UDA2182
Universal Dual Analyzer
Product Manual

70-82-25-119

January 2009

Notices and Trademarks

Revision 5 January 2009

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office for warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is Buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Honeywell Process Solutions

Honeywell
2500 W. Union Hill Drive
Phoenix, Arizona 85027

About This Document

Abstract

This document provides descriptions and procedures for the Installation, Configuration, Operation, and Troubleshooting of your UDA2182 Universal Dual Analyzer.

Contacts

World Wide Web

The following lists Honeywell's World Wide Web sites that will be of interest to our customers.

Honeywell Organization	WWW Address (URL)
Corporate	*http://www.honeywell.com*
Honeywell Field Solutions	*http://www.honeywell.com/ps*
Technical tips	*http://content.honeywell.com/ipc/faq*

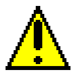
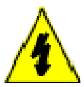
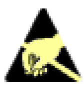
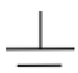
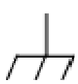
Telephone

Contact us by telephone at the numbers listed below.

	Organization	Phone Number	
United States and Canada	Honeywell	1-800-423-9883 1-800-525-7439	Tech. Support Service

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 you 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 you 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.
	**ATTENTION,** Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices
	Protective Earth (PE) terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	Functional earth terminal. Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to protective earth at the source of supply in accordance with national local electrical code requirements.
	Earth Ground. Functional earth connection. NOTE: This connection shall be bonded to Protective earth at the source of supply in accordance with national and local electrical code requirements.
	Chassis Ground. Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

Contents

Tables

Figures

1 Introduction

1.1 Overview

Multi-function instrument

The UDA2182 Universal Dual Analyzer is the next level of dual channel analyzers providing unprecedented versatility and flexibility.
The UDA2182 can accept single or dual inputs from Honeywell Direct pH, pH from preamp, ORP (Oxidation Reduction Potential), Contacting Conductivity and Dissolved Oxygen sensors. Measurements for Dual channel units can be arranged in any combination of measurement.

User interface

"Process Information at a Glance" is a unique feature of the UDA2182 graphical backlit LCD.

Two PV values with corresponding UOM (unit of measure), temperature, alarm state, scales, and limits, tagging, and status messages can be displayed simultaneously.

Ten dedicated keys provide direct access to Setup configuration menus and sub-menus and Calibration.

Easy to configure

Menu-driven configuration of the UDA2182 is intuitive, fast and easy. A Setup 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 model you purchased.

In fact, Setup configuration screens will contain only prompts and menu choices that apply to your application.

Multi-language prompts guide the operator step-by-step through the configuration process assuring quick and accurate entry of all configurable parameters. Nine languages are available via configuration: English, French, German, Spanish, Italian, Russian, Turkish, Polish and Czech.

Inputs

Analytical measurements of Direct pH, pH from preamp, ORP, Conductivity and Dissolved Oxygen (ppm or ppb) can all be done in one analyzer. The unit can be used as a single input or dual input instrument – you decide what measurements are included. The input boards are factory calibrated and easily replaced. Addition of additional relays or an analog output is done with a single board. The "Mix –n- Match" design reduces inventory and increases flexibility. You can purchase a basic unit and then add input and output boards as needed.

Outputs

Two standard Analog outputs 0 –20 or 4–20 mAdc, 750 ohms maximum, isolated from inputs, ground, and each other, and independently assignable to any parameters and ranges Proportional to user-set output range(s) of selected parameter(s).

One optional Analog output 0 –20 or 4–20 mAdc, 750 ohms maximum, isolated from inputs, ground, and each other, and independently assignable to any parameters and ranges.

Relays

Two 4A SPDT alarm/control relays are standard; with an additional two 4A relays available as an option.

Infrared Communications

The infrared connection provides a non-intrusive wireless connection with the instrument and maintains its weather tight integrity when combined with the optional PIE (Process Instrument Explorer).

No need to get access to the back of the analyzer to communicate with the instrument, no need to take your screw driver to wire the communication cable, no wiring mistake possible. You can now duplicate an instrument’s configuration, upload or download a new configuration in a matter of seconds, just by pointing your Pocket PC in the direction of the instrument.

Communications Card (Optional)

The Communication card provides one Serial Port and one Ethernet Port.

Serial port provides

RS422/RS485 multi-drop

Modbus RTU protocol to read signals and read/write variables

Ethernet port provides:

Multi-language web pages to monitor readings, alarms, statuses, events

Multi-language web pages to setup Ethernet port settings

Multi-language email to send alarm status changes

Modbus TCP protocol to read signals and read/write variables

Both ports can communicate to a PIE tool

1.2 Features

Standard and solution temperature compensation

Measured pH temperature is compensated in one of two ways. Electrode temperature sensitivity is automatically compensated to display the correct pH value at temperature. In addition, displayed pH can be optionally normalized to a solution temperature of 25°C as determined by the current Solution Temperature Coefficient, which is expressed in units of pH/°C with precision to the hundredths decimal place. The parameter "Solu Temp Coeff" allows the selection of Pure Water, Ammonia, Phosphate, Morpholine, and Custom or None (User Entry).

Measured Conductivity and Resistivity can optionally be temperature compensated to 25°C for a specific solution type. TDS and concentration are always measured based on a specific solution type. The cell constant and measurement type determines which solution types are available for selection.

Dissolved Oxygen accurately measures the concentration of dissolved oxygen in water. The Analyzer energizes the probe and receives dissolved oxygen and temperature signals. Optional salinity compensation is provided. The Analyzer provides for Air or Sample calibration with ambient temperature and atmospheric pressure compensation.

Calculated pH

High purity water pH can be calculated from Specific and Cation conductivities to be used as a check on in-line high purity water pH measurements.

Automatic buffer recognition

"Buffer Group" types NIST/USP, USA, or Europe determines the set of standard pH buffer values to be used for Zero and Slope calibration by automatic buffer recognition. Each of the available Buffer Groups is a set of 5 or 6 pH buffer standards.

Solution Temperature Compensation

For high purity water measurement you can select pre-set compensations or configure custom values.

USP26 Alarm Capabilities

Relays can be configured to alarm on conductivity values as determined by the USP26 standards.

Computed Variables

The availability of calculated variables in the list of available sources for alarms, math and control and for status display is determined by similarity of units of measure between the two input boards. For example with Dual Conductivity, %Rejection/Passage, Difference, or Ratio can be displayed and assigned to the outputs or alarms.
CO_2 concentration in ppm can be calculated from de-gassed conductivity measurement.

Password protection

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

Auto Clean/Auto Cal

Built-in real time clock is used to set-up versatile cycles that can be used to initiate automatic sensor cleaning and then calibration.

Diagnostic/Failsafe Outputs

Continuous diagnostic routines detect failure modes, trigger a failsafe output value and identify the failure to minimize troubleshooting time. The UDA2182 Analyzer performs extensive self-diagnostics as a background task during normal operation. If a problem is detected, a message is displayed on the Message stripe to alert the operator. In addition, the operator can initiate keypad and display tests using Maintenance Menu functions.

High Noise Immunity

The analyzer is designed to provide reliable, error-free performance in industrial environments that often affect highly noise-sensitive digital equipment.

Watertight corrosion-resistant case

CSA Type 4X (NEMA 4X) rated enclosure permits use in applications where it may be subjected to moisture, dust, or hose-down conditions. The UDA2182 is designed for panel, pipe or wall mounting.

2 Specifications

2.1 Specifications

UDA2182 Universal Dual Analyzer	
Display	Graphical LCD with white LED Backlight *Viewing Area:* 66.8 mm (W) X 35.5 mm (H) *Dot Pixels:* 128 (W) X 64 (H)
Display Ranges	*pH:* 0-14 pH Temperature: -10 to 110°C (14 to 230°F) *ORP:* -1600 to +1600 mV *Conductivity:* 0.01 Cell: 0-2 uS/cm displayable to 200 uS/cm; 0-0.2 mS/cm; 0-2,000 ppb TDS; 0-200 ppm TDS 0.1 Cell: 0-20 uS/cm displayable to 2000 uS/cm; 0-2 mS/cm, 0-2,000 ppb TDS; 0-2,000 ppm TDS, 1.0 Cell: 0-200 uS/cm displayable to 20,000 uS/cm; 0-20 mS/cm; 0-200 ppm TDS; 0-20 ppt TDS 10 Cell: 0-2,000 uS/cm displayable to 99999 uS/cm; 0-200 mS/cm; 0-2,000 ppm TDS; 0-200 ppt TDS 25 Cell: 0-20,000 uS/cm displayable to 99999 uS/cm; 0-500 mS/cm; 0-10% Concentration displayable to 20% 50 Cell: 0-20,000 uS/cm displayable to 99999 uS/cm; 0-1,000 mS/cm; 0-20% Concentration Temperature: 0 to + 140°C (32 to 284°F) *Dissolved Oxygen:* 0 - 20 ppm 0 –200 ppb, displayable to 20000 ppb 0 – 100% saturation, displayable to 200% saturation Temperature: 2 – 60°C (35.6 – 104°F), must not freeze
Keypad	10 Button Membrane Switch w/Directional Functionality UV/Solvent/Abrasion Resistant
Case Material	GE Valox® 357 (un-reinforced thermoplastic polyester)
Performances (Under reference operating conditions)	*Accuracy:* 0.5% of reading *Output Accuracy:* +/- 0.01 mA *Drift:* Negligible *Repeatability:* 0.05% *Temperature Accuracy*: pH and Conductivity Thermistor: +/- 0.1°C from –10 to 100° C, +/- 1.0° C from 101° to 140° C pH 1000 ohm RTD: +/- 0.4° C D.O. Thermistor: +/- 0.1° C from 0 to 60° C *Reference Operating Conditions:* 25 +/- 1° C; 10-40% RH; 120 or 240 Vac
Operating Conditions	Ambient Temperature *Operating:* 0 to 60°C (32 to 140°F) *Storage:* -30 to 70°C (-22 to 158°F) *RH:* 5 to 90% max. Non-condensing up to 40°C (104°F). For higher temperatures the RH specification is derated to maintain constant moisture content *Vibration:* 5-15 Hz disp 8 mm pk to pk 15-200 Hz accel 2 G
Standard Analog Output	Two 0-20 mAdc or 4-20 mAdc, 750 ohms max., isolated from inputs, ground, and each other, Independently field-assignable to any parameters and ranges. Proportional to user-set output range(s) of selected parameter(s),
Optional Analog Output	One 0-20 mAdc or 4-20 mAdc, 750 ohms max., isolated from inputs, ground, and each other. Independently field-assignable to any parameters and ranges

UDA2182 Universal Dual Analyzer	
Control Loop/Outputs	*Control Loops:* 2 standard (one for each PV); current, pulse frequency, or time proportional *Control Loop Types:* PID (optional), Duplex (optional), On/Off (standard) *Auto-tuning:* Accutune II, fuzzy logic overshoot suppression, applicable to both PID loops
Standard Alarm/ Control Relays	Two SPDT (Form "C") Relays Resistive Load Rating: 4A, 120/240 Vac
Optional Additional Alarm/Control Relays	Two SPDT (Form "C") Relays *Resistive Load Rating:* 4A, 120/240 Vac
Alarm/Control Settings	*Alarm/on-off control delay:* 0-100 seconds. *Alarm/on-off control deadbands:* individually set, from 1 count to full scale for pH, ORP, and temperature. *On/off cycle period:* 0 to 1000 seconds. *On/off percent "on" time:* 0 to 100%, 1% resolution. *Set point and proportional band limit ranges:* ±19.99 pH, ±1999 mV, -10 to 130°C, 1 count resolution. *DAT cycle period:* 1 to 1999 seconds. *PFT maximum frequency:* 1 to 200 pulses/minute. *PFT pulse width:* 50 ms, compatible with electronic pulse-type metering pumps.
Remote Preamplifier Input Option	Optional input card to accept input signal from Honeywell digital preamplifiers: Meridian II – 31075707 and 31022283 Durafet – 31079288 and Cap Adapter cables
pH Temperature Compensation	Conventional compensation for changing electrode output (Nernst response), plus selectable solution temperature compensation for high-purity water.
Calculated pH from Differential Conductivity	User selectable when unit has two Conductivity inputs. Used when ammonia or amine is the water treatment chemical.
Auto Buffer Recognition (pH)	User Selectable *Available Buffer Series:* NIST/USP, US, and Euro
Conductivity Compensations	NaCl, HCl, H_2SO_4, PO_4, NaOH, NH_3, C_4H_9C, Pure Water, Custom (User Selectable)
Dissolved Oxygen Measurement	*Max flowrate (probe):* 950 ml/min with flow chamber; no dependence on stirring or flowrate *Atmospheric pressure:* 500-800 mm Hg with internal sensor, for calibration Calibration with either Air or Sample
Auto Clean/ Auto Cal Function	Real time clock is used to set-up cycles to initiate a cleaning and calibration sequence. Cycle Set-up is user configurable.
Event History Screen	Event history screen stores 256 events with a description of the event and a Date/time stamp.
Calibration History Screen	Calibration history screen stores information on 128 calibration events with a date/time stamp.
Power Requirements	90 -264 Vac, 47-63 Hz, 15 VA. Memory retained by E^2PROM when power is off.
Wireless Interface	*Type:* Infrared (IR) *Length of Link:* 0 –1 M, 0 –15° Offset *Baud Rate:* 9600 *Data Format:* Modbus Protocol
RS422/RS485 Modbus RTU Slave Communications Interface (Optional)	*Baud Rate*: 2400, 4800, 9600, 19200, 38400, 57600, or 115200 selectable *Data Format:*: IEEE floating point and 32-bit integer. Word swap configurable. *Length of Link*: 2000 ft (600 m) max. with Belden 9271 Twinax Cable and 120 ohm termination resistors 4000 ft (1200 m) max. with Belden 8227 Twinax Cable and 100 ohm termination resistors *Link Characteristics*: Two-wire (half-duplex), multi-drop Modbus RTU protocol, 15 drops maximum or up to 31 drops for shorter link length. *Modbus RTU slave*: Provides monitoring of inputs outputs, statuses, alarms, and variables. Provides writing of variables for remotely modifying parameter settings.

UDA2182 Universal Dual Analyzer	
Ethernet TCP/IP Communications Interface (Optional)	*Type:* 10 or 100 BaseT; auto-speed and auto-polarity sensing *Length of Link*: 330 ft. (100 m) maximum. Use Shielded twisted-pair, Category 5 (STP CAT5) Ethernet cable. *Link Characteristics*: Four-wire plus shield, single drop, five hops maximum *IP Address*: IP Address is 192.168.1.254 as shipped from the factory *Recommended network configuration*: Use Switch rather than Hub in order to maximize UDA Ethernet performance *Configuration*: Ethernet parameters are configured via the front-panel or web pages. *Modbus TCP/IP*: Five simultaneous socket connections provide monitoring of inputs outputs, statuses, alarms, and variables. Provides writing of variables for remotely modifying parameter settings. *Modbus TCP/IP Data Format*: IEEE floating point and 32-bit integer. Word swap configurable. *Web server*: multiple client support *Multi-language Web pages*: monitoring inputs, outputs, statuses, alarms, and events *Multi-language Email*: Alarm notification to eight email addresses. These must be configured using web pages signed in as the administrator. *DHCP*: (Dynamic Host Configuration Protocol) selectable via web page or front-panel
Safety Compliance	UL/CSA General Purpose FM/CSA Approval for Class I, Div 2; Groups A, B, C and D. T4, T_a =60°C
CE Compliance	*CE Conformity (Europe):* CE Mark on all models signifies compliance to EMC Directive 84/336/EEC and LVD Directive 73/23/EEC. *EMC Classification:* Group 1, Class A, ISM Equipment *Method of Assessment:* Technical File (EN61010-1; EN 61326) *Declaration of Conformity:* 51453667
Case Dimensions	156 mm X 156 mm X 150 mm (6.14" X 6.14" X 5.91") *Panel cutout:* 138.5 mm X 138.5 mm (5.45" X 5.45") *Panel thickness:* 1.52 mm (0.06") min, 9.5 mm (0.38") max
Enclosure Rating	CSA Type 4X (NEMA 4X) rated enclosure FM Class 1, Div 2
Installation Ratings	*Installation Category (Overvoltage Category):* Category II *Pollution Degree:* 2 *Altitude:* 2000 m
Weight	Approx 3 lbs (6.6kg)
Mounting	Panel mounting-hardware supplied. Optional Wall and 1" to 2" pipe mounting. Select option appropriate in Model Number.

2.2 CE Conformity (Europe)

This product is in conformity with the protection requirements of the following European Council Directives: 73/23/EEC, the Low Voltage Directive, and 89/336/EEC, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed.

Product Classification: Class I: Permanently connected, panel-mounted Industrial Control Equipment with protective earthing (grounding) (EN61010-1).

Enclosure Rating: The front panel of the analyzer is rated at NEMA4X when properly installed.

Installation Category (Overvoltage Category): Category II (EN61010-1)

Pollution Degree: Pollution Degree 2: Normally non-conductive pollution with occasional conductivity caused by condensation. (Ref. IEC 664-1)

EMC Classification: Group 1, Class A, ISM Equipment (EN61326, emissions), Industrial Equipment (EN61326, immunity)

Method of EMC Assessment: Technical File (TF)

ATTENTION

The emission limits of EN61326 are designed to provide reasonable protection against harmful interference when this equipment is operated in an industrial environment. Operation of this equipment in a residential area may cause harmful interference. This equipment generates, uses, and can radiate radio frequency energy and may cause interference to radio and television reception when the equipment is used closer than 30 meters (98 feet) to the antenna (e). In special cases, when highly susceptible apparatus is used in close proximity, you may have to employ additional mitigating measures to further reduce the electromagnetic emissions of this equipment.

WARNING

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

3 Unpacking, Preparation, and Mounting

3.1 Overview

Introduction

This section contains instructions for unpacking, preparing, and mounting the Analyzer. Instructions for wiring are provided in Section 4 (power wiring) and Section 7 (input wiring). Software configuration is described in Section 6.

The UDA2182 Analyzer can be panel, wall, or pipe mounted.

Each unit has (4) 22.22mm [.87"] dia. holes on the bottom of the unit for lead wires and conduit fittings. The user supplies the conduit fittings.

⚠CAUTION

To avoid damage to the case when connecting to a rigid metallic conduit system, the conduit hub must be connected to the conduit before the hub is connected to the enclosure

ATTENTION

When installing the unit, you must select appropriate watertight fittings to insure watertight integrity.

What's in this section?

The topics in this section are listed below.

3.2 Unpacking and Preparing

Procedure

Table 3-1 Procedure for Unpacking and Preparing the UDA2182

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. • 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 UDA2182 Analyzers are calibrated and tested at the factory prior to shipment. Examine the model number on the nameplate to verify that the instrument has the correct optional features.
5	Select an installation location that meets the specifications in Section 2. The UDA2182 can be panel-, wall-, or pipe-mounted (see Section 3.3).
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.

3.3 Mounting

Introduction

The Analyzer can be mounted on either a vertical or tilted panel or can be pipe or wall mounted (option) using the mounting kit supplied. Overall dimensions and panel cutout requirements for mounting the analyzer are shown in Figure 3-1. Pipe mounting is shown in Figure 3-3. Wall Mounting is shown in Figure 3-4.

For Sample Tap Electrode Mounting recommendations, See Section 15.15 – page 229.

The analyzer's mounting enclosure must be grounded according to CSA standard C22.2 No. 0.4 or Factory Mutual Class No. 3820 paragraph 6.1.5.

Before mounting the analyzer, refer to the nameplate on the outside of the case and make a note of the model number. It will help later when selecting the proper wiring configuration.

Panel Mounting Dimensions

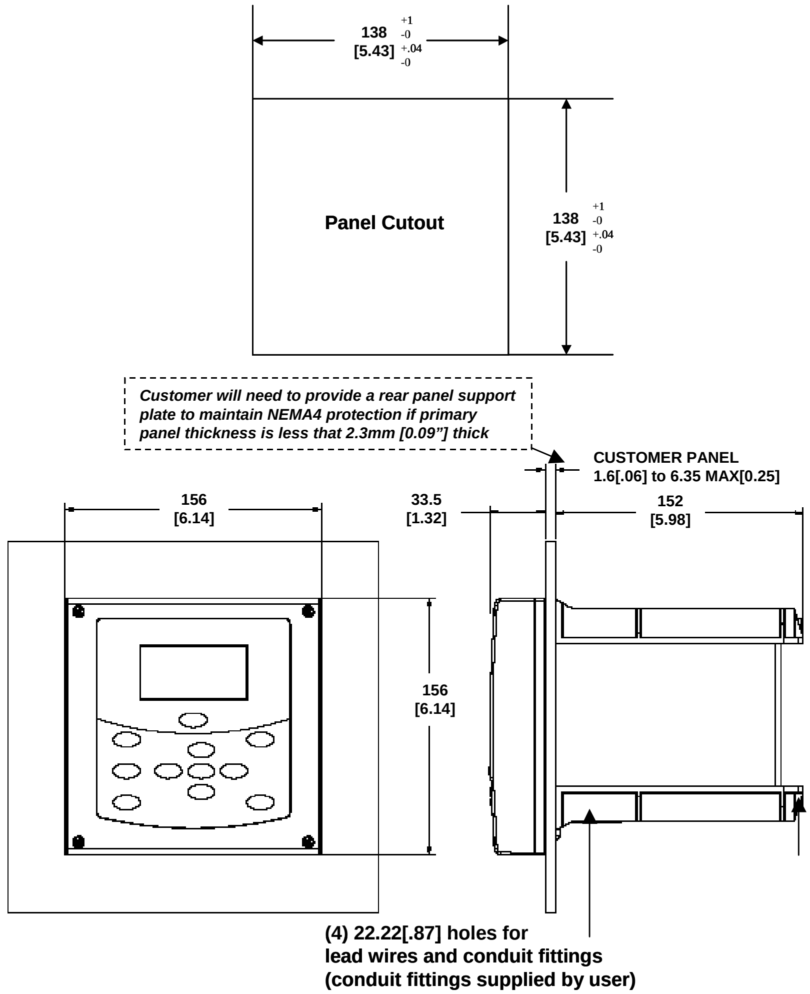


Figure 3-1 Panel Mounting Dimensions (not to scale)

Panel Mounting Procedure

Table 3-2 Panel Mounting Procedure

Step	Action
1	Mark and cut out the analyzer hole in the panel according to the dimension information in Figure 3-1.
2	Orient the case properly and slide it through the panel hole from the front. ***Customer will need to provide a rear panel support plate to maintain NEMA4 protection if primary panel thickness is less that 2.3mm [0.09"] thick – See* Figure 3-2.**
3	Remove the mounting kit from the shipping container and clamp the edges of the cutout between the case flange and the supplied U-bracket that is fastened to the rear of the case using (2) M5 X 16mm long screws and (2) M5 lock washers supplied.

Rear Panel Support Plate Dimensions

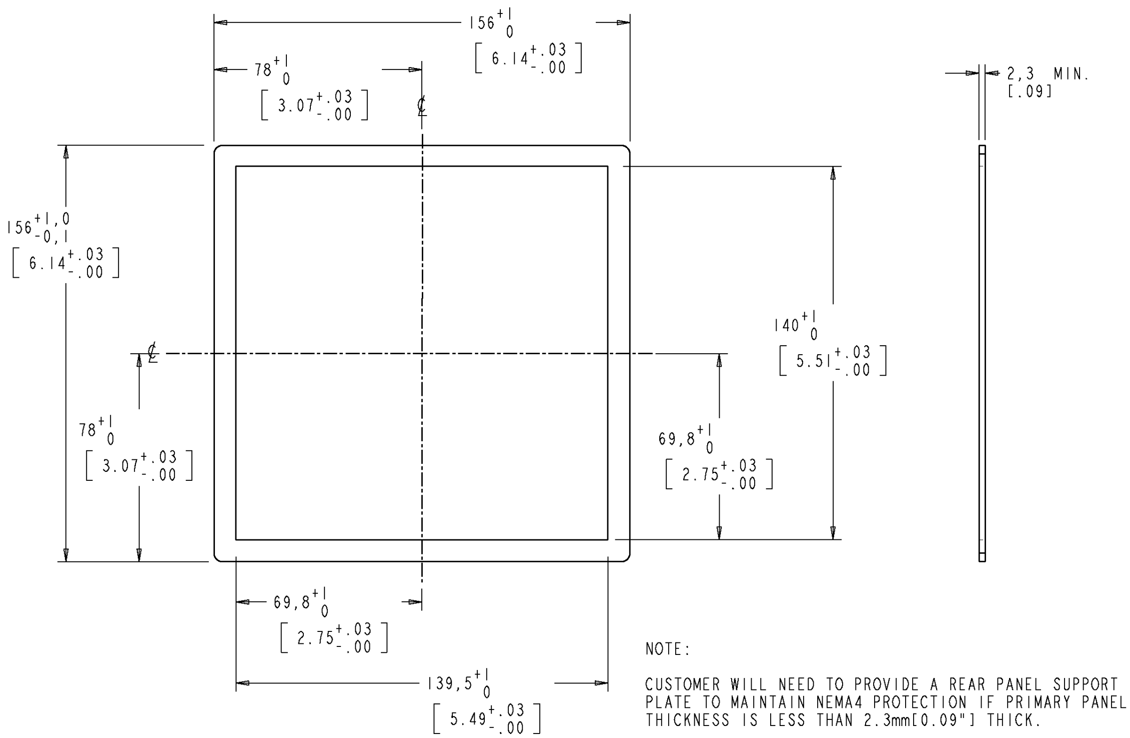


Figure 3-2 Rear Panel Support Plate Dimensions

Pipe Mounting

The analyzer can be mounted vertically or horizontally on a pipe. Use the bracket and hardware supplied in the mounting kit.
Select 1 inch or 2 inch U-Bolts.

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

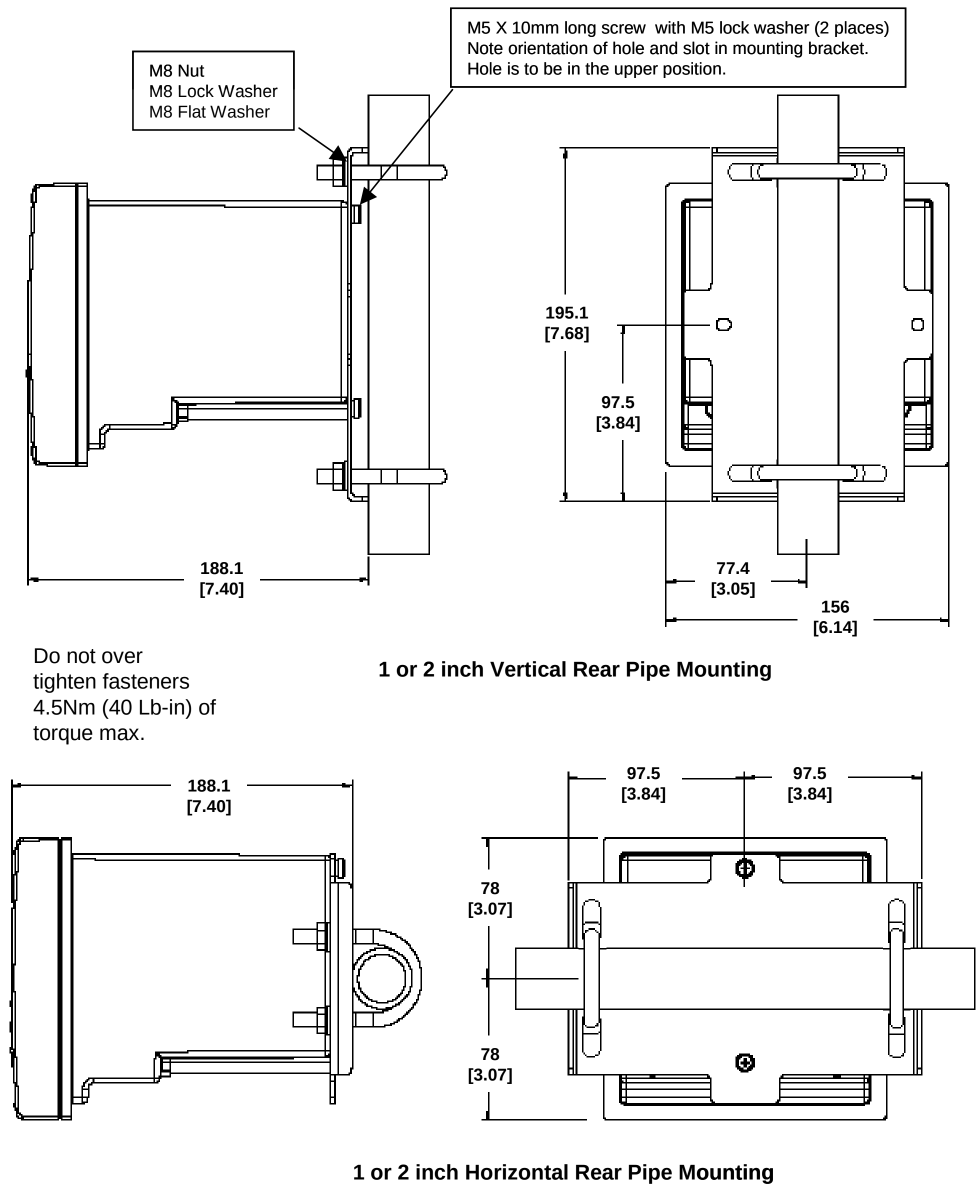


Figure 3-3 Pipe Mounting Dimensions (not to scale)

Wall Mounting Dimensions

The analyzer can be mounted on a wall. Use the bracket and hardware supplied in the mounting kit.

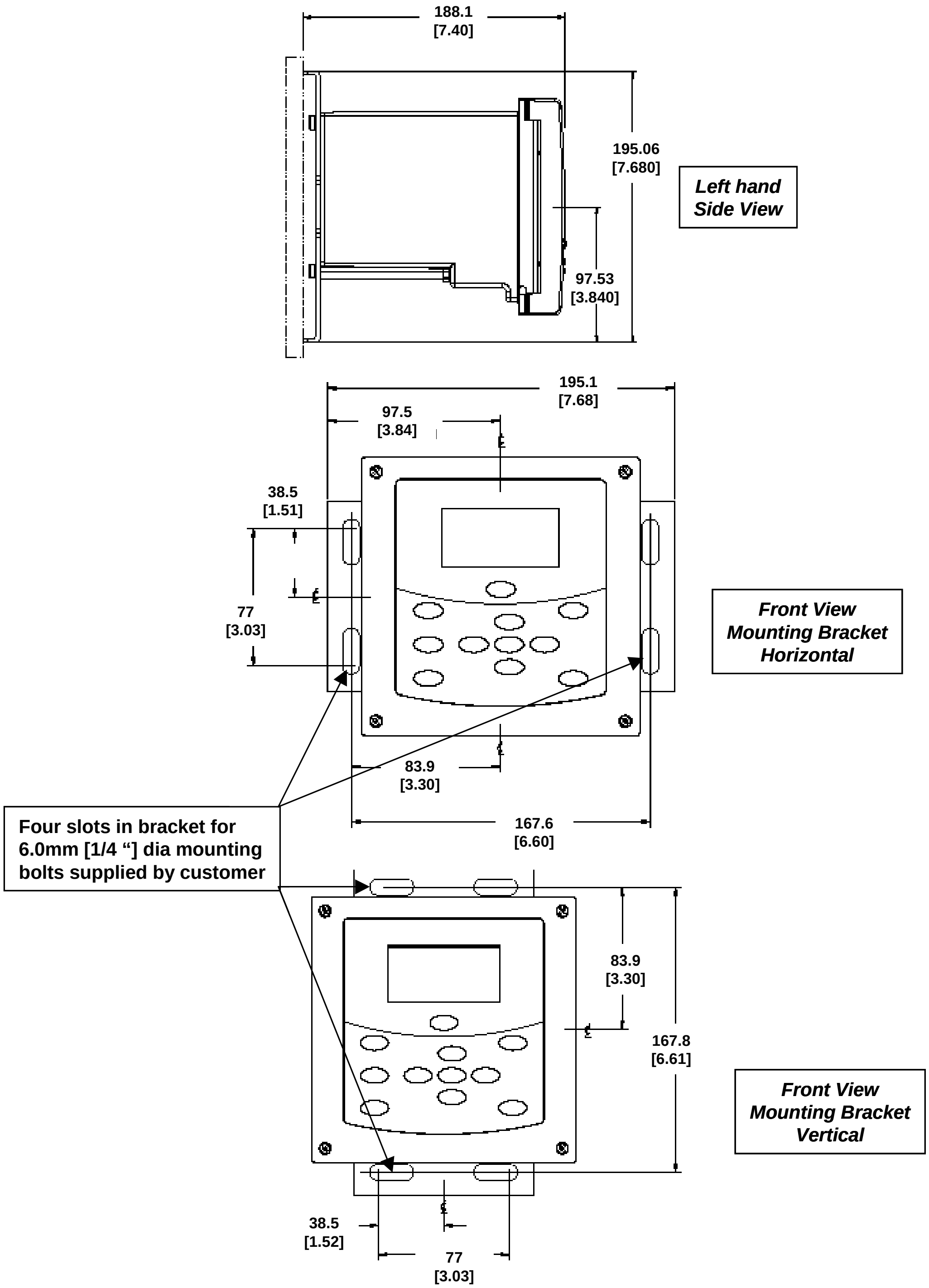


Figure 3-4 Wall Mounting Dimensions (not to scale)

4 Power Wiring

4.1 Overview

Introduction

This section contains instructions for installing ac power wiring for the Analyzer, in preparation for performing configuration setup as described in Section 6.

We recommend that you wait to install input and output wiring (See Section 7) until after Configuration Setup. During configuration 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.

4.2 General Wiring Practices

WARNING

Qualified personnel should perform wiring 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 workstations and wrist straps must be used. If soldering irons are used, they must also be grounded.

A grounded workstation 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.

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 mm^2) 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.

4.4 Installing Power Wiring

Procedure

WARNING

Turn power off at mains before installing AC Power Wiring. Do not remove boards with power ON.

WARNING

The ground terminal 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.

CAUTION

To avoid damage to the case when connecting to a rigid metallic conduit system, the conduit hub must be connected to the conduit before the hub is connected to the enclosure

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	**With Power off**, open the case: • Loosen the four captive screws on the front of the bezel. • Grasp the bezel on the right side. Lift the bezel gently and swing the bezel open to the left.
3	Refer to Figure 7-1 for the location of the printed wiring board retainer. Loosen the two

Step	Action
	screws that hold the retainer and slide the retainer to the left until the retainer tabs disengage from the terminal boards.
4	Refer to Figure 7-1 for the location of the Power Supply/Analog Output/Relay Output board. Insert a screwdriver into the hole in the middle of the terminal board and pull out gently. Slide the board half way out. There is a notch in the terminal board into which you can slide the retainer tabs and hold the board in place while wiring.
5	Install a fused disconnect switch in the power line that will be connected to the Analyzer. •If a 230/240 Vac line is to be connected, use a 0.15 amp fuse. •If a 110/120 Vac line is to be connected, use a 0.30 amp fuse. Fuse must be a Time-Delay or Slo-Blo type.
6	Each unit has (4) 22.22mm [.87"] dia. holes on the bottom of the unit for lead wires and conduit fittings. Conduit fittings to be supplied by the user. Feed the power wiring through the wiring port on the bottom of the case. Connect the power wiring to terminals L1 and L2/N as shown in Figure 4-1. Connect the Green safety ground wire to the grounding stud on the case. Attention: Terminal 1 must be connected to the ground stud on the grounding bar using a #14 AWG UL/CSA-approved wire.
7	Slide the retainer to the left then slide the terminal board back into place. Slide retainer to engage the tabs and tighten the screws.
8	Close the Bezel and secure four captive screws to a torque value of .20 Nm (1.5 Lb-in). Power up the unit. Do not apply power until the bezel is closed.

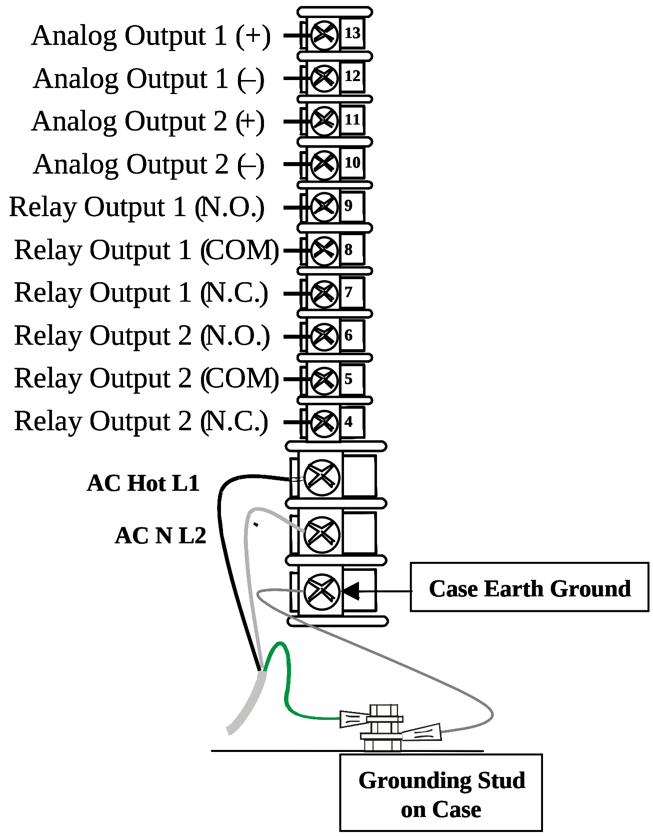


Figure 4-1 Power Wiring

5 Operating the Analyzer

5.1 Overview

Introduction

This section contains instructions for operating the Analyzer.

What's in this section?

The topics in this section are listed below.

5.2 Analyzer Overview

The UDA2182 Universal Dual Analyzer is the next level of dual channel analyzers providing unprecedented versatility and flexibility.

The analyzer can accept single or dual inputs from Honeywell Direct pH, pH from preamp, ORP (Oxidation Reduction Potential), Contacting Conductivity and Dissolved Oxygen sensors.

Measurement for Dual channel units can be arranged in any combination of measurement.

A Communications card provides one Serial Port (RS485) and one Ethernet Port.

Figure 5-1 UDA2182 Operator Interface (all display items shown)

5.3 Key Navigation

Table 5-1 shows each key on the operator interface and defines its function.

Table 5-1 Function of Keys

Key	Function
Display	• When process values are on display: Use DISPLAY to cycle between PV Displays, PID Loop Displays, Auto Cycle Displays, Pharma Displays, Cation Display, Status Displays and an Event History Display. • In Setup mode, calibration mode, or calibration edit mode, use DISPLAY to abort current mode and return to the last accessed online display.
Hold	• Engages hold of analog and digital values at their current values and any relays assigned to alarm events or control are deactivated. **ATTENTION:** This takes precedence over the FAILSAFE function.
Setup	• Selects the configuration main menu when online, in calibration mode, or at a calibration submenu.
Exit	• In configuration menu, exits submenu to parent menu. If at configuration main menu, selects current online display. • In configuration edit mode, aborts editing of current parameter. • When online, acknowledges current alarm event to stop the flashing of the relay indicator and status message area.
Calibrate	• Selects the calibration main screen when online, in configuration mode or at another calibration screen.
▲ or ▼	• When a Setup configuration menu or configuration edit screen is on display: Use Up/Down keys to highlight a different item. • In configuration edit mode, either selects the parameter character or numerical digit to change or selects an enumerated parameter value: Use Up/Down key to increment the value of the digit at the cursor. Increases/decreases the selected parameter value. • When in display mode, use up/down keys to adjust the contrast on the screen.
◀ or ▶	• In configuration edit mode, selects the character or digit to change. • In calibration mode, selects the next or previous calibration screen. • In display mode, selects a single or dual display on a unit with dual input.
Enter	• In configuration menu, selects edit mode for selected parameter. • In configuration edit mode, saves edited parameter selection or value. • In calibration mode, selects parameters to reset and the next calibration screen.

5.4 Displays Overview

Viewing the Displays

To view display screens, push the Display key. Pushing the Display key repeatedly scrolls through screens which show the current status of pH/ORP, Conductivity, or Dissolved Oxygen Concentration. There are displays for PID, Auto Cycle, and Pharma. It also lets you view a Status Display and an Event History Display.

Displays Shown

One Input - When only one input board is installed, the online screen displays **one PV** and its units in a larger font size (Section 5.5).

Two Inputs - When two input boards are installed, the online screen displays **two PVs** and its units in a smaller font size. Press ◄► to see single PV screens (Section 5.5).

PID - When PID 1 or 2 is active (Section 5.6), there is a display screen for each. There is a sub-screen that allows editing of the Setpoint value, Setpoint Source, Control Mode, and Output value. You can also enable or disable Accutune and Tune set.

Auto Cycle **–** When Auto Cycle 1 or 2 is active (Section 5.7), there is a display screen for each. There is a sub-screen that allows you to start or stop the Cycle.

Pharma **–** Enabled in Conductivity inputs. Each Pharma screen monitors standard procedure stages for determining Purified Water. There is a sub-screen that allows you to change the Pharma Test Stage and adjust the Pct Warning value (Stage 1), Test µS/cm value (Stage 2) and the Test pH (Stage 3). (See Section 5.8 for details)

Cation Calc **–** When cation Calc 1 or 2 is active there is a display screen for either cation or degassed CO_2 measurement. (Section 5.9)

Status Display - of Alarms Status, PID Alarms Status, Logic Status, Input Status, Output Levels, Relay States, Monitor Status, Math Values, Aux Values, Variables, Comm Status, System Status, and Calculated Values. (Section 5.10)

Event History - Event History records events with timestamp. (Section 5.11) Events recorded include setup change, power on, calibrations (no values) and alarms with detail available on alarm type and source by scrolling and selecting event name. Status warns of event history at 50% and 90% and when erasing old records.

Contrast Adjustment

When viewing a PV or Control display, you can adjust the contrast by pressing the ▲ or ▼ key.

Bargraphs Overview

Output Bargraphs will represent up to three current output values. On the display, the Bargraphs are the output in Engineering Units. The corner annunciators are the physical relay states (light – de-energized, dark – energized). The third output and the 3 and 4 relays are shown only when the source other than NONE is selected.

Menu Indicators

An upward-pointing arrow indicator above the menu at the left end of the header appears when there are currently menu items above the screen accessible by moving the cursor up.

A downward-pointing arrow indicator below the menu at the left end of the status footer appears when there are currently menu items below the screen accessible by moving the cursor down.

Use the ▲▼ keys.

Online Functions

Table 5-2 Display Details Functions

<table>
<tr><th>Detail</th><th>Function</th></tr>
<tr><td>Process Variable Values</td><td>When two input boards are installed, the default online screen displays both PVs and their units of measure, as determined by the input boards, the probe (if memory-embedded) or any measurement configuration options that may be available. When only one input board is installed, the default online screen displays one PV and its units in a larger font size.

The currently selected PV type determines the numerical format and the units of measure on the online PV display. Measured PV is generally displayed in the highest decimal precision possible with five digits and has a potentially displayable range of 0.0000 to 99999. The exceptions are dissolved oxygen, pH, ORP and temperature, which are displayed with fixed decimal precision.

PV Type determines specific ranges and in the case of Conductivity, cell constant determines available PV Types. Each PV measurement and display is updated every 500ms maximum. Each temperature measurement and display is updated every 10 seconds maximum.

See the Specific Input configuration for available ranges. (Section 6.6)</td></tr>
<tr><td>Tag Name</td><td>The real-time displays of process values show the instrument’s tag name (or other configurable fixed sixteen-character string) at the top of the screen.</td></tr>
<tr><td>PV Temperature</td><td>Each PV value is accompanied by a temperature value for all measurements except ORP, as ORP probes do not contain temperature sensors and no measurement compensation for temperature is required. Temperature values are displayed in units of degrees Fahrenheit or degrees Celsius as determined by configuration.

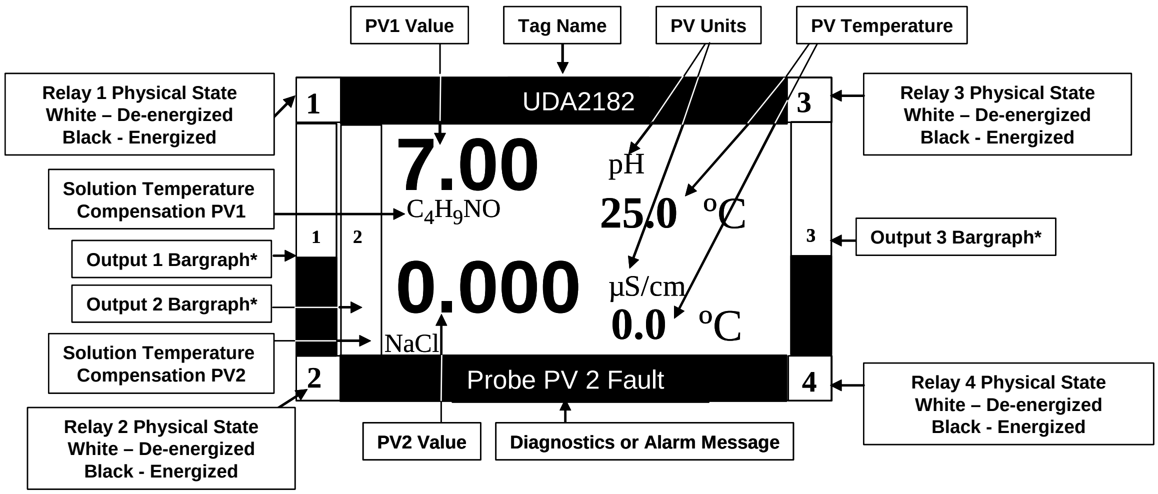
Measured temperature is always expressed in fixed tenths decimal precision and has a displayed range according to input type:
<table>
<tr><td>PH/ORP</td><td>-10.0 to 110.0°C or 14.0 to 230.0°F</td></tr>
<tr><td>Conductivity</td><td>0 to 140.0°C or 32.0 to 284°F</td></tr>
<tr><td>Dissolved Oxygen</td><td>0 to 60.0°C or 32 to 140°F</td></tr>
</table></td></tr>
<tr><td>Status Messages</td><td>A text string appears on the bottom of all displays. Online displays provide messages relaying online diagnostics, alarms and other events. Offline screens display messages relevant to data entry and calibration. See Section 12.</td></tr>
<tr><td>Bargraphs</td><td>The Bargraphs will represent up to three output values. The corner indicators represent the physical state of the Relay Outputs [1, 2, 3, and 4].</td></tr>
</table>

*Note that all values and indicators on the main (input) display screen are maintained in the input setup group.

