INSTRUCTION MANUAL

pH/mV CONTROLLER/RECORDER

TOWN & COUNTRY PLASTICS

Customized For Precision

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(732) 780-5300

LIMITED ONE YEAR WARRANTY

Manufacturer warranties all instruments (excluding batteries, damage caused by batteries, probes, standards, buffers) against defects in materials and workmanship for one year from date of original purchase. During this warranty period, the manufacturer will repair or at their option, replace at no charge a product which proves to be defective, provided the product is returned, shipping prepaid to the manufacturer's service center.

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Note: pH buffers will deteriorate if left exposd to the atmosphere. Keep tightly closed. ph 10 buffers deteriorate very quickly when exposed to the air.

NOTE: pH calibration is not permanent. It should be done on a regular basis, or any time the pH reading response becomes slow and/or erratic.

15.1 TROUBLESHOOTING GUIDE

Both the single and dual probe controllers are designed for maximum unattended operation on a continuous basis. Use the following steps to isolate a problem and determine a probable solution.

a. To check electrode.
   1. Move mV-Stby-pH switch to Stby. If the pointer was off scale, pointer should return on scale.
   2. Using the Set adjust knob, the meter pointer should travel the full scale.
   3. Problem is probably in the probe side including the BNC connectors.

b. To check instrument operation.
   1. Exchange pH probe and determine if meter is functioning correctly.
   2. With toggle switch in the Stby position, if the analog meter pointer remains off scale, then the instrument is at fault.

Note: Call distributor for further repair information.

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1.0 INTRODUCTION

This pH/mV controller is either a single or dual probe pH/mV controller enclosed in a bench style aluminum case or a NEMA enclosure. Some models have an independent pH monitor/recorder built into the case. Dual probe input models function as a primary site pH/mV controller with a separate pH/mV monitor/recorder located at a secondary site.

Bench models are protected by the aluminum case from normal environmental conditions. The NEMA cabinet protects the internal solid state components and meter functions from adverse environmental conditions. The pH/mV readings are displayed on a six inch mirror-backed analog meter. All models are equipped with a 1Ox scale expansion capability for use in critical pH/mV measurement and control situations.

2.1 SPECIFICATIONS

2.2 Controller

pH Range	0 - 14 pH
mV Range	± 900 mV
Control Limits	
High pH	0 - 14 pH
mV	± 900 mV
Low pH	0 - 14 pH
mV	± 900 mV
Power Consumption	55 watts @ 115/230V (maximum)
Power Output	350 watts @ 115V
Manual Temperature Compensation	0 - 100°
Alarm Signal Output	3.5V PP (Squarewave) 20mA

2.2 Recorder

pH Range	0 - 14
Accuracy	2% Full Scale
Response	1 sec. Full Scale

13.1 EXPANDED MILLIVOLT (mV) OPERATION

a. Place mV-Stby-pH switch to Stby.
b. Use Set control knob and adjust analog meter pointer to pH 7.00 or 0 mV (mV scale).
c. Adjust Exp-Norm toggle switch to Exp and readjust meter pointer to O mV using Set control knob.
d. The controller is now calibrated for expanded scale miliivolt (mV) operation. The full scale of the meter face now reads ±70 millivolts (mV).

Note: The single probe with recorder model will respond in the expanded mode.

14.1 pH BUFFERS & ELECTRODES

14.2 Three buffers are normally used to calibrate pH controllers. A pH 7 buffer is use to SET the meter. Then a pH 4 or 10 is used along with the slope knob. Use the buffer which is closest to the pH range you will be measuring. If your use will span the entire pH range, the instrument would be calibrated with two buffers and checked with the third.

14.2 Check meter needle position before calibrating. The needle position should be checked with the meter turned off. If the needle does not read zero, then use the mechanical zero screw to adjust needle to zero.

14.3 The electrode tip should always be immersed completely. Freshly poured buffers should be used for each calibration.

NOTE: DO NOT POUR USED BUFFERS BACK IN THE STOCK CONTAINER. This will contaminate the good standards and give inaccurate results.

14.4 Between readings, rinse the electrode with distilled water and carefully shake dry. CAUTION: Do not wipe the electrode. Wiping can cause static electrical charges which can result in faulty readings.

