

**9782 Series pH/ORP
Analyzer/Controller
Operator's Manual**

70-82-25-73

Rev 5

3/00

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Revision 5 – March 30, 2000

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About This Document

Abstract

This manual contains instructions for installation and operation of the 9782 Series pH/ORP Analyzer/Controller.

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
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Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
	This CAUTION symbol on the equipment refers the user to the Product Manual for additional information. This symbol appears next to required information in the manual.
	WARNING PERSONAL INJURY: Risk of electrical shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible. Failure to comply with these instructions could result in death or serious injury.
	Protective Earth (PE) terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.

Contents

1. INTRODUCTION	1
1.1 Description	1
1.2 Features.....	2
1.3 Operating the Analyzer/Controller	4
1.4 Menu Hierarchy	6
1.5 Planning	8
1.5.1 Overview.....	8
1.5.2 Using Relays.....	8
1.5.3 Deciding on a Control Strategy	9
1.6 Overview of Installation and Setup Tasks.....	11
2. SPECIFICATIONS AND MODEL NUMBER.....	13
2.1 Specifications	13
2.2 Model Number Breakdown	16
3. UNPACKING, PREPARATION, AND MOUNTING	19
3.1 Overview	19
3.2 Unpacking and Preparing	20
3.3 Installing Optional Internal Preamplifier.....	21
3.4 Mounting	22
4. POWER WIRING	27
4.1 Overview	27
4.2 General Wiring Practices.....	28
4.3 Power Wiring Considerations	29
4.4 Installing Power Wiring	30
5. I/O SETUP AND SYSTEM CONFIGURATION.....	33
5.1 Overview	33
5.2 I/O Setup and Configuration Tasks	34
5.3 Performing I/O Setup.....	39
5.4 Configuring Current Adjusting Type (CAT) Control and/or Retransmission of Process Variables	43
5.5 Configuring On/Off, Duration Adjusting Type (DAT), or Pulse Frequency Type (PFT) Control	46

5.6	Configuring Alarms	50
5.7	Setting the Clock	51
5.8	Configuring AutoCal and AutoClean	52
6.	INPUT AND OUTPUT WIRING	61
6.1	Overview	61
6.2	General Wiring Practices.....	62
6.3	Wiring Analog Inputs and Outputs.....	64
	6.3.1 Installation	64
	6.3.2 Special Information for DualCAT	66
6.4	Wiring Relays.....	72
	6.4.1 Installation	72
	6.4.2 Special Information for DualCal	74
	6.4.3 Disconnecting RC Arc Suppression Circuits.....	76
7.	AUTOCLEAN AND AUTOCAL THEORY AND PIPING	77
7.1	Overview	77
7.2	AutoClean Sequence and Piping	78
7.3	AutoCal Sequence and Piping	80
8.	MANUAL CALIBRATION	83
8.1	Overview	83
8.2	Buffering Method of Calibrating pH Electrodes	85
8.3	Grab Sample Method of Calibrating pH Electrodes	87
8.4	ORP Calibration Using Reference Solution.....	89
8.5	ORP Calibration Using Voltage Input.....	91
8.6	Calibrating pH Electrodes Using Automatic Buffer Recognition.....	94
	8.6.1 Introduction.....	94
	8.6.2 Choosing Neutral and Alkaline Buffers	95
	8.6.3 Manual Calibration Using Automatic Buffer Recognition.....	96
8.7	Viewing Zero Offset and Percent Theoretical Slope	99
8.8	Recommendations for Successful Measurement and Calibration.....	100
9.	DIAGNOSTICS AND MESSAGES	101
9.1	Overview	101
9.2	System Status Message.....	102
9.3	Process Alarm Messages	103
9.4	On-Line Diagnostics and System Error Messages	104
9.5	Off-Line Diagnostics	105
	9.5.1 Display and Keyboard Test	105
	9.5.2 Output Tests.....	107

10. MAINTENANCE.....	109
10.1 Overview	109
10.2 Output Calibration.....	111
10.3 Restoring Factory Calibration Settings	114
10.4 Specifying a Tagname or Other Display String.....	115
10.5 Viewing Product Information and Changing Model Number Stored in Memory.....	116
10.6 Adjusting the Screen Contrast.....	118
10.7 Entering a Password for Security	119
10.8 Resetting All Configuration and Calibration Values to Factory Settings	120
10.9 Switching Between Electrodes with DualCal	121
10.10 Determining and Entering a Solution Temperature Coefficient	122
10.10.1 Introduction	122
10.10.2 Determining Solution Temperature Coefficient.....	122
10.10.3 Entering Solution Temperature Coefficient	124
10.11 Turning on Temperature Display (Durafet Electrodes without Cap Adapter Only).....	125
10.12 Specifying Relay Activation.....	126
10.13 Replacing the Fuse	127
11. ACCESSORIES AND REPLACEMENT PARTS LIST	129
11.1 Overview	129
11.2 Part Numbers	130
A. TEMPERATURE MEASUREMENT CHARACTERISTICS	133
B. CYANIDE WASTE TREATMENT	135
B.1 Introduction	135
B.2 First Stage of Cyanide Destruction	136
B.3 Second Stage of Cyanide Destruction	137
B.4 Batch Treatment	138
B.5 ORP Potential a Measure of Status of Reaction.....	138
C. CHROME WASTE TREATMENT	139
C.1 Use of Chromates	139
C.2 First Stage of Chrome Removal	140
C.3 Second Stage of Chrome Removal.....	141
C.4 Batch Treatment	142
C.5 ORP Potential a Measure of Status	142
D. SIMULTANEOUS PH AND ORP MEASUREMENT	143

E.	PROPORTIONAL CONTROL TUNING	145
E.1	Overview	145
F.	MICROPROCESSOR BOARD SWITCH SETTINGS	147
F.1	Overview	147

Tables

Table 1-1	Key Functions	4
Table 1-2	9782 pH Analyzer/Controller Menu Hierarchy	6
Table 1-3	Overview of Analyzer/Controller Installation Tasks	11
Table 3-1	Procedure for Unpacking and Preparing the 9782	20
Table 4-1	Procedure for Installing AC Power Wiring	30
Table 5-1	Menu Choices and System Defaults	35
Table 5-2	Procedure for Performing I/O Setup	40
Table 5-3	Procedure for Configuring CAT Control and/or Retransmission of Process Variables	44
Table 5-4	Procedure for Configuring On/Off Control	47
Table 5-5	Procedure for Configuring PFT Control	48
Table 5-6	Procedure for Configuring DAT Control	49
Table 5-7	Procedure for Configuring Alarms	50
Table 5-8	Procedure for Setting the Clock	51
Table 5-9	Procedure for Configuring AutoClean	54
Table 5-10	Procedure for Configuring One-Point AutoCal	55
Table 5-11	Procedure for Configuring Two-Point AutoCal	57
Table 6-1	Recommended Maximum Wire Size	63
Table 6-2	Procedure for Installing Analog I/O Wiring	64
Table 6-3	Relay Contact Maximum Ratings	72
Table 6-4	Procedure for Wiring Relays	73
Table 6-5	Procedure for Disconnecting RC Arc Suppression Circuits	76
Table 8-1	Procedure for Standardization and Slope Adjustment	85
Table 8-2	Procedure for Calibrating Using Grab Sample	87
Table 8-3	Oxidation-Reduction Potential of Reference Solutions at Specified Temperature	89
Table 8-4	Procedure for Calibrating ORP System Using Reference Solution	90
Table 8-5	Procedure for Calibrating ORP Analyzer/Controller Using Voltage Input	91
Table 8-6	Representative Buffer Values at Various Temperatures	94
Table 8-7	Buffer Specification Procedure	95
Table 8-8	Standardization Procedure Using Automatic Buffer Recognition	97
Table 8-9	Procedure for Viewing System Calibration Values	99
Table 9-1	System Status Messages	102
Table 9-2	Process Alarm Messages	103
Table 9-3	On-Line Diagnostics and System Error Messages	104
Table 9-4	Procedure For Initiating Display and Keyboard Tests	105
Table 9-5	Procedure for Testing Relays and Analog Outputs	107
Table 10-1	Procedure for Calibrating Outputs	112
Table 10-2	Procedure for Restore Factory Calibration Values	114
Table 10-3	Procedure for Specifying a Tagname or Other Display String	115
Table 10-4	Procedure for Viewing Product Information and Changing the Stored Model Number	116
Table 10-5	Procedure for Adjusting the Screen Contrast	118
Table 10-6	Procedure for Entering a Password	119
Table 10-7	Procedure for Resetting All Configuration to Factory Settings	120
Table 10-8	Procedure for Switching Between Electrodes with DualCal	121
Table 10-9	Solution Temperature Compensation Coefficients for Selected Treatment Types at Specified Temperatures	123

Table 10-10 Procedure for Determining a Solution Temperature Coefficient Experimentally.....	123
Table 10-11 Procedure for Entering a Solution Temperature Coefficient.....	124
Table 10-12 Procedure for Turning on Temperature Display.....	125
Table 10-13 Procedure for Specifying Relay Activation.....	126
Table 10-14 Procedure for Replacing the Fuse.....	128
Table 11-1 Part Numbers	130
Table F-1 Microprocessor Board Switch Settings	148

Figures

Figure 1-1	9782 Front Panel.....	3
Figure 1-2	Dual DAT or PFT Control Using Two Setpoints and Relays	9
Figure 1-3	DualCAT Control Using a Single Analog Output.....	10
Figure 3-1	Sample Nameplate.....	21
Figure 3-2-1	Mounting and Dimensions - Non-Backlit Display Option	23
Figure 3-3-1	Mounting and Dimensions - Backlit Display Option	25
Figure 4-1	AC Power Terminals	31
Figure 6-1	Dual Reagent CAT Typical Wiring Using Relay 1 to Select Reagent Feeder.....	66
Figure 6-2	Terminal Connections.....	67
Figure 6-3	Terminal Connections.....	68
Figure 6-4	Terminal Connections.....	69
Figure 6-5	Terminal Connections.....	70
Figure 6-6	Terminal Connections.....	71
Figure 6-7	Backup Electrode Installation Using DualCal Alternate Electrode Calibration	74
Figure 6-8	Two Tank Batch Treatment with DualCal Alternate Electrode Calibration	75
Figure 7-1	Automatic Electrode Wash Setup.....	78
Figure 7-2	Rinse and One-Point Calibration.....	81
Figure 7-3	Two-Point AutoCal Operation.....	82
Figure 10-1	Location of Power Fuse	127
Figure A-1	Resistance vs. Temperature Characteristics of the Temperature Compensator	133
Figure B-1	Cyanide Treatment System	135
Figure B-2	First Stage Cyanide Oxidation - Typical Titration Curve.....	136
Figure C-1	Chrome Treatment System.....	139
Figure C-2	Chrome Reduction - Typical Titration Curve.....	141
Figure D-1	Installation Diagram Simultaneous pH and ORP Measurements with 9782 pH/ORP Analyzer and 7773-6□-□-40-□ Electrode Mounting Plus ORP Electrode	143
Figure F-1	Microprocessor Board DIP Switches	147

1. Introduction

1.1 Description

Multi-function instrument

The Honeywell 9782 pH/ORP Analyzer/Controller (Figure 1-1) is a microprocessor-based instrument for analysis of pH or ORP (Oxidation Reduction Potential, also referred to as Redox) in industrial processes. The pH, ORP and temperature can be measured simultaneously, depending on configuration (see Section 5). The units of measure are pH, mV, and °C. Resolution is 0.01 pH, 1 mV ORP, and 1 °C.

User interface

An easy-to-read display provides instant access to process values. The displays of process values show the instrument's tagname (or other configurable text) at the top of the screen.

Every display includes an "alarm stripe", a line dedicated to displaying process alarm messages, status messages, and system diagnostic messages, whenever any are active.

Dedicated-function membrane keys to the right of the display on the front panel are used to:

- cycle through the displays of real-time values
- access configuration, calibration, and maintenance menus
- change and enter setpoints and other parameters

In addition, three variable function keys are below the display. The function of each of these "soft keys" depends on the purpose of the screen currently on display. Soft key labels are always displayed at the bottom of the screen, immediately above the relevant function key.

Easy to configure

Menu-driven configuration is fast and easy. Only configuration parameters related to features supported by the hardware and relevant to the specific application are displayed.

Input

Input to the 9782 can be from any Honeywell pH electrode/preamplifier system or Durafet II electrode with Cap Adapter at distances up to 914.4 m (3000 ft). If the Analyzer/Controller is equipped with an optional internal preamplifier, input can come directly from any glass pH or ORP electrode located within 3.66 m (12 ft) of the analyzer or directly from a Durafet II pH electrode within 15.24 m (50 ft).

Outputs

Optional isolated 0-1 V, 0-10 V and 4-20 mA outputs are available. Use these analog outputs for retransmission of process variables, or for Current Adjusting Type control using an output signal that is directly proportional to the input (see 1.5.3).

Relays

Two 2A SPDT alarm/control relays are standard, with an additional two 3A relays (either general purpose or hermetically sealed) available as an option. These relays can be used to:

- take advantage of special features such as automatic cleaning of electrodes
- control process variables (see 1.5.3)
- annunciate alarms

1.2 Features

Storage of calibration data for two electrodes

The DualCal feature allows storage of calibration data for two electrode assemblies. The second electrode can be used as a manual backup or in a two-tank batch control setup.

Standard and solution temperature compensation

In addition to standard temperature compensation (for electrode response to temperature), the 9782 Analyzer/Controller also features solution temperature compensation (to adjust for the solution's change in pH as temperature changes). These temperature-induced changes are significant in analysis of high purity water.

Automatic electrode washing and calibration

The standard AutoClean and AutoCal features periodically rinse and calibrate electrodes automatically. The schedule and duration of the operations are configurable. AutoCal can be configured for one or two point calibrations. Internal relays actuate external solenoid valves to control the flow of the buffer solutions and rinse water to the electrodes.

Automatic buffer recognition

The instrument automatically recognizes six commonly used buffer solutions and the temperature variation characteristic of each. This simplifies manual calibration, and permits automatic calibration.

Password protection

A password (up to four digits) can be configured. If the security feature is enabled, the password will be required to access configuration, calibration, and maintenance software functions.

Extensive diagnostics

The 9782 Analyzer/Controller performs extensive self-diagnostics as a background task during normal operation. If a problem is detected, a message is displayed on the alarm stripe to alert the operator. In addition, the operator can initiate keypad and display tests using Maintenance Menu functions.

Watertight corrosion-resistant case

The 9782 is enclosed in a *watertight* and corrosion resistant industrial case, designed for panel, pipe or wall mounting. It has an EMI/RFI shielded plastic case.

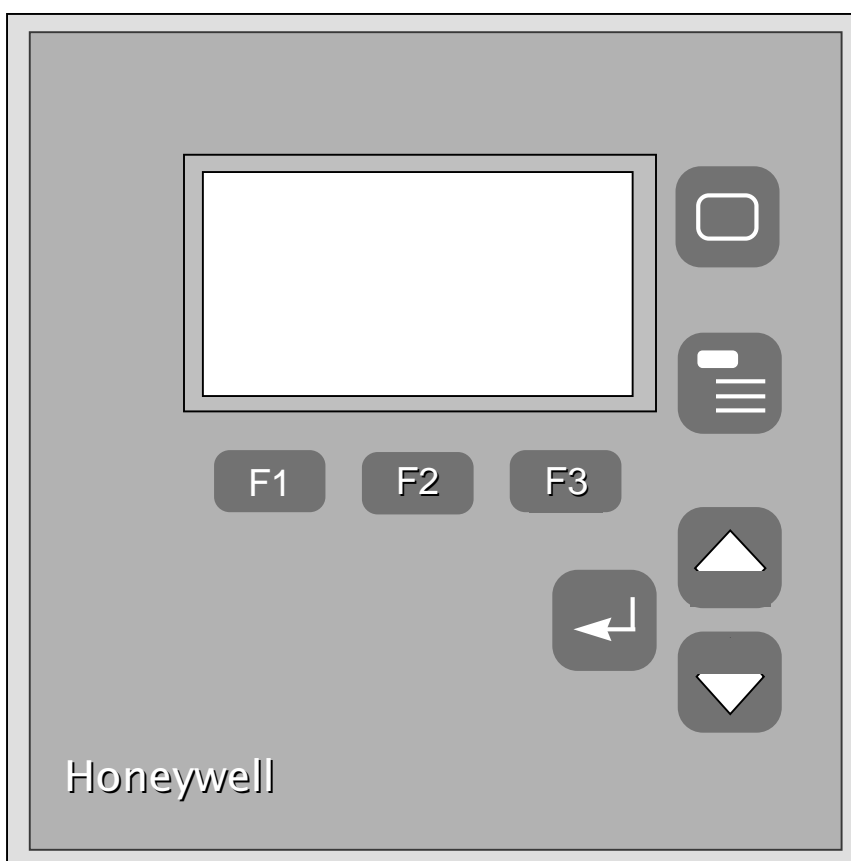








Figure 1-1 9782 Front Panel

1.3 Operating the Analyzer/Controller

Front panel keys used for all operator tasks

As shown in Figure 1-1, five keys with dedicated functions are on the front panel. In addition, three “soft keys” vary their function according to the needs of the screen on display. Use of the keys is described in Table 1-1.

Table 1-1 Key Functions

Key	Name	Use
	DISPLAY	<p>When process values are on display: Use DISPLAY to cycle through available real-time displays.</p> <p>When the main menu (Configuration, Calibration, Maintenance, I/O Setup) is on display: Use DISPLAY to return to displaying process values.</p>
	MENU	<p>When process values are on display: Use MENU to access the menus. If the security feature is enabled, the display will prompt for entry of the password before access to the menus is permitted. (Enter the password using the procedure for editing a parameter numeric value as described on the next page.)</p> <p>When any menu or configuration screen is on display: Use MENU to go up a level in the display hierarchy. Frequently this means returning to the main menu.</p>
	UP	<p>When a menu or configuration screen is on display: Use UP to highlight a different item.</p> <p>When changing a numerical value: Use UP key to increment the value of the digit at the cursor.</p>
	DOWN	<p>When a menu or configuration screen is on display: Use DOWN to highlight a different item.</p> <p>When changing a numerical value: Use DOWN to decrement the value of the digit at the cursor.</p>
	ENTER	<p>When a menu item is highlighted: Use ENTER to select it.</p> <p>When editing a parameter: Use ENTER to save the new value.</p>
	F1, F2, F3 [function keys]	<p>When a “soft key” label is displayed below the alarm stripe: Use the function key directly below the label to perform the action.</p>

Selecting a parameter for edit

To select a parameter for edit:

- display the screen containing the parameter
- use the **UP** or **DOWN** keys to highlight the parameter name
- press the **ENTER** key to highlight the displayed current value

Editing a parameter assignment from a list of available choices

To edit a parameter having a text string as an assigned value:

- select the parameter and highlight its current value as described above
- use the **UP** or **DOWN** keys to display the other valid choices
- when your choice is displayed, press **ENTER**

Editing a parameter numeric value

To edit a parameter having a numeric value:

- select the parameter and highlight its current value as described above; the ← and → soft keys will be displayed (During calibration the ← and → soft keys will be displayed once the **UP** or **DOWN** key has been pressed.)
- use the ← or → soft keys to move the cursor to the digit to be changed
- use the **UP** and **DOWN** keys to increment or decrement the value
- when all digits necessary have been changed, press **ENTER**

Entering and retrieving data

During I/O setup, configuration and calibration, while the unit is either retrieving data from memory or entering a new data value into memory, a time period will elapse until this action is complete. For the duration of this time period (which can be as great as 2 minutes for a large step change in values) a message will appear on the alarm stripe. If data is being retrieved from memory, the message will be “Retrieving Data” and if a new value is being stored in memory, the displayed message will be “Entering Data”.

Placing the unit in Hold mode

To put the Analyzer/Controller in Hold mode, maintaining a constant output and alarm condition, (and disabling solution temperature compensation if used) use the HOLD soft key available on the appropriate screens. “HOLD ACTIVE” will be displayed on the alarm stripe.

Use of Hold mode is recommended:

- Before starting manual calibration.
- Alarms are always held during an Automatic clean/calibration. The user selects whether outputs are held during these automatic functions. In either case the alarm stripe will display “HOLD ACTIVE.”
- Before making configuration changes that should not take effect immediately.

To take the unit out of Hold mode, press HOLD again.

Controlling an AutoClean and/or AutoCal operation manually

To initiate an Auto/Clean and/or AutoCal operation manually, press the **DISPLAY** key until the AutoClean/Cal screen is displayed. Next press the “START” soft key.

This display can also be used to see how much time is remaining during an automatic operation. When AutoClean and/or AutoCal are active, the alarm stripe will display “AUTOSEQUENCE”, and the AutoClean/Cal display will show the remaining time.

If necessary, pause the operation using the “PAUSE” soft key. To resume the operation, press “PAUSE” again. To cancel the operation, use the “STOP” soft key.

1.4 Menu Hierarchy

Menus for every task

For your convenience, menus are provided for configuration, calibration, maintenance, and I/O setup tasks. The menu hierarchy is shown in Table 1-2. Not every menu item applies to every system.

Table 1-2 9782 pH Analyzer/Controller Menu Hierarchy

Menu Item	Purpose	Described in Section
CONFIGURATION	set up Analyzer/Controller to implement your alarm and control strategy	5
CAT/RETRANSMISSION	configure parameters for using analog outputs for control and retransmission of process values	5.4
ALARMS	specify alarm setpoints, deadbands, and delays	5.6
DISCRETE CONTROL	specify setpoints, range limits, etc. to use relays for control	5.5
ADVANCED FEATURES	set up automatic cleaning and calibration of electrodes and sets up clock	5.7 and 5.8
CALIBRATION	select buffers for automatic buffer recognition and perform manual calibration	8
pH BUFFER CAL	calibrate pH system manually using one or two reference solutions	8.2
ORP CAL	calibrate ORP system manually using a reference solution or voltage input	8.4 or 8.5
SAMPLE CAL	calibrate pH system manually using a standard meter	8.3
AUTO BUFFER CAL	calibrate pH electrodes manually using automatic buffer recognition	8.6.3
AUTO BUFFER SETUP	select buffers for automatic buffer recognition	8.6.2
CAL DIAGNOSTICS	display standardization and slope values	8.7

Menu Item	Purpose	Described in Section
MAINTENANCE	do occasional system tasks	9 and 10
OFF-LINE FUNCTIONS	<i>[see functions listed below]</i>	<i>[see below]</i>
DISPLAY TEST	test display	9.5.1
KEYBOARD TEST	test keyboard	9.5.1
OUTPUT TESTS	test relays and analog outputs	9.5.2
OUTPUT CALIBRATION	calibrate outputs electrically	10.2
CALIBRATION RESET	set standardization offset and slope values back to zero	10.3
INSTRUMENT SETUP	<i>[see functions listed below]</i>	<i>[see below]</i>
INSTRUMENT TAGGING	configure tagname or other text to be displayed when no alarms are active	10.4
PRODUCT INFO	view software version and stored model number; if a special technical support password is known, alter model number in memory (in case of hardware upgrades)	10.5
SCREEN CONTRAST	adjust display contrast	10.6
SECURITY	assign password to limit access to configuration, calibration, and maintenance functions	10.7
RESET UNIT	reset all configuration and calibration values back to factory settings	10.8
ELECTRODE FUNCTIONS	<i>[see functions listed below]</i>	<i>[see below]</i>
SELECT ELECTRODE	specify which electrode is being used if calibration values for two electrodes are stored (DualCal)	10.9
SOLUTION TEMP COMP	enter a temperature coefficient if solution temperature compensation feature is used	10.10
DURAFET TEMP DISPLAY	turn Durafet temperature display on and off	10.11
RELAY ACTIVATION	specify whether relays should be activated or de-activated on alarm (or when discrete control output is on)	10.12
I/O SETUP	choose features, make relay and analog output assignments	5.3

1.5 Planning

1.5.1 Overview

Configuration system minimizes decisions

The 9782 was designed for easy configuration using menu displays and the keys on the front panel. Numeric values such as setpoints and range limits are easy to enter using the **UP** and **DOWN** keys and function keys (see 1.3). Other configuration parameter assignments are selected by scrolling through a list of available choices using the **UP** and **DOWN** keys.

During configuration only those parameters and choices relevant to features supported by your Analyzer/Controller's hardware will be available for configuration. For example, if the model purchased does not contain hardware for the optional analog outputs, then none of the screens relating to output configuration will be applicable.

Although configuration is a simple process, to make best use of the 9782 Analyzer/Controller and its features, a little advance planning is recommended.

1.5.2 Using Relays

Relays assigned automatically by priority

Every 9782 model includes two internal relays. Two more relays are available as an option. Many features use relays. During system setup, the first stage of configuration, you choose the features to be used. Based on your selections, the software will automatically assign relays based on the priority scheme described below. You will not be permitted to select features requiring more than the available number of relays.

Relay priority scheme

During I/O setup (see 5.3) the 9782's software will assign relays for the features listed below in the order shown. **The 9782 implements this scheme for you automatically.** However, it is presented here to make you aware of which features use relays, and of the trade-offs involved when selecting features.

- 1) Using an alternate electrode (DualCal) has top priority. Relay 4 will automatically be assigned to switch between electrodes. If the unit has only two relays, DualCal can still be used, but switchover of electrode input must be done manually (see 6.4.2).
- 2) Automatic functions AutoClean and AutoCal have second priority. (Manual calibration described in Section 8 does not require use of any relays.)
 - AutoClean always uses Relay 1 to activate the solenoid valve used to direct washing fluid to the electrode (see Section 7 for piping).
 - AutoCal with one reference solution (standardization for zero adjustment) uses Relay 2 to activate the solenoid valve used to direct the reference solution to the electrode (see Section 7 for piping).

- Using a second reference solution for AutoCal (permitting slope adjustment to match instrument gain to the electrode output response) requires Relay 3 to activate the solenoid valve for the second reference solution.
- 3) Use of relays for one of the discrete control strategies (see 1.5.3) has third priority.
 - Up to four relays can be used for On/Off cycle timers.
 - One or two relays can be used for Duration Adjusting Type (DAT) control.
 - One or two relays can be used for Pulse Frequency Type (PFT) control.
 - 4) Use of a relay for DualCat switchover has next priority, permitting two reagents to be fed using a single analog output for Current Adjusting Type control.
 - 5) Lowest priority is given to use of relays for activation of an annunciator for process alarms and/or system errors. (Note that any problems found by the Analyzer/Controller's self-diagnostics will always be displayed on the alarm stripe.)

1.5.3 Deciding on a Control Strategy

All 9782 models can use relays for control

All 9782 models have at least two relays. (Two more relays are optional.) These relays can be used to control process variables using one of the three types of discrete control available:

- On/Off Control using one to four cycle timers with configurable setpoint, deadband, cycle period, and “on” time.
- PFT (Pulse Frequency Type) Proportional-Only Control using one or two relays. The pulse output is generated by repeated relay contact opening and closure. The frequency of the pulse is proportional to the deviation from the configurable setpoint. The proportional band limit and maximum pulse frequency rate are also configurable. This type of output is used to control such devices as pulse-type electronic metering pumps.
- DAT (Duration Adjusting Type) Proportional-Only Control using one or two relays. Also known as time-proportioning control, DAT cycles a relay output on and off, varying the “on” time in proportion to the deviation from setpoint. This type of output is used to control devices such as solenoid valves.

PFT and DAT can use two relays to control two reagents. Figure 1-2 diagrams this application.

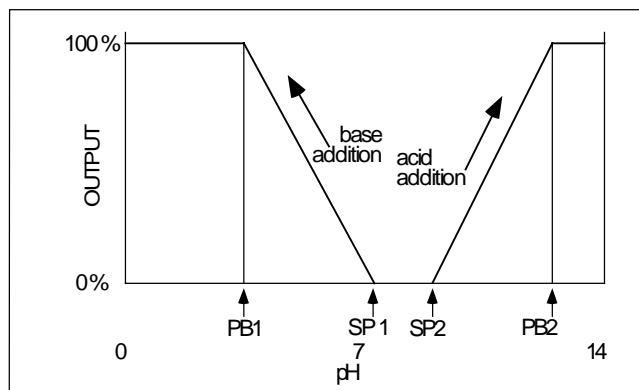


Figure 1-2 Dual DAT or PFT Control Using Two Setpoints and Relays

Optional analog outputs for control

Current and voltage outputs are available as options. These analog outputs can be used to retransmit a process variable using an output signal that is directly proportional to the input. This directly proportional analog output can also be used for Current Adjusting Type (CAT) control. (Despite the name of this control type, voltage outputs can also be used.)

DualCAT is a feature that permits control of two reagents with a single analog output. (An internal relay is used to make the switchover.) This scheme is diagrammed in Figure 1-3.

When an output is used to retransmit a process variable, the values representing 0 % and 100 % outputs are configurable.

In CAT control the process values for the setpoint and proportional band limit are configurable. In addition, if the DualCAT feature is used, a “failover” value can be configured. If the feature is enabled, then this value will be used as the output if the Analyzer/Controller’s diagnostics detect a problem with the system.

To control two reagents with two output signals, simply configure the output ranges appropriately. No switching relay is needed if two outputs are used.

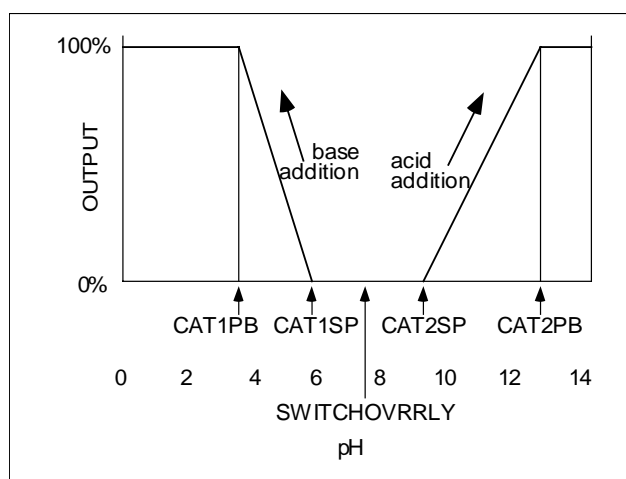


Figure 1-3 DualCAT Control Using a Single Analog Output

Selecting a strategy

When considering whether to use On/Off control or one of the proportional-only strategies, compare the requirements of your application with the benefits of each control type.

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 and for pretreatment in continuous neutralization systems.

Proportional-only control does not include any reset action. As a result, changes in reagent demand that occur in continuous processes are not accommodated and control will not reach the setpoint. In a batch process, reagent is added until a setpoint is reached and the batch is not emptied until this occurs.

If you decide to use proportional-only control, select the type based on the input requirements of the device to be controlled. See Appendix E for a discussion of tuning proportional-only control.

1.6 Overview of Installation and Setup Tasks

Setup tasks described in this manual

This manual contains instructions for all installation and operation tasks relating to the Analyzer/Controller. (Instructions for installing and using the electrodes are provided in the manuals supplied with the electrodes.) Table 1-3 provides an overview of the Analyzer/Controller installation tasks, as well as providing references to the relevant sections of the manual.

Table 1-3 Overview of Analyzer/Controller Installation Tasks

Sequence	Task	Section
1	Consider the environmental and electrical specs when selecting a site to install the Analyzer/Controller.	2
2	Unpack, inspect and mount the unit.	3
3	Install any optional hardware.	3
4	Check tag to confirm that unit is compatible with the voltage at your site.	4
5	Install power wiring.	4
6	Perform I/O setup and configure the software to implement your control strategy.	5
7	Wire inputs and outputs to match I/O setup in Step 6.	6
8	If AutoClean and AutoCal will be used, install necessary piping and valves.	7
9	If AutoCal will not be used, calibrate the system manually.	8
10	Specify whether relays should be energized or de-energized on alarm.	10
11	If solution temperature compensation will be used, enter a solution temperature coefficient. (If desired, specify that temperature will be one of the displayed real-time values.)	10
12	Configure a tagname or other text string to be displayed at the top of the screens showing real-time process values.	10
13	To limit access to I/O setup, configuration, calibration, and maintenance functions, enter a password.	10
14	Display model number stored in memory and software version number. Note these for future reference. (If you call for technical assistance, you will need this information.)	10

The manual also contains:

- information about diagnostics, status messages, and system error messages (Section 9)
- instructions for returning all parameter values to the factory settings (Section 10)
- instructions for calibrating the outputs and changing the fuse (Section 10)
- parts list (Section 11)
- supplementary information for special applications and proportional control tuning tips (appendices).

2. Specifications and Model Number

2.1 Specifications

Display

LCD dot matrix display, 128 by 64 dpi. Backlit display – solid state LED. Displays pH/ORP, temperature, time, alarm conditions, alarm setpoints, calibration, output limits and diagnostics.

Display Ranges

pH: –2.00 pH to +14.00 pH; resolution 0.01 pH.

ORP: –1638 to +1638 mV; resolution 1 mV.

Temperature: –10 to +140 °C; resolution 1 °C.

Display Scan Mode

Key used to cycle through displays of measured parameters and autosequence operation status. Alarm messages, status messages, and diagnostic messages available on all displays.

Keypad

Monoplanar front panel with 8 keys. Push-button entry with tactile feedback.

Auto Buffer Recognition

Recognizes 4.01, 6.86, 7.00, 9.00, 9.18, 10.00 pH standard buffer solutions with temperature correction from 0 °C to 60 °C (32 °F to 140 °F).

