OPERATION AND
SERVICE GUIDE
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TROUBLE SHOOTING
pH INSTRUMENTATION AND CONTROLS

ISOLATE THE PROBLEM TO:

1. The instrument
2. The electrode
3. The extension cable or electrode installation

INSTRUMENT CHECKOUT

A. Short the input with a shorting strap, shunt or paper clip by connecting the center conductor to the shell of the BNC probe connection.
   1. The instrument should span from pH 5 to 9 when the calibration knob is turned from full left to full right.
   2. Some instruments will have a 10 turn calibration knob and will span from 0 to 14 pH.
   3. If the instrument is offset for antimony electrodes,(Optional Feature) the span will be below 0 to 4 or 5 pH.
   4. Adjust the calibration knob to read pH 9 and turn the temperature knob from 0° to 100°C. The reading should change almost a full pH unit.
   5. If the pointer doesn't move:
      a. Check the wire to the meter for a short or a loose connection.
      b. If possible, move the instrument to see if the pointer will move. If the pointer is stuck, remove the meter and remove the cover. Carefully check and remove the obstruction. The meter zero adjust may have broken and jammed the movement; the mechanical zero adjust is not necessary in most pH measurements.
   6. If the meter drifts,is erratic or is full upscale or downscale with the BNC shorted, the electronics may need service. Consult your dealer or the factory.

B. Set the indicator to pH 7 with the calibration knob.
   1. Rotate the set point knob through the indicator value. There should be relay actuation and the lamp should go on or off. Power at the output terminals should also go on or off.
   2. On some older instruments the set point lamp will go on only above the set point. In these instruments there are separate output connections for alkaline and acid feeder.
   3. Newer instruments have a switch on the set point circuit board to select for above or below set point operation. These controllers have outputs labeled line and common.
   4. Some instruments are wired for a contact closure only (Optional). These will show an open or closed measurement with an ohmmeter.
   5. Series wired set points (Interwired set points) (Optional).
      a. In this case a second set point will also have an effect on set point output. The most common case is that the first set point has to be on and the overrange safety set point has to be on.
      b. With the first set point on, rotate the second set point to see if it will control the output. Generally, the second set point will interrupt feed if the pH goes above the second set point.

ELECTRODE CHECKOUT

The problems involving the pH electrode are of the two general types.

1. The electrode gives a stable reading but doesn't respond to pH.
2. The electrode is slow to respond, drifts, has short span between buffers, or cannot be calibrated to buffer values.

A. Stable pH but no response to pH buffers.
Connect the electrode to the meter and set the meter to read millivolts. Immerse the electrode in pH 7.00 buffer solution.
   a. If the reading is zero millivolts, there is a short in the electrode or the cable. An electrical short in the cable can sometimes be repaired. A short inside the electrode cannot be repaired and the electrode should be replaced.
   b. The reading is + 160 to + 180 millivolts.
   This indicates that there is a crack in the pH-sensitive bulb. In combination electrodes this cannot be repaired. In a two-electrode system, the glass electrode will have to be replaced.
   c. The reading is between zero and + 120 millivolts
   This is caused by a crack between the pH half of the electrode and the reference cell in a combination electrode. Occasionally this type of reading will be caused by severe contamination of the reference portion of the electrode.The electrode will still respond to ph changes, but the reading will be offset.

B. Unstable pH response.
Set the meter to read pH and cycle the electrode between 4.01, 7.00 and 9.18 buffer solutions.

(over)

Allow at least three minutes for each reading.

a. Slow response or compressed span.
   1. Dirty or contaminated glass bulb: even a fingerprint can cause this type of response.
   2. Clogged reference junction
      Immerse the electrode in filling solution and using a water bath, temperature-cycle from room temperature to 80°C for 5 to 15 minutes. Allow the electrode to cool before removing from the filling solution. This works well with sealed electrodes.

b. Short span between buffers.
   1. High resistance short in the electrode, cable or connector. Can be caused by dirt or moisture in the connector. This can be cleaned with alcohol.
   2. Inexpensive pH meter with low input impedance.
      Serfilco instruments typically have an input impedance of 1 x 10-12 and can be used with almost any electrode. This type of failure is not a problem with our instruments.

C. Drifty and Unstable readings.
   1. Clogged reference junction (See "Slow Response").
   2. Sample of very low ionic strength.
      a. Causes precipitation of silver chloride in the reference junction.
      b. Increases the sensitivity of the electrode to electrostatic field pick up.
   3. Protein interference in the reference junction.

D. Cannot calibrate to buffers; Offset from 7.00
   1. Caused by contaminated reference solution in a refillable electrode. Empty the reference solution. Rinse, refill and retest.
   2. Using a millivolt meter, connect the good reference to plus and the reference under test to minus. The voltage difference between the two should be less than 10 mv and the nominal value would be less than 5 mv. The same values hold true for calomel references. A calomel reference compared to a silver chloride reference will show an offset of 44 mv.

EXTENSION CABLES AND ELECTRODE INSTALLATION

A. Extension cable failure
   1. The BNC shell has become grounded. There should be more than 100 megohms between the BNC shell and instrument and solution ground.
   2. The cable is shorted
      a. There should be more than 100 megohms between the center conductor and the shell of the BNC connector. If a high resistance short is found, it may be caused by moisture in the BNC. Clean with alcohol and retest.
      b. A low resistance short is caused by the shield coming in contact with the center conductor of the cable. In this case replace the cable.
   3. The cable is open and should be replaced.
      a. There should be continuity between the shell at one end and the shell at the other.
      b. There should be continuity between the center contacts at both ends of the cable.

B. Electrode Installation
   1. The electrode should be deep enough into the solution so that both the reference and the glass bulb are submerged.
   2. The electrode should be close to vertical with the pH bulb down.
   3. The BNC connector should be insulated from any electrical ground potential.
   4. In some installations the sample sclution will have to be grounded in order to have accurate readings, and normal electrode life.

OTHER FAILURE CONDITIONS

A. The instrument reacts when a solenoid (not supplied) or valve turns on or off..
   1. Improper grounding of the instrument or solution.
   2. Low voltage to the instrument, causing the instrument to fall out of regulation.

B. pH measurements are not stable or controller is unable to stabilize the sample.
   1. Insufficient mixing of the sample.
   2. The electrode and the neutralizer feeder are too close together or too far apart.

C. Instrument calling for feed and no indication of pH change.
   1. Lack of neutralizer in the supply tank.
   2. Failure of the feed solenoid to open; frozen or jammed.
   3. Lack of agitation in the neutralization tank, or loss of sample flow past the electrode.
   4. Fuse blown at the instrument, and no voltage to the feeder.
   5. Override switch on the instrument in the off position.

D. Instrument not calling for feed and pH changing.
   1. Solenoid or valve stuck in the open position.
   2. Instrument relay stuck in the on position.

E. Instrument calibrates correctly in buffers but will not read pH correctly in the sample
   1. The BNC has become grounded in the electrode system.

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