14.5 Rinse pH electrode and repeat calibration procedure using fresh buffers if pH 10.00±0.10 limit was not observed.

mode to read full scale pH 3.00 to 4.40 pH units.

1. pH 0.00 is equal to pH 3.00
2. pH 1.00 is equal to pH 3.10
3. pH 2.00 is equal to pH 3.20
4. pH 10.00 is equal to pH 4.00
5. pH 11.00 is equal to pH 4.10
6. pH 14.00 is equal to pH 4.40

Note: Only the SET control knob should be used for pH/mV offset. The single probe with recorder model will respond as the pH meter pointer and reflect the scale expansion. Make a note on recorder paper about new scale. The dual probe controller can be used in the expanded mode, but the recorder portion cannot be used in the expanded mode since it monitors pH at a second site.

11.0 mV OPERATION

12.1 SPECIFIC-ION OR ORP OPERATION

a. Connect the specific-ion or ORP electrode to the controller. Note: an adaptor may be necessary to connect a U.S. standard connector to the BNC input.
b. Exp-Norm switch in the Norm position.
c. Immerse electrode(s) in appropriate standard. Note millivolt reading.
d. Adjust Set control knob so analog meter pointer is midscale - 0 mV.
e. Meter is now adjusted to ± 90mV full scale from original millivolt reading.

The net millivolt (mV) change with some specific-ion or ORP electrodes may be small, thus the need for scale expansion.

3.1 INSTRUMENT FAMILIARITY

3.2 Bench Models

Front Panel

OFF-ON	Main Power Switch.
Power Light	Main Power Indicator.
$^1/_4$ Amp. Fuse	Fuse for electronic components. Located on back panel of bench models.
High Control	Adjustable set control for High limit set point.
High LED	High limit indicator.
High TD	An adjustable Time Delay (TD) safety feature which prevents over addition of neutralization solutions. Time Delay (TD) interval (0 -10 min.) determines the time that power is available to the High side output terminals after the High limit set point is exceeded. If the Time Delay (TD) expires, the Alarm LED activates and output power is terminated.
Low Control	Adjustable set control for Low limit set point.
Low LED	Low limit indicator.
Low TD	An adjustable Time Delay (TD) safety feature. Time Delay (TD) interval (0 - 10 min.) deter mines the time power is available to the Low side output terminals after the Low limit set point is exceeded. If the Time Delay (TD) expires, the Alarm LED activates and output power is terminated.
Alarm LED	Alarm indicator flashes intermittently when either High or Low Time Delay (TD) expires.
mV-Stby-pH	Function switch (3 position), sets controller function. Millivolts (mV) - Standby (Stby) - pH.
Temp°C	Manual Temperature (Temp. °C) Compensation for monitored pH. Not operable in mV mode.

3.1 Bench Models... (Continued)

Exp-Norm	Expanded (Exp) or Normal (Norm) meter scale operation.
Set	Adjustable control to set pH/mV meter calibration, i.e. pH 7.00. May also be used to offset meter.
Slope	Slope adjustment to calibrate pH meter, i.e. pH 4.00. Located on back panel of bench models.

Back Panel

8 Amp	8 Amp fuse to output terminals.
1/4 Amp.Fuse	Fuse for electronic components.
HIGH	High output terminal. AC receptical to power external pump, solenoid, or relay for pH/mV control when High Limit is exceeded.
Man-Off-Auto	Three-position toggle switch. Man - manual "On" position is used to power and test external device. Off- Off position to external device. Auto - Functional mode for pH/mV controller operation. Activated by exceeding High Limit.
LOW	Low output terminal. AC receptical to power external pump, solenoid, or relay for pH/mV control when Low Limit is exceeded.
Man-Off-Auto	Three-position toggle switch. Man - manual "On" position is used to power and test external device. Off- Off position to external device. Auto - Functional mode for pH/mV controller operation. Activated by exceeding Low Limit.
pH (BNC)	Female BNC connector for pH/mV electrode input.
REF (black)	Terminal input post for separate pin reference electrode (pH, ORP, REDOX). Note: for pH pin reference (Black) unscrew terminal post exposing a 1 " diameter hole. Insert reference pin and tighten.

b. Adjust temperature compensation (Temp °C) to temperature of pH buffer.
c. Place pH probe in pH 7.00 buffer.
d. Adjust recorder pen to pH 7.00 using recorder SET control.
e. Rinse probe with deionized or distilled water.
f. Place probe in pH 4.00 buffer.
g. Adjust recorder pen to pH 4.00 using recorder SLOPE control.
h. Rinse probe.
i. Check calibration and linearity by using pH 10.00 buffer. Place probe in pH 10.00 buffer. Recorder pen should be 10.00± 0.10 pH units.
j. Rinse probe.
k. Recorder/monitor is now calibrated and ready for use.
l. Check recorder paper length and adjust temperature compensation knob to test solution temperature.

