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Rosemount Analytical

MODEL 880A
NON-DISPERSIVE INFRARED
ANALYZER
INSTRUCTION MANUAL

748250-L

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The information contained in this document is subject to change without notice.

This manual is based on the production version of the Model 880A Non-Dispersive Infrared Analyzer. Hardware and/or software changes may have occurred since this printing.

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Manual Part Number 748250-L
October 1999
Printed in U.S.A.

Rosemount Analytical Inc.
4125 East La Palma Avenue
Anaheim, California 92807-1802

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WARRANTY

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PREFACE

SAFETY SUMMARY

To avoid explosion, loss of life, personal injury and damage to this equipment and on-site property, all personnel authorized to install, operate and service the Model 880A NDIR Analyzer should be thoroughly familiar with and strictly follow the instructions in this manual. **Save these instructions.**

DANGER is used to indicate the presence of a hazard which **will** cause **severe** personal injury, death, or substantial property damage if the warning is ignored

WARNING is used to indicate the presence of a hazard which **can** cause **severe** personal injury, death, or substantial property damage if the warning is ignored.

CAUTION is used to indicate the presence of a hazard which **will** or **can** cause **minor** personal injury or property damage if the warning is ignored.

NOTE is used to indicate installation, operation, or maintenance information which is important but not hazard-related.



WARNING: ELECTRICAL SHOCK HAZARD

Do not operate without doors and covers secure. Servicing requires access to live parts which can cause death or serious injury. Refer servicing to qualified personnel.

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

Alarm and zero/span switching relay contacts wired to separate power sources must be disconnected before servicing.

This instrument is shipped from the factory set up to operate on 115 volt, 50/60 Hz electric power. For operation on 230 volt, 50/60 Hz power, see Section 2.3 for modifications.



WARNING: PARTS INTEGRITY

Tampering or unauthorized substitution of components may adversely affect safety of this product. Use only factory documented components for repair.

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WARNING: HIGH PRESSURE GAS CYLINDERS

This analyzer requires periodic calibration with known zero and standard gases. Refer to Sections 2.6, 3.8, 3.9, 3.10 and 3.11. See also General Precautions for Handling and Storing High Pressure Cylinders, following Section 7.



WARNING: POSSIBLE EXPLOSION HAZARD

This analyzer is of a type capable of analysis of sample gases which may be flammable. If used for analysis of such gases the instrument must be protected by a continuous dilution purge system in accordance with Standard ANSI/NFPA 496-1989, Chapter 8.

If explosive gases are introduced into this analyzer, the sample containment system must be carefully leak-checked upon installation and before initial startup, during routine maintenance and any time the integrity of the sample containment system is broken, to ensure the system is in leak-proof condition. Leak-check instructions are provided in Paragraph 2.8.

Internal leaks resulting from failure to observe these precautions could result in an explosion causing death, personal injury or property damage.



CAUTION: TOPPLING HAZARD

This instrument's internal pullout chassis is equipped with a safety stop latch located on the left side of the chassis.

When extracting the chassis, verify that the safety latch is in its proper (counter-clockwise) orientation. If access to the rear of the chassis is required, the safety stop may be overridden by lifting the latch; however, further extraction must be done very carefully to insure the chassis does not fall out of its enclosure.

If the instrument is located on top of a table or bench near the edge, and the chassis is extracted, it must be supported to prevent toppling.

Failure to observe these precautions could result in personal injury and/or damage to the product.

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SPECIFICATIONS

POWER REQUIREMENTS:	115/230 VAC ±10%, 50/60 ±3 Hz, 350 W
OPERATING TEMPERATURE:	32°F to 113°F (0°C to 45°C)
DIMENSIONS:	8.7 in (22.0 cm) H
	19 in. (48.3 cm) W
	19 in. (48.3 cm) D, standard case
	24 in. (61.0 cm) D, extended case
WEIGHT:	56 lbs (25 kg), standard case
	68 lbs (31 kg), extended case
REPEATABILITY:	1% of fullscale
NOISE:	1% of fullscale
ZERO DRIFT:[1]	±1% of fullscale per 24 hours; ±2% of fullscale per week
SPAN DRIFT:[1]	±1% of fullscale per 24 hours; ±2% of fullscale per week
RESPONSE TIME: **(ELECTRONIC)**	Variable, 90% of fullscale in 0.5 sec to 20 sec, field selectable. (Application dependent)
SENSITIVITY:	100 ppm fullscale carbon monoxide at atmospheric pressure 50 ppm fullscale carbon dioxide at atmospheric pressure
SAMPLE CELL LENGTH:	0.04 in. (1 mm) to 14.0 in. (381 mm)
MATERIALS IN CONTACT WITH SAMPLE	
WINDOWS:	Sapphire, quartz, Irtran
CELLS:	Gold plated Pyrex or stainless steel
TUBING:	FEP Teflon
FITTINGS:	316 stainless steel
O-RINGS:	Viton-A
SAMPLE PRESSURE:	Max 10 psig (69 kPa), standard
	Pressurized application available upon request
ANALOG OUTPUT:	Standard: 0 to 5 VDC
	Optional: 0 to 20 mA/4 to 20 Ma
LINEARIZATION:	Keypad entered coefficients for linearizing 1, 2 or all 3 ranges
ENCLOSURE:	General purpose for installation in weather-protected area. Optional purge kit per Type Z, ANSI/NFPA 496-1989.[2]

[1] Performance specifications based on ambient temperature shifts of less than 20°F (11°C) per hour.

[2] When installed with user-supplied components, meets requirements for Class I, Division 2 locations per National Electrical Code (ANSI/NFPA 70) for analyzers sampling non-flammable gases. Analyzers sampling flammable gases must be protected by a continuous dilution purge system in accordance with Standard ANSI/NFPA 496-1989, Chapter 8. Consult factory for recommendations.

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OPTIONS SPECIFICATIONS

ALARM

Alarm Relay Outputs: Two single point, field programmable high or low, deadband 5% to 20% of fullscale.
Two form C contacts rated 3A-125/250 VAC or 5A-30 VDC (resistive)

ZERO/SPAN

Relay Outputs: Two front panel actuated contact closures
Two form C contacts rated 3A-125/250 VAC or 5A-30 VDC (resistive)

AUTO ZERO/SPAN

Relay Outputs: Four form C contacts rated 3A-125/250 VAC or 5A-30 VDC (resistive), field programmable frequency and duration of closure.

Two form A contact closures for indication of insufficient zero and span adjustment, rated (resistive load):
Max switching power: 10 Watts
Max switching voltage: 30 VDC
Max switching current: 0.5 A

REMOTE RANGE CHANGE & ID

Three remotely changeable ranges with positive identification.
Binary code field selectable.

RELAY OUTPUTS: Eight form A contacts rated (resistive load):
Max switching power: 10 Watts
Max switching voltage: 30 VDC
Max switching current: 0.5 A

INPUTS: Eight optical couplers
Input Range: +5 VDC to +24 VDC

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CUSTOMER SERVICE, TECHNICAL ASSISTANCE AND FIELD SERVICE

For order administration, replacement Parts, application assistance, on-site or factory repair, service or maintenance contract information, contact:

Rosemount Analytical Inc.
Process Analytical Division
Customer Service Center
1-800-433-6076

RETURNING PARTS TO THE FACTORY

Before returning parts, contact the Customer Service Center and request a Returned Materials Authorization (RMA) number. Please have the following information when you call: *Model Number, Serial Number, and Purchase Order Number or Sales Order Number.*

Prior authorization by the factory must be obtained before returned materials will be accepted. Unauthorized returns will be returned to the sender, freight collect.

When returning any product or component that has been exposed to a toxic, corrosive or other hazardous material or used in such a hazardous environment, the user must attach an appropriate Material Safety Data Sheet (M.S.D.S.) or a written certification that the material has been decontaminated, disinfected and/or detoxified.

Return to:

Rosemount Analytical Inc.
4125 East La Palma Avenue
Anaheim, California 92807-1802

TRAINING

A comprehensive Factory Training Program of operator and service classes is available. For a copy of the *Current Operator and Service Training Schedule* contact the Technical Services Department at:

Rosemount Analytical Inc.
Phone: 1-714-986-7600
FAX: 1-714-577-8006

DOCUMENTATION

The following Model 880A Non-Dispersive Infrared Analyzer instruction materials are available. Contact Customer Service or the local representative to order.

748250 Instruction Manual (this document)

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COMPLIANCES

Model 880A Non-Dispersive Infrared Analyzers, Catalog Numbers 191811 (Standard) and 191812 (Extended) when installed with optional Type Z Purge Kit P/N 624446 for use in indoor Class I, Division 2, Groups B, C, and D hazardous locations and for use in indoor non-hazardous locations when sampling flammable gases. When installed without purge kit option, this equipment is intended for sampling only non-flammable gases in non-hazardous locations.

This product may carry approvals from a certifying agency or may be in compliance with EMC Directive. If so, the product will carry approval insignia, like those shown here, on the product name rating plate.

FM
APPROVED

PA
97-C209

Rosemount Analytical Inc. has satisfied all obligations from the European Legislation to harmonize the product requirements in Europe.

CE

This product complies with the standard level of NAMUR EMC. Recommendation (May 1993).

NAMUR

This product satisfies all obligations of all relevant standards of the EMC framework in Australia and New Zealand.

N96

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1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The Model 880A Non-Dispersive Infrared Analyzer is designed to continuously determine the concentration of a particular component of interest in a flowing gaseous mixture. Within the analyzer, two equal energy infrared beams are directed through two parallel optical cells, a flow-through sample cell and a reference cell. The Luft detector continuously measures the difference in the amount of infrared energy absorbed within each of the two cells. This difference is a measure of the concentration of the component of interest in the sample.

Readout is on the 16-character, backlighted liquid crystal display in parts per million, percent of composition or percent of fullscale. Additionally, a 0 to +5 VDC output for a potentiometric (voltage) recorder is provided as standard.

A linearizer, based on a fourth-order polynomial, is incorporated in the electronic circuitry. By turning the linearizer ON and entering the correct coefficients, an output linear with concentration is obtained.

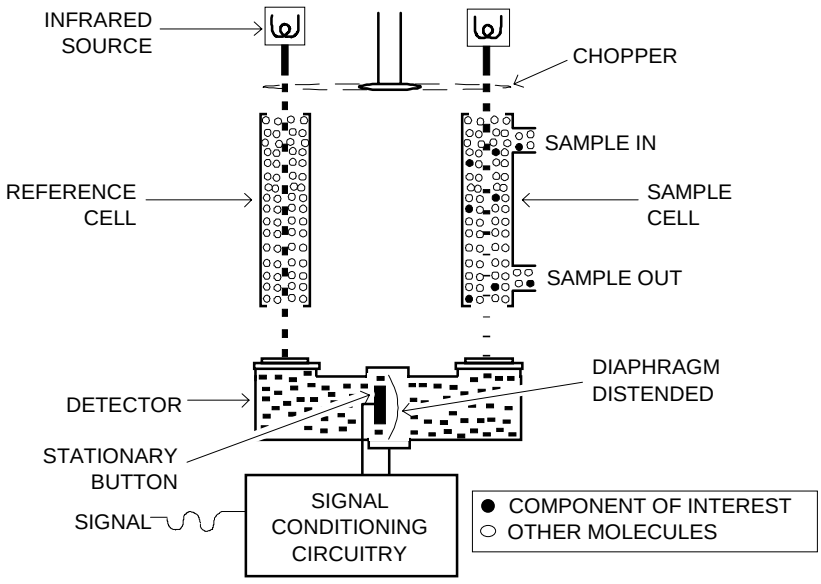


FIGURE 1-1. MODEL 880A DETECTION SYSTEM

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1.2 AVAILABLE OPTIONS

Operation of the Model 880A can be enhanced with the choice of several options:

DUAL ALARMS (STANDARD AND FAIL-SAFE)

User-set dual alarms are available with configurable HI/LO designations and deadband.

CURRENT OUTPUT

For normal usage, the 0/4 to 20 mA current output can be set to represent 0 to 100% of fullscale, or a suppressed range of 25% or more of fullscale may be selected.

AUTO ZERO/SPAN

An Automatic Zero/Span is available for unattended calibration of all three ranges.

CALIBRATION GAS CONTROL

A Calibration Gas Control allows two solenoids to be remotely actuated from the front panel, enabling one-man calibration without leaving the analyzer.

REMOTE RANGE SELECTION AND ID

A remote range change and ID is available.

CASE HEATER

A proportional temperature controller with fan assembly maintains proper operating temperature inside the case.

PURGE KITS

An air purge kit, when installed with user-supplied components, meets Type Z requirements of standard ANSI/NFPA 496-1989 for installation in Class I, Division 2 locations as defined in the National Electrical Code (ANSI/NFPA 70) when sampling non-flammable gases. If analyzer is used to sample a flammable gases it must be protected by a continuous dilution purge system per standard ANSI/NFPA 496-1989, Chapter 8. Consult factory for further information.

A motor source or motor source/reference cell purge kit accompanies some configurations of the Model 880A. The purpose for these kits is reduction of ambient CO_2 interference and, thus, improved performance and accuracy. These purges do not provide explosion hazard protection.

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2 UNPACKING AND INSTALLATION

2.1 UNPACKING

Carefully examine the shipping carton and contents for signs of damage. Immediately notify the shipping carrier if the carton or its contents are damaged. Retain the carton and packing material until the instrument is operational

2.2 LOCATION

Locate the analyzer in a weather-protected, non-hazardous location free from vibration. For best results mount the analyzer near the sample stream to minimize sample-transport time. Refer to Installation Drawing 624190.

If equipped with P/N 624446 air purge kit and installed with user-provided components per Instructions 015-748157, the analyzer may be located in a Class I, Division 2 area as defined by the National Electrical Code (ANSI/NFPA 70). This kit is designed to provide Type Z protection in accordance with Standard ANSI/NFPA 496-1989, Chapter 2, when sampling nonflammable gases. For flammable samples, the instrument must be equipped with a continuous dilution purge system in accordance with ANSI/NFPA 496-1989, Chapter 8.

2.3 VOLTAGE REQUIREMENTS



WARNING: ELECTRICAL SHOCK HAZARD

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

This instrument was shipped from the factory configured to operate on 115 VAC, 50/60 Hz electric power. For operation on 230 VAC, 50/60 Hz, voltage select switches S1, S2, located on Power Supply Board (Figure 2-1) and, if installed, S3, located on the Case Heater Temperature Control Board Figure 2-2 (see Figure 7-2, Case Heater Temperature Control Assembly) must be in the 230 VAC position. Power consumption is 350 watts.

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2.4 ELECTRICAL CONNECTIONS

The power, recorder and current output cable glands are shipped already installed to allow attachment of cables to connectors or terminal strips. Cable glands for specific cables are as follows:

CABLE	GLAND PART NO.
POWER	899330
RECORDER	899329
OPTION BOARD	899329

Remove the rear cover to access the terminals. Route each cable through the cable gland and connect to appropriate connector or terminal strip, tighten the gland.

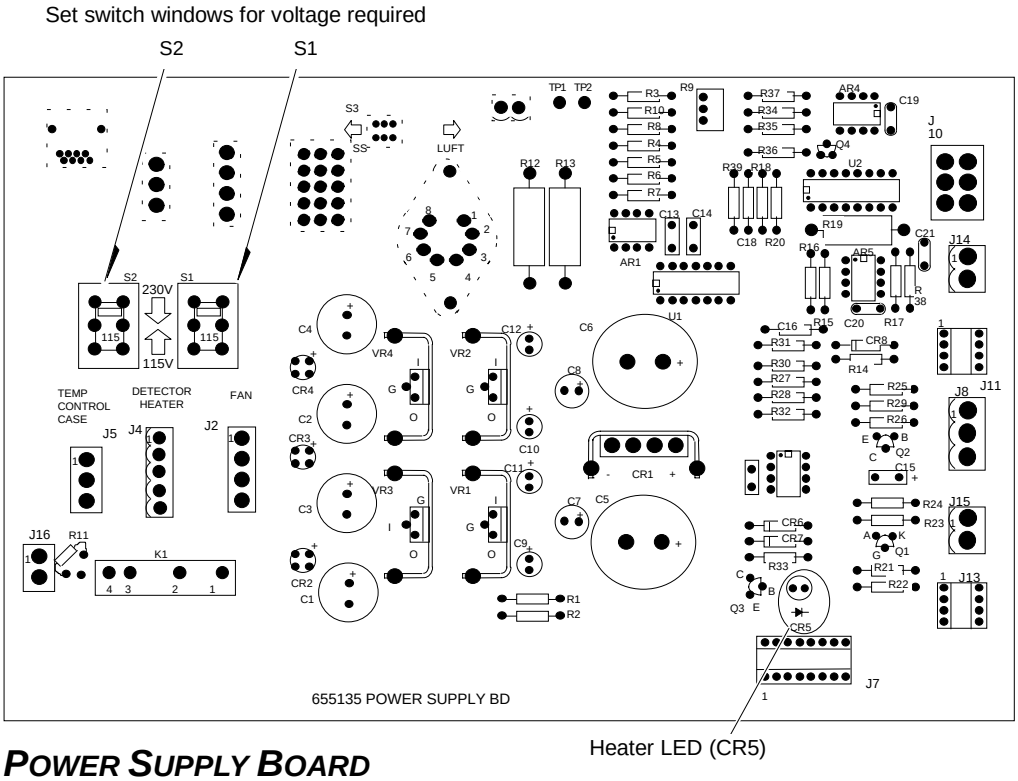


FIGURE 2-1. POWER SUPPLY BOARD

2.4.1 LINE POWER CONNECTIONS

Refer to Figures 2-3, 2-4 and drawing 624190. If this instrument is located on a bench or table top or is installed in a protected rack, panel or cabinet, power may be connected via a 3-wire flexible power cord, minimum 18 AWG (max. O.D. 0.480", min. O.D. 0.270") through hole labeled POWER, utilizing connector gland (P/N 899330) provided.

