button. If this step is missed, ORP readings may be inaccurate.
3. Point 1 calibration must be performed with a calibration solution of lowest ORP value. Point 2 calibration must be performed with a calibration solution of ORP value higher than Point 1 but lower than Point 3. And point 3 calibration must be performed with a solution of highest ORP value. If this step is missed, ORP curve formation will be inaccurate and ORP readings will be inaccurate.

In **CALIBRATION** menu, choose **POINT 1**. Calibration menu for point 1 is shown in figure below.

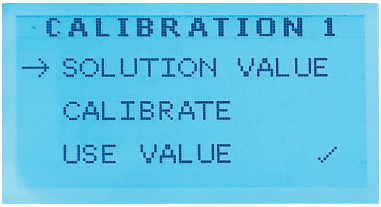


Fig. 66: POINT 1 Calibration

Choose **SOLUTION VALUE** and enter the value of ORP calibration solution. Press **enter** button to save the value. Remember to choose the calibration solution of lowest pH value for point 1.

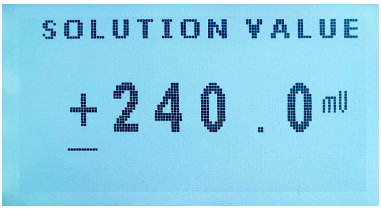


Fig. 67: Solution Value

Stir the electrode thoroughly in calibration solution for at least a minute. Then navigate to the **CALIBRATE** option and press the **enter** button to start calibration process. A screen **CALIB IN PROGRESS** will appear for 30 seconds followed by a **CALIBRATION COMPLETE** screen which indicates that the calibration process was successful.

Fig. 68: Calibration in Progress

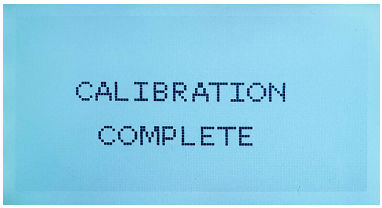


Fig. 69: Calibration Complete

Once the calibration is complete, navigate to **USE VALUE** (fig. 65) option and check it so that POINT 1 is used in calibration curve. It is important that the **USE VALUE** option is checked so this point is used in calibration curve or else it can cause deviations in ORP readings.

Repeat the procedure for **POINT 2** and **POINT 3**. As stated earlier, remember to choose

an ORP calibration solution of value higher than point 1 but lower than point 3 for point 2, and the ORP calibration of highest ORP value for point 3.
Also make sure that the **USE VALUE** option is checked for all three points to get accurate ORP readings.

7.4 TEMPERATURE SETTINGS

In ORP channel menu, navigate to **SETTINGS > TEMP SETTINGS** to configure temperature settings for ORP channel. The temperature settings menu is shown in figure below.

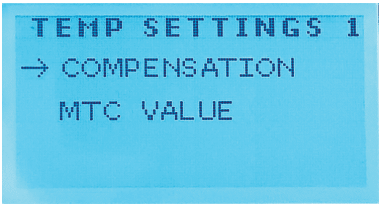


Fig. 70: Temperature Settings Menu

7.4.1 TEMPERATURE COMPENSATION

In **TEMP SETTINGS** choose **COMPENSATION** to set temperature compensation to automatic (**ATC**), manual (**MTC**), or no temperature compensation (**NO TC**). Choose the desired option and press **enter** button to confirm choice.

Fig. 71: Temperature Compensation

7.4.2 MTC VALUE

In **TEMP SETTINGS** menu (fig. 69), select **MTC VALUE** to set the reference temperature value which will be used if temperature compensation is set to manual temperature compensation. Set desired value and press **enter** button to save the value.

Fig. 72: MTC Value

7.5 LOOP CURRENT

Navigate to **LOOP CURRENT** in ORP channel menu to configure loop current settings. Loop current menu is shown in the figure below.

Fig. 73: Loop Current Menu

7.5.1 CHANNEL 1

In **LOOP CURRENT** menu, navigate to **CHANNEL 1** option to access loop current settings for channel 1 analog output.