AutoCal Automatic Calibration and AutoClean Electrode Washing Schedule Settings

Clock Cycle: 28 days with day, hour, minute resolution.

Rinse Time: 60-1999 seconds.

Buffer Duration: 60-1999 seconds.

Resume Process Time Delay: 1-1999 seconds.

Calibration Interval: Adjustable, number of rinse cycles between one-point calibrations; or number of one-point calibrations between two-point calibrations.

Performance under reference operating conditions

Accuracy: ± 0.02 pH, or ± 2 mV (display).

Drift: Negligible.

Repeatability: ± 0.1 % of span ± 1 count.

Reference Operating Conditions: 25 ± 1 °C; 10-40 % RH; 120 Vac

Operating Influences under normal operating conditions

Effect on accuracy (% of span): Temperature: 0.05 % per °C; RH: < 1 %; Line Voltage: < 0.1 % per volt.

Power Loss: Memory retention by EEPROM (no batteries).

Operating Conditions

Ambient Temperature: Normal 0 °C to 60 °C (32 °F to 140 °F), extreme -10 °C to +60 °C (-4 °F to 140 °F); storage -30 °C to +70 °C (-22 °F to 158 °F).

Line Voltage: Normal 120 ± 10 % Vac, (extreme 100 Vac to 132 Vac, 47 Hz to 63 Hz.)
Normal 240 ± 10 % Vac, to 264 Vac, (extreme 200 Vac to 264 Vac, 50 Hz to 60 Hz.)

RH: 90 % maximum non-condensing @ 40 °C (104 °F) max.

Installation Category: II

Pollution Degree: 2

Altitude: ≤ 20000 M (6562 ft)

Output

Adjustable to within 0.01 mA, repeatable to within ± 0.1 % of span.

Optional Output

Two or three 4-20 mA outputs are available via an optional plug-in circuit card and program module. Isolated from ground, inputs and each other.

Maximum isolation voltage: 240 Vac (will withstand 1500 V hi-pot test).

Output adjustable: to within 0.01 mA.

Repeatability: ± 0.1 % of span. 600 ohm maximum load resistance.

Output Range

Adjustable to any pH/ORP/TEMP range within the display range.

Output Signals

Proportional to selected output range.

9782P -__ - 00:	None
9782P -__ - VC:	0-1 V or 0-10 Vdc, or isolated 4-20 mA dc (600 ohms maximum load)
9782P -__ - C2:	Two isolated 4-20 mA dc.
9782P -__ - C3:	Three isolated 4-20 mA dc.

Standard Alarm/Control Relays

Two SPDT Form C general purpose relays rated 0.6 amps at 120/240 Vac, 0.6 amps at 110 Vdc, 2 amps at 30 Vdc. Maximum switching power for ac, 125 VA resistive; for dc, 60 W resistive.

Optional Alarm/Control Relays

9782P -__ - R0:	Two hermetically sealed Form C, rated at 3 amps at 120 Vac, 28 Vdc, 0-1 V or 0-10 V or isolated 4-20 mA
-----------------	---

Control Settings

On/off period: 1 to 1000 seconds

On/off percent "on" time: 0 to 100 %, 1 % resolution.

Setpoint and proportional band limit ranges: ± 19.99 pH, ± 1999 mV, -10 °C to $+100$ °C (14 °F to 284 °F), one count resolution.

DAT cycle period: 1 second to 200 seconds.

PFT maximum frequency: 1 to 200 pulses/minute.

PFT pulse width: 50 ms, compatible with electronic pulse-type metering pumps.

Temperature Compensation

Conventional compensation for changing electrode output (Nernst response), plus selectable solution temperature compensation for high-purity water.

Power Requirements

108-132/216-264 Vac, 47-63 Hz, 15 VA. Memory retained by EEPROM when power is off.

Fuse Rating

120 V operation: 0.25 amp/250 V

240 V operation: 0.125 amp/250 V

Case

Gray Noryl plastic, waterproof and corrosion resistant. Interior conductive coating to provide effective RFI/EMI shielding.

Case Dimensions

156 x 156 x 178 mm (6 1/8 x 6 1/8 x 7 in.); panel cutout 141 x 141 mm (5.53 x 5.53 in.).

Weight

1.8 kg (4 lb).

Mounting

Panel mounting hardware supplied. Surface and pipe mounting hardware available. See Figure 3-2 or the Parts List.

2.2 Model Number Breakdown

Introduction

The model number breakdown is presented in the tables that follow.

The basic model number consists of a key number. Appended to this key number are characters that identify the features in various categories. The meaning of the characters in each category is presented in a table identified below.

Key Number Table I Table II Table III Table IV
 9782P - -- - -- - ----- - --

Model Number Table I - INPUTS

Description	Model No.
pH/ORP Electrodes	
pH from external pre-amp or Cap Adapter	0 1
direct glass/antimony pH/ORP electrode/internal preamp	0 2
direct Durafet pH electrode, internal preamp	0 3
Direct Glass from HPW 7000 Hi-pHurity Water Assembly	04

**Model Number Table II - AVAILABLE OUTPUTS
 (in addition to two standard relays)**

Description	Model No.
no analog outputs nor additional relays	0 0
one analog output: 4 to 20 mA, or 0 to 1 V or 0 to 10 V	V C
two analog outputs: both 4 to 20 mA	C 2
three analog outputs: all 4 to 20 mA	C 3
two additional relays (hermetically sealed) and one analog output: 4 to 20 mA, or 0 to 1 V or 0 to 10 V	R 0

Model Number Table III - OPTIONS

Description		Model No.
User's Manual		
English		E _ _ _ _
Pipe Mounting Kit		
none		_ 0 _ _ _
one kit		_ 1 _ _ _
Tagging		
none		_ _ 0 _ _
linen		_ _ L _ _
stainless steel		_ _ S _ _
Power		
factory set for 110/120 Vac		_ _ _ 0 _
factory set for 220/240 Vac		_ _ _ 1 _
Future		_ _ _ _ 0

Model Number Table IV – BACKLIT DISPLAY OPTION

Description		Model No.
Backlit display option	No	0 0
	Yes	BD

3. Unpacking, Preparation, and Mounting

3.1 Overview

Introduction

This section contains instructions for unpacking, preparing, and mounting the Analyzer/Controller. Instructions for wiring are provided in Sections 4 and 6. Software configuration is described in Section 5.

What's in this section?

The topics in this section are listed below.

Topic	See Page
3.1 Overview	19
3.2 Unpacking and Preparing	20
3.3 Installing the Optional Internal Preamplifier	21
3.4 Mounting	22

3.2 Unpacking and Preparing

Procedure

Table 3-1 contains procedure for unpacking and preparing the 9782.

Table 3-1 Procedure for Unpacking and Preparing the 9782

Step	Action
ATTENTION	
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 only (see specifications in Section 2).	
1	Carefully remove the instrument from the shipping container.
2	Compare the contents of the shipping container with the packing list. <ul style="list-style-type: none"> • Notify the carrier and Honeywell immediately if there is equipment damage or shortage. • Do not return goods without contacting Honeywell in advance.
3	Remove any shipping ties or packing material. Follow the instructions on any attached tags, and then remove such tags.
4	All 9782 Analyzer/Controllers are calibrated and tested at the factory prior to shipment. Examine the model number on the nameplate (Figure 3-1) to verify that the instrument has the correct optional features. (See Section 2 for model number breakdown.)
5	Select an installation location that meets the specifications in Section 2. The 9782 can be panel-, wall- or pipe-mounted (see 3.4).
ATTENTION	
Pipe mounting is not recommended if the pipe is subject to severe vibration. Excessive vibration may affect system performance.	
6	If extremely hot or cold objects are near the installation location, provide radiant heat shielding for the instrument.

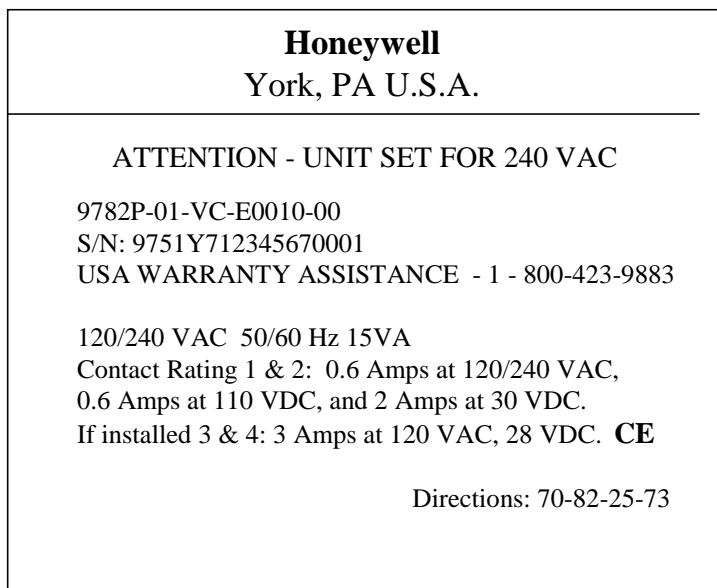


Figure 3-1 Sample Nameplate

3.3 Installing Optional Internal Preamp

Instructions elsewhere

If an optional internal preamp is to be installed in the 9782, follow the directions provided with the preamp kit.

3.4 Mounting

Introduction

The 9782 Analyzer/Controller can be panel-, wall- or pipe-mounted.

Panel-mounting

Figures 3-2-1 and 3-3-1 show panel cutout dimensions. They also illustrate how the instrument is attached to a panel by clamping the edges of the cutout between the case flange and the supplied U-bracket which is fastened to the rear of the case.

The panel may be up to 3/8 in. thick. Cutouts for adjacent 9782 Analyzer/Controllers may be no closer than 0.687 in. horizontally and 0.937 in. vertically, resulting in a nominal edge-to-edge bezel separation of 0.078 in.

Note that if the panel already has a cutout for a 7082 instrument, the same cutout can be used for the 9782. If the panel has a cutout for a 7070, 7075, 7076, 7077, or 7078 instrument, a Reducer Panel Kit is available for mounting the 9782. The part number is in Section 11.

Wall- and pipe-mounting

A bracket is available as an option for wall or pipe mounting the unit as shown in Figures 3-2-1, 3-2-2, 3-3-1, and 3-3-2.

The mounting kit part numbers are in Section 11.

ATTENTION

Pipe mounting is not recommended if the pipe is subject to severe vibration. Excessive vibration may affect system performance.

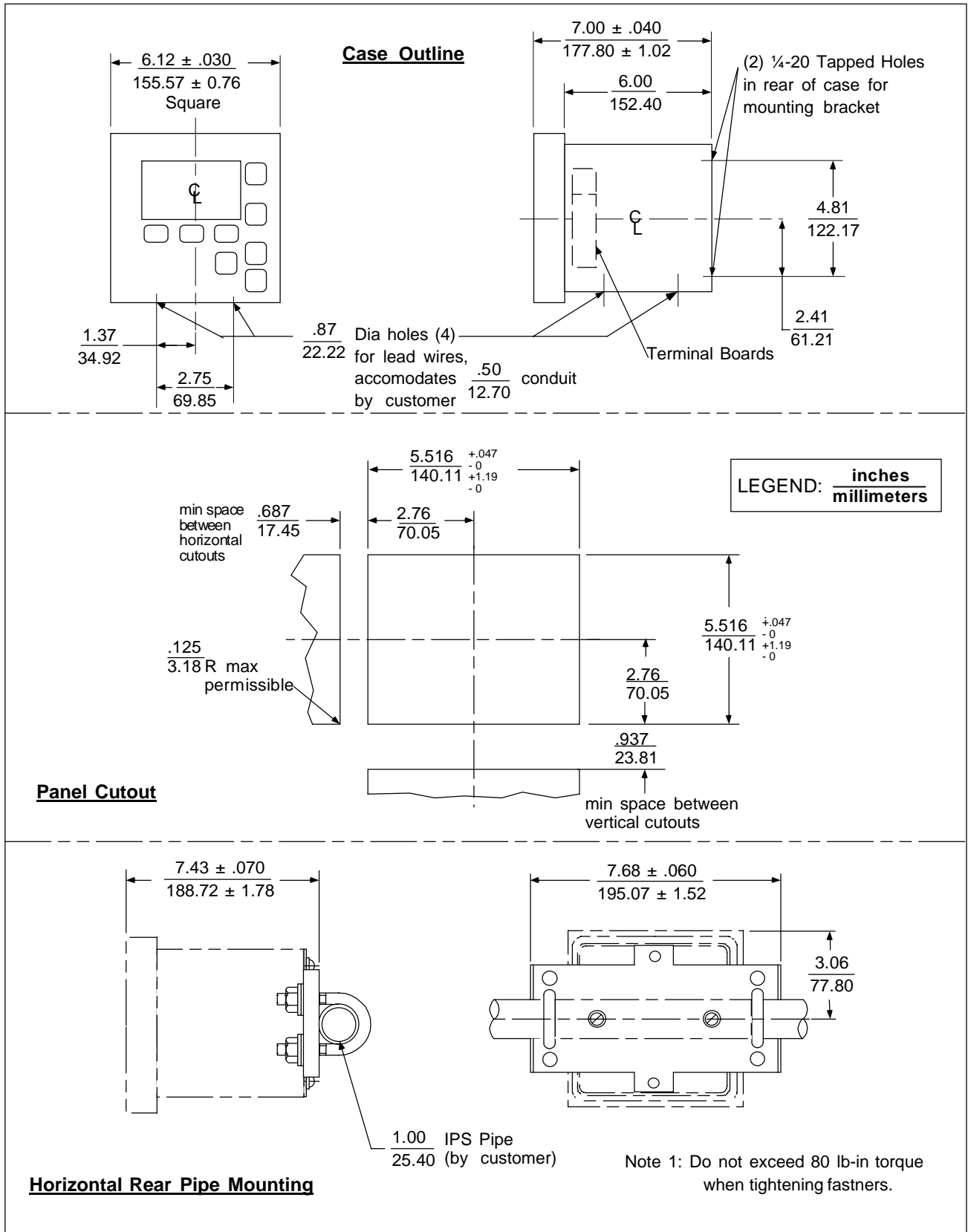


Figure 3-2-1 Mounting and Dimensions - Non-Backlit Display Option

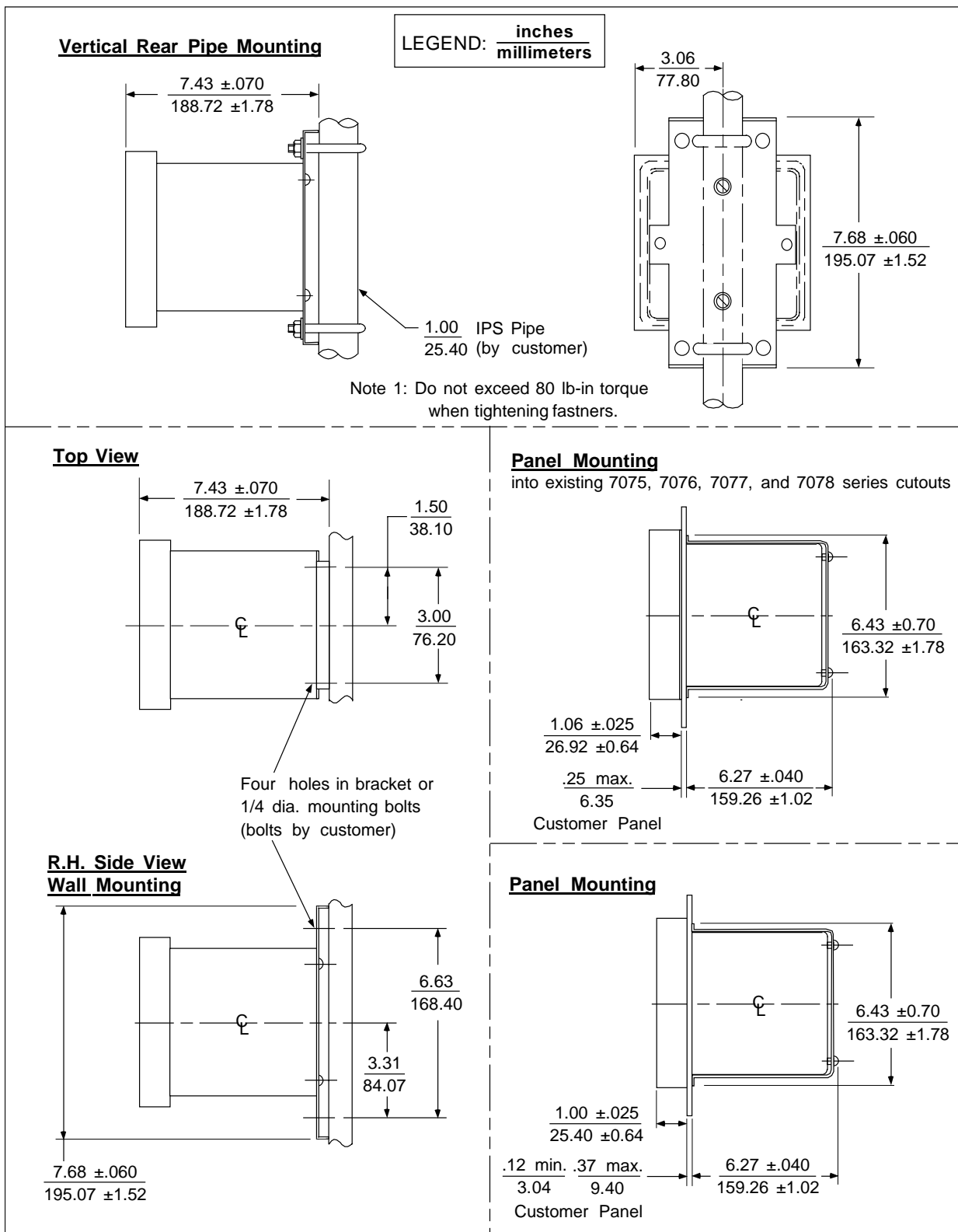


Figure 3-2-2 Mounting and Dimensions - Non-Backlit Display Option

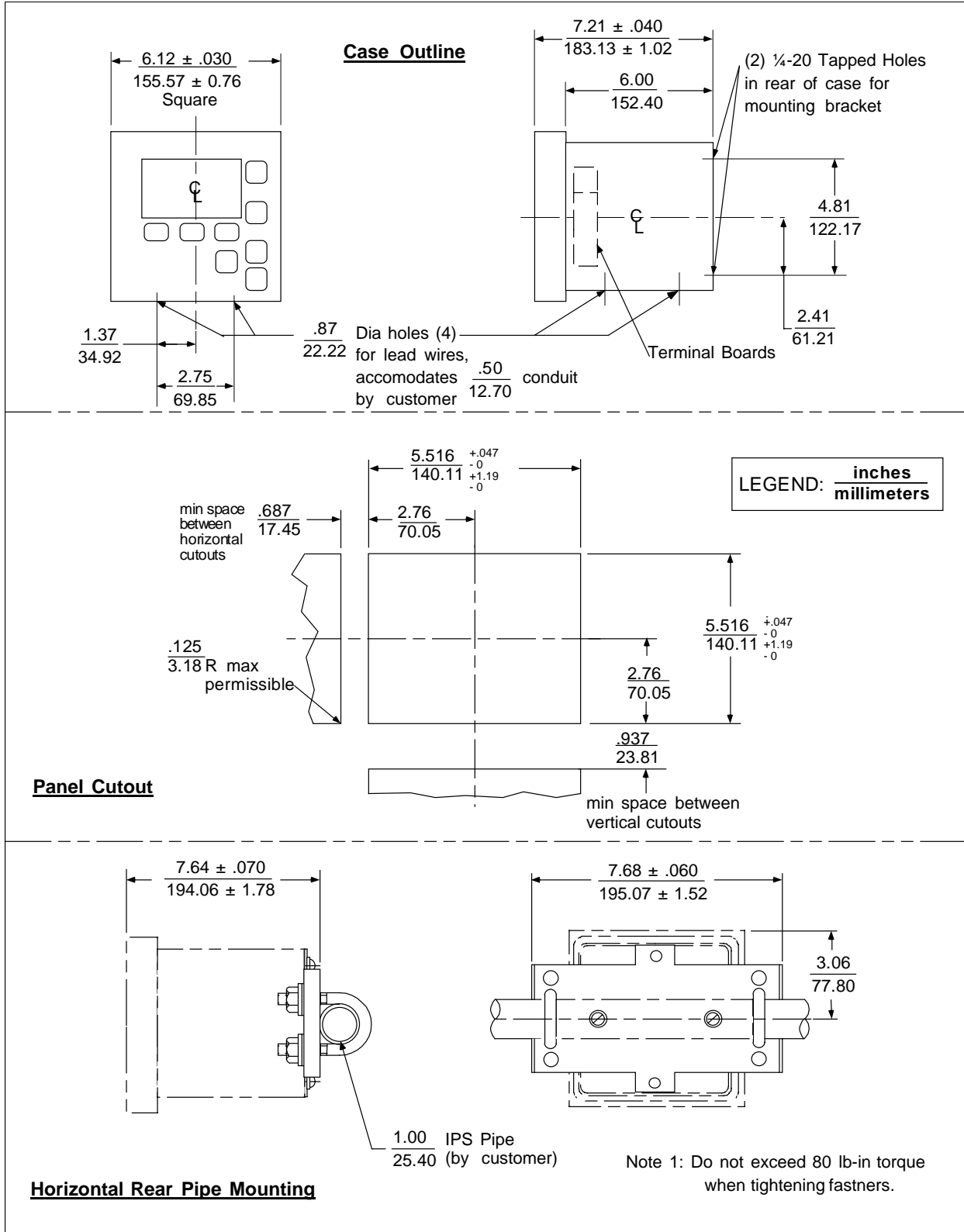


Figure 3-3-1 Mounting and Dimensions - Backlit Display Option

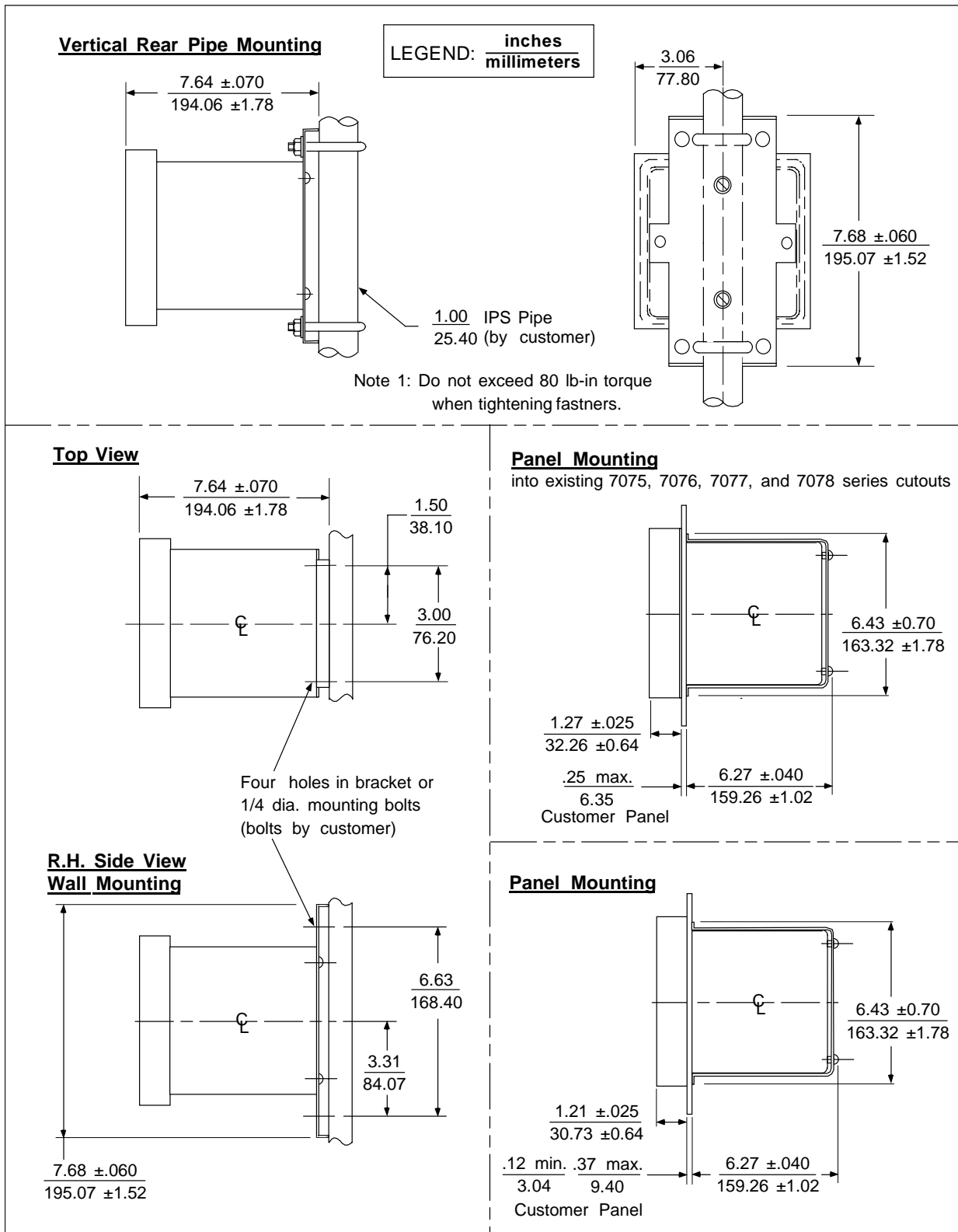


Figure 3-3-2 Mounting and Dimensions - Backlit Display Option

4. Power Wiring

4.1 Overview

Introduction

This section contains instructions for installing ac power wiring for the Analyzer/Controller, in preparation for configuring the software and performing I/O setup as described in Section 5.

We recommend that you wait to install input and output wiring (see Section 6) until after I/O setup. During I/O setup the software will determine for you which relay to use for each feature.

What's in this section?

The topics in this section are listed below.

Topic	See Page
4.1 Overview	27
4.2 General Wiring Practices	28
4.3 Power Wiring Considerations	29
4.4 Installing Power Wiring	30

4.2 General Wiring Practices



WARNING

Wiring should be performed by qualified personnel only.

Safety precaution



WARNING

A disconnect switch must be installed to break all current carrying conductors. Turn off power before working on conductors. Failure to observe this precaution may result in serious personal injury.



WARNING

An external disconnect switch is required for any hazardous voltage connections to the relay outputs.

Avoid damage to components

ATTENTION

This equipment contains devices that can be damaged by electrostatic discharge (ESD). As solid state technology advances and as solid state devices get smaller and smaller, they become more and more sensitive to ESD. The damage incurred may not cause the device to fail completely, but may cause early failure. Therefore, it is imperative that assemblies containing static sensitive devices be carried in conductive plastic bags. When adjusting or performing any work on such assemblies, grounded work stations and wrist straps must be used. If soldering irons are used, they must also be grounded.

A grounded work station is any conductive or metallic surface connected to an earth ground, such as a water pipe, with a 1/2 to 1 megohm resistor in series with the ground connection. The purpose of the resistor is to current limit an electrostatic discharge and to prevent any shock hazard to the operator. The steps indicated above must be followed to prevent damage and/or degradation, which may be induced by ESD, to static sensitive devices.

Wiring for immunity compliance



In applications where either the power, input or output wiring are subject to electromagnetic disturbances, shielding techniques will be required. Grounded metal conduit with conductive conduit fittings is recommended.

Connect the ac mains through a fused disconnect switch. To ensure that the unit meets the immunity levels specified by EMC directive 89/336/EEC, install power line filter kit p/n 079163. Wind three turns of each wire (14 AWG maximum) through the filter core for the two power and protective earth leads as illustrated in Figure 4-1. The wound filter cores shall be located external to the 9782 case within 25 cm.

Conform to code

Instrument wiring should conform to regulations of the National Electrical Code.

4.3 Power Wiring Considerations

Recommended wire size

Observe all applicable electrical codes when making power connections. Unless locally applicable codes dictate otherwise, use 14 gauge (2.081 mm²) wire for ac power, including protective earth.

Power supply voltage and frequency within specs

The power supply voltage and frequency must be within the limits stated in the specifications in Section 2.

Power for external preamp

The preamplifier power supply at terminals V+, V– and SC provides a nominal, unregulated +10 volts and –10 volts for an external preamp. If the 31022283 preamp is used, it will perform correctly from this supply although its terminals are designated +16, –16 and SC.

4.4 Installing Power Wiring

Procedure

Follow the procedure in Table 4-1 to install AC power wiring.



WARNING

Turn power off at mains before installing AC power wiring.

Table 4-1 Procedure for Installing AC Power Wiring

Step	Action
1	Check the tag on the outside of the case to be sure that the voltage rating of the unit matches the input voltage at your site.
ATTENTION	
The unit may be damaged if you apply power with the wrong voltage.	
2	Open the case: <ul style="list-style-type: none"> • Grasp the bottom center portion of the front bezel and pull it downward and toward you slightly to disengage the bottom of the bezel from the edge of the case. • Lift the bezel gently to disengage it from the top edge of the case. • Swing the bezel to the left. (The bezel and display assembly is mounted on pivot arms.) The safety cover with its warning label will be visible.
3	Remove the safety cover by removing the single screw holding it in place.
4	Install a fused disconnect switch in the power line which will be connected to the Analyzer/Controller. <ul style="list-style-type: none"> • If a 230/240 Vac line is to be connected, use a 0.125 amp fuse. • If a 110/120 Vac line is to be connected, use a 0.25 amp fuse.
5	To ensure that the unit meets the immunity levels specified by EMC directive 89/336/EEC, install power line filter supplied with Analyzer/Controller. Wind three turns of each wire (14 AWG maximum) through the filter core for the two power and protective earth leads as illustrated in Figure 4-1. The wound filter cores shall be located external to the 9782 case within 25 cm.
6	Connect the power wiring to terminals L1 and L2/N as shown in Figure 4-1. Connect the hot side of the line to terminal L1 and the grounded side of the line to terminal L2/N. <p>If the L2/N side of the line cannot be grounded, add an isolating transformer electrically between the power supply and the instrument and ground the L2/N terminal.</p>
WARNING	
The ground terminal (green screw) must be connected to a reliable earth ground for proper operation and to comply with OSHA and other safety codes. If metal conduit is used, connect a bonding wire between conduits. Do not rely upon the conductive coating of the instrument case to provide this connection. Failure to observe this precaution may result in serious personal injury.	
7	Replace the safety cover and secure it with the screw.
8	Close the case and power up the unit. Do not apply power until the case is closed.



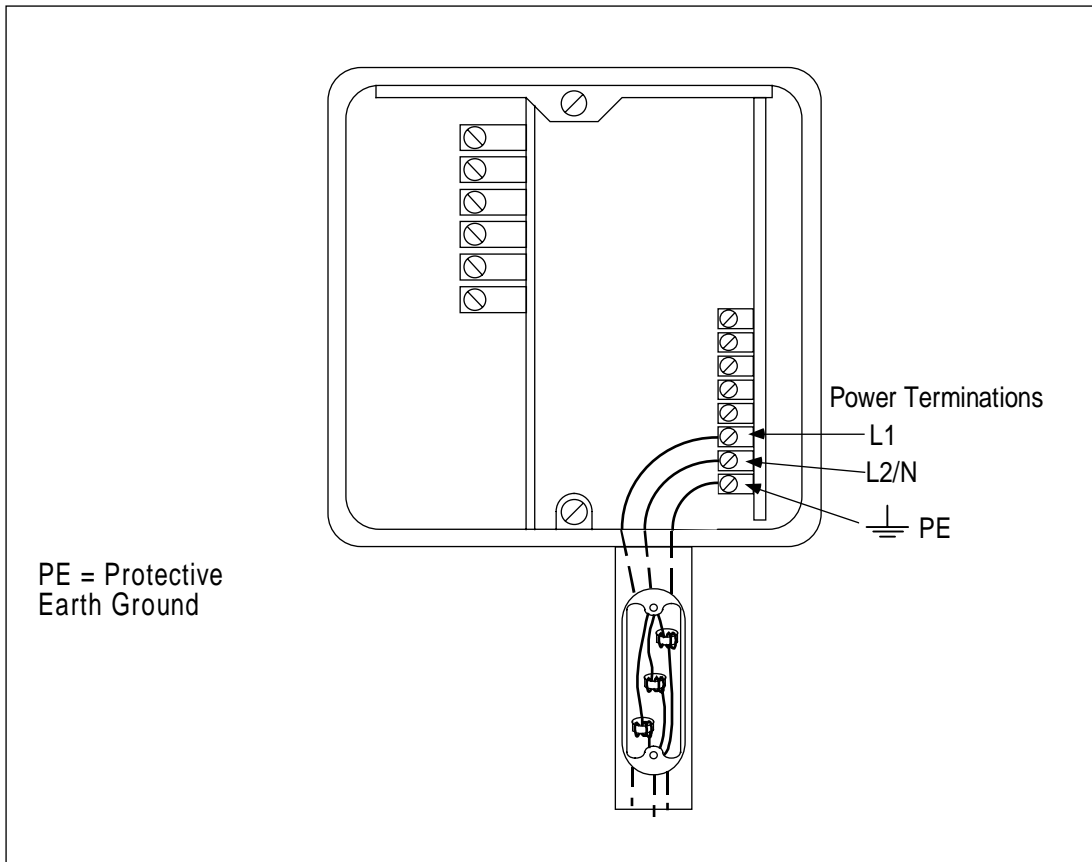


Figure 4-1 AC Power Terminals

5. I/O Setup and System Configuration

5.1 Overview

Introduction

This section provides instructions for performing I/O setup and for configuring the Analyzer/Controller's software to implement your control strategy.

