

Instruction Manual

PN 51-1054BCL/rev.B

April 2003

Model 1054B CL

Free Residual Chlorine Microprocessor Analyzer



ESSENTIAL INSTRUCTIONS **READ THIS PAGE BEFORE PRO-** **CEEDING!**

Rosemount Analytical designs, manufactures, and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use, and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- Read all instructions prior to installing, operating, and servicing the product. If this Instruction Manual is not the correct manual, telephone 1-949-757-8500 and the requested manual will be provided. Save this Instruction Manual for future reference.
- If you do not understand any of the instructions, contact your Rosemount representative for clarification.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look alike substitutions may result in fire, electrical hazards, or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

WARNING **ELECTRICAL SHOCK HAZARD**

Making cable connections to and servicing this instrument require access to shock hazard level voltages which can cause death or serious injury.

Be sure to disconnect all hazardous voltage before opening the enclosure.

Relay contacts made to separate power sources must be disconnected before servicing.

Electrical installation must be in accordance with the National Electrical Code (ANSI/NFPA-70) and/or any other applicable national or local codes.

Unused cable conduit entries must be securely sealed by non-flammable closures to provide enclosure integrity in compliance with personal safety and environmental protection requirements.

The unused conduit openings need to be sealed with NEMA 4X or IP65 conduit plugs to maintain the ingress protection rating (IP65).

For safety and proper performance this instrument must be connected to a properly grounded three-wire power source.

Proper relay use and configuration is the responsibility of the user.

No external connection to the instrument of more than 69VDC or 43V peak allowed with the exception of power and relay terminals. Any violation will impair the safety protection provided

Do not operate this instrument without front cover secured. Refer installation, operation and servicing to qualified personnel..

WARNING

This product is not intended for use in the light industrial, residential or commercial environment, per the instrument's certification to EN50081-2.

Emerson Process Management

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EMERSON
Process Management

⚠ WARNING

HAZARDOUS VOLTAGE



Can cause severe injury or death. Disconnect power before servicing.

⚠ CAUTION

The analyzer has a metalized enclosure. Ground conduit to metal stiffener or to metal enclosure. Use non-flammable watertight conduit fittings/plugs to preserve rating.

⚠ VYSTRAHA

NEBEZPEČNĚ NAPĚTÍ



Muže způsobit vážné zranění nebo smrt. Odpojte napájení před údržbou

⚠ VAROVANI

Zemnici vodice musí být vodive spojen s kostrou přístroje. Používejte nehorlavé vodotesné průchodky, abyste zachovali stupen krytí přístroje.

⚠ AVISO

VOLTAJE PELIGROSO



Puede causar severas lesiones o muerte. Desconecte la alimentación antes del mantenimiento.

⚠ ATENCION

La toma a tierra debe hacerse a un contrafuerde metal o a la caja metálica. Utilice accesorios/enchufes no inflamables y estancos al agua para preservar las especificaciones de la caja

⚠ ADVARSEL

FARLIG SPÆNDING



Kan forårsage alvorlige kvæstelser eller død. Afbryd spænding før servicering

⚠ FORSIGTIG

Jordforbindelse til metal kapsel. Brug uantændelig vandtæt forskrning som sikkerhed for bevaring af kapslings klasse.

⚠ ATTENTION

HAUTE TENSION



Peut provoquer des blessures graves ou la mort. Déconnecter l'alimentation avant manipulation.

⚠ ATTENTION

Raccorder le tube à la masse métallique d'une entretoise ou du coffret. Utiliser des raccords et des bouchons étanches ininflammables afin de préserver la classification du boîtier.

⚠ OSTRZEZENIE

NIEBEZPIECZNE NAPIECIE



Może spowodować uszkodzenie ciała lub śmierć. Odłącz zasilanie przed przystąpieniem do prac.

⚠ UWAGA

Uziemij przewód do metalowego płaskownika lub obudowy. Aby zachować stopień szczelności obudowy stosuj niepalne, wodoszczelne dławiki.

⚠ WARNUNG

GEFAEHRLICHE SPANNUNG



Am Geraet liegt eine gefaehrliche Spannung an. Schalten Sie immer vor dem Oeffnen des Geraetes alle Zuleitungen spannungsfrei.

⚠ ACHTUNG

Der Analysator ist vorschriftsmaessig zu erden. Um die Schutzart des Geraetes sicherzustellen ist es mit den entsprechenden Kabelverschraubungen und Blindkappen auszuruesten.

⚠ Waarschuwing

GEVAARLIJKE SPANNING



Kan ernstig of dodelijk letsel veroorzaken. Schakel de voeding uit voordat u onderhoudswerkzaamheden uitvoert.

⚠ Voorzichtig

Aardleiding naar metalen profiel of naar metalen behuizing. Gebruik onbrandbare, waterdichte wartels en pluggen om de beschermingsklasse te handhaven.

⚠ Attenzione

ALTA TENSIONE



Può causare grave lesione o morte. Disattivare le tensioni prima di effettuare la manutenzione.

⚠ Attenzione

Tubo di protezione per messa a terra con elemento di ingresso in metallo o con custodia in metallo. Utilizzare accessori/connettori del tubo di protezione a tenuta stagna, non infiammabili, per assicurare i limiti di resistenza della custodia

⚠ ADVARSEL

FARLIG SPENNING



Kan føre til alvorlige skader eller dødsulykker. Spenningstilførsel må frakobles før service utføres.

⚠ ADVARSEL

Kabelinnføring må jordes til metallavstiver eller til metallkapslingen. Bruk flammesikre og vanntette nipler/plugger slik at kapslingens tetthetsgrad opprettholdes.

⚠ VARNING

LIVSFARLIG SPÄNNING



Kan medföra allvarlig skada eller dödsfall. Bryt spänning innan service utföres.

⚠ IAKTTAG FÖRSIKTIGHET

Anslutningspunkt är jordad till chassi. Använd brandsäker, vattentät kabelanslutning för att bevara klassificering av apparatskåp.

⚠ AVISO

TENSÃO PERIGOSA



Pode causar lesões graves ou a morte. Desligar a energia antes de proceder a trabalhos de manutenção.

⚠ ATENÇÃO

Ligar a conducta de cabos à terra através de suporte ou invólucro metálicos. Utilize buçins e acessórios ignífugos e estanques para preservação da estanqueidade.

MODEL 1054B CL MICROPROCESSOR ANALYZER

TABLE OF CONTENTS

Section	Title	Page
1.0	DESCRIPTION AND SPECIFICATIONS	1
1.1	Features and Applications	1
1.2	Physical Specifications - General	2
1.3	Analyzer Specifications @ 25°C	2
1.4	Recommended Sensors	2
1.5	Ordering Information	3
2.0	INSTALLATION	4
2.1	General	4
2.2	Unpacking and Inspection	4
2.3	Installation	4
2.4	Electrical Connections - General	10
2.5	Sensor Wiring	12
3.0	DESCRIPTION OF CONTROLS	14
3.1	Display and Keyboard Functions	14
3.2	View	16
3.3	Edit	16
3.4	Configure Display	16
4.0	CONFIGURATION	18
4.1	General	18
4.2	Memory	18
4.3	Start-up	18
4.4	Set Function	18
4.5	Alarm 1 and 2	22
4.6	Interval Timer	23
4.7	Temperature Configuration	24
4.8	Current Output	24
4.9	Defaults	25
4.10	Input Filter	26
4.11	Alarm Setpoint	26
4.12	Output Scale Expansion	27
4.13	Simulate Current Output	28
4.14	pH Correction	29
5.0	START UP AND CALIBRATION	30
5.1	General	30
5.2	Start-up	30
5.3	Calibration	30
6.0	KEYBOARD SECURITY	34
7.0	THEORY OF OPERATION	35
8.0	DIAGNOSTICS AND TROUBLESHOOTING	36
8.1	Diagnostics	36
8.2	Troubleshooting	36
8.3	CPU and Power Board Replacement	39
8.4	Maintenance	39
9.0	RETURN OF MATERIALS	42

LIST OF FIGURES

Figure No.	Title	Page
2-1	Panel Mounting Cutout Information	5
2-2	Panel Mounting Tab Installation	6
2-3	Wall Mounting Junction Box Assembly	6
2-4	Wall Mounting Junction Box Wiring Diagram	7
2-5	Pipe Mounting Installation.....	8
2-6	Wall Mount Enclosure (option -20).....	9
2-7	Electrical Wiring	10
2-8	Wiring Sensor with Standard Cable to 1054B CL Analyzer.....	12
2-9	Wiring Sensor with Optimum EMI/RFI Cable to 1054B CL Analyzer.....	12
2-10	Wiring Sensor Model 389-01-10-54 to Model 1054B CL Analyzer	13
2-11	Wiring Sensor Model 396P-01-10-54 to Model 1054B CL Analyzer.....	13
2-12	Wiring Sensor Model 399-07 or 399-08 to Model 1054B CL Analyzer	13
3-1	Front Panel	14
3-2	Key Labels	16
3-3	Accessing Editing Function.....	16
3-4	Accessing Configuration Menus	16
4-1	Set Function Menu	20
4-2	Alarm 1 and Alarm 2 Set Up	22
4-3	Timer Diagram for One Cycle	23
4-4	Interval Timer Setup.....	23
4-5	Temperature Configuration Setup	24
4-6	Current Output Setup	24
4-7	Default Setup	25
4-8	Alarm Setpoint	26
4-9	Output Scale Expansion	27
4-10	Simulate Output Current	28
8-1	Three-wire 100 ohm Platinum RTD.....	37
8-2	Temperature Simulation into 1054B CL Analyzer	37
8-3	Electronic Bench Check Setup	38

LIST OF TABLES

Table No.	Title	Page
1-1	Replacement Parts	3
1-2	Accessories.....	3
3-1	Description of Keys and Functions	15
3-2	Information Mnemonics.....	16
4-1	Configuration Worksheet.....	19
4-2	Set Mode Function Mnemonics	21
4-3	Relay States.....	25
8-1	Fault Message Codes	36
8-2	RTD Resistance Values	37
8-3	Troubleshooting Guide.....	40

SECTION 1.0

DESCRIPTION AND SPECIFICATIONS

- 1.1 Features and Applications**
- 1.2 Physical Specifications - General**
- 1.3 Analyzer Specifications @ 25°C**
- 1.4 Recommended Sensors**
- 1.5 Ordering Information**

1.1 FEATURES AND APPLICATIONS

The Model 1054B Microprocessor Analyzers with the appropriate sensor are designed to continuously measure and control pH, ORP, conductivity, percent concentration, ratio, resistivity, dissolved oxygen, free residual chlorine, or dissolved ozone in industrial and municipal processes.

The Model 1054B Analyzer is housed in a NEMA 4X (IP65) weatherproof, corrosion-resistant, flame retardant enclosure suitable for panel, pipe, or wall mounting. All functions are accessed through the front panel membrane keypad which features tactile feedback. Settings may be protected against accidental or unauthorized changes by a user selectable security code. Measurement data may be read at any time on either an LED or LCD display. The display shows the concentration of free residual chlorine, the pH (optional), temperature, alarm status, and hold and fault conditions.

The 1054B transmits isolated current outputs for chlorine and pH that are continuously expandable over the measurement range. Current outputs can be configured for either direct or reverse action and can be displayed in milliamps or percent of full scale. Output dampening of 0-255 seconds is user selectable. The output and relay settings for hold and fault mode operation are also user selectable. The hold output function allows the user to manually control the process while the sensor is off-line for maintenance. Continuous self diagnostics alert the operator to faults caused by analyzer electronics, RTD failure, and open wiring.

Two alarm relays are standard, and the relays can be programmed for high or low activation. For Model 1054B CL Analyzers equipped with dual output (chlorine and pH), either alarm can monitor either output. Alarm 2 can be programmed as a fault alarm. Both alarms feature independent setpoints, adjustable deadband or hysteresis, and time delay action. A dedicated relay with programmable timer function is also provided.

The Model 1054B CL Analyzer is intended for use with a membrane covered amperometric sensor.* Because the permeability of the membrane is a function of temperature, a correction is necessary when the sensor is used at a temperature different from the one at which it was calibrated. The analyzer automatically applies the temperature correction factor. The temperature of the process is measured by an RTD in the sensor and is displayed in either °C or °F.

An aqueous solution of free chlorine is a mixture of hypochlorous acid and hypochlorite ion. The relative amount of each species depends on temperature and pH. Generally, increasing the pH and temperature reduces the amount of hypochlorous acid in the mixture. Because the response of the sensor to hypochlorous acid is greater than its response to hypochlorite, accurate determination of chlorine requires knowledge of the pH and temperature of the sample. If the pH is relatively constant, a fixed pH correction factor can be entered into the analyzer software. If the pH is greater than 7 and fluctuates by more than 0.1 unit, continuous measurement of pH and automatic pH correction is necessary. For analyzers having automatic pH correction, two-point buffer calibration is standard.

An input filter allows the user to configure the analyzer for rapid response or low noise.

The 1054B CL Analyzer is intended for use in applications where species that react with free chlorine, such as ammonia, certain organic amines, and bromide are absent.

1.2 PHYSICAL SPECIFICATIONS - GENERAL

Panel Mount Enclosure: Black, ABS, NEMA 4X, IP65, CSA Enclosure 4
144 X 144 X 192 mm
(5.7 X 5.7 X 7.6 in.)

Wall Mount Enclosure: NEMA 4X, Heavy duty fiberglass, reinforced thermoplastic.
356.4 X 450.1 X 180.2 mm* (14 X 17.7 X 7.1 in.*)

Front Panel: Membrane keypad with tactile feedback and user selectable security code

Digital Display: LCD, black on grey
Optional red LED
Character height: 18 mm (0.7 in.)

Electrical Classification:

FM Class I, Div. 2, Group A thru D
28 Vdc relays - 5.0 amps resistive only
150 mA - Groups A & B; 400 mA - Group C;
540 mA - Group D; Ci = 0; Li = 0
CSA Class I, Div. 2, Group A thru D
28 Vdc, 110 Vac & 230 Vac relays
5.0 Amps resistive only
Wall Mount Enclosure: General Purpose

Power: 100 - 127 VAC, 50/60 Hz ±6%, 4.0 W
200 - 253 VAC, 50/60 Hz ±6%, 4.0 W

Current Output: Isolated, 0-20 mA or 4-20 mA into 600 ohms maximum load at 115/230 Vac *or* 550 ohms maximum load at 100/200 Vac; direct or reverse acting; dampening: 0-255 seconds
Output 1: total free chlorine (ppm)
Output 2 (optional): pH

EMI/RFI: EN 61326



LVD: EN 61010-1

Model option -20 Wall Mount Enclosure does not meet CE requirements

Ambient Temperature: -10 to 65°C (14 to 149°F)

Ambient Humidity: LED: 0-95% RH
LCD: 0-85% RH

Weight/Shipping Weight: 1.0 kg/1.5 kg (3.0 lb/4.0 lb)

*Includes latches and mounting feet

1.3 ANALYZER SPECIFICATIONS @ 25°C.

Measurement Range: 0-20 ppm (mg/L) chlorine, 0-14 pH

Resolution: 0.001 ppm free residual chlorine (as Cl₂) and 0.01 pH units (3-1/2 digit display)

Automatic pH Correction: 5.0 to 9.5 pH

Output Stability: ± 0.25% of span over 30 days, non-cumulative

Temperature Compensation: Automatic or manual 0-50°C. Can be disabled if desired.

Input Filter: 1-255 samples

Alarms: Dual, field selectable High/Low, High/High, or Low/Low

Alarm 2 configurable as a fault alarm

Time delay: 0 to 254 seconds

Dual setpoints, continuously adjustable

Hysteresis is adjustable up to 25% of setpoint for low side/high alarm and high side/low alarm

Interval Timer: Controls dedicated relay

Interval: 10 min. to 2999 days

On Counts: 1 to 60

On Duration: 1 to 299.9 seconds

Off Duration: 1 to 299.9 seconds

Wait Duration: 1 to 299.9 seconds

Relay Contacts: Epoxy Sealed Form A contacts, SPST, Normally Open.

	<u>Resistive</u>	<u>Inductive</u>
28 VDC	5.0 Amps	3.0 Amps
115 VAC	5.0 Amps	3.0 Amps
230 VAC	5.0 Amps	1.5 Amps

1.4 RECOMMENDED SENSORS

Chlorine: Model 499A CL Free Residual Chlorine

pH: Model 389-01-10-54

Model 396P-01-10-54

Model 399-07 or 399-08

1.5 ORDERING INFORMATION

Model 1054B Free Residual Chlorine Microprocessor Analyzer: Housed in a NEMA 4X corrosion resistant, weatherproof housing suitable for panel, pipe, or wall mounting. Standard features include digital display, isolated current outputs, dual programmable alarms, programmable timer with independent relays, and manual or automatic temperature correction for membrane permeability. Optional pH correction is available for processes in which the pH exceeds 7 and varies by more than ±0.1.

MODEL	
1054B	MICROPROCESSOR ANALYZER (3.5 lb./1.5 kg)
CODE	Measurement
CL	Free Residual Chlorine
CODE	Display (Required Selection)
01	LCD Display
02	LED Display
CODE	pH Correction
10	Automatic pH Correction with 2nd Output (Requires pH Sensor with preamplifier)
CODE	Options
20	Wall Mount Enclosure (not CE approved)
1054B	CL 01 10 EXAMPLE

TABLE 1-1. Replacement Parts

PN	DESCRIPTION
33469-00	Enclosure Body
33470-00	Enclosure, Rear Cover
32938-00	Gasket, Front Cover
32937-00	Gasket, Rear Cover
22966-00	PCB, LCD Digital Display
23245-01	PCB, LED Digital Display
23695-22	Keyboard Overlay, LCD Version, CL
23695-23	Keyboard Overlay, LED Version, CL
23666-03	PCB, CPU, Free Residual Chlorine
23332-00	PCB, CPU, pH
23739-00	PCB, Power Supply
23740-02	PCB, Motherboard
9100157	Fuse, 0.1A, 250V, 3AB, Slo Blo
9100160	Fuse, 0.25A, 125V Axial Lead PICO II
9100189	Fuse, 0.75A, 125V Axial Lead PICO II

TABLE 1-2. Accessories

PN	DESCRIPTION
2001492	Tag, Stainless Steel, Specify Marking
23025-01	Panel Mounting Kit
23053-00	Pipe Mounting Kit for 2-inch pipe, complete; includes mounting bracket, U-bolts, and all necessary fasteners
23054-01	Wall Mounting Kit, complete; includes wall mounting bracket, junction box, conduit nipples to connect analyzer to junction box, and all necessary seals and fasteners
23268-01	Heater, 115 VAC, 50/60 Hz, 1054B (Code 20 only)
23268-02	Heater, 230 VAC, 50/60 Hz, 1054B (Code 20 only)

SECTION 2.0 INSTALLATION AND WIRING

2.1 General

2.2 Unpacking and Inspection

2.3 Installation

2.4 Electrical Connections - General

2.5 Sensor Wiring

2.1 GENERAL. The analyzer is suitable for outdoor use. However, the analyzer should be located in an area where temperature extremes and vibrations are minimized or absent. Installation must be performed by a trained technician.

2.2 UNPACKING AND INSPECTION. Inspect the analyzer for shipping damage. If damage is found, notify the carrier immediately. Confirm that all items shown on the packing list are present. Notify Rosemount Analytical if items are missing.

2.3 INSTALLATION. Select a location at least one foot from any high voltage conduit, with easy access for operating personnel, and not in direct sunlight. Prepare the analyzer for installation by following the procedure for the appropriate mounting configuration:

Panel Mounting	Section 2.3.1
Wall Mounting	Section 2.3.2
Pipe Mounting	Section 2.3.3
Wall Mount Enclosure	Section 2.3.4

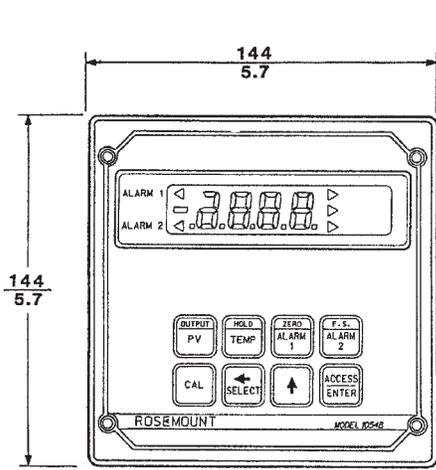
2.3.1 Panel Mounting (Standard). The Model 1054B fits into a DIN standard 137.9 mm X 137.9 mm (5.43 in. X 5.43 in.) panel cutout. Refer to Figures 2-1 and 2-2.

