WALCHEM

IWAKI America Inc.

Disinfection Sensors

Non-Membrane Disinfection Sensors Instruction Manual

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Notice

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Proprietary Material

Statement of Limited Warranty

WALCHEM warrants equipment of its manufacture, and bearing its identification to be free from defects in workmanship and material for a period of 24 months for electronics and 12 months for mechanical parts and electrodes from date of delivery from the factory or authorized distributor under normal use and service and otherwise when such equipment is used in accordance with instructions furnished by WALCHEM and for the purposes disclosed in writing at the time of purchase, if any. WALCHEM's liability under this warranty shall be limited to replacement or repair, F.O.B. Holliston, MA U.S.A. of any defective equipment or part which, having been returned to WALCHEM, transportation charges prepaid, has been inspected and determined by WALCHEM to be defective. Replacement elastomeric parts and glass components are expendable and are not covered by any warranty.

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March 2018

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1.0 Introduction

The Walchem non-membrane chlorine and chlorine dioxide sensors consist of an amperometric sensor assembly, cable and a flow cell. Assembly of these parts is required, so please read these instructions carefully. The sensor is capable of measuring the disinfectant in drinking water or drinking water quality water.

Sensor

The sensor assembly includes the sensor body, a 50-ml bottle of electrolyte fill solution, and special abrasive emery paper. Make sure that all parts are included.

The sensors are open (not-membrane covered) amperometric 3-electrode types. The measuring and counter electrode are in direct contact with the measuring water. The reference electrode is separated from the measuring water by a housing which contains an electrolyte. Together with the electrolyte, an electrical signal is generated at the measuring electrode which is proportional to the concentration of the disinfectant, and amplified by the electronics of the sensor. The measuring signal is temperature compensated.

Flow Cell

The flow cell consists of a translucent flow cell body, mounting nut and o-ring, washer set and o-ring. Make sure that all parts are included.

The flow cell is required. The sensor will not read accurately if it is not installed in the flow cell, with a steady flow rate between 20 and 100 liters per hour, at an operating pressure of 8 atmospheres or less.

2.0 Installation

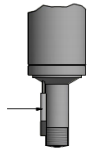
Assembling the Sensor

CAUTION: Wear gloves and safety glasses during assembly of the sensor since the electrolyte is a diluted acid. It is recommended to perform this operation over a sink with running water available. Please heed the warnings on the electrolyte bottle. Do not swallow the electrolyte. Avoid contact of the electrolyte with skin and eyes. Otherwise wash with a lot of water. In case of eye inflammation, contact a doctor.

After using, re-cap any remaining electrolyte and store the bottle upside-down until the next use.

Never shake the electrolyte bottle, as this will introduce air bubbles that will negatively impact performance!

Do not touch or otherwise contaminate the electrodes!

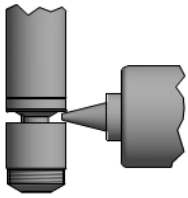


For PEEK sensors, never remove the reservoir cartridge attached to the reference electrode!

Sensors without optional cleaning attachment

1. Holding the sensor at the housing as shown, unscrew the dark grey protective cap. The cap contains liquid. Save the protective cap in case the electrode will need to be stored for more than a month of downtime.

2. Unscrew the housing until there is a gap, then fill it to the top with the electrolyte until it overflows. **Never shake the electrolyte bottle, it must stay free of bubbles!**



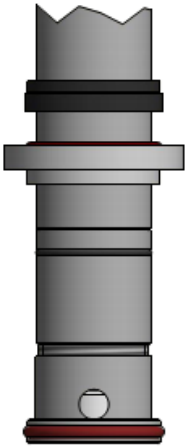
3. SLOWLY screw on the housing until it is hand tight. **Be prepared for some electrolyte solution to squeeze out.**

4. Rinse your hands, the sensor, and all surfaces contaminated with electrolyte solution with running water. Check the sensor for leaks.

5. Push the cable onto the end of the sensor, aligning the pins with the holes. Turn the connector until hand tight to seal the cable connection.

Sensors with optional cleaning attachment

The cleaning attachment consists of a cleaning chamber and two bags of glass balls. **When using the cleaning attachment, the minimum sample flow rate is 45 l/hour!** The cleaning attachment is only effective in removing thin deposits.



1. Complete the steps above for sensors without cleaning attachment.

2. Remove the o-ring holder from the acrylic flow cell and slide it up onto the sensor to sit below the o-ring.

3. Place three of the glass balls into the cleaning chamber and screw it onto the electrolyte housing.

Flow Cell Placement

Instructions for mounting the sensor into the process can vary greatly with the circumstances that are encountered in your application. Here are some general guidelines to assist you. Refer also to the typical installation drawings.

The flow cell should be placed on the discharge side of a circulation pump or downhill from a gravity feed. Flow into the cell must come from the bottom side that has the 8 mm OD tubing x ¼" straight thread fitting installed.

The outlet of the flow cell must be plumbed to open atmosphere unless the system pressure is at or below 8 atmospheres. If the flow through the line cannot be stopped to allow for cleaning and calibration of the sensor, then it should be placed in a by-pass line with isolation valves to allow for sensor removal. Install the sensor vertically, with the measuring surface pointing down, at least 5 degrees above horizontal. (Refer to Installation drawing)

Flow rate regulation must be done upstream from the sensor, because any flow restriction downstream can increase the pressure above the rated value. The acrylic flow cell has a flow regulator knob on the lower left hand side.

