



O2X
Dissolved Oxygen
Sensor

Cerlic

O2X

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1. Introduction

The O2X sensor is designed to continuously measure dissolved oxygen levels in liquids. The O2X is effective in saving energy costs associated with aeration systems in an activated sludge process. In addition, accurate measuring of dissolved oxygen allows for better control of nitrification/denitrification.

2. A few words about this manual

This manual details installation procedures and operational features of the Cerlic O2X sensor. Menu navigation and technical data for the BB2 control box can be found in the BB2 service manual.

3. Design

The O2X sensor is manufactured with SS2343 (316SS) stainless steel. Built-in flushing nozzles allow for the most accurate readings with little maintenance. The electronics is protected in the rugged casing, ensuring its reliability in very demanding environments.

The sensor has a fixed, shielded 10 m (33') cable used for signal transmission between the sensor and the BB2 control box. The cable sheath is made of Hytrel and is highly resistant to aggressive materials and fluids.

4. Measuring principle

The electrode is a Clark type electrode with a membrane in FEP. The Clark cell detects the oxygen through its reduction at the Gold electrode. The sensor consists of a Gold cathode and Silver anode. A membrane covers the two electrodes and blocks access of most species to the electrodes. Only dissolved gases such as oxygen can traverse the membrane, hence the reduction current responds to the oxygen concentration.

Active components included in the electrode are treated to maximize their life span. Inside the electrode there is also a temperature sensor mounted in a way that minimizes problems with temperature adjustments. This provides excellent compensation of the electrode temperature instability. The electrode housing is made of PVC and is equipped with an O-ring sealing against the mounting. There is a connector on the electrode for the amplifier cable. The temperature can be read in BB2 and can be used as secondary signal when a sensor is configured to use both outputs in BB2. The temperature measurement is not high precision, but more to be seen as an indication.

5. Unpacking the sensor

The unit has been tested and approved before delivery from the supplier. Please check to confirm that no visible damages occurred during shipment.

Damages

If damages occurred during shipment, immediately contact UPS or other truck line as well as your Cerlic representative. The shipment can be returned only after contact has been made with Cerlic.

Packaging

The original packaging is designed to protect the equipment and should be used for storage or if the goods must be returned.

Content

Please check that the content corresponds to your order and packing list.

You will also need an electrode (below) to get the sensor working:

Optional parts for O2X Dissolved Oxygen sensor:	P/N
• Electrode cartridge.	11805160
• Stainless steel Mounting bracket X, including rod holder	11205539
• Telescopic rod, 4 m, including transmitter holder	20205501
• Adjustable slide rail	11205600
• Solenoid valve for flushing Incoming hose Ø16mm (5/8") , to sensor Ø 6mm (1/4")	11705516
• Aluminum mounting plate predrilled for BB2 or solenoid valves w/ u-bolts, outside US version	10605532
• Aluminum mounting plate predrilled for BB2 or solenoid valves w/ u-bolts, US version	31204054
• 10m (33 ft) extension cable with plug-in connectors.	20805510
• Y-Splitter for two sensors to one BB2 control box	21505534
• Connection box for two sensors to one BB2 control box with 1m. (3 ft) cable to connect to BB2	11505748
• Connection box for four sensors to one BB2 control box with 1m (3 ft.) cable to connect to BB2	11505785

6. Mounting the sensor

Cable Connections

Connect the sensor to the BB2 control box using the attached connector on the end of the sensor cable. In the event that two sensors are to be connected to the same BB2 control box, use the Y-splitter (P/N 21505534) or Connection box (P/N 11505748).

NOTE! Never try to turn the connector housing to fasten or remove the connector, only the fluted ring at the top of the connector shall be turned.

The O2X is mounted on a telescopic fibreglass rod and placed in a mounting bracket that fastens to a handrail, please refer to the Appendix 1 for further details. As an alternative way of mounting the sensor, an adjustable slide rail holder is available, please refer to the Appendix 2 for further details.

Note! For best measurement, the rod shall be mounted in an angle, 5 – 30 degrees from vertical.

Installation Tips

- Adjust the rod so that the sensor is at least 30 cm (12”) below the liquid surface or the lowest water level in decant applications (SBRs) to prevent the sensor from coming out of the liquid.
- In an aeration tank, ensure that the sensor is not directly above a diffuser head. To obtain the most representative dissolved oxygen level, the sensor should be installed on the backside of the rolling diffuser effect.
- In an aeration basin, flushing may not be required if the tank is well agitated. To verify the need for flushing, remove the sensor from the liquid after it has been in the liquid for several days. If the sensor is coated with solids, flushing with water or compressed air is recommended.

