



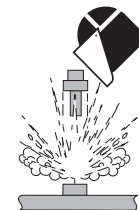
3-2754.090 Rev. E 3/06 English

WARNING!



SAFETY INSTRUCTIONS

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature/pressure specifications.
4. Wear safety goggles or faceshield during installation/service.
5. Do not alter product construction.
6. When using chemicals or solvents care should be taken and appropriate eye, face, hand, body, and/or respiratory protection should be used.



1. Specifications

General

Compatibility: Signet 2750 Electronics
Signet 2760 Preamplifiers

Operating Range:

- pH: 0 to 14 pH
- ORP (Redox): 2765, 2767: ± 1500 mV
2755, 2757: ± 2000 mV
2775, 2777: ± 1500 mV

Wetted Materials (2764 and 2774 series):

- Body: PPS (Ryton®)
- Reference junctions: PTFE (Teflon™)
- Sensing surface: Glass membrane (pH)
Platinum (ORP)
- O-rings: FPM
- Solution ground: carbon graphite (2764 series only)

Wetted Materials (2754-2757 Series):

- Body: CPVC
- Reference junctions: UHMW Polyethylene
- Sensing surface: Glass membrane (pH)
Platinum (ORP)
- O-rings: FPM

Reference Electrolyte:

- 2754 series electrodes: solidified acrylamide gel, KCl
- 2764 series electrodes: Equitransferant reference buffer
acrylamide KNO_3 salt bridge
- 2774 series electrodes: acrylamide gel, KNO_3 / KCl

Reference Element:

Ag/AgCl

Temperature Sensor:

- pH: $3\text{K}\Omega$, PT1000 or 300Ω
- ORP: $10\text{K}\Omega$, PT1000 or 300Ω

Temperature response time τ :

- 2754 electrodes: 140 s
- 2756 electrodes: 196 s
- 2764, 2774, 2776 series: 20 s

Maximum Temperature/Pressure:

Operating Temperature:

- 2764 series: 0°C to 95°C (32°F to 203°F)
- 2774 series: 0°C to 85°C (32°F to 176°F)
- 2754 series: 0°C to 85°C (32°F to 176°F)

Max. Operating Pressure: 6.89 bar @ 95°C
(100 psi @ 203°F)

Storage Temperature: $>0^\circ\text{C}$ (32°F)

Shipping Weight: 0.25 kg (0.55 lbs.)

Standards & Approvals

- Manufactured under ISO 9001:2000 for Quality

2764 series

Differential electrode

2774 series

Bulb electrode

2776 series

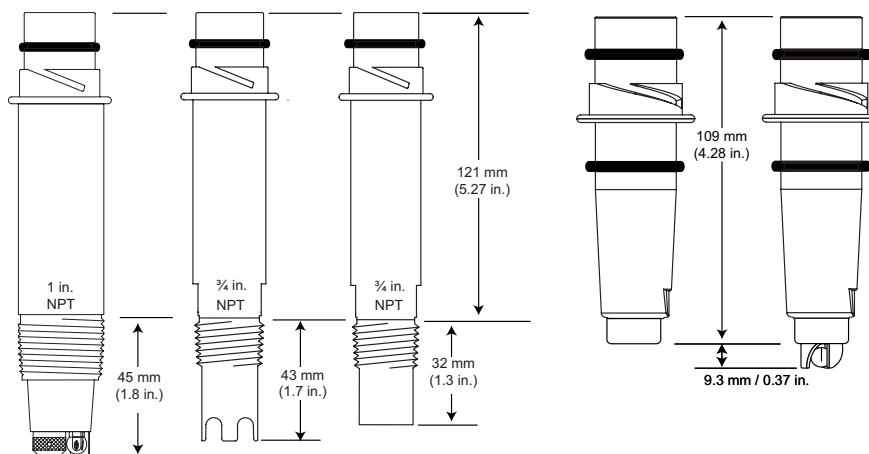
Flat electrode

2754 & 2755

Flat electrode

2756 & 2757

Bulb electrode



2. Electrode care and application

pH/ORP electrodes are similar to batteries; they age with time and usage. The following information will help maximize electrode life.

