Honeywell

7096 pH/ORP Analyzer Operator's Manual

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TotalPlant

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Revision 2 – 8/15/97

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Honeywell
Industrial Automation and Control
Automation College
2820 West Kelton Lane
Phoenix, AZ 85023

(602) 313-5669

About This Document

Abstract

This document is releases for the sole purpose of supporting the installation, operation and maintenance of the 7096 pH Analyzer.

Revision Notes

The following list provides notes concerning all revisions of this document.

Rev. ID	Date	Notes
0	2/97	This is the initial release of the Honeywell manual.
1	4/97	Typos were corrected.
2	8/97	Additional information was added to cover the ORP option.

References

Honeywell Documents

The following list identifies all Honeywell documents that may be sources of reference for the material discussed in this publication.

Document Title	ID #	Binder Title	Binder ID #

Non-Honeywell Documents

The following list identifies select non-Honeywell documents that may be sources of reference for the material discussed in this publication.

Title	Author	Publisher	ID/ISDN #

Contacts

The following list identifies important contacts within Honeywell.

Organization	Telephone	Address
Technical Assistance Center	1-800-423-9883 Phone (215) 641-3610 Phone (215) 641-3400 FAX	Honeywell IAC 1100 Virginia Dr. Fort Washington, PA 19034

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1. Introduction

1.1 Overview

The Honeywell 7096 pH/ORP Analyzer / Controller is a microprocessor-based instrument for the measurement and control of pH or ORP in industrial processes. The pH unit can also be used to measure temperature and mV. The unit has electrode temperature compensation for pH measurement.

Designed for ease of day-to-day operation, the front panel display and keyboard allow access to a variety of information and control functions, all of which are described in this manual. The touch-sensitive, dedicated keyboard offers audible feedback. Calibration is simplified by use of the dedicated standardize / slope key, which permits rapid one or two-point calibration. Rechecking the standardize calibration after a slope adjustment is unnecessary because microprocessor calculations eliminate any interaction. A "hold" function maintains the analyzer output level and alarm status during the calibration process. The instrument automatically recognizes three commonly used buffer solutions and the temperature variation characteristic of each.

The 7096 offers operational error indications, an easy to read LCD display, and simplicity of operations. The 7096 has a NEMA Type 4 rated Front Bezel when mounted in a NEMA Type 4 enclosure. All calibration and set point values are retained using an internal EEPROM in the case of power line transients or loss of AC power. A security function is provided for the user to protect the control parameters and calibration data from undesired access. Additional features are a reversible isolated 4-20 mA output current or "Progressive Proportional Gain Adjusted" pulse output for direct drive of metering pumps.

2. Specifications

2.1 Physical

Operating Conditions

Ambient Temperature:

Normal: 0 - 50 °C

Storage: 0 - 70 °C

Line Voltage:

Normal: 115 / 230 VAC, +/- 15%

Relative Humidity (R.H.): 0 - 95 %

Case

NEMA Type 4 (Front Panel Only) - Watertight and Dusttight - Indoor and Outdoor enclosures are intended for use indoors or outdoors to protect the enclosed equipment against splashing water, seepage of water, falling or hose-directed water, and severe external condensation. The unit must be mounted in a NEMA type 4 enclosure. The front panel is 1/4 DIN, with a depth of 3.75 inches.

Weight

1.7 lbs (0.745 kg)

Mounting

Panel-Mounted

Electrical Classification

No listing

Display

0.5" LCD displays pH or mV, temperature, alarm conditions, alarm setpoints, calibration, diagnostics, output setpoints, security status

Keyboard

Monoplanar front panel with 12 keys for pushbutton entry with audible feedback.

Performance

Display Ranges:

pH:	-2.00 to 16.00
mV:	-1999 to 1999
Temp:	0.00 to +110.0

Resolution

pH:	0.01
mV:	1
Temp:	0.1

Accuracy (+/- 1 Digit)

pH:	+/-0.01
mV:	+/-0.1 %
Temp (0-110 C):	+/- 0.2 C
ATC (0-110 C):	+/- 0.2C

Input Impedance: Greater than 10^{12} Ohms

Temperature Compensation - conventional compensation for changing electrode output (Nernst Response)

ATTENTION

Although the numerical display may be changed to read beyond the limits given, the readings cannot be guaranteed for accuracy or validity.

Auto:	0 to +110.0 C
Manual:	0 to +110.0 C

Calibration

Automatic Buffer Recognition: 4.01, 6.86, 9.18

Dual Point Calibration: Calculates and compensates for electrode slope deviation and drift.

Security

All user entered values and calibration can be protected by a four-digit security code.

Alarms

Relay Set Point Hysteresis: User Programmable from 0.00 to 0.99 pH

Standard Alarm Relays: Rated at 5 Amps at 115 VAC, 2.5 Amp at 230 VAC

Controls

Proportional Controller with Current-Adjusting-Type (CAT) output or Pulse-Frequency-Type (PFT) output.

Output Signals

4-20 mA Output: Reversible 4 to 20 mA output between set points

4-20 mA Output Isolation: 1000 VDC Maximum

4-20 mA Load: 550 Ohms Maximum

Power Requirements

Memory protected from power loss or power surge through EEPROM

Power Source: 115 VAC, 60 Hz; 230 VAC, 50 Hz; +/-15% on voltages

2.2 Model Selection Guide

Catalog Number:

7096PC *

Meredian II or Durafet pH electrode controller with isolated 4-20 mA output

7096PP *

Meredian II or Durafet pH electrode controller with pulse frequency output

7096RC

ORP controller with isolated 4-20 mA output

* Electrode type is switch selectable on back of unit.

3. Installation

3.1 Unpacking

Compare the contents of the shipping container with the packing list. Notify the carrier and Honeywell immediately if there is equipment damage or shortage.

Please do not return goods without contacting Honeywell in advance.

Carefully remove the instrument and remove any shipping ties or packing material. Follow the instructions on any attached tags and then remove such tags.

3.2 Inspection

The 7096 Analyzer is calibrated and tested at the factory prior to shipment. Examine the catalog number on the nameplate, to verify that the instrument has the correct optional features. See the Specifications section for information on interpreting nameplate data.