1. Remove the four screws holding the front panel assembly of the enclosure and carefully pull the front panel and connected printed circuit boards straight out.

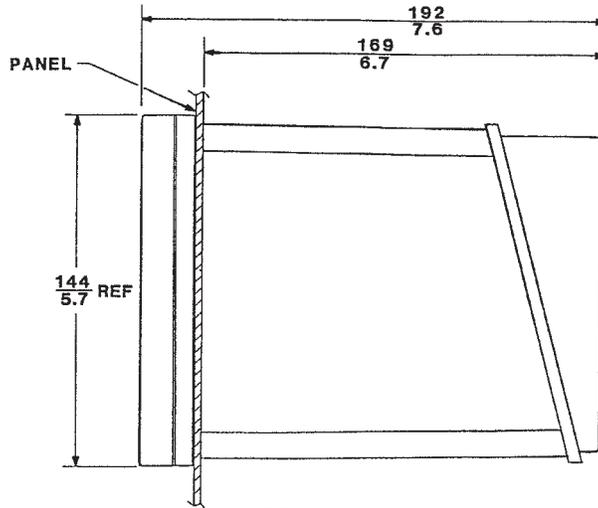
2. Align the latches as shown in Figure 2-2 and insert the analyzer enclosure through the front of the panel cutout. Tighten the screws for a firm fit. Do not overtighten.
3. Replace the front panel assembly. The circuit boards must align with the slots on the inside of the enclosure. Tighten the four front panel screws.

2.3.2 Wall Mounting Plate with Junction Box (PN 23054-01). Refer to Figures 2-3 and 2-4.

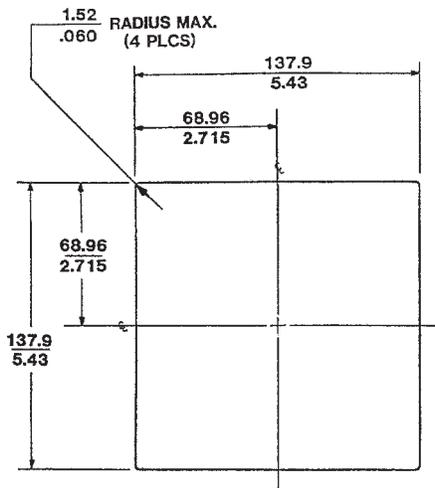
1. Remove the four screws holding the front panel assembly of the enclosure and carefully pull the front panel and connected printed circuit boards straight out.
2. Attach the mounting bracket to the junction box with the hardware provided. See Figure 2-3. Wiring can be brought to the terminal strip prior to mounting the analyzer to the junction box.
3. Place the metal stiffener on the inside of the analyzer and install the two 1/2 in. conduit fittings using two weather seals. Place the NEMA 4X conduit plug in the center hole.
4. Attach the analyzer to the junction box using the 1/2 in. conduit fittings.
5. Complete the wiring connections between the analyzer and the junction box. Refer to Figure 2-4.



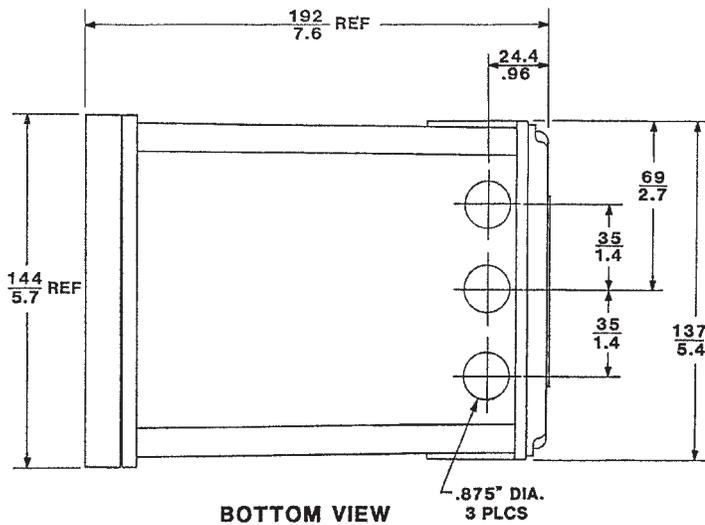
FRONT VIEW



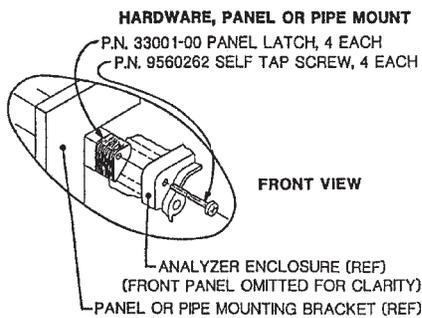
SIDE VIEW



PANEL, CUT-OUT INFORMATION



BOTTOM VIEW



HARDWARE, PANEL OR PIPE MOUNT

- P.N. 33001-00 PANEL LATCH, 4 EACH
- P.N. 9560262 SELF TAP SCREW, 4 EACH

FRONT VIEW

- ANALYZER ENCLOSURE (REF)
(FRONT PANEL OMITTED FOR CLARITY)
- PANEL OR PIPE MOUNTING BRACKET (REF)

DWG. NO. 41054B01	REV. A
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FIGURE 2-1. Panel Mounting Cutout Information

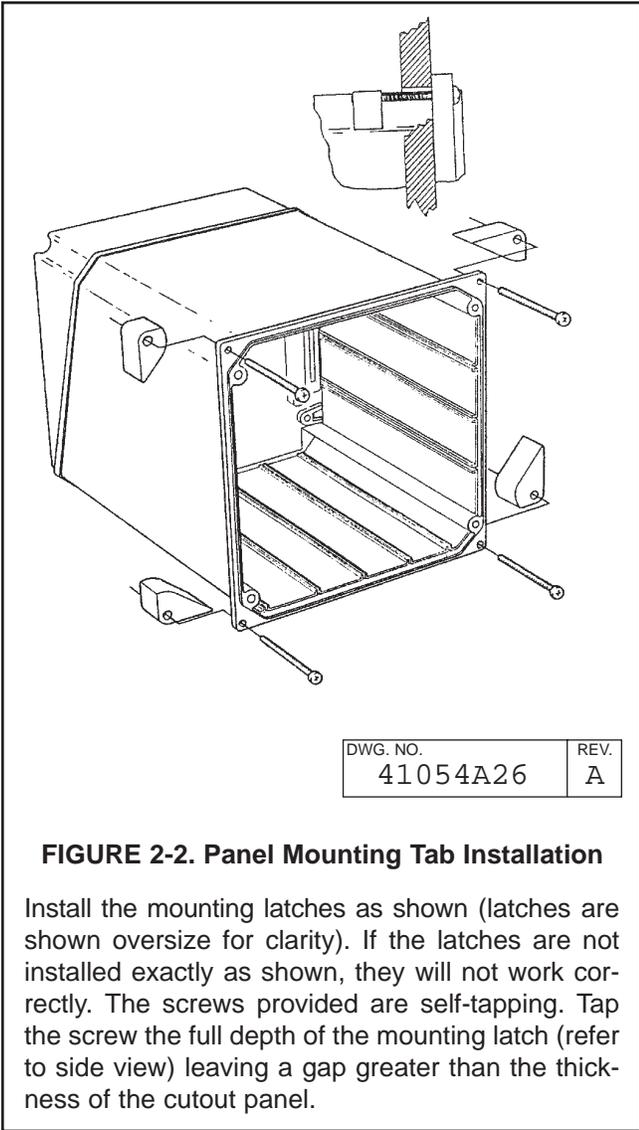


FIGURE 2-2. Panel Mounting Tab Installation

Install the mounting latches as shown (latches are shown oversize for clarity). If the latches are not installed exactly as shown, they will not work correctly. The screws provided are self-tapping. Tap the screw the full depth of the mounting latch (refer to side view) leaving a gap greater than the thickness of the cutout panel.

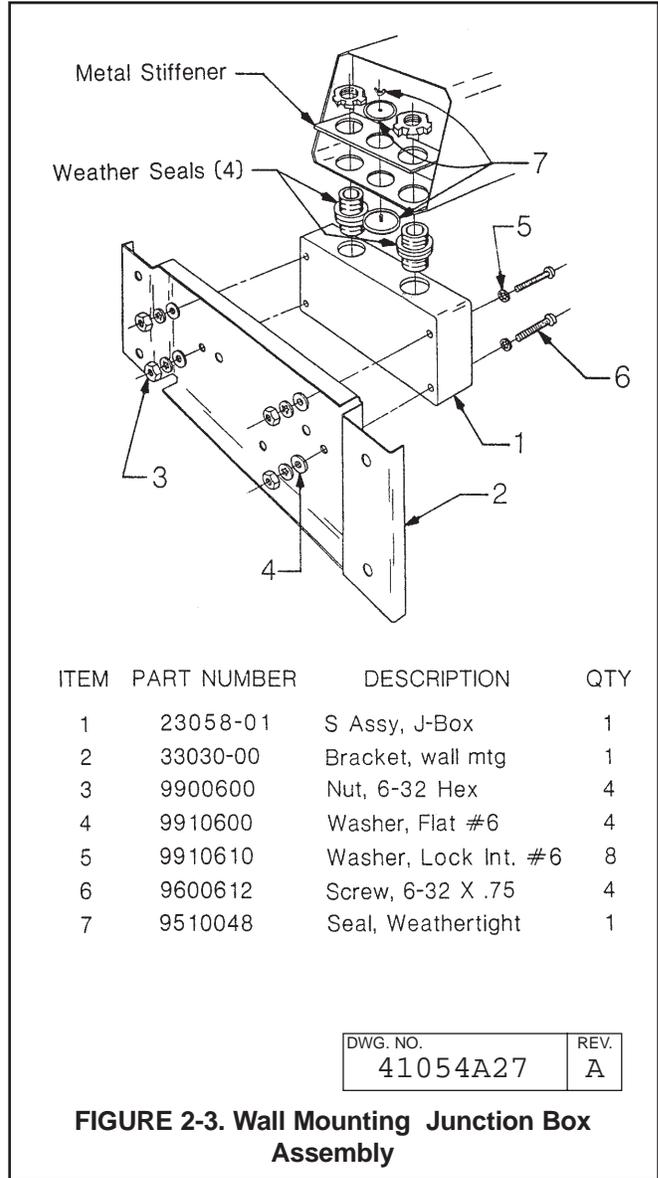


FIGURE 2-3. Wall Mounting Junction Box Assembly

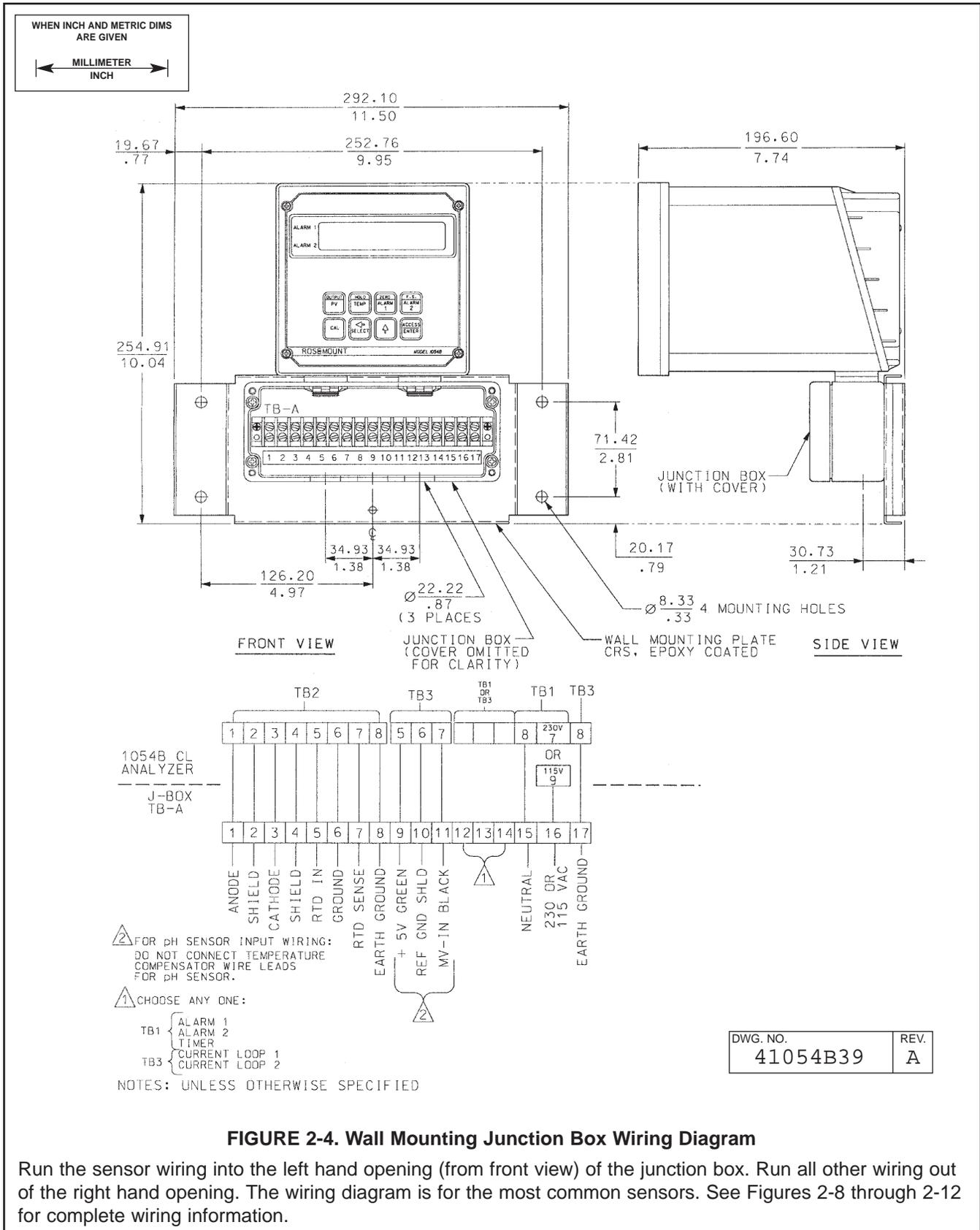


FIGURE 2-4. Wall Mounting Junction Box Wiring Diagram

Run the sensor wiring into the left hand opening (from front view) of the junction box. Run all other wiring out of the right hand opening. The wiring diagram is for the most common sensors. See Figures 2-8 through 2-12 for complete wiring information.

2.3.3 Pipe Mounting (PN 23053-00). The 2 in. pipe mounting kit includes a metal plate with a cutout for the analyzer. Refer to Section 2.3.1 for mounting the analyzer into the plate. Mounting details are shown in Figure 2-5 (below).