What's in this section?

The topics in this section are listed below.

Topic	See Page
5.1 Overview	33
5.2 I/O Setup and Configuration Tasks	34
5.3 Performing I/O Setup	39
5.4 Configuring Current Adjusting Type Control and/or Retransmission of Process Variables	43
5.5 Configuring Duration Adjusting Type or Pulse Frequency Type Control	46
5.6 Configuring Alarms	50
5.7 Setting the Clock	51
5.8 Configuring AutoCal and AutoClean	52

Powering up the Analyzer/Controller

Every time the Analyzer/Controller is powered up the unit performs a "warm reset". During a warm reset, alarms are not cleared, and outputs are maintained at their last value prior to the loss of power or initiation of the warm reset. A warm reset has no effect on configuration or calibration values.

In addition to this warm reset, a "cold reset" function is available to return **ALL** configuration values and some I/O setup values to the factory settings shown in Table 5-1. During a cold reset the standardization offset is also returned to 0.0 and the percent theoretical slope is set back to 100.0, eliminating any changes made during manual or automatic calibration. All alarms will be cleared. Analog outputs will go to zero momentarily, then go to the factory default values. A cold reset can be initiated using a maintenance menu function as described in Section 10. It will also be initiated during I/O setup if the input type is changed.

5.2 I/O Setup and Configuration Tasks

Ease of configuration

Configuring the 9782 software is fast and easy. A menu is provided for every configuration task. You will be permitted to configure only those parameters relevant to your application and supported by the Analyzer/Controller model you purchased. In fact, configuration screens will contain only prompts and menu choices that apply to your application.

Accessing the I/O setup and configuration menus

Use the **MENU** key to access the main menu which includes CONFIGURATION and I/O SETUP choices.

If the security feature has been enabled as described in Section 10, the password must be entered in response to the prompt before you can proceed. (Out-of-the-box units do not require entry of a password to access the menu system.)

Purpose of I/O setup

I/O setup is the process of choosing the features to be used, so that the software can make appropriate I/O assignments. I/O setup (see 5.3) must precede configuration. The choices made during I/O setup determine which prompts and menu choices are available during configuration. (Even though I/O setup is performed first, I/O SETUP is last on the main menu because you usually only have to access this function once in the life of your Analyzer/Controller.)

Purpose of configuration menu items

The configuration menu contains the following items for accessing screens used to configure the features described below.

- **CAT/RETRANSMISSION:** If the hardware supports analog outputs, configure parameters related to use of these outputs as described in 5.4. Output 1 and/or Output 2 can be used for Current Adjusting Type (CAT) control. Any one, two or three outputs can be used for retransmission of process variables. If the unit contains only one analog output, it can be used for DualCAT (pH only); this feature controls two reagents using a single output channel.
- **ALARMS:** If one or more relays are available for annunciation of alarms, configure each alarm setpoint, deadband, and delay as described in 5.6. (Action is configured with I/O SETUP.)
- **DISCRETE CONTROL:** One or more relays can be used to achieve control of process variables using On/Off, Duration Adjusting Type (DAT) or Pulse Frequency Type (PFT) control strategies. Configure the related parameter values as described in 5.5.
- **ADVANCED FEATURES:** This menu item provides access to configuration screens for the following features:
 - Clock Setup: A display showing the current time can be accessed when the unit is online. The 24-hour clock must be set before you can use the AutoClean feature described below. Set the clock as described in Section 5.7.
 - Auto Clean: AutoClean is a feature that lets the Analyzer/Controller periodically rinse the electrodes automatically. Configure AutoClean as described in Section 5.8.

- AutoCal 1pt: This is a feature used in conjunction with AutoClean that lets the Analyzer/Controller periodically standardize the electrodes automatically. Configure AutoCal 1pt as described in Section 5.8.
- AutoCal 2pt: This is a feature used in conjunction with AutoClean that lets the Analyzer/Controller periodically standardize and slope the electrodes automatically. Configure AutoCal 2pt as described in Section 5.8.

Illustrations

The procedures in this section contain illustrations of display screens. These pictures are intended to show the types of information displayed on each screen. However, the screens you will actually see on your Analyzer/Controller may be different from the pictures in the manual. The displays will be customized for the hardware and application.

System defaults

Table 5-1 contains the menu choices available (or ranges for numeric values) and system defaults for I/O assignments and configuration parameters, as well as for values entered during maintenance functions described in Section 10.

Table 5-1 Menu Choices and System Defaults

PARAMETER	CHOICES or RANGE (Default is underlined)
I/O setup: input 1	<p>9782P-03 <u>DURAFET</u> (without Cap Adapter)</p> <p>9782P-01, -02, or -04 DURAFET (not for Durafet with Cap Adapter) <u>GLASS</u> (including Durafet with Cap Adapter) ANTIMONY ORP <i>when ORP only is measured</i></p>
I/O setup: input 2	<p>9782P-03-R2 or 9782-03-R0 ALTELTRD [alternate electrode] <u>N/A</u></p> <p>9782P-03-009782P-03-VC, 9782P-03-C2, 9782P-03-C3 <u>N/A</u></p> <p>9782P-01-R2, 9782P-01-R0, 9782P-02-R2, 9782-02-R0 ORP <i>when both pH and ORP are measured</i> ALTELTRD <i>when pH or ORP is measured</i> <u>N/A</u> <i>when pH only or ORP only is measured, or Durafet is used</i></p> <p>9782P-01-00, 9782P-01-VC, 9782P-01-C2, 9782P-01-C3, 9782P-02-00, 9782P-02-VC, 9782P-02-C2, 9782P-02-C3, ORP <u>N/A</u></p>
I/O setup: automatic functions	<p>ACLN ONLY [AutoClean only] ACAL-1PT [AutoClean plus AutoCal one-point] ACAL-2PT [AutoClean plus AutoCal two-point] (<i>4 relays only</i>) <u>N/A</u></p>

PARAMETER	CHOICES or RANGE (Default is underlined>)
I/O setup: discrete control type	<i>two relays only</i> 1PFT [pulse frequency type] 1DAT [duration adjusting type] 1O/F [on/off] 2PFT 2DAT 2O/F ALM1 [alarm] ALM2 ALM3 <u>N/A</u> <i>four relays - all of the above, plus</i> 3O/F 4 O/F
I/O setup: analog output types	2CAT [DualCAT] PCAT [CAT control based on pH measured value] OCAT [CAT control based on ORP measured value] pHCAT [retransmission of process pH value] default for Output 1 ORPCAT [retransmission of process ORP value] TEMPCAT [retransmission of process temperature value] <u>N/A</u> default for Outputs 2 and 3
I/O setup: value alarmed or controlled	<u>pH</u> TEMP ORP p/D [pH or self-diagnostic] T/D [temperature or self-diagnostic] O/D [ORP or self-diagnostic] N/A
I/O setup: alarm associated with relay (two relay units only; one-to-one correspondence between relay and alarm is fixed when four alarms are available)	ALM1 [alarm 1] default for Relay 1 ALM2 [alarm 2] default for Relay 2 ALM3 [alarm 3] ALM1/2 [alarm 1 and/or 2] ALM4 [alarm 4] N/A
I/O setup: relay alarm action	HIGH [high alarm] default for Relay 1 and Relay 3 LOW [low alarm] default for Relay 2 and Relay 4 N/A
configuration: retransmission 0 %	<i>pH:</i> -2.00 to 14.00, default = 0 <i>ORP:</i> -1999 to +1999 mV, default = 0 <i>TEMP:</i> -10 to 140 ± 1 °C, default = 0
configuration: retransmission 100 %	<i>pH:</i> -2.00 to 14.00, default = 14.00 <i>ORP:</i> -1999 to +1999 mV, default = 1999 <i>TEMP:</i> -10 to 140 ± 1 °C, default = 140
configuration: CAT/retransmission failover usage (only available with VC or RO output options)	<u>DISABLED</u> ENABLED
configuration: CAT/retransmission failover value (only available with VC or RO output options and when Failover ENABLED)	<i>pH:</i> -2.00 to 14.00, default = 14.00 <i>ORP:</i> -1999 to +1999 mV, default = 1999

PARAMETER	CHOICES or RANGE (Default is underlined)
configuration: standard CAT 1 or CAT 2 setpoint	<i>pH</i> : -2.00 to 14.00, default = 0 <i>ORP</i> : -1999 to +1999 mV, default = 0 <i>TEMP</i> : -10 to 140 ± 1 °C, default = 0
configuration: standard CAT 1 or CAT 2 proportional band limit	<i>pH</i> : -2.00 to 14.00, default = 14.00 <i>ORP</i> : -1999 to +1999 mV, default = 1999 <i>TEMP</i> : -10 to 140 ± 1 °C, default = 140
configuration: DualCAT pH CAT1 or CAT 2 setpoint	-2.00 to 14.00, default = 0
configuration: DualCAT pH CAT1 or CAT 2 proportional band limit	-2.00 to 14.00, default = 14
configuration: DualCAT pH switchover value	-2.00 to 14.00, default = 0 for Relays 2 and 4; 14.00 for Relays 1 and 3
configuration: alarm setpoint value configuration: cycle timer setpoint configuration: PFT control setpoint configuration: DAT control setpoint	<i>pH</i> : -19.99 to 19.99, default = 0 for Relays 2 and 4; 14.00 for Relays 1 and 3 <i>ORP</i> : -1999 to +1999 mV, default = 0 for Relays 2 and 4; 1999 for Relays 1 and 3 <i>TEMP</i> : 1 to 100 °C, default = 0 for Relays 2 and 4; 140 for Relays 1 and 3
configuration: alarm deadband value configuration: cycle timer deadband upper limit configuration: PFT control proportional band limit (pH and ORP only) configuration: DAT control proportional band limit (pH and ORP only)	<i>pH</i> : -0.01 to 19.99, default = 0.01 for Relays 1 and 2; setpoint default for Relays 3 and 4 <i>ORP</i> : -1999 to +1999 mV, default = 1 for Relays 1 and 2; setpoint default for Relays 3 and 4 <i>TEMP</i> : 1 to 100 °C, default = 1 for Relays 1 and 2; N/A for Relays 3 and 4
configuration: alarm delay	0 to 100 seconds, default = 0
configuration: cycle timer period	1 to 1000 seconds, default = 60
configuration: cycle timer “on” time	0 to 100 % at 1 % resolution, default = 100
configuration: PFT control maximum pulse frequency	1 to 200 pulses/second, default = 60
configuration: DAT control cycle period	1 to 200 seconds, default = 15
configuration: 24-hour clock set mode	<u>OFF</u> ON W/ RESET ON W/O RESET
configuration: 24-hour clock set hour	0-23, default = 00
configuration: 24-hour clock set minute	0-59, default = 0X
configuration: AutoCal/AutoClean timer days	0 to 28, default = 0
configuration: AutoCal/AutoClean timer hours	0 to 23, default = 1
configuration: AutoCal/AutoClean timer minutes	0 to 59, default = 0
configuration: AutoCal/AutoClean rinse duration	1 to 1999 seconds, default = 60
configuration: AutoCal/AutoClean output hold	YES <u>NO</u>

I/O Setup and System Configuration

PARAMETER	CHOICES or RANGE (Default is underlined)
configuration: AutoCal/AutoClean buffer flow duration	1 to 1999 seconds, default = 200
configuration: AutoCal/Clean resume delay	1 to 1999 seconds, default = 60
configuration: AutoCal/AutoClean number between operations	1 to 1999 occurrences, default = 1
maintenance: enable security	<u>NO</u> YES
maintenance: password	0000 to 9999; default = 0000
maintenance: solution temperature compensation type	PURE WATER AMMONIA PHOSPHATE MORPHALINE OTHER <u>N/A</u>
maintenance: solution temperature compensation value	<i>for PURE WATER = - 0.16 for AMMONIA = - 0.32 for PHOSPHATE = - 0.32 for MORPHALINE = - 0.32 for N/A = 0</i>
maintenance: Durafet temperature display	ON <u>OFF</u>
maintenance: electrode selection	<u>PRIMARY</u> ALTERNATE
maintenance: relay activation on alarm/control	ENERGIZE <u>DE-ENERGIZE</u>

5.3 Performing I/O Setup

Purpose

Before you can configure your Analyzer/Controller to implement your control strategy you must perform I/O setup. In I/O setup you choose the features to be used, based on the hardware capability of the 9782 model being configured. Using your selections, the software will display the relay and analog output assignments appropriate for your application. The choices made during I/O setup determine which prompts and menu choices are available during configuration.

For a discussion of the features available, and of the priority scheme used to assign relays, see Section 1.

ATTENTION

If you add an option card to the 9782, it is very important that you change the model number stored in memory (see Section 10).

During I/O setup the software will display prompts only for those features the hardware can support. The model number of the unit was stored in the 9782 memory at the factory. Each combination of features has a unique model number (see Section 2). Therefore, the processor can use this information to determine which prompts and selections are appropriate.

Entering the new number when you modify the hardware will let the processor know about the new hardware capabilities. As a result, you will be able to configure the unit to take advantage of features requiring that hardware.

Procedure

The procedure for I/O setup configuration is shown in Table 5-2.

Table 5-2 Procedure for Performing I/O Setup

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP ----- DIAGNOSTICS ----- NEXT </pre>	<p>Go to I/O SETUP.</p>
2	<pre> RELAY SETTINGS ----- RLY1 RLY2 RLY3 RLY4 N/A N/A pH TEMP ACLN ACAL HIGH LOW N/A N/A ALM3 ALM4 ----- DIAGNOSTICS ----- PREV NEXT </pre>	<p>The first screen shows the present use of available relays. This information is read-only.</p> <p>In this example the 9782 has four relays. Relay 1 and Relay 2 are used for AutoClean and one-point AutoCal (standardization). Relay 3 is used to trigger an annunciator if process variable pH goes over the alarm setpoint. Relay 4 is used for a low alarm on the temperature value.</p> <p>If the 9782 has only two relays, the screen will show Relay 1 twice. This permits display of alarm assignments even in the case where two alarms are assigned to Relay 1.</p> <p>Go to the next screen.</p>
3	<pre> ANALOG OUTPUTS ----- OUTPUT 1 : pH OUTPUT 2 : pH OUTPUT 3 : TEMP ----- DIAGNOSTICS ----- PREV NEXT </pre>	<p>The next screen shows the present assignments for the optional current or voltage outputs, if available. This information is read-only.</p> <p>Go to the next screen.</p>
4	<pre> ATTENTION : ----- ANY RECONFIGURATION CAN AFFECT OTHER PARAMETERS! ----- DIAGNOSTICS ----- PREV NEXT </pre>	<p>I/O setup is performed only once, before field connections are made to the Analyzer/Controller.</p> <p>Go to the next screen.</p>
5	<pre> SELECT INPUT TYPE: ----- INPUT 1: DURAFET INPUT 2: N/A ----- DIAGNOSTICS ----- NEXT </pre>	<p>Specify the type of input(s) to be used.¹</p> <p>NOTE: Set INPUT1 to "GLASS" if using Durafet II electrode with Cap Adapter. For regular Durafet with external or internal preamp input set to "DURAFET".</p> <p>If you specify any inputs other than the defaults, the unit will immediately perform a cold reset, returning all configuration and calibration values to the factory defaults.</p> <p>A cold reset will also return some I/O setup values to factory settings. If you change the input type, be sure to cycle through all the other I/O setup screens and check that the settings are appropriate for your application.</p> <p>Go to the next screen.</p>

Step	Screen	Action																																
6	<table border="1"> <tr><td colspan="2">AUTOMATIC FUNCTIONS</td></tr> <tr><td>SELECT:</td><td>ACAL-2PT</td></tr> <tr><td colspan="2"> </td></tr> <tr><td colspan="2">DIAGNOSTICS</td></tr> <tr><td> </td><td>NEXT</td></tr> </table>	AUTOMATIC FUNCTIONS		SELECT:	ACAL-2PT			DIAGNOSTICS			NEXT	<p>Specify the automatic functions to be used.</p> <p>Note that if AutoCal is used, AutoClean is always also used, too.</p> <p>Go to the next screen.</p>																						
AUTOMATIC FUNCTIONS																																		
SELECT:	ACAL-2PT																																	
DIAGNOSTICS																																		
	NEXT																																	
7	<table border="1"> <tr><td colspan="2">DISCRETE CONTROL</td></tr> <tr><td>SELECT:</td><td>1PFT</td></tr> <tr><td colspan="2"> </td></tr> <tr><td colspan="2">DIAGNOSTICS</td></tr> <tr><td> </td><td>NEXT</td></tr> </table>	DISCRETE CONTROL		SELECT:	1PFT			DIAGNOSTICS			NEXT	<p>If discrete control using relays is planned, enter the control type (ON/OFF with cycle timers, Pulse Frequency Type or Duration Adjusting Type).</p> <p>Go to the next screen.</p>																						
DISCRETE CONTROL																																		
SELECT:	1PFT																																	
DIAGNOSTICS																																		
	NEXT																																	
8	<table border="1"> <tr><td colspan="2">ANALOG OUTPUTS</td></tr> <tr><td>OUTPUT1:</td><td>pH</td></tr> <tr><td>OUTPUT2:</td><td>ORP</td></tr> <tr><td>OUTPUT3:</td><td>TEMP</td></tr> <tr><td colspan="2"> </td></tr> <tr><td colspan="2">DIAGNOSTICS</td></tr> <tr><td> </td><td>NEXT</td></tr> </table>	ANALOG OUTPUTS		OUTPUT1:	pH	OUTPUT2:	ORP	OUTPUT3:	TEMP			DIAGNOSTICS			NEXT	<p>If the hardware supports analog outputs, specify which process variables will be retransmitted (pH, ORP, or TEMP) or used for Current Adjusting Type control using an output signal that is directly proportional to the input signal (PCAT for pH and OCAT for ORP).</p> <ul style="list-style-type: none"> • Any output can be used for retransmission. • Only Outputs 1 and 2 can be used for CAT control. • A unit having only one output can use it for retransmission, CAT control of a single variable, or DualCAT control of two reagents. <p>Go to the next screen.</p>																		
ANALOG OUTPUTS																																		
OUTPUT1:	pH																																	
OUTPUT2:	ORP																																	
OUTPUT3:	TEMP																																	
DIAGNOSTICS																																		
	NEXT																																	
9	<table border="1"> <tr><td colspan="2">CONTROL/ALARM INPUTS</td></tr> <tr><td>ALM1</td><td>pH</td></tr> <tr><td>PFT1</td><td>pH</td></tr> <tr><td>ALM3</td><td>ORP</td></tr> <tr><td>ALM4</td><td>TEMP</td></tr> <tr><td colspan="2"> </td></tr> <tr><td colspan="2">DIAGNOSTICS</td></tr> <tr><td> </td><td>NEXT</td></tr> </table>	CONTROL/ALARM INPUTS		ALM1	pH	PFT1	pH	ALM3	ORP	ALM4	TEMP			DIAGNOSTICS			NEXT	<p>If you specified a type of discrete control earlier, use this screen to specify the process variables (inputs) on which the control action will be based.</p> <p>If you have any relays left for alarms, use this screen to specify what will be alarmed. (Whether relays energize or de-energize on alarm is configurable using the Maintenance Menu; see Section 10.)</p> <p>Go to the next screen.</p>																
CONTROL/ALARM INPUTS																																		
ALM1	pH																																	
PFT1	pH																																	
ALM3	ORP																																	
ALM4	TEMP																																	
DIAGNOSTICS																																		
	NEXT																																	
10	<table border="1"> <tr><td colspan="2">TWO RELAYS AVAILABLE FOR ALARM ASSIGNMENT</td></tr> <tr><td> </td><td> </td></tr> <tr><td>RLY1</td><td>RLY2</td></tr> <tr><td>AL1/2</td><td>ALM3</td></tr> <tr><td colspan="2"> </td></tr> <tr><td colspan="2">DIAGNOSTICS</td></tr> <tr><td> </td><td>NEXT</td></tr> </table>	TWO RELAYS AVAILABLE FOR ALARM ASSIGNMENT				RLY1	RLY2	AL1/2	ALM3			DIAGNOSTICS			NEXT	<p>If the unit has only two relays, and none are being used for AutoClean, AutoCal, or discrete control, then a screen is available for assigning alarms to relays. (A parallel screen is never displayed for units with four relays because the mapping of an alarm to an available relay is fixed.)</p> <p>Go to the next screen.</p>																		
TWO RELAYS AVAILABLE FOR ALARM ASSIGNMENT																																		
RLY1	RLY2																																	
AL1/2	ALM3																																	
DIAGNOSTICS																																		
	NEXT																																	
11	<table border="1"> <tr><td colspan="4">CONTROL/ALARM ACTION</td></tr> <tr><td>RLY1</td><td>RLY2</td><td>RLY3</td><td>RLY4</td></tr> <tr><td>pH</td><td>pH</td><td>ORP</td><td>TEMP</td></tr> <tr><td>ALM1</td><td>PFT1</td><td>ALM3</td><td>ALM4</td></tr> <tr><td>HIGH</td><td>N/A</td><td>LOW</td><td>HIGH</td></tr> <tr><td colspan="4"> </td></tr> <tr><td colspan="4">DIAGNOSTICS</td></tr> <tr><td> </td><td> </td><td> </td><td>NEXT</td></tr> </table>	CONTROL/ALARM ACTION				RLY1	RLY2	RLY3	RLY4	pH	pH	ORP	TEMP	ALM1	PFT1	ALM3	ALM4	HIGH	N/A	LOW	HIGH					DIAGNOSTICS							NEXT	<p>This screen shows the control or alarm input, and alarm number (if applicable) associated with each relay using earlier screens.</p> <p>Use this screen to configure the action (high or low) associated with each alarm. Note that relays assignments for discrete control, AutoClean, and AutoCal cannot be changed here.</p> <p>Go to the next screen.</p>
CONTROL/ALARM ACTION																																		
RLY1	RLY2	RLY3	RLY4																															
pH	pH	ORP	TEMP																															
ALM1	PFT1	ALM3	ALM4																															
HIGH	N/A	LOW	HIGH																															
DIAGNOSTICS																																		
			NEXT																															

Step	Screen	Action
12	<pre> NEW RELAY SETTINGS RLY1 RLY2 RLY3 RLY4 pH pH ORP TEMP ALM1 PFT1 ALM3 ALM4 HIGH N/A LOW HIGH ----- DIAGNOSTICS ----- NEXT </pre>	<p>The screen will display the new relay assignments, reflecting the choices you made earlier. This information is read-only.</p> <p>Make a note of it so that you can wire the relay terminals correctly (see Section 6).</p> <p>Go to the next screen.</p>
13	<pre> NEW ANALOG OUTPUTS OUTPUT1: pH OUTPUT2: ORP OUTPUT3: TEMP ----- DIAGNOSTICS ----- NEXT </pre>	<p>The screen will display the new current or voltage output assignments, reflecting the choices you made earlier. This information is read-only.</p> <p>Make a note of it so that you can wire the output terminals correctly (see Section 6).</p> <p>Go to the next screen.</p>
14	<pre> ENTER TO CONTINUE ----- DIAGNOSTICS ----- NEXT </pre>	<p>Pressing ENTER will do a warm reset and will also store these changes in memory, overwriting any previous I/O setup.</p>
15	<pre> PRESS ENTER TO RETURN TO MAIN MENU ----- DIAGNOSTICS ----- NEXT </pre>	<p>Press ENTER again to complete the operation and return the display to the main menu.</p>

¹ **For Durafet II electrodes with a standard preamp input**, if you want to display process temperature, or take advantage of the Durafet electrode’s ability to compensate for pH changes in a solution due to temperature changes, then a separate temperature input is required. It is not specified here, because temperature input uses special input terminals. However, the temperature input must be wired as shown in section 6. In addition, to use the solution temperature compensation feature, a solution temperature coefficient must be entered as described in section 10.

For Durafet II electrodes with a Cap Adapter, a separate temperature sensor is not required.

5.4 Configuring Current Adjusting Type (CAT) Control and/or Retransmission of Process Variables

Purpose

If the hardware supports analog outputs, during I/O setup you had an opportunity to specify which process variables will be retransmitted, or used as the basis for DualCAT or CAT control. (The DualCAT feature permits control of pH with two reagents alternately using a single output, as described in Section 1.) Before using an analog output for retransmission or control, you must configure the related parameter values.

Regardless of whether you plan to retransmit a process value to a recorder or control a device based on that value, the output signal will be directly proportional to the input. However, the configuration screens are different for the different output uses.

For a discussion of tuning proportional control see Appendix E.

Procedure

The procedure for configuring CAT control and/or retransmission of process variables is shown in Table 5-3.

Hold mode

To place the unit in Hold mode before configuring CAT control, go to an online display screen and press the HOLD soft key. To take the unit out of Hold mode after configuration, go back to an online screen and press the HOLD soft key again.

Table 5-3 Procedure for Configuring CAT Control and/or Retransmission of Process Variables

Step	Screen	Action
<p>1</p>	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP ----- DIAGNOSTICS ----- PREV NEXT </pre>	<p>Go to CONFIGURATION CAT/RETRANSMISSION.</p> <p>ATTENTION: Any value entered for one of these parameters will take effect as soon as it is entered UNLESS THE 9782 IS IN HOLD MODE.</p>
	<pre> CONFIGURATION CAT/RETRANSMISSION ALARMS DISCRETE CONTROL AUTO CAL/CLEAN ----- DIAGNOSTICS ----- </pre>	
<p>2</p>	<pre> CAT/RETRANSMISSION OUTPUT 1 CAT 2 OUTPUT 3 ----- DIAGNOSTICS ----- CAT/RETRANSMISSION DUAL CAT ----- DIAGNOSTICS ----- CAT/RETRANSMISSION DE ENABLED ----- DIAGNOSTICS ----- </pre>	<p>What configurable items are displayed depends on what analog output type was specified during I/O setup.</p> <ul style="list-style-type: none"> • A retransmitted variable will be indicated here as "OUTPUT n". • CAT based on pH (PCAT) or ORP (OCAT) will be indicated here as "CAT n". • DualCAT (2CAT) is only available if the unit has only one analog output, so this choice is always displayed alone. <p>Select the output to be configured.</p>
<p>3</p>	<pre> OUTPUT e INPUT pH 0% 1 pH 100% 7 pH FAILOVER : ENABLE FAILOVER VAL: 9 pH ----- DIAGNOSTICS ----- HOLD < > </pre>	<p>For each output to which a retransmitted process variable was assigned during I/O setup, the PV will be displayed, and the appropriate unit of measure will be filled in. (This is read-only information.)</p> <p>Specify the range by entering the values to be represented by outputs of 0 % and 100 %. If reverse-acting output is required, enter the high range value at the 0 % prompt and the low range value at the 100 % prompt.</p> <p>For output options VC or RO the FAILOVER feature is available. If failover is enabled here, then when the unit's self-diagnostics find a malfunction, the output will go the failover value entered on this screen. When FAILOVER is ENABLED or DISABLED the 0 and 100% values are changed back to factory defaults.</p>

Step	Screen	Action
4	<pre> DUALCAT pH CAT1 SP: 7 pH CAT1 PB: 2 pH CAT2 SP: 7 pH CAT2 PB: 14 pH SWITCHOVRRLY: 7 pH ----- DIAGNOSTICS ----- <---> </pre>	<p>If DualCAT is used, specify the range for control of each reagent.</p> <p>Enter the value at which the output switchover must occur.</p>
5	<pre> CAT 2 INPUT: pH CAT2 SP: 7 pH CAT2 PB: 1.5 pH ----- DIAGNOSTICS ----- <---> </pre>	<p>For each output to which a CAT based on pH or ORP was assigned during I/O setup, the PV will be displayed, and the appropriate unit of measure will be filled in. (This is read-only information.)</p> <p>Specify the setpoint and proportional band limit.</p>
6		<p>When all output parameters have been configured, take the unit out of Hold mode.</p>

5.5 Configuring On/Off, Duration Adjusting Type (DAT), or Pulse Frequency Type (PFT) Control

Purpose

During I/O setup you had an opportunity to specify whether to use one or more relays to achieve control of a process variable with a discrete control strategy: On/Off, DAT or PFT.

If one of these control types was selected, you will be able to configure the related parameter values.

For a discussion of tuning proportional control (applicable to PFT and DAT control) see Appendix E.

Procedure

The procedure for configuring On/Off control is shown in Table 5-4.

The procedure for configuring PFT control is shown in Table 5-5.

The procedure for configuring DAT control is shown in Table 5-6.

Table 5-4 Procedure for Configuring On/Off Control

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT CONFIGURATION CAT/RETRANSMISSION ALARMS DISCRETE CONTROL AUTO CAL/CLEAN DIAGNOSTICS DISCRETE CONTROL ON/OFF PFT DAT DIAGNOSTICS </pre>	<p>Go to CONFIGURATION DISCRETE CONTROL ON/OFF.</p> <p>ATTENTION: Any value entered for one of these control-related parameters will take effect as soon as it is entered UNLESS THE 9782 IS IN HOLD MODE.</p>
2	<pre> ON/OFF CONTROL CYCLE PERIOD: 100 s CYCLE TMR 1 CYCLE TMR 2 CYCLE TMR 3 CYCLE TMR 4 DIAGNOSTICS </pre>	<p>Use this screen to specify the length of the cycle period for all timers.</p> <p>To configure an individual timer associated with one of the relays, select it from the menu.</p>
3	<pre> ON/OFF CYCLE TIMER e INPUT: pH OUTPUT: RLY1 SETPOINT: 9pH DEADBAND: 1pH ONTIME: 50% DIAGNOSTICS HOLD < > </pre>	<p>The input type, relay assignment and appropriate relay output action will already be filled in, based on the process variable assigned to this On/Off control output during I/O setup. (This is read-only information.)</p> <p>Enter the setpoint at which the output should be turned on.</p> <p>If desired, specify a deadband limit. (If the PV varies from the setpoint while the output is ON, but by less than the value of the deadband limit, the output will remain on.)</p> <p>Enter the percent of the cycle period that the relay should stay on when the setpoint is reached.</p> <p>Take the unit out of Hold mode.</p>

Table 5-5 Procedure for Configuring PFT Control

Step	Screen	Action
1	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> DIAGNOSTICS PREV NEXT </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> CONFIGURATION CAT/RETRANSMISSION ALARMS DISCRETE CONTROL AUTO CAL/CLEAN </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> DIAGNOSTICS </div> <div style="border: 1px solid black; padding: 5px;"> DISCRETE CONTROL ON/OFF PFT DAT </div> <div style="border: 1px solid black; padding: 5px;"> DIAGNOSTICS </div>	<p>Go to CONFIGURATION DISCRETE CONTROL PFT.</p> <p>ATTENTION: Any value entered for one of these control-related parameters will take effect as soon as it is entered UNLESS THE 9782 IS IN HOLD MODE.</p>
2	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> PFT CONTROL PFT1 PFT2 </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> DIAGNOSTICS </div> <div style="border: 1px solid black; padding: 5px;"> HOLD NEXT </div>	<p>Use this screen to select the PFT control output to be configured.</p>
3	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> PFT 1 INPUT: pH OUTPUT: RLY1 SETPOINT: 9pH PB LIMIT: 14pH PB FREQ RATE: 60Hz </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> DIAGNOSTICS </div> <div style="border: 1px solid black; padding: 5px;"> HOLD <- - - - > </div>	<p>The input type, relay assignment and appropriate unit of measure will already be filled in, based on the process variable assigned to this PFT control output during I/O setup. (This is read-only information.)</p> <p>Enter the setpoint at which the output should be turned on.</p> <p>Enter the PB Limit. This is the value for which the output's pulse output rate will be at its maximum frequency.</p> <p>Specify the maximum frequency rate representing 100% output. (Be sure this rate is compatible with the controlled device.) The rate specified for the last PFT control output configured will apply to all PFT outputs.</p> <p>Take the unit out of Hold mode.</p>

Table 5-6 Procedure for Configuring DAT Control

Step	Screen	Action
1	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP <hr/> DIAGNOSTICS <hr/> PREV NEXT </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> CONFIGURATION CAT/RETRANSMISSION ALARMS DISCRETE CONTROL AUTO CAL/CLEAN <hr/> DIAGNOSTICS <hr/> </div> <div style="border: 1px solid black; padding: 5px;"> DISCRETE CONTROL ON/OFF PFT DAT <hr/> DIAGNOSTICS <hr/> </div>	<p>Go to CONFIGURATION DISCRETE CONTROL DAT.</p> <p>ATTENTION: Any value entered for one of these control-related parameters will take effect as soon as it is entered UNLESS THE 9782 IS IN HOLD MODE.</p>
2	<div style="border: 1px solid black; padding: 5px;"> DAT CONTROL DAT1 DAT2 <hr/> DIAGNOSTICS <hr/> HOLD NEXT </div>	<p>Use this screen to select the DAT control output to be configured.</p>
3	<div style="border: 1px solid black; padding: 5px;"> DAT1 INPUT: pH OUTPUT: RLY1 SETPOINT: 9pH PB LIMIT: 14pH CYCLE PERIOD: 120Hz <hr/> DIAGNOSTICS <hr/> HOLD <-- --> </div>	<p>The input type, relay assignment and appropriate unit of measure will already be filled in, based on the process variable assigned to this DAT control point during I/O setup. (This is read-only information.)</p> <p>Enter the setpoint at which the output should be turned on.</p> <p>Enter the PB Limit. This is the value for which the output's on duration will be maximum.</p> <p>Specify the length of the cycle period (in seconds) for the time-proportioned control. The cycle period specified for the last DAT control output configured will apply to all DAT outputs.</p> <p>Take the unit out of Hold mode.</p>

5.6 Configuring Alarms

Purpose

If you configured input and action for one or more alarms during I/O setup (described in 5.3), configure each alarm’s setpoint, deadband, and delay as described below.