5.5 Input Displays

Two Input Display

Press Display . You will see:



On the display, the bargraphs are the outputs in Engineering Units, the corner annunciators are the physical relay states.

Figure 5-2 Example – Two Input Display

Single Displays

For **single displays** on a two input unit;

Press ◄► to display a single display for Input 1.

Press ◄► again to display a single display for Input 2.

Press ◄► again to return to a Dual Display.

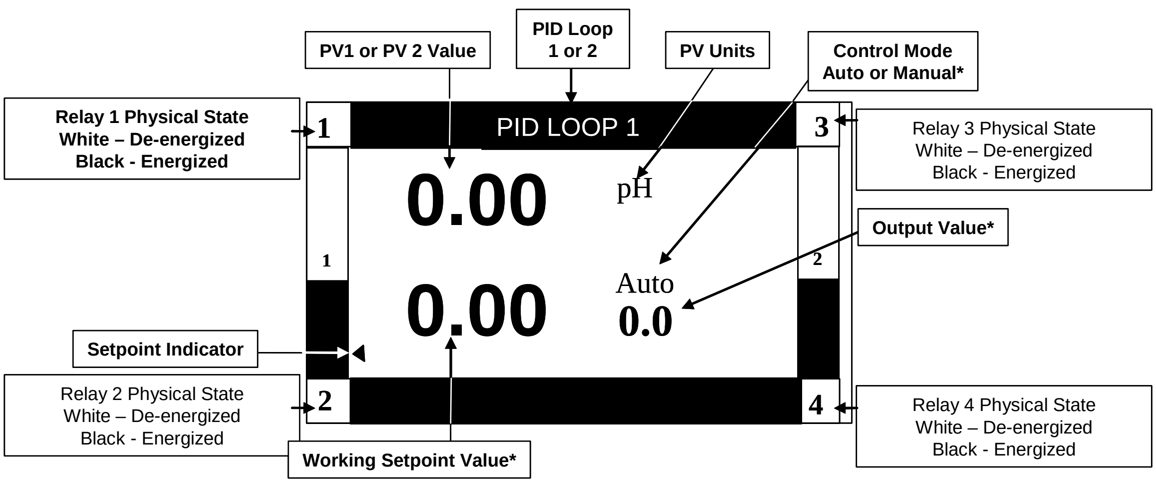
5.6 PID Displays

Overview

When PID 1 or 2 is active - there is a display screen for each. There is a sub-screen that allows editing of the Setpoint value, Setpoint Source, Control Mode, and Output value. You can also enable or disable Accutune and Tune Set.

Selecting Control Display

Press [Display] until you see the PID Display screen. If PID 1 and 2 have been configured, press DISPLAY again. In each instance, you can edit some control parameters. See Table 5-3.



*These Control parameters can be edited. See Table 5-3.

Figure 5-3 PID Loop 1 Edit Display screen example

Changing Parameters on the PID Display

When either PID Display is on the Display screen, you can edit the Setpoint value, Setpoint Source, Control Mode, and the Output value. You can also enable or disable Accutune and Tune Set.

Table 5-3 Changing PID Parameters on the Display

Press	Action
Enter	to access the PID Parameters. You will see: **PID LOOP 1** **LSP** 0.00 **SP Source** Local SP **Mode** Manual **Output** 0.00 **Tune Set 2** Disable Example – PID Loop 1 Edit Display
▲▼	to highlight the parameter you want to change.
Enter	to access the value or selection of each.
▲▼	to change the value or selection. *Note: Output can only be changed in Manual mode.* Refer to "Section 6.4.1 – "***General Rules for Editing***".
Enter	to make the edit permanent.
Display	to return to the selected PID Display.

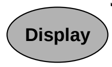
5.7 Auto Cycle Displays

5.7.1 Overview

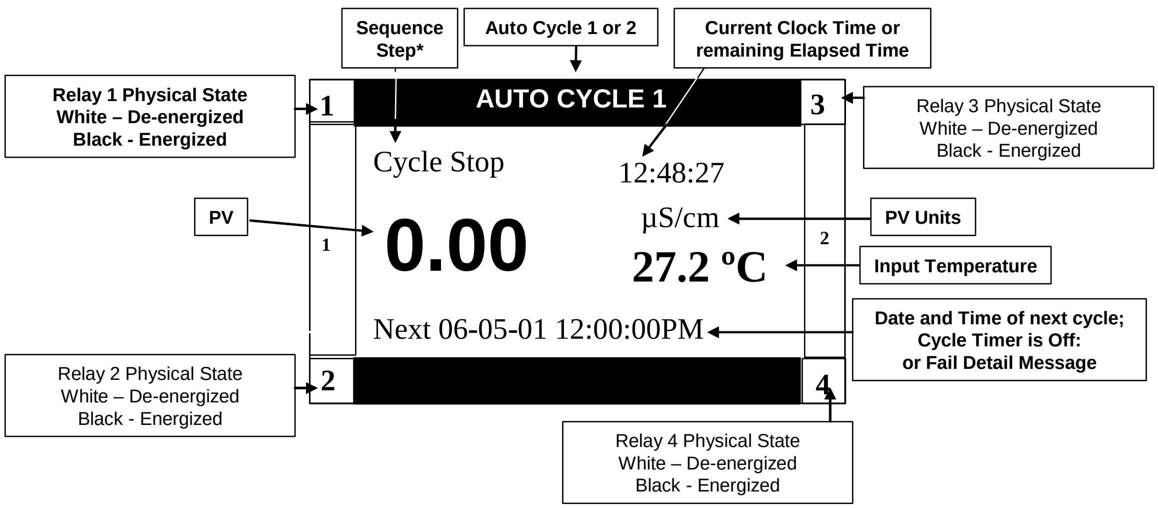
Auto Cycling allows each input probe to be automatically rinsed and calibrated on a recurring schedule, in response to an event, or on demand.

Auto cycling is supported with Setup Menus (Section 6.15- Auto Cycle Configuration), Status Displays (Section 5.10 – Status Display) and Operational Displays (Section 5.7 as well as Event History (Section 5.11) and Calibration History logging (Section 11).

5.7.2 Access to Auto Cycle Displays

- When Auto Cycle is enabled (see Auto Cycling Setup –Section 6.15), press 

until you see:



* See Table 5-5.

Figure 5-4 Auto Cycle Display screen example

5.7.3 How it works

Each occurrence of a sequence of actions for the cleaning and calibration of a probe is a cycle. The status message "Auto Cycle *n* Active" appears for the duration of a non-failing cycle (where *n* refers to 1 or 2). Each cycle consists of the following sequence that will vary depending on the input type and parameters selected:

Cycle Start

Probe Extract (if enabled)

Probe Rinse

Cal pt 1

Cal pt 2 (If the input is pH)

Probe Insert (If enabled)

Resume Delay (If a time is selected)

For a more detailed explanation please refer to Table 5-5.

5.7.4 Displays

The *current sequence step* is shown in the upper half of the Auto Cycle display.

When *Cycle Stop* is displayed, the field to the right displays the current clock time in the format configured in Setup/Maintenance/Clock.

When the cycle is active, the same field provides the remaining elapsed time for the current sequence step.

The lower half of the Auto Cycle display provides either: the *date and time* of the next cycle, an indication that the *cycle timer is off*; or an auto cycle *fail detail message*.

5.7.5 Hold Active

If Hold Active is enabled in Auto cycling Setup, then the values remain in the hold state during auto cycle. When Hold is active on either input, the status message "Hold Active" is displayed and the specific PV value flashes at a very slow rate.

When Hold is activated manually from the front panel Hold button, the values remain in the hold state until its state is changed via the front panel again.

5.7.6 Probe Transit

This parameter is available to allow you to automate functions that relate to probe removal and insertion. Once the probe transit parameter is enabled, the extract wait source, insert wait source and max transit mins can be selected. The extract wait source and insert wait source can be set to any digital input so that the extract or insert operations continue until the selected digital input is low. Once the wait source signal is low then the probe extraction or insertion sequence step can end or otherwise time out if the duration of the "max transit mins" is exceeded. If probe transit is enabled and probe extract src/insert src is set to none, then the probe extract/insert step will occur for the duration of the max transit mins.

5.7.7 Cycle Start Src

The Auto cycle can be started in one of three ways. It can start upon the occurrence of a specific digital input changing state from low to high. The cycle can also start when the cycle timer engages. The cycle can also be manually started from the Auto Cycle display screen op panel.

5.7.8 Cycle Interval

This parameter enables the cycle timer and allows you to set the Auto cycle to recur at a period defined by you. If the cycle interval is set to Custom, Monthly, Weekly or Daily then specific menu items are activated to set-up cycle start and period times. You can select a cycle interval appropriate to the application.

5.7.9 Rinse Cycle Cnt

This parameter allows you to select when or if a rinse sequence occurs during a cycle. A selection of 0 indicates that a rinse sequence will not occur. A selection of 1 indicates that a rinse sequence occurs during every cycle. There is an option to set the rinse sequence for less frequent times by selecting values from 2 to 100. For example; a selection of 3 means that the rinse sequence will occur every 3rd cycle.

5.7.10 Rinse Mins

This parameter allows you to select the duration of a rinse.

5.7.11 Resume Dly Mins

This parameter allows you to specify a delay time before the cycle is completed.

5.7.12 Manual Starting/Stopping the Auto Cycle

Pressing Enter on the Auto Cycle Operational Display brings up an operator panel menu that enables you to manually start or stop an auto cycle sequence or place the cycle in Hold, regardless of whether or not the cycle timer is configured. Start cycle is visible when the Auto Cycle is not active and Stop Cycle is visible during an auto cycle.

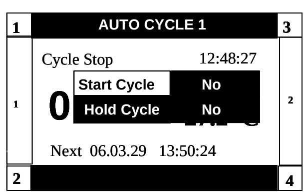
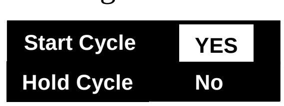
The objective of a Cycle Stop is to terminate the Auto Cycle by putting the probe back into the process. The selection of Cycle Stop causes the sequencer to proceed directly to the Probe Insert stage, if Probe Transit is enabled, and then to the Resume Delay stage. Selecting Stop Cycle during Probe Insert advances the sequencer to resume delay. Finally, a Stop Cycle selection during Resume Delay will stop the cycle completely.

If enabled, the cycle timer will still trigger a cycle at the configured time provided the sequencer returns to Cycle Stop beforehand. Otherwise, the cycle will execute at the next available time.

The Hold Cycle selection is available in both auto cycle active and inactive states. When inactive, enabling Hold Cycle will hold the sequencer at the beginning of the sequence until released to continue by disabling the Hold Cycle.

Selecting Hold Cycle during an active cycle will suspend the sequencer at the current step as well as the step timer. Disabling Hold Cycle will resume the sequencer and step timer. During cycle Hold, the status bar will show the message "Auto Cycle in hold".

Table 5-4 Manually Starting/Stopping the Auto Cycle

Press	Action
Enter	to access the Auto Cycle Operator Panel. You will see:  Example – AUTO CYCLE 1 Operator Panel Note: The item "Start Cycle" is replaced with "Stop Cycle" when the cycle is active.
▲▼	To access Start Cycle or Hold Cycle
Enter	to access the Start Cycle/Hold Cycle selection.
▲▼	to change the selection from NO to YES. 
Enter	to Start or Hold the Auto Cycle.
	See Table 5-5 for sequencer steps.

5.7.13 Auto Cycle Fail

The status message "Auto Cycle *n* Fail" is displayed during a fail state. Once detected, the current cycle proceeds immediately to the Probe Insert step (if enabled) or to the Resume Delay step. The fail state remains for the duration of the Resume Delay, whereupon the fail state returns to zero and the fail message is cancelled.

A fail state also provides a detail message in the lower half of the Auto Cycle display regarding the specific reason for the error. **These messages are listed in Section 12.4.**

The digital output "AC n Fail" is also available and is active whenever an auto cycle failure has occurred. The auto cycle digital outputs: AC *n* Extract, AC *n* Rinse, AC *n* Cal Pt 1 and AC *n* Cal and AC *n* Cal 2 are available as relay digital input sources (See Table 6-4) to control the operation of valves and solenoids for exposure to rinse water and buffer solutions or air to accomplish the automatic probe rinse and calibration functions.

5.7.14 Conditional Sequencer Steps

Table 5-5 Conditional Sequencer Steps for Auto Cycle

Step	AC n Extract	AC n Rinse	AC n Cal	AC n Cal 2	Output Hold State (if enabled)	Condition
Cycle Stop	0	0	0	0	Inactive	Cycle inactive
Cycle Start (transitional)	0	0	0	0	Active	Operator panel Cycle Start is Yes or Cycle Start Src state is 1 or cycle timer engages
Probe Extract	1	0	0	0	Active	Probe Transit is enabled
Probe Rinse	1	1	0	0	Active	Rinse Cycle Cnt > 0 and enables current cycle and if Probe Transit enabled, Extract Wait Src is None or state is 1 or Max Transit Timer expires
Cal Point 1	1	1	1	0	Active	Rinse timer expires if enabled and Cal 1 (Cal) Cycle Cnt > 0 and enables current cycle
Cal Point 2	1	1	0	1	Active	Rinse timer expires or Cal 1 complete and Cal 2 Cycle Cnt > 0 and enables current cycle
Probe Insert	0	1	0	0	Active	Auto Cycle Fail or Probe Transit is enabled
Resume Delay	0	0	0	0	Active	Auto Cycle Fail or Rinse timer expires or Cal 1 or Cal 2 complete and Insert Wait Src is None or state is 1 or Max Transit Timer expires

5.8 Pharma Display

5.8.1 Overview

The Pharma Parameter is available when a Conductivity Input is enabled. Pharma supports USP (United States Pharmacopoeia) and PhEur (Pharmacopoeia Europa) standard procedure stages for determining Purified Water.

Selecting Pharma Type USP or PhEur (in Section 6.6 – Conductivity Input Configuration) enables the Pharma monitor screen and adds it to the sequence of displays accessed by each press of the Display button.

Also, configure Pharma PV High, Pharma PV Low, and Pharma Timer Minutes in this section.

5.8.2 How it works

Pharmacopoeia Test Procedure

For Procedure steps in each stage, refer to UPS section <645> Test Procedure for Purified Water and Water for Injection. The procedure for this determination involves a series of three stages or tests. If the sample does not pass the Stage 1 conductivity requirement, the State 2 test can be initiated. If the Stage 2 requirements are not met, then the Stage 3 test can be initiated. If Stage 3 requirements are not met, the sample is not Purified Water.

In Stage 1 the non-temperature-compensated conductivity reading is compared to the value specified in the USP standard for a particular temperature. If the measured conductivity is not greater than the table value, the water meets the requirements of the test for conductivity and the Pharma test is complete. If the conductivity is higher than the table value, then the user can manually proceed with Stage 2.

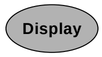
To complete stage 2, transfer a sufficient amount of water (100 mL or more) to a suitable container, and stir the test specimen. While maintaining the temperature at 25° ± 1°, begin vigorously agitating the test specimen and note the conductivity reading when the change is less than 0.1 m S/cm per 5 minutes. If the conductivity is not greater than 2.1 m S/cm, the water meets the requirements of the test for conductivity. If the conductivity is greater than 2.1 m S/cm, proceed with Stage 3.

Stage 3 must be completed within approximately 5 minutes of the conductivity determination in stage 2. While maintaining the sample temperature at 25° ± 1°, add a saturated potassium chloride solution to the same water sample (0.3 mL per 100 mL of the test specimen), and measure the pH to the nearest 0.1 pH unit, as directed under pH (791). From USP section <645>, determine the desired conductivity value for a pH value between 5pH and 7pH. If the measured conductivity is not greater than the conductivity from USP, section <625>, the water meets the requirements for stage 3 - purified water. If either the measured conductivity is greater than this value or the pH is outside of the range of 5.0 to 7.0, the water does not meet the requirements of stage 3 - purified water.

For Procedure steps in each stage, refer to UPS section <645> Test Procedure for Purified Water and Water for Injection.

The UDA also supports Pharma Europa (PhEur) section 2.2.38, which specifies tests for determining Highly Purified Water which are identical to USP Stages 1, 2 and 3. PhEur adds a less demanding test for determining Purified Water at the end of the sequence.

5.8.3 Access to Pharma Display

- When Pharma is enabled (see Input Configuration – Section 6.6) press  until you see:

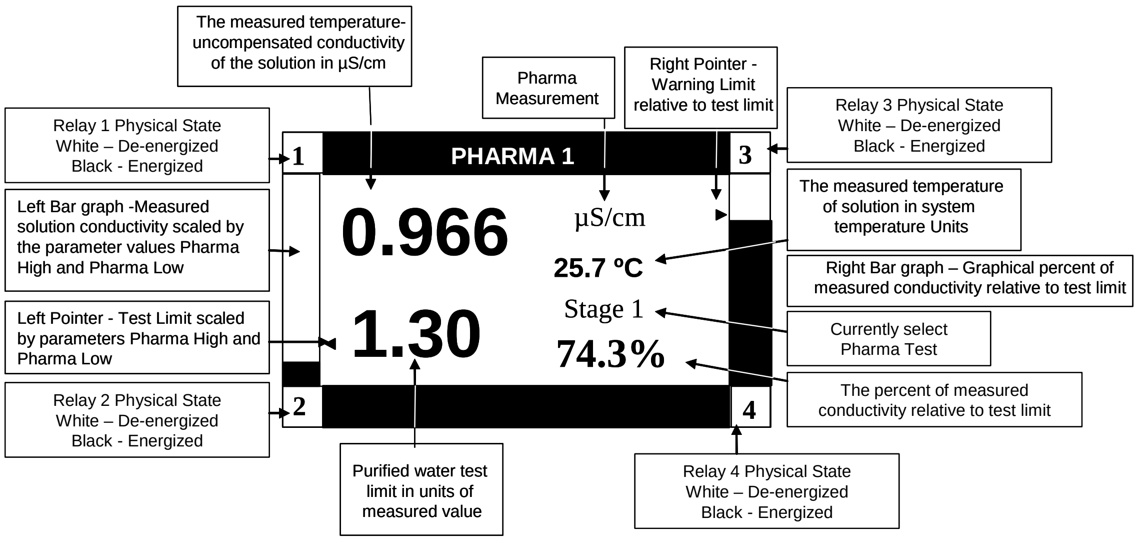


Figure 5-5 Pharma Display screen example

5.8.4 Displays

The upper left portion of the screen shows the measured temperature uncompensated conductivity of the solution in uS/cm for Stage 1. For stage 2 and 3 it displays the test conductivity value entered during the measurement in stage 2

The process temperature is shown in the upper right of the screen

The lower right portion of the screen shows the USP stage 1 purified water limit, the stage 2 limit of 2.1 uS/cm and the stage 3 purified water test limit at the measured pH.

When the Pharma n display window is active the various stages can be accessed through the pharma op panel. (Table 5-6)

Table 5-6 Selecting the Pharma Test on Display

<table>
<tr><th>Press</th><th>Action</th></tr>
<tr><td>Enter</td><td>to access the Pharma Op Panel. A pop-up dialog box will appear:
<table>
<tr><td>Pharma Test</td><td>Stage 1</td></tr>
<tr><td>PCT Warn</td><td>80.00</td></tr>
</table>
Various parameters appear for each stage:
<table>
<tr><th>Parameter</th><th>Values</th><th>Visibility</th></tr>
<tr><td>Pharma Test Selection</td><td>Stage 1
Stage 2
Stage 3
Pure H2O (PhEur only)</td><td>Always on</td></tr>
<tr><td>Pct Warning (% at which the test warn occurs)</td><td>0 to 100 %</td><td>Stage 1 only</td></tr>
<tr><td>Test µS/cm</td><td>0 to 10 (default=10)</td><td>Stage 2 only</td></tr>
<tr><td>Test pH</td><td>0 to 14 (default=0)</td><td>Stage 3 only</td></tr>
</table></td></tr>
<tr><td>Enter</td><td>to access the Stage selection.</td></tr>
<tr><td>▲▼</td><td>to change the selection to
Stage 1, Stage 2, Stage 3 or Pure H2O (PhEur only).</td></tr>
<tr><td>Enter</td><td>to make the selection permanent.</td></tr>
<tr><td>▲▼</td><td>to select Pct Warning (Stage 1 only)</td></tr>
<tr><td>Enter</td><td>to access the Pct Warning Value and allow editing</td></tr>
<tr><td>▲▼</td><td>to select a value</td></tr>
<tr><td>Enter</td><td>to make the selection permanent.</td></tr>
<tr><td>▲▼</td><td>to select Test µS/cm (After Stage 2 is selected)</td></tr>
<tr><td>Enter</td><td>to access the Test µS/cm Value</td></tr>
<tr><td>▲▼</td><td>to select a value</td></tr>
<tr><td>Enter</td><td>to make the selection permanent.</td></tr>
<tr><td>▲▼</td><td>to select Test pH (After Stage 3 is selected)</td></tr>
<tr><td>Enter</td><td>to access the Test pH Value</td></tr>
<tr><td>▲▼</td><td>to select a value</td></tr>
<tr><td>Enter</td><td>to make the selection permanent.</td></tr>
</table>

5.8.5 Pharma Warning and Fail Signal

The Pharma 1 warning limit is entered from the op-panel for stage 1 and is user selectable. The digital output "Pharma *n* Warn" is available (See Digital Source Selection - Table 6-4).

The Pharma Fail signal is generated whenever any of the following conditions are met:

Stage 1 – Measured Conductivity exceeds 100%
Stage 1 – Temperature not within range of 0-100 degrees C
Stage 2 – Conductivity is 0.1 µS/cm or greater for 5 minutes
Stage 3 – pH not within range of 5 – 7pH
Stage 2 and 3 – Temperature not within range of 24 – 26 degrees C.

The digital output "**Pharm *n* Fail**" is available (See Digital Source Selection - Table 6-4).

When the Stage 2 or Stage 3 test is successful, the fail signal is cancelled and the Pharma Timer begins to count down from the timer minutes value that was configured. When the Timer countdown is completed, the Pharma function block returns to Stage 1. A fail signal will return if measured conductivity exceeds 100% or warn signal if measured conductivity exceeds Pct Warning value.

See Section **12.5** for Pharma Fail Messages.

5.9 Cation Calc Display

5.9.1 Overview

This group allows you to configure dual conductivity inputs for cation or degassed CO_2 measurement. The cation selection of Ammonia or Amines will display a calculated pH value from differential conductivity and provide continuous pH monitoring using reliable, maintenance free conductivity cells. An outline of the conductivity cells' installation is illustrated in Figure 5-6.

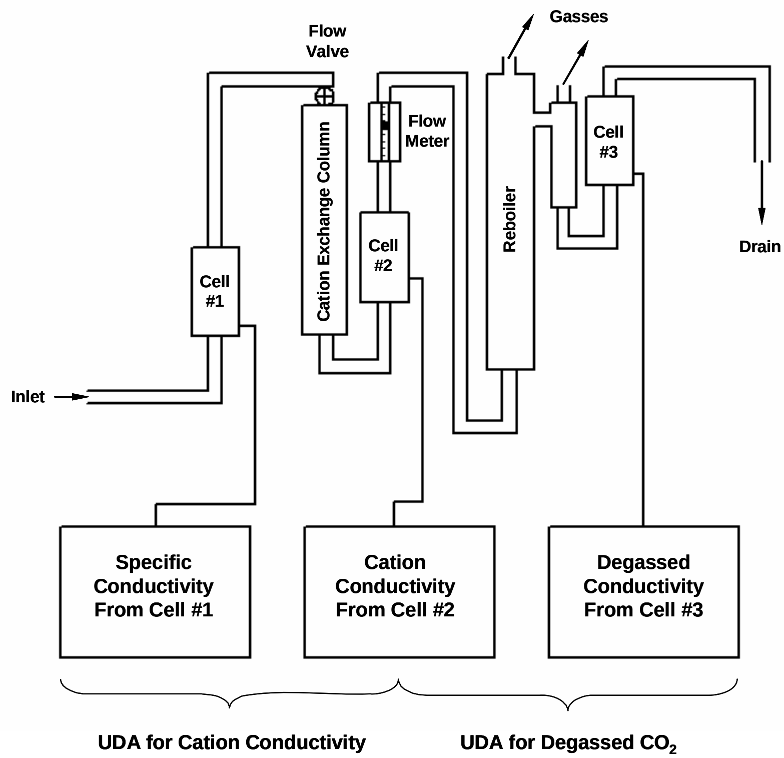


Figure 5-6 UDA for Cation and Degassed CO_2

5.9.2 How it works

UDA2182 will monitor on-line treated water for Specific Conductivity and Cation bed discharge conductivity, using reliable and maintenance free Honeywell conductivity cells, and calculate the pH, using the assumption that the water is pure water with Amine type treatment chemical and residual trace un-removed salts.

pH Calculation from Cation and Specific Conductivity

The equipment consists of Cell #1 which is used for specific conductivity determination of the influent water sample. The water sample is then passed through a strong acid cation exchange resin which replaces all cations in the influent stream with hydrogen ion. On passing though the resin, a second Cell #2 is used to measure the effluent or cation conductivity. These two measurements in combination are useful for measuring the amount of base contained in the influent sample and the extent of contamination by unwanted salts such as sodium chloride, sodium sulfate, etc.

Degassed CO_2

The dual input UDA can also be configured for degassed CO_2 measurement by employing cells #2 and #3. Here the cation effluent stream is degassed of CO_2, typically by heating the cation effluent stream to a near boiling temperature. This heating step results in CO_2 out-gassing. The resulting 25°C compensated conductivity measurement of Cell #3 is lower in value in proportion to the amount of dissolved CO_2.

5.9.3 pH Calculation from Specific and Cation Conductivity Setup

Connect cell 1 to input 1 and cell 2 to input 2. Follow the appropriate instructions to configure the UDA for Cation Calc (See Section 6.18 – Maintenance Configuration.) Under the sub menu selection of Inputs, the Cation Calc parameter offers two possible selections.

1. **pH Ammonia:** Specific conductivity temperature compensation assumes ammonia (NH_3) is the base reagent. In addition to display of conductivity values, this selection provides for determination and display of solution pH value.
2. **pH Amine pH:** Specific conductivity temperature compensation assuming a generic amine base. These include any one or combination of the following amines:

   Hydrazine
   Morpholine
   Ethanolamine
   Aminomethylpropanol
   Methoxypropylamine
   4-aminobutanol
   5-aminopentanol
   Diaminopropane
   Cyclohexylamine
   Methylamine
   Dimethylamine
   1,5-diaminopentane
   Piperidine
   Pyrrolidine

   This generic selection employs ammonia temperature compensation and optimizes pH calculation for these base reagents.

Note: The relationship between the electrolytic conductivity and the pH of ammonia and amines is well established in the technical literature. It must be understood that the UDA was designed for accurate results over the pH range of 8 to 10.5 based on ammonia or amine chemistries. Other chemistries such as phosphate or systems that employ alternative anions, such as borate, cannot be expected to realize results with similar accuracy.

Standardization for cations

The UDA allows for a sample calibration of the cation pH value. Here an independent sample is withdrawn from the sampling equipment and pH is determined with equipment of known accuracy. This independent pH value is then entered into the UDA as a pH calibration constant. To avoid process pH changes during standardization, it is very desirable to complete the sample extraction, independent measurement and UDA update as soon as possible.

5.9.4 Calibration

For Calibration procedure, refer to Section 8.7.7 Cation pH Calibration.

5.9.5 CO_2 by Degassed Conductivity

The UDA can be configured for CO_2 determination by degassed conductivity. The cation conductivity cell is connected to Input 1 and the degassed sample conductivity cell is connected to channel 2. The UDA performs HCl temperature compensation of both measurements to 25°C. The difference between the cation and degassed 25°C values is taken and ppb CO_2 is determined by ASTM D 4519.

5.9.6 Access to Cation Display

- When Cation Calc is enabled (See Section 6.18 – Maintenance Configuration), press **Display** until you see:

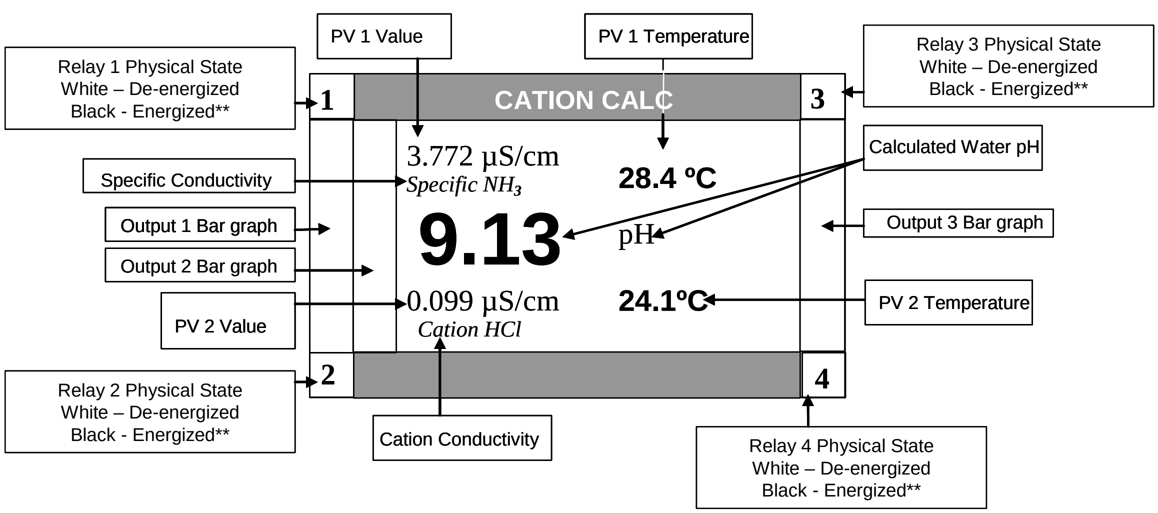


Figure 5-7 Cation Display screen example for pH calculations

5.9.7 Troubleshooting

In normal operation, both the direct electrode pH measurement and the pH from differential conductivity should very closely match each other.

If they **DO NOT** match each other, the possible causes are listed below:

1. Upsets in water chemistry, such as cation exchange resin exhaustion, can cause the pH readings to not agree with each other.

   CHECK EXCHANGE RESIN

2. A low reboiler temperature will not be effective in removing dissolved CO_2 resulting in an incorrect and low CO_2 indication.

   CHECK REBOILER TEMPERATURE

3. Nernst Electrode pH system failure will cause the two readings to disagree. Electrode pH systems are more susceptible to failure than conductivity cells, and depleted reference electrodes (incorrectly LOW readings) or broken measuring electrodes (usually incorrectly HIGH readings) can occur.

   CHECK pH ELECTRODE SYSTEM

5.10 Status Display

Overview

The Status Displays let you see the status of the Alarm Status, PID Alarm Status, Logic Status, Input Status, Output levels, Relay states, Monitor Status, Math Values, Aux Values, Auto Cycling, Variables, Comm Status, System Status, and the Calculated values (Calc Values available only if both units of measurement are identical).

Access to Status Displays

- Press **Display** until you see:

STATUS DISPLAY
Alarm Status
PID Alarm Status
Logic Status
Input Status
Output Levels
Relay States
Monitor Status
Math Values
Aux Values
Variables
Comm Status
Auto Cycling (if configured)
Calc Values (if configured)

- Use the ▲▼ keys to highlight the Status Display required.
- Press **Enter** to display the parameters and the status of each.

Figure 5-8 Status Display screen example

Table 5-7 Status Display Details

Status Display	Parameter	Status (Read Only)	Status Definition
Alarm Status	Alarm 1 Alarm 2 Alarm 3 Alarm 4	ON OFF	ON = Latching Alarm in alarm. ***Acknowledge*** alarm by changing status to OFF. If status changes back to ON, alarm condition still exists.
PID Alarm Status	PID 1 Alm 1 PID 1 Alm 2 PID 2 Alm 1 PID 2 Alm 2	ON OFF	ON = PID Alarm Active PID alarms are not latching.

Status Display	Parameter	Status (Read Only)	Status Definition
Logic Status	Logic 1 Logic 2 Logic 3 Logic 4	ON Off	Read Only
Input Status	In 1 Fault In 2 Fault Digital In 1 Digital In 2	OK or Fail OK or Fail On or Off On or Off	Read Only – depends on the Input selected
Output Levels	Output 1 mA Output 2 mA Output 3 mA	Output Level in Milliamps	Read Only – depends on the Output type selected at setup “Outputs”, “Output n”, “Source”: None Input 1 PV Input 2 PV Input 1 Tmp Input 2 Tmp Pharma Out 1 Pharma Out 2 Math 1 Math 2 Math 3 Math 4 Func Gen 1 Func Gen 2 Switch 1 Switch 2 Sum Difference Ratio %Passage %Rejection PID 1 PID 2 See Table 6-6 for configuration.
Relay States	Relay 1 Relay 2 Relay 3 Relay 4	State of the relay	Read Only – state depends on the Output source selected at Relay Setup Group, parameter “Relay Types”: *Digital Output (On or Off)* *Time Proportional (Value)* *Frequency Proportional Output (Value)* *On/Off (On or Off)* *Pulse Out (On or Off)* See Table 6-7 for configuration.
Monitor Status	Monitor 1 Monitor 2 Monitor 3 Monitor 4	ON Off	Read Only – State depends on the output of the analog monitor blocks.

Status Display	Parameter	Status (Read Only)	Status Definition
Math Values	Math 1 Math 2 Math 3 Math 4	Analog Values	Read Only – Shows the calculated values of the Math blocks.
Aux Values	Switch 1 Switch 2 Func Gen 1 Func Gen 2	Analog Values	Read Only – Shows the calculated values of the blocks in the Aux Group. This includes the current output of the **Switch** and **Function Generator** blocks.
Variables	AnlgVar 1 AnlgVar 2 AnlgVar 3 AnlgVar 4 Dgtl Var 1 Dgtl Var 2 Dgtl Var 3 Dgtl Var 14	Analog Values Digital Values (On or Off)	Read Only – shows values of Analog and Digital variables written from Modbus client.
Comm Status	Comm Card Stat	Ok/ Not Present/ HW Failure/ Fail Init	Read Only – This displays the status of the Communication card. Information present only if the Communication card is present. **Comm Card Stat** gives the status of the communication card Status shown **OK** if the communication card is working fine. Status shown as **Not present** if the communication card is not present. Status shown as **HW Failure** if the communication card is installed but unable to communicate to the Main CPU board. Status shown as **Fail** if the communication card is not functioning properly. It could be the result of a software failure, a bad flash chip on the board or DHCP is selected but the DHCP server was not found. Check cable connections and potential network issues for DHCP related problems. Status shown as **INIT** if the communication card is getting initialized.
	SW Version	Value	**SW Version** gives the software version of the Communication Card.
	Web Page	Value	**Web Page** gives the web page version number. The web pages are separate from the Communication card firmware, and can be upgraded independently. Both the SW version and Web Page version should be the same value to guarantee compatibility.

Status Display	Parameter	Status (Read Only)	Status Definition
	WebPgLngSet	EE/RT/PC	Identifies the web page language set programmed into the Communications card. EE web pages support English, French, German, Italian and Spanish. RT web pages support English, Russian and Turkish PC web pages support English, Polish and Czech
	Address	Value	**Address** states the Modbus RTU slave ID
	Baud Rate	Value	**Baud Rate** set for RS485
	Word Swap	Yes/No	**Word Swap** indicates whether the word order set for Modbus Communications is Little Endian (NO) or Big Endian (YES)
	MACaddr Hi MACaddr Low	Value	**MACaddr Hi and MACaddr Low** is the MAC address of the Communication card
	DHCP	Yes/No	**DHCP** indicates whether Dynamic Host Configuration Protocol is used. DHCP is a protocol used by network devices (clients) to obtain various parameters necessary for the clients to operate in an Internet Protocol (IP) network.
	IPaddr	Value	**IPaddr** gives the IP address of the Communication card.
	SubnetMsk	Value	**SubnetMsk** indicates the Subnet mask used by the Communication card.
	Gateway	Value	**Gateway** Indicates the default Gateway IP address used by the Communication card.
	DnsSrvr	Value	**DnsSrvr** displays the DNS (Domain Name Service) server IP address used by the Communication card
	SMTPsrvr	Value	**SMTPsrvr** displays the SMTP (Simple Mail Transfer Protocol) server IP address used by the Communication card.
Auto Cycling **(if configured)**	Next Rinse 1 Next Rinse 2 Next Cal 1 Next Cal 2	Date and Time	Read Only – The Status Displays menu includes an Auto Cycling selection when any auto cycle is enabled and its cycle timer is also enabled. This display provides information on the next occurrences of rinses and calibrations for any auto cycle with timer according to the configured cycle count of each operation.

Status Display	Parameter	Status (Read Only)	Status Definition
Calc Values **(if configured)**	Sum Difference Ratio %Passage %Rejection	Value	**Available only if both units of measure** between the two input boards **are identical.** See Table 6-5 for configuration. **Sum** = Input 1 + Input 2 **Difference** = Input 1 – Input 2 **Ratio** = Input 1 / Input 2 **%Passage** = Min(Input 1 or 2)/Max(Input 1 or 2) *100 **%Rejection** = (1-Min(Input 1 or 2)/Max(Input1 or 2))*100

5.11 Event History

Overview

Event History records events with timestamp. Events recorded include setup change, power on, calibrations (no values) and alarms with detail available on alarm type and source by scrolling and selecting event name. Status warns of event history at 50% and 90% and when erasing old records.

Access to Event History Displays

- Press Displa until you see:

EVENT HISTORY	
Setup Chg	04.19 08:58
Alarm 1 On	03.15 13:02
Setup Chg	03.15 13:01
Hold On	03.15 12:38
Setup Chg	03.15 11:21
Power On	03.09 02:31
HOLD ACTIVE	

- Use the ▲▼ keys to highlight the Event History required.
- Press Enter to display the event, date, time, and alarm parameters.

Figure 5-9 Event History Display screen example

Event History Display Example (Alarm)

ALARM 1 ON	
Event	Alarm 1
Source	Input 1 PV
Type	High
State	On
Date	2006/03/15
Time	13:02:13
ALARM 1 INPUT 1 PV HIGH	

Figure 5-10 Alarm Event Display screen example (Read Only)

Clear Event History

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Maintenance"** then press Enter to enter the sub-menu.
- Use the ▲▼ keys to select **"Display"** then press Enter to enter the sub-menu.
- Use the ▲▼ keys to select **"Clr Evt Hist"** then press Enter to allow change.
- Use the ▲▼ keys to select **"Yes"** then press Enter to clear the Event History screen.

5.12 Process Instrument Explorer Software

Overview

Process Instrument Explorer lets you configure your analyzer on a desktop/laptop or Pocket PC. For details see Process Instrument Explorer manual #51-52-25-131.

Features

- Create configurations with intuitive software program running on a Pocket PC, a Desktop or a laptop computer. ·
- Create/edit configurations live; just connect software to analyzer via IR port.
- Create/edit configurations offline and download to analyzer later via IR port.
- Infrared port available on every UDA2182.
- This software is available in English, Spanish, Italian, German, French, Russian, Turkish, Polish and Czech.
- Generate Configuration Reports.

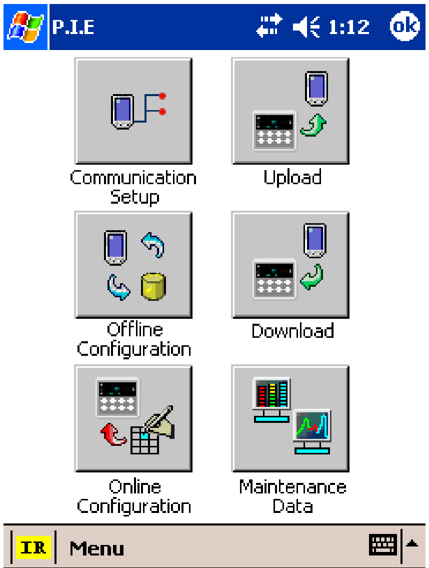


Figure 5-11 Screen capture of Process Instrument Explorer running on a Pocket PC

Infrared communications

The infrared connection provides a non-intrusive wireless connection with the instrument and maintains its waterproof integrity when used in conjunction with the optional PIE (Process Instrument Explorer Software).

No need to get access to the back of the analyzer to communicate with the instrument, no need to take your screw driver to wire the communication cable, no wiring mistake possible. You can now duplicate an instrument’s configuration, upload or download a new configuration in a matter of seconds, just by pointing your Pocket PC in the direction of the instrument.

It takes just a few seconds to upload a configuration from an instrument. You can then save the configuration file onto your PC or pocket PC for review, modification or archiving. Furthermore, this software also gives you important maintenance information on the analyzer: instantly, get information on the current operating parameters, digital inputs and alarm status, identify internal or analog input problems.

Question: What if I have several analyzers on the same panel? How can I be sure I am communicating with the correct one?

Answer: The infrared port of the analyzer is normally “off”. You activate the infrared port on a particular analyzer by pressing any key. You can now communicate with the analyzer. If no communications are received for 2 minutes, the port will be shut down again.

5.13 Modbus Communications

Overview

The UDA2182 provides Modbus communication support on two communication interfaces using the optional Communication Card. A general summary is listed below. **For details see UDA2182 Communications User Guide #70-82-25-126.**

Summary

Communications Card (Optional)

The Communications card provides one Serial Port (RS485) and one Ethernet Port.

Serial port provides

- RS422/RS485 multi-drop
- 1200 to 38400 programmable baud rate
- Modbus RTU protocol to read signals including PV, Temperature, Alarm Status, outputs, relay status, etc.
- Read/write four analog and four digital variables ***(Note 1)***

Ethernet port provides:

- Up to 5 Modbus TCP connections simultaneously
- Ethernet parameters are configured via the front-panel or web pages.
- Web server with up to10 clients simultaneously
- Multi-language Web pages ***(Note 2)*** setup the Ethernet port settings and monitor readings, alarms, statuses, events
- Multi-language Email to send alarm status changes. Alarm notification to eight email addresses. These must be configured using web pages signed in as the administrator.
- *DHCP*: *(Dynamic Host Configuration Protocol)* selectable via web page or front-panel
- Firmware upgrade to Main CPU board
- Firmware upgrade to Communications card

Note 1

There are four analog and four digital variables. These variables can be read and written remotely using Modbus function codes.

Variables will appear as a selection for various parameters:

- *Analog variables* can be an alarm source, analog relay source, current output source, monitor source, math source, auxiliary switch source, PID TRV, and PID remote setpoint.
- *Digital variables* can be an alarm disable, remote setpoint select, Tune Set2 select, digital relay source, logic-in source, auxiliary switch select, PID TRC select, PID RSP select, and auto cycle start source

Note 2

Web pages provide the following:

- Multiple language support
- “Guest” accessibility for read-only permission
- “Admin” accessibility for read and write permission
- Readings of Inputs, Outputs, and Relay Outputs
- Status of Inputs, Outputs, and Alarms.
- Readings and Status of optional parameters (control, pharma, and auto-cycle)
- List of last twelve events
- Network configuration including IP address, subnet mask, gateway etc.
- Email configuration for alarm event notification

6 Configuration

6.1 Overview

Introduction

Configuration is a dedicated operation where you use straightforward keystroke sequences to select and establish (configure) pertinent setup data best suited for your application.

To assist you in the configuration process, there are prompts that appear in the Main Setup menu and associated sub menus. These prompts let you know what group of configuration data (Set Up prompts) you are working with and also, the specific parameters associated with each group.

What's in this section?

The topics in this section are listed below.

