

ATS-CD1000

Conductivity, TDS & Resistivity Controller



User Instruction Manual

ATS-CD1000 Process Controller

Read this before using ATS-CD1000

Thank you for choosing the **ATS-CD1000** controller.

ATS-CD1000 is an ARM processor-based controller that can analyze and control conductivity, TDS or resistivity parameters in various industrial water applications. **ATS-CD1000** provides 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 in industry. 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-CD1000 controller comes with a 1-Year limited warranty. Kindly make sure to read the Warranty Terms & Conditions enclosed in the box.

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-CD1000 is a single-channel conductivity controller used for industrial and commercial purposes. The isolated design provides superior noise control making it well suited for field application. Advance control with industry-acceptable control loop and relay logic makes it one of the most economical controllers in the market. This controller provides set point values and relay for High and Low digital control. Single-point calibration makes life easy for the field calibration.

Enhanced user interface and easy-to-use 6-Button keypad make the controller intuitive. Provided logging function can save parameters values in a dedicated microSD card with user-specified time. A password feature is an added functionality which keeps the process safe and secure.

1.2 FEATURES

ATS-CD1000 Controller is 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
- Programmable high-low relay function
- Wi-Fi feature (available on customer requirement)
- 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

Measuring Range (Conductivity)	0.000 $\mu\text{S}/\text{cm}$ - 200mS/cm, minimum resolution: 0.001 $\mu\text{S}/\text{cm}$, $\pm 0.5\%$ accuracy
Measuring Range (TDS)	0.00 - 100ppt, minimum resolution: 0.001ppm, $\pm 0.5\%$ accuracy
Measuring Range (Resistivity)	5.00 Ω - 200M Ω , minimum resolution: 0.001k Ω , $\pm 0.5\%$ accuracy
Measuring Range (Temperature*)	-50.0 $^{\circ}\text{C}$ - 200.0 $^{\circ}\text{C}$, 0.1 $^{\circ}\text{C}$ resolution, Linear Coefficient, 0.1 $^{\circ}\text{C}$ accuracy

Units	Conductivity	TDS	Resistivity
	μS mS	ppm ppt	kΩ MΩ
Calibration Mode	Easy single point calibration. Any certified conductivity calibration solution can be used. Manual input of cell constant is also available		
Cell Constant	2-pole electrode: 0.0 - 10.0 /cm fixed, 0.01 - 10.0/cm freely selectable (user defined)		
Temperature Compensation	Linear temperature compensation through-out the sensor range		
Analog Output 1 (Isolated Output)	4~20mA corresponding to any selected parameter, ±0.001mA accuracy, 0.001mA resolution, maximum load: 500Ω		
Analog Output 2* (Isolated Output)	4~20mA corresponding to any selected parameter, ±0.001mA accuracy, 0.001mA resolution, maximum load: 500Ω		
Relays	1 (HI) - 24 VDC, 0.5A - On/Off programmable 2 (LO) - 24 VDC, 0.5A - On/Off programmable Relay function with customized dead band		
Clock (Optional)	Internal Clock, 24-Hour format, ±1 min/month accuracy		
SD Card (Optional)	Built in SD card storage for storing values of up to 5 years after specific time intervals		
RS-485 Communication (Optional)	RS-485 based communication with AT systems software for microSD card data retrieval MODBUS communication option also available		
Mounting Type	Panel Mount		
Panel Cutout Size	LxW (93mm x 93mm)		
Dimensions	LxWxD (113.5mm x 113.5mm x 83mm)		
Power Requirement	24 VDC (Max up to 35 VDC), 2.5 Watts		
Weight (Assembly)	≈ 255 grams		
IP Class Protection	IP65 (In panel mount installation)		

*2nd analog output feature is available upon user request. Please select ATS-CD1000-N2 to avail this feature

1.4 APPLICATIONS

ATS-CD1000 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

2.1 PANEL MOUNTING

ATS-CD1000 controller can be mounted on control panel plate for different industrial applications. Fig. 1 below shows the controller with panel cutout dimensions in mm. Panel cutout sticker is also provided in package for reference cutting.

