



CR-200/300 Corrosion Sensor Operation Manual



November 18, 2017
Rev. 1.1

Pyxis Lab, Inc.
120 Jeffrey Ave.
Holliston, MA 01746 USA
www.pyxis-lab.com

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1. Introduction

The Pyxis CR-200/300 corrosion sensor measures the metal corrosion rate in an aqueous environment based on the principle of linear polarization resistance (LPR). A small polarization DC voltage is applied to two test metal electrodes and the resulting current is measured by the sensor. The polarization resistance value is calculated from the measured current and the applied polarization voltage. The metal corrosion rate in the unit of thousandths of inch per year (or mils per year, MPY) is then determined as:

Equation 1.
$$\text{MPY} = B/R_p,$$

where R_p is the polarization resistance (LPR) and B the proportional constant.

To calculate R_p originated from the electrochemical reaction at the metal water interface, the Pyxis CR-200/300 sensor subtracts the solution resistance R_s due to the test solution conductivity from the total resistance measured between the two test electrodes. The Pyxis CR-200/300 sensor accurately measures the test solution conductivity using the two test electrodes and the bipolar pulse technique, which has been successfully used in other Pyxis conductivity sensors and handheld meters.

A challenge of using the LPR method to measure corrosion rate below 0.01 MPY is to measure electric current in the range of pico and nano-amperes. The Pyxis CR-200/300 sensor adapts a range of techniques that are practiced in our fluorimeters where low pico ampere current is measured. These techniques include electromagnetic interference shielding, special analog circuit designs, and digital signal processing.

The proportional constant B has a theoretical value for a given metal type and size. The Pyxis CR-200/300 assumes B equal to 1.24 MPY·Ω for a 5 cm² mild steel electrode, which is a typical value that has been used in many LPR corrosion researches. This proportional constant may be also referred as to the alloy factor of the test metal and normalized to 1.0 for the steel electrode for convenience. It can be adjusted by the user to account for variations in a real application environment.

To determine the corrosion situation of real process equipment is not a simple matter. The corrosion rates for various metal surfaces contacting aqueous fluids in a process depends on many parameters, including the corrosivity pertaining to the chemistry of the aqueous fluid, physical parameters such as temperature and the velocity of the fluid, and the metallurgical composition of the process equipment itself. Because of this, the corrosion rate measured by the Pyxis CR-200/300 should not be used alone to predict or assess the real corrosion rate of the process equipment. Nevertheless, the science of using the LPR technique to quantify the corrosion rate has been well established. The corrosion rate measured by the Pyxis CR-200/300 sensor can be used to understand the corrosivity trend of the aqueous fluid over a period and its correlation to changes in the process parameters.

Measuring corrosion rate using a weight loss corrosion coupon is still widely practiced in many industry applications. LPR is an instantaneous method compared with the corrosion coupon method. It can indicate a change in corrosion rate in a time scale of a few minutes. In theory, a time averaged corrosion rate measured by the Pyxis LPR sensor should agree with that from the weight loss coupon method if both are practiced according to the common practices known in the industry. For monitoring mild steel corrosion

rate in an industrial cooling water system, one could also treat the LPR metal electrode itself as the weight loss corrosion coupon, and compare the corrosion rate calculated from the weight loss of the electrode to the averaged LPR corrosion rate in order to calibrate the LPR corrosion rate by adjusting the alloy factor.

The electrochemical noise measurement has long been used to quantify the localized corrosion or pitting corrosion rate. The Pyxis CR-200/300 sensor measures the short circuit electric current flowing through the electrodes between the two LPR measurements. The Pyxis sensor first applies a signal process algorithm to remove high frequency noise in the acquired electrochemical current data for a period of 3 minutes and then calculates the standard deviation of the processed data set. The standard deviation calculated is scaled to generate a localized corrosion index. In such a scaling, the index value for a 304-stainless steel electrode immersed in a 10% ferric chloride solution at 72°F is arbitrarily defined as 100. The real time electrochemical current noise data are graphically displayed in the Pyxis display panel, an optional item that can be purchased separately. With the graphic trend, the noise pattern and magnitude can be easily analyzed visually.

2. Specification

	CR-200	CR-300
Power Supply	3.6V ER26500 battery	24 V 2W
Output	Bluetooth 4.1 32 ft. (10 Meters) Line of Sight	Isolated RS-485 MODBUS and two 4-20 mA
Data Storage	6 months (30 minutes per measurement)	N/A
Dimensions	10.3 inch (260.5 mm) long, 0.9 in (23.0 mm) diameter lower portion, 1.7 in (43.0 mm) upper portion	11.1 inch (281.5 mm) long, 0.9 in (23.0 mm) diameter lower portion, 1.7 in (43.0 mm) upper portion
Weight	655 g with battery	687 g
Cable Length	N/A	5 ft. (1.5 m), extension cable available
Range, general corrosion	0.001 - 10 MPY	
Range, localized corrosion	0 – 100 (304 stainless steel in 10% ferric chloride as 100)	
Conductivity Compensation	10 - 10,000 μ S/cm	
Sample Temperature	-20 - 50°C	
Reading Interval	1 min, 2 min, 3 min (default), or 30 min	3 min, or 30 min, or 60 min (default)
Resolution	0.001 MPY	
Alloy Factor	0 – 3 (1 as default)	
Installation	Flow cell with 1-inch NPT	
Enclosure Material	304 stainless steel	
Working Pressure	Up to 100 psi (7 bar)	
Temperature	Working: -10 - 50 °C Storage: -20 - 70 °C	
Protection	IP65	
Regulation	CE	

*With Pyxis' continuous improvement policy, this specification is subject to change without notice.

3. Unpackaging the Instrument

Remove the instrument and find the standard accessories from the shipping container as listed below. Inspect each item for any damage that may have occurred during shipping. Verify that all accessory items are included. If any item is missing or damaged, please contact Pyxis Lab Customer Service at service@pyxis-lab.com.

3.1. Standard Accessories

3.1.1. CR-200 Package (P/N: 51006)

- The CR-200 sensor - 1
- 3.6V ER26500 battery - 1
- One pair of copper (P/N: 51003) and one pair of mild steel electrodes (P/N: 51002)
- One 2.0 MPY calibration check cap (P/N: 51010)
- One 0.1 MPY copper calibration check cap (P/N: 51011)
- One Bluetooth adapter for PC (P/N: MA-NEB)
- Instruction manual. The Instrument Manual is also available from <http://www.pyxis-lab.com/support.html>

3.1.2. CR-300 Package (P/N: 51007)

- The package should include one CR-300 sensor, a 5-foot extension cable terminated with connectors, a 2-foot cable with one end terminated with a connector
- A USB adapter (P/N: MA-485) for connecting uPyxis PC app to CR-300 and other Pyxis devices
- One pair of copper (P/N: 51003) and one pair of mild steel electrodes (P/N: 51002)
- One 2.0 MPY steel calibration check cap (P/N: 51010)
- One 0.1 MPY copper calibration check cap (P/N: 51011)
- Instruction manual. The Instrument Manual is also available from <http://www.pyxis-lab.com/support.html>

3.2. Optional Accessories, purchased separately

- Pyxis Display Panel **UC-300**, graphic charting, touch panel, and power supplier to Pyxis sensors and probes, P/N: 51008
- Bluetooth-to-4-20mA Adapter **BTA-100**, converting Bluetooth signal to 4-20 mA DC current signal, P/N: 50729
- **10, 20, 50, 100-foot** CR-300 extension cables (P/N: MA-10CR, MA-20CR, MA-50CR, and MA-100CR)

4. Installation

The CR-200/300 sensor is shipped without the electrodes installed. A pair of copper and mild steel electrodes are included in the package. Remove the O-rings in the electrode package and place an O-ring to each threaded rod on the sensor. Fasten the electrodes to the threaded rods to slightly compress the O-ring on the bottom of the threaded rod. Clean the electrodes with isopropanol to remove any oil or other foreign materials on the electrode surfaces.

