Instruction Manual
PN 51-1054BT/rev.B
April 2003

Model 1054B T

Toroidal Conductivity Microprocessor Analyzer

ROSEMOUNT® Analytical

EMERSON™ Process Management

ESSENTIAL INSTRUCTIONS
READ THIS PAGE BEFORE PROCEEDING!

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.

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.

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.

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

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

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

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.

WARNING

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

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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

NEBEZPECNE NAPETI

Muze zpusobit vazne zraneni nebo smrt. Odpojte napajeni pred udrzbou

VAROVANI

Zemnici vodic musi byt vodive spojen s kostrou pristroje. Pouzivejte nehorlave vodotesne pruchodky, abyste zachovali stupen kryti pristroje.

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 forskruning 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 preserver la classification du boîtier.

OSTRZEZENIE

NIEBEZPIECZNE NAPIECIE

Moze spowodowac uszkodzenie ciala lub smierc.Odlacz zasilanie przed przystapieniem do prac.

UWAGA

Uziemij przewod do metalowego plaskownika lub obudowy. Aby zachowac stopien szczelnosci obudowy stosuj niepalne, wodoszczelne dlawiki.

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 onderhoudswerk zaamheden uitvoert.

Voorzichtig

Aardleiding naar metalen profiel of naar metalen behuizing. Gebruik onbrandbare, waterdichte wartels en pluggen orn 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 bucins e acessórios ignífugos e estanques para preservação da estanquecidade.

About This Document

This manual contains instructions for installation and operation of the Model 1054BT Toroidal Conductivity Analyzer.

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

Rev. Level	Date	Notes
A	3/99	This is the initial release of the product manual. The manual has been reformatted to reflect the Emerson documentation style and updated to reflect any changes in the product offering.
B	4/03	CE certification updated (page 2)

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MODEL 1054B T
TOROIDAL CONDUCTIVITY MICROPROCESSOR ANALYZER

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DESCRIPTION AND SPECIFICATIONS

1.1 GENERAL DESCRIPTION

The Rosemount Analytical Model 1054B T Microprocessor Analyzer is designed to monitor and control acids, bases and salts in industrial applications such as acid or caustic dilution, rinse tank control in metal plating operations, leak detection in boiler condensate return lines and control of total dissolved solids in water to prevent scale formation.

The Model 1054B T is housed in a NEMA 4X (IP 65) enclosure suitable for panel, pipe or wall mounting. All analyzer functions are accessed via the Model 1054B T's tactile-feedback membrane keyboard. All analyzer settings are protected against accidental or unauthorized changes by a user selected security code. The display indicates conductivity, temperature, temperature slope, and output current, as well as alarm status, hold output and fault conditions. Field wiring is easily accessed by removing the rear cover.

1.2 PERFORMANCE SPECIFICATIONS
(Analyzer Only)

Measurement Range: From 0-50 µS/cm to 0-2,000 mS/cm

Resolution: 0.05% of full scale reading

Repeatability: ±0.25% of output range

Accuracy: ±0.5% of measurement range

Stability: ±0.25% of output range over 30 days, non-cumulative

Temperature Coefficient:
Input: ±0.03%/°C of reading

Output: ±0.04%/°C of reading

Temperature Compensation: Pt 100 RTD
Automatic or Manual: 0 to 200°C (32-392°F)

Temperature Slope Adjustment: (continuously adjustable) 0-5%/°C

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

Span: Span from 10% to 100% full scale

Zero Suppression: Up to 90% full scale

Ambient Temperature: -20 to 65°C (-4 to 149°F)

1.3 PHYSICAL SPECIFICATIONS

Enclosure: Black ABS (Acrylonitrile Butadiene Styrene), NEMA 4X, IP 65; CSA Enclosure 4

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 keyboard with tactile feedback.

Digital Display: LCD, black on grey

Optional -Red LED

Character Height: 18 mm (0.7 in.)

Dimensions: 144 x 144 x 192 mm (5.7 x 5.7 x 7.6 in.) DIN Size

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 1, Div. 2, Group A thru D

28 Vdc, 110 Vac & 230 Vac relays

5.0 Amps resistive only

Wall Mount Enclosure (code -20): General Purpose

EMI/RFI: EN61326 CE

LVD: EN61010-1

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

200 - 253 VAC, 50/60 Hz ±6%, 4.0 W

Code -20 Wall Mount Enclosure does not meet CE requirements

*Includes latches and mounting feet

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

Dual Set Points, continuously adjustable, 0-2,000 mS/cm.

High alarm adjustable up to 25% of full scale hysteresis on the low side.

Low alarm adjustable up to 25% of full scale hysteresis on the high side.

Relays: Epoxy sealed FORM A contacts, SPST, Normally Open.

	Resistive	Inductive
28 VDC	5.0 Amps	3.0 Amps
115 VAC	5.0 Amps	3.0 Amps
230 VAC	5.0 Amps	1.5 Amps

Relative Humidity: LED: 0-95% RH, LCD: 0-85% RH

Weight/Shipping Weight:
2.5 lb/3.5 lb (1.1 kg/1.6 kg)
(Does not include optional mounting brackets)

RECOMMENDED TOROIDAL SENSORS:

	FULL SCALE	
	Minimum	**Maximum**
Model 222 Sensor	0-500 µS/cm	0-2000 mS/cm
Model 225 Sensor	0-250 µS/cm	0-1000 mS/cm
Model 226 Sensor	0-50 µS/cm	0-2000 mS/cm
Model 228 Sensor	0-250 µS/cm	0-2000 mS/cm

SECTION 2.0
INSTALLATION

2.1 GENERAL. This analyzer's enclosure is suitable for outdoor use. However, it 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 damaged, notify the carrier immediately. Confirm that all items shown on the packing list are present. Notify Rosemount Analytical if items are missing.

2.3 MECHANICAL INSTALLATION. Select an installation site that is at least one foot from any high voltage conduit, has easy access for operating personnel, and is not in direct sunlight.

Select the applicable procedure for the mechanical mountings described in Sections 2.3.1 through 2.3.4.

2.3.1 Panel Mounting (standard). The Model 1054B is designed to fit into a DIN standard 137.9 mm (5.43 in.) x 137.9 mn (5.43 in.) panel cutout. See Figure 2-1 for case and cutout dimensions.

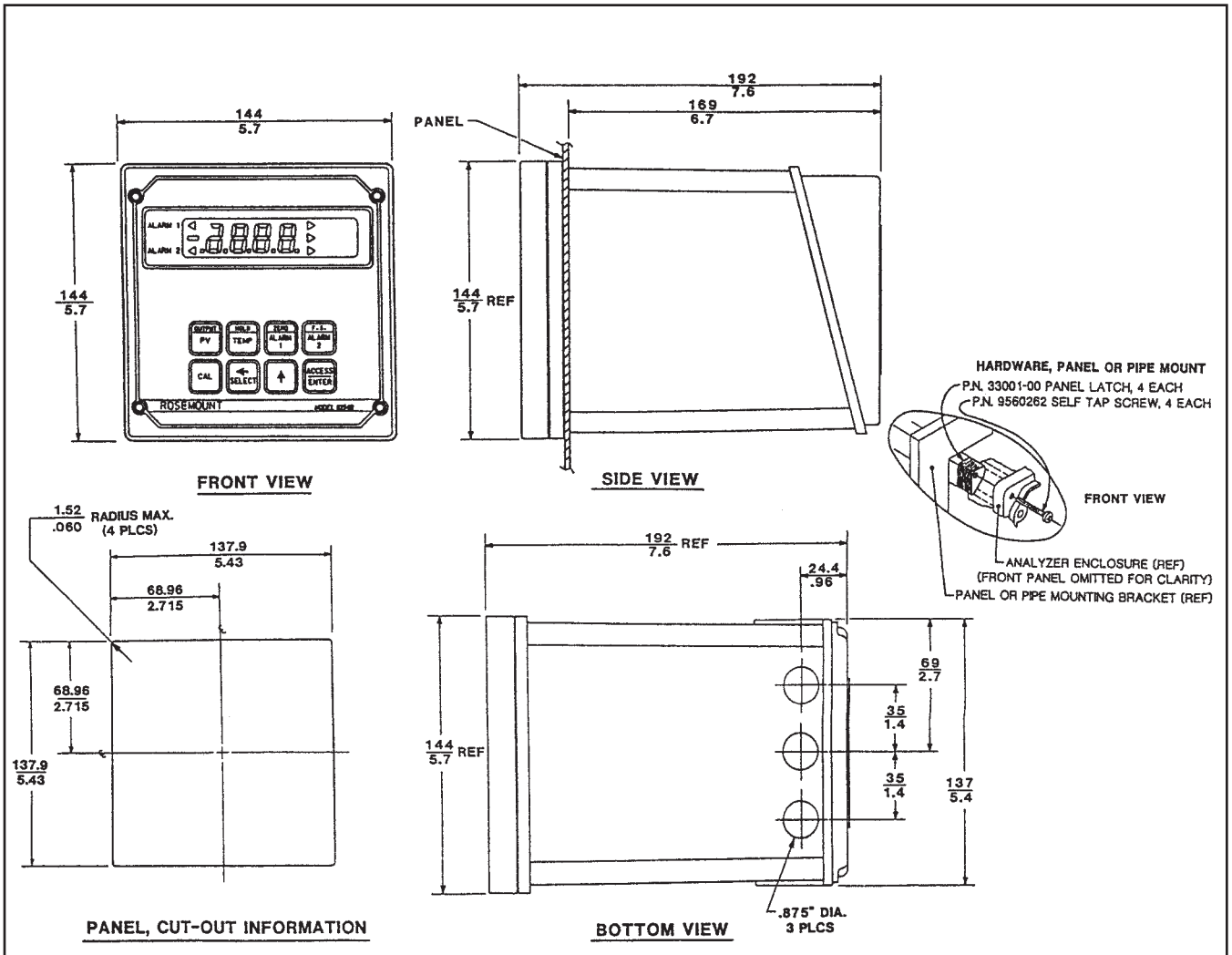


FIGURE 2-1. Case and Cutout Dimensions

1. Remove four screws holding front panel assembly.
2. Carefully pull the front panel assembly and connected printed circuit boards straight out.
3. Remove the three conduit mounting knockouts. (Leave back on while removing.)

NOTE

Step 4 may have to be done from the rear of the panel after completing Step 6. Assure that the continuity wire is connected to the rear cover and the interface board's closest mounting screw before replacing cover.

4. Remove back, mount conduit fittings and route wires into case. Route Input power through center knockout, Output lines through left knockout (as viewed from the rear), and Sensor lines through the right knockout.
5. Refer to Section 2.4.1 for input power wiring, Section 2.4.2 for Output wiring, and Section 2.4.3 for Sensor wiring instructions.
6 Insert case into panel cutout and fasten with the four mounting tabs. See Figure 2-2 for help.
7. Carefully replace front panel assembly with printed circuit boards.
8. Replace and tighten four front panel mounting screws.

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

1. Remove four screws holding front panel assembly.
2. Carefully pull the front panel assembly and connected printed circuit boards straight out.
3. Remove the three conduit mounting knockouts. (Leave back on while removing.)
4. Remove back cover; assemble case, metal stiffener, weather seals, junction box and mounting plate as illustrated in Figure 2-3.
5. Connect 1054B analyzer to junction box terminal strip (TB-A) as shown under Point-to-point wiring diagram in Figure 2-4.
6. Route sensor leads in through the left conduit opening (facing open junction box). Current output, alarms and Power through the right conduit opening.
7. Refer to Point-To-Point Wiring diagram in Figure 2-4 for connections from input power, output signals, and contact sensors.
8. Assure that the continuity wire is connected to the rear cover and the interface board's closest mounting screw. Replace instrument back cover.
9. Replace junction box cover and mount plate to wall.
10. Replace front panel assembly. Replace and tighten four screws holding front assembly to case.

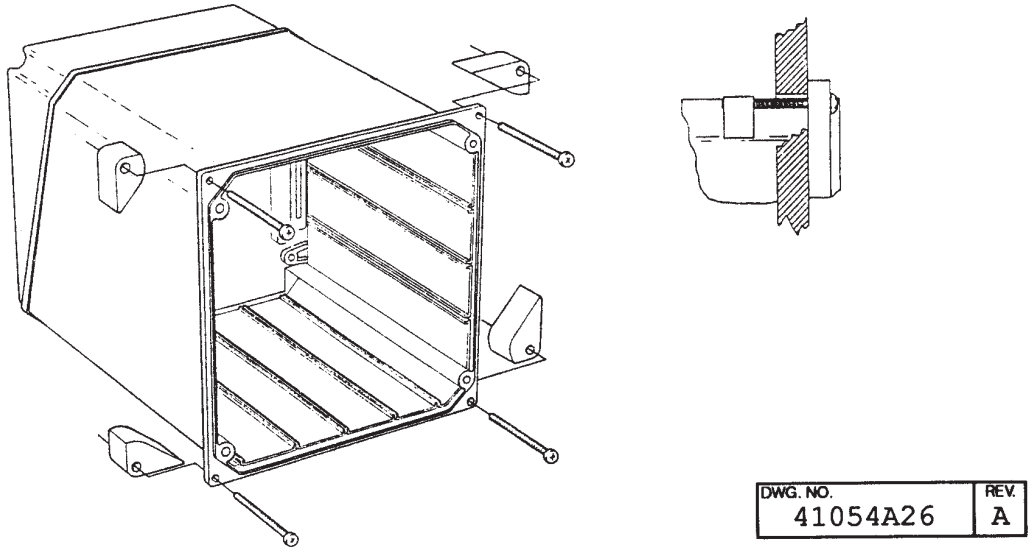
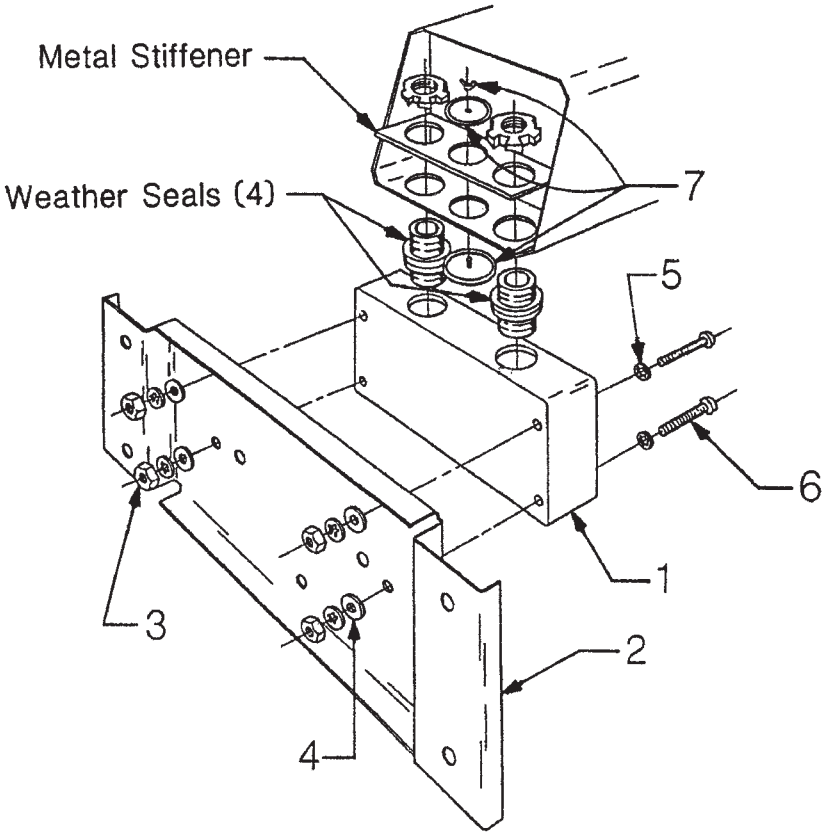