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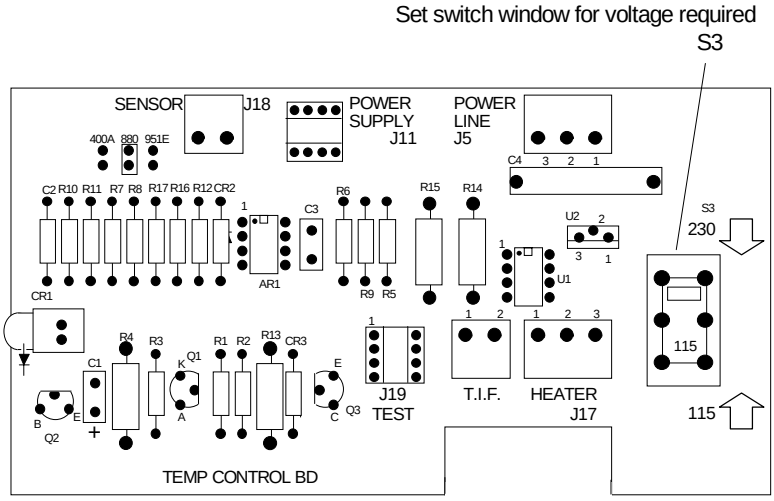


FIGURE 2-2. CASE HEATER TEMPERATURE CONTROL BOARD

Accessory kits are available which include one of the following: 1) a 10-foot North American power cord set and four enclosure support feet (P/N 654008) for bench top use, 2) the power cord only (P/N 634061), or 3) the four feet only (P/N 634958). If the instrument is permanently mounted in an open panel or rack, use electrical metal tubing or conduit.

Route the power cable through the cable gland and connect the leads to TB1. After connecting the leads, tighten the cable gland adequately to prevent rotation or slippage of the power cable. Since the rear terminals do not slide out with the chassis, no excess power cable slack is necessary.

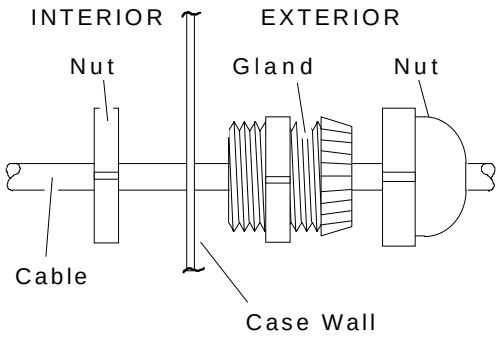


FIGURE 2-3. CABLE GLAND CONNECTIONS

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2.4.2 RECORDER CONNECTIONS

Refer to Figures 2-3, 2-4 and drawing 624190. Recorder connections are made to the rear panel. Route the recorder cable through the cable gland in hole labeled RECORDER OUTPUT and connect to TB2.

Recorder and interconnection cables should meet the following requirements:

VOLTAGE OUTPUT: 0 TO +5 VDC

- Maximum distance from recorder to analyzer: 1000 ft. (305 m)
- Recorder input impedance: >5000 ohms
- Customer-supplied cable: 2-conductor, 20 AWG (min.), shielded

CURRENT OUTPUT: 0 TO 20 MA OR 4 TO 20 MA (KEYBOARD PROGRAMMABLE)

- Maximum load impedance: 700 ohm

2.5 SAMPLE INLET/OUTLET CONNECTIONS

Most applications of the Model 880A are intended for atmospheric pressure operation with venting to the atmosphere. High pressure and sub-atmospheric pressure applications require careful regulation of the sample pressure. Sample inlet and outlet connections are located on the rear panel. All connections are 1/4-inch ferrule-type compression fittings.

2.6 CALIBRATION GAS REQUIREMENTS

Analyzer calibration consists of setting a zero point and one upscale point per range. All applications require a zero standard gas to set the zero point on the display or recorder chart.

If the factory Calibration and Data Sheet (included with the drawings at the end of the manual) specifies a background gas, use this as the zero gas. If a background gas is not specified, use dry nitrogen for the zero gas.

Ideally, span gas should be between 75% and 100% of the fullscale span.

2.7 SAMPLE HANDLING SYSTEM

Many different sample handling systems are available, either assembled completely or as loose components. The type used depends on the requirements of the particular application and the preferences of the individual user. Typically, the sample handling system incorporates such components as pumps and valves to permit selection of sample, zero standard and upscale standard gas; needle valve in sample-inlet line for flow adjustment; flowmeter for flow measurement and/or indication of flow stoppage; and filter(s) to remove particulate matter.

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2.8 LEAK TEST PROCEDURE

To check for leaks in the sample system, do the following:

1. Supply air or inert gas such as nitrogen to the sample inlet of the analyzer at 10 psig (69 kPa).

2. Seal off sample outlet with a cap, and turn off supply of inert gas. After 1 hour, pressure reading should not drop. If it does, the system is leaking. Continue with steps 3 thorough 4 to locate source of leak.

3. Use a suitable test liquid such as SNOOP (P/N 837801) to detect leaks. Cover all fittings, seals or possible leak sources.

4. Check for bubbling or foaming which indicates leakage and repair as required. Any leakage must be corrected before introduction of sample and/or application of electrical power.

5. For smaller leaks, use a Halogen or helium leak detection device.



WARNING: POSSIBLE EXPLOSION HAZARD

This analyzer is of a type capable of analyzing sample gases which may be flammable. If used for analysis of such gases the instrument must be protected by a continuous dilution purge system in accordance with Standard ANSI/NFPA 496-1989, Chapter 8.

If explosive gases are introduced into this analyzer, the sample containment system must be carefully leak-checked upon installation and before initial startup, during routine maintenance and any time the integrity of the sample containment system is broken, to ensure the system is in leak-proof condition. Leak-check instructions are provided in this section.

Internal leaks resulting from failure to observe these precautions could result in an explosion causing death, personal injury or property damage.

Note

Apply test liquid to cell or detectors and IR source windows only as a last resort. Should this occur, follow instructions in Section 6.1 to clean these components.

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2.9 SAMPLE FLOW RATE

Recommended sample flow rate is 1 to 2 SCFH (500 to 1000 cc/min). A subnormal flow rate will not affect readings but may result in an undesirable time lag. However, an excessive flow rate can result in cell pressurization and reading error.

Assume that two cell volumes are required to flush any cell. Approximate flushing time for the Model 880A's 12-inch cell at atmospheric sampling pressure (i.e., the outlet of the cell venting to atmosphere) is approximately 12 seconds. Flushing time decreases with cell volume (see Table 2-1). Flushing time is inversely proportional to flow rate.

The primary effect of flow rate, other than flushing time, is cell pressure. Due to restrictions in exit flow configuration, an increasing flow rate increases sample pressure in the cell.

In all cases, the effect of pressure on readout is eliminated if the same flow rate is used for the measured sample as well as for the zero gas and span gas.

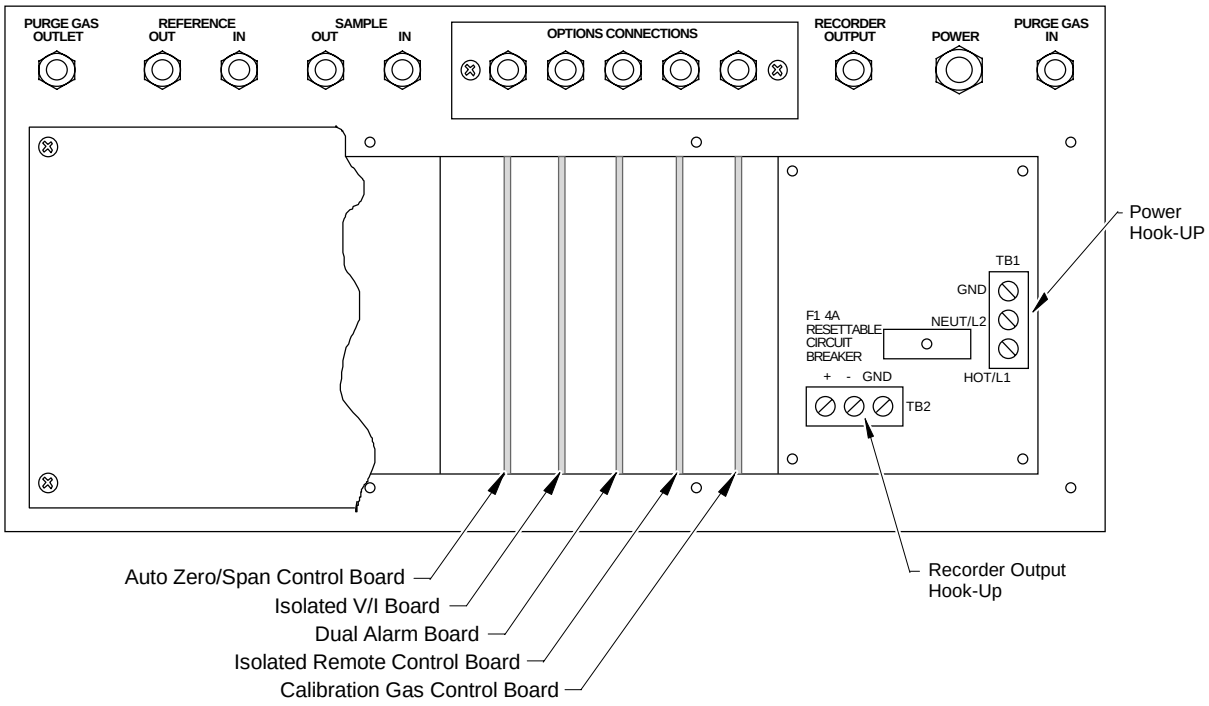
Note that at higher flow rates the nonlinearity of the calibration curve increases, because of increase in sample cell pressure. Therefore, if higher flow rates are required, the calibration curve should be redrawn at the higher rate.

At flows up to 2 CFH (1 L/min), gaseous sample temperatures are equilibrated to instrument temperature regardless of stream temperature. At extremely high flow rates, this may not be true, but no such effect has been noted up to 18 CFH (9 L/min).

CELL LENGTH MM	CELL LENGTH INCH	CELL VOLUME IN CC WITHOUT INLET TUBE	TOTAL VOLUME IN CC CELL WITH INLET TUBE	TIME FOR 2 VOLUMES AT 2 SCFH (1 L/MIN) AT 750 MM HG
3	0.118	0.85	12	2 sec.
4	0.157	1.14	12	2 sec.
8	0.315	2.28	13	2 sec.
16	0.630	3.56	16	2 sec.
32	1.25	9.12	20	2 sec.
64	2.52	18.24	25	3 sec.
128	4.03	35.48	44	3 sec.
232	9.13	65.12	73	6 sec.
343	13.50	97.76	105	13 sec.
381	15.00	108.60	116	14 sec.

TABLE 2-1. PURGING TIME AT ATMOSPHERIC SAMPLE PRESSURE

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OPTION BOARDS INSTALLED WITH COMPONENT SIDE TO THE LEFT.

FIGURE 2-4. REAR VIEW OF MODEL 880A

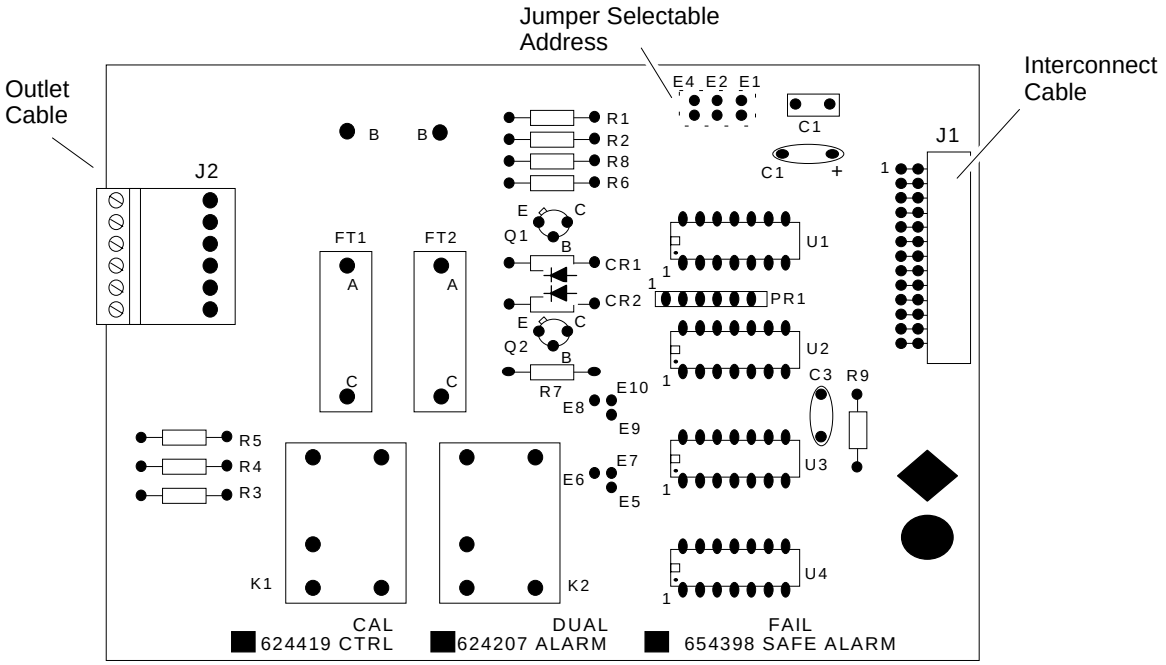
2.10 OPTION BOARDS

The following option boards may be ordered factory installed or as kits from the factory at a later date: Alarm, Current Output, Calibration Gas Control, Auto Zero/Span and Remote Range I/O. The boards are supplied with outlet connector mating plugs installed on each board for field wiring. Attach the cable (customer supplied) to the outlet connector plug per the appropriate schematic diagram for each option board.

If an option board has been ordered installed at the factory, this board will be inserted into one of

five slots inside the rear of the analyzer (See Figure 2-4). Each option will require a cable (user-provided) which connects to a female plug. The female plug, in original packaging, is attached to the appropriate terminal block on the option board. If the instrument came equipped with one option, the interconnect cable will be in place for all options. The Alarm, Auto Zero/Span, Calibration Gas Control and Remote Range Change Boards have jumper-selectable addresses (Figures 2-5, 2-7 and 2-8, Section 6.8 and Table 6-2).

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Note: The Dual Alarm, Fail Safe Alarm and Calibration Gas Control use the same board. However, the jumpers locations are different.

Cal Gas Control: E1, E4, E5 - E7 and E9 - E10
Dual Alarm: E1, E2, E5 - E7 and E9 - E10
Fail Safe Alarm: E1, E2, E6 - E7 and E8 - E10

FIGURE 2-5. CALIBRATION GAS CONTROL AND ALARM CONNECTIONS

2.10.1 ALARM CONNECTIONS

Refer to Figures 2-3, 2-5 and drawing 655147. Connect cable (customer supplied) to the 6-pin connector J2. The Dual Alarm consists of two form C contacts rated 3A-125/250 VAC or 5A-30 VDC (resistive).

Run the cable through the cable gland and tighten once the connector has been secured.

2.10.2 CURRENT OUTPUT CONNECTIONS

Refer to Figures 2-3, 2-6 and Drawing 655147. Connect cable (customer supplied) to the 2-pin connector J2. The voltage-to-current board has a fixed address at the top of the board.

Run the cable through the cable gland and tighten once the connector has been secured.

2.10.3 CALIBRATION GAS CONTROL CONNECTIONS

Refer to Figures 2-3, 2-5 and Drawing 655147. Connect cable (customer supplied) to the 6-pin connector J2. The Calibration Gas Control consists of two form C contacts rated 3A-125/250 VAC or 5A-30 VDC (resistive). Run the cable through the cable gland and tighten the latter once the connector has been secured.