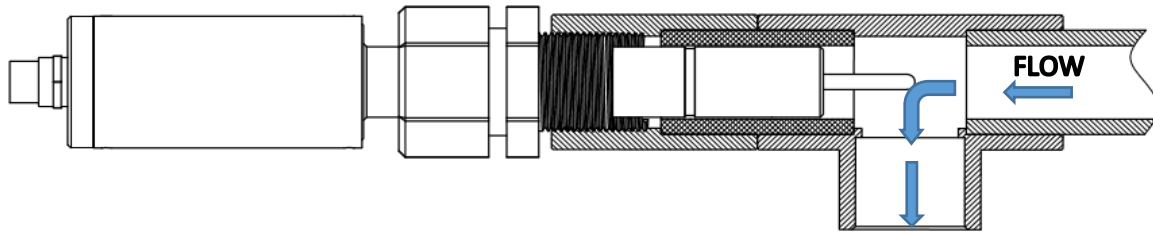


Figure 1. CR-200/300 installation to the sample flow

The sensor probe shall be inserted into a pipe via a 1-inch threaded tee. The corrosion rate measured by the CR-200/300 sensor may be affected by the position of the two-test metal electrodes in relation to the water flow. The electrodes should be fully immersed in the water sample and away from any turbulence. The sensor body has three O-ring grooves to allow the 1-inch male NPT thread to be locked at three positions on the probe with a compression nut. Thus, the depth of the probe insertion in the pipe can be adjusted. For the best performance, the two-test metal electrodes should be installed to be parallel to the flow and maintain a symmetry between the electrodes with respect to the flow environment as much as possible.

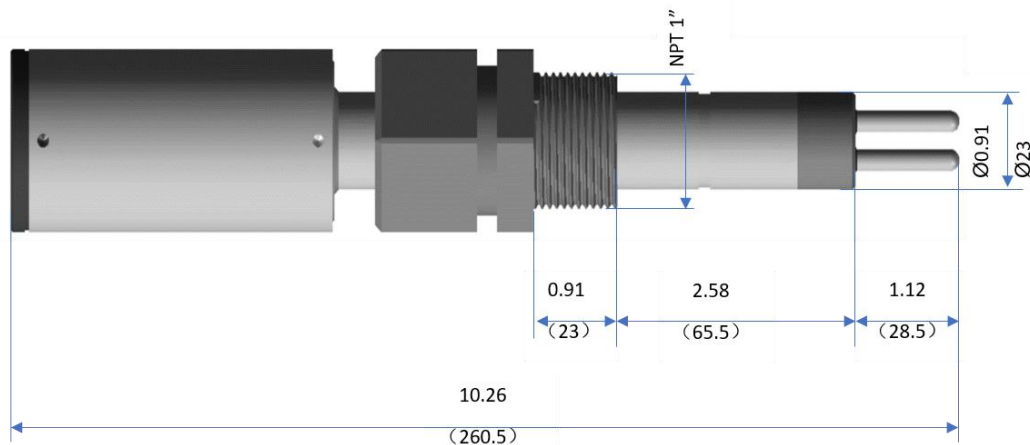


Figure 2. CR-200 dimensions in inch [mm]

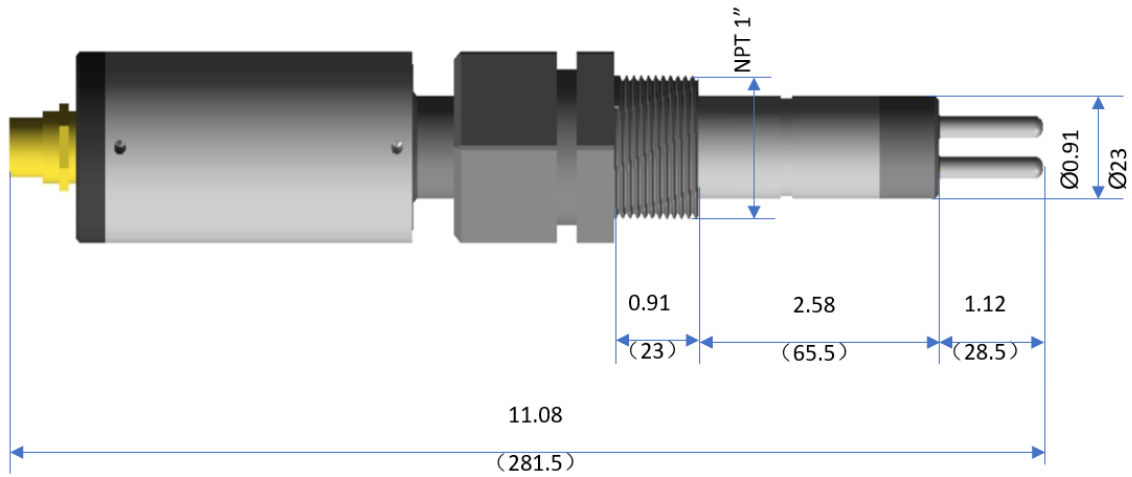


Figure 3. CR-300 dimensions in inch [mm]

5. Test Metal Electrodes

Pyxis provides 5-cm² (0.736 square inch) metal electrodes, commonly used in the LPR corrosion measurement applications. The common names, UNS codes, and alloy factors are listed the table below.

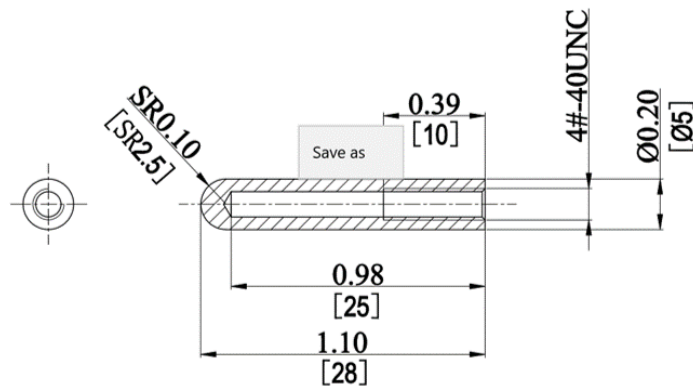


Figure 4. Test Metal Electrode Dimensions (inch [mm])

Common Designation	UNS	Alloy Factor
Aluminum AA1100	A91100	0.94
Aluminum Alloy AA6061	A96061	0.94
Copper CDA110	C11000	2.00
Arsenical Admiralty Brass CDA443	C44300	1.67
Mild Steel C1010	G10100	1.00
Stainless Steel 304	S30400	0.89

Metal electrodes with a different length and a slightly different diameter could be used with the CR-200/300 sensor as long as the electrodes fit into the 4-40 external thread. The alloy factor for a given metal alloy is proportional to the surface area of the electrode. If an electrode with a surface area different than 5 cm² (0.736 square inch) is used, please calculate the alloy factor according to the surface area and the alloy factor listed above.

