



ELECTRO-CHEMICAL DEVICES, INC.

DCA-23 Instruction Manual

Seawater Chlorination/Dechlorination Analyzer



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Part No. 33DCA-23 Revision A

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PREFACE

Purchasing products from Electro-Chemical Devices, Inc. provides you with the finest liquid analytical instrumentation available. If this is your first purchase from ECD, please read this manual before installing and commissioning your new equipment.

If there are any questions concerning this equipment, please contact your local ECD representative, or the factory directly at:

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WARRANTY

Electro-Chemical Devices, Inc. (ECD) warrants all products it manufactures to be free from defect in materials and factory workmanship, and agrees to repair or replace any product that fails to perform, as specified, within one (1) year after date of shipment. This warranty shall not apply to any product that has been:

1. Subjected to misuse, negligence or accident;
2. Connected, installed, adjusted or otherwise used not in accordance with the instructions furnished by ECD;
3. Repaired, modified or altered by persons not authorized by ECD, resulting in injury to the performance, stability or reliability of the product.

This warranty is in lieu of any other warranty, expressed or implied. ECD reserves the right to make changes in the design or construction of its products at any time, without prior notification, and without incurring any obligation to make any changes in previously delivered products.

Seller's sole liabilities and the buyer's sole remedies under this agreement shall be limited to a refund in the purchase price, or at ECD's discretion, to the repair or replacement of any product that proves, upon ECD's examination, to be defective, when returned to the factory, transportation prepaid by the buyer, within one (1) year of the product's original shipment date. Seller shall not be liable for damages consequential or incidental to defects in any product, for failure of delivery in whole or in part, for injuries resulting from its use, or for any other cause.

This warranty and the writing attached constitute the full understanding of seller and the buyer, and no terms, conditions, understanding, or agreement purporting to modify or vary the terms hereof shall be binding unless hereafter made in writing and signed by an authorized official of Electro-Chemical Devices, Inc.

This warranty does not cover pH, ORP or Specific Ion measurement, reference or combination electrodes or electrode cartridges that have been commissioned in service.

IMPORTANT SERVICE INFORMATION

Use only factory authorized components for repair. Tampering or unauthorized substitution of components may adversely affect the operation of this product and may void the warranty.

If service or repair is required, please obtain the serial number(s) or sales order number of the product(s) in question and contact ECD's Service Department at:

+1-800-729-1333 (USA/Canada) or +1-949-336-6060

or email Service@ecdi.com

A Return Material Authorization (RMA) number must be obtained from the service department before returning any material to ECD. All material returned to ECD shall be shipped prepaid to the factory.

UNPACKING THE INSTRUMENT

Your Electro-Chemical Devices instrument has been carefully packaged to protect it from damage during shipment and dry storage. Upon receipt please follow the procedure outlined below.

1. Before unpacking, inspect the condition of the shipping container to verify proper handling by the carrier. If damage is noted, save the shipping container as proof of mishandling for the carrier.
2. Check the contents of the shipping container with the items and quantities shown on the packing list. Immediately report any discrepancies to ECD.
3. Save the original packing material until you are satisfied with the contents. In the event the product(s) must be returned to ECD, the packing material will allow you to properly ship it to ECD.
4. Familiarize yourself with the instrument before installation, and follow proper installation and wiring procedures.

1.0 GENERAL DESCRIPTION

The Model DCA-23 is a single purpose analyzer designed to monitor the chlorination and/or dechlorination of seawater in the range of 0.00 - 2.00 ppm.

Sea water is used for cooling in power plants, refineries and SWAC systems (salt water air conditioning). The heat exchangers on LNG terminals use large quantities of sea water in the regasification process. Sea water is also chlorinated and de-chlorinated at desalination plants. The chlorination of sea water inhibits the growth of marine life on the various filters, screens and heat exchange surfaces that the sea water passes over. Before the chlorinated water is returned to the environment it must be dechlorinated to a level acceptable to the local authorities.

Sea water contains approximately 68 mg/L of bromide. When chlorine is added to sea water, the bromide ion is oxidized to hypobromous acid (HOBr) and hypobromite (OBr-) by the Free Chlorine (HOCl and OCl-). This is a very rapid reaction and essentially all of the chlorine is instantaneously converted into bromine and bromamines. The DCA-23 displays Chlorine ppm in order to conform to existing conventions. It actually measures the temperature, pH and Total Residual Oxidant (TRO) potential of the seawater and converts them into an equivalent "ppm chlorine" value. TRO is defined as the total oxidizing capacity (free and combined) of the sea water that is available after chlorination.

The Model DCA-23 analyzer is supplied as a fully assembled rack mounted system. The ¾" schedule 80 PVC pipe flow through assembly is configured with ¾" slip fittings on both the Input and Drain ends. The flow through assembly and the T23 Analyzer/Transmitter are mounted on two 1 ½" x 1 ½" Uni Strut rails pre-drilled with two 0.38" holes 24" apart and with 6" between the Struts. The Standard Configuration allows the sample to flow through either the measurement loop or the bypass loop depending on the valve orientations. The pH sensor and TRO sensor are pre-wired into the analyzer allowing for easy installation and Start Up of this measurement system. Simply mount the DCA-23 assembly to a wall, plumb the Input and Drain lines, connect the power and output wiring and the system is up and running.



1.1 Features

- **Uni Strut Rail Mounted System**, Easy Installation
- **Plumb and Play Design**, Ready to Use
- **Not Flow Sensitive**, Eliminates Pressure Regulators and Rotameters
- **Direct Chlorine Readout**, pH and Temperature compensated

1.2 Specifications

Sensor and Flow Train

TRO Sensor:

Platinum Indicator/Silver-Silver chloride Reference, PTFE junction
0.75" OD x 10.5" length, Internal Signal Conditioning

pH Sensor:

Glass Indicator/Silver-Silver chloride Reference, PTFE junction
0.75" OD x 10.5" length, Internal Signal Conditioning

Measurement Range:

Chlorine: 0.00 to 2.00 ppm

pH: 0 to 14 pH

Operating Temperature:

0° C to 60° C (32° F to 140° F)

Operating Pressure:

0-50 psig at 60° C

Wetted Materials:

PVC, PP, PTFE, Glass, Platinum, 316 SS

Process Connections:

Input: ¾" NPT Slip fitting,

Drain: ¾" NPT Slip fitting

Response Time:

T90 in 2 minutes

C22 Analyzer:

Measurements:

Chlorine: 0.01 to 2.00 ppm

pH: 0 to 14 pH

Temperature: 0° C to 100° C (32° F to 212° F)

pH Compensation:

Automatic

Display:

4" X 1" LCD, 2 x 16 characters

Enclosure:

NEMA 4X, LxWxD: 5.7" x 5.7" x 7

Outputs:

(1) 4-20 mA for Chlorine (set to Sensors Range, 0-2.00 ppm or 0-1.00 ppm)

(1) 4-20 mA for pH (Optional) set 0-14 pH

Alarm Relay Ratings:

Optional (2) SPDT 230 VAC/5A or 30 VDC / 5A resistive max.