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2.10.4 AUTO ZERO/SPAN CONNECTIONS

Refer to Figures 2-3, 2-7 and Drawing 655147. Connect cable (customer supplied) to the 9-pin connectors J2 and J3. The Auto Zero/Span consists of four form C contacts rated 3A-125/250 VAC or 5A-30 VDC (resistive) and two form A contacts rated at 10 watts maximum switching power, 200 VDC maximum switching voltage and 0.5 A maximum switching current.

Run the cable through the cable gland and tighten once the connector has been secured.

If installed, this board can also be activated from the keyboard (Zero/Span) for the selected range.

2.10.5 REMOTE INPUT/OUTPUT CONNECTIONS

Refer to Figures 2-3, 2-8 and Drawing 655147. Connect cable (customer supplied) to the 9-pin connectors J2 and J3.

The signal output is at J2 which consists of eight form A contacts rated (resistive load) 10 watts, maximum switching power, 200 VDC maximum switching voltage and 0.5 A maximum switching current.

The signal input is at J3 which consists of eight optocouplers, operated from a user-supplied 24 VDC power source.

Run the cable through the cable gland and tighten once the connector has been secured.

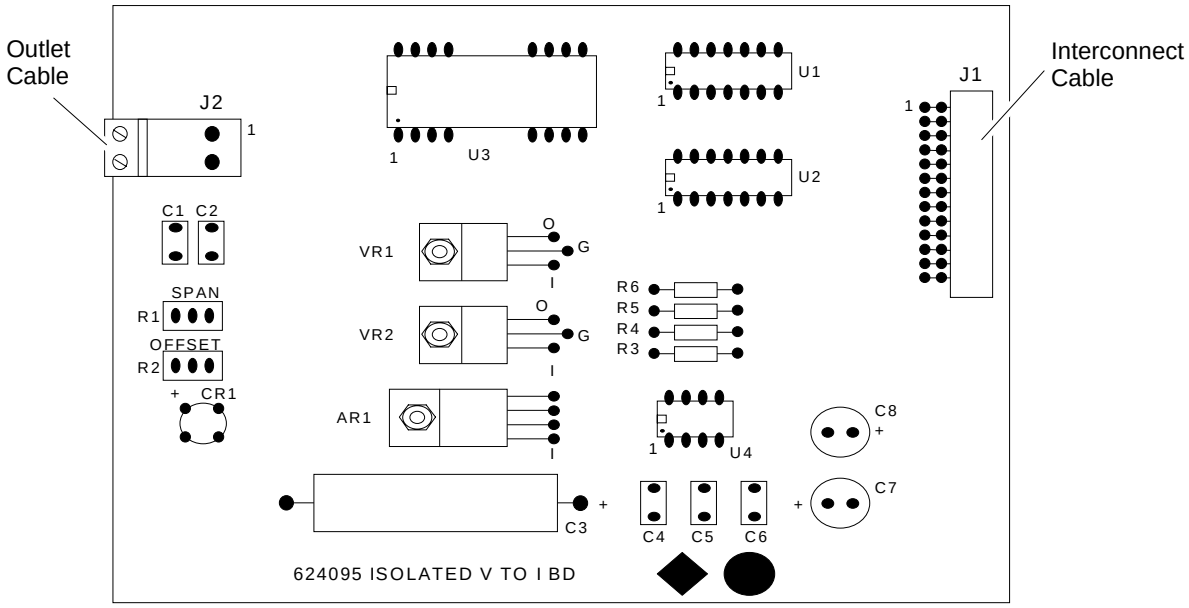


FIGURE 2-6. CURRENT OUTPUT CONNECTIONS

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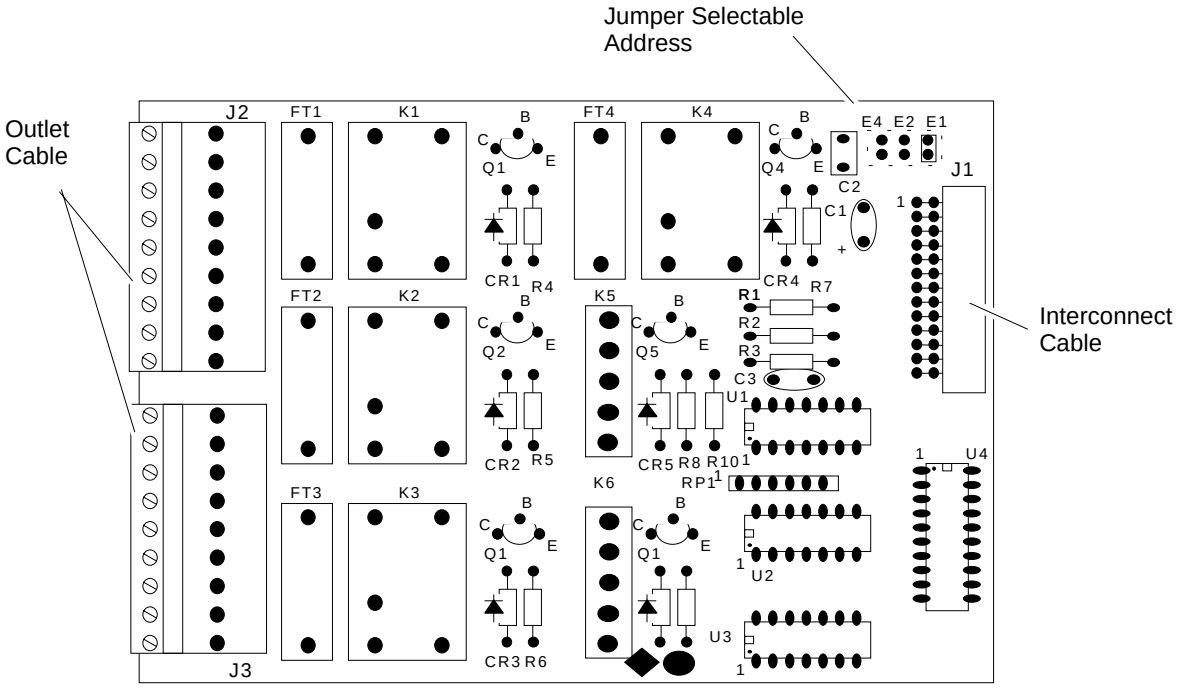


FIGURE 2-7. AUTO ZERO/SPAN BOARD CONNECTIONS

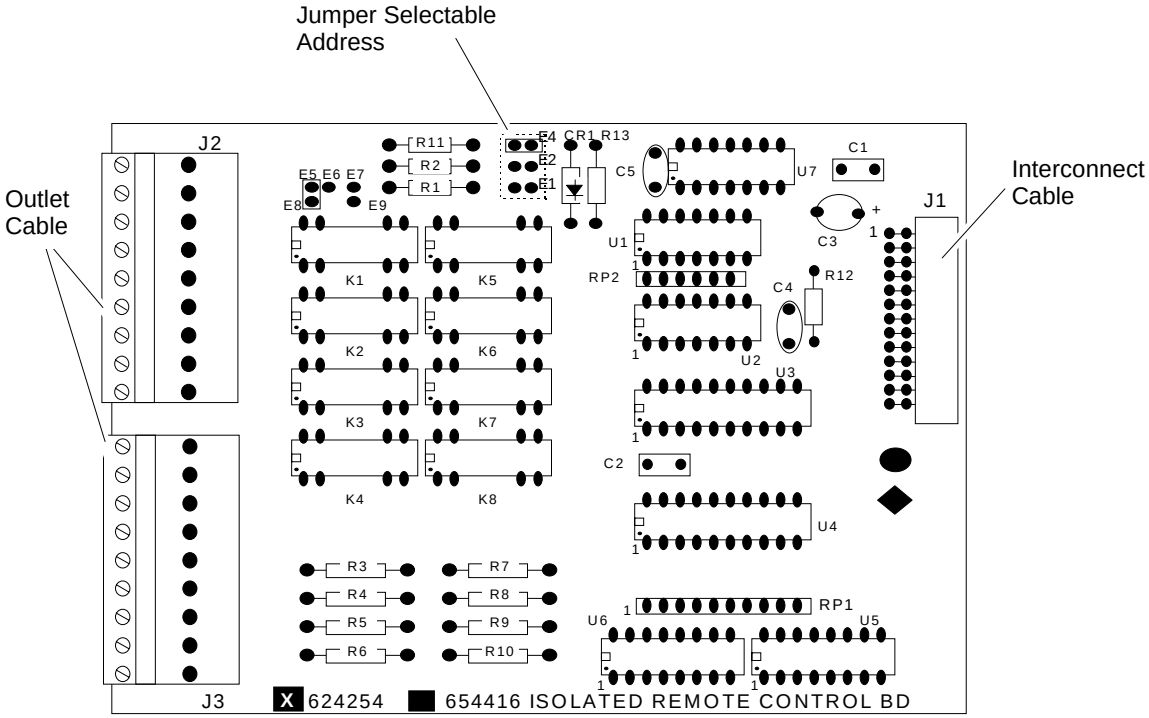


FIGURE 2-8. REMOTE INPUT/OUTPUT BOARD CONNECTIONS

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2.11 ORDERING OPTION KITS

Options not ordered from the factory at the time of purchase of the Model 880A may be ordered as the following kits:

- 624422 Isolated Remote Control Kit
- 624423 Dual Alarm Kit
- 654399 Fail Safe Dual Alarm Kit
- 624424 Auto Zero/Span Control Kit
- 624426 Calibration Gas Control Kit
- 624425 Current Output Kit

The option kit consists of the circuit board, a cable gland and two circuit card guides which are inserted into predrilled holes in the card cage. Mount the option board in the card guides and follow the wiring directions in Section 2.10. There are five connectors on the interconnect cable. Ensure that the appropriate connections are made.

For installation of any of the above Option Kits, the Option Boards Kit, P/N 624414, must also be ordered. If the analyzer was originally ordered with any of the above options, the Accessory Kit is already installed and need not be ordered again for additional options. This kit consists of a card cage which mounts in the rear of the case and three interconnect cables for internal wiring as shown in drawing 655147.

2.12 MOTOR SOURCE/REFERENCE CELL PURGE KITS

Model 880A configurations 23 and 26 are often equipped with the Motor Source Assembly Purge Kit (P/N 655095) for reducing CO_2 interference.

Optimum purge flow is 100 cc/min, optimum pressure is 8 psig. The pressure should not exceed 10 psig.

Nitrogen is recommended for the purge gas. If available gas is limited, flow may be reduced, but reading errors become significant below 20 cc/min. At 50 cc/min., errors may exceed 1% of fullscale.

The purge uses capillary 634398, tested to 70 cc/min. (±10 cc/min.) at 4 psig.

Configuration 46 instruments are equipped with a Motor Source/Reference Cell Purge Kit as standard.

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NOTES

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3 INITIAL STARTUP AND CALIBRATION

Prior to shipment this instrument was subjected to extensive factory performance testing, during which all necessary optical and electrical adjustments were made. The following instructions are recommended for initial startup and subsequent standardization of the analyzer.

3.1 LEAK TEST

Perform the Leak Test Procedure in Section 2.8.

3.2 POWER VERIFICATION

1. Verify power switch settings are for available power (115 VAC/230 VAC). Refer to Section 2.
2. Apply power. On the Power Supply Board, verify that heater LED (CR5) is ON. Refer to Figure 2-1 and Drawing 655137.

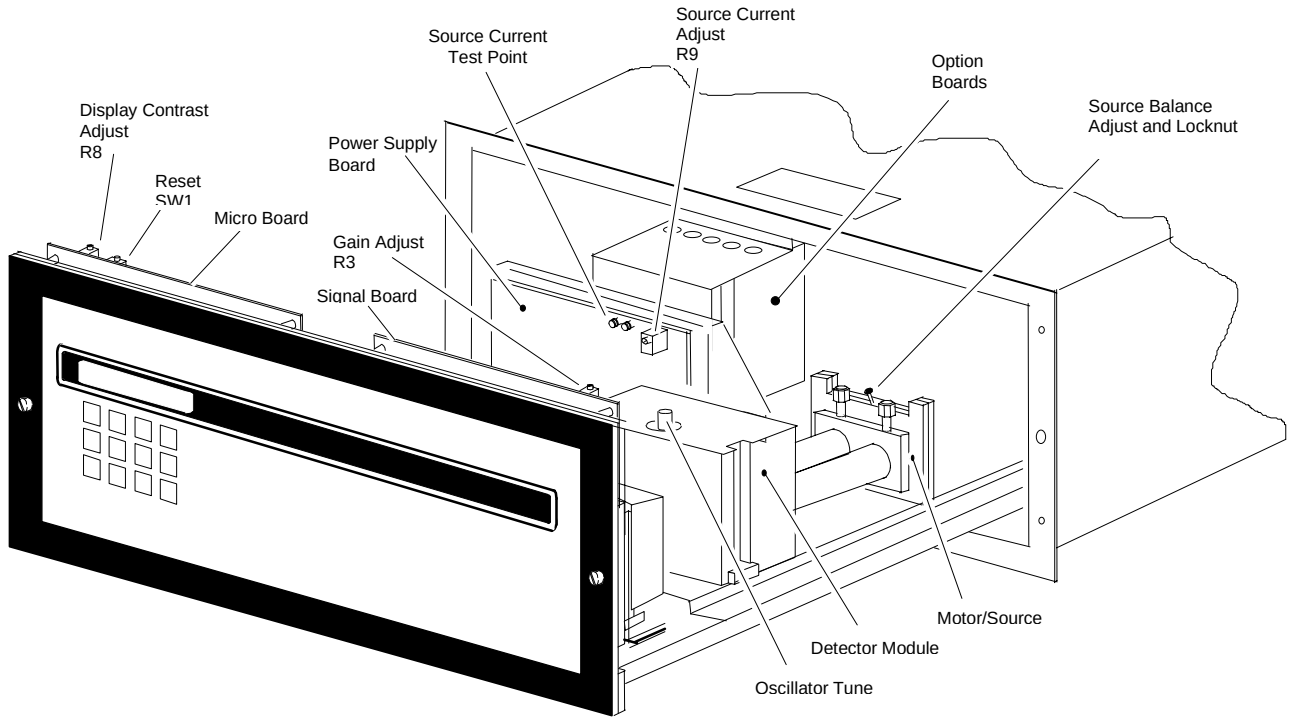


FIGURE 3-1 MODEL 880A ADJUSTMENTS

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3.3 FRONT PANEL INDICATORS AND CONTROLS

3.3.1 DISPLAY

The display consists of a 16-character LED-backlighted Liquid Crystal Display. The contrast on the display may be adjusted so that the display can be read from any vertical angle. This adjustment is made by loosening the two screws on the front of the case and sliding the front panel forward, then turning the potentiometer (R8) to adjust the contrast until the best view of the display is obtained. See Figure 3-1.

In the normal RUN mode of operation, the display will show current process value, component name, control mode and range. In other modes, relevant information will be displayed as is necessary. See Figure 3-3.

3.3.2 FUNCTION KEYS

The Model 880A has twelve function keys (Figure 3-2). Each key must be pressed firmly to insure that the microprocessor recognizes the keystroke. The definitions for these keys are as follows:

ZERO To activate the manual zero calibration of the analyzer.

SPAN To activate the manual span calibration of the analyzer.

STATUS To display the configuration and the status of alarms and error messages.

SHIFT Used in conjunction with left and right or up and down arrows, F1, F2 and ENTER keys. Pressing the SHIFT key in any display except Run Mode, Zero Setting, Span Setting and Status causes a ↑ to be displayed at the far right hand position. Pressing → will then move the cursor 16 characters to the right, pressing ← will move the cursor 16 characters to the left, and, if a displayed parameter is being modified, pressing ↑ will access the highest value allowed for that parameter and pressing ↓ will access the lowest value allowed for that parameter.

F1 **F2** Software programmable keys for quick access to mode functions. When used in conjunction with the SHIFT key, two additional functions are available: SHIFT/F1 and SHIFT/F2. The computer acknowledges the keystrokes by flashing [** KEY SAVED **] on the display. These four functions can immediately access a particular display for the following modes: Range, Diagnostics, Linearization, Alarm, Current Output, Auto Zero/Span or Remote Range I/O. Refer to the detailed description in Section 3.3.3.