NOTE! The transmitter is delivered with the electrode uninstalled. A yellow plastic cap protects the electrode connection plug and the flushing nozzle in the transmitter. The plastic cap must be removed and the electrode must be installed and calibrated before the transmitter is submerged into water (refer to Section 7). Retain the yellow cap as it may be used as protection later. Do not press on the top of the cap if the electrode is installed.



7. Removing the sensor

The sensor housing may not be opened except by Cerlic service personnel. Opening the sensor housing will void all warranty.

The sensor is removed in the following steps:

- Disconnect the sensor cable from the BB2 and the flushing hose from solenoid.
- Open the clamp, and pull the rod out of the mounting bracket
- Make sure all water inside the rod is drained.
- Clean the sensor and rod with a brush or clean cloth. Do not use a wire brush!
- Open the black sensor adapter.
- Flush the inside of the rod with clean water.
- Mount the protective cap (or a small plastic bag) on the sensor cable connector.
- Pull the cable and flushing hose out of the rod.
- Blow compressed air through the flushing hose to get rid of the water in the hose and the sensor.

8. Changing or installing a new electrode

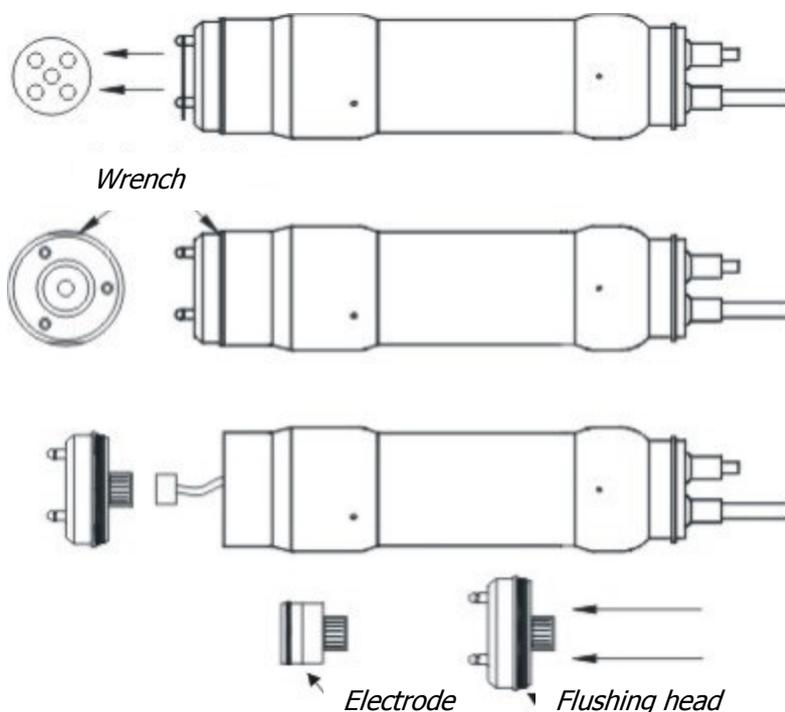
The electrode can usually be both assembled and disassembled without tools. Do not ever clamp onto the sensor housing or part of the cable when installing or removing the flushing head.

Removing an old electrode:

- Make sure automatic flushing is disabled.
- If using the protection plate, you must remove it before changing the electrode.
- Remove the flushing head by rotating it.
- **Make sure the electrode housing is dry.** Water may come in to the housing when the flushing head is removed.
- Unplug the electrode.
- Remove the electrode from the flushing head by pressing firmly on the backside of the electrode near the cable connector.
- Ensure that the O-ring that seals the flushing head is fixed in its proper position in the sensor body.
- Screw the flushing head back onto the sensor, do not screw it tight.
- If a new electrode is not to be mounted, the yellow plastic cap shall be mounted to protect the electrode connection plug and the flushing nozzle in the transmitter.

Installing a new electrode:

- Untighten the flushing head about one turn (if not already loose) to let the air out when the electrode is pushed in place.
- Plug the electrode cable into the connector on the electrode.
- Install the new electrode into the flushing head. **Don't touch the membrane of the electrode when mounting.**
- Tighten the flushing head and mount the protection plate, if needed. See below for instructions on mounting the protection plate.
- A new air-calibration must be performed whenever the electrode is changed.
- The date when the electrode is changed shall be entered in the calibration menu.