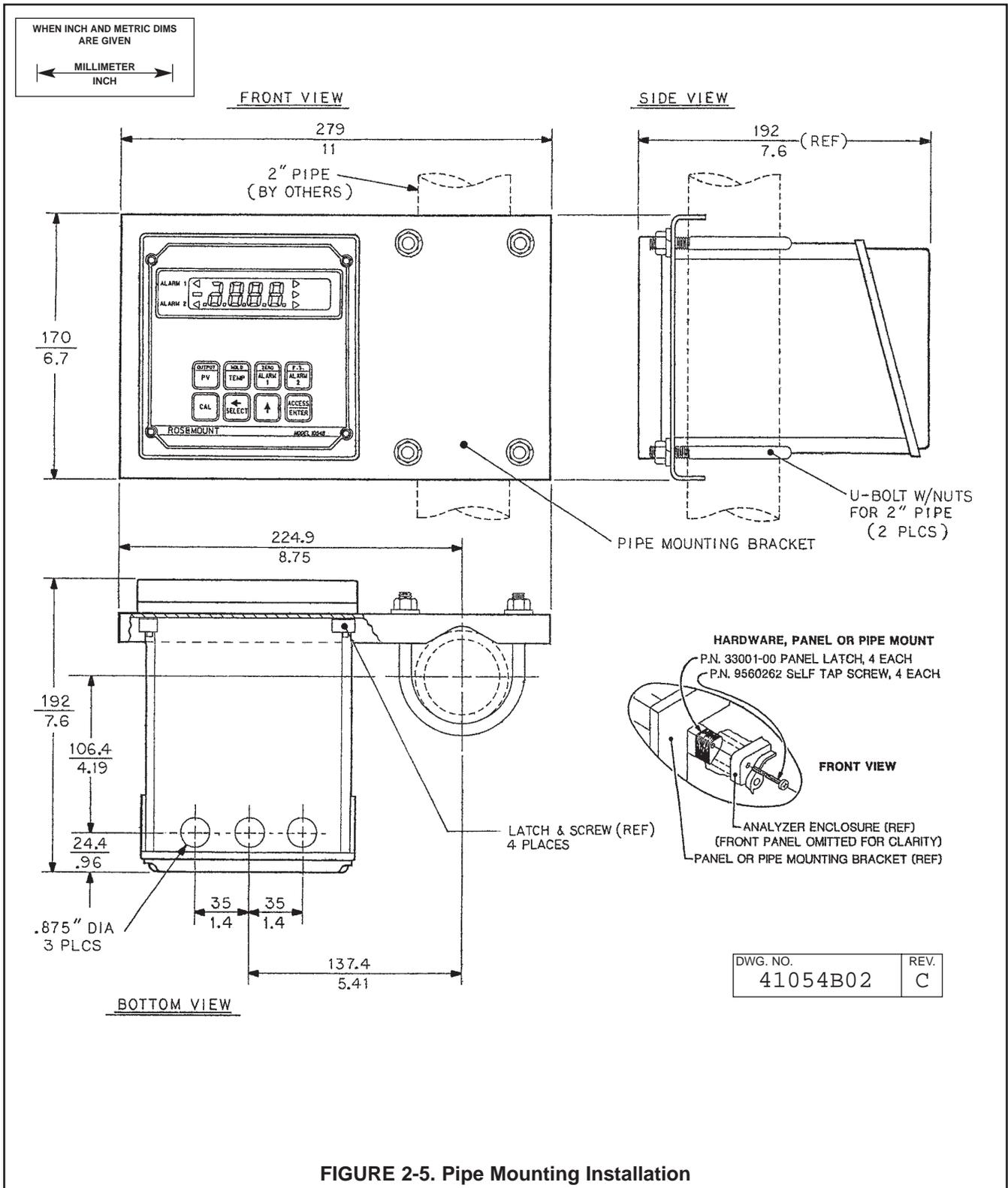


FIGURE 2-5. Pipe Mounting Installation

2.3.4 Wall Mount Enclosure (option -20). See Figure 2-6 (below) for installation details.

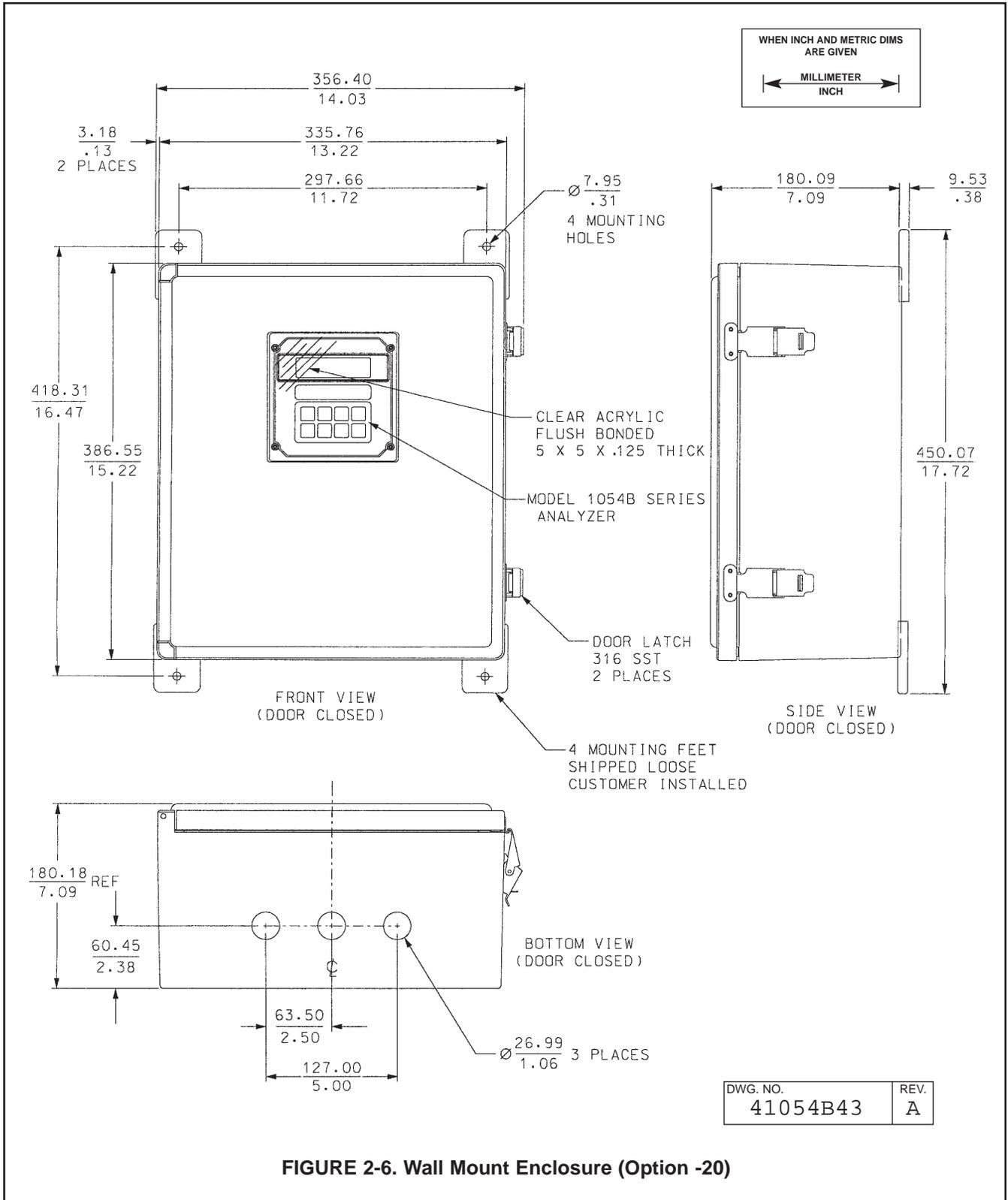
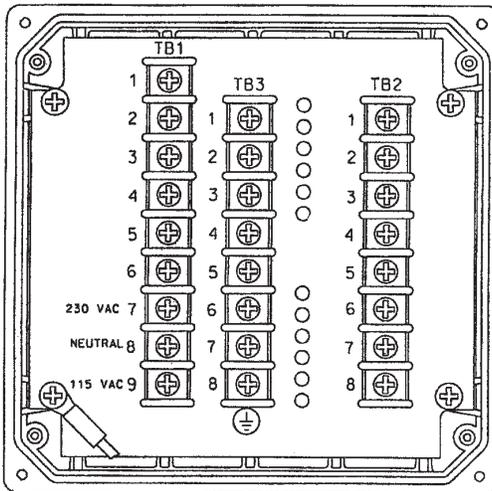


FIGURE 2-6. Wall Mount Enclosure (Option -20)

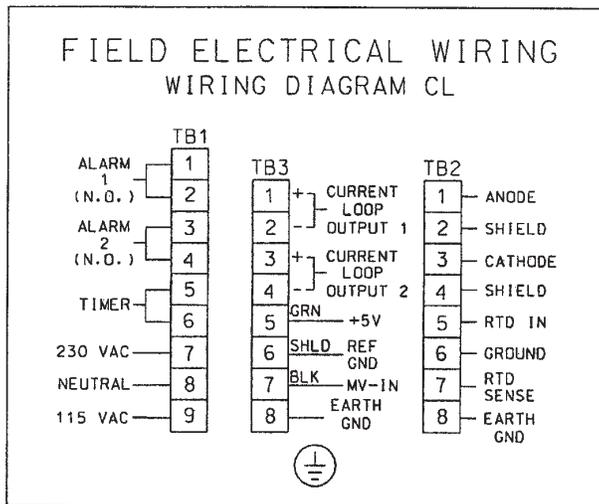
2.4 ELECTRICAL CONNECTIONS-GENERAL

All electrical connections are made to terminal blocks on the rear panel (interface board) of the analyzer. To reach the rear panel, remove the four screws securing the back cover of the enclosure. Gently pull away the cover, which is connected to the rear panel by a continuity wire. If the wire is disconnected for any reason, reconnect it to the nearest mounting screw before replacing the cover.

Figure 2-7 (below) shows the interface panel and wiring connections.



BACK VIEW / COVER OMITTED



DWG. NO.	REV.
41054B38	A

FIGURE 2-7. Electrical Wiring

Wire the pH sensor to terminal block TB3 (see Figures 2-10, 2-11, and 2-12).
Wire the chlorine sensor to TB2 (see Figures 2-8 and 2-9).

The three openings in the bottom rear of the analyzer housing accommodate 1/2 in. conduit fittings. Looking at the analyzer from the rear, the right opening is for sensor wiring, the center opening is for signal output, and the left opening is for power, timer, and alarm wiring. Always run sensor wiring in a separate conduit from power wiring.

2.4.1 Power Connections. The model 1054BCL analyzer uses either 115 Vac or 230 Vac power. See Figure 2-7 for connections. AC power wiring should be 14 gauge or greater.

2.4.2 Output Signal Wiring. Terminals 1 and 2 on TB3 are for the chlorine output signal and terminals 3 and 4 are for the pH signal. Maximum output load is 600 ohms. For best EMI/RFI protection shield the output cable and enclose it in an earth grounded metal conduit. If the output wiring is connected directly to the analyzer, connect the cable shield to terminal 8 on TB3. If the output wiring runs through a junction box, connect the cable shield to earth ground on terminal board TBA.

2.4.3 Alarm Wiring. Connect the alarm and timer circuits to terminals 1 through 6 on TB1. See Figure 2-7 for details.

CAUTION

The sensitivity and stability of the analyzer will be impaired if the input wiring is not grounded. DO NOT apply power to the analyzer until all electrical connections are verified and secure. The following precautions are a guide using UL 508 as a safeguard for personnel and property.

NOTE

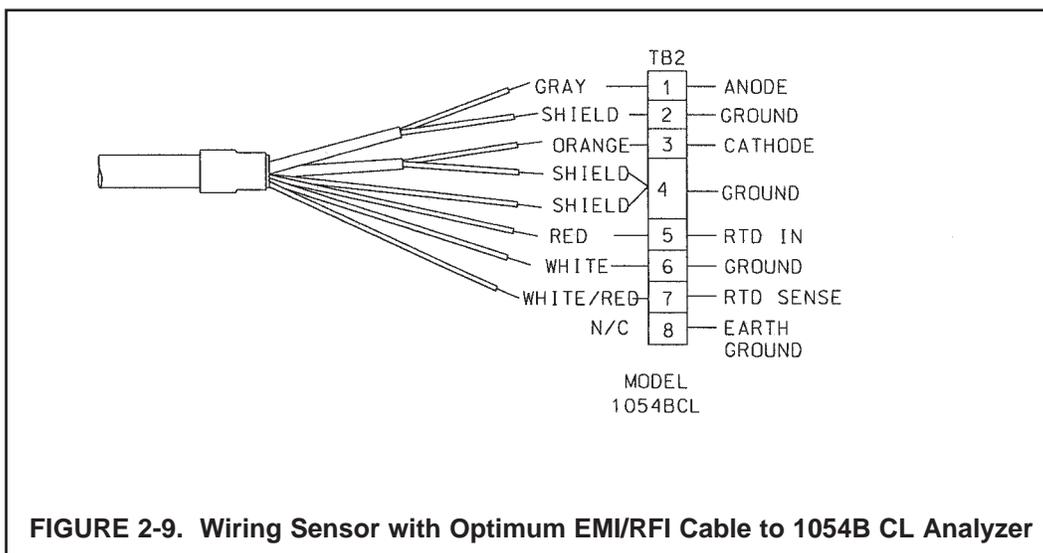
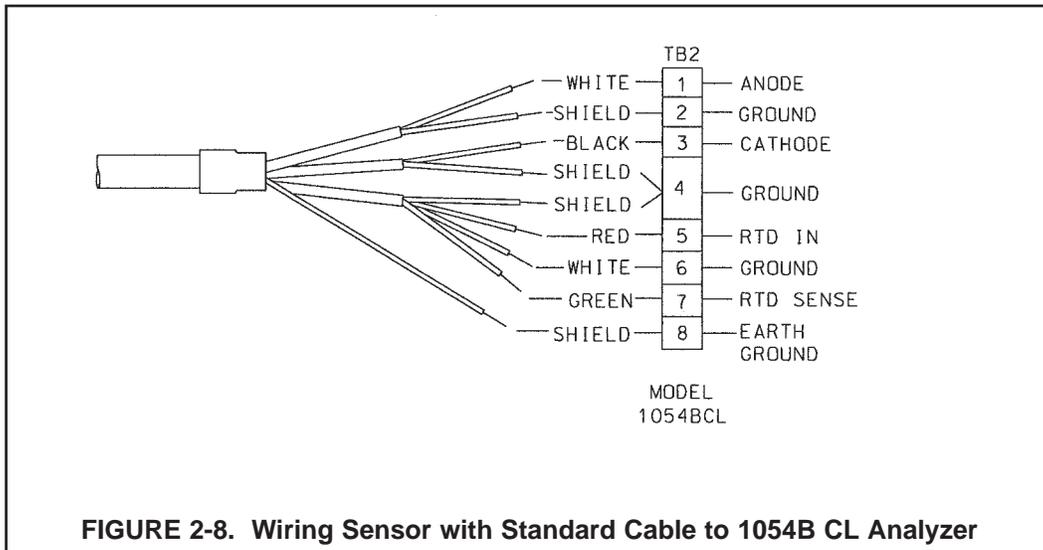
The user must provide a means to disconnect the main power supply in the form of circuit breaker or switch. The circuit breaker or the switch must be located in close proximity to the instrument and identified as the disconnecting device for the instrument.

1. AC connections and grounding must be in compliance with UL 508 and/or local electrical codes.
2. The metal stiffener is required to provide support and proper electrical continuity between conduit fittings.
3. This type 4/4X enclosure requires a conduit hub or equivalent that provides watertight connect, REF UL 508-26.10.
4. Watertight fittings/hubs that comply with the requirements of UL 514B must be used.
5. Conduit hubs must be connected to the conduit before the hub is connected to the enclosure, REF UL 508-26.10.
6. If the metal support plate is not used, plastic fittings must be used to prevent structural damage to the enclosure. Also, appropriate grounding lug and AWG conductor must be used with the plastic fittings.

2.5 SENSOR WIRING

2.5.1 Chlorine Sensor. The analyzer is recommended for use with only the 499ACL chlorine sensor. Wire the sensor to terminal block TB2. See Figure 2-8 for sensors having standard cable. See Figure 2-9 for sensors having optimum EMI/RFI cable.

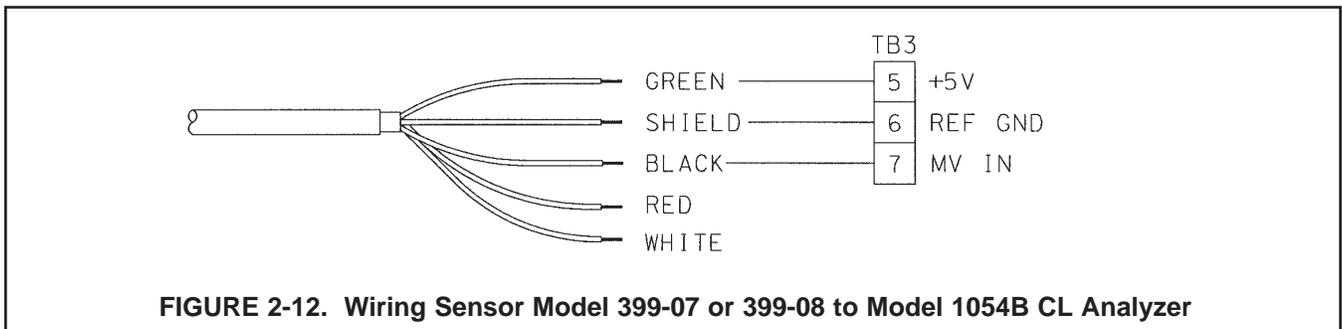
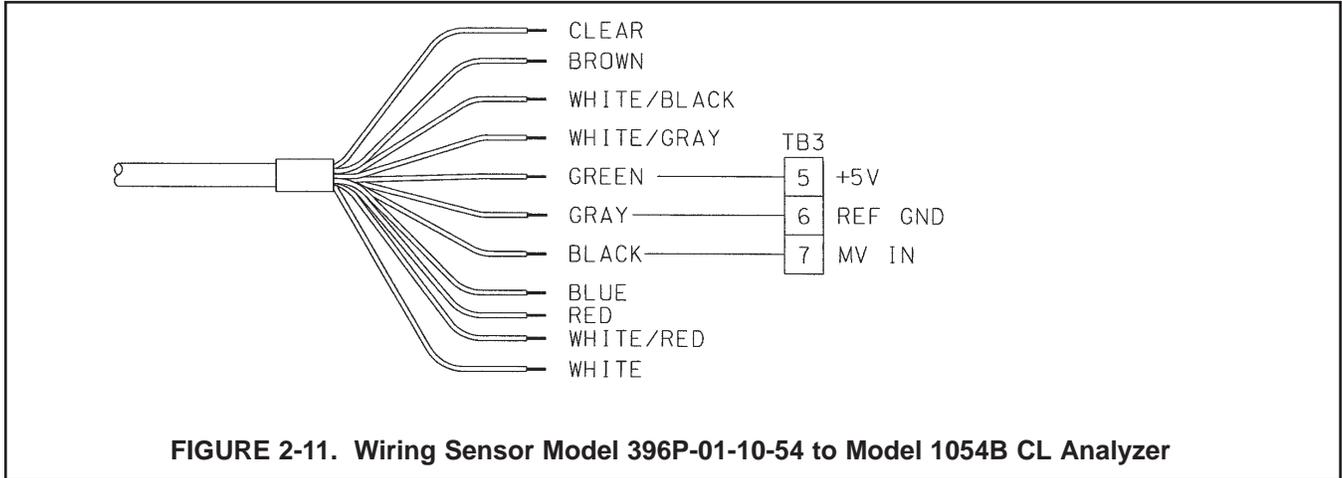
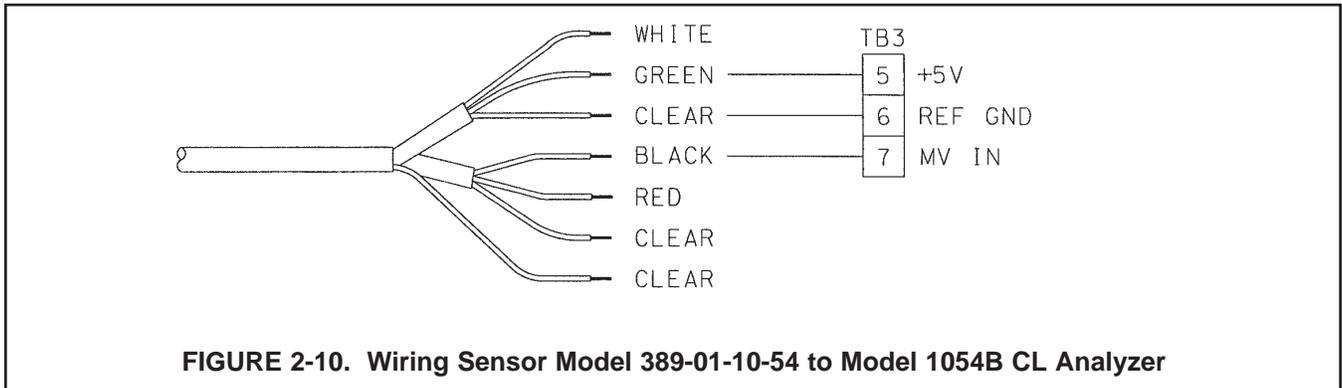
Sensor cable should also be shielded. If the sensor is wired directly to the analyzer, connect the outer shield of the sensor cable to earth ground using terminal 8 on TB2. If the sensor is wired through a wall mounting junction box, connect the outer shield to the earth ground terminal of TBA. If the outer shield of the cable is metal braid, use a metal cable gland fitting to connect the braid to earth ground by way of the instrument case.



2.5.2 pH Sensor. Wire the pH sensor to terminal block TB3. The table lists recommended pH sensors and the figure number of the wiring diagram. The pH sensor must have a preamplifier compatible with the Model 1054B.

Insulate unused leads and connect them to the cable to prevent shorted connections.

pH Sensor	Wiring Diagram
389-01-10-54	Figure 2-10
396P-01-10-54	Figure 2-11
399-07 or 399-08	Figure 2-12



SECTION 3.0 DESCRIPTION OF CONTROLS

- 3.1 Display and Keyboard Functions
- 3.2 View
- 3.3 Edit
- 3.4 Configure Display

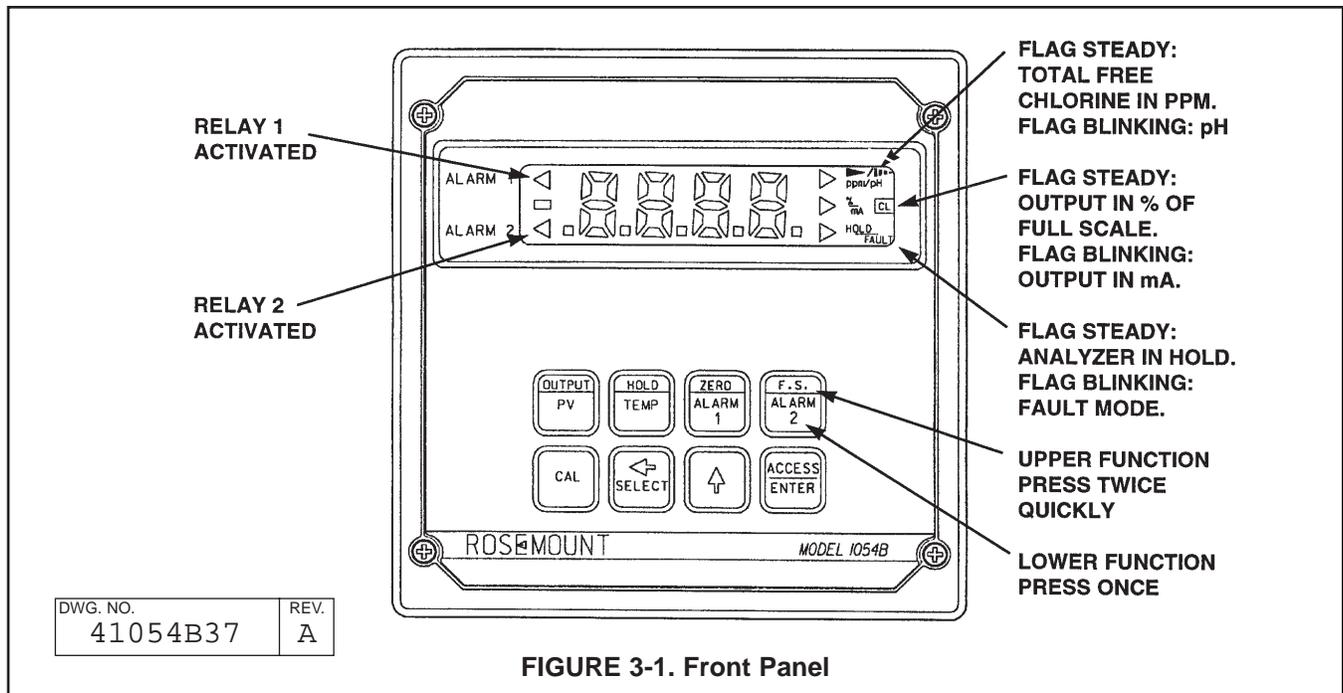
3.1 DISPLAY AND KEYBOARD FUNCTIONS. Figure 3-1 shows the front panel of the 1054B CL Microprocessor Analyzer. The front panel consists of a single line display with information flags and an eight key membrane keypad. Readings and instrument settings and the mnemonics that guide the user through configuring the instrument appear in the main display. The flags at the sides of the display show whether an alarm relay is activated or deactivated, indicate hold and fault conditions, and show the units of the value being displayed. As explained in Figure 3-1 a steady flag and a flashing flag have different meanings.