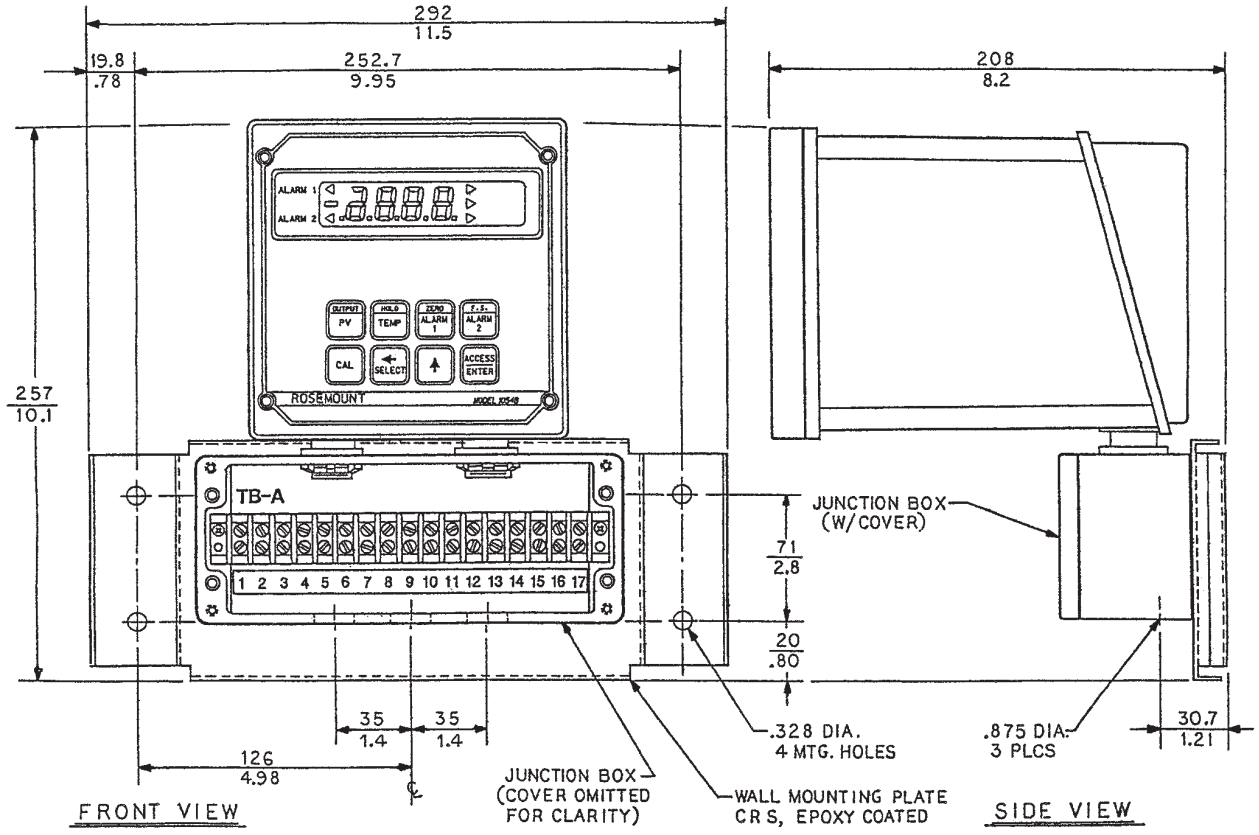
FIGURE 2-2. Panel Mounting Tab Installation

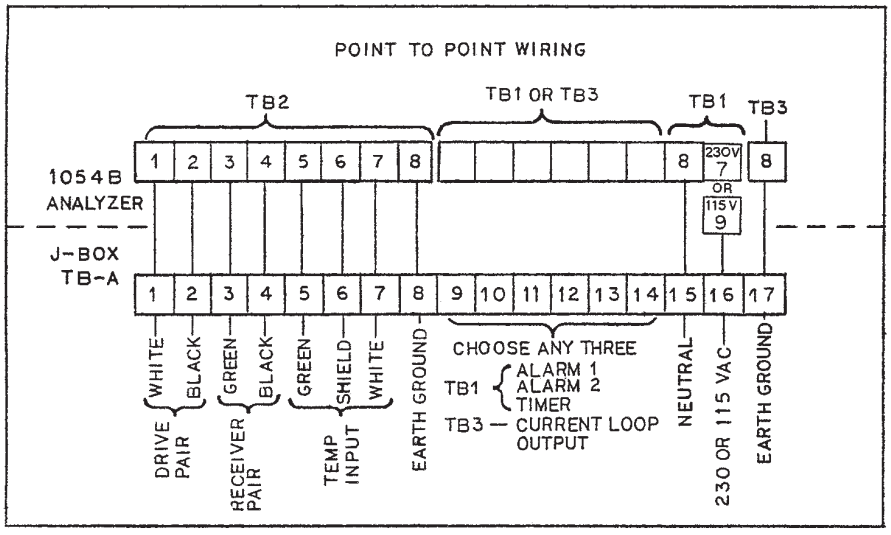


ITEM	PART NUMBER	DESCRIPTION	QTY
1	23058-01	S Assy, J-Box	1
2	33030-00	Bracket, wall mtg	1
3	9900600	Nut, 6-32 Hex	4
4	9910600	Washer, Flat #6	4
5	9910610	Washer, Lock Int. #6	8
6	9600612	Screw, 6-32 X .75	4
7	9510048	Seal, Weathertight	1

DWG. NO.	REV.
41054A27	A

FIGURE 2-3. Wall Mounting with Junction Box Installation





DWG. NO.	REV.
41054B15	B

FIGURE 2-4. Wiring to a Junction Box

2.3.3 Pipe Mounting (PN 23053-00). The 2-in. pipe mounting bracket includes a metal plate with a cutout for the analyzer. Mounting details are shown in Figure 2-5. To Install:

1. Mount plate with the two U-bolts provided in the kit. Tighten U-bolt nuts to allow the plate to be pivoted for ease of wiring.
2. Remove back, mount conduit fittings and route wires into case. Route Input power and alarm in the left knockout (as viewed from the rear), Signal output lines through center knockout, and Sensor lines through the right knockout.
3. Refer to Section 2.4.1 for input power wiring, Section 2.4.2 for signal output wiring, and Section 2.4.3 for sensor wiring instructions.
4. Assure that the continuity wire is connected to the rear cover and the interface board's closest mounting screw. Replace back field terminal board cover.
5. Position mounting bracket in final position and tighten U-bolt nuts to hold in place.

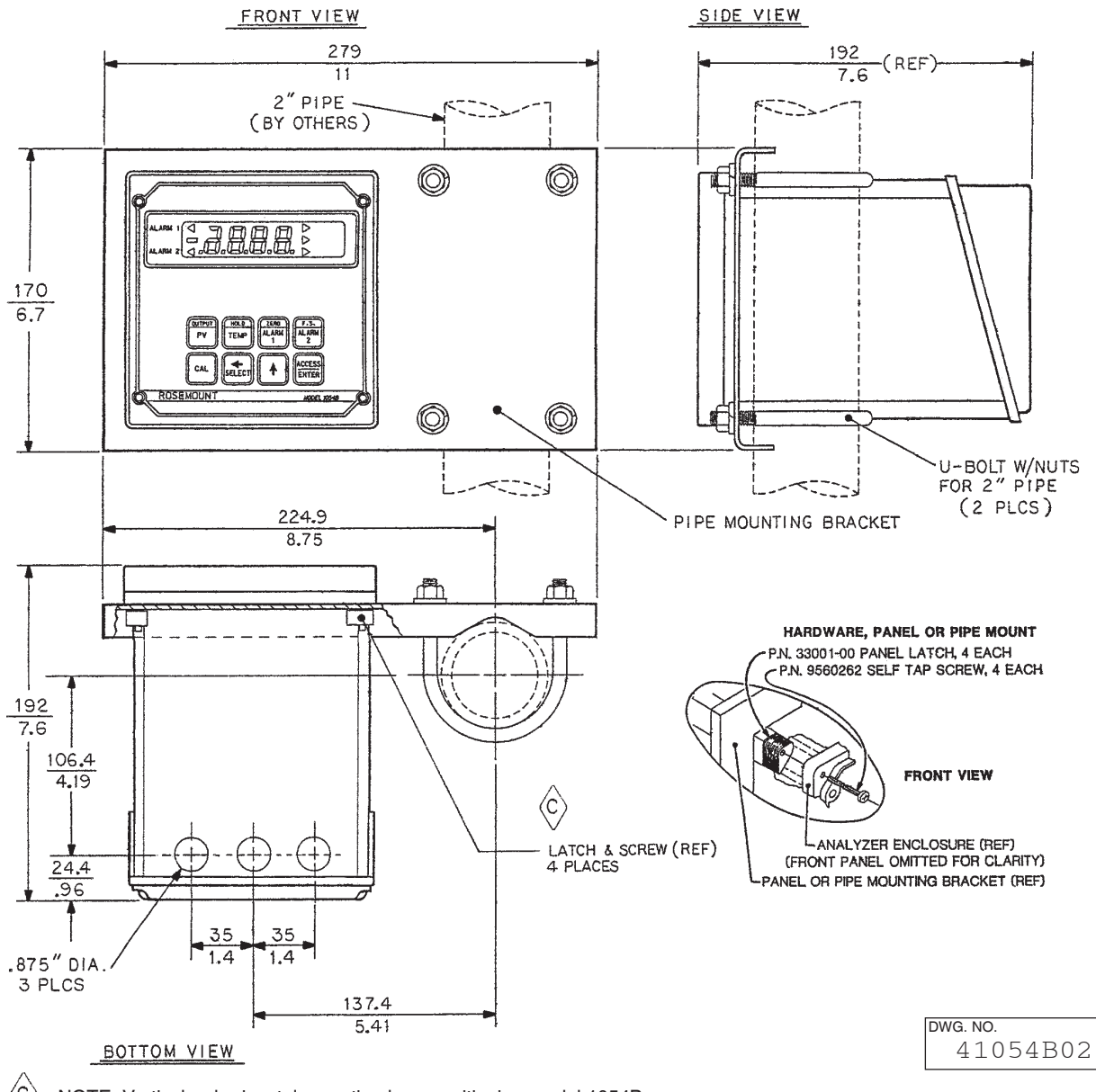


FIGURE 2-5. Pipe Mounting Installation

2.3.4 Wall Mounting Enclosure (Option -20). Refer to Figure 2-6. In this configuration, the analyzer is housed in NEMA 4X heavy duty enclosure and may be mounted on a wall or handrail. Sufficient clearance should be provided in front of the enclosure to permit opening the door, which is hinged on the left side.

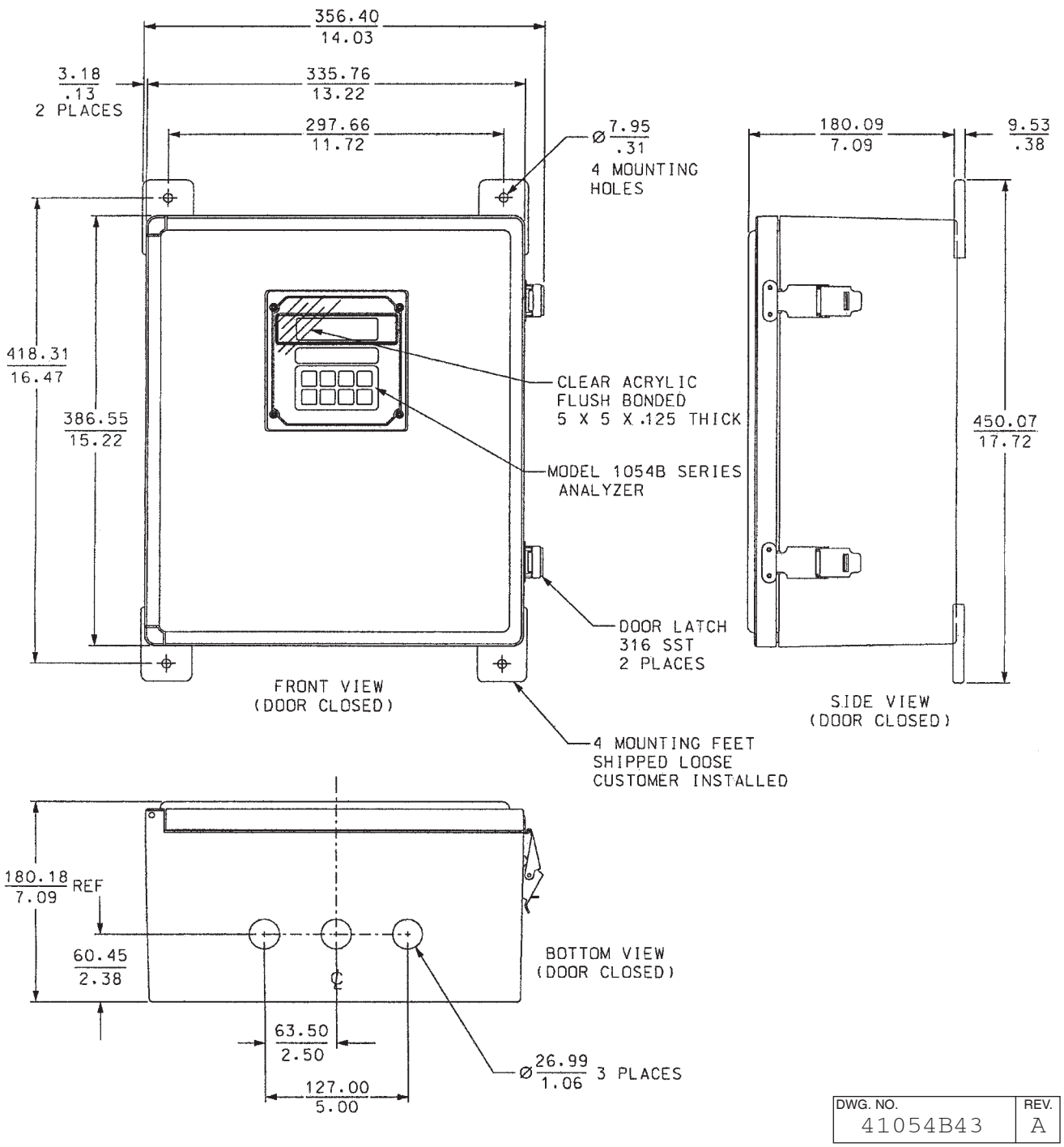


FIGURE 2-6. Wall Mount Enclosure (Option -20)

2.4 ELECTRICAL WIRING. Location of power, alarms, output current, and sensor signals on analyzer terminal blocks are shown in Figure 2-7. Connect wires starting from bottom of terminal block to permit better visibility of terminal block numbering. AC wiring should be 14 gauge or greater.