6.2 UDA2182 Block Diagram

Overview

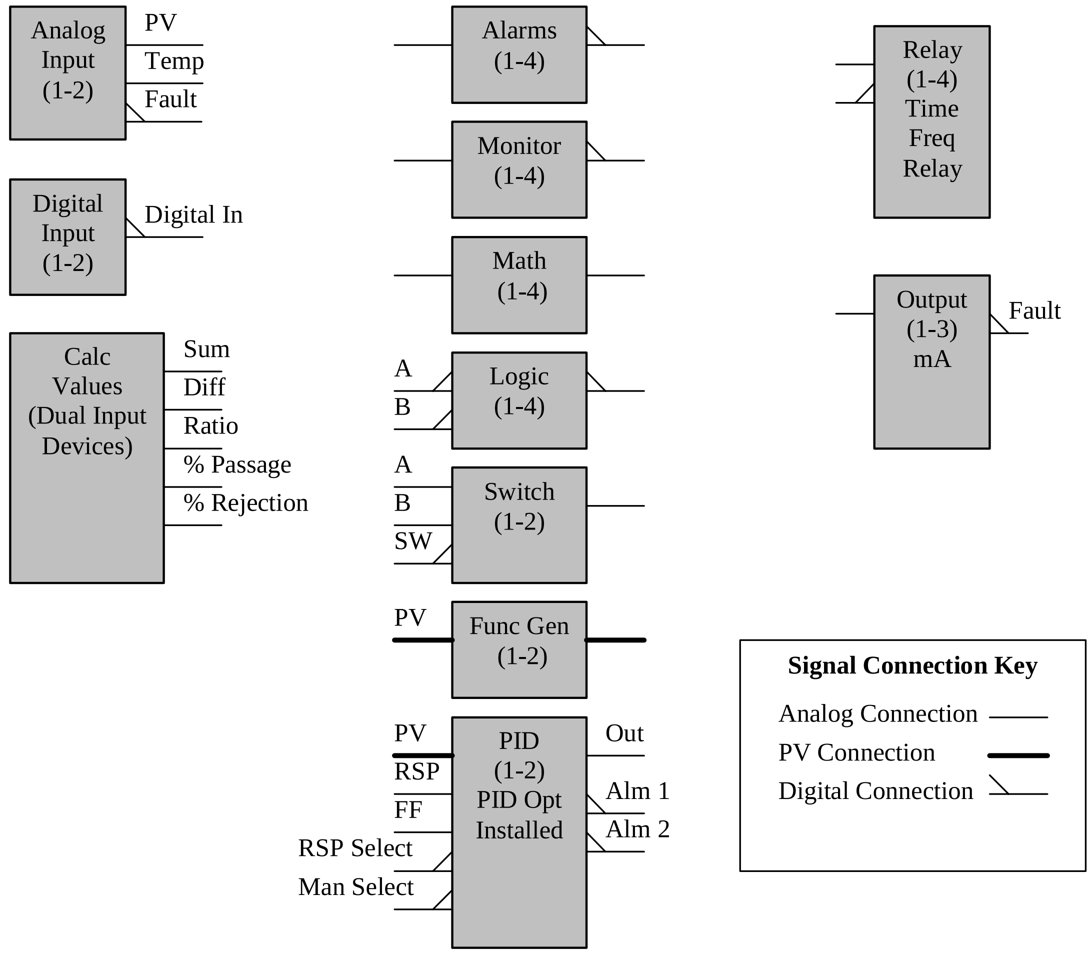
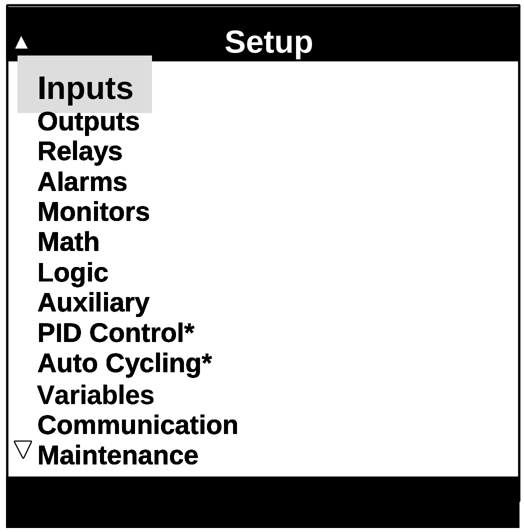


Figure 6-1 UDA2182 Block Diagram

6.3 Main Setup Menu

Accessing the Main Menu

Press Setup. The main Menu will appear.



**Some item are dependent on the Option selection*

Menu Indicators

An upward-pointing arrow indicator above the menu at the left end of the header appears when there are currently menu items above the screen accessible by moving the cursor up.

A downward-pointing arrow indicator below the menu at the left end of the status footer appears when there are currently menu items below the screen accessible by moving the cursor down.

Use the ▲▼ keys.

Setup Group Overview

Refer to "**General Rules for Editing**" and Table 6-1 Basic Configuration Procedure to configure the following Setup Groups.

Inputs Configuration (Table 6-5) – configure:

Input 1 and Input 2 for pH/ORP, pH Preamp, Conductivity, or Dissolved Oxygen and associated parameters
Calc Value 1 and 2 (*both units of measurement must be the same*) select the Calculation type [Ratio, sum, etc.], High range and Low range.

Outputs Configuration (Table 6-6) – configure ***Output 1, 2, or 3 source***, % Range High and Low and associated parameters

Relays Configuration (Table 6-7) – configure **Relay 1, Relay 2, Relay 3, and Relay 4** for Relay Types: Digital Out (Digital Output Relay), Time Prop (Time

Proportional Output), Pulse Frequency (Pulse Frequency Type), Frequency Prop (Frequency Proportional), or On/Off type and associated parameters.

Alarms Configuration (Table 6-8) - configure **Alarm 1 through 4** for Alarm's Source and associated parameters.

Monitors Configuration (Table 6-9) – configure **Monitor 1 through 4** for Monitor Type, Source and associated parameters.

Math Configuration (Table 6-10) – configure **Math 1, 2, 3, and 4** for Input Source, Math Type, and associated parameters.

Logic Configuration (Table 6-11) – configure **Logic 1, 2, 3, and 4** for Input Sources, Type, and associated parameters.

Auxiliary Configuration (Table 6-12) – configure **Switch 1, Switch 2, Function Generator 1 and Function Generator 2**(for pre-control linearizing of inputs) for Sources and associated parameters.

PID Control (Option) Configuration (Table 6-13) **–** configure:

PID 1 and PID 2 Configuration parameters,
Tune (Enable Accutune, Fuzzy Logic, Use Prop Band, Use RPM, configure Tuning parameters) and
Alarms Parameters (Setpoint types and Values, alarm hysteresis)

Auto Cycling (Table 6-16) – enable **Auto Cycle 1 and 2** and set rinse schedule and associated parameters. Auto cycling provides automated timing, control and functionality for the cleaning and calibration of input probes.

Variables (Analog Table 6-3 **and Digital** Table 6-4**)** selections can be read and written remotely using Modbus function codes. You are setting up the initial values for the variables when power is applied to the UDA (Refer to Table 6-18 for an Example)

Communication Configuration (Table 6-19) – configure **IR Front Panel, Modbus, RS485 and Ethernet.**

Maintenance Configuration (Table 6-20) – Configure:

System - read the Software version, configured Language, selected Mains Frequency, and PID Control Selections, enter a Password, and reset the Unit.

Input 1 and Input 2 - configure Input types, Conductivity units' type, wire size, and wire length, and temperature Units.

Display – setup the Main Display Header; and Clear Event and Cal Histories.

Tag Names – configure tag name strings for input names on single channel main display, Auto Cycle display header, Pharma display header, PID display header. Alarm names to appear in status and event history.

Clock - set real time clock date; time; date format; and time format.

Tests - run Display and Keyboard tests, read Output levels, and read Relay States.

6.4 Basic Configuration Procedure

Introduction

Each of the Set Up groups and their functions are pre-configured at the factory.
If you want to change any of these selections or values, read the "General Rules for Editing" and follow the procedure in Table 6-1. This procedure tells you the keys to press to get to any Setup group and any associated parameter prompt.

6.4.1 General Rules for Editing

***Selecting a parameter for edit*:**

- Display the screen containing the parameter.
- Use the ▲▼ keys to highlight the parameter name.
- Press Enter to highlight the displayed current value.

***Editing a parameter having a text string as an assigned value*:**

- Select the parameter as explained above.
- Use the ▲▼ keys to display other valid choices.
- When your choice is displayed, press Enter to select.

Editing a parameter having a numeric value

- Select the parameter as explained above.
- Use the ◄ ► keys to move the cursor to the digit to be changed.
  Moving the cursor left into leading spaces changes space to 0.
  Moving the cursor right causes any leading 0 to change to a space.

  If you hold down the ◄ key, the cursor will move to the left and increment to the next highest digit available for the particular parameter. If you hold down the ► key, the cursor will move to the right and increment the next lowest digit available for the particular parameter.
- Use the ▲▼ keys to increment or decrement the numerical value at and to the left of the digit. Increment/decrement past range limit displays limit value and causes status message.

  Use the ◄ ► keys to move the cursor to the next digit. Repeat.

  When all digits have been changed, press Enter to store.

Basic Configuration Procedure

Table 6-1 Basic Configuration Procedure

Step	Operation	Press	Result
1	**Enter Set Up Mode**	Setup	**Setup** **Inputs** **Outputs** **Relays** **Alarms** **Monitors** **Math** **Logic** **Auxiliary** **PID Control*** **Auto Cycling*** **Variables** **Communication** **Maintenance** The Main Menu is displayed. Use ▲▼ to scroll and select a setup group (Example – Inputs). The selection will be highlighted.
2	**Enter Set Up Group**	Enter	The Setup group selected is shown at the top of the screen and will display all the selections within that group. **INPUTS** **Input 1 Pre ph** **Input 2 Conduc** Press ▲▼ to highlight the desired selection. (Example – Input 1 PRE PH)
3	**Enter the selection**	Enter	The list of parameters for that selection will be displayed. (Example – Input 1 PRE PH) **INPUT 1 PRE PH** **PV Type** **pH Glass** **PV Range** **0 - 14** **Temp Input** **Enable** **Temp Type** **8550 O** **Solu Temp Comp** **Custom** **Solution pH/°C** **0.000** Press ▲▼ to highlight the desired selection.
4	**Changing a parameter**	Enter	The displayed current value for the parameter is displayed.
5	**Change the Value or Selection**	▲▼	Depending on whether you are changing a text string or a numerical value, follow the "***General Rules for Editing***" in section 6.4.1 to make the changes.

6	**Enter the Value or Selection**	Enter	Enters value or selection made into memory after another key is pressed. Repeat the procedure for changing any parameter for any group.
7	**To Abort the Changes Made**	Exit	Any changes made to a parameter value will revert to the original value before editing.
8	**Exit Setup Mode**	Exit	Until you see the main Setup screen.

6.5 Analog and Digital Signal Sources

Overview

This section contains a list of signals that are available for connection as digital and analog sources.

Table 6-2 Signal Sources

Signal Type	Applies Source to:	Selections
Analog Source Selections (Table 6-3)	Alarms (PV) Outputs Math Blocks Auxiliary - Function Generators Monitor 1 through 4 Auxiliary - Switch (A,B) Relays (Time Prop, Pulse Freq) PID (RSP Source, Feedforward Source)	None Input 1-2 PV Input 1-2 Temp Pharma Out 1-2 Math 1-4 Func Gen 1-2 Switch 1-2 Sum Difference Ratio %Passage %Rejection Cation Value PIDout 1-2 AnlgVar 1-4
PV Source Selections	PID 1 and 2 PV Source Function Generator 1 and 2	None Input 1 – 2 PV
Digital Source Selections (Table 6-4)	Logic (InA, InB) Relays (Digital Out, Pulse out) Auxiliary - Switch (Select B Source) Alarms Disable PID (Remote setpoint select, Manual select) Auto Cycle – Start Source	None Alarm1-4 Alm Grp 1-2 Monitor 1-4 Logic 1-4 Digital In 1-2 In 1-2 Fault In 1-2 Hold Out 1-3 Fault Hold Pharma 1-2 Fail Pharma 1-2 Warn PID 1 Alarm 1-2 PID 2 Alarm 1-2 Auto Cycle 1 – Extract, Rinse, Cal PT1, Cal PT2, Fail Auto Cycle 2 – Extract, Rinse, Cal PT1, Cal PT2, Fail Input 1-2 Cal Output 1-3 Cal DgtlVar 1-4

Table 6-3 Analog Signal Sources

Analog Signal	Description	Definition
Input 1 PV	**Input 1 Process Variable**	PV Source selection
Input 2 PV	**Input 2 Process Variable**	PV Source selection
Input 1 Temp	**Input 1 Temperature**	Input 1 Temperature Selection
Input 2 Temp	**Input 2 Temperature**	Input 2 Temperature Selection
Pharma Out 1	**Pharmacopoeia Output 1**	Input 1 Pharmacopia 1 Output (for Conductivity) = percent of USP stage limit Output = 100 * pv in uScm / USP stage limit Valid for Conductivity Input
Pharma Out 2	**Pharmacopoeia Output 2**	Input 2 Pharmacopia 2 Output = percent of USP stage limit Output = 100 * pv in uScm / USP stage limit Valid for Conductivity Input
Math 1	**Math 1**	Math selections can be connected to any Input PV, secondary variable (Temperature), or Calculated Value. Math blocks include scaling for the linear selection only. See Table 6-10 for Math Configuration
Math 2	**Math 2**	
Math 3	**Math 3**	
Math 4	**Math 4**	
Func Gen 1	**Function Generator 1**	Generates an output characteristic curve based on up to 11 configurable data points for both input (X) and output values (Y). Part of the Auxiliary Configuration group. See Table 6-12 for Function Generator Configuration
Func Gen 2	**Function Generator 2**	
Switch 1	**Switch 1**	Switch selections have 2 input sources (A and B). A switch block is used to select between two analog signals. The switch block can be used for many monitor and control strategies. A Digital Signal Source when active will select the B input source of the switch as the output. Part of the Auxiliary Configuration group. See Table 6-12 for Switch Configuration
Switch 2	**Switch 2**	
Sum*	**Input 1 + Input 2**	The availability of calculated variables in the list of available sources for alarms, math and control and for status display is determined by similarity of units of measure between the two input boards.
Difference*	**Input 1 – Input 2**	
Ratio*	**Input 1 / Input 2**	
%Passage*	**Min(Input 1 or 2)** **Max(Input 1 or 2)** ***100**	
% Rejection*	**(1-Min(Input 1 or 2)/** **Max(Input1 or 2))** ***100**	
Cation Value	**pH Value**	Calculated pH value from differential conductivity
PID Out 1	**PID Output 1**	PID 1 Output in percent (0 to 100). Normally connected to a proportional current (Current Type) or time proportional or frequency proportional relay.

PID Out 2	**PID Output 2**	PID 2 Output in percent (0 to 100). Normally connected to a proportional current (Current Type) or time proportional or frequency proportional relay.
Anlg Var 1	**Analog Variable 1**	Initial values of Analog Variable 1 applied at power on.
Anlg Var 2	**Analog Variable 2**	Initial values of Analog Variable 2 applied at power on.
Anlg Var 3	**Analog Variable 3**	Initial values of Analog Variable 3 applied at power on.
Anlg Var 4	**Analog Variable 4**	Initial values of Analog Variable 4 applied at power on.

Table 6-4 Digital Signal Sources

Digital Signal	Description	Definition
Alarm 1	Alarm 1	Any Alarm 1 configuration. See Table 6-8 for Alarm configuration
Alarm 2	Alarm 2	Any Alarm 2 configuration. See Table 6-8 for Alarm configuration
Alarm 3	Alarm 3	Any Alarm 2 configuration. See Table 6-8 for Alarm configuration
Alarm 4	Alarm 4	Any Alarm 4 configuration. See Table 6-8 for Alarm configuration
Monitor 1	Monitor 1	Any Monitor 1 configuration. See Table 6-9 for Monitor configuration
Alarm Group 1	Alarm Group 1	Is the OR of the Alarm 1 - 4 signals. Will be TRUE when any Alarm 1 - 4 is TRUE. If a single digital signal is needed to go TRUE for any alarm, OR alarm group 1 and alarm group 2 together to create a logic signal.
Alarm Group 2	Alarm Group 2	Is the OR of the PID Control alarm signals. Will be TRUE when any PID Control Alarm is TRUE. If a single digital signal is needed to go TRUE for any alarm, OR alarm group 1 and alarm group 2 together to create a logic signal.
Monitor 2	Monitor 2	Any Monitor 2 configuration. See Table 6-9 for Monitor configuration
Monitor 3	Monitor 3	Any Monitor 3 configuration. See Table 6-9 for Monitor configuration
Monitor 4	Monitor 4	Any Monitor 4 configuration. See Table 6-9 for Monitor configuration
Logic 1	Logic 1	Any Logic 1 configuration. See Table 6-11 for Logic configuration
Logic 2	Logic 2	Any Logic 2 configuration. See Table 6-11 for Logic configuration
Logic 3	Logic 3	Any Logic 3 configuration. See Table 6-11 for Logic configuration
Logic 4	Logic 4	Any Logic 4 configuration. See Table 6-11 for Logic configuration
Digital In 1	Digital Input 1	Digital Input 1 signal from Option Board (must be installed)
Digital In 2	Digital Input 2	Digital Input 2 signal from Option Board (must be installed)
In 1 Hold	In 1 Hold	Input is in Hold. This condition occurs either by pushing the HOLD button on the front panel or when an Auto Cycle is being run.
In 2 Hold	In 2 Hold	
In 1 Fault	Input 1 Fault	Input open conditions. An input board disconnect while powered results in an input fault condition and allows an alarm to be triggered.
In 2 Fault	Input 2 Fault	

Out 1 Fault	Output 1 Fault	Output open conditions. This allows an alarm to be triggered if the respective 4-20 mA output opens.
Out 2 Fault	Output 2 Fault	
Out 3 Fault	Output 3 Fault	
Hold	Hold	Engages Hold of Analog Inputs
Pharm 1 Warn	Pharmacopoeia 1 Warning	The Pharma 1 Display (Section 5.8) outputs digital **Warning** signal whenever the measured conductivity exceeds the Percent Warning Value selected in the "Pharma Op Panel" on the Pharma Display (Stage 1only)
Pharm 1 Fail	Pharmacopoeia 1 Failure	The Pharma 1 Display (Section 5.8) outputs digital **Failure** signal whenever one of the following conditions occur: Stage 1 – Measured Conductivity exceeds 100% Stage 1 – Temperature not within range of 0-100 degrees C Stage 2 – Conductivity is 0.1 µS/cm or greater for 5 minutes Stage 3 – pH not within range of 5 – 7pH Stage 2 and 3 – Temperature not within range of 24 – 26 degrees C.
Pharm 2 Warn	Pharmacopoeia 2 Warning	The Pharma 2 Display (Section 5.8) outputs digital Warning signal whenever the measured conductivity exceeds the Percent Warning Value selected in the "Pharma Op Panel" on the Pharma Display (Stage 1only)
Pharm 2 Fail	Pharmacopoeia 2 Failure	The Pharma 2 Display (Section 5.8) outputs digital **Failure** signal whenever one of the following conditions occur: Stage 1 – Measured Conductivity exceeds 100% Stage 1 – Temperature not within range of 0-100 degrees C Stage 2 – Conductivity is 0.1 µS/cm or greater for 5 minutes Stage 3 – pH not within range of 5 – 7pH Stage 2 and 3 – Temperature not within range of 24 – 26 degrees C.
PID 1 Alm 1	PID Control 1 Alarm 1	Control Alarms – See Table 6-15 PID Alarms
PID 1 Alm 2	PID Control 1 Alarm 2	
PID 2 Alm 1	PID Control 2 Alarm 1	
PID 2 Alm 2	PID Control 2 Alarm 2	
AC 1 Extract	Auto Cycle 1 Probe Extraction	Auto Cycle 1 digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.
AC 1 Rinse	Auto Cycle 1 Probe Rinse	Auto Cycle 1 digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.
AC1 Cal	Auto Cycle 1 Calibration Point 1	Auto Cycle 1 digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.
AC 1 Cal 2	Auto Cycle 1 Calibration Point 2	Auto Cycle 1 digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.
AC 1 Fail	Auto Cycle 1 Failure	Auto Cycle 1 Failure is active whenever an Auto Cycle 1 failure occurs Auto Cycle 1digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.
AC 2 Extract	Auto Cycle 2 Probe Extraction	Auto Cycle 2 digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.
AC 2 Rinse	Auto Cycle 2 Probe Rinse	Auto Cycle 2 digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.
AC 2 Cal	Auto Cycle 2 Calibration Point 1	Auto Cycle 2 digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.

AC 2 Cal 2	Auto Cycle 2 Calibration Point 2	Auto Cycle 2 digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.
AC 2 Fail	Auto Cycle 2 Failure	Auto Cycle 2 Failure is active whenever an Auto Cycle 2 failure occurs Auto Cycle 2 digital output (Cycle Start Source) configuration selection See Table 6-16 Auto Cycling Configuration.
Input 1 Cal	Input 1 Calibration	This signal goes TRUE when the calibration factor for input 1 is being calculated. The TRUE state is active for less than one second.
Input 2 Cal	Input 2 Calibration	This signal goes TRUE when the calibration factor for input 2 is being calculated. The TRUE state is active for less than one second.
Output 1 Cal	Output 1 Calibration	The signal indicates when the Output 1 calibration values are being changed. The signal goes TRUE when the “4ma Offset” or “20ma Offset” is being modified. The signal goes FALSE when the value is entered.
Output 2 Cal	Output 2 Calibration	The signal indicates when the Output 2 calibration values are being changed. The signal goes TRUE when the “4ma Offset” or “20ma Offset” is being modified. The signal goes FALSE when the value is entered.
Output 3 Cal	Output 3 Calibration	The signal indicates when the Output 3 calibration values are being changed. The signal goes TRUE when the “4ma Offset” or “20ma Offset” is being modified. The signal goes FALSE when the value is entered.
DgtlVar 1	Digital Variable 1	Initial values of Digital Variable 1 applied at power on.
DgtlVar 2	Digital Variable 2	Initial values of Digital Variable 2 applied at power on.
DgtlVar 3	Digital Variable 3	Initial values of Digital Variable 3 applied at power on.
DgtlVar 4	Digital Variable 4	Initial values of Digital Variable 4 applied at power on.

6.6 Inputs Configuration

Overview

This group lets you select pH/ORP, Preamp pH, Conductivity, or Dissolved Oxygen Input type and the associated output parameters.

Accessing Inputs Menu

Press Setup to display the Main menu.

Use the ▲▼ keys to select "Inputs" then press Enter to enter the sub-menus.

Input 1 and Input 2 – Direct pH/ORP, Preamp pH, Conductivity, or Dissolved Oxygen are available for selection. Select PV type, read the range, select Temp Type, Solution Temp Compensation, Bias, Failsafe and Filter Time.

For Dissolved Oxygen, also select the Salinity type and Pressure type.

Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-5 Input Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Input 1 or 2 Direct pH **ORP**	PV Type	pH Glass pH HPW **pH Durafet (default)** ORP	The PV type determines the numerical format and the units of measure on the online PV display. Measured PV is generally displayed in the highest decimal precision possible to .001 and has a potentially displayable range of 0.000 to 99999. The exceptions are dissolved oxygen, pH, ORP and temperature, which are displayed with fixed decimal precision. PV Type determines specific ranges.
	PV Range	0.0 to 14.0 pH -1600 to 1600 ORP	Read Only
	Temp Input (ORP only)	Enable Disable	Enable to allow "Temp Type" selection – see below.
	Temp Type	**8550Ω Therm (default)** 1000Ω RTD Manual	8550Ω Thermistor 1000Ω Resistance Temperature Detector Manual

<table>
<tr><th>Sub-menu selection</th><th>Parameter</th><th>Selection or Range of Setting</th><th>Parameter Definition</th></tr>
<tr><td rowspan="6"></td><td>Temp Deg F or C
(Temp Type = Manual)</td><td>14.0 to 230.0ºF
default = 77ºF
-10 to 110ºC
default = 25ºC</td><td>Temp Deg F or C will appear depending on what Temperature Unit was selected in “Maintenance” setup group, parameter “Temp Units”.</td></tr>
<tr><td>Solu Temp Comp
(Not ORP)</td><td>None (default)
Custom
$H_2$0
NH_3
Phosphate
Morpholine</td><td>Enter “Solution pH/ºC” value
Pure Water
Ammonia
Phosphate
Morpholine</td></tr>
<tr><td>Solution pH/ºC
(Solu Temp Comp = Custom)
(Not ORP)</td><td>0.000 (default)
to
-0.050</td><td>Measured pH is displayed and transmitted normalized to a solution temperature of 25°C as determined by the current Solution Temperature Coefficient. This is expressed in units of pH/°C with precision to the hundredths decimal place. The parameter “Solu Temp Coeff” allows the selection of the following entries. Follow the “General Rules for Editing” in section 6.4.1 to make the changes. (-) Will appear when first digit to the right of decimal point is changed.
<table>
<tr><th>Solution Type</th><th>Temp Coefficient</th></tr>
<tr><td>None (Default)</td><td>0.000</td></tr>
<tr><td>H_2O (Pure Water)</td><td>-0.016</td></tr>
<tr><td>NH_3 (Ammonia)</td><td>-0.032</td></tr>
<tr><td>PO_4 (Phosphate)</td><td>-0.032</td></tr>
<tr><td>C_4H_9NO (Morpholine)</td><td>-0.032</td></tr>
<tr><td>Custom</td><td>User Entry</td></tr>
</table></td></tr>
<tr><td>PV Bias</td><td>-99999 to 99999
default = 0.00</td><td>PV Bias Constant - is used to compensate the input for drift of an input value.</td></tr>
<tr><td>Failsafe</td><td>-99999 to 99999
default = 14.00</td><td>The output value to which the output will go to protect against the effects of failure of the equipment.</td></tr>
<tr><td>Filter Time</td><td>0 to 120
default = 0</td><td>A software digital filter is provided for dampening the process noise. This filter is applied before the limit functions.</td></tr>
</table>

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Input 1 or 2 Preamp pH	The pH Preamp input card measures pH and accepts inputs from a Durafet series Preamp, a glass Meredian II Preamp or a Durafet series Cap Adapter. The pH Preamp input is similar to the pH/ORP input shown previously and has an identical Setup/Inputs parameter menu with the following important differences: No ORP measurement. ORP is not selectable as a PV Type in Setup/Inputs. No HPW measurement. HPW is not selectable as a PV Type in Setup/Inputs. The parameter "Temperature Input" is available for either Durafet or Glass PV type to enable or disable. A temperature input disable accommodates preamps that do not transmit measured temperature from the probe. This will disable all monitored temperature values, temperature input diagnostics and faults and the parameter "Solution Temp Comp" under Setup/Inputs/pH Preamp *n*. You need to disable "Temperature Input" for Durafet from External Preamp.		
	PV Type	pH Glass pH HPW pH Durafet **(default)**	The PV type determines the numerical format and the units of measure on the online PV display. Measured PV is generally displayed with fixed decimal precision.
	PV Range	0.0 to 14.0 pH	Read Only
	Temp Input	Enable Disable (default)	Enable to allow "Temp Type" selection – see below.
	Temp Type *(Temp Input = Enable*)	**8550Ω Therm (default)** 1000Ω RTD Manual	8550Ω Thermistor 1000Ω Resistance Temperature Detector Manual
	Temp Deg F or C *(Temp Input = Enable, Temp Type = Manual)*	14.0 to 230.0ºF **default = 77ºF** -10 to 110ºC **default = 25ºC**	Temp Deg F or C will appear depending on what Temperature Unit was selected in "Maintenance" setup group, parameter "Temp Units".
	Solu Temp Comp *(Temp Input = Enable*)	**None (default)** Custom H_20 NH_3 Phosphate Morpholine	 Enter "Solution pH/ºC" value Pure Water Ammonia Phosphate Morpholine

<table>
<tr><th>Sub-menu selection</th><th>Parameter</th><th>Selection or Range of Setting</th><th>Parameter Definition</th></tr>
<tr><td rowspan="4"></td><td>Solution pH/ºC

(Temp Input = Enable, Solu Temp Comp = Custom)</td><td>0.0 (default) to -0.050 pH/ºC</td><td>Measured pH is displayed and transmitted normalized to a solution temperature of 25°C as determined by the current Solution Temperature Coefficient. This is expressed in units of pH/°C with precision to the hundredths decimal place. The parameter “Solu Temp Coeff” allows the selection of the following entries. Follow the “General Rules for Editing” in section 6.4.1 to make the changes. (-) Will appear when first digit to the right of decimal point is changed.

<table>
<tr><th>Solution Type</th><th>Temp Coefficient</th></tr>
<tr><td>None (Default)</td><td>0.000</td></tr>
<tr><td>H_2O (Pure Water)</td><td>-0.016</td></tr>
<tr><td>NH_3 (Ammonia)</td><td>-0.032</td></tr>
<tr><td>PO_4 (Phosphate)</td><td>-0.032</td></tr>
<tr><td>C_4H_9NO (Morpholine)</td><td>-0.032</td></tr>
<tr><td>Custom</td><td>User Entry</td></tr>
</table></td></tr>
<tr><td>PV Bias</td><td>-99999.00 to 99999.00
default = 0.00</td><td>PV Bias Constant - is used to compensate the input for drift of an input value.</td></tr>
<tr><td>Failsafe</td><td>-99999.00 to 99999.00
default = 14.00</td><td>The output value to which the output will go to protect against the effects of failure of the equipment.</td></tr>
<tr><td>Filter Time</td><td>0 to 120
default = 0.0</td><td>A software digital filter is provided for dampening the process noise. This filter is applied before the limit functions.</td></tr>
</table>

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Input 1 or Input 2 Conductivity	For every cell constant the PV type includes selections for both conductivity µS/cm and conductivity mS/cm. Conductivity µS/cm displays µS/cm and provides standard range solution type selections: None, NaCl, Morpholine, HCL, Acid, and NH3. Conductivity mS/cm displays mS/cm and provides wide range solution type selections: None, HCl, NaCl, H2SO4, and NaOH. Upper range limit defaults according to the table below: For every cell constant the PV type also includes selections for either TDS ppb/TDS ppm or TDS ppm/TDS ppt.: TDS ppb/ppm provides standard or wide solution type selections and TDS ppm/ppt provides standard or wide solution type selections. Solution selections are the same as above with the exception of None. Upper range limit defaults according to the table below:		

Cell Const 0.01	Cell Const 0. 1	Cell Const 1	Cell Const 10	Cell Const 25	Cell Const 50
0 - 2 µS/cm *displayable to 200 µS/cm* 0 - 0.2 mS/cm 0 - 2000 ppb TDS 0 - 200 ppm TDS	0 - 20 µS/cm *displayable to 2000 µS/cm* 0 - 2 mS/cm 0 - 20000 ppb TDS 0 - 2000 ppm TDS	0 - 200 µS/cm *displayable to 20000 µS/cm* 0 - 20 mS/cm 0 - 200 ppm TDS 0 - 20 ppt TDS	0 - 2000 µS/cm *displayable to 99999 µS/cm* 0 - 200 mS/cm 0 - 2000 ppm TDS 0 - 200 ppt TDS	0 - 20000 µS/cm *displayable to 99999 µS/cm* 0 - 500 mS/cm 0 - 10 % conc *displayable to 20%*	0 - 20000 µS/cm *displayable to 99999 µS/cm* 0 - 1000 mS/cm 0 - 20 % conc

<table>
<tr><th>Sub-menu selection</th><th>Parameter</th><th>Selection or Range of Setting</th><th>Parameter Definition</th></tr>
<tr><td></td><td>PV Type

Select Cell Constant First</td><td>Cond µS/cm (NIST-default)+
Cond mS/cm – (NIST)
Concentrtn
TDS ppb
TDS ppm
TDS ppt
Resistivity

Cond mS/m (ISO-Default)+
Cond S/m – (ISO)
Concentrtn
TDS ppb
TDS ppm
TDS ppt
Resistivity
Cond µS/m

+ parameter selected in MAINTENANCE → INPUTS menu</td><td>These selections are only available with regard to the Cell Constant selected (See “Cell Constant”).
<table>
<tr><th>Cell Constant</th><th>Available Selectable PV Types
Use the ▲▼ keys to select</th></tr>
<tr><td>0.01</td><td>Conductance µS/cm (default- NIST), Conductance mS/cm (NIST), Conductance mS/m(default - ISO), Conductance S/m (ISO), TDS ppb, TDS ppm, Resistivity, Conductance µS/m (ISO)</td></tr>
<tr><td>0.1 (Default)</td><td>Conductance µS/cm (default- NIST), Conductance mS/cm (NIST), Conductance mS/m(default - ISO), Conductance S/m (ISO), TDS ppb, TDS ppm, Resistivity, Conductance µS/m (ISO)</td></tr>
<tr><td>1</td><td>Conductance µS/cm (default- NIST), Conductance mS/cm (NIST), Conductance mS/m(default - ISO), Conductance S/m (ISO), TDS ppm, TDS ppt,</td></tr>
<tr><td>10</td><td>Conductance µS/cm (default- NIST), Conductance mS/cm (NIST), Conductance mS/m(default - ISO), Conductance S/m (ISO), TDS ppm, TDS ppt.</td></tr>
<tr><td>25</td><td>Concentration (default), Conductance µS/cm (default- NIST), Conductance mS/cm (NIST), Conductance mS/m(default - ISO), Conductance S/m (ISO),</td></tr>
<tr><td>50</td><td>Concentration (default), Conductance µS/cm (default- NIST), Conductance mS/cm (NIST), Conductance mS/m(default - ISO), Conductance S/m (ISO),</td></tr>
</table></td></tr>
<tr><td></td><td>PV Range</td><td></td><td>Read Only</td></tr>
<tr><td></td><td>Cell Constant *</td><td>0.01
0.1 (default)
1
10
25
50</td><td>The Cell Constant is a value specific to a category of cells for the measurement range required.</td></tr>
<tr><td></td><td>Cal Factor *</td><td>0.850 to 1.150
default = 1.000</td><td>The Cal Factor is a correction value applied to the cell’s Cell Constant, which is unique to each cell to take into account tolerances in manufacture.

If a standard cell is attached to the sensor, the Cell Constant defaults to “0.1” and the Cal Factor defaults to “1.000”. These standard cell parameter values are editable and are retained through a power cycle.</td></tr>
<tr><td></td><td colspan="3">*Cell Constant and Cal Factor are automatically uploaded from Honeywell conductivity cells with EEPROM (blue & brown leads) and these values cannot be edited.</td></tr>
</table>

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	TDS Factor **(only PV Type TDS)**	0.010 **1.000(default)** 2.000	The TDS Factor is a conversion value applied to conductivity to derive total dissolved solids, in units of ppm per µS/cm.
	Temp Type	**8550Ω Therm (default)** 1000Ω RTD Manual	8550Ω Thermistor 1000Ω Resistance Temperature Detector Manual
	Temp Deg C or F	-10.0 to 140.0ºC 14 to 284ºF	If “Manual” is selected at “Temp Type” -Temp Deg F or C will appear depending on what Temperature Unit was selected in “Maintenance” setup group, parameter “Temp Units”.

<table>
<tr><th>Sub-menu selection</th><th>Parameter</th><th>Selection or Range of Setting</th><th>Parameter Definition</th></tr>
<tr><td></td><td>Solu Temp Comp</td><td>None
Custom
H20
NH3
PO4
C4H9NO
HCl
NaCl (default)
H2SO4
NaOH</td><td>Measured Conductivity and Resistivity can optionally be temperature compensated to 25°C for a specific solution type. TDS and concentration are always measured based on a specific solution type. The cell constant and measurement type determines which solution types are available for selection, according to the table below:
<table>
<tr><th>Cell Constant</th><th>Available Selectable Solution Types
Use the ▲▼ keys to select</th></tr>
<tr><td>0.01</td><td>None (Conductivity/Resistivity only),
NaCl (µS/cm, mS/cm, TDS ppb, TDS ppm),
NH_3 (µS/cm, TDS ppb, TDS ppm),
C_4H_9NO (µS/cm, TDS ppb, TDS ppm),
H2SO4;HCL;NaOH (mS/cm)</td></tr>
<tr><td>0.1
(Default)</td><td>None (Conductivity/Resistivity only),
NaCl(µS/cm, mS/cm, TDS ppb, TDS ppm),
NH_3(µS/cm, TDS ppb, TDS ppm),
C_4H_9NO (µS/cm, TDS ppb, TDS ppm),
H_2SO_4;HCL;NaOH (mS/cm)</td></tr>
<tr><td>1</td><td>None (Conductivity only),
NaCl (µS/cm, mS/cm, TDS ppm, TDS ppt),
NH_3 (µS/cm, TDS ppm),
C_4H_9NO (µS/cm, TDS ppm),
H_2SO_4;HCL;NaOH (mS/cm, TDS ppt)</td></tr>
<tr><td>10</td><td>None (Conductivity only),
NaCl (µS/cm, mS/cm, TDS ppm, TDS ppt),
NH_3 (µS/cm, TDS ppm),
C_4H_9NO (µS/cm, TDS ppm),
H_2SO_4;HCL;NaOH (mS/cm, TDS ppt)</td></tr>
<tr><td>25</td><td>None (Conductivity only),
HCl (mS/cm, Concentration),
NaCl (µS/cm, mS/cm, Concentration),
H_2SO_4 (mS/cm, Concentration),
NaOH (mS/cm, Concentration)</td></tr>
<tr><td>50</td><td>None (Conductivity only),
HCl (mS/cm, Concentration),
NaCl (µS/cm, mS/cm, Concentration),
H_2SO_4 (mS/cm, Concentration),
NaOH (mS/cm, Concentration)</td></tr>
</table></td></tr>
<tr><td></td><td>Wire Len Feet +</td><td>0 to 1000 ft
default = 0</td><td rowspan="2">Refer to appendix 15.2 to enter values for lead wire resistance compensation</td></tr>
<tr><td></td><td>Wire Len Meters +</td><td>0 to 304.80
default = 0</td></tr>
</table>

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	Wire Size AWG +	16 AWG **18 AWG(default)** 20 AWG 22 AWG	
	Wire Size Sq mm +	0.33 to 2.08 **default = 0.82**	
	Pharma Type	None PhEur USP **default = None**	PhEur - Pharmacopoeia Europa USP - United States Pharmacopoeia standard procedure stages for determining Purified Water
	Pharma PV High	-99999.00 to 99999.00 **(default 10.000)**	Pharma PV High Value – Measured solution conductivity value scaled for 100%
	Pharma PV Low	-99999.00 to 99999.00 **(default 0.000)**	Pharma PV Low Value - Measured solution conductivity value scaled for 0%
	Pharm Tmr Mins	000.0 to 120.0 **(default 10.000)**	**Pharma Timer Minutes** - If the Pharma sample does not pass the Stage 1 conductivity requirement a **Fail signal** is generated, then the State 2 and Stage 3 tests are conducted. When the Stage 2 or Stage 3 test is successful, the fail signal is cancelled and the **Pharma Timer begins to count down from the configured minutes value set here.** When the Timer countdown is completed, the Pharma function block returns to Stage 1.
	PV Bias	-9999.00 to 9999.00 **default = 0.000**	PV Bias Constant - is used to compensate the input for drift of an input value.
	Failsafe	0.0 to 2000 **default = 2000.000**	The output value to which the output will go to protect against the effects of failure of the equipment.
	Filter Time	0 to 120.0 **default = 0.000**	A software digital filter is provided for dampening the process noise and is applied before the limit functions.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Input 1 or Input 2 DO *Dissolved Oxygen*	PV Type	DO% Sat **DO Concen (default)**	The concentration of oxygen dissolved in water (or other liquid) may be described by either "dissolved oxygen **(DO) concentration**" or **percent saturation**. The units for DO are either parts per million - PPM (equivalent to milligrams per liter) or parts per billion - PPB (equivalent to micrograms per liter). The units of saturation are percent where 100% saturation is equivalent to the concentration of oxygen dissolved in air-saturated water. For instance, at 25°C and one atmosphere pressure, 8.24 ppm = 100% saturation. Although the ppm and ppb concentration units are the most frequently used units by far, % saturation may be appropriate for non-aqueous liquids like vegetable oil.
	PV Range	0 – 200 ppb, displayable to 20000ppb 0-20 ppm 0 – 100% sat, displayable to 200% sat	Read Only
	Temp Type	**5000Ω Therm Default** 1000Ω RTD Manual	5000Ω Thermistor 1000Ω Resistance Temperature Detector Manual
	Temp Deg C or F (Temp Type = Manual)	0 to 60ºC 32 to 140ºF	Temp Deg F or C will appear depending on what Temperature Unit was selected in "Maintenance" setup group, parameter "Temp Units".
	Salinity Type	**Manual (default)** Conduc Input	Salinity is used to correct for salt in the process water. Manual Valid only if conductivity board is present.
	Salinity ppt *"Manual" Salinity type only*	0.00 to 40.00ppt **default = 0.00**	(parts per thousand) as sodium chloride 0.0 = No selection
	Pressure Type	Manual **Sensor (default)**	Allows manual entry of atmospheric pressure compensation Internal sensor for atmospheric pressure compensation during air calibration
	Pressure mm Hg *(Manual Pressure type only)*	500.0 to 800.0 **default = 760 mmHg**	Atmospheric pressure compensation. Enter a value in mmHg.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	PV Bias		PV Bias Constant - is used to compensate the input for drift of an input value.
		-20.00 to 20.00 PPM	If PPM Board is installed.
		-20000 to 20000 PPB	If PPB Board is installed.
		default = 0.000	
	Failsafe		The output value to which the output will go to protect against the effects of failure of the equipment.
		0.000 to 20.00 PPM	If PPM Board is installed.
		0.000 to 20000 PPB	If PPB Board is installed.
		default = 20.000	
	Filter Time	0 to 120.0 **default = 0.0**	A software digital filter is provided for dampening the process. The units are in time constant seconds.

6.7 Outputs Configuration

Overview

This group lets you select the signal that will be transmitted.

Accessing Outputs Menu

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Outputs"** then press Enter to enter the sub-menu.
- **Output 1, Output 2, or Output 3** and their associated parameters are available for selection.
- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 - ***General Rules for Editing***".

Table 6-6 Outputs Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Output 1 **Output 2** **Output 3**	Source	Any Analog Signal See Table 6-3	Process Variable Source - Selects the signal that will be transmitted. See Note 1 for units.
	High Range	-99999.00 to 99999.00	High Range Value - value of input that corresponds to 100 % output value. See Note 1 for units.
	Low Range	-99999.00 to 99999.00	Low Range Value - value of input that corresponds to 0 % output value. See Note 1 for units.
	Slew Time	0.000 to 999.00 in seconds **default = 0.000**	Slew Time is the maximum rate of change required to drive the output from full OFF (0% - typically 4 mA) to full ON (100% - typically 20mA).
	mA Range High	0 to 20 **default = 20**	Value of mA output that corresponds to 100 % output signal (for example: 20 mA).
	mA Range Low	0 to 20 **default = 4**	Value of mA output that corresponds to 0 % output signal (for example: 4 mA).
	mA Limit High	0 to 21 **default = 21**	Value of mA that you want to set the High Range Limit.
	mA Limit Low	0 to 21 **default = 3**	Value of mA that you want to set the Low Range Limit.

NOTE 1.

The entries for any parameter are in the units of that parameter.

For example:

Parameters in engineering units.

Input 1 PV

Input 1 Temp

Input 2 PV

Input 2 Temp

Pharma Out 1

Pharma Out 2

Parameters in %

Control 1

Control 2

Math 1,2,3,4

Output 1,2,3

So in the SETUP OUTPUT menu, for the SOURCE and Hi Range and Low Range values, **these look at the units of that source.**

If retransmitting a pH input, the Hi Range and Low Range values would normally be set to 14 pH and 0 pH. (14 pH= 100% output, and 0 pH = 0% output.)

But if the output is to go to a valve, to open the valve or operate a pump through a range of 0-100% open, and has a SOURCE of CONTROL 1, then the units of the CONTROL 1 output is in units of %, so in the SETUP OUTPUT menu, the High Range and Low Range would be in % units.

6.8 Relays Configuration

Overview

Programming the relays consists of selecting the relay type, identifying the input parameter, which activates the relay and selecting whether the relay is energized when the input parameter is on or off. The Relay group lets you select a relay type for up to four relays. When planning relay operation, it is wise to consider the state of the relay when power is not applied to the UDA. The invert parameter of the relay configuration is helpful in assuring that the Off device state is consistent with the relay normal operation.

Each relay output can be independently configured to be one of four basic types:

A Digital Output Relay allows connection to any Alarm, Alarm Group, Monitor, Logic, Digital Input, Input Fault, Output Fault, Hold Key, Pharm Warn, Pharm Fail, Control Alarms, Input 1 and 2 Rinse and Cal Pts, Cycle on or fail.

Time proportional output is a form of a process variable transmitter or control output that pulses the relay as a pulse width modulated signal that is proportional to the input signal over a configured input range. The Time Proportional cycle time is configurable between 0.1 and 999 seconds while the duty cycle is directly proportional to the selected input signal.

Frequency proportional output is a form of a process variable transmitter or control output that pulses the relay as a pulse rate that is proportional to the input signal over a configured input range. The maximum frequency is set by the cycle time that is configurable between 0.1 and 999 seconds. The pulse duration is fixed and configured in seconds by an on time parameter.

On / Off output relay turns On when the input is greater than the high and low ranges and turns off when the input is less than the high and low ranges. This allows an on / off control action with an adjustable dead band. The On state is controlled by a cycle time and on duration parameters such to achieve a selectable output proportion. An invert parameter is available to allow inverse action such that the relay will cycle ON when below the low range limit.

Pulse Output relay will provide a fixed duty cycle when the applied input signal is ON. The cycle time and pulse duration are configurable parameters. The relay will be OFF when the applied input is OFF. An inverse parameter allows the input to be inverted for reverse behavior.

Accessing Relays Menu

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Relays"** then press Enter to enter the sub-menu.
- **Relay 1, Relay 2, Relay 3 or Relay 4** and their associated parameters are available for selection.

- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-7 Relays Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Relay Types ***Set relay types first***	**Type**	**Digital Out** **Time Prop** **Freq Prop** **On/Off** **Pulse Out**	Digital Output Relay (default) Time Proportional Output Relay Frequency Proportional Output On / Off control relay Pulse Output
Relay 1 **Relay 2** **Relay 3** **Relay 4** ***Digital Output Relay***	A **Digital Output Relay** allows connection to any Alarm, Control Alarm, Logic, Alarm Event, Hold, Input or Output Fault, or Digital Input.		
	Source	Any Digital Signal See Table 6-4	Digital Source
	Invert	Enable **Disable (default)**	Inverts the input state of the applied digital input such that inverse relay operation is achieved
Relay 1 **Relay 2** **Relay 3** **Relay 4** ***Time Proportional Output Relay***	**Time proportional output** is a form of a process variable transmitter or control output that pulses the relay as a pulse width modulated signal that is proportional to the input signal over a configured input range. The Time Proportional cycle time is configurable between 0.1 and 999 seconds while the duty cycle is directly proportional to the selected input signal.		
	Source	Any Analog Signal See Table 6-3	PV Source
	High Range	-99999 to 99999 **default = 100.00**	The high range is the PV based engineering unit value configured as the value that will produce a 100 percent (always active) duty cycle.
	Low Range	-99999 to 99999 **default = 0.00**	The low range is the PV based engineering unit value configured as the value that will produce a 0 percent (always inactive) duty cycle.
	Invert	Enable **Disable (default)**	Inverts the proportional range of the applied analog input such that inverse relay operation is achieved.
	Cycle Time	0 to 999 seconds **default = 10**	Cycle time is that time period, in seconds, the relay will be activated.
	Min Off Time	0 to 15 **default = 0**	Minimum off is that time period, in seconds, the relay will be activated.
	Min On Time	0 to 15 **default = 0**	Minimum On is that time period, in seconds, the relay will be activated.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Relay 1 **Relay 2** **Relay 3** **Relay 4** ***Frequency Proportional Output Relay***	**Frequency proportional output** is a form of a process variable transmitter or control output that pulses the relay as a pulse rate that is proportional to the input signal over a configured relay range. The maximum frequency is set by the cycle time that is configurable between 0.1 and 999 seconds. The pulse duration is fixed and configured in seconds by an on time parameter.		
	Source	Any Analog Signal See Table 6-3	PV Source
	High Range	-99999 to 99999 **default = 100.00**	The high range is the PV based engineering unit value configured as the value that will produce a 100 percent (Maximum Frequency) duty cycle.
	Low Range	-99999 to 99999 **default = 0.00**	The low range is the PV based engineering unit value configured as the value that will produce a 0 percent (always inactive) duty cycle.
	Invert	Enable **Disable (default)**	Inverts the proportional range of the applied analog input such that inverse relay operation is achieved.
	Cycle Time	0 to 999 **default = 10**	Sets the Cycle Time of the maximum output frequency. Max Freq=1/Cycle Time Freq Output = Max Freq * (% Input/100) For example: Freq Output (100%)=Max Freq * 1 Freq Ouput (50%)= Max Freq * .5 Freq Ouput (25%)=Max Freq * .25
	On Time	0.0 to 999 **default = 5**	Sets the pulse duration. This value should be less than the cycle time for proper operation. Typically this value is used to control the pulse duration for the finial output control element.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Relay 1 **Relay 2** **Relay 3** **Relay 4** ***ON/OFF Control Relay***	**On / Off output** relay turns On when the input is greater than the relay high and low ranges and turns off when the input is less than the relay high and low ranges. This allows an on / off control action with an adjustable dead band. The On state is controlled by a cycle time and on duration parameters such to achieve a selectable output proportion. An invert parameter is available to allow inverse action such that the relay will cycle ON when below the low range limit.		
	Source	Any Analog Signal See Table 6-3	PV Source
	High Range	-99999 to 99999 **default = 100.00**	The high range is the PV based engineering unit value configured as the value that will produce a 100 percent (Maximum Frequency) duty cycle.
	Low Range	-99999 to 99999 **default = 0.00**	The low range is the PV based engineering unit value configured as the value that will produce a 0 percent (always inactive) duty cycle.
	Invert	Enable **Disable (default)**	Inverts the proportional range or input state of the applied digital or analog input such that inverse relay operation is achieved.
	Cycle Time	0 to 999 **default = 10**	Cycle time is that time period, in seconds, between relay activations.
	On Time	0,0 to 999 **default = 5**	Sets the pulse duration. This value should be less than the cycle time for proper operation. Typically this value is used to control the pulse duration for the finial output control element.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Relay 1 **Relay 2** **Relay 3** **Relay 4**	**Pulse Output relay** will provide a fixed duty cycle when the applied input signal is ON. The cycle time and pulse duration are configurable parameters. The relay will be OFF when the applied input is OFF. An inverse parameter allows the input to be inverted for reverse behavior.		
Pulse Output Control Relay	Source	Any Digital Signal See Table 6-4	PV Source
	Invert	Enable **Disable (default)**	The digital output relays "invert" parameter can be used to allow direct (invert disabled) or reverse (invert enabled) control actuation.
	Cycle Time	0 to 999 **default = 10.0**	Cycle time is that time period, in seconds, between relay activations.
	On Time	0 to 999 **default = 5.0**	The time in seconds that the relay is On during each cycle when the input to the Pulse Output is ON. When the Input to the Pulse output is OFF the relay is not activated.

6.9 Alarms Configuration

Overview

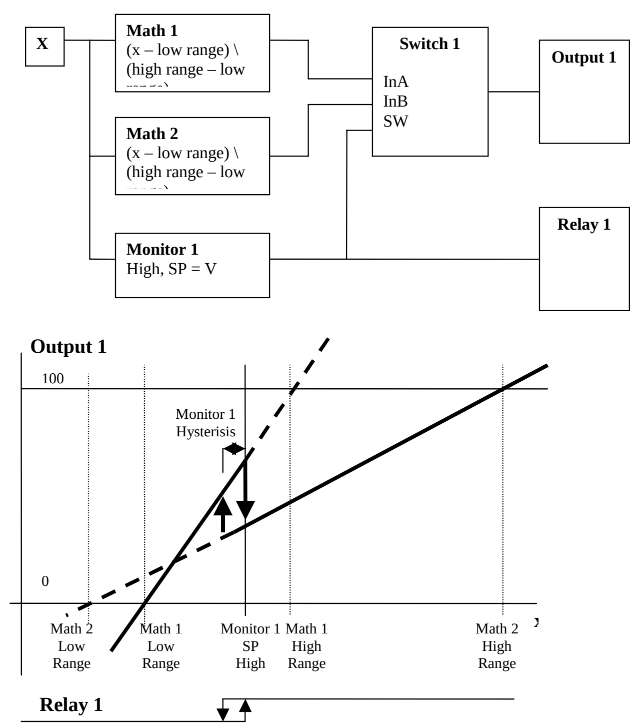
Alarm 1 through 4

Alarm selections can be connected to any Analog Signal (Table 6-3 Analog Signal Sources). Each alarm supports a setpoint type and value.
Alarm selections generate front panel alerts, support latching/acknowledge, with on delay timers. Select any Digital signal (Table 6-4 Digital Signal Sources) to disable the Alarm

Example: Using Math, Switch and Monitor blocks to achieve auto range functions

This example shows how to use the math blocks to scale the output in multiple ranges and uses a monitor and switch to select the desired amplification for the input. A relay is connected in parallel to the switch to provide an indication as to which range is currently being transmitted.

Range Switch using Math, Monitor, and Switch Blocks



Accessing Alarms Menu

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Alarms"** then press Enter to enter the sub-menu.
- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-8 Alarms Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Alarm 1 **Alarm 2** **Alarm 3** **Alarm 4**	Source	Any Analog Signal See Table 6-3	Process Variable Source – Process Variable to be monitored by the alarm.
	Disable	Any Digital Signal See Table 6-4	Select any Digital signal to disable the Alarm
	Type	**High (default)** Low	Alarm actions may be High or Low.
	Setpoint Value	-99999 to 99999.9 in Engineering Units **default = 0.000**	Setpoint value in engineering units
	Latch	**Disable (default)** Enable	When enabled, the alarm is latch ON until acknowledged from the Alarm Status display.
	Hysteresis	0.0 to 99999.9 in engineering units **default = 0.000**	Hysteresis - A user-specified hysteresis value in the engineering units of the process variable source is provided. Hysteresis in engineering units can be set from 0 to the input span of the monitored variable.
	On Delay	0 to 120 seconds **default = 0.000**	An on-delay time value up to 120 seconds is available to prevent momentary alarm actions. Number of seconds the alarm is active before activating the Output.

6.10 Monitors Configuration

Overview

Monitor 1, 2, 3, and 4

A Monitor Block is used to determine when a process value is greater or less than a specified setpoint. Monitor blocks can be used for ON/OFF type control or, in conjunction with switch and math blocks to change process gain based upon control regions. The Monitor block provides a hysteresis value limit output transitions near the set point value. The Monitor block can be configured as either a High or Low Monitor type. There are four monitor blocks provided for general use.
Unlike Alarms, Monitor blocks do not create an event in the event history, nor do they cause a status message to appear on the display.

Accessing Monitors Menu

- Press [Setup] to display the Main menu.
- Use the ▲▼ keys to select **"Monitors"** then press [Enter] to enter the sub-menu.
- Press ▲▼ to highlight the desired Monitor selection then press [Enter] to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-9 Monitors Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Monitor 1 **Monitor 2** **Monitor 3** **Monitor 4**	Monitor Type	**High (default)** Low	Alarm actions may be High or Low. (See NOTE 2 on next page)
	Source	Any Analog Signal See Table 6-3	Analog Signal Source – Process signal to be monitored by the Alarm. Any analog source such as PV, Temperature, Pharma, Math, Function Generator, Switch, PID, or Calculated Values* * units of measure between the two input boards must be similar
	Setpoint Value	0 to 99999.9 in Engineering Units **default = 0.000**	Setpoint Value in Engineering Units used for activation of the output based upon the monitor type
	Hysteresis	0.0 to 99999.9 in engineering units **default = 0.000**	Hysteresis - A user-specified hysteresis value in the engineering units of the process variable source is provided. Hysteresis in engineering units can be set from 0 to the input span of the monitored variable.
	On Delay	0 to 999 seconds **default = 0.0**	An on-delay time value up to 999 seconds is available to prevent momentary alarm actions. Number of seconds the alarm is active before activating the Output.

See Notes on next page

NOTE 2: For High Monitor
If Input greater than setpoint Output = ON
else if Input less than set point – hysteresis, Output = OFF
else Output is unchanged

For Low Monitor
If Input less than setpoint Output = ON
else if Input greater than set point + hysteresis, Output = OFF
else Output is unchanged

6.11 Math Configuration

Overview

The Math group has four Math selections (Math 1, Math 2, Math 3, and Math 4). Math selections can be connected to any Analog Signal source (Table 6-3). Math blocks include scaling for the linear selection only.

The Math Block can also be used for proportional control over the math blocks configured range for control of any Input PV, Temperature, or calculated values by connecting it to a current output, TPO relay, or FPO relay. Since multiple outputs can share a common math block, the output range of a math block can be split over multiple outputs or relays with each output or proportional relay using a specific portion of the % output range of the math block.

Accessing Math Menu

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Math"** then press Enter to enter the sub-menu.
- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-10 Math Configuration

Sub-menu	Parameter	Selection or Range of Setting	Parameter Definition
Math 1 **Math 2** **Math 3** **Math 4**	Type	**Linear (default)**	Provide a linear output with Gain and Offset with digital filtering. Output = Filter (Gain * (Input) + Offset) Linear is simple linear scale used to retransmit the PV using the High Range as scaled 100% output and the Low Range is the scaled to 0% output. There is no restriction on the High and Low ranges. Setting the high range to a value less than the low range will invert the action of the math output. Limit out has no effect on the output.
		Log	Log (base 10): Output = Log(Input): Input > 10^-10 Output = -10 Input <= 10^-10 Output Block Low Range=Log(Input low value)
		Sq Root	Square Root: Output = SqRoot(Input). Input > 0 Output = 0 Input < 0
		Abs Value	Absolute Value If Input >= 0 then Output = Input If Input < 0 then Output = -Input
		Any Analog Signal See Table 6-3	Analog Signal Source – Process signal to be monitored by the Alarm. Any analog source such as PV, Temperature, Pharma, Math, Function Generator, Switch, PID, or Calculated Values* * units of measure between the two input boards must be similar
	Source	-99999 to 99999.9 in Engineering Units **default = 1.000**	For Linear Math Types. Gain multiplier for Calculation Output = Gain * Input + Offset
	Gain (Linear Only)	-99999 to 99999.9 in Engineering Units **default = 0.000**	For Linear Math Types. Offset for Calculation Output = Gain * Input + Offset
	Offset (Linear Only)	-99999 to 99999.9 in Engineering Units **default = 0.000**	
	Filter Time	0 to 120 **default = 0.0**	A software digital filter is provided for dampening the process noise and is applied before the limit functions. The units are in time constant seconds.

6.12 Logic Configuration

Overview

The Logic group has four selections (Logic1, Logic 2, Logic 3, and Logic 4). Logic selections have 2 input sources (A and B) and a selection for the Logic Type – "AND", OR", or LATCH.

The sources can be any Digital Signal Source (Table 6-4).

Accessing Logic Menu

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Logic"** then press Enter to enter the sub-menu.
- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-11 Logic Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Logic 1 **Logic 2** **Logic 3** **Logic 4**	Type	**None (default)** **AND** **OR** *Note: User must set to "OR" if only one input source is being used.* **LATCH**	None **AND** -Turns digital output ON when input IN A Source and IN B Source are ON. Thus, If *all* inputs are ON, then: OUT = ON. If *any* input is OFF, then: OUT = OFF. **OR -** Monitors Input A Source and Input B Source to set state of digital output signal. If A = OFF and B = OFF, then OUT = OFF. If A = ON and/or B = ON, then: OUT = ON. **LATCH** – Sets and Resets Latch state of the Output. If A=ON, B=OFF The Output is Latched ON. If A=OFF, B=ON, The Output is Latched OFF. If A and B are ON the Output = ON If A and B are OFF the Output = Latch State. Power On considerations. The output state of the latch is cleared on power on.
	In A Source In B Source	Any Digital Signal See Table 6-4	Input A logic source selections, and Input B logic source selections
	Invert	**None (default)** IN A IN B In A and B	You can invert Input A or Input B or both. If the input is inverted, an input line that is ON is seen as OFF
	On Delay	0 to 120 seconds **default = 0.0**	An on-delay time value up to 120 seconds is available to prevent momentary logic gate output actions. Number of seconds the logic gate is true before activating the Output.

6.13 Auxiliary Configuration

Overview

The Auxiliary group has four selections (Switch 1 and Switch 2) and (Func Gen 1 and Func Gen 2).

Switch

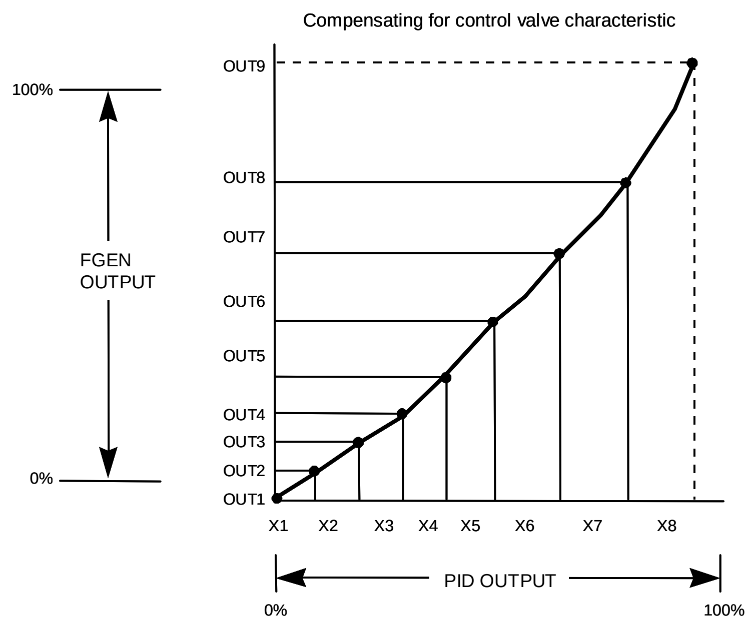
Switch selections have 2 input sources (A and B). A switch block is used to select between two analog signals. The switch block can be used for many monitor and control strategies. A Digital Signal Source (Table 6-4) when active will select the B input source of the switch as the output.
The Switch Input sources can be any Analog Signal Source (Table 6-3).
There are two switch blocks provided for general use.

Func Gen (Function Generator)

Function Generators are used for pre-control linearizing of inputs (such as during pH titration).
Function Generator selections have 2 input sources (Input 1 PV and Input 2 PV).

It generates an output characteristic curve based on up to 11 configurable "Breakpoints" for both Input (X) and Output (Y) values.

The figure below shows an example of using the Func Gen to characterize the PID control loop output for control valve operation using 9 breakpoints.

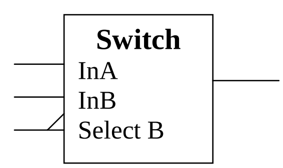


Accessing Auxiliary Menu

- Press **Setup** to display the Main menu.
- Use the ▲▼ keys to select **"Auxiliary"** then press **Enter** to enter the sub-menu.
- Press ▲▼ to highlight the desired menu selection then press **Enter** to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-12 Auxiliary Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Switch 1 **Switch 2**	In A Source In B Source	Any Analog Signal See Table 6-3	Analog Signal Source – Process signal to be monitored by the Alarm. Any analog source such as PV, Temperature, Pharma, Math, Function Generator, Switch, PID, or Calculated Values* * units of measure between the two input boards must be similar
	Select B	Any Digital Signal See Table 6-4	Digital Signal Source when active will select the B input source of the switch as the output  If Select B is OFF then Switch Output = In A If Select B is ON then Switch Output = In B
Func Gen 1 **Func Gen 2**	Source	None Input 1 PV Input 2 PV PID 1 Out PID 2 Out	Function Generator selections have 2 input sources (Input 1 PV and Input 2 PV).
	ATTENTION The X (n) value must be < X(n+1) value. Thus, **if fewer than 11 breakpoints are needed**, be sure to configure any unneeded breakpoints with the same X and Y values used for the previous breakpoint.		

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	X1 Y1	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 0.000	X-value at Input Breakpoint 1 Y-value at Input Breakpoint 1
	X2 Y2	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 10.000	X-value at Input Breakpoint 2 Y-value at Input Breakpoint 2
	X3 Y3	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 20.000	X-value at Input Breakpoint 3 Y-value at Input Breakpoint 3
	X4 Y4	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 30.000	X-value at Input Breakpoint 4 Y-value at Input Breakpoint 4
	X5 Y5	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 40.000	X-value at Input Breakpoint 5 Y-value at Input Breakpoint 5
	X6 Y6	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 50.000	X-value at Input Breakpoint 6 Y-value at Input Breakpoint 6
	X7 Y7	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 60.000	X-value at Input Breakpoint 7 Y-value at Input Breakpoint 7
	X8 Y8	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 70.000	X-value at Input Breakpoint 8 Y-value at Input Breakpoint 8
	X9 Y9	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 80.000	X-value at Input Breakpoint 9 Y-value at Input Breakpoint 9
	X10 Y10	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 90.000	X-value at Input Breakpoint 10 Y-value at Input Breakpoint 10
	X11 Y11	–99999 to 999999 Default= 0.000 –99999 to 999999 Default= 100.000	X-value at Input Breakpoint 11 Y-value at Input Breakpoint 11

6.14 PID Control Configuration

Overview

PID (Option) - Proportional (P), Integral (I) and Derivative (D), (3-mode) control action based on the deviation or error signal created by the difference between the setpoint (SP) and the Process variable analog input value (PV). PID Tuning parameters are available.

Automatic tuning with Fuzzy Logic Overshoot Suppression can be configured.

Other parameters listed in this group deal with how the analyzer will control the process including: PV High and Low, Setpoint High and Low limits, the Control Algorithm and Action, PID Tracking (TRV and TRC), Number of Tuning Parameter Sets and associated parameters, Setpoint Rate, Power-up Recall, Output Limits, Failsafe Output Value, Alarm setpoint type and value, and Alarm Hysteresis.

PID Tracking

PID tracking is a means to control a PID's output without the PID loop winding up.
It is accomplished by the use of two inputs.

TRC (tracking control) – selects the tracking mode (See Table 6-13)

TRV (tracking value) **–** is the commanded output value in percentage
(PID Output = TRV Input when TRC = ON) (See Table 6-13)

When TRC is active, the front-panel display will indicate TRV for the PID loop.

Remote PID Tracking

Variables can be connected to TRC and TRV to allow remote control of the PID output.
TRC can be connected to a digital variable
TRV can be connected to an analog variable

PID Tracking versus Manual Mode

Tracking is not the same as manual mode.

- Tracking value cannot be adjusted from the front-panel. Manual output value can.
- Manual output cannot be adjusted remotely. Tracking value can.
- Manual has priority over tracking. If operating in the tracking mode, the output can be adjusted from the front-panel by selecting manual and adjusting the output. When manual is terminated, the active mode will be TRC and the output will go to TRV.

Using Auto/Manual Switch

It may be desirable to use a discrete input to place a PID into manual momentarily to freeze the output. With tracking, this can be done.

1. Connect the TRV to PID output
2. Connect the TRC to a discrete input

When the discrete input is active, the output is frozen – MANUAL select.

When the discrete input is inactive, the PID runs in the auto mode – AUTO select.

While TRV is active, the output can be adjusted using manual mode from the front-panel. After manual mode is terminated, the output will remain at the level because the output is tied to TRV.

ATTENTION

Upgrading software on the UDA2182 to a new version will remove PID control (on units where PID has been ordered or been added in the Field).

Therefore, the following steps need to be followed in order to retrieve that option:

If PID was ordered when the unit was originally ordered:

- Retrieve your Unit ID by going to the MAINTENANCE → SYSTEM menu
- Call GTS (1-800-423-9883)
- Inform them that you are going to do a software upgrade and you need the Option ID for your unit (this is why you need the Unit ID)
- Record **Option ID** for next step
- After upgrading software, go to MAINTENANCE → SYSTEM menu and enter the recorded **OPTION ID** value.
- The PID will have to be reconfigured to settings prior to upgrade.

If PID was added after the unit was originally shipped:

- Before upgrading software, go to MAINTENANCE → SYSTEM menu and record the **OPTION ID** value.
- After upgrading software, go to MAINTENANCE → SYSTEM menu and enter the recorded **OPTION ID** value.

The PID will have to be reconfigured to settings prior to upgrade.

Accessing Control Menu

(See "Maintenance" Menu item (Section 6.18), "System" selection to Enable PID Control)

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"PID Control"** then press Enter to enter the sub-menu.
  PID Control 1 and 2 are divided into 3 sections:

  PID(n) Config (Table 6-13)**,**
  PID(n)Tune (Table 6-14),
  PID(n)Alarms (Table 6-15)
- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-13 PID Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
PID 1 Config **PID 2 Config**	PV Source	None **Input 1 PV (default)** Input 2 PV	Process Variable Source
	PV High	-99999 to 99999 **default = High Range of PV Input**	Input Range of the PV - High Range Value These values are in units of that Input PV, such as 0-14pH.
	PV Low	-99999 to 99999 **default = Low Range of PV Input**	Input Range of the PV **-** Low Range Value These values are in units of that Input PV, such as 0-14pH.
	SP High Limit	-99999 to 99999 **default = High Range of PV Input**	Setpoint High Limit Value - prevents the setpoint from going above the value set here.
	SP Low Limit	-99999 to 99999 **default = Low Range of PV Input**	Setpoint Low Limit Value - prevents the setpoint from going below the value set here.
	Output High Limit	-99999 to 99999 **default = 100.00**	Output High Limit Value - is the highest value of output beyond which you do not want the automatic output to exceed.
	Output Low Limit	-99999 to 99999 **default = 0.00**	Output Low Limit Value - is the lowest value of output beyond which you do not want the automatic output to go below.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	Control Alg	**PIDA (default)** PIDB Duplex A Duplex B *Note:* *In PID A, a step change in setpoint will result in a step change in output.* *In PID B, step changes in setpoint will not bump the output; the output will slew smoothly to the new value.*	**PID A** - is normally used for 3-mode control. The output can be adjusted somewhere between 100 % and 0 %. It applies all three control actions -Proportional (P), Integral (I), and Derivative (D) - to the error signal. **PID B** - Unlike the PID-A equation, the analyzer gives only an integral response to a setpoint change, with no effect on the output due to the Gain or Rate action, and gives full response to PV changes. **DUPA -** like PID A but provides an automatic method to switch tuning constant sets. **DUPB -** like PID B but provides an automatic method to switch tuning constant sets. Note: For Duplex A and Duplex B if the output is greater than 50%, then tuning set 1 is used. If the output is less than 50%, then tuning set 2 is used.
	Control Action	Direct **Reverse (default)**	**DIRECT** - PID action causes output to **increase** as process variable increases. **REVERSE** - PID action causes output to **decrease** as process variable increases.
	Power Mode	**Manual(default)** Last	Mode permitted at power up.
	Power Out	**Failsafe (default)** Last	Output at Power up **FAILSAFE** - Failsafe output value. **LAST** - Same as at power down.
	Failsafe Out	-5.00 to 105.00% **default = 0.00**	Failsafe Output Value – The Output value to which the analyzer will go if there is a power down or Failsafe condition (Input Faults).
	Manual Select	Any Digital Signal See Table 6-4	Selects Manual Output
	SP Power On	Last **Local SP(default)**	Setpoint at Power up **LAST** - Same as at power down. **Local SP** – Local Setpoint value.
	RSP Source	Any Analog Signal See Table 6-3	Selects the analog signal that will be used as the remote setpoint. The remote setpoint should be supplied in PV engineering units.
	Ratio	**1.0 (Default)** -20 to 20	Ratio that is applied to the Remote Setpoint.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	Bias	**0.0 Default** **-9999 to 99999**	Bias that is applied to the Remote Setpoint.
	RSP Select	Monitor (1 – 4) Logic (1 – 4) Digital In (1 – 2)	When this input is ON, the Remote Setpoint is used. If set to None, the operator can select the remote setpoint from the PID operator display.
	FF Source	Any Analog Signal See Table 6-3	Feed Forward value that is applied to the output. A change in the feed forward signal input will result in a proportional change in the output per the feed forward gain parameter.
	FF Gain	**1.000 (default)** **0.1 to 1000.0**	Feed Forward Gain used to calculate the change in the PID output based upon a change of the feed forward input signal.
	TRC Select	Any Digital Signal See Table 6-4	**TRC** (tracking control) – selects the tracking mode **TRV** (tracking value) – is the commanded output value in percentage (PID Output = TRV Input when TRC = ON) When TRC is active, the front-panel display will indicate TRC for the PID loop. Variables can be connected to TRC and TRV to allow remote control of the PID output. **TRC** can be connected to a digital variable **TRV** can be connected to an analog variable
	TRV Select	Any Analog Signal See Table 6-3	
	Manual Permit	**Enable (default)** Disable	Allows the operator to select Manual Operation of the PID loop from the PID Operator Display
	Auto Permit	**Enable (default)** Disable	Allows the operator to select Auto Operation of the PID loop from the PID Operator Display
	LSP Permit	**Enable (default)** Disable	Allows the operator to select the Local Setpoint from the PID Operator Display
	RSP Permit	**Enable (default)** Disable	Allows the operator to select the Remote Setpoint from the PID Operator Display

Table 6-14 PID Tuning

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
PID 1 Tune **PID 2 Tune**	Accutune	Enable **Disable (default)**	When enabled, the analyzer will start controlling to the setpoint while it identifies the process and adjusts the Gain or Proportional Band (P), Rate (I), and Reset Time (D) tuning constants in response to setpoint changes and/or Process Variable disturbances.
	Fuzzy Logic	Enable **Disable (default)**	Fuzzy Overshoot Suppression minimizes overshoot after a setpoint change or a process disturbance. The fuzzy logic observes the speed and direction of the PV signal as it approaches the setpoint and temporarily modifies the internal control response action as necessary to avoid an overshoot. There is no change to the PID algorithm, and the fuzzy logic does not alter the PID tuning parameters. This feature can be independently Enabled or Disabled as required by the application to work with Accutune.
	Use Prop Band	Enable **Disable (default)**	When enabled, Proportional band is used instead of Gain (default). See "Gain or Prop Band".
	Use RPM	Enable **Disable (default)**	When enabled, Repeat per minute is used instead of Minutes per Repeat (default). See "Reset".
	Gain or Prop Band	Gain – 0.1% to 1000.0% PB – 0.1 to 1000.0% **default = 1.000**	Gain (default) – is the ratio of output change (%) over the measured variable change (%) that caused it. $G = \frac{100\ \%}{PB\ \%}$ where Prop Band is the proportional Band (in %of Input Range) Proportional Band (Prop Band) - is the percentage of the range of the measured variable for which a proportional controller will produce a 100 % change in its output.
	Rate	-0.035 to 10.000 **default = 0.000**	RATE action, in minutes affects the control output whenever the deviation is changing; and affects it more when the deviation is changing faster. The amount of corrective action depends on the value of Gain.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	Reset	-0.02 to 50 **default = 1.000**	RESET (Integral Time) - adjusts the control output according to both the size of the deviation (SP-PV) and the time it lasts. The amount of corrective action depends on the value of Gain. The reset adjustment is measured as how many times proportional action is repeated per minute (Repeats/minute) or how many minutes before one repeat of the proportional action occurs (Minutes/repeat – default).
	Tune Set 2	**None (default)** Monitor 1 Monitor 2 Monitor 3 Monitor 4 Logic 1 Logic 2 Logic 3 Logic 4 Digital In 1 Digital In 2	Digital Source for selection of Tuning set 2. When active, this input will override the current tuning set selection and force the PID to use tuning set 2. This applies for non-duplex type control. Note: For duplex control types, the tune set is automatically select by the output zone (Tune 2 selected for Output < 50).
	Gain or Prop Band 2	0.1 to 1000.0 **default = 1.000**	Gain or Prop Band2 for Tuning Set 2. Same as Gain or Prop Band.
	Rate 2	-0.035 to 10.000 **default = 0.000**	Rate 2 for Tuning Set 2. Same as Rate.
	Reset 2	-0.02 to 50 **default = 1.000**	Reset 2 for Tuning Set 2 Same as Reset.

Table 6-15 PID Alarms

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
PID 1 Alarms **PID 2 Alarms**	Alm 1 SP1 Type	**No Alarm (default)** PV High PV Low Dev High Dev Low SP High SP Low Output High Output Low	*Alarm 1 Setpoint 1 Type* High PV Alarm: PV > Alm SP Low PV Alarm: PV < Arm SP High Deviation Alarm: |PV – SP| > Alm SP Low Deviation Alarm: |PV – SP| < Alm SP High Setpoint Alarm: SP > Alm SP Low Setpoint Alarm: SP < Alm SP High Output Alarm: Out > Alm SP Low Output Alarm: Out < Alm SP
	Alm 1 SP1 Value	-99999 to 99999 **default = 0.000**	Alarm 1 Setpoint 1 Value

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	Alm 1 SP2 Type	Same as **Alarm 1 Setpoint 1** **No Alarm (default)**	Same as **Alarm 1 Setpoint 1 Type**
	Alm 1 SP2 Value	-99999 to 99999 **default = 0.000**	Alarm 1 Setpoint 2 Value
	Alm 2 SP1 Type	Same as **Alarm 1 Setpoint 1** **No Alarm (default)**	Same as **Alarm 1 Setpoint 1 Type**
	Alm 2 SP1 Value	-99999 to 99999 **default = 0.000**	Alarm 2 Setpoint 1 Value
	Alm 2 SP2 Type	Same as **Alarm 1 Setpoint 1** **No Alarm (default)**	Same as **Alarm 1 Setpoint 1 Type**
	Alm 2 SP2 Value	-99999 to 99999 **default = 0.000**	Alarm 2 Setpoint 2 Value
	Alm Hysteresis	0 to 100% **default = 0.00**	Alarm Hysteresis ─ an adjustable overlap of the ON/OFF states of each alarm.

6.15 Auto Cycling Configuration

6.15.1 Overview

Auto cycling provides automated timing, control and functionality for the cleaning and calibration of input probes. Each input PV has a dedicated auto cycle function block. The input board type and in the case of pH, the PV type, determines the level of auto cycling capability, as indicated below:

Input Board Type	Auto Cycle Operation
Preamp pH	Rinse, Auto Buffer Cal 1 (zero offset), Auto Buffer Cal 2 (slope)
pH/ORP, PV Type not ORP	Rinse, Auto Buffer Cal 1, Auto Buffer Cal 2
pH/ORP, PV type is ORP	Rinse Only
Conductivity	Rinse Only
DO ppm	Rinse, Auto Air Cal
DO ppb	Rinse, Auto Air Cal

Auto cycling is supported with setup menus, status displays and operational displays (Section 5.7) as well as event (Section 5.11) and calibration history logging (Section 11).

6.15.2 Accessing Auto Cycle Menu

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Auto Cycling"** then press Enter to enter the sub-menu:
  Auto Cycle 1 or Auto Cycle 2
- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

6.15.3 Auto Cycling Configuration

Table 6-16 Auto Cycling Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition and Restrictions
Auto Cycle 1 **Auto Cycle 2**	Auto Cycling	**Disable (default)** Enable	Allows auto cycling to be selected. This should be enabled after configuration is complete.
	Hold Active	**Enable (default)** Disable	When enabled, the output(s) sourced by input *n* for Auto Clean *n* is in hold during auto cycling.
	Probe Transit	**Disable (default)** Enable	When enabled, allows probe extract and probe insert sequence steps to occur and automated probe extract and insert parameters are made available.
	Cycle Start Source	None or Any Digital Signal See Table 6-4	Starts Auto Cycle on specific Digital Signal selected changing from 0 to 1.
	Extract Wait Src *(Probe Transit = Enabled)*	None or Any Digital Signal See Table 6-4	Allows selection of a specific Digital Signal that causes a delay in the probe extraction sequence. While the selected digital input is active the probe extraction will not end unless a timeout occurs as determined by the duration configured in Probe Transit Mins. If a source is configured, the timeout results in an Auto Cycle Fail. If a digital signal is not available, the source may be left at “None” and the extract step will occur for the duration of Probe Transit Mins.
	Insert Wait Src *(Probe Transit = Enabled)*	None or Any Digital Signal See Table 6-4	Allows selection of a specific Digital Signal that causes a delay in the probe insertion sequence. While the selective digital input is active the probe insertion will not end unless a timeout occurs as determined by the duration configured in Probe Transit Mins. If a source is configured, the timeout results in an Auto Cycle Fail. If a digital signal is not available, the source may be left at “None” and the extract step will occur for the duration of Probe Transit Mins.
	Cycle Interval	**Off(default)** Monthly Weekly Daily Custom	Frequency of Auto Cycle occurrence
	Start Time (Custom)	**Disable (default)** Enable	Set specific time for Auto-Cycle to start.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition and Restrictions
	Start Day (Dependent parameters)	**1 to 28 (default = 1)** **Sunday – Saturday (default = Sunday)** **1 to 31 (default = 1)**	Cycle Interval is Monthly Cycle Interval is Weekly Cycle Interval is Custom, Start Time enabled
	Start Hour (Dependent parameters)	**0 to 23 (default = 12)**	Cycle Interval is Monthly, Weekly, Daily
	Start Mins (Dependent parameters)	**0 to 59 (default = 0)**	Cycle Interval is Monthly, Weekly or Daily Cycle Interval is Custom, Start Time enabled
	Period Days (Custom)	**0 to 100(default = 0)**	The period day parameter allows the selection of how often the Auto cycle will occur. For Example: 20 means that the Auto Cycle will occur every 20 days.
	Period Hours (custom)	**0 to 23 (default = 1)**	For Example: 4 means that the Auto-cycle will occur every 4 hours when the days and minutes are set to 0.
	Period Mins	**0 to 59 (default = 0)**	For Example: 30 means that the Auto-cycle will occur every 30 minutes when the days and hours are set to 0.
	Rinse Cycle Cnt	**0 to 100(default = 1)**	Allows selection for frequency of rinse occurrence.
	Cal Cycle Cnt (PV is DO)	**0 to 100(default = 1)**	Allows selection for frequency of calibration occurrence. For Example: 1 indicates that a calibration will occur every cycle while a 10 indicates that a calibration will occur every 10th cycle.
	Cal 1 Cycle Cnt (PV is pH)	**0 to 100(default = 1)**	Allows selection for frequency of calibration occurrences.
	Cal 2 Cycle Cnt (PV is pH)	**0 to 100(default = 1)**	Allows selection for frequency of calibration occurrences.
	Max Transit Mins (Probe Transit = Enabled)	**0 to 30.00 (default = 0.50)**	Maximum Probe Transit time in minutes.
	Rinse Mins	**0 to 30.00 (default = 0.50)**	Duration of Rinse sequence in minutes
	Max Cal Mins (PV pH, DO)	**0 to 30.00 (default = 0.50)**	Maximum calibration time in minutes. Enough time should be entered to allow process stabilization and a 20 second measurement time.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition and Restrictions
	Resume Dly Mins	**0 to 30.00 (default = 0.50)**	Process resume delay in minutes.

6.15.4 pH Auto Cycling Configuration Example

The example in Table 6-17 configures the UDA to perform a rinse function once per day, at 8:00 AM, and once per week perform a 1 point Standardization, using 7 buffer. Then once every 4 weeks, perform a complete 2 point Standardize & Slope, using 7 buffer and 4 buffer. Also assume that the sensor is retracted from the sample line during the rinse and cal (not required).

Table 6-17 Example Auto Cycling Configuration for pH

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition and Restrictions
Auto Cycle 1 **Auto Cycle 2**	Auto Cycling	Enable	Allows auto cycling to be selected. This should be enabled after configuration is complete.
	Hold Active	**Enable**	When enabled, the output(s) sourced by input *n* for Auto Clean *n* is in hold during auto cycling.
	Probe Transit	Enable	When enabled, allows probe extract and probe insert sequence steps to occur and automated probe extract and insert parameters are made available.
	Cycle Start Source	None	
	Extract Wait Src	Digital Signal 1 See Table 6-4	This is the end of travel “out” switch on the extraction device
	Insert Wait Src	Digital Signal 2 See Table 6-4	This is the end of travel “in” switch on the extraction device
	Cycle Interval	Daily	Frequency of Auto Cycle to occur daily
	Start Hour	8	Cycle to start at 8:00 AM
	Start Mins	**0**	
	Rinse Cycle Cnt	**1**	Rinse to occur every cycle.
	Cal 1 Cycle Cnt	7	Standardize occurs once every 7 cycles, or once per week.
	Cal 2 Cycle Cnt	28	Slope Cal occurs once per 28 days, or every 4 weeks
	Max Transit Mins (Probe Transit = Enabled)	0.5	If extraction takes longer than 30 seconds, then get a “AUTOCYCLE FAIL ALARM”
	Rinse Mins	2	Each rinse duration is 2 minutes

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition and Restrictions
	Max Cal Mins	2	If the reading is unstable after 2 minutes then get a “AUTOCYCLE FAIL ALARM”.
	Resume Dly Mins	5	Wait 5 minutes after cycle completes and sensor is reinserted before removing HOLD and returning to On-Line mode.

6.16 Variables Configuration

Overview

The Variables menu allows you to configure the values that variables are set to when the UDA is first powered on.
This group has two selections:

Analog
This selection lets you configure the initial values of the Analog Variables.

Digital
This selection lets you configure the initial values of the Digital Variables.

Accessing Variables Menu

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Variables"** then press Enter to enter the sub-menu.
- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-18 Variables Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
Analog	Anlg Var 1 Init	-99999.99 to 99999.99	Initial Values of the Analog Variable applied at power on.
	Anlg Var 2 Init		
	Anlg Var 3 Init		
	Anlg Var 4 Init		
Digital	Dgtl Var 1 Init	Off ON	Initial Values of the Digital Variable applied at power on.
	Dgtl Var 2 Init		
	Dgtl Var 3 Init		
	Dgtl Var 4 Init		

6.17 Communication Configuration

Overview

The communication menu allows you to configure the Communications Card. There are four selections:

IR Front Panel – configure the IR Front Panel interface

Modbus – configure the byte order

RS485 – configure the RS485 interface of the Communications Card.

Ethernet – configure the Ethernet interface of the Communication card.

Accessing Communication Menu

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Communication"** then press Enter to enter the sub-menu.
- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-19 Communication Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
IR Front Panel	Port Reset	Off (default) Enable	When enabled, Port Reset initializes the IR Interface.
	Mode	Enable(default) Setup Address Disable	Enable - allows IR to work anytime. No **IR** address required and on any front-panel screen. Setup – IR only works when the front-panel is in a setup screen. **This will allow the IR interface to be password protected if a password is configured.** No **IR** address required. Address -- The UDA's IR address must be used to communicate to the UDA. Disable – The UDA will not respond to any request on the IR interface.
Modbus	Word Swap	Yes (default) No	**Word Swap** lets you set the word order for Modbus communications. YES – sets the order to "Big Endian" format NO – sets the order to "Little Endian" format
RS485	Port Reset	Off (default) Enable	Enable selection resets the Communication card. It should be enabled when the Address or Baud Rate or both are changed.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	Address	0 to 999 (default = 0)	Modbus RTU Slave ID – 0 is offline
	Baud Rate	2400 (default) 4800 9600 19200 38400 57600 115200	Modbus RTU Baud Rate
Ethernet	Port Reset	Off (default) Enable	Enable selection resets the Communication card. It should be enabled when configurations for Ethernet are modified.
	DHCP	No (default) Yes	When YES, **D**ynamic **H**ost **C**onfiguration **P**rotocol server automatically assigns a dynamic IP address to UDA. *The set dynamic IP can be seen from "Comm Status" display.*
	IpAddr Octet 1 IpAddr Octet 2 IpAddr Octet 3 IpAddr Octet 4	0 to 255	These parameters are visible only when DHCP option is NO. Allows you to assign Static IP address to the UDA.
	SbntMsk Octet 1 SbntMsk Octet 2 SbntMsk Octet 3 SbntMsk Octet 4	0 to 255	These parameters are visible only when DHCP option is NO. Allows you to assign Subnet Mask as per the local network settings
	Dflt Gtwy Octet 1 Dflt Gtwy Octet 2 Dflt Gtwy Octet 3 Dflt Gtwy Octet 4	0 to 255	These parameters are visible only when DHCP option is NO. Allows you to assign the Default Gateway as per the local network settings
	DNS Srvr Octet 1 DNS Srvr Octet 2 DNS Srvr Octet 3 DNS Srvr Octet 4	0 to 255	These parameters are visible only when DHCP option is NO. Allows you to assign the DNS server IP address as per the local network settings

6.18 Maintenance Configuration

Accessing Maintenance Menu

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Maintenance"** then press Enter to enter the sub-menu.
- Press ▲▼ to highlight the desired menu selection then press Enter to display the group of parameters.
- Press ▲▼ to highlight the parameter selection, then press Enter to allow changes.

Refer to "Section 6.4.1 – "***General Rules for Editing***".

Table 6-20 Maintenance Configuration

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
System	SW Version*	Software version number	Read Only **See note at end of table*
	Language	**Language Set EE** **English (default)** Italiano Deutsch Francais Espanõl	Multi-language prompts guide the operator step-by-step through the configuration process assuring quick and accurate entry of all configurable parameters. Select from: English, French, German, Spanish and Italian (Language Set EE).
		Language Set RT **English (default)** Русский Türkçe	English, Russian and Turkish (Language Set RT)
		Language Set PC **English (default)** Polski Česká	English, Polish and Czech (Language Set PC)
	Read Only - Language Set	**EE** **RT** **PC**	Read only language set of the software EE - English, French, German, Spanish and Italian RT - English, Russian and Turkish PC - English, Polish and Czech
	Mains Freq	**60 Hz (default)** 50 Hz	This function determines the frequency of AC line noise suppression for the input ADC circuitry.

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	Password	**0000 (default)** to 9999 AAAA to ZZZZ	Setup configuration, calibration and maintenance functions can be password-protected. The password can be any number between 1 and 9999 or letters. (When the password is zero, the operator will not be prompted to enter a password.) Follow the " *General Rules for Editing*" to change the digits.
	Unit ID	**Unit Identification**	Read Only
	Option ID*	**Option ID Number**	= 0 if PID is not available = ID Number if PID available **See note at end of table*
	PID Control*	1 Loop **2 Loops (default)**	Enables the PID Control configuration Parameters **See note at end of table*
	Unit Reset	**No (default)** Yes	Unit Reset initializes all calibration and configuration data to factory default values, with the exception of the Factory Temperature Calibration correction values
Inputs	Input 1 Type Input 2 Type	***Read Only***	**pH/ORP** - pH or Oxidation Reduction Potential **pH Preamp – pH with preamplifier** **Conductivity (Dual if both inputs same)** **DO ppm** - Dissolved Oxygen **DO ppb** - Dissolved Oxygen

<table>
<tr><th>Sub-menu selection</th><th>Parameter</th><th>Selection or Range of Setting</th><th>Parameter Definition</th></tr>
<tr><td rowspan="4"></td><td>Cond Units Type</td><td>NIST (default)

ISO</td><td>The NIST system of conductivity measurement uses units of centimeters, and in the UDA are specifically µS/cm and mS/cm for conductivity and KΩ-m for resistivity.

The ISO system of conductivity measurement uses units of meters, and in the UDA are specifically µS/m, mS/m and S/m for conductivity and KΩ-m for resistivity.

The conductivity “Units Type” selected here affects the “PV Type” selections available under “Setup/Inputs/pH Preamp n. Selection of units type will scale all live conductivity and Resistivity readings on monitor and input calibration screens according to the factors listed:
<table>
<tr><th>NIST</th><th>ISO</th><th>ISO/NIST factor</th></tr>
<tr><td>µS/cm</td><td>µS/m</td><td>0.01</td></tr>
<tr><td>µS/cm</td><td>mS/m</td><td>10</td></tr>
<tr><td>mS/cm</td><td>S/m</td><td>10</td></tr>
<tr><td>MΩ-cm</td><td>KΩ-m</td><td>0.1</td></tr>
</table></td></tr>
<tr><td>Cond Wire Size</td><td>AWG (default)
Sq mm</td><td>“Wire Size Units” allows selection of either AWG or Square millimeters (Sqmm). When changing units, the wire size parameter value is not converted. A pop-up message warns you of this.</td></tr>
<tr><td>Cond Wire Len</td><td>Feet (default)
Meters</td><td>“Wire Length Units” allows selection of either meters or feet for the Wire Length parameter in the Inputs group. When changing units, the wire length parameter value is not converted. A pop-up message warns you of this. If the value is no longer within range, it will change to closest range limit.</td></tr>
<tr><td>Cation Calc</td><td>None

pH NH_3

pH Amines

ppbCO_2</td><td>None

Ammonia pH – Specific conductivity temperature compensation assumes Ammonia NH_3 is the base reagent

Amine pH – Specific conductivity temperature compensation assuming a generic amine base.