2.1 Conditions to Avoid:

- High temperatures, strong acids or caustics will elevate electrochemical reactions and speed electrode aging.
- Coatings on the glass or junction surfaces (i.e. proteins) cause extended response time and inaccurate measurement.
- Never store the electrode tip in deionized (DI) water. (Use pH 4 buffer solution to keep the glass wet when out of the process.)
- Never expose electrode to temperatures below 0°C (32°F) or allow it to dehydrate. These conditions will damage the electrode.
- Never scrape or sand the glass electrode surface.
- Treat glass electrode surfaces with care to prevent accidental breakage.

2.2 Submersible Installation Tips:

- Choose a location that keeps the electrode glass completely submerged at all times.
- Mount electrodes in a location with ample clearance for removal.
- Place the electrode tip in pH 4 buffer during system maintenance or storage to avoid dehydration.
- Mount the electrode near tank outlets, away from reagent addition areas.

2.3 In-Line Installation Tips:

- pH and ORP electrodes respond best in moving fluids.
- Standard (2754 series) and Differential (2764 series) electrodes must be mounted at a downward angle (>10° from horizontal). 2774 and 2775 electrodes can be mounted at any angle.

3. pH Electrode Calibration

All pH electrodes are designed to provide linear output during their lifespan. The following sections define proper electrode operation.

3.1 Offset (STD)

Electrode offsets occur due to:

- Clogged reference junction
- Aged or contaminated reference solution/wire

Check offsets in a pH 7 buffer @ 25°C. The theoretical output is 0 mV. Any deviation from 0 mV is the pH electrode offset.

pH Electrode Offset pH 7 buffer @ 25°C Theoretical: 7.0 pH (0.0 mV)
New electrode: pH 7 ± 0.25 pH (±15 mV)
Reliable: pH 7 ± 0.85 pH (± 50 mV)

Electrode offsets greater than 0.85 pH (50 mV) indicate the electrode requires cleaning or replacement. See section 5: Maintenance and cleaning.

| Theoretical mV Values @ 25°C | |
|------------------------------|---------|
| pH | mV |
| 2 | +296 mV |
| 3 | +237 mV |
| 4 | +177 mV |
| 5 | +118 mV |
| 6 | +59 mV |
| 7 | 0 mV |
| 8 | -59 mV |
| 9 | -118 mV |
| 10 | -177 mV |
| 11 | -237 mV |
| 12 | -296 mV |

3.2 Slope (SLP)

Electrode slope is the number of mV per pH unit. At 25°C the theoretical slope is 59.16 mV per pH. Temperature has an appreciable affect on electrode slope. Reliable instrumentation includes temperature compensation. The graph below illustrates potential pH error when a temperature compensated instrument is not used.

Recommendations:

- Calibrate temperature before calibrating the standard and slope.
- The mV offset will track across the entire pH range. The slope is usually not affected by offset changes.
(i.e. pH 7= +10 mV, pH 4= +187 mV); slope = 59 mV
- Coatings on the glass may affect sensor slopes. See section 5 maintenance and cleaning.
- A constant output near 0 mV in all buffer solutions indicates a shorted electrode that must be replaced.

| °C | pH Error | | | | | | | | | | | |
|----|----------|------|------|------|------|---|------|------|------|------|------|--|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| 15 | 0.15 | 0.12 | 0.09 | 0.06 | 0.03 | 0 | 0.03 | 0.06 | 0.09 | 0.12 | 0.15 | |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 35 | 0.15 | 0.12 | 0.09 | 0.06 | 0.03 | 0 | 0.03 | 0.06 | 0.09 | 0.12 | 0.15 | |
| 45 | 0.3 | 0.24 | 0.18 | 0.12 | 0.06 | 0 | 0.06 | 0.12 | 0.18 | 0.24 | 0.3 | |
| 55 | 0.45 | 0.36 | 0.27 | 0.18 | 0.09 | 0 | 0.09 | 0.18 | 0.27 | 0.36 | 0.45 | |

3.3 Response Time/Stability

Response time and stability are affected by the condition of the pH glass measuring surface (ORP electrode - Platinum surface), the reference junction, and the reference solution. Restoration to acceptable levels can often be accomplished by cleaning the measuring surface and reference junction.