3.3 Storage & Shipment

For prolonged storage or for shipment, the instrument should be kept in its shipping container. Do not remove shipping clamps or covers. Store in a suitable environment. (see Specifications).

3.4 Location

The 7096 Analyzer is designed for panel or bracket mounting in any convenient location which has a suitable environment (see Specifications) and which provides access for connections and adjustments. If extremely hot or cold objects are nearby, provide radiant heat shielding.

CAUTION

Pipe mounting is not recommended if the pipe is subject to severe vibration.

3.5 Mounting

To mount the 7096 Analyzer, use the following procedure.

Step	Action
1	Make a cutout on any panel, with a thickness of 1/6" (1.5mm) to 3/8" (9.5mm) Refer to Figure 3-1.
2	Remove the mounting bracket assembly from the analyzer.
3	Insert the analyzer into the cutout. Refer to Figure 3-2
4	Replace the mounting bracket assembly onto the analyzer.
5	Fasten the mounting screws to secure the analyzer to the mounting panel. Refer to Figure 3-3.

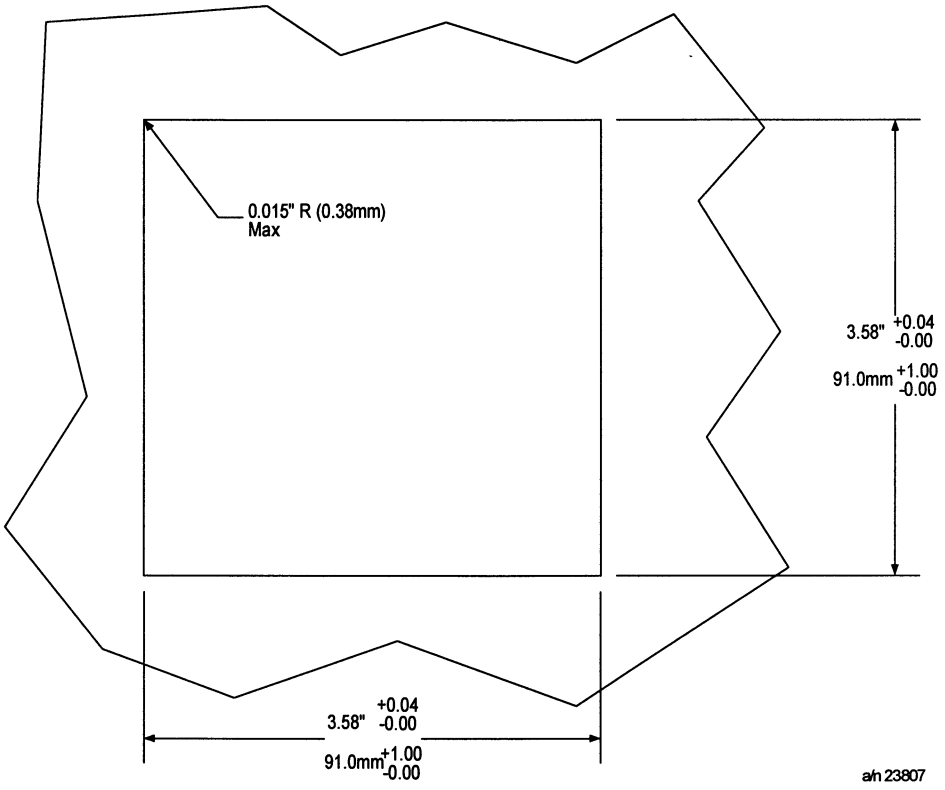


Figure 3-1 Panel Cutout

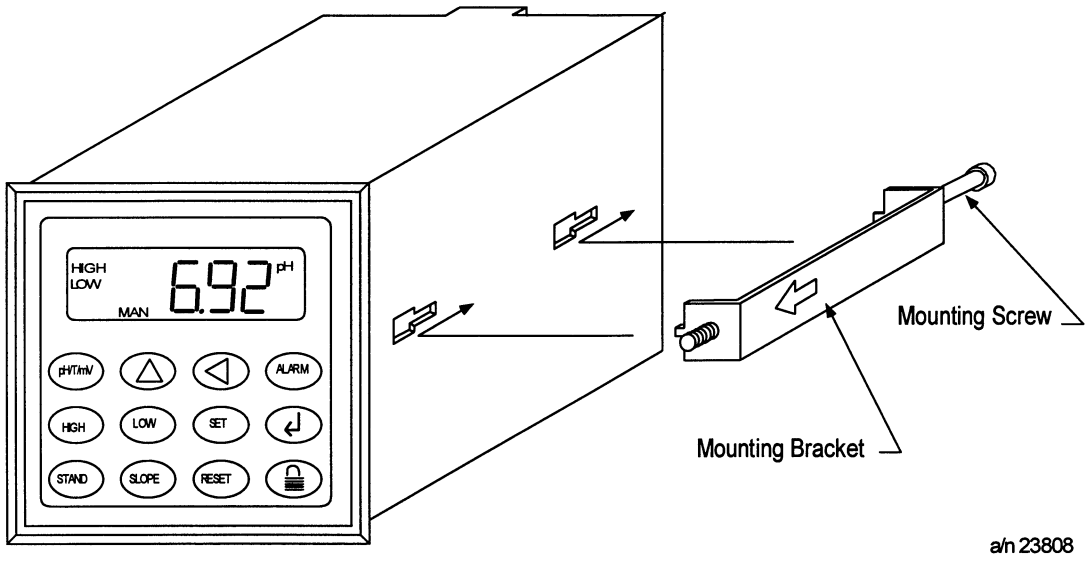


Figure 3-2 Panel Analyzer with Mounting Bracket and Screw

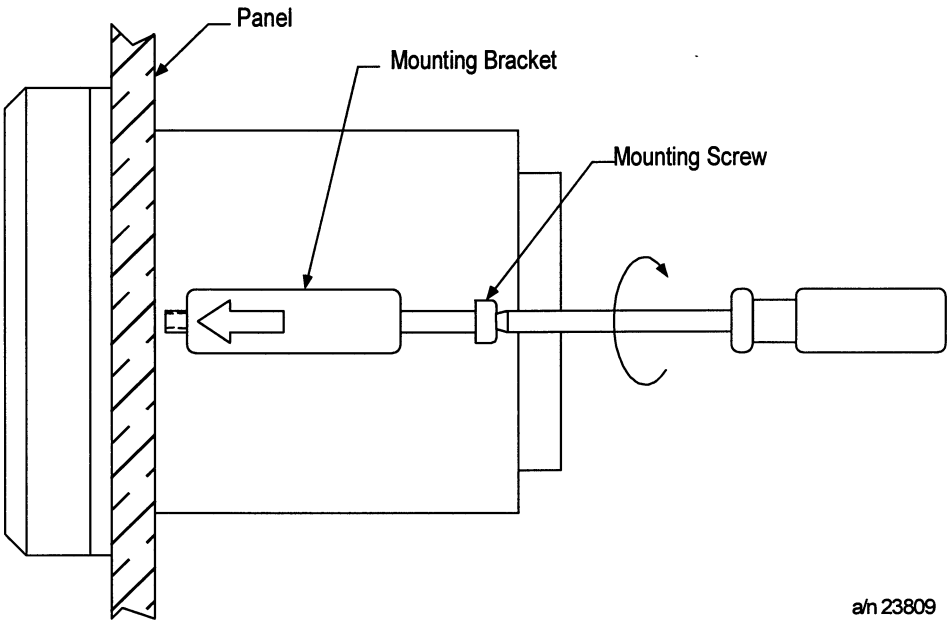


Figure 3-3 Mounting Method

3.6 Wiring

General Wiring Practices

Instrument wiring should conform to regulations of the National Electrical Code. Instrument wiring is considered Level 1, per section 6.3 of IEEE STD. 518 for plant facilities layout and instrumentation application. Level 1 wiring must not be run close to higher level signals such as power lines or drive signals for phase-fired SCR systems, etc. Unprotected input wiring in high electrical noise environments is subject to electromagnetic, electrostatic, and radio frequency interference pickup of sufficient magnitude to overload input filters. The best instrument performance is obtained by keeping the interfering signals out of the instruments altogether by using proper wiring practices.

For steel (metal) conduit or open wiring away from any sources of interference, use recommended cables listed in the Parts section of this manual.

In applications where plastic conduit or open wire trays are used, shielded 6-conductor 22 gage (0.326 mm^2) or heavier signal input wiring is required.

References:

IEEE STD 518, Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources.

Follow the procedure listed below to complete the wiring installation of the 7096.