CO_2 determination by degassed conductivity.</td></tr>
</table>

Sub-menu selection	Parameter	Selection or Range of Setting	Parameter Definition
	Temp Units	º F **º C (default)**	"Temperature Units" allows selection of either degrees C or degrees F for the display of measured temperature on monitor, pharmacopoeia, control and input calibration screens and for the entry of manual temperature input values in Setup/Inputs. When changing the temperature units, the manual temperature input value is not converted. A pop-up message warns you of this. If the value is no longer within range, it will change to the closest range limit.
Display	Header	**1 Label (default)** 2 Labels Label/Time Date/Time	Determines the time and date displayed within the Monitor Display header.
	Label	Alphanumeric text (max 16 characters) **default: "Honeywell UDA"**	Header Format is 1 Label
	Label	Alphanumeric text (max 10 characters) **default: "Honeywell"**	Header Format is Label/Time
	Label 1	Alphanumeric text (max 10 characters) **default: "Honeywell"**	Header Format is Label 1 / Label 2
	Label 2	Alphanumeric text (max 10 characters) **default: "UDA2182"**	Header Format is Label 1 / Label 2
	Clr Evt Hist	**No (default)** Yes	Clear Event History – Yes, clears the Event History Screen (see Section 5.11)
	Clr Cal Hist	**No (default)** Yes	Clear Cal History – Yes, clears the Calibration History Screen (see Section 11)

Tag Names	Select Tag and Press "Enter". Follow the "*General Rules for Editing*" to edit the character string.		
	Input 1 Input 2 PID Loop 1 PID Loop 2 Auto Cycle 1 Auto Cycle 2 Pharma 1 Alarm 1 Alarm 2 Alarm 3 Alarm 4	0 to 16 Characters	The real-time displays of process values show the instrument's tag name (or other configurable fixed sixteen-character string) at the top of the screen.
Clock	Date Format	**YYYY/MM/DD (default)** MM/DD/YYYY DD/MM/YYYY	The parameters Date Format and Time Format determine how time and date are displayed in both the Monitor Display header and the Event History.
	Time Format	**24 Hour (default)** 12 Hour	
	Year	2005-2037	
	Month	1 to 12	
	Day	1 – 28, 29, 30 or 31 (default: 1) (determined by year & month)	
	Hour	0 – 23 (24 Hour format) 1 – 12 (12 Hour format)	
	AM/PM	**AM (default)** PM Time Format is 12 Hour	
	Minutes	0 – 59	
Tests	Display Test	**Off (default)** Enable	Display Test action occurs when the "**Enter**" key is pressed to accept the selection.
	Keypad Test	**Off (default)** Enable	When the keyboard test is enabled, the Status Message area displays the name of the key currently pressed. **Note:** ***The keypad test will exit three seconds after no key is pressed.***

	Output Level 1 Output Level 2 Output Level 3	**Off (default)** 0% 25% 50% 75% 100% Low Limit High Limit	Output action occurs when the "**Enter**" key is pressed to accept selection. Actual output current is consistent with selected current range of 0 to 20 mA or 4 to 20 mA.
	Relay 1 State Relay 2 State Relay 3 State Relay 4 State	**Off (default)** Energized De-energized	Relay state action occurs when the "**Enter**" key is pressed to accept selection.

*ATTENTION

Upgrading software on the UDA2182 to a new version will remove PID control (on units where PID has been ordered or been added in the Field).

Therefore, the following steps need to be followed in order to retrieve that option:

If PID was ordered when the unit was originally ordered:

- Retrieve your Unit ID by going to the MAINTENANCE → SYSTEM menu
- Call GTS (1-800-423-9883)
- Inform them that you are going to do a software upgrade and you need the Option ID for your unit (this is why you need the Unit ID)
- Record **Option ID** for next step
- After upgrading software, go to MAINTENANCE → SYSTEM menu and enter the recorded **OPTION ID** value.
- The PID will have to be reconfigured to settings prior to upgrade.

If PID was added after the unit was originally shipped:

- Before upgrading software, go to MAINTENANCE → SYSTEM menu and record the **OPTION ID** value.
- After upgrading software, go to MAINTENANCE → SYSTEM menu and enter the recorded **OPTION ID** value.
- The PID will have to be reconfigured to settings prior to upgrade.

7 Inputs and Outputs Wiring

7.1 Overview

Introduction

This section contains instructions for wiring the inputs and outputs of the Analyzer.

What's in this section?

The topics in this section are listed below.

7.2 General Wiring Practices

WARNING

Qualified personnel should perform wiring 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.

CAUTION

To avoid damage to the case when connecting to a rigid metallic conduit system, the conduit hub must be connected to the conduit before the hub is connected to the enclosure

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 workstations and wrist straps must be used. If soldering irons are used, they must also be grounded.

A grounded workstation 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 7-1 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

Shielded wiring for locations with interference

In applications where plastic conduit or open wire trays are used, shielded milticonductor 22 gage (0.326 mm^2) 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 from External Sources.
- Appropriate wiring diagram supplied with electrode mounting or preamplifier module.

7.3 Inputs and Outputs

Introduction

The analyzer can accept single or dual inputs from Honeywell Direct pH, pH Input from External Preamplifier, ORP, Contacting Conductivity and Dissolved Oxygen sensors.

Two analog outputs standard

One additional output optional

Two electromechanical relays standard

Two additional relays optional

Two Digital Inputs

Wiring these inputs and outputs is described here.

Accessing the terminals

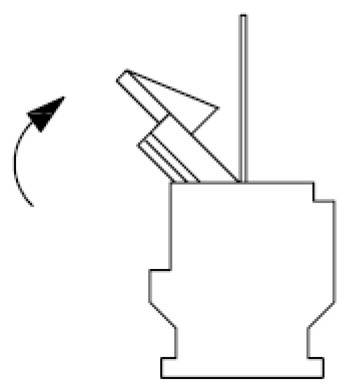
The wiring is easily accessible through the front and the boards can be pulled out to facilitate the wiring of sensor input.

Open the case.

***ATTENTION**

The display cable can become loose from the connector on the display board. Follow these instructions for re-inserting the cable into the connector:

Open connector by carefully lifting connector as shown:



Once the cable has been inserted carefully close the connector.

Loosen the four captive screws on the front of the bezel.
Grasp the bezel on the right side. Lift the bezel gently and swing the bezel open to the left.

Wiring terminals and board location

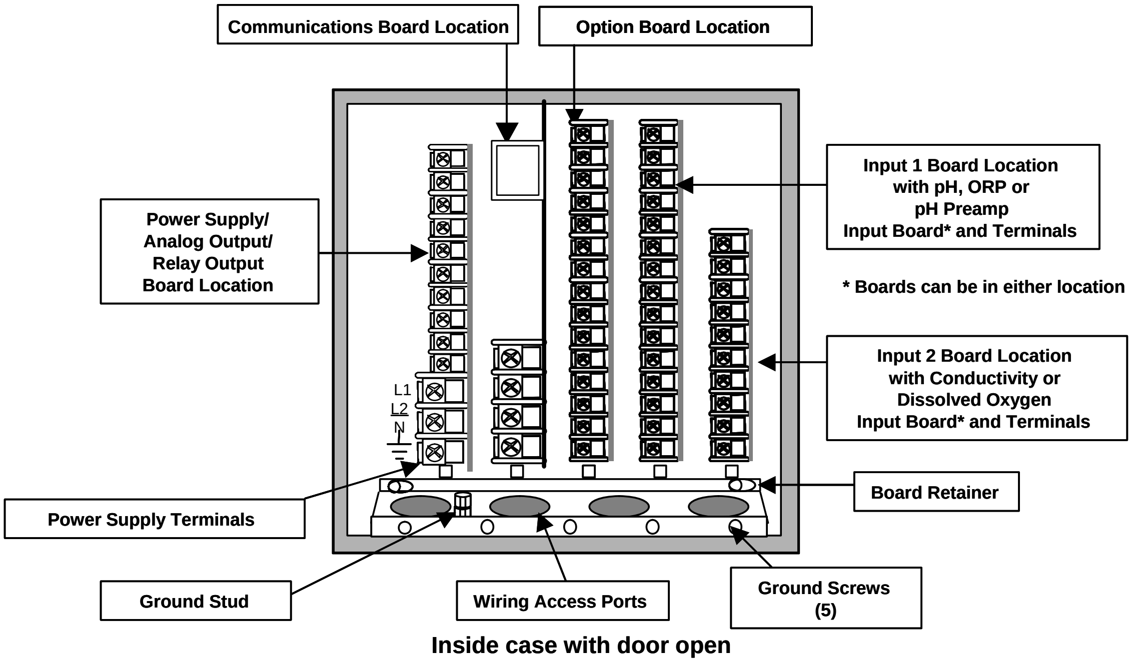
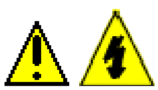


Figure 7-1 Wiring Terminals and board Location

Procedure



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 7-2 Procedure for installing Input and Output wiring

Step	Action
1	Go to Configuration 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 analyzer to work as expected (See Section 6).
ATTENTION	
	Turn off the power to the analyzer. More than one switch may be required to remove power.
2	With power off, open the case: • Loosen the four captive screws on the front of the bezel. • Grasp the bezel on the right side. Lift the bezel gently and swing the bezel open to the left.
3	Refer to Figure 7-1 for the location of the terminal board retainer. Loosen the screws that hold the retainer and slide the retainer left until the retainer tabs disengage from the terminal boards.
4	Insert a screwdriver into the tab in the terminal board to be wired and pull out gently. Slide the board half way out. There is a notch in the terminal board into which you can slide the retainer tabs and hold the boards in place while wiring.
5	Connect the inputs from the electrode or cells to the terminals in accordance with the configuration setup assignments. Refer to the wiring diagram provided with the electrode or cell, and to Figure 7-2 through Figure 7-20
6	Analog outputs (In addition to the standard outputs, one more is available as an option). See Option Board Wiring - Figure 7-20). Connect the outputs from the Analyzer terminals in accordance with the configuration setup assignments. Refer to the wiring diagrams provided with the field devices receiving the signals, and to Figure 7-2 through Figure 7-20.
7	If the relay outputs are to be used, leave the unit open and powered down. The relays can be used for Time Proportioning Output, Pulse Frequency Output, and Digital Output control as well as alarm annunciation. (In addition to the standard relays, two more are available as an option. See Option Board Wiring - Figure 7-20). Connect the outputs from the Analyzer terminals in accordance with the configuration setup assignments. Refer to the wiring diagrams provided with the external device and to Figure 7-2 through Figure 7-20. These relays can be programmed to de-energize or energize on alarm. Use the Maintenance configuration setup to specify relay state. (NOTE 1)
CAUTION: Alarm circuits are not internally fused in the analyzer. Provision for fuses in external circuits is recommended.	
8	Slide the retainer to the left then slide the terminal board back into place. Slide retainer to engage the tabs and tighten the screws.
9	Close the Bezel and secure four captive screws to a torque value of .20Nm (1.5 Lb-in). Power up the unit. Do not apply power until the bezel is closed.

Note 1: 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.

7.4 Direct pH/ORP Input Wiring Diagrams

Durafet III

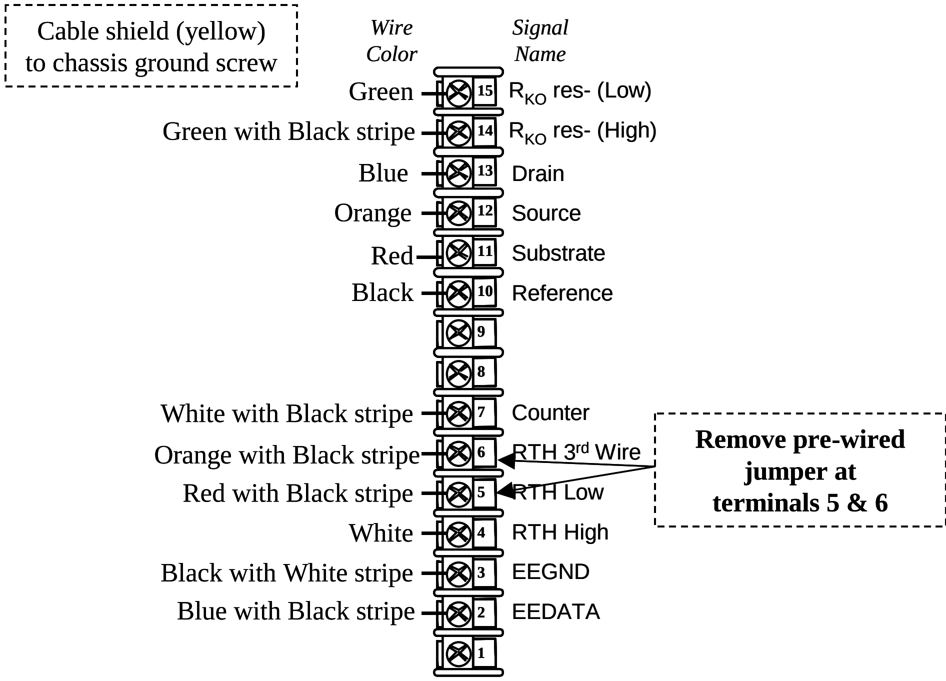


Figure 7-2 Terminal Designations for Durafet III Electrode

Durafet II

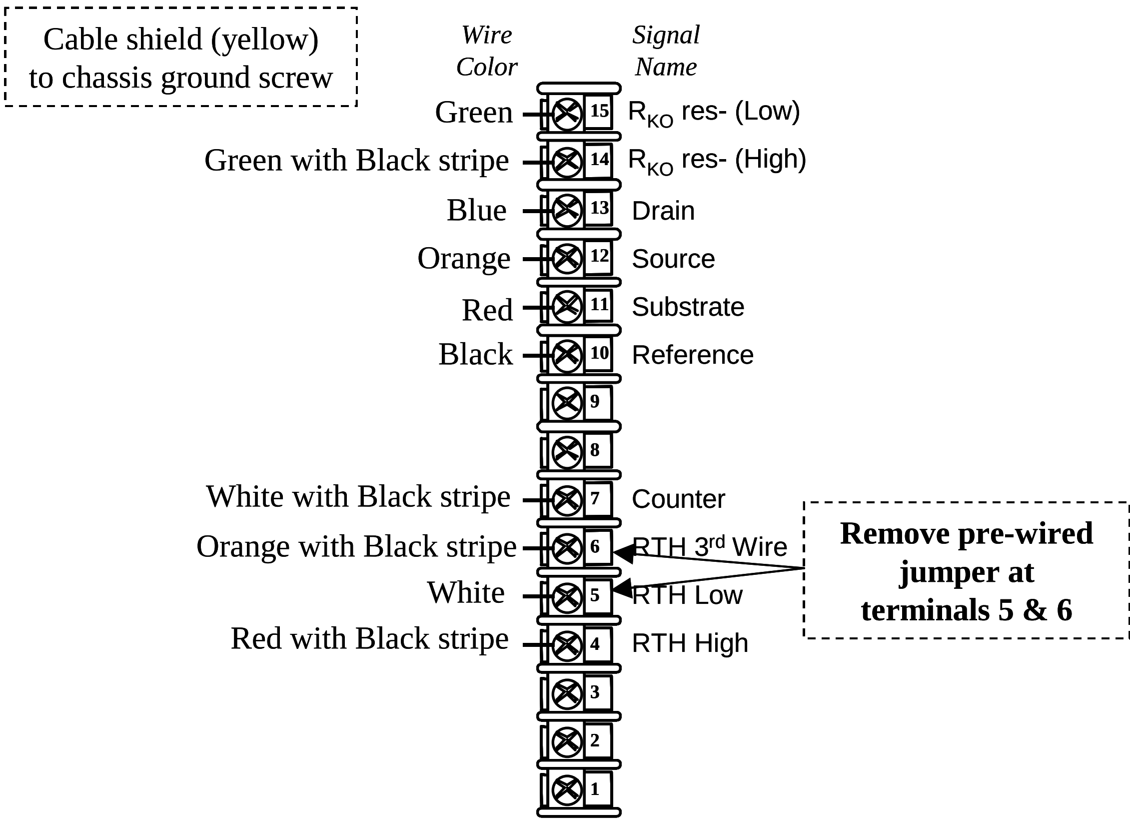


Figure 7-3 Terminal Designations for Durafet II Electrode

Glass Meredian II

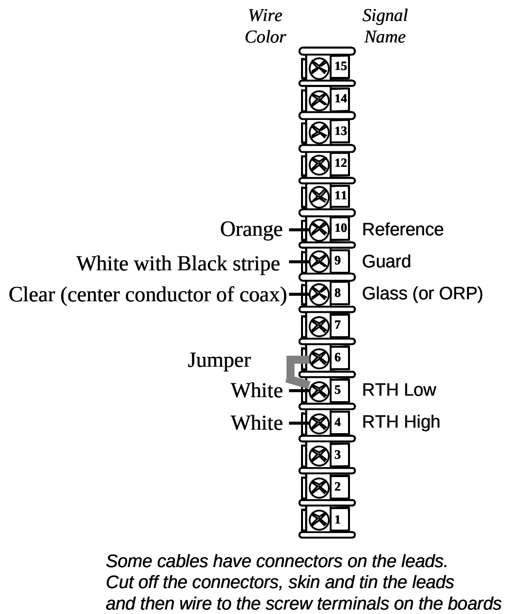


Figure 7-4 Terminal Designations for Meredian II Electrode

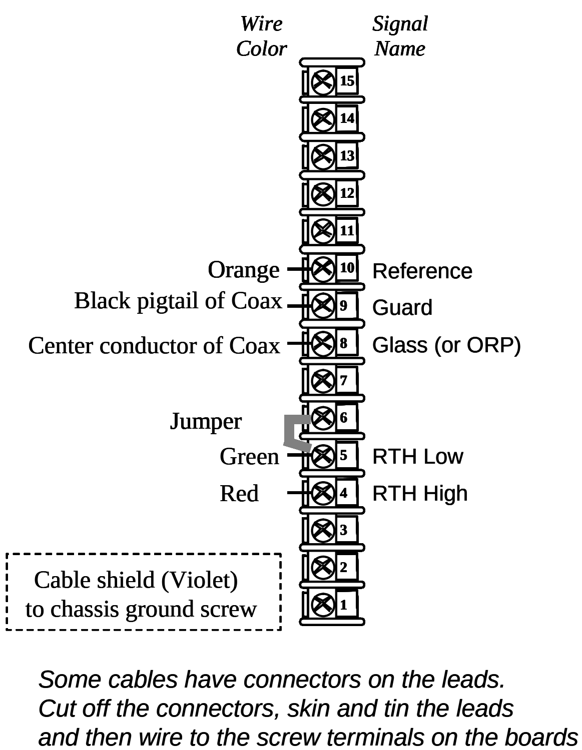


Figure 7-5 Terminal Designations for Meredian II Electrode with Quick Disconnect

ORP

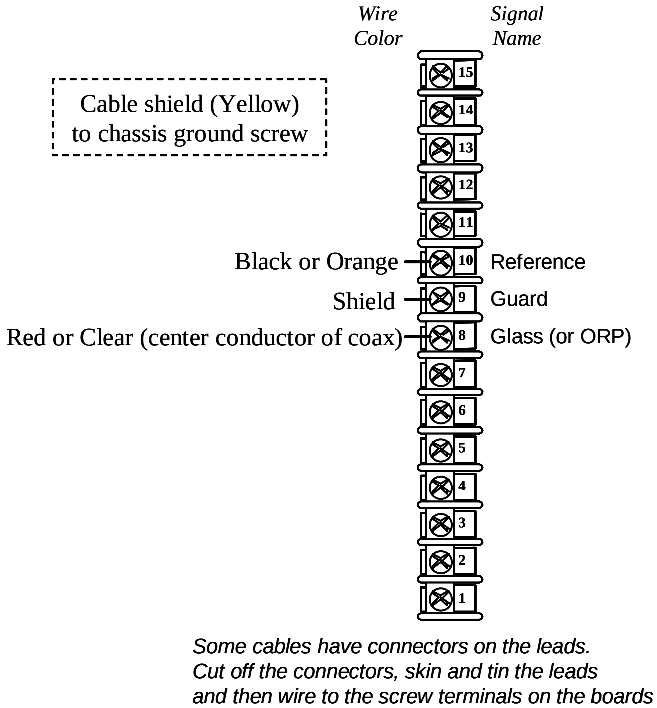


Figure 7-6 Terminal Designations for ORP

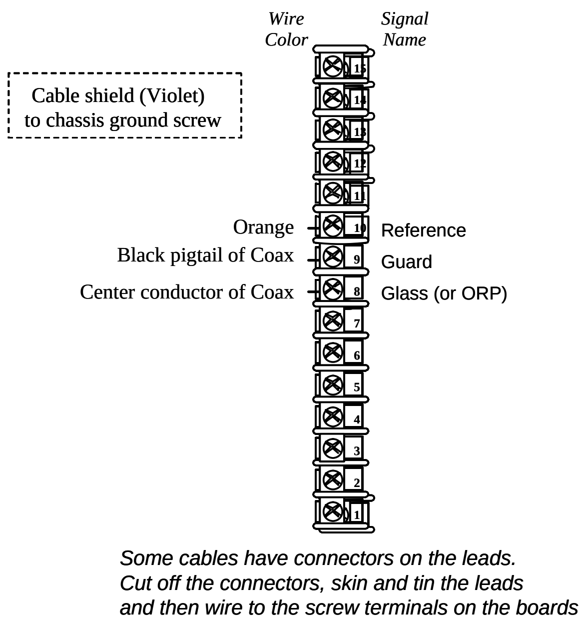
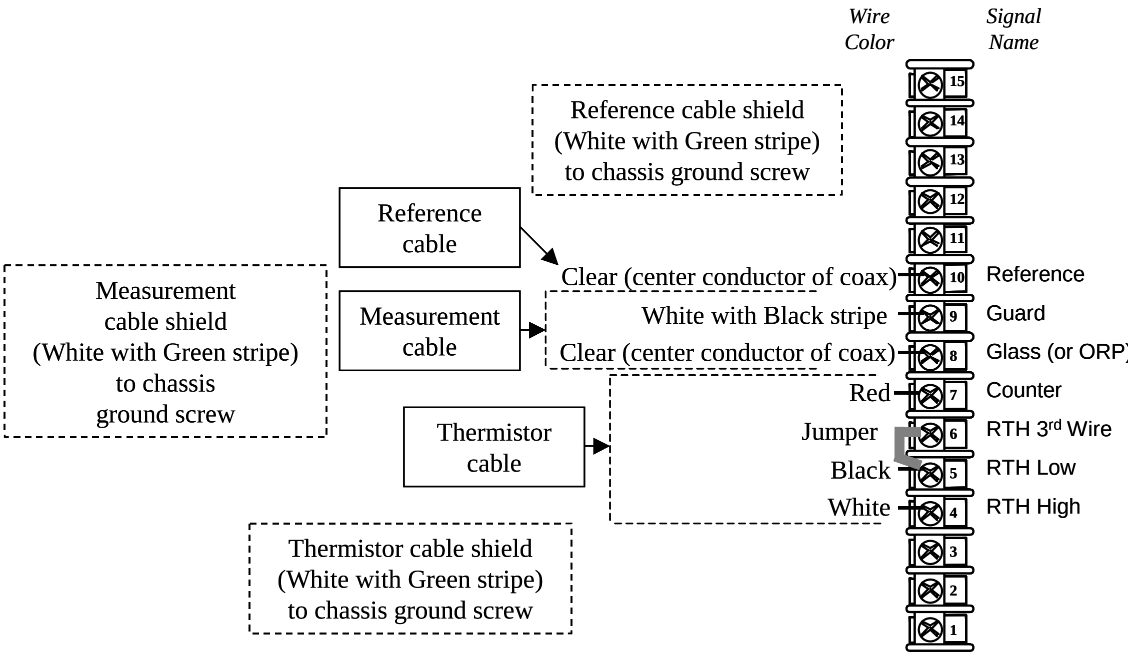


Figure 7-7 Terminal Designations for Direct pH/ORP with Quick Disconnect Option

HPW7000



Some cables have connectors on the leads.
Cut off the connectors, skin and tin the leads
and then wire to the screw terminals on the boards

Figure 7-8 Terminal Designations for HPW7000 System

HB Series pH or ORP

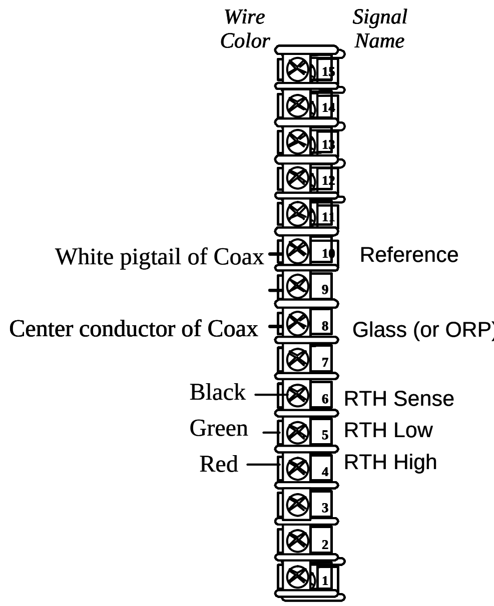


Figure 7-9 Terminal Designations for HB Series pH or ORP

7.5 pH Input from External Preamplifier/Cap Adapter Wiring Diagrams

Glass Meredian External Preamp[1]

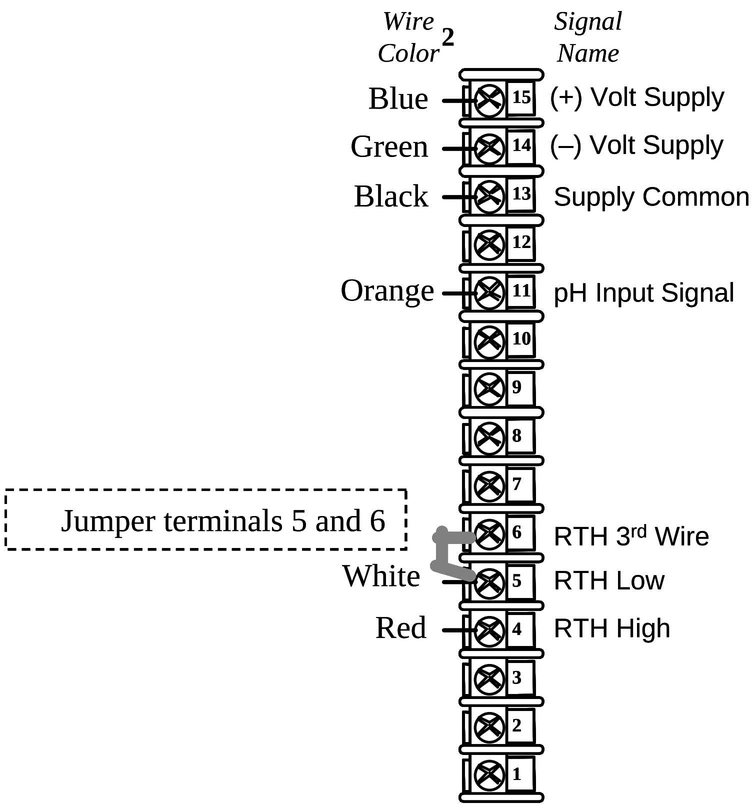


Figure 7-10 Terminal Designations for Meredian Electrode with External Preamplifier

[1] When using 022283 preamplifier module, jumper between "SC" and "ET" **at** the preamp

[2] Color of wires corresponds to Honeywell cables:

→ 834088

→ 31075723

→ 51309677-001

Durafet II External Preamp

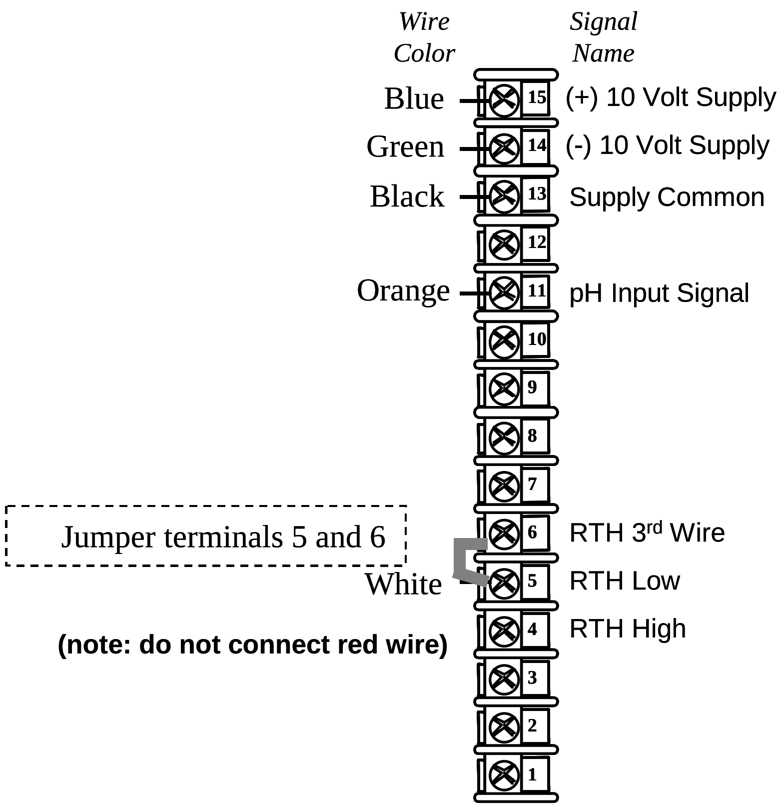


Figure 7-11 Terminal Designations for Durafet II Electrode with External Preamplifier

Durafet II Cap Adapter

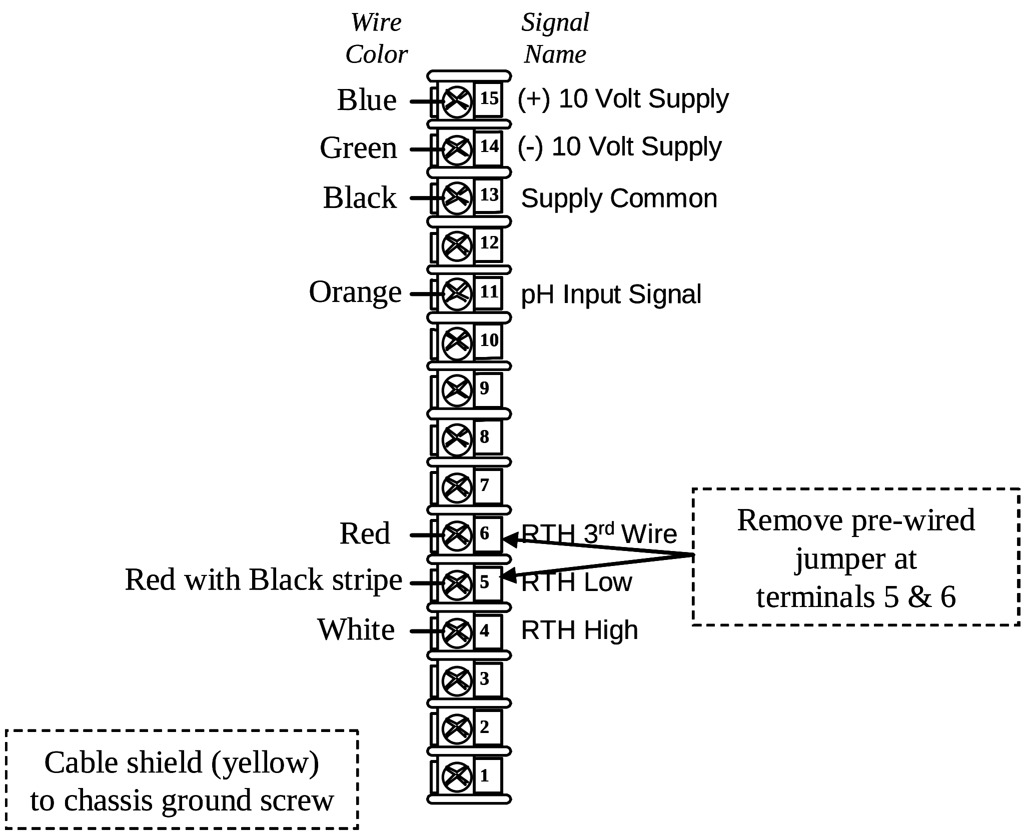


Figure 7-12 Terminal Designations for Durafet II Electrode with Cap Adapter

Durafet III Cap Adapter

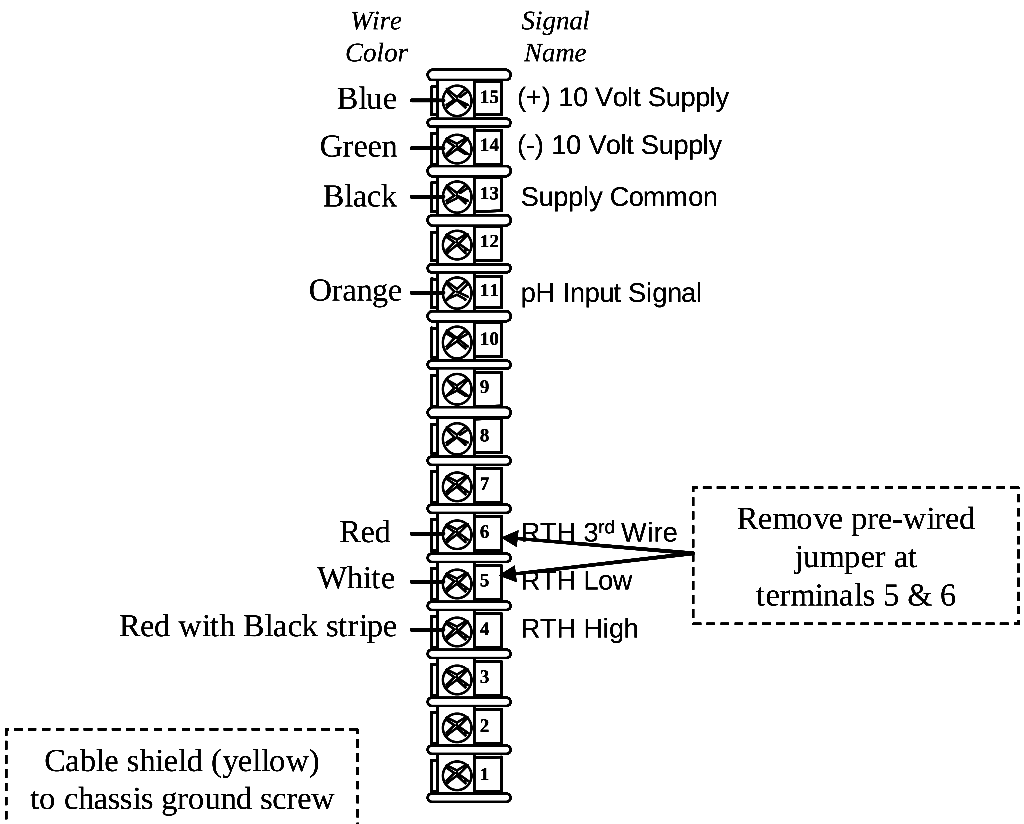


Figure 7-13 Terminal Designations for Durafet III Electrode with Cap Adapter

7.6 Conductivity

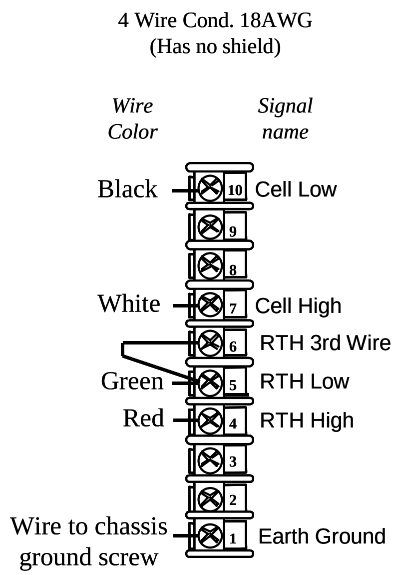


Figure 7-14 Terminal Designations for Conductivity with Integral Cable

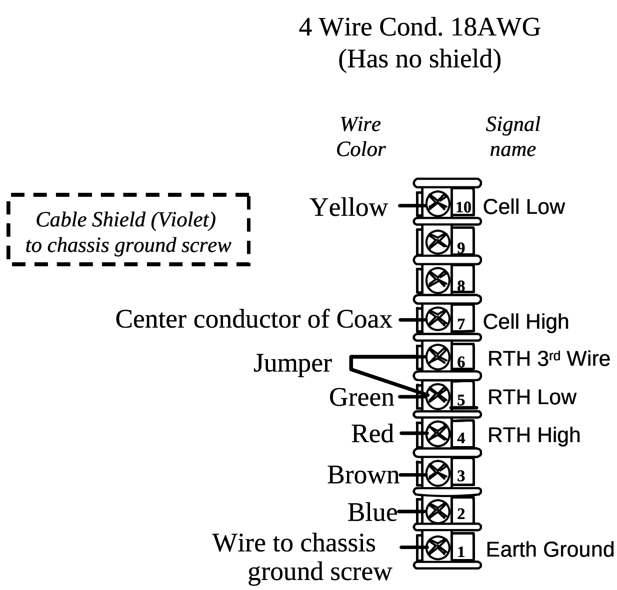


Figure 7-15 Terminal Designations for Conductivity Cells with Quick Disconnect

7.7 Dissolved Oxygen

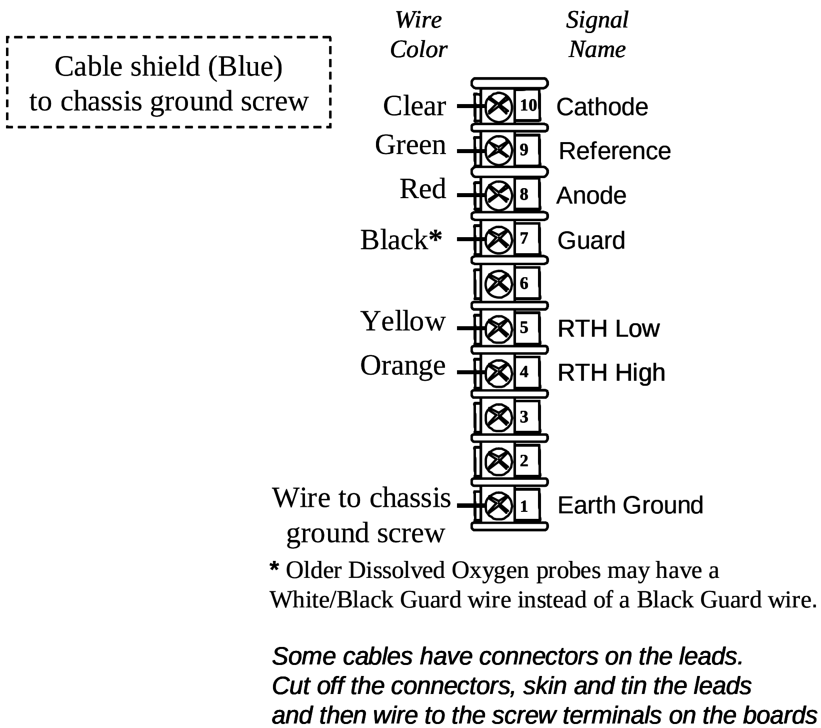


Figure 7-16 Terminal Designations for Dissolved Oxygen with Integral Cable

CAUTION

When installing the probe, the wiring must be done in the order shown below even if the analyzer is not powered. This is because the DO Input card is continuously supplying a voltage (bias) to the terminals.

Connecting – Blue Shield wire first, then in this order:

Red
Green
Coax (clear)
Guard (Black)
Yellow
Orange

Disconnecting – Go in reverse

Orange – first
Yellow
Guard (Black)
Coax (clear)
Green
Red
Blue Shield Wire

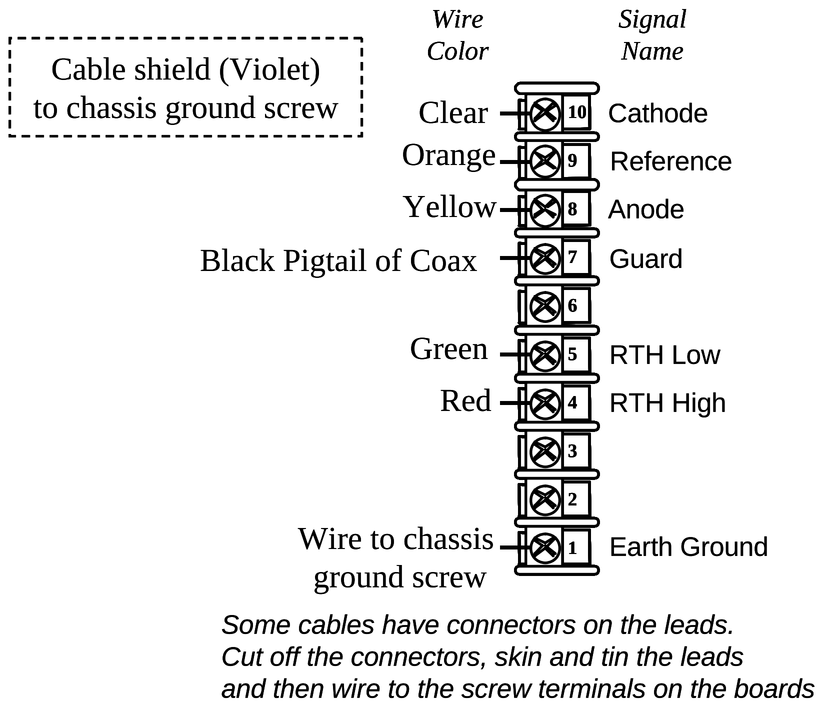


Figure 7-17 Terminal Designations for Dissolved Oxygen with Quick Disconnect Option

7.8 Communications Card

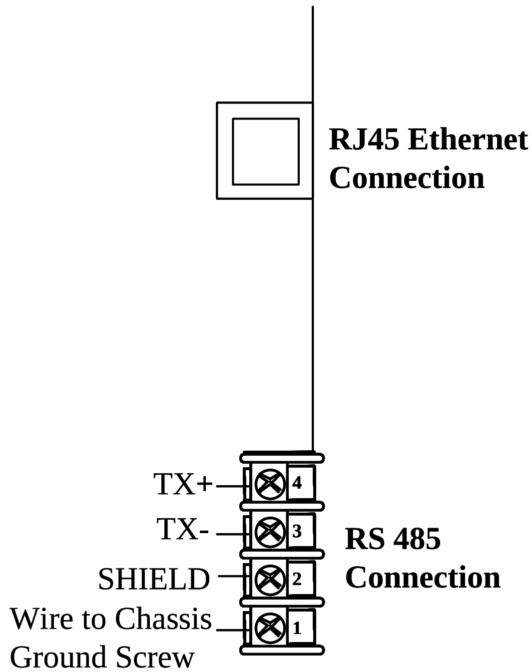


Figure 7-18 Terminal Designations for Communications Card

7.9 Outputs

Power Supply/Analog Output/Relay Output Card

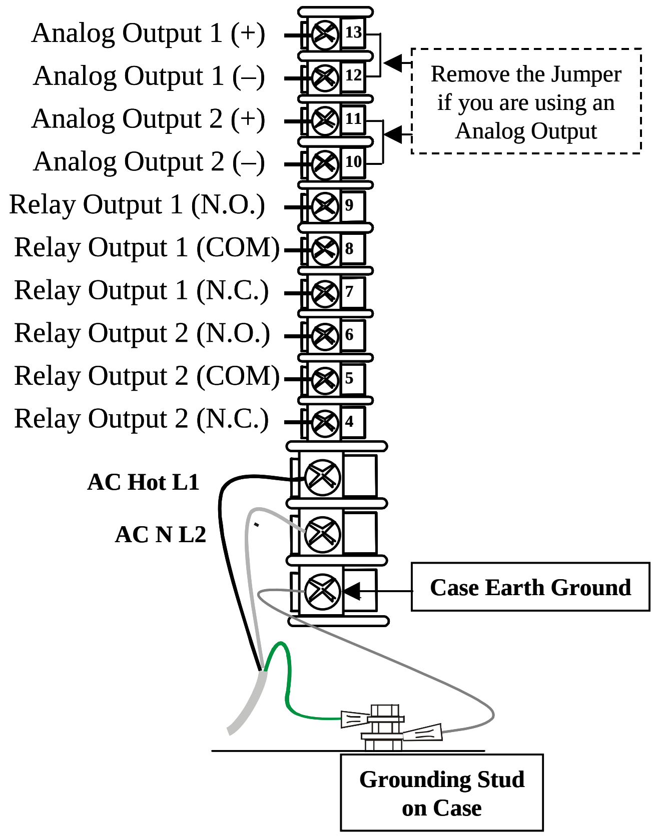


Figure 7-19 Terminal Designations for Power, Analog Output, and Relay Output

7.10 Option Card

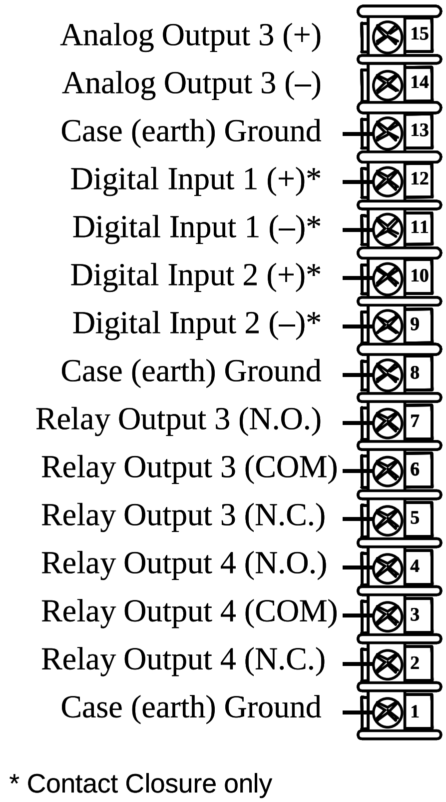


Figure 7-20 Terminal Designations for Option Board

8 Input Calibration

8.1 Overview

Introduction

The section describes the calibration procedures for the following:

Input Cal – calibrate ***Input 1*** **and** ***Input 2*** **for** ***pH/ORP, Conductivity***, ***or Dissolved Oxygen.***

For other Calibration Procedures refer to the sections listed below.

Output Cal – calibrate ***Analog Output 1, Analog Output 2, and Analog Output 3*** (See Section 1).

Temp Input Cal – calibrate ***Temperature 1*** **and** ***Temperature 2*** **for** ***pH/ORP*** **or** ***Conductivity*** (See Section *1).*

For Calibration History, refer to Section 11.

