WDS Differential pH/ORP Sensor Instruction Manual

Five Boynton Road Hopping Brook Park Holliston, MA 01746 USA
TEL: 508-429-1110 FAX: 508-429-7433 WEB: www.walchem.com

Notice

Proprietary Material

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1.0 INTRODUCTION

The WDS Series of pH and ORP electrodes are differential sensors that are available with a choice of preamplifiers, one for Walchem controllers and another for certain other pH/ORP controllers. The differential measurement technique is reliable and immune to ground loop related problems.

This technique utilizes two glass electrodes to make the measurement differentially with respect to a third metal electrode. The second glass electrode is immersed in pH 7 buffer inside the electrode body, but electrically connected via a porous double junction salt bridge. If the internal solution becomes contaminated, the sensor may be rejuvenated by replacing the solution and salt bridge.

Four models of sensors are available:
WDS-PHW (for pH) and WDS-MVW (for ORP) contain a differential preamplifier that is compatible with Walchem controllers. These electrodes will have three twisted pairs plus a shield wire.
WDS-PHC (for pH) and WDS-MVC (for ORP) contain a differential preamplifier that is compatible with competitive, conventional pH/ORP controllers. These will have 5 wire cables with a shield wire.

The WDS Series are threaded at each end, allowing for both submersion and in-line mounting with a single electrode.

2.0 SPECIFICATIONS

Measurement Performance

Ranges:	0 to 14 pH
	-2000 to +2000 mV
	-5 to 95 C (23 to 203 F)
Sensitivity:	0.001 pH
	0.1 mV
Stability:	0.03 pH/day, non-cumulative
	2 mV/day, non-cumulative

Mechanical

Wetted materials:	CPVC Body
	Ceramic reference junction
	Glass sensor
	Titanium palladium alloy ground rod
	EPDM
	Platinum (ORP sensor only)
Cable length:	15 ft. (4.6m)
Maximum cable length:	3000 ft (900m)
Pressure:	100 psig (0.7 MPa) at 65 C (149 F) maximum
Temperature:	23 to 203°F (-5 to 95°C)
Dimensions:	7.1” x 2.14” x 2.14” (18 cm x 5.5 cm x 5.5 cm)
	1 ½” NPTM pipe threads
Maximum Flow Rate:	10 feet/sec (3m/sec)

3.0 UNPACKING & INSTALLATION

3.1 Unpacking the Unit

Inspect the contents of the carton. Please notify the carrier immediately if there are any signs of damage to the sensor. Contact your distributor if any of the parts are missing. The carton should contain a WDS Series pH/ORP electrode and instruction manual. Any options or accessories will be incorporated as ordered.

3.2 General Guidelines

Instructions for mounting the electrode into the process solution will vary greatly with the type of electrode and the circumstances that are encountered in your application. Here are some general guidelines to assist you. Refer also to the typical installation drawings.

The electrode should be mounted such that the measuring surfaces will always stay wet. If the electrode dries out, it will respond slowly to changing pH/ORP values for 24 hours, and if dried out repeatedly, will fail prematurely.

For submersion applications, mount the electrode below the minimum solution level. If the tank will be completely drained, plan on removing the electrode and storing it in tap water (NOT DI water) or pH 4 buffer solution while the tank is empty. If this is undesirable, a recirculation loop may be installed and the electrode mounted in-line.

For in-line applications, where the electrode is installed in a pipe, the electrode should be placed on the discharge side of the pump (under positive pressure). A “U” trap should be installed so that if the flow stops, the electrode is still immersed in the solution. If the flow through the pipe can not be stopped to allow for cleaning and calibration of the electrode, then the electrode should be placed in a by-pass line with isolation valves to allow for electrode removal. (Refer to installation drawings)

The electrode 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 electrode relative to the placement of chemical replenishment, along with the quality of the mixing, and the replenishment pump flow rate are each critical to accurate process control.