10.1 EXPANDED pH OPERATION

This controller has expanded mode capabilities. The scale expands 10 times (10x) which allows the operator to monitor and control such changes in critical pH/mV measurements. i.e. pH, specification and ORP/Redox systems.

a. Controller pH meter must be calibrated in the normal mode to determine slope adjust before use in the expanded mode.
b. Place pH probe in an appropriate buffer or solution of known pH, i.e. pH 4.00.
c. With the Set control knob, adjust meter pointer to pH 7.00. This prevents an electrical jolt to meter needle when the meter is switched from normal mode to expanded mode.
d. Switch position of Exp-Norm from Norm to Exp mode of operation.
e. Adjust meter pointer to pH value of 10.00 using the set control knob.

f. Now the analog pH meter is adjusted in the expanded

8.2 Calibration of Recorder - Without Buffers

a. Place function switch to Standby (Stby).
b. Use controller Set control knob to adjust analog meter to pH 7.00.
c. Adjust recorder pen to pH 7.00 using recorder Zero knob.
d. With the Set control knob, adjust analog meter to pH 2.00.
e. Recorder pen should follow analog meter pointer.
f. Adjust recorder pen to match analog meter pointer using Recorder Gain adjust. Both analog meter and recorder pen should read pH 2.00.
g. Restandarize controller pH using pH 7.00 buffer and Set control knob.
h. To operate without the recorder, the recorder input plug can easily be disconected inside the instrument panel on the reverse side of recorder.

Both controller and recorder are now calibrated.

9.1 RECORDER CALIBRATION - DUAL PROBE

The dual probe model is a pH/mV controller with an independent pH monitor/recorder in a NEMA case. Two probes are required, a primary probe for the pH/mV controller function and a secondary probe for downstream monitoring and recording.

a. Connect second probe to recorder pH input (BNC) on the right side of case.

Back Panel (Continued)

RDX (red)	Terminal input post for ORP or REDOX electrode.
Slope	Slope adjustment for calibrating analog pH meter. Located on front panel of NEMA models.
Alarm	Alarm Output terminals Black (-) Red (+). Alarm is a pulsed 3.5 VDC, pp, 20mA.
Zero	Recorder zero adjustment screw. Set to match pH/mV meter reading i.e. pH 7.00.
Slope	Recorder Slope adjustment screw. Set to match pH/mV meter reading i.e. 4.00.

3.2 NEMA Single Probe Controller/Recorder Models

This model is basically the model in section 3.1 with an additional recorder function. The recorder operates when the pH/mV function is activated. There are additional recorder controls to adjust the recorder pen to match the analog meter function.

Recorder Controls

Zero	Recorder zero adjstment knob to match pH/mV meter set reading, i.e. pH 7.00.
Gain	Recorder gain adjustment knob to match pH meter/mV set reading (similar pH slope adjustment), i.e. pH 4.00.

3.3 NEMA Dual Probe Input/Recorder Model

Basically the above model (section 3.2), capable of performing pH/mV controller functions, plus an additional pH meter with independent recorder/monitor function. Two separate monitoring probes allow controller functions at a system's primary site and pH recording and monitoring at a secondary site downstream.
Appropriate pH set controls are incorporated for independent pH recorder applications.

Recorder Controls

Power Switch	Three position power switch.
OFF	All power is off.
ON	Controller power on.
ON REC	Controller and recorder power on.

3.3 NEMA Dual Probe Input/Recorder Model (Continued)

Temp°C	Manual Temperature (Temp °C) Compensation for recorder pH probe.
Set	Recorder set adjust for pH calibration, i.e. pH 7.00.
Slope	Recorder slope adjust for pH calibration, i.e. pH 4.00.