The sensor should be installed in an area where there is good solution movement and where it will respond rapidly to chemical additions. The placement of the sensor relative to the placement of chemical replenishment, along with the quality of the mixing, and the replenishment chemical flow rate are critical to accurate process control.

To avoid biological growth on the electrodes, which can block measurement, never leave the sensor in water without oxidant for longer than 24 hours, unless using the optional cleaning attachment.

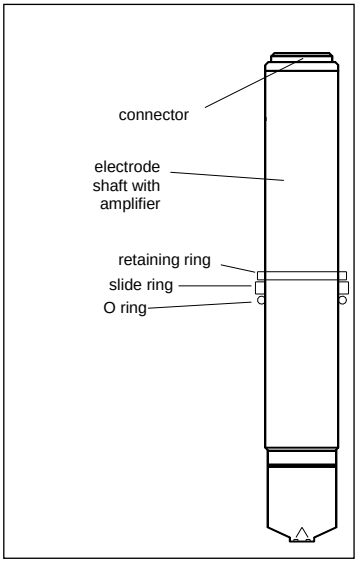
Installing Sensor into Flow Cell

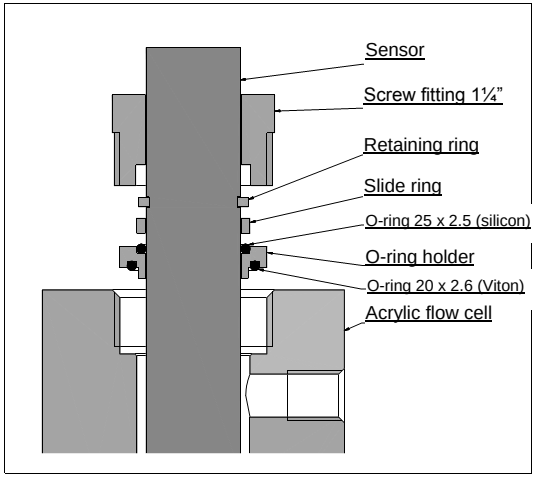
1. For sensors without the cleaning attachment, unscrew the 1 ¼" fitting from the acrylic flow cell. Insert the sensor as shown below.
   Push the 1 ¼" fitting over the sensor and fasten it tightly. Make sure that the sensor is tightly fastened in place, otherwise it may be pushed out of the flow cell when it is under pressure, or leaks can occur.
2. For sensors with the cleaning attachment, unscrew the 1 ¼" fitting from the acrylic flow cell. Insert the sensor with mounted cleaning attachment and o-ring holder into the flow cell by turning it CLOCKWISE until the o-ring holder is snug (turning CCW can loosen the electrolyte housing

and/or cleaning attachment). Make sure that the large black o-ring is located between the o-ring holder and the flow cell, as shown below. Push the 1 ¼" fitting over the sensor and fasten it tightly. Make sure that the sensor is tightly fastened in place, otherwise it may be pushed out of the flow cell when it is under pressure, or leaks can occur.

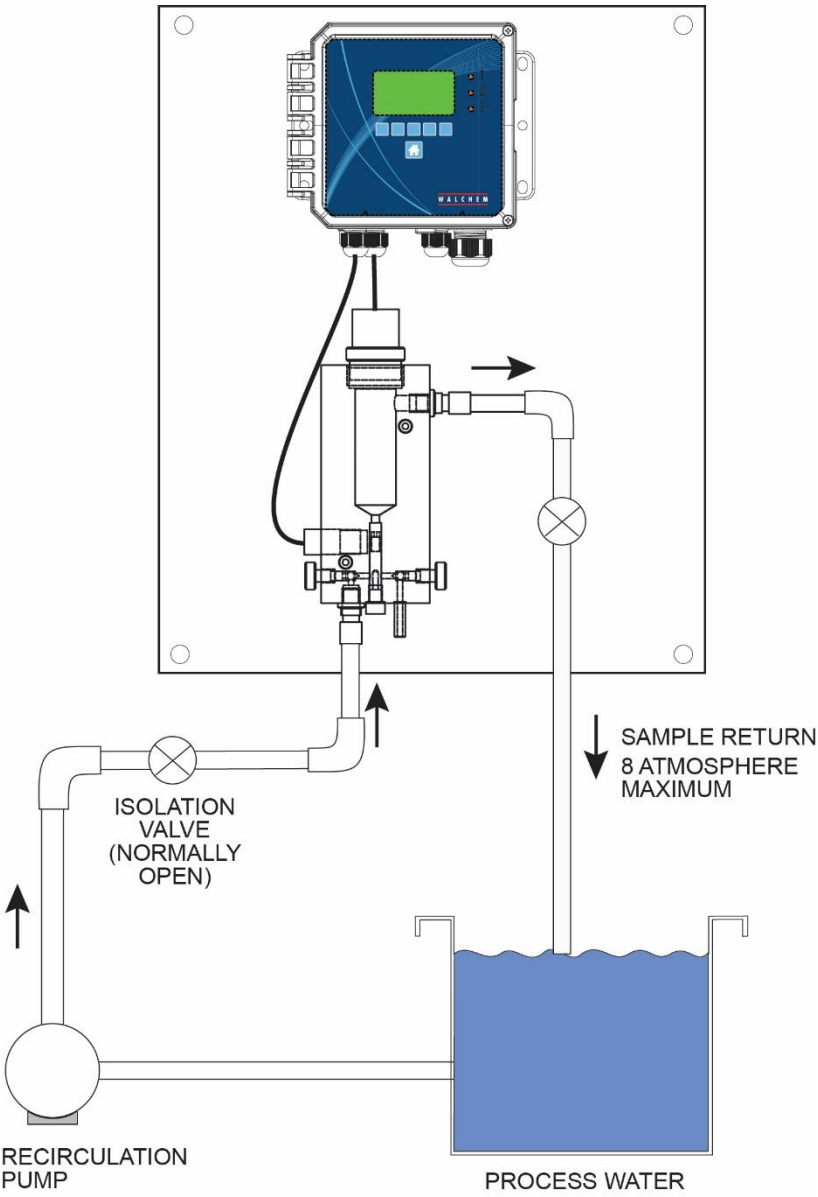
3. To supply a sample, first open the water outlet valve. Then open slowly the measuring water supply valve. The minimum flow rate is 45 liters/hour when using the cleaning attachment, 20 liters/hour without. The acrylic flow cell has a flow regulator knob on the lower left hand side. Avoid installations that allow air bubbles to enter the measuring water.