Avoid locations that are in close proximity to sources of electrical noise (motor starters, power transformers, variable speed motor drives, radio transmitters, etc.), corrosive fumes or excessive moisture.

The electrode requires clearance of 6 cm (2.4”) to remove it from an in-line tee.

3.3 Installation

For submersion applications, feed the cable through an appropriate length of 1" pipe with a 1 x 1 ½ " NPTF reducing coupling at each end. Thread the electrode into one coupling, sealing the threads with Teflon tape. The cable is NOT immune to contact with the solution and must be protected! The opposite end of the pipe should be sealed against the cable with a water-tight cable gland.

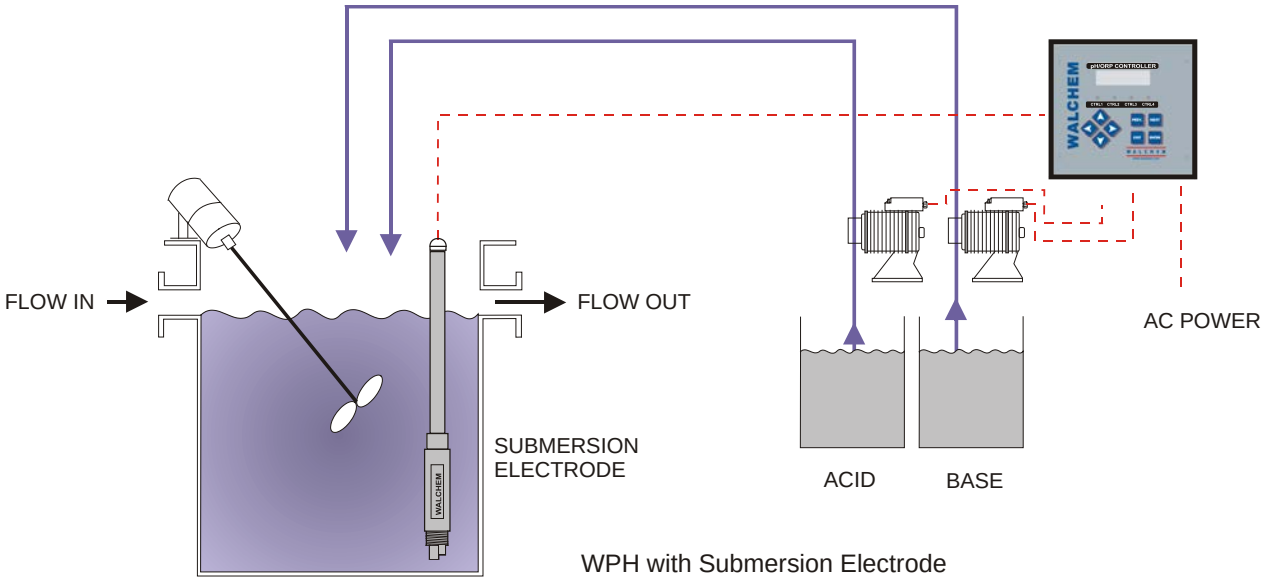
If the cable length will exceed the supplied 15 feet (4.6 meter), it may be extended using 24 AWG or higher gauge, twisted pair, shielded cable and a water-tight (NEMA 4X, IP67 or better) junction box. The shield wire must be continuous and grounded only at one point (normally inside the controller). If the junction box is grounded, DO NOT allow the shield wires to connect to ground inside the box.

Remove the protective caps from the measurement electrode and the salt bridge and immediately immerse the electrode in the solution to be measured. Do not allow the electrode to dry out!