Step	Action
1	Connect the AC line to the rear of the instrument. The 7096 can be used with 115 VAC or 230 VAC 50/60 Hz. Connect to the proper terminal.
2	Make sure that the Earth Ground connector is connected to the ground lead of the AC power line.
3	Connect the proper load to the output relays if relays will be used.

Step	Action
4	Make sure that the load does not exceed the relay rating --> 5 Amps at 115 VAC and 2.5 Amp at 230 VAC.
5	Connect a proper load to the 4-20 mA connector if the current output will be used.
6	Make sure that the load impedance is less than 550 Ohms
7	Connect the electrode lead to either the BNC connector if a Meredian pH or ORP electrode will be used, or the rectangular connector if a Durafet electrode will be used. If a Meredian glass electrode will be used, connect the two temperature compensator leads to terminals 8 and 9. On the pH instrument, make sure that the electrode selector switch is set to the correct type of electrode - "FET" for Durafet and "Glass" for the Meredian. See Appendix A for ORP wiring diagram.

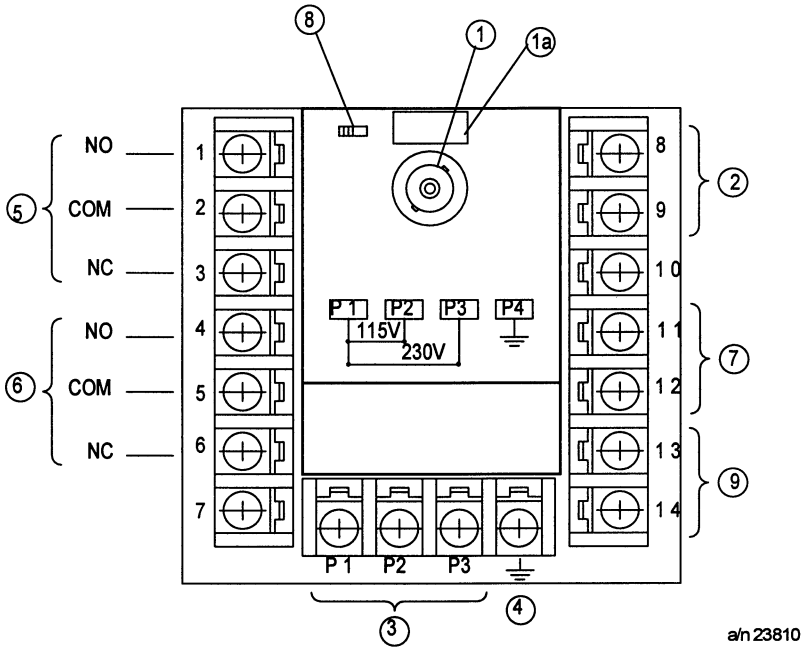


Figure 3-4 Wiring Diagram

1. Glass pH electrode input BNC connector

   1a. Durafet pH electrode input connector
2. ATC/TEMP input connectors (Glass electrode only)
3. AC input connector
4. Earth connector
5. HIGH set point relay output
6. LOW set point relay output
7. 4 - 20 mA/output (07096PC or 07096RC)
8. Input type Switch - Glass/Durafet
9. Pulse Output (07096PP)

4. Operation

4.1 General

The operator functions of the 7096 pH Analyzer / Controller are controlled using the front panel keys and LCD display.

It is important to pay careful attention to the description of the display features in this section. Annunciators will appear on the display as various keys are pressed. These annunciators refer to the information currently shown on the display. They will be helpful for identifying your position in a key-in sequence, or for observing the current status of the instrument.

The key functions described in the following Touch Keys section are general in nature. Specific instructions for use of the keys to utilize all functions are included in later sections. Refer also to the "Quick Reference Card" on the inside back cover of this manual for a condensed summary of key functions.

4.2 Touch Keys - pH Analyzer

(See Appendix for ORP Analyzer information)

Description

pH / T / mV

The pH/T/mV key can be used to scroll through the calculated value for pH, temperature, and mV.