Mounting the protection plate

First remove the o-rings in the groove at the top of the three nozzles. Bend the plate slightly and press it down between the flushing nozzles. Ensure that the plate fits into the notches on the flushing nozzles. Correct the plate when it is mounted. Do not ever remove a flushing nozzle in order to mount the protection plate. The nozzles are fastened with a special locking jam.

9. Cleaning unit

The transmitter is equipped with built-in flushing nozzles. The nozzles are used to direct the cleaning medium, compressed air or water, via a flushing hose that is connected to the top of the transmitter. The air or liquid is controlled with a solenoid valve that is wired into the BB2 control box. Please refer to the technical description for allowed pressure.

Note! Pay attention to the requirements for protection against backflow, according to the EN 1717 standard for drinking water devices. If possible, use plant reuse water or effluent water for cleaning.

- Flush as little as possible, flushing wears the membrane of the electrode. Excessive flushing reduces the lifetime of the electrode.
- Try flushing shortly twice per day (720 minutes interval, 5 seconds length). If this doesn't keep the membrane clean, first reduce the interval, then increase the length.
- Never flush if the electrode is not installed.
- When the electrode is not installed, the yellow plastic cap should be kept on the end of the transmitter for protection.

Flushing must be activated in the “Settings” menu in the BB2 control box:



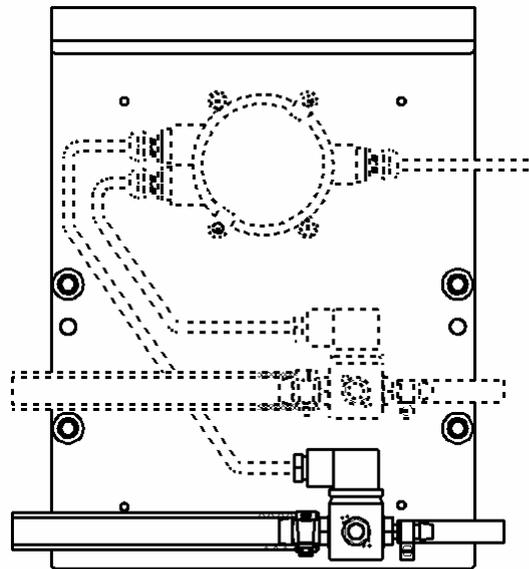
- Select the O2X transmitter in the Main Menu by using the  or  buttons,
- Press ENTER for five seconds to enter the Transmitter Menu.
- Use the arrows to select “Cleaning” and press ENTER.
- If the sensor is to be cleaned as master, i.e. it has its own relay, then set the “Cleaner” setting to “flush”, specify the cleaning interval in minutes, and the flush time in seconds. If the sensor is to be cleaned as a slave, along with another sensor, these parameters are set for the sensor being the master.
- If needed, specify the extra freeze time in seconds.
- If the sensor shall be cleaned as master, specify the relay to be used according to the wiring inside the control box. For example, if the solenoid is wired to relay #1, select “#1” for flushing. If the sensor is to be cleaned as a slave, specify “Along #1” or “Along #2” depending on what relay the master sensor uses.
- For sensors configured as masters, “Next time” displays the next time flush will be activated, pushing ENTER will set it to current time and those start cleaning.

Cleaning the Flushing Nozzle

If the flushing nozzle becomes plugged, removing the flushing head to backflush the nozzles with clean water can clean it. Before removing the flushing head, close the valve for the flush water source. Place a ½” hose over the flush nozzle and carefully open the water valve. The pressure should clear the line of solids. If backflushing does not work initially, try cleaning the three flushing nozzles with a needle. Try backflushing the nozzles again as described above until clean water comes out.

Mounting plate for solenoid valves

To provide an easy mounting of solenoid valves for the built-in flushing nozzles Cerlic offers a predrilled Aluminum handrail mounting plate. The Mounting plate is fixed to the rail using two u-bolts.



Mounting plate P/N 10305533 for one or two solenoids, outside US version P/N 11705516A (11705516 B US Version) and a connection box P/N 11505748.