Sensor Parts





Typical Installation



Optional Flow Switch Installation

Unscrew the plug at the bottom of the acrylic flow cell and insert the red float, notched end up. Then screw the flow switch into the cavity on the left side of the flow cell.

Wiring Instructions

WebMaster

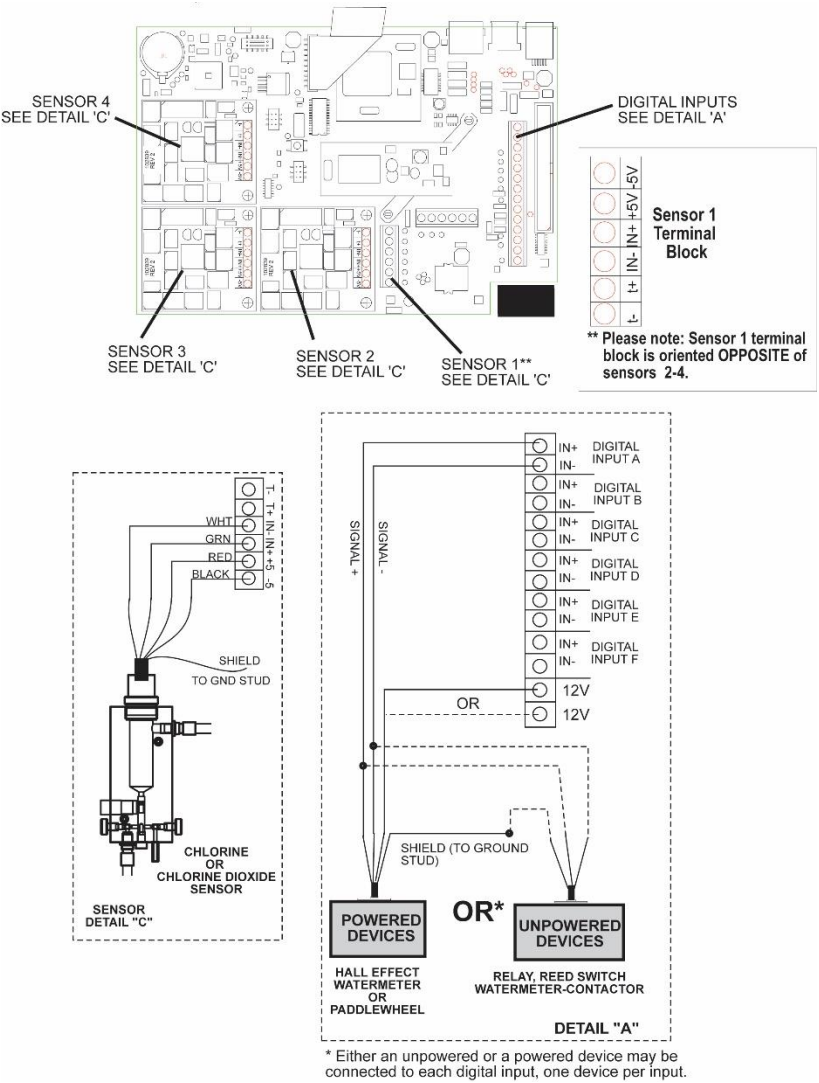
The sensor is provided with a 2-twisted pair, shielded, 24 AWG, 35 pF/foot capacitance cable. The wiring to the controller is as follows:

Shield Drain:	Earth Ground
GRN:	IN+
WHT:	IN-
RED:	+5 V
BLK:	- 5 V

If the required cable length exceeds the 6 meters (20 feet) that is supplied, wire the housing to a 190851 terminal box, then use a p/n 100084 cable to reach the instrument. The maximum cable length is 30.5 meters (100 feet).