◁ (DIGIT)

The DIGIT key, in conjunction with the COUNT key, will be used whenever a user-entered value is required. Pressing the DIGIT key will cause the next digit to blink, indicating that the blinking digit may be changed using the COUNT key.

△ **(COUNT)**

The COUNT key, in conjunction with the DIGIT key, is used whenever a user-entered value is required. Pressing the COUNT key will cause the blinking digit to increase.

ALARM

Pressing the ALARM key will display the alarm hysteresis value.

HIGH

Pressing the HIGH key when the pH value or low output setpoint is displayed will show the high output setpoint. Pressing the HIGH key when the alarm hysteresis value or low alarm setpoint is displayed will show the high alarm setpoint.

LOW

Pressing the LOW key when the pH value or high output setpoint is displayed will show the low output setpoint. Pressing the LOW key when the alarm hysteresis value or high alarm setpoint is displayed will show the low alarm setpoint.

SET

The SET key is used to allow the user to change any of the user-programmable values. These include the alarm setpoints and hysteresis, calibration values, output setpoints, and the lock. In most cases the SET key must be preceded by another key before a value may be changed. The SET key will not be active whenever the LOCK annunciator is active.

↵ **(ENTER)**

The ENTER key is used to save any user-entered values into memory.

STAND

The STAND key is used to perform the standardization calibration.

SLOPE

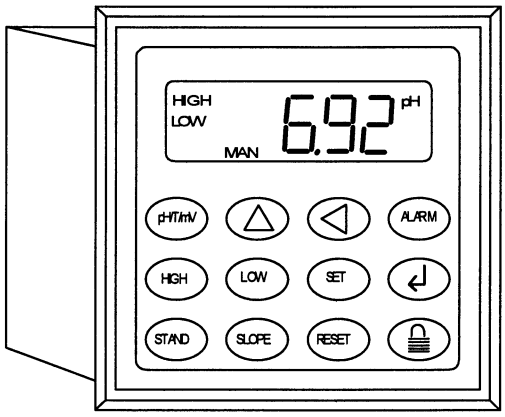
The SLOPE key is used to perform the slope adjustment calibration.

RESET

When the RESET key is pressed, the internal memory of the 7096 pH Analyzer is cleared. This function is only available whenever an error code is active (See the Service section for a list of error codes). All user-entered values will be restored to the default values. The instrument will have to be recalibrated and reprogrammed. This includes all alarm setpoints and hysteresis, output setpoints, calibration values, and the lock.

(LOCK)

The LOCK function may be used to secure all user-entered values and calibration. This may be activated by pressing the LOCK key and then the SET key. The user will have the option of entering in a four-digit password. Once the ENTER key is pressed, the LOCK annunciator will appear on the display, indicating that all programming and calibration has been protected.



a/n 23811

Figure 4-1 Front Panel Display - pH Analyzer

(See Appendix A for ORP Analyzer)

4.3 Temperature Compensation

Temperature Compensation - Durafet Electrode

Durafet electrodes are temperature compensated by means of a thermistor (8550 Ohms at 25 °C). Unlike conventional compensation, which is performed by the analyzer itself, a Durafet's temperature

compensation is done by the preamplifier. Because of this, no temperature display will be accessible when using a Durafet probe.

The temperature compensation must be in the manual mode. No additional temperature sensor or fixed resistor should to be attached to terminals 8 and 9. The "MAN" annunciator MUST be on. Make sure the switch on the rear panel is set to the FET position.

Temperature Compensation - Meredian Glass Electrode

Meredian electrodes are temperature compensated by means of a thermistor (8550 Ohms at 25 °C). The unit will be in the ATC mode when the Meredian electrode is properly connected. The "ATC" annunciator will be displayed. The temperature will be displayed when the pH/T/mV key is pressed.

Temperature Compensation - ORP

Meredian ORP electrodes do not include a temperature compensator. No temperature compensation is used since temperature effects are not well defined and will vary from one application to another.

Temperature Compensation - Manual

The 7096 pH Analyzer features manual temperature compensation which is useful whenever the temperature reading compensator is suspect. The "MAN" annunciator will automatically be displayed when a temperature compensator is not connected.

The default condition for the manual temperature compensation is 25.0 °C. To change this value to something other than the default condition, the following sequence should be followed.

1. Press the pH/T/mV key for the analyzer to display the temperature.
2. Press the SET key. The numerical display will flash.
3. Press the DIGIT and COUNT keys for the desired temperature reading.
4. Press the ENTER key.

4.4 Outputs

Current Output

The optional 4-20 mA current output is proportional to the pH values between two set points. This current output may be used as a retransmission signal or as a CAT (Current Adjusting Type) proportional-only control signal. The HIGH and LOW annunciators will be on whenever a value is stored in memory for the output setpoints.

20 mA (100%) Set Point

1. Press the HIGH, then SET keys.
2. Press the DIGIT and COUNT keys for the desired 20 mA output pH value.

   The 20 mA value can be any value between 0.00 and 14.00 pH.
3. Press the ENTER key.

4 mA (0%) Set Point:

1. Press the LOW, then SET keys.
2. Press the Digit and COUNT keys for the desired 4 mA output pH value.

   The 4 mA value can be any value between 0.00 and 14.00 pH.
3. Press the ENTER key.

Examples:

1. 20 mA set point at 14.00 pH, 4 mA set point at 0.00 pH.
   Current output will be 12 mA at pH 7.00; output will increase for increasing pH values.
2. 20 mA Setpoint at 8.00 pH, 4 mA set point at 10.00 pH.
   Current output is 12 mA at 9.00 pH; output will decrease for increasing pH values.

Control Outputs

Two types of outputs for control purposes are available in the 7096 Analyzer / Controller:

1. CAT (Current Adjusting Type) Proportional-Only Control

2. PFT (Pulse Frequency Type) Proportional-Only Control

The availability of these functions in a particular instrument depends on the options it includes. See the Specifications section.

Proportional- Only Control

Proportional control will usually provide faster batch treatment with less overshoot than ON-OFF control. However, it is important to note that proportional-only control is recommended only for batch processes or for pretreatment in continuous neutralization systems where a tight control band is required. The 7096 may be used to control the flow rate of acid or base reagent.