NOTE

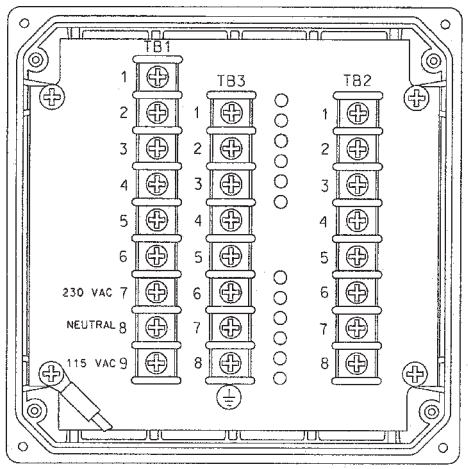
For maximum EMI/RFI protection the output cable should be shielded and enclosed in an earth grounded, rigid metal conduit. When wiring directly to the instrument connect the output cable's outer shield to the transmitter's earth ground via terminal 8 on TB3, Fig. 2-7. When wiring to the wall mounting junction box connect the output cable's outer shield to the earth ground terminal on TB-A, Fig. 2-3.

The sensor cable should also be shielded. When wiring directly to the instrument connect the sensor cable's outer shield to the transmitter's earth ground via terminal 8 of TB2, Fig. 2-7. If the sensor cable's outer shield is braided an appropriate metal cable gland fitting may be used to connect the braid to earth ground via the instrument case. When wiring to the wall mounting junction box connect the sensor cable's shield to the earth ground terminal on TB-A, Fig. 2-3.

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.

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.



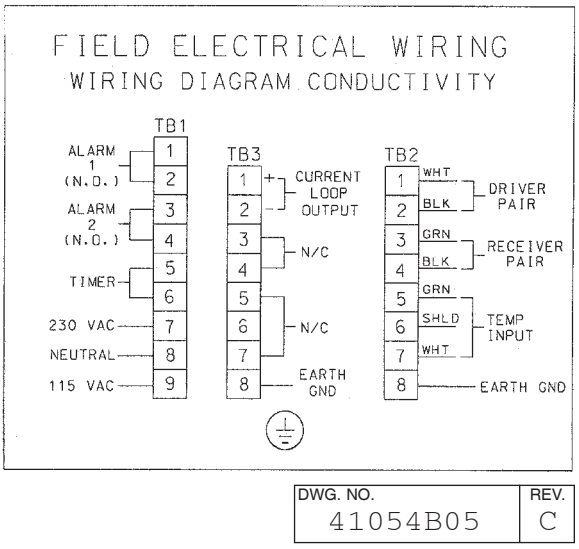


FIGURE 2-7. Terminal Board Connections

2.4.1 Input Power Wiring. The Model 1054B can be configured for either 115 VAC or 230VAC input power.

Connect AC power to TB1-8 and -9 (115 VAC) or TB1-7 and -8 (230 VAC), ground to TB3-8 as shown in Figure 2-7.

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 requirement of UL 514B are to be used.
5. Conduit hubs are to be connected to the conduit before the hub is connected to the enclosure, Ref UL 508-26.10.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.

2.4.2 Signal Output and Alarms. These signals are present on TB1 and TB3. Connect leads as shown in Figure 2-7. Route these wires out of the case through the left conduit opening (as viewed from the rear).

2.4.3 Sensor Wiring. Sensor wiring should be brought in from the right side (as viewed from the rear), closest to TB2, where sensor leads are attached.

Refer to Figure 2-7 for model 200 series sensor (code -54) connections to 1054B T.

Refer to Figure 2-8 for Model 200 Series sensors (code -55) connections to junction box input and output.

Assure that the continuity wire is connected to the rear cover and the interface board's closest mounting screw before replacing rear cover.

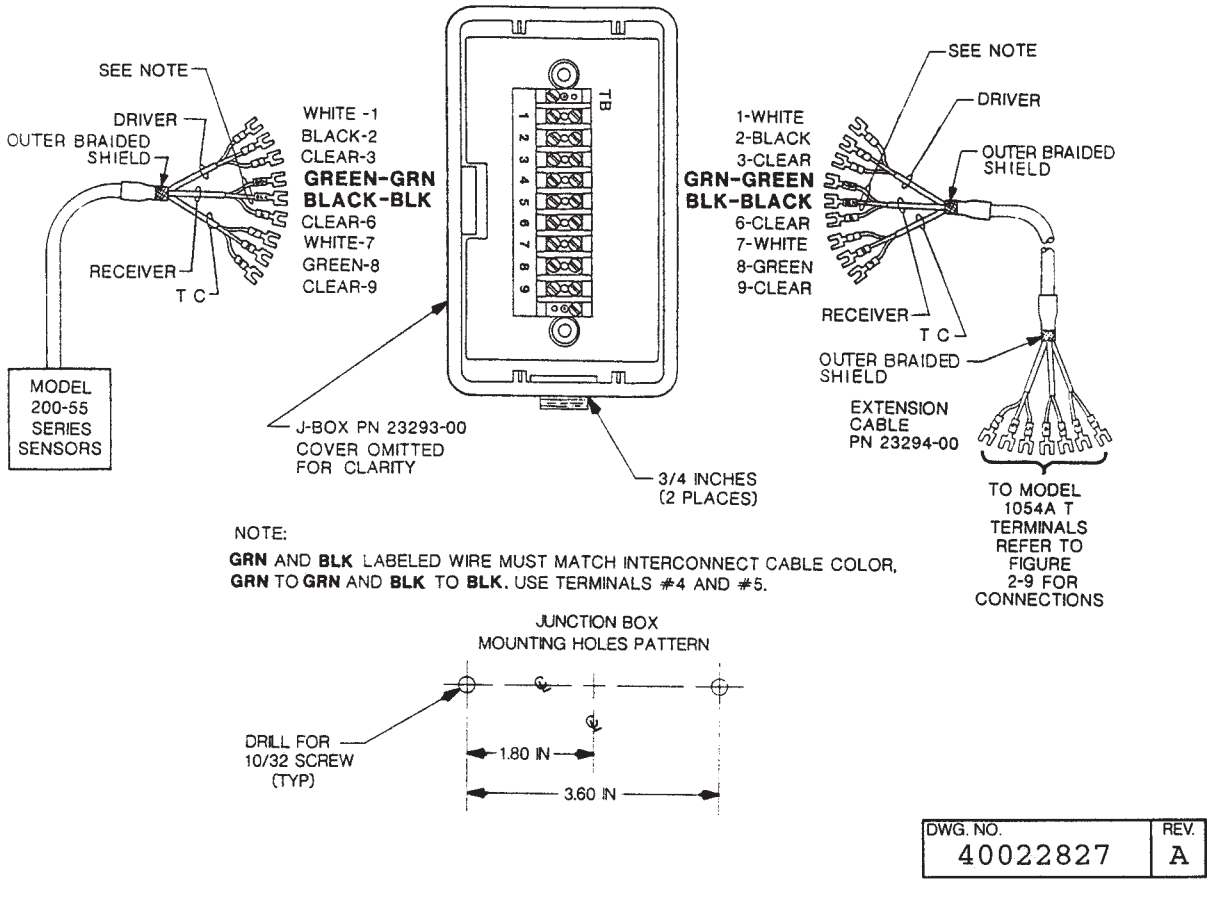


FIGURE 2-8. Code-55 Sensor Wiring to Junction Box

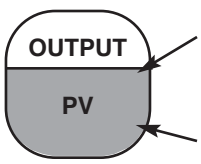
SECTION 3.0
DESCRIPTION OF CONTROLS

3.1 KEYBOARD FUNCTIONS. All operations of the Model 1054B T microprocessor Analyzer are controlled by the eight (8) keypads on the front of the instrument. These keypads are used to :

1. Display parameters other than the primary parameter.
2. Edit setpoints for alarms, set up specific output current value for simulation, calibrate temperature, conductivity, etc.
3. Configure display for temperature units, for automatic temperature compensation, alarm usage, setting timer functions, security, and output range.

3.2 VIEW PARAMETERS. To view parameters other than the primary parameter (but not change), find the keypad with the parameter to be changed and press either once or twice. As shown in Figure 3-1, a single keypress accesses the lower parameter printed on the keypad, while quick, double keypresses access the top.

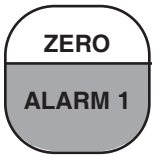
3.3 EDIT PARAMETERS. To edit the displayed parameters, requires the pressing of the SELECT keypad while the parameter is displayed. The mnemonic AdJ will appear briefly and the value will return with the digit that can be edited flashing. See Figure 3-2.



Quick double press will access the current output current value in mA or %. **Read only.**

Single press of the keypad will access the present Conductivity reading. **Read only.**

FIGURE 3-1. Function select on keypad.



1. Press Key twice.
2. Lo shows briefly.
3. Zero point is displayed.

1. Press Key.
2. AdJ shows briefly.
3. Numbers show with digit flashing.

FIGURE 3-2. Accessing Editing Function

To adjust the value displayed, use the SELECT/Shift (🡐) key to select the displayed menu or shift to the next digit.

To scroll through the menu selected, or digits on the flashing numeric display, press the SCROLL (🡑) key.

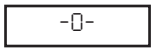
3.4 CONFIGURE DISPLAY. Configuration of the instrument display is made through the Set Menu program See Figure 4-1 in the next section.

To access these set menus the ACCESS keypad is pressed **TWICE** in **RAPID** succession.

1. Press twice in rapid succession.

2. See SEt on display. Confirms entry into set mode menu.

3. First menu item is displayed. Analyzer now ready to configure.



4. Use the SCROLL keypad to rotate through the available menus

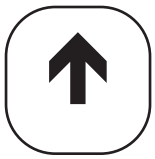


FIGURE 3-3. Accessing Configuration Menus

Once inside the Set mode menu, use the scroll keypad to scroll through the menu list. When the menu desired is displayed, release the scroll keypad. See Figure 3-3.

To enter the next menu level press the SELECT keypad. If this menu allows editing, the item that can be edited will be flashing. If not, use the scroll keypad to scroll through this list of submenus. SELECT will enter the next menu level , and if it can be edited, the field will flash.

To exit the menu and SAVE the new value, press the ENTER keypad (once).

To exit the menu without saving the edited value, press the PV keypad. To change other parameters will require re-entering the set menu program.

Figure 3-4 shows the meaning the various fields surrounding the Primary process on the LC display.

Table 3-1 is provided for a quick review of;

1. parameters available with the eight keypads
2. number of times to press the keypad to access each parameter
3. function of the keypad when used in conjunction with the SELECT key or the Set Menu functions.

Table 3-2 describes the information mnemonics used.

Table 3-3 describes the set function mnemonics used.