6. CR-300 Quick 4-20mA Start

The CR-300 comes with 4-20mA transmitters embedded in the sensor body. It outputs two channels of 4-20mA signals that represent general corrosion rate and localized corrosion rate respectively.

Converting the 4-20 mA output from the CR-300 to a corrosion rate in the unit of MPY can be carried out by setting up one of three configurable parameters. The configurable parameters are the alloy factor, the sensor's 4-20 mA range, and the controller's 4-20 mA range. The first two reside in the CR-200/300 sensor itself and can be configured by using the uPyxis app (reference Section 8 for details). The third approach is in the controller's 4-20 mA range and must be configured according to the controller instruction/procedure. Pyxis provides two calibration check caps that can easily be used to verify the controller's 4-20 mA range for steel and copper corrosion measurements.

The user can set up just one of the three parameters to convert the sensor output to a meaningful MPY value. Optionally, the user can change one of three, two, or all three parameters to achieve the best result for a specific measurement situation, such as ultra-low corrosion rate measurement for copper.

6.1. Wiring

Follow the wiring table below to connect the CR-300 probe to a controller. The grey wire and the brown wire are the power ground and internally connected. The grey wire can be used for the 4-20 mA return. The green earth ground wire should be connected to the controller chassis ground if it is available.

Wire Color	Designation
Red	24 V +
Brown	Power ground
White	General corrosion rate, 4 - 20 mA +
Pink	Localized corrosion rate, 4 - 20 mA +
Grey	4 - 20 mA return
Blue	RS-485 A
Yellow	RS-485 B
Green	Earth Ground

Wiring instructions for common controllers are shown in figures 5-8.