Without reset action, changes in reagent demand that occur in continuous processes are not accommodated and control will not maintain a tight control band around the setpoint. In a batch process, reagent is added until a setpoint is reached and the batch is not emptied until this occurs.

Proportional action occurs between the setpoint (0% output) and the proportional band limit (100% output). Depending on whether the proportional band limit is above or below the setpoint, control action will be appropriate for acid or base feed, respectively.

CAT (Current Adjusting Type) Control Setup

CAT control provides a 4-20 mA current signal spanned between the setpoint and the proportional band limit. Set up as follows:

Proportional Band Limit (20 mA)

1. Press the HIGH, then SET keys.
2. Press the DIGIT and COUNT keys for the desired 20 mA proportional band limit value.

   The 20 mA value can be any value between 0.00 and 14.00 pH.
3. Press the ENTER key.

Set Point (4 mA):

1. Press the LOW, then SET keys.
2. Press the Digit and COUNT keys for the desired 4 mA set point value.

   The 4 mA value can be any value between 0.00 and 14.00 pH.
3. Press the ENTER key.

Example:

1. 4 mA Setpoint at 8.5 pH, 20 mA proportional band limit at 12.5 pH.

Current output is 12 mA at 10.5 pH; output will increase for increasing pH values.

PFT (Pulse Frequency Type) Control Setup

PFT is another type of proportional-only control output which may be set up in the 7096 Analyzer / Controller. The pulse output is generated by repeated relay contact opening and closure. The frequency of

the pulse is proportional to the deviation from setpoint. This type of output is used to control such devices as pulse-type electronic metering pumps. The output volume of the pump is directly proportional to the output pulse rate of the controller. The 7096 is calibrated for the pulse rate to be proportional to the concentration of the OH- or H+ ions, instead of the pH value, for a set point differential of 2 pH units.

100 PPM Set Point:

1. Press the HIGH, SET keys.
2. Press the DIGIT and COUNT keys for the desired 100 ppm output pH value.
3. The 100 ppm value can be any value between 0.00 and 14.00 pH.
4. Press the ENTER Key.

1 PPM Set Point:

1. Press the LOW, SET keys.
2. Press the DIGIT and COUNT keys for the desired 1 ppm output pH value.
3. The 1 ppm value can be any value between 0.00 and 14.00 pH.
4. Press the ENTER key.

Example:

1. 100 PPM set point at 14.00 pH, 1 PPM set point at 0.00 pH.

Pulse frequency is 10 ppm at 7.00 pH, output rate will increase for increasing pH values .

2. 100 PPM set point at 8.00 pH, 1 PPM set point at 10.00 pH.

Pulse frequency is 10 PPM at 9.00 pH, output rate will decrease for increasing pH values.

ATTENTION

Since the set point differential is exactly 2 pH units, the pulse rate conforms to the H+ ion concentration.

4.5 ALARMS

Alarm for pH or ORP can be set up to activate two relays. See the Specifications section and the Installation section for complete information. The high alarm is assigned to the relay designated as "HIGH" and the low alarm is assigned to the relay designated as "LOW" on the rear panel.

High Alarm Set Point

1. Enter the pH mode by pressing the pH/T/mV key. Enter the ORP mode by pressing the ORP/T key.
2. First press the ALARM key, followed by the HIGH key and then the SET key.
3. Enter the desired set point value via the DIGIT and COUNT keys.
4. Press the ENTER key.

The High Relay will be energized if the display value is greater than the HIGH set point value. This will be evident by the LED on the HIGH key being lit.

Low Alarm Set Point

1. Enter the pH mode by pressing the pH/T/mV key. Enter the ORP mode by pressing the ORP/T key.
2. First press the ALARM key, followed by the LOW key and then the SET key.

3. Enter the desired set point value via the DIGIT and COUNT keys.

4. Press the ENTER key

The Low Relay will be energized if the display value is less than the LOW set point value. This will be evident by the LED on the LOW key being lit.

Relay Hysteresis and Setpoints

Relay Hysteresis Set:

1. Enter the pH mode by pressing the pH/T/mV key. Enter the ORP mode by pressing the ORP/T key.

2. Press the ALARM key. The instrument will display HL.10, the default value, indicating that the hysteresis of the high set point and low set point relay is +/- 0.10 pH. The hysteresis value is user-selectable between 0.00 and 0.99 pH.

3. Press the SET key, followed by the DIGIT and COUNT keys to enter the desired hysteresis value.

4. Press the ENTER key.

Examples:

1. High Alarm is set at 9.00 pH. The hysteresis value is set at 0.50 pH. The alarm will activate once the pH value is equal to or above 9.50 pH, and will not deactivate until the pH value falls below 8.50.

2. Low Alarm is set a 4.00 pH. The hysteresis value is set at 0.10 pH. The alarm will activate once the pH value is equal to or below 3.90 pH, and will not deactivate until the pH value rises above 4.10 pH.

4.6 Security

Security Lock

The calibration and set point values can be locked to prevent tampering with the user-entered values.

Lock:

1. Press the LOCK key, followed by the SET key.

2. Press the DIGIT and COUNT keys to enter the desired numeric code.

3. Press the ENTER key, the LOCK annunciator will be displayed.

4. The instrument is locked and all calculation and set point values cannot be changed.

Unlock:

1. Press the LOCK key, followed by the SET key.

2. Press the DIGIT and COUNT keys to enter the same numeric code used to lock the instrument.

3. Press the ENTER key, the LOCK annunciator will disappear.

4. The instrument is unlocked and new parameters can be entered.

5. Calibration

5.1 pH Calibration

Calibration Types

Calibration of pH and ORP measuring instruments is necessary because of potentials and resistances in the electrodes and the process which will change over time. Periodic calibration is necessary for best performance of the entire system. Recalibration intervals are best determined from operating experience with an individual process.

pH instrument calibration typically consists of standardization and slope adjustments using a buffer of known pH. Standardization is a zero adjustment which compensates for electrode drift. Slope adjustment is a span adjustment which matches the gain of the instrument to the electrode output response. This is known as a two-point calibration.

Calibration may also be done by the grab sample method. This method is recommended only where the pH is stable and changes very slowly. This is also known as a one-point calibration.