The optional flow switch is a powered device and is wired to one of the digital inputs as follows:

BLK:	IN+
BLU:	IN-
BRN:	12 V

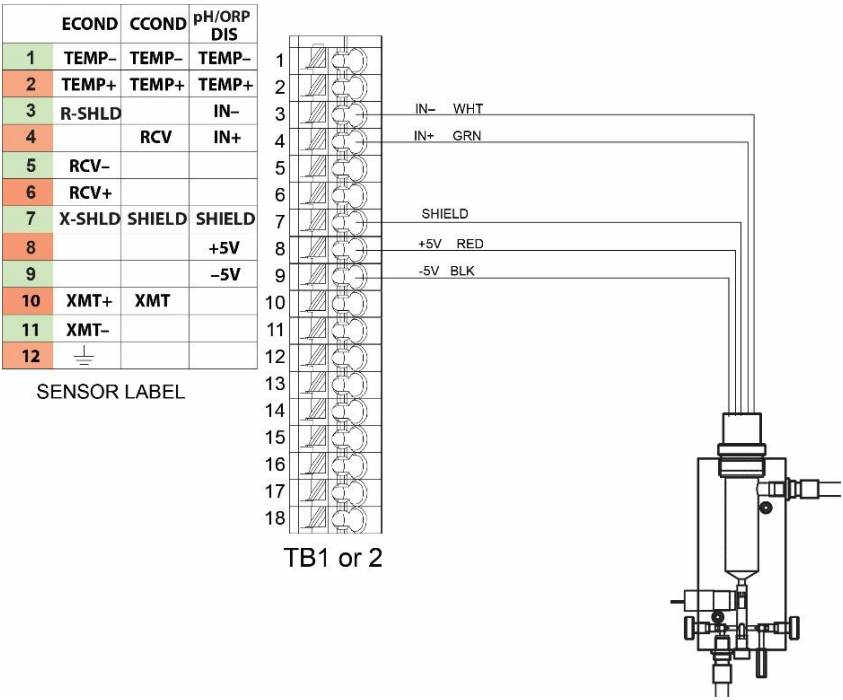


WDIS410 or WDS100 or WDS600 or W900

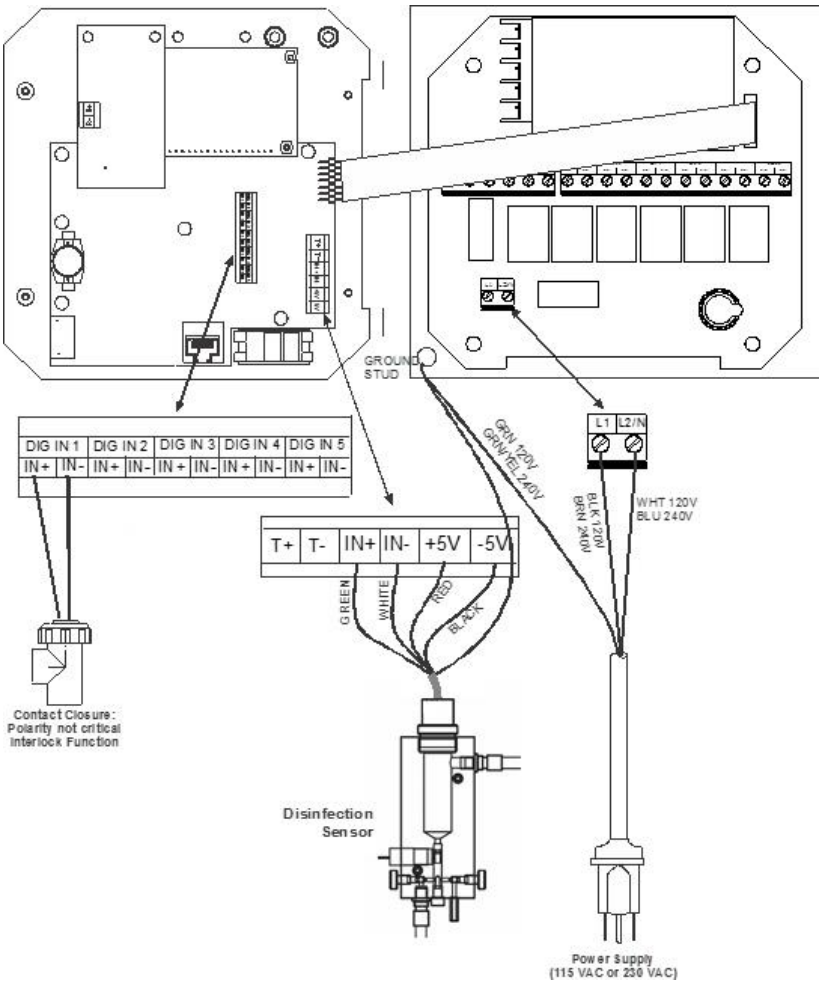
The sensor is provided with a 2-twisted pair, shielded, 24 AWG, 35 pF/foot capacitance cable. The wiring to the controller is as follows:

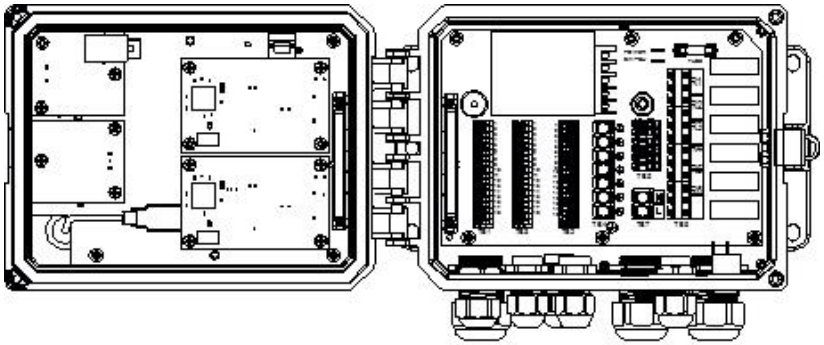
Shield Drain:	Earth Ground
GRN:	IN+
WHT:	IN-
RED:	+5 V
BLK:	- 5 V

If the required cable length exceeds the 6 meters (20 feet) that is supplied, wire the housing to a 190851 terminal box, then use a p/n 100084 cable to reach the instrument. The maximum cable length is 30.5 meters (100 feet).