4.0 INTERNAL TERMINAL STRIP - NEMA MODELS ONLY

A twelve pin terminal strip is located behind the instrument panel on the left inside vertical panel of the supporting frame. Access is made by opening the hinged instrument panel (loosen the two thumb screws on the right of the panel). The terminal strip is numbered from the top to bottom (1 to 12).

Pin #	Case Ground {GND) for main input Power
1	Main input power AC 1
2	Main input power AC 2
3	High Output Power AC 1
4	High Output Power AC 2
5	High Output Power Ground (gnd)
6	Low Output Power AC 1
7	Low Output Power AC 2
s	Low Output Power Ground (gnd)
9	Not Used
10	Not Used
11	Alarm Output Positive (+)
12	Alarm Output Negative (-)

4.1 Solid State Relays

Minimum load of 75 mA.

5.0 pH CONTROLLER OPERATION

The basic controller allows an operator to monitor and control either the pH or millivolts of a solution, slurry or aqueous mixture by using pumps, solenoids, or relays with suitable reagents. The determination of the High and Low control set points in the pH mode and the calibration of the analog pH meter using standard buffers, i.e., pH 4.00, 7.00, 10.00, insure correct application of the pH/mV controller.

j. Check calibration and linearity of probe by using pH 10.00 buffer. Place probe in pH 10.00 buffer. The meter should read 10.00±0.10 pH units.
k. Rinse probe. pH controller is now calibrated and the High and Low control setpoints determined with the Time Delay (TD) intervals set.

8.0 RECORDER CALIBRATION - Single Probe

The recorder monitors the pH/mV for 30 days on a continuous basis with one roll of chart paper. Check the agreement between the analog meter and the recorder pen by adjusting the recorder zero (similar to pH set) and recorder gain (similar to slope adjust on pH function).

Note: These adjsutments of the recorder response may also be done during pH calibration of the analog meter. This completes recorder calibration for the single probe with recorder model .

8.1 Calibration of Recorder - Controller pH Method

a. Turn function switch to pH mode.
b. Place Exp-Norm switch in the Norm (Normal) mode.
c. Set the Temperature compensation switch to the buffer temperature.
d. Place pH probe in pH 7.00 buffer.
e. Adjust analog meter pointer to pH 7.00 using controller Set knob.
f. Adjust recorder pen to pH 7.00 using recorder Zero Set knob.
g. Rinse probe with deionized or distilled water.
h. Place probe in pH 4.00 buffer.
i. Adjust analog meter pointer to pH 4.00 using controller Slope knob.
j. Adjust recorder pen to pH 4.00 using recorder Gain knob.
k. Rinse probe.
I. Check calibration and probe linearity by using pH 10.00 buffer. The analog meter pointer and recorder pen should both read pH 10.00±0.10 units. Rinse probe.

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This completes the High and Low setpoint adjustments. In this example, the High limit is set at pH 9.50 and the Low limit is set at pH 8.00. As long as the pH of the monitored solution remains within these limits, the controller will not be activated. If the pH falls below pH 8.00 or rises above pH 9.50, then the controller will activate and apply current to the appropriate output terminals. If the pH remains outside these limits for longer then the preset Time Delay (TD) interval (10 minutes max.), then the alarm light will start flashing, provide a pulsed 3.5V ,pp, 20mA current to the alarm output terminals and disconnect the power to the output terminals.

6.8 mV Control Set-Up

Note: Appropriate controller set points for mV are adjusted in either the expanded or normal mode. These adjustments are made similarly to pH set points. With the set control knob, the analog meter can be offset ± 900 mV.

7.1 CALIBRATION OF THE ANALOG pH METER

a. Function switch must be in the pH mode.
b. Exp-Norm switch in the Norm (normal) mode.
c. Standard pH 4.00, 7.00, and 10.00 buffers are suggested for calibration purposes.
d. Place pH electrode in pH 7.00 buffer.
e. Adjust analog meter to pH 7.00 using the Set knob.
f. Rinse probe with deionized or distilled water.
g. Place probe in pH 4.00 buffer.
h. Adjust analog meter to pH 4.00 using Slope adjustment.
i. Rinse probe.

6.1 CONTROL SETUP

6.2 Bench Models - Device Setup

a. Connect controller to AC power.
b. Connect solenoids, pumps, or relays to appropriate outlet (HI/Low) on the back of controller.
c. Test external devices using the Man-Off-Auto switch. In the Man mode, power is available to activate the external devices, solenoids, etc.. Note: for controller operation, the switch must be in the Auto mode.
d. Connect pH or ORP/REDOX electrode to appropriate input.