Automatic Buffer Recognition Calibration

Automatic Buffer Recognition is an advanced feature which simplifies the task of calibrating by the buffering method. The 7096 Analyzer / Controller's permanent memory contains information on three commonly used buffer solutions, including the pH versus temperature characteristics of each. These three buffers are 4.01, 6.86, and 9.18.

The automatic buffer recognition feature utilizes the automatic temperature compensator reading to determine what the buffer's actual pH is. To use this feature with the Durafet electrode, either a separate temperature compensator must be connected or the manual temperature reading must be changed to read the exact buffer temperature.

5.2 Calibration Procedures

One-Point Calibration

This method is recommended only where the pH is stable and changes very slowly. It utilizes the standardize calibration only. This section has been broken down into two steps, Normal Calibration and Automatic Buffer Recognition Calibration.

Normal Calibration

Standardize Adjustment:

1. Press the pH/T/mV key to enter the pH mode.

2. Press the STAND key. The "SET" annunciator will be displayed, indicating that all outputs from the instrument are frozen to the status when the "STAND" key is pressed. The numerical display will begin to flash. The number which is flashing is based upon automatic buffer recognition, and is not used for this type of calibration.

3. Rinse the electrode thoroughly with distilled water and then place it into the standardizing buffer. Typically the standardize adjustment is done with a 6.86 buffer, but other buffers may be used.

4. Press the SET key, the rightmost digit will begin to flash. If the SET key is not pressed within approximately one minute after pressing the STAND key, the unit will attempt to calibrate based on the automatic buffer recognition feature.

5. Use the DIGIT and COUNT keys to enter the desired pH value corresponding to the buffer's measured temperature.

6. Press the ENTER key.

7. The numerical display will begin to flash again. At this point, the unit is checking to determine if the user-entered pH value is within 1 pH of the pH value that the electrode was actually reading. The numerical display will blink the user-entered value until the pH reading has fully stabilized (usually about 5 seconds).

8. If E--1 is displayed, the 7096 determined that the user-entered pH value and the pH value that the electrode was actually reading were not within 1 pH amount. The E--1 error code will continue until the problem is resolved. Check the Service Troubleshooting section to determine possible causes for this error code.

9. If the calibration worked correctly, the STAND and SET annunciators will be displayed.

10. Press the pH/T/mV signal to return back to normal operating mode. The SET annunciator will disappear and the STAND annunciator will remain, indicating that a successful standardization calibration has taken place. The outputs will begin tracking the pH value again.

Automatic Buffer Recognition Calibration

Standardize Adjustment:

1. Press the pH/T/mV key to enter the pH mode.

2. Press the STAND key. The "SET" annunciator will be displayed, indicating that all outputs from the instrument are frozen to the status when the "STAND" key is pressed. The numerical display will begin to flash a 6.86 pH.

3. Rinse the electrode thoroughly with distilled water and then place it into the 6.86 pH standardizing buffer.

4. The numerical display will flash the 6.86 pH value until the reading fully stabilizes. The unit is checking to determine if the automatic buffer recognition pH value is within 1pH of the pH value that the electrode was actually reading. The numerical display will blink the user-entered value until the pH reading has fully stabilized (may be as long as 60 seconds).

5. If E--1 is displayed, the 7096 determined that the user-entered pH value and the pH value that the electrode was actually reading were not within 1 pH amount. The E--1 error code will continue until the problem is resolved. Check the Service Troubleshooting section to determine possible causes for this error code.

6. If the calibration worked correctly, the STAND and SET annunciators will be displayed.

7. Press the pH/T/mV signal to return back to normal operating mode. The SET annunciator will disappear and the STAND annunciator will remain, indicating that a successful standardization calibration has taken place. The outputs will begin tracking the pH value again.

Two-Point Calibration

This method is recommended for best accuracy in most applications. The standardization adjustment is performed first, followed by a slope adjustment.

Normal Calibration

Slope Adjustment: (This can only be done after a standardization adjustment. See "One-Point Calibration.")

1. Press the pH/T/mV key to enter the pH mode.

2. Press the SLOPE key. Access to this mode is only possible after a standardize adjustment has been performed. The "SET" annunciator will be displayed, indicating that all outputs from the instrument are frozen to the status when the "SLOPE" key is pressed. The numerical display will begin to flash. The number which is flashing is based upon automatic buffer recognition, and is not used for this type of calibration.

3. Rinse the electrode thoroughly with distilled water and then place it into the standardizing buffer. Typically the standardize adjustment is done with a 4.01 or 9.18 buffer, but other buffers may be used.

4. Press the SET key, the rightmost digit will begin to flash. If the SET key is not pressed within approximately one minute after pressing the SLOPE key, the unit will attempt to calibrate based on the automatic buffer recognition feature.

5. Use the DIGIT and COUNT keys to enter the desired pH value corresponding to the buffer's measured temperature.

6. Press the ENTER key.

7. The numerical display will begin to flash again. At this point, the unit is checking to determine if the user-entered pH value is within 1pH of the pH value that the electrode was actually reading. The numerical display will blink the user-entered value until the pH reading has fully stabilized (usually about 5-10 seconds).

8. If E--2 is displayed, the 7096 determined that the user-entered pH value and the pH value that the electrode was actually reading were not within the 1 pH amount. The E--2 error code will continue until the problem is resolved. Check the Service Troubleshooting section to determine possible causes for this error code.

9. If the calibration worked correctly, the SLOPE and SET annunciators will be displayed.

10. Press the pH/T/mV signal to return back to normal operating mode. The SET annunciator will disappear and the SLOPE annunciator will remain, indicating that a successful standardization calibration has taken place. The outputs will begin tracking the pH value again.

Automatic Buffer Recognition Calibration

Standardize Adjustment:

1. Press the pH/T/mV key to enter the pH mode. (This can only be done after a standardization adjustment. See "One-Point Calibration.")

2. Press the SLOPE key.

The "SET" annunciator will be displayed, indicating that all outputs from the instrument are frozen to the status when the "SLOPE" key is pressed. The numerical display will begin to flash a 4.01 or 9.18 pH value.

3. Rinse the electrode thoroughly with distilled water and then place it into the standardizing buffer.

4. The numerical display will flash the pH value until the reading fully stabilizes. The unit is checking to determine if the automatic buffer recognition pH value is within 1 pH of the pH value that the electrode was actually reading. The numerical display will blink the user-entered value until the pH reading has fully stabilized (may be as long as 60 seconds).