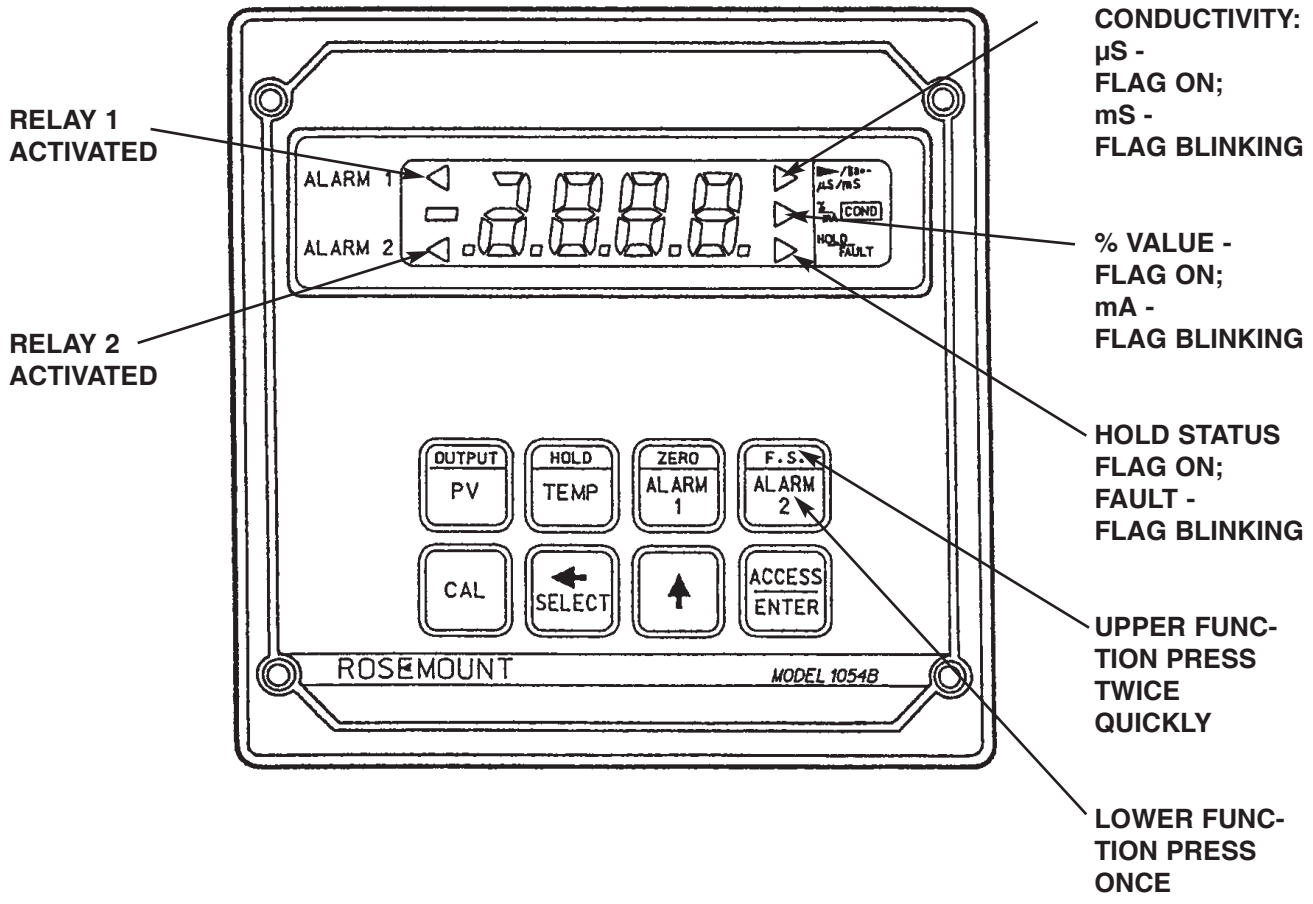


FIGURE 3-4. LCD Display

	MAIN FUNCTION (PRESS ONCE)	SECOND FUNCTION (PRESS TWICE)
OUTPUT / PV	Displays - conductivity. Set Function (w/SELECT) - One point standardization of conductivity. (PV = Process Variable)	Displays - current output (mA or % full scale). Set Function (w/SELECT) - Simulates current output.
HOLD / TEMP	Displays - process temperature (°C or °F). Set Function (w/SELECT) - One point standardization of temperature.	Initiates or removes analyzer from hold condition.
ZERO / ALARM 1	Displays - Alarm 1 setpoint. Set Function (w/SELECT) - Sets Alarm 1 setpoint.	Displays - low current output setpoint. Set Function (w/SELECT) - Sets low current (4 or 0 mA) output point.
F.S. / ALARM 2	Displays - Alarm 2 setpoint. Set Function (w/SELECT) - Sets Alarm 2 setpoint.	Displays - full scale output setpoint. Set Function (w/SELECT) - Sets full scale (20 mA) output point.
CAL	Two Point Calibration	Displays - temperature slope in percent. Set Function (w/SELECT) - manually sets temperature slope.

← SELECT	Select sub menu (mnemonic display) Shift to next digit (numeric display)
↑	Scroll through menu (mnemonic display) Scroll digits (numeric display) Scroll decimal position and µS/mS flag Holding key down autoscrolls digits or set menu items
ACCESS / ENTER	Press twice to access set-up menu Enter displayed value into memory Enter displayed menu item (flashing) into memory

TABLE 3-1. Key Description

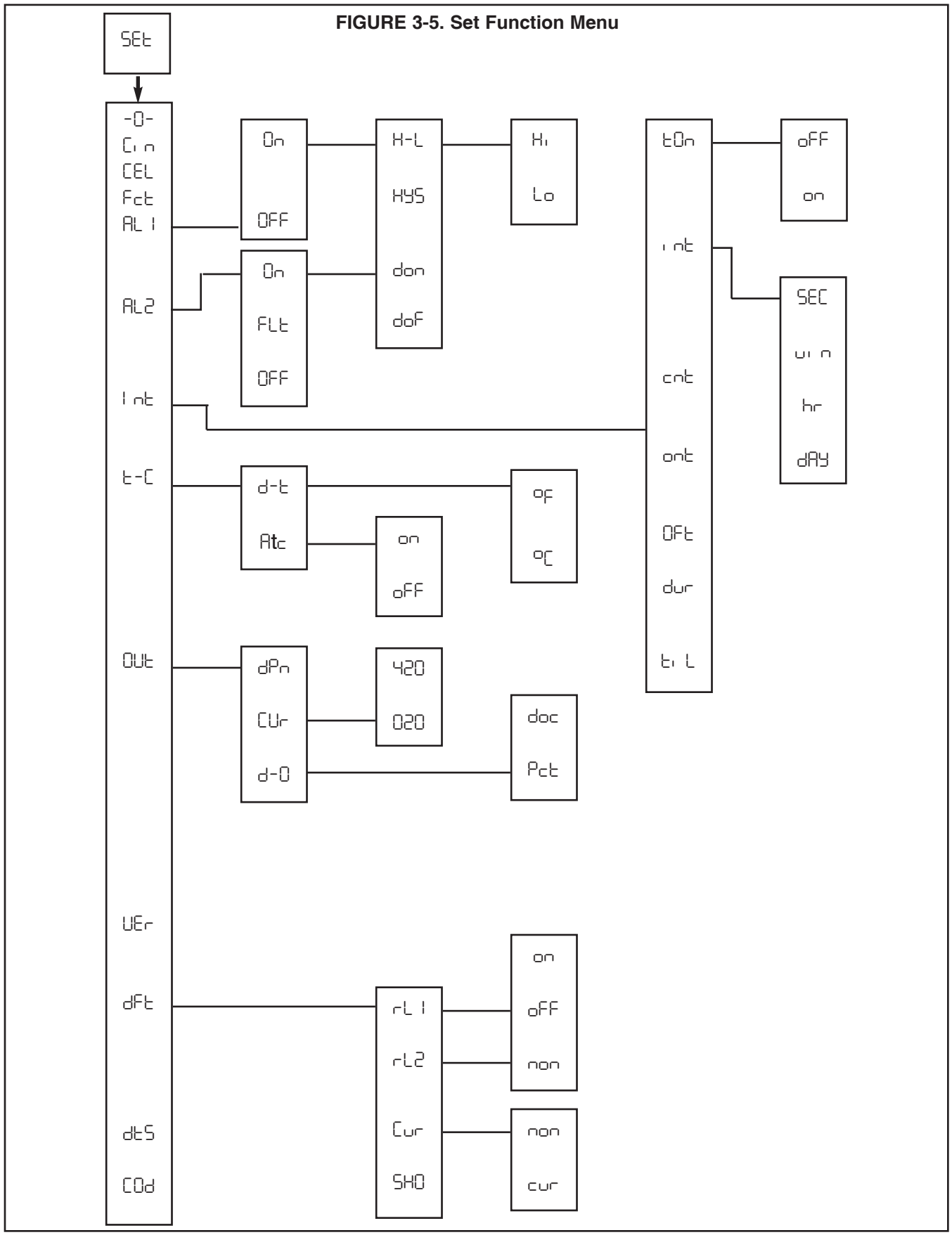
TABLE 3-2. Information Mnemonics

MNEMONIC	DESCRIPTION
AdJ	Adjustment to value reading
bAd	Incorrect entry
Con	Conductivity Display
HLd	Analyzer in hold position
HI	Displays high range value for current output
ı tr	Interval timer activated
LO	Displays low range value for current output
LOC	Access locked – enter security code
Pct	Displays conductivity output (percent)
SEt	Set mode
S ı P	Simulates current output (percent)
S ı C	Simulates current output (mA)
SLP	Displays temperature slope
SP 1	Displays Alarm 1 setpoint
tP 1	Displays Alarm 2 setpoint
tP2	Standardize conductivity
1 St	Calibration Point 1
2nd	Calibration Point 2

TABLE 3-3. Set Function Mnemonics

AL 1	Alarm 1 setup	dtS	LCD/LED Display test	Pct	Display output in percent
AL2	Alarm 2 setup	dur	Timer duration	rL 1	Relay 1 fault setup
Atc	Automatic temp. comp.	°F	Temperature °F	rL2	Relay 2 fault setup
CEL	Cell Constant	FCt	Calibration Factor	SEC	Seconds
°C	Temperature °C	FLt	Use alarm as fault alarm	SHO	Show fault history
C ı n	Display Sensor input	H ı	Relay action - high	t-C	Temperature config.
COd	Security Code	H-L	Alarm logic	t ı L	Timer - time remaining
cnt	Timer count	hr	Hours	tOn	Timer status
CUr	Config. current output	HYS	Hysteresis	UEr	Software version
Cur	Config. fault output	ı nt	Interval period	u ı n	Minutes
cur	Default current set point	Int	Timer setup	420	4mA to 20mA output
dAY	Days	Lo	Relay action - low	020	0mA to 20mA output
dFt	Fault Configuration	non	No action on fault		
d-O	Display output	-0-	Zero sensor		
d-t	Display temperature	oFF	Alarm not used		
doc	Display output in mA	ont	Timer on time		
doF	Alarm delay off time	On	Use alarm as process alarm		
don	Alarm delay on time	OFt	Timer off time		
dPn	Dampen output	OUt	Current output setup		

FIGURE 3-5. Set Function Menu



SECTION 4.0
CONFIGURATION

4.1 GENERAL. This section details all of the items available in the Set Mode to configure the analyzer to a specific application.

4.1.1. Configuration Worksheet. The configuration worksheet on page 17 should be filled out before proceeding with the analyzer's configuration. This sheet gives a brief parameter description, the factory setting, and a space for user setting.

4.1.2 Set Mode. Display Mnemonic SEt**.** Most of the analyzer's configuration is done while in the Set Mode. Please refer to Figure 3-5 for the layout of all menu items. All menu variables are written to the analyzer's EEPROM (memory) when selected and remain there until changed. As these variables remain in memory even after the analyzer's power is removed, the analyzer configuration may be performed prior to installing it.

1. Power up the analyzer. Only power input wiring is required for analyzer configuration (Refer to Section 2.4.1). The analyzer's display will begin showing values and/or fault mnemonics. All fault mnemonics will be suppressed while the analyzer is in Set Mode (the fault flag will continue to blink).

2. Enter Set Mode. Pressing the **ACCESS** key twice in rapid succession will place the analyzer in Set Mode. The display will show SEt to confirm that it is in Set Mode. It will then display the first item in the set menu. The analyzer is now ready for user configuration.

   NOTE:
   If LOC displays, the Keyboard Security Code must be entered to access the Set Mode. (Refer to Section 6.0.)

3. Analyzer variables can be entered in any order. On initial configuration, however, it is recommended that the variables be entered in the order shown on the worksheet. Refer to the configuration worksheet (Table 4-1). This will reduce the chance of accidentally omitting a needed variable.

TABLE 4-1. Configuration Work Sheet

Use this work sheet to assist in the configuration of the analyzer.

	RANGE	FACTORY SET	USER SET
A. Alarm 1 Setup (AL 1)			
1. Alarm Status (On/OFF)		On	_____
2. High or Low (H-L) (Hi /Lo)		Lo	_____
3. Hysteresis (HYS)	0-25 % of setpoint	0.00%	_____
4. Delay Time On (don)	0-255 sec.	000 Seconds	_____
5. Delay Time Off (doF)	0-255 sec.	000 Seconds	_____
B. Alarm 2 Setup (AL2)			
1. Alarm Status (On/FLt/OFF)		On	_____
2. High or Low (H-L) (Hi /Lo)		Hi	_____
3. Hysteresis (HYS)	0-25 % of setpoint	0.00%	_____
4. Delay Time On (don)	0-255 sec	000 Seconds	_____
5. Delay Time Off (doF)	0-255 sec	000 Seconds	_____
C. Interval Timer (i nt)			
1. Active Status (tOn) (oFF/on)		oFF	_____
2. Interval Time (i nt)	minimum 10 minutes	1 Day	_____
3. Count (cnt)	1 to 60	5	_____
4. On Time (ont)	0 to 299 sec	1 Second	_____
5. Off Time (OFt)	0 to 299 sec	1 Second	_____
6. Duration (dur)	0 to 299 sec	2 Seconds	_____
D. Temperature Setup (t-C)			
1. Display Temperature (d-t) (°C/°F)		°C	_____
2. Automatic Temp. Comp. (Atc) (on/oFF)		on	_____
a. Manual Temp. Value	-20°C to 200°C		_____
E. Current Output Setup (OUt)			
1. mA Output (CUr) (020/420)		420	_____
2. Display Current Output (d-O) (Pct/doc)		doc	_____
3. Dampen Current Output (dPn)	0-255 sec.	0.0 Seconds	_____
F. Default Setup (dFt)			
1. Relay 1 Default (rL 1) (non/oFF/on)		non	_____
2. Relay 2 Default (rL2) (non/oFF/on)		non	_____
3. Current Output Default (Cur) (non/cur)		non	_____
			_____
G. Keyboard Security Setup (COd)			
1. Keyboard Security Required	001-999	_	_____
2. Keyboard Security Not Required	000	000	_____
H. Alarm Set Points			
1. Alarm 1 (SP 1)	0-2,000 mS	0.00 mS	_____
2. Alarm 2 (SP 2)	0-2,000 mS	1,000 mS	_____
I. Current Output			
1. Zero (0 or 4 mA) (Lo)	0-2,000 mS	0.00 mS	_____
2. F.S. (20 mA) (Hi)	0-2,000 mS	1,000 mS	_____

4.2. ALARM 1 AND 2. Display Mnemonic AL 1 or AL2. Used to set alarm relay logic. The alarms may be used to perform on-off process control. See note below.

A. ON. Display Mnemonic On. Select this item if Alarm 1 or 2 is to be used as a process alarm. See Steps D through G for further configuration.

B. OFF. Mnemonic OFF. Select this item if alarm 1 or 2 will not be used or to temporarily disable the alarm. Alarm 1 or 2 setpoint will display oFF if this item is selected. Omit Steps D through G.

C. Fault. Display Mnemonic FLt. (Alarm 2 only). Select to make Alarm 2 a fault alarm. Relay 2 will energize when the unit shows a fault condition. See Table 8-1 for a listing of the fault mnemonics and their descriptions. Alarm 2 setpoint will display FIt if this item is selected. Omit Steps D through G.