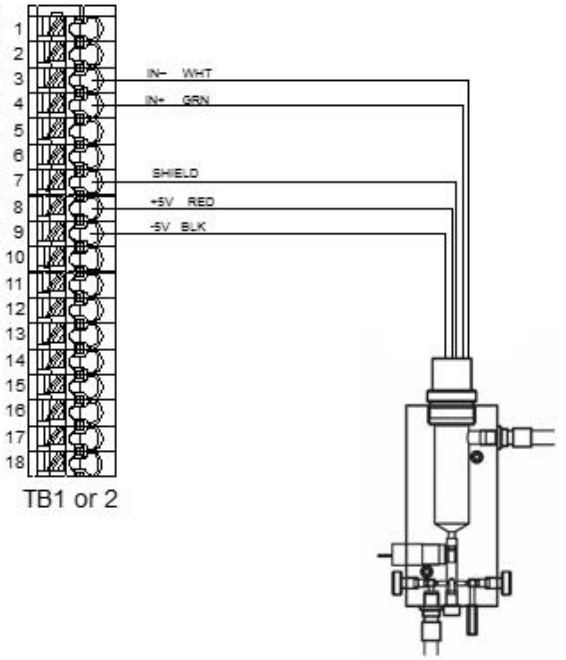
WDIS410


GROUND STUD
DIG IN 1
DIG IN 2
DIG IN 3
DIG IN 4
DIG IN 5
IN+
IN-
T+
T-
+5V
-5V
GREEN
WHITE
RED
BLACK
GRN 120V
GRN/YEL 240V
L1
L2/N
BLK 120V
BRN 240V
WHT 120V
BLU 240V
Contact Closure:
Polarity not critical
Interlock Function
Disinfection
Sensor
Power Supply
(115 VAC or 230 VAC)



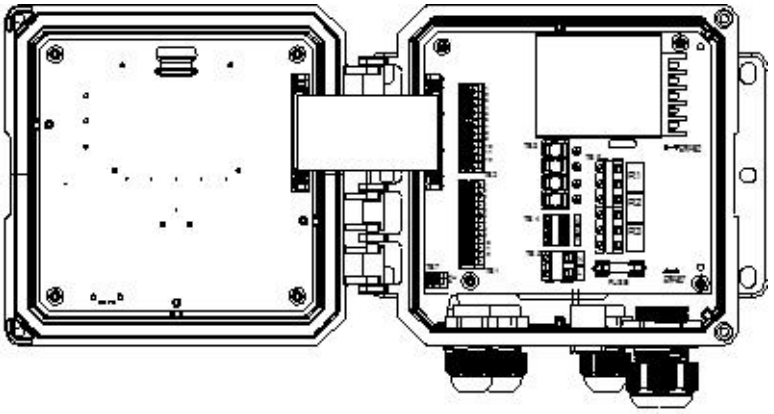
	ECOND	COOND	pH/ORP DIS
1	TEMP-	TEMP-	TEMP-
2	TEMP+	TEMP-	TEMP+
3	R-SHLD		IN-
4		RCV	IN+
5	RCV-		
6	RCV+		
7	X-SHLD	SHIELD	SHIELD
8			+5V
9			-5V
10	XMT-	XMT	
11	XMT-		
12	⏚		

SENSOR LABEL



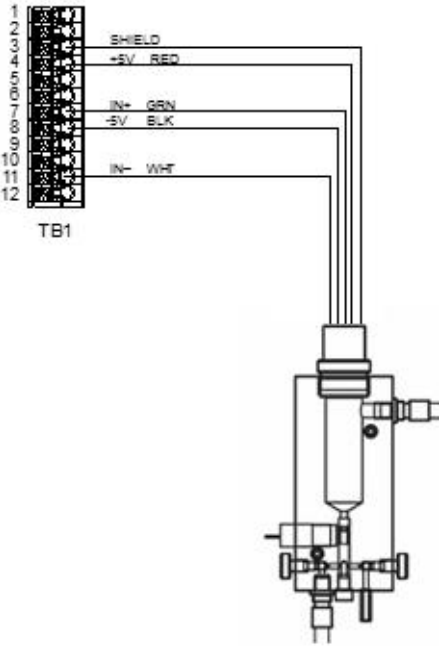
TB1 or 2

WDSW100



TB1	ECOND	CCOND	pH/ORP W/BNC	pH/ORP DIS	TB2	FUNCTION
1	XMT+	XMT			1	4-20OUT-
2	XMT-				2	4-20OUT+
3	X-SHLD	SHIELD	SHIELD	SHIELD	3	SHIELD
4			USE	+5V	4	DIG IN 2-
5	RCV-		BNC		5	DIG IN 2+
6	RCV+		FOR		6	+9VDC
7		RCV	INPUT	IN+	7	SHIELD
8			SIGNAL	-5V	8	DIG IN 1-
9	TEMP-	TEMP-	TEMP-	TEMP-	9	DIG IN 1+
10	TEMP+	TEMP+	TEMP+	TEMP+	10	+9VDC
11	R-SHLD			IN-	11	SHIELD
12	⏚				12	