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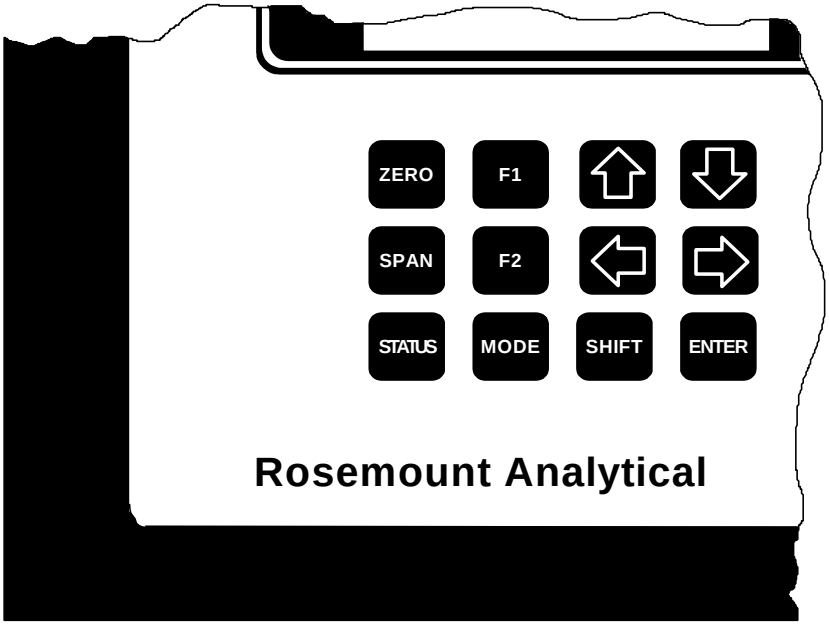


FIGURE 3-2. MODEL 880A KEYPAD

MODE To display instrument functions. The standard functions are security, range, diagnostics, and linearization. Additional functions, in conjunction with option boards, are Auto Zero/Span, Remote Range I/O, Current Output, and Alarm.

The up and down arrow keys are used to modify the data in the display. Depress either the up or down arrow to change the values displayed above the cursor. When used in one of the editing modes, SHIFT ↑ causes the highest value allowed in a function to be displayed. SHIFT ↓ causes the lowest value to be displayed.

Depress the arrow key once to change one digit; depress and hold either key to scroll (continuous value change), thereby reducing the time required to make large value changes.

To move cursor one position at a time or, when used in conjunction with the SHIFT key moves the cursor 16 characters, one full display, at a time.

ENTER To access a function, to store a value in nonvolatile memory or to return to run mode from span, zero and security screens. The computer acknowledges ENTER by momentarily flashing [** DATA STORED **] on the display when used to store a setting in non-volatile memory. Use ENTER to engage the span and zero functions, which are initiated by the SPAN and ZERO keys. [CALCULATING SPAN] or [CALCULATING ZERO] will then be momentarily displayed.

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SHIFT ENTER

The SHIFT key in conjunction with the ENTER key will return to Run Mode from any function screen except: 1) the [CALCULATING ZERO/SPAN] screen and 2) during an auto calibration cycle.

SHIFT/ENTER during operation of zero and span functions will turn off the appropriate solenoid valve, if connected, for instruments with the Calibration Gas Control or Auto Zero/Span.

The SHIFT/ENTER combination is the Escape feature.

3.3.3 USER-PROGRAMMABLE KEYS

Refer to Figure 3-2. F1, F2, SHIFT/F1 and SHIFT/F2 are software-programmable keys which can be user-programmed to access any frequently used display or sub-menu for the following modes: Range, Diagnostics, Linearization, Auto Zero/Span, Remote Range I/O or Alarm, provided the option board selected is still present.

To use this feature, the function keys must be preprogrammed by the user through the following steps:

1. Access a display or sub-menu that will be frequently used by following the steps in the particular set of instructions given in the figures in this section until the desired display is obtained.
2. Press F1, F2, SHIFT/F1 or SHIFT/F2 to program the analyzer to return to this display from the RUN mode. This will assign F1, F2, SHIFT/F1 or SHIFT/F2 to this particular display, and will retain those assignments until the key or combination of keys is reprogrammed using the same procedure described in this section. The analyzer acknowledges this command by flashing [**KEY SAVED**] on the display.
3. Exit to the RUN mode display by completing the remaining steps in the figure chosen in Step 1.
4. When the analyzer returns to the RUN mode display, press the key or keys selected in Step 2 (F1, F2, SHIFT/F1 or SHIFT/F2) to check the setup. The analyzer will return to the display or sub-menu selected in Step 1.
5. Press SHIFT/ENTER to return to the RUN mode.

Note:

The programmable keys <u>cannot</u> be assigned to the zero or span screens since these screens are already single-key accessed by the ZERO and SPAN keys, respectively, on the front panel.

To reprogram the key or keys selected in Step 2, repeat Steps 1 through 5 for another display or sub-menu.

For example, if the GAIN is frequently changed, access the RANGE sub-menu to access the GAIN display and press the F1 key. Press SHIFT/ENTER to return to the

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RUN mode. To get to the GAIN display from the RUN mode display, press the F1 key. To reprogram the F1 key, go to another display other than the RUN mode display and press the F1 key. This will reprogram the F1 key to the new display.

3.3.4 RUN MODE DISPLAY

The RUN mode is the normal mode of operation. In this mode the display will show current process value component designation, control mode and range. Should an error condition or an alarm condition occur, [ER?] (where ? is an alphanumeric character) or [AL#] (where # is either the number 1 or 2) will flash on the display in the component name location. A list of error messages is located in Section 5.1. Refer to Figure 3-3 for the different run mode displays.

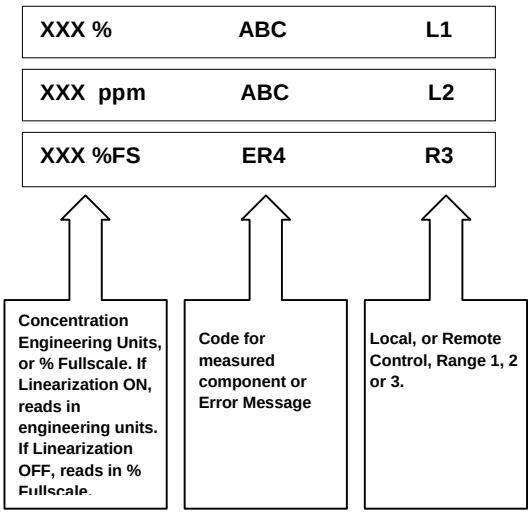


FIGURE 3-3. RUN MODE DISPLAY

3.3.5 GENERAL DISPLAY INFORMATION

The following features are present to the right of all display sequences (except Run Mode display, Zero/Span screens, Status screen, and Auto Zero/Span screens):

→ The beginning of a sub-menu is indicated by → in the extreme right position of the display. This arrow indicates that there will be more information in subsequent displays which can be obtained by either pressing the → key until the next display is obtained, or pressing SHIFT → to move 16 characters, one full display, at a time.

→ ← Indicates that there are subsequent displays which can be accessed by pressing the → key to view a new display or the ← key to return to a previous display. To move 16 characters, one full display at a time, press SHIFT → or SHIFT ←.

← The last display of a routine is indicated by the ← To return to other displays in the routine, press the → key or SHIFT ← to move 16 characters, one full display at a time.

↑ Indicates that the SHIFT key was pressed.

Note:

At any point in the sequence, a sub-menu may be exited by pressing SHIFT/ENTER.

The [WAIT-CALCULATING] message is displayed briefly after the user changes displayed data on some of the screens and then exits the screen.

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3.4 ACCESSING MODE DISPLAYS

Ensure that all MODE displays are functional and that all options ordered from the factory are present by following the flow chart in Figure 3-4. To follow the logic flow chart, use the following steps:

Note:

For more detailed instructions, refer to Figures 3-5 through 3-8, 3-11, and 3-13 through 3-15.

1. Press MODE.
2. Use the → key to move to the desired sub-menu (SECURITY, RANGE, DIAG-NOSTICS, LINEARIZER, ALARM, CUR-RENT OUTPUT, AUTO-CAL or REMOTE I/O) and press ENTER.
3. Press SHIFT then → to move through each sub-menu.
4. At the end of each routine, press SHIFT/ENTER to return to the RUN mode.
5. Repeat steps 1 through 4 to check the next function.

3.5 SECURITY CODE

See Figure 3-5. The Model 880A is equipped with a security code feature, which is deactivated when the instrument is shipped from the factory. When the security feature is activated, only the STATUS and MODE function keys are active to access the STATUS and SECURITY displays. A valid password must be entered to activate the rest of the keyboard.

INITIAL PASSWORD IS "880"

This password may be changed to any three character group. Entering the correct password activates the keyboard.

To gain access, follow the steps in the appropriate figure in this section. Once access has been gained, the procedure described in Figure 3-5 may be performed.

In the event the password is misplaced, the operator may return to the initial password (880) through the following steps:

1. Press and release the RESET push-button switch on the Micro Board (see Figure 3-1).
2. Press and hold the ENTER key until the RUN mode display appears.

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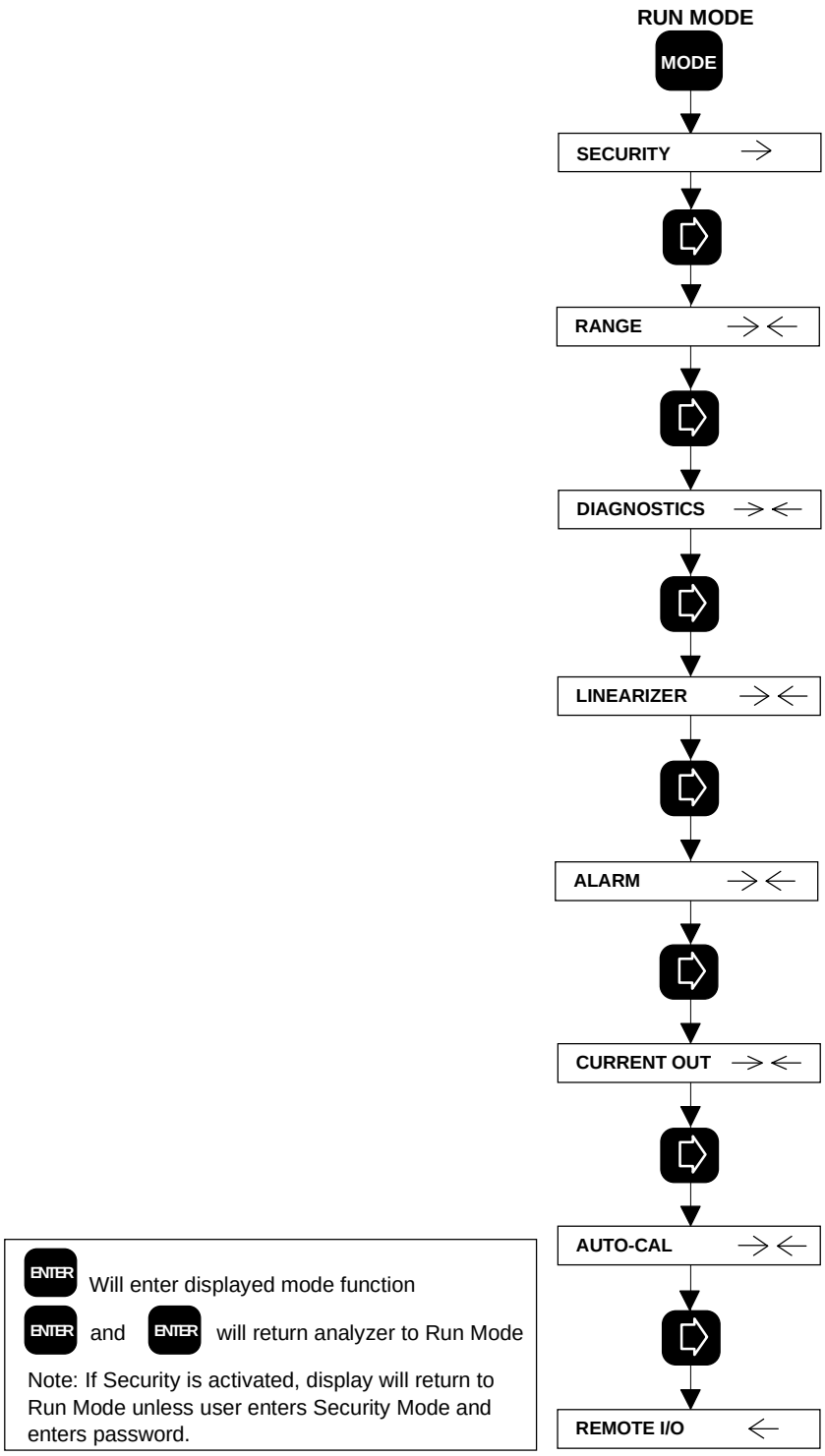
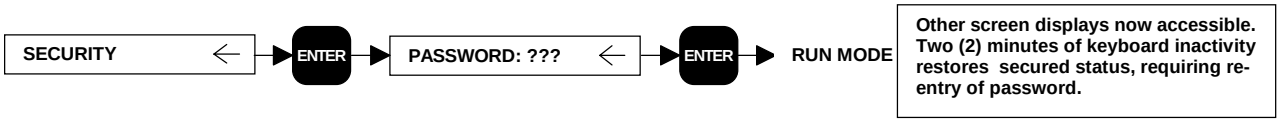


FIGURE 3-4. LOGIC FLOW CHART

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A. ACCESSING SECURED SCREEN DISPLAYS.



B. ACTIVATING/DE-ACTIVATING SECURITY FEATURES AND CHANGING PASSWORD.

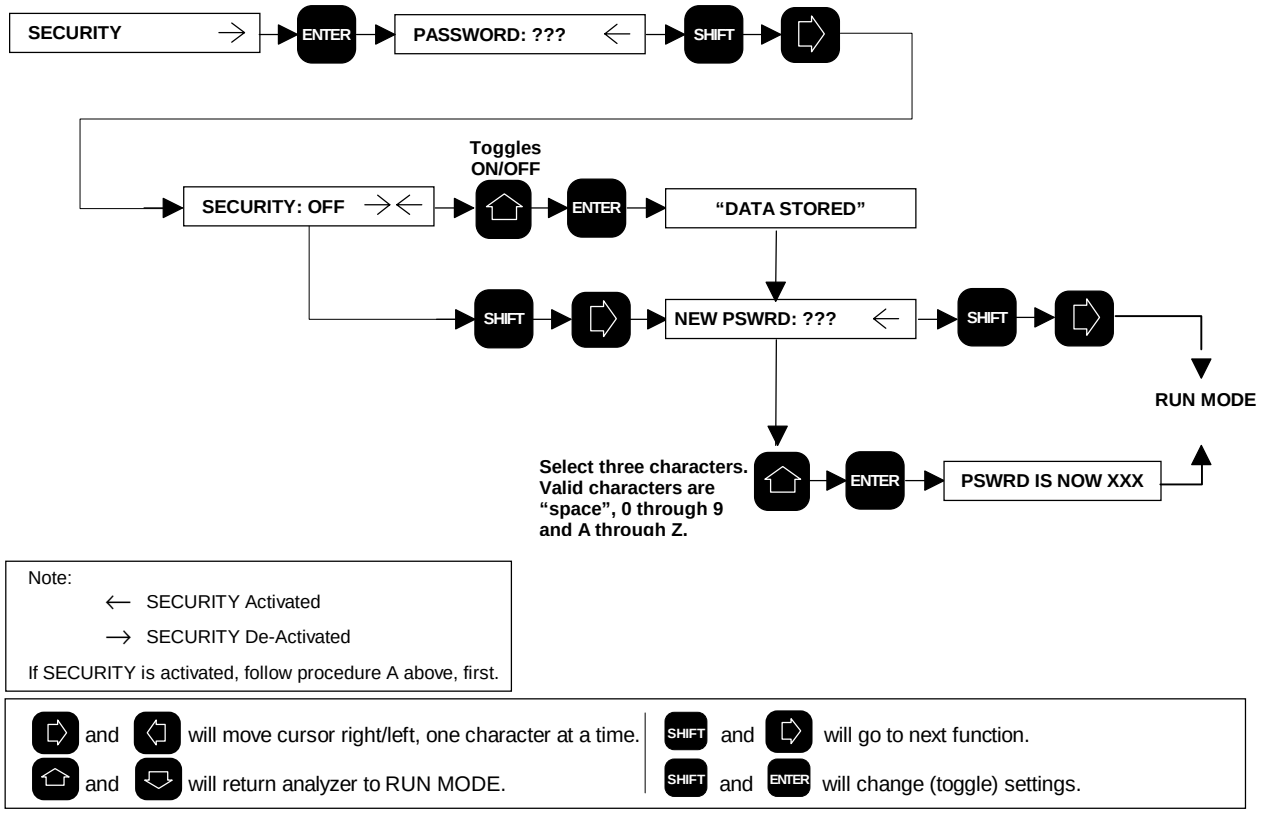


FIGURE 3-5. SECURITY MODE

3.6 RANGE PARAMETERS

3.6.1 RANGE SELECTION

See Figure 3-6. There are several range parameters that may be changed. The first display [RANGE: # CMP NNN →] allows RANGE 1, RANGE 2 or RANGE 3 to be selected with the ↑ or ↓: key. Of these three independent ranges, RANGE 3 should always be the least sensitive range (highest fullscale range).

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3.6.2 COMPONENT OF INTEREST

The component of interest is designated by a 3-digit group of letters or numbers. This gas name or designation may be selected for each range by placing the cursor under the desired digit [NNN] and selecting a letter or number with ↑ or ↓ key. This name will appear on the display when the analyzer is in the run mode.

3.6.3 GAIN

In the [GAIN=X] display, an amplifier gain of 1, 2, 4, or 8 can be selected for each range with the ↑ or ↓ key depending on the sensitivity desired (Refer to Section 5.5). Range 3 is normally the least sensitive range.