D. Alarm Logic. Mnemonic H-L. Select this item for high or low alarm logic. High logic activates the alarm when the reading is greater than the set point value. Low logic activates the alarm when the reading is less than the set point value.

E. Relay Hysteresis. Display Mnemonic HyS. Sets the relay hysteresis (dead band) for deactivation after reading has passed the alarm set point. May be set from 0 to 25%. Use hysteresis when a specific conductivity should be reached before alarm deactivation.

F. Delay Time On. Display Mnemonic don. Sets time delay for relay activation after alarm set point is reached. May be set from 0 to 255 seconds.

G. Delay Time Off. Display Mnemonic doF. Sets time delay for relay deactivation after alarm set point is reached. May be set from 0 to 255 seconds. Alarm state restarts time from zero. Use when a fixed time should pass before relay deactivation occurs.

4.2.1 Alarm Configuration (AL 1/AL2). Refer to Figure 4-1.

1. Enter Set Mode by pressing **ACCESS** key twice.
2. **SCROLL** (↑) until AL 1 or AL2 appears on the display.
3. **SELECT** to move to the next menu level. On, OFF or (AL2 only) FLt will display.
4. **SCROLL** (↑) to display desired item then **SELECT**.
5. If OFF is selected, display will show oFF to acknowledge. Press **ENTER** key to return to AL 1 or AL2, concluding routine. Skip to Step 11.

   If On is selected, display will show on to acknowledge, then display H-L. Proceed to Step 6.

   If FLt is selected, display will show FIt to acknowledge. Press **ENTER** key to return to AL2.
6. **SELECT** H-L. Hi or Lo will display (flashing).
7. **SCROLL** (↑) to the desired item and ENTER it into memory. Display will return to H-L. If changes to relay activation logic are desired, proceed to Step 8, otherwise Step 12.
8. **SCROLL** (↑) to display HyS, don or doF then **SELECT** desired item. Numerical display will flash to indicate that a value is required.
9. Use **SCROLL** (↑) and **SHIFT** (←) to display the desired value.
10. **ENTER** value into memory. The analyzer will acknowledge and return to display of last item selected. Repeat Step 8 if further changes are desired, otherwise Step 12.
11. Repeat Step 3 for the other Alarm's settings as required.
12. To return to the first level of the Set Mode, Press the **ACCESS** key.

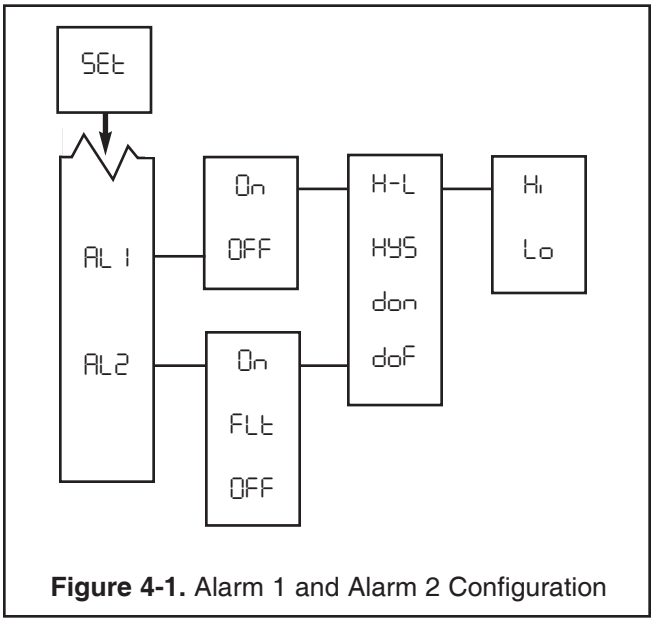


Figure 4-1. Alarm 1 and Alarm 2 Configuration

4.3 INTERVAL TIMER. Display Mnemonic int. This item is used to set the interval timer's relay logic. The timer can be used for sensor maintenance, such as a wash cycle to clean the sensor in a bypass line. Choices are:

A. Interval Timer Enable/Disable. Display Mnemonic tOn. Select this item to begin interval cycle on or disable interval cycle oFF.

B. Interval Period. Display Mnemonic int. Select this item to set the time period between control cycles. SEC for seconds, min for minutes, hr for hours, and dAY for days. May be set from a minimum of 10 minutes.

C. On Periods Per Cycle. Display Mnemonic cnt. Select this item to enter the number of on periods per cycle. May be set from 1 to 60 on periods.

D. Duration of On Periods. Display Mnemonic ont. Select this item to enter the relay activation time for each on period. May be set from 0.1 to 299.9 seconds.

E. Duration of OFF Periods. Display Mnemonic OFt. Select this item to enter the relay deactivation time between each on period during the control cycle. Valid when cnt is 2 or greater. May be set from 0 to 299.9 seconds.

F. Sensor Recovery Time. Display Mnemonic dur. Select this option to enter the duration time after the last on period in a cycle. May be set from 0 to 299.0 seconds. The wait duration can be used for electrode recovery after a wash cycle.

G. Interval Time remaining. Display Mnemonic ti L. Select this item to display the time remaining to the next control cycle. If selected during the control cycle, display will show ---.

NOTE

The Model 1054B is placed *on hold* during the control cycle (from first on period through the wait duration). The analyzer will simulate a fault condition and briefly show int every eight seconds. The display will continue to show the measured value.

4.3.1 Interval Timer Configuration (int).
Refer to Figures 4-2 and 4-3.

1. Enter Set Mode by pressing **ACCESS** Key twice.
2. **SCROLL** (↑) until int appears on the display.
3. **SELECT** to move to the next menu level. tOn will display.

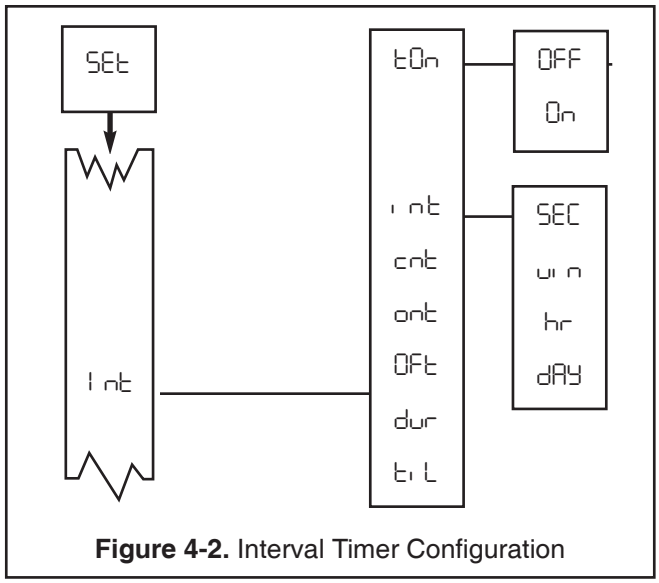


Figure 4-2. Interval Timer Configuration

4. **SCROLL** (↑) to display on or oFF and **ENTER** it into memory. If interval configuration is required, proceed to Step 5, otherwise Step 10.
5. **SCROLL** (↑) to display desired menu item. If int is selected, go to Step 6, otherwise Step 10.
6. **SCROLL** (↑) to display desired interval period and **SELECT** it. Numerical Display will flash.
7. **SCROLL** (↑) and **SHIFT** (←) to display the desired value and **ENTER** it into memory. Display will return to interval period menu.
8. Repeat Steps 6 and 7 as needed.
9. Press the **ENTER** key to return to the main timer menu.
10. **SELECT** the desired item. The Numerical Display will flash.
11. **SCROLL** (↑) and **SHIFT** (←) to display the desired value and **ENTER** it into memory.
12. Repeat Steps 5, 10, and 11 as required.
13. Press the **ENTER** key to return to Set Menu.

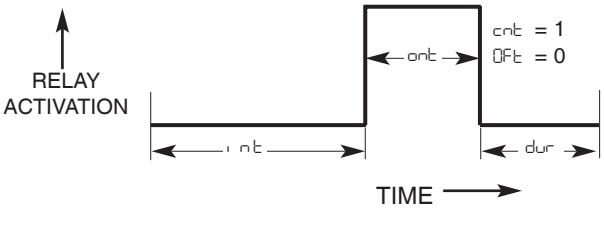


FIGURE 4-3. Timer Diagram for One Cycle

4.4 TEMPERATURE. Display Mnemonic t-C. Select this item for temperature reading and compensation choices.

A. Temperature Display. Display Mnemonic d-t. Select this item to toggle between °F and °C temperature display. The analyzer will show all temperatures in units selected until the selection is changed.

B. Automatic Temperature Compensation. Display Mnemonic Atc. The analyzer will use the temperature input from the sensor for temperature correction when on is selected. When oFF is selected, the analyzer will use the value entered by the user for temperature correction. This manual temperature option is useful if the temperature sensor is faulty or not on line. Temperature specific faults will be disabled (refer to Section 8.0).

4.4.1 Temperature Configuration (t-C)**.** Refer to Figure 4-4.

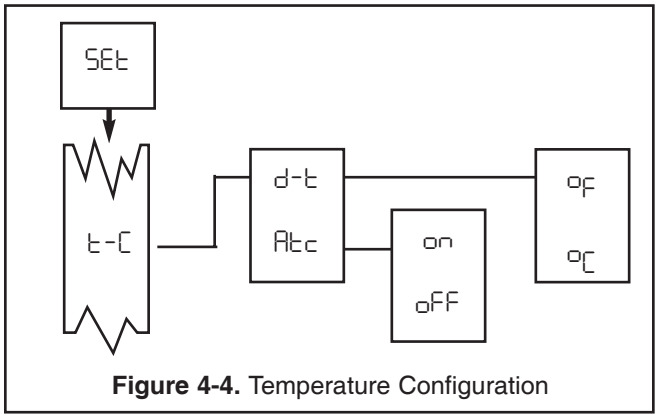


Figure 4-4. Temperature Configuration

1. Enter Set Mode by pressing **ACCESS** key twice
2. **SCROLL** (↑) until t-C appears on the display.
3. **SELECT** to move to the next menu level. d-t will display.
4. **SCROLL** (↑) to display desired item then **SELECT** it.
5. If d-t is selected, display will show °C or °F.

   If Atc is selected, display will show on or oFF.
6. **SCROLL** (↑) then **ENTER** desired item into memory.
7. If °C, °F or on are entered, display will return to the previous level (proceed to Step 9).

   If oFF is selected, numerical display will flash indicating that a process temperature value is required (proceed to Step 8).
8. Use **SCROLL** (↑) and **SHIFT** (←) to display the desired value. **ENTER** value into memory.
9. Repeat Steps 4-8 as required for other item.
10. Press the **ENTER** key to return to Set Menu.

4.5 CURRENT OUTPUT. Display Mnemonic is OUt. This item is used to configure the output signal.

A. Output Dampening. Display Mnemonic dPn. Dampens the response of the signal output. This option is useful to minimize the effect of a noisy reading. The number entered is the sample time (in seconds) for an averaged output. Zero to 255 seconds may be entered.

B. mA Output Range. Display Mnemonic CUr. Selection of this item will allow choice of 0 to 20 mA or 4 to 20 mA output range.

C. Display Output. Display Mnemonic d-0. This item is used to select logic of output display. Selecting this item will allow the analyzer to display current output as mA (doc) or as a percent of full scale output range (Pct).

4.5.1 Current Output Configuration OUt**.** Refer to Figure 4-5.

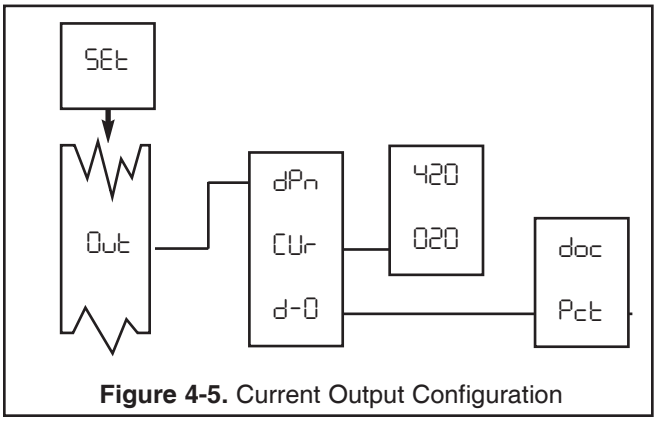


Figure 4-5. Current Output Configuration

1. Enter Set Mode by pressing the **ACCESS** key twice.
2. **SCROLL** (↑) until OUt appears on the display.
3. **SELECT** to move to the next menu level. dPn will display.
4. **SCROLL** (↑) then **SELECT** desired item.
5. If dPn is selected, numerical display will flash indicating that a value is required (proceed to Step 6).

   If CUr or d-0 is selected, proceed to Step 7.
6. **SCROLL** (↑) then **SHIFT** (←) to display the desired value. **ENTER** into memory
7. **SCROLL** (↑) then **ENTER** desired item.
8. Repeat Steps 4-7 as required.
9. Press the **ENTER** key to return to the Set Menu.

4.6 DEFAULTS. Display Mnemonic dFt. This item is used to set the configuration of relays and output default conditions during fault or hold status. See Table 8-1 for a listing of the possible fault conditions which can be diagnosed by the analyzer. A hold status is initiated by pressing the **HOLD** key twice. (Press twice again to remove the hold.)

A. Relay 1 and 2. Display Mnemonic rL1 and rL2. The relays can be set to activate on, deactivate oFF, or hold present status non. See Table 4-2.

B. Current Output. Display Mnemonic Cur.The current output is held non or goes to a specified value cur during a fault condition. cur will probably be the most informative selection.

C. Fault History. Display Mnemonic SHO. Selecting this item will display the most recent detected faults. Press the **SCROLL** key once for each previous fault history. Pressing **ACCESS** will clear SHO history.