Standard Configuration (1) High Alarm Chlorine, (1) Low Alarm Chlorine, (User adjusted Set Points)

(Optional User Defined configuration, Configurable at the Factory Only)

Input Power

24 VDC (12 to 50 VDC) @ 0.25A

Optional 110/220 VAC @ 50/60 Hz

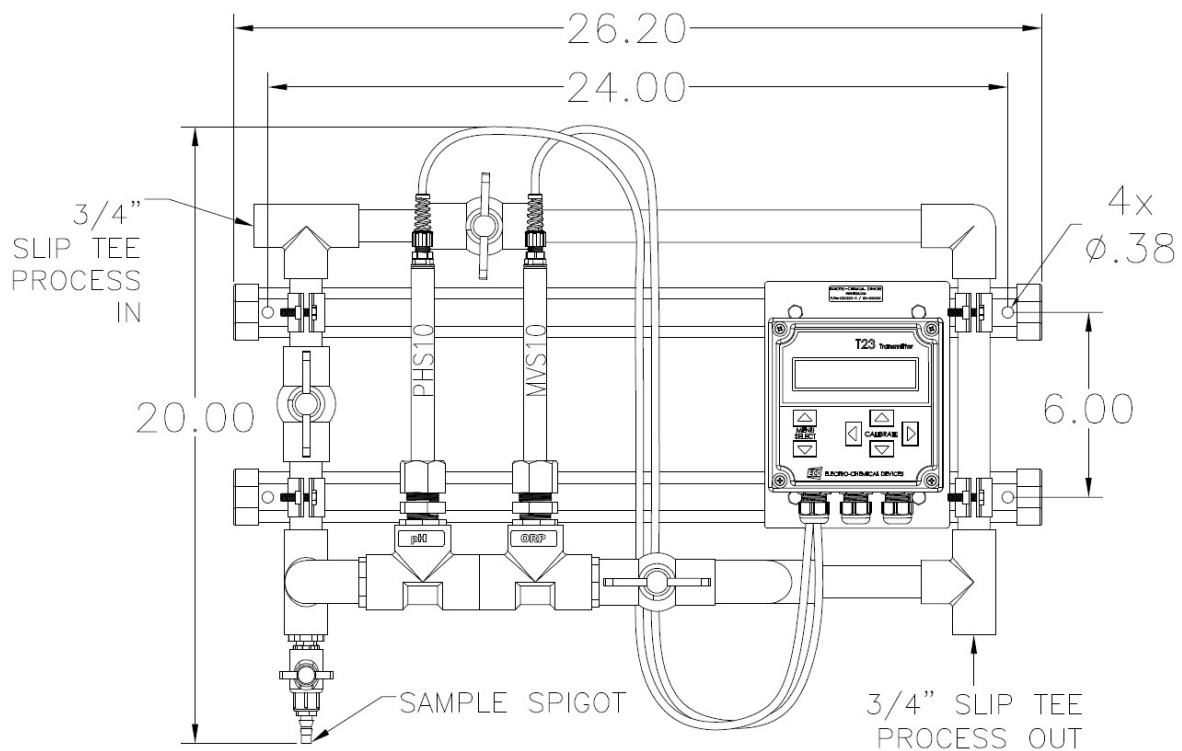
2.0 INSTALLATION

Mount the DCA-23 in a location where there is easy access to the analyzer and sensors. Install the system in an area where vibrations, electromagnetic and radio frequency interference are minimized or absent.

Do not mount in direct sunlight or areas of extreme heat. The DCA-23 is suitable for outdoor use if mounted with a protective cover or sunshield. (Consult with Factory)

2.1 MOUNTING

The DCA-23 Uni-Strut Rails are drilled with 4 x 0.38" holes, one at each corner.



2.2 WIRING

Electrical wiring should only be conducted by qualified personnel. See the wiring color code for the DCA-23 in Section 8.3 below.

2.2.1 Wiring, Sensor(s)

The TRO Sensor and the PHS10 pH Sensor were connected to the T-23 transmitter at the factory, no additional connections are necessary. Color coded connections for these sensors are shown in the wiring diagrams in Section 8.3 or inside the cover of the T-23 analyzer.

2.2.2 Wiring, power

Attach power cable, either 110/220 VAC or 24 VDC, as shown in the diagram in Section 8.3 or inside of the T-23 cover. Feed the cable through the gland fitting on the right hand side of the T-23. Tighten the cable gland to provide a good seal to the cable. The instrument can be powered up at this point with no harm to the analyzer but it is best to wait until the sensors are installed.

2.2.3 Wiring, 4-20 mA Outputs

The 4-20 mA outputs are unpowered outputs, 24V can be supplied from an external source (loop powered), i.e. the PLC or DCS or from the optional internal PS10/11 power supply.

If the internal PS10/11 Power Supply is used, follow the wiring diagram in Section 8.3 for the particular instrument.

If the 4-20 mA loop is powered from an external source then simply connect a shielded 22 gauge twisted pair communication wire to Terminals #1 and #2 of the 4-20 mA terminal.

The standard configuration has Chlorine (TRO) on mA 1 and (optional) pH on mA 2.

2.2.4 Wiring, Contact Relay Outputs

This optional configuration has two SPDT 230V 5 A relays that can be wired either normally open (NO) or normally closed (NC). The default configuration is set to use the relays as normally open.

Relays 1&2

Wire Relays as a **NO** relay. (See diagram in Section 8.3) The Relays are alarm relays and should be connected to the Control System or an external alarm.

Do not run the Alarm Relay cable through the same cable gland fitting as the electrodes or the 4-20 mA signals.

2.3 PLUMBING

2.3.1 Sample Requirements

Sample Pressure: 1 to 50 psig (0.1 – 3.4 bar)

Temperature: 32° to 140°F (0° to 60°C)

2.3.2 Connecting the Inlet and Drain fittings

The DCA-23 is intended for wall mounting only.

Sample Inlet:

A ¾" pipe slip fitting is provided for the sample inlet.

Sample Drain:

The sample drains through the ¾" pipe slip fitting.

The sample can be introduced after the sensors have been calibrated and installed in the flow cells.

2.4 INSTALLING the SENSORS

The DCA-23 is supplied with the sensor cables pre-wired to the analyzer. The DCA-23 instrument and sensors were calibrated at the factory and should be ready for use when assembled. However, changes may have occurred during shipping and storage requiring recalibration. (See Calibration section below)

The TRO sensor mounts in the Flow Cell using the supplied ¾" compression gland fitting. Remove the protective cap from the sensor and save it for future use, the cap contains a potassium chloride solution use care when removing the cap from the sensor. Loosen the compression fitting to allow the sensor to spin freely in the fitting. Insert the sensor into the flow cell using a twisting motion. There are o-ring seals inside the fitting the twisting motion will facilitate passing these seals. Slide the sensor to the bottom of the flow cell and then retract the pH sensor approximately ½" from the bottom of the flow cell and hand tighten the compression nut to fix its position.

The pH sensor mounts in the Flow Cell using the supplied ¾" compression gland fitting. Remove the protective cap from the sensor and save it for future use, the cap contains a potassium chloride solution use care when removing the cap from the sensor. Loosen the compression fitting to allow the sensor to spin freely in the fitting. Insert the sensor into the flow cell using a twisting motion. There are o-ring seals inside the fitting the twisting motion will facilitate passing these seals. Slide the sensor to the bottom of the flow cell and then retract the pH sensor approximately ½" from the bottom of the flow cell and hand tighten the compression nut to fix its position.

3.0 OPERATION

This section will provide a basic overview of the DCA-23 Analyzer. It covers the basic Menu structure and the functions of the MENU SELECT keys and the CALIBRATE keys.

3.01 Measurement Overview

Sea water contains approximately 68 mg/L of bromide. When chlorine is added to sea water, the bromide ion is oxidized to hypobromous acid (HOBr) and hypobromite (OBr-) by the Free Chlorine (HOCl and OCl-). This is a very rapid reaction and essentially all of the chlorine is instantaneously converted into bromine and bromamines. The DCA-23 measures the temperature, pH and Total Residual Oxidant (TRO) potential of the seawater and converts them into an equivalent “ppm chlorine” value, using the stored TRO/pH/Cl ppm table, see below. Even though there is no chlorine present, the DCA-23 displays Chlorine ppm in order to conform to existing conventions. TRO is defined as the total oxidizing capacity (free and combined) of the sea water that is available after chlorination.