SAFETY COVER LABEL



TB1

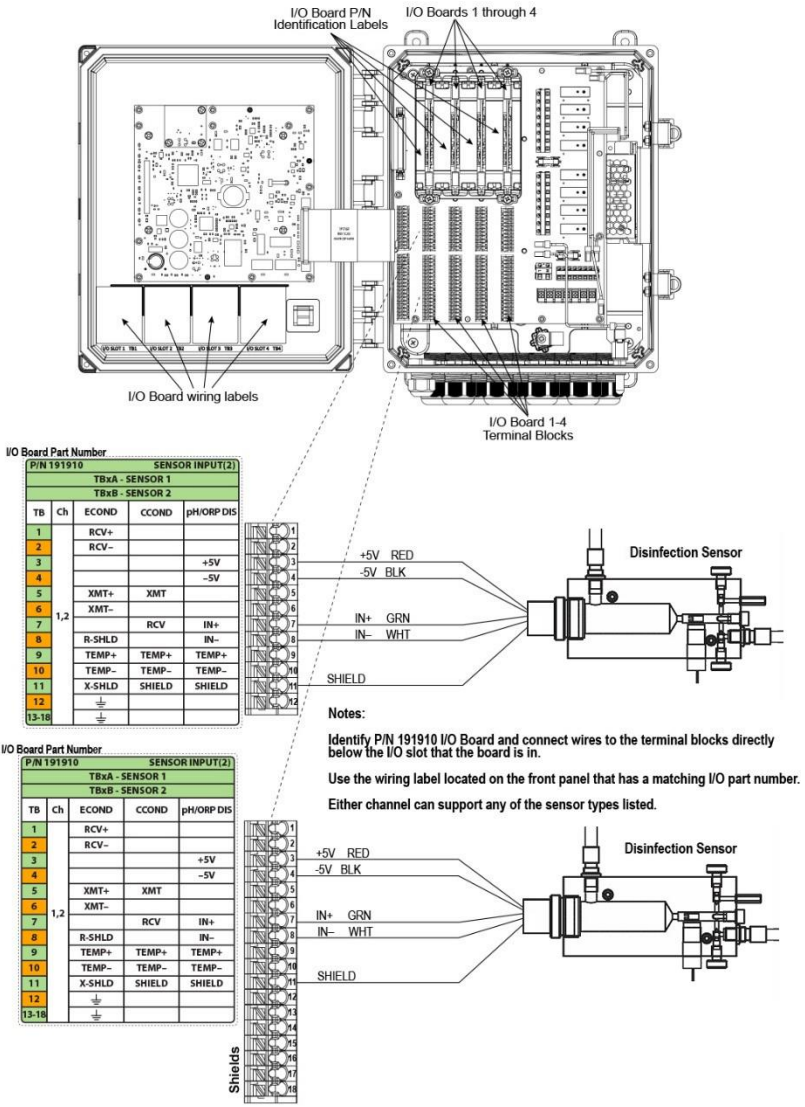
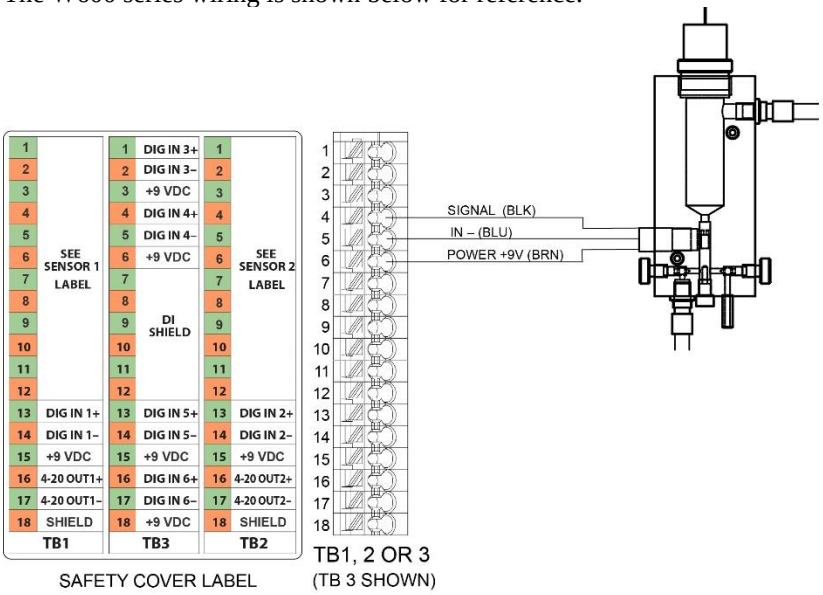


Figure 9 Part Number 191910 Dual Sensor Board Wiring - Disinfection

The optional flow switch is wired to one of the digital inputs as follows:

BLK:	DIG IN+
BLU:	DIG IN-
BRN:	+9 VDC

The W600 series wiring is shown below for reference.



3.0 Operation

This section describes how to prepare the sensor for use.

Conditioning

The sensor requires conditioning to acclimate the electrodes prior to generating stable readings. Conditioning consists of installing the sensor in the flow cell, ensuring that the sensor remains wet at all times with water containing the disinfectant to be measured, and supplying power to the sensor.