Procedure

The procedure for configuring parameters for an alarm is described in Table 5-7.

Table 5-7 Procedure for Configuring Alarms

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to CONFIGURATION ALARMS ALARM e .
	<pre> CONFIGURATION CAT/RETRANSMISSION ALARMS DISCRETE CONTROL AUTO CAL/CLEAN DIAGNOSTICS </pre>	ATTENTION: Any value entered for one of these alarm-related parameters will take effect as soon as it is entered UNLESS THE 9782 IS IN HOLD MODE .
	<pre> ALARMS DELAY 5 S ALARM 1 ALARM 2 ALARM 3 ALARM 4 DIAGNOSTICS </pre>	Enter a delay value to prevent brief upsets from activating an alarm. This configured delay value will apply to all alarms. Select the appropriate alarm for configuration.
2	<pre> ALARM e INPUT: pH ALARM: HIGH DELAY: 5 S SETPOINT: 10pH DEADBAND: 1pH DIAGNOSTICS HOLD <-- --> </pre>	The process variable and action configured for the alarm during I/O setup will be displayed. The delay time in seconds configured under ALARMS will also be displayed. Enter the setpoint value at which the alarm will become active. Specify the deadband. Once the alarm is active, it will not deactivate until the PV differs from the setpoint by at least the value of the deadband limit. Take the unit out of Hold mode.

5.7 Setting the Clock

Purpose

A display showing the current time can be accessed when the unit is online. The 24-hour clock must be set before you can use the AutoClean feature described in Subsection 5.8.

Procedure

Follow the procedure in Table 5-8 to set the 24-hour clock.

Table 5-8 Procedure for Setting the Clock

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to CONFIGURATION ADVANCED FEATURES CLOCK SETUP .
	<pre> CONFIGURATION CAT/RETRANSMISSION ALARMS: DISCRETE CONTROL ADVANCED FEATURES DIAGNOSTICS PREV NEXT </pre>	
	<pre> ADVANCED FEATURES CLOCK SETUP AUTO CLEAN: DIAGNOSTICS PREV NEXT </pre>	
2	<pre> AUTO CLEAN CLOCK SETUP: CLOCK ON W/RESET HOURS 13 MINUTES 30 DIAGNOSTICS PREV NEXT </pre>	<p>Set the clock. For example, if you will start the clock at 1:30 PM, enter 13 hours, 30 minutes.</p> <p>Start the clock and specify what should happen to the clock if the power fails.</p> <ul style="list-style-type: none"> • ON W/RESET starts the clock now. Following power failure, the clock will be reset to 00:00 and the diagnostic message "RESET CLOCK" will be displayed. • ON W/O RESET starts the clock now. Following power failure the clock will remain off, and the diagnostic message "RESET CLOCK" will be displayed. <p>Display of "RESET CLOCK" will continue until you either reset the clock or turn it off.</p>

5.8 Configuring AutoCal and AutoClean

Purpose

Periodic calibration of electrodes is necessary for best system performance because electrode outputs change over time. One-point calibration (standardization) is a zero adjustment to compensate for electrode drift. Two-point calibration (standardization and slope adjustment) includes a span adjustment to match the gain of the Analyzer/Controller to the electrode response. Standardization and slope each depend on the electrode measuring a reference solution (buffer) of known pH.

The AutoCal and AutoClean features periodically rinse and calibrate electrodes automatically (see Section 7). If these features were selected during I/O setup (described in 5.3), configure control of AutoCal and AutoClean as described below. (If manual calibration will be used instead, see Section 8.)

AutoCal and AutoClean configuration consists of setting the clock, and specifying the frequency and duration of the cleaning and calibration operations.

ATTENTION

For Auto Clean/Cal to operate, the 24-hour clock must be set as described in 5.7.

The piping and valves required by AutoCal and AutoClean are shown in Section 7.

Timer-initiated operation

With the 24-hour clock turned ON and the AutoClean feature enabled (and the appropriate piping in place), this mode performs unassisted cell cleaning. The AutoClean Time Remaining on-line display provides an up-to-date time stamp of the next occurrence of an automatic cell cleaning. Once the timer reaches zero, the cell cleaning will occur. Upon completion, the timer will be reset and the Time Remaining display will again provide a countdown to the next cleaning. To temporarily disable timer-initiated AutoClean, you must either turn off the 24-hour clock (which preserves your timer setup), or set the timer to all zeros (see Step 2 in Table 5-9). Unless the Time Remaining display is on screen, you will not see the AUTO CLEAN message during a scheduled cleaning.

Operator-initiated operation

To operate in this mode, you must have the AutoClean Time Remaining display on screen. Initiate the AutoClean sequence by pressing the START soft key. Once the START soft key is pushed, the time display will go to zero and the message “AUTO CLEAN” will appear on the alarm stripe.

The sequence will stop cleaning if the STOP soft key is pressed or if you leave this display. Once stopped, the Analyzer/Controller will wait for the configured resume delay time (to allow the cell measurement to stabilize) before coming back on-line. During the resume the “AUTO CLEAN” message will flash.

If the PAUSE soft key is used while the AutoClean Time Remaining display is on screen, the AutoClean sequence will stop temporarily. If the PAUSE soft key is not pushed again to resume the sequence, then the sequence will automatically resume in 20 minutes.

Once the AutoClean sequence has been completed (including resume delay), the “AUTO CLEAN” message disappears and the time remaining clock will be displayed again, showing the time remaining until the next scheduled timer-initiated cleaning.

ATTENTION

Once an AUTOSEQUENCE is initiated you cannot go into the menu displays until sequence is completed. If you do, sequence will stop.

Hold mode

During AutoClean and AutoCal operations alarms are always held. This means that no alarms will become active during the automatic operation. If one or more relays are being used for alarm annunciation, they will go to the non-alarm state.

The behavior of analog outputs and discrete control relays during automatic operations is configurable. The outputs can either be held at their current value or state when the operation starts, or they can continue to respond to input changes during the automatic operation.

ATTENTION

The alarm stripe will display “HOLD ACTIVE.”

At the completion of the automatic operation the hold will be released and normal operation will resume after the configured delay.

Procedure

If only AutoClean was selected during I/O setup, follow the procedure in Table 5-9 to use the displayed screens for configuration when AUTO CAL/CLEAN is selected from the menu.

If one-point AutoCal (standardization only) was selected during I/O setup, follow the procedure in Table 5-10.

If two-point AutoCal (standardization and slope adjustment) was selected during I/O setup, follow the procedure in Table 5-11.

Table 5-9 Procedure for Configuring AutoClean

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to CONFIGURATION ADVANCED FEATURES AUTO CLEAN.
	<pre> CONFIGURATION CAT/RETRANSMISSION ALARMS DISCRETE CONTROL ADVANCED FEATURES DIAGNOSTICS PREV NEXT </pre>	
	<pre> ADVANCED FEATURES CLOCK SETUP AUTO CLEAN DIAGNOSTICS PREV NEXT </pre>	
2	<pre> AUTO CLEAN TIMER SETUP DAYS 3 HOURS 16 MINUTES 30 CURRENT DAY 2 DIAGNOSTICS HOLD </pre>	<p>Timer setup is used to specify the frequency of the rinses.</p> <ul style="list-style-type: none"> • If several rinses are to be performed in a single day <ul style="list-style-type: none"> a) specify the number of days as zero b) specify the number of hours and minutes in the interval between rinses. • If rinses are to occur at intervals of days <ul style="list-style-type: none"> a) specify the number of days in the interval b) specify the time of day (hours and minutes) the rinse should occur. <p>In our example, the rinse will occur every third day at 4:30 PM.</p> • If you plan to use AutoClean/Cal, but initiate rinses manually using the real time AutoClean/Cal Time Remaining display: <ul style="list-style-type: none"> a) specify the number of days as zero b) specify the number of hours and minutes in the interval between rinses as zero also. <p>IF YOU ENTER ALL ZEROS, NO AUTOMATIC RINSES WILL BE PERFORMED.</p> <p>Specify where today falls in the AutoClean cycle. For example, if the interval for rinses is 3 days and you want the first rinse to be tomorrow, specify that today is day 2.</p>
3	<pre> AUTO CLEAN RINSE SETUP DURATION 180 RESUME DELAY 60 DIAGNOSTICS PREV NEXT </pre>	<p>Enter the duration of the rinse (in seconds).</p> <p>Enter the number of seconds the Analyzer/Controller should wait after the rinse before resuming normal operation.</p>

Table 5-10 Procedure for Configuring One-Point AutoCal

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to CONFIGURATION AUTOCAL/CLEAN .
	<pre> CONFIGURATION CAT/RETRANSMISSION ALARMS DISCRETE CONTROL ADVANCED FEATURES DIAGNOSTICS </pre>	
	<pre> ADVANCED FEATURES CLOCK SETUP AUTO CAL 1PT DIAGNOSTICS NEXT </pre>	
2	<pre> AUTO CAL 1PT ATTENTION! FUNCTION REQUIRES AUTO BUFFER SETUP IN CALIBRATION MENU DIAGNOSTICS HOLD NEXT </pre>	Buffer specification is described in Table 8-6. Go to the next screen.
3	<pre> AUTO CAL 1PT HOLD OUTPUTS? YES DIAGNOSTICS NEXT </pre>	Specify whether or not output values should be held during the automatic operations. Alarms are always held and for that reason "HOLD ACTIVE" will appear on the alarm stripe. Go to the next screen.

Step	Screen	Action
4	<pre> AUTO CAL 1PT TIMER SETUP DAYS 3 HOURS 16 MINUTES 30 CURRENT DAY 2 ----- DIAGNOSTICS ----- NEXT </pre>	<p>Timer setup is used to specify the frequency of the AutoClean rinses that are included in the AutoCal schedule.</p> <ul style="list-style-type: none"> • If several rinses are to be performed in a single day: <ul style="list-style-type: none"> a) specify the number of days as zero b) specify the number of hours and minutes in the interval between rinses (1 hour is the minimum). • If rinses are to occur at intervals of days: <ul style="list-style-type: none"> a) specify the number of days in the interval b) specify the time of day (hours and minutes) the rinse should occur. <p>In our example, the rinse will occur every third day at 4:30 PM.</p> • If you plan to use AutoCal, but initiate operations manually using the real time AUTOCAL/CLEAN display: <ul style="list-style-type: none"> a) specify the number of days as zero b) specify the number of hours and minutes in the interval between rinses as zero also. <p>IF YOU ENTER ALL ZEROS, NO AUTOMATIC RINSES AND NO AUTOMATIC CALIBRATIONS WILL BE PERFORMED.</p> <p>Specify where today falls in the AutoCal/AutoClean cycle. For example, if the interval for rinses is 3 days and you want the first rinse to be tomorrow, specify that today is day 2.</p> <p>Go to the next screen.</p>
5	<pre> AUTO CAL 1PT RINSE SETUP: DURATION 180s #BETWEEN STD 2 ----- DIAGNOSTICS ----- NEXT </pre>	<p>Enter the duration of the AutoClean rinse in seconds (60 is the minimum).</p> <p>Specify the frequency of AutoCal standardization operations by entering the number of rinses between standardization operations. In our example, timer setup was configured for rinses to be done every third day. If, during rinse setup, two rinses are scheduled to occur between standardization operations, then the one-point AutoCal standardization will be performed every sixth day.</p> <p>Go to the next screen.</p>
6	<pre> AUTO CAL 1PT STANDARDIZE SETUP: DURATION 70s DELAY 90s ----- DIAGNOSTICS ----- NEXT </pre>	<p>Enter the length of time in seconds (60 is the minimum). The standardization reference solution should flow past the electrode.</p> <p>Enter the number of seconds the Analyzer/Controller should wait after the AutoCal operation before resuming normal operation.</p>

Table 5-11 Procedure for Configuring Two-Point AutoCal

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to CONFIGURATION AUTO CAL/CLEAN .
	<pre> CONFIGURATION CAT/RETRANSMISSION ALARMS DISCRETE CONTROL ADVANCED FEATURES DIAGNOSTICS </pre>	
	<pre> ADVANCED FEATURES CLOCK SETUP AUTO CAL 2PT DIAGNOSTICS NEXT </pre>	
2	<pre> AUTO CAL 2PT ATTENTION FUNCTION REQUIRES AUTO BUFFER SETUP IN CALIBRATION MENU DIAGNOSTICS NEXT </pre>	Buffer specification is described in Table 8-6. Go to the next screen.
3	<pre> AUTO CAL 2PT HOLD OUTPUTS? YES DIAGNOSTICS NEXT </pre>	Specify whether or not output values should be held during the automatic operations. Alarms are always held and for that reason "HOLD ACTIVE" will appear on the alarm stripe. Go to the next screen.

Step	Screen	Action
4	<pre> AUTO CAL 2PT TIMER SETUP DAYS 3 HOURS 16 MINUTES 30 CURRENT DAY 2 ----- DIAGNOSTICS ----- [] [] [] NEXT </pre>	<p>Timer setup is used to specify the frequency of the AutoClean rinses that are included in the AutoCal schedule.</p> <ul style="list-style-type: none"> • If several rinses are to be performed in a single day: <ol style="list-style-type: none"> a) specify the number of days as zero b) specify the number of hours and minutes in the interval between rinses (1 hour is the minimum). • If rinses are to occur at intervals of days: <ol style="list-style-type: none"> a) specify the number of days in the interval b) specify the time of day (hours and minutes) the rinse should occur. <p>In our example, the rinse will occur every third day at 4:30 PM.</p> • If you plan to use AutoCal, but initiate operations manually using the real time AUTOCAL/CLEAN display: <ol style="list-style-type: none"> a) specify the number of days as zero b) specify the number of hours and minutes in the interval between rinses as zero also. <p>IF YOU ENTER ALL ZEROS, NO AUTOMATIC RINSES AND NO AUTOMATIC CALIBRATIONS WILL BE PERFORMED.</p> <p>Specify where today falls in the AutoCal/AutoClean cycle. For example, if the interval for rinses is 3 days and you want the first rinse to be tomorrow, specify that today is day 2.</p> <p>Go to the next screen.</p>
5	<pre> AUTO CAL 2PT RINSE SETUP: DURATION 180s #BETWEEN STD 2 ----- DIAGNOSTICS ----- [] [] [] NEXT </pre>	<p>Enter the duration of the AutoClean rinse in seconds (60 is the minimum).</p> <p>Specify the frequency of AutoCal standardization operations by entering the number of rinses between standardization operations. In our example, timer setup was configured for rinses to be done every third day. If, during rinse setup, two rinses are scheduled to occur between standardization operations, then the AutoCal standardization will be performed every sixth day.</p> <p>Go to the next screen.</p>

Step	Screen	Action
6	<pre> AUTO CAL 2PT STANDARDIZE SETUP: DURATION 70s #BETWEEN SLOPE 5 DIAGNOSTICS NEXT </pre>	<p>Enter the length of time in seconds (60 is the minimum). Each reference solution should flow past the electrode.</p> <p>Specify the frequency of AutoCal slope adjustments by entering the number of standardization operations between slope adjustments. In our example slope adjustments will be made every 30 days (5 x the 6-day interval in Step 5 for standardizations).</p> <p>Go to the next screen.</p>
7	<pre> AUTO CAL 2PT SLOPE SETUP: SLOPE INTERVAL 70s DELAY 90s DIAGNOSTICS NEXT </pre>	<p>The length of time specified in Step 6 will be displayed here as the duration of the flow of slope buffer solution past the electrode (read-only information).</p> <p>Enter the number of seconds the Analyzer/Controller should wait after the AutoCal operation before resuming normal operation.</p>

6. Input and Output Wiring

6.1 Overview

Introduction

This section contains instructions for installing input and output wiring for the Analyzer/Controller.

We recommend that you wait to install input and output wiring until after I/O setup (see Section 5). During I/O setup the software will determine for you which relay to use for each feature.

What's in this section?

The topics in this section are listed below.

Topic	See Page
6.1 Overview	61
6.2 General Wiring Practices	62
6.3 Wiring Analog Inputs and Outputs	64
6.4 Wiring Relays	72



WARNING

While the unit is powered, a potentially lethal shock hazard exists inside the case. Do not open the case while the unit is powered. Disconnect power before installing I/O wiring. More than one switch may be required to disconnect power.

6.2 General Wiring Practices



WARNING

Wiring should be performed by qualified personnel only.

Safety precaution



WARNING

A disconnect switch must be installed to break all current carrying conductors. Turn off power before working on conductors. Failure to observe this precaution may result in serious personal injury.



WARNING

An external disconnect switch is required for any hazardous voltage connections to the relay outputs.

Avoid damage to components

ATTENTION

This equipment contains devices that can be damaged by electrostatic discharge (ESD). As solid state technology advances and as solid state devices get smaller and smaller, they become more and more sensitive to ESD. The damage incurred may not cause the device to fail completely, but may cause early failure. Therefore, it is imperative that assemblies containing static sensitive devices be carried in conductive plastic bags. When adjusting or performing any work on such assemblies, grounded work stations and wrist straps must be used. If soldering irons are used, they must also be grounded.

A grounded work station is any conductive or metallic surface connected to an earth ground, such as a water pipe, with a 1/2 to 1 megohm resistor in series with the ground connection. The purpose of the resistor is to current limit an electrostatic discharge and to prevent any shock hazard to the operator. The steps indicated above must be followed to prevent damage and/or degradation, which may be induced by ESD, to static sensitive devices.

Immunity Compliance



In applications where either the power, input or output wiring are subject to electromagnetic disturbances, shielding techniques will be required. Grounded metal conduit with conductive conduit fittings is recommended.

Conform to code

Instrument wiring should conform to regulations of the National Electrical Code.

Recommended maximum wire size**Table 6-1 Recommended Maximum Wire Size**

Gage Number	mm ²	Description
14	2.081	power, relays, and PE (protective earth)
18	0.823	inputs
18	0.823	isolated outputs

Cables for locations without interference

For **steel (metal) conduit or open wiring** away from any sources of interference, use recommended Honeywell cables listed in the parts list in Section 11.

Shielded wiring for locations with interference

In applications where plastic conduit or open wire trays are used, shielded 6-conductor 22 gage (0.326 mm²) or heavier signal input wiring is required.

Avoiding interference

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.

References

Refer to the following when wiring the unit.

- IEEE STD. 518, Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources.
- Appropriate wiring diagram supplied with electrode mounting or preamplifier module.

6.3 Wiring Analog Inputs and Outputs

6.3.1 Installation

Introduction

Every 9782 Analyzer/Controller requires one or more analog input signals to provide pH and/or ORP values for the system. Temperature input can also be provided for display and for use by the solution temperature compensation algorithm (see 10.10).

In addition, some 9782 models provide from one to three analog output signals (current and/or voltage) that can be used to retransmit process variables, or to provide Current Adjusting Type control (see 1.5.3).

Wiring these analog inputs and outputs is described here. Wiring relay outputs is described in 6.4.

Procedure

Follow the procedure in Table 6-2 to install analog I/O wiring.

If DualCAT control will be used, also refer to the special instructions in 6.3.2.



WARNING

While the unit is powered, a potentially lethal shock hazard exists inside the case. Do not open the case while the unit is powered.

Table 6-2 Procedure for Installing Analog I/O Wiring

Step	Action
1	Go to I/O SETUP to view the displays showing analog input, relay, and analog output use. Note the assignments shown. You must wire the unit to match these assignments in order for the unit to work as expected. (See Section 5.)
2	Turn off the power to the Analyzer/Controller. More than one switch may be required to remove power.
3	With the power off , open the case: <ul style="list-style-type: none"> • Grasp the bottom center portion of the front bezel and pull it downward and toward you slightly to disengage the bottom of the bezel from the edge of the case. • Lift the bezel gently to disengage it from the top edge of the case. • Swing the bezel to the left. (The bezel and display assembly is mounted on pivot arms.) The safety cover with its warning label will be visible.
4	With the power off remove the safety cover by removing the single screw holding it in place.



Step	Action
5	Connect the inputs from the electrode to the terminals in accordance with the system setup assignments. Refer to the wiring diagram provided with the electrode and/or preamp, and to Figure 6-1 through Figure 6-6.
6	If a Durafet pH electrode is being used, and you want to display temperature and/or use solution temperature compensation described in 10.10, then connect a separate temperature input to the TH and SC terminals on the Analyzer/Controller.
7	If analog outputs are to be used, connect the outputs from the Analyzer/Controller terminals in accordance with the system setup assignments. Refer to the wiring diagrams provided with the field devices receiving the signals, and to Figure 6-1 through Figure 6-6.
8	If the relay outputs are to be used, leave the unit open and powered down. See 6.4.
9	If the relays will not be used, replace the safety cover and secure it with the screw.
10	Close the case and power up the unit. Do not apply power with the case open.



* The Durafet pH electrode has a built-in temperature compensator for normal Nernstian temperature compensation. However, this temperature compensator can not provide input for temperature display, nor for solution temperature compensation.

6.3.2 Special Information for DualCAT

Current adjusting type control

Two devices can be controlled using Current Adjusting Type Control and a single analog output. This DualCAT control is an option selectable during system setup (see Section 5). If DualCAT is used, refer to Figure 6-1 for acid and base feeder connections. Note that the unused feeder receives an open circuit at its input with which it must be compatible.

ATTENTION

In Figure 6-1 Relay 1 is used for illustrative purposes only. When wiring your unit, use the relay assigned by the software during I/O setup as described in Section 5.

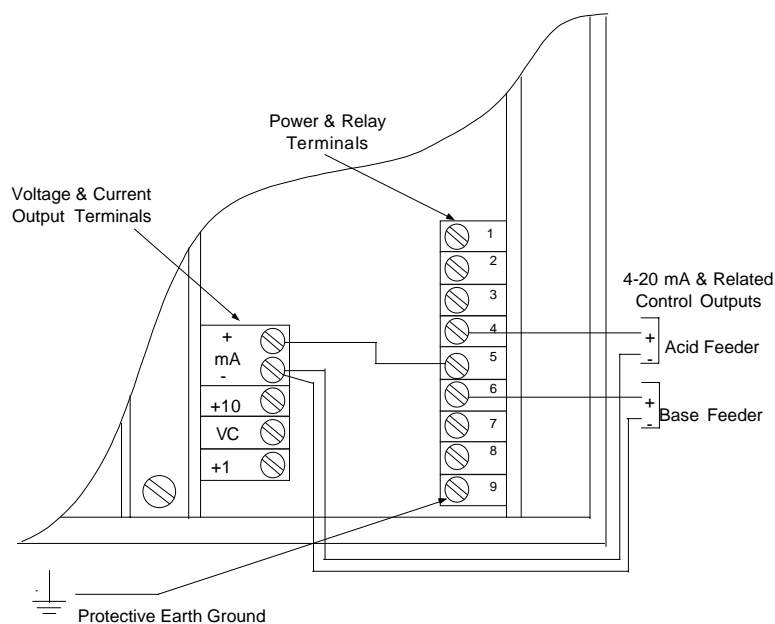


Figure 6-1 Dual Reagent CAT Typical Wiring Using Relay 1 to Select Reagent Feeder