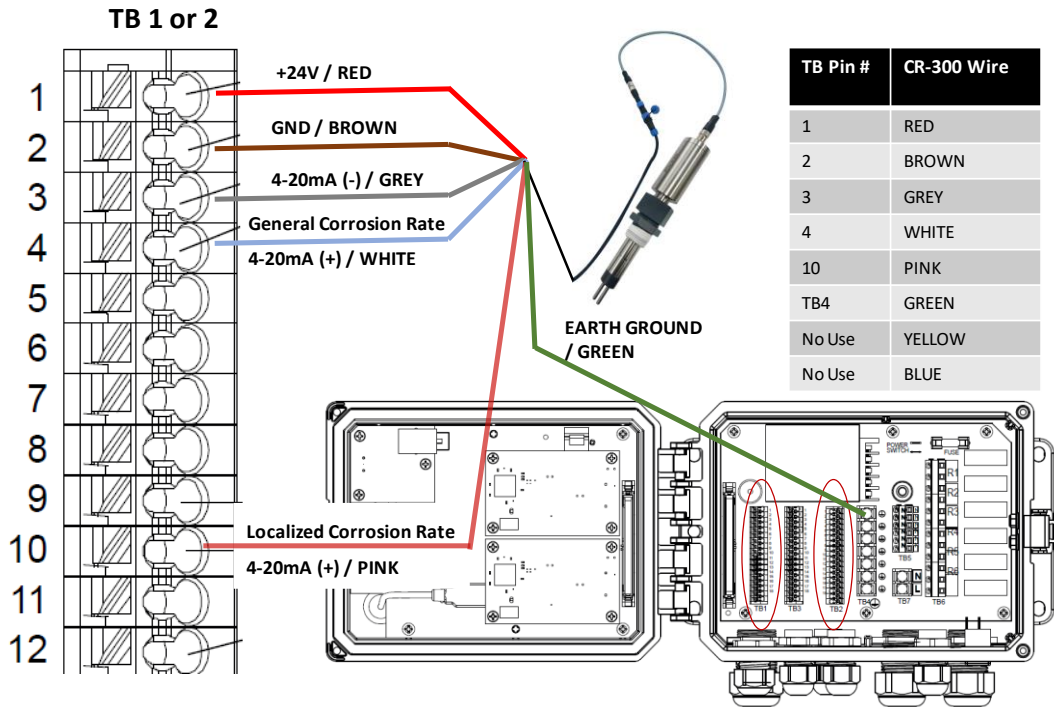


Figure 5. Typical Wiring Diagram for WalChem W600

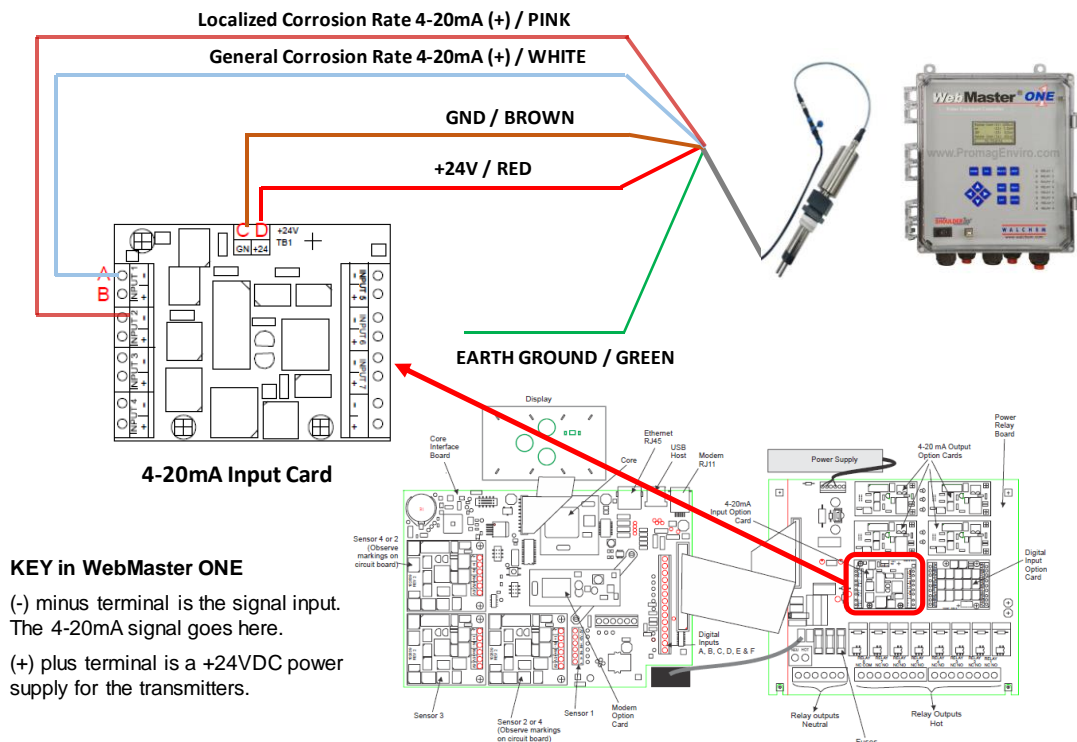


Figure 6. Typical Wiring Diagram for WalChem WebMaster One

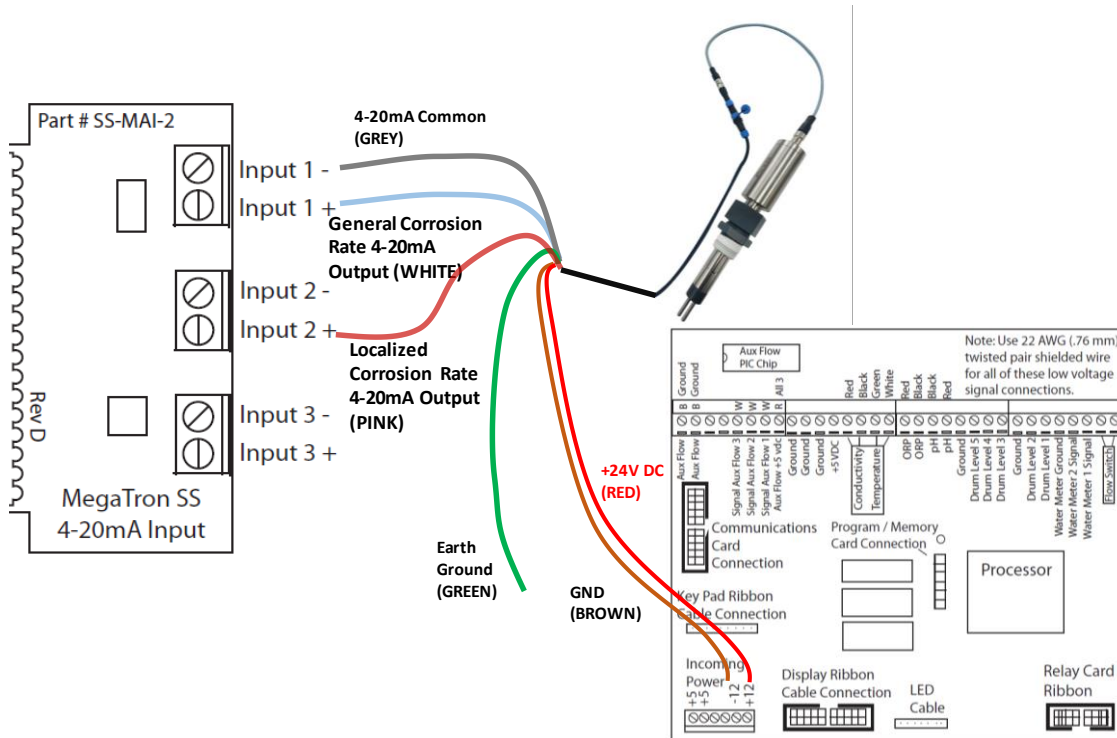


Figure 7. Typical Wiring Diagram for Advantage MegaTronSS

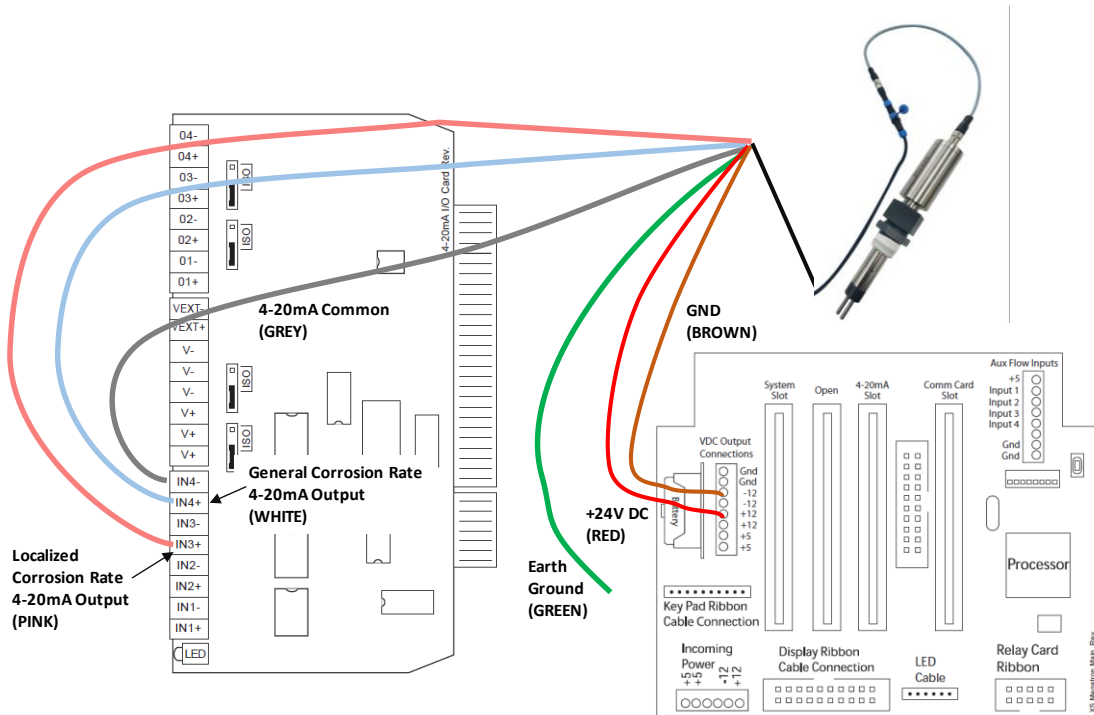


Figure 8. Typical Wiring Diagram for Advantage MegaTronXS

6.2. Default Settings for Steel Corrosion

The default 4-20 mA current outputs are scaled as:

- 4 mA = 0 MPY or 0 localized corrosion index
- 20 mA = 10 MPY (White)
- 20 mA = 120 (localized)

The sensor is configured to measure the corrosion of mild steel by default. For measuring the corrosion rate of steel, the user just needs to scale 20 mA = 10 MPY in the controller. Please use uPyxis apps to re-scale the 4-20 mA output or/and the alloy factor for other metals.

6.3. Convert 4-20 mA Output to MPY using the Calibration Check Caps

A 2.0 MPY steel and 0.1 MPY copper calibration check caps are included in the CR-300/200 package. Follow the steps below to configure the controller's 4-20 mA range:

- Install two new test electrodes
- Plug the sensor into the calibration check cap and wait for at least 15 minutes for the sensor to carry out three measurements (figure 9)
- Change the controller's analog input setup to have the corrosion rate value on the controller match with the value marked on the calibration cap

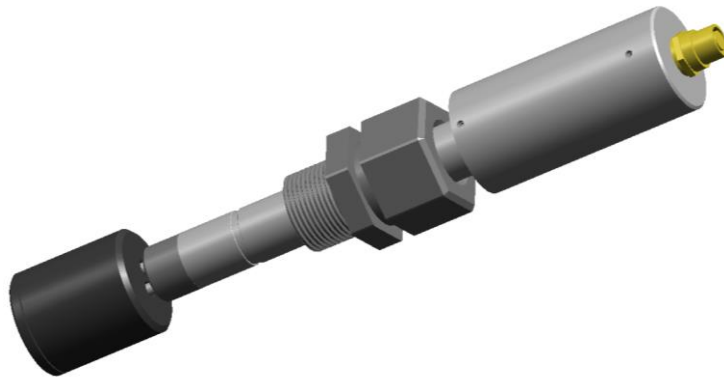


Figure 9. Plug the sensor into the calibration cap

7. CR-200 Bluetooth LPR Sensor

7.1. Battery Installation

The 3.6 V ER26500 type of battery should be used as illustrated. This 3.6 v lithium battery is available from Pyxis (Item P/N: 50730).