The operations of the 1054B Microprocessor Analyzer are controlled by the eight keys shown in Figure 3-1. The keys are used to:

1. Display values other than the primary value (PV). Free residual chlorine concentration is the primary value.

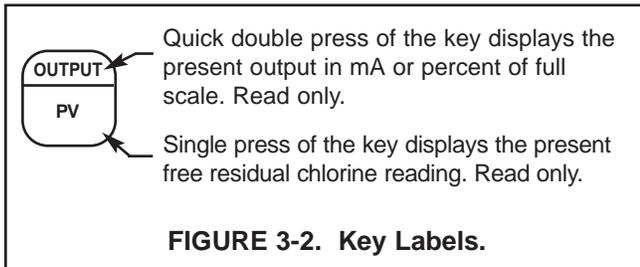
2. Set alarm points, generate specific output currents for testing, set zero and full-scale outputs, and calibrate concentration, pH and temperature.
3. Select temperature in °C or °F, configure alarms (setting an alarm and configuring an alarm are different operations [see Section 4.0]), set timer functions, establish a password, and set the current output range.

Each key in the top row of the keypad has dual functions. Pressing the key once displays the value identified by the lower (white on blue) label. Pressing the key twice in rapid succession displays the value or activates the function identified by the upper (blue on white) label. Two keys in the bottom row also have dual functions. The use of these keys is explained in later sections. Table 3-1 summarizes the values and functions associated with each key.



MAIN FUNCTION (PRESS ONCE)		SECOND FUNCTION (PRESS TWICE QUICKLY)
<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content;"> <p>OUTPUT</p> <hr/> <p>PV</p> </div>	<p>Displays the concentration of free residual chlorine.</p> <p>Pressing SELECT with the concentration showing allows one point standardization of the analyzer.</p>	<p>Displays the present output in mA or percent of full scale.</p> <p>Pressing SELECT with the output showing causes the analyzer to simulate an output current</p>
<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content;"> <p>HOLD</p> <hr/> <p>TEMP</p> </div>	<p>Displays the process temperature (°C or °F).</p> <p>Pressing SELECT with temperature showing allows the temperature to be scalibrated.</p>	<p>Places the analyzer in hold or removes the analyzer from hold. When the analyzer is in hold, the display shows the present chlorine concentration, but the output remains at the value it was when hold was initiated.</p>
<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content;"> <p>ZERO</p> <hr/> <p>ALARM 1</p> </div>	<p>Displays Alarm 1 setpoint.</p> <p>Pressing SELECT with the setpoint showing allows the setpoint to be changed.</p>	<p>Displays the value corresponding to the low current (4 or 0 mA) output.</p> <p>Pressing SELECT with the value showing allows the value to be changed.</p>
<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content;"> <p>F.S.</p> <hr/> <p>ALARM 2</p> </div>	<p>Displays Alarm 2 setpoint.</p> <p>Pressing SELECT with the setpoint showing allows the setpoint to be changed.</p>	<p>Displays the value corresponding to the full scale (20 mA) output .</p> <p>Pressing SELECT with the value showing allows the value to be changed.</p>
<div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content;"> <p>CAL</p> </div>	<p>Display pH.</p> <p>Pressing SELECT with pH showing allows the pH reading to be changed.</p> <p>Pressing SCROLL (↑) with pH showing allows the automatic pH correction feature to be set and permits the pH sensor to be calibrated.</p>	
<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 20px;"> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin-bottom: 5px;"> <p style="text-align: center;">←</p> <hr/> <p style="text-align: center;">SELECT</p> </div> <ol style="list-style-type: none"> 1. Selects a sub-menu when a mnemonic is displayed. 2. Shifts to next digit when a number is displayed. </div> <div style="margin-bottom: 20px;"> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin-bottom: 5px;"> <p style="text-align: center;">↑</p> </div> <ol style="list-style-type: none"> 1. Moves to the next item in the menu when a mnemonic is displayed. 2. Pressing once increases the flashing digit by one. 3. Holding the key down autoscrolls the display. </div> <div> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin-bottom: 5px;"> <p style="text-align: center;">ACCESS</p> <hr/> <p style="text-align: center;">ENTER</p> </div> <ol style="list-style-type: none"> 1. Pressing key twice in rapid succession allows access to the set function menu. 2. Enters displayed value into memory. 3. Enters displayed mnemonic into memory. </div> </div>		
<p>TABLE 3-1. Description of Keys and Functions.</p>		

3.2 VIEW. To view a measurement or a setting without changing its value, press the appropriate key in the top row. Press once to display the value of the lower label. Press twice in rapid succession to display the value of the upper label (see Figure 3-2).



In some cases, an information mnemonic appears momentarily before the value is displayed. Table 3-2 explains the meaning of the information mnemonics.

3.3 EDIT. If desired, the values accessed by the keys in the upper row of the keypad can be edited. Use the **SELECT**, **SCROLL (↑)**, **SHIFT (←)**, and **ENTER** keys to change a displayed value. With the value to be changed showing in the display, press **SELECT**. An information mnemonic appears momentarily, then the number reappears with the right hand digit flashing to indicate that the number can be changed (see Figure 3-3). Pressing the **↑** key increases the value of the blinking digit by one unit. To move to the next digit, use the **←** key. To place the new value in memory, press **ENTER**. Refer to Table 3-2 for an explanation of the information mnemonics.

Table 3-1 summarizes the functions of the edit keys.

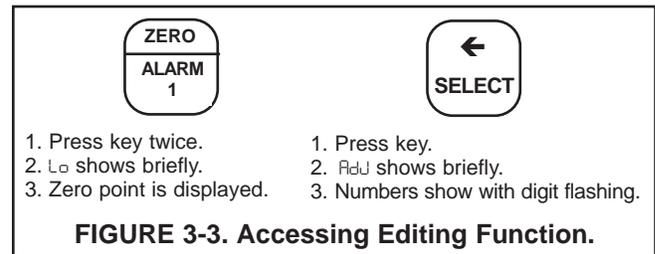


TABLE 3-2. Information Mnemonics

Mnemonic	Description	Mnemonic	Description
Adj	Adjust value	LOC	Access locked – enter security code
bAd	Incorrect entry	Pc 1	Displays FRC output in percent
bF 1	Buffer 1	Pc 2	Displays pH output in percent
bF 2	Buffer 2	PH	pH display (measured process pH)
dc 1	Displays FRC output value in mA	Frc	Free residual chlorine display
dc 2	Displays pH output value in mA	SEt	Set mode
do 1	Display output (FRC)	Si 1	Simulates FRC output (mA)
do 2	Display output (pH)	Si 2	Simulates pH output (mA)
FPH	Fixed pH display (manual pH input)	SP 1	Simulates FRC output (%)
HLd	Analyzer in hold mode	SP 2	Simulates pH output (%)
HI 1	Displays 20 mA setpoint (FRC)	SLP	Displays pH electrode slope
HI 2	Displays 20 mA setpoint (pH)	SP 1	Displays Alarm 1 setpoint
i t r	Interval timer activated	SP 2	Displays Alarm 2 setpoint
L0 1	Displays 0 or 4 mA setpoint (FRC)	Std	Standardize
L0 2	Displays 0 or 4 mA setpoint (pH)		

3.4 CONFIGURE DISPLAY. The display and analyzer functions are configured using the set function program. To enter the program, quickly double press the **ACCESS/ENTER** key (see Figure 3-4).

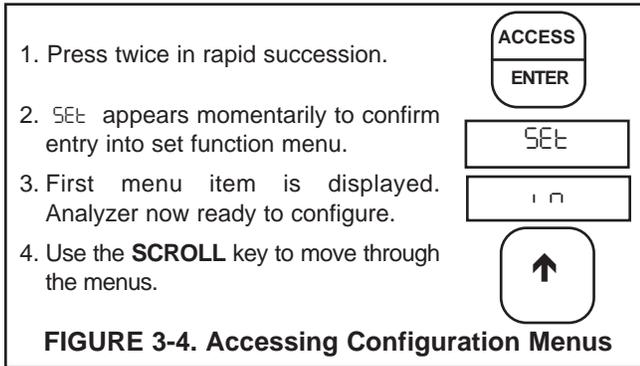


Figure 4-1 on page 20 shows the main menu, the sub-menus, and the shorthand labels or mnemonics assigned to each item in the menus. Table 4-2 on page 24 explains the meaning of each mnemonic. The set function is used to configure alarms, set the interval timer, change the units in which temperature is displayed, configure the output signal, tell the analyzer what to do during fault or hold conditions, filter the input signal, and set a security code.

To move through the main menu press and hold the **SCROLL (↑)** key. When the desired item is displayed, release the key. Most items in the main menu have a sub-menu associated with them. To enter a sub-menu, press **SELECT** and use the **SCROLL (↑)** key to move through the sub-menu. To choose an item in a sub-menu, press **SELECT**. If the item selected can be edited, the screen will change to a flashing display. If digits are showing, use the **SCROLL (↑)** key to change number and the **SHIFT (←)** key to move to the next digit. Press **ENTER** to place the value in memory. If a word or a mnemonic is flashing, indicating it can be changed to a different mnemonic, use the **SCROLL (↑)** key to display the desired setting and press **ENTER** to place the selection in memory.

To leave a menu or sub-menu without entering the edited value, press **PV**. The display will change to the concentration of free residual chlorine in the sample.

SECTION 4.0 CONFIGURATION

- 4.1 General
- 4.2 Memory
- 4.3 Start-Up
- 4.4 Set Function
- 4.5 Alarm 1 and 2
- 4.6 Interval Timer
- 4.7 Temperature Configuration
- 4.8 Current Output
- 4.9 Defaults
- 4.10 Input Filter
- 4.11 Alarm Setpoint
- 4.12 Output Scale Expansion
- 4.13 Simulate Current Output
- 4.14 pH Correction

4.1 GENERAL. This section explains how to configure the Model 1054 B CL Analyzer to a specific application.

NOTE

The analyzer is configured at the factory for the best general use. Table 4-1 lists the factory settings. Use the worksheet (Table 4-1) to record your configuration. The configuration can be done in any order. However, to reduce the chance of accidentally omitting important settings, it is best to configure the analyzer in the order presented in the manual and on the worksheet.

4.2 MEMORY. The Model 1054B CL Analyzer can be configured before or after installation. Configuration settings are written into non-volatile memory and remain in memory when power is removed.

4.3 START-UP. If the sensor is not connected, the analyzer may start up flashing a fault mnemonic. The mnemonic will be suppressed when the analyzer is in the set function mode; however, the fault flag will continue to flash.

NOTE

To shorten sensor warmup time, wire the sensor to the analyzer as soon as possible.

4.4 SET FUNCTION. Enter the set function by pressing the **ACCESS/ENTER** key twice in rapid succession. The mnemonic **SEt** appears momentarily, confirming that the analyzer is in the set mode. The display then changes to the first item in the main menu, **IN**.

NOTE

If **LOC** is displayed instead of **SEt**, the keypad is locked, and the security code must be keyed in to gain access to the set function menus. Refer to Section 6.0.

The first three items in the menu, **IN**, **SEN**, and **-0-** are not used for configuring the analyzer. Instead, selecting **IN** displays the current being generated in the sensor, selecting **SEN** allows the approximate sensitivity (current per ppm) of the sensor to be entered, and selecting **-0-** sets the present current equal to zero concentration.

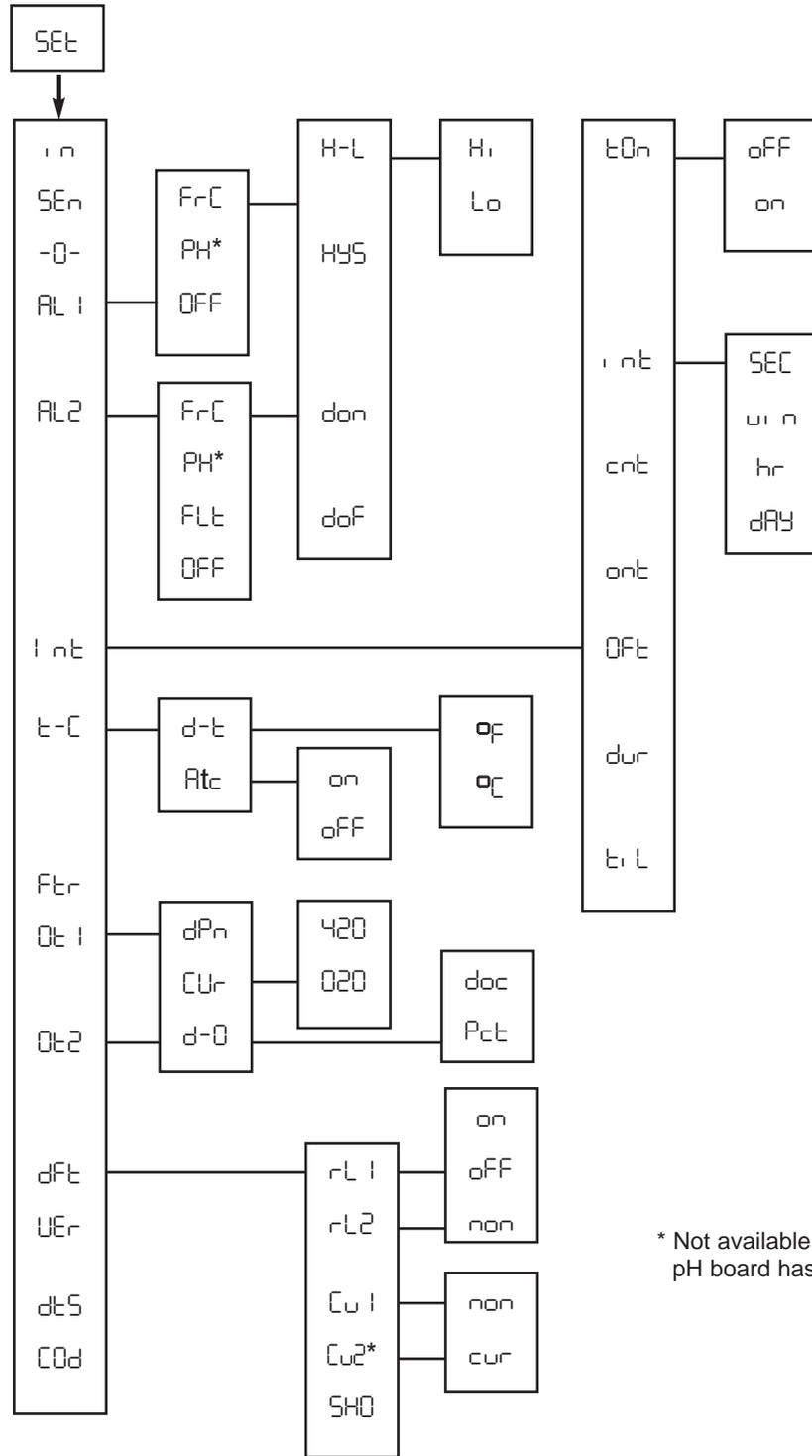
Figure 4-1 is a map of the set function program. The program contains a main menu, shown on the left hand side of the figure, and several sub-menus connected to items in the main menu. The menu items are identified by mnemonics. Refer to Table 4-2 for an explanation of each mnemonic. Selecting an item in the main menu gives access to the associated sub-menu. For example, choosing **AL 1** in the main menu moves the user into a sub-menu containing **FRC**, **PH**, and **OFF**. Selecting **FRC** or **PH** in this sub-menu gives access to a deeper sub-menu containing **H-L**, **HYS**, **don**, and **doF**. Selecting **H-L** from this menu gives a mnemonic display that can be edited (**HI** or **LO**). Selecting any other item gives a numeric display for editing.

To move around in the main menu or in a sub-menu, press the **SCROLL (↑)** key. To choose an item in the menu, press the **SELECT** key. If pressing **SELECT** produces a flashing display, the mnemonic or number shown can be changed. Press the **SCROLL (↑)** and **SHIFT (←)** keys to change a number; press the **SCROLL (↑)** key to change a mnemonic. To place

the value in memory, press **ENTER**. After an edited value has been stored, the display returns to the item in the sub-menu that allowed access to the value. For example, selecting HYS from the sub-menu attached to RL 1, allows access to a number whose value can be changed. After the number has been edited and stored in memory, the display returns to HYS.

TABLE 4-1. Configuration Worksheet

		FACTORY SET	USER SET
A. Alarm 1 Setup (RL 1)			
1. Alarm Configuration (Frc PH OFF)		Frc	_____
2. High or Low (H-L) (Hi /Lo)		Lo	_____
3. Hysteresis (HYS)	0-25%	0.00	_____
4. Delay Time On (don)	0-255 sec	000 sec	_____
5. Delay Time Off (doF)	0-255 sec	000 sec	_____
B. Alarm 2 Setup (RL2)			
1. Alarm Configuration (Frc/PH/OFF/FLt)		Frc	_____
2. High or Low (H-L) (Hi /Lo)		Hi	_____
3. Hysteresis (HYS)	0-25%	0.00%	_____
4. Delay Time On (don)	0-255 sec	000 sec	_____
5. Delay Time Off (doF)	0-255 sec	000 sec	_____
C. Interval Timer (int)			
1. Active Status (EOn) (OFF/on)		OFF	_____
2. Interval Time (int)	minimum 10 minutes	1 Day	_____
3. Count (cnt)	1 to 60	5	_____
4. On Time (ont)	0 to 299 sec	1 sec	_____
5. Off Time (offt)	0 to 299 sec	1 sec	_____
6. Duration (dur)	0 to 299 sec	2 sec	_____
D. Temperature Setup (t-C)			
1. Display Temperature (d-t) (°C/°F)		°C	_____
2. Automatic TC (Rtc) (on/off)		on	_____
Manual Temp. Value	0°C to 50°C		_____
E. Current Output Setup (O1 O2)			
1. mA Output (Cur) (020/420)		420	_____
2. Display Current Output (d-O) (Pct/doc)		doc	_____
3. Dampen Current Output (dPn)	0 to 255 sec	000 sec	_____
F. Default Setup (dFt)			
1. Relay 1 Default (rL 1) (non/off/on)		non	_____
2. Relay 2 Default (rL2) (non/off/on)		non	_____
3. Frc Output Default (Cu 1) (non/cur)		non	_____
4. PH Output Default (Cu2) (non/cur)		non	_____
G. Keyboard Security Setup (Kd)			
1. Keyboard Security Required	001-999	-	_____
2. Keyboard Security Not Required	000	000	_____
H. Alarm Setpoints			
1. Alarm 1 (SP 1)	0-20 ppm or 0-14 pH	0 ppm	_____
2. Alarm 2 (SP2)	0-20 ppm or 0-14 pH	20 ppm	_____
I. Current Outputs			
1. Zero (0 or 4 mA) (L0 /L02)	0-20 ppm or 0-14 pH	0 ppm or 0 pH	_____
2. F.S. (Full Scale) (20 mA) (HI 1/HI 2)	0-20 ppm or 0-14 pH	20 ppm or 14 pH	_____



* Not available unless the optional pH board has been installed

FIGURE 4-1. Set Function Menu

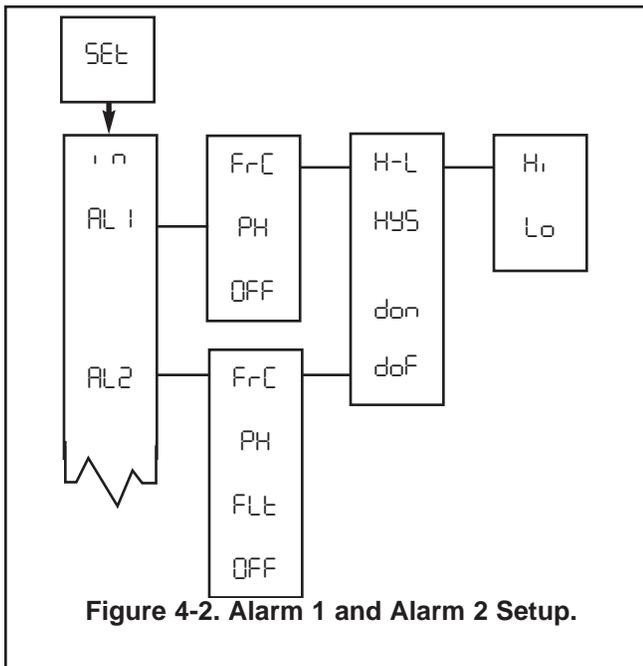
TABLE 4-2.
Set Function Mnemonics

AL1	Alarm 1 setup	in	Sensor input current
AL2	Alarm 2 setup	int	Interval period
APH	Automatic pH adjustment	int	Timer setup
Atc	Automatic temperature compensation	Lo	Relay action – low
°C	Temperature °C	non	No action on fault
COd	Security code	not	pH CPU PCB not installed
cnt	Timer count	OFF	Alarm not used
CUr	Configure current output	oFF	Function off
CU1	Configure fault output 1 (FRC)	ont	Timer on time
CU2	Configure fault output 2 (pH)	On	Use alarm as process alarm
cur	Default current setpoint	on	Function on
dAD	Days	OFFt	Timer off time
dFt	Fault configuration	0t1	Configure output 1 (FRC)
d-O	Display output	0t2	Configure output 2 (pH)
d-t	Display temperature	Pct	Display output in percent
doc	Display output in mA	rL1	Relay 1 fault setup
doF	Relay delay off time	rL2	Relay 2 fault setup
don	Relay delay on time	SEC	Seconds
dPn	Dampen outputs	SHD	Show fault history
dES	LCD/LED display test	t-C	Temperature configuration
dur	Timer duration	tL	Timer – time remaining
°oF	Temperature °F	tOn	Timer status
FLE	Use alarm as fault alarm	UEr	Software version
Hi	Relay action – high	ur	Minutes
H-L	Alarm logic	420	4mA to 20mA output
hr	Hours	020	0mA to 20mA output
HYS	Hysteresis	-0-	Zero sensor

4.5 ALARM 1 AND 2. The alarms can be configured to perform on - off process control. Selecting AL 1 or AL 2 allows alarm 1 or alarm 2, respectively, to be configured.