The following conditioning times are recommended:

New Sensor	1 – 48 hours, depending upon water quality
New electrolyte	1 – 3 hours

Calibration

The frequency of calibration is a function of many factors. These factors include:

1. The accuracy required by the application.
2. The value of the off-specification product versus the cost of calibration.
3. The coating or abrasive nature of the application.
4. The stability of the sensor and controller as a system.

The frequency of calibration is really determined by experience. At a new installation, calibration might initially be checked every day by comparing the controller reading to a DPD test or other manual analysis and logging the results. If the reading drifts off significantly in one direction you should consider calibrating. Resist the temptation to calibrate to correct for small errors that may be a result of normal variations in the test methods.

A calibration MUST be performed on initial installation, or after cleaning the electrodes, or after replacing the electrolyte. A sensor installed in clean water can hold its calibration for several months.

DO NOT attempt to perform a calibration until the following conditions have been met:

1. The sensor has been conditioned as described above.
2. The sensor has equilibrated to the temperature of the water (for the zero calibration) or the sample (for the 1 point process calibration).

Zero Calibration

1. Remove the sensor from the flow cell and place it in a beaker of clean, oxidizer-free water.
2. Allow the sensor 1 hour to equilibrate.
3. Go to the Zero Calibration menu of the controller. Refer to the controller instructions.
4. Stir the water with the sensor until the mV reading is stable for at least 5 minutes.
5. When the reading is stable, continue to the final steps of the calibration.
6. Return the sensor to the flow cell and check for leaks.

One Point Process Calibration

1. Ensure that the sensor is conditioned and equilibrated to the temperature of the sample.
2. Ensure that the sample flow rate is between 20 and 100 liters/hour. The acrylic flow cell has a flow regulator knob on the lower left hand side.

3. Perform a DPD test or other manual analysis on the sample water.
4. Go to the One Point Process Calibration menu of the controller. Refer to the controller instructions.
5. When the reading is stable, continue to the final steps of the calibration.

NOTE: Disinfectant concentration can change rapidly in the sample! Minimize the time between performing the DPD test or manual analysis and finishing the calibration!

4.0 Troubleshooting

The disinfectant reading is much lower than the manual analysis

Possible Causes	Corrective Actions
Insufficient conditioning	Wait for the appropriate amount of time before attempting a calibration
Insufficient sample flow	Increase flow rate to between 20 and 100 liter per hour
Air bubbles in sample	Dislodge bubbles Adjust flow rate higher if necessary Allow sample to outgas
Loose electrolyte housing	Tighten electrolyte housing
Protection cap not removed	Remove protection cap
Dirty electrodes	Clean electrodes with emery paper Replace balls in cleaning attachment
No electrolyte fill solution in electrolyte housing	Fill electrolyte housing with electrolyte
Air bubbles in electrolyte	Empty electrolyte housing and refill it
Faulty cable	Replace cable
Faulty sensor	Replace sensor
Faulty analysis equipment or reagents	Consult test equipment instructions

The disinfectant reading is much higher than the manual analysis

Possible Causes	Corrective Actions
Insufficient conditioning	Wait for the appropriate amount of time before attempting a calibration
Faulty sensor	Replace sensor
Faulty analysis equipment or reagents	Consult test equipment instructions
Sample contaminated with interfering molecule (refer to Sensitivity specification in Section 6)	Remove source of contamination

Sensor Error

This error message appears if the signal from the sensor is outside the range of –1400 to 1400 mVDC (WebMaster) or –2000 to 2000 (WDIS) or -2560 to 60 mV (W100/W600/900)

Possible Causes	Corrective Actions
Faulty wiring	Check wiring
Faulty sensor	Replace sensor
Faulty controller sensor input	WebMaster, WDIS4 Go to the Sensor Input menu and perform a self-test. If this passes, then the problem is with the sensor or its wiring. If it fails, then disconnect the sensor from the circuit board and try the self-test again. If it still fails, replace the circuit board.

Disinfectant Reading is Unstable

Possible Causes	Corrective Actions
Air bubbles on electrodes	Dislodge bubbles Adjust flow rate higher if necessary Allow sample to outgas
Air bubbles in electrolyte	Refill electrolyte housing
Pressure fluctuations in sample	Check installation
Faulty wiring	Check wiring
Faulty sensor	Replace sensor

Calibration Failure

For WebMaster

The controller will display a calibration failure if the offset calculated in the Zero Calibration is outside of the range –20 to 40 mV or the slope (mV/ppm) calculated in the One Point Process Calibration is outside of the range of the nominal mV per 0.1 to 2.0 ppm.

For WDIS:

The acceptable range for the slope (mV/ppm) is the nominal mV per 0.5 to 2.0 ppm. The range of mV for a Zero Calibration is –100 mV to 100 mV.

For W100 or W600 or 900:

The acceptable range for the slope (mV/ppm) is the nominal mV per 0.2 to 10.0 ppm. The range of mV for a Zero Calibration is –100 mV to 100 mV.

To calculate the nominal slope for your sensor, divide the high end of the nominal range by -2000. For example, for a 0-20 ppm sensor, the nominal slope is -2000/20 = -100 mV/ppm.