10. Sensor display

By simultaneously pressing  and ENTER you alter between BB2 main menu and the sensor information display for the selected sensor. O2X has two information displays, the first one shows in addition to the measured value shows the current temperature of the electrode, the setvalue for air, and the “slope” of the electrode at the last air calibration. The second information display shows the date of the last calibration and the date the electrode was changed.

11. Menu for O2X Transmitter

Use **▲** or **▼** to select the sensor in the main display. The menu for the selected sensor is accessed by pressing ENTER for five seconds. If the selected sensor is not active (the text **No transmitter** is shown) a warning is displayed that asks you to make another choice in order to show the sensor menu.

Settings

Tag	Name of the sensor (10 characters) shown in the main display.
I-Time	Integration time or dampening - can be set up to 999 seconds.
Decimals	1 or 2 for display and menu.
Analog	"None", "Out1", "Out2", "Out3", "Out4", "Out1+2", or "Out3+4". Pick which analog output(s) to be used with sensor.
Second	"Temp" or "=Prim". If two are chosen above, the first will always give the primary value according to the sensors selected scale. The second will either give the temperature scaled as stated below, or the same signal as the first channel. The temperature is additional information, not a precision measurement.
Temp 0-	Temperature scaling, value that will give max output on second channel.

Calibrate

Airpres.mB	Specify within 10 mBar
Calibrate	"No", "Zero", or "Air". Select what calibration to do.
Temp (info)	Shows actual temperature in the electrode
Test (info)	Shows actual dissolved oxygen level
Setvalue	Theoretical reading in air at current temperature and with the air pressure entered above. Shall be the same as "test" immediately after the calibration
Slope	Slope of the electrode at last air calibration. This value is an indication of the wearing of the electrode and it is normally over 80 for a well functioning electrode. But there is nothing that eliminates the possibility of an electrode functioning well at lower values. However at values below 50 it is recommended to replace the electrode.
Calibrated	Date of last air calibration.
New eletcr.	Date when electrode was last changed. Push ENTER to edit the date, then ENTER again to store it.

Cleaning

Cleaner	Press ENTER to go to Cleaning program "None", "Flush", or "Brush". Do not select "Brush" since this does not exist for this sensor
Interval min	0-999 minutes, time between cleaning cycles
Length sec	0-999 seconds, duration of flushing cycle
Freeze sec	0-999 seconds, extra freeze time of output signal after a flushing cycle
Relay	"-", "#1", "#2", "Along #1", or "Along #2". Select relay to operate solenoid for flush cycle if this sensor is a master with its own

	relay, or relay used by master if this sensor is a slave. These are the same relays used for "Alarm relay" below
Next time	The next scheduled cleaning time. Pushing "Enter" on this line will set the time to current time and start a cleaning cycle. This could be used to test the "Flush" cycle.
Scale / Alarm	
Max	0-99.9 mg/l, measured value equal to 20 mA output signal.
Min	0-99.9 mg/l, measured value equal to 4 mA output signal.
Hi-Alarm	0-99.9 mg/l, the value zero inactivates the alarm
Low-Alarm	0-99.9 mg/l, the value zero inactivates the alarm
Alarm Relay	"-" "#1", "#2", or "#1 and #2". Check that the relay is not being used for cleaning
System	
Type	Type of sensor, (read only)
Serial	Serial number of the sensor, (read only)
SoftW	Software version of the sensor, (read only)
Temp	Sensor temperature, (read only)
MaxTemp	The highest temperature the sensor has been exposed to, (read only)
Info	Press "ENTER" to go to "info" (read only)
MS0	SA value for zero sample
MS1	SA value for air sample
Cons 1	Calculated concentration at last air calibration
Ch1	Raw value for dissolved oxygen measurement
Ch2	Raw value for channel temperature measurement
Con	mg/l, This is what is displayed on main screen
Samp/s	Number of samples per second
Service	Not accessible for users.

12. Calibration

It is important that the instrument has been turned on for about 30 minutes prior to calibration so that the sensor and electronics can stabilize.

Zero Calibration

The sensor is zero calibrated at the factory, and does not often need to be zero calibrated. We do however recommend to do a new zero calibration when replacing the electrode since half the job is then already done. Remove the electrode before performing a zero calibration. Refer to “Section 8 – Changing or installing a New Electrode”.