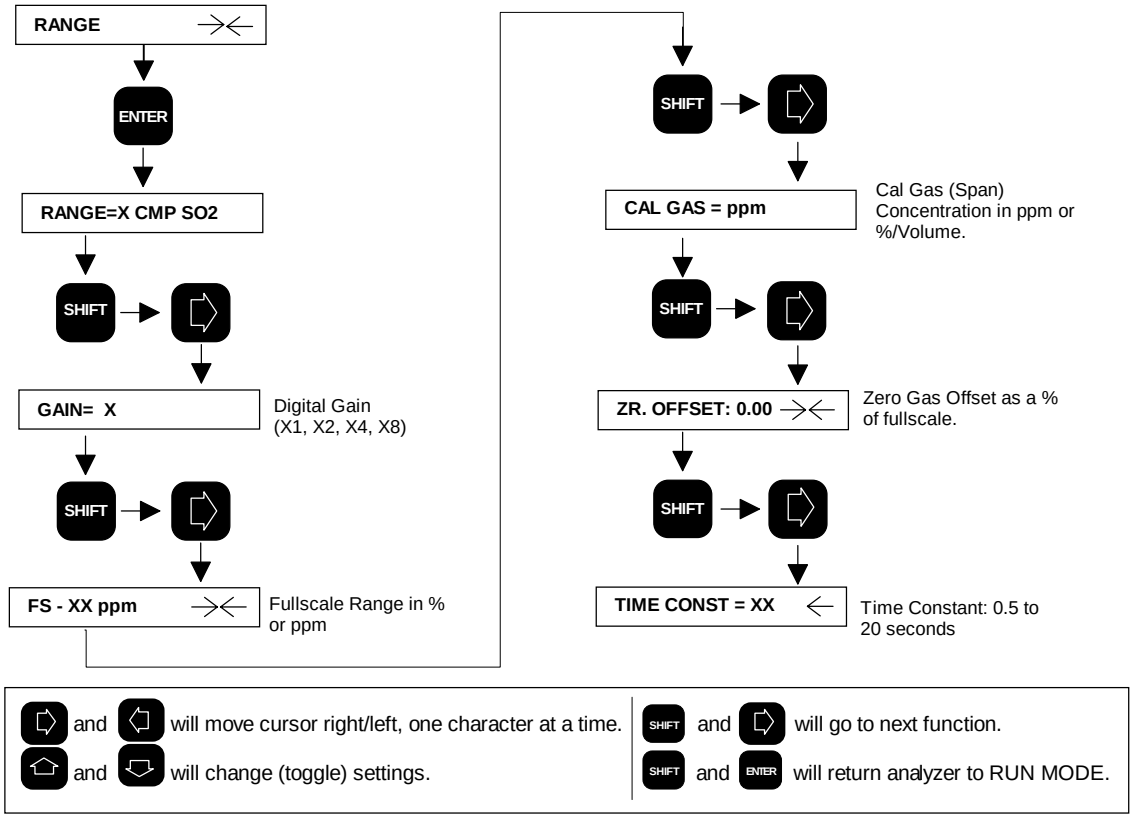


FIGURE 3-6. RANGE MODE

Other ranges are generally set with gains that are proportional to their relative fullscale spans. Thus, if range 1 is 0 to 50 ppm CO and range 3 is 0 to 500 ppm CO, then the respective gains will usually be 8 and 1.

3.6.4 RANGE, FULLSCALE

In the [FS=XXXX ppm *] or [FS=XX.X % *] display, up to a four-digit fullscale value is entered in ppm (parts per million).

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Note:

The instrument will not allow the user to enter a value in the [CAL GAS = XXXX] screen that is larger than the fullscale value entered in the [FS = XXXX ppm) screen.

3.6.5 CALIBRATION GAS

In the [CAL GAS=XXXX ppm *] display, up to a four-digit calibration gas value is entered in ppm for each linearized range. **It is recommended that cal gas concentration be from 80% to 100% of fullscale.**

3.6.6 ZERO OFFSET

In the [ZR-OFFSET:X.XX *] display, the amount of zero offset in percent of fullscale is entered for each range. The zero offset feature compensates for impurities in zero calibration gas. If there are no impurities in the zero gas, set ZR-OFFSET to 0.00.

3.6.7 TIME CONSTANT

In the [TIME CONST=XX ← display, the value of the TIME CONSTANT can be changed for each range. This TIME CONSTANT is responsible for the amount of time (in seconds) in which the analyzer responds to change. A different TIME CONSTANT can be selected for each range.

To change or check the settings of the different range parameters, follow the steps in the appropriate figure in this section.

Note:

After changing a setting, press ENTER to retain the new setting in nonvolatile memory. Settings stored in nonvolatile memory will be saved even in the event of a power outage.

At any point in the sequence, the routine may be exited by pressing SHIFT/ENTER.

The analyzer must be in LOCAL mode (L1, L2 or L3 appears in RUN MODE display) to change ranges in [RANGE=XXX] screen of Figure 3-6.

3.7 ANALYZER DIAGNOSTICS

Diagnostics are selectable through the MODE function. This function allows the source current, detector signals, oscillator tune voltage, and the four power supply values (+5 V, +15 V, +12 V, and -15 V) to be displayed.

It is recommended that the values for oscillator tune, detector signal and source current be recorded when the diagnostic display is first accessed. See Figure 3-7.

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3.8 ZERO CALIBRATION

The Model 880A Analyzer automatically calculates zero when the analyzer is in the zero setpoint mode. Simply press ZERO (display notes [ZERO - WAIT] and then [ZR = XX PS = XX %]). (Ensure that zero gas is flowing through the cell until display reading stabilizes.) Then press ENTER (display notes [CALCULATING ZERO]). Zero is then set for all three ranges, and the analyzer returns to Run Mode (after a delay of about 20 to 30 seconds).

Note:

When entering this function, ensure that zero calibration gas is flowing through the analyzer. When entering this function for viewing purposes only, press SHIFT/ENTER to exit without changing zero value.

To calibrate zero:

1. Allow system to warm up a minimum of two hours.
2. Connect zero gas to the sample cell inlet at the back of the analyzer. Flow the gas at a flow rate of 500 cc/min, as read on a flowmeter, until display reading stabilizes.

To calibrate the zero setting for the analyzer for all three ranges, press ZERO and then press ENTER.

3.9 SPAN CALIBRATION

The Model 880A Analyzer sets span for the selected range in a simple two-keystroke procedure.

To span the analyzer, the operator simply presses SPAN and ENTER. When SPAN is pressed, display notes [SPAN - WAIT] and then [X.XX NN % MMM $\rightarrow$], where X.XX is the run mode value, NN % is the percentage of span potentiometer in use and MMM is the span gas value. When ENTER is pressed, display notes [CALCULATING SPAN] and the analyzer re-enters Run mode on completion of function (after a delay of about 15 to 20 seconds).

Note:

For instruments with the Calibration Gas Control or Auto Zero/Span, press ENTER to perform the new calibration. Press SHIFT/ENTER to abort this function, turn off the relay for this valve, and maintain previous calibration settings.

When entering this function, ensure that span calibration gas is connected to the analyzer. When entering this function for viewing purposes only (by pressing the SPAN key), press SHIFT/ENTER to exit.

To perform span:

1. Allow system to warm up a minimum of two hours.

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2. Connect span gas to the sample cell inlet at the back of the analyzer. Flow the gas at a rate of 500 to 1000 cc/min (1 to 2 SCFH), as read on a flowmeter, until the display reading stabilizes.
3. To calibrate, press SPAN and then ENTER.

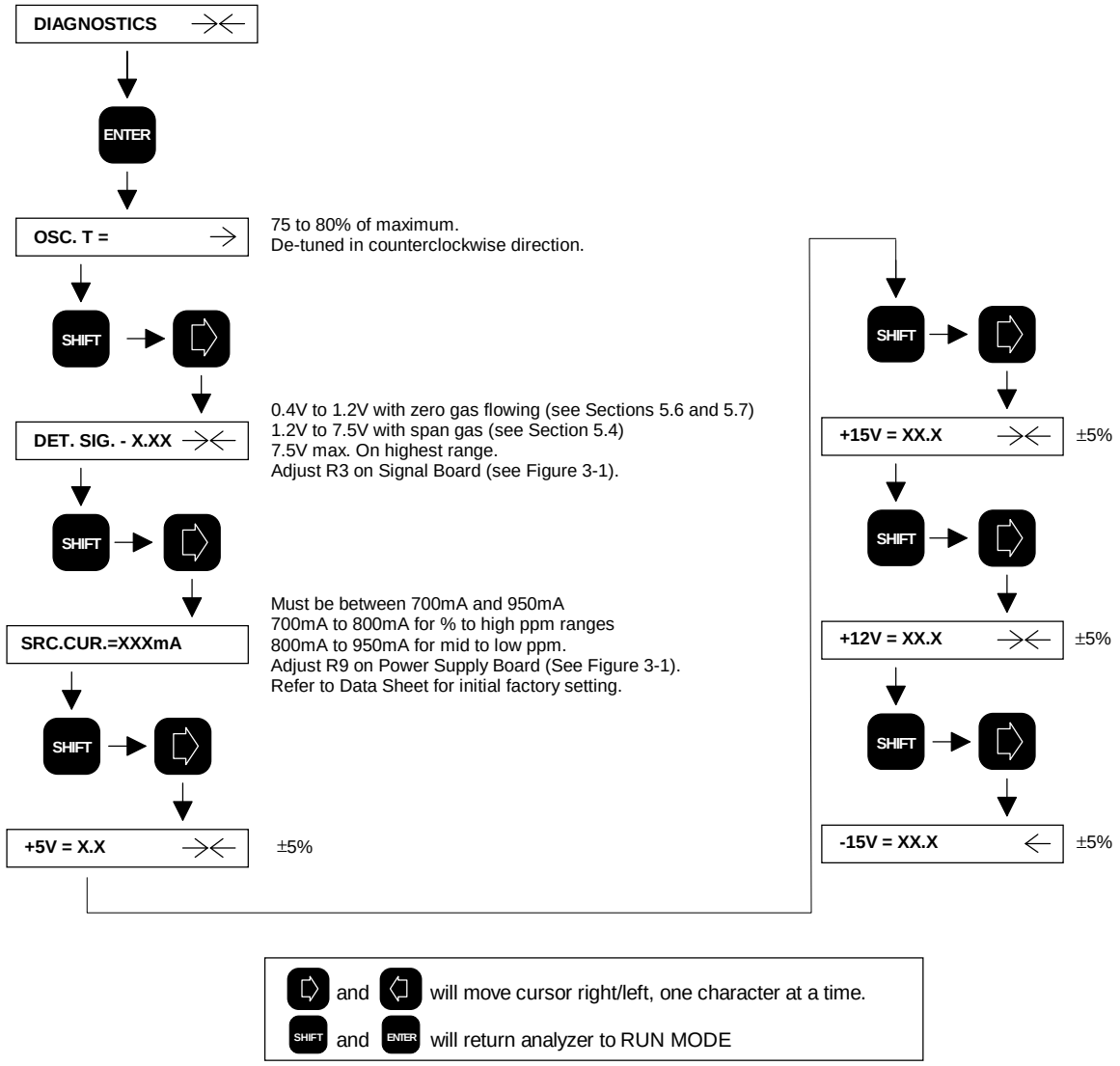


FIGURE 3-7. DIAGNOSTIC MODE

3.10 LINEARIZATION

The Model 880A Analyzer can be operated in the linear and non-linear mode. Linearization can be toggled ON/OFF with the ↑ or ↓ key in the Linearization Mode Screen (see Figure 3-8) In the OFF position, linearization is disabled for all ranges. In the linear mode, the component of interest is measured in engineering units, either ppm (parts per million) or % (percent of composition). In the non-linear mode, the component of interest is measured is in %FS (percent of fullscale).

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The analyzer is linearized with the following fourth-order polynomial:

$$Y = A_0 + A_1X + A_2X^2 + A_3X^3 + A_4X^4$$

Where X is the nonlinear input; A0, A1, A2, A3 and A4 are the linearization coefficients; and Y is the linear output.

Linearization coefficients can be developed for each range and stored in the analyzer using the front panel keypad. The operating range is selected by entering RANGE = 1, 2, or 3 in the Range Mode. Coefficients for the selected range are automatically used, independent of the position of Range = n, from the Linearization Mode (except for the ALL Range selection).

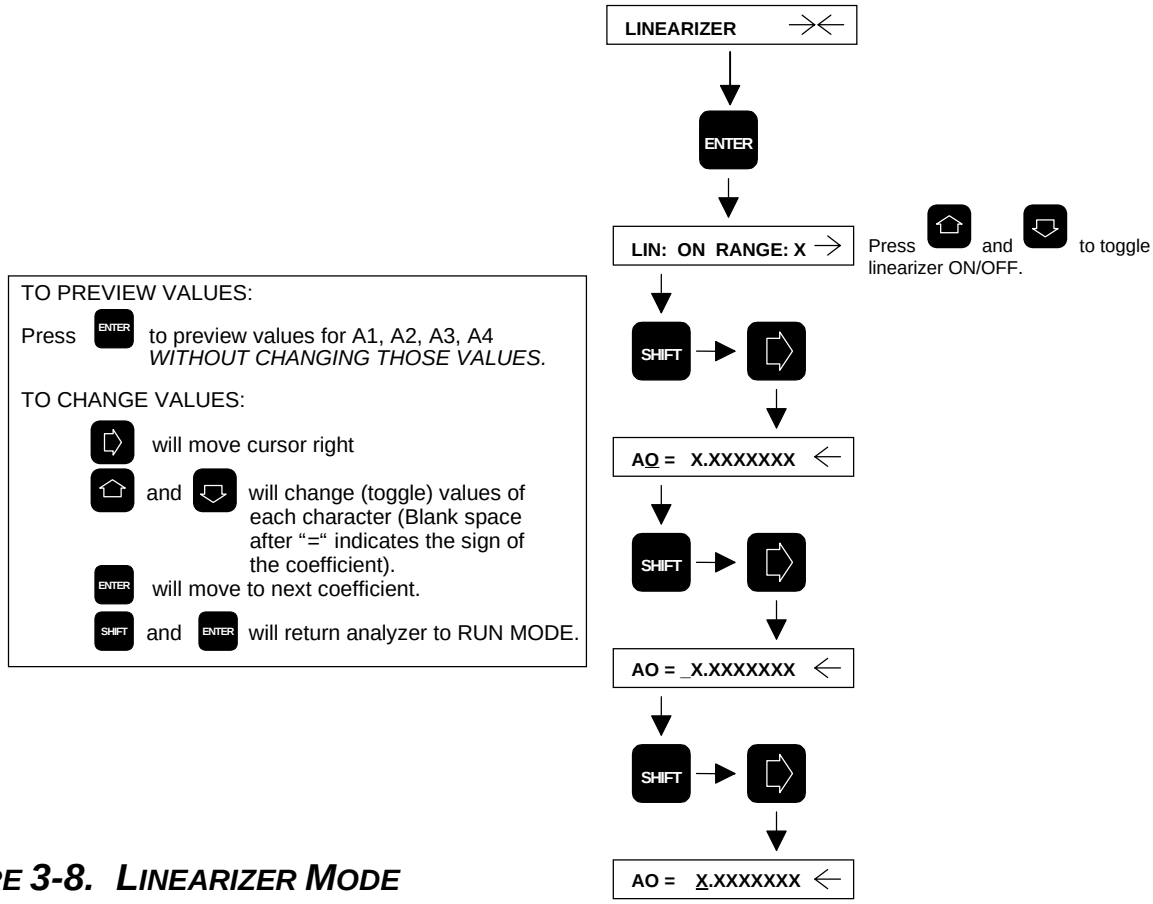


FIGURE 3-8. LINEARIZER MODE

3.10.1 ALL RANGE

The "All" range is a special feature that allows the user to use Range 3 coefficients for all three ranges. It should only be used over dynamic ranges of 3:1 or less. If Range A is selected in the Linearization Mode, the microprocessor will use the coefficients in Range 3. Also, if the linearizer is ON and in Range A, the microprocessor will use the GAIN and TIME CONSTANT from Range 3, regardless of the GAIN and TIME CONSTANT selected for Ranges 1 and 2.

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3.10.2 NON-STANDARD RANGES AND COEFFICIENTS

When ordered, special linearization coefficients for non-standard fullscale ranges are entered in the appropriate range(s) at the factory. If one set of linearization coefficients has been ordered and a range has not been specified, these coefficients will be for Range 3.

The user may want the display to read in engineering units (ppm). This response is linear over the operating range.

The following coefficients will make no correction to the straight line response, but will cause the analyzer to display engineering units:

$A_0 = 0.00000$
$A_1 = 1.00000$
$A_2 = 0.00000$
$A_3 = 0.00000$
$A_4 = 0.00000$

To calculate linearization coefficients other than those installed at the factory, either 11 or 21 data points should be taken. (If urgent, a curve can be created with as few as 4 points. This should be considered temporary and a more accurate curve made with more points should be created as soon as possible.)