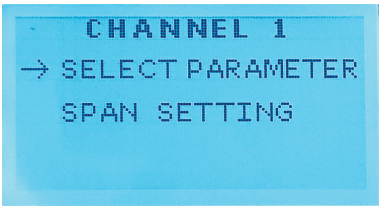


Fig. 74: Channel 1 Loop Current Settings

7.5.1.1 PARAMETER SELECTION

Select **SELECT PARAMETER** option to select between **MILLIVOLTS** or **TEMPERATURE** parameter for channel 1 analog output. Select the desired parameter and press **enter** button to confirm changes.

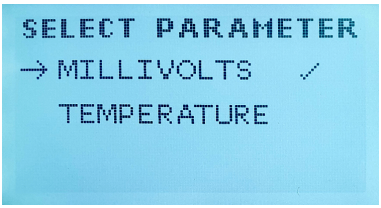


Fig. 75: Select Parameter

7.5.1.2 SPAN SETTINGS

In **LOOP CURRENT** menu, navigate to **SPAN SETTING** option to access span settings for channel 1 analog output.

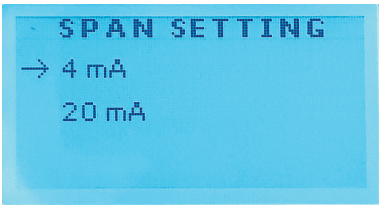


Fig. 76: Span Settings

Choose **4mA** option to set low value and **20mA** option set high value for span adjustment of channel 1 analog output. Unit of the values depends upon the parameter selected (section 7.5.1.1).

Fig. 77: Span Setting - Low Value

Fig. 78: Span Setting - High Value

7.5.2 CHANNEL 2

Navigate to **CHANNEL 2** in **LOOP CURRENT** menu for loop current settings of channel 2 analog output. Options are the same as **CHANNEL 1** (Refer to section 7.5.1).

7.6 RELAY SETTINGS

Navigate to **RELAY SETTINGS** in ORP channel menu to configure relay settings. Relay settings menu is shown in the figure below.

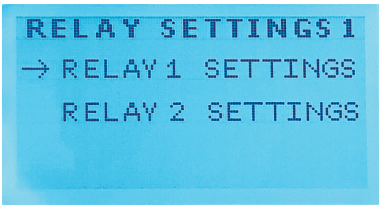


Fig. 79: Relay Settings Menu

7.6.1 RELAY 1 SETTINGS

Select **RELAY 1 SETTINGS** in **RELAY SETTINGS** menu to configure relay 1 settings. Relay 1 settings menu is shown in the figure below.

Fig. 80: Relay 1 Settings

ATS-X2000 Series offer both automatic and manual relay operation both of which are described below.

7.6.1.1 MANUAL RELAY 1 OPERATION

Relay 1 can be manually turned on or off. Select **RELAY 1 HI** option to turn relay 1 on or **RELAY 1 LO** option to turn relay 1 off (fig. 79).

5.6.1.2 AUTOMATIC RELAY 1 OPERATION

Selecting **AUTO MODE** will turn relay 1 on and off based on high and low set point values. The relay will turn off when the value rises above high set point and will turn off when the value falls below the low set point. There is no change in the state of relay when the value is in between the high and low set point value.

High Set Point & Low Set Point Values for Relay Auto Mode

For auto operation of relay 1 operation, high set point and low point can be set by selecting **HI SETPOINT** and **LO SETPOINT** option. Enter the desired value for the set points and press **enter** button to save the values. High set point and low set point screens are shown in the figures below.

Fig. 81: Relay 1 high set-point

Fig. 82: Relay 2 high set-point

Invert Logic for Relay Auto Mode

Select **INVERT LOGIC** option in **RELAY 1 SETTINGS** to invert the logic for auto mode of relay 1 operation. If this option is checked, the relay will turn off if the value falls below the low set point and will turn on if the value rises above the high set point. There will be no change in the state of relay when the value is in between the high set point and low set point values.

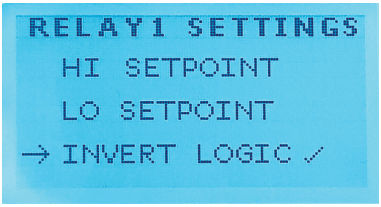


Fig. 83: Invert Logic

7.6.2 RELAY 2 SETTINGS

Select **RELAY 2 SETTINGS** in **RELAY SETTINGS** menu of pH channel to change relay 2 settings (fig. 34). The options are same as described in section 7.6.1.