Figure 10. ER26500 Battery

WARNING

Please do NOT use type C alkaline batteries for CR-200. Although type C alkaline batteries are in the same dimensions as ER26500 lithium batteries, they are 1.5-volt nominal voltage batteries. CR-200 will NOT work with type C alkaline batteries.

Follow the following steps to install the ER26500 battery to the CR-200.

1. Loosen the two screws that fasten the battery cover plate.



Figure 11. Loosen the battery cover screws

2. Separate the cover plate from the CR-200 body as shown in figure 12. **DO NOT TWIST THE COVER PLATE!**



Figure 12. Pull open the battery cover plate slowly

3. Place a ER26500 battery to the CR-200. Make sure that the positive terminal of the battery is facing out as shown in figure 13.



Figure 13. Facing the positive terminal up

4. Place the battery cover plate back and fasten the two screws. Please make sure that the flat cable is being fully pushed inside the CR-200 battery compartment and avoid pinching the cable between the CR-200 body and the cover plate.



Figure 14. Place the battery cover plate back to CR-200

7.2. Turn on and off CR-200

Press ON/OFF button to turn on the sensor and Bluetooth (figure 15). The green indicator light on the left and blue indicator light on the right will be on for two seconds. After that, the green indicator light on the left will flash every 5 seconds continuously to indicate that the sensor is in the measurement mode. The CR-200 will make first measurement immediately. Since each measurement takes three minutes to complete, the first corrosion rate value will be available 3 minutes after being powered on. The time to the next measurement depends on the measurement interval setting in the CR-200. The default measurement interval is one measurement per hour. The measurement interval can be configured via uPyxis PC or phone app.

Press and hold ON/OFF button for 3 seconds to turn off the CR-200. The green indicator light on the left will stop flashing.



Figure 15. CR-200 Power ON/OFF and Bluetooth Mode Buttons

7.3. Connect CR-200 to uPyxis Phone App

The CR-200 sensor can be connected to the **uPyxis** phone or PC app for configuration and result charting. Download and install the uPyxis phone app from the Apple Store or the google Play Store.

The Bluetooth of the CR-200 can be operated in two modes. The default mode after the battery installation is the beacon mode. At this mode, the corrosion measured is broadcasted as an encrypted Bluetooth beacon. The Pyxis **uPyxis** phone or PC app reads and interprets the CR-200 beacon to obtain the corrosion rate.

Press and hold the mode button on the top of the sensor for 5 seconds to switch to the connectable peripheral (pairing) mode. In this mode, the **uPyxis** app can pair with the CR-200 sensor. After pairing, the **uPyxis** app can configure the sensor and display the corrosion rate result.

7.3.1. Read CR-200 by uPyxis Phone App

Press the power button to turn on the CR-200. The CR-200 will be in the default beacon mode. Turn on the phone's Bluetooth first and then launch the app. The app will automatically scan the Pyxis Bluetooth devices. Select the desired CR-200, identified by the series number (SN), from the list of the discovered devices to connect (figure 16). After connection, the app will display and chart the corrosion rate of the CR-200 (figure 17).

7.3.2. Configure CR-200 via uPyxis Phone App

Press and hold the Bluetooth mode button on the CR-200 for 20 seconds (or until the Bluetooth indicator light is on) to switch to the pairing mode. In this mode, the Bluetooth mode indicator light will be flashing. Turn on the phone's Bluetooth first and then launch the app. The app will automatically scan the Pyxis Bluetooth devices. Select the desired CR-200 from the list of the discovered devices to connect (figure 16). After connection, tap **Setting** tab to launch the setup page (figure 18).

When the configuration is complete, quit the uPyxis app to allow the CR-200 to automatically switch back to the beacon mode to save the battery power.

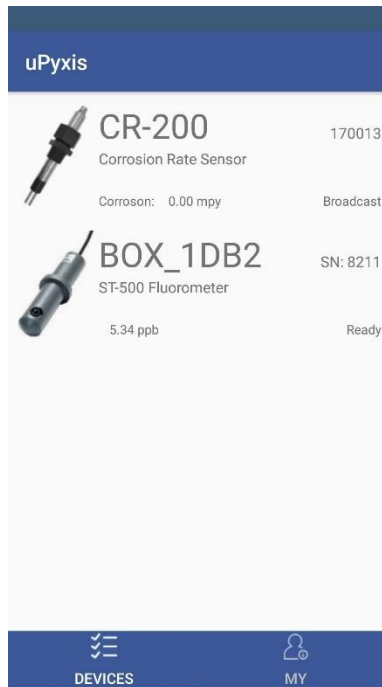


Figure 16. Discovered Pyxis Bluetooth Devices

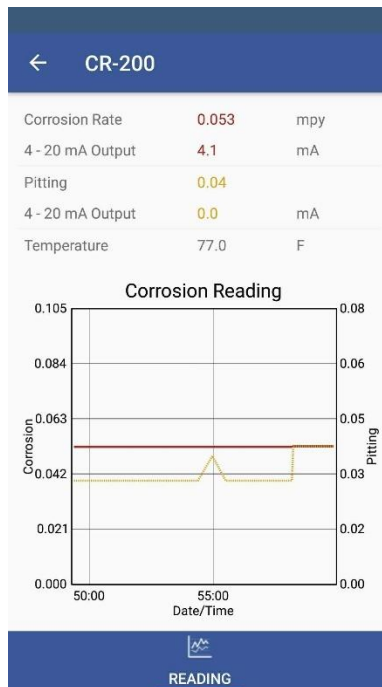


Figure 17. uPyxis showing the results of the connected CR-200

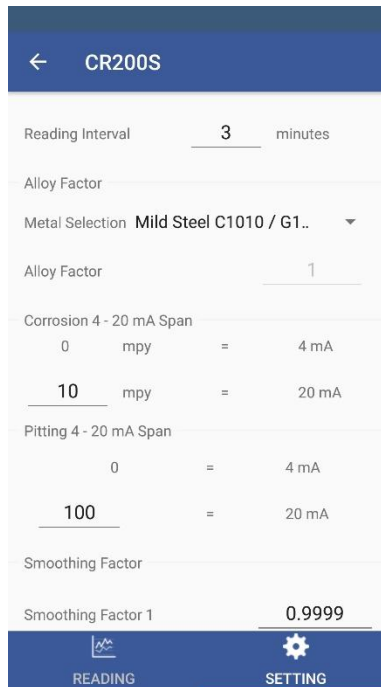


Figure 18. Configure CR-200 via uPyxis phone app

7.4. Output 4-20 mA via BTA-100 adapter

The corrosion rate can also be converted to a 4-20 mA output that can be wired to a controller's 4-20 mA input terminal via Pyxis BTA-100 as illustrated in figure 19 (P/N: 50729).