These data points can be obtained with an accurate gas divider or other flow mixing device. Before calculating coefficients, the data must be normalized to ranges of 0 to 1 units for both % and concentration readings. Then the axis must be reversed as illustrated in Figures 3-9 and 3-10. A multiple linear regression is then used to calculate coefficients. (For example: If the range is 0 to 5000 ppm and readings are 0 to 100%, then divide all of the concentrations by 5000 and the readings by 100. Put the normalized concentrations on the Y-axis and the normalized readings on the X-axis.

These data points can be entered into any program capable of computing a fourth order polynomial curve. This curve will be the mirror image of the curve on the application sheet at the back of the manual, however the linearization coefficients will be different. Use the coefficients calculated with the curve for linearization coefficients. Use these coefficients to solve the following equation:

$$Y = A_0 + A_1X + A_2X^2 + A_3X^3 + A_4X^4.$$

After taking the data points, the user may determine coefficients for user-specific gas by either using any program capable of calculating a fourth order curve fit or calling the factory to have the specific coefficients calculated.

When entering user-determined coefficients, note that the microprocessor only recognizes five significant figures to the right of the decimal point (i.e., 0.12345). Also, the user should ignore the three non-significant digits as they may change value while the significant digits are being changed. The values of the non-significant digits do not affect the instrument's linearity.

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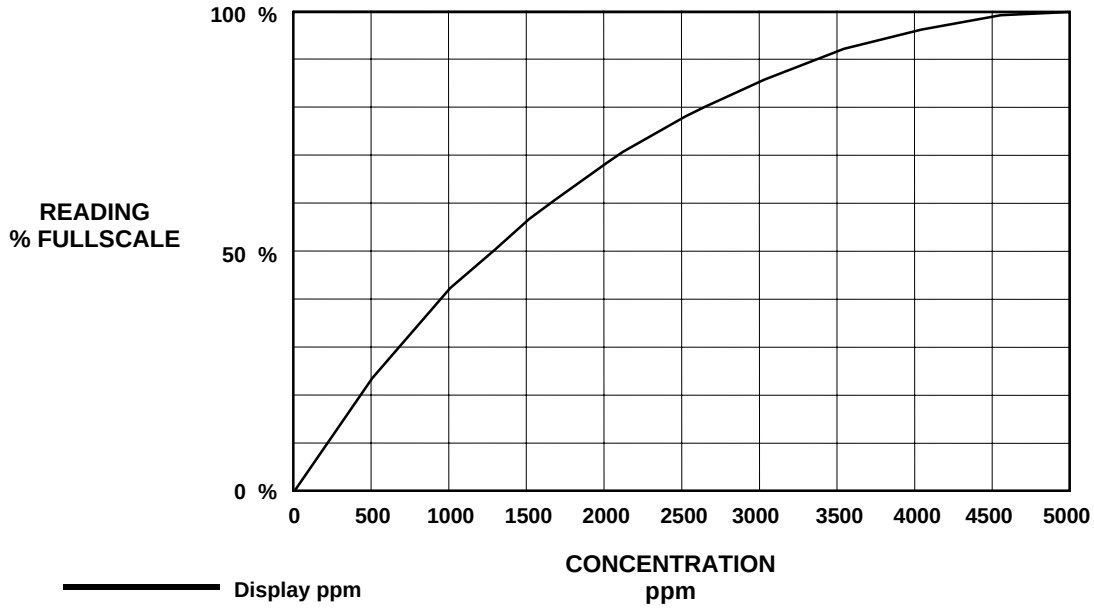


FIGURE 3-9. TYPICAL APPLICATION LINEARIZATION CURVE, LINEARIZER OFF

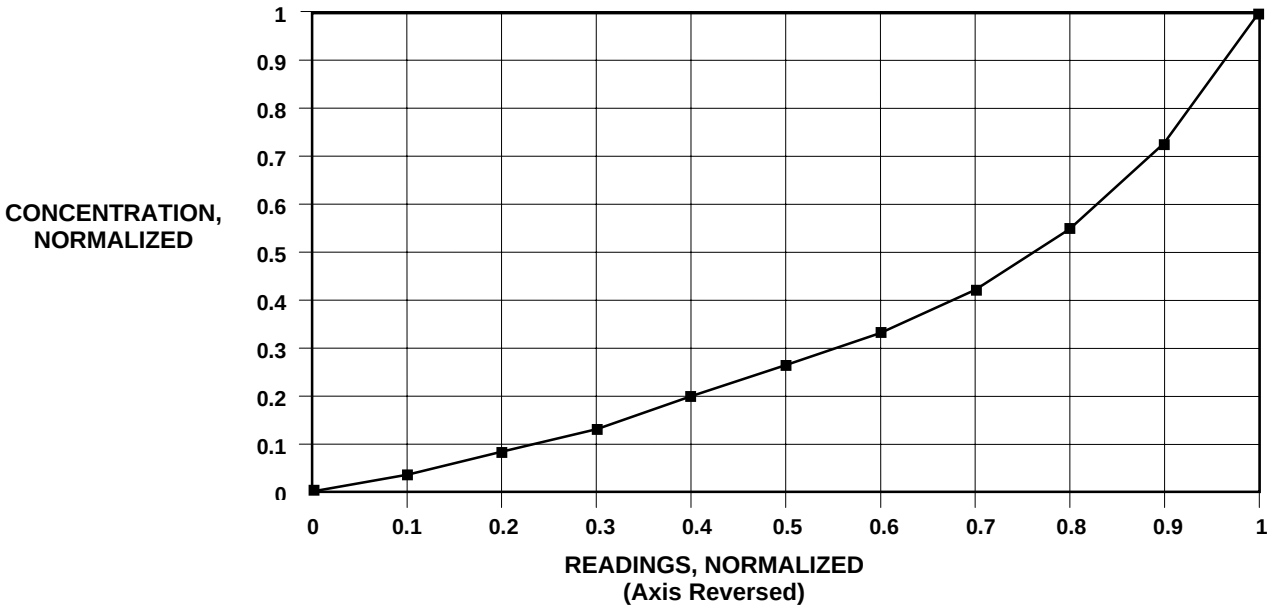


FIGURE 3-10. USER DETERMINED LINEARIZATION CURVE (NORMALIZED)

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3.11 ALARM

The Alarm consists of two single point, field-programmable high or low outputs with a deadband of up to 20% of fullscale. The two alarm setpoints are programmable for one range selected, and are dimensionless. The alarms can be set with one alarm HIGH and one alarm LOW, both alarms HIGH or both alarms LOW. This option is completely user configurable (See Figure 3-11).

The Status Display (see Section 3.11.1) will reflect an alarm condition should one occur. When the instrument is in alarm condition (exceeding the alarm setpoint), the latch associated with the alarm is set. When the alarm condition clears, (run mode value is less than the alarm setpoint plus the deadband) the latch is reset.

The high alarm is determined when RUN mode value exceeds the alarm setpoint. The alarm is cleared when run mode value is less than alarm setpoint minus the deadband. The low alarm is determined when the run mode value is less than the alarm setpoint. This alarm is cleared when the run mode value is greater than the alarm setpoint plus the deadband.

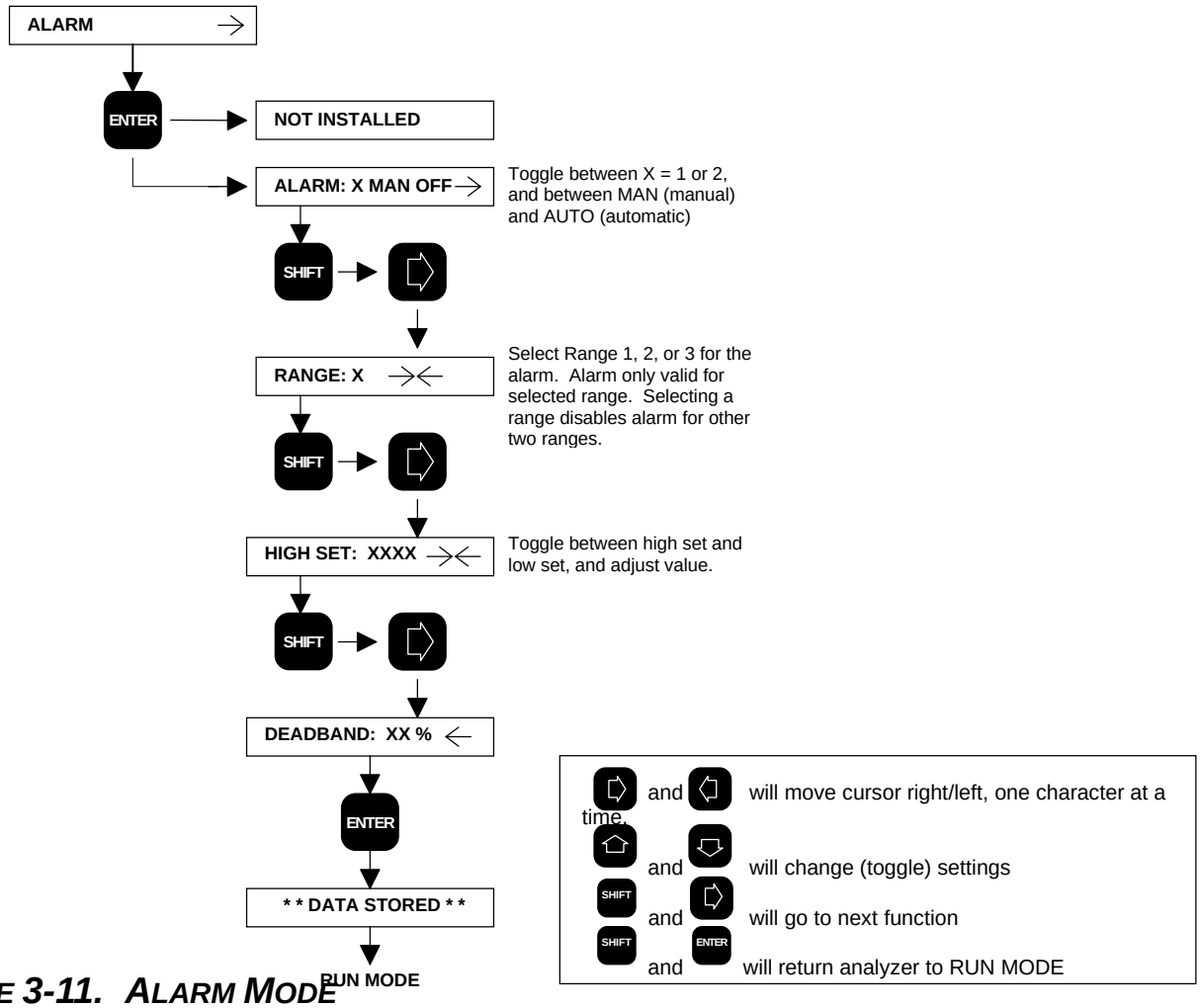


FIGURE 3-11. ALARM MODE

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ALARM 1 and ALARM 2 can be toggled with the up and down arrows to either AT (automatic) or MAN (manual). In the AUTO (automatic) setting, an alarm relay will be activated should an alarm condition occur. Alarms are calculated in the AUTO mode on the basis of parameter settings. The MANUAL mode is the test mode and alarms are not scanned by the CPU. In the MANUAL (test) mode, the ALARM ON/OFF can be toggled with the up and down arrows to set and reset the alarm latch.

The Fail-Safe not only sets the alarm when an alarm condition is present, but also in the event of a power outage.

3.11.1 STATUS DISPLAY

Refer to Figure 3-12. The STATUS display shows the alarms, error messages and security lockout status. (See explanations of error messages in Section 5.1.) The STATUS display can be used to check the following alarm setpoints without entering one of the MODE functions: HIGH/LOW, AUTO/MANUAL and ON/OFF.

The order of priority for error messages, security status and alarms is as follows:

[SECURITY ENABLED/DISABLED]
[ERL]
[EL-LIN.COEFF ERR]
[E0-ZERO POT LMTS]
[E1-SPAN #1 LMTS]
[E2-SPAN #2 LMTS]
[E3-SPAN #3 LMTS]
[E4-ADC SATURATED]
[E5-ZERO DRIFT]
[E6-SPAN DRIFT]
[E7-GAIN TOO HIGH]
[RMT: R/L]
[ALARM 1 AUTO/{MAN ON/OFF}]
[ALARM 2 AUTO/{MAN ON/OFF}]
[MAN-CAL PRESENT]
[AUTOCAL: ON/OFF]
[CURRENT 0/4 SP ON/OFF]

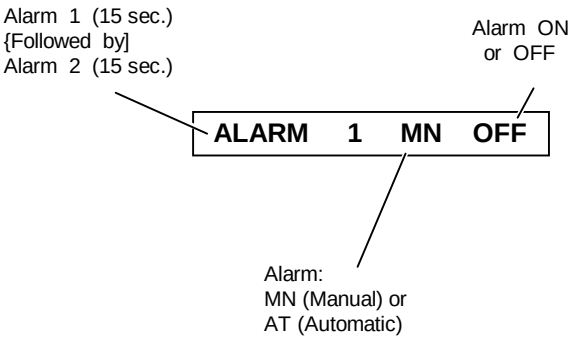
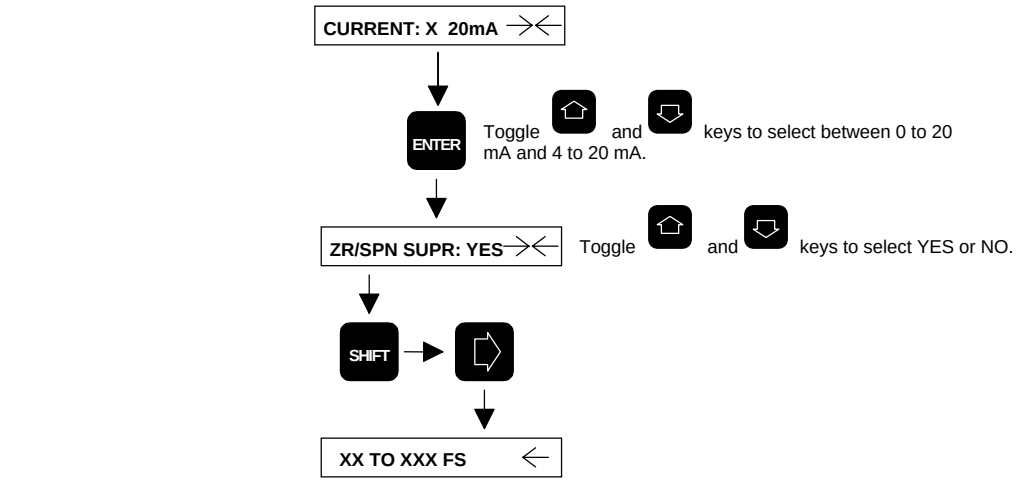


FIGURE 3-12. STATUS DISPLAY

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3.12 CURRENT OUTPUT

Refer to Figure 3-13. The Model 880A Analyzer has a standard 0 to 20 or 4 to 20 mA current output with zero span suppression. This function can represent any suppressed range with at least a 25% span. For example. a valid range could be 0% to 25%, 28% to 61% or 33% to 100%. When the Zero Span Suppression is off (NO), the analyzer defaults to the 0% to 100% range.



Note: Current Output is factory set at 4 to 20 mA. If an adjustment is needed, Zero (R2, labeled OFFSET on the board) and Span (R1) potentiometers are located on the Current Output Board (Figure 2-6).

SHIFT and ENTER will return analyzer to RUN MODE.

FIGURE 3-13. CURRENT OUTPUT MODE

3.13 ZERO/SPAN CALIBRATION WITH CALIBRATION GAS CONTROL

The Calibration Gas Control allows one-man calibration. This option consists of two form C contacts, rated 3A-125/250 VAC or 5A-30 VDC (resistive). These contacts are connected to solenoid valves (customer supplied) which will turn zero and span calibration gases on and off when activated. Simply press ZERO or SPAN to open the appropriate valve, thus allowing the gas to flow through the instrument. Press ENTER to initiate the calibration process. At the conclusion of calibration, the valve is closed and the instrument returns to Run Mode. See Section 3.16 for more information.

Note:

For instruments with Calibration Gas Control or Auto Zero/Span, press ENTER to perform the selected calibration. Press SHIFT/ ENTER to abort the function, turn off the relay for this valve, and maintain previous calibration settings.

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Note:

When entering this function for viewing purposes only (by pressing the ZERO or SPAN key), press SHIFT/ENTER to exit.

To calibrate the analyzer with the Calibration Gas Control.

1. Allow system to warm up a minimum of two hours.
2. Connect the solenoid valve for the zero gas to the two form C contacts. Connect the zero gas to the sample cell inlet located on the back of the analyzer. The gas should flow at a rate of 500 cc/min, as read on a flowmeter, until the display reading stabilizes.
3. To calibrate the zero setting for the analyzer, press ZERO. To calibrate the span setting for the analyzer, press SPAN. Wait for the reading to stabilize, and then press ENTER.