Electrode mV values should remain stable ±3 mV. Conditions that may cause fluctuations are:

- Electrode coating
- Ground fault: If proper operation is observed in the beaker, but readings are unstable in the application, a ground fault may exist.
 - Using instrumentation with isolated inputs and outputs may restore stable operation.
 - Solution grounding may also restore stable operation.

4. ORP Electrode Calibration

ORP electrodes are designed to ensure linearity during their lifespan. The following sections define proper electrode operation.

4.1 Offset (STD)

- Electrode offsets are usually caused by clogged reference junctions or by aged or contaminated reference solution/wire.
- Offsets should be checked in pH 7 buffer saturated with quinhydrone @ 25°C. The theoretical output is +86 mV. Any deviation from +86 mV is the ORP electrode offset (i.e. +90 mV).
- Quinhydrone is the oxidizer measured by the ORP electrode and is required for calibration. To measure ORP electrode offset, saturate 50 mL of pH 4 and pH 7 buffers with ½ g quinhydrone:

| | 4 pH w/Quinhydrone | | | 7 pH w/Quinhydrone | | |
|-------|--------------------|--------|--------|--------------------|-------|-------|
| Temp: | 20°C | 25°C | 30°C | 20°C | 25°C | 30°C |
| ORP: | 268 mV | 263 mV | 258 mV | 92 mV | 86 mV | 79 mV |

A new ORP electrode measures these values ± 15 mV. The electrode continues to be functional until the offset from these values exceeds 50 mV. Electrodes with offset greater than 50 mV should be cleaned and replaced if necessary.

4.2 Slope (SLP)

ORP slope errors are generally caused by contamination of the platinum electrode surface. Cleaning the electrode surface will usually restore proper values, response time, and stability. See section 5: Maintenance and Cleaning.

Many systems require both pH and ORP calibration. To conserve calibration reference solutions, use pH 7 and 4 buffers for pH calibration first. ORP calibration can be performed with the same buffers by adding quinhydrone.

5. Maintenance and Cleaning

5.1 Maintenance

Variables can affect long term pH or ORP electrode life. For this reason, a maintenance log is recommended for trend analysis. When storing boxed sensors, lay the sensor flat to maximize hydration of the glass surface. Keep the glass surface wet at all times. Soak the sensor tip in pH 4.0 buffer during system maintenance intervals. In-line applications should be plumbed with a depression (trap) so liquid is maintained around the sensor tip. If the sensor dehydrates, soak the sensor tip in pH 4 buffer for 24 to 48 hours, then visually inspect the electrode for surface cracks, swelling, or discoloration. Severely dehydrated electrodes cannot be restored to normal operation.

5.2 Cleaning

Cleaning techniques vary depending on the type of coating present on the glass electrode surface or reference junction.

- Soft coatings can be removed by vigorous stirring, or with directed spray of an applicable detergent or solvent onto the glass surface. Chlorine bleach or mild detergent can be used to remove soft coatings. Always rinse electrode tip in clean water after cleaning.
- Hard coatings can be chemically removed. Use the least harsh chemical which will remove the contaminant within two (2) minutes without attacking the materials of construction. e.g. calcium carbonate may be removed with a 5% HCL (muriatic acid) solution.
- Oily or organic coatings can be removed with detergents or an appropriate solvent that does not attack the materials of construction e.g. isopropyl alcohol may be used but acetone must be avoided to prevent damage to the CPVC sensor body.
- ORP electrode surface (platinum rod) can be gently sanded with 600 grit wet and dry silicone or carbide sandpaper, jewelers rouge, crocus cloth, or very fine steel wool.