A. Alarm for Free Residual Chlorine. Select FRC if the alarm is to monitor the concentration of free residual chlorine. See steps E through H for further alarm configuration.

B. Alarm for pH. Select PH if the alarm is to monitor pH. See steps E through H for further alarm configuration.



C. Fault (Alarm 2 Only). Selecting FLt makes Alarm 2 a fault alarm. Relay 2 energizes when the analyzer senses a fault condition.

D. Off. Select OFF if the alarm is not to be used or to temporarily disable the alarm. Alarm setpoints will display oFF if this item is selected.

E. Alarm Logic. Select H-L to set high or low alarm logic. Hi activates the alarm when the reading is greater than the setpoint value. Lo activates the alarm when the reading is less than the setpoint value.

F. Relay Hysteresis. Select HYS to set the hysteresis or dead band. Hysteresis is the difference between the alarm setpoint and the reading past the setpoint at which the relay deactivates. Hysteresis may be set between 0 and 25% of the setpoint. Use hysteresis when a specific chlorine concentration should be reached before the alarm deactivates.

G. Delay On Time. Select don to set the delay on time. Delay on time is the time between an alarm setpoint being reached and the relay activating. The delay may be set between 0 and 255 seconds. An alarm state restarts the time from zero.

H. Delay Off Time. Select doF to set the delay off time. Delay off time is the time between an alarm setpoint being cleared and a relay deactivating. The delay may be set between 0 and 255 seconds. An alarm state restarts the time from zero.

4.5.1 Alarm Setup (AL 1/AL2). Refer to Figure 4-2.

1. Enter the set function menu by double pressing the **ACCESS/ENTER** key.
2. **SCROLL (↑)** until AL 1 or AL2 appears in the display.
3. Press **SELECT** to move into the sub-menu. FRC, PH, OFF, or FLt (Alarm 2 only) will be displayed.
4. **SCROLL (↑)** until the desired item appears, then press **SELECT**.
5. If OFF was selected, the display will show oFF. Press the **ENTER** key to return to AL 1 or AL2 (whichever alarm was being configured). Skip to Step 11.
If FRC or PH was selected, the display will show FRC or PH momentarily, then change to H-L. Go to Step 6.
If FLt was selected, the display will show FLt. Press the **ENTER** key to return to AL2. Go to Step 11.
6. With H-L showing in the display, press **SELECT**. Hi or Lo will appear as a flashing display.
7. **SCROLL (↑)** to the desired setting and press **ENTER** to store the setting in memory. The display will return to H-L. To make changes to the relay activation logic, proceed to Step 8, otherwise go to Step 11.
8. **SCROLL (↑)** to display HYS, don, or doF then **SELECT** the desired item. A flashing numeric display will appear, indicating that a number is required.
9. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired value.
10. Press **ENTER** to store the value in memory. The analyzer will acknowledge, and the display will return to the mnemonic that permitted access to the value. Repeat Step 8 if further changes are desired.
11. Repeat Steps 3 through 10 to configure the other alarm.
12. To return to the top menu of the set function menu, press the **ACCESS/ENTER** key.

4.6 INTERVAL TIMER. Select *int* to set the interval timer relay logic. The timer can be used to activate and control a sensor cleaner. Refer to Figure 4-3 for an explanation of the terms used.

A. Interval Timer Enable/Disable. Select *en* to enable the interval cycle (*on*) or disable the interval cycle (*OFF*).

B. Interval Period. Select *int* to set the amount of time between control cycles (see Figure 4-3). *int* opens a sub-menu that asks for time in *SEC* for seconds, *min* for minutes, *hr* for hours, and *DAY* for days. The recommended minimum interval is 10 minutes.

C. Relay Activations Per Cycle. Select *cnt* to enter the number of times the relay activates per cycle. The range is 1 to 60.

D. Relay Activation Duration. Select *ont* to enter the amount of time the relay remains on each time it activates. The range is 0.1 to 299.9 seconds.

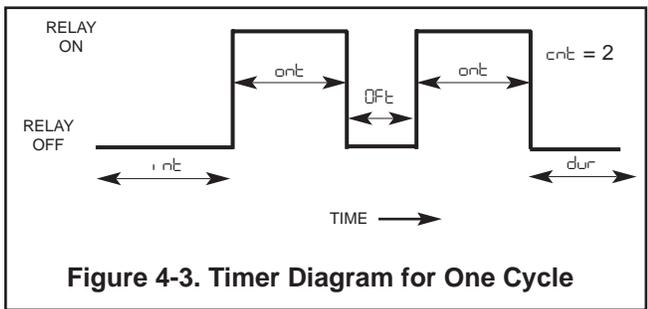


Figure 4-3. Timer Diagram for One Cycle

E. Relay Deactivation Duration. Select *OFF* to set the amount of time the relay remains deactivated between each on-period during the cycle. Deactivation time is valid only when *cnt* is 2 or greater. The range is 0.1 to 299.9 seconds.

F. Sensor Recovery Time. Select *dur* to set the length of time between the end of the last on-period and the end of the control cycle. The recovery time gives the sensor time to restabilize before the analyzer returns to on-line operation. Recovery time may be set between 0 and 299 seconds.

G. Interval Time Remaining. Select *tiL* to display the time remaining before the next cycle starts. If *tiL* is selected during the control cycle, display will show --.

NOTE

The Model 1054B CL is placed on **HOLD** during the control cycle (from first on-period through the sensor recovery time). The analyzer simulates a fault condition and briefly shows *tiL* every eight seconds. The display continues to show the measured value.

4.6.1 Interval Timer Set Up (*int*). Refer to Figure 4-4.

1. Enter the set function menu by double pressing the **ACCESS/ENTER** key.

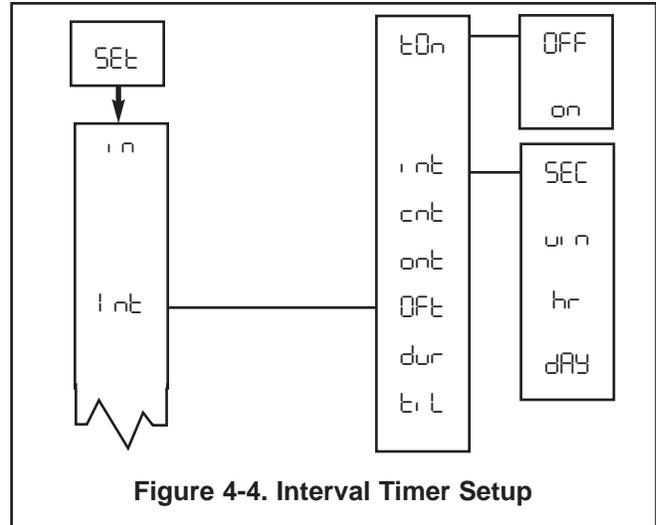


Figure 4-4. Interval Timer Setup

2. **SCROLL (↑)** until *int* appears in the display.
3. Press **SELECT** to move to the next menu level. The display will show *en*. Press the **SELECT** key again.
4. **SCROLL (↑)** to display *on* or *OFF* and press **ENTER** to store the desired setting in memory. If the interval timer was selected, go to Step 5, otherwise go to Step 10.
5. Press the **SCROLL (↑)** key once to display *int*, then press the **SELECT** key. The display will change to *SEC*. **SCROLL (↑)** until the desired unit, minutes (*min*), hours (*hr*), or days (*DAY*) appears in the display. Press **SELECT**. The display will change to a numeric value with the right hand digit flashing.
6. Use the **SCROLL (↑)** and the **SHIFT (←)** keys to change the displayed number to the desired value. **ENTER** the number into memory.
7. Repeat steps 5 and 6 if needed. For example, if the desired interval is 6.5 hours, enter 30 *min* and 6 *hr*.
8. Press the **ENTER** key again to return to the main timer menu. **SCROLL (↑)** to the next desired item and press **SELECT**.
9. Selecting any of the remaining menu items (*cnt*, *ont*, *OFF*, and *dur*) causes the display to show a numeric value. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the displayed number to the desired value and **ENTER** the new value into memory. Continue until all the settings have been made.
10. Press the **ENTER** key to return to the main menu.

4.7 TEMPERATURE CONFIGURATION. Select t-c for temperature reading and compensation choices.

A. Temperature Display. Select d-t to display temperature in $^{\circ}\text{C}$ or $^{\circ}\text{F}$.

B. Automatic Temperature Compensation. Select Atc to enable or disable automatic temperature compensation. The 1054B CL Analyzer uses a membrane-covered amperometric sensor. Because the permeability of the membrane increases about $3\%/^{\circ}\text{C}$, temperature compensation is critical if the measurement and calibration temperatures are different. When on is selected, the analyzer uses the temperature input from the sensor for temperature compensation. When off is selected, the analyzer uses the value entered by the user. Turning off the automatic temperature compensation, i.e., placing the analyzer in manual temperature compensation, is useful only if the temperature sensor is faulty and the calibration and measurement temperatures differ by at most 1 or 2 $^{\circ}\text{C}$. Selecting off disables temperature specific fault messages (refer to Section 8.1).

4.7.1 Temperature Setup (t-c). Refer to Figure 4-5.

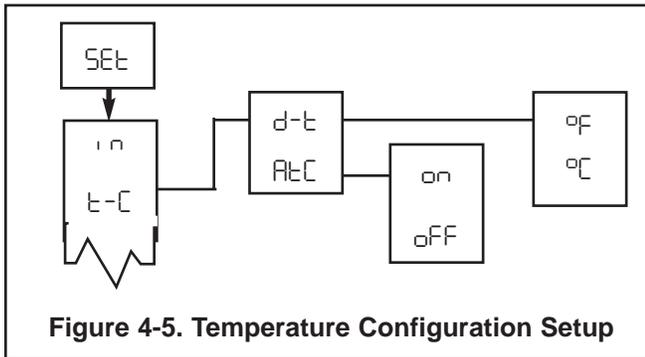


Figure 4-5. Temperature Configuration Setup

1. Enter the set function menu by double pressing the **ACCESS/ENTER** key.
2. **SCROLL (↑)** until t-c appears in the display.
3. Press **SELECT** to move to the next menu level. d-t will show the display.
4. **SCROLL (↑)** to display desired item, then **SELECT** it.
5. If d-t is selected, the display will flash $^{\circ}\text{C}$ or $^{\circ}\text{F}$. **SCROLL (↑)** until the desired unit appears in the display. Press **ENTER** to store the selection into memory. The display will return to d-t .
6. If Atc is selected, the display will flash on or off . **SCROLL (↑)** and **ENTER** the desired temperature compensation into memory. Choosing on causes the display to return to Atc . Choosing off causes a flashing number to be displayed. Use the

SCROLL (↑) and **SHIFT (←)** keys to change the display to the desired temperature and press **ENTER**. The display returns to Atc .

7. Press the **ENTER** key to return to the main menu.

4.8 CURRENT OUTPUT. Select Oe 1 to configure the current output for free residual chlorine. Select Oe 2 to configure the output for pH. Note that Oe 2 is available only if the pH board has been installed. See Figure 4-6.

A. Output Dampening. Select dPn to dampen the analyzer output. Dampening reduces the apparent noise but increases the response time of the output. The dampening feature averages the signal for a set period of time (between 0 and 255 seconds) and changes the output by an amount equal to 63% of change between the present and previous sampling period.

B. mA Output Range. Select Cur to set the output signal to 0-20 mA (020) or to 4-20 mA (420).

C. Display Output. Select d-0 to display the output in mA (doc) or in percent of full scale (Pct).

4.8.1 Output Setup (Oe 1/Oe 2). Refer to Figure 4-6.

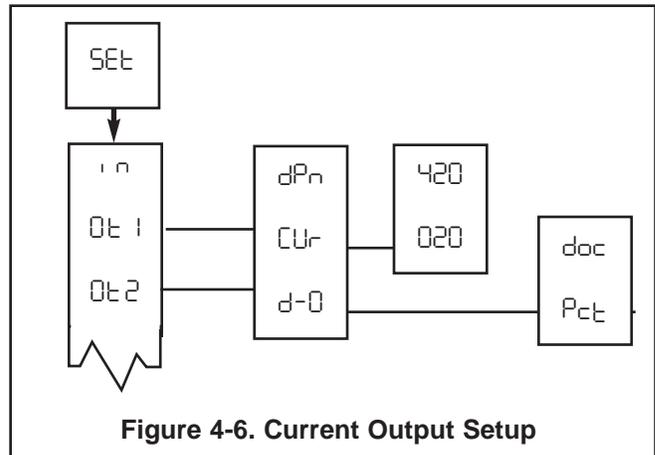


Figure 4-6. Current Output Setup

1. Enter the set function menu by double pressing the **ACCESS/ENTER** key.
2. **SCROLL (↑)** until Oe 1 appears in the display.
3. Press **SELECT** to move to the next menu level. dPn will displayed.
4. **SCROLL (↑)** then **SELECT** desired item.
5. If dPn is selected, a numeric display will flash to indicate that a value is required. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired value. Press **ENTER** to place the value in memory.

6. If **CUr** or **d-0** is selected, **SCROLL (↑)** to the desired mnemonic and press **ENTER** to store it in memory.
7. Press **ENTER** to return to the main menu and **SCROLL (↑)** until **0Et2** shows in the display. Repeat steps 5 and 6 to configure the pH output. **0Et2** is available only if the pH correction board has been installed in the analyzer.
8. Press the **ENTER** key to return to the main menu.

4.9 DEFAULTS. Select **dFt** to configure default settings during faults or hold status. See Table 8-1 for a listing of the fault conditions that can be diagnosed by the analyzer.

A. Relay 1 and 2. **rL1** is relay 1 and **rL2** is relay 2. The relays can be set to activate (**on**), deactivate (**off**), or hold present status (**non**). Table 4-3 describes how to configure the relays for various fault or hold conditions. For example, for relay 1 to activate when the analyzer is in hold, both alarm 1 and relay 1 must be on.

B. Current Output. **CU1** sets the value to which the current at output 1 goes and **CU2** sets the value to which the current at output 2 goes when the analyzer is in hold or senses a fault. To hold the output current at the last process value, choose **non**. To send the output current to a specified value, chose **cur**; **cur** is probably the better choice.

C. Fault History. Selecting **SH0** causes all the faults detected during the most recent event to be displayed one at a time. Several faults occurring at the same time are considered to be one fault event. To view the previous fault event, press the **SCROLL (↑)** key. To clear the **SH0** history, press **ENTER**.

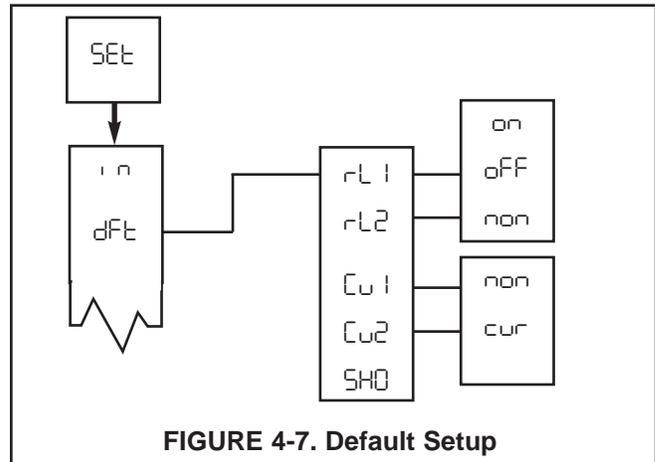


FIGURE 4-7. Default Setup

4.9.1 Default Setup (dFt). Refer to Figure 4-7.

1. Enter the set function menu by double pressing the **ACCESS/ENTER** key.
2. **SCROLL (↑)** until **dFt** appears in the display.
3. Press **SELECT** to move to the next menu level. **rL1** will show in the display.
4. To set default relay 1, **SELECT rL1**.
5. **SCROLL (↑)** to **on**, **off**, or **non**, and press **SELECT** to enter the desired mnemonic.
6. Repeat Steps 4 and 5 for relay 2.
7. To set the default current for output 1, **SCROLL (↑)** to **CU1** and **SELECT** it.
8. **SELECT non** or **cur**. Choosing **cur** causes the display to change to a flashing number. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired value. Press **ENTER** to place the value in memory.
9. To set the default current for output 2, repeat steps 7 and 8.
10. Press the **ENTER** key to return to the main menu.

TABLE 4-3. Relay States for Various Analyzer Conditions and Alarm/Default Configurations

Default setting rL1 rL2	ANALYZER CONDITION								
	NORMAL			HOLD			FAULT		
	AL1/AL2 setting			AL1/AL2 setting			AL1/AL2 setting		
	On	OFF	FLt (Alarm 2 only)	On	OFF	FLt (Alarm 2 only)	On	OFF	FLt (Alarm 2 only)
on	PV dtmns	-	-	+	-	-	+	-	+
off	PV dtmns	-	-	-	-	-	-	-	+
non	PV dtmns	-	-	PV dtmns	-	-	PV dtmns	-	+

PV dtmns : Process value determines the alarm state.
+ : means the relay activates
- : means the relay does not activate

4.10 INPUT FILTER. The input filter (F_{LT}) compensates for noise by averaging a given number samples of the input signal. Increasing the sample number reduces noise but increases the response time (see Section 7.1 for more information).