Zero calibrating a sensor:

- Select the O2X transmitter in the Main Menu by using the  or  buttons.
- Press ENTER for approximately five seconds to enter the Transmitter Menu.
- Use the arrows to select the “Calibration” sub menu, and press ENTER.
- Select “Calibrate”. Press ENTER.
- Use the arrows to select “Zero” (three choices can be done, Air/No/Zero). Press ENTER.
- Wait for the zero calibration to finish (usually takes about ten seconds). A dialog box saying "Calibration done" will come up after successful calibration, Press Enter to return to the previous menu.

Install the electrode before performing an air calibration. Refer to “Section 8 – Changing or installing a New Electrode”. Continue with “*Air calibrating a sensor*”

Air calibrating a sensor

The most important thing to keep in mind while performing an air calibration is to create a constant environment. The electrode cartridge must be dry with no water drops on the membrane. Fill a bucket halfway with water. Place the sensor ~1-1.5 ft above the water surface to create a humid environment and cover the bucket with a towel. If rain and/or strong winds are present, the calibration procedure could be disturbed. In this case shield the equipment so that it is protected from the rain or wind. An open plastic bag over the transmitter may slow the calibration time down, but is otherwise a good way to help constant conditions.

- Select the O2X transmitter in the Main Menu by using the  or  buttons.
- Press ENTER for approximately five seconds to enter the Transmitter Menu.
- Select the “Calibration” press ENTER.
- Enter the current air pressure in mBar. It is sufficient to specify the pressure within 10 mBar (see table below for conversion from inHg to mBar).
- Select “Calibrate”. Press ENTER.
- Use the arrows to select “Air” (three choices can be made, Air/No/Zero). Press ENTER.

- Wait for the transmitter to be calibrated. A successful calibration will take anywhere between 5 and 15 minutes for the sensor to stabilize. A dialog box saying "Calibration done" will come up after successful calibration, Press Enter to return to the calibration menu.

The following appear in the Calibration menu as read-only:

- Temp (info): Displays the current temperature of the sensor.
- Test (info): Displays the current measured dissolved oxygen value. Immediately after calibration and before the sensor is placed in the liquid, this value should closely resemble the setvalue. A reading outside of an acceptable range may indicate that the electrode needs to be replaced.
- Set value: Ideal value calculated using temperature and air pressure.

Air pressure conversion

It is important to enter the correct air pressure before doing an air calibration. Air pressure is measured in mBar (which is exactly the same as the SI-unit hPa).

Below is a formula and a table to convert from inHG to mBar (and thus to hPa).

InHg	mBar / hPa
29.2	990
29.3	993
29.4	997
29.5	1000
29.6	1003
29.7	1007
29.8	1010
29.9	1014
30.0	1017
30.1	1020
30.2	1024
30.3	1027
30.4	1030

$$mBar = \frac{inHg * 1000}{29.5}$$

13. Scaling

The “Scale / Alarm” menu allows the user to set the high and low boundaries for a 4-20mA output signal. In addition, this menu allows the user to set high and low alarms values that can be used to notify when the level has reached critical points.

Max sets the 20 mA point output

Min sets the 4 mA point output (may be a negative value for special applications)

Hi-Alarm sets the High Alarm set point, the value zero inactivates the alarm

Low-Alarm sets the Low Alarm set point, the value zero inactivates the alarm

14. Technical description

O2X	P/N 11305473
Material	SIS2343 (316SS)
Dimensions	See section 13.
Weight	2,1 kg. (4.6 lbs)
Process connection	Submerged
Max Depth	10 m (33 ft.)
Max temperature	60°C (140°F)
Measuring principle	Clark cell
Cable, connection	5-pin M12-plug
Cable, length	10 m (33 ft.)
Cable, material	Hytrel
Flushing, Pressure	water 4-6 bar (60-90 psi) filtered air 2 bar (30 psi)
Flushing hose, length	10 m (33 ft.)
Flushing hose, material	PE-LD
Enclosure	IP68 (NEMA 4X)

Certificate of conformity:

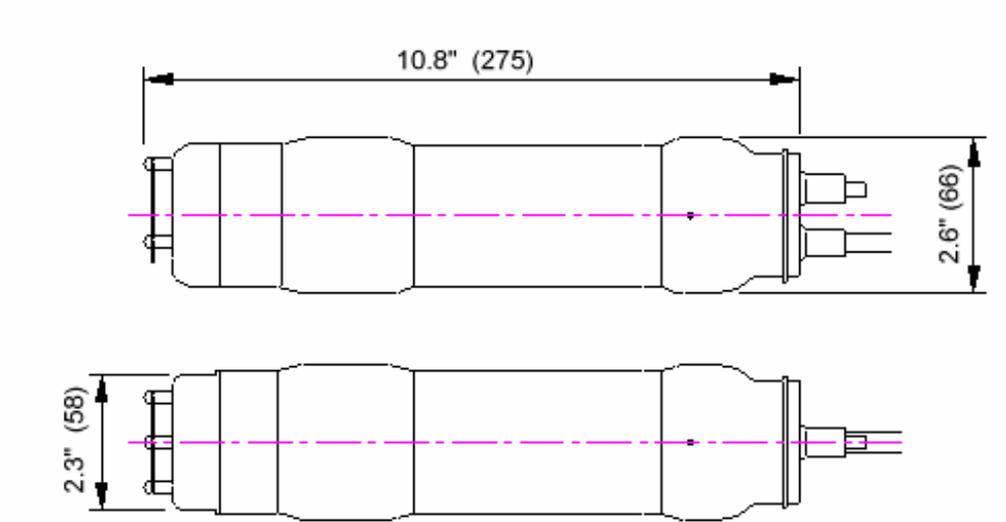
The O2X sensors along with their central unit BB2 are in conformance with the following EC Directive(s) when installed in accordance with the installation instructions contained in the product documentation:

73/23/EEC	Low Voltage Directive as amended by 93/68/EEC
89/336/EEC	EMC Directive as amended by 92/31/EEC and 93/68/EEC

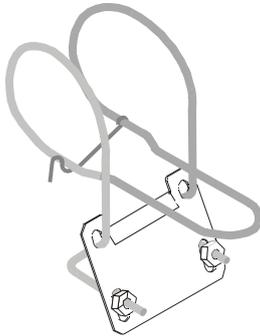
The following standards and/or technical specifications have been applied:

EN 61000-6-4:2001	Electromagnetic compatibility (EMC) Part 6-4 Generic standards – Emission standard for industrial environments
EN 61000-6-2:2001	Electromagnetic compatibility (EMC) Part 6-2 Generic standards - Immunity for industrial environments
EN 61010-1:2001	Safety requirements for electrical equipment for measurement, control, and laboratory use

15. Dimensions

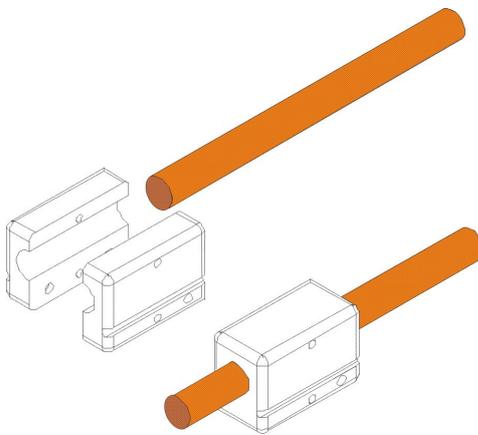
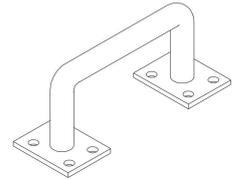


Appendix 1, Assembly of handrail mounting kit



Mount the Flexible Mounting Bracket on existing handrail or on separate holder, diameter 1 1/4" – 2" (32-50 mm) or square 1 1/8" – 1 5/8" (28-42 mm). The bent lip on the mounting plate shall be on top and faced toward the liquid or tank. Adjust the Mounting Bracket to the correct angle and tighten the nuts. The bracket shall be fixed to the rail, and must not be able to rotate around it.

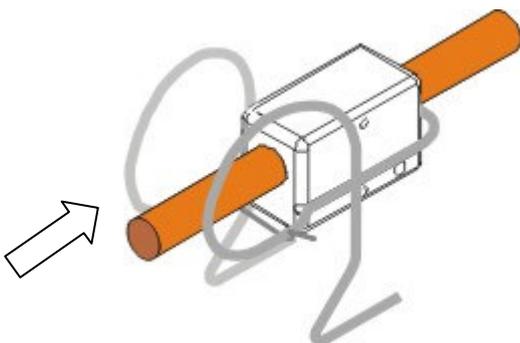
Example of a holder to be used for the mounting bracket when no handrail is available.



- Disassemble the bracket guide and place around the telescopic rod.
- Use the SS screws on bracket to tighten the bracket to the rod.