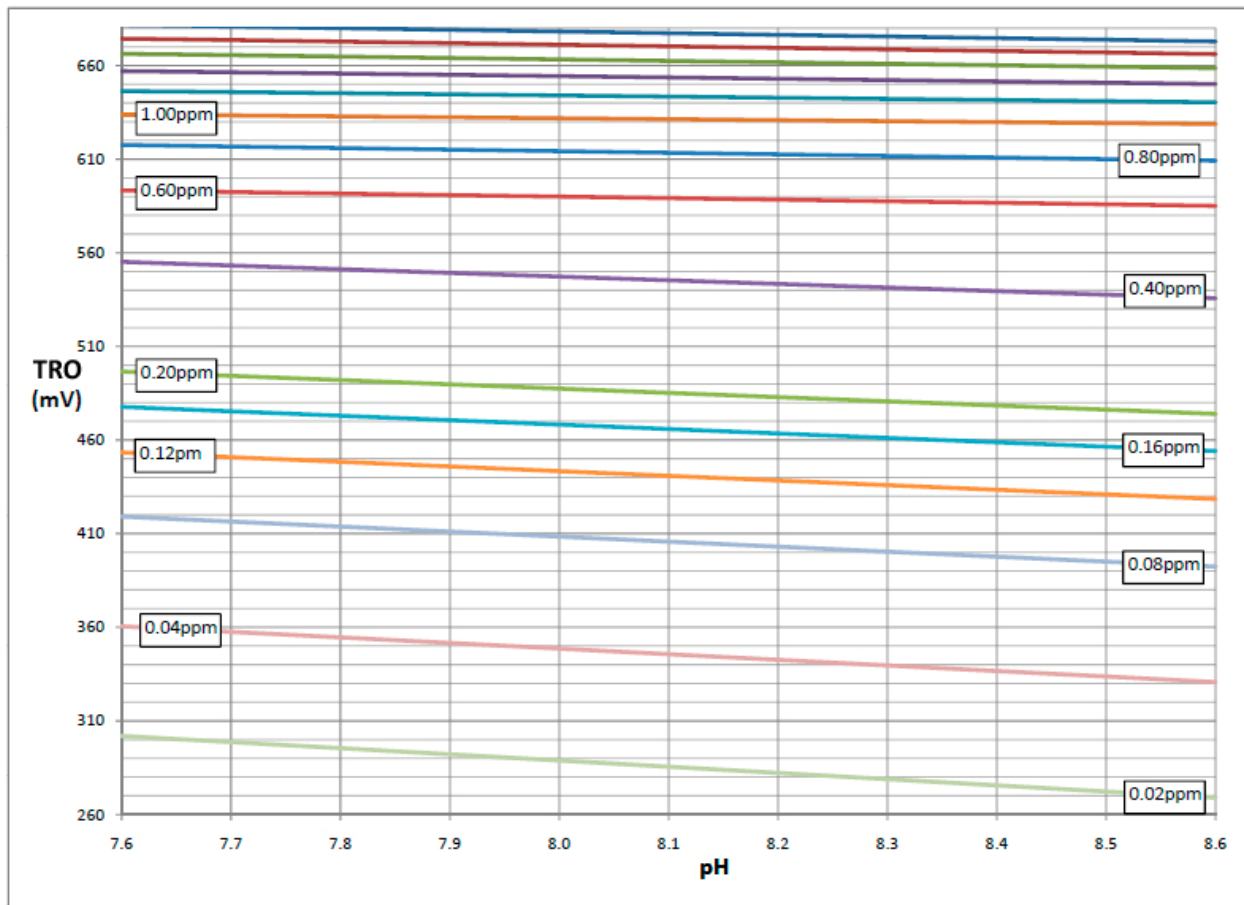


Table #1 TRO/pH/Equivalent Chlorine ppm

3.1 KEYS

The **blinking cursor** indicates the active point where menus can be selected or numerical values adjusted. There are two sets of keys on the DCA-23 analyzer, the MENU SELECT keys and the CALIBRATE keys.

The **MENU SELECT** keys are used to move the cursor vertically changing the displayed menu. These keys are also used to Save/Accept the calibration data and exit the calibration menu.

The **CALIBRATE** keys are used to enter menus, change numerical values and move the cursor.

To enter a calibration menu or parameter adjustment line, simultaneously press both of the Horizontal CALIBRATE keys, ◀CALIBRATE▶

Pressing either of the **Horizontal CALIBRATE** keys separately will **move the cursor horizontally to the point under the digit to be adjusted**. The **Vertical CALIBRATE** keys are used to adjust numeric values. Pressing the upper key will increase the value and pressing the lower key will decrease the value.

3.2 MENUS

There are two sets of menus on the Model DCA-23. The Channel 1 menus (PV1) are the TRO menus, the Channel 2 menus (PV2) are the pH menus. Pressing the MENU SELECT **Down** key will access the pH channel, pressing the MENU SELECT **Up** key will access the TRO channel. See the guide below for the general menu structure.

3.2.1 TRO Menus

Screen Displayed	Button Pressed
Cl ppm .23 23.6% 12.8°C	Home Screen (view only) Press MENU SELECT ▲ to move to TRO Screen
TRO 526.9 mV 12.8°C	TRO Screen (view only) MENU SELECT ▲
Input 520.5 mVa 0 mVa 6.4 mV	TRO Raw Input Screen (view only) MENU SELECT ▲
1 TRO 180.0 mV Cal 173.5 mVa	TRO Calibration 1 Screen MENU SELECT ▲
2 TRO 0.0 mV Cal 1.000 mV/TRO	TRO Calibration 2 Screen MENU SELECT ▲
4 mA .00 ppm 20 mA 1.00 ppm	Chlorine 4-20 mA Adjustment screen MENU SELECT ▲
ON .00 ppm OFF .00 ppm	Chlorine Alarm Relay Adjustment screen MENU SELECT ▲

Contrast 20	Contrast Adjustment screen MENU SELECT ▼..... To return to the Home screen
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3.2.1.1 Home Screen

The Home Screen displays the calculated Chlorine value and engineering units, Chlorine ppm, the % 4-20 mA output and the temperature.

3.2.1.2 TRO Screen

The TRO Screen displays the **TRO mV value** used to calculate the displayed chlorine ppm value.

3.2.1.3 TRO Raw Input Screen

The TRO Raw Input Screen displays the actual TRO signal from the sensor on line 1 and the amount of zero point correction applied on line 2. (Actual TRO + ZP Correction = TRO)

3.2.1.4 TRO Cal 1 Screen

The TRO Calibration 1 Screen is an ENTRY screen. To calibrate the system Enter the TRO mV value that corresponds to the DPD determined Chlorine value from the calibration chart.

3.2.1.5 TRO Cal2 Screen

The TRO Calibration 2 Screen is an ENTRY screen. This is a slope correction screen, mV/TRO. In all cases this screen should be set to the default value 1.000 mV/TRO.

3.2.1.6 Chlorine 4-20 mA Screen

The Chlorine 4-20 mA Screen is an ENTRY screen. Set the range of the 4-20 mA output in this screen. Default is 0.00 ppm – 2.00 ppm = 4-20 mA.

3.2.1.7 Chlorine Alarm Relay Screen (optional)

The Chlorine Alarm Relay screen is an ENTRY screen. This allows the alarm relay to be configured as High or Low Set Point (ON) and hysteresis value (OFF).