4.10.1 Filter Response Setting.

1. Enter the set function menu by double pressing the **ACCESS/ENTER** key.
2. **SCROLL (↑)** until F_{LT} appears in the display.
3. Press **SELECT**. A numeric display appears with the right hand digit flashing.
4. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired number of samples.
5. Press **ENTER** to place the number in memory.

4.11 ALARM SETPOINT. Configure the analyzer as described in sections 4.5 through 4.10 before programming the alarm setpoints. Refer to Figure 4-8.

1. Press the **PV** key to ensure the analyzer is not in the set function menu.
2. Press the **ZERO/ALARM 1** or **F.S./ALARM 2** key. SP 1 for alarm 1 or SP2 for alarm 2 will show briefly, followed by the present alarm setpoint.

NOTE

If the alarm was set to OFF or, in the case of alarm 2, to FAULT during configuration, the analyzer will display OFF or F_{LT} respectively when the ALARM key is pressed.

3. To change the alarm setpoint, press **SELECT**. AdJ will show briefly followed by a numeric display with right hand digit flashing.
4. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired setpoint.
5. Press **ENTER** to place the new value in memory. The display will show SP 1 (or SP2) briefly followed by the new setpoint.
6. To program the second alarm setpoint repeat Steps 2 through 5.

NOTE

Relays are normally open (N.O.), but they can be changed to normally closed (N.C.). Locate the relay to be changed. K1 is relay 1, K2 is relay 2, and K3 is relay 3. For the relay selected, cut the conductor at the bowtie on the reverse side of the power supply board. For relay 1, solder a jumper between the center terminal and W4. For relay 2, solder a jumper between the center terminal and W6. For relay 3, solder a jumper between the center terminal and W8.

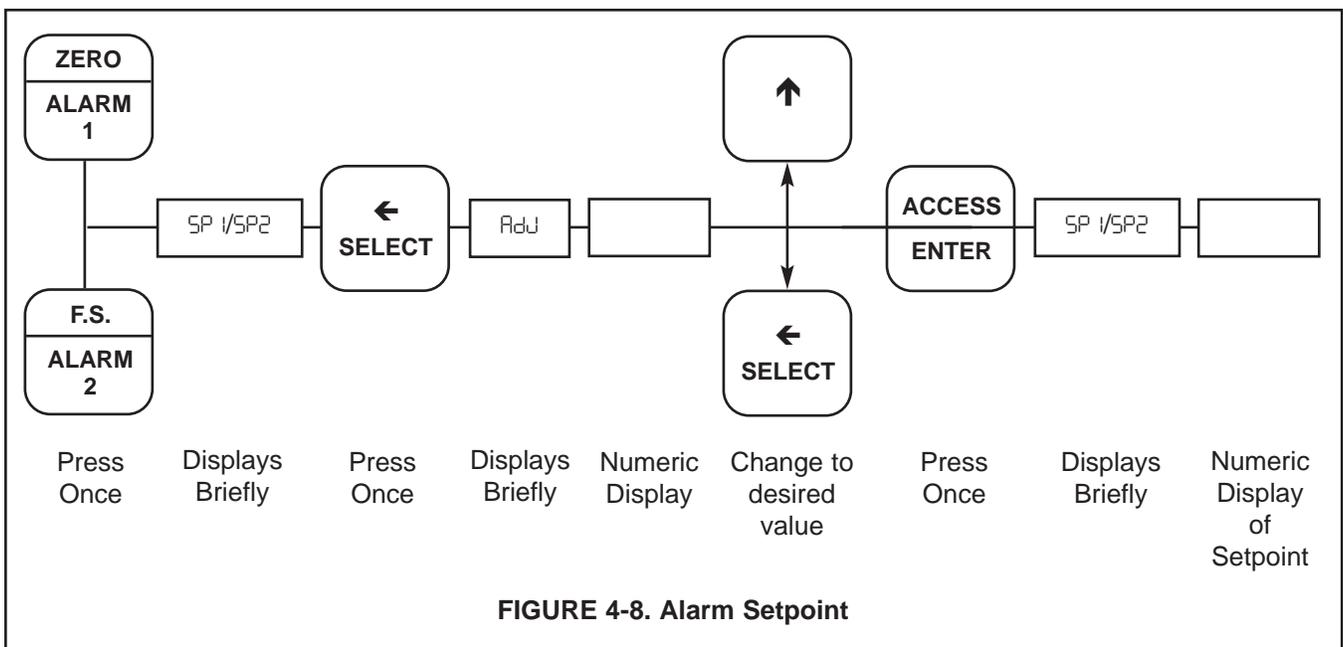


FIGURE 4-8. Alarm Setpoint

4.12 OUTPUT SCALE EXPANSION. Configure the analyzer as described in Sections 4.5 through 4.10 before programming the zero and full scale setpoints. Refer to Figure 4-9.

A. Zero Setpoint. The zero setpoint is the reading that produces a 0 or 4mA output (depending on how the output was configured). $L01$ identifies the zero setpoint for output 1, and $L02$ identifies the zero setpoint for output 2. For analyzers equipped with automatic pH compensation, output 1 is chlorine and output 2 is pH.

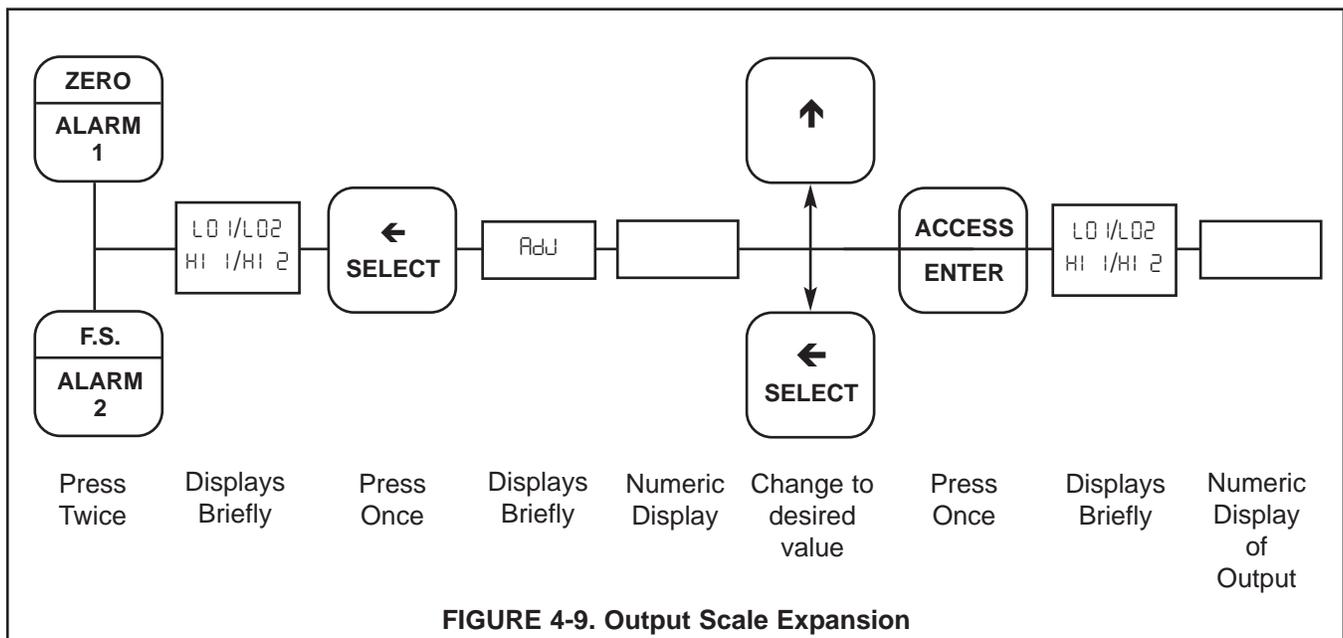
1. Press the **PV** key to ensure the analyzer is not in the set function menu.
2. Quickly double press the **ZERO/ALARM1** key. $L01$ or $L02$ will show briefly in the display, followed by the present zero setpoint for the output selected. To switch outputs, press the **ZERO/ALARM1** key twice again and the display will toggle to the other output.
3. To change the setpoint, press the **SELECT** key. The display will acknowledge briefly with RdJ followed by a numeric display with the right hand digit flashing.
4. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired value.
5. Press **ENTER** to place the new value in memory. The display will show $L01$ or $L02$ briefly followed by the new zero setpoint.
6. If the analyzer has two outputs, repeat steps 2 through 5 to program the zero setpoint for the second output.

B. Full Scale Setpoint. The full scale setpoint is the reading that produces a 20 mA output. $H11$ identifies the full scale for output 1, and $H12$ identifies the full scale setpoint for output 2. For an analyzer equipped with automatic pH compensation, output 1 is chlorine and output 2 is pH.

1. Press the **PV** key to ensure that the analyzer is not in the set function menu.
2. Quickly double press the **F.S./ALARM2** key. $H11$ or $H12$ will show briefly in the display, followed by the present full scale setpoint for the output selected. To switch outputs, press the **F.S./ALARM2** key twice again and the display will toggle to the other output.
3. To change the setpoint, press the **SELECT** key. The display will acknowledge briefly with RdJ followed by a numeric display with the right hand digit flashing.
4. Use the **SCROLL (↑)** and **SHIFT (←)** keys to display the desired setpoint.
5. Press **ENTER** to place the new value in memory. The display will show $H11$ or $H12$ briefly followed by the new zero setpoint.
6. If the analyzer has two setpoints, repeat steps 2 through 5 to program the full scale setpoint for the second output.

NOTE

For reverse output, enter the higher concentration or pH for zero and the lower concentration or pH for full scale.



4.13 SIMULATE CURRENT OUTPUT. The analyzer can provide a simulated output to check the operation of pumps, valves, and recorders. The output can be in current (d01) or in percent of full scale (Pc1). The output configuration programmed in Section 4.9 determines which mnemonic appears. If the analyzer has dual outputs, i.e., the pH correction board has been installed, a simulated signal can be generated at both outputs. Pc1 or d01 identifies output 1 (free residual chlorine), and Pc2 or d02 identifies output 2 (pH). Refer to Figure 4-10.

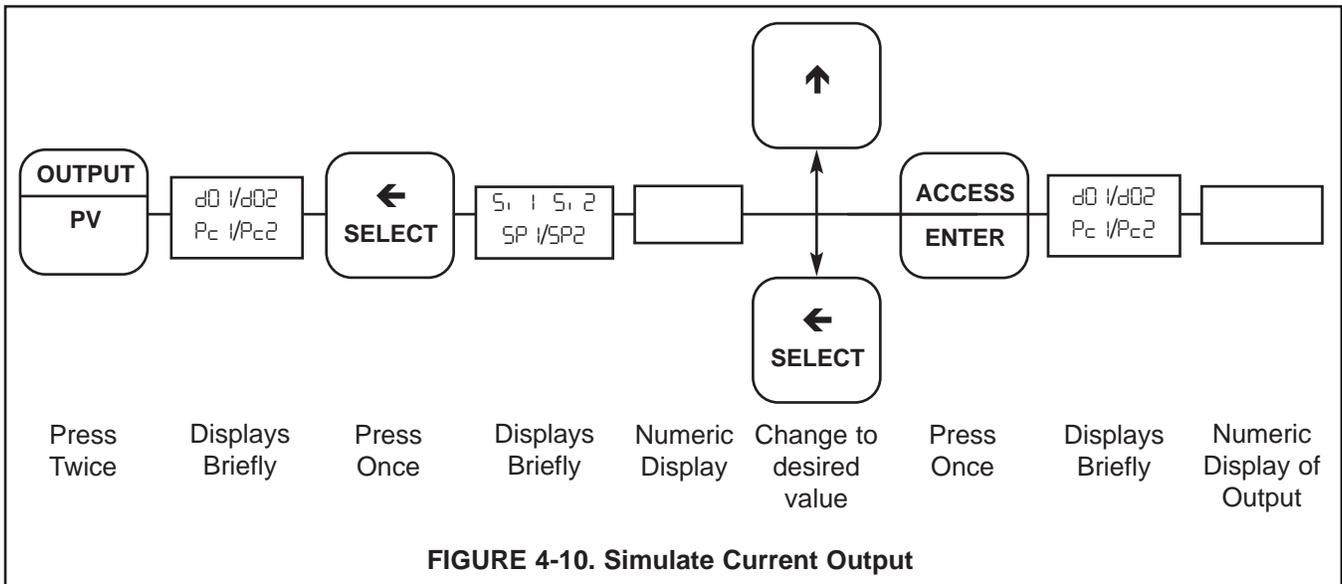
A. Simulate Output in Percent. The simulated output will be in percent full scale if 0t1 or 0t2 in Section 4.8 was configured to display percent (Pct).

1. Press the **PV** key once to ensure that the analyzer is not in the set function menu.
2. Quickly double press the **OUTPUT/PV** key. Pc1 or Pc2 will show briefly in the display, then the display will change to the last simulated output. If the analyzer has dual outputs and the wrong output is displayed, double press the **OUTPUT/PV** key a second time. The display will toggle to the other output.
3. To make the analyzer generate the simulated output, press the **SELECT** key. SP1 or SP2, depending on which output was selected in step 2, will appear momentarily, followed by a numeric display with the right hand digit flashing.

4. To change the simulated output to a different value, use the **SCROLL (↑)** and **SHIFT (←)** keys.
5. Press **ENTER** to store the new value in memory. The display will briefly show Pc1 or Pc2 followed by the entered value. Because the analyzer is in hold while the simulated current is being generated, the display flashes and the mnemonic Hld appears occasionally. After one minute the display returns to the measured value (flashing), the hold flag remains on, and the output remains at the simulated value. The relays will operate as programmed in Section 4.9.
6. To end the simulated output and remove the analyzer from hold, quickly double press the **HOLD/TEMP** key. The display stops flashing, the hold flag turns off, and the output returns to the value determined by the scale expansion programmed in Section 4.12.

B. Simulate Output in Current. The simulated output will be in mA if 0t1 or 0t2 in Section 4.8 was configured to display current (doc).

1. Press the **PV** key once to ensure that the analyzer is not in the set function menu.
2. Quickly double press the **OUTPUT/PV** key. d01 or d02 will show briefly in the display, then the display will change to the last simulated output. If the analyzer has dual outputs and the wrong output is displayed, double press the **OUTPUT/PV** key a second time. The display will toggle to the other output.



3. To change the simulated output, press the **SELECT** key. S_1 1 or S_1 2, depending on which output was selected in step 2, will appear momentarily, followed by a numeric display with the right hand digit blinking.
4. To change the simulated output to a different value, use the **SCROLL (↑)** and **SHIFT (←)** keys.
5. Press **ENTER** to store value in memory. The display will briefly show $d0$ 1 or $d0$ 2 followed by the entered value. Because the analyzer is in hold while the simulated current is being generated, the display flashes and the mnemonic **HLd** appears occasionally. After one minute the display returns to the measured value (flashing), the hold flag remains on, and the output remains at the simulated value. The relays will operate as programmed in Section 4.9.
6. To end the simulated output and remove the analyzer from hold, quickly double press the **HOLD/TEMP** key. The display stops flashing, the hold flag turns off, and the output returns to the value determined by the scale expansion programmed in Section 4.12.

4.14 pH CORRECTION. Free residual chlorine is the sum of hypochlorous acid and hypochlorite ion. The fraction of each species present is determined by the pH. Because the sensor responds only to hypochlorous acid, a pH correction is necessary to convert sensor response into the total concentration of free chlorine. The analyzer permits either automatic or manual pH correction. In automatic pH correction, the analyzer uses the measured pH of the sample to calculate the total concentration of free chlorine. In manual pH correction, the user keys in the sample pH.

A. Analyzer Equipped with Automatic pH Correction. Select o_n to enable and select o_{FF} to disable automatic pH correction. If automatic pH correction is disabled, a manual pH value must be entered. The analyzer uses the entered value for the correction.

1. Press the **PV** key to ensure that the analyzer is not in the set function menu.
2. Press **CAL**. The display will show P_H momentarily followed by the present pH.

3. **SCROLL (↑)** until o_{PH} appears in the display, then press **SELECT**. The display will be flashing either o_n or o_{FF} .
4. Press **SCROLL (↑)** until the desired mnemonic appears in the display. Press **ENTER** to place the selection in memory.
5. If o_n was selected, mnemonic P_H appears momentarily, and the display returns to the current pH value.
6. Press the **PV** key to return the display to the chlorine reading.
7. If o_{FF} was selected, the mnemonic F_{PH} appears followed by a number. Press **SELECT**. R_{dJ} appears momentarily followed by a number with the right hand digit flashing. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired pH value. Press **ENTER** to store the value in memory. F_{PH} appears momentarily, and the entered number reappears in the display. The analyzer will use the pH value entered in this step for future pH corrections.
8. Press the **PV** key to return the display to the chlorine reading.

B. Analyzer Without pH Correction. The analyzer uses the pH value entered in this step for all corrections.

1. Press the **PV** key to ensure that the analyzer is not set in the set function menu.
2. Press **CAL**. The display will show F_{PH} momentarily followed by a number.
3. Press **SELECT**. R_{dJ} will appear momentarily followed by a number with the right hand digit flashing. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired pH value. Press **ENTER** to store the value in memory. F_{PH} appears momentarily, and the entered number reappears in the display.
4. Press the **PV** key to return the display to the chlorine reading.

SECTION 5.0 START-UP AND CALIBRATION

5.1 General

5.2 Start-Up

5.3 Calibration

5.1 GENERAL. This section gives the start-up and calibration procedures for the Model 1054B CL Analyzer with the Model 499A CL sensor and, if appropriate, a Model 389, 396P, or 399 pH sensor.

5.2 START-UP. When the analyzer is powered up, a polarization voltage is applied between the anode and cathode. The sensor current is initially very high but then falls off quickly and usually reaches a steady state after a few hours.

5.3 CALIBRATION.

This section describes how to do the following:

1. calibrate the temperature response of the chlorine sensor;
2. zero the chlorine sensor;
3. calibrate the chlorine sensor against a grab sample or a known standard
4. calibrate the pH sensor.

5.3.1 Temperature Standardization. The 1054B CL analyzer uses a membrane-covered amperometric sensor. Because the permeability of the membrane is a strong function of temperature, accurate temperature measurement is necessary for accurate chlorine measurements. The 499A CL sensor measures temperature using a 100 ohm platinum RTD. The accuracy of a new sensor/analyzer loop is about $\pm 1^\circ\text{C}$, which is adequate for most applications. A new sensor seldom requires temperature calibration. If $\pm 1^\circ\text{C}$ accuracy is not acceptable or if the temperature measurement is suspected of being in error, use the following procedure to calibrate the RTD.

1. Immerse the sensor in a container of water to at least an inch from the bottom of the lower threads. If the temperature of the water is appreciably different from ambient, use an insulated container.
2. Place a calibrated thermometer in the water with the sensor.
3. Stir the water continuously.
4. Allow temperature readings to stabilize. The stabilization step may take as long as 30 minutes.

If the temperature reading from the analyzer does not agree with the standard thermometer, adjust the analyzer temperature display.

1. Press the **PV** key to ensure that the analyzer is not in the set function menu.
2. Press the **TEMP** key once. The display will briefly show $^\circ\text{F}$ or $^\circ\text{C}$ followed by the present temperature in either $^\circ\text{F}$ or $^\circ\text{C}$ (depending on the units selected in Section 4.7).
3. Press the **SELECT** key. **Adj** will show briefly followed by a numeric display with the right hand digit flashing.
4. Use the **SCROLL** (**↑**) and **SHIFT** (**←**) keys to change the display to the correct value.
5. Press **ENTER** to place the new value in memory. $^\circ\text{F}$ or $^\circ\text{C}$ shows briefly followed by the corrected temperature.

Temperature calibration can be done without removing the sensor from the process stream. To ensure that the reference instrument and the 499A CL sensor are measuring the same sample temperature, install the reference thermowell as close to the sensor as possible. If a thermowell is not available, measure the temperature of the process at a sample tap. Let a sample of the process stream, taken from a point as close to the sensor as possible, discharge into the bottom of a small container. To minimize heat exchange between the sample and the ambient air, let the sample flow as rapidly as possible. Place the reference temperature sensor in the container so that it is completely bathed in the sample. Allow adequate time for equilibration and compare the analyzer temperature reading with the reference temperature. Adjust the analyzer reading if necessary.