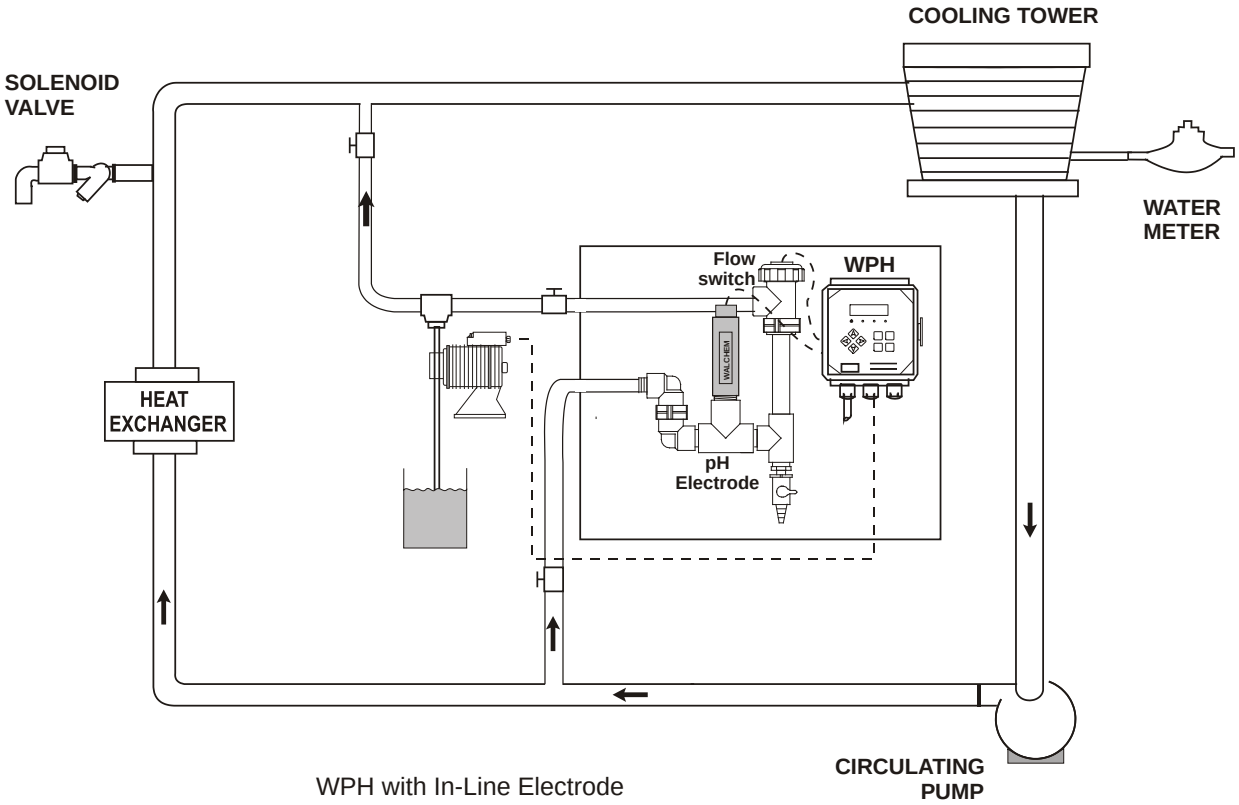
For in-line applications, wrap the threads at the electrode end of the sensor with Teflon tape. Remove the protective caps from the measurement electrode and the salt bridge and immediately immerse the electrode in the solution to be measured by threading it into the 1 ½" NPTF process tee. Do not allow the electrode to dry out!

The sensor is designed for installation with the electrode end pointing down (at least 15 degrees above horizontal). DO NOT install it horizontally or with the electrodes pointing up.

If the cable length will exceed the supplied 15 feet (4.6 meter), it may be extended using 24 AWG or higher gauge, twisted pair, shielded cable and a water-tight (NEMA 4X, IP67 or better) junction box. The shield wire must be continuous and grounded only at one point (normally inside the controller). If the junction box is grounded, DO NOT allow the shield wires to connect to ground inside the box.