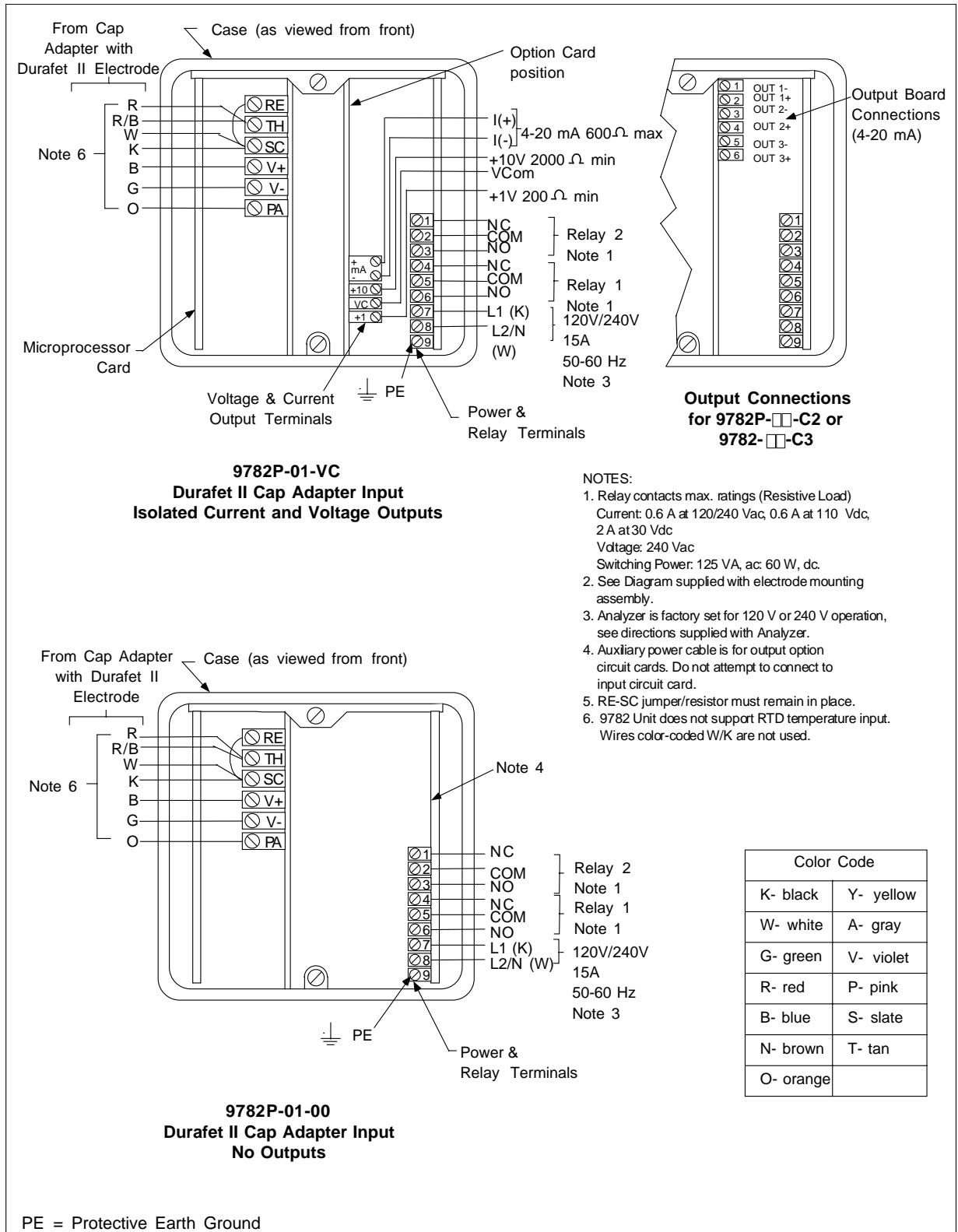


Figure 6-2 Terminal Connections

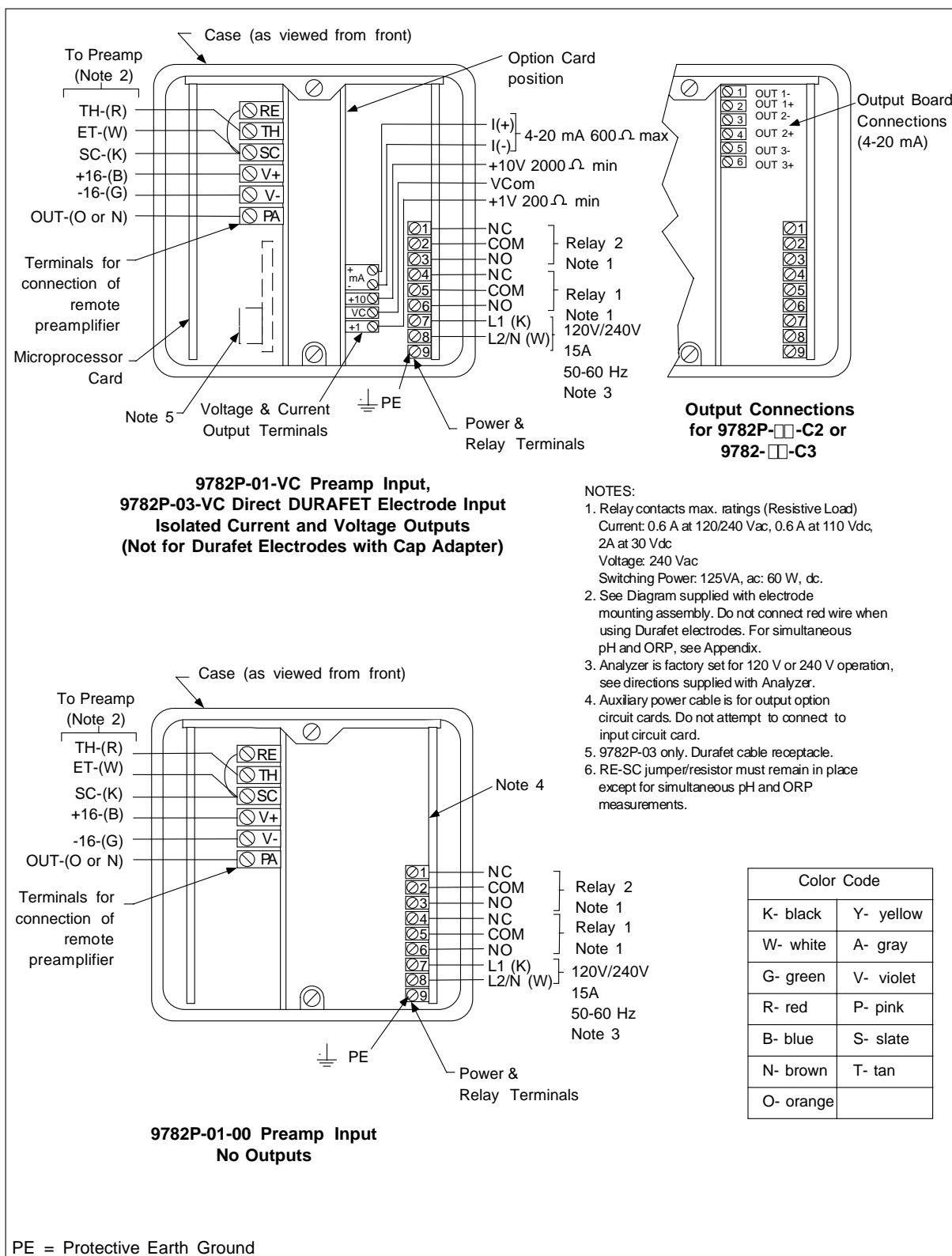


Figure 6-3 Terminal Connections

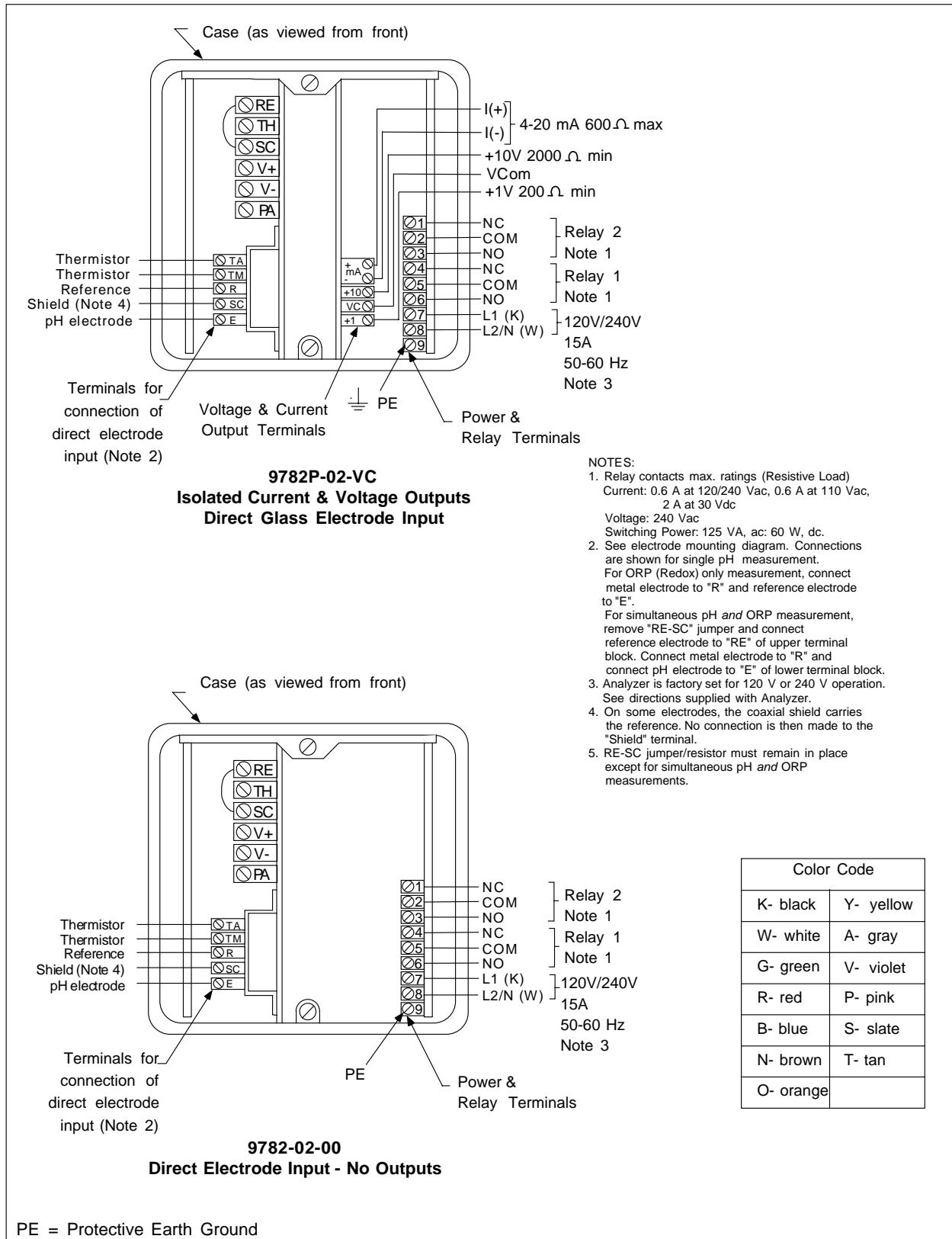


Figure 6-4 Terminal Connections

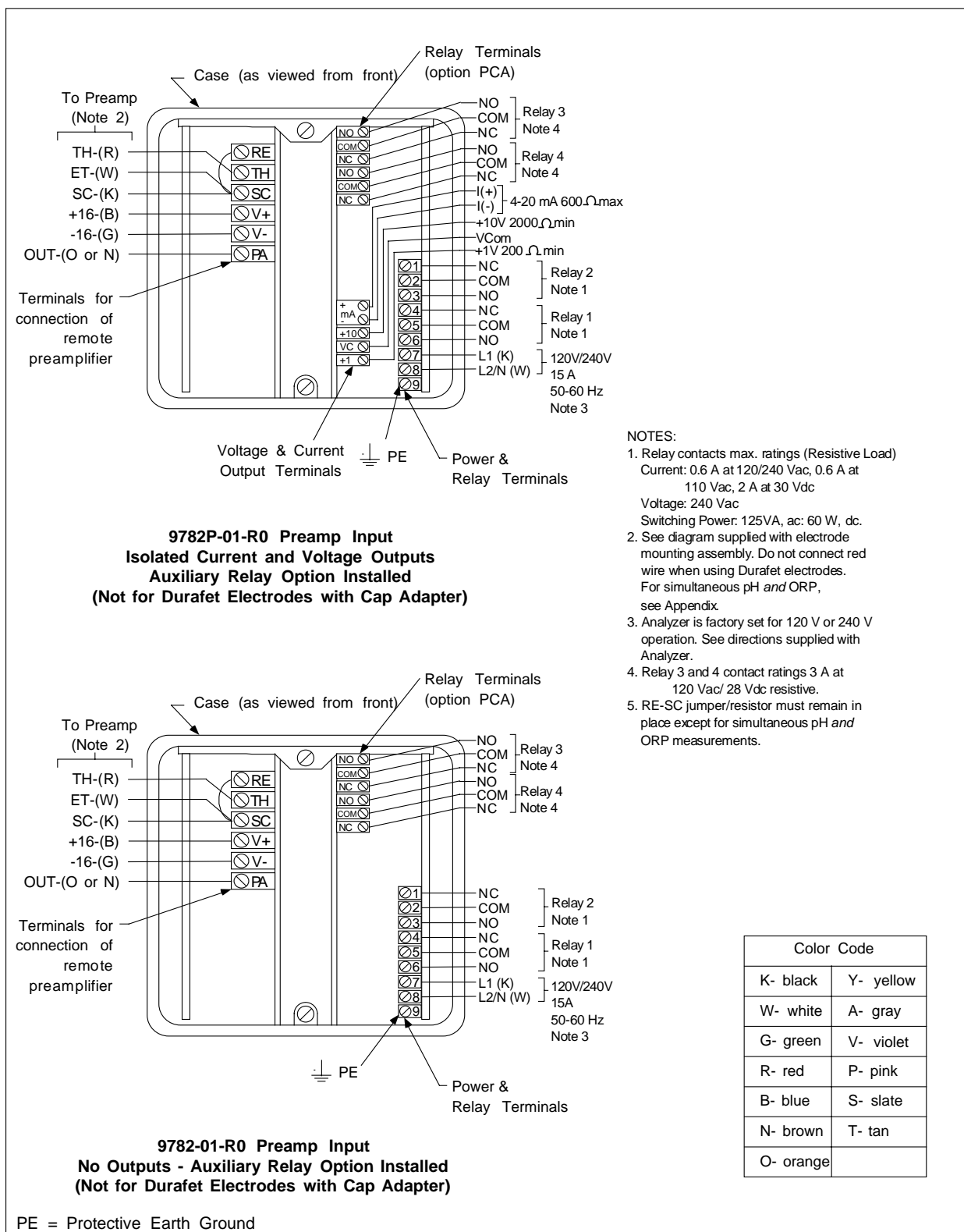


Figure 6-5 Terminal Connections

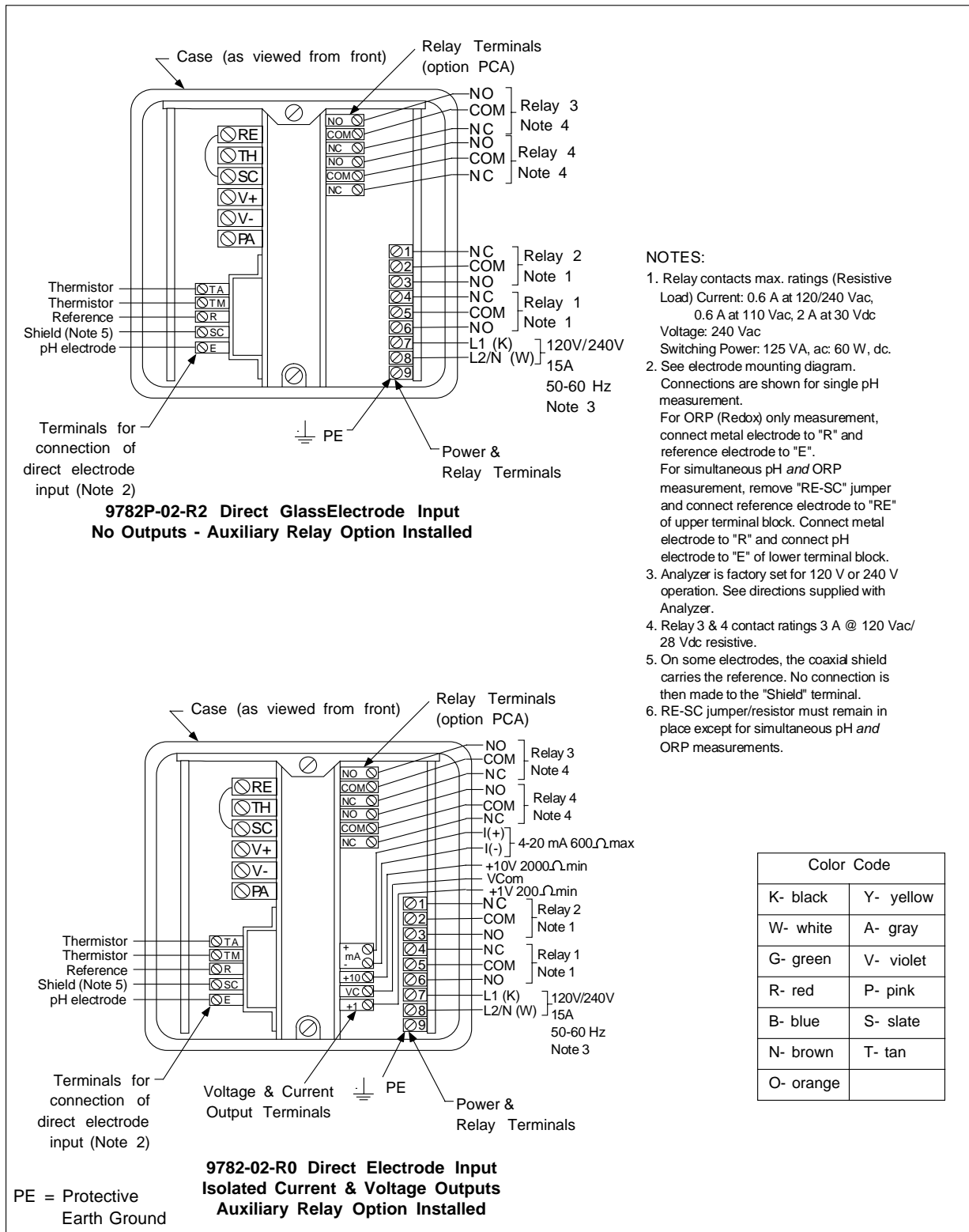


Figure 6-6 Terminal Connections

6.4 Wiring Relays

6.4.1 Installation

Introduction

Every 9782 model includes two relay outputs that can be used with special features such as AutoClean and AutoCal, or to perform Pulse Frequency Type or Duration Adjusting Type control, or for alarm annunciation. In addition to these two standard relays, two more are available as an option.

The Analyzer/Controller can be programmed for these relays to de-energize on alarm, or to energize on alarm. Use the maintenance menu to specify relay action (see 10.12.)

If set to de-energize on alarm, this means that when an alarm occurs (or the discrete control point becomes active), the relay coil will be de-energized. The NC contacts will then be closed and the NO contacts will be open. Conversely, during normal non-alarm operation (or when the control point is not active) the NC contacts will be open, and the NO contacts will be closed.

If de-energize on alarm is selected, a power loss will force all relays to the same position as an alarm condition.

The relay contact maximum ratings are in Table 6-3.

Table 6-3 Relay Contact Maximum Ratings

Current, Standard:	0.6 amps at 120/240 Vdc, 0.6 amps at 110 Vdc, 2 amps at 30 Vdc
Current, Optional:	3 A, 120 Vac, 28 Vdc
Voltage, Standard:	120/240 Vac
Switching Power, Standard:	ac - 125 VA resistive dc - 60 watts resistive

ATTENTION

Alarm circuits are not internally fused in the Analyzer/Controller. Provision for fuses in external circuits is recommended.

Procedure

Follow the procedure in Table 6-4 to install relay output wiring.

If the RC arc suppression circuits in the Analyzer/Controller interfere with other devices at your site, refer to 6.4.2 for instructions for disconnecting the suppression circuits.



WARNING

While the unit is powered, a potentially lethal shock hazard exists inside the case. Do not open the case while the unit is powered. More than one switch may be required to disconnect power.

Table 6-4 Procedure for Wiring Relays

Step	Action
1	If you have not already noted the relay assignments made during I/O setup, go to I/O SETUP on the main menu to view the display showing relay output use. Note the assignments shown. You must wire the unit to match these assignments in order for the unit to work as expected. (See Section 5.)
2	Turn off the power to the Analyzer/Controller. More than one switch may be required to remove power.
3	With the power off , open the case: <ul style="list-style-type: none"> • Grasp the bottom center portion of the front bezel and pull it downward and toward you slightly to disengage the bottom of the bezel from the edge of the case. • Lift the bezel gently to disengage it from the top edge of the case. • Swing the bezel to the left. (The bezel and display assembly is mounted on pivot arms.) The safety cover with its warning label will be visible.
4	With the power off remove the safety cover by removing the single screw holding it in place.
5	Wire the relays in accordance with the system setup assignments. Refer to the wiring diagram provided with the external device receiving the output and to Figure 6-2 through Figure 6-6.
WARNING	
An external disconnect switch is required for any hazardous voltage connections to the relay outputs.	
6	Replace the safety cover and secure it with the screw.
7	Close the case and power up the unit. Do not apply power until the case is closed.



6.4.2 Special Information for DualCal

Backup (alternate) electrode for critical process

The DualCal feature allows precalibration of an alternate electrode system for backup purposes in applications where interruptions in measurements must be avoided. Because the 9782 retains the calibration data in memory, the spare electrode can be manually put in place and quickly switched on. In the meantime, the spare electrode can be stored in the process, or in a storage solution (see Figure 6-7).

One Analyzer/Controller in two tank batch treatment system

DualCal may also be used for two-tank batch treatment systems, where a single Analyzer/Controller can be used to select electrode/preamp systems in each tank (see Figure 6-8).

External switch determines which electrode signal reaches the Analyzer/Controller

A 5-PDT switch (supplied by the customer) is used to switch between the two electrode systems. This 5-PDT switch can be switched manually by the operator, or can be switched by the Analyzer/Controller internal Relay 4, assigned during I/O setup (see Section 5). If the use of DualCal is specified during I/O setup and internal Relay 4 is used, then switching between electrodes can be done quickly at the Analyzer/Controller keypad using the maintenance menu (see 10.9).

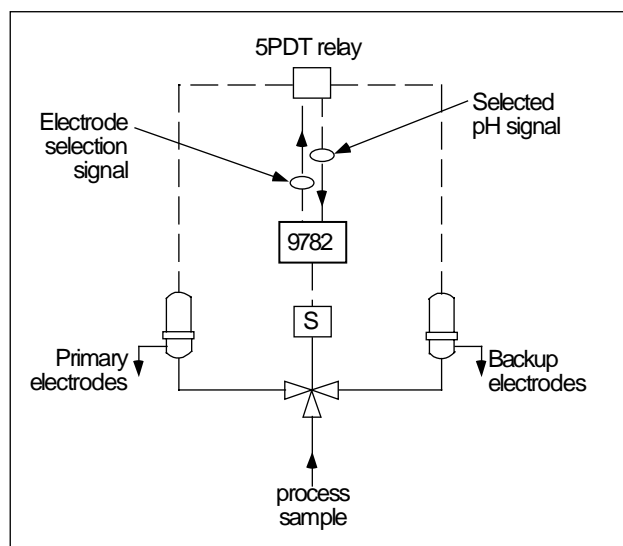


Figure 6-7 Backup Electrode Installation Using DualCal Alternate Electrode Calibration

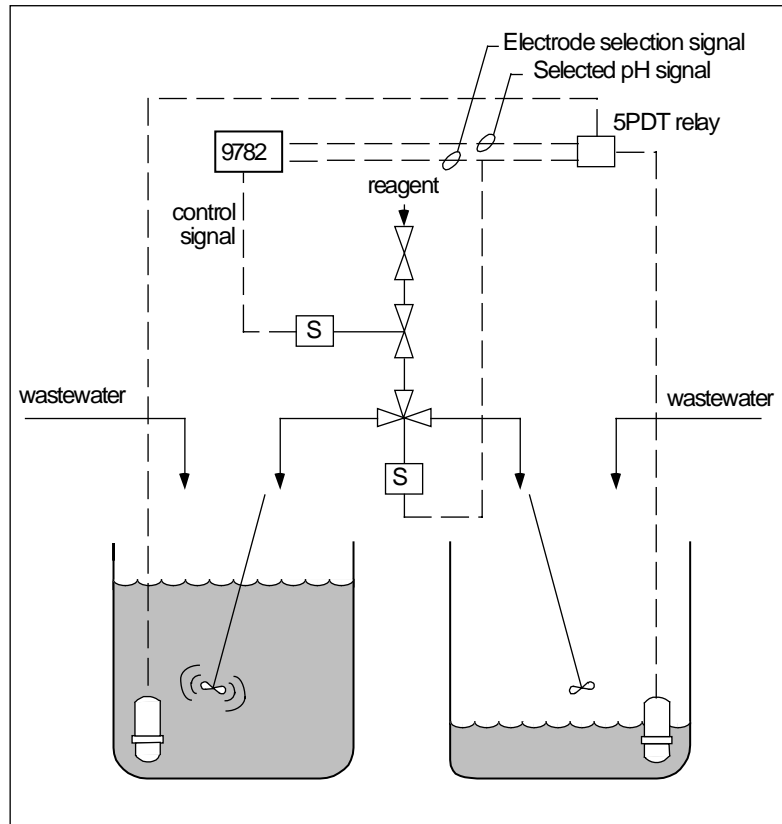


Figure 6-8 Two Tank Batch Treatment with DualCal Alternate Electrode Calibration

6.4.3 Disconnecting RC Arc Suppression Circuits

Introduction

Relay contacts are protected by RC arc suppression circuits. Alternating current leakage through these circuits may be sufficient to trigger very light ac loads such as neon bulbs, PLC logic inputs, continuity testers, etc. If this leakage cannot be tolerated, the suppression circuits may be disconnected as described below.

Procedure

Follow the procedure in Table 6-5 to disconnect the RC arc suppression circuits.

Table 6-5 Procedure for Disconnecting RC Arc Suppression Circuits



Step	Action
WARNING	
1	Turn off the power to the Analyzer/Controller. More than one switch may be required to remove power.
2	With the power off , open the case: <ul style="list-style-type: none"> • Grasp the bottom center portion of the front bezel and pull it downward and toward you slightly to disengage the bottom of the bezel from the edge of the case. • Lift the bezel gently to disengage it from the top edge of the case. • Swing the bezel to the left. (The bezel and display assembly is mounted on pivot arms.) The safety cover with its warning label will be visible.
3	With the power off remove the safety cover by removing the single screw holding it in place.
4	Disconnect and tag all wiring from the terminal boards.
5	Remove the circuit card retainer clamp at the top of the case. Then slide all the circuit cards half way out of the case.
6	On the right-most vertical printed circuit card (power supply card p/n 056305) remove 330 ohm resistors R29 and R30 for Relay 1, and R31 and R32 for Relay 2 from the upper corner of the card.
7	If the auxiliary relays are installed (card p/n 056382 or p/n 056442), also remove 330 ohm resistors R39, R40, R44 and R45 from those optional assemblies.
8	Reconnect all wiring removed in Step 4.
9	Replace the safety cover and secure it with the screw.
10	Close the case and power up the unit. Do not apply power until the case is closed.



7. AutoClean and AutoCal Theory and Piping

7.1 Overview

Introduction

Periodic calibration of pH electrodes is necessary for best system performance because electrode outputs change over time. One-point calibration (standardization) is a zero adjustment to compensate for electrode drift. Two-point calibration (standardization and slope adjustment) includes a span adjustment to match the gain of the Analyzer/Controller to the electrode response. Standardization and slope each depend on the electrode measuring a reference solution (buffer) of known pH.

The AutoClean and AutoCal features periodically rinse and calibrate pH electrodes automatically as described in this section. To take advantage of these features you must:

- Select them during I/O setup (see Section 5).
- Set the clock, and specify the frequency and duration of the cleaning and calibration operations (see Section 5).
- Configure the system to use automatic buffer recognition (see Subsection 8.6.2).
- Wire the relays assigned to these operations during system setup to operate the necessary valves. (See Section 6 for relay wiring.)
- Install piping and valves as diagrammed in this section.

If manual calibration will be used instead, see Section 8.

What's in this section?

The topics in this section are listed below.

Topic	See Page
7.1 Overview	77
7.2 AutoClean Sequence and Piping	78
7.3 AutoCal Sequence and Piping	80

7.2 AutoClean Sequence and Piping

Rinse sequence

The AutoClean operation occurs at the configured intervals. The sequence is described below.

- 1 All alarm action is held at existing levels. The output(s) can be held or be active, depending on configuration. Even if the outputs are not held, “HOLD ACTIVE” is displayed on the alarm stripe because alarms are always held.
Also, “AUTOSEQUENCE” is displayed. Pressing the **DISPLAY** key will call up a special display that shows how much time is left in the operation.
- 2 Relay 1 activates 3-way solenoid valve S1 (see Figure 7-1) to direct rinsing fluid to the electrodes for the configured rinse duration (1 to 1999 seconds). If the measured sample is normally returned to the process but quantities of rinsing fluid cannot be tolerated there, use an additional 3-way solenoid valve S4. It is activated simultaneously with S1 to divert the discharge to drain.
- 3 At the end of the configured rinse time Relay 1 de-activates the solenoid valve S1 (and S4, if used). After the configured delay period (1 to 1999 seconds) the Analyzer/Controller resumes sampling the process. (Note that even with S4 for diversion, one system volume of washing fluid will pass to the process at this point.)
- 4 The “HOLD” and “AUTOSEQUENCE” messages are cleared.

Note that the operator can make the operation pause using the “soft key” on the special AutoClean display. If the operator does not remove the pause by pressing the PAUSE soft key again, the Analyzer/Controller will resume normal operation after 20 minutes.

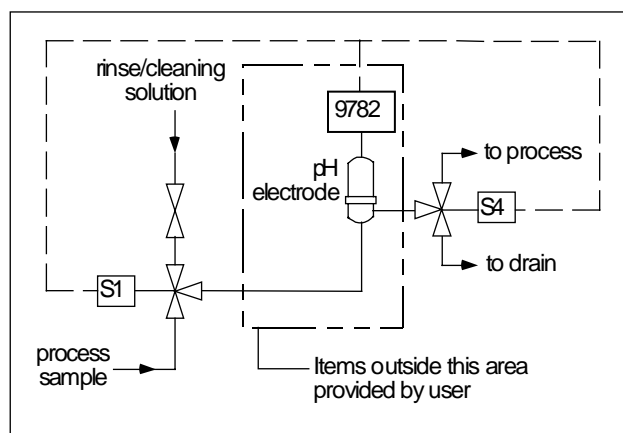


Figure 7-1 Automatic Electrode Wash Setup

Select valves and fittings with appropriate pressure ratings

Make the process connections as shown in Figure 7-1. Be sure that valves and fittings (S1) have sufficient pressure ratings to withstand pressure peaks which will occur when process flow is blocked.

Minimize liquid volume in system

Keep pipe sizes small and couplings close to minimize the liquid volume in the system. Smaller volumes require less time to rinse.

7.3 AutoCal Sequence and Piping

Introduction

AutoCal can include one-point calibration (standardization) to adjust zero to compensate for electrode drift, or two-point calibration (standardization and slope adjustment) to also adjust span to match the gain of the Analyzer/Controller to the electrode response. Standardization and slope each depend on the electrode measuring a reference solution (buffer) of known pH.

Rinse and one-point calibration sequence

The AutoCal operation automatically occurs at the configured intervals. It always includes AutoClean rinsing of the pH electrode, in addition to any other AutoClean sequences that are configured to occur between standardization operations. The sequence is described below.

- 1 All alarm action is held at existing levels. The output(s) can be held or be active, depending on configuration. Even if the outputs are not held, “HOLD ACTIVE” is displayed on the alarm stripe because alarms are always held.

Also, “AUTOSEQUENCE” is displayed. Pressing the **DISPLAY** key will call up a special display that shows how much time is left in the operation
- 2 In preparation for the calibration, Relay 1 activates 3-way solenoid valve S1 (see Figure 7-2) to direct rinsing fluid to the electrodes for the configured rinse duration (1 to 1999 seconds). If the measured sample is normally returned to the process but quantities of rinsing fluid cannot be tolerated there, use an additional 3-way solenoid valve S4. It is activated simultaneously with S1 to divert the discharge to drain.
- 3 Relay 2 activates solenoid valve S2 for the preset buffer time (1 to 1999 seconds) to direct buffer solution past the electrodes by gravity.
- 4 After a stable reading is reached or the set maximum buffer time elapses, the 9782 stores the new calibration value using automatic buffer recognition. Diagnostics detect excessive instability or offset, prevent erroneous calibrating and can activate an alarm, depending on configuration. If the diagnostic fails, an error message is always displayed on the alarm stripe (see Section 9).

If an unacceptable value is obtained, it will be rejected and the previous value will be retained for uninterrupted operation.

- 5 All valves are deactivated to resume measurement of the sample.
- 6 A delay period (1 to 1999 seconds) can be configured to permit the measurement to stabilize on the process sample. At the end of the delay period normal alarm, control and output operation resumes. The “HOLD” and “AUTOSEQUENCE” messages are cleared.

Note that the operator can make the operation pause using the “soft key” on the special AutoClean/AutoCal display. If the operator does not remove the pause by pressing the PAUSE key again, the Analyzer/Controller will resume normal operation after 20 minutes.

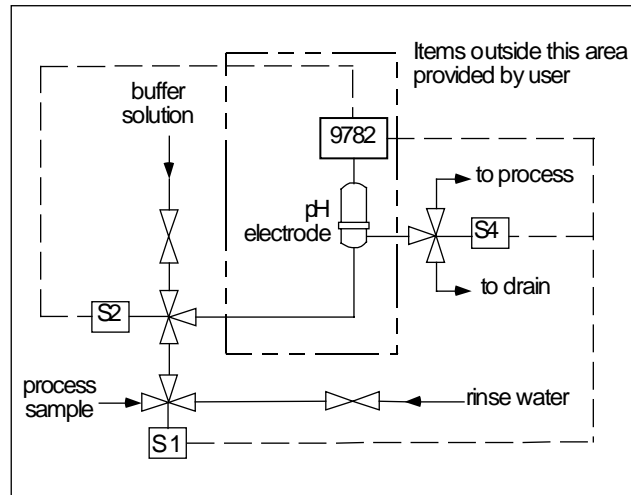


Figure 7-2 Rinse and One-Point Calibration

Rinse and two-point calibration sequence

With this function, rinse and one-point standardization operations are performed as described previously according to the configured schedule. If two-point calibration is to be performed periodically, then after the configured number of standardization operations, Steps 4a and 4b shown below are also performed (before Step 5 above) to make the slope adjustment.

- 4a** Relay 3 activates solenoid valve S3 for the configured buffer time to direct the second buffer flow to the electrodes.
- 4b** After stability is reached or the set maximum buffer time elapses, the instrument calculates and stores a new slope value using automatic buffer recognition. Diagnostics detect excessive instability or offset, prevent erroneous calibrating and can activate an alarm, depending on configuration. If the diagnostic fails, an error message is always displayed on the alarm stripe (see Section 9).

If an unacceptable value is obtained, it will be rejected and the previous value will be retained for uninterrupted operation.

Select piping and valves based on chemical resistance and pressure ratings

Make the process connections as shown in Figure 7-2 or Figure 7-3. Materials and components should be carefully selected for chemical resistance to process and buffer solutions at anticipated temperatures. Be sure that valves and fittings have sufficient pressure ratings to withstand pressure peaks which will occur when process flow is blocked.

Minimize liquid volume in system

Keep pipe sizes small and couplings close to minimize the liquid volume in the system. Smaller volumes require less buffer solution and less time to rinse and to calibrate.

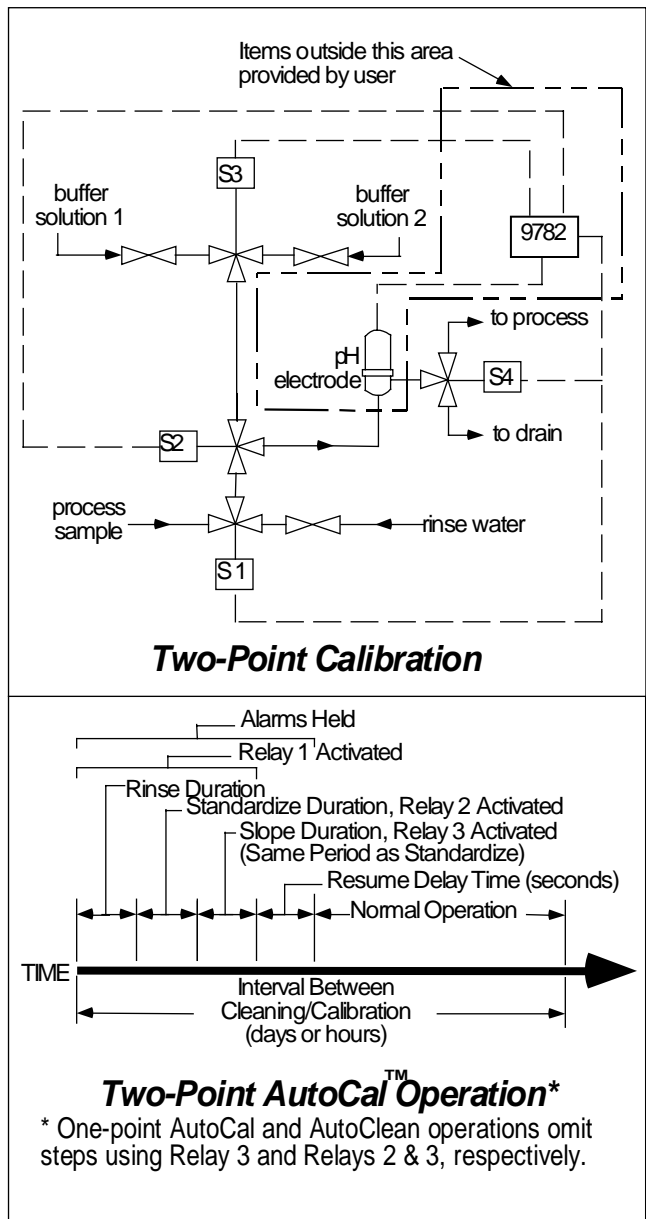


Figure 7-3 Two-Point AutoCal Operation

8. Manual Calibration

8.1 Overview

Introduction

Calibration of pH or ORP measuring instruments is necessary because similar electrodes may produce slightly different potentials in the same solution, requiring a corrective adjustment at the measuring instrument. Also, electrode outputs change over a period of time, making periodic re-calibration necessary for best performance. Determine re-calibration intervals based on operating experience.

This section contains instructions for calibrating electrodes manually.

To calibrate electrode automatically using the the AutoCal feature, follow the configuration instructions in Section 5, and install piping and valves as shown in Section 7.

What's in this section?

The topics in this section are listed below.

Topic	See Page
8.1 Overview	83
8.2 Buffering Method of Calibrating pH Electrodes	85
8.3 Grab Sample Method of Calibrating pH Electrodes	87
8.4 ORP Calibration Using Reference Solution	89
8.5 ORP Calibration Using Voltage Input	91
8.6 Calibrating pH Electrodes Using Automatic Buffer Recognition	94
8.7 Viewing Zero Offset and Percent Theoretical Slope	99
8.8 Recommendations for Successful Measurement and Calibration	100

pH calibration

pH instrument calibration consists of standardization and slope adjustments. Standardization is a zero adjustment to compensate for electrode drift. Slope adjustment is a span adjustment to match the gain of the instrument to the electrode output response.

The 9782 supports two methods of calibration:

- With the “buffering” method described in 8.2, you use your electrode system to measure two reference solutions (“buffers”) having known pH values, then adjust the 9782 so that its readings match the actual pH of each. The two reference solutions must have a pH difference of at least 2.
- With the “grab sample” method described in 8.3 you measure your process, both with your electrode system and with a separate (accurately calibrated) meter, then adjust the 9782 so that its reading matches the meter.

The 9782 includes AutoCal, an automatic buffer calibration that eliminates the need to go out to the instrument to manually calibrate the electrodes. This feature is described in Section 7. Configuring the unit to use AutoCal is described in Section 5.

ORP calibration

ORP calibration consists of adjusting the reading of the 9782 to match a known value. There are two types of ORP calibration supported:

- To calibrate the system to compensate for changes in electrode potentials over time, the ORP electrode is placed in a reference solution of known ORP value, and the 9782 reading is adjusted to match this value, as described in 8.4. Instructions for preparing standard solutions are also provided in 8.4. **These solutions are stable for only short periods of time (less than 8 hours) and are only approximations of ORP potentials.**
- To calibrate the 9782 only, not the whole system including electrodes, apply a known millivolt signal to the Analyzer/Controller instead of input from the electrode, then adjust the 9782 reading to match the actual millivolt input, as described in 8.5.

IMPORTANT

In order to calibrate the instrument if the simultaneous pH/ORP technique is to be used, all three electrode connections must be made according to the drawing in Appendix D.

IMPORTANT

If you plan to measure pH (glass) and ORP simultaneously, then before doing an ORP calibration the first time, you *must* do a complete pH buffer calibration (standardization and slope). Once the first pH and ORP calibrations have been performed, there is no further restriction on the order of pH and ORP calibration. Multiple ORP calibrations can be performed between pH calibrations.

8.2 Buffering Method of Calibrating pH Electrodes

Recommended for most applications

This technique is recommended for best accuracy in most applications.

Materials and procedure

To perform manual standardization and slope adjustment, follow the instructions in Table 8-1.

Materials required are:

- Two standard buffer reference solutions that are at least 2 pH different from one another
- A container for each, large enough to immerse the electrode to measuring depth.
- Distilled or de-ionized water to rinse the electrode.