5.3 Differential Electrodes

Differential electrodes have a replaceable salt bridge and the electrolyte chamber can be refilled.

The electrolyte chamber should be full. If any fluid is audible when shaken, the chamber should be refilled.

Refill the electrolyte chamber when the electrode offset exceeds 50 mV.

The salt bridge should be replaced when performance becomes sluggish, or if the output is erratic or inaccurate.

Replacing the salt bridge

Parts Required: Salt Bridge (order number 3864-0001) and Differential Reference Solution (order number 3864-0002)

Tools Required: small pliers

1. Remove sensor from mounting.
2. Hold upside down and unscrew salt bridge using a pair of small pliers. Be careful not to damage the glass bulb!
3. Drain the depleted reference solution and dispose of properly.
4. Fill reference chamber with fresh reference solution (approx. 30 ml).
5. Replace salt bridge and screw finger tight. Solution will drip out while screwing in salt bridge. Use pliers to turn approximately ¼ turn past finger-tight.
6. Perform calibration (standard and slope) before returning the system to service.



NOTE:

The refillable electrolyte chamber in 2764 series Differential electrodes may leak during storage and shipping. Check the fluid and refill before installation if necessary.



WARNING!

Wear appropriate eye, face, hand, body, and respiratory protection when using chemicals or solvents.

Ordering Information

| Mfr. Part No. | Code | Description |
|--------------------------------------|-------------|---|
| DryLoc pH Electrodes | | |
| 3-2754 | 159 000 747 | Electrode, pH, DryLoc, flat, PT1000 |
| 3-2754-1 | 159 001 380 | Electrode, pH, DryLoc, flat, 3K Ω |
| 3-2754-HF | 159 000 748 | Electrode, pH, DryLoc, flat, PT1000, HF-resist (<2%) |
| 3-2754-HF-1 | 159 001 381 | Electrode, pH, DryLoc, flat, 3K Ω , HF-resist (<2%) |
| 3-2756 | 159 000 750 | Electrode, pH, DryLoc, bulb, PT1000 |
| 3-2756-1 | 159 001 397 | Electrode, pH, DryLoc, bulb, 3K Ω |
| 3-2756-DI | 159 000 751 | Electrode, pH, DryLoc, bulb, PT1000, DI (<100 μ S) |
| 3-2756-DI-1 | 159 001 382 | Electrode, pH, DryLoc, bulb, 3K Ω , DI (<100 μ S) |
| 3-2764-1 | 159 000 943 | Electrode, pH, DryLoc, flat, 3K Ω , differential, 1 in. NPT process connection |
| 3-2764-2 | 159 000 944 | Electrode, pH, DryLoc, flat, PT1000, differential, 1 in. NPT process connection |
| 3-2764-3 | 159 000 945 | Electrode, pH, DryLoc, flat, 300 Ω , differential, 1 in. NPT process connection |
| 3-2766-1 | 159 000 949 | Electrode, pH, DryLoc, bulb, 3K Ω , differential, 1 in. NPT process connection |
| 3-2766-2 | 159 000 950 | Electrode, pH, DryLoc, bulb, PT1000, differential, 1 in. NPT process connection |
| 3-2766-3 | 159 000 951 | Electrode, pH, DryLoc, bulb, 300 Ω , differential, 1 in. NPT process connection |
| 3-2774 | 159 000 955 | Electrode, pH, DryLoc, flat, 3K Ω , 3/4 in. NPT process connection |
| 3-2774-1 | 159 000 956 | Electrode, pH, DryLoc, flat, PT1000, 3/4 in. NPT process connection |
| 3-2776 | 159 000 959 | Electrode, pH, DryLoc, bulb, 3K Ω , 3/4 in. NPT process connection |
| 3-2776-1 | 159 000 960 | Electrode, pH, DryLoc, flat, PT1000, 3/4 in. NPT process connection |
| DryLoc ORP (Redox) Electrodes | | |
| 3-2755 | 159 000 749 | Electrode, ORP, DryLoc, flat, 10K Ω ID |
| 3-2757 | 159 000 752 | Electrode, ORP, DryLoc, bulb, 10K Ω ID |
| 3-2765-1 | 159 000 946 | Electrode, ORP, DryLoc, flat, 10K Ω ID, differential, 1 in. NPT process connection |
| 3-2765-2 | 159 000 947 | Electrode, ORP, DryLoc, flat, PT1000, differential, 1 in. NPT process connection |
| 3-2765-3 | 159 000 948 | Electrode, ORP, DryLoc, flat, 300 Ω , differential, 1 in. NPT process connection |
| 3-2767-1 | 159 000 952 | Electrode, ORP, DryLoc, bulb, 10K Ω ID, differential, 1 in. NPT process connection |
| 3-2767-2 | 159 000 953 | Electrode, ORP, DryLoc, bulb, PT1000, differential, 1 in. NPT process connection |
| 3-2767-3 | 159 000 954 | Electrode, ORP, DryLoc, bulb, 300 Ω , differential, 1 in. NPT process connection |
| 3-2775 | 159 000 957 | Electrode, ORP, DryLoc, flat, 10K Ω ID, 3/4 in. NPT process connection |
| 3-2775-1 | 159 000 958 | Electrode, ORP, DryLoc, flat, no tc, 3/4 in. NPT process connection |
| 3-2777 | 159 000 961 | Electrode, ORP, DryLoc, bulb, 10K Ω ID, 3/4 in. NPT process connection |
| 3-2777-1 | 159 000 962 | Electrode, ORP, DryLoc, bulb, no tc, 3/4 in. NPT process connection |

