

INSTRUCTION MANUAL
HBPH
DIFFERENTIAL 2-WIRE (4-20 mA) pH Sensor

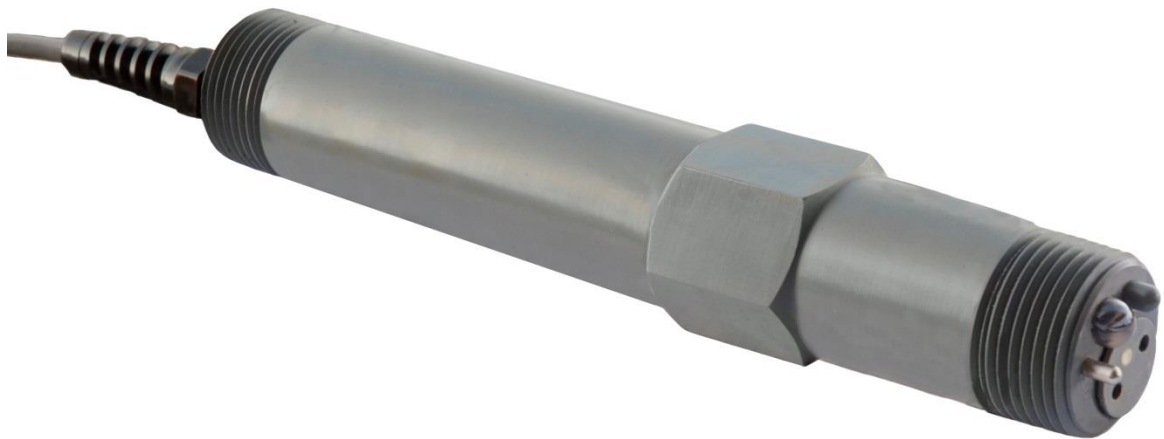


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1. GENERAL INFORMATION

This manual cover HBPH sensor for pH measurement in brine.

The HBPH sensor features differential design for long lifetime, user serviceability and more accurate readings. In typical installations these probes will last for years whereas the more common combination probe lasts only months.

The sensor is a 2-wire device. It incorporates an encapsulated transmitter that outputs a 4-20 mA analog signal. It was designed to connect directly to a PLC.

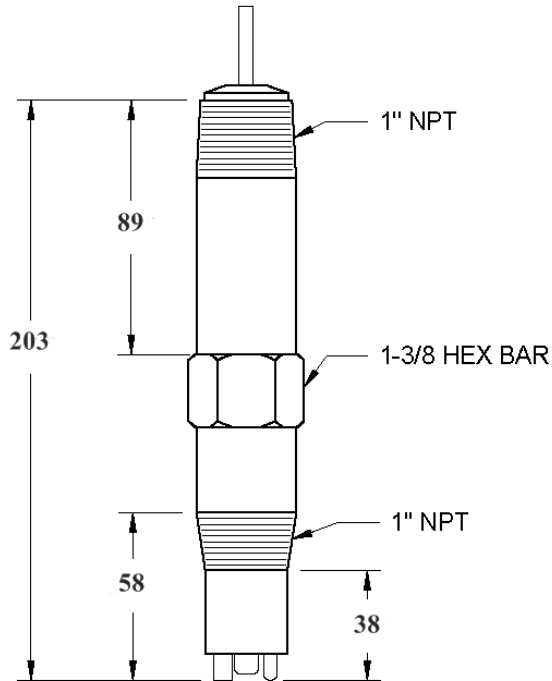
The output from a two-wire transmitter type is non-isolated and un-calibrated. The system must provide 24 VDC, with the "low" input isolated from earth ground, and a means of calibrating for offset and span.

NOTE: Do not discard the protective cap(s) that came with the sensor. If the sensor is removed from the process for an extended period of time, thoroughly clean the sensor, put a piece of cotton ball with few drops of water into the protective cap and replace it on the sensor. This keeps the junction from drying out which causes slow response when put back into operation or causes permanent damage to the sensor. **Sensors should not be left in dry lines or empty tanks for extended periods.**

Do not store the sensors in a dry or humid location. When storing, check the protective cap(s) regularly to make sure the cotton ball remains moist. Improper storage of sensors voids the warranty.

2. Specifications

	pH
Measurement Range	0 to 14.00
Wetted Materials	CPVC, Kynar/ceramic, titanium, Viton
Stability	0.03 pH/day
Resolution	0.01 mm
Sensitivity	< 0.005 pH
Output Span	1.14 mA/pH
Output Offset	12±1 mA @ pH 7
Mounting	1.5" NPT
Flow Rate	3,0 m/sec / 10 ft/sec
Maximum Load	450 Ω
Temperature Limits	6,9 bar (100 psig) @ 65 °C, 2,75 bar (40 psig) @ 95°C
Power Supply Limit	24±4 VDC
Cable	4.6 m (15 ft.)