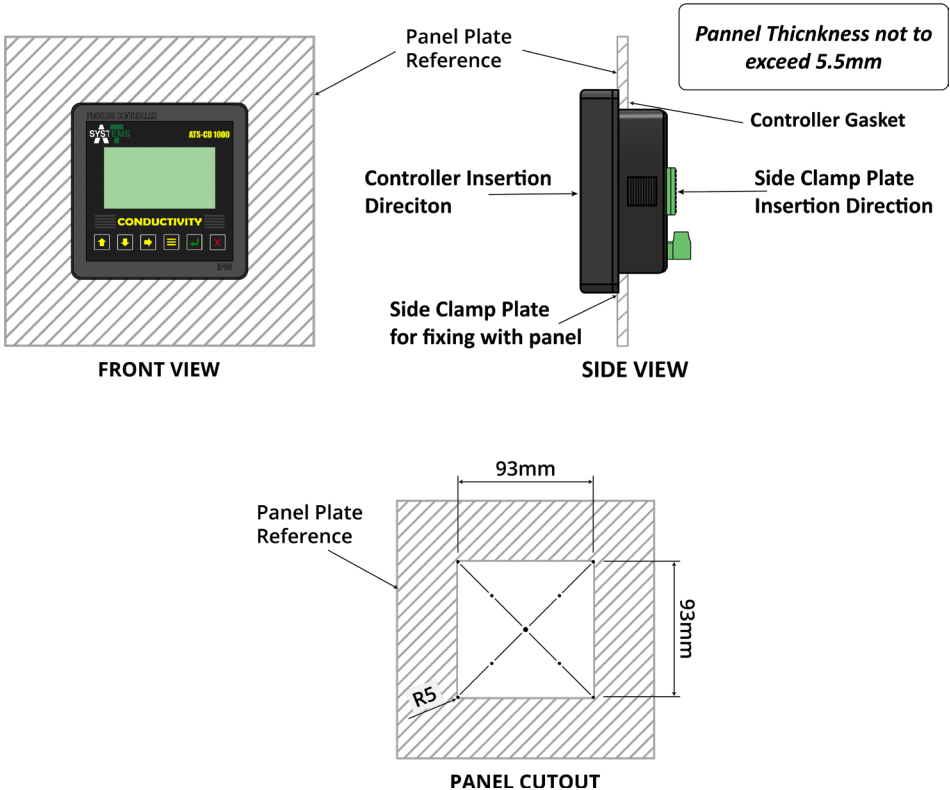


Fig. 1 - ATS-CD1000 Panel Mounting

2.2 SENSOR MOUNTING

Sensor can be installed within the cable length (05 meters cable length is included with the sensor). It is recommended to install the sensor in a line which does not run dry. If required, an offline housing is also available which can be purchased from AT systems. It is recommended to install the sensor away from pumps, frequency drive systems or other high frequency sources.

Refer to the installation manual of conductivity sensor for sensor installation

and maintenance. **AT Systems** provide industrial grade conductivity sensors.

2.3 CONNECTIONS

2.3.1 ELECTRICAL CONNECTIONS

ATS-CD1000 controller requires 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-CD1000 controller.

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

ATS-CD1000 has power polarity protection which protects the controller from 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.

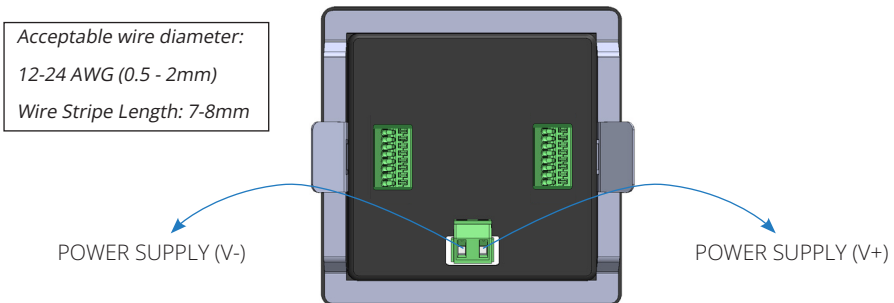


Fig. 2 - ATS-CD1000 VDC Connections

2.3.2 SENSOR CONNECTIONS

The sensor electrode cables can be connected to the **ATS-CD1000** controller terminal strip by matching the wire colors on the cable conductors. For convenience terminal blocks are labeled on back of the controller.

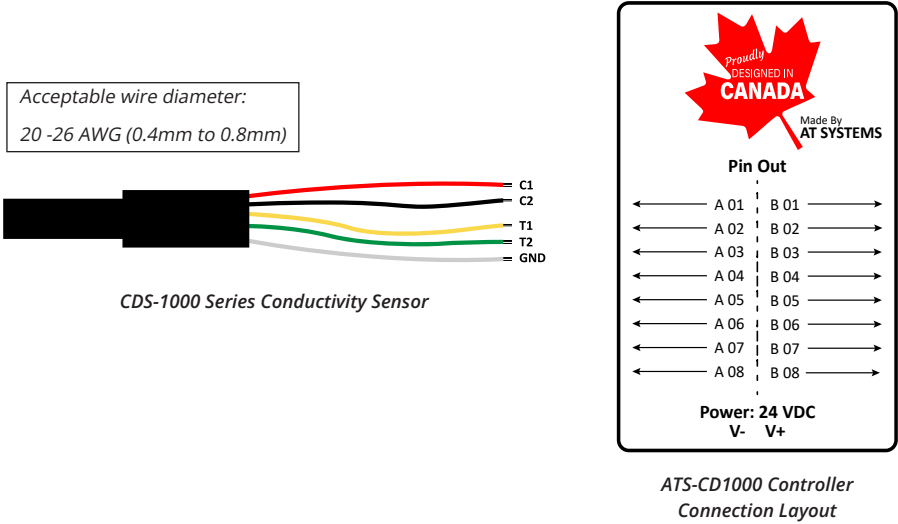


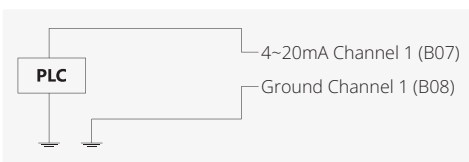
Fig. 3 - ATS-CD1000 Compatible Sensor Connections