5.3.2 Analyzer Zero. The analyzer/sensor loop must be zeroed every time a new sensor is placed in service or an existing sensor is rebuilt. Rebuilding a sensor means replacing the membrane and/or replenishing the electrolyte. Zero the loop by placing the sensor in chlorine-free water, and allow it to operate until the current reaches a minimum value. The minimum current is called the residual current.

- Place the sensor in a container of fresh distilled or deionized water. Immerse the sensor to at least an inch from the bottom of the lower threads. Add 4 to 6 mL of pH 7 buffer for every 1000 mL of water. If pH 7 buffer is not available, add about 0.50 gram of a neutral salt, like sodium chloride or potassium chloride, to the water. The buffer or salt increases the ionic concentration of the water and reduces the rate of loss of electrolyte through the sensor membrane.
- Allow the sensor to stabilize. The stabilization time may be as long as **4 hours**. Periodically measure the current while the sensor is stabilizing. To view the current, quickly double press the **ACCESS/ENTER** key. **SEt** will be displayed momentarily, then the display will change to **0.00**. Press the **SELECT** key to display the current.
- Flush the sample line thoroughly then rinse the sample bottle several times before sampling. Because aqueous solutions of free chlorine decompose rapidly in light, collect the sample in a colored glass bottle.
- Glassware used for sampling may have a chlorine demand. Before taking the sample, soak the sample bottle for several days in a solution of dilute chlorine (20 drops of bleach in one liter of water) and rinse thoroughly. Check the bottle for residual chlorine before using it for samples.
- Aqueous solutions of free chlorine are unstable. Start the analysis immediately after collecting the sample. See Standard Methods, 19th edition, 4500-Cl for appropriate analytical methods.

NOTE

The sensor current and, therefore, the displayed concentration will fluctuate and may even become negative while the loop is zeroing.

- Once the current is stable, press the **ACCESS/ENTER** key twice to return to the top of the main menu.
- Press the **SCROLL (↑)** key until **-0-** is displayed.
- Press the **SELECT** key. **-0-** will flash for about five seconds and then freeze. The analyzer loop is now zeroed.
- Press the **PV** key to leave the set function menu. The analyzer should read near zero ppm.

5.3.3 Calibrating the Chlorine Sensor Against a Grab Sample. The chlorine sensor can be calibrated against a grab sample taken from the process stream. Observe the following precautions:

- Calibrate the pH sensor before starting the grab sample calibration. See Sections 5.3.5, 5.3.6, and 5.3.7. If automatic pH correction is not being used, measure the pH of the process stream and enter the value before starting the calibration. See Section 4.14.
- Ensure that the grab sample is representative of the liquid flowing past the sensor. Take the sample from the process stream at a point as close to the sensor as possible.
- The sensor requires continuous flow of liquid past it. Place the sample valve downstream from the sensor to avoid starving the sensor when taking the sample.

To calibrate the sensor follow the steps below:

- Wait until the analyzer reading is stable or drifting slowly. Note the reading and take the sample.

NOTE

For best results calibrate the sensor when the chlorine level in the process stream is at the high end of the normal operating range. Ideally, the sensor current should be at least 70 nanoamps when the sensor is calibrated. If the pH of the process stream is high and the chlorine levels are low, the sensor current might be too low for an accurate calibration.

- Immediately measure the free residual chlorine concentration in the sample.
- Note the present concentration of chlorine in the sample stream. Be sure the concentration is stable. Calculate the calibration value using the following formula:

$$C = (X/Y) (A)$$

where C is the calibration value to be entered, X is the present analyzer reading, Y is the analyzer reading at the time the grab sample was taken, and A is the concentration of free residual chlorine in the grab sample.

- Enter the calibration value:
 - Press the **PV** key to make sure the analyzer is not in the set function menu.

- B. Press the **SELECT** key. 5.00 appears momentarily, then the display changes to the last free chlorine reading. The right hand digit will be flashing.
- C. Use the **SCROLL** (**↑**) and **SHIFT** (**←**) keys to change the display to the value calculated in step 3.
- D. Press the **ENTER** key to place the calibration value in memory. The analyzer is now standardized.

5.3.4 Calibration Against a Known Standard. If calibration against a grab sample is not feasible, the loop can be calibrated against a solution containing a known concentration of chlorine.

1. The procedure requires that pH be known. If automatic pH correction is being used, calibrate the pH sensor following the procedure in Section 5.3.6 before starting. If automatic pH correction is not being used, obtain and calibrate a pH meter and sensor.
2. Pour about 900 mL of process water into a 1-liter beaker. Place the chlorine and pH sensors in the beaker. Place a magnetic string bar in the beaker and begin stirring. Adjust the stirring speed until the chlorine reading is essentially independent of stirring speed. Do not stir so fast that a vortex appears. A thin sheet of plastic foam placed between the stirrer and the beaker will insulate the liquid from the heat generated by the stirrer.
3. Using household bleach, adjust the chlorine level until it is at the high end of the normal operating range. Bleach contains about 45,000 ppm chlorine (as Cl_2). Adding 0.05 mL of bleach (one drop) to 1000 mL of sample increases the chlorine level about 2 ppm. To increase the chlorine level by a smaller amount, dilute the bleach before adding it to the sample.
4. Monitor the temperature, pH, and the chlorine reading until all are stable or drifting slowly. If manual pH correction is being used, enter the pH value. Note the analyzer reading and immediately remove a sample of the standard solution for analysis. Determine the concentration of free chlorine in the sample. Aqueous solutions of free chlorine are unstable. Start the analysis immediately after collecting the sample. See Standard Methods, 19th edition, 4500-Cl for appropriate analytical methods

5. Note the present concentration of chlorine in the standard. Be sure the concentration is stable. Calculate the calibration value using the following formula:

$$C = (X/Y) (A)$$

where C is the calibration value to be entered, X is the present analyzer reading, Y is the analyzer reading at the time the grab sample was taken, and A is the concentration of free residual chlorine in the grab sample.

6. Enter the calibration value:
 - A. Press the **PV** key to make sure the analyzer is not in the set function menu.
 - B. Press the **SELECT** key. 5.00 appears momentarily, then the display changes to the last free chlorine reading. The right hand digit will be flashing.
 - C. Use the **SCROLL** (**↑**) and **SHIFT** (**←**) keys to change the display to the value calculated in step 3.
 - D. Press the **ENTER** key to place the calibration value in memory. The analyzer is now standardized.

5.3.5 Calibration of the pH Sensor. Because the chlorine sensor reacts only with hypochlorous acid and the fraction of total chlorine present as hypochlorous acid changes with pH, a correction is necessary to convert the measured signal to total free chlorine. The correction can be manual or automatic. Manual pH correction is appropriate when the pH of the sample varies by no more than pH 0.1 or 0.2 units. If the variability is greater, automatic pH correction is recommended. Automatic pH correction requires a pH sensor with integral preamplifier and a 1054B CL Analyzer with a pH CPU board.

5.3.6 Two Point Buffer Calibration. This section gives the procedure for calibrating a pH sensor using two buffers.

1. Obtain pH 4, 7, and 10 buffer solutions. Use buffers traceable to NIST (National Institute of Standards and Technology). Select the two buffers that bracket the likely pH of the sample. For most applications, pH 7 and pH 10 buffer are appropriate. The pH of a buffer changes with temperature. Be sure pH-temperature data are available for the buffers selected.

2. Press the **PV** key to ensure the analyzer is not in the set function menu.
3. Rinse the pH sensor with deionized water and using a clean, absorbent tissue gently daub (**DO NOT WIPE**) excess water from the sensor. Immerse the sensor in the first buffer to at least two inches above the tip of the sensor. Swirl a few times to dislodge bubbles. Place a calibrated thermometer in the container with the buffer.
4. Let the sensor reach the same temperature as the buffer. If the temperature of the buffer and the process stream from which the sensor was taken differ by more than a few degrees, 10 to 20 minutes may be needed for temperature equilibration.
5. Press **CAL** to display the pH reading. Once the pH is constant, **SCROLL (↑)** until **bF 1** appears in the display.
6. Press **SELECT**. **Adj** appears momentarily, followed by a number with the right hand digit flashing. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the pH of buffer 1 at temperature of the buffer. Press **ENTER** to store the first buffer value in memory. **bF 2** appears momentarily in the display. The analyzer is now ready for the second buffer.
7. Remove the sensor from the first buffer and rinse with deionized water. Use a clean, absorbent tissue to gently daub (**DO NOT WIPE**) excess water from the sensor. Immerse the sensor in the second buffer to at least two inches above the tip of the sensor. Swirl the sensor a few times to dislodge bubbles. The display will show the apparent pH of the buffer. Also rinse the thermometer and place it in the buffer.
8. Once the pH reading is stable, press **SELECT**. **Adj** appears momentarily, followed by a number with the right hand digit flashing. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the pH of buffer 2 at the temperature of the buffer. Press **ENTER** to store the second buffer value in memory.
9. Compare the actual electrode slope with the theoretical slope. Press the **SCROLL (↑)** key until **SLP** appears in the display. Then press **SELECT**. **Adj** appears momentarily, followed by the current slope.

CAUTION

The right hand digit will be flashing, and the slope can be changed at this point. Because the purpose of the buffer calibration was to set the electrode slope and offset, **DO NOT ALTER THE SLOPE**. Press **ENTER** to save the value.

The measured slope should be between 95 and 105% of the theoretical slope.

Temperature (°C)	Slope (mV/decade)
15	57.2
20	58.2
25	59.1
30	60.1
35	61.1

10. Press **PV** to return the display to the free residual chlorine reading.
11. To read the pH cell voltage, press **CAL**, then **SCROLL (↑)** until **E₁** appears in the display. Press **SELECT** to display the cell voltage. Press **PV** to return the display to the chlorine reading.

5.3.7 Offsetting pH Readings. If desired, the analyzer reading can be made to agree with a reference pH measurement. Offsetting brings the readings into agreement at one point only. It retains the slope determined by the last two point calibration.

1. Wait until the pH of the process stream is stable or slowly changing. Use a calibrated pH meter to measure the pH. Note the analyzer reading at the time the reference measurement is made.
2. The offset is the absolute value of the difference between the analyzer and reference meter readings.
3. Press **CAL**. The display will change to pH. Press **SELECT**. **Std** will show momentarily, then the display will change to the present pH reading with the right hand digit flashing. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired value. Press **ENTER** to store the value in memory.
5. Press **PV** to return the display to the free residual chlorine reading.

SECTION 6.0

KEYBOARD SECURITY

KEYBOARD SECURITY. The security feature allows the user to enter a three digit security code to prevent accidental changes to the analyzer configuration and calibration. When the security feature is activated, all read functions can be accessed normally, but the instrument configurations, alarm settings, zero and full scale settings, and calibration cannot be changed. If an attempt is made to access a protected function, the mnemonic **LOC** appears momentarily followed by a numeric display. Keying in the correct code unlocks the analyzer and returns the display to the function just attempted. Keying in an incorrect code results in the mnemonic **ERR** followed by the numeric display ready to receive the correct code. Once the analyzer is unlocked, it allows access to all functions until it is powered down or no keystrokes are made for two minutes.

NOTE

To retrieve a forgotten code, press and hold the **ACCESS/ENTER** key for five seconds. The access code will be displayed. Release the **ACCESS/ENTER** key and press it again to unlock the analyzer.

Keyboard Security Procedure.

1. Enter the set mode by double pressing the **ACCESS/ENTER** key.
2. **SCROLL (↑)** until **000** appears on the display. Press **SELECT**.
3. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to the desired value. Press **ENTER** to place the number in memory. To disable the security feature, enter **000**. The security feature will not activate until two minutes have elapsed without keyboard activity or until power to the analyzer has been removed and restored.

SECTION 7.0

THEORY OF OPERATION

The Model 1054B Free Residual Chlorine Analyzer is designed for use with the Model 499A CL sensor. The analyzer/sensor loop automatically and continuously measures the concentration of free chlorine in water. Free chlorine is defined as the sum of the concentrations of hypochlorous acid (HOCl) and hypochlorite ion (OCl^-) expressed as chlorine (Cl_2). Because hypochlorous acid is a weak acid, the relative amount of each species (HOCl and OCl^-) depends on pH and to a lesser extent on temperature. As the pH increases, the fraction of hypochlorite increases and the fraction of hypochlorous acid decreases. The total concentration of free chlorine remains constant.

The sensor is a membrane covered amperometric detector. It consists of the membrane, a platinum cathode, a silver anode, and the electrolyte solution (potassium chloride). The membrane, which is a proprietary, microporous polymer, stretches tightly over the cathode. Because the membrane is hydrophilic, it allows passage of both hypochlorous acid and hypochlorite ion (as well as other substances dissolved in the sample) into the thin film of electrolyte at the surface of the cathode. Once in the electrolyte film, hypochlorous acid and hypochlorite diffuse to the surface of the cathode where a polarizing voltage applied to the cathode reduces hypochlorous acid to chloride. The electrons required for the reaction come from the silver anode. Therefore, as the sensor operates, the anode is oxidized to silver chloride. Because the concentration of hypochlorous acid in the sensor is practically zero, a concentration gradient continuously forces hypochlorous acid from the sample into the sensor where it is reduced. The current produced by the electrochemical reaction in the sensor is proportional to the concentration of free chlorine in the sample.

Although the sensor reduces only hypochlorous acid, the current produced for a given concentration of hypochlorous acid is greater than expected. The reason is conversion of hypochlorite to hypochlorous acid in the sensor. Free chlorine is an equilibrium mixture of hypochlorous acid and hypochlorite. As the sensor operates, it consumes hypochlorous acid, upsetting the equilibrium and causing the conversion of hypochlorite to hypochlorous acid. The hypochlorous acid thus produced is reduced at the cathode, making the current greater than the value

predicted from the equilibrium concentration alone. Because conversion of hypochlorite to hypochlorous acid in the sensor is not complete, the sensitivity (current generated per ppm of free chlorine) is not constant, but falls as the pH increases. The sensitivity of the 499A CL sensor is about 250 nanoamps/ppm at pH 7 and drops to about 50 nanoamps/ppm at pH 9.5. The analyzer automatically compensates for the change in sensitivity with pH. Although the analyzer responds well to gradual changes in pH, a step change usually produces a sudden change in chlorine reading followed by a gradual settling toward the final value. Normally, several minutes are needed for the chlorine reading to recover after a pH step.

Temperature also influences the sensitivity. The permeability of the membrane increases about 3% for every °C rise in temperature. Increased permeability allows more free chlorine (HOCl and OCl^-) to pass through the membrane to be reduced at the cathode. Therefore, current and the apparent free chlorine concentration increase even though the actual free chlorine concentration did not change. The change in membrane permeability with temperature is predictable, and the analyzer can readily compensate for it. The analyzer also compensates for the affect of temperature on the relative amounts of hypochlorous acid and hypochlorite ion present at any pH.

The cleanliness of the membrane surface and the flow of liquid past the sensor also affect sensitivity. A sensor with a fouled or dirty membrane has lower sensitivity than a sensor with a clean membrane because fouling hinders the passage of chlorine through the membrane. Flow influences the sensitivity because the analyzer consumes the chlorine it measures. Therefore, to sustain the current, fresh chlorine-containing sample must be continuously supplied to the membrane. If the sample flow is inadequate, chlorine readings will be low.

The 1054B CL Analyzer converts the sensor current to concentration by multiplying the current by a sensitivity factor. The sensitivity factor is determined by the calibration procedure described in Section 5.0, by the membrane permeability temperature factor, and by the pH compensation factor. Because the sensitivity is about 200 nanoamps/ppm, low concentrations of chlorine produce fairly low currents. To remove the noise in these measurements, electronic filtering is helpful. A 25 sample filter (see Section 4.10) usually reduces noise to negligible levels while increasing response time only by about 13 seconds.

SECTION 8.0

DIAGNOSTICS AND TROUBLESHOOTING

8.1 Diagnostics

8.2 Troubleshooting

8.3 CPU and Power Board Replacement

8.4 Maintenance

8.1 DIAGNOSTICS. The 1054B CL Analyzer has a diagnostic feature that automatically searches for and identifies fault conditions. Faults arise from analyzer and sensor malfunctions and from improper wiring and connections. If the analyzer identifies a fault, the display flashes and shows the fault flag and fault mnemonic. In addition, the current outputs and relays will operate as configured in Section 4.9. If more than one fault exists, the display sequences through the faults at eight second intervals. The analyzer will continue to display the fault code mnemonic(s) until the fault has been corrected. Fault mnemonics are suppressed when the analyzer is in the set function. Selecting **SHD** from the set function menu displays the two most recent fault conditions. Refer to Section 4.11 for more details.

8.1.1 Fault Message Codes. Table 8-1 lists the fault message codes and an explanation of the cause of each fault. Refer to Table 8-3 for additional information.

8.2 TROUBLESHOOTING. The Model 1054B CL Analyzer is designed with state of the art microprocessor circuitry, making troubleshooting simple and direct. Once a problem has been identified, fixing it is usually as simple as replacing a printed circuit board.

8.2.1 Troubleshooting Guide. Refer to Table 8-3 for assistance in interpreting fault codes and identifying the cause of analyzer malfunctions and measurement problems. The troubleshooting guide also gives suggested remedies for common problems.

8.2.2 Improper Installation. If failure occurs when the analyzer is first started up, check the following:

1. If a fault mnemonic is showing, refer to Table 8-1 and Table 8-3 to identify the problem and the likely cause.
2. Check wiring connections between the sensor and analyzer.
3. Check for proper operation of the sensor. Verify that the process stream contains free chlorine.

8.2.3 Display Test. Select mnemonic **dE5** from the set function menu to activate all display segments and flags. Refer to Figure 2-2.

8.2.4 Software Version. Select **UEr** from the set function menu to display the software revision of the CPU. The revision number may be requested by factory service personnel.

1. Double press the **ACCESS/ENTER** key to enter the set function menu. **SCROLL** to **UEr** and press **SELECT**.
2. Press the **ACCESS/ENTER** key to return to the first level of the menu, or press the **PV** key to leave the set function menu.

TABLE 8-1. Fault Message Codes

Display	Description	Display	Description
EEP	EEPROM write error (bad EEPROM chip).	EcH	High temperature compensation error.
CHS	ROM failure (check sum error) (bad ROM chip).	EcL	Low temperature compensation error.
r c i	Reverse current input.	Orn	Overrange error (+20.00 ppm).
SEn	Sensor line error or wire length error.	Ec i	Excessive current input.
COF	Computer not operating properly.	FAC	Factory calibration required.
Cr d	pH board not communicating	SLP	pH electrode slope error
i n L	Input low	i n H	Input high

8.2.5 Temperature Measurement. Accurate determination of chlorine requires accurate measurement of temperature. The sensor uses a 100 ohm platinum RTD temperature element. Disconnect the RTD leads and measure the resistances shown in Figure 8-1. The measured resistance should agree with the value in the table to within about 1%. Minor discrepancies (between 1 and 5%) can be calibrated out. See Section 5.3.1. See Figure 8-1.

To check the performance of the analyzer, simulate the RTD by connecting a known resistance between terminals 5 and 6 on TB2. See Figure 8-2 and Table 8-2.