Figure 19. Bluetooth-to-4-20mA Transmitter BTA-100



The default 4-20 mA current outputs are scaled as:

- 4 mA = 0 MPY or 0 localized corrosion index
- 20 mA = 10 MPY (White)
- 20 mA = 120 (localized)

The sensor is configured to measure the corrosion of mild steel. For measuring the corrosion rate of steel, the user just need to scale 20 mA = 10 MPY in the controller to which the BTA-100 is connected. Please use uPyxis apps to re-scale the 4-20 mA output or/and the alloy factor for other metals. The 2.0 MPY steel and 0.1 MPY copper calibration check caps can be used to check if the controller's 4-20 mA scale is set up correctly.

Follow the steps to establish CR-200 to BTA-100 connection in the beacon-to-reader mode.

- Switch CR-200 to the beacon mode (the indicator light id off).
- Press the power button to turn on the BTA-100 adapter. Switch the BTA-100 to the observer mode (Bluetooth mode indicator "O" on the BTA-100 screen). The BTA-100 adapter will automatically discover all nearby Bluetooth devices and list the discovered Bluetooth derive MAC addresses on the screen.

Use the selection button  to scroll to the MAC address that belongs to the CR-200 sensor and press the enter button  to establish the reader-to-beacon relationship. The last four digits of the Bluetooth Mac address are laser marked on the CR-200 body.

8. CR-200/300 Advanced Configuration

The default configuration of the CR-200/300 sensors before shipping is to measure the corrosion rate of mild steel. The alloy factor was set to be the theoretical value of iron. The sensor can be configured for other metals with alloy factors and the 4-20 mA ranges different from the default using the Pyxis **uPyxis** Desktop in Windows.

8.1. Install uPyxis Desktop

Download the latest version of **uPyxis** Desktop software package from: <http://www.pyxis-lab.com/support.html#Software>. This setup package will download and install .Net Framework 4.5 (if not installed on the PC before), the USB driver for the USB-Bluetooth adapter, the USB-RS485 adapter, and the main uPyxis Desktop application.

Double click the **uPyxis.Setup.exe** file to install.

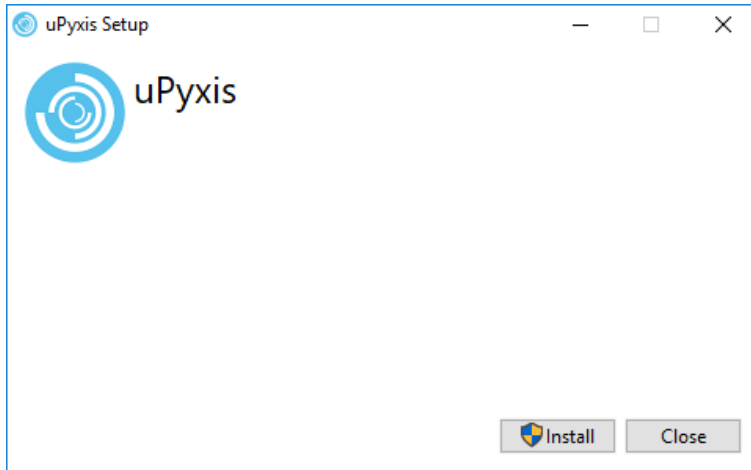






Figure 20. uPyxis Desktop installation screenshot

Click **Install** to start the installation process. Follow the screen instruction to complete the USB driver and uPyxis installation.

8.2. Connection to Apps

The CR-200 sensor has its built-in Bluetooth. It can be paired directly with the Pyxis **uPyxis** app. The CR-300 can be connected to the apps via Pyxis **WiFi/Bluetooth adapter** (P/N: MA-WB) through either Bluetooth or WiFi connection. In addition, the CR-300 can be connected to a PC with using the Pyxis **USB adapter** (P/N: MA-485). The connection options are listed below. Further instructions are given in the following sections (8.3.1 – 8.3.4).

Connection Option	Accessories		
	PC	CR-300	CR-200
PC to CR-300 via USB	USB Port	USB adapter, MA-485 	N/A
PC to CR-300 via WiFi	Built-in WiFi	WiFi/Bluetooth Adapter 	N/A
PC to CR-200/300 via Bluetooth	Bluetooth USB adapter 	WiFi/Bluetooth Adapter 	Built-in Bluetooth

Launch the **uPyxis** app and select the proper connection means to establish the connection to the sensors as shown in figure 21.