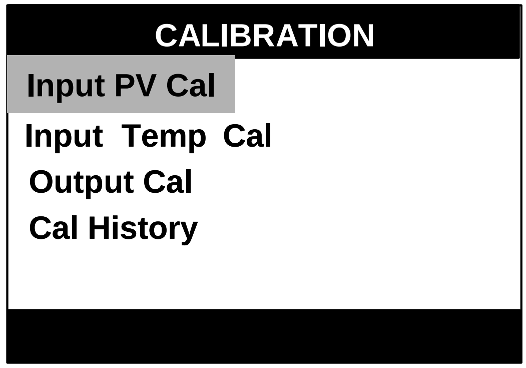
What's in this section?

The topics in this section are listed below.

8.2 Calibration Menu

Accessing the Main Calibration Menu and sub-menus

Press Calibrate. The Main Calibration Menu will appear.



Use the ▲▼ keys to highlight the "**Input PV Cal**" selection.

Press Enter to display the sub-menu for that selection.

Depending on the Input board installed, you can select from:

IN 1 or 2 pH/ORP Cal
IN 1 or 2 Pre pH Cal
IN 1 or 2 Conduc Cal
IN 1 or 2 DO Cal

Use the ▲▼ keys to highlight the Input selection for calibration.

Refer to the following sections for "calibration instructions":

8.5 **pH Calibration** Page 140
8.6 **ORP Calibration** Page 151
8.7 **Conductivity Calibration** Page 157
8.8 **Dissolved Oxygen Calibration** Page 166

8.3 pH/ORP and Conductivity Overview

pH/ORP Calibration

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 recalibration necessary for best performance. Determine recalibration intervals based on operating experience.

Conductivity

Each type of cell has an associated cell constant entered during Configuration Setup. (See Section 6.6) This number is part of the cell model number. However, for greater precision, every Honeywell cell is individually tested at the factory, and a calibration factor unique to that cell is determined. The cal factor for a cell can be found on the plastic tag hanging from the cell lead wires. Instructions for entering this cell cal factor are in Section 6.6. The UDA automatically uploads the Cal Factor from Honeywell cells with EEPROM. This value is displayed in the "Setup" menu.

For some conductivity applications even greater accuracy is required. For those applications it is possible to perform a calibration trim procedure. The Analyzer's reading can be adjusted while the associated cell is measuring a reference solution of known conductivity, as described in Section 8.7. The same procedure can be used to adjust the Analyzer's reading while the cell is in the process, if a reference instrument is used to determine the conductivity of the process. In this case the process fluid becomes the "reference solution".

Calibration trim is recommended for acid concentration applications above 5%.

Calibration trim can be reset as described in Section 8.7.

For accurate measurement of total dissolved solids (TDS) a conversion factor is entered for each cell as described in Section 6.6.

ATTENTION

Any time a unit reset is performed; the TDS Value will be reset to 1.0. Calibration trim and cal factor will be reset for cells.

8.4 Recommendations for Successful Measurement and Calibration

Selection and care of electrode system or cell essential

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

pH/ORP Calibration

- 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.

Conductivity Calibration

- For most accurate temperature measurement and compensation, insulate the outer body of the cell to minimize the effect of ambient conditions on process temperature measurement.
- Rinse the cells thoroughly with de-ionized water before immersing in a reference solution.
- Always deactivate control or alarm circuits before removing cells from the process.
- Do calibration trim with a reference solution, which is at about the same temperature and conductivity as the process solution.
- Inspect and, if necessary, clean the cells periodically according to experience and conditions.

ATTENTION

For successful measurement in pure water applications where plastic piping is used, you may have to provide an earth ground for the cell. Run a wire from the black electrode terminal of the cell to one of the earth ground screws.

8.5 pH Calibration

8.5.1 Introduction

pH instrument calibration consists of standardization and slope adjustments. Standardization is a pH Offset adjustment to compensate for electrode drift. Slope adjustment is a span adjustment to match the gain of the instrument to the electrode output response. For Durafet III pH electrodes, initial factory default value of offset and slope are automatically uploaded by the UDA. These values will appear in the "pH/ORP Cal" screens Table 8-2, step 4.

The analyzer supports two methods of calibration:

- With the **"Buffering"** method described in this section, you use your electrode system to measure two reference solutions ("buffers") having known pH values, and then adjust the analyzer so that its readings match the actual pH of each.

  ATTENTION

  The two reference solutions must have a pH difference of at least 2.

- With the **"Sample"** method described in this section you measure your process, both with your electrode system and with a separate (accurately calibrated) meter, then adjust the analyzer so that its reading matches the meter.

  ATTENTION

  When a Durafet III pH electrode is replaced, its electrode calibration data needs to be updated by the UDA2182 Analyzer. This is done either by power cycling the analyzer or using the restart screen.

Using the restart screen

Press	Action
Display	Repeatedly until the ***One Input*** or ***Two Inputs*** display screen appears.
Enter	You will see: Was probe replaced? No
▲▼	to change to Yes
Enter	to restart the UDA.

8.5.2 Calibrating pH Electrodes Using Automatic Buffer recognition

Analyzer stores information on multiple buffers

The UDA2182 Universal Dual Analyzer contains (in its permanent memory) information on several commonly used buffer solution standards in three groups, including the pH versus temperature characteristics of each.

By command, the instrument will automatically select one of these buffers in the selected group 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 Table 8-2.

The standard pH Buffer values are listed in Table 8-1.

Calibration functions

Calibrating the pH Offset (Standardization) –. In auto buffer recognition calibration, you can select one of the other buffer pH values directly above or below the recognized buffer value in the current buffer group. (See Table 8-1.)

Calibrating the Slope - In auto buffer recognition calibration, you can select one of the other buffer pH values directly above or below the recognized buffer value in the current buffer group. (See Table 8-1.)

Table 8-1 Standard pH Buffer Values

Temperature °C		0	5	10	15	20	25	30	35	40	45	50
Group	*Buffer*											
NIST/USP	**1.68**	1.67	1.67	1.67	1.67	1.68	1.68	1.68	1.69	1.69	1.70	1.71
	4.01	4.01	4.00	4.00	4.00	4.00	4.01	4.01	4.02	4.03	4.04	4.06
	6.86	6.98	6.95	6.92	6.90	6.88	6.86	6.85	6.84	6.84	6.83	6.83
	9.18	9.46	9.40	9.33	9.28	9.23	9.18	9.14	9.10	9.07	9.04	9.01
	12.45	13.42	13.21	13.01	12.80	12.64	12.45	12.30	12.13	11.99	11.84	11.71
USA	**2.00**	2.01	2.01	2.01	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	4.00	4.01	3.99	4.00	3.99	4.00	4.00	4.01	4.02	4.03	4.04	4.06
	7.00	7.13	7.10	7.07	7.05	7.02	7.00	6.99	6.98	6.97	6.97	6.97
	10.00	10.34	10.26	10.19	10.12	10.06	10.00	9.94	9.90	9.85	9.82	9.78
	12.00	12.60	12.44	12.28	12.14	12.00	11.88	11.79	11.66	11.53	11.43	11.32
Europe	**1.00**	0.98	0.98	0.99	0.99	1.00	1.00	1.01	1.01	1.01	1.01	1.02
	3.00	3.02	3.02	3.02	3.02	3.00	3.00	2.99	2.99	2.98	2.98	2.97
	6.00	6.03	6.02	6.01	6.00	6.00	6.00	6.00	6.01	6.02	6.04	6.05
	8.00	8.15	8.11	8.07	8.03	8.00	7.97	7.94	7.91	7.88	7.87	7.86
	10.00	10.22	10.17	10.12	10.05	10.00	9.95	9.90	9.86	9.82	9.78	9.74
	13.00	13.81	13.60	13.39	13.19	13.00	12.83	12.68	12.53	12.38	12.25	12.11

Procedure

Make sure you have selected "PV Type –pH Glass, pH Durafet, or pH HPW" in the Inputs configuration -Table 6-5.

Refer to Section 6.4.1 – ***General Rules for Editing***.

Table 8-2 Calibrating pH Electrodes Using Automatic Buffer Recognition

Step	Action	Screen
1	Prepare containers of two standard reference solutions.	
2	Press Calibrate	**CALIBRATION** **Input PV Cal** **Input Temp Cal** **Output Cal** **Cal History** Use ▲▼ to select **Input PV Cal**
3	Press Enter	**PV INPUT CAL** **In 1 pH/ORP Cal** **In 2 Conduc Cal** Use ▲▼ to select **Input 1 or 2 pH/ORP Cal**
4	Press Enter	**IN 1 pH/ORP Cal** **Auto Buffer Cal** **Buffer Cal** **Sample Cal** **Buffer Group** **pH Offset** **pH Slope** **Reset pH Offset** **Reset pH Slope** Use ▲▼ to select **"Buffer Group"**
5	Press Enter	Use ▲▼ to select **NIST/USP (default)** USA, or Europe

Step	Action	Screen
6	Press **Enter**	IN 1 pH/ORP Cal Auto Buffer Cal Buffer Cal Sample Cal Buffer Group pH Offset pH Slope Reset pH Offset Reset pH Slope Use ▲▼ to select **"Auto Buffer Cal"**
7	• Put the unit in "Hold" mode • Remove the electrode from the process. • Rinse the electrode thoroughly with distilled or de-ionized water	
8	***Calibrating the pH Offset*** Press **Enter** Follow the prompts at the top and bottom of the screen.	**"Place probe in Buffer 1"** The display will show the pH of the buffer 1 solution as measured by the electrode system. The reading will be automatically adjusted to match the known pH value stored in the UDA2182 memory. **"Press Enter when stable"**
9	Once the reading is stable Press **Enter**	**"Buffer 1 stability check"** Use ▲▼ to change the value of the Buffer. **"Up/Down changes Buffer"**
10	Rinse the electrode thoroughly with distilled or de-ionized water	
11	***Calibrating the Slope*** Press **Enter** Follow the prompts at the top and bottom of the screen.	**"Place probe in Buffer 2"** The display will show the pH of the buffer 2 solution as measured by the electrode system. The reading will be automatically adjusted to match the known pH value stored in the UDA2182 memory. **"Press Enter when stable"**

Step	Action	Screen
12	Once the reading is stable Press **Enter**	**"Buffer 2 stability check"** Use ▲▼ to change the value of the Buffer. **"Up/Down changes Buffer"**
13	If the calibration fails, an error message will be displayed across the bottom stripe of the screen. Make necessary adjustments and re-calibrate.	***Error Messages:*** Buffer span too low OFFSET UNDERRANGE OFFSET OVERRANGE Slope underrange Slope overrange Solution Unstable Temp Too Low Temp too High See Table 12-2 for definitions

8.5.3 Buffering Method of Calibrating pH Electrodes

Recommended for most applications

This technique is recommended for best accuracy in most applications.

Materials

Materials required are:

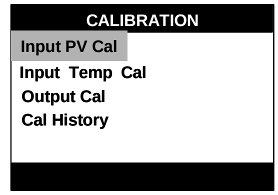
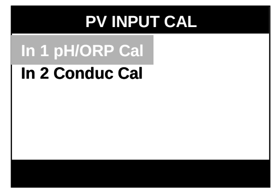
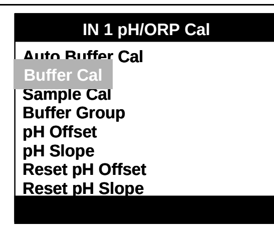
- Two standard buffer reference solutions that are at least 2 pH apart from one another.
- A container for each, large enough to immerse the electrode to measuring depth.
- Distilled or de-ionized water to rinse the electrode.

Procedure

Make sure you have selected "PV Type –pH Glass, pH Durafet, or pH HPW " in the Inputs configuration - Table 6-5.

Refer to Section 6.4.1 – ***General Rules for Editing***.

Table 8-3 Procedure for Buffering Method of Calibrating pH Electrodes

Step	Action	Screen
1	Press Calibrate	 Use ▲▼ to select **Input PV Cal**
2	Press Enter	 Use ▲▼ to select **Input 1 or 2 pH/ORP Cal**
3	Press Enter	 Use ▲▼ to select **Buffer Cal**
4	• Put the unit in "Hold" mode • Remove the electrode from the process. • Rinse the electrode thoroughly with distilled or de-ionized water	
5	*Standardization (adjust instrument zero)* Press Enter Follow the prompts at the top and bottom of the screen.	**"Place probe in Buffer 1"** The display will show the pH of the buffer 1 solution as measured by the electrode system. **"Press Enter when stable"**

Step	Action	Screen
6	Once the reading is stable Press **Enter**	**"Change to Buffer 1 value"** Use ▲▼ to change the value to match the actual pH of the Buffer 1 solution at its current temperature. **"Enter to save, Exit to cancel"**
7	Rinse the electrode thoroughly with distilled or de-ionized water.	
8	*Percent Theoretical Slope Adjustment* Press **Enter** Follow the prompts at the top and bottom of the screen.	**"Place probe in Buffer 2"** The display will show the pH of the buffer 2 solution as measured by the electrode system. **"Press Enter when stable"**
9	Once the reading is stable Press **Enter**	**"Change to Buffer 2 value"** Use ▲▼ to change the value to match the actual pH of the Buffer 2 solution at its current temperature. **"Enter to save, Exit to cancel"**
10	If the calibration fails, an error message will be displayed across the bottom stripe of the screen. Make necessary adjustments and re-calibrate	***Error Messages:*** Buffer span too low Slope (Percent Theoretical Slope) underrange Slope(Percent Theoretical Slope) overrange Solution Unstable See Table 12-2 for definitions

8.5.4 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

To use the sample method, follow the instructions in Table 8-4.

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.

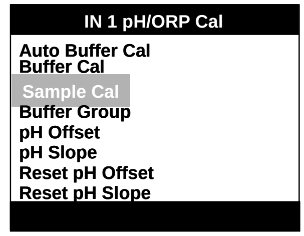
Procedure

Make sure you have selected "PV Type –pH Glass, pH Durafet, or pH HPW" in the Inputs configuration - Table 6-5.

Refer to Section 6.4.1 – ***General Rules for Editing***.

Table 8-4 Procedure for Sample Method of Calibrating pH Electrodes

Step	Action	Screen
1	Prepare the Calibration meter.	
2	Press (Calibrate)	CALIBRATION Input PV Cal Input Temp Cal Output Cal Cal History Use ▲▼ to select **Input PV Cal**
3	Press (Enter)	PV INPUT CAL In 1 pH/ORP Cal In 2 Conduc Cal Use ▲▼ to select **Input 1 or 2 pH/ORP Cal**

Step	Action	Screen
4	Press **Enter**	 Use ▲▼ to select **Sample Cal**
5	• Put the unit in "Hold" mode • **DO NOT** Remove the electrode from the process.	
6	Press **Enter** Follow the prompts at the top and bottom of the screen.	**"Place probe in Sample"** The display will show the pH of the process as measured by the electrode system. **"Press Enter when stable"**
7	Collect a beaker of the process sample from a point near the electrode mounting and measure its pH value with a calibrated portable instrument. **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	Once the reading is stable, press **Enter**	**Change to Sample Value"** Use ▲▼ keys to change the displayed value to match the value on the portable meter. **"Enter to save, Exit to cancel"**
9	If the calibration fails, an error message will be displayed across the bottom stripe of the screen. Make necessary adjustments and re-calibrate	Error Messages: See Table 12-2.

8.5.5 Viewing and resetting pH Offset and (Standardization) pH Slope

If the calibration is suspect, you can reset the pH Offset and pH Slope and calibrate again.

In the same screen as “Sample Cal”, use the ▲▼ keys to highlight “Reset pH Offset” or “Reset pH Slope”.

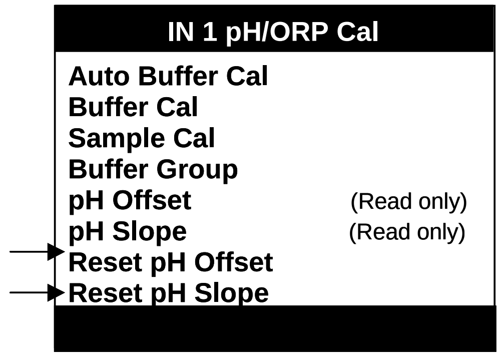


Figure 8-1 Resetting pH Offset and pH Slope

Press **ENTER**. The pH Offset or pH Slope will be reset to (Factory calibration default for Durafet III).

8.6 ORP Calibration

8.6.1 Introduction

ORP calibration consists of adjusting the reading of the analyzer 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 analyzer reading is adjusted to match this value, as described in Section 8.6. Instructions for preparing standard solutions are also provided below. These solutions are stable for only short periods of time (less than 8 hours) and are only approximations of ORP potentials.
- To calibrate the UDA2182 only, not the whole system including electrodes, apply a known millivolt signal to the Analyzer instead of input from the electrode, then adjust the UDA2182 reading to match the actual millivolt input, as described in Table 8-7.

8.6.2 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 UDA2182 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 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 8-5 have a ± 30 mV tolerance.

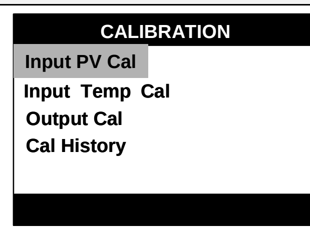
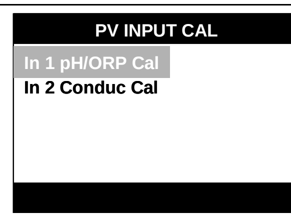
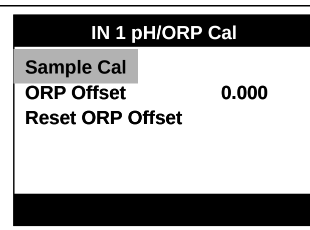
Table 8-5 Oxidation-Reduction Potential of Reference Solutions at Specified Temperature

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

Make sure you have selected "PV Type –ORP" in the Inputs configuration – Table 6-5
Refer to Section 6.4.1 – ***General Rules for Editing***.

Table 8-6 Procedure for Calibrating ORP System Using a Reference Solution

Step	Action	Screen
1	Press Calibrate	 Use ▲▼ to select **Input PV Cal**
2	Press Enter	 Use ▲▼ to select **Input 1 or 2 pH/ORP Cal**
3	Press Enter	

Step	Action	Screen
4	Put the unit in "Hold" mode Remove the electrode from the process. Rinse the electrode thoroughly with distilled or de-ionized water	
5	Press **Enter**	
6	Follow the prompts at the top and bottom of the screen.	**"Place probe in Sample"** The display will show the Oxidation Reduction Potential of the reference solution as measured by the electrode system. **"Press Enter when stable"**
7	Once the reading is stable Press **Enter**	**"Change to Sample value"** Use ▲▼ to change the value to match the actual oxidation-reduction potential of the reference solution at its current temperature. **"Enter to save, Exit to cancel"**
8	Press **Enter**	This will standardize the unit.
9	Take the unit out of "Hold" and return to the calibration menu.	
10	If the calibration fails, an error message will be displayed across the bottom stripe of the screen.	**Error Messages** Refer to Table 12-2.

8.6.3 ORP Calibration Using Voltage Input

Calibrates Analyzer only

The procedure described in this sub-section calibrates the Analyzer only. It does not involve compensating for electrode drift. Instead, a known millivolt signal is applied to the analyzer input terminals in place of the signal from the electrode, and the UDA2182 is adjusted so that its reading matches the known input.

ATTENTION

This procedure can only be used when measuring ORP *only*

Materials

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

- A source of a known millivolt signal.
- A screwdriver to fit the Analyzer input terminal screws and the terminal retainer.

Procedure

Make sure you have selected “PV Type –ORP” in the Inputs configuration – Table 6-5. Refer to Section 6.4.1 – ***General Rules for Editing***.

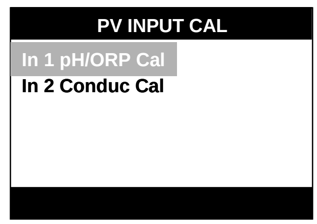
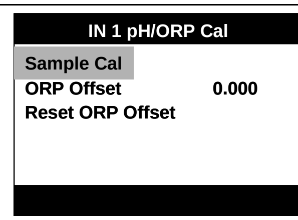
To calibrate the ORP Analyzer using Voltage Input, follow the instructions in Table 8-7.

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 8-7 Procedure for Calibrating ORP Analyzer Using Voltage Input

Step	Action	Screen
1	Turn off the power to the Analyzer. More than one switch may be required to disconnect power.	
2	With the power off open the case: Loosen the four captive screws on the front of the bezel. Grasp the bezel on the right side. Lift the bezel gently and swing the bezel open to the left. (The bezel and display assembly is mounted on pivot arms.)	
3	Refer to Figure 7-1 for the location of the terminal board retainer. Loose the screws that hold the retainer and slide the retainer right or left until the retainer tabs disengage from the terminal boards.	

Step	Action	Screen
4	Insert a screwdriver into the tab in the terminal board to be wired and pull. Slide the board half way out. There is a notch in the terminal board into which you can slide the retainer tabs and hold the boards in place while wiring.	
5	Label and remove the input wiring from the input terminals. Terminals 8 and 10. (See Figure 7-6 Terminal Designations for ORP).	
6	Feeding the test wiring through the conduit hole in the case, connect a voltage supply to the 8 and 10 input terminals • To apply a signal in the range 0 to 1600 mV, connect the plus to 8 and the minus to 10. • To apply a signal in the range -1 to -1600 mV, connect the plus to 10 and the minus to 8. Slide the Input board back and close the case and power up the unit. Do not apply power until the case is closed.	
7	Press Calibrate	 Use ▲▼ to select **Input 1 or 2 pH/ORP Cal**
8	Press Enter	
9	• Put the unit in "Hold" mode	
10	Press Enter	The display will show the Oxidation Reduction Potential in Millivolts. The value should match the Input signal.
11	Ignore the instructions to put the electrode in the reference solution. Instead, apply an appropriate millivolt signal (between –2000 and 2000 mV) to the input terminals. To obtain a negative value, you must reverse the input to the unit as described in Step 5.	

Step	Action	Screen
12	Once the reading is stable, if it does not match the input signal, press **Enter**	**"Change to Sample value"** Use ▲▼ to change the value to match the Voltage being applied to the input terminals. **"Enter to save, Exit to cancel"**
13	Press **Enter**	This will standardize the unit.
14	Take the unit out of "Hold" and return to the calibration menu.	
15	Turn off the voltage source and turn off power to the Analyzer. Do not open the case until power is disconnected.	
16	Reconnect field wiring removed in Step 5.	
17	Re-insert the terminal board into the case.	
18	Close the case and power up the unit. Do not apply power until case is closed.	

8.6.4 Viewing and Resetting ORP Offset

If the calibration is suspect, you can reset the ORP Offset and calibrate again.

In the same screen as "Sample Cal", use the ▲▼ keys to highlight "Reset ORP Offset".

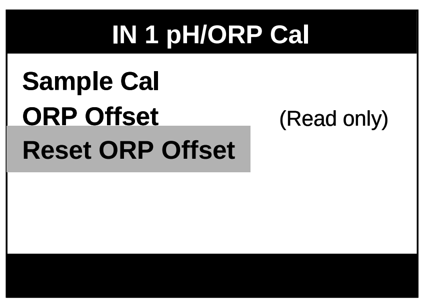


Figure 8-2 Resetting ORP Offset

Press ENTER. The ORP Offset will be reset to 0.000 (default).

8.7 Conductivity Calibration

8.7.1 Introduction

Each type of cell has an associated cell constant entered during Configuration setup (see Section 6.6). This number is part of the cell model number. However, for greater precision, every Honeywell cell is individually tested at the factory, and a calibration factor unique to that cell is determined. The cal factor for a cell can be found on the plastic tag hanging from the cell lead wires. Instructions for entering this cell cal factor are in Section 6.6. The UDA automatically uploads the Cal Factor from Honeywell DL4XXX type cells. This value is displayed in the "Setup" menu.

For some conductivity applications even greater accuracy is required. For those applications it is possible to perform a calibration trim procedure. The Analyzer's reading can be adjusted while the associated cell is measuring a reference solution of known conductivity, as described in Table 8-9. The same procedure can be used to adjust the Analyzer's reading while the cell is in the process, if a reference instrument is used to determine the conductivity of the process. In this case the process fluid becomes the "reference solution".

Calibration trim is recommended for acid concentration applications above 5%.

Calibration trim can be removed as described in this section.

For accurate measurement of total dissolved solids (TDS) a conversion factor is entered for each cell as described in Table 6-5 (Input1, Input 2, Conductivity).

8.7.2 Entering the Cal Factor for each cell

Introduction

Each type of cell has an associated cell constant; this number is part of the cell model number. The constant for each cell is entered during Input setup. However, for greater precision, every Honeywell cell is individually tested at the factory, and a calibration factor unique to that cell is determined. The cal factor for a cell can be found on the plastic tag hanging from the cell lead wires.

Procedure

If you have not done so already, refer to Table 6-5 (Input1/Input2/Conductivity) to enter the cal factor for each cell

8.7.3 Determining and Entering the TDS Conversion Factor

Introduction

The UDA2182 measures conductivity. However, the process value can be displayed in terms of total dissolved solids (TDS). If a TDS PV type was specified during Input setup (Section 6.6), then the same menu in will contain an entry for the TDS conversion factor for each cell.

8.7.4 Determining TDS conversion factor

To determine the TDS conversion factor, it is first necessary to establish the total dissolved solids in a representative sample of the process. The formal determination of TDS is a laboratory standard method performed on a weighed grab sample of the process fluid. To summarize how to obtain a TDS value:

- Suspended solids, if present, are filtered out.
- All water is evaporated.
- The residue is dried and weighed.
- The result is divided by the original sample weight to obtain ppm TDS.

For detailed guidance in determining the official TDS, see “Standard Methods for the Examination of Water and Wastewater,” jointly published by the American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, DC.

To determine the conversion factor needed by the Analyzer, first use the laboratory procedure summarized above to give an official TDS value. Next divide the TDS value by the conductivity of the sample to yield the conversion factor for that particular process fluid. The conversion factor is then entered into the analyzer to normalize the TDS readout.

With power plant cation conductivity measurements, ion chromatography results may be used to establish the conversion factor for readout in ppb chloride or sulfate ion. Nominal values are 83 ppb per μS/cm for chloride ion and 111 ppb per μS/cm for sulfate ion. The analyzer does not provide temperature compensation in TDS for chloride or sulfate ions.

Out-of range-values forced to closest limit

As long as the entered TDS value is within the acceptable limits for a given cell constant, the Analyzer accepts the value. If a value is outside the accepted range, the unit will not display an error message; instead it will force the value to either the high or low limit of the range of the cell constant. Refer to Table 6-5 (Input1/Input2/Conductivity) for TDS conversion factor defaults.

Calibrate the Analyzer before entering TDS conversion factor

If you intend to enter a cal factor or use calibration trim, do so before entering the TDS conversion factor as described here.

If you use calibration trim, first set the solution temperature compensation in Table 6-5 to the non-TDS choice for your process. For example, if you plan to use “NaCl” set the solution temperature compensation type to “NaCl” temporarily for calibration purposes. (Solution temperature compensation type is the one Input setup parameter that can be changed without triggering a cold reset.)

Next, perform the calibration. Once calibration has been completed, go back to Input setup and set the solution temperature compensation type to the TDS choice, for example “NaCl”.
At this point you are ready to enter the TDS conversion factor as described in Table 6-5.

8.7.5 Performing Calibration Trim

Introduction

For most applications entering the cal factor for each cell will achieve satisfactory system performance. However, it is possible to perform a calibration trim procedure in which the Analyzer and cell combination are used to measure a reference solution of known conductivity; the reading of the Analyzer is adjusted to match.

The same procedure can be used to adjust the Analyzer's reading while the cell is in the process, if a reference instrument is used to determine the process conductivity. In this case, the process fluid becomes the "reference solution".

Calibration trim is recommended for acid concentration measurements above 5%.

Materials

To perform calibration trim using a standard reference solution, follow the instructions in Table 8-9.

Materials required are:

- A reference solution of known conductivity near the point of interest, with the temperature controlled (or measured and compensated) to within ± 1 °C. Conductivities of potassium chloride solutions are provided in Table 8-8. Solutions must be prepared with high-purity de-ionized, CO_2-free water, and dried potassium chloride.
- For acid concentration applications, a certified reagent grade solution with the temperature controlled.
- A container for the reference solution, large enough to immerse the cell to measuring depth.
- De-ionized water to rinse the cell.

Table 8-8 Conductivity of Potassium Chloride Solutions at 25 °C

Concentration M*	Conductivity (microSiemens per cm)
0.001	147.0
0.005	717.8
0.01	1,413
0.02	2,767
0.05	6,668

* M = Molarity; 1M = 74.555g potassium chloride per liter of solution

Procedure

Table 8-9 Procedure for Performing Calibration Trim Using a Reference Solution

Step	Action	Screen
1	Press Calibrate	CALIBRATION Input PV Cal Input Temp Cal Output Cal Cal History
2	Press Enter	PV INPUT CAL In 1 pH/ORP Cal In 2 Conduc Cal Use ▲▼ to select Input 1 or 2 Conduc Cal
3	Press Enter	IN2 Conduc Cal Sample Cal Cal Trim 1.00 Reset Cal Trim
4	• Remove the cell from the process. • Rinse the cell thoroughly with de-ionized water.	

Step	Action	Screen
5	Press **Enter**	
6	Follow the prompts at the top and bottom of the screen.	**"Place probe in Sample"** The display will show the conductivity of the reference solution as measured by the cell and Analyzer system. **"Press Enter when stable"**
7	Once the reading is stable, Press **Enter**	**"Change to Sample value"** Use ▲▼ to change the value to match the actual conductivity of the reference solution at its current temperature. **"Enter to save, Exit to cancel"**
8	Press **Enter**	This will save the Calibration Trim Value. If the calibration trim adjustment is successful, the calibration menu will again be displayed. Return the cell to the process. Repeat the operation for the other cell.
9	If the calibration fails, an error message will be displayed across the bottom stripe of the screen.	**Error Messages** Refer to Table 12-2.

8.7.6 Resetting Calibration Trim

If the calibration is suspect, you can reset the Calibration Trim and calibrate again.

In the same screen as “**Sample Cal**”, use the ▲▼ keys to highlight “**Reset Trim**”.

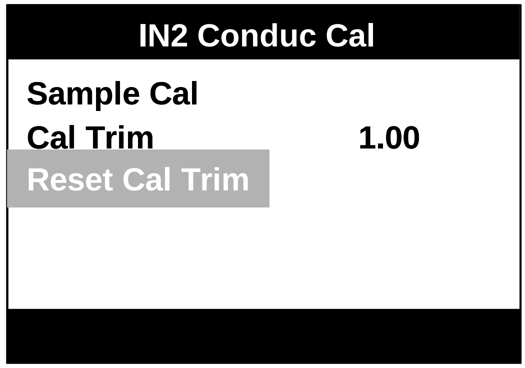


Figure 8-3 Resetting Calibration Trim

Press **ENTER**. The Calibration Trim will be reset to 1.00 (default).

8.7.7 Cation pH Calibration

The UDA allows for a sample calibration of the specific or influent pH value. Here an independent sample is withdrawn from the sampling equipment and pH is determined with equipment of known accuracy. This independent pH value is then entered into the UDA as a pH calibration constant.

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

To use the sample method, follow the instructions in Table 8-4.

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.

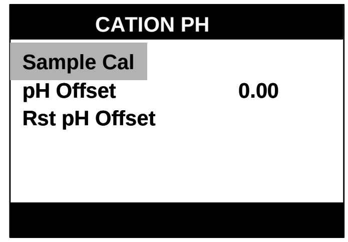
Procedure

Make sure both inputs are "Conductivity".

Refer to Section 6.4.1 – ***General Rules for Editing***.

Table 8-10 Procedure for Sample Method of Calibrating Cation pH

Step	Action	Screen
1	Prepare the Calibration meter.	
2	Press (Calibrate)	CALIBRATION Input PV Cal Input Temp Cal Output Cal Cal History Use ▲▼ to select **Input PV Cal**
3	Press (Enter)	Input 1 Conduc Input 2 Conduc Cation pH Use ▲▼ to select **Cation pH**

Step	Action	Screen
4	Press **Enter**	 Use ▲▼ to select **Sample Cal**
5	• **DO NOT** Remove the electrode from the process.	
6	Once the reading is stable, press **Enter**	**Change to Sample Value"** Use ▲▼ keys to change the displayed value to match the value on the portable meter. **"Enter to save, Exit to cancel"**
7	Follow the prompts at the top and bottom of the screen.	**"Cal Complete"** **To recalibrate, press "Enter".** **"Enter = recal, Exit = exit"**
8	If the calibration fails, an error message will be displayed across the bottom stripe of the screen. Make necessary adjustments and re-calibrate.	Error Messages: See Table 12-2.

8.7.8 Resetting pH Offset

If the calibration is suspect, you can reset the Ph Offset and calibrate again.

In the same screen as "**Sample Cal**", use the ▲▼ keys to highlight "**Rst pH Offset**".

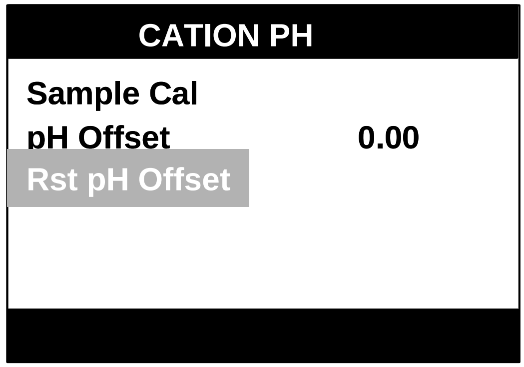


Figure 8-4 Resetting pH Offset

Press **ENTER**. The pH Offset will be reset to 0.00 (default).

8.8 Dissolved Oxygen Calibration

Overview

The analyzer supports three methods of Dissolved Oxygen calibration:

Air Calibration - is done with the probe removed from the process. This is the recommended method of calibration and should be completed unless the process set-up prohibits removing the probe. This is recommended prior to installation as it saves system parameters that are used in optimizing error diagnostics.

If the probe has just been removed from a sample low in dissolved oxygen, it takes longer to complete a calibration than that of a probe that is already near ambient conditions (sample high in dissolved oxygen).

Sample Calibration - Sample calibration allows a calibration based on a known dissolved oxygen concentration where a DO value may be entered that is based on a reference measurement. Sample calibration is usually executed by leaving the probe in the measured sample and adjusting the Analyzer to agree with the sample dissolved oxygen measured with a properly calibrated portable dissolved oxygen meter whose probe is held very close to the process probe.

For those situations where sample calibration is preferred, it is recommended that an Air Calibration be performed before the probe is put into service. It is also good practice to Air Calibrate the probe once every 2 - 4 months of service.

Pressure Compensation - The concentration of oxygen dissolved in air-saturated water depends on the air pressure. This dependence is automatically compensated for during air calibration using a pressure sensor built into the Analyzer. The purpose of the pressure calibration is to insure that the atmospheric oxygen level is known at the time of air calibration. Pressure compensation is only employed at the time of Air Calibration.

In this section there is also a procedure for running a **Probe Bias Scan**.

Do's and Don'ts for Dissolved Oxygen Calibration

Do check the key parameters on the Display screen before performing an air calibration for the first time. The parameters should be within the following ranges:

Pressure: 500 to 800 mmHg

Salinity: 0.0 if not being used

Temperature should be a stable reading

Don't perform a probe bias test while the probe is in normal measurement service.

Don't perform an air calibration while the probe is in either the ppm or ppb process water.

Don't perform a sample calibration when the Dissolved Oxygen reading is in the 0.0 - 2.0 ppb range.

Don't measure the dissolved oxygen in gas streams or air streams. This product measures dissolved oxygen in water.

Calibrating a Dissolved Oxygen Probe Using Air Calibration Method

Introduction

This is the simplest and most commonly used method of calibration.

ATTENTION

If “Initial Installation”, power probe and analyzer for 24 hours before first air calibration.

1. Assure that the probe has been powered for at least one hour.
2. Press the Hold button, if required.
3. Expose the probe to air (or air-saturated water) until the temperature and DO value reading stabilizes.

Procedure

Table 8-11 Calibrating a Dissolved Oxygen Probe Using Air Calibration Method

Step	Action	Screen
1	Press Calibrate	CALIBRATION Input PV Cal Input Temp Cal Output Cal Cal History
2	Press Enter	PV INPUT CAL In 1 DO Cal Use ▲▼ to select **Input 1 or 2 DO Cal**
3	Press Enter	IN1 DO CAL Air Cal Sample Cal Reset Cal Factor Pressure Cal Pressure Offset Reset Prs Offset Bias Scan Bias Volts Reset Bias Volts Use ▲▼ to select **Air Cal**

Step	Action	Screen
4	Press Enter Follow the prompts at the top and bottom of the screen.	**“Place probe in air”** The display will show the live Dissolved Oxygen value. **Press Enter when ready”**
5	Press Enter	**“Cal stability check”** This screen remains until the Air Calibration is complete. At that time the previous screen is displayed indicating that the air calibration is complete. **“Wait for cal complete”**
6		**“ Cal Complete”** This screen gives you an option to exit or recalibrate. Press ENTER to recalibrate. Press EXIT to return to Input Cal Screen.
7	If the calibration fails, an error message will be displayed across the bottom stripe of the screen.	**Error Messages** Readings Unstable Cal Factor Underrange Cal Factor Overrange Refer to Table 12-2.
Air Calibration is not completed until both the probe temperature and the probe signal are stable. If the probe has just been removed from a sample low in dissolved oxygen or with temperature significantly different from the air temperature, it takes longer to reach stability than if the probe were already near ambient conditions when calibration was initiated.		

Calibrating a Dissolved Oxygen Probe Using Sample Calibration Method

Introduction

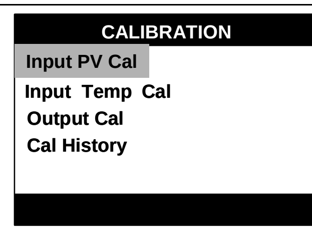
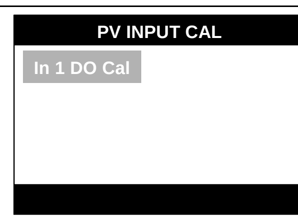
Sample calibration allows a calibration based on a known dissolved oxygen concentration. It is similar to air calibration except that the known DO value may be entered. Assuming an accurate reference is available, use the sample calibration method rather than air calibration if any of the following conditions apply:

- The air is below freezing (32°F, 0°C), or hot (above 104°F, 40°C) or very dry (below 20% relative humidity).
- The probe is mounted such that it is much easier to measure the concentration of the DO in the water independently than to expose the probe to air. Such mounting is not recommended but is sometimes necessary.
- The measurement interruption for air calibration cannot be tolerated.

Sample calibration is usually executed by leaving the probe in the measured sample and adjusting the analyzer to agree with the sample dissolved oxygen measured with a properly calibrated portable dissolved oxygen meter whose probe is held very close to the probe of the analyzer. Alternatively, the probe may be removed from the measured sample and placed in a sample of known dissolved oxygen concentration.

Procedure

Table 8-12 Calibrating a Dissolved Oxygen Probe Using Sample Calibration Method

Step	Action	Screen
1	Power the probe for at least one hour. (power the probe for 24 hours if initial installation)	
2	Press **Calibrate**	
3	Press **Enter**	 Use ▲▼ to select **Input 1 or 2 DO Cal**

Step	Action	Screen
4	Press **Enter**	 Use ▲▼ to select **Sample Cal**
5	• Put the unit in "Hold" mode, if required.	
6	Press **Enter** Follow the prompts at the top and bottom of the screen.	**"Place probe in sample"** Immerse the probe in the sample of known DO concentration and wait until the DO reading is stable. **"Press Enter when stable"**
7	Once the reading is stable, press **Enter**	**Change to sample value"** Use the arrow keys to change the displayed value to match the value of the known sample DO concentration. **"Enter to save"** when the value displayed equals the known sample DO concentration. **Exit to cancel"**
8	Press **Enter**	**" Cal Complete"** This screen gives you an option to exit or recalibrate. Press ENTER to recalibrate. Press EXIT to return to Input Cal Screen.
9	Press **Enter**	
10	If the calibration fails, an error message will be displayed across the bottom stripe of the screen. Make necessary adjustments and re-calibrate.	***Error Messages:*** Cal Factor Underrange Cal Factor Overrange See Table 12-2.

Calibrating the Integral Pressure Sensor

Introduction

The concentration of oxygen dissolved in air-saturated water depends on the barometric pressure. This dependence is automatically compensated for during air calibration using a pressure sensor built into the Analyzer. The purpose of the pressure calibration is to calibrate that pressure sensor. However, this sensor has been factory calibrated and should not require re-calibration.

Procedure

Determine the true ambient barometric pressure, such as from a calibrated pressure transmitter or a mercury barometer. Absolute barometric pressure is required - not the "relative" sea-level pressure normally reported by the weather bureau.

Table 8-13 Calibrating the Integral Pressure Sensor

Step	Action	Screen
1	Press **Calibrate**	**CALIBRATION** Input PV Cal Input Temp Cal Output Cal Cal History
2	Press **Enter**	**PV INPUT CAL** In 1 DO Cal Use ▲▼ to select **Input 1 or 2 DO Cal**
3	Press **Enter**	**IN1 DO CAL** Air Cal Sample Cal Reset Cal Factor Pressure Cal Pressure Offset Reset Prs Offset Bias Scan Bias Volts Reset Bias Volts Use ▲▼ to select **Pressure Cal**

Step	Action	Screen
4	Press Enter Follow the prompts at the top and bottom of the screen.	**"Pressure Sensor Cal"** Display shows the barometric pressure value in mm Hg. **"Press Enter when stable"**
5	Once the reading is stable, press Enter	**Change to sample value"** Use the arrow keys to change the displayed value until the displayed pressure in mmHg agrees with the known pressure. **"Enter to save, Exit to cancel"**
6		**" Cal Complete"** This screen gives you an option to exit or recalibrate. Press ENTER to recalibrate. Press EXIT to return to Input Cal Screen.
7	If the calibration fails, an error message will be displayed across the bottom stripe of the screen. Make necessary adjustments and re-calibrate.	***Error Messages:*** See Table 12-2.

Running a Probe Bias Scan

Introduction

The dissolved oxygen probe is an electrochemical cell, which produces an electric current that is directly proportional to the concentration of oxygen dissolved in the sample in which the probe tip is immersed. (When the probe is in air, the current is identical to that produced when the probe is in air-saturated water.) This current is a direct measurement of oxygen level. Usually, the probe is operated at -0.55V with respect to a reference electrode within the probe. **(The minus sign is omitted from the screen as well as from the following discussion.)** However, in some applications, the performance of the DO probe can be enhanced by using other bias voltages. The purpose of this test is to evaluate whether the probe bias voltage should be adjusted. Possible interference with probe performance may also be inferred from the Probe Bias Test (PBT).

Test initiation

When the test is initiated, the bias voltage is adjusted down from its original value (usually 0.55V) at 25mV/sec until 0V is reached. Then the bias voltage is driven up to 1.0 V at 25mV/sec and finally, it is driven down again until it has returned to the value it had just before the test was initiated. During this voltage sweep, the probe current is monitored and the graph of current as a function of voltage is displayed.

If during the test the probe current rises above a factory-set upper limit, the bias voltage is returned to its pre-test value at 25mV/sec and the test is terminated without completing the full 1.0 Volt sweep. (The bias voltage test may also be terminated at any time by pressing the “EXIT” button.)

Display Graph

Under normal conditions, the completed display shows a graph of current as a function of voltage with the following features: from approximately 0 to 0.2 volts a fairly rapid increase in current is observed; from approximately 0.2 to 0.8 volts, the current exhibits a “flat” region where it is nearly independent of voltage and at some voltage above about 0.8 volts, the current rises quickly.

A typical current-voltage curve is shown below. The Sweep Bias millivoltage (along the bottom of the graph) is a voltage from 0 -1V that is applied to perform the test. The Operating Bias millivoltage is the current position of the cursor on the graph and represents the current bias voltage. The horizontal axis numerals are in hundreds of millivolts.

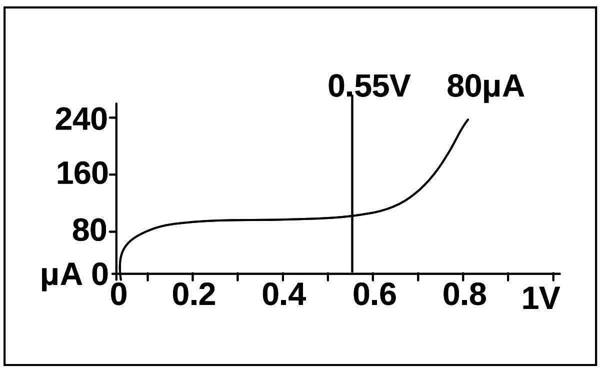


Figure 8-5 Display of Probe Bias Test Done in Air

Note that the curve is quite flat at 0.55V. This means that even rather large changes in the probe current-voltage characteristic do not affect the current (and, thus, probe sensitivity) at 0.55V. In general, the curve formed by decreasing voltage is not identical to that formed by increasing voltage. This hysteresis is a function of the voltage scan rate and may be ignored.

The interpretation of figure shown above is as follows:

As the bias voltage of the oxygen-consuming electrode (relative to an internal reference electrode) is increased, there is an initial increase in current as more and more of the oxygen that approaches the electrode is reacted. However, at about 0.2V, the current stops rising and a flat region, independent of voltage, is observed. It is in this region that probe current is determined by oxygen mass transport limitation. Increasing the voltage cannot increase the current because oxygen movement is diffusion limited. Finally, at a voltage exceeding 0.8 volts, a second process (**water reduction**) begins to occur and the current again rises. To achieve stable results, the probe should be operated within the flat region so that small changes in the probe characteristics result in negligible changes in probe current.

In some industrial wastewater applications, particularly those in petroleum refineries, active gases dissolved in the wastewater can cause this current-voltage characteristic to shift, moving the flat region to other, usually lower, voltages. Also, in some very rare instances, the chemical treatment of boiler water can cause this current-voltage characteristic to shift, moving the flat region to other, usually lower, voltages.