Fig. 3 shows the wiring connection names for **CDS-1000** series sensor and **ATS-CD1000** controller. Each sensor wire connection detail is provided:

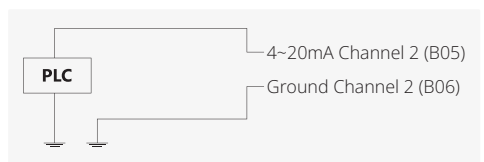
- Connect **C1** (Red wire) with **A01** connection of Controller
- Connect **C2** (Black wire) with **A02** connection of controller
- Connect **T1** (Yellow wire) with **A03**
- Connect **T2** (Green wire) with **A04**
- Connect **GND** (Bare wire) with **A05**

2.3.3 PLC/ANALOG OUTPUT AND COMMUNICATION CONNECTIONS

Communication connection descriptions is illustrated in figures below.



Channel 1



Channel 2 (*available only with ATS-CD1000-N2)

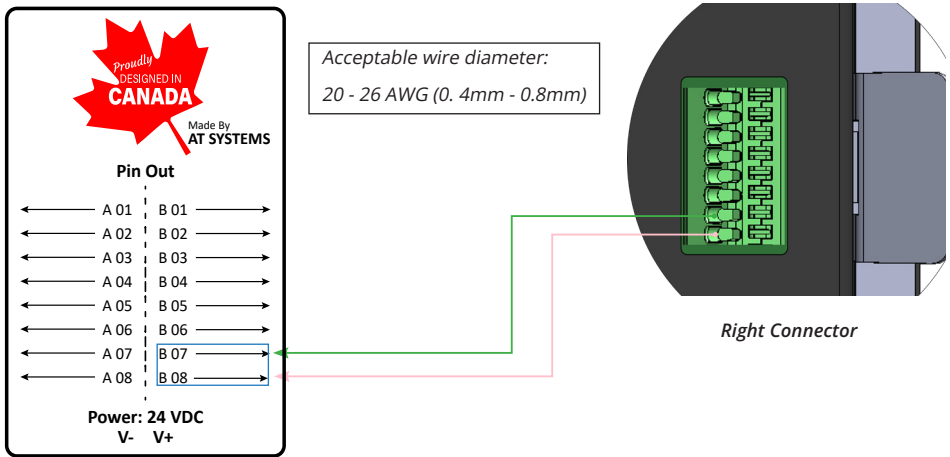


Fig. 4 - PLC/Analog output and communication Connections

2.3.4 RELAY HI / LO CONNECTIONS

Two channel relays (high and low) cables can be connected to the ATS-CD1000 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

See section 7.1 for details relays.

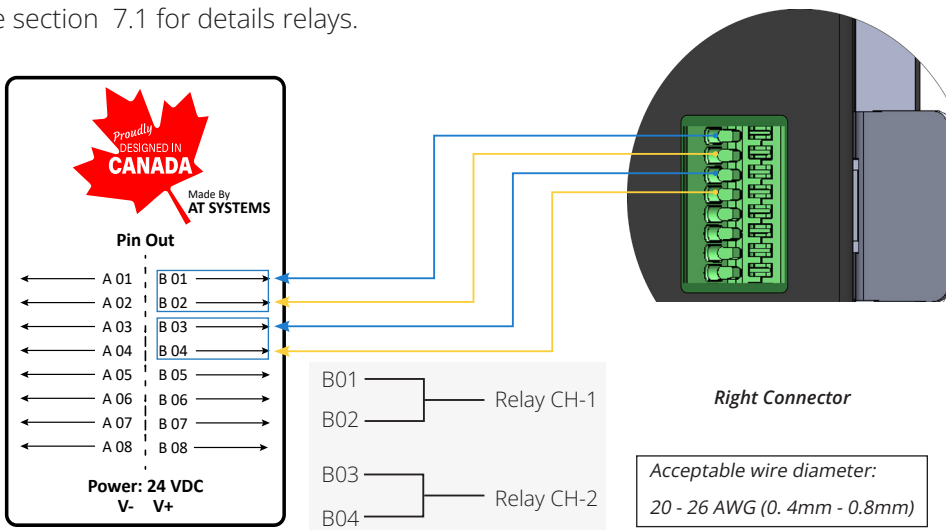


Fig. 5 - Relay HI / LO Connections

2.3.5 RELAY CONNECTIONS



Caution

Read this before connecting ATS-CD1000 controller to any external relays

ATS-CD1000 controller comes 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 the **ATS-CD1000** controller as shown in the figure below.