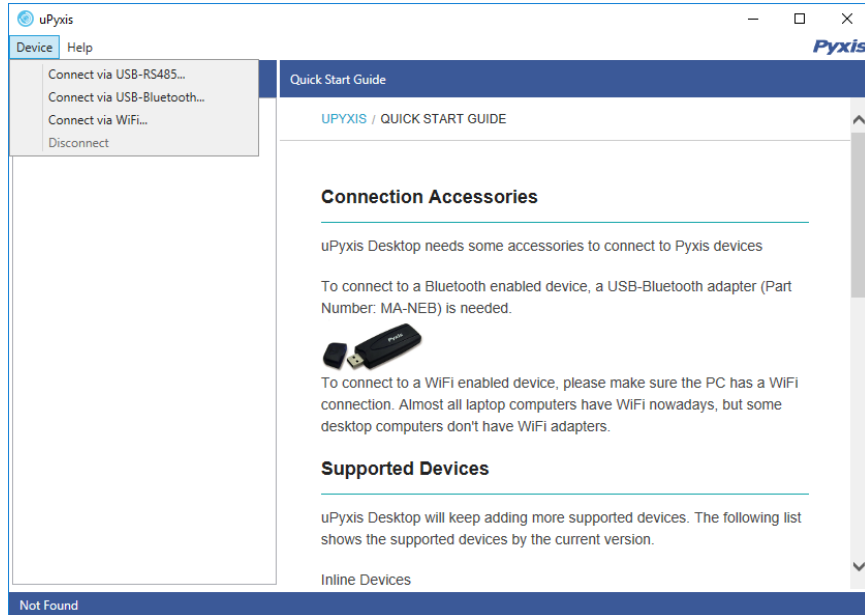


Figure 21. Connect uPyxis PC app to CR-200/300

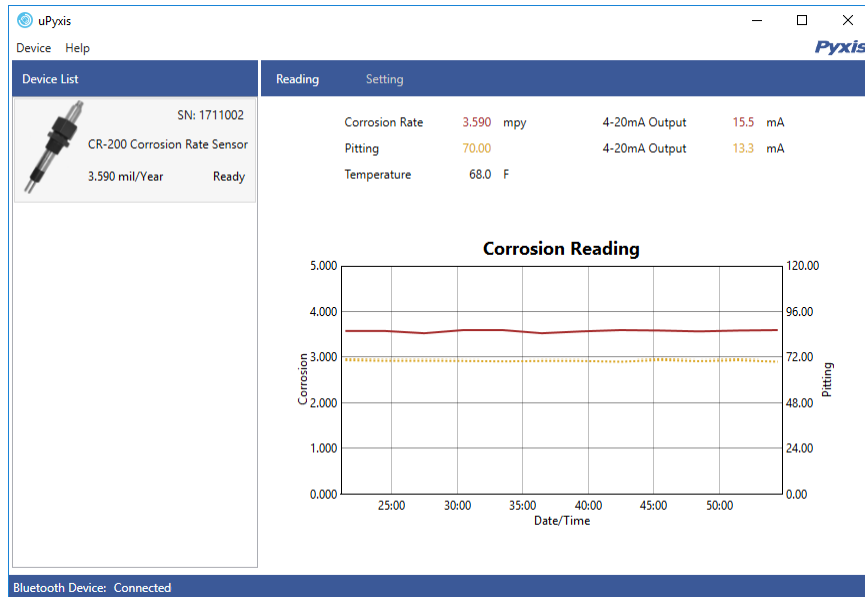



Figure 22. Select a connection Method

8.2.1. Connect CR-300 via USB

Hardware and accessories

PC	Built-in USB Port
CR-300	USB Adapter (MA-485)

Connect the CR-300 sensor to a Windows computer using a USB-485 adapter. Properly connect the USB adapter to the probe and the 24V power supplier (i.e. standard controller or UC-300 etc.) as shown in figure 23. Double click the uPyxis icon  to launch the program. The uPyxis application will detect the com port number and set up the communication parameters automatically. Click menu Device -> Connect via USB-RS485 as shown in Figure 14 to connect to the CR-300 sensor. If the connection is successful, the CR-300 sensor and its Serial Number will be displayed in the left pane of the uPyxis window. Measurement will be updated with probe measurement values at a frequency according to the CR-300 measurement frequency. The default is 5 minutes per measurement.

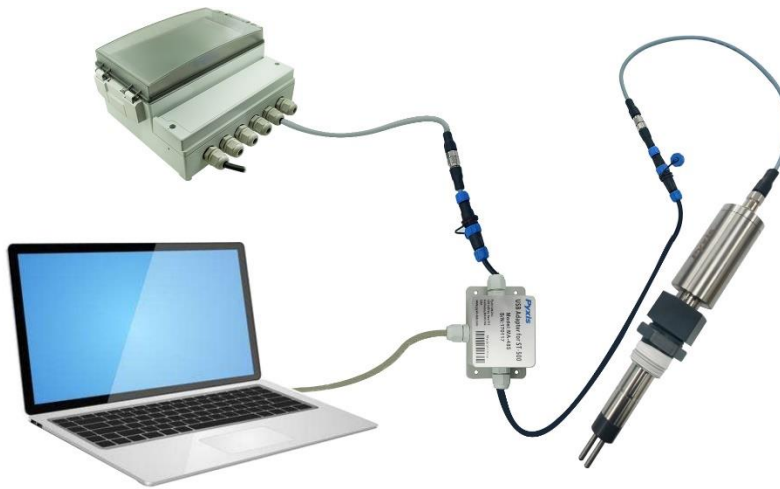


Figure 23. Connect CR-300 to a PC via Pyxis USB adapter


If the connection fails, please check the power supplier and make sure that the probe/adaptor/power supplier are connected according to Figure 23.

8.2.2. Connect CR-300 to PC via WiFi

Hardware and accessories

PC	Built-in WiFi
CR-300	WiFi/Bluetooth Adapter (MA-WB)

Connect the CR-300 sensor to a Windows computer using a MA-WB adapter according to following steps:

1. Connect the probe to the WiFi/Bluetooth adapter first and then connect the adapter to the controller or a 24VDC power supply according to Figure 24.
2. Double click the uPyxis.exe icon  to launch the program.
3. On uPyxis Desktop, click menu Device -> Connect via WiFi as shown in Figure 21.
4. Click the Refresh button to locate the hotspot and then click the Connect to Device button as shown by Figure 25.

Note: After the sensor and WiFi/Bluetooth is powered up, it may take up to 10 seconds for the adapter to establish the wireless signal for communication.

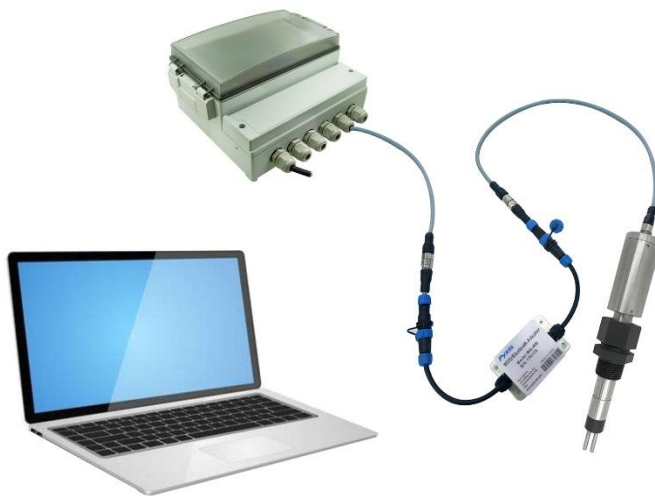


Figure 24. Connect to CR-300 via PC's built-in WiFi

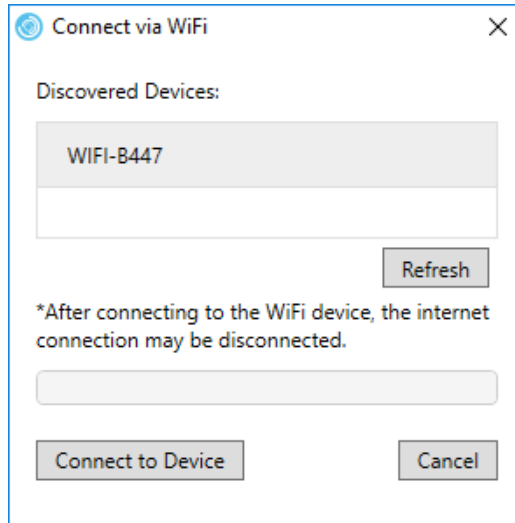


Figure 25. WiFi Adapter discovered

8.2.3. Connect CR-300 to PC via Bluetooth

Hardware and Accessories

PC	Bluetooth USB Adapter
CR-300	WiFi/Bluetooth Adapter

Connect the CR-300 sensor to a Windows computer using a MA-WB adapter via Bluetooth according to following steps:


1. Connect the probe to the WiFi/Bluetooth adapter first and then connect the adapter to the controller or a 24VDC power supply according to Figure 26.
2. Plug the Bluetooth USB Adapter to a PC USB port.
3. Double click the uPyxis.exe icon  to launch the program.
4. On uPyxis Desktop, click menu Device -> Connect via Bluetooth as shown in Figure 21.