3.2.1.8 Contrast Screen

The Contrast screen allows for the adjustment of the screen contrast.

3.2.2 pH Menus

Screen Displayed	Button Pressed
Cl ppm .23 23.6% 12.8°C	Home Screen (view only) MENU SELECT ▼
pH 7.35 52.5% 12.8°C	pH Screen (view only) MENU SELECT ▼
Input -20.0 mVa 0 mVa 7.00	pH Raw Input Screen (view only) MENU SELECT ▼

1 pH 7.00 Cal .0 mV@25	pH Cal 1 Screen MENU SELECT ▼
2 pH 10.01 Cal -59.1 mV/pH	pH Cal 2 Screen MENU SELECT ▼
4 mA .00 20 mA 14.00	pH 4-20 mA Adjustment screen MENU SELECT ▼
ON .00 pH OFF .00 pH	pH Alarm Relay Adjustment screen MENU SELECT ▼
Trim °C .0 Unit 12.8°C	Temperature Trim/ Units Screen MENU SELECT ▲..... To return to the Home screen

3.2.2.1 Home Screen

The Home Screen displays the calculated Chlorine value and engineering units, Chlorine ppm, the % 4-20 mA output and the temperature.

3.2.2.2 pH Screen

The pH Screen displays the pH value, the % mA output and the temperature.

3.2.2.3 pH Raw Input Screen

The pH Raw Input Screen displays the actual mV signal from the pH sensor on line 1 and the amount of zero point correction applied on line 2.

3.2.2.4 pH Cal 1 Screen

The pH Calibration 1 Screen is an ENTRY screen. This is a zero point calibration screen, use pH 7.00 buffer to set the zero point, also used to standardize the reading.

3.2.2.5 pH Cal 2 Screen

The pH Calibration 2 Screen is an ENTRY screen. This is a slope correction screen, mV/pH. Use pH 10 buffer to set the slope. The default value is -59.1 mV/pH.

3.2.2.6 pH 4-20 mA Screen(optional)

The pH 4-20 mA Screen is an ENTRY screen. Set the range of the 4-20 mA output in this screen. Default is 0.00 pH – 14.00 pH = 4-20 mA.

3.2.2.7 pH 4-20 mA Screen(optional)

The pH Alarm Relay screen is an ENTRY screen. This allows the alarm relay to be configured as High or Low Set Point (ON) and hysteresis value (OFF).

3.2.2.8 Temperature Trim and Units Screen

The Temperature Trim allows the temperature to be adjusted, removing inaccuracies from extended cable lengths. Units, °C or °F are also set in this menu.

3.3 CALIBRATION MENUS

3.3.1 pH Calibration

Screen Displayed	Button Pressed
<u>1</u> pH 7.00 pH Cal .0 mV	◀ CALIBRATE ▶ (enters calibration line, zero pt. Cal 1) Sensor should be in a 7.0 pH solution.
1 pH 7.0 <u>0</u> pH Cal 0.2 mV	MENU SELECT ▼ (accepts the Calibration when the mV value is stable)
<u>1</u> pH 7.00 pH Cal 0.2 mV	MENU SELECT ▼ (move down to Cal line) (Entering the Cal line resets value to 0.0 mV)
1 pH 7.00 pH <u>Cal</u> 0.2 mV	MENU SELECT ▼ (move to Cal 2, Slope) Remove and rinse sensor with distilled water
<u>2</u> pH 10.00 pH Cal 59.1 mV/pH	◀ CALIBRATE ▶ (enter Cal Line) Place Sensor in a pH 10.00 solution
2 pH 10.0 <u>0</u> pH Cal 60.2 mV/pH	Set the pH value using the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.
2 pH <u>1</u> 0.00 pH Cal 60.2 mV/ppm	MENU SELECT ▼ (accept Calibration)
<u>2</u> pH 10.00 pH Cal 60.2 mV/ppm	MENU SELECT ▲ (return to Home Screen)

3.3.2 TRO Calibration

Screen Displayed	Button Pressed
<u>1</u> TRO 180.0 mV Cal 173.4 mVa	Run DPD test on Sample, Determine TRO value from Calibration Curve using DPD Value and pH
<u>1</u> TRO 180.0 mV Cal 173.4 mVa	press ◀ CALIBRATE ▶ to initiate Calibration.
1 TRO 52 <u>6</u> .0 mV Cal 519.0 mVa	Enter the TRO Value using the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.
<u>1</u> TRO 526.0 mV Cal 519.0 mVa	MENU SELECT ▲ (accept Calibration)
2 TRO .00 mV Cal 1.000 mV/TRO	MENU SELECT ▲ Verify slope 1.000 mV/TRO
2 TRO .00 mV <u>Cal</u> 1.000 mV/TRO	◀ CALIBRATE ▶ (enter Cal Line) Resets value to factory Default: 1.000 mV/TRO
<u>2</u> TRO .00 mV Cal 1.000 mV/TRO	MENU SELECT ▼ (return to Home Screen)

3.3.3 Temperature Trim

Screen Displayed	Button Pressed
_Trim °C .0 Unit 12.8°C	press ◀ CALIBRATE ▶ to initiate Calibration.
Trim °C 2. <u>4</u> Unit 15.2°C	Enter the Temp Value using the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.

3.4 OUTPUTS (4-20 mA Channels)

The DCA-23 has one 4-20 mA output configured for 0-2.00 ppm Chlorine. An optional second 4-20 mA output for pH is available.

3.4.1 pH Output

Screen Displayed	Button Pressed
_4mA1 2.00 pH 20mA1 12.00 pH	◀ CALIBRATE ▶ (enter 4mA line)
4mA1 0.0 <u>0</u> pH 20mA1 12.00 pH	To adjust the value use the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.
4mA1 0.00 pH 20mA1 12.00 pH	MENU SELECT ▼ (accept the Value)
_4mA1 0.00 pH 20mA1 12.00 pH	MENU SELECT ▼
4mA1 0.0 pH 20mA1 12.00 pH	◀ CALIBRATE ▶ (enter 20mA line)
4mA1 0.0 pH 20mA1 12.0 <u>0</u> pH	To adjust the value use the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.
4mA1 0.0 pH 20mA1 14.0 <u>0</u> pH	MENU SELECT ▼ (accept the Value)
4mA1 0.0 pH 20mA1 14.00 pH	MENU SELECT ▲ (Return to Home Screen) (4-20 mA1 is set to 0.00 pH to 14.00 pH)

3.4.2 Chlorine Output

Screen Displayed	Button Pressed
4mA1 0.00 ppm 20mA1 1.00 ppm	◀ CALIBRATE ▶ (enter 20 mA line)
4mA1 0.00 ppm 20mA1 2.0 <u>0</u> ppm	To adjust the value use the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.
4mA1 0.00 ppm 20mA1 2.00 ppm	MENU SELECT ▼ (accept the Value)

3.4.3 Manual Mode (4-20 mA Hold Function)

The % Output values are displayed on the Home Screen for the Cl ppm output, mA 1, and in the pH Screen for the optional pH Output, mA 2.

The outputs can be set to manual control by simultaneously pressing both horizontal CALIBRATE keys when the cursor is in front of the % Output line. An “M” will be displayed in front of the % Output value. The Output will remain frozen at the last value until the Manual Mode is turned off. The Manual Mode hold function is commonly used to freeze the outputs during maintenance and calibration cycles. While in Manual Mode the Output can be adjusted between 0 and 99.9% using the CALIBRATE keys, very useful for troubleshooting loop communication problems.

To exit Manual Mode press the left CALIBRATE arrow, ◀, three times and the “M” will disappear, the Output will return to a live reading.