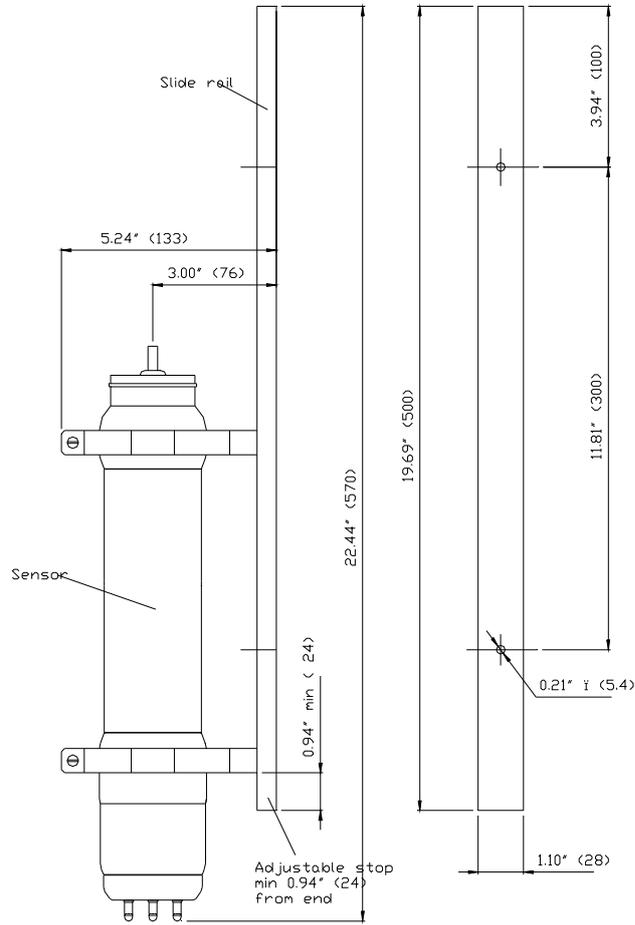


- Pull the cable and hose through the sensor holder and rod.
- Connect the telescoping fiberglass rod to the sensor with the two piece black PVC adapter.
- The adapter halves should be tightened until snug, which will leave about 1-2 mm (1/16") gap. **NOTE!** The gap is required so the water can drain from the rod.
- Adjust the length of the telescopic sensor rod as necessary by twisting the nuts while holding the rod. **NOTE!** Do not extend the rod sections beyond the black lines. This could lead to rod damage.



- Insert the PVC bracket guide with the telescopic rod into the mounting bracket. Make sure that the bracket guide tracks are properly seated in the bracket.
- Fasten the safety-locking clamp.
- Check that the bracket is safely fixed to the rail for the spring to work the way it is intended.

Appendix 2, Assembly of adjustable slide rail



Appendix 3, Support information

Before calling Cerlic support, please collect the information in this form and have it at hand.

Company _____

Name _____

Phone _____

E-mail _____

Sensor Type _____

Position / Tag

First go to the BB2 menu, it is accessed by pressing  and ENTER at the same time for five seconds. Select “System” and press ENTER.

Version _____

Serial _____

Box temp _____

Box heat _____

Leave the BB2 menu by pressing  and ENTER at the same time. Use  or  to select the sensor in the main display. Go to the sensor menu, it is accessed by pressing ENTER for five seconds. Select “System” and press ENTER.

Type _____

Serial _____

SoftW _____

Temp _____

Select “Info”, then press “ENTER” to go to the “info” menu.

MS0 _____

MS1 _____

Cons 1 _____

Ch1 _____

Ch2 _____

Con _____

Samp/s _____

Leave the BB2 menu by pressing  and ENTER at the same time.

Appendix 4, Setup information

This sheet can be used to document the setup of a sensor.

Sensor Type _____

Position / Tag _____

In the System sub menu of the sensor menu the following information can be collected.

Serial _____

SoftW _____

In the Settings sub menu of the sensor menu the following parameters can be set.

I-time _____

No of decimals _____

Analog _____

Second _____

In the Cleaning sub menu of the sensor menu the following parameters can be set.

Cleaner _____

Cleaning interval _____

Cleaning length _____

Cleaning freeze _____

Cleaning relay _____

In the Scale / Alarm sub menu of the sensor menu the following parameters can be set.

Max _____

Min _____

High-Alarm _____

Low-Alarm _____

Alarm Relay _____

Leave the BB2 menu by pressing  and ENTER at the same time.