WPH with Submersion Electrode



WPH with In-Line Electrode

Figure 1 Typical Installation

3.4 Icon Definitions

Symbol	Publication	Description
	IEC 417, No.5019	Protective Conductor Terminal
	IEC 417, No. 5007	On (Supply)
	IEC 417, No. 5008	Off (Supply)
	ISO 3864, No. B.3.6	Caution, risk of electric shock
	Pending	Caution, High temperature, risk of burn
	ISO 3864, No. B.3.1	Caution

3.5 Electrical Installation

Note: Proper grounding of this product is required. Any attempt to bypass the grounding will compromise the safety of persons and property.

CAUTION! There are live circuits inside the controller even when the power switch on the front panel is in the OFF position! The front panel must never be opened before power to the controller is REMOVED!

CAUTION! The electrical installation of the controller must be done by trained personnel only and conform to all applicable National, State and Local codes!

WDS-PHW and WDS-MVW Wiring

Wire Color	WebMaster	W400	W100/600/900
Orange	IN+	IN+	IN+
Orange/White	IN-	IN-	IN-
Green	T+	T+	TEMP+
Green/White	T-	T-	TEMP-
Blue	+5	+5V	+5V
Blue/White	-5	-5V	-5V
Shield	Earth Ground	Earth Ground	SHIELD

WDS-PHC and WDS-MVC Wiring

Most controllers that utilize the 5-wire conventional differential electrode have a color coded terminal block that matches the color of the electrode cable. If not, please refer to the controller operating instruction manual for wiring directions.

Connect Black wire to BLK, Red to RED, Green to GRN, White to WHT, Yellow to YEL and the shield drain wire to SHLD.

4.0 MAINTENANCE

The WDS Series pH/ORP electrodes are ruggedly made and easy to maintain. Because the pH responsive glass bulb is relatively thin, care should be taken so that the bulb does not become scratched or broken. It is also important that ORP measuring surfaces are not scratched or gouged.

4.1 Cleaning the Sensor

The probe should be kept reasonably clean to avoid measurement errors. Frequency of cleaning can only be determined by experience. To clean proceed as follows:

Rinse with clean warm water.

Soak the end of the probe in warm water and dish detergent for 3 or 4 minutes.

Brush the end of the probe, particularly the three electrodes with a soft bristle brush such as a toothbrush. Take care not to scratch the glass electrode.

If the probe is still not clean, it may have to be cleaned with acid. *CAUTION: Do not acid clean probes used in processes containing cyanide solutions.* Some experimentation may be required to determine the most suitable acid for your process. Use the most dilute acid that is effective. Normally 10 parts of water to one part hydrochloric acid is sufficient. *Do not use hydrofluoric acid.*

Soak the probe for not more than 5 minutes in the chosen acid; then rinse thoroughly with clean warm water and soak in water for 3-5 minutes.

Calibrate the system in accordance with the instrument instruction manual.

4.2 Replacing the Salt Bridge

If the system can't be calibrated after cleaning the probe, it may be necessary to replace the standard cell solution.

Hold the probe vertically electrodes up. Put a 15 mm (9/16") crescent wrench around the salt bridge and turn counter-clockwise taking care not to damage the glass electrode. Discard the used salt bridge.

Up-end the probe and pour out the contents of the standard electrode chamber. Flush the chamber with a small amount of pH 7 buffer or clean water.

Refill the chamber with 7pH buffer solution, up to the tip of the electrode, inside the chamber. DO NOT OVERFILL. It is important to leave space for the salt bridge thread and a small amount of air.

Screw the new salt bridge into the cavity until finger tight. Now turn 1/4 turn with the wrench. The front face of the salt bridge will stick out less than half an inch from the front of the probe.

4.3 Important Considerations

The pH electrode is shipped with plastic caps covering the sensing electrode and salt bridge. The caps contain a solution of pH adjusted salt solution. The electrode should remain stored with these caps full of solution.

Electrodes are a form of battery and have a limited shelf life. Electrodes in inventory should be rotated so older electrodes are used first.