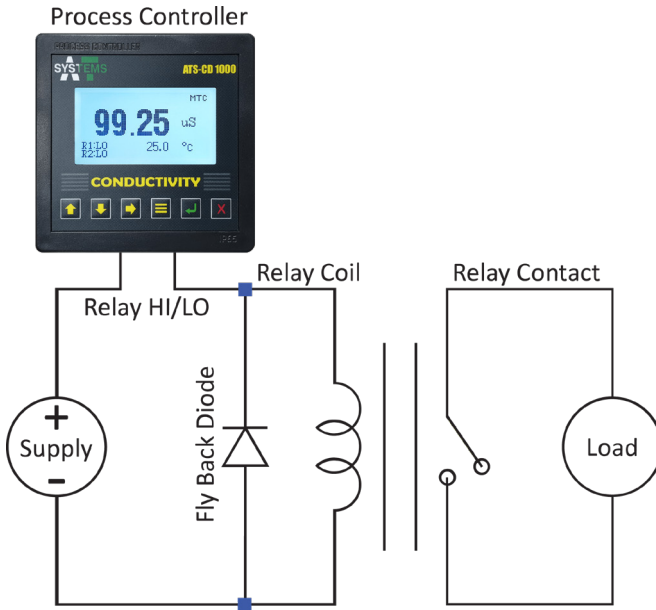


Fig: Fly Back Diode Circuit Diagram

SECTION 3: GENERAL OPERATION

ATS-CD1000 controller has 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)

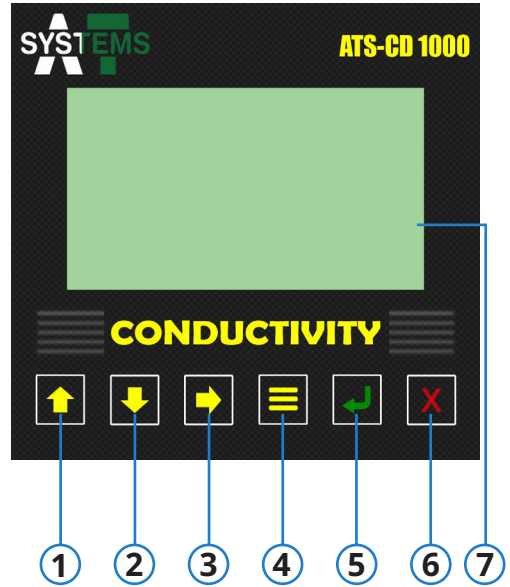


Fig. 6 - ATS-CD1000 Layout

3.1 START UP

Before Startup, ensure proper transmitter wire connections and the clamping of the controller with panel plate. To start **ATS-CD1000** connect the power connector to the back of instrument. Fig. 7 shows the main LCD display and the information it displays.

1	Parameter value with unit
2	Relay 1 status (high or low)
3	Relay 2 status (high or low)
4	Temperature with unit
5	Temperature compensation (Auto, Manual or No compensation)

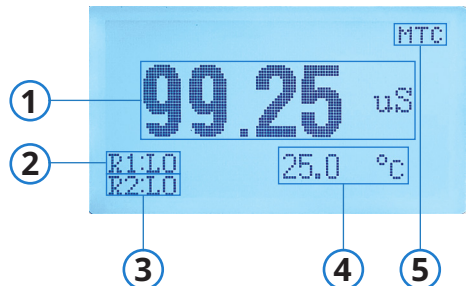


Fig. 7 - Main Screen

The controller comes factory calibrated but if required, can be performed with any certified calibration solution. For detailed procedure please see section 5.1.

3.2 OPERATING THE CONTROLLER

3.2.1 MENU NAVIGATION

ATS-CD1000 is user friendly and easy to use with its 6 button layout. To access the menu screen, press the menu button. Main menu screen is shown in fig. 8.



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.

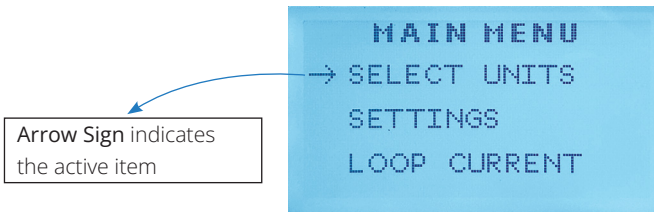


Fig. 8 - Main Menu

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.

3.2.1.1 MENU TREE

Fig. 9 below shows the menu tree for the user to have an overview of all the options available. Menu options are discussed from section 4 to section 8.