Table 8-1 Procedure for Standardization and Slope Adjustment

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS </pre>	Prepare containers of the two standard reference solutions.
2	<pre> pH BUFFER CAL ORP CAL SAMPLE CAL AUTO BUFFER CAL AUTO BUFFER SETUP CAL DIAGNOSTICS DIAGNOSTICS </pre>	Go to CALIBRATION BUFFER CAL pH .
3	<pre> STANDARDIZE PUT ELECTRODE IN BUFFER ATTENTION WAIT FOR STABLE READING! DIAGNOSTICS HOLD NEXT </pre>	<p>Put the unit in Hold mode.</p> <p>Remove the electrode from the process.</p> <p>Rinse the electrode thoroughly with distilled or de-ionized water.</p> <p>Immerse it in the buffer solution with a pH closest to the process.</p> <p>Go to the next screen.</p>
4	<pre> STANDARDIZE pH VALUE: 4.00 DIAGNOSTICS < > </pre>	<p>The display will show the pH of the buffer solution as measured by the electrode system.</p> <p>Once the reading is stable, change the value to match the actual pH of the buffer solution at its current temperature.</p> <p>Press ENTER to standardize the instrument (adjust instrument zero).</p>

Step	Screen	Action
5a	<pre> STANDARDIZE STANDARDIZATION COMPLETED STD BUFFER VALUE SAVED DIAGNOSTICS HOLD NEXT </pre>	<p>If the standardization is successful, the completion screen will be displayed and the entered buffer value will be saved.</p> <p>After successful standardization go the to the next screen described in Step 6.</p>
5b	<pre> pH BUFFER CAL ORP CAL SAMPLE CAL AUTO BUFFER CAL AUTO BUFFER SETUP CAL DIAGNOSTICS OFFSET> 5pH </pre>	<p>If the attempted standardization is greater than the allowable ± 5 pH offset, the operation will not be successful. The display will return to the calibration menu and an error message will be displayed.</p> <p>Check the electrode and replace if necessary.</p>
6	<pre> SLOPE NOTE: BUFFER MUST BE >2pH UNITS AWAY FROM STD BUFFER DIAGNOSTICS HOLD NEXT </pre>	<p>Leave the unit in Hold mode.</p> <p>Go to the next screen.</p>
7	<pre> SLOPE PLACE ELECTRODE IN BUFFER ATTENTION WAIT FOR STABLE READING! DIAGNOSTICS HOLD NEXT </pre>	<p>Rinse the electrode thoroughly with distilled or de-ionized water.</p> <p>Immerse it in the second buffer solution.</p> <p>Go to the next screen.</p>
8	<pre> SLOPE pH VALUE: 9.00 DIAGNOSTICS < > </pre>	<p>The display will show the pH of the buffer solution as measured by the electrode system.</p> <p>Once the reading is stable, change the value to match the actual pH of the buffer solution at its current temperature.</p> <p>Press ENTER to make the slope adjustment (adjust instrument gain).</p>
9a	<pre> SLOPE SLOPE COMPLETED SLOPE BUFFER VALUE SAVED DIAGNOSTICS HOLD NEXT </pre>	<p>If the slope adjustment is successful, the completion screen will be displayed.</p> <p>Take the unit out of Hold mode and return to the calibration menu.</p>
9b	<pre> pH BUFFER CAL ORP CAL SAMPLE CAL AUTO BUFFER CAL AUTO BUFFER SETUP CAL DIAGNOSTICS SLOPE FAIL </pre>	<p>If the slope adjustment is not successful, the display will return to the menu automatically, and an error message will be displayed. Possible causes are:</p> <ul style="list-style-type: none"> • The difference in pH between the two solutions was less than 2. Use a different solution • The (glass) electrode is cracked. Replace it. • The attempted slope adjustment is too great. Replace the electrode.

8.3 Grab Sample Method of Calibrating pH Electrodes

Recommended where pH is stable, or for high-purity water applications

This method is recommended only where the pH is stable and changes very slowly. It is also recommended for high-purity water measurement applications. Special instructions for high-purity water applications are provided below.

Materials and procedure

To use the grab sample method, follow the instructions in Table 8-2.

Materials required are:

- A clean beaker for collecting the sample.
- A calibrated portable instrument for measuring pH of the sample.
- Distilled or de-ionized water to rinse the electrode.

Table 8-2 Procedure for Calibrating Using Grab Sample

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS </pre>	Prepare the calibration meter.
2	<pre> BUFFER CAL ORP CAL SAMPLE CAL AUTO BUFFER CAL AUTO BUFFER SETUP CAL DIAGNOSTICS </pre>	Go to CALIBRATION SAMPLE CAL .
3	<pre> SAMPLE CAL ATTENTION DO NOT REMOVE ELECTRODE FROM PROCESS! DIAGNOSTICS HOLD NEXT </pre>	Put the unit in Hold mode. DO NOT remove the electrode from the process. Go to the next screen.
4	<pre> SAMPLE CAL 6.80 PROCESS VALUE NOTE: SET PROCESS pH TO EQUAL SAMPLE DIAGNOSTICS <--- ---> </pre>	The display will show the pH of the process as measured by the electrode system. Collect a beaker of the process sample from a point near the electrode mounting and measure its pH value with a calibrated portable instrument. (For high-purity water, see special instructions below.) Once the reading is stable, change the displayed value to match the value on the portable meter. Press ENTER to standardize the instrument (adjust instrument zero).

Step	Screen	Action
5a	<pre> SAMPLE CAL SAMPLE CALIBRATION COMPLETED! STANDARDIZATION VALUE SAVED ----- DIAGNOSTICS HOLD NEXT </pre>	<p>If the standardization is successful, the completion screen will be displayed.</p> <p>After successful standardization take the unit out of Hold mode and return to the calibration menu.</p>
5b	<pre> BUFFER CAL ORP CAL SAMPLE CAL AUTO BUFFER CAL AUTO BUFFER SETUP CAL DIAGNOSTICS OFFSET>5pH </pre>	<p>If the attempted standardization is greater than the allowable ± 5 pH offset, the operation will not be successful. The display will return to the calibration menu and an error message will be displayed. Check the electrode and replace if necessary.</p>

Special instructions for high-purity water applications

For a high purity water application, do not remove the sample from the process for measurement. Bring the portable instrument to the sampling site and measure a continuously flowing sample that has not been exposed to air. This prevents lowering the sample pH by absorption of carbon dioxide from the air.

8.4 ORP Calibration Using Reference Solution

Recommended to adjust for changes in electrode potential over time

An ORP measuring system can be checked by measuring a solution having a known oxidation-reduction potential, then adjusting the 9782 to match. Although a reference solution provides only an approximation of ORP potential, the system can be adjusted periodically to compensate for changes in electrode potential over time.

Materials

The materials required to use the ORP standardization method are:

- A solution with a known oxidation reduction potential. (See “*Instructions for preparing solution*” below.
- A container for the solution, large enough to immerse the electrode to measuring depth.
- Distilled or de-ionized water to rinse the electrode.

Instructions for preparing solution

To prepare an ORP standardization solution, dissolve 0.1 g of quinhydrone powder (available as Honeywell part number 31103015 for a 2 oz. bottle) in 5 cc of acetone or methyl alcohol (methanol). Add this to not more than 500 cc of a standard pH reference solution (buffer), 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 be used within eight hours of preparation.

All mV values in Table 8-3 have a ± 30 mV tolerance.

Table 8-3 Oxidation-Reduction Potential of Reference Solutions at Specified Temperature

pH Buffer Solution (Honeywell Part Number)	Temperature		
	20 °C	25 °C	30 °C
4.01 @ 25 °C (31103001)	267 mV	263 mV	259 mV
6.86 @ 25 °C (31103002)	100 mV	94 mV	88 mV
7.00 @ 25 °C (not available from Honeywell)	92 mV	86 mV	80 mV
9.00 @ 25 °C **(not available from Honeywell)	-26 mV	-32 mV	-39 mV
9.18 @ 25 °C (31103003)	-36 mV	-43 mV	-49 mV

Procedure

To calibrate the system follow the instructions in Table 8-4.

Table 8-4 Procedure for Calibrating ORP System Using Reference Solution

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP ----- DIAGNOSTICS </pre>	<p>Prepare container of a solution with known oxidation reduction potential.</p>
2	<pre> pH BUFFER CAL ORP CAL SAMPLE CAL AUTO BUFFER CAL AUTO BUFFER SETUP CAL DIAGNOSTICS </pre>	<p>Go to CALIBRATION ORP CAL .</p>
3	<pre> ORP CAL PUT ELECTRODE IN ORP SOLUTION ATTENTION WAIT FOR STABLE READING! ----- DIAGNOSTICS HOLD NEXT </pre>	<p>Put the unit in Hold mode.</p> <p>Remove the electrode from the process.</p> <p>Rinse the electrode thoroughly with distilled or de-ionized water.</p> <p>Immerse it in the reference solution.</p> <p>Go to the next screen.</p>
4	<pre> ORP CAL ----- ORP VALUE: 86.0 ----- DIAGNOSTICS </pre>	<p>The display will show the oxidation reduction potential of the reference solution as measured by the electrode system.</p> <p>Once the reading is stable, change the value to match the actual oxidation reduction potential of the reference solution at its current temperature.</p> <p>Press ENTER to standardize the instrument (adjust instrument zero).</p>
5	<pre> ORP CAL STANDARDIZATION COMPLETED STD BUFFER VALUE SAVED ----- DIAGNOSTICS HOLD NEXT </pre>	<p>The completion screen will be displayed.</p> <p>Take the unit out of Hold mode and return to the calibration menu.</p>

8.5 ORP Calibration Using Voltage Input

Calibrates Analyzer/Controller only

The procedure described in this sub-section calibrates the Analyzer/Controller only. It does not involve compensating for electrode drift. Instead, a known millivolt signal is applied to the 9782 input terminals in place of the signal from the electrode, and the 9782 is adjusted so that its reading matches the known input.

ATTENTION

This procedure can only be used when measuring ORP *only* with a 9782P-02 (not simultaneous measurement with glass pH).

Materials

The materials required to calibrate the Analyzer/Controller using a voltage input are:

- A source of a known millivolt signal.
- A screwdriver to fit the Analyzer/Controller input terminal screws and the screw securing the safety cover.

Procedure

To calibrate the Analyzer/Controller follow the instructions in Table 8-5.



WARNING

This procedure should be performed by qualified personnel only. Disconnect the power before opening the instrument case. A potentially lethal shock hazard exists inside the case if the unit is opened while powered. More than one switch may be required to disconnect power.

Table 8-5 Procedure for Calibrating ORP Analyzer/Controller Using Voltage Input

Step	Screen	Action
1		Turn off the power to the Analyzer/Controller. More than one switch may be required to disconnect power.
2		With the power off open the case: <ul style="list-style-type: none"> • Grasp the bottom center portion of the front bezel and pull it downward and toward you slightly to disengage the bottom of the bezel from the edge of the case. • Lift the bezel gently to disengage it from the top edge of the case. • Swing the bezel to the left. (The bezel and display assembly is mounted on pivot arms.) The safety cover with its warning label will be visible.





Step	Screen	Action																								
3		With the power off remove the safety cover by removing the single screw holding it in place.																								
4		Label and remove the input wiring from the preamp at the 9782 input terminals.																								
5		Feeding the test wiring through the conduit hole in the case, connect a voltage supply to the PR and SE input terminals (see Figure 6-4). <ul style="list-style-type: none"> • To apply a signal in the range 0 to 1999 mV, connect the plus to R and the minus to E. • To apply a signal in the range -1 to -1999 mV, connect the plus to E and the minus to R. 																								
6		Close the case and power up the unit. Do not apply power until the case is closed.																								
7	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">MENU</td></tr> <tr><td>CONFIGURATION</td></tr> <tr><td>CALIBRATION</td></tr> <tr><td>MAINTENANCE</td></tr> <tr><td>I/O SETUP</td></tr> <tr><td colspan="3"> </td></tr> <tr><td style="text-align: center;">DIAGNOSTICS</td></tr> <tr><td> </td><td> </td><td> </td></tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>PH BUFFER CAL</td></tr> <tr><td>ORP CAL</td></tr> <tr><td>SAMPLE CAL</td></tr> <tr><td>AUTO BUFFER CAL</td></tr> <tr><td>AUTO BUFFER SETUP</td></tr> <tr><td>CAL DIAGNOSTICS</td></tr> <tr><td colspan="3"> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </table>	MENU	CONFIGURATION	CALIBRATION	MAINTENANCE	I/O SETUP				DIAGNOSTICS				PH BUFFER CAL	ORP CAL	SAMPLE CAL	AUTO BUFFER CAL	AUTO BUFFER SETUP	CAL DIAGNOSTICS							Go to CALIBRATION ORP CAL .
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8	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">ORP CAL</td></tr> <tr><td style="text-align: center;">PUT ELECTRODE IN</td></tr> <tr><td style="text-align: center;">ORP SOLUTION</td></tr> <tr><td style="text-align: center;">ATTENTION</td></tr> <tr><td style="text-align: center;">WAIT FOR STABLE</td></tr> <tr><td style="text-align: center;">READING!</td></tr> <tr><td style="text-align: center;">DIAGNOSTICS</td></tr> <tr><td>HOLD</td><td> </td><td>NEXT</td></tr> </table>	ORP CAL	PUT ELECTRODE IN	ORP SOLUTION	ATTENTION	WAIT FOR STABLE	READING!	DIAGNOSTICS	HOLD		NEXT	Put the unit in Hold mode. Ignore the instructions to put the electrode in the reference solution. Instead, apply an appropriate millivolt signal (between -1999 and 1999 mV) to the input terminals. To obtain a negative value you must reverse the input to the unit as described in Step 5. Go to the next screen.														
ORP CAL																										
PUT ELECTRODE IN																										
ORP SOLUTION																										
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9	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">ORP CAL</td></tr> <tr><td style="text-align: center;">ORP VALUE: 68.0</td></tr> <tr><td colspan="3"> </td></tr> <tr><td style="text-align: center;">DIAGNOSTICS</td></tr> <tr><td> </td><td> </td><td> </td></tr> </table>	ORP CAL	ORP VALUE: 68.0				DIAGNOSTICS				The display will show the an oxidation reduction potential in millivolts. The value should match the input signal. Once the reading is stable, if it does not match the input signal, change the value to match the voltage being applied to the input terminal. Press ENTER to standardize the instrument (adjust instrument zero).															
ORP CAL																										
ORP VALUE: 68.0																										
DIAGNOSTICS																										



Step	Screen	Action
10	<div style="border: 1px solid black; padding: 5px; text-align: center;"> ORP CAL STANDARDIZATION COMPLETED STD BUFFER VALUE SAVED </div> <div style="border: 1px solid black; padding: 2px; text-align: center; margin-top: 5px;"> DIAGNOSTICS </div> <div style="border: 1px solid black; padding: 2px; text-align: center; margin-top: 5px;"> HOLD NEXT </div>	The completion screen will be displayed. Exit the menus.
11		Turn off the voltage source and turn off power to the Analyzer/Controller. Do not open the case until power is disconnected.
12		Reconnect field wiring removed in Step 4.
13		Replace the safety cover and secure it with the screw.
14		Close the case and power up the unit. Do not apply power until case is closed.

8.6 Calibrating pH Electrodes Using Automatic Buffer Recognition

8.6.1 Introduction

Analyzer /Controller stores information on multiple buffers

Automatic buffer recognition is an advanced feature which simplifies the task of calibrating by the buffering method. Note that if the system is configured to include a Durafet electrode, a separate temperature compensator is required to use the automatic buffer recognition feature.

The 9782 Multi-Function Analyzer/Controller contains (in its permanent memory) information on several commonly used buffer solutions, including the pH versus temperature characteristics of each.

By command, the instrument will automatically select one of these buffers and use its values in the calibration process. Automatic checks are included to ensure that reasonable and correct values are entered.

The procedure for using the automatic buffer recognition feature in an actual calibration is provided in 8.6.3. (Automatic buffer recognition is also used in the AutoCal automatic calibration procedure as described in Section 7.)

Three default buffers

The three default buffer nominal values at 25 °C are 4.01, 7.00 and 9.00 pH.

While 4.01 will always be used for the acid buffer, a choice of neutral and alkaline buffers may be selected as described in 8.6.2. Representative values are in Table 8-6.

Table 8-6 Representative Buffer Values at Various Temperatures

Nominal pH	°C									
	5	10	15	20	25	30	35	40	50	60
4	4.00	4.00	4.00	4.00	4.00	4.01	4.02	4.03	4.06	4.09
6.86	6.95	6.92	6.90	6.88	6.86	6.85	6.84	6.84	6.83	6.84
7	7.08	7.06	7.03	7.01	7.00	6.99	6.98	6.98	6.97	6.98
9	9.21	9.15	9.10	9.05	9.00	8.96	8.92	8.89	8.83	8.78
9.18	9.39	9.33	9.28	9.23	9.18	9.14	9.11	9.07	9.02	8.96
10.00	10.24	10.17	10.11	10.05	10.00	9.96	9.92	9.88	9.82	9.76

8.6.2 Choosing Neutral and Alkaline Buffers

NOTE

If the defaults 7.00 and 9.00 are acceptable, skip this sub-section and go to 8.6.3.

The procedure for specifying neutral and alkaline buffers is described in Table 8-7. The buffers selected will be used along with 4.01 whenever the automatic buffer recognition function is executed by operator command or by AutoCal.

Table 8-7 Buffer Specification Procedure

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS </pre> <pre> BUFFER ORP CAL SAMPLE CAL AUTO BUFFER CAL AUTO BUFFER SETUP CAL DIAGNOSTICS DIAGNOSTICS </pre>	Go to CALIBRATION AUTO BUFFER SETUP .
2	<pre> AUTO BUFFER SETUP SELECTED BUFFERS ACID(FIXED) 4.01 NEUTRAL 7.00 ALKALINE 9.00 DIAGNOSTICS </pre>	Select one neutral buffer and one alkaline buffer. Go back to the calibration menu. (Your choices have been stored.)

8.6.3 Manual Calibration Using Automatic Buffer Recognition

Materials and procedure

To perform manual calibration using the automatic buffer recognition feature, follow the instructions in Table 8-8.

Materials required are:

- Two standard buffer reference solutions out of the three (acid, neutral, alkaline) in Auto Buffer Setup described in 8.6.2.
- A container for each, large enough to immerse the electrode to measuring depth.
- Distilled or de-ionized water to rinse the electrode.

NOTE

A Durafet pH electrode has a temperature compensator for normal Nernstian temperature compensation. This integral temperature compensator cannot be used to display temperature. When a Durafet electrode type is selected, temperature display must be activated (see 10.11) and a separate temperature compensator must be connected to the TH and SC terminals. If a compensator is not used, temperature measurement is not possible; AutoCal and Automatic Buffer Recognition will assume 25 °C.

Table 8-8 Standardization Procedure Using Automatic Buffer Recognition

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS </pre>	Prepare containers of two standard reference solutions (from Auto Buffer Setup).
2	<pre> BUFFER ORP CAL SAMPLE AUTO BUFFER CAL AUTO BUFFER SETUP CAL DIAGNOSTICS DIAGNOSTICS </pre>	Go to CALIBRATION AUTO BUFFER CAL.
3	<pre> AUTO BUFFER CAL PUT ELECTRODE IN BUFFER AFTER STABLE READING STD VALUE IS ENTERED DIAGNOSTICS HOLD NEXT </pre>	<p>Put the unit in Hold mode.</p> <p>Remove the electrode from the process.</p> <p>Rinse the electrode thoroughly with distilled or de-ionized water.</p> <p>Immerse it in the buffer solution with a pH closest to the process.</p> <p>Go to the next screen.</p>
4	<pre> AUTO BUFFER CAL BUFFER VALUE 7.0 DIAGNOSTICS </pre>	<p>The display will show the pH of the buffer solution. Within fifty seconds the reading will be automatically adjusted to match the known pH value for the buffer stored in the 9782 memory (see Note above). The instrument will be standardized (instrument zero adjusted).</p> <p>If you see a stable reading before 50 seconds have elapsed, you can avoid waiting by pressing ENTER.</p>
5a	<pre> AUTO BUFFER CAL STANDARDIZATION COMPLETED STD BUFFER VALUE SAVED DIAGNOSTICS HOLD NEXT </pre>	<p>If the standardization is successful, the completion screen will be displayed.</p> <p>After successful standardization go to the next screen described in Step 6.</p>
5b	<pre> BUFFER ORP CAL SAMPLE AUTO BUFFER CAL AUTO BUFFER SETUP CAL DIAGNOSTICS OFFSET > 5pH </pre>	<p>If the attempted standardization is greater than the allowable ± 5 pH offset, the operation will not be successful. The display will return to the calibration menu and an error message will be displayed.</p> <p>Check the electrode and replace if necessary.</p>
6	<pre> AUTO BUFFER CAL PUT ELECTRODE IN BUFFER NOTE: BUFFER MUST BE >2pH UNITS AWAY FROM STD BUFFER DIAGNOSTICS HOLD NEXT </pre>	<p>Leave the unit in Hold mode.</p> <p>Rinse the electrode thoroughly with distilled or de-ionized water.</p> <p>Immerse it in the second buffer solution.</p> <p>Go to the next screen.</p>

Step	Screen	Action
7	<pre> AUTO BUFFER CAL AFTER STABLE READING SLOPE VALUE IS ENTERED DIAGNOSTICS HOLD NEXT </pre>	Go to the next screen.
8	<pre> AUTO BUFFER CAL BUFFER VALUE HHH.HH DIAGNOSTICS </pre>	<p>The display will show the pH of the buffer solution. Within fifty seconds the reading will be automatically adjusted to match the known pH value for the buffer stored in the 9782 memory (see Note above). The instrument gain (slope) will be adjusted.</p> <p>If you see a stable reading before 50 seconds have elapsed, you can avoid waiting by pressing ENTER.</p>
9a	<pre> SLOPE SLOPE COMPLETED SLOPE BUFFER VALUE SAVED DIAGNOSTICS HOLD NEXT </pre>	<p>If the slope adjustment is successful, the completion screen will be displayed.</p> <p>Take the unit out of Hold mode and return to the calibration menu.</p>
9b	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS </pre>	<p>If the slope adjustment is not successful, the display will return to the menu automatically, and an error message will be displayed. Possible causes are:</p> <ul style="list-style-type: none"> • The difference in pH between the two solutions was less than 2. Use a different solution • The (glass) electrode is cracked. Replace it. • The attempted slope adjustment is too great. Replace the electrode.

8.7 Viewing Zero Offset and Percent Theoretical Slope

Introduction

The manual standardization and slope adjustments described in this section, as well as the automatic calibration procedure described in Section 7, change the zero offset (standardization) and the percent theoretical slope used by the system. These values can be viewed as read-only information. It is good practice to observe these values after calibration. Monitoring the values over time will help you predict when the electrode will need to be replaced.

To set the zero offset back to 0.0 and the percent theoretical slope back to 100 %, use the procedure described in 10.3.

Procedure

To view the zero offset and percent theoretical slope being used for the measurement system, follow the procedure in Table 8-9. Note that percent theoretical slope applies only to pH calibration, not ORP.

Table 8-9 Procedure for Viewing System Calibration Values

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS </pre> <pre> BUFFER CAL SAMPLE CAL AUTO BUFFER CAL AUTO BUFFER SETUP DUAL CAL ELECTRODE CAL DIAGNOSTICS DIAGNOSTICS </pre>	Go to CALIBRATION CAL DIAGNOSTICS .
2	<pre> CAL DIAGNOSTICS ZERO OFFSET SS.SS SLOPE % VVV% DIAGNOSTICS NEXT </pre>	View the values currently being used. This is read-only information. NOTE: The display shown is for pH only measurement. For ORP only measurement only zero offset is displayed. For simultaneous pH and ORP measurement, an additional zero offset for ORP is displayed below the pH offset and slope.

8.8 Recommendations for Successful Measurement and Calibration

Selection and care of electrode system essential

Successful measurements and calibration depend upon selection and care of the electrode system. Always prepare electrodes and their mountings in accordance with the instructions supplied with them, observing temperature, pressure and flow limitations. Note the following recommendations:

- Rinse electrodes thoroughly between buffer solutions.
- Always use HOLD, or otherwise deactivate control or alarm circuits before removing electrodes from the process.
- Standardize with a buffer solution which is at about the same temperature and pH as the sample solution.
- Inspect and, if necessary, clean and/or rejuvenate the electrode system periodically according to experience and conditions.

9. Diagnostics and Messages

9.1 Overview

Introduction

This section contains information on status and alarm messages, as well as on diagnostics and system error messages. All these messages are displayed on the “alarm stripe” in “reverse video”, with the background lit and the letters black. If more than one message is active, the display will cycle through all the messages, then repeat.

What’s in this section?

The topics in this section are listed below.

Topic	See Page
9.1 Overview	101
9.2 System Status Message	102
9.3 Process Alarm Messages	103
9.4 On-Line Diagnostics and System Error Messages	104
9.5 Off-Line Diagnostics	105

9.2 System Status Message

Related to normal operation

System status messages, displayed on the alarm stripe, are related to normal operation of the Analyzer/Controller. These messages, shown in Table 9-1, alert the operator that a special feature is in use, or that a special mode is active.

Table 9-1 System Status Messages

MESSAGE	WHEN DISPLAYED
AUTOSEQUENCE	<p>This message indicates that AutoClean or AutoCal operations are active.</p> <p>To see how much time is remaining, use the DISPLAY key to access the special AutoClean/Cal screen available during these operations.</p>
HOLD ACTIVE	<p>This message indicates that the unit is in Hold mode, maintaining a constant output and alarm status, and disabling solution temperature compensation, if used.</p> <p>The unit can be put in Hold mode (and taken out of Hold) using the “soft key” available on the appropriate screens.</p> <p>During AutoClean and AutoCal operations the alarms are always held. Hold of outputs is configurable. Whether or not outputs are being held when an automatic sequence is active, the message will be displayed. The Hold is released at the end of the operation.</p>
RETRIEVING DATA	<p>This message is displayed during I/O setup, configuration, and calibration while the unit processes data from its memory.</p>
ENTERING DATA	<p>This message is displayed during I/O setup, configuration, and calibration while the unit processes data entered by the user.</p>

9.3 Process Alarm Messages

Alarms dependent on configuration

Alarms are configurable as described in Section 5. When an alarm is active, it is always displayed on the alarm stripe. All available alarm messages are shown in Table 9-2.

Table 9-2 Process Alarm Messages

MESSAGE	WHEN DISPLAYED
<p>HIGH pH HIGH TEMP HIGH ORP LOW pH LOW TEMP LOW ORP</p>	<p>Process value has exceeded (high alarm) or fallen below (low alarm) the configured alarm setpoint.</p>
<p>HI pH/DIAG HI TEMP/DIAG HI ORP/DIAG LO pH/DIAG LO TEMP/DIAG LO ORP/DIAG</p>	<p>Process value has exceeded (high alarm) or fallen below (low alarm) the configured setpoint,</p> <p>OR</p> <p>System error is active (see 9.4).</p>

9.4 On-Line Diagnostics and System Error Messages

Self-tests at 0.5 second intervals

On-line diagnostics are self-tests which are performed automatically as a background task every 1/2 second. The system error messages (displayed on the alarm stripe if a test is failed) are listed in Table 9-3.

Output affected by error

In an error condition, the Analyzer will continue to perform all the functions it is capable of except that the output signal(s) will go to 0 %, or, on single parameter output models, to the preset “failover” value, if entered. (Output signal manipulation does not occur with calibration failure or clock reset diagnostics.)

Table 9-3 On-Line Diagnostics and System Error Messages

SYSTEM ERROR MESSAGE	WHEN TESTED	CONDITION	CORRECTIVE ACTION
A/D CONVERTER ERROR	background	faulty analog-to-digital converter	Have instrument serviced.
AUTOCAL SLOPE FAIL	at calibration	failed slope value limit	Check electrode and buffer solutions (AutoCal only).
AUTOCAL STAND FAIL	at calibration	failed standardize value limit	Check electrode and buffer solutions (AutoCal only).
CLOCK RESET	background	clock reset (usually by power loss)	Reset day and time, then turn clock off if not required.
RAM ERROR IN CPU	at reset	faulty RAM in microprocessor	Have instrument serviced.
ELECTRODE ERROR	background	sensor readings are out-of-range	Check electrode, connections and presence of sample.
EPROM ERROR	at reset	faulty EPROM	Have instrument serviced.
RAM DATA CORRUPTED	at reset	data in non-volatile memory has been changed by a fault	Power down, check power supply and wiring for high voltage spikes. Have instrument serviced, if necessary.
RAM ERROR	at reset	faulty RAM	Have instrument serviced.
TEMP COMP ERROR	background	faulty thermistor (pH only)	Check electrode and connections.
ZERO ADJUST ERROR	background	sensor zero adjustment readings are out-of range	Check electrode, then have instrument serviced, if necessary.

9.5 Off-Line Diagnostics

Introduction

The following off-line diagnostics can be initiated by the operator:

- display test (see 9.5.1)
- keyboard test (see 9.5.1)
- output tests (see 9.5.2)

9.5.1 Display and Keyboard Test

Procedure

The procedure for initiating the display and keyboard test is described in Table 9-4.

Table 9-4 Procedure For Initiating Display and Keyboard Tests

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP ----- DIAGNOSTICS PREV NEXT </pre>	Go to MAINTENANCE OFF-LINE FUNCTIONS DISPLAY TEST .
	<pre> MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION ----- DIAGNOSTICS </pre>	
	<pre> OFF-LINE FUNCTIONS DISPLAY TEST KEYBOARD TEST OUTPUT TESTS OUTPUT CALIBRATION CALIBRATION RESET ----- DIAGNOSTICS </pre>	
2	<pre> DISPLAY TEST ----- DIAGNOSTICS DTEST </pre>	<p>Pressing the specified function key will display a test pattern on the first line of the display. Press the key repeatedly to test the rest of the display.</p> <p>After confirming that each line of the display is functional, press the MENU key to return to the off-line functions menu.</p>
	<pre> DISPLAY TEST F1=TOGGLE MENU=ABORT ----- DIAGNOSTICS </pre>	

Step	Screen	Action
3	<pre> OFF-LINE FUNCTIONS DISPLAY TEST KEYBOARD TEST OUTPUT TESTS OUTPUT CALIBRATION CALIBRATION RESET DIAGNOSTICS </pre>	<p>Go to MAINTENANCE OFF-LINE FUNCTIONS KEYBOARD TEST.</p>
4	<pre> KEYBOARD TEST PRESS A KEY TO TEST MENU TO ABORT DIAGNOSTICS </pre>	<p>Press any key (except MENU) to display the name of the key.</p> <p>Use MENU to exit.</p>

9.5.2 Output Tests

Procedure

Use the procedure in Table 9-5 to test the relays and analog outputs.

Testing the analog outputs requires ammeters or voltmeters as appropriate.



WARNING

While the unit is powered, a potentially lethal shock hazard exists inside the case. Do not open the case while the unit is powered.

Do not access the output terminal as described below while the unit is powered. More than one disconnect switch may be required to remove power.

CAUTION

Consider the effects on your process before testing relays with controlled devices active.

Table 9-5 Procedure for Testing Relays and Analog Outputs

Step	Screen	Action
1		Turn off the power to the Analyzer/Controller. More than one switch may be required to remove the power.
2		<p>With the power off open the case:</p> <ul style="list-style-type: none"> • Grasp the bottom center portion of the front bezel and pull it downward and toward you slightly to disengage the bottom of the bezel from the edge of the case. • Lift the bezel gently to disengage it from the top edge of the case. • Swing the bezel to the left. (The bezel and display assembly is mounted on pivot arms.) The safety cover with its warning label will be visible.
3		With the power off remove the safety cover by removing the single screw holding it in place.
4		Label and remove the field wiring connected to the analog output terminals.
5		Feed the test wiring through the conduit hole in the case and connect the appropriate type of meter to each of the analog output terminals to be tested. Be sure to observe correct polarity.
6		Close the case and power up the unit. Do not connect power until the case is closed.