4.6.1 Default Configuration (dFt). dFt Refer to Figure 4-6.

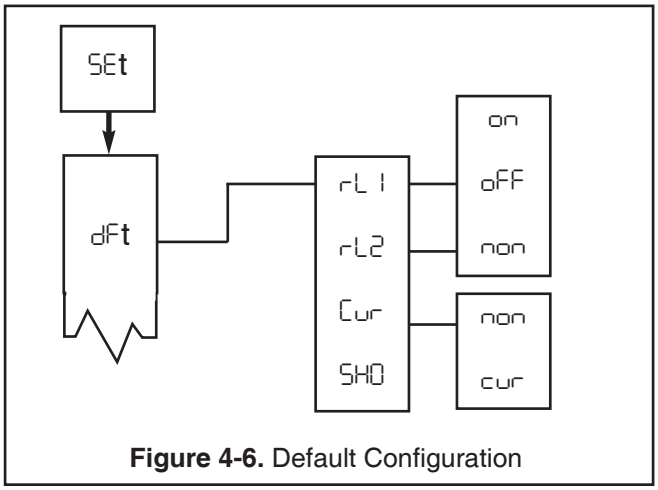


Figure 4-6. Default Configuration

1. Enter Set Mode by pressing the **ACCESS** key twice.
2. **SCROLL** (↑) until dFt appears on the display.
3. **SELECT** to move to the next menu level. rL1 will display.
4. **SCROLL** (↑) then **SELECT** desired item.
5. Display will show next item selection. **SCROLL** (↑) and **ENTER** desired item.
6. Repeat Steps 4 and 5 as required for other default settings rL2 and Cur. If cur is selected for Cur, press **ENTER** then use the **SCROLL** (↑) and **SHIFT** (←) keys to enter the desired current value in mA.
7. Press the **ENTER** key to return to Set Menu.

TABLE 4-2. Relay States for Various Conditions and Alarm/Default Configurations

Set Menu default (dFt) setting rL1 rL2	ANALYZER CONDITION								
	NORMAL			HOLD			FAULT		
	Set menu AL1 AL2 setting			Set menu AL1 AL2 setting			Set menu AL1 AL2 setting		
	On	OFF	FLt (Alarm 2 only)	On	OFF	FLt (Alarm 2 only)	On	OFF	FLt (Alarm 2 only)
on	Proc. det.	–	–	+	–	–	+	–	+
oFF	Proc. det.	–	–	–	–	–	–	–	+
non	Proc. det.	–	–	Proc. det.	–	–	Proc. det.	–	+

Proc. det.: Alarm state is determined by the process value.
+ : Relay will activate.
– : Relay will not activate.

Example: If you want the analyzer to activate relay 1 in hold mode during calibration, set AL1 to On in Section 4.3, and set rL1 to on.

4.7 ALARM SETPOINT. The alarm setpoints should be adjusted after completing the configuration procedure outlined in Sections 4.1 to 4.6 (refer to Figure 4-7).

1. Press the **PV** key to ensure that the analyzer is not in Set Mode.

2. Press the **ALARM 1** or **ALARM 2** key. SP 1 or SP2 will show briefly, followed by the Alarm 1 or Alarm 2 Setpoint.

NOTE:
If the alarm is set to OFF or FAULT (Alarm 2 only), the analyzer will display oFF or FIt respectively. (Refer to Section 4.2, Alarm Configuration.)

3. Press **SELECT** to adjust the value. The display will acknowledge briefly with AdJ followed by the Numeric Display with digit flashing.

4. **SCROLL** (↑) and **SHIFT** (←) to display the desired value.

5. **ENTER** value into memory.

6. Repeat Steps 2 to 5 for the second setpoint.

NOTE
Selection of µS/mS and decimal positions is achieved by pressing **SHIFT** (←) until the µS/mS flag flashes, then **SCROLL** (↑) until the desired combination of decimal position and mS (quick flashing)/µS (slow flashing) flag are displayed.

NOTE
Alarm logic may be changed from normally open (N.O.) to normally closed (N.C.) by cutting circuits (W5, W7, W9) on the power supply PCB and adding jumpers (W4, W6, W8).

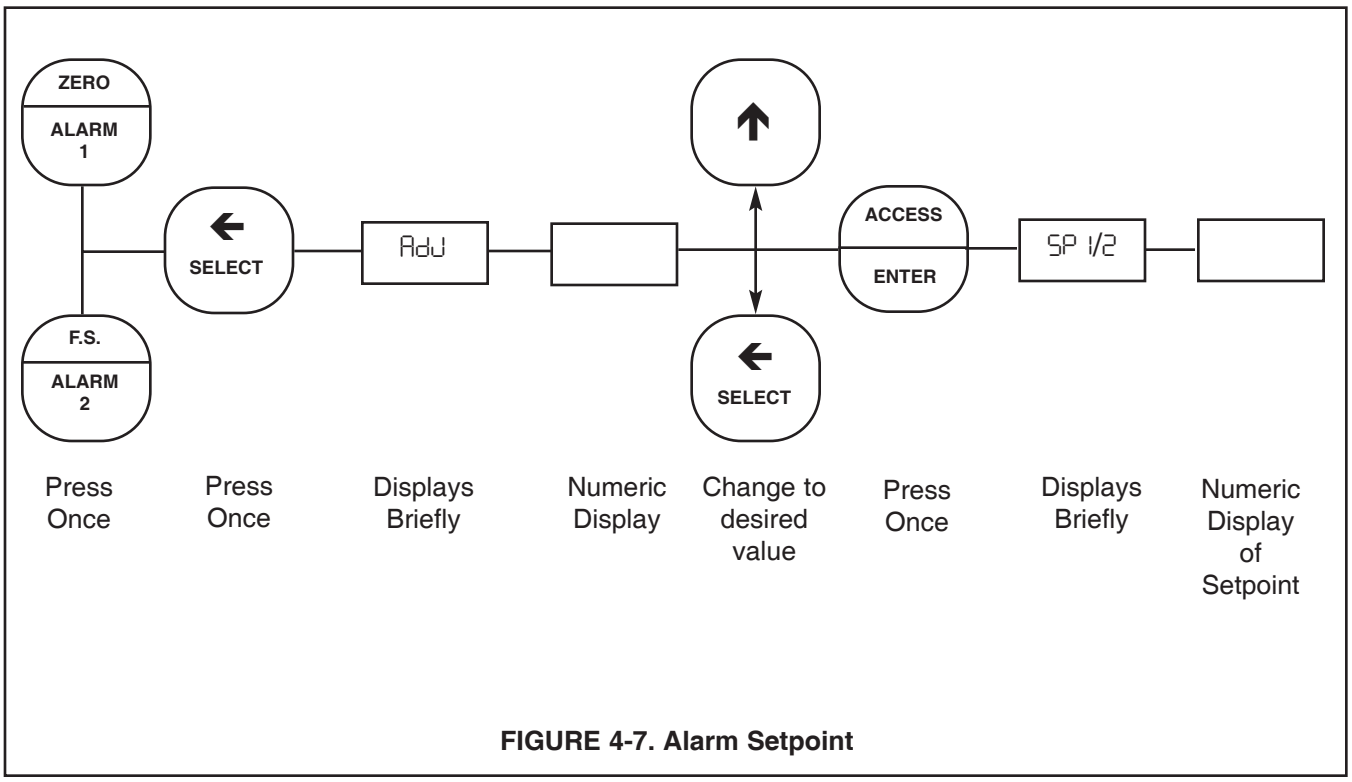


FIGURE 4-7. Alarm Setpoint

4.8 OUTPUT SCALE EXPANSION. This section should be followed if it is desired to scale the current output range other than the factory setting of 0-20 millisiemen. The output zero and full scale value should be adjusted after completing the configuration procedure as outlined in Sections 4.1 to 4.6 (refer to Figure 4-8).

A. ZERO POINT (0 mA or 4 mA) LO

1. Press the **PV** key to ensure that the unit is not in Set Mode.
2. Press the **ALARM 1** key twice. The display will show LO briefly then display the ZERO point.
3. Press **SELECT** to adjust the value. The display will acknowledge briefly with AdJ followed by the Numeric Display with digit flashing.
4. **SCROLL** (↑) and **SHIFT** (←) to display the desired value.
5. **ENTER** value into memory. The display will show LO and display the entered value.

B. Full Scale (F.S.) Point (20 mA) HI

1. Press the **PV** key to ensure that the analyzer is not in Set Mode.
2. Press the **ALARM 2** key twice. The display will show HI briefly then display the FULL SCALE point.
3. Press **SELECT** to adjust the value. The display will acknowledge briefly with AdJ followed by the Numeric Display with digit flashing.
4. **SCROLL** (↑) and **SHIFT** (←) to display the desired value.
5. **ENTER** value into memory. The display will show HI and display the entered value.

NOTE

For a reverse output, enter the higher value for zero, and the lower value for the Full Scale.

NOTE

Selection of µS/mS and decimal positions is achieved by pressing **SHIFT** (←) until the µS/mS flag flashes, then **SCROLL** (↑) until the desired combination of decimal position and mS (quick flashing)/µS (slow flashing) flag are displayed.

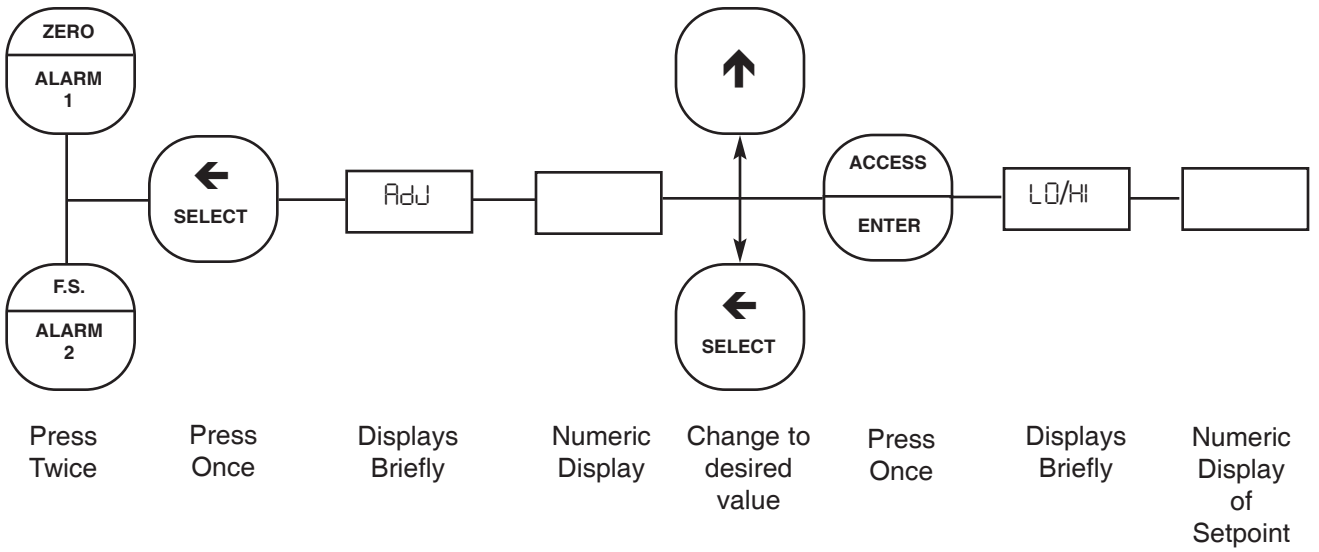


FIGURE 4-8. Output Scale Expansion

4.9 SIMULATE CURRENT OUTPUT. The output can be simulated to check the operation of devices such as valves, pumps, or recorders. The output can be simulated in either current (mA) or percent of full scale, depending on how the output display d-O was configured in Section 4-5 (refer to Figure 4-9).

A. Simulate Output in Percent SiP. The output can be simulated in percent if d-O in Section 4.5 was configured to display percent Pct.

1. Press the **PV** key once to insure that the analyzer is not in the Set Mode.

2. Press the **OUTPUT** key twice. The display will show Pct briefly, then display the output value in percent of full scale.

3. Press **SELECT** to simulate the output. The display will briefly acknowledge with SiP followed by the Numeric Display with digit flashing.

4. **SCROLL** (↑) and **SHIFT** (←) to display the desired value.

5. **ENTER** value into memory. The display will show Pct and display the entered value. Also, the display will flash to acknowledge that the analyzer is placed on hold HLd. In hold mode the relays will be set as determined in Section 4-6.

6. To remove the analyzer from hold, press the **HOLD** key twice. The hold flag on the display will be removed and the display will stop flashing.

B. Simulate Output in Current SiC. The output can be simulated in mA units if d-O in Section 4.5 was configured to display current doc.

1. Press the **PV** key once to insure that the analyzer is not in the Set Mode.

2. Press the **OUTPUT** key twice. The display will show dOC briefly, then display the output value in mA.

3. Press **SELECT** to simulate the output. the display will briefly acknowledge with Sic followed by the Numeric Display with digit flashing.

4. **SCROLL** (↑) and **SHIFT** (←) to display the desired value.

5. **ENTER** value into memory. The display will show dOC and display the entered value. Also, the display will flash to acknowledge that the analyzer is placed on hold HLd. In hold mode the relays will be set as determined in Section 4-6.

6. To remove the analyzer from hold, press the **HOLD** key twice. The hold flag on the display will be removed and the display will stop flashing.