6.2 NEMA Models - Device Setup

This is an electrical setup and should be done by a qualified person.
a. Install controller using appropriate mounting holes in the NEMA case. Allow sufficient space to open front cover.
b. Carefully connect main input power to pins #1 and #2 and grounding hex nut (ground).
c. Connect High control device leads to pins #3,4, and 5. Pin #5 is a ground.
d. Connect Low ocontrol device leads to pins #6,7, and 8. Pin #8 is a ground.
e. Connect alarm to pins #11 and #12. Pin #11 is positive and pin #12 is negative. Alarm is pulsed 3.5 VDC, pp, 20mA output.
f. Connect pH electrode(s) to BNC connector(s) on right side of NEMA case. NOTE: The upper input on the Dual Probe unit is marked recorder pH input. The lower input is marked controller pH input. *Only pH can be monitored on the recorder.*

6.3 Front Panel Preset - Bench Models

a. Set manual temperature (Temp0) compensation to the temperature of monitoring solution (pH only).
b. Norm-Exp is set to Norm (Normal).
c. Set High limit at pH 14.00 (full clockwise).
d. set Low limit at pH 0 (full clockwise).
e. Set mV-Stby-pH to pH mode.
f. Adjust both High and Low Time Delays (TD) to a maximum time delay of 10 minutes (full clockwise).
h. Turn power switch ON.

6.4 Front Panel Preset - NEMA Models

a. Set manual temperature (Temp0) compensation to the temperature of monitoring solution (pH only).
b. Dual probe models only: Adjust manual temperature compensation for recorder pH probe.
c. Set Exp-Norm to Norm (Normal).
d. Set High limit at pH 14.00 (full clockwise).
e. Set Low limit at pH O (full clockwise).
f. Set mV-Stby-pH to pH mode.
g. Adjust both High and Low Time Delays (TD) to a maximum time delay of 10 minutes (full clockwise).

h. Turn power switch ON.

6.5 High Limit Set-Up

a. Manually adjust analog meter pointer to desired high control limit using the SET control knob. i.e. pH 9.50.
b. Turn High control knob counterclockwise until the High LED lights up.
c. Check limit (pH 9.50) by slowly turning Set control to move the analog meter pointer (indicator) back and forth through the desired High pH limit. At a pH value just under the High limit, the High LED will remain off. As the pointer reaches pH 9.50 or greater, the High LED will activate, indicating that power is available to the High control output terminal.

6.6 Low Limit Set Up

a. Manually adjust analog meter pointer to desired set point using the SET control knob. i.e. pH 8.00.
b. Turn Low control set knob counterclockwise until the Low LED lights up.
c. Check set point (pH 8.00) by slowly turning Set control to move the analog meter pointer (indicator) back and forth through the desired Low pH set point. At a pH value just under the Low set point, the Low LED will remain off. As the pointer reaches pH 8.00 or less, the Low LED will activate, indicating that power is available to the Low controller output terminal.
d. Slight adjustment of Low Control set may be necessary to define a certain pH or set point.

6.7 Time Delay Set-Up

a. Adjust High or Low Time Delay (TD) while the appropriate LED is activated. Note: Time Delay intervals can be set for a maximum (clockwise) 10 minutes and a minimum (counterclockwise) less than 20 seconds.
b. Turn Time Delay (TD) to a minimum (counterclockwise).
c. Alarm LED will activate and flash intermittently indicating that the Set Point has been exceeded for longer than the Time Delay (TD) will allow (less than 20 seconds).
d. With the flashing alarm LED activated, output current to the pump, solenoid or relay will be terminated and warn operator of out of range condition, a possible pH meter/probe malfunction, or insufficient addition of neutralizing solution.

This Time Delay (TD) safety feature prevents over addition of neutralizing solutions. It is reactivated automatically when the pH is returned to below the set point.

e. Adjust Time Delay (TD) to maximum (clockwise) or some intermediate interval (0 - 10 minutes).

This safety feature insures against excess neutralization even if the pH electrode is broken or disabled or a controlled neutralizing pump, solenoid, or valve malfunctions.

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