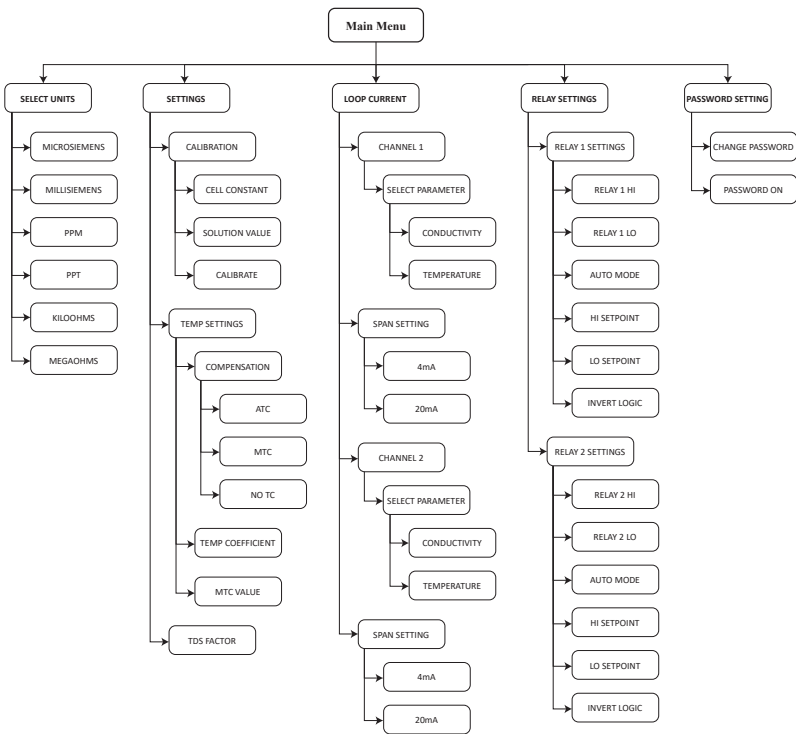


Fig. 9 - Menu Tree

3.2.2 SELECT OR TURN ON/OFF AN OPTION

If an option is to be selected or turned on from available options, a check sign next to it will indicate that an option is selected or turned on. *Up* and *down* buttons are used to navigate between the available options, and *confirm* button is used to selected/deselect or turn on/off the active option.

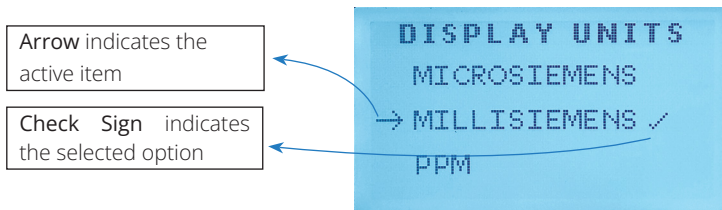


Fig. 10 - Select or Turn on/off an option

3.2.3 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 active digit. *Up* and *down* buttons are used to change the value. Once the desired value is set, press *confirm* button.

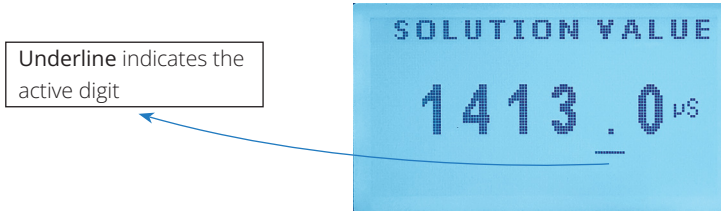


Fig. 11 - Set a Value

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. 12 - Value Saved

SECTION 4: UNIT SELECTION

To select desired unit from Navigate to [MENU > SELECT UNITS](#). Unit selection screen is shown in fig. 13.

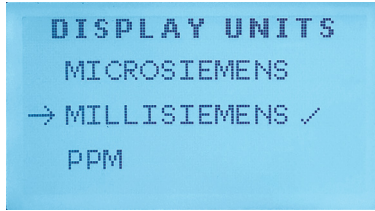


Fig. 13 - Display Units

Fig. 13 above shows the unit selection screen. Desired unit can be selected from six available units. A check sign shows the selected unit. Available units are shown in below table.

Units	Conductivity	TDS	Resistivity
	μS	ppm	$\text{k}\Omega$
	mS	ppt	$\text{M}\Omega$

SECTION 5: SETTINGS

For controller setup navigate to [MENU > SETTINGS](#). This menu contains settings for calibration, temperature compensation and TDS factor. Settings menu is shown in fig. 14.

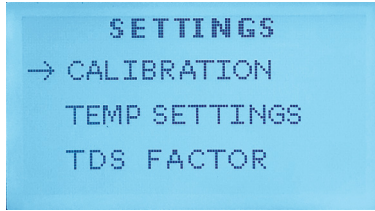


Fig. 14 - Settings Menu

5.1 CALIBRATION

To access calibration settings, navigate to [MENU > SETTINGS > CALIBRATION](#) and press *enter* button. Fig. 15 shows calibration menu.

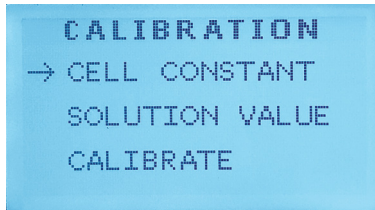


Fig. 15 - Calibration Menu

5.1.1 PROCEDURE

ATS-CD1000 offers an option to manually enter the cell constant or else calibration can be performed with any certified calibration solution.