3. INSTALLATION

3.1. General Instructions

1. If the distance between the probe and the instrument is such that a direct connection is not possible, the probe cable should be routed to a junction box with a terminal strip. The box should be well sealed and away from corrosion danger. Be sure that you have sufficient slack cable to allow for probe removal for calibration and servicing.
2. Route the interconnect cable from the junction box to the instrument, preferably in metal conduit. Do not run the power cable or control cables in the same conduit with the probe interconnect cable.
3. Remove the protective plastic caps from the end of the probe before placing in service.
4. For best results probes should always be mounted vertically with electrodes down. If this is not possible, the probe must be at least 15° above horizontal.

3.2. HBPH 4-20 mA Sensor

1. HBPH probes have four wires; black, red, green and white. The red wire is to be connected to the +24 VDC terminal and the back wire to the 24 Vdc common terminal via the load in the loop.

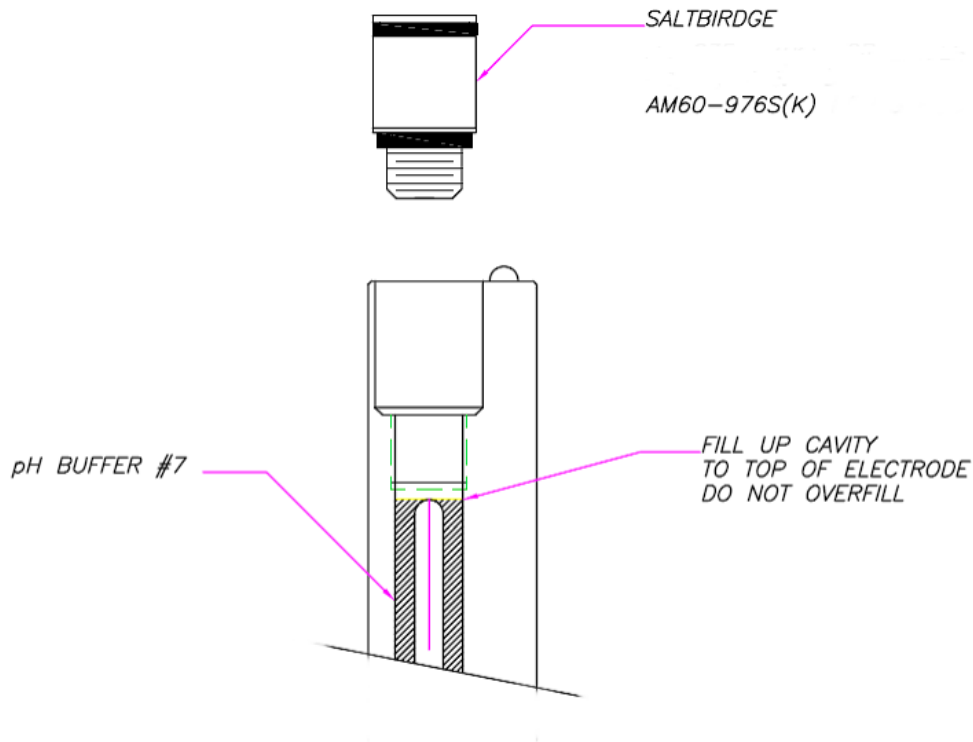
4. SERVICE AND MAINTENANCE

4.1. Probe Cleaning

- a) 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:
- b) Rinse with clean warm water.
- c) Soak the end of the probe in warm water and dish detergent for 3 or 4 minutes.
- d) 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.
- e) 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, which is effective. Normally 10 parts of water to one part muriatic acid is sufficient. *Do not use hydrofluoric acid.*
- f) 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.
- g) Calibrate the system in accordance with the instrument instruction manual.

4.2. Replacement of Salt Bridge

- a) If the system can't be calibrated after cleaning the probe, it may be necessary to replace the standard cell solution and/or the salt bridge. A salt bridge kit is available from HB Products for this purpose.
- b) Hold the probe vertically electrodes up. Remove the used salt bridge. The salt bridge is a hexagonal-shaped capsule that can be removed using a 9/16" socket wrench. Use needle nose pliers to unscrew the piece.
- c) Discard the used salt bridge.
- d) Dispose of the used solution inside the bridge chamber and flush with pH 7 solution or distilled water.
- e) 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.
- f) Screw the new salt bridge into the cavity until finger tight. Now perform a 1/4 turn with a 9/16" socket wrench. The salt bridge edges should be flush with the front of the probe face.