Step	Screen	Action																												
7	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">MENU</td></tr> <tr><td style="text-align: center;">CONFIGURATION</td></tr> <tr><td style="text-align: center;">CALIBRATION</td></tr> <tr><td style="text-align: center;">MAINTENANCE</td></tr> <tr><td style="text-align: center;">I/O SETUP</td></tr> <tr><td colspan="2" style="text-align: center;">DIAGNOSTICS</td></tr> <tr><td style="text-align: center;">PREV</td></tr> <tr><td style="text-align: center;">NEXT</td></tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">MAINTENANCE</td></tr> <tr><td style="text-align: center;">OFF-LINE FUNCTIONS</td></tr> <tr><td style="text-align: center;">INSTRUMENT SETUP</td></tr> <tr><td style="text-align: center;">ELECTRODE FUNCTIONS</td></tr> <tr><td style="text-align: center;">RELAY ACTIVATION</td></tr> <tr><td colspan="2" style="text-align: center;">DIAGNOSTICS</td></tr> <tr><td colspan="2" style="text-align: center;"> </td></tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">OFF-LINE FUNCTIONS</td></tr> <tr><td style="text-align: center;">DISPLAY TEST</td></tr> <tr><td style="text-align: center;">KEYBOARD TEST</td></tr> <tr><td style="text-align: center;">OUTPUT TESTS</td></tr> <tr><td style="text-align: center;">OUTPUT CALIBRATION</td></tr> <tr><td style="text-align: center;">CALIBRATION RESET</td></tr> <tr><td colspan="2" style="text-align: center;">DIAGNOSTICS</td></tr> <tr><td colspan="2" style="text-align: center;"> </td></tr> </table>	MENU	CONFIGURATION	CALIBRATION	MAINTENANCE	I/O SETUP	DIAGNOSTICS		PREV	NEXT	MAINTENANCE	OFF-LINE FUNCTIONS	INSTRUMENT SETUP	ELECTRODE FUNCTIONS	RELAY ACTIVATION	DIAGNOSTICS				OFF-LINE FUNCTIONS	DISPLAY TEST	KEYBOARD TEST	OUTPUT TESTS	OUTPUT CALIBRATION	CALIBRATION RESET	DIAGNOSTICS				<p>Go to MAINTENANCE OFF-LINE FUNCTIONS OUTPUT TESTS.</p>
MENU																														
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CALIBRATION																														
MAINTENANCE																														
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8	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">OUTPUT TESTS</td></tr> <tr><td style="text-align: center;">01 02 03 R1R2R3R4</td></tr> <tr><td style="text-align: center;">0 0 0 A A A A</td></tr> <tr><td style="text-align: center;">25 0 0 A A A A</td></tr> <tr><td style="text-align: center;">50 25 0 A A A A</td></tr> <tr><td style="text-align: center;">75 50 25 A A A A</td></tr> <tr><td colspan="2" style="text-align: center;">DIAGNOSTICS</td></tr> <tr><td style="text-align: center;"> </td></tr> <tr><td style="text-align: center;">NEXT</td></tr> </table>	OUTPUT TESTS	01 02 03 R1R2R3R4	0 0 0 A A A A	25 0 0 A A A A	50 25 0 A A A A	75 50 25 A A A A	DIAGNOSTICS			NEXT	<p>Select the combination of output values to be supplied to the terminals, or go to the next window for additional choices.</p> <p>When one of the rows of output combinations has been selected, observe the meter readings to check that the analog output values match those selected. Also listen for the “click” of an energized relay.</p> <p>If the results of the analog output test are not satisfactory, recalibrate the output’s zero and span using the procedure in 10.2.</p> <p>If the results of the relay output test are not satisfactory, consult Honeywell for assistance.</p>																		
OUTPUT TESTS																														
01 02 03 R1R2R3R4																														
0 0 0 A A A A																														
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OUTPUT TESTS																														
01 02 03 R1R2R3R4																														
100 75 50 A A A N																														
0 100 75 A N A A																														
0 0 100 A A N A																														
0 0 0 A N N N																														
DIAGNOSTICS																														
PREV																														
10		<p>If only one meter is available, so that only one output can be tested at a time, then for each analog output repeat Steps 1 through 9, including powering down the unit before changing the connections to the output terminals.</p>																												
11		<p>When output testing has been completed, re-install field wiring removed in Step 4. Disconnect power before opening case.</p>																												
12		<p>Replace the safety cover and secure it with the screw.</p>																												
13		<p>Close the case and power up the unit. Do not apply power until case is closed.</p>																												



10. Maintenance

10.1 Overview

Introduction

This section provides instructions for a variety of maintenance tasks.



WARNING

Maintenance should be performed by qualified personnel only.

What's in this section?

The topics in this section are listed below.

Topic	See Page
10.1 Overview	109
10.2 Calibrating Outputs	111
10.3 Restoring Factory Calibration Settings	114
10.4 Specifying a Tagname or Other Display String	115
10.5 Viewing Product Information and Changing Model Number Stored in Memory	116
10.6 Adjusting the Screen Contrast	118
10.7 Entering a Password for Security	119
10.8 Resetting All Configuration and Calibration Values to Factory Settings	120
10.9 Switching Between Electrodes with DualCal	121
10.10 Determining and Entering A Solution Temperature Coefficient	122
10.11 Turning on Durafet Temperature Display	125
10.12 Specifying Relay Activation	126
10.13 Replacing the Fuse	127



WARNING

While the unit is powered, a potentially lethal shock hazard exists inside the case. Do not open the case while the unit is powered.

ATTENTION

Most of the operations described in this section are performed with the unit off-line (that is, not connected to the process). However, some of the operations described in this section are performed with the Analyzer/Controller on-line. Unless you put the unit in Hold mode before starting a maintenance function with the unit on-line, your process may be affected as soon as you initiate the maintenance function. For example, if you change the relay activation from ENERGIZE on alarm to DE-ENERGIZE on alarm, the change will be implemented as soon as you press the ENTER key.

ATTENTION

This equipment contains devices that can be damaged by electrostatic discharge (ESD). As solid state technology advances and as solid state devices get smaller and smaller, they become more and more sensitive to ESD. The damage incurred may not cause the device to fail completely, but may cause early failure. Therefore, it is imperative that assemblies containing static sensitive devices be carried in conductive plastic bags. When adjusting or performing any work on such assemblies, grounded work stations and wrist straps must be used. If soldering irons are used, they must also be grounded.

A grounded work station is any conductive or metallic surface connected to an earth ground, such as a water pipe, with a 1/2 to 1 megohm resistor in series with the ground connection. The purpose of the resistor is to current limit an electrostatic discharge and to prevent any shock hazard to the operator. The steps indicated above must be followed to prevent damage and/or degradation, which may be induced by ESD, to static sensitive devices.

ATTENTION

The preamplifier power supply at terminals V+, V– and SC provides a nominal, unregulated +10 and –10 volts for an external preamp. If the 31022283 preamp is used, it will perform correctly from this supply although its terminals are designated +16, –16 and SC.

10.2 Output Calibration

Introduction

The 9782 is available with one or more optional analog outputs. The output signals can be adjusted to trim the high and low output current or voltage values over a range of $\pm 0.4\%$ of span to compensate for component tolerance variations.

Required equipment

Output calibration involves connecting a meter to the Analyzer/Controller's output terminals. The meter required for output calibration depends on the type of outputs.

- **current outputs:** current meter capable of resolving 0.01 mA over the range 0 to 20 mA dc
- **voltage outputs:** a 250 ohm $\pm 0.05\%$ shunt and a volt meter (capable of measuring 1 to 5 Vdc within 1 mV)

A screwdriver to fit the terminal block screws and the screw securing the safety cover is also required.

Procedure

To calibrate outputs, follow the procedure described in Table 10-1. The output terminals are inside the case as shown in Figures 6-1 through 6-6.



WARNING

While the unit is powered, a potentially lethal shock hazard exists inside the case. Do not open the case while the unit is powered. Do not access the output terminal as described below while the unit is powered.



WARNING

A disconnect switch must be installed to break all current carrying conductors. Turn off power before working on conductors. Failure to observe this precaution may result in serious personal injury.

Table 10-1 Procedure for Calibrating Outputs



Step	Screen	Action																		
1		Turn off the power to the Analyzer/Controller. More than one switch may be required to disconnect power.																		
2		With the power off open the case: <ul style="list-style-type: none"> • Grasp the bottom center portion of the front bezel and pull it downward and toward you slightly to disengage the bottom of the bezel from the edge of the case. • Lift the bezel gently to disengage it from the top edge of the case. • Swing the bezel to the left. (The bezel and display assembly is mounted on pivot arms.) The safety cover with its warning label will be visible. 																		
3		With the power off remove the safety shield by removing the single screw holding it in place.																		
4		Label and remove the field wiring connected to the analog output terminals.																		
5		Feed the test wiring through conduit hole in the case and connect the appropriate type of meter to the terminals for the output to be calibrated. Be sure to observe correct polarity.																		
6		Close the case and power up the unit.																		
7	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; padding: 5px;"> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP </td> </tr> <tr> <td style="text-align: center; padding: 5px;"> DIAGNOSTICS </td> </tr> <tr> <td style="text-align: center; padding: 5px;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;"></td> <td style="width: 33%; text-align: center;">PREV</td> <td style="width: 33%; text-align: center;">NEXT</td> </tr> </table> </td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; padding: 5px;"> MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION </td> </tr> <tr> <td style="text-align: center; padding: 5px;"> DIAGNOSTICS </td> </tr> <tr> <td style="text-align: center; padding: 5px;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;"></td> <td style="width: 33%;"></td> <td style="width: 33%;"></td> </tr> </table> </td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; padding: 5px;"> OFF-LINE FUNCTIONS DISPLAY TEST KEYBOARD TEST OUTPUT TESTS OUTPUT CALIBRATION CALIBRATION RESET DIAGNOSTICS </td> </tr> <tr> <td style="text-align: center; padding: 5px;"> DIAGNOSTICS </td> </tr> <tr> <td style="text-align: center; padding: 5px;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;"></td> <td style="width: 33%;"></td> <td style="width: 33%;"></td> </tr> </table> </td> </tr> </table>	MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP	DIAGNOSTICS	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;"></td> <td style="width: 33%; text-align: center;">PREV</td> <td style="width: 33%; text-align: center;">NEXT</td> </tr> </table>		PREV	NEXT	MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION	DIAGNOSTICS	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;"></td> <td style="width: 33%;"></td> <td style="width: 33%;"></td> </tr> </table>				OFF-LINE FUNCTIONS DISPLAY TEST KEYBOARD TEST OUTPUT TESTS OUTPUT CALIBRATION CALIBRATION RESET DIAGNOSTICS	DIAGNOSTICS	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;"></td> <td style="width: 33%;"></td> <td style="width: 33%;"></td> </tr> </table>				Go to MAINTENANCE OFF-LINE FUNCTIONS OUTPUT CALIBRATION.
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Step	Screen	Action
8	<pre> OUTPUT1 SPAN OUTPUT1 ZERO OUTPUT2 SPAN OUTPUT2 ZERO OUTPUT3 SPAN OUTPUT3 ZERO DIAGNOSTICS </pre>	<p>The first display will reflect the quantity of analog outputs supported by the hardware.</p> <p>Select the value to be calibrated.</p> <p>Go to the next screen.</p>
9	<pre> SPAN CAL OUTPUT1 USE UP/DOWN ARROW KEYS TO ADJUST ENTER TO SAVE DIAGNOSTICS </pre>	<p>Use the UP and DOWN keys to correct the reading on the test meter.</p> <p>To save the correction, press ENTER.</p>
10	<pre> OUTPUT CALIBRATION SAVED MENU TO EXIT DIAGNOSTICS </pre>	<p>This screen confirms that the value was saved.</p>
11		<p>To calibrate additional values, repeat Steps 1 through 10, including powering down the unit before changing the connections to the output terminals.</p>
12		<p>When output calibration has been completed, re-install field wiring removed in Step 4. Disconnect power before opening case.</p>
13		<p>Replace the safety cover and secure it with the screw.</p>
14		<p>Close the case and power up the unit. Do not apply power until the case is closed.</p>



10.3 Restoring Factory Calibration Settings

Introduction

A pH measuring system can be calibrated using one- and two-point manual or automatic calibrations. One-point calibration, also known as standardization, is a zero adjustment to compensate for electrode drift. Two-point calibration also includes a slope adjustment of span, matching gain of the instrument to the electrode output response.

A standardization operation can also be performed on an ORP measuring system.

The calibration reset function described here “undoes” standardization and slope adjustments. This function has no effect on output calibration as described earlier in this section.

Procedure

Use the procedure in Table 10-2 to restore factory calibration values, returning the standardization offset to 0.0, and the percent theoretical slope to 100 %.

Table 10-2 Procedure for Restore Factory Calibration Values

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP ----- DIAGNOSTICS ----- PREV NEXT </pre>	Go to MAINTENANCE OFF-LINE FUNCTIONS CALIBRATION RESET .
	<pre> MAINTENANCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION ----- DIAGNOSTICS ----- </pre>	
	<pre> OFF-LINE FUNCTIONS DISPLAY TEST KEYBOARD TEST OUTPUT TESTS OUTPUT CALIBRATION CALIBRATION RESET DIAGNOSTICS ----- </pre>	
2	<pre> CALIBRATION RESET ATTENTION: ALL CALIBRATIONS WILL BE RESET TO FACTORY DEFAULTS! ----- DIAGNOSTICS ----- FCAL </pre>	Pressing the specified function key at this point will return the standardization offset to 0.0 and the percent theoretical slope to 100.0.
3	<pre> INSTALLING FACTORY CALIBRATION DEFAULTS ----- MENU TO EXIT DIAGNOSTICS ----- </pre>	Wait for the display to go back to the off-line function menu.

10.4 Specifying a Tagname or Other Display String

Introduction

The real-time displays of process values show the instrument's tagname (or other configurable fixed nineteen-character string) at the top of the screen.

Procedure

Use the procedure in Table 10-3 to specify the text to be displayed at the top of the process value displays.

Table 10-3 Procedure for Specifying a Tagname or Other Display String

Step	Screen	Action
1	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP <hr/> DIAGNOSTICS PREV NEXT </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> MAINTENANCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION <hr/> DIAGNOSTICS </div> <div style="border: 1px solid black; padding: 5px;"> INSTRUMENT SETUP INSTRUMENT TAGGING PRODUCT INFO SCREEN CONTRAST SECURITY RESET UNIT <hr/> DIAGNOSTICS </div>	Go to MAINTENANCE INSTRUMENT SETUP INSTRUMENT TAGGING .
2	<div style="border: 1px solid black; padding: 5px;"> UPDATE TAGE DATA EDIT 19 CHAR STRING XXXXXXXXXXXXXXXXXXXXX DIAGNOSTICS <--- ---> </div>	The text string currently stored in memory will be displayed. If desired, edit the string (nineteen characters maximum). Press ENTER to change text.

10.5 Viewing Product Information and Changing Model Number Stored in Memory

Introduction

During I/O setup (see Section 5) the software will display prompts only for those features the hardware can support. To do this, the software uses the model number of the unit stored in memory at the factory. Each combination of features has a unique model number (see Section 2). Therefore, if you add an option card to the 9782, it is very important that you change the model number stored in memory using the procedure described below.

ATTENTION

A special password is required to change the stored model number. If the password was not supplied with the new option card, call the Honeywell Technical Assistance Center.

Before calling for technical support, follow the procedure in Table 10-4 to determine the version of the software in the Analyzer/Controller. The support team will ask for this information.

Procedure

Use the procedure in Table 10-4 to see the software version and model number, and to change the model number if required.

Table 10-4 Procedure for Viewing Product Information and Changing the Stored Model Number

Step	Screen	Action							
1	<table border="1"> <tr> <td>MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP</td> </tr> <tr> <td>DIAGNOSTICS</td> </tr> <tr> <td>PREV NEXT</td> </tr> </table> <table border="1"> <tr> <td>MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION</td> </tr> <tr> <td>DIAGNOSTICS</td> </tr> </table> <table border="1"> <tr> <td>INSTRUMENT SETUP INSTURMENT TAGGING PRODUCT INFO SCREEN CONTRAST SECURITY RESET UNIT</td> </tr> <tr> <td>DIAGNOSTICS</td> </tr> </table>	MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP	DIAGNOSTICS	PREV NEXT	MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION	DIAGNOSTICS	INSTRUMENT SETUP INSTURMENT TAGGING PRODUCT INFO SCREEN CONTRAST SECURITY RESET UNIT	DIAGNOSTICS	Go to MAINTENANCE INSTRUMENT SETUP PRODUCT INFO.
MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP									
DIAGNOSTICS									
PREV NEXT									
MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION									
DIAGNOSTICS									
INSTRUMENT SETUP INSTURMENT TAGGING PRODUCT INFO SCREEN CONTRAST SECURITY RESET UNIT									
DIAGNOSTICS									

Step	Screen	Action
2	<pre> PRODUCT INFORMATION VERSION: A1.0 MODEL NUMBER: 0782X-XXXX-XXXXXXXXX ----- DIAGNOSTICS EDIT </pre>	<p>The software version is read-only information.</p> <p>If the model number displayed no longer matches the hardware because you have added or changed an option card, use the specified function key to edit the model number. (See Section 2 for available model number selections.)</p>
3	<pre> FACTORY PASSWORD 0000 ENTER PASSWORD ----- DIAGNOSTICS </pre>	<p>Note that a special password is required to change the model number.¹ (This is <i>not</i> the same as the security password described in 10.7.) Enter it when prompted.</p>
4	<pre> MODEL NUMBER: 9782X-XXXX-XXXXXXXXX ----- ATTENTION: RESET UNIT FOR EDITS TO BECOME ACTIVE! ----- DIAGNOSTICS RESET </pre>	<p>ATTENTION: Changing the model number stored in memory will do a “cold reset” of the unit, returning <i>ALL</i> configuration values to the factory settings shown in Table 5-1. During a cold reset the standardization offset is also returned to 0.0 and the percent theoretical slope is set back to 100.0, eliminating any changes made during manual or automatic calibration.</p> <p>To reset the unit, use the specified function key.</p> <p>To cancel the edit and avoid resetting the unit, press the MENU key.</p>

¹ If you do not have the factory password, call the Technical Assistance Center. The telephone number is in the front of this manual.

10.6 Adjusting the Screen Contrast

Introduction

The display contrast can be adjusted to suit the viewing conditions at the installation site.

Procedure

To adjust the display contrast, follow the procedure in Table 10-5.

Table 10-5 Procedure for Adjusting the Screen Contrast

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to MAINTENANCE INSTRUMENT SETUP SCREEN CONTRAST .
	<pre> MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION DIAGNOSTICS </pre>	
	<pre> INSTRUMENT SETUP INSTURMENT TAGGING PRODUCT INFO SCREEN CONTRAST SECURITY RESET UNIT DIAGNOSTICS </pre>	
2	<pre> SCREEN CONTRAST CONTRAST: 0 USE UP/DOWN ARROW KEYS TO ADJUST MENU TO EXIT DIAGNOSTICS </pre>	<p>Use the UP and DOWN keys to change the contrast.</p> <p>When the displayed contrast is acceptable, use the MENU key to return to the instrument setup menu. The new contrast setting will be saved automatically.</p>

10.7 Entering a Password for Security

Introduction

I/O setup, configuration, calibration and maintenance functions can be password-protected. The password can be any number between 1 and 9999. (When the password is zero, the operator will not be prompted to enter a password.)

ATTENTION

The configurable password entered here is not the same as the special password needed to edit the model number stored in memory as described in 10.5.

Procedure

Follow the procedure in Table 10-6 to enter a password.

Table 10-6 Procedure for Entering a Password

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to MAINTENANCE INSTRUMENT SETUP SECURITY .
	<pre> MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION DIAGNOSTICS </pre>	
	<pre> INSTRUMENT SETUP INSTURMENT TAGGING PRODUCT INFO SCREEN CONTRAST SECURITY RESET UNIT DIAGNOSTICS </pre>	
2	<pre> PASSWORD SECURITY ENABLE SECURITY: YES PASSWORD: 000 DIAGNOSTICS </pre>	<p>To enable the security function, select YES.</p> <p>The current password will be displayed. It can be edited using this screen.</p>

10.8 Resetting All Configuration and Calibration Values to Factory Settings

Introduction

A “cold reset” function is available to return *ALL* configuration values to the factory settings shown in Table 5-1. During a cold reset the standardization offset is also returned to 0.0 and the percent theoretical slope is set back to 100.0, eliminating any changes made during manual or automatic calibration. All alarms will be cleared and outputs will go to zero. Some I/O setup values will also return to factory settings.

This “cold reset” contrasts with the “warm reset” that occurs following loss of power and at the end of system setup (see Section 5). During a warm reset, alarms are not cleared, and outputs are maintained at their last value prior to the loss of power or initiation of the cold reset. A warm reset has no effect on configuration or calibration values.

Procedure

To do a cold reset, returning all configuration and calibration values to their factory settings, follow the procedure in Table 10-7.

Table 10-7 Procedure for Resetting All Configuration to Factory Settings

Step	Screen	Action
1	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP <hr/> DIAGNOSTICS PREV NEXT </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION <hr/> DIAGNOSTICS </div> <div style="border: 1px solid black; padding: 5px;"> INSTRUMENT SETUP INSTURMENT TAGGING PRODUCT INFO SCREEN CONTRAST SECURITY RESET UNIT DIAGNOSTICS RESET </div>	Go to MAINTENANCE INSTRUMENT SETUP RESET UNIT .
2	<div style="border: 1px solid black; padding: 5px;"> UNIT RESET ATTENTION ALL PARAMETERS WILL BE RESET TO FACTORY DEFAULTS! <hr/> DIAGNOSTICS RESET </div>	Pressing the specified function key at this point will perform a cold reset as described above. As the reset is completed. the display will go blank, then for a few seconds product information will be displayed. Finally, the display will return to showing process values.

10.9 Switching Between Electrodes with DualCal

Introduction

The DualCal feature allows storage of calibration data for two electrode assemblies. The second can be used as a backup or in a two-tank batch control setup. During I/O setup (see Section 5), the Analyzer/Controller can be configured to use this feature. If the feature was enabled during I/O setup, use the procedure in Table 10-8 to select the electrode for which the input and calibration factors are to be used.

Table 10-8 Procedure for Switching Between Electrodes with DualCal

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to MAINTENANCE ELECTRODE FUNCTIONS SELECT ELECTRODE.
	<pre> MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION DIAGNOSTICS </pre>	
	<pre> ELECTRODE FUNCTIONS SELECT ELECTRODE SOLUTION TEMP COMP DURAFET TEMP DISPLAY DIAGNOSTICS </pre>	
2	<pre> SELECT ELECTRODE ELECTRODE PRIMARY DIAGNOSTICS HOLD </pre>	The display will show the electrode currently being used. Select the PRIMARY or ALTERNATE electrode.

10.10 Determining and Entering a Solution Temperature Coefficient

10.10.1 Introduction

Automatic temperature compensation

Corrective adjustment, or compensation, is needed for the effects of temperature on pH measurement. This is done automatically by the Analyzer/Controller, which offers two types of automatic temperature compensation. They are referred to as conventional electrode temperature compensation (Nernstian) and solution temperature compensation. Neither type of compensation applies to ORP measurement.

Conventional electrode temperature compensation (Nernst Response)

Conventional temperature compensation is included in most pH instruments. Compensation is made for the fact that the measuring electrode response is proportional to temperature as well as pH. The electrode output is greater at higher temperature. The Analyzer/Controller uses information from a temperature sensor in the electrode assembly to adjust the measured value for this effect. **Conventional compensation is always active and requires no setup.** Note that the Durafet electrode preamplifier performs the basic temperature compensation.

Solution temperature compensation

This type of compensation adjusts for the fact the actual pH of a solution will change if its temperature changes. The change is so slight for normal applications it is usually ignored, but for high-purity water measurements, it is significant. By means of a special algorithm, the Analyzer/Controller applies the needed correction for this effect, once a value for an appropriate solution temperature coefficient has been entered using the procedure in Table 10-11. **A separate temperature input is required for solution temperature compensation when Durafet electrode without a Cap Adapter is used. For Durafet electrodes with a Cap Adapter, no separate temperature input is required.**

Using this compensation algorithm, the Analyzer/Controller measures pH at any temperature and displays the pH referenced to 25 °C. During the Hold mode, the algorithm is bypassed, so that the display is allowed to show uncompensated pH of a buffer solution for calibration. Buffer solutions are provided with their own pH/temperature data on the label.

10.10.2 Determining Solution Temperature Coefficient

Introduction

Recommended coefficients for some applications are already stored in the Analyzer/Controller's memory. If your application is one of the following, specify it as described in Table 10-11.

- power plant steam and condensate with ammonia and/or morpholine (15 °C to 40 °C)
- boiler phosphate treatment (15 °C to 40 °C)
- untreated pure water samples (15 °C to 40 °C)

For these applications at a temperature range other than 15 °C to 40 °C, select an appropriate solution temperature compensation coefficient from Table 10-9, or determine the solution

temperature compensation coefficient experimentally by measuring the pH of the process liquid at several different temperatures as described in Table 10-10. Once you have determined the appropriate value for your application, enter it in memory as described in Table 10-11.

Table 10-9 Solution Temperature Compensation Coefficients for Selected Treatment Types at Specified Temperatures

Temperature Range Degrees Celsius	Treatment Type				
	Pure Water	All Volatile Treatment (AVT)	AVT/Amine	Phosphate	Oxygenated Treatment
0 to 25	-0.019	-0.037	-0.035	-0.037	-0.037
15 to 25	-0.017	-0.034	-0.033	-0.034	-0.035
25 to 50	-0.014	-0.028	-0.027	-0.028	-0.029
15 to 40*	-0.016	-0.031	-0.030	-0.032	-0.032
0 to 50	-0.017	-0.033	-0.031	-0.033	-0.033

*Temperature range typical for most power plant sampling panels.

Determining coefficient experimentally

Use the procedure in Table 10-10 for determining a solution temperature coefficient experimentally.

Table 10-10 Procedure for Determining a Solution Temperature Coefficient Experimentally

Step	Action
1	Using the procedure in Table 10-11, enter a value of zero for solution temperature coefficient.
2	Immerse the electrode with temperature compensator in a sample of the process fluid.
3	Warm or cool the sample to several different temperatures within the operating range. Hold the temperature constant at each point for at least 10 minutes to be sure of a stable reading and uniform temperature throughout.
4	Record the pH and temperature indicated by the instrument at each of the test temperatures.
5	Plot the data to produce a graph of pH versus temperature and calculate the slope near the region of interest in pH units per 10 °C. Enter that value for solution temperature coefficient.

10.10.3 Entering Solution Temperature Coefficient

Introduction

To use the solution temperature compensation algorithm correctly, a solution temperature coefficient must be selected from among those stored in memory at the factory, or entered as described below.

Procedure

Use the procedure in Table 10-11 to enter a solution temperature coefficient for pH measurement into memory.

Table 10-11 Procedure for Entering a Solution Temperature Coefficient

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to MAINTENANCE ELECTRODE FUNCTIONS SOLUTION TEMPERATURE COMP.
	<pre> MAINTANENCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION DIAGNOSTICS </pre>	
	<pre> ELECTRODE FUNCTIONS SELECT ELECTRODE SOLUTION TEMP COMP DURAFET TEMP DISPLAY DIAGNOSTICS </pre>	
2	<pre> SOLUTION TEMP COMP TYPE: PURE WATER DIAGNOSTICS HOLD </pre> <pre> SOLUTION TEMP COMP TYPE: OTHER pH VALUE/10 C: xxxxxx DIAGNOSTICS HOLD </pre>	<p>The display will show the application type currently being used.</p> <p>If one of the standard types is appropriate, select it from the list of available types. The coefficient for that type will be displayed automatically.</p> <p>If one of the standard types in not appropriate, select OTHER from the list of available types, then enter the appropriate coefficient.</p>

10.11 Turning on Temperature Display (Durafet Electrodes without Cap Adapter Only)

Introduction

Temperature is one of the process variables that can be displayed. To turn on the display of temperature, follow the procedure in Table 10-12.

ATTENTION

A Durafet pH electrode has a temperature compensator for normal Nernstian temperature compensation. This integral temperature compensator can not be used to display temperature. For temperature to be displayed when a Durafet electrode type is selected, temperature display must be activated (see Table 10-12) and a separate temperature input must be connected to the TH and SC terminals. If a separate temperature input is not provided, display (and alarming) of temperature is not possible; AutoCal and Automatic Buffer Recognition will assume 25 °C.

Table 10-12 Procedure for Turning on Temperature Display

Step	Screen	Action
1	<pre> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP DIAGNOSTICS PREV NEXT </pre>	Go to MAINTENANCE ELECTRODE FUNCTIONS DURAFET TEMP DISPLAY .
	<pre> MAINTENANCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION DIAGNOSTICS </pre>	
	<pre> ELECTRODE FUNCTIONS SELECT ELECTRODE SOLUTION TEMP COMP DURAFET TEMP DISPLAY DIAGNOSTICS </pre>	
2	<pre> DURAFET TEMP DISPLAY DISPLAY ON? NO DIAGNOSTICS </pre>	<p>The display will indicate whether temperature display is currently turned on.</p> <p>Use this display to toggle display of temperature ON and OFF.</p>

10.12 Specifying Relay Activation

Introduction

All 9782 models are equipped with two relays. As an option, two additional relays are available. The relay action used for alarm and/or control action for all relays in the Analyzer/Controller can be specified as **energized** or **de-energized** on alarm (or when discrete control point is ON).

Procedure

Use the procedure in Table 10-13 to specify relay action.

Table 10-13 Procedure for Specifying Relay Activation

Step	Screen	Action
1	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> MENU CONFIGURATION CALIBRATION MAINTENANCE I/O SETUP </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> DIAGNOSTICS PREV NEXT </div> <div style="border: 1px solid black; padding: 5px;"> MAINTENANCE OFF-LINE FUNCTIONS INSTRUMENT SETUP ELECTRODE FUNCTIONS RELAY ACTIVATION </div> <div style="border: 1px solid black; padding: 5px;"> DIAGNOSTICS </div>	Go to MAINTENANCE RELAY ACTIVATION .
2	<div style="border: 1px solid black; padding: 5px;"> RELAY ACTIVATION STATE ON ALARM SELECT: ENERGIZE </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> DIAGNOSTICS </div>	The display will indicate whether relay activation in case of alarm (or control output "ON" state) is currently ENERGIZE or DE-ENERGIZE. Use this display to specify the desired relay action.

10.13 Replacing the Fuse

Introduction

Figure 10-1 shows the location of the power fuse on the power supply card in the right-most position inside the case. (See Section 11 for the part number of the kit containing fuses.)

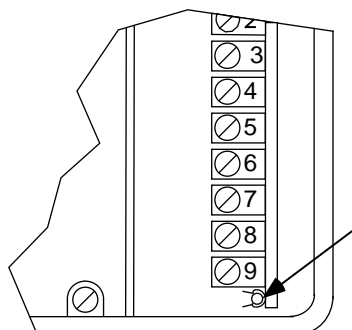


Figure 10-1 Location of Power Fuse



WARNING

Disconnect power before opening the instrument case to replace the fuse. A potentially lethal shock hazard exists inside the case if the unit is opened while powered. More than one switch may be required to disconnect power.

ATTENTION

To avoid potentially serious damage to expensive components, a blown fuse should not be replaced until the cause has been determined by a qualified service technician.

Procedure

To replace the fuse, follow the procedure in Table 10-14.

Table 10-14 Procedure for Replacing the Fuse

Step	Action
1	Determine why the fuse blew and correct the problem.
2	Check the fuse's packaging (in miscellaneous parts kit 51198177-501) to be sure that the fuse is correct for the voltage at your site.
3	Turn off the power to the Analyzer/Controller. More than one switch may be required to remove power.
4	<p>With the power off open the case:</p> <ul style="list-style-type: none"> • Grasp the bottom center portion of the front bezel and pull it downward and toward you slightly to disengage the bottom of the bezel from the edge of the case. • Lift the bezel gently to disengage it from the top edge of the case. • Swing the bezel to the left. (The bezel and display assembly is mounted on pivot arms.) The safety cover with its warning label will be visible.
5	With the power off remove the safety cover by removing the single screw holding it in place.
6	If more room is needed, remove the circuit card retainer bracket at the top of the case and pull the circuit card assembly partially out of the instrument case. (It may be necessary to temporarily disconnect leads from some terminals to do so.)
7	Remove the old fuse and insert the new one.
8	If any leads were disconnected in Step 6, reconnect them.
9	Replace the safety cover and secure it with the screw.
10	Close the case and power up the unit. Do not apply power until the case is closed.



11. Accessories and Replacement Parts List

11.1 Overview

Introduction

This section provides part numbers for field-replaceable parts and for accessories.

What's in this section?

The topics in this section are listed below.

Topic	See Page
11.1 Overview	129
11.2 Part Numbers	130

11.2 Part Numbers

Introduction

Part numbers for field-replaceable parts and accessories are provided in Table 11-1.