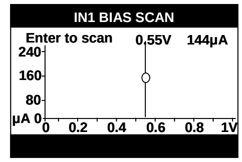
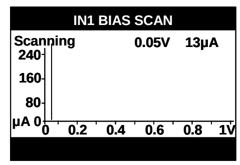
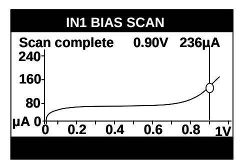
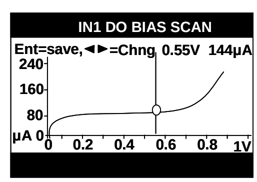
To summarize, the Probe Bias Test automatically varies the probe voltage while displaying the probe current as shown in the figure. At the completion of the test an opportunity to change the bias voltage is provided. Thus, even where significant gaseous contamination might otherwise interfere with the response of the probe to dissolved oxygen, this advanced feature allows the probe to operate.

(If the results of the probe bias test should ever be significantly different from those shown in the figure, Honeywell Service should be consulted.)

Procedure

Table 8-14 Running a Probe Bias Scan

Step	Action	Screen
1	Press Calibrate	**CALIBRATION** **Input PV Cal** **Input Temp Cal** **Output Cal** **Cal History**
2	Press Enter	**PV INPUT CAL** **In 1 DO Cal** Use ▲▼ to select **Input 1 or 2 DO Cal**
3	Press Enter	**IN1 DO CAL** **Air Cal** **Sample Cal** **Reset Cal Factor** **Pressure Cal** **Pressure Offset** **Reset Prs Offset** **Bias Scan** **Bias Volts** **Reset Bias Volts**

Step	Action	Screen
		Use ▲▼ to select **Bias Scan**
4	Press Enter to initiate the Bias Scan screen **At any time press "Exit" to abort scan.**	You will see:  **µA may be 0, 40, 80, 120**
5	Press Enter to start scan	**Scan in Progress (Example)** The bias voltage is adjusted down from its original value (usually 0.55V) at 25mV/sec until 0V is reached. 
		Then the bias voltage is driven up to 1.0 V at 25 mV/sec until "Scan complete" appears. 
		and finally, it is driven down again until it has returned to the value it had just before the test was initiated. During this voltage sweep, the probe current is monitored and the graph of current as a function of voltage is displayed.  At the completion of the test an opportunity to change the bias voltage is provided. Press ◄ ► to change the bias voltage, or

Step	Action	Screen
6	Press **Enter** to save	Screen returns to **“IN1 DO CAL**” screen. Bias Volts will be indicated on the screen.

Resetting Pressure Offset or Bias Volts

If the calibration is suspect, you can reset any of these values and calibrate again.

In the same screen as "**IN 1 DO Cal**", use the ▲▼ keys to highlight "**Reset Prs Offset**" or "**Reset Bias Volts**".

Figure 8-6 Resetting Pressure Offset or Bias Volts

Press **ENTER**. The selected value will be reset to (default).

9 Outputs Calibration

9.1 Overview

Introduction

The section describes the calibration procedures for the following:

Output Cal – calibrate ***Analog Output 1, Analog Output 2, and Analog Output 3***

For other Calibration Procedures refer to the sections listed below.

PV Input Cal – calibrate ***Input 1*** **and** ***Input 2*** **for** ***pH/ORP, Conductivity*** **or Dissolved Oxygen** (See Section 8)

Temperature Cal – calibrate ***Temperature 1*** **and** ***Temperature 2*** **for** ***pH/ORP*** **or** ***Conductivity*** (See Section *1)*

For Calibration History, refer to Section 11.

What's in this section?

The topics in this section are listed below.

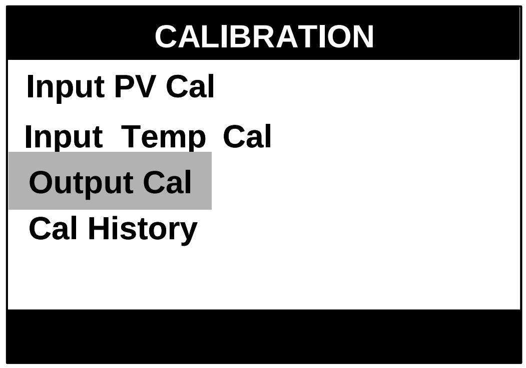
9.2 Output Calibration

Introduction

The UDA2182 is available with two standard and one optional analog outputs. The output signals can be adjusted to trim the high and low output current or voltage values over a range of ± 0.4 % of span to compensate for component tolerance variations.

Accessing the Main Calibration Menu and sub-menus

Press Calibrate. The Main Calibration Menu will appear.



Use the ▲▼ keys to highlight the "**Output Cal**" selection.

Press Enter to display the sub-menu for that selection.

Required equipment

Output calibration involves connecting a meter to the Analyzer'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 ± 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 terminal board retainer is also required.

Procedure

To calibrate outputs, follow the procedure described in Table 9-1 Procedure for Calibrating Analyzer Outputs. The output terminals are inside the case as shown in Figures 6-1 through 6-6.

WARNING

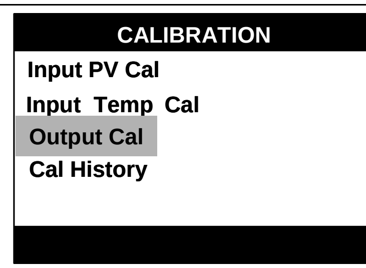
While the unit is powered, a potentially lethal shock hazard exists inside the case. Do not open the case while the unit is powered. Do not access the output terminal as described below while the unit is powered.

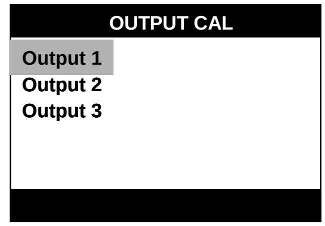
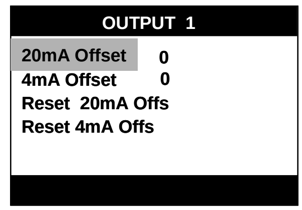
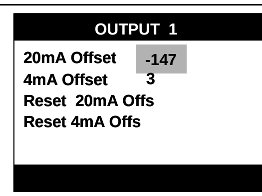
WARNING

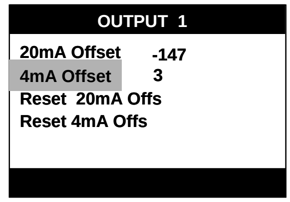
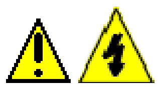
A disconnect switch must be installed to break all current carrying conductors. Turn off power before working on conductors. Failure to observe this precaution may result in serious personal injury.

Procedure

Table 9-1 Procedure for Calibrating Analyzer Outputs

Step	Action	Screen
1	**Turn off the power to the Analyzer**. More than one switch may be required to disconnect power.	
2	**With the power off**, open the case: Loosen the four captive screws on the front of the bezel. Grasp the bezel on the right side. Lift the bezel gently and swing the bezel open to the left.	
3	Refer to Figure 7-1 for the location of the terminal board retainer. Loose the screws that hold the retainer and slide the retainer right or left until the retainer tabs disengage from the terminal boards.	
4	Insert a screwdriver into the tab in the terminal board to be wired and pull. Slide the board half way out. - Refer to Figure 7-1 for the location. (Output 1 and 2 – Power Supply/Analog Output/Relay Output card) (Output 3 – Option card) There is a notch in the terminal board into which you can slide the retainer tabs and hold the boards in place while wiring.	
5	Label and remove the field wiring from the output terminals. Output 1 – Terminals 12– and 13+ Output 2 – Terminals 10– and 11+ Output 3 – Terminals 14– and 15+	
6	Feeding the test wiring through the conduit hole in the case and connect the appropriate type meter to the specific output terminals Be sure to observe the correct polarity. Slide the Input board back and close the case and power up the unit. **Do not apply power until the case is closed.**	
7	Press Calibrate	 Use ▲▼ to select ”Output Cal”

Step	Action	Screen
8	Press Enter	 Use ▲▼ to select an Analog Output to be calibrated
9	Press Enter	 Use ▲▼ to select " 20 mA Offset"
10	Press Enter	 The right most digit will be "blinking".
11	To correct the value on the meter: • Use the ▲▼ keys to increment or decrement the value of the digit • Use the ◀ ▶ keys to move the cursor to the next digit. • Repeat as required to achieve a 20mA reading on the test meter • When all digits have been changed, press "Enter" to store the 20mA value. Press "Exit" to cancel. The previous value is retained.	

Step	Action	Screen
12	Use ▲▼ to select ” 4 mA Offset” and repeat the process.	
13	Press “Enter” to store the 4mA Offset value. Press “Exit” to cancel. The previous value is retained.	
14	If the calibration is suspect, you can reset the 20mA and 4mA Offset and calibrate again.	
	 To calibrate additional Outputs, repeat the above steps Including powering down the unit before changing the connections to the output terminals. When output calibration has been completed, re-install the field wiring removed in step 5. **Disconnect power before opening the case.** Close the case and power up the unit. **Do not apply power until the case is closed.**	

Viewing and resetting 20mA and 4mA Offset

If the calibration is suspect, you can reset the 20mAand 4mA Offset and calibrate again.

In the same screen as "**20mA and 4mA Offset**", use the ▲▼ keys to highlight "**Reset 20mA Offset**" or "**Reset 4mA Offset**".

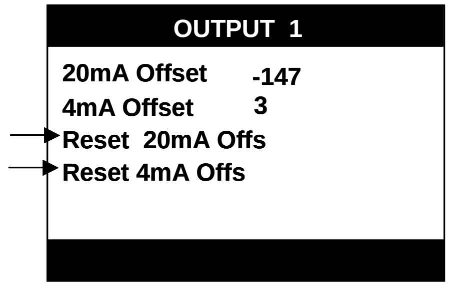


Figure 9-1 Resetting Output 1 Offsets (example)

Press **ENTER**. The 20mA Offset or 4mA Offset will be reset to 0(default).

10 Temperature Input Calibration

10.1 Overview

Introduction

The section describes the calibration procedures for the following:

Temp Input Cal – calibrate **(T1)** ***Temperature 1*** **or (T2)** ***Temperature 2*** **for** ***pH/ORP*** **or** ***Conductivity***

For other Calibration Procedures refer to the sections listed below.

PV Input Cal – calibrate ***Input 1*** **and** ***Input 2*** **for** ***pH/ORP, Conductivity*** **or Dissolved Oxygen** (See Section 8)

Output Cal – calibrate ***Analog Output 1, Analog Output 2, and Analog Output 3*** (See Section 1)

For Calibration History, refer to Section 11.

What's in this section?

The topics in this section are listed below.

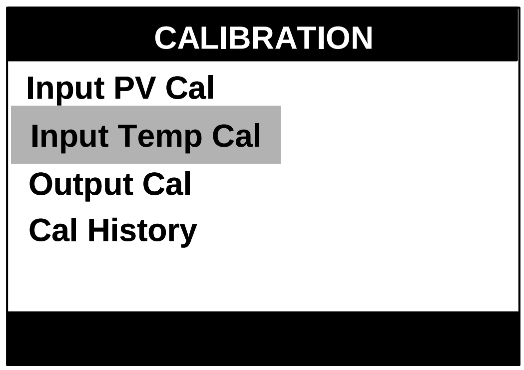
10.2 Temperature Input Calibration

Introduction

Temperature Input Calibration lets you monitor a live temperature reading while continuing to monitor the sample. The currently displayed temperature value can be edited through a series of prompts on the screen. The temperature offset value is always displayed in the temperature units selected in the Maintenance setup menu.

Accessing the Main Calibration Menu and sub-menus

Press Calibrate. The Main Calibration Menu will appear.

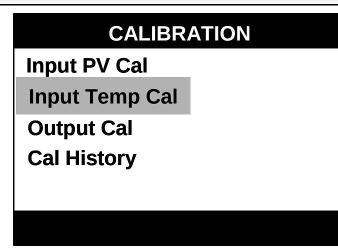
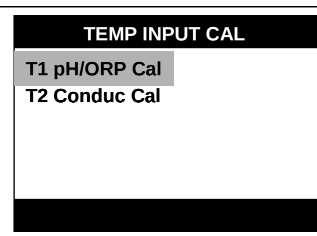


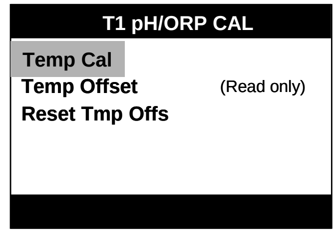
Use the ▲▼ keys to highlight the "**Input Temp Cal**" selection.

Press Enter to display the sub-menu for that selection.

Procedure

Table 10-1 Procedure for Calibrating the Temperature Inputs

Step	Action	Screen
1	Press Calibrate	 Use ▲▼ to select **" Input Temp Cal"**
2	Press Enter	

Step	Action	Screen
		Use the ▲▼ keys to highlight the desired "Temperature Input" selection.
3	Press **Enter**	
4	Press **Enter**	
5	Follow the prompts at the top and bottom of the screen.	**"Place probe in sample"** The display will show the temperature of the reference solution as measured by the probe and Analyzer system. **"Press Enter when stable"**
6	Once the reading is stable, Press **Enter**	**"Change to sample value"** Use ▲▼ to change the value to match the actual temperature of the reference solution at its current temperature. **"Enter to save, Exit to cancel"** **Limit is ± 5ºC (± 9ºF)**
7	Press **Enter**	This will save the Temperature Offset value. If the calibration is not successful, an error message will be displayed.
8	If the calibration is suspect, you can reset the Temperature Offset and calibrate again.	

Viewing and resetting Temperature Offset

If the calibration is suspect, you can reset the Temperature Offset and calibrate again.

In the same screen as “**Temp Cal**”, use the ▲▼ keys to highlight “**Reset Tmp Offset**”.

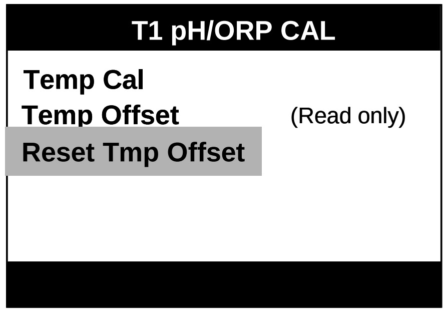


Figure 10-1 Resetting temperature offset

Press **ENTER**. The Temperature Offset will be reset to (default).

11 Calibration History

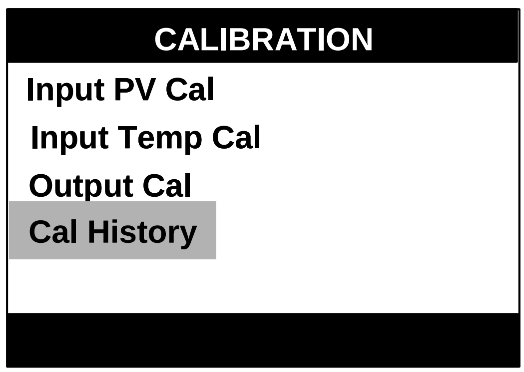
11.1 Overview

Calibration History records every successful input or output calibration with timestamp, with detail available on cal type and before and after cal values by scrolling and selecting cal event name. Calibration records are listed top down from most recent to least recent. Each line in the list consists of a calibration event name and the date and time of occurrence.

Successful automatic cals from auto cycling also recorded and identified. Status warns of cal history at 50% and 90% and when erasing old records.

Accessing the Main Calibration Menu and sub-menus

Press Calibrate. The Main Calibration Menu will appear.



Use the ▲▼ keys to highlight the "**Cal History**" selection. Press "Enter".

Calibration Records

Table 11-1 Cal History items

Item	Values
Calibration event name	In 1 PV Cal In 2 PV Cal In 1 Temp Cal In 2 Temp Cal Out 1 4mA Cal Out 1 20mA Cal Out 2 4mA Cal Out 2 20mA Cal Out 3 4mA Cal Out 3 20mA Cal

Item	Values
Calibration type	Sample Conduc Sample pH/ORP Buffer pH 1 Buffer pH 2 Auto Buffer pH 1 Auto Buffer pH 2 Auto Cycle pH 1 Auto Cycle pH 2 Sample DO Auto Air DO Auto Cycle DO

The list is fully scrollable and individual records are selectable for further detail by highlighting specific event names and pressing Enter. The calibration history has a capacity of 128 records.

11.2 Clear Calibration History

- Press Setup to display the Main menu.
- Use the ▲▼ keys to select **"Maintenance"** then press Enter to enter the sub-menu.
- Use the ▲▼ keys to select **"Display"** then press Enter to enter the sub-menu.
- Use the ▲▼ keys to select **"Clr Cal Hist"** then press Enter to allow change.
- Use the ▲▼ keys to select **"Yes"** then press Enter to clear the Calibration History screen.

12 Diagnostics and Messages

12.1 Overview

Introduction

This section contains information on status and alarm messages, as well as on diagnostics and system error messages and Fail messages. All these messages are displayed on the "Status Message" stripe. If more than one message is active, the display will cycle through all the messages, and then repeat the cycle.

What's in this section?

The topics in this section are listed below.

12.2 System Status Messages

Overview

The following table lists all the error messages that can appear for Measurement errors, Input errors, Output errors, and Alarm Conditions.

Table 12-1 Status Messages

Status Message	Definition
HOLD ACTIVE	Analog Inputs (PVs) are held at their last active levels by pressing the "HOLD" button, until cancelled by pressing the "HOLD" button again.
n = 1 or 2	**Measurement Errors**
TEMP n UNDERRANGE	Measured temperature is less than the minimum range value according to measurement type, where: ***n*** is 1 (Input 1) or 2 (Input 2).
TEMP n OVERRANGE	Measured temperature is greater than the maximum range value according to measurement type, where: ***n*** is 1 (Input 1) or 2 (Input 2).
PV n UNDERRANGE	Measured PV is less than the minimum range value according to measurement type, where ***n*** is 1 (Input 1) or 2 (Input 2).
PV n OVERRANGE	Measured PV is greater than the maximum range value according to measurement type, where ***n*** is 1 (Input 1) or 2 (Input 2).
n = 1 or 2	**Input Errors – Output(s), for which Input is source, will go to failsafe level**
PROBE TEMP n INPUT FAULT	Probe temperature sensor at Input ***n*** is defective.
PROBE PV n INPUT FAULT	Probe PV sensor at Input ***n*** is defective.
PROBE n INPUT OUT OF SOLUTION	Probe at Input n is out of solution.
TEMP n INPUT OPEN	Probe temperature sensor at Input ***n*** is not connected. Check Wiring.
PV n INPUT OPEN	Probe PV sensor at Input ***n*** is not connected. Check Wiring.
INPUT BOARD n FAULT	An input board disconnect while powered results in an input fault condition and this status message. The PV value is the failsafe parameter value and the temperature is at the lower limit of the input board's temperature range. Re-insert the input board, or cycle the unit's power if the input board is no longer needed.
n = 1, 2, or 3	**Output Errors – Output in error goes to failsafe level**
OUTPUT n OPEN	Analog output n current is less than 3 mA and is less than output minimum mA value. Check wiring.
n = 1, 2, 3, or 4	**Alarm Conditions**
ALARM n ACTIVE	Alarm number ***n*** is currently active.

12.3 Calibration Diagnostics

pH/ORP/DO

All of the possible errors are detected during a probe calibration and will abort the calibration process with the message "FAIL" appearing briefly, followed by a return to the online pH/ORP/DO display. At that point, the specific error will be displayed as described. In addition, any of following errors may occur during probe calibration and abort the calibration process.

Table 12-2 Probe Calibration Diagnostics

Status Message	Definition
BUFFER SPAN TOO LOW	The span between pH buffer 1 and pH buffer 2 is less than 2 pH. Use a set of buffers that are at least 2 pH apart. As a warning status, will clear when an appropriate buffer 2 value is selected. As an error message, will abort calibration and preserve original slope value.
OFFSET UNDERRANGE	Resulting pH offset (standardization) value is less than –2 pH after pH slope calibration. Calibration is aborted and original pH offset and slope values are preserved.
OFFSET OVERRANGE	Resulting pH offset (standardization) value is greater than 2 pH after pH slope calibration. Calibration is aborted and original pH offset and slope values are preserved.
SLOPE UNDERRANGE	Resulting pH slope is less than 80%. Calibration is aborted and original slope value is preserved.
SLOPE OVERRANGE	Resulting pH slope is greater than 105%. Calibration is aborted and original slope value is preserved.
CAL FACTOR UNDERRANGE	Resulting DO calibration factor is less than 0.001268. DO calibration is aborted and original calibration factor is preserved.
CAL FACTOR OVERRANGE	Resulting DO calibration factor is greater than 0.040580. DO calibration is aborted and original calibration factor is preserved.
PROBE CURRENT TOO LOW	DO probe current is less than 5 µA. DO bias scan is aborted and original bias voltage is preserved.
PROBE CURRENT TOO HIGH	DO probe current exceeds the greater of 133% of the probe current at last successful calibration or 160 µA. During DO bias scan, scan is aborted and original bias voltage is preserved.
READINGS UNSTABLE	DO air PV or temperature readings too unstable for successful air calibration. Calibration is aborted and original calibration factor is preserved.
SOLUTION UNSTABLE	pH solution PV or temperature readings too unstable for successful auto buffer calibration. Calibration is aborted and original pH offset (for buffer 1) or slope value (for buffer 2) is preserved.
SOLUTION TEMP TOO LOW	pH solution temperature readings less than minimum of 0 degrees C. Auto buffer calibration is aborted and original pH offset (for buffer 1) or slope value (for buffer 2) is preserved
SOLUTION TEMP TOO HIGH	pH solution temperature readings greater than maximum of 100 degrees C. Auto buffer calibration is aborted and original pH offset (for buffer 1) or slope value (for buffer 2) is preserved

12.4 Auto Cycle Fail Messages

Overview

Auto Cycle Fail is active whenever an auto cycle failure has occurred. The status message "Auto Cycle *n* Fail" is also displayed during a fail state. Once detected, the current cycle proceeds immediately to the Probe Insert step (if enabled) or to the Resume Delay step. The fail state remains for the duration of the Resume Delay, whereupon the fail state returns to 0 and the fail message is cancelled. A fail state also provides a detail message in the lower half of the Auto Cycle display regarding the specific reason for the error. These messages are listed below:

Table 12-3 Auto Cycle Fail Messages

Fail Message	Reason
Probe Extract Timeout	Probe Transit enabled, Extract Wait Src not None and state not 0 within Max Transit Mins of start of Probe Extract.
Probe Insert Timeout	Probe Transit enabled, Insert Wait Src not None and state not 0 within Max Transit Mins of start of Probe Insert.
Input Fault	Input board, PV or temperature fault has occurred during calibration (fault type in status message).
Solution Unstable	PH PV or temperature not stable for calibration within elapsed time limit Max Cal Mins.
Buffer Span Too Low	Difference of PV reading for pH Cal 2 (Slope) and that of last pH Cal 1 (zero offset) < 1.8 pH.
Offset Underrange	PH calibration has calculated and rejected a zero offset < -2 pH.
Offset Overrange	PH calibration has calculated and rejected a zero offset > 2 pH.
Slope Underrange	PH calibration has calculated and rejected a slope < 80 %.
Slope Overrange	PH calibration has calculated and rejected a slope > 105 %.
Readings Unstable	DO PV or temperature not stable for calibration within elapsed time limit Max Cal Mins.
Probe Current Too Low	Probe current is < 5 μA during DO calibration.

12.5 Pharma Fail Messages

Overview

Pharma Fail is active whenever a Pharma failure has occurred. Status messages are also displayed during a fail state. These messages are listed below:

Table 12-4 Pharma Fail Messages

***Warn* Condition**	**Diagnostic Message**
Stage 1: Measured conductivity exceeds Pct Warning value.	PHARMA *n* PV LIMIT WARN
***Fail* Condition**	**Diagnostic Message**
Stage 1: Measured conductivity exceeds 100%	PHARMA *n* PV OVERLIMIT
Stage 1: Temperature not within range of 0 – 100 degrees C.	PHARMA *n* TEMP OVERRANGE PHARMA *n* TEMP UNDERRANGE
Stage 2: Conductivity (due to uptake of atmospheric carbon dioxide) is 0.1 µS/cm or greater per 5 minutes	PHARMA *n* PV OVERLIMIT
Stage 3: pH not within range of 5 – 7 pH.	PHARMA *n* PH OVERRANGE PHARMA *n* PH UNDERRANGE
Stages 2 and 3: Temperature not within range of 24 – 26 degrees C.	PHARMA *n* TEMP OVERRANGE PHARMA *n* TEMP UNDERRANGE
***Status* Condition**	**Diagnostic Message**
Stages 2 and 3: Pharma	PHARMA *n* TIMER ACTIVE

13 Ethernet and Communications

13.1 Overview

For all information relating to the UDA2182 and Communications please refer to the UDA2182 Communications User Guide #70-82-25-126.

14 Accessories and Replacement Parts List

14.1 Overview

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.

14.2 Part Numbers

Introduction

Part numbers for field-replaceable parts and accessories are provided in Table 14-1.

Table 14-1 Part Numbers

Kit/Part Number	Description	Quantity
51453313-501	pH Input Card	1
50009551-501	pH for Preamp Input Card	1
51453316-501	Conductivity Input Card	1
51453319-501	ppm Dissolved Oxygen Input Card	1
51453319-502	ppb Dissolved Oxygen Input Card	1
51453518-502	Bezel Assembly	1
51453540-501	Power Supply Card	1
51453328-501	Additional Analog & (2) Relay card	1
50010239-501	Rear Case and CPU Card	1
50010610-501	PID Control Field Update	1
50001619-001	Process Instrument Explorer Software	1
50025563-501	Communications Card	1

15 Appendices

15.1 Table of Contents

15.2 Appendix A – Entering Values for Lead Resistance Compensation

(**See Appendix B** for titanium cells mounted into stainless steel flow chamber 31079198)

Introduction

If you use standard Honeywell cell lead lengths of 7 or 20 feet connected directly to the Analyzer, no compensation for lead resistance is necessary. Similarly, if a junction box is used to extend the leads up to 150 feet, no compensation is required. However, if longer leads are used (greater than 150 feet), signal accuracy can be adversely affected unless you enter information that will permit the UDA2182 to compensate for lead resistance in the black and white cell leads only. Lead resistance compensation is not necessary, nor applied to the other cell leads.

For lengths up to 1000 feet*, simply specify the gauge and length as described in Table 6-5. Note that the maximum wire size for sensor inputs at the input terminal board is 16AWG.

* DirectLine DL4000 series cells have a total lead length limit of 250 feet.

If mixed wired gauges are used, or lead length or wire gauge are not within the stated ranges, the UDA2182 can still perform the compensation. However, you must first calculate the lead resistance, and then put it in terms of the available settings for AWG gauge and length.

The resistance of each available gauge choice (in copper wire) is:

16 AWG = 4.0 ohms per 1000 feet

18 AWG = 6.4 ohms per 1000 feet

20 AWG = 10.2 ohms per 1000 feet
22 AWG = 16.1 ohms per 1000 feet

For example, suppose extension cables between the cell and Analyzer consist of 500 feet of 18-gauge wire and 200 feet of 16-gauge WIRE. The cell has the TC head option.

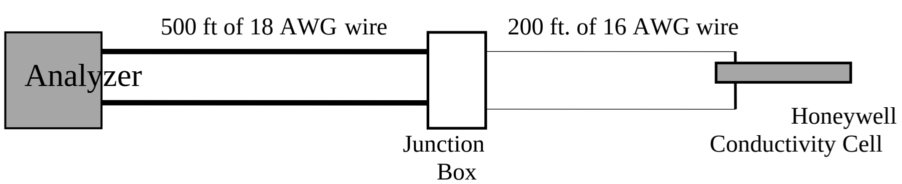


Figure 15-1 Example of a Conductivity Loop

Because there are two different types of wire used in each lead to the cell in this example, the total lead resistance is calculated as follows: (Note: the analyzer accounts for the fact that there is always a pair of conductor wires in the system loop.)

(0.5 x 6.4) + (0.2 x 4.0) = 4.0 ohms

Since the analyzer only allows entry of one wire gauge type, we allow for the worst-case condition by dividing the total resistance by the resistance per thousand feet of the higher resistance gauge wire. In our example this would be:

4.0 ohms ÷ 6.4 ohms per thousand feet of 18 AWG wire = 625 feet

Therefore, in our example we would use the procedure in Table 6-5, and specify the wire gauge as 18 AWG and the length as 625 feet.

15.3 Appendix B – Entering Values for Lead Resistance Compensation [Titanium Cells]

(4973 or DL4311 **Titanium cells** mounted in stainless steel flow chamber 31079198)

Introduction

If you use standard Honeywell cell lead lengths of 7 or 20 feet connected directly to the Analyzer, no compensation for lead resistance is necessary. Similarly, if a junction box is used to extend the leads up to 150 feet, no compensation is required. However, if longer leads are used (greater than 150 feet), signal accuracy can be adversely affected unless you enter information that will permit the UDA2182 to compensate for lead resistance in the black and white cell leads only. Lead resistance compensation is not necessary, nor applied to the other cell leads.

For lengths up to 1000 feet*, simply specify the gauge and length as described in Table 6-5. Note that the maximum wire size for sensor inputs at the input terminal board is 16AWG. Coax cable is recommended for extension of the black and white cell leads.

* DirectLine DL4000 series cells have a total lead length limit of 250 feet.

If mixed wired gauges are used, or lead length or wire gauge are not within the stated ranges, the UDA2182 can still perform the compensation. However, you must first calculate the lead resistance, and then put it in terms of the available settings for AWG gauge and length. Because the smaller gauge coax cables consist of a low resistance shield and a higher resistance conductor, an average equivalent resistance is used for calculations, i.e. 20 AWG wire is used to simulate 22AWG coax.

The resistance of each available gauge choice (in copper wire) is:

16 AWG = 4.0 ohms per 1000 feet

18 AWG = 6.4 ohms per 1000 feet

20 AWG = 10.2 ohms per 1000 feet
(Use 18 AWG values for Input Configuration and calculations)

22 AWG = 16.1 ohms per 1000 feet
(Use 20 AWG values for Input Configuration and calculations)

For example, suppose extension cables between the cell and Analyzer consist of 200 feet of 22-gauge coax and 500 feet of 18-gauge coax. The cell has the TC head option.

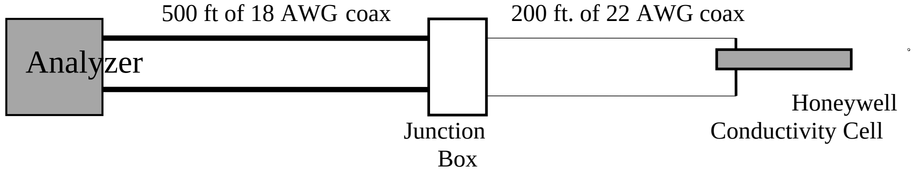


Figure 15-2 Example of a Conductivity Loop

Because there are two different types of wire used in each lead to the cell in this example, the total lead resistance is calculated as follows: (Note: the analyzer accounts for the fact that there is always a pair of conductor wires in the system loop.)

(0.5 x 6.4) + (0.2 x 10.2) = 5.24 ohms

Since the analyzer only allows entry of one wire gauge type, we allow for the worst-case condition by dividing the total resistance by the resistance per thousand feet of the higher resistance gauge wire. In our example this would be:

5.24 ohms ÷ 10.2 ohms per thousand feet of 22 AWG wire = 514 feet

Therefore, in our example we would use the procedure in Table 6-5, and specify the wire gauge as 20 AWG and the length as 514 feet. (20 AWG wire simulates 22 AWG coax)

15.4 Appendix C - Cyanide Waste Treatment

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 cyanide 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 15-3. Retention time is calculated by dividing the filled or usable tank volume by the waste flowrate. Typically it is 10 minutes or more.

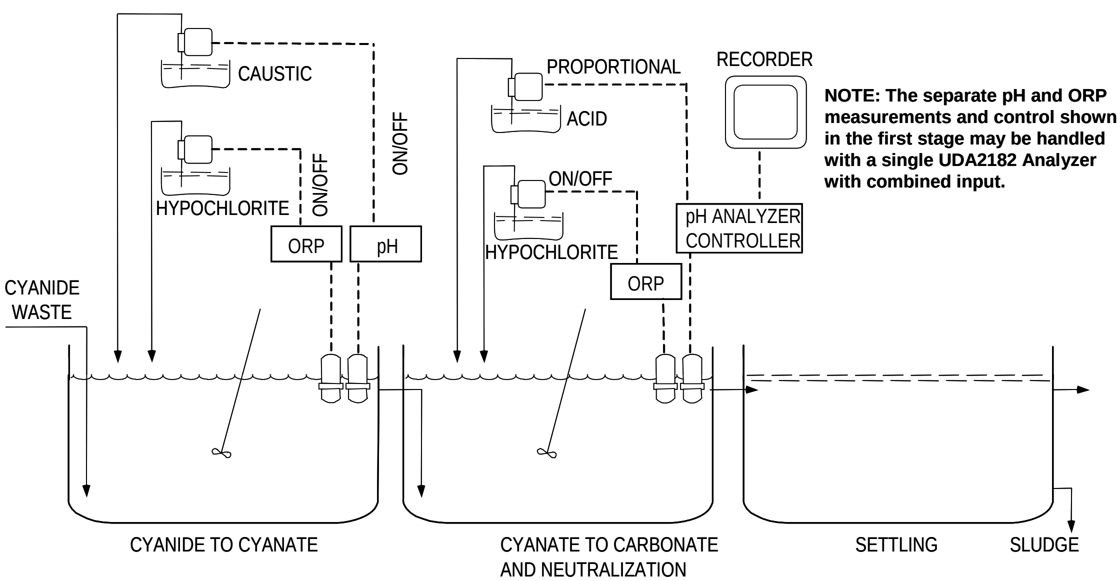


Figure 15-3 Cyanide Treatment System

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^-).

$$NaOCl + CN^- \rightarrow NaCNO + Cl^-$$

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 15-4 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.

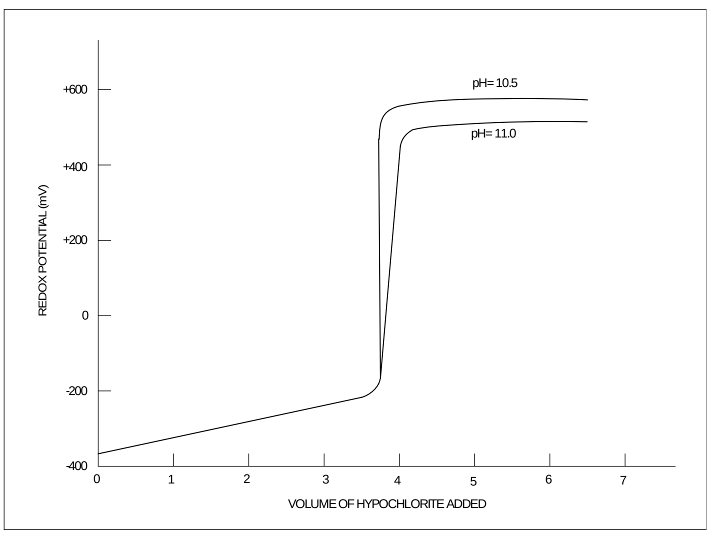


Figure 15-4 First Stage Cyanide Oxidation - Typical Titration Curve

Importance of pH control

As shown in Figure 15-4, 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 cyanide. In fact, a slight loss of gold serves to keep the electrode clean.

Second Stage of Cyanide Destruction

Neutralize and further oxidize cyanate

The wastewater 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 ($NaHCO_3$) in the following reaction:

$$2NaCNO + 3NaOCl + H_2O \rightarrow 2NaHCO_3 + N_2 + 3NaCl$$

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.

Batch Treatment

Sequence of steps

Continuous treatment is shown in Figure 15-3. 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.

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.

15.5 Appendix D – Chrome Waste Treatment

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 form 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 15-5). Retention time is calculated by dividing the filled or usable tank volume by the waste flowrate. Typically, it is ten minutes or more.

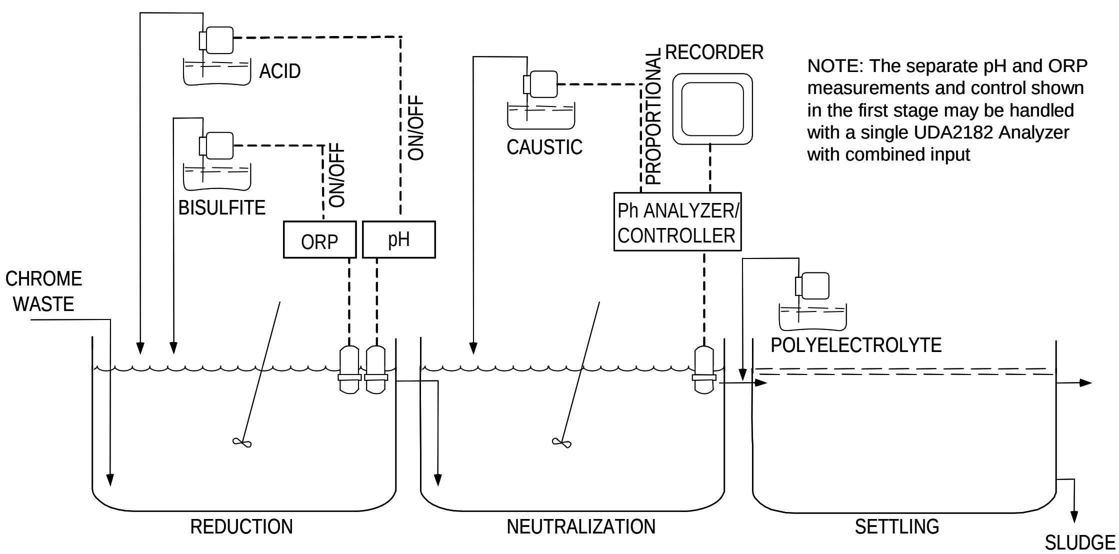


Figure 15-5 Chrome Treatment System

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:

$$2CrO_3 + 3H_2SO_3 \rightarrow Cr_2(SO_4)_3 + 3H_2O$$

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 15-6 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.

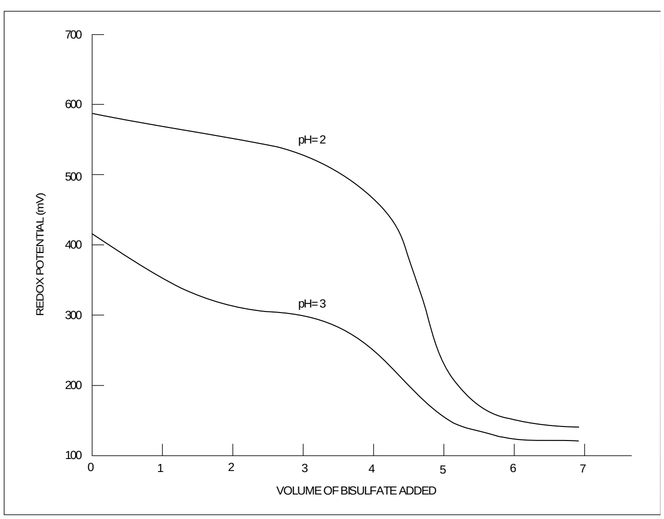


Figure 15-6 Chrome Reduction - Typical Titration Curve

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 15-6. Therefore, pH must be controlled to achieve consistent ORP control.

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.

$$Cr2(SO_4)_3 + 6NaOH \rightarrow 3Na_2SO_4 + 2Cr(OH)_3$$

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.

Batch Treatment

Sequence of steps

Continuous treatment for chrome removal is shown in Figure 15-5. 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.

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.

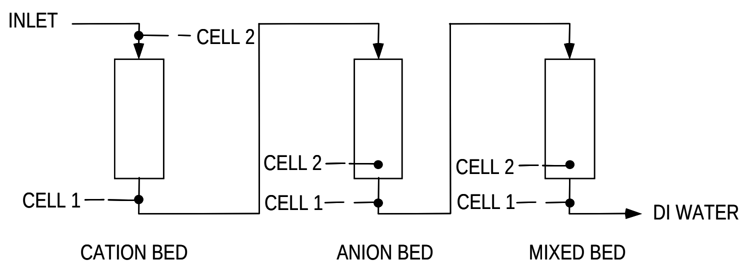
Importance of clean electrode

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.

15.6 Appendix E – Two-cell Applications

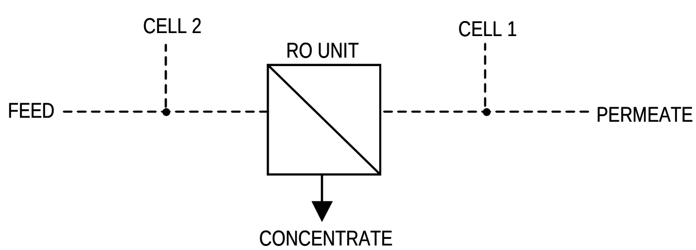
Ion Exchange

Ion exchange operations can achieve especially precise control using the conductivity ratio of two points with each bed. Ratio measurement accounts for feedwater variations when the upstream point is measured at the cation bed inlet. With the upstream point in the bed as shown for following stages, it can identify exhaustion before breakthrough.



Reverse Osmosis

Reverse Osmosis efficiency is monitored by comparing inlet and outlet conductivity (or TDS). Automatic calculations of Percent Rejection or Percent Passage are provided. If readout is in resistivity, cell locations are interchanged. Temperature readout assists with normalized performance comparisons.

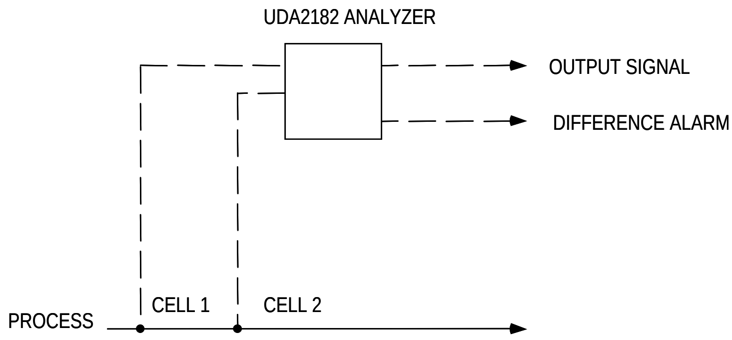


Percent Passage = $\frac{Cell1}{Cell2}$ x100 Typical Range is 0 to 20%

Percent Rejection = $(1- \frac{Cell1}{Cell2})$ x100 Typical Range is 80 to 100%

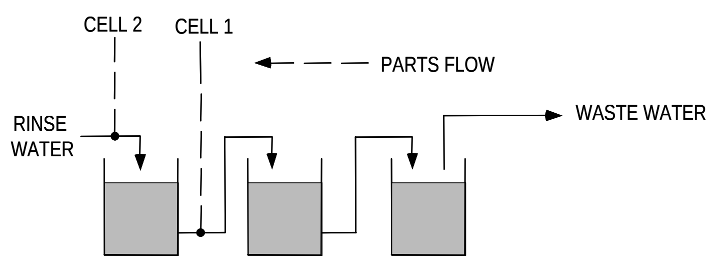
Conductivity/Resistivity/TDS Difference

Conductivity/Resistivity/TDS difference using redundant cells on critical processes can provide a valuable diagnostic capability. If the difference in measurements exceeds the alarm points, an operator is summoned for corrective action. Monitoring may be switched to the alternate cell during maintenance. For deviation in either direction, two different alarms (+ and -) are used. A difference kind of diagnostic can be provided by a precision check resistor in place of one cell to give continuous Analyzer/Controller checking at one value. Also see 15.11 Appendix J – Discussion on Chemical Interferences on Measured DO Currents.



Parts Rinsing

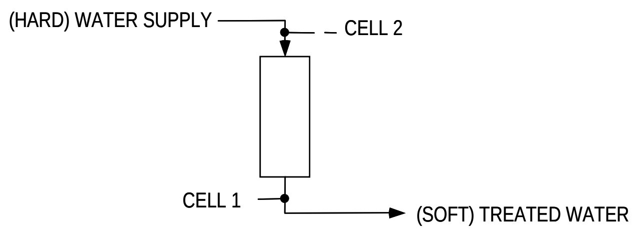
Parts rinsing is usually controlled by conductivity to obtain adequate rinsing without wasting excess water, whether a single stage or a counter-current series of tanks. The two-cell ratio approach can determine whether inadequate rinsing is due to low flowrate or due to poor supply water quality.



Conductivity Ratio = $\frac{Cell1}{Cell2}$ Typical Ratio Range is 0.1 to 1.1

Softener Monitor

Softener monitoring by conductivity ratio gives a continuous indication of performance. Sodium is typically more conductive than the hardness minerals it displaces, yielding a higher conductivity at the outlet. A ratio approaching 1 indicates that hardness ions are breaking through and that regeneration is needed.