5.1.1.1 CELL CONSTANT

To manually enter the cell constant, navigate to [MENU > SETTINGS > CALIBRATION > CELL CONSTANT](#). Cell constant value can range from 0.01 to 1.00. Enter the desired value for the cell constant and press *accept* button. Fig. 16 shows the cell constant setting screen.



Fig. 16 - Cell Constant

5.1.1.2 USING CALIBRATION SOLUTION

Any certified calibration solution can be used for calibration of **ATS-CD1000** controller. Before calibration it is highly recommended to thoroughly wash the electrodes of the sensor with DEMIN water and dry it.

Navigate to **MENU > SETTINGS > CALIBRATION > SOLUTION VALUE** and enter the conductivity value of the solution to be used for calibration.

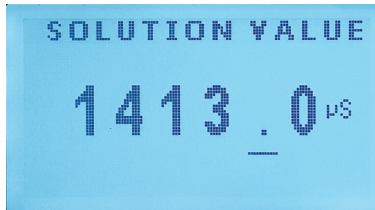


Fig. 17 - Solution Value

After the value is entered, press accept button to save the value. Then navigate to **MENU > SETTINGS > CALIBRATION > CALIBRATE**. Screen saying "CALIB IN PROGRESS" will appear indicating that calibration is in progress.

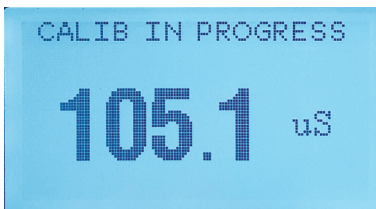


Fig. 18 - Calibration in Progress

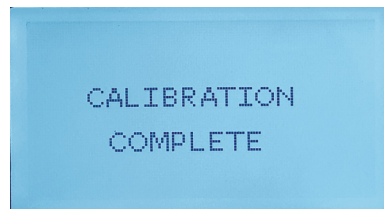


Fig. 19 - Solution Value

After about 30 seconds a message saying "CALIBRATION COMPLETE" will appear which shows that the calibration is complete.

5.2 TEMPERATURE SETTINGS

To set temperature compensation, temperature coefficient or manual temperature coefficient value, navigate to **MENU > SETTINGS > TEMP SETTINGS** and press *enter* button. Fig. 15 shows calibration menu.

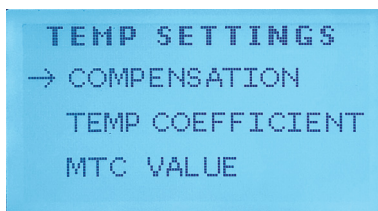


Fig. 20 - Temperature Settings

5.2.1 COMPENSATION

Navigate to **MENU > SETTINGS > TEMP SETTINGS > COMPENSATION** to choose from ATC (automatic temperature compensation), MTC (manual temperature compensation (See section 5.2.3 for details on how to set manual temperature compensation)), or NO TC (No temperature compensation).



Fig. 21 - Temperature Compensation

5.2.2 TEMPERATURE COEFFICIENT

To set temperature coefficient value, navigate to **MENU > SETTINGS > TEMP SETTINGS > TEMP COEFFICIENT**. Set desired value and press *confirm* button.



Fig. 22 - 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

5.2.3 MTC VALUE

In this menu user can set reference temperature if temperature compensation is set to MTC (see section 5.2.1). Navigate to [MENU > SETTINGS > TEMP SETTINGS > MTC VALUE](#). Set desired value and press *confirm* button to set MTC value.

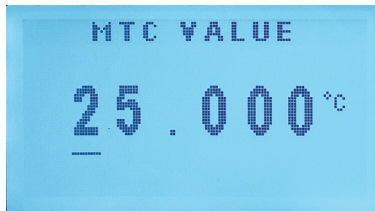


Fig. 23 - MTC Value

5.3 TDS FACTOR

To set desired TDS factor for conductivity conversion to TDS, navigate to [MENU > SETTINGS > TDS FACTOR](#). Set the desired TDS factor and press *confirm* button.

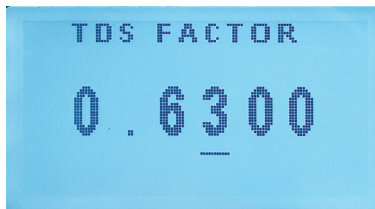


Fig. 23 - TDS Factor

SECTION 6: LOOP CURRENT

To access loop current settings navigate to **MENU > LOOP CURRENT**. Fig. 24 shows loop current settings menu.

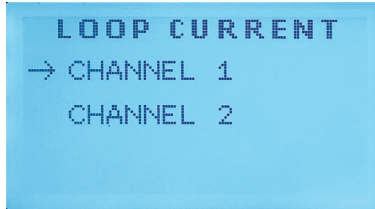


Fig. 24 - Loop Current

6.1 CHANNEL 1

Navigate to **MENU > LOOP CURRENT > CHANNEL 1** to access loop current settings for channel 1.