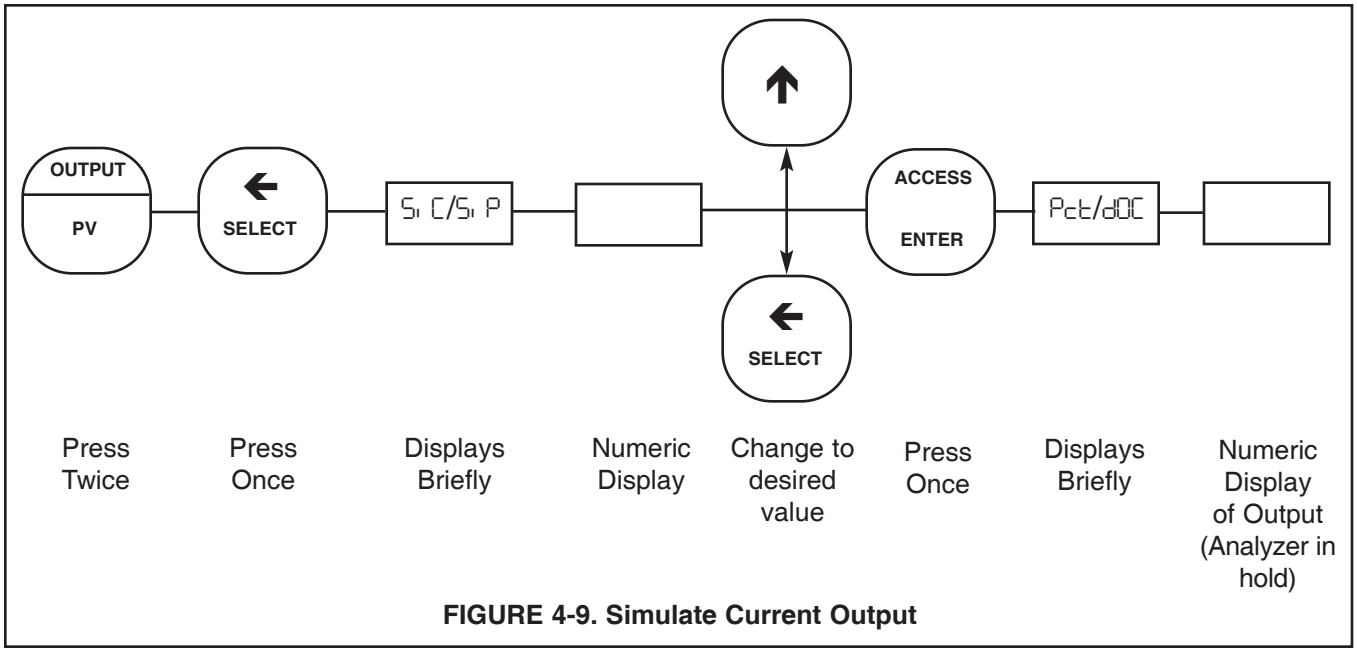


FIGURE 4-9. Simulate Current Output

SECTION 5.0
START-UP AND CALIBRATION

5.1 GENERAL. Calibration and operation of the Model 1054B T should begin only after configuration of the analyzer. The sensor must be wired (including junction box and interconnecting cable) as it will be in operation.

NOTE

READ THE ENTIRE CALIBRATION SECTION TO DETERMINE THE CALIBRATION PLAN MOST SUITABLE FOR YOUR NEEDS.

5.2 ENTERING THE CELL CONSTANT. The first time the analyzer is calibrated and any time there is a sensor change, the cell constant must be entered into memory. Entering a cell constant into memory will reset the cell factor FCt to 1.0 and will initiate the analyzer (The cell factor indicates sensor scaling. Refer to Section 8.2.6).

NOTE

The typical cell constants are as follows:

Model	Cell Constant
222 (1 in.)	6.0
222 (2 in.)	4.0
225	3.0
226	1.0
228	3.0

1. Enter the Set Mode by pressing the **ACCESS** key twice in rapid succession. The analyzer will display SEt briefly then display -0-.
2. **SCROLL** (↑) through the menu until CEL is displayed, then **SELECT** it. The Numeric Display will flash to indicate that a value is desired.
3. Use **SCROLL** (↑) and **SHIFT** (←) to key in the nominal cell constant and **ENTER** it into memory .

NOTE

Only reenter the cell constant when the conductivity sensor is replaced or serviced. Then perform a standardization (See Section 5.6.)

5.3 ZEROING THE SYSTEM. The 1054B T must calibrate the process zero point before the sensor is placed into the process solution.

CAUTION

DO NOT PLACE THE SENSOR IN PROCESS. The sensor must be placed into solution only after performing a system zero.

1. Assure that the sensor is properly wired and out of process (in air).
2. Enter the Set Mode by pressing the **ACCESS** key twice. The analyzer will display SEt briefly then show -0-.
3. **SELECT** -0-. The analyzer will now calculate the process zero point. This should take 10-20 seconds. -0- stops flashing when zero point is calibrated.
4. Place the sensor in solution and proceed with the system calibration.

5.4 TEMPERATURE CALIBRATION. For accurate temperature correction, the temperature reading may need adjusting. The following steps must be performed with the sensor in the process or in a grab sample. For the most accurate results, the standardization should be performed at or near operating temperature, especially if the distance between the analyzer and sensor is more than a few feet.

1. Observe the analyzer temperature reading by pressing the **TEMP** key. Allow the reading to stabilize to insure that the sensor has acclimated to the process temperature. This could take up to 10 minutes or more from room temperature because the RTD is imbedded in the plastic.
2. Compare the analyzer reading to a calibrated temperature reading device. If the reading requires adjusting, proceed to Step 3, otherwise, go to Section 5.5.
3. Press the **TEMP** key then the **SELECT** key to correct the temperature display. The analyzer will display AdJ briefly, then the Numeric Display will show with digit flashing.
4. **SCROLL** (↑) and **SHIFT** (←) to key in the correct value and **ENTER** it into memory. Proceed to Section 5.5.

5.5 INITIAL LOOP CALIBRATION. Please read the entire calibration section before proceeding to determine the best plan to follow.

A. Two Point Calibration - Standard Method. This is the recommended procedure for the initial calibration if the processes temperature slope is unknown. If any of the steps below are impossible or impractical, refer to the alternate Section 5.5 B. Please refer to the appropriate sensor manual for any additional appropriate instructions.

1. Obtain a grab sample of the process to be measured.

2. Determine the sample's conductivity using a calibrated bench or portable analyzer. The analyzer must be able to reference the conductivity to 25°C, or the solution must be measured at 25°C. **Note** the reading. Insure that the analyzer is in hold. Press the **HOLD** key twice and observe the solid flag.

3. Immerse the analyzer's sensor into the process solution. The sensor body must be held away from the bottom and sides of the sample's container and the sensor cable must not be allowed to contact the solution. Shake the sensor to ensure that no air bubbles are present.

4. Adjust the sample's temperature to either the normal high or normal low temperature of the process. To raise the sample's temperature, a hot plate with stirrer is recommended. To lower the process temperature, place the grab sample's container in an ice bath or let it slowly cool down.

5. Allow the sensor to acclimate to the solution. (The temperature reading should be stable. This could take up to 10 minutes or more because the RTD temperature element is imbedded in the sensor plastic).

6. Press the **CAL** key. 1St displays briefly (if 2nd displays, press **CAL** again), then the Numeric Adjustment window displays.

7. **SCROLL** (↑) and **SHIFT** (←) to key in the grab sample's conductivity value at 25°C as noted in Step 2, then **ENTER** into memory.

8. Adjust the sample's temperature to the other normal temperature extreme of the process. The minimum recommended temperature difference is 10°C (18°F). To raise the sample's temperature, a hot plate with stirrer is recommended. To lower the process temperature, place the grab sample container in an ice bath.

9. Allow the sensor to acclimate to the solution. (The temperature reading should be stable. This could take up to 10 minutes or more because the RTD temperature element is embedded in the sensor plastic).

10. Press the **CAL** key. 2nd displays briefly (If 1St displays, press **CAL** again), then the Numeric Adjustment window displays.

11. **SCROLL** (↑) and **SHIFT** (←) to key in the grab sample's conductivity value at 25°C as noted in Step 2, then **ENTER** into memory.

The analyzer will then calculate the true cell constant and the temperature slope then return to reading conductivity. The temperature slope of the process can now be read. Press the **CAL** key twice. The display will show SLP briefly then the calculated slope for the two calibration points (The value should be between 0 and 5%). Place the sensor in the process, then remove the analyzer from hold by pressing the **HOLD** key twice again.

The slope may be calculated from the following formula:

$$\%\ \text{SLOPE/°C} = \frac{\left(\frac{\text{Conductivity } T^{max}}{\text{Conductivity } T^{min}} - 1\right) X100}{\Delta T}$$

Where: Conductivity T^{max} is the conductivity at the maximum process temperature, Conductivity T^{min} is the conductivity at the lower process temperature, and the ³T is the difference between the maximum and minimum process temperature.

EXAMPLE:

$$\%\ \text{SLOPE/°C} = \frac{\left(\frac{45K}{35K} - 1\right) X100}{60\text{-}50=10} = 2.8\%/°C$$

B. Single Point Calibration - Slope Known. This is the recommended procedure for the initial calibration if the temperature slope of the process is known.

If you do not know the exact temperature slope value, but wish to approximate it, refer to the following guide. However, the conductivity reading may have reduced accuracy compared to the value if the procedure in Section A is performed.

Acids: 1.0 to 1.6% per °C
Bases: 1.8 to 2.2% per °C
Salts: 2.2 to 3.0% per °C
Water: 2.0% per °C

1. Press the **CAL** key twice. The analyzer will display SLP briefly, then show the temperature slope in memory.

2. **SELECT** to change the value. The analyzer will display AdJ briefly, then show the Numeric Display window.

3. **SCROLL** (↑) and **SHIFT** (←) to key in the proper temperature slope for the process to be measured, then **ENTER** into memory.

4. Obtain a grab sample of the process to be measured.

5. Determine the conductivity of the sample using a calibrated bench instrument or portable analyzer. The instrument must be able to reference the conductivity to 25°C or the solution must be measured at 25°C. Note the reading. Insure that the analyzer is in hold. Press the **HOLD** key twice and observe the solid flag.

6. Press the **PV** key once then press the **SELECT** key once. Std will display followed by the Numeric Display with digit flashing.

7. **SCROLL** (↑) and **SHIFT** (←) to key in the conductivity value you noted in Step 5, then **ENTER** it into memory.

8. Install the sensor in the process, then remove the analyzer from hold by pressing the **HOLD** key twice.

The analyzer will calculate the true cell constant after the initial calibration.

5.6 ROUTINE STANDARDIZATION. The sensor should be standardized routinely if it is suspected that the process might degrade or coat the sensor. After the initial calibration, each time a standardization is performed the cell factor FcE is changed. Refer to Section 8.2.6 for a description of the cell factor.

To perform a standardization do the following:

1. Take a grab sample which is as close to the sensor as possible. Write down the value the analyzer is reading at this time.

2. Measure the conductivity of the grab sample using a calibrated bench analyzer referenced to 25°C/77°F or measured at 25°C. Write down this value.

3. Before entering the reference value, note the value the analyzer is reading now and compare it to the value in Step 1. This accounts for the change while the grab sample is being measured.

4. Press the **PV** key once, then press **SELECT**. Std will display briefly followed by the Numeric display with flashing digit.

5. The corrected conductivity reference value (C_{RV}) value may be determined by multiplying the value in Step 2 (C_2) by the value noted in Step 3 (C_3) and dividing the product by the analyzer value from Step 1 (C_1):

$$\frac{C_2 \times C_3}{C_1} = C_{RV}$$

   Enter this corrected reference value in the analyzer using the **SCROLL** (↑) and **SHIFT** (←) keys. Then press **ENTER**.

6. Note the cell factor value FcE. Press the **ACCESS** key twice quickly. **SCROLL** (↑) to FcE press **SELECT** and note this value. Keep track of this value to determine a sensor cleaning schedule.

5.7 SENSOR MAINTENANCE. Before performing maintenance or cleaning of the sensor, the analyzer should be placed in hold. This will place the current output and relays in the states determined in Section 4.6. Before removing the sensor from the process, press the **HOLD** key twice. The **HOLD** flag will show to indicate the hold condition.

Always reenter the cell constant and restandardize (Sections 5.2 and 5.6) after cleaning or replacement of the sensor.

Replace the sensor back into the process and press the **HOLD** key twice again to remove the analyzer from hold. The hold flag will disappear.

SECTION 6.0
KEYBOARD SECURITY

6.1 GENERAL.

Display Mnemonic COd. Select this feature to display the user defined security code. Any three digit number may be used for this code. 000 will disable the security feature. This item is used to prevent accidental changes to the calibration and configuration of the analyzer. When activated, the analyzer will allow all read functions to read normally. If an attempt is made to change a value, LOC will display followed by the Numeric Display ready for the code to be entered. A proper code will unlock the analyzer and the analyzer will return to the last function attempted. Any incorrect value will result in bAd briefly displaying. The analyzer will then return to numeric display and await the entry of the code. Once unlocked, the analyzer will allow access to all functions until the analyzer is either powered down or no keystrokes are made for a period of 2 minutes. If the code should be forgotten, pressing and holding the **ACCESS** key for 5 seconds will result in display of the code. Releasing the **ACCESS** key, then pressing **ENTER** will unlock the analyzer.

6.2 PROCEDURE (COd).

1. Enter Set Mode by pressing **ACCESS** key twice.
2. **SCROLL** (↑) until COd appears on the display.
3. Press **SELECT.**
4. **SCROLL** (↑) and **SHIFT** (←) to display the desired value, then **ENTER** it into memory.

NOTE

Entering 000 disables the keyboard security.

NOTE

Security feature will not activate until 2 minutes without keyboard activity or power is removed from the analyzer then restored.

SECTION 7.0
THEORY OF OPERATION

7.1 THEORY OF OPERATION. This section is a general description of how the Model 1054B T analyzer operates. This section is for those users who desire a greater understanding of the analyzer's operation.

The basic conductivity measurement is made using two toroids. The first toroid (transmitter) induces a voltage (drive voltage) in the liquid loop. The second toroid (receiver) senses the current in the liquid loop resulting from this induced voltage. By keeping the number of turns (windings around each toroid) and the drive voltage across the transmitter toroid constant the current in the liquid loop is directly proportional to the conductivity of the loop.

The actual value of the drive voltage generated by the Model 1054B T (either 1 volt peak-to-peak or 0.1 volt peak-to-peak) is determined by the conductivity being measured. The current sensed by the receiver toroid is converted at the instrument to an AC voltage through a high performance amplifier. This voltage is further converted to a DC time-proportional signal which is used by the microprocessor to measure and compute absolute conductivity. The microprocessor also measures the raw DC voltage used to generate the drive voltage and the zero input at the time-proportional converter. These measurements are used to correct for ambient temperature and line voltage variations.

The Model 1054B T compensates the conductivity to 25°C using the temperature measured by a PT-100 RTD located in the conductivity sensor. The microprocessor also adjusts the amount of correction required for temperature compensation by means of a temperature slope adjustment. This slope may be adjusted between 0-5%/°C either manually via the keyboard or automatically during bench or process calibration. This slope controls the amount of correction required in the temperature compensation circuit, and is specific to the process, giving you the most accurate conductivity reading possible.

The Model 1054B T can provide conductivity measurements below 50 uS/cm and as high as 2000 mS/cm full scale over a process temperature range of 0 to 200°C.

Rosemount Analytical also offers a booklet titled Conductance Data for Commonly Used Chemicals. This booklet includes conductance information for commonly used chemicals.