Readings stabilize faster in some solutions than in others. Allow time for readings to stabilize. The temperature element can take as much as 15 minutes to equilibrate at the new temperature.

All pH electrodes age with time. Aging is characterized by shortened span and slower speed of response. Aging is best detected by performing a 2-point calibration.

Electrodes should be replaced when their readings cannot be corrected by the meter's controls and/or when their speed of response is too slow for the application for which they are being used.

The frequency of electrode replacement is a function of the application. Electrodes operating in hot liquids or at very high or low pH values will have shorter lives than those operating at neutral pH and ambient temperature will.

Coatings on the electrode's surface prevent new liquids from contacting its measuring surface and can mimic the effects of electrode aging. Before concluding that an electrode needs replacing, clean the electrode.

5.0 TROUBLESHOOTING

The probe can be checked by a few simple measurements. Two pH buffer solutions, 7 pH and either 4 pH or 10 pH, and a multimeter are required. For ORP probes two calibration solutions, 200 and 600 mV, are required. Millivolt solutions may be ±20% of nominal value. Actual value is noted on the bottle.

WDS-PHC pH Electrodes

Clean the probe as described in Section 5.1. If the system cannot be calibrated, replace the salt bridge and 7pH buffer solution as described in 5.2. If the system still can't be calibrated check the probe as follows:

Disconnect red, green, yellow and black wires at the junction box. If you are not using a junction box, disconnect at the instrument after shutting off the power.

Place the probe in 7 pH buffer. Allow enough time for the temperature of the probe and buffer to stabilize at room temperature.

Measure the resistance between the yellow and black wires to check the probe's temperature compensator. The resistance should be between 250 and 350 ohms at 25°C (78 °F). If the resistance is within specifications the probes thermistor is functioning correctly.

Reconnect the yellow and black wires and restore power to the instrument.

Measure the voltage between the red and green wires. If it is not within –50 to +50 millivolts with the probe in 7 pH buffer, the probe is defective. If the voltage is OK proceed to the next step.

Rinse the probe and place it in 4 pH or 10 pH buffer. Allow it to stabilize then check the voltage again between the red and green wires. If the voltage is between 100 and 230 millivolts (negative in 10 pH buffer, positive in 4 pH buffer) the probe is within specifications.

WDS-MVC ORP Electrodes

Rinse the probe and place it in 200 mV solution. The reading should be between 160 and 240 mV.

Repeat the above in a 600 mV solution. The reading should be between 560 mV and 640 mV.

WDS-PHW pH Electrodes

Clean the probe as described in Section 5.1. If the system cannot be calibrated, replace the salt bridge and 7pH buffer solution as described in 5.2. If the system still can't be calibrated check the probe as follows:

Disconnect green, green/white, orange and orange/white wires at the junction box. If you are not using a junction box, disconnect at the instrument after shutting off the power.

Place the probe in 7 pH buffer. Allow enough time for the temperature of the probe and buffer to stabilize at room temperature.

Measure the resistance between the green and green/white wires to check the probe's temperature compensator. The resistance should be between 1000 and 1200 ohms at 25°C (78 °F). If the resistance is within specifications the probes RTD is functioning correctly.

Reconnect the green and green/white wires and restore power to the instrument.

Measure the voltage between the orange and orange/white wires. If it is not within –60 to +60 millivolts with the probe in 7 pH buffer, the probe is defective. If the voltage is OK proceed to the next step.

Rinse the probe and place it in 4 pH or 10 pH buffer. Allow it to stabilize then check the voltage again between the orange and orange/white wires. If the voltage is between 100 and 230 millivolts (negative in 10 pH buffer, positive in 4 pH buffer) the probe is within specifications.

WDS-MVW ORP Electrodes

Rinse the probe and place it in 200 mV solution. The reading should be between 160 and 240 mV.
Repeat the above in a 600 mV solution. The reading should be between 560 mV and 640 mV.