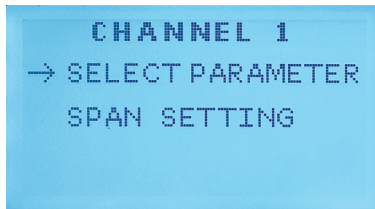


Fig. 25 - Loop Current - Channel 1

6.1.1 SELECT PARAMETER

In this menu, desired parameter can be selected from conductivity and temperature for channel 1. Navigate to **MENU > LOOP CURRENT > CHANNEL 1 > SELECT PARAMETER**. Choose between conductivity and temperature options. Check sign next to a parameter name indicates the selected parameter.

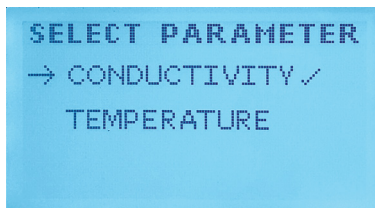


Fig. 26 - Select Parameter for Channel 1

6.1.2 SPAN SETTING

In this menu, span settings for 4mA and 20mA are available. Navigate to [MENU > LOOP CURRENT > CHANNEL 1 > SPAN SETTING](#). 4mA is low set value for relay and 20mA is high set value for relay.

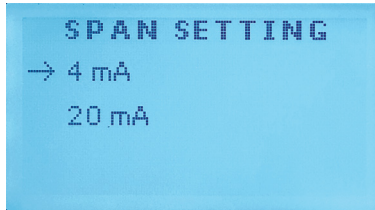


Fig. 27 - Span Settings for Channel 1

6.1.2.1 4mA

Navigate to [MENU > LOOP CURRENT > CHANNEL 1 > SPAN SETTING > 4mA](#) to set low value for channel 1. Unit depends on selected parameter (section 6.1.1).

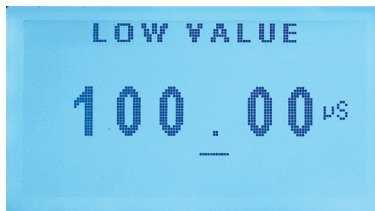


Fig. 28 - Span Setting - 4mA

6.1.2.1 4mA

Navigate to [MENU > LOOP CURRENT > CHANNEL 1 > SPAN SETTING > 20mA](#) to set high value for channel 1. Unit depends on selected parameter (section 6.1.1)



Fig. 29 - Span Setting - 20mA

6.2 CHANNEL 2

All options are same as in channel 1 settings (Section 6.1).

SECTION 7: RELAY SETTINGS

To access loop current settings navigate to [MENU > RELAY SETTINGS](#). As shown in fig. 30, in this menu, settings for relay 1 and relay 2 can be accessed.

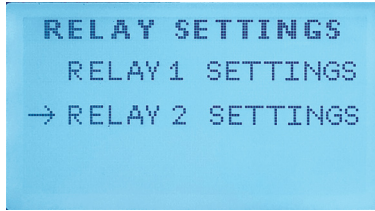


Fig. 30 - Relay Settings

7.1 RELAY 1 SETTINGS

Navigate to [MENU > RELAY SETTINGS > RELAY 1 SETTINGS](#) to access relay 1 settings.



Fig. 31 - Relay 1 Settings

7.1.1 RELAY 1 MANUAL MODE

Relay 1 can be manually set to on or off. Check [RELAY 1 HI](#) to turn relay 1 on or [RELAY 1 LO](#) to turn relay 1 manually off.

7.1.2 RELAY 1 AUTO MODE

Relay 1 can also operate on auto mode based on user-entered high and low set-point values. Relay will turn on when value falls below the low set-point value and will turn off when values rises above high set-point value. Navigate to [MENU > RELAY SETTINGS > RELAY 1 SETTINGS > HI SETPOINT](#), enter the desired value for high set-point and press *accept* button. To set low set-point value, navigate to [MENU > RELAY SETTINGS > RELAY 1 SETTINGS > LO SETPOINT](#), enter desired value and press *accept* button. High set-point and low set-point screens are shown in fig. 32 and fig. 33 below.



Fig. 32 - Relay 1 high set-point



Fig. 33 - Relay 2 high set-point

Once high and low setpoints are set. Navigate to [MENU > RELAY SETTINGS > RELAY 1 SETTINGS > AUTO MODE](#) and press **enter** button to activate auto mode. Fig. 34 shows checked auto mode screen.



Fig. 34 - Relay 1 auto mode

7.1.2 INVERT LOGIC

This option inverts the logic for auto mode operation of relay 1. Checking this option will turn the relay off when it falls below the low set-point and will turn on when value rises above high set-point. Navigate to [MENU > RELAY SETTINGS > RELAY 1 SETTINGS > INVERT LOGIC](#) and press **enter** button to invert the logic.