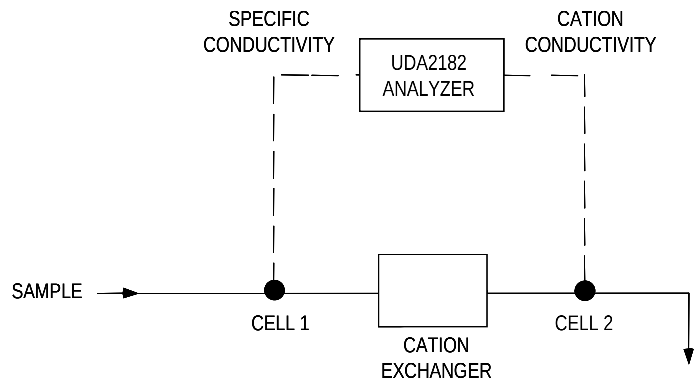


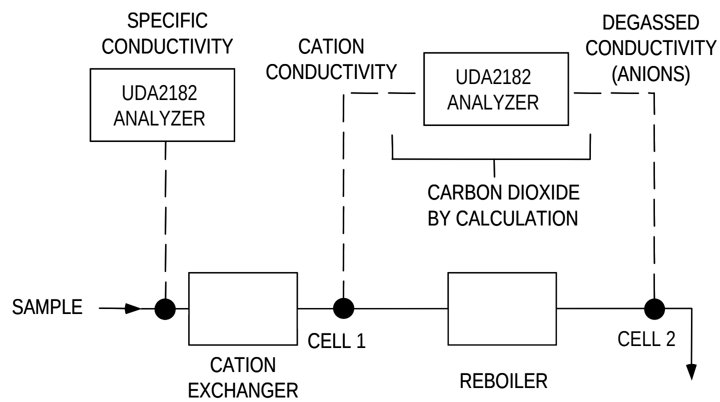
Softening Ratio = $\frac{Cell1}{Cell2}$ Typical Ratio Range is 1 to 1.25

Steam Power Measurements

The three conductivity measurements in power plants relate to water chemistry parameters as follows:

- Specific conductivity -- chemical treatment level
- Cation conductivity -- total anion contaminants
- Degassed conductivity -- non-volatile anion contaminants
- Cation minus degassed conductivities -- carbon dioxide





Sodium Hydroxide and Hydrochloric Acid Concentration Measurements

The measurement range of sodium hydroxide by conductivity is limited by temperature. The conductivity is limited by temperature. The conductivity of sodium hydroxide reaches a maximum value near 14% at 0º C and 29% at 100º C. Near the maximum there is poor resolution and no reliable way to know which side of the peak is being measured. Therefore, the UDA2182 measurement range is restricted by temperature to assure reliable values. Maximum concentrations are 10% at 0º C, 13% at 25º C and 20% at 75º C and above, with linear interpolation between these points. Operation above these limits gives a flashing display.

The measurement range of hydrochloric acid is restricted to less than 15.5% above 40º C and less than 18% below 40º C.

15.7 Appendix F – Using a Precision Check Resistor (For Conductivity)

Introduction

The operation of the Analyzer/Controller can be verified by replacing the input from a cell with a precision check resistor across the Analyzer/Controller input terminals. In addition, an 8550 ohm resistor (Honeywell Part No. 31233300) can be wired in place of the inputs from the temperature compensator to simulate 25º C, the reference temperature. The unit will display a simulated "process value" appropriate for the check resistor installed. (Equations showing the relationship between resistor rating and displayed value are provided below.) If the displayed value is incorrect, the Analyzer/Controller should be serviced.

This technique can be used two ways:

- Offline - Install the precision check resistor temporarily in place of the input from either cell to check the operation of the Analyzer/Controller. When correct operation has been verified, remove the resistor and replace the field wiring.
- Online - To provide a constant check of the Analyzer/Controller's operation in a critical process, connect the conductivity cell to the Cell 1 input terminals; instead of a Cell 2 input, install a check resistor at the Cell 2 input terminals. The Cell 2 "process value" should always be the appropriate value for the resistor (see equations below). Configure an alarm to monitor this value.

Set cal factor and calibration trim for ideal conditions

When a check resistor is used instead of cell input, the Analyzer/Controller must be set for theoretically ideal conditions to achieve display of the appropriate value for the installed resistor. This means that you set the cell calibration factor to 1.00 and remove the calibration trim for the cell input being replaced by the check resistor.

Calculations for conductivity, resistivity, and TDS

To verify instrument operation at any point of measurement, calculate the check resistance needed to simulate that value. (It is assumed that you have selected a display measurement value that is within the range of your cell constant; see 2.1for ranges.) The equation used depends on the measurement type. For concentration check values see the table on the following page.

$$\text{Conductivity check resistance (ohms)} = \frac{\text{Cell Constant (cm}^{-1}\text{) x }10^{6}}{\text{Conductivity (microSiemens/cm)}}$$

Resistivity check resistance (ohms) = Cell Constant (cm^{-1}) x Resistivity (ohm-cm)

$$\text{TDS check resistance (ohms)} = \frac{\text{Cell Constant (cm}^{-1}\text{) x }10^{6}}{\text{TDS (ppm)/TDS factor}}$$

(TDS factor has units of ppm/microSiemens-cm^{-1})

Example 1: To determine the check resistor value needed to simulate conductivity measurement of 10 μS, use cell constant 0.1 and perform the following calculation:

$$10 \text{ k ohms} = \frac{(0.1) \times (1{,}000{,}000)}{10}$$

Example 2: To determine the check resistor value needed to simulate resistivity measurement of 10 M ohms, use cell constant 0.01 and perform the following calculation:

$$100 \text{ K ohms} = (0.01) \times (10{,}000{,}000)$$

Concentration values

Obtain the appropriate check resistance value from the table below.

Table 15-1 Data for Concentration Range Measurements

Material/Weight % Concentration	Simulation Resistance (ohms) @ 25º C Cell Constant		
	10	25	50
Hydrochloric Acid (HCl) 0 1 4		∞ 242.5 68.9	∞ 485.0 137.7
Sulfuric Acid (H2SO4) 0 1 4	∞ 215.5 56.0	∞ 538.7 140.0	∞ 1077.4 280.0
Sodium Chloride (NaCl) 0 1 4	∞ 574.1 195.2	∞ 1435.1 398.0	∞ 2870.3 796.1
Sodium Hydroxide (NaOH) 0 1 4	∞ 189.2 54.0	∞ 473.0 135.1	∞ 946.1 270.1

15.8 Appendix G – Noise Testing, Dissolved Oxygen Application

Hints for Reducing Noise

Specifications for proper operation of Honeywell dissolved oxygen (DO) probes demand that the alternating current (AC) voltage signal (noise) between anode and shield connections and cathode and shield connections be less than 1 mV AC.

While it is your responsibility to assure that this specification is met, the following are some hints that have been successful in reducing these signals to the required value in a variety of installations.

1. First eliminate external connections as a source of excess AC noise.
2. After installation of all wiring, use a digital voltmeter to check the following voltages:

Anode - Shield	1.2 to 2.0 VDC depending on oxygen level less than 1 mV AC. In low ppb measurements, this value may be zero.
Cathode - Shield	< 1 mV DC less than 1 mV AC

3. Any readings greater than the limits shown above indicate electrical noise that should be corrected.
4. Systematically remove external connections to the Analyzer, noting if the voltage drops within the acceptable limit.
5. If a noise source is identified, improved shielding, grounding or re-routing of that cable may be required. (In attempting to reduce AC noise, do not ground the shield as this shunt filtering is designed to reduce electromagnetic interferences {EMC}.)
6. If the measured voltages are greater than procedures states, one at a time remove an external connection (ex., isolated outputs and relays) and re-measure the AC signal. If the AC signal has decreased after disconnecting one of these connections, then this was the source of the noise.
7. If the noise remains at a value greater than 1 mV AC after disconnecting all external connections described in step 1, disconnect the shield wire from Terminal 7 and connect it to instrument ground inside the case.
8. If the noise remains at a value greater than 1 mV AC after performing step 2, reconnect the shield wire to Terminal 7 and connect an additional (jumper) wire from ground to the shield connection, Terminal 7.

If these steps fail to reduce the Anode-Shield and Cathode-Shield AC signals to the specified 1mV AC or less, obtain an isolated transformer and power the analyzer from that.

15.9 Appendix H – DO Probe and Analyzer Tests

Before performing air leak detection, it is necessary to determine that both Probe and Analyzer are working properly.

Assumptions:

- The probe and analyzer should be connected, the analyzer powered-up, and the probe in the process water for at least 24 hours prior to testing.
- No additional configuration should be done.
- The process is as it would be normally. All equipment in the process is online and contributing to the process. This is to ensure that the Probe and Analyzer are working in a known environment.

Check for probe membrane leakage

If the probe has membrane leaks, incorrect readings may occur. Follow this procedure to check for probe membrane leakage:

1. Remove probe from analyzer and process.
2. Using either the flow chamber or original protective adapter, screw this piece on the probe. If using the adapter, wrap electrical tape around the adapter to seal the holes.
3. Next, wrap electrical tape around the hole on the side of the probe. The intent is to create a reservoir for the sealed probe.
4. Position probe with the membrane pointing up.
5. Make a solution of salt water using 2 T. of salt and 8 oz. of water.
6. Fill the probe (via the adapter or flow chamber opening) with the salt water until water is overflowing from the top of the reservoir.
7. If using the adapter or a PVC flow through chamber, place a wire (uncurled paper clip) in adapter or flow through chamber opening such that one end is immersed in the salt water solution. If using a Stainless Steel (SS) flow chamber, you do not need the wire.
8. Using a DVM that can measure Mohms, attach one DVM lead to the paper clip (or touch side of SS flow through chamber) and the other DVM lead to the cathode (black lead). Measure the impedance between the Cathode and the wire (probe side). If the probe has no leakage problem, this resistance will be greater than 1 Mohm. Go to Step 10. If the reading is in the k ohms or ohms range, there is a leak in the membrane, which can cause erratic readings in the probe. Stop any further testing until the probe is replaced.
9. If you are here, it has been confirmed that there are no membrane leaks in the DO probe. Remove the tape and wire from probe and rinse probe with tap water. Go to Steps 9 – 16 on the following pages.

Check that analyzer is working

1. Remove power from analyzer.
2. Disconnect the probe and put the following resistor values on the terminal block of the analyzer:
   - Jumper (bare wire) - Anode(8) to Ref(9)
   - 10k resistor - Ref(9) to Cathode(10)
   - 5k resistor across thermistor leads - 4 and 5
3. Turn analyzer back on.
4. If you see a reading of between 5 and 10 ppm or 5000 and 10000 ppb at 25°C, the analyzer is working correctly.
5. If not, the analyzer maybe the problem. Consult Honeywell TAC for support.

Check that the analyzer and probe are working together correctly.

1. If not already done, connect the probe to the analyzer and power up the analyzer. Put probe in a bucket of water for approx. 1 hour so it can stabilize before proceeding.
2. Expose probe to ambient air for 3-5 minutes or until the temperature is stable.
3. Press the Display key on the Analyzer until the following parameters **DO**, **TEMP**erature, **SAL**inity, and **PRESS**ure are showing on the analyzer's display.
4. Perform a Visual Check on these parameters while the probe is in ambient Air:
5. The Temperature is not flashing and is between 15 - 35 Deg C.
6. DO's Barometric Pressure is approx. in the range of 500 to 600 mmHg.
7. The Salinity value should be 0.0 PPT. (Indicates that Salinity is turned OFF).
8. If any of the above parameters are incorrect, make the necessary changes to correct them so that they are as stated above.
9. Perform an air calibration.
10. When air calibration is completed, look at the DO value and the Temperature on the Analyzer's display.
11. Confirm that these two parameters are correct by comparing them to values in Table 15-1. If the measured values are not similar to the table, the probe is suspect, call *TAC for assistance.
12. With probe still in air, perform a Probe Bias Test under the Maintenance Menu.
13. When completed, the display should look exactly like Figure 8-5 under Probe Bias Test. If it does, move to Step 16.
14. If the problem is a shift of the curve either to the left or right of the cursor, move the cursor so that it is positioned on the flat portion of the curve. At this point, the probe is suspect and should be sent to the Technical assistance Center for analysis. If the

problem is that the cursor is positioned too far to the left or right of the flat portion of the curve, move the cursor back to the flat portion of the curve.

15. Perform another Air Calibration to correct any changes that occurred during the PBT.
16. If you reached this point, you have both a working probe and analyzer that are calibrated to one another correctly.

15.10 Appendix I – Parameters Affecting Dissolved Oxygen Measurement

The actual quantity of oxygen that can be present in solution is governed by the partial pressure of the gas in the atmosphere, the solubility in solution, the temperature and purity of the solution.

Pressure

UDA2182 Universal Dual Analyzers include an internal pressure sensor and software algorithm that automatically compensates for atmospheric pressure variations during calibration. Pressure variations have a direct effect on the dissolved oxygen concentration during normal measurement so no pressure compensation is applied at that time. The information given below is only for reference to published solubility tables and is not needed for operation of the Analyzer.

The equilibrium concentration of oxygen dissolved in a liquid is directly proportional to the partial pressure of oxygen in the vapor phase with which the solution is in contact. Dry air, which contains 20.9% oxygen, will have an oxygen partial pressure of 159 mmHg if the total pressure is 760 mmHg. Tables of oxygen solubility are normally referenced to this value. An altitude or pressure correction must be made when conditions differ from this level. The correction is made using the following equation:

$$S = S' (P - p)/(760 - p)$$

where:

S is the solubility at barometric pressure of interest (P)
S' is the solubility at 760 mmHg at a given temperature
P is the barometric pressure
p is the partial pressure of water at the given temperature

Temperature

Honeywell dissolved oxygen probes and analyzers include temperature sensors and an automatic temperature compensation algorithm. The algorithm takes the raw oxygen signal from the probe (which is proportional to the partial pressure of oxygen) and converts it into the actual concentration of oxygen at the measuring temperature. The algorithm is based on the decreasing solubility of oxygen with increasing temperature and on the probe temperature coefficient.

Salinity

The significant effect of dissolved solids on reducing oxygen solubility is well documented. However, the partial pressure of oxygen (raw oxygen probe signal) is the same whether in pure or saline water. Since the actual solubility is reduced, a correction must be made when measuring brackish, sea or other water containing much more than 1 ppt (1000 ppm) of dissolved solids. The Analyzer includes a salinity correction algorithm, which uses input from a fixed value of salinity in ppt (parts-per-thousand) entered from the front panel. Suspended and settled solids have negligible effect on solubility, but may affect the transfer rate of oxygen when in excess of 2%.

15.11 Appendix J – Discussion on Chemical Interferences on Measured DO Currents

There are four contributors to measured current:

Faradaic Currents

Faradaic currents are those resulting from oxidation or reduction of chemical species. The reduction of oxygen to water, the oxidation of water to oxygen, and the oxidation of hydrogen, hydrazine or sulfur dioxide, are examples of Faradaic currents.

Residual Currents

Residual currents are unwanted Faradaic currents caused by impurities in the probe electrolyte. These impurities are metals (e.g. lead, zinc) in electrolyte reagents, which are capable of being reduced at the cathode and give rise to zero offset currents at "zero ppb oxygen".

Electrode Conditioning Currents

The platinum cathode and anode materials are actually made up of conducting platinum oxides. These oxides exist at the molecular level. The actual platinum surface state strongly affects the observed Faradaic currents. Before methods of wire conditioning were established, upwards of 96 hours was needed to allow these conditioning currents to stabilize. Once wire-conditioning methods were established, it now takes approximately 24 hours for these conditioning currents to completely stabilize. Electrode conditioning currents occur on first probe power-ups, following power interruptions of more than 1 second (back-up power is provided for the probe to prevent this current during a power outage of 1 hour or less) and following a Probe Bias test.

Charging Currents

The Dissolved Oxygen (DO) probe consists of closely spaced bi-filar platinum windings separated by a high dielectric constant material. This is a description of a capacitor; the capacitance of a DO probe is in the hundreds if microFarads. When the probe is scanned during a Probe Bias Test(PBT) at 25mV/sec, an appreciable charging current is observed. This is equivalent to several hundred ppb dissolved oxygen.

The purpose of the PBT is to verify the optimum operating range of the current/voltage curve. It further allows one to determine if a reference shift has occurred. Most importantly, it allows one to select to identify a new bias point, if one is needed. To employ this diagnostic, you should be in air or air saturated water (ppm current is in uA range). A PBT should not be performed in a ppb application (ppb current is in nA range), due to charging and electrode currents being at a maximum value (µA range) during one of these scans. Furthermore, the final current rise during the PBT produces both hydrogen and oxygen gases within the probe. Time is needed before these gases can re-establish equilibrium with the outside sample. Therefore, the PBT should be limited to air level conditions and adequate time should be allowed for probe recovery following a PBT.

Faradaic Interferences

The DO probe responds to oxygen partial pressure as follows:

$$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O \qquad (1)$$

Reaction (1) is a chemical reduction in which dissolved oxygen is reduced to water. This reduction occurs at the working electrode, commonly referred to as the cathode. The equal and opposite (oxidation) reaction occurs at the counter electrode (anode). Any gaseous substance, which is permeable through the membrane and is capable of being oxidized or reduced (electroactive) at the working electrode will interfere. Cl_2, O_3, H_2, N_2H_4 and SO_2 are examples of interfering dissolved gases.

$$Cl_2 + 2e^- \rightarrow 2Cl^- \qquad (2)$$

$$H_2 \rightarrow 2H^+ + 2e^- \qquad (3)$$

Reaction (2) is a reduction and hence a positive interference will be observed; reaction (3) is an oxidation, which will result in a negative interference. All amperometric probes are subject to reduction or oxidation interference as shown above. In addition to the direct interference shown in these two equations, the equilibrium probe provides an additional indirect interference. In normal probe operation oxygen is consumed at the working electrode and an equal amount of oxygen is produced at the counter electrode. In a positive interference condition, such as (2) above, chlorine is reduced at the working electrode and an equivalent amount of oxygen is produced at the anode. This oxygen is electroactive, along with the dissolved chlorine and is a contributor to the measured current.

In the absence of dissolved oxygen and in a negative interference situation as in (3), hydrogen gas is consumed at the working electrode and the opposite reaction, the reduction of water to hydrogen gas occurs at the counter electrode. In this hydrogen interference mode, the probe is both consuming and producing equal amounts of hydrogen, and is operating in a hydrogen detection equilibrium mode.

In cases of electrochemical interference, if the interference is positive, dissolved oxygen will be produced at the counter electrode giving a perceived higher oxygen reading. If the interference is negative, dissolved hydrogen gas will be produced at the counter electrode giving a perceived zero oxygen reading.

Sulfite Based Zero Testing

Often as a quick check to determine if a DO probe can reach 0.0 ppb, you can immerse the probe in a solution of sodium sulfite (Na_2SO_3) or sodium meta bisulfite ($Na_2S_2O_5$). A 2 to 5% by weight solution in water is sufficient. If available, a small level of coboltous ion CO^{2+} will act as a catalyst and speed up the reaction of oxygen with the scavenger. Note: The lifetime of this solution is related to its exposure to air. Namely, the greater the exposure, the shorter the lifetime.

However, a Honeywell proven low ppb DO test using Nitrogen, an oxygen displacer, is recommended in Appendix M – Procedure for Low Level ppb Dissolved Oxygen Testing of this manual.

15.12 Appendix K – Percent Saturation Readout

In some special applications, it is desirable to read out in percent saturation rather than concentration. These are usually in non-aqueous solutions where the normal temperature compensation of the Series UDA2182 Analyzer for the solubility of air/oxygen in water does not apply. The percent saturation readout disables this solubility part of the temperature compensation. The readout is 100% when measuring in air or in a solution saturated with air, regardless of the temperature. Thus an air calibration will always produce approximately a 100% saturation readout. With this readout, salinity should be left at zero since the normal salinity correction also does not apply to non-aqueous media.

When percent saturation readout is selected, the on-line displays read in percent saturation, however, all the dissolved oxygen settings in the Analyzer remain in concentration units (ppm or ppb). Therefore, percent saturation alarms, output, etc. Should be used only if the process temperature is nearly constant.

For example, assume it is desired to have an alarm setpoint at 75% saturation while operating at 20°C. The corresponding setpoint is the 0.75 x 9.07 = 6.80 ppm.

Table 15-2 Dissolved Oxygen Solubility vs. Temperature

(From Standard Methods for the Examination of Water and Wastewater)

Sample Temperature (°C)	Solubility (ppm, mg/L)
0	14.60
1	14.19
2	13.81
3	13.44
4	13.09
5	12.75
6	12.43
7	12.12
8	11.83
9	11.55
10	11.27
11	11.01
12	10.76
13	10.52
14	10.29
15	10.07
16	9.85
17	9.65
18	9.45
19	9.26
20	9.07
21	8.90
22	8.72
23	8.56
24	8.40
25	8.24
26	8.09
27	7.95
28	7.81
29	7.67
30	7.54
31	7.41
32	7.28
33	7.16
34	7.05
35	6.93
36	6.82
37	6.71
38	6.61
39	6.51
40	6.41
41	6.31
42	6.22
43	6.13
44	6.04
45	5.95
46	5.86
47	5.78
48	5.70
49	5.62
50	5.54

15.13 Appendix L – Leak Detection in PPB Applications

Before performing air leak detection, it is necessary to determine that both the probe and analyzer are working properly. Refer to Probe and Analyzers tests in Section 15.9

1. First, check to see that the probe contains an O-ring. Per the probe directions, an O-ring must go into a probe that is used in ppb applications. This creates a tight seal between the probe and flow chamber. MAKE SURE THIS O-RING IS IN THE PROBE.
2. Unless already in air, open the probe to air for 30 seconds.
3. Put it back into the process again.
4. Allow the DO to drift down to the 20-30 ppb range. The 20-30 ppb range was chosen because the reading was low enough that the drift was small with respect to the changes observed for various flow rates but high enough that changes could be observed.
5. At this range, vary the flow rate from 10 to 100 ml/min. These low flow rates were selected for two reasons. The first, the tester may only have a 0 - 100 ml/min flow indicator. The other reason is a leak that exists at this low flow, will cause a change in the DO reading.
6. If the DO value at 10 ml/min exceeds the DO value at 100 ml/min, a leak is present in the sampling line.
7. Fixing the leak may require plastic tubing to be replaced with metal tubing, tape to be put on fittings, and/or fittings at the bottom of the probe to be tightened securely.
8. Now, repeat Steps 2 - 6 until the flow can be changed from >100 ml/min to 10 ml/min with no change in the DO value.

15.14 Appendix M – Procedure for Low Level ppb Dissolved Oxygen Testing

Overview

The purpose of this procedure is two-fold. First, using a controlled environment, new probes and/or analyzers can be tested to determine if each is performing correctly before being installed in the field. Second, this procedure can be used to re-test the performance of an existing analyzer and/or probe.

You may choose to use this set-up for a zero calibration test. However, a zero calibration test would require, as a minimum, modifications to two of the test parameters. One modification would require a closed loop water system. The sample water must be tapped directly from the customer's process water. The other modification would be the gas. For zero calibration, a high purity nitrogen gas (very expensive) must be piped into the process sample. Since Honeywell can neither control the quality of the gas the customer purchases nor the quality of the process water used, the company will not guarantee the accuracy of the results of a zero calibration done by this modified method.

Equipment Needed

- One Tank of Oxygen in Nitrogen gas mixture
- One pressure regulator/shutoff valve
- Wash bottle - used to add moisture to the sample gas before the gas reaches the probe. (Without addition of moisture, the Nitrogen gas would dry out the probe membrane.)
- One Beaker - used to vent the gas sample
- One Dissolved Oxygen probe - used to make DO measurement
- One Dissolved Oxygen flow through chamber - provide a closed environment
- One Honeywell Model UDA2182 Analyzer - monitors and displays DO value.

Oxygen Measurement Procedure

1. Connect probe and energize the electronics.
2. Allow probe to sit in tap water for 1 hour.
3. Perform an air calibration per the manual instructions.
4. Set-up equipment as shown in Figure 15-7.
5. Install probe into sealed flow chamber and connect to wash bottle piping.
6. Set room temperature to 25°C and sparge water with nitrogen overnight. Reading should be less than 1 ppb.
7. Remove probe from flow chamber and expose to 25°C air for 2 hours.
8. Perform an air calibration.

9. Return probe to flow chamber and resume nitrogen sparging.
10. When analyzer indicates that DO level is below 20 ppb, change gas to 250 ppm O_2 in nitrogen. Run until equilibrated (4-6 hours). After equalization, note barometric pressure and temperature.
11. Compare reading with calculated value.

To Calculate True Value

$$\frac{\text{*Air Sat. Value at T °C} \times \text{known gas } O_2 \text{ Value}}{20.9\%} \times \frac{\text{Barometric Pressure}}{760 \text{ mmHg}} = \text{True Value}$$

Example Calculation

At 25°C using 250 ppm O_2 in N_2 at 770 mm Hg

$$\text{True Value} = \frac{8.24 \times 10^{-6} \times 250 \times 10^{-6}}{20.9 \times 10^{-2}} \times \frac{770}{760} = 9.986 \times 10^{-9} \text{ or } 10 \text{ ppb}$$

***** If the temperature of the process water is not at 25°C, use O_2 Solubility Tables in Table 15-2 and the process water temperature to determine the Air Saturated O_2 value.

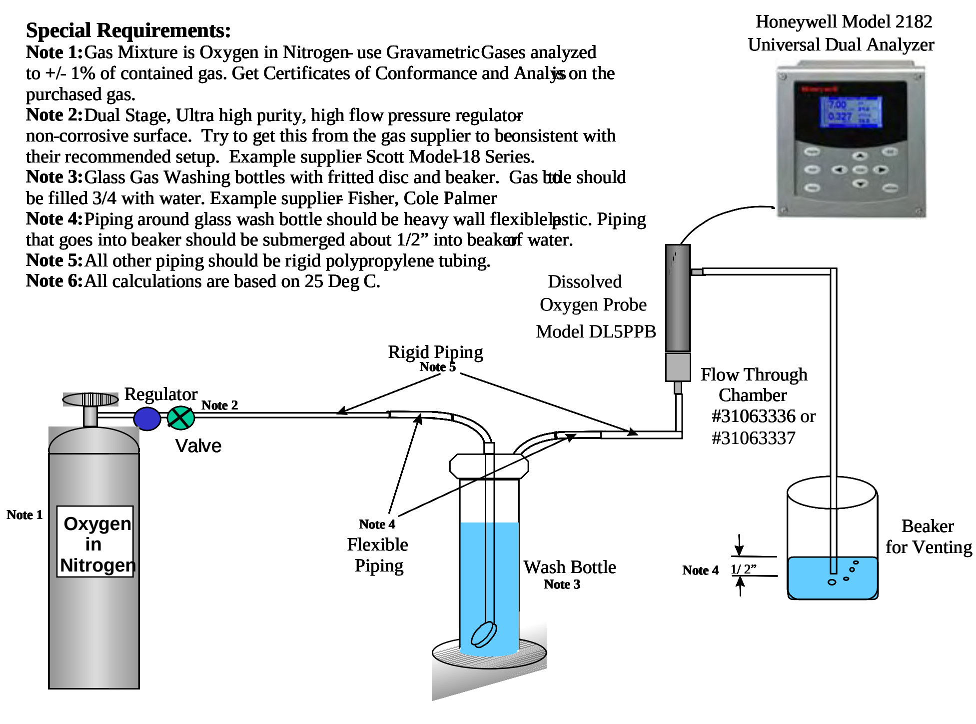


Figure 15-7 Suggested ppb Dissolved Oxygen Test Set-up

15.15 Appendix N – Sample Tap Electrode Mounting Recommendations

Overview

Many applications tap a sample from a main process stream and, after the flow has passed through the measurement manifold, it is discharged to a sink or floor drain.

Typical Probe Installation

A typical probe installation will find the probe mounted in a flow chamber or tee arrangement similar to what is shown in Figure 15-8. Key installation features are provision for flow rate adjustment, a water trap to assure that the probe remains immersed if sample flow is turned off and means to prevent a below atmospheric pressure within the manifold.

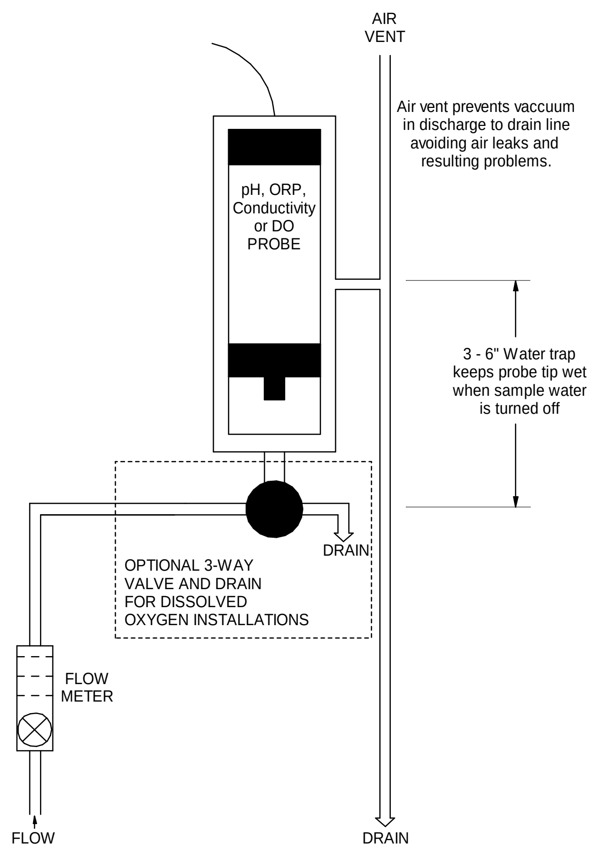


Figure 15-8 Typical Probe Installation

It is desirable for water to exit the manifold 3 to 6 inches above the sensor tip. This will insure that the sensor remains immersed if sample flow is turned off.

The air vent extension is sized so normal sample flow does not completely fill this tube. Its purpose is to prevent negative pressure within the manifold. Without this air vent, if for example the exit stream is discharged to a floor drain four feet below the manifold, then the pressure at the sensor is four feet water-column below atmospheric pressure. Any fitting leaks at or beyond the flow adjustment valve will result in air infiltration into the sample. This entrapped air can result in noisy and unstable measurement. In the case of a part per billion dissolved oxygen (DO) measurement, the indicated DO value can be substantially higher than the true value.

When it becomes necessary to discharge the sample stream in a loop higher than the manifold, then the air vent should be located above the highest point in the loop.

15.16 Appendix O – Auto Clean and Auto Cal Examples

Automatic Cleaning and Calibration

Overview

Although the Honeywell probe accuracy is unaffected by inert fouling, there are two conditions where probe cleaning may be required. (These conditions affect all conventional dissolved oxygen probes as well.)

The first is where the fouling is so thick that the response time of the probe becomes unacceptably long. The second is where organic fouling is consuming oxygen before it reaches the surface of the probe.

A feature allowing automatic cleaning at preconfigured times is included in the UDA2182 analyzer. Cleaning may be initiated with a frequency of every few minutes to monthly.

Cleaning

Functionally, relays within the analyzer are tripped, allowing withdrawal of the probe from the sample, turning on a cleaning spray, turning off the spray, and reinserting the probe into the sample. Execution of automatic cleaning and calibration requires you to install a drive unit, a solenoid valve, and mounting hardware. See **Figure 15-9**

Calibration

Similarly, all probes drift with time. Although the Honeywell probe is very stable, included in the analyzer is a feature that allows withdrawal of the probe into air for automatic air calibration at user-configured times.

The sequence of calibrations and cleanings are user-configurable.

Low Dissolved Oxygen

One symptom of the need for cleaning is a low dissolved oxygen reading. The UDA2182 dissolved oxygen analyzer can be configured to execute a cleaning cycle if the measured dissolved oxygen falls below a user-selected value. An alarm can be configured to alert you if the cleaning fails to restore the dissolved oxygen to a higher level. The alarm will indicate either a true decrease in dissolved oxygen concentration or unsuccessful cleaning.

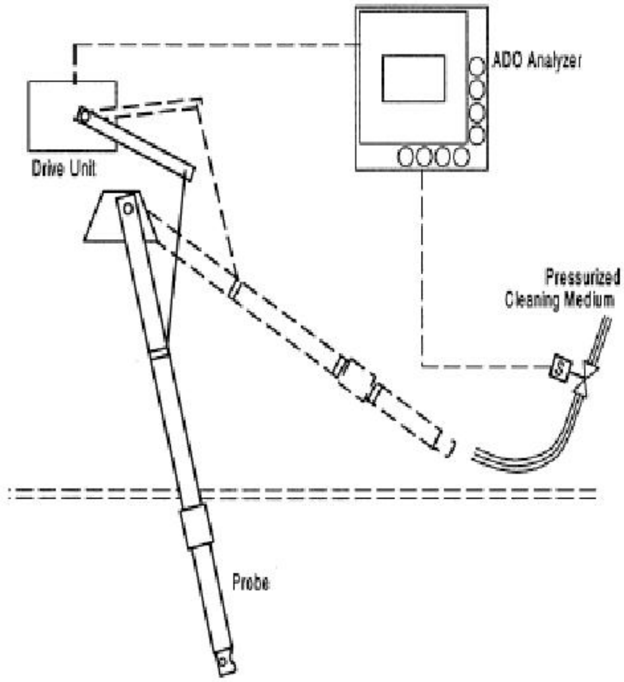


Figure 15-9 Auto Clean Setup

Automatic Calibration of ppb Dissolved Oxygen Probe

A typical set – up for automatic calibration in a boiler water sampling system is shown in **Figure 15-10**. The solenoid valve and connections should be supplied by others and must be positively air tight to prevent leakage and erroneous measurements.

The solenoid valve is wired to assigned relay contacts in the UDA2182 analyzer and will operate at a frequency, and for duration as assigned by the end user.

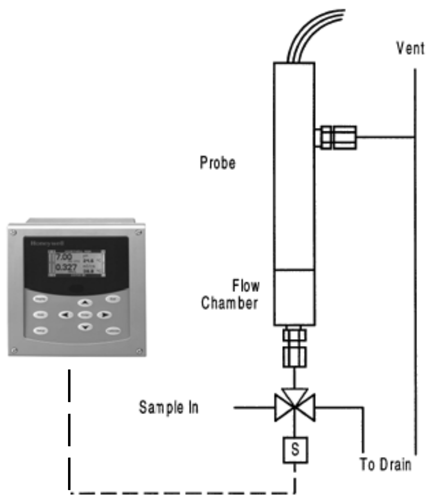


Figure 15-10 Auto Cal Setup

15.17 Appendix P – AutoClean and AutoCal Theory and Piping

Overview

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 (Section 6.15)

• Set the clock (Section 6.18), and specify the frequency and duration of the cleaning and calibration operations. (Section 6.15)

• Configure the system to use automatic buffer recognition. (Section 8.5.2).

•Wire the relays assigned to these operations during system setup to operate the necessary valves. (Section 7.3).

• Install piping and valves as diagrammed in this section.

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 15-11) 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 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.

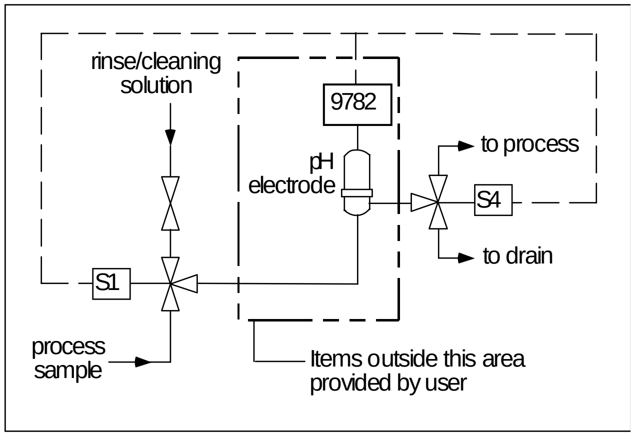


Figure 15-11 Automatic Electrode Wash Setup

Select valves and fittings with appropriate pressure ratings

Make the process connections as shown in Figure 15-11. 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.

15.17.1 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 15-12) 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 12).

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.

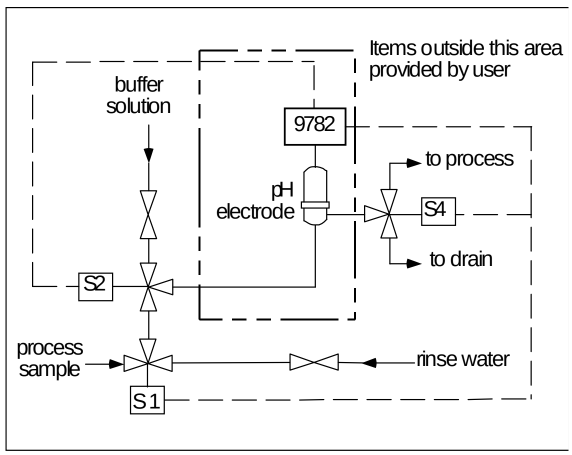


Figure 15-12 Rinse and One-Point Calibration

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 15-12 or Figure 15-13. 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.

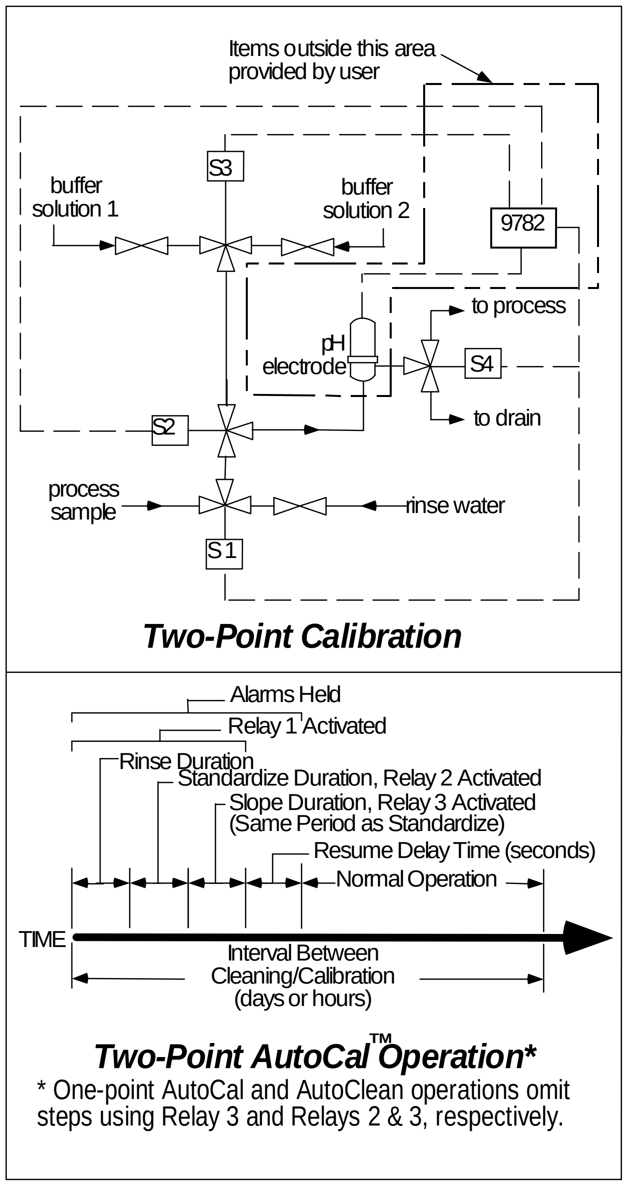


Figure 15-13 Two-Point AutoCal Operation

Index

D

E

F

G

H

I, J

K

L

M

N

O

P, Q

Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

Control Products
Asia Pacific Headquarters
Phone: +(65) 6355-2828
Fax: +(65) 6445-3033

Asia Pacific Global Technical Support

Field Instruments
Phone: +65 6580 3156
Fax: +65 6445-3033
Process Instruments
Phone: (603) 76950 4777
Fax: (603) 7958 8922

Australia
Honeywell Limited
Phone: +(61) 7-3846 1255
FAX: +(61) 7-3840 6481
Toll Free 1300-36-39-36
Toll Free Fax:
1300-36-04-70

China – PRC - Beijing
Honeywell China Inc.
Phone: +(86-10) 8458-3280
Fax: +(86-10) 8458-4650

China – PRC - Shanghai
Honeywell China Inc.
Phone: (86-21) 5257-4568
Fax: (86-21) 6237-2826

China – PRC - Chengdu
Honeywell China Inc.
Phone: +(86-28) 8678-6348
Fax: +(86-28) 8678-7061

China – PRC - Xi'an
Honeywell China Ltd - Xi'an.
Phone: +(86-29) 8833-7490
Fax: +(86-29) 8833-7489

China – PRC - Shenzhen-
Honeywell China Inc.
Phone: +(86) 755-2518-1226
Fax: +(86) 755-2518-1221

Indonesia
PT Honeywell Indonesia
Phone: +(62) 21-535-8833
FAX: +(62) 21-5367 1008

India Automation India Ltd.
Honeywell Ltd.
Phone:+(91) 5603-9400
Fax: +(91) 5603-9600

Japan
Honeywell Inc.
Phone: +(81) 3 6730 7150
Fax: +(81) 3 6730 7228

Malaysia
Honeywell Engineering Sdn Bhd
Phone: +(60-3) 7950-4776
Fax: +(60-3) 7958-8922

New Zealand
Honeywell Limited
Phone: +(64-9) 623-5052
Fax: +(64-9) 623-5060
Toll Free (0800) 202-088

Philippines
Honeywell Systems (Philippines) Inc.
Phone: +(63-2) 633-2830-31/
636 1661-62
Fax: +(63-2) 638-4013

Singapore
Honeywell Pte Ltd.
Phone: +(65) 6580 3278
Fax: +(65) 6445-3033

South Korea
Honeywell Korea Co Ltd
Phone: +(822) 799 6315
Fax: +(822) 792 9015

Thailand
Honeywell Systems (Thailand) Ltd.
Phone: +(662) 693-3099
FAX: +(662) 693-3089

Taiwan R.O.C.
Honeywell Taiwan Ltd.
Phone: +(886-2) 2245-1000
FAX: +(886-2) 2245-3241

SE Asia Countries

see Honeywell Pte Ltd (Singapore)
for: Pakistan, Cambodia, Guam, Laos, Myanmar, Vietnam, East Timor

SE Asia Countries

see Honeywell Automation India Ltd for:
Bangladesh
Nepal
Sri Lanka

EUROPE

Austria
Honeywell Austria GmbH
Phone: +43 (316)400123
FAX: +43 (316)40017

Belgium
Honeywell SA/NV
Phone: +32 (0) 2 728 24 07
FAX: +32 (0) 2 728 22 45

Bulgaria
Honeywell EOOD
Phone: +(359) 2 40 20 900
FAX: +(359) 2 40 20 990

Czech Republic
Honeywell spol. s.r.o.
Phone: +420 242 442 232
FAX: +420 242 442 131

Denmark
Honeywell A/S
Phone: +(45) 39 55 55 55
FAX: +(45) 39 55 55 58

Finland
Honeywell OY
Phone: +358 (0)20752 2753
FAX: +358 (0) 20752 2751

France
Honeywell SA
Phone: +33 (0)1 60198075
FAX: +33 (0)1 60198201

Germany
Honeywell AG
Phone: +49 (69)8064-299
FAX: +49 (69)806497336

Hungary
Honeywell Kft.
Phone: +36-1-451 4300
FAX: +36-1-451 4343

Italy
Honeywell S.p.A.
Phone:+390292146307
FAX: +39 0292146377

The Netherlands
Honeywell B.V.
Phone: +31 (0) 20 5656200
FAX: +31 (0) 20 5656210

Norway
Honeywell A/S
Phone: (45) 39 55 55 55

Poland
Honeywell Sp. zo.o
Phone: +48-22-6060900
FAX: +48-22-6060901

Portugal
Honeywell Portugal Lda
Phone: +351 21 424 5000
FAX: +351 21 424 50 99

Romania
Honeywell Bucharest
Phone: +40 (0) 21 2316437
FAX: +40 (0) 21 2316439

Russian Federation (RF),
ZAO "Honeywell"
Phone: +7 (095) 796 98 00
FAX: +7 (495) 797 99 64

Slovak Republic
Honeywell s.r.o.
Phone: +421-2-58247 410
FAX: +421-2-58247 415

Spain
Honeywell S.A.
Phone: +34 (0)91313 61 00
FAX: +34 (0)91313 61 30

Sweden
Honeywell AB
Phone: +(46) 8 775 55 00
FAX: +(46) 8 775 56 00

Switzerland
Honeywell AG
Phone: +41 18552448
FAX: +(41) 1 855 24 45

Turkey
Honeywell Turkey A.S.
Phone: +90 216 578 71 00
FAX: +90 216 575 66 35

Ukraine
Honeywell
Tel: +380-44-201 44 74
Fax: +380-44-201-44-75

United Kingdom
Honeywell Control Systems Ltd.
Phone: +44 (0)1344 655251
FAX: +44 (0) 1344 655554

MIDDLE EAST

Abu Dhabi U A E
Middle East Headquarters
Honeywell Middle East Ltd.
Phone: +971 2 4041246
FAX: +971 2 4432536

Sultanate of Oman
Honeywell & Co Oman LLC
Phone: +968 24 701153/ Ext.33
FAX +968 24 787351

Saudia Arabia
Honeywell Turki Arabia Ltd
Jubail Office
Phone: +966-3-341-0140
Fax: +966-3-341-0216
Honeywell - ATCO
Dammam Office
Phone: 0096638304584
Fax: 0096638338059

Kuwait
Honeywell Kuwait KSC
Phone: +965 242 1327 to 30
Fax: +965 242 8315
And
Phone: +965 326 2934/1821Fax: +965 326 1714

AFRICA

Mediterranean & African Distributors
Honeywell SpA
Phone: +39 (02) 250 10 604
FAX: +39 (02) 250 10 659

South Africa (Republic of) and sub saharan
Honeywell Southern Africa
Honeywell S.A. Pty. Ltd.
Phone: +27 11 6958000
FAX +27 118051504

NORTH AMERICA

Canada
Honeywell LTD
Phone: 1-800-737-3360
FAX: 1-800-565-4130

USA
Honeywell Process Solutions,
Phone: 1-800-343-0228
FAX: 1-717-771-8251
Email:sc-cp-appssales@honeywell.com

LATIN AMERICA

Argentina
Honeywell S.A.I.C.
Phone: +(54-11) 4383-3637
FAX: +(54-11) 4325-6470

Brazil
Honeywell do Brasil & Cia
Phone: +(55-11) 7266-1900
FAX: +(55-11) 7266-1905

Chile
Honeywell Chile, S.A.
Phone: +(56-2) 233-0688
FAX: +(56-2) 231-6679

Mexico
Honeywell S.A. de C.V.
Phone: +(52) 55 5259-1966
FAX: +(52) 55 5570-2985

Puerto Rico
Honeywell Inc.
Phone: +(809) 792-7075
FAX: +(809) 792-0053

Trinidad
Honeywell Inc.
Phone: +(868) 624-3964
FAX: +(868) 624-3969

Venezuela
Honeywell CA
Phone: +(58-2) 238-0211
FAX: +(58-2) 238-3391

Honeywell

Honeywell Process Solutions
Honeywell
2500 W. Union Hill Drive
Phoenix, Arizona 85027
www.honeywell.com/ps

70-82-25-119 Rev.5
January 2009