3.5 ALARM RELAYS

The DCA-23 has an option of two alarm relays. Relay 1 is set as an alarm on PV1 the Chlorine channel. Relay 2 is set for an alarm on the pH channel. The relays can be wired as NO, Normally Open or NC, Normally Closed. The default configuration assumes NO status.

3.5.1 Chlorine Alarm Relay

Screen Displayed	Button Pressed
1 On > .0 ppm 1 Off < .0 ppm	◀ CALIBRATE ▶ (enter Relay Set Point)
1 On > .0 ppm 1 Off < .0 ppm	To adjust the value use the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.
1 On > 2.00 ppm 1 Off < .0 ppm	MENU SELECT ▼ (accept the Value)
1 On > 2.00 ppm 1 Off < .0 ppm	MENU SELECT ▼
1 On > 2.00 ppm 1 Off < .0 ppm	◀ CALIBRATE ▶ (enter Relay Hysteresis Point)
1 On > 2.00 ppm 1 Off < .0 ppm	To adjust the value use the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.
1 On < 2.00 ppm 1 Off > 1.75 ppm	MENU SELECT ▼ (accept the Value) ** Whether the relay is a High or Low Alarm is determined by the Off value **
1 On > 2.00 ppm (High Alarm example) 1 Off < 1.75 ppm (Low Alarm example) 1 On < 1.00 ppm 1 Off > 1.15 ppm	MENU SELECT ▼ (If the Off value is below the set point then the relay will be a High Alarm, closing at 2.00 ppm and re-opening below 1.75 ppm. If the Off is above the set point the relay will switch to a Low Alarm.)

3.5.2 pH Alarm Relay

Screen Displayed	Button Pressed
1 On > .0 pH 1 Off < .0 pH	◀ CALIBRATE ▶ (enter Relay Set Point)
1 On > .0 pH 1 Off < .0 pH	To adjust the value use the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.
1 On > 8.50 pH 1 Off < .0 pH	MENU SELECT ▼ (accept the Value)
1 On > 8.50 pH 1 Off < .0 pH	MENU SELECT ▼
1 On > 8.50 pH 1 Off < .0 pH	◀ CALIBRATE ▶ (enter Relay Hysteresis Point)
1 On > 8.50 pH 1 Off < .0 pH	To adjust the value use the CALIBRATE ◀ or ▶ to move cursor. Use the ▲ or ▼ to adjust the integer value.
1 On < 8.50 pH 1 Off > 8.45 pH	MENU SELECT ▼ (accept the Value) ** Whether the relay is a High or Low Alarm is determined by the Off value **
1 On > 8.50 pH (High Alarm example) 1 Off < 8.45 pH (Low Alarm example) 1 On < 1.00 pH 1 Off > 1.15 pH	MENU SELECT ▼ (If the Off value is below the set point then the relay will be a High Alarm, closing at 8.50 pH and re-opening below 8.45 pH. If the Off is above the set point the relay will switch to a Low Alarm.)

4.0 START UP

Supply sample flow to the system. Verify the sample flow is passing through both flow cells and returning to the drain. The S10 style sensors tend to self purge air from the flow cell naturally and usually don't require any special treatment. Purge any trapped air in the system by loosening the electrode fitting allowing water to overflow out of the Tee Flowcell.

Allow the system to run at least 1 hour before proceeding to the Chlorine/TRO Sensor calibration.

4.1 CALIBRATION

The DCA-23 was calibrated before shipping and should not require calibration at Start Up. If Calibration is required calibrate the Temperature Sensor first then the pH10 Sensor and finally the TRO Sensor.

4.2 TEMPERATURE SENSOR

Allow the sensor to equilibrate for at least 10 minutes. Verify the displayed temperature agrees with the thermometer. If not, then adjust the temperature in the **Temperature Trim °C/°F** menu (see section 3.3.3 above) to agree with the thermometer. This calibration was performed in the factory calibration but it is advisable to perform a temperature check every 2-3 months.

4.3 pH SENSOR

The PHS10 pH sensor was calibrated with pH 7.0 and pH 10.0 buffers at the factory before shipping. Verify the displayed pH agrees with the actual pH. If the pH value deviates by more than 0.2 pH then adjust the value in the pH Cal 1 Menu by setting the existing pH 7 value to the actual sample value and then accepting the calibration. (See section 3.3.1 above)

4.3.1 Two Point Calibration

Remove the PHS10 pH sensor from the flow cell and place it in a beaker of pH 7.00 Calibration Buffer. Scroll down to the pH Calibration 1 Menu and enter the menu by pressing both horizontal CALIBRATE keys, Enter the Cal 1 line and adjust the calibration value to pH 7.00. When the mV value has stabilized accept the value by pressing the down MENU key. An Acceptable mV value is ± 60 mV zero point offset. Rinse the sensor and place it in a beaker of pH 10.0 Calibration buffer for the second point calibration. Scroll down and enter the Cal2 Line. Enter the value of the Calibration Solution and accept the calibration when the mV/pH value has stabilized. An Acceptable value is > 54 mV/pH. Rinse the sensor and return it to the DCA-23 flow cell. (See section 3.3.1 above)

4.4 CHLORINE SENSOR (TRO)

Chlorine Calibration

Using an approved method, the DPD test for an example, verify the displayed chlorine concentration agrees with the actual value. If further calibration is necessary, first verify the displayed temperature and pH values are correct before beginning the chlorine standardizing procedure.

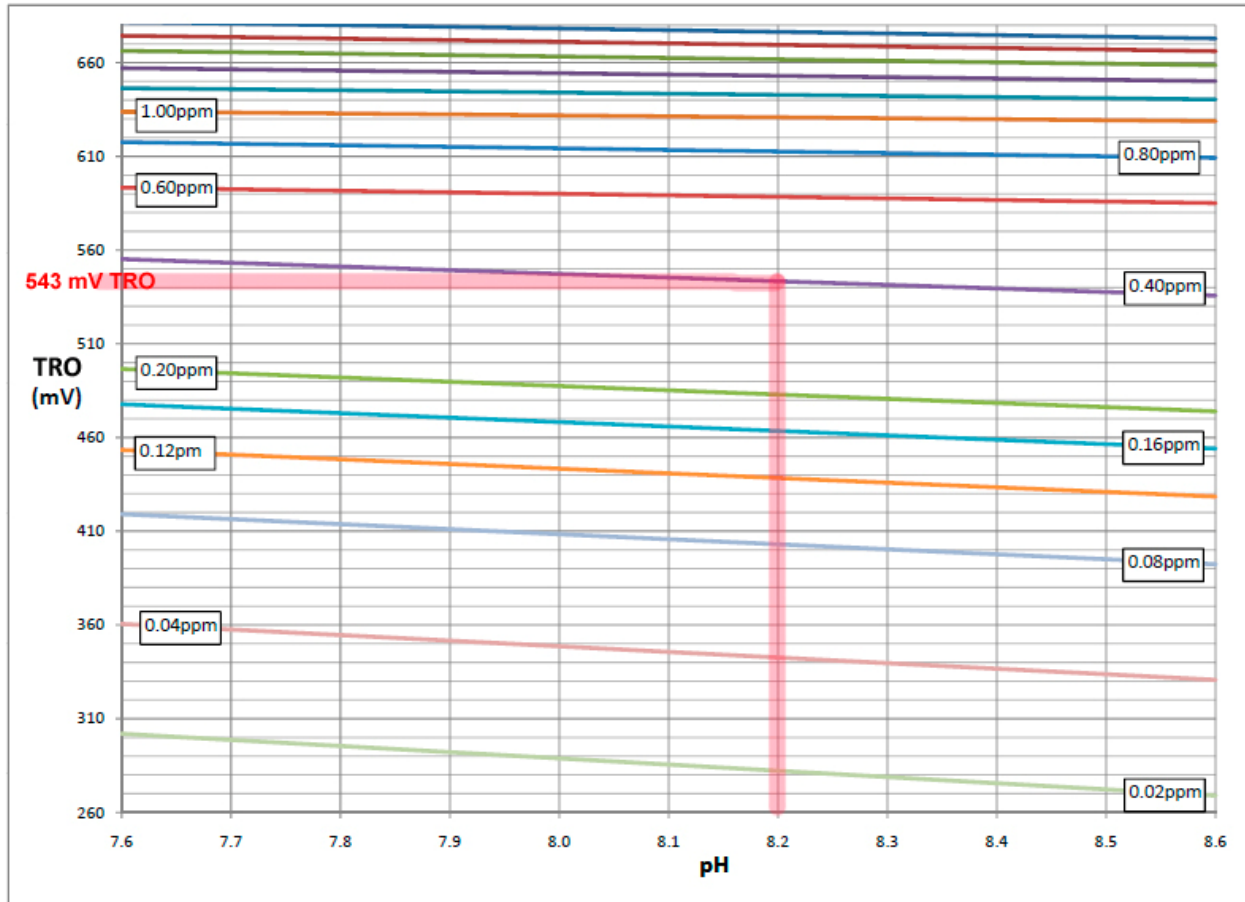
Perform a DPD test on the sample. Then using the TRO/pH/Chlorine Calibration Curve determine the proper TRO mV value for the tested DPD Chlorine and pH values. Enter the TRO mV value in the **TRO Cal 1 Screen** as described in section 3.3.2 above. The DCA-23 will now display the Chlorine value associated with that TRO value.