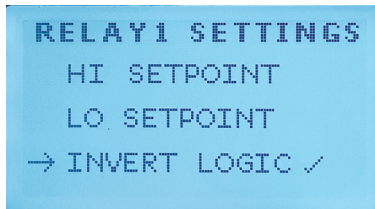


Fig. 35 - Relay 1 invert logic

7.2 RELAY 2 SETTINGS

All options are same as in relay 1 settings (Section 7.1).

SECTION 8: PASSWORD SETTING

ATS-CD1000 has a password protection feature for enhanced operation security.

8.1 SET/CHANGE PASSWORD

To set the password, navigate to **MENU > PASSWORD SETTING > CHANGE PASSWORD** and press *enter* button.

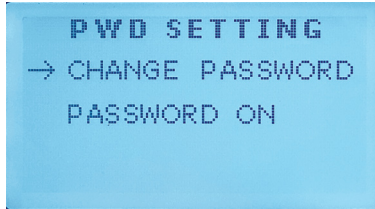


Fig. 36 - Password Settings

Password is 6 digit. Use *right* button to navigate between the digits and *up* and *down* button to change value of the active digit (underlined digit).



Fig. 37 - Enter Password Screen

Once the desired password is entered, press accept button to set the password. A screen showing "Saved" will appear for 3 seconds to show that the entered password is saved.

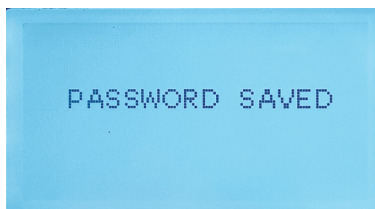


Fig. 38 - Password saved screen

8.2 TURN PASSWORD PROTECTION ON/OFF

To turn password protection on or off, navigate to [MENU > PASSWORD SETTING > PASSWORD ON](#). Press the enter button to check/uncheck [PASSWORD ON](#) option to turn on/off the password protection feature.

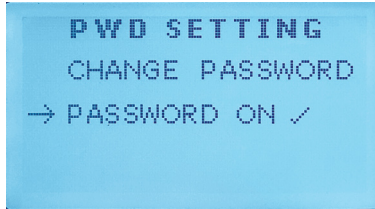


Fig. 39 - Password On/Off feature

12.1 GENERAL GUIDELINES

Controller requires little to no maintenance for its smooth operation. Routine maintenance will be recommended for its ideal operation. Calibration (see section 8.2) should be performed once every two weeks for accurate readings.

12.2 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.

12.2 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.

13.3 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. 40 - Field Mounting

SECTION 13: TECHNICAL DRAWINGS

13.1 CONTROLLER DIMENSIONS

ATS-CD1000 controller technical detailed dimensions can be seen below:

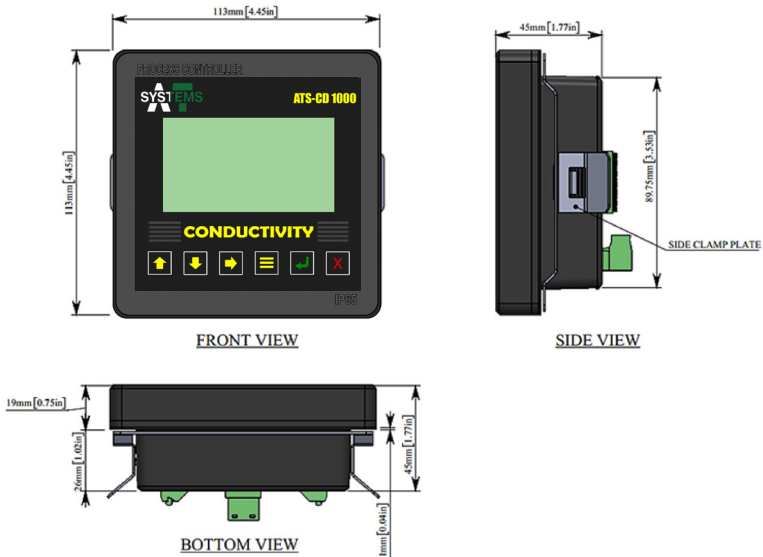


Fig. 41 - Controller Dimensions

13.2 EXPLODED VIEW

ATS-CD1000 controller exploded view can be seen below:

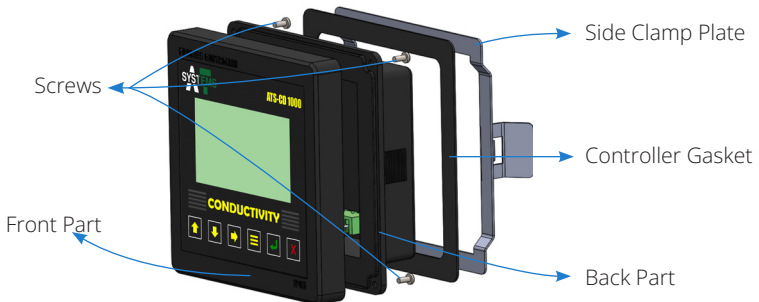


Fig. 42 - Controller Exploded View

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.