Accessories and Replacement Parts

| Mfr. Part No. | Code | Description |
|---------------|-------------|--|
| 3-2750-1 | 159 000 744 | In-line Sensor Electronics w/Junction Box |
| 3-2750-2 | 159 000 745 | In-line Sensor Electronics w/Junction Box and Easy-Cal |
| 3-2750-3 | 159 000 746 | Submersible Sensor Electronics with 15 ft. cable, 3/4 in. NPT threads |
| 3-2750-4 | 159 000 842 | Submersible Sensor Electronics with 15 ft. cable, ISO 7-1/R3/4 threads |
| 3-2760-1 | 159 000 939 | Submersible Preamplifier with 3/4 in. NPT threads and 4.6 m (15 ft.) cable |
| 3-2760-2 | 159 000 940 | Submersible Preamplifier with 3/4 in. ISO threads and 4.6 m (15 ft.) cable |
| 3-2760-3 | 159 000 941 | Submersible Connector with 4.6 m (15 ft.) cable and 3/4 in. NPT threads |
| 3-2760-4 | 159 000 942 | Submersible Connector with 4.6 m (15 ft.) cable and ISO 7/1R 3/4 in. threads |
| 3-2760-11 | 159 001 367 | In-line Preamplifier with 3/4 in. NPT threads and 4.6 m (15 ft.) cable |
| 3-2760-21 | 159 001 368 | In-line Preamplifier with 3/4 in. ISO threads and 4.6 m (15 ft.) cable |
| 3-2760-31 | 159 001 369 | In-line Connector with 4.6 m (15 ft.) cable and 3/4 in. NPT threads |
| 3-2760-41 | 159 001 370 | In-line Connector with 4.6 m (15 ft.) cable and ISO 7/1R 3/4 threads |
| 3-0700.390 | 198 864 403 | pH Buffer Kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 mL) |
| 3864-0001 | 159 001 007 | Replacement Salt Bridge for Differential electrodes |
| 3864-0002 | 159 001 008 | Reference solution refill for Differential electrodes, 500 mL (approx. 12 refills) |
| 5523-0624 | 159 000 636 | Cable, 6 conductor, 24 AWG, shielded |
| 3-2759 | 159 000 762 | pH/ORP System Tester (adapter cable sold separately) |
| 3-2759.391 | 159 000 764 | 2759 DryLoc Adapter Cable (for use with 2750 and 2760) |



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