SECTION 8: PASSWORD PROTECTION

ATS-X2000 Series controllers offers a password protection layer as an added security feature to protect process parameters. Navigate to **MENU > PASSWORD SETTING** to set/change the password or to toggle on/off the password protection feature. Password settings menu is shown in the figure below.

Fig. 84: Password Settings

8.1 SET/CHANGE PASSWORD

Under the password settings menu, navigate to **CHANGE PASSWORD** to set a new password or change the existing one.

Password is a 6 digit numerical value with decimal point. Use **right** button to navigate between the digits and **up** and **down** buttons to change value of the active digit (underlined digit). Once the desired password is entered, press accept button to save the password. A screen showing **PASSWORD SAVED** will appear for 3 seconds to show that the entered password is saved.

Fig. 85: Enter Password Screen

Fig. 86: Password Saved Message

8.2 ENABLE/DISABLE PASSWORD PROTECTION

In the **PASSWORD SETTING** menu, check the **PASSWORD ON** option (fig. 83) to turn password protection on or uncheck it to turn password protection off.

SECTION 9: MAINTENANCE

9.1 GENERAL GUIDELINES

Controller requires little to no maintenance for its smooth operation. Routine maintenance will be recommended for ideal operation. For accurate readings, calibration should be performed as per instructions for a desired channel described in section 5.3 for pH channel, section 6.3 for Conductivity channel, and section 7.3 for ORP channel.

9.2 MAINTENANCE PARTS

Maintenance / replacement parts for controller are available as per requirement. For any requirement of parts kindly contact the Manufacturer representative. Damaged electronic PCB's , PCB components, buttons, connectors and LED can also be replaced if required. Manufacturer's corresponding personnel will remain in contact until the issue is resolved.

9.3 MAINTENANCE PARTS

Controller is provided with high quality stainless steel side clamp for fixing with panel plate. For panel mounting procedure kindly refer to section 2.1. Side clamp plate can be ordered separately if required.

9.4 FIELD MOUNTING PARTS

Controller is already assembled in IP65 panel mount enclosure for dust and water protection. For field mounting, manufacturer can also provide IP67 field enclosure with installed cable glands for cables connection. Field enclosure also contains the through hole of lock for protection from unknown users' interaction on the field.

Fig. 87: Field Mounting

SECTION 10: TECHNICAL DRAWINGS

10.1 CONTROLLER DIMENSIONS

ATS-X2000 Series controllers technical detailed dimensions can be seen below:

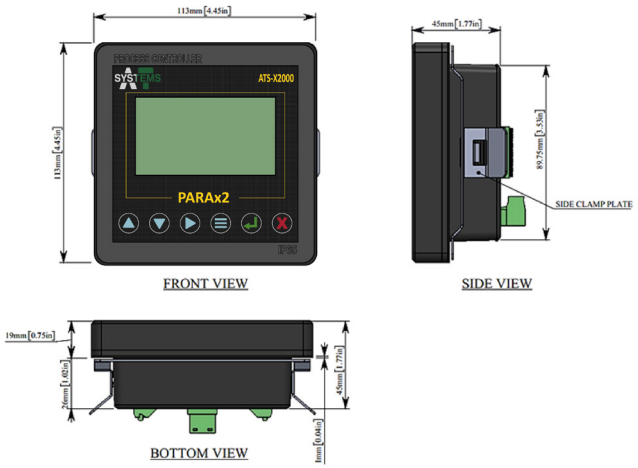


Fig. 88: Controller Dimensions

10.2 EXPLODED VIEW

Exploded view for ATS-X2000 Series controllers can be seen below:

Fig. 89: Exploded View

Front Part includes LCD and controller buttons PCB.
Back Part includes power supply PCB, Main PCB and connectors.
Controller Gasket is provided for insulation of controller with electrical panel and IP65 protection.
Side Clamp Plate is provided for clamping of controller with electrical panel.
Screws are for front and back box encapsulation and IP65 protection.

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