TABLE 8-2. RTD Resistance Values

Temperature	Resistance
0°C	100.0 ohms
10°C	103.9 ohms
20°C	107.7 ohms
30°C	111.7 ohms
40°C	115.5 ohms
50°C	119.4 ohms

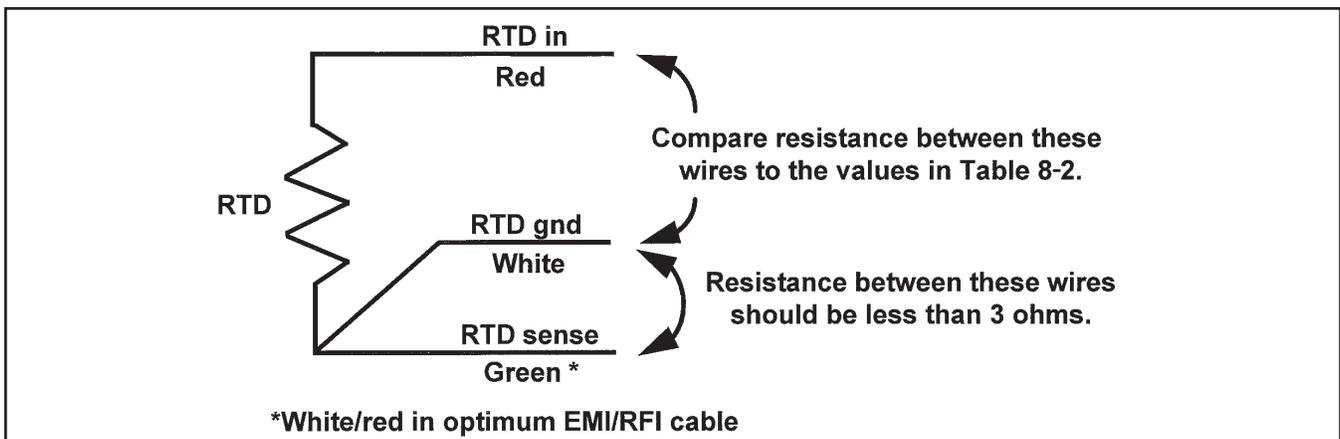


FIGURE 8-1. Three-wire 100 ohm Platinum RTD. Three-wire 100 ohm Platinum RTD. Consult Table 8-2 for resistance temperature data. Lead resistance is about 0.05 ohm/ft at 25°C. Therefore, 25 feet of cable increases the resistance by about 2.5 ohm. The resistance between the RTD and and RTD sense leads should be less than 3 ohm. Lead colors for both standard cable and optimum EMI/RFI cable are given in the figure.

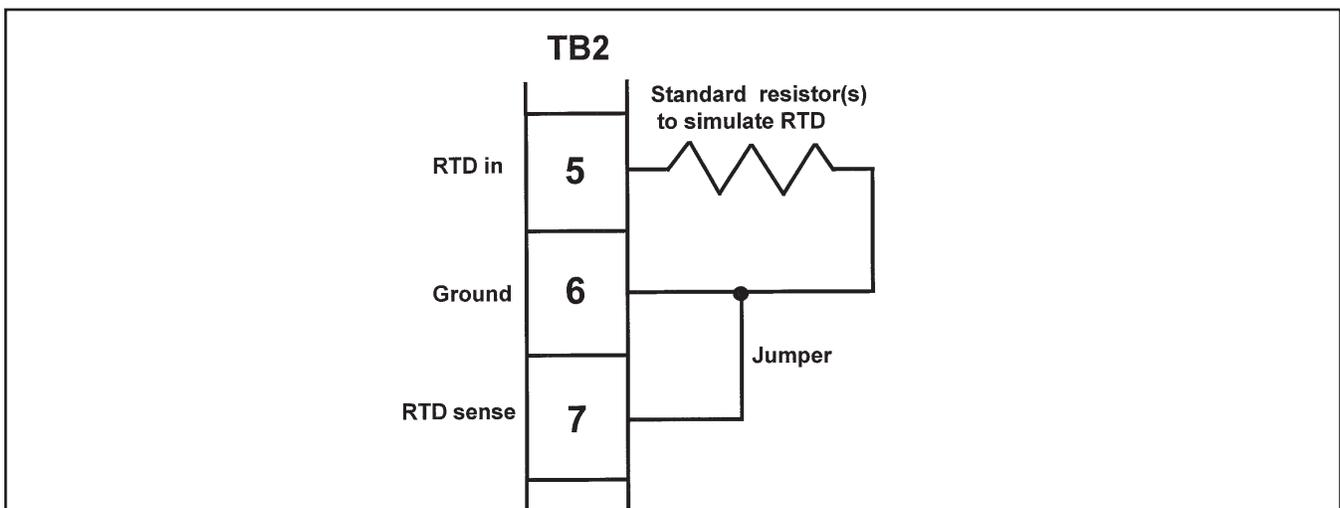


FIGURE 8-2. Temperature Simulation into 1054BCL Analyzer. The measured temperature should equal the value from the table to within $\pm 2^\circ\text{C}$. If the measured temperature is incorrect, calibrate the analyzer against the standard resistance. After calibrating, check the temperature response of the sensor. See Section 5.3.1.

8.2.6 pH Sensor Performance. If pH measurements seem inaccurate, the problem is most likely caused by a dirty or defective sensor.

1. Inspect the glass electrode for physical damage. If the glass is cracked or broken, replace the sensor.
2. If the electrode appears undamaged, check its performance in buffers. Perform the two point calibration described in Section 5.3.6. Verify that the slope is between 95% and 105% of the expected value.
3. Occasionally, glass electrodes can be rejuvenated by soaking the glass bulb in dilute (10%) hydrochloric acid or in pH 4 buffer for 30 to 60 minutes. If the electrode was soaked in acid, soak it in pH4 buffer for at least 4 hours before calibrating.

NOTE

Soaking the pH sensor in hydrochloric acid, will probably expose the reference junction to acid as well. If the acid enters the junction, subsequent measurements may be substantially offset from the expected value and will drift as the acid diffuses out of the junction.

4. If the sensor still fails to calibrate properly after cleaning and rejuvenating, it must be replaced.

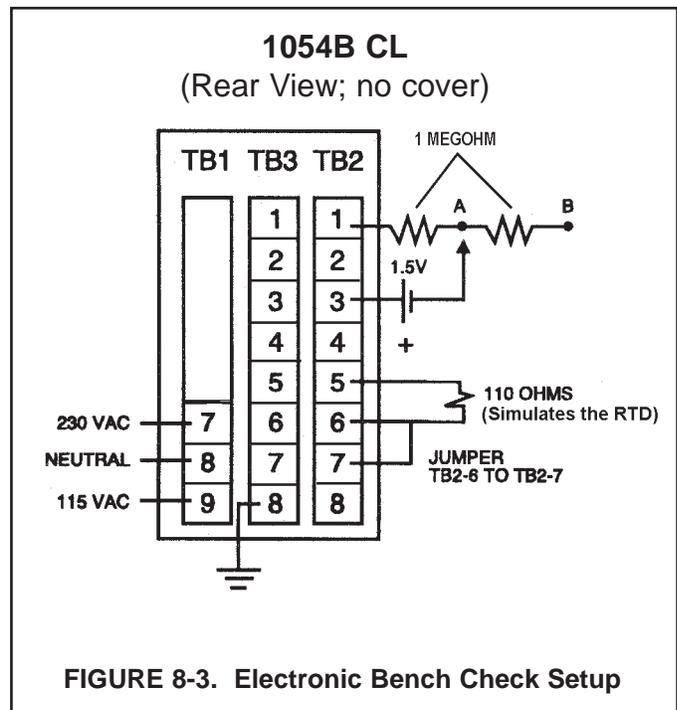
8.2.7 Electronic Simulation for pH. Most pH measurement problems can be traced to the sensor. If necessary, however, the performance of the analyzer can be checked by simulating a pH 7 input.

1. With the pH sensor connected, short terminal 6 and 7 on TB3.
2. Verify that the pH reading is close to 7.00.

3. If the measured pH is appreciably different from 7.00, the pH CPU board probably needs replacing.

8.2.8 Electronic Simulation for Chlorine. The majority of chlorine measurement problems can be traced to the sensor. See Table 8-3 for troubleshooting and corrective actions. If necessary the performance of the analyzer can be checked by simulating a current between the cathode and anode input terminals.

1. Disconnect the sensor and wire the circuit shown in Figure 8-3.
2. If the analyzer is so equipped, disable the automatic pH correction. Press **CAL**, then press **SCROLL (↑)** until **APH** appears in the display. Press **SELECT** and **SCROLL (↑)** until **OF** appears in the display. Press **ENTER**. If 7.00 does not appear in the display at this point, press **SELECT**. A numeric display will appear with the right hand digit flashing. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to 7.00. Press **ENTER** to store the number in memory.



3. If the analyzer does not have automatic pH correction, set the manual pH to 7.00. Press **CAL** followed by **SELECT**. A numeric display will appear with the right hand digit flashing. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to 7.00. Press **ENTER** to store the number in memory.
4. Electronically zero the analyzer. Disconnect the lead from terminal 1 on TB-2. Double press the **ACCESS/ENTER** key to enter the set function menu. **SCROLL (↑)** until **-□-** appears in the display. Press **ENTER**. The display will flash for about five seconds and freeze. Press the **PV** key. The display will show 0.000 ppm. Reconnect the lead to TB2-1.
5. Connect the negative end of the battery to point A between the two 1-megohm resistors. The circuit will generate about 1400 nanoamps (1.4 microamps). To measure the current, double press the **ACCESS/ ENTER** key to enter the set function menu. The mnemonic **SEt** will appear momentarily followed by **□□**. Press **SELECT** to display the current in nanoamps.
6. Standardize the analyzer to 10 ppm. Press the **PV** key followed by **SELECT**. Use the **SCROLL (↑)** and **SHIFT (←)** keys to change the display to 10.00. Press **ENTER** to store the value in memory.
7. Check linearity by connecting the negative end of the battery to point B, thus placing the 1 megohm resistors in series. The measured current will be close to 700 nanoamps, and the simulated chlorine reading will be 5.0 ppm.

8.3 CPU AND POWER BOARD REPLACEMENT. If a problem with the CPU or the power board required that the board be replaced, the installation procedures shipped with the replacement board must be followed exactly. Failure to follow the instructions will cause the microprocessor to be incorrectly programmed and will require the analyzer to be returned to the factory for reprogramming.

8.4 MAINTENANCE. To maintain the appearance and extend the life of the enclosure, clean it regularly with a mild soap and water solution followed by a clean water rinse.

NOTE

A new 1.5 volt battery generates about 1.6 volts. Because the battery opposes the 200 mV polarizing voltage from the analyzer, the voltage is about 1.4 volts. The circuit resistance is 1 megohm, so the expected current is 1.4 microamps.

TABLE 8-3. Troubleshooting Guide

SYMPTOM	PROBLEM/ACTION
Fault Code <code>rct</code>	Message typically appears while the sensor is being zeroed and usually disappears after several hours. If the message persists, verify that the sensor is properly wired.
Fault Code <code>bRd</code>	<ol style="list-style-type: none"> 1. The current generated by the sensor is too small for accurate calibration. Check the sensor current. To calibrate the sensor, the current should be at least 70 nanoamps. 2. Increase the chlorine level in the calibration sample. 3. Service the sensor. Use a cotton-tipped swab to polish the cathode with a paste of sodium bicarbonate (baking soda) or, better, alumina. Use type A dry powder alumina intended for metallographic polishing of medium or soft metals. Rinse the cathode thoroughly with deionized water. Replenish the electrolyte solution and install a new membrane.
Fault Code <code>not</code>	<ol style="list-style-type: none"> 1. A pH CPU board is not installed, or if a board is installed, the analyzer does not recognize it. 2. If a pH CPU board is installed, reset the analyzer by removing the power for a few minutes and then restoring it.
Fault Code <code>tCH /tCL</code>	<ol style="list-style-type: none"> 1. A temperature compensation error is present. 2. Verify that the sensor is properly wired to the analyzer. 3. Perform temperature calibration. See Section 5.3.1. 4. Use manual temperature compensation to bypass a faulty RTD and replace the faulty sensor as soon as possible.
Fault Code <code>Orn /EcL</code>	<ol style="list-style-type: none"> 1. Current generated in the sensor is too high. 2. Check the membrane for splits or tears. Replace the membrane if it appears damaged. Replenish the electrolyte and recalibrate the sensor.
Fault Code <code>SEn</code>	<ol style="list-style-type: none"> 1. Sensor is not properly wired to the analyzer. 2. Check connections, particularly TB2-6 and TB2-7. 3. Check for loose connections, bad lug crimps, and broken conductors.
Fault Code <code>EEP /CHS</code>	<ol style="list-style-type: none"> 1. There is a problem with the chlorine CPU circuit board. 2. Replace the chlorine CPU board.
Fault Code <code>EEP / CHS</code>	<ol style="list-style-type: none"> 1. There is a problem with the pH CPU circuit board. The apostrophe prefix in the fault mnemonic signifies the pH board. 2. Replace the pH CPU board.
Chlorine sensor will not zero	<ol style="list-style-type: none"> 1. Be sure the membrane is completely covered with chlorine-free water and that no air bubble is trapped against the membrane. 2. Allow sufficient time for sensor to zero – as long as 24 hours. 3. Check sensor membrane for damage. Replace membrane if necessary. 4. Perform sensor electrical checks. Refer to the troubleshooting section of the sensor instruction manual for details. 5. Check analyzer performance. See Section 8.2.8 for details.
Chlorine sensor has little or no response to changes in chlorine concentration	<ol style="list-style-type: none"> 1. Verify that the flow of sample past the sensor is adequate. Refer to the sensor instruction manual for suggested flows. 2. Inspect the surface of the membrane for fouling. Use a stream of water from a wash bottle to clean the membrane. If washing the membrane does not improve the response, service the electrode. Use a cotton-tipped swab to polish the cathode with a paste of sodium bicarbonate (baking soda) or, better, alumina. Use type A dry powder alumina intended for metallographic polishing of medium or soft metals. Rinse the cathode thoroughly with deionized water. Replenish the electrolyte solution and install a new membrane. 3. Perform the sensor electrical checks. Refer to the troubleshooting section of the sensor instruction manual for details. 4. Check analyzer performance. See Section 8.2.8 for details.
Chlorine reading erratic	<ol style="list-style-type: none"> 1. Readings are typically erratic when a new or rebuilt sensor is first placed in chlorine-free water to zero. The current usually stabilizes after several hours, although it may require as long as 24 hours. Adjusting the pH to between 5 and 7 helps reduce the noise. 2. If the pH of the sample is fluctuating, the chlorine reading will fluctuate slightly even if automatic pH correction is being used. Remove the chlorine sensor from the process stream, and place

TABLE 8-3. Troubleshooting Guide (continued)

Chlorine reading erratic (cont'd)	<p>it in a chlorine sample buffered to about pH 7. If readings stabilize, the erratic readings are caused by fluctuations in pH.</p> <ol style="list-style-type: none"> If erratic readings persist in a buffered solution, the chlorine sensor may need service. Inspect the membrane and the wooden junction for damage, and replace them if necessary. Also ensure that the sensor is filled with electrolyte. Recalibrate the sensor. Check the pH sensor for noisy operation. Place the sensor in buffer. If pH readings in the buffer are noisy, replace the sensor. If pH readings in the buffer are quiet, but are noisy when the buffer is stirred, replace the sensor. Also check the response of the sensor in a stirred and quiescent sample of the process stream. If readings are stable in the quiescent solution, but noisy in the stirred solution, replace the sensor.
pH output and alarm options are not available under menus	<ol style="list-style-type: none"> No pH board is installed in the analyzer; therefore, the options are not available. If the analyzer was retrofitted with a pH board, see the instruction sheet supplied with the board for the procedure for configuring the board.
pH sensor has wrong or no response to pH changes	<ol style="list-style-type: none"> Verify that the pH sensor has the proper preamplifier and is correctly wired to the analyzer. Check performance of pH sensor in buffer (see Section 5.3.6). Perform pH simulation. If analyzer responds to simulated pH but not to the sensor, replace the sensor.
Display is scrambled or all line segments are lit. Current outputs work properly.	Replace the display board.
Display is scrambled or all line segments are lit. Current outputs do not work and/or relays are chattering.	Replace the chlorine CPU board.
Analyzer does not respond or responds improperly to key presses.	<ol style="list-style-type: none"> Verify that the ribbon cable between the keypad and the display board is firmly seated in the display board connector. Replace front panel.
No display	<ol style="list-style-type: none"> Verify that the proper AC power is being supplied to the analyzer. Check the fuses on the power supply board. Replace fuses if necessary. Verify that the display board is properly connected to the other boards. Replace the power supply board.
No chlorine current output, but pH current output is working	<ol style="list-style-type: none"> Verify that the output terminals are not shorted. Voltage with no load connected across TB3-1 and TB3-2 should be about 15 Vdc. Replace power supply board. Replace chlorine CPU board.
No pH current output, but the chlorine current output is working	<ol style="list-style-type: none"> Verify that the output terminals are not shorted. Voltage with no load connected across TB3-3 and TB3-4 should be about 15 Vdc. Replace pH CPU board.
No pH and chlorine current outputs.	<ol style="list-style-type: none"> Verify that the output terminals are not shorted. Voltage with no load connected across the chlorine output (TB3-1 and TB3-2) and the pH output (TB3-3 and TB3-4) should be about 15 Vdc Call factory service for assistance.
Low chlorine and/or pH current	Check for excessive loading on the output circuit. Maximum load is 600 ohms.
Analyzer does not compensate for pH changes.	Verify that automatic pH correction is on.
Analyzer does not compensate for temperature changes.	<ol style="list-style-type: none"> Verify that automatic temperature correction is on. Check response of chlorine sensor RTD (see Section 8.2.5)

SECTION 9.0 RETURN OF MATERIALS

GENERAL. To expedite the repair and return of instruments, proper communication between the customer and the factory is important. A return material authorization (RMA) number is required. Call (949) 757-8500 or (800) 854-8257. A Return of Materials Request form is provided for you to copy and use in case the situation arises. The accuracy and completeness of this form will affect the processing time.

WARRANTY REPAIR. To return product under warranty:

1. Contact the factory for authorization.
2. Complete a copy of the Return of Materials Request form as completely and accurately as possible.
3. To verify warranty, supply the factory sales order number or the original purchase order number. In the case of individual parts or sub-assemblies, the serial number on the mother unit must be supplied.
4. Carefully package the materials and enclose your Letter of Transmittal and the completed copy of the Return of Materials Request form. If possible, pack the materials in the same manner in which they were received.

IMPORTANT

Please see second section of Return of Materials Request Form . Compliance to the OSHA requirements is mandatory for the safety of all personnel. MSDS forms and a certification that the equipment has been disinfected or detoxified are required.

5. Send the package prepaid to:

Rosemount Analytical Inc.
Uniloc Division
2400 Barranca Parkway
Irvine, CA 92606

Attn: Factory Repair

Mark the package:

Returned for Repair RMA No. _____

Model No. _____

NON-WARRANTY REPAIR.

1. Contact the factory for authorization.
2. Fill out a copy of the Return of Materials Request form as completely and accurately as possible.
3. Include a purchase order number and make sure to include the name and telephone number of the individual to be contacted should additional information be needed.
4. Do Steps 4 and 5 of Warranty Repair section

NOTE

Consult the factory for additional information regarding service or repair.

WARRANTY

Seller warrants that the firmware will execute the programming instructions provided by Seller, and that the Goods manufactured or Services provided by Seller will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first. **Consumables, such as glass electrodes, membranes, liquid junctions, electrolyte, o-rings, catalytic beads, etc., and Services are warranted for a period of 90 days from the date of shipment or provision.**

Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products.

If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, promptly correct any errors that are found by Seller in the firmware or Services, or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services.

All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources, unsuitable environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by an authorized Seller representative. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller.

Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller. Except as otherwise expressly provided in the Agreement, THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

RETURN OF MATERIAL

Material returned for repair, whether in or out of warranty, should be shipped prepaid to:

**Emerson Process Management
Liquid Division
2400 Barranca Parkway
Irvine, CA 92606**

The shipping container should be marked:

Return for Repair

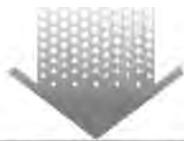
Model _____

The returned material should be accompanied by a letter of transmittal which should include the following information (make a copy of the "Return of Materials Request" found on the last page of the Manual and provide the following thereon):

1. Location type of service, and length of time of service of the device.
2. Description of the faulty operation of the device and the circumstances of the failure.
3. Name and telephone number of the person to contact if there are questions about the returned material.
4. Statement as to whether warranty or non-warranty service is requested.
5. Complete shipping instructions for return of the material.

Adherence to these procedures will expedite handling of the returned material and will prevent unnecessary additional charges for inspection and testing to determine the problem with the device.

If the material is returned for out-of-warranty repairs, a purchase order for repairs should be enclosed.



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the right answers,
right now.*

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