4.4.1 TRO Calibration Example

Measured pH = 8.2 pH

DPD Test = 0.40 ppm Chlorine

TRO value to be entered into TRO Cal 1 Menu = 543 mV



5.0 MAINTENANCE

The DCA-23 output should be verified weekly against an approved method like a DPD test. Inspect the flow train for leaks or a buildup of debris in the pipes prior to testing the sample. There are no consumable components aside from the pH electrode and the TRO electrode and these should be replaced yearly.

5.1 Chlorine TRO Sensor

When used in chlorinated water, TRO sensors require little maintenance. TRO sensors do require periodic calibration due to drift in the reference electrode as it ages. This aging causes the displayed TRO value to be lower than the true mV value of the sample.

Check the sensor on a monthly basis, recalibrate if necessary. Clean or replace the pH sensor when it becomes noisy and slow to respond.

If the sensor needs cleaning then it can be soaked in a dilute solution of HCl, 1-5%, for 10-30 minutes. This will remove scale or biofilms from the sensor, rinse well and soak in pH 4 buffer for 15 minutes before returning the sensor to service.

5.2 pH Sensor

When used in chlorinated water, pH sensors require little maintenance. pH sensors do require periodic calibration due to drift in the reference electrode as it ages. This aging causes the displayed pH value to be higher than the true pH of the sample.

Check the sensor on a monthly basis, recalibrate if necessary. Clean or replace the pH sensor when it becomes noisy and slow to respond.

If the sensor needs cleaning then it can be soaked in a dilute solution of HCl, 1-5%, for 10-30 minutes. This will remove scale or biofilms from the sensor, rinse well and soak in pH 4 buffer for 15 minutes before returning the sensor to service.

6.0 TROUBLESHOOTING

The DCA-23 was evaluated and calibrated at the factory before shipment. Upon initial start up the system should require minimal to no adjustments.

Verify the system has sample flow and the pH and the temperature sensors are reading correctly. These parameters affect the measurement and must be reading properly. If these conditions are met and problems still exist use the Troubleshooting Table to find a remedy.

Troubleshooting Guide

Symptom	Possible Cause	Remedy
Displayed value is Higher than DPD test value.	pH sensor reading to high TRO sensor reading to high	Check mV value in pH 7 buffer, if > -60 mV replace the electrode cartridge. If < -60mV perform a one pt. Cal Check the TRO value vs. the tested DPD chlorine value on Calibration Curve. Correct if necessary.
Displayed value is Lower than DPD test value	pH sensor reading to low TRO sensor reading to low	Check pH of grab sample and standardize the pH reading Check the TRO sensor in a ORP standard solution, if more than 60 mV low then replace the electrode, otherwise recalibrate to DPD test.
Zero Chlorine Reading in a solution with measureable chlorine.	TRO sensor electrically shorted	Check TRO sensor in a ORP standard solution Electrode failure or sealing o-ring failure. Remove electrode cartridge from sensor and look for water inside the sensor, replace electrode and sensor if water inside.
Unstable Chlorine Reading	Mostly Air bubbles in line Oscillating pressure > 5 psi Coating on pH or TRO sensor	Remove air from line. Dampen pulses with accumulator before flow cell Oil or grease on pH or TRO will cause noisy readings, clean electrode tips with detergent

7.0 ORDERING INFORMATION

Model CDA-22 Complete System	
Part #	Model and Description
1290220-1	DCA-23 System Complete, Loop Powered, (1) 4-20 mA
1290220-2	DCA-23 System Complete, 24 VDC-50mA powered, (2) 4-20 mA
1290220-3	DCA-23 System Complete, 24 VDC-100mA powered, (2) 4-20 mA, (2) relays
1290220-4	DCA-23 System Complete, 110 VAC powered, (2) 4-20 mA, (2) relays
1290220-5	DCA-23 System Complete, 220 VAC powered, (2) 4-20 mA, (2) relays

7.1 ACCESSORIES and SPARE PARTS

Instruments, Parts and Accessories	
Part #	Model and Description
1900120.1527	DCA-23 Transmitter, Loop Powered, (1) 4-20 mA
1900130.1527	DCA-23 Transmitter, 24 VDC-50mA powered, (2) 4-20 mA
19R0130.1527	DCA-23 Transmitter, 24 VDC-100mA powered, (2) 4-20 mA, (2) relays
19E0130.1527	DCA-23 Transmitter, 110 VAC powered, (2) 4-20 mA, (2) relays
19F0130.1527	DCA-23 Transmitter, 220 VAC powered, (2) 4-20 mA, (2) relays
140406J.30G0	PHS10 pH sensor, PHS10-T23-CBL4-EG-75PP (no electrode cartridge)
141406J.30G0	MVS10 TRO sensor, MVS10-T23-CBL4-EG-75PP (no electrode cartridge)
2005145.VIT	Replacement pH cartridge (recommended spare part)
2005167.VIT	Replacement TRO cartridge (recommended spare part)
1000250	Flow cell, 1" slip x 1" slip x ¾" NPT Tee, with ¾" Compression fitting
1000300-1	4-20 mA USB Data Logger,
2010100	pH Calibration Buffer, 4.01 pH
2010101	pH Calibration Buffer, 7.00 pH
2010103	pH Calibration Buffer, 10.0 pH
2010170	ORP Calibration Solution +465 mV

8.0 ENGINEERING DOCUMENTATION

The information and technical data disclosed in this document may be used and disseminated only for the purposes and to the extent specifically authorized in writing by Electro-Chemical Devices. Electro-Chemical Devices reserves the right to change published specifications and designs without prior notice.