5. If E--2 is displayed, the 7096 determined that the user-entered pH value and the pH value that the electrode was actually reading were not within the 1 pH amount. The E--2 error code will continue until the problem is resolved. Check the Service Troubleshooting section to determine possible causes for this error code.

6. If the calibration worked correctly, the SLOPE and SET annunciators will be displayed.

7. Press the pH/T/mV signal to return back to normal operating mode. The SET annunciator will disappear and the SLOPE annunciator will remain, indicating that a successful standardization calibration has taken place. The outputs will begin tracking the pH value again.

5.3 ORP Calibration with Meredian ORP Electrodes

Calibration Types

Calibration of ORP measuring instruments may be necessary because of potentials and resistances in the reference electrode and the process which will change over time. Periodic calibration may be necessary for best performance of the entire system. Although the exact value of the ORP potential measured is not needed for the usual empirical-type application, a means of checking the electrodes and measuring instrument as a maintenance procedure may be desired.

ORP instruments are normally calibrated by substituting an absolute millivolt signal in place of the ORP electrode. Some users may wish to use the standardization adjustment with the ORP electrode immersed into an ORP reference solution. However, this method is typically accurate only to about +/- 30 mV. This method is good for verifying electrode operation, but is not precise enough for most calibration needs. To prepare such a reference solution, dissolve 0.1 grams of quinhydrone powder in 5 cc of acetone or methyl alcohol (methanol). Add this to not more than 500 cc of a standard pH reference buffer, giving about 1 part saturated quinhydrone to 100 parts buffer solution. The oxidation potential of this solution is listed below for several temperatures. The polarity sign shown is that of the measuring element with respect to the reference element. These solutions are unstable and should not be stored for more than a few days.

Table 5-1 Solutions and Temperatures

	Temperature		
pH Buffer Solution	20°C	25°C	30°C
4.01 @ 25°C	267 mV	263 mV	259 mV
6.86 @ 25°C	100 mV	94 mV	88 mV
9.18 @ 25°C	-36 mV	-43 mV	-49 mV

Calibration Procedure

Step	Action
1	Immerse the ORP electrode in a standard solution as described in Table 5-1.
2	Press the CAL key and the annunciator "CAL" will be displayed.
3	Press the STAND key and the display will begin to flash.
4	Press the ENTER key before the LCD stops flashing.
5	Press the DIGIT and the COUNT keys to display the desired ORP value.
6	Press the ENTER key
7	The display will flash until the ORP value is stable (within ±0.5 mV of the entered value).
8	Press the ORP/T key to return to the normal measurement mode for ORP.

6. Service

6.1 Troubleshooting

Error Codes

Error Code	Reason for Error
E-1	- pH electrode offset voltage is greater than 90 mV. - Standardization Calibration attempted to adjust display value more than 1 pH from actual value.
E-2	- pH electrode slope is less than 30% of theoretical value. - Slope Calibration attempted to adjust display value more than 1 pH from actual value.
E-3	- Temperature Measurement exceeds 110°C.
E-4	- Temperature measurement of the buffer solution during calibration is outside of the temperature range of 0 to 95°C.
E-5	- Display value is over-range.

All error indications will disappear if the condition is corrected.

6.2 Electronic Calibration - pH Analyzer

WARNING

Electronic calibration of the 7096 will result in all user programmable values returning to their factory default conditions!

Equipment

Resistance Decade Box (accurate to 0.1 ohms), 0 - 20,000 ohms or greater

Digital Volt Meter (accurate to 0.1 volts)

Voltage Source (accurate to 0.1 volts), 0 - 2 volts or greater

Precision Resistor, 250 Ohms, 0.1%, 1/4W

Connection Setup

1. Attach the 250 Ohm Precision Resistor across terminals 11 and 12, the current output terminals.

2. Connect the Resistance Decade Box across terminals 8 and 9, the temperature compensator terminals.

3. Connect the Voltage Source to the BNC connector, with the center lead being the positive terminal. (Make sure that the 7096 is set to "Glass" mode on the switch on the rear panel.)

4. Connect the Digital Volt Meter across terminals 11 and 12, the current output terminals.

Calibration Sequence

1. To begin electronic calibration of the 7096, press and hold the pH/T/mV key and then cycle AC line power to the unit. The instrument will enter into the calibration mode and the following sequence will begin.

2. The display will flash **0000 mV**. Input 0.0 mV to the BNC connector and wait approximately 10 seconds. Press the ALARM key to move on to the next step in the sequence.

3. The display will change to **1990 mV**. Input 1990 mV to the BNC connector and wait for approximately 10 seconds. Press the ALARM key to move on to the next step. Disconnect the Voltage Source once the ALARM key has been pressed.

4. The display will change to **10**. Set the decade box to 17014.5 ohms and wait for approximately 10 seconds. Press the ALARM key to move on to the next step.

5. The display will change to **100**. Set the decade box to 580 ohms and wait for approximately 10 seconds. Press the ALARM key to move on to the next step.

6. The display will change to **P** for the pulse output calibration only. Use the DIGIT and COUNT keys toggle the display between **P** and **E** for current output units). Toggle the display to read **E**. Press the ALARM key to move on to the next step.

7. The display will change to **4**. Press the COUNT key to increase the output current and the DIGIT key to reduce the output current until the current output is set to 4.00 mA. Press the ALARM key to move on to the next step.

8. The display will change to **20**. Press the DIGIT key to increase the output current and DIGIT key to reduce the output current. Press the ALARM key to finish the calibration sequence.

9. Calibration is completed. Instrument enters into the operational mode. All user programmable values will be restored to their default conditions.