3.14 AUTO ZERO/SPAN

Refer to Figure 3-14. The Auto Zero/Span allows automatic, unattended calibration at set intervals. The option has six contact closures, four of which are field programmable for frequency and duration of the calibration cycle (span 1, span 2, span 3 and zero). Meanwhile, the other two contact closures indicate insufficient zero and span adjustments and also drift limits for zero and span, if activated.

The auto zero/span [AUTO-CAL: ON] display allows the user to select ON or OFF to turn the Auto Zero/Span “on” or “off”. Toggling from OFF to ON resets the timers for the Auto Zero/Span. To reset the timers when the Auto Zero/Span is “on”, toggle from ON to OFF to ON.

The sample and hold [SH: YES] display allows the user to select YES or NO to turn the automatic sample and hold “on” or “off”. When the sample and hold feature is “on”, the recorder and Current Output do not get updated until the calibration sequence is completed.

The range selection [RANGE: 1Y 2Y 3Y] display allows the user to select the ranges which will be automatically calibrated with span gas by using the →arrow to move the cursor to the desired range and using the ↑ or ↓ key to select Y (yes) or N (no) for each range. The zero for all three ranges will be calibrated at each interval regardless of range(s) selected.

The initial delay [DELAY nnn HR] display allows the user to select the amount of time until the first automatic calibration occurs. This is the initial delay until the automatic cycle starts. At this time a zero and span calibration is made regardless of selection. If a zero delay is selected there will be an automatic two minute delay.

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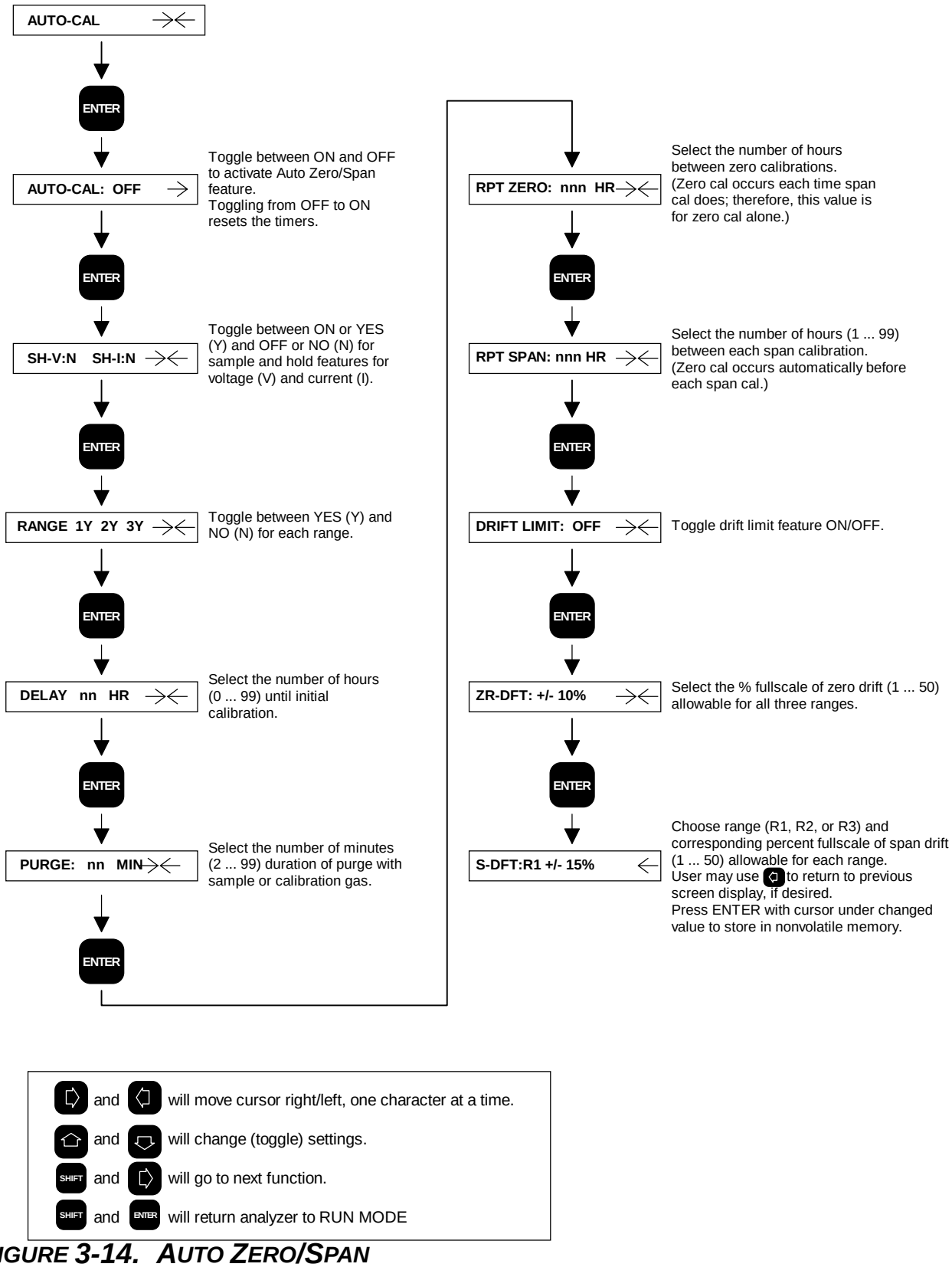


FIGURE 3-14. AUTO ZERO/SPAN

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The purge [PURGE: nnn MIN] display allows the user to select the amount of time for the calibration gas to flow through the analyzer before the calibration starts for zero and span or the amount of time for sample gas to flow through the analyzer before run mode values are recorded when the sample and hold feature is selected. The analyzer is calibrated during the final minute of purge time. During the remaining purge time the signal is modified according to previous calibration data.

The repeat zero [RPT ZERO nnn HR] display allows the user to select the amount of time between zero calibrations. This is the amount of time after the initial calibration before the zero calibration is repeated without repeating the span calibration.

Note:

Each time an auto span calibration is made, a zero calibration is also made regardless of selection.

The keyboard is disabled during the auto zero/span sequence.

During the auto zero/span sequence, the time constant is set to one second. Upon completion of the calibration sequence, the time constant is reset to the value chosen in Range Parameters.

In order to engage the Auto-Cal function with the Remote Range I/O, the Auto-Cal function must be disabled by toggling AUTO-CAL to OFF in the [AUTO-CAL:OFF] display.

The repeat span [RPT SPAN nnn HR] display allows the user to select the amount of time between span calibrations. This is the amount of time after the initial span calibration before this calibration is repeated.

The [DRIFT LIMIT: ON] display allows the user to determine the maximum amount of span and zero drift allowable. The [ZR-DFT: ± XX%] or [SP-DFT ± XX%] display allows the user to select the percentage of fullscale by

which the analyzer is allowed to drift from the reference span or zero calibration values. The maximum zero drift limit is 10% fullscale and the maximum span drift is 15% fullscale.

In the linearized mode, these values should be obtained from the Response Curve for Range located at the back of the manual. For the linear mode, locate the amount of span or zero drift limit desired on the bottom scale and find the corresponding Recorder Deflection value on the side scale. These are the values that should be entered in [ZR-DFT: ± XX% → ←] or [S-DFT:R# ± XX% ←].

Calibration drift calculations for all ranges toggled "ON" in the [Range: 1Y 2Y 3Y] display include only calibrations occurring after initiation of the Calibration Drift function. Two reference zero and/or span calibrations after initiation of the Calibration Drift function are required for calculation of the Calibration Drift value.

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3.15 REMOTE RANGE INPUT/OUTPUT

Refer to Figure 3-15. The Model 880A Analyzer has optional remote range change and ID capability. When the Remote Range Input/Output is switched to REMOTE in the RUN mode, the range indicator at the right corner of the display will be R# instead of L#. Refer to Tables 3-1 and 3-2 for explanations of BIN (binary) and DEC (decimal).

When SPECIAL is selected, only autocal status and remote/local status on pins 8 and 9, respectively, are active.

This option allows the user to remotely change ranges and initiate Auto/Zero/Span. The input section is level triggered by the user's 5 to 24 VDC pulses. The output section allows monitoring ranges, auto-cal, and remote/local status.

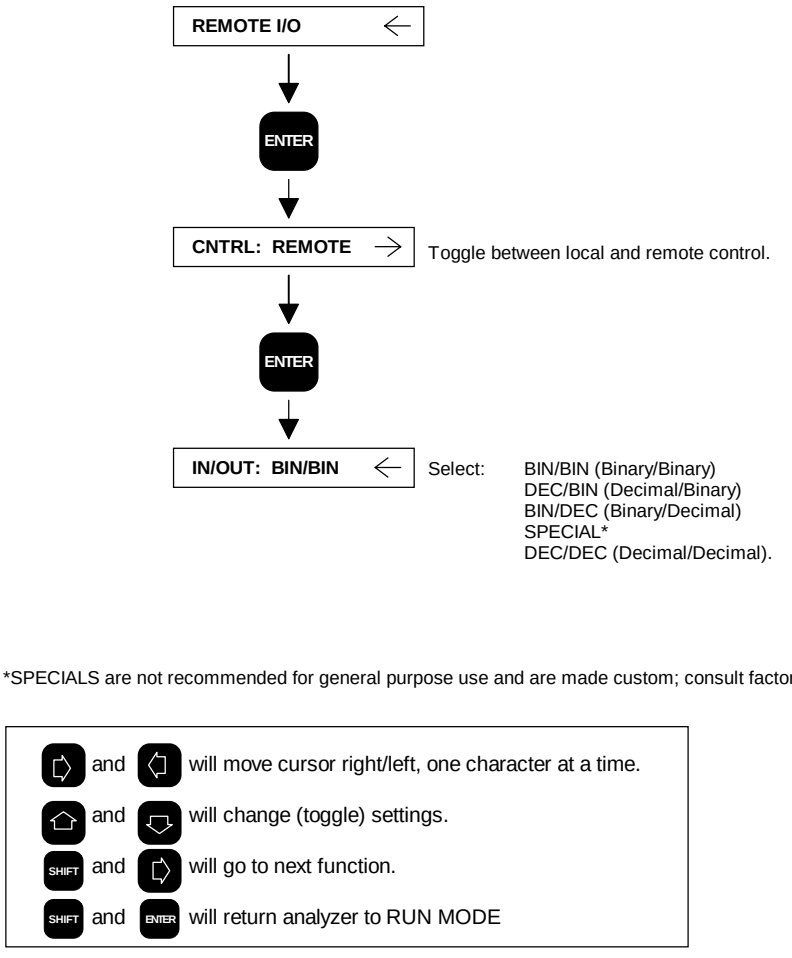


FIGURE 3-15. REMOTE INPUT/OUTPUT

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OUTPUT		INPUT	
J2 PIN #	DESIGNATION	J3 PIN #	DESIGNATION
1	Common	1	Range selection in remote
2	Range I.D.	2	Range selection in remote
3	Range I.D.	3	Range selection in remote
4	Not Used	4	Not Used
5	Not Used	5	Not Used
6	Not Used	6	Not Used
7	Not Used	7	Auto-Cal request
8	AUTO-CAL status	8	Not Used
9	REMOTE/LOCAL status	9	Common

Note: The Auto-Cal request input is level triggered, therefore, it is the responsibility of the user to verify that the input is brought low before the analyzer completes the Auto-Cal process.

TABLE 3-1. REMOTE RANGE I/O DESIGNATION

MODE	RANGE	J3 PIN 3	J3 PIN 2	J3 PIN 1
BIN	R3	0	1	1
BIN	R2	0	1	0
BIN	R1	0	0	1
DEC	R3	1	0	0
DEC	R2	0	1	0
DEC	R1	0	0	1

1 = High Voltage Pulse (5 to 24 VDC)
0 = Low

TABLE 3-2. REMOTE RANGE I/O BINARY AND DECIMAL CODING

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NOTES

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4 ROUTINE OPERATION AND THEORY

4.1 ROUTINE OPERATION

First set the range for desired operating range: 1, 2, or 3. Then follow the steps for zero and span (Sections 3.8 and 3.9). Next supply sample gas through the instrument. The Model 880A will now automatically and continuously analyze the sample stream.

As a check of instrument performance, it is recommended that the operator keep a log of the zero/span status (percentage of pot value).

4.2 RECOMMENDED CALIBRATION FREQUENCY

Maximum permissible interval between calibrations depends on the analytical accuracy required and cannot, therefore, be specified. It is recommended initially that the instrument be calibrated once every 24 hours and that this practice be continued unless experience indicates that some other interval is more appropriate.

Readout accuracy is directly proportional to change in barometric pressure (i.e., a change in cell pressure of 10 mm of mercury will result in a readout error of approximately 1% of reading). Therefore, if barometric pressure changes significantly, it is advisable to recheck the calibration against an upscale standard gas.

4.3 SHUTDOWN

The Model 880A will retain settings during prolonged shutdown. Recalibrate the instrument upon restart.

4.4 DETECTION SYSTEM THEORY

As shown in Figure 1-1, infrared radiation is produced from two separate energy sources. This radiation is interrupted by a chopper at 5 Hz. Depending on the application, the radiation may then be optically filtered to reduce background interference from other infrared-absorbing components.

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Each infrared beam passes through a cell, one containing a continuously flowing sample and the other cell sealed or with a continuously flowing reference gas.

During analysis, a portion of the infrared radiation is absorbed by the component of interest in the sample, with the quantity of infrared radiation absorbed being proportional to the component concentration. The detector is a “gas microphone” based on the Luft principle. It converts the difference in energy between sample and reference cells to a capacitance change. This capacitance change, proportional to component concentration, is processed and indicated on the display.

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5 TROUBLESHOOTING

5.1 ERROR CODE SUMMARY

In the Run Mode, the error codes described in Table 5-1 may appear on the display. These messages also are shown on the STATUS display in a slightly different format. Error messages in Table 5-1 are listed in order of priority.

Note:

The ERL error message takes precedence over other error messages [ER0 - ER7] in the Run Mode screen.

RUN MODE DISPLAY	STATUS DISPLAY	EXPLANATION
ERL	[EL-LIN.COEFF ERR]	Either an improper linearization coefficient or a CAL GAS value larger than fullscale has been inputted. See Section 5.10 for further information.
ERO	[EO-ZERO POT LMTS]	Zero Potentiometer setting is such that *more* than ±500 mV is required to make a software zero. The zero pot cannot compensate. System must be balanced with source balance shutter adjustment. See Section 5.6.
ER1	[E1-SPAN #1 LMTS]	
ER2	[E2-SPAN #2 LMTS]	Span errors for Range 1, Range 2, or Range 3. Software span is outside limits so that the rum mode value is not between 51% and 100% of the span gas value while in the Span Mode. Check gain settings.
ER3	[E3-SPAN #3 LMTS]	
ER4	[E4-ADC SATURATED]	Signal into ADC is greater than fullscale rating. Refer to Figure 3-6 and reduce the digital GAIN setting by one value, i.e. 8 to 4, 4 to 2 or 2 to 1. If the GAIN is initially on 1, switch from High to Low gain.
ER5	[E5-ZERO DRIFT]	Zero drift limit exceeded. To clear, recalibrate or toggle the drift limit OFF and then ON. See Figure 3-14.
ER6	[E6-SPAN DRIFT]	Span drift limit exceeded. To clear, recalibrate or toggle the drift limit OFF and then ON. See Figure 3-14.
ER7	[E7-GAIN TOO HIGH]	The gain setting in the “RANGE” sub-menu is producing too high of a signal. Reduce gain.
[IR SOURCE ERROR]		Infrared source current has been below 300 mADC for more than 2 minutes. Check source current, adjust R9 for minimum 700 mADC. Replace source, if required.

Note: If any of the above error messages occur during calibration, software will restore previous calibration values. The analyzer is then operable under values resident before modification.

TABLE 5-1. ERROR CODE SUMMARY

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Note:

If several error conditions are active simultaneously, only one error message will take precedence in the Run Mode display. To view all error messages, press the STATUS key.