8.1 SPECIFICATIONS

Sensors and Flow Train

TRO (Total Residual Oxidant Sensor)

Combined sensor, Platinum electrode, KCl/AgCl reference electrode with porous Teflon junction, 3 K-ohm temperature sensor and signal conditioner

PHS 10 (pH sensor)

Combined sensor, pH glass electrode, KCl/AgCl reference electrode with porous Teflon junction, 3 K-ohm temperature sensor and signal conditioner

Measurement Range

TRO	±1500 mV
pH	2 - 12 pH
Temperature	0° to 60° C (32° - 122°F)
Pressure	50 psig, max. (3.4 bar, max.)

Wetted Materials

PVC, Poly Propylene, PTFE, Viton, Glass, Platinum

Process Connections

Input	Schedule 80 PVC, ¾" slip fitting
Drain	Schedule 80 PVC, ¾" slip fitting

Performance Characteristics

Measurement Range:	0.00 to 2.00 ppm Chlorine
Accuracy:	Dependent on the accuracy of the DPD test and pH value
Minimum Detection Limit:	0.014 ppm (MDL)
Limit of Quantification:	0.044 ppm (LOQ)
Response Time:	Chlorine < 2 minutes (T90) Temp. < 2 minutes (T90) pH < 30 seconds (T90)
Drift	< 1.5% month

T-23 Transmitter

Measurements

Chlorine	0.00 to 2.00 ppm
pH	2 – 12 pH
Temperature	0° to 100° C (32°-212°F)

Cl₂/pH Compensation Between pH 7.5 - 8.6

Display 2.5" X 1.75" backlit LCD 4 lines of text and Graphical

Case NEMA 4X, LxWxD 5.7" x 5.7" x 7"

Operating Conditions Temperature -20° to 50° C, Protect from direct sunlight and excessive heat.
Humidity, RH from 5% - 95%, non-condensing

Outputs One 4-20mA for Chlorine (Optionally (2) 4-20 mA outputs, one Chlorine, one pH)

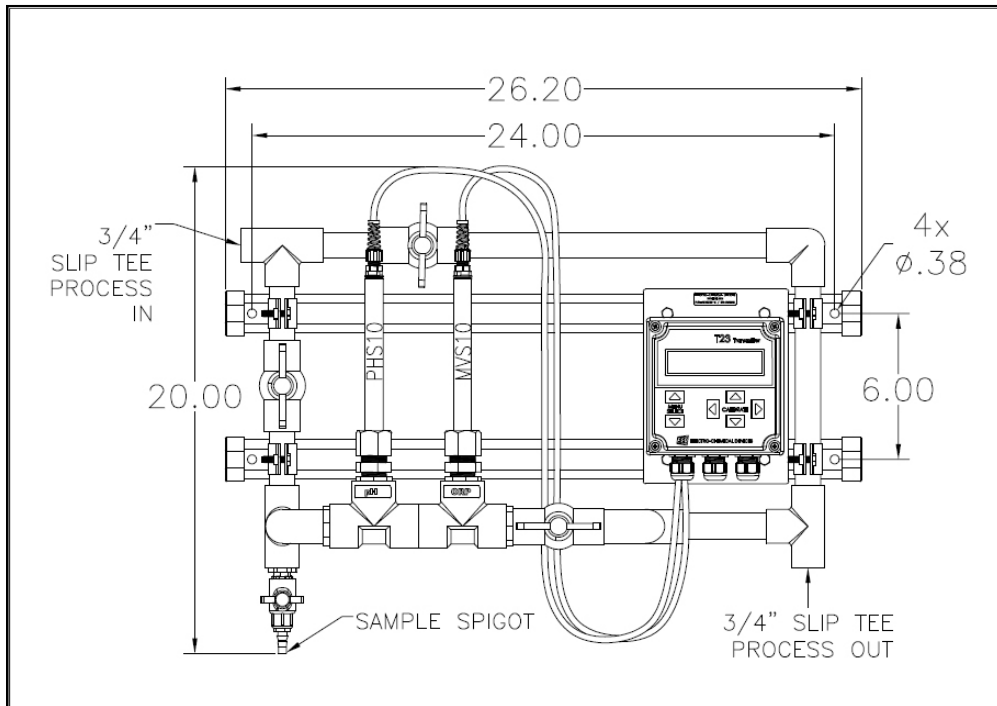
Alarms Optional (2) Form C, SPDT 230VAC 5A; 30 VDC 5A

Power Loop powered or optionally 24 VDC @ 0.5A or 110/220 VAC @ 50-60 Hz

Weight 11 lbs (5 kg)

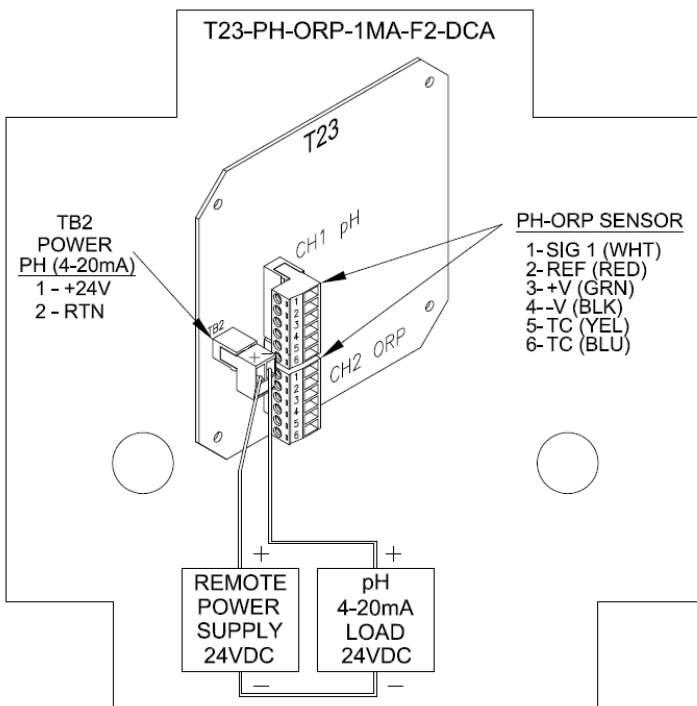
Shipping Weight 14 lbs (6.5 kg)