4.3. Storage

- a) Do not discard the protective cap(s) that came with the sensor. If the sensor is removed from the process for an extended period of time, thoroughly clean the sensor, put a piece of cotton ball with few drops of water into the protective cap and replace it on the sensor. This keeps the junction from drying out which causes slow response when put back into operation or causes permanent damage to the sensor. **Sensors should not be left in dry lines or empty tanks for extended periods.**
- b) Do not store the sensors in a dry or humid location. When storing, check the protective cap(s) regularly to make sure the cotton ball remains moist. Improper storage of sensors voids the warranty.

5. TROUBLESHOOTING AND SERVICE

5.1. Checking Sensor

The operation of the 2-wire, 4-20 mA sensor can be checked by a few simple measurements. Two pH buffer solutions, 7 pH and either 4 pH or 10 pH, and a dc milliammeter are required.

1. Disconnect the red wire at the instrument or power supply and connect it to the milliammeter (-) black.
2. Connect the milliammeter (+) red to the instrument or power supply red wire output terminal.
3. Rinse the probe and place it in 7 pH buffer. Allow the temperature of the buffer and probe to stabilize at room temperature.

4. Check the offset of the probe by reading the milliammeter. The reading should be between 11 and 13 mA. If not the probe is defective. If the offset is OK, note the exact reading and proceed to the next step.
5. Rinse the probe and place it in 4 pH or 10 pH buffer. Allow the temperature of the probe and buffer to stabilize at room temperature. Now check the span of the probe by reading the milliammeter. If the probe is in 4 pH buffer, the reading should be between 2.85 and 3.99 lower than the reading obtained in (4).
6. If the probe is in 10 pH buffer, the reading should be between 2.85 and 3.99 higher than the reading obtained in (4).
7. If this test is not satisfied the probe is defective.
8. If you wish to check the temperature compensator proceed to step (10).
9. If the span of the probe drops below 2.85mA than the probe still can be used adjustments will have to be made to the receiving device to compensate for the low span.
10. To check the operation of the temperature sensor in the probe, heat the buffer used in step (e) with the probe in it to about 50°C. The milliammeter reading should be within ± 0.15 mA of the reading observed in step (4).

5.2. Troubleshooting

A pH probe is a simple instrument. As a potentiometric device it outputs a voltage in response to a change in pH. The built-in transmitter converts the voltage to a current. A probe that is not functioning properly will output a current that is out of range of the specifications listed in Section 5.1. The change in output with calibration standard constitutes the span. For a pH probe: The span between pH 4 and pH 7 or between pH 7 and pH 10 should be between 2.85 and 3.99 mA.

If the span of an pH probe do not satisfy these criteria then the cause of the problem may be one of the following:

1. The process electrode (glass bulb) is coated with scaling or biofouling.
2. The process electrode is inoperable (likely broken).
3. The reference solution has been contaminated with the process to the point that it is no longer pH 7.
4. The salt bridge has fouled to the point that reference solution cannot pass through that is needed to complete the potentiometric circuit.
5. The printed circuit board (PCB) has shorted out by ingress or the op-amp on the board has failed.

The manifestations of these different sources are as follows:

1. A coated electrode (1) will create a narrower span. If the coating is from scaling then soaking the probe in a weak acid (e.g. vinegar or 0.1 N HCl) will remove the scale. If the coating is from fouling then soaking the probe in bleach will clear it.
2. Either problems 2 or 5 If the pH reading does not change when changing from one calibration solution to another then either the cause is a failed PCB (5) or broken electrode (2).
3. A contaminate reference solution (3) will result in both a lower span and higher offset for pH probes.
4. A fouled salt bridge (4) will result in a slower response but not necessarily a narrower span or inaccurate readings. HB Products sells replacement salt bridges at very modest pricing.

5.3. Parts and Accessories

Description	Part #
500 mL pH 4 Buffer Solution	pH 4-500ml
500 mL pH 7 Buffer Solution	pH 7–500 ml
500 mL pH 10 Buffer Solution	pH 10-500ml
Salt bridge kit	SBK-pH

5.4. Sensor Return

If you are returning a probe for inspection, enclose description of the problem. Pack the probe adequately to avoid damage to the glass electrode and ensure that it will not be exposed to temperatures below -5°C . HB Products cannot be responsible for shipping damage nor for damage due to frozen electrodes. For safety reasons, HB Products cannot accept probes which have not been thoroughly cleaned to remove all process material.