7. Parts

7.1 Parts List

Buffers:

4.01 @ 25°C	P/N 31103001
6.86 @ 25°C	P/N 31103002
9.18 @ 25°C	P/N 31103003

Electrodes:

Industrial

Durafet pH-Immersion	31079231
Durafet pH-Inline	31079230
Glass pH-Immersion	31086925
Glass pH-Inline	31086926
Platinum ORP-Immersion	31086966
Gold ORP-Immersion	31086965

Sanitary

11/2" Flange, Shallow Immersion	31086200
11/2" Flange, Deep Immersion	31086201
2" Flange, Shallow Immersion	31086202
2" Flange, Deep Immersion	31086203
3" Flange, Shallow Immersion	31086204
3" Flange, Deep Immersion	31086205

Durafet Cables:

12 feet	31079227
20 feet	31079228
30 feet	31086236
40 feet	31086237
50 feet	31086238

Appendix A ORP Analyzer

Wiring

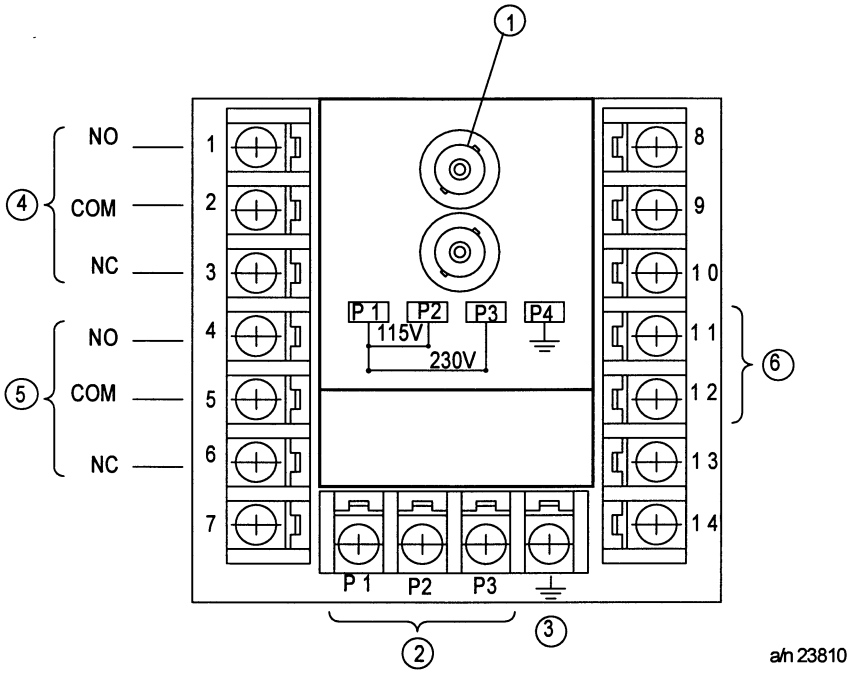


Figure A-1 Wiring Diagram - ORP Diagram

1. ORP electrode input BNC connector
2. AC input connector
3. Earth connector
4. HIGH set point relay output
5. LOW set point relay output
6. 4 - 20 mA/output (07096PC or 07096RC)

Operation

Touch Keys - ORP Analyzer

ORP / T

The ORP/T key can be used to scroll through the value for ORP and temperature.

◁ (DIGIT)

The DIGIT key, in conjunction with the COUNT key, will be used whenever a user-entered value is required. Pressing the DIGIT key will cause the next digit to blink, indicating that the blinking digit may be changed using the COUNT key.

△ (COUNT)

The COUNT key, in conjunction with the DIGIT key, is used whenever a user-entered value is required. Pressing the COUNT key will cause the blinking digit to increase.

ALARM

Pressing the ALARM key will display the alarm hysteresis value.

HIGH

Pressing the HIGH key when the ORP value or low output setpoint is displayed will show the high output setpoint. Pressing the HIGH key when the alarm hysteresis value or low alarm setpoint is displayed will show the high alarm setpoint.

LOW

Pressing the LOW key when the ORP value or high output setpoint is displayed will show the low output setpoint. Pressing the LOW key when the alarm hysteresis value or high alarm setpoint is displayed will show the low alarm setpoint.

↵ (ENTER)

The ENTER key is used to save any user-entered values into memory.

CAL

The CAL key is used to put the ORP Analyzer into the calibration mode.

STAND

The STAND key is used to perform the standardization calibration.

ZERO

The ZERO key is used to perform the zero adjustment calibration.

RESET

When the RESET key is pressed, the internal memory of the 7096 pH/ORPAnalyzer is cleared. This function is only available whenever an error code is active (See the Service section for a list of error codes). All user-entered values will be restored to the default values. The instrument will have to be recalibrated and reprogrammed. This includes all alarm setpoints and hysteresis, output setpoints, calibration values, and the lock.

(LOCK)

The LOCK function may be used to secure all user-entered values and calibration. This may be activated by pressing the LOCK key and then the SET key. The user will have the option of entering in a four-digit password. Once the ENTER key is pressed, the LOCK annunciator will appear on the display, indicating that all programming and calibration has been protected.

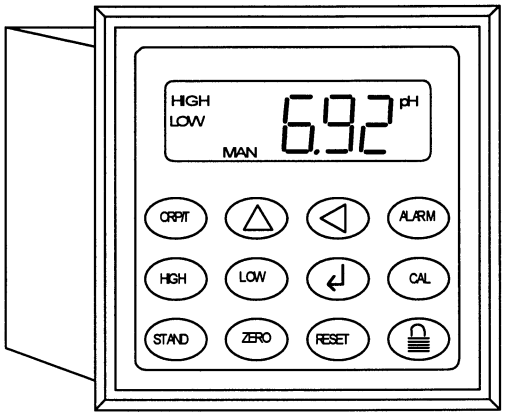


Figure A-2 Front Panel Display - ORP Analyzer

Quick Reference Guide

pH Analyzer

Function	Key Sequence
Measurements:	
Electrode Measurement (pH or ORP)	pH/T/mV
Temperature measurement	pH/T/mV
Calibration:	
Standardize Calibration	STAND then SET
Slope Calibration	SLOPE then SET
Standardize with Auto Buffer Recognition	STAND
Slope with Auto Buffer Recognition	SLOPE
Manual Temperature Adjustment	pH/T/mV then SET
Current Output:	
Output 20 mA Setpoint	HIGH then SET
Output 4 mA Setpoint	LOW then SET
Pulse Output:	
Output 100 PPM Setpoint	HIGH then SET
Output 10 PPM Setpoint	LOW then SET
Alarm/Relay Output:	
High Alarm Setpoint	ALARM then HIGH then SET
Low Alarm Setpoint	ALARM then LOW then SET
Alarm Hysteresis	ALARM then SET
Security:	
Lock	LOCK then SET
Unlock (when locked)	LOCK then SET