8.2 OUTLINE & DIMENSIONAL DRAWING

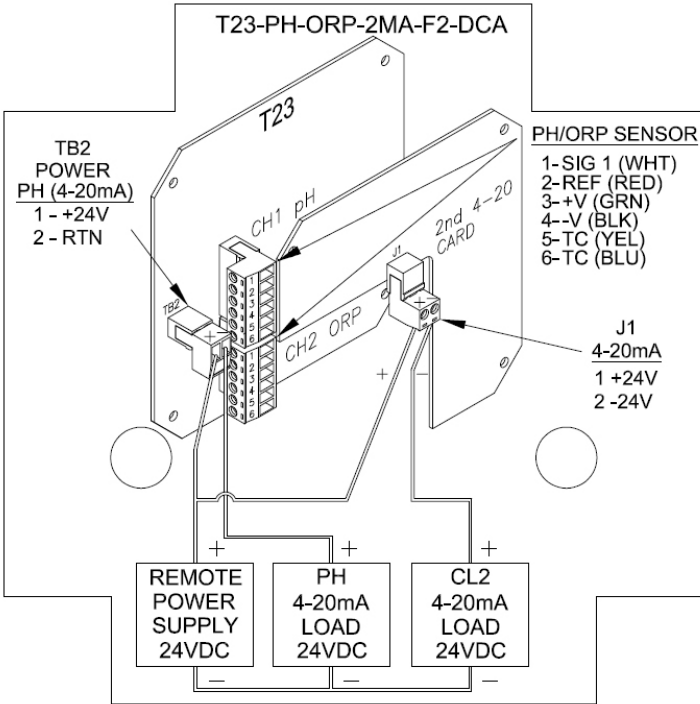


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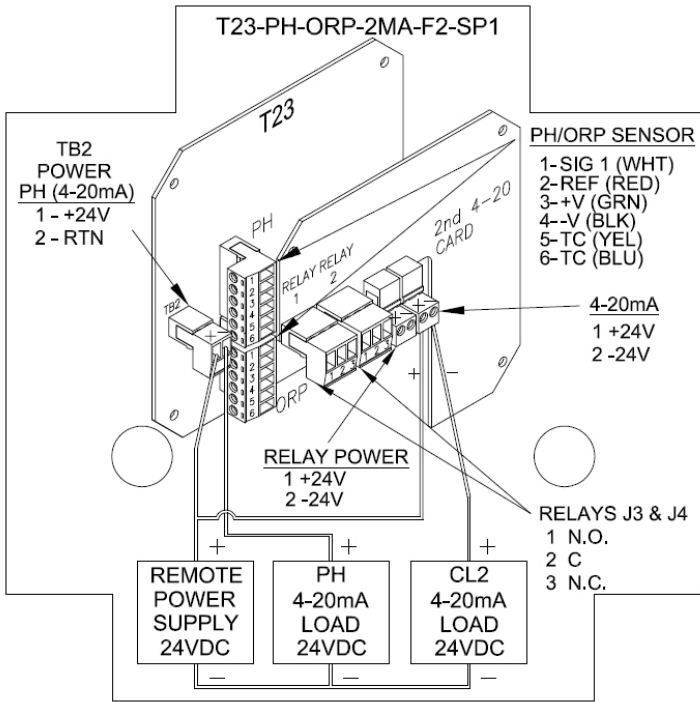
8.3 WIRING DIAGRAMS



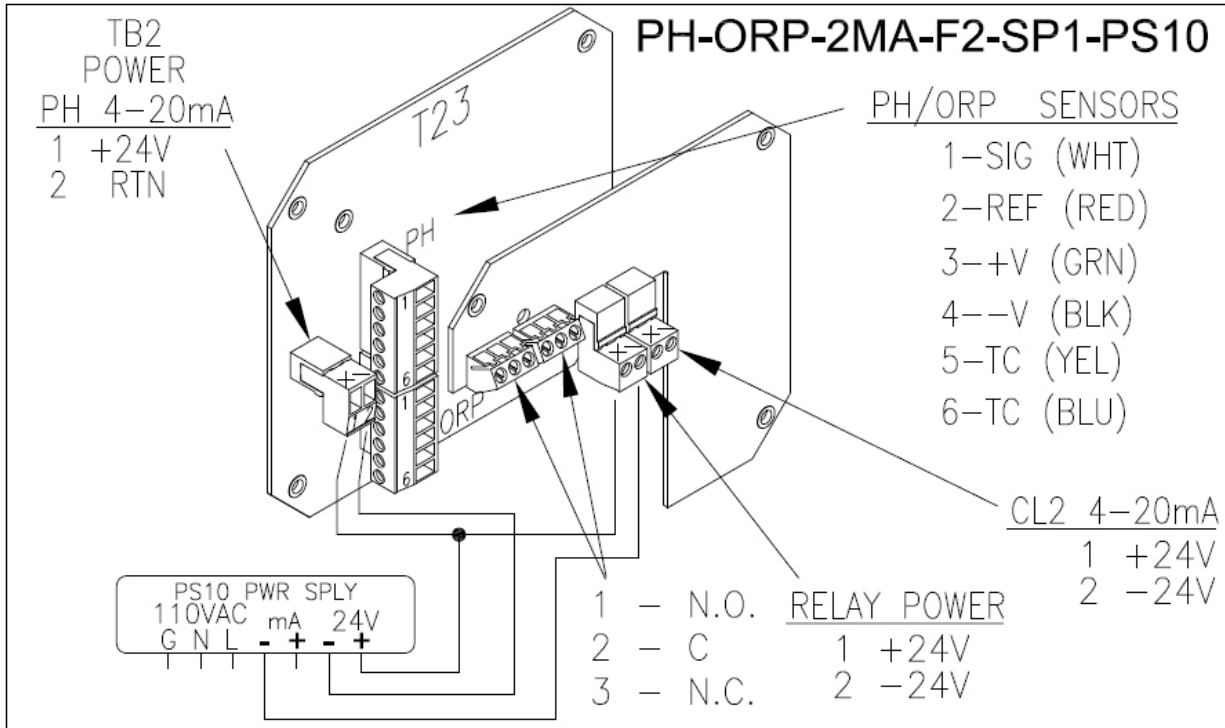
PN 1290220-1



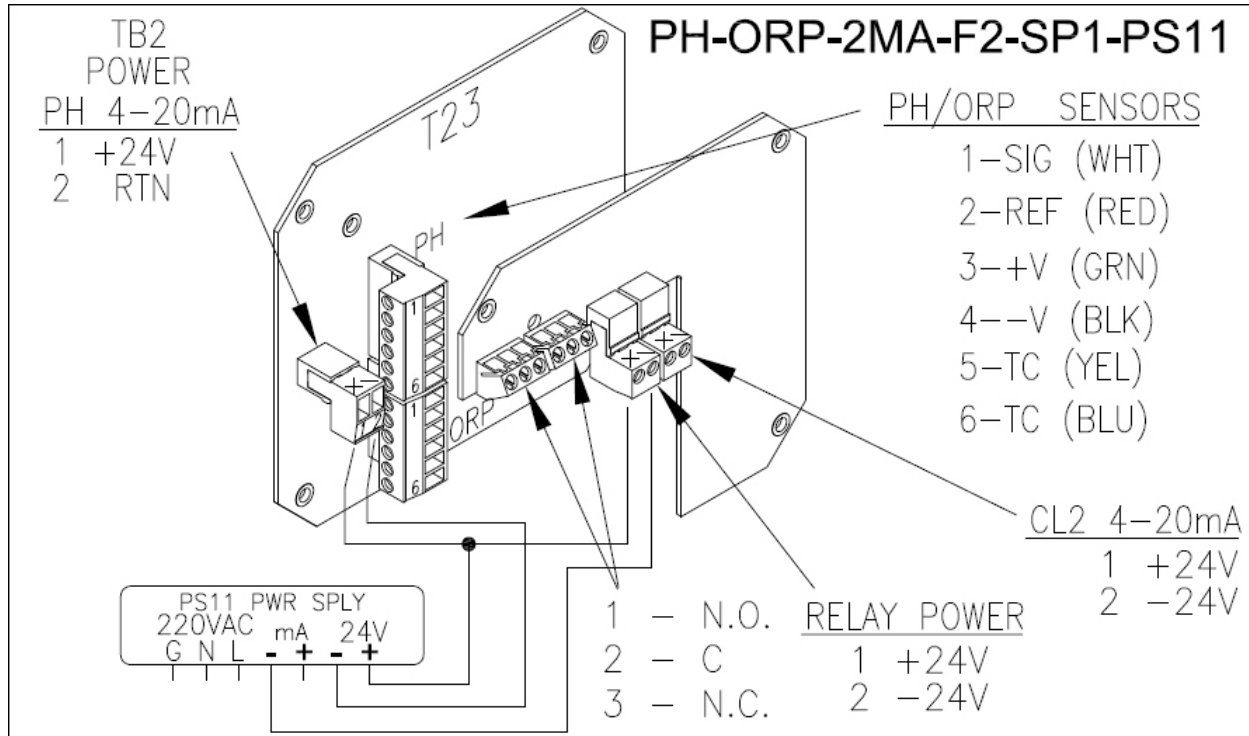
PN 1290220-2



PN 1290220-3



PN 1290220-4



PN 1290220-5