SECTION 8.0
DIAGNOSTICS AND TROUBLESHOOTING

8.1 DIAGNOSTICS. The Model 1054B T has a diagnostic feature which automatically searches for fault conditions that would cause an error in the measured conductivity value. If such a condition occurs, the current output and relays will act as configured in Section 4.6 and the fault flag and display will flash. A fault code mnemonic will display at frequent intervals. If more than one fault condition exists, the display will sequence the faults at one second intervals. This will continue until the cause of the fault has been corrected. Display of fault mnemonics is suppressed when in Set Mode. Selecting the SHO item will display a history of the two most recent fault conditions unless SHO was cleared. Refer to Section 4.6.

NOTE

If the analyzer is in hold and a fault occurs, the Mnemonic HLd will display during the fault sequence.

8.1.1 Fault Mnemonics. Table 8-1 lists the fault mnemonics and describes the meaning of each.

TABLE 8-1. FAULT MNEMONICS

Display	Description
EEP	EEPROM write error (bad EEPROM chip).
CHS	ROM failure (check sum error) (bad ROM chip).
Orn	Overrange.
SEn	Sensor line error or wire length error.
COP	Computer not operating properly.
tcH	High temperature compensation error.
tcL	Low temperature compensation error.
Ein	Input shorted.
rin	Sensor miswired.
FAC	Factory calibration required.

8.1.2 Temperature Compensation. Table 8-2 is a ready reference of RTD resistance values at various temperatures. These are used for test and evaluation of the sensor.

TABLE 8-2. RTD Resistance Values

Temperature	Resistance
0°C	**100 ohms**
10°C	103.90 ohms
20°C	107.70 ohms
25°C	109.62 ohms
30°C	111.67 ohms
40°C	115.54 ohms
50°C	**119.40 ohms**
60°C	123.24 ohms
70°C	127.07 ohms
80°C	130.89 ohms
90°C	134.70 ohms
100°C	**138.50 ohms**
110°C	142.29 ohms
120°C	146.06 ohms
130°C	149.82 ohms
140°C	153.58 ohms
150°C	**157.31 ohms**
160°C	161.04 ohms
170°C	164.76 ohms
180°C	168.46 ohms
190°C	172.16 ohms
200°C	**175.84 ohms**

NOTE

Ohmic values are read across the T.C. element and are based on the stated values (R_O ± .12%). Allow enough time for the T.C. element to stabilize to the surrounding temperature. Each 1°C change corresponds to a change of 0.385 ohms.

8.2 TROUBLESHOOTING. The analyzer is designed with state of the art microprocessor circuitry, making troubleshooting simple and direct. Subassembly replacement, i.e. printed circuit board replacement, is all that is usually required.

8.2.1 Installation Failure. If failure does occur, complete the following steps:

1. Check for a fault flag. If a fault condition exists, refer to Table 8-1 for the fault mnemonic explanation.

2. Check for sensor failure.

3. Check wiring connections for proper installation.

4. The following Troubleshooting Table 8-3 is a guide to problems which may occur during normal usage. The table is arranged with the most common problems listed first.

8.2.2 Display Test. Display Mnemonic dtS. Selecting this option will activate all the display segments. This item is used if a faulty display is suspected. Refer to Figure 3-1 Keyboard Overlay.

A. Press the **ACCESS** key twice to access the set menu, then **SCROLL** (↑) through to dtS and **SELECT**.

8.2.3 Software Version. Display Mnemonic UEr. Selection of this item will display the software revision level of the CPU. This number may be requested by factory service personnel if troubleshooting is required.

A. Press the **ACCESS** key twice to access the set menu, then **SCROLL** (↑) through to UEr and **SELECT**.

8.2.4 Sensor Troubleshooting. In addition to the fault mnemonics that directly relate to a possible sensor problem (SEn, tcH, tcL), the Model 1054B T can display the absolute conductivity of the process. This information can aid in determining conductivity versus temperature and application problems.

8.2.5 Absolute Conductivity. Display Mnemonic Cın. When selected the uncorrected (absolute) conductivity of the process is displayed. The displayed value is not temperature corrected.

To read the absolute conductivity of the process, do the following:

1. Press the **ACCESS** key twice. SEt will briefly display followed by -0-. Not required if already in Set Menu.

2. **SCROLL** (↑) then **SELECT** Cın to read the absolute conductivity.

3. Press the **PV** key to return to normal operation.

8.2.6 Cell Factor. Display Mnemonic Fct. When selected after a standardization or calibration, displays a value showing the change in the calculated cell constant since the initial calibration. Initial cell factor value is 1.0. This value will change as sensor coating occurs. Keep a trend of this value to determine a sensor maintenance schedule. Refer to Section 5.2 for typical cell constants. This value will be reset to 1.0 every time the cell constant is reentered.

1. Press the **ACCESS** key twice. SEt will briefly display followed by -0-.

2. **SCROLL** (↑) to display Fct and **SELECT** it.

3. Press **PV** key to return to normal operation.

8.2.7 CPU Board Replacement. If there is a problem with the CPU board resulting in its replacement, specific procedures included with the CPU board for calibrating the new board must be followed exactly or the microprocessor will be improperly programmed. Should this occur, it will be necessary to return the Model 1054B T to the factory for reprogramming.

8.2.8 Power Board Replacement. If it becomes necessary to replace the power board, the CPU board will need to be recalibrated following specific procedures that are included with the power board. Failure to follow these procedures exactly will cause the microprocessor to be improperly programmed and require the return of the Model 1054B T to the factory for reprogramming.

8.2.9 Sensor Resistance Check. With sensor disconnected from 1054B T, check resistance according to Table 8-3 .

TABLE 8-3. Sensor Resistance Check

FOR USE WITH MODEL 1054/1054A/1054B/2054 SERIES

WIRE	RESISTANCE
WHITE (DRIVE)	1 TO 2 OHMS
BLACK (DRIVE RETURN)	
GREEN (INPUT)	1 TO 2 OHMS
BLACK (INPUT COMMON)	
GREEN (RTD IN)	110 OHMS**
SHIELD (RTD COMMON)	0 OHMS
WHITE (SENSE GROUND)	

** Ambient temperature 25°.

8.2.10 Electronic Bench Check. Set temperature compensation to oFF. Set to 25°C (Refer to Section 4.4.1). A decade box or resistor is wired in series with a wire looped through the toroids as shown in Figure 8-1. Set cell constant to 1.0.

Calculate the resistance to enter into the decade box:

$$\text{Resistance in ohms} = \frac{1}{\text{Conductance (in Microsiemens)}} \times 1{,}000{,}000$$

Example

$$500 \text{ ohms} = \frac{1}{2000\ \mu S} \times 1{,}000{,}000$$

Display should follow input variations.

8.3 INSTRUMENT MAINTENANCE. To maintain the appearance and extend the life of the enclosure, it should be cleaned on a regular basis using a mild soap and water solution followed by a clean water rinse.

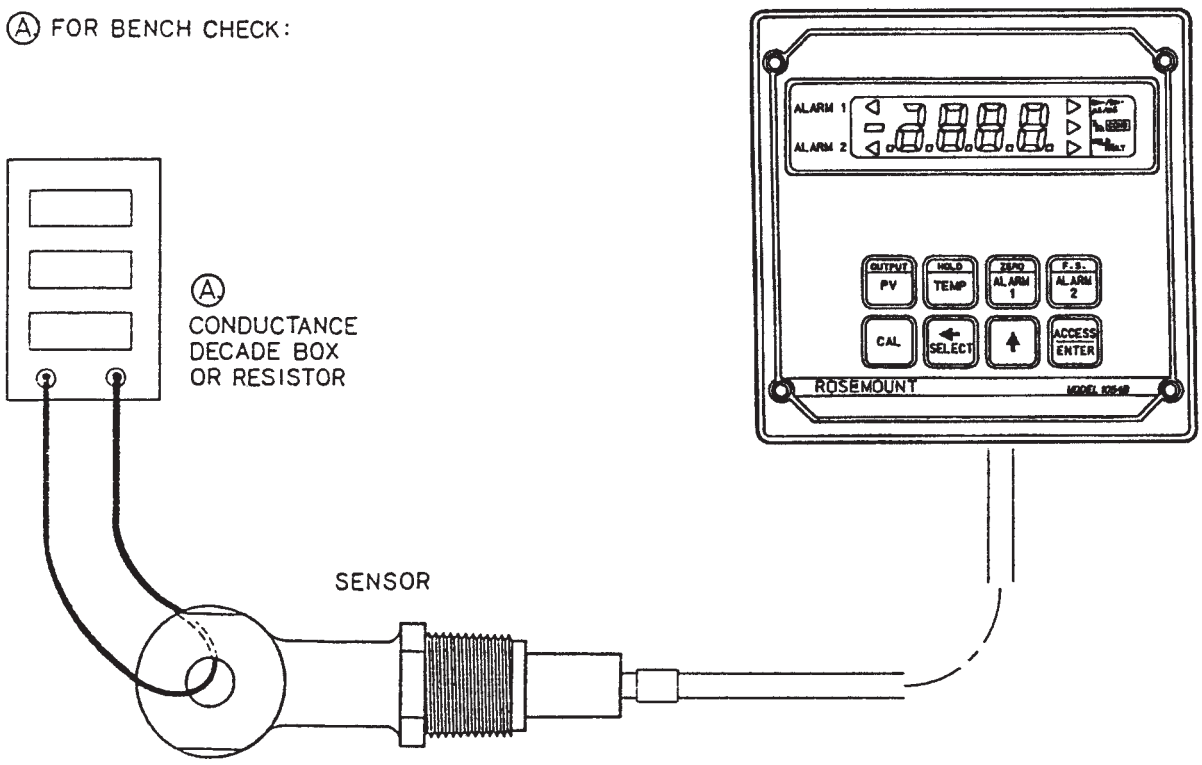


FIGURE 8-1. Electronic Bench Check

TABLE 8-4. Troubleshooting Guide

SYMPTOM	PROBLEM	ACTION
FCt below 0.5 or above 2.0. Actual range determined by user.	1. Old or coated sensor.	1. Clean or replace sensor.
Analyzer value not the same as grab sample of process.	1. Grab sample incorrect. 2. Unclear what is correct. 3. Analyzer out of calibration.	1. Re-evaluate sample technique and equipment. 2. Bench test analyzer. 3. Recalibrate per Section 5.
Fault code tcH/tcL/rtn.	1. Miswire. 2. Open or shorted RTD.	1. Check wiring between the sensor and analyzer. 2. Replace sensor (RTD if Model 222).
Fault code Orn.	1. Process conductivity too high for sensor in use. 2. Process upset.	1. Replace sensor with higher cell constant. 2. Check for process control problem.
Fault code SEn.	1. Open wire between sensor and analyzer. 2. Cable length has been exceeded Maximum cable length 200 ft.	1. Repair wire/check connection. 2. Locate analyzer within 200 ft. of sensor.
Fault code EEP.	1. Defective EEPROM.	1. Replace CPU PCB.
Fault code CHS.	1. Defective CPU.	1. Replace CPU PCB.
No alarm relay closure.	1. Defective power board. 2. Defective CPU.	1. Replace power PCB. 2. Replace CPU PCB.
No output current.	1. Defective power board. 2. Miswire.	1. Replace power PCB. 2. Check for short.
Low output current.	1. Circuit loading with excessive resistance on output.	1. Consult output loading limits analyzer specifications (600 ohms max load).
Zero conductivity reading.	1. Sensor miswired. 2. Solids coating sensor. 3. Open wire in sensor.	1. Fix wiring. 2. Clean sensor. 3. Replace sensor.
Fault code Ern. Very high conductivity reading.	1. Sensor miswired. 2. Shorted sensor.	1. Fix wiring. 2. Replace sensor.

TABLE 8-5. Replacement Parts

PN	DESCRIPTION
22966-00	PCB, LCD Digital Display
23025-01	Panel Mounting Kit
23739-00	PCB, Power Supply
23664-00	PCB, CPU, Toroidal Conductivity
23245-01	PCB, LED Digital Display
23740-00	PCB, Motherboard
23695-06	Keyboard Overlay, LCD Version
23695-07	Keyboard Overlay, LED Version
33469-00	Enclosure, Body
33470-00	Enclosure, Rear Cover
32937-00	Gasket, Rear Cover
32938-00	Gasket, Panel
9100157	Fuse, 0.250A, 125V
9100189	Fuse, 0.750A, 125V
9100157	Fuse, 0.10A, 3AB, 250V, Slo-Blow

TABLE 8-6. Accessories

PN	DESCRIPTION
2001492	Tag, Stainless Steel, Specify Marking
23053-00	Mounting Bracket, 2-inch Pipe
23054-01	Mounting Bracket, Wall, with Junction Box
23268-01	Heater, 115 VAC, 50/60 Hz, 1054B (Code 20 Only)
23268-02	Heater, 230 VAC, 50/60 Hz, 1054B (Code 20 Only)

TABLE 8-7. Ordering Information

The Model 1054B Microprocessor Analyzer: Housed in a corrosion resistant, weatherproof enclosure and operates on either 115 or 230 VAC, 50/60 Hz power. Standard features include digital display, isolated current output, dual alarms, and automatic or manual temperature compensation.

MODEL 1054B T	MICROPROCESSOR ANALYZER (3.5 lbs./1.5 kg)
CODE	STANDARD ENCLOSURE OPTIONS
01	LCD Display
02	LED Display
CODE	OPTIONS
20	Wall Mount Enclosure

1054B T	01	20	EXAMPLE

SECTION 9.0
RETURN OF MATERIAL

9.1 GENERAL.

To expedite the repair and return of instruments, proper communication between the customer and the factory is important. Before returning a product for repair, call 1-949-757-8500 for a Return Materials Authorization (RMA) number.

9.2 WARRANTY REPAIR.

The following is the procedure for returning instruments still under warranty:

1. Call Rosemount Analytical for authorization.
2. 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 unit must be supplied.
3. Carefully package the materials and enclose your "Letter of Transmittal" (see Warranty). If possible, pack the materials in the same manner as they were received.
4. Send the package prepaid to:

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

   Attn: Factory Repair

   RMA No. _____

   Mark the package: Returned for Repair

   Model No. ____

9.3 NON-WARRANTY REPAIR.

The following is the procedure for returning for repair instruments that are no longer under warranty:

1. Call Rosemount Analytical for authorization.
2. Supply the purchase order number, and make sure to provide the name and telephone number of the individual to be contacted should additional information be needed.
3. Do Steps 3 and 4 of Section 9.2.

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,
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