Possible Causes	Corrective Actions
Insufficient conditioning	Wait for between 1 hour and 48 hours before attempting a calibration.
Insufficient sample flow	Increase flow rate to between 20 and 100 liters per hour
Air bubbles in sample	Dislodge bubbles Adjust flow rate higher if necessary Allow sample to outgas
Loose electrolyte housing	Tighten electrolyte housing
Protection cap not removed	Remove protection cap
Dirty electrodes	Clean electrodes with Emory paper Replace balls in cleaning attachment
No electrolyte fill solution in electrolyte housing	Fill electrolyte housing with electrolyte
Air bubbles in electrolyte	Empty electrolyte housing and refill it
Faulty sensor	Replace sensor
Faulty analysis equipment or reagents	Consult test equipment instructions
Sample contaminated with interfering molecule (refer to Sensitivity specification in section 6.0)	Remove source of contamination
Faulty wiring	Check wiring
Faulty controller sensor input	WebMaster, WDIS4 Go to the Sensor Input menu and perform a self-test. If this passes, then the problem is with the sensor or its wiring. If it fails, then disconnect the sensor from the circuit board and try the self-test again. If it still fails, replace the circuit board.

5.0 Maintenance

The sections below describes normal maintenance.

See section 4.0 Troubleshooting for assistance in determining when maintenance may be required.

Cleaning the Electrodes

It is recommended to clean the electrodes every 4 – 12 weeks or sooner if calibration is impossible due to unstable or low values are displayed.

Remove the sensor from the flow cell by first closing the water supply valve, then the water discharge valve, then unscrewing the 1 ¼" fitting. If the optional cleaning attachment is present, pull the sensor out while turning it in a CLOCKWISE direction.

Dry the outside of the sensor with a clean paper towel. If necessary hold the electrolyte housing tight to unscrew the cleaning attachment.

Use the emery paper supplied to clean the electrodes. Do NOT move the emery paper from one electrode to the other! Then put the sensor into operation again.

If the sensor still displays unstable or too low values, the electrolyte has to be changed as described in Section 2. It is recommended to change the electrolyte every 3 – 6 months.

If the electrodes are dirty and the optional cleaning attachment is being used, it is possible that the cleaning balls need to be replaced.

Sensor Storage

The sensor may be stored for up to one month in the flow cell assuming that the membrane is always kept submerged in water.

An unused sensor, still in the box with protective cap, may be stored up to 1 year if the ambient temperature is above freezing.

For long term storage, up to 3 years, follow this procedure:

CAUTION: Wear gloves and safety glasses during disassembly of the sensor since the electrolyte is a diluted acid. It is recommended to perform this operation over a sink with running water available.

Please heed the warnings on the electrolyte bottle. Do not swallow the electrolyte. Avoid contact of the electrolyte with skin and eyes. Otherwise wash with a lot of water. In case of eye inflammation, contact a doctor.

To store the sensor unscrew the electrolyte housing.
Rinse the electrolyte housing and the electrode finger in clean water and dry in a dust-free location.
Replace the protective cap onto the electrolyte housing.
Loosely screw the electrolyte housing with protective cap onto the electrode shaft to protect the electrodes.

When putting the sensor back into operation after storage, the electrodes must be cleaned with the emery paper.

6.0 Specifications

	Free Chlorine PVC	**Free Chlorine PEEK**	**Chlorine Dioxide PVC**	**Chlorine Dioxide PEEK**
Range (W100, W600, W900)	0.03-20 mg/l (reduce the range by a factor of 3 if using the optional cleaning attachment)			
Range (WebMaster)	0.03-8 mg/l (reduce the range by a factor of 3 if using the optional cleaning attachment)			
Resolution	0.01 mg/l			
Sensitivity	NaOCl, Ca(OCl)2, Cl2. O3 (900%), ClO2 (400%), ClO2- detected		ClO2. Cl2, ClO2- < 2% detection	
Flow Rate of Sample	20 – 100 liter/hour (constant, 80 l/hr. optimum if using the optional cleaning attachment, 50 l/hr. without)			
pH range of sample	pH 5.00 – 9.00 (pH must be stable within ±0.10)		pH 1.00 – 12.00	
Conductivity range of sample	No Limit			
Response time	30 seconds			
Conditioning time	1 hour – 2 days depending on water quality			
Operating Pressure	0 - 8 bar (0 – 116 PSI)			
Operating Temperature	0 – 50 C	0 – 70 C	0 – 50 C	0 – 70 C
Storage	Frost-protected, dry and without electrolyte – no limit			
Flow cell connectors	6 mm ID x 8 mm OD tubing fittings in ¼" straight threaded holes			
Electrolyte	P/N 104039, 50 ml			
Power requirements	±5 VDC, 5 mA			
Signal	0 to -2000 mV DC			
Maximum cable length	30 meters (100 feet)			
Extension cable	4 conductor 24 AWG shielded (Walchem 100084)			
Materials of construction				
Sensor	PVC-U	PEEK	PVC-U	PEEK
Flow cell	Acrylic (PMMA), natural PVDF			
Mounting rings	Natural PVDF, PETP, FKM, Silicone			
Optional Cleaning cap	PVDF, Acrylic (PMMA), Silicone, Ceramic balls			
Optional flow switch	Switch: Stainless steel, Polyester (not wetted) Float: PEEK, epoxy			

7.0 Sensor Part Numbers

	Sensor	Electrolyte
SENSOR, Cl2, PVC, NON MEMBRANE, 20 PPM	104037	104039
SENSOR, Cl2, PEEK, NON MEMBRANE, 20 PPM	104030	
SENSOR, ClO2, PVC, NON MEMBRANE, 20 PPM	104038	
SENSOR, ClO2, PEEK, NON MEMBRANE, 20 PPM	103939	

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