Table 11-1 Part Numbers

Kit/Part Number	Description	Parts Included in Kit	Quantity
51198177-501	miscellaneous parts for all 9782 controller/analyzers	120 volt fuse 240 volt fuse case gasket upper card retainer bracket lower card retainer bracket screws for retainer brackets	1 1 1 1 1 2
51198063-501	output card: single current or voltage output	card installation instructions	1 1
51198064-501	output card: single current or voltage output with two hermetically sealed relays	card installation instructions	1 1
51198065-501	output card: two general purpose relays and no analog outputs	card installation instructions	1 1
51198066-501	replacement output card: two current outputs	card installation instructions	1 1
51198066-502	new output card: two current outputs	card PROM installation instructions	1 1 1
51198067-501	replacement output card: three current outputs	card installation instructions	1 1
51198067-502	new output card: three current outputs	card PROM installation instructions	1 1 1
51198068-501	Case and gasket	case (no bezel) case gasket	1 1
51198172-501	pH input card	card installation instructions	1 1
51198173-501	bezel assembly	assembly	1
51198176-501	Non-backlit LCD display	assembly	1
51198176-502	Backlit LCD display	assembly	1
51198056-501	internal preamp for use with glass/ORP	preamp mounting rivets installation instructions	1 4 1
51198057-501	internal preamp for use with Durafet	preamp mounting rivets installation instructions	1 4 1
51205501-501	Power supply PC	card, installation instructions	1 1
51205502-501	Microprocessor PC	card, installation instructions	1 1

Kit/Part Number	Description	Parts Included in Kit	Quantity
51205503-501	Backplane PC	card, installation instructions	1 1
51198059-501	relay: standard general purpose (used on all 9782 models)	relay	1
51198060-501	relay: optional hermetically sealed	relay	1
51198061-501	relay: optional general purpose	relay	1
079163	power line filter kit	filter cores installation instructions	4 1
51198055-501	panel mounting kit	bracket screws washers	1 2 2
084711	pipe/wall mounting kit	bracket U-bolt for 1 in. pipe U-bolt for 2 in. pipe mounting plate nuts washers lock washers	1 2 2 1 4 4 4
056349	reducer panel kit	filler plate	1
31103015	quinhydrone powder	2 oz bottle	1
31103001	pH buffer solution: 4.01 pH @ 25 °C	16 fluid oz bottle	1
31103002	pH buffer solution: 6.86 pH @ 25 °C	16 fluid oz bottle	1
31103003	pH buffer solution: 9.18 pH @ 25 °C	16 fluid oz bottle	1
preamp-to-instrument cables for 7758-06, 7773-70, 7774-10, -50, -70, and -90, and all 7777 mountings			
31075723	20 ft length with quick disconnect and tinned leads	cable	1
51309677- 001	50 ft length with quick disconnect and tinned leads	cable	1
51309677- 002	100 ft length with quick disconnect and tinned leads	cable	1
51309677- 003	200 ft length with quick disconnect and tinned leads	cable	1
pre-amp to-instrument cables for 7758-01, 05, 7773-10, -12, -50, -52, -60, -62, and 7774-30, -60, -80 mountings			
834023	six-conductor cable (specify length)	cable	1

A. Temperature Measurement Characteristics

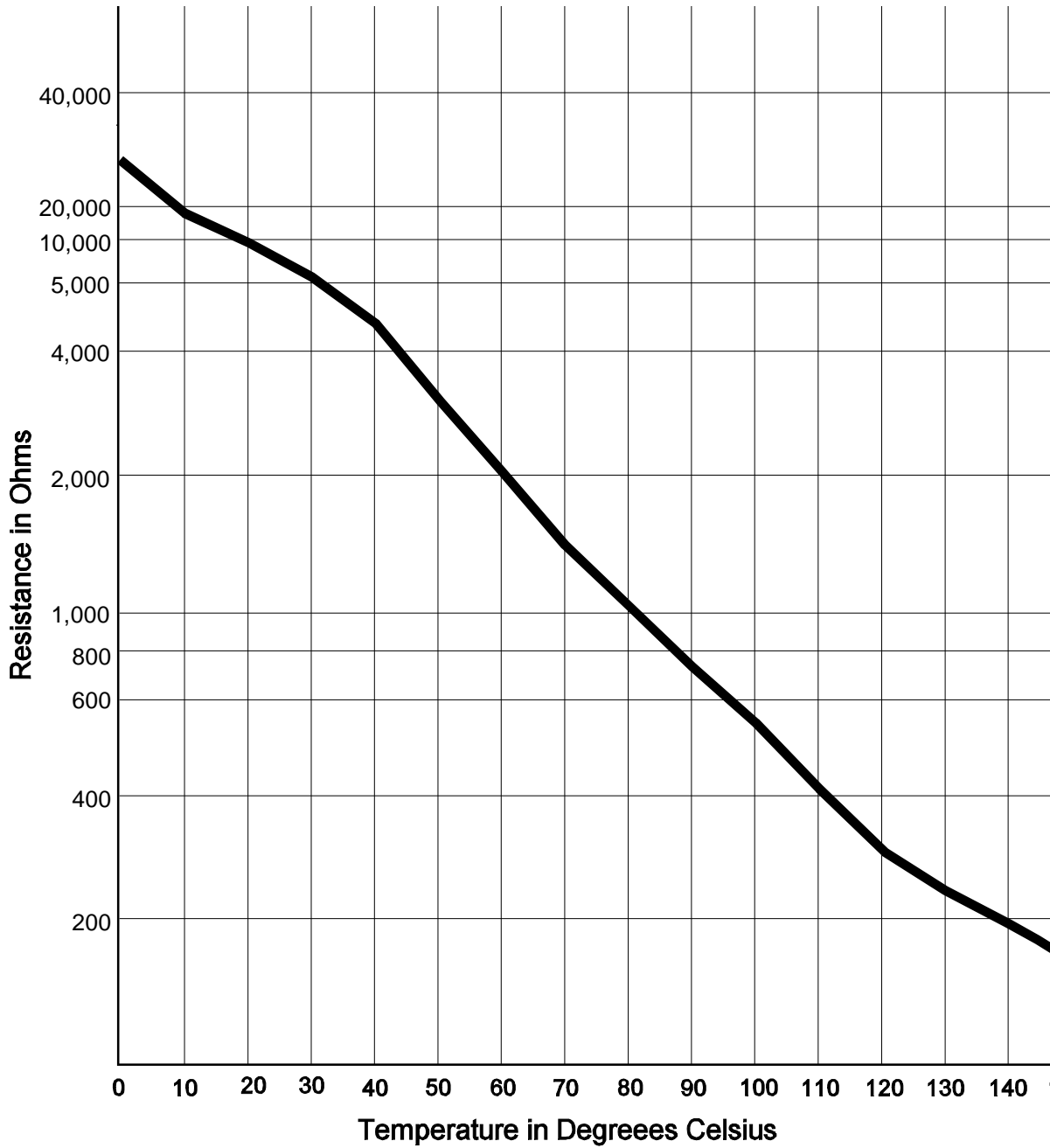


Figure A-1 Resistance vs. Temperature Characteristics of the Temperature Compensator

B. Cyanide Waste Treatment

B.1 Introduction

Uses of cyanide solutions

Cyanide solutions are used in plating baths for zinc, cadmium, copper, brass, silver and gold. The toxic rinse waters and dumps from these operations require destruction of the cyanide (typically to a level below 0.1 ppm) before its discharge.

Technique for cyanide destruction

The technique most often used for cyanide destruction is a one or two-stage chemical treatment process. The first stage raises the pH and oxidizes the cyanide to less toxic cyanate. When required, the second stage neutralizes and further oxidizes the cyanate to harmless carbonate and nitrogen. The neutralization also allows the metals to be precipitated and separated from the effluent.

Consistent treatment and stable control in this type of process requires well-mixed reaction tanks with enough volume for adequate retention time. See Figure B-1. Retention time is calculated by dividing the filled or usable tank volume by the waste flowrate. Typically it is 10 minutes or more.

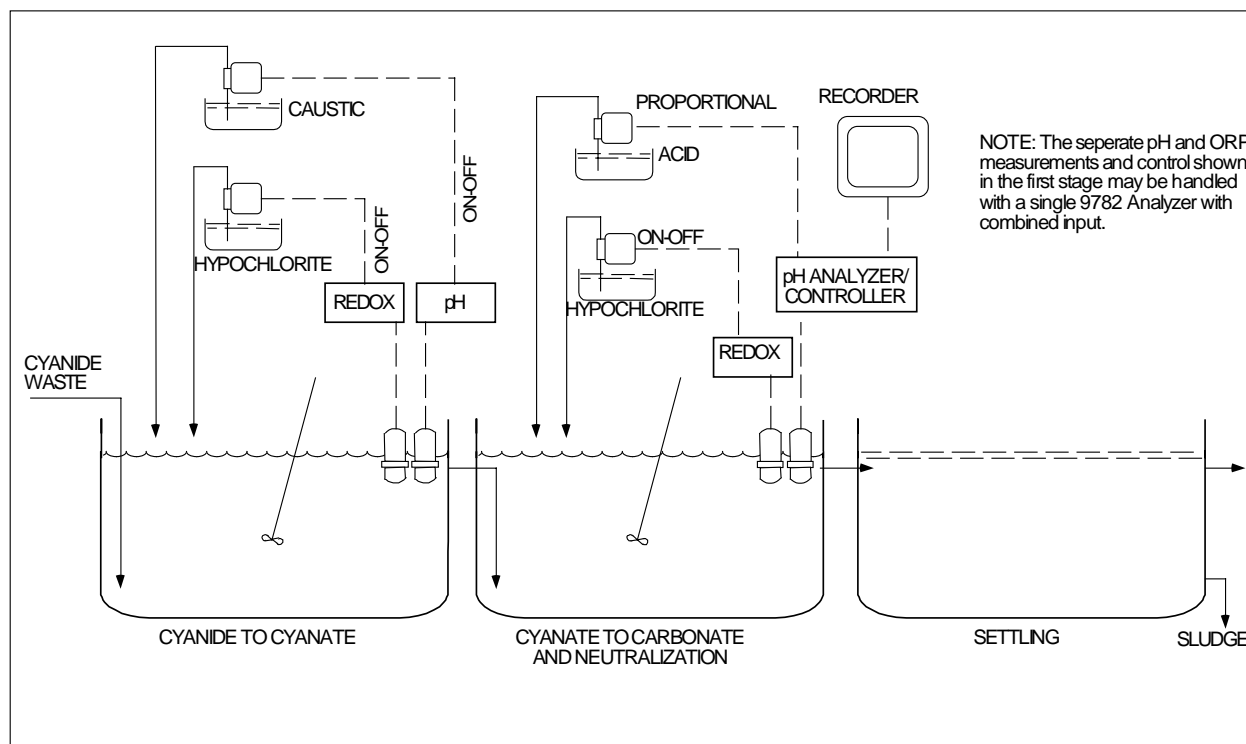
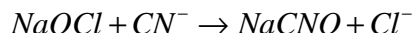


Figure B-1 Cyanide Treatment System

B.2 First Stage of Cyanide Destruction

Raise pH and oxidize cyanide

Sodium hydroxide (caustic) is used to raise the effluent to about 11 pH, which will promote the oxidation reaction and ensure complete treatment. The oxidizing agent is usually sodium hypochlorite, NaOCl. The reaction for the first stage is given below using the NaOCl and with cyanide expressed in ionic form (CN^-). The result is sodium cyanate (NaCNO) and chloride ion (Cl^-).



This first-stage reaction is analyzed and controlled by independent control loops: caustic addition by pH control and oxidizing-agent addition by ORP control (redox potential or ORP, oxidation-reduction potential). Often an ON-OFF type of control using solenoid valves or metering pumps can be used. The pH controller simply calls for more caustic whenever pH falls below 11. The ORP controller calls for additional hypochlorite whenever ORP potential falls below about +450 mV. (The metal ORP electrode is positive with respect to the reference electrode.)

Titration curve

The ORP titration curve in Figure B-2 shows the entire millivolt range if cyanide is treated as a batch. For continuous treatment, operation is maintained in the oxidized, positive region of the curve near the +450 mV setpoint. The ORP setpoint can vary between installations, depending upon pH, the oxidizing agent, the presence of various metals in solution, and the type of reference electrode used. Determine the exact setpoint empirically at that potential where all the cyanide has been oxidized without excess hypochlorite feed. This point can be verified with a sensitive colorimetric test kit or similar check for cyanide.

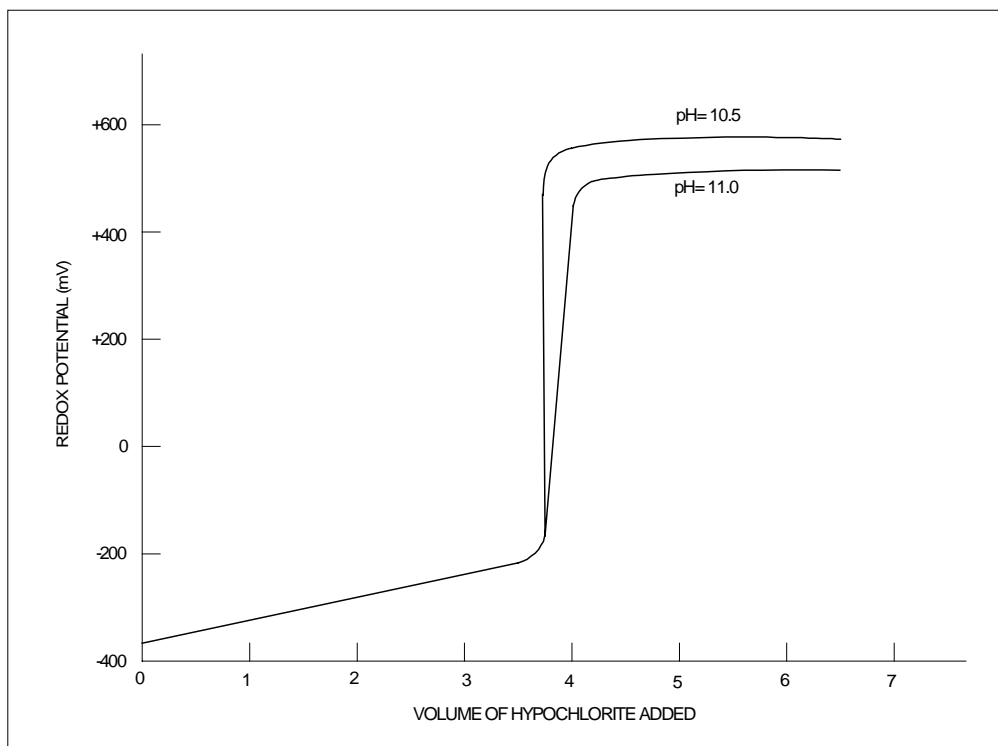


Figure B-2 First Stage Cyanide Oxidation - Typical Titration Curve

Importance of pH control

As shown in Figure B-2, pH has a direct effect on the ORP potential and must be closely controlled to achieve consistent ORP control, especially if hypochlorite is used as the oxidizing agent. Hypochlorite raises pH, which lowers the ORP potential, which in turn calls for additional hypochlorite -- a runaway situation. To avoid this situation, use close pH control and locate the ORP electrode at a distance from the hypochlorite addition point.

Reliable measurement with gold electrode

For this application, a gold ORP electrode gives a more reliable measurement than does a platinum electrode, because platinum may catalyze additional reactions at its surface and is more subject to coating than gold. Note that the solubility of gold in cyanide solutions does not present a problem as it is in contact, primarily, with cyanate. In fact, a slight loss of gold serves to keep the electrode clean.

B.3 Second Stage of Cyanide Destruction

Neutralize and further oxidize cyanate

The waste-water is neutralized in order to promote additional oxidation and to meet the discharge pH limits. Typically, sulfuric acid is added to lower the pH to about 8.5. At this pH the second oxidation occurs more rapidly.

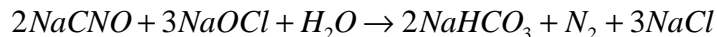


WARNING

Failure to comply with these instructions could result in death or serious injury.

An interlock must be provided to prevent the addition of acid before the positive oxidation of ALL cyanide. Failure to observe this precaution can result in the generation of highly toxic hydrogen cyanide.

Additional chlorine or sodium hypochlorite (NaOCl) can be added in proportion to that added in the first stage, or by separate ORP control to complete the oxidation to sodium bicarbonate (NaHCO₃) in the following reaction:



ORP control in the second stage is very similar to that in the first stage, except that the control point is near +600 mV. Control of pH in the second stage is more difficult than in the first stage, because the control point is closer to the sensitive neutral area. Proportional type pH control is often used.

Removal of suspended metal hydroxides

Following the second stage, a settling tank and/or a filter can be used to remove suspended metal hydroxides. However, further treatment may be required to lower concentrations of some metals below their hydroxide solubilities.

B.4 Batch Treatment



Sequence of steps

Continuous treatment is shown in Figure B-1. However, all of the reactions can be achieved with semi-automatic batch control. Only a single tank with a pH controller and an ORP controller are required. The steps are sequenced, and the pH and ORP setpoints are changed to give the same results as for the continuous treatment. Caustic is added to raise pH to 11; then hypochlorite is added to raise the ORP potential to about +450 mV while more caustic is added as required to maintain 11 pH.

WARNING

Failure to comply with these instructions could result in death or serious injury.

An interlock must be provided to prevent the addition of acid before the positive oxidation of ALL cyanide. Failure to observe this precaution can result in the generation of highly toxic hydrogen cyanide.

Then the acid can be added to neutralize the batch and further oxidation will complete the cyanate-to-carbonate conversion. A settling period can then be used to remove solids, or the batch can be pumped directly to another settling tank or pond.

B.5 ORP Potential a Measure of Status of Reaction

Cyanide is reducing ion

An oxidation-reduction reaction involves the transfer of electrons from the ion being oxidized to the oxidizing agent. In cyanide destruction, chlorine or hypochlorite accepts electrons from the cyanide, oxidizing it, while simultaneously the hypochlorite is reduced to chloride. ORP potential is a measure of the status of the oxidation-reduction reaction; i.e., the gold electrode detects the solution's ability to accept or donate electrons. The hypochlorite, an oxidizing ion, accepts electrons, which makes the electrode more positive. The cyanide, a reducing ion, provides electrons and makes the electrode more negative. The net electrode potential is related to the ratio of concentrations of reducing and oxidizing ions in the solution.

Potential cannot be used as monitor of effluent

This electrode potential is extremely sensitive in measuring the degree of treatment in the reaction tank. However, it cannot be related to a definite concentration of a cyanide or cyanate; therefore it cannot be used as a monitor of final effluent concentration.

Importance of clean electrode

Reliable ORP measurement requires a very clean metal electrode surface. Routinely clean the electrodes with a soft cloth, dilute acids, and/or cleaning agents to promote fast response.

C. Chrome Waste Treatment

C.1 Use of Chromates

Corrosion inhibition

Chromates are used as corrosion inhibitors in cooling towers and in metal-finishing operations including bright dip, conversion coating, and chrome plating.

Necessity for removal of chromium ion from wastewater

The wastewater from rinse tanks, dumps, and cooling tower blowdown contains toxic soluble chromium ion, Cr^{+6} , which must be removed, typically to a level less than 0.5 ppm before discharge.

Technique for chrome removal

The technique most often used for this chrome removal is a two-stage chemical treatment process. The first stage lowers the pH and adds the reducing agent to convert the chrome from soluble Cr^{+6} to Cr^{+3} . The second stage neutralizes the wastewater, forming insoluble chromium hydroxide which can then be removed.

Consistent treatment and stable control in this type of process requires well-mixed reaction tanks with enough volume for adequate retention time (see Figure C-1). Retention time is calculated by dividing the filled or usable tank volume by the waste flowrate. Typically, it is ten minutes or more.

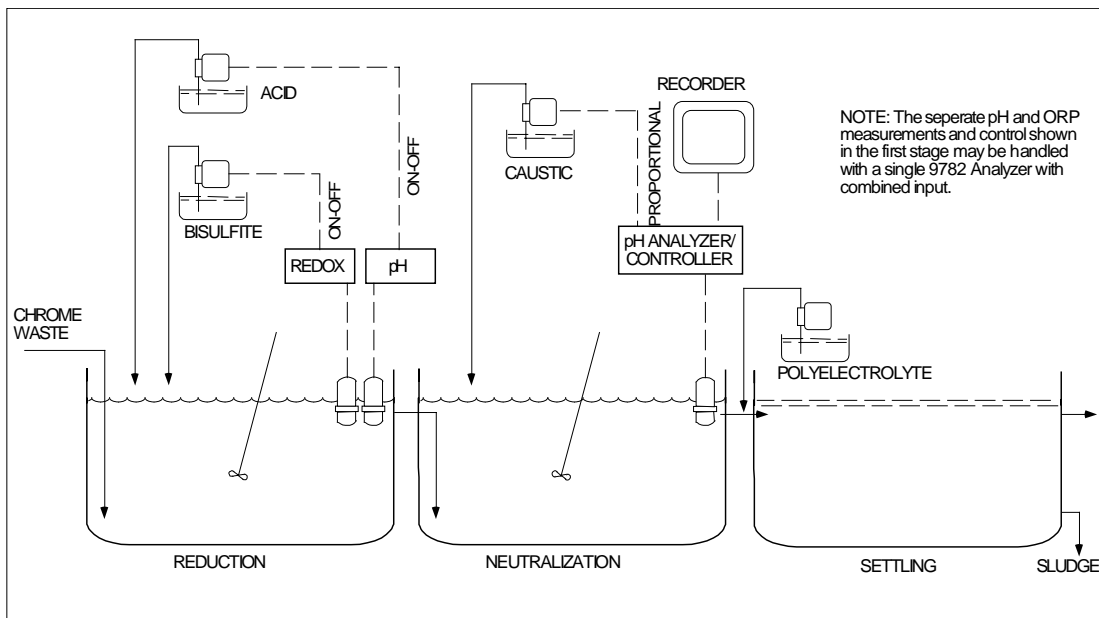
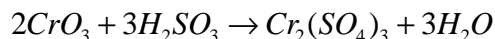


Figure C-1 Chrome Treatment System

C.2 First Stage of Chrome Removal

Lower pH and add reducing agent

Sulfuric acid is used to lower the pH to about 2.5, which promotes the reduction reaction and ensures complete treatment. The reducing agent may be sulfur dioxide, sodium sulfite, sodium bisulfite, sodium metabisulfite, sodium hydrosulfite, or ferrous sulfate. The reaction is given below. The chromate is expressed as chromic acid, CrO_3 , with a +6 charge on the chromium and the reducing agent is expressed as sulfurous acid, H_2SO_3 , which is generated by sulfites at low pH. The result is chromium sulfate, $Cr_2(SO_4)_3$, with a +3 charge on the chromium. The reaction is expressed as:



This first stage reaction is analyzed and controlled by independent control loops: acid addition by pH control; reducing-agent addition by redox potential or ORP (oxidation-reduction potential) control. Often an ON-OFF type of control using solenoid valves or metering pumps can be used. The pH controller simply calls for additional acid whenever the pH rises above 2.5. The ORP controller calls for additional reducing agent whenever the ORP potential rises above about +250 mV. (The metal ORP electrode is positive with respect to the reference electrode.)

Titration curve

The ORP titration curve in Figure C-2 shows the entire millivolt range if Cr^{+6} chrome is treated as a batch. With continuous treatment, operation is maintained in the fully reduced portion of the curve near the +250 mV setpoint. The ORP setpoint can vary between installations, depending on pH, reducing agent, presence of additional contaminants and dissolved oxygen, and the type of reference electrode used. Determine the exact setpoint empirically. This ORP setpoint should be at a potential where all of the Cr^{+6} has been reduced without excess sulfite consumption, which can release sulfur dioxide gas. This point can be verified with a sensitive colorimetric test kit or similar check.

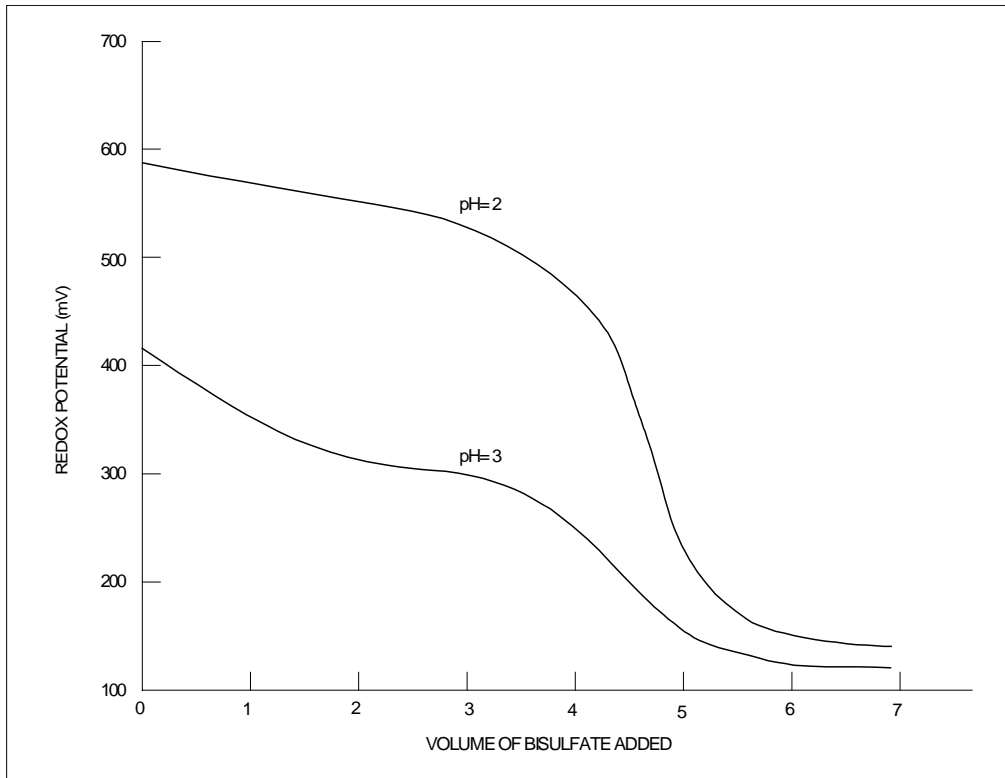


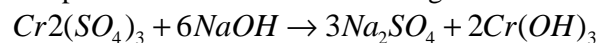
Figure C-2 Chrome Reduction - Typical Titration Curve

Chrome reduction is slow enough that 10 to 15 minutes may be required for a complete reaction and this time increases if pH is controlled at higher levels. The pH also has a direct effect on the ORP potential as shown in Figure C-2. Therefore, pH must be controlled to achieve consistent ORP control.

C.3 Second Stage of Chrome Removal

Neutralize the wastewater

In this stage the wastewater is neutralized to precipitate the Cr^{+3} as insoluble chromium hydroxide, $Cr(OH)_3$. Another reason is to meet the discharge pH limits. Sodium hydroxide or lime is used to raise the pH to 7.5 to 8.5 in the following reaction.



pH control point close to neutral point

Control of pH in the second stage is more difficult than in the first because the control point is in the sensitive area closer to the neutral point. Although this reaction is fast, for stability, a retention time of at least 10 minutes is usually needed for continuous treatment. Proportional pH control is often used in this stage.

Remove suspended chromium hydroxide

Subsequently, a settling tank and/or filter will remove the suspended chromium hydroxide. Flocculating agents are helpful in this separation.

C.4 Batch Treatment

Sequence of steps

Continuous treatment for chrome removal is shown in Figure C-1. However, all of the reactions can be achieved with semi-automatic batch control. Only a single tank with a pH controller and an ORP controller are required. The steps of the treatment are sequenced, and the pH setpoint is changed to give the same results as for the continuous treatment. Acid is added to lower pH to 2.5; then reducing agent is added to lower ORP potential to +250 mV. After waiting a few minutes to ensure a complete reaction (and possible test for Cr^{+6}), the sodium hydroxide is added to raise pH to 8 as in the second stage of the continuous treatment. The settling period then begins, or the batch is pumped to a separate settling tank or pond.

C.5 ORP Potential a Measure of Status

Sulfite is reducing ion

An oxidation-reduction reaction involves the transfer of the electrons from the reducing agent to the ion being reduced. In the chrome removal application, sulfur in the sulfite ion donates electrons to reduce the chromium; simultaneously the chromium oxidizes the sulfur. The ORP potential is a measure of the status of the oxidation-reduction reaction; the platinum or gold electrode detects the solution's ability to accept or donate electrons. Sulfite (SO_3^{+2}), a reducing ion, donates electrons which makes the electrode more negative. The chromium, an oxidizing ion, Cr^{+6} , accepts electrons and makes the electrode more positive. The net electrode potential is related to the ratio of concentrations of reducing and oxidizing ions in the solution.

Potential cannot be used as monitor of effluent

This electrode potential is extremely sensitive in measuring the degree of chrome treatment in the reaction tank. However, it cannot be related to a definite concentration of chrome and, therefore, cannot be used as a final effluent monitor of chrome concentration.

Importance of clean electrode

Reliable ORP measurements require a very clean metal electrode surface. Clean the electrodes routinely with a soft cloth, dilute acids, and/or cleaning agents to promote fast response. Control at low pH levels in the first stage of treatment has also been found to help maintain clean ORP electrodes.

D. Simultaneous pH and ORP Measurement

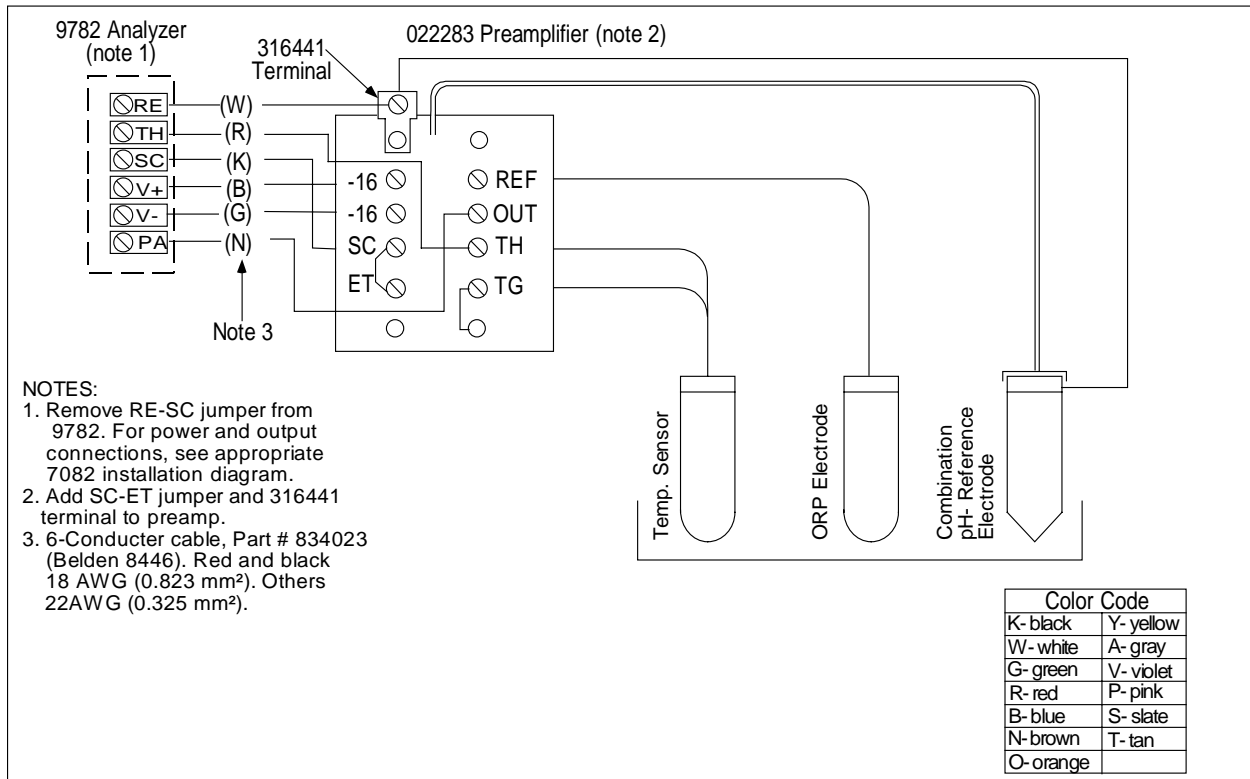


Figure D-1 Installation Diagram
Simultaneous pH and ORP Measurements with 9782 pH/ORP Analyzer and 7773-6□-□-40-□ Electrode Mounting Plus ORP Electrode

E. Proportional Control Tuning

E.1 Overview

Adjust effective proportional band width

The only adjustment in proportional-only control is the effective proportional band width. For startup, enter the desired control setpoints for discrete control types (or the value representing 0 % in CAT control). Set the proportional band limits (value for 100 % output) to the extreme pH (or ORP) values anticipated before treatment of the batch.

Treatment takes too long, but no unacceptable overshoot

After observing treatment performance, some improvement may be possible. If treatment takes too long, and there has been no unacceptable overshoot beyond the setpoint, make one or more the following changes:

- Increase the reagent delivery capacity.
- Increase the reagent concentration.

CAUTION

More concentrated reagents freeze at higher temperatures.

- Decrease the proportional band width by adjusting the proportional band limit closer to the setpoint.

Unacceptable overshoot

If unacceptable overshoot occurs, make one or more of the following changes:

- Increase mixing in the treatment tank.
- Reduce the reagent delivery capacity.
- Reduce the reagent concentration.

CAUTION

Sulfuric acid at lower concentrations is more corrosive to metals

- Widen the proportional band by adjusting the proportional band limit further from the setpoint.

F. Microprocessor Board Switch Settings

F.1 Overview

Introduction

The information in this appendix will not be needed for normal set up and operation of the 9782 Analyzer/Controller. It is included here for use during troubleshooting with the telephone assistance of the Honeywell Technical Assistance Center.

Location of switches

Two 8-position DIP switches to be set by the user are mounted on the microprocessor board (far left board). The switch locations are shown in Figure F-1.

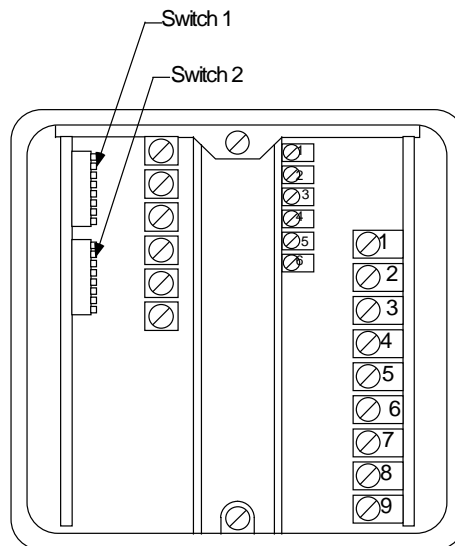


Figure F-1 Microprocessor Board DIP Switches

Note that S1 switch (030480), CR1-CR8 and CR12-CR16 (188056) are not used as of June 1993.

SW1 - all positions set to off

Regardless of the options used, all eight switches in SW1 are set to off.

SW2 - settings are dependent on options

The settings of the eight switches in SW2 depend on the options used. The appropriate settings are shown in Table F-1.

Table F-1 Microprocessor Board Switch Settings

Option	SW2-1	SW2-2	SW2-3	SW2-4	SW2-5	SW2-6	SW2-7	SW2-8
None	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Single Parameter Current or Voltage Output	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Auxiliary Relays	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
Two Analog Outputs	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Three Analog Outputs	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF

Honeywell

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