Figure 26. Connect to CR-300 via the Bluetooth USB adapter plugged onto the PC and the Bluetooth/WiFi adapter inserted between CR-300 and a controller as the power source

8.2.4. Connect CR-200 to PC via Bluetooth

Hardware and Accessories

PC	Bluetooth USB Adapter
CR-200	None, built-in Bluetooth

Connect the CR-200 to a Windows computer using a MA-WB adapter via Bluetooth according to following steps:

1. Plug the Bluetooth USB adapter to a PC USB port.
2. Press On/Off button to turn on CR-200 and switch to the paring mode (indicator on).
3. Double click the uPyxis.exe icon to launch the program.
4. On uPyxis Desktop, click menu Device -> Connect via Bluetooth as shown in Figure 21.

8.3. Set up

8.3.1. Select Metallurgy and Set up Alloy Factor

Select metallurgy from the Metal selection dropdown. A default alloy factor will be filled in the Alloy Factor field. The default alloy factor is calculated according to equation 1 and listed in the table in Section 5. The user could adjust this factor to make the corrosion rate measured by the sensor best match the corrosion rate determined by other means such as metal coupon weight loss.

8.3.2. 4-20 mA Output Setup

The default setting for the corrosion rate 4-20 mA output is 20 mA = 10 MPY and 4 mA = 0 MPY. The default setting for the pitting index is 20 mA = 120 and 4 mA = 0. The user can change the 4-20 mA scale by filling the fields shown in figure 27.

It is recommended to set up the 4-20 mA current output to 20 mA = 1.0 MPY for the measurement of copper corrosion below 0.1 MPY.

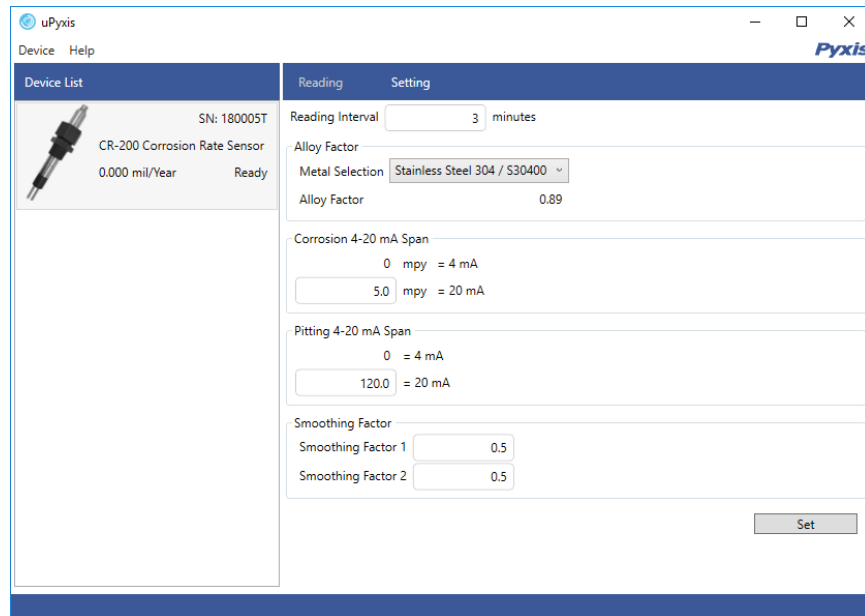


Figure 27. Select metal type, 4-20 mA output scale, and reading interval

8.3.3. Set up Reading Interval

The default reading interval is 5 minutes per measurement. This parameter can be set to 1, 2, 5, or 30 minutes per measurement (figure 27). Please note that the interval must be set to 5 or 30 minutes for the sensor to measurement the localized corrosion index.

9. Connection to Pyxis display Panel UC-300

The Pyxis UC-300 can provide 24 VDC power to two CR-300 sensors. The panel connects to the sensor by Modbus and reads the sensor data every 4 seconds. The trends of the corrosion rates and localized corrosion indexes (or pitting index) from the two connected sensors can be displayed and recorded (figure 28). The panel passes the four (4) 4-20mA current signals, two (2) from each sensor, to other controllers. An alarm on the general corrosion rate for each probe can be set up. The panel turns on a relay output if an alarm condition is met. Please reference the UC-300 manual for further information.

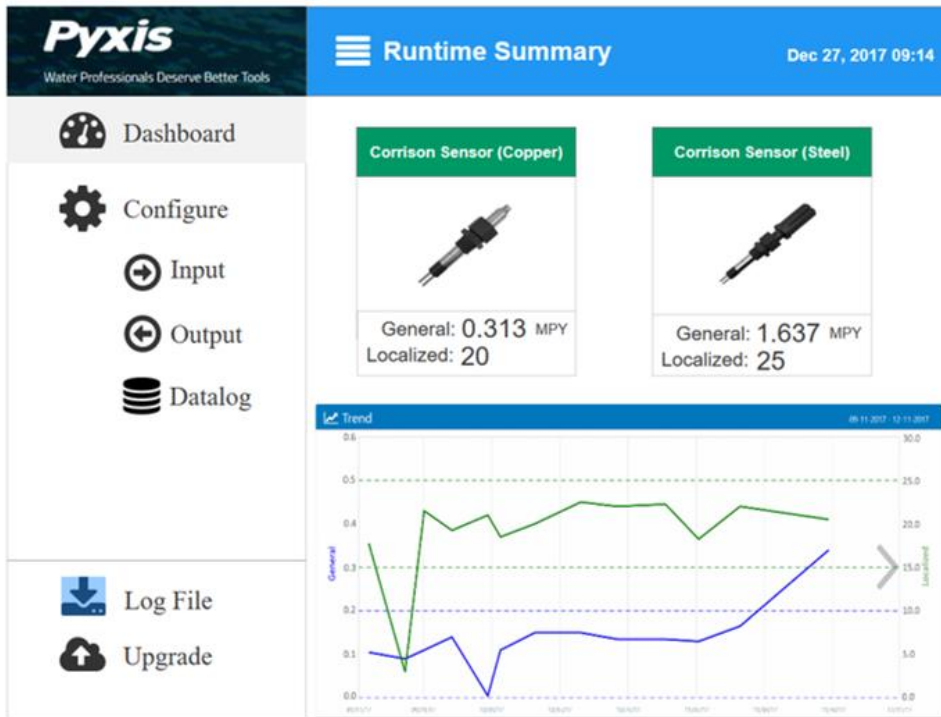


Figure 28. UC-300 dashboard showing measured corrosion rate and trend chart

10. Communicating using Modbus RTU

The CR-300 can be configured as a Modbus slave device. In addition to the general corrosion rate and localized corrosion index, many operational parameters, including warning and error messages, are available via a Modbus RTU connection.

Contact Pyxis Lab Customer Service (service@pyxis-lab.com) for more information.

11. Sensor Cleaning and Maintenance

For best performance, severely corroded sensor metal electrodes should be replaced. Any deposit on the sensor body and near the base area of the metal electrode should be cleared. Minor corrosion product deposit on the electrode surface is acceptable. Non-corrosion product deposit such as calcium carbonate scale should be removed. The sensor should not be left in stagnant water for a long period unless measuring corrosion rate of the metal in such condition is the purpose for evaluation.

12. REGULATORY APPROVAL

United States

The CR-200 sensor has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in an installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

Canada

This device complies with Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible

Contact Us

Pyxis Lab, Inc.

120 Jeffrey Ave
Holliston, MA 01746 USA

www.pyxis-lab.com

service@pyxis-lab.com