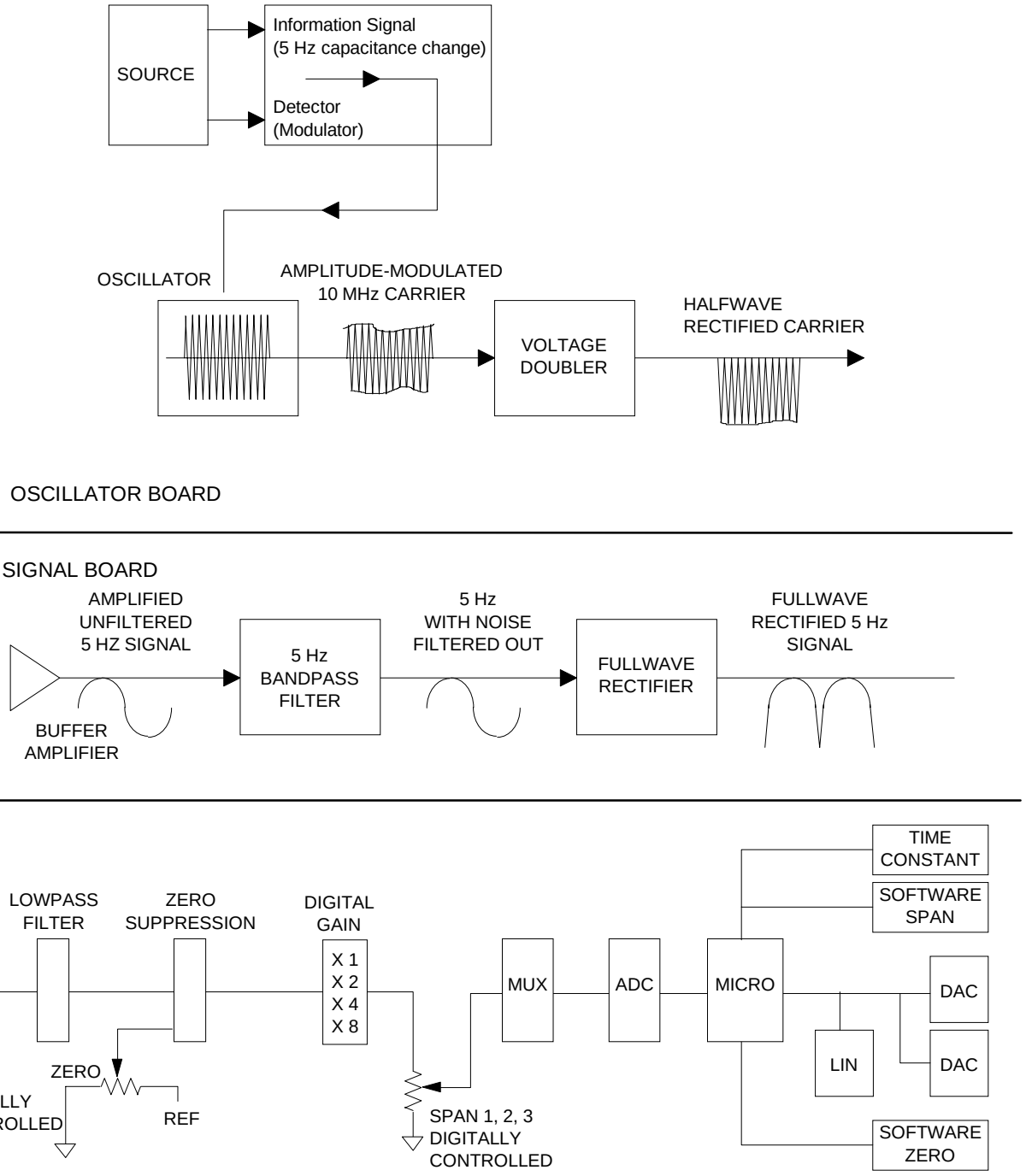


FIGURE 5-1. FUNCTIONAL BLOCK DIAGRAMS

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5.2 VOLTAGE CHECKS

Refer to Section 3.7 and ensure that the voltages for the detector signal and the three power supplies are correct.

5.3 OSCILLATOR TUNE ADJUSTMENT

This procedure should not be performed on a routine basis:

1. Refer to Section 3.7, and access the Oscillator Tune display.
2. Refer to Figure 3-1. Adjust coil knob (Oscillator Tune, located on top of the detector housing) until a maximum reading is obtained on the display.
3. Adjust the coil **counterclockwise** until the unit reads between 75 and 80% of the maximum value.

5.4 PREAMP GAIN

The preamp gain is used to adjust the fullscale value at TP2 and the diagnostic display to 7.5V. To prevent saturation, this value must never be higher than 7.5V, fullscale. If this value is too low or is above 7.5V, adjust the preamp gain.

1. Refer to Section 3.7, and access the Detector Signal display.
2. Flow SPAN calibration gas for the least sensitive range through the SAMPLE CELL until display reading stabilizes.

   An example:

   Range 1 - 500 ppm CO
   Range 2 - 2000 ppm CO
   Range 3 - 5000 ppm CO

   In this case, the least sensitive range would be 5000 ppm.

   If the calibration gas is not equal to fullscale, find the percent fullscale of the calibration gas by looking at the application curve at the back of the manual.

   Multiply this value by 7.5 and record the resultant value for Step 5. For example, if the SPAN gas is 67 % of fullscale, then

   (0.67)(7.5)= 5

   In this case, the value to be used in Step 5 is 5.

3. Refer to Figure 3-1. Adjust the displayed value with preamplifier gain potentiometer R3, located on the Signal Board, for the value obtained in Step 4. THIS VALUE SHOULD NEVER BE HIGHER THAN 7.5.

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Note:

For applications with very low concentrations (for example Range 3 = 400 ppm CO), the fullscale value at TP2 and the Diagnostics Display may be considerably less than 7.5V.

5.5 DIGITAL GAIN ADJUSTMENT

The digitally controlled GAIN amplifier does not normally need adjustment, however, in the event that the analyzer cannot be spanned, the GAIN must be adjusted as follows:

1. Follow the STEPS for Spanning the Analyzer in Sections 3.9 (standard analyzer) or 3.13 (analyzer with the Calibration Gas Control Option) and span the analyzer. If the Run Mode value is not between 51% and 100% of the span gas value, while keeping the span potentiometer between 5% and 95%, then the digital GAIN should be adjusted. (The ideal span pot setting is 50%.) Note the final value of the PS (potentiometer status) for Step 4.
2. Exit to the Run Mode.
3. Follow the steps in Figure 3-6 to obtain the GAIN display in the RANGE parameters menu.
4. Change the GAIN setting to a value higher or lower than the original value. The GAIN may be changed to 1, 2, 4, or 8. If the span potentiometer status (PS) was at the top of its range in Step 2 (95%), then the GAIN should be raised. If the span potentiometer status (PS) was at the bottom of its range in Step 2 (5%), the GAIN should be lowered.
5. Press SHIFT/ENTER to return to the Run Mode.
6. Repeat Step 1. If the analyzer still cannot be spanned, repeat steps 2 through 5 for a new GAIN value.

5.6 SOURCE BALANCE SHUTTER ADJUSTMENT

Note:

These adjustments are part of the factory checkout and are not normally required for routine operation, but must be performed whenever the optical system is disturbed (i.e., removal of cells for cleaning).

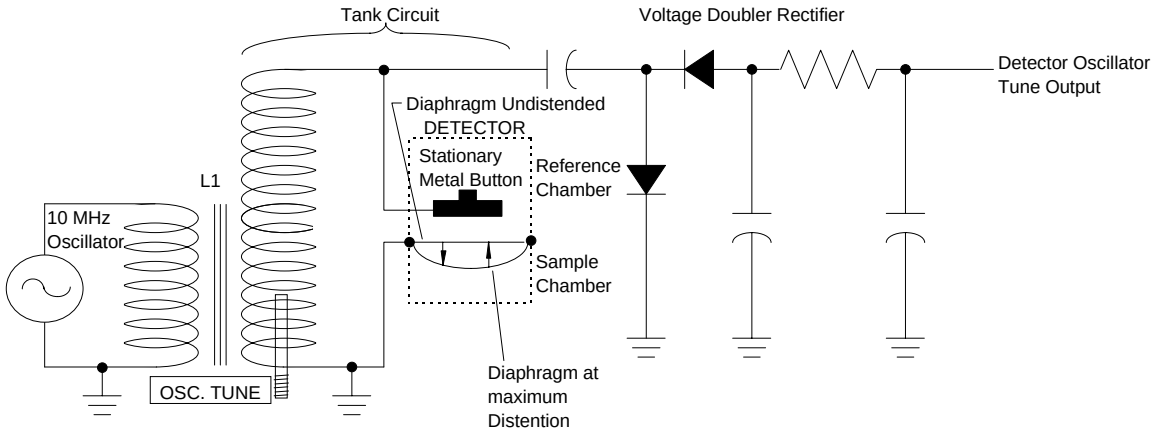
1. Access Diagnostics Mode (See Section 3.7), and access the Detector Signal display.
2. Flow zero gas (nitrogen) through the SAMPLE CELL until the display reading stabilizes.
3. Refer to Figure 3-1. Slightly loosen the locking nut on the sample cell shutter adjust screw. The shutter adjust screw is located on top of the motor source assembly.
4. Using a screwdriver, rotate the shutter adjust screw until a minimum reading on the display is obtained. A typical reading is 0.2 to 0.5. Add 0.4 to this value. Use this

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value for Step 5. (If this reading exceeds 1.2 V, then a Source Alignment is necessary; see Section 5.7.)

5. Rotate the shutter adjust screw clockwise (viewed from the screw head) until the display reads the value obtained in Step 4.
6. Re-tighten the locking nut. Ensure that the display does not change.

A. Functional Diagram - Circuitry in Tune Mode



B. Tank Circuit Resonance Curves

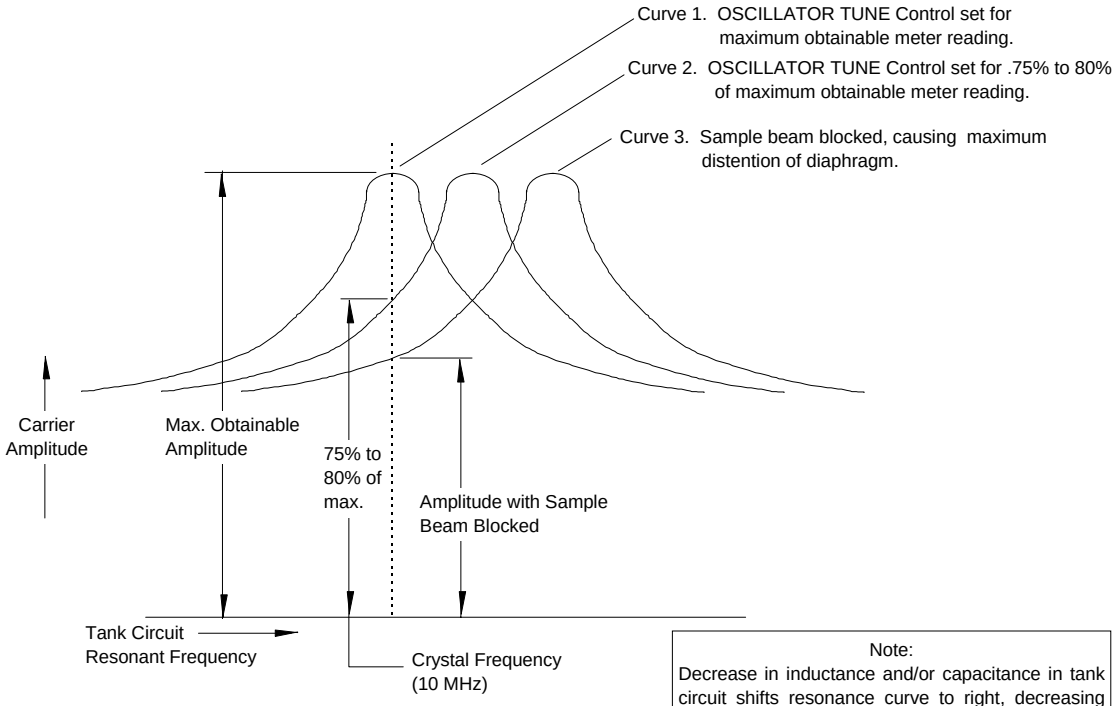


FIGURE 5-2. MODULATION SYSTEM

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5.7 SOURCE ALIGNMENT

Note:

These adjustments are part of the factory checkout, are not normally required for routine operation, and should be done only if the detector signal obtained at the end of Step 5, above, is greater than 1.2V.



WARNING: BURN HAZARD

The source housing is very hot. Ensure adequate measures are taken to avoid touching this component during this procedure.

Before doing this procedure, balance the source as outlined in Section 5.6. Then do the following:

1. Connect a digital voltmeter between TP6 and TP2 on the signal board.
2. Refer to Figure 6-2. Set the source adjustment screw so that ½" of screw threads are visible (about halfway screwed in).
3. Loosen the two screws holding each source in place.
4. Adjust both measurement and reference sources up or down to reach the minimum detector signal.
5. Re-tighten source housing screws.
6. Do the Source Balance procedure in Section 5.6.

5.8 SOURCE CURRENT ADJUSTMENT

1. Follow the steps in Figure 3-7 to access the Source Current display.
2. Refer to Figure 3-1. Adjust the trim potentiometer (R9) located on the Power Supply Board to view the desired current on the digital display until the value on the display is within ±10 of the value on the application data sheet. Clockwise adjustment of R9 will increase the value. Counterclockwise will decrease the value.

5.9 CASE HEATER TEMPERATURE CONTROL

Refer to Figures 7-1 and 7-2. Malfunction in this option can occur in three sections:

Heater - Check with an ohmmeter for continuity. The heater resistance is approximately 113 ohms at 25°C.

Temperature Sensor - This is an RTD and should have approximately 550 ohms at 25°C. Check with ohmmeter for continuity.

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Over Temperature Fuse - This is a thermal fuse that opens above 72°C. Check for continuity with an ohmmeter.

If the above are functional, refer to Drawing 624073 for circuit diagram and troubleshoot board.

5.10 ERL ERROR MESSAGE

The error message, ERL, indicates one of two events has occurred:

1. An improper linearization coefficient has been inputted, thereby causing a calculation loop error. This message is only displayed in the Run Mode, and since the calculation is generally executed in Range Mode or the linearizer setup screens, the user will not see the ERL message until the analyzer is returned to the Run Mode.
2. If the user enters a CAL GAS value that is larger than the fullscale value, the ERL message may be displayed. In such an instance, the software attempts to calculate a percent-of-fullscale value which is higher than fullscale.

Note:

The ERL message occurs only in extreme cases, i.e., FS value = 5 ppm and CAL GAS = 5000 ppm. If the user inputs, for example, 50 ppm on a fullscale of 5 ppm, the ERL message will not appear. But when the user attempts to span the range with this value, the ER# [SPAN POT LMTS] error message will appear instead.

To correct this condition, do the following:

The user should cross-reference the linearizer coefficients entered with those provided by the factory (or those the user has calculated). Re-enter them properly. Exit into the Run Mode, and the ERL message should disappear.

If the coefficients are correct, then check the fullscale/CAL GAS value relationship in the Range setup screens. Correct this condition, exit the Range setup screen, and once the calculation has been automatically redone, the ERL message will disappear.

Note:

The linearization calculation loop normally takes from 2 to 3 seconds to perform its task. If either of the two events described above occur, though, causing a calculation loop error, "WAIT-CALCULATING" may be displayed for up to 20 seconds before it exits with the ERL error message.

Also, when the ERL message is flashing in the Run Mode screen, if the STATUS key is pressed, the message [EL-LIN.COEFF ERR] will be displayed briefly

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NOTES

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6 ROUTINE SERVICING

WARNING: ELECTRICAL SHOCK HAZARD

Servicing requires access to live parts which can cause death or serious injury. Refer servicing to qualified personnel.

Note:

Before servicing analyzer, disconnect power and shut off sample flow to unit.

6.1 CELL REMOVAL, CLEANING AND INSTALLATION

6.1.1 LONG CELL CONFIGURATIONS

Refer to Figure 6-1A.

1. Slide chassis out.
2. Remove sample lines from the end cap assembly and the end cap/optical filter assembly.
3. If installed, remove the two motor/source assembly support brackets.
4. Remove the two screws holding the motor/source assembly to the optical bench plate.
5. Support the cells and gently move the motor/source assembly away from the detector. The cells and its o-rings will now be free.
6. Rinse the cell with acetone. If this does not remove all foreign matter, use a soft brush. Do not use any metallic object inside the cell because it will scratch the gold plating. Loss of gold plating may require cell replacement.
7. After all matter has been removed, rinse the cell with distilled water and allow to air dry. Do not use towels.
8. Inspect the cell inside by holding it up to a bright light. If particles are seen, repeat Steps 6 and 7 as often as necessary.
9. After cleaning cells, examine o-rings at the end cap assembly and end cap/optical filter assembly and replace If damaged.

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10. Remove any contaminants from optical filters with a lint free cloth soaked in acetone. Do not use alcohol or other solvents. Allow to air dry.
11. To install the cells, fit into position. Make sure that the o-rings seat properly. Move the motor/source assembly back into position. Make sure that the o-rings seat properly.
12. Replace the two screws which hold the motor/source assembly to the optical bench plate. Do not overtighten.
13. Replace the two Motor/Source Assembly support brackets.
14. Install the sample lines.
15. Check for leaks as instructed in Section 2.8. Take corrective action if necessary.
16. Replace desiccant if required (see Section 6.2).
17. Perform source balance and source alignment adjustments per Sections 5.6 and 5.7.

6.1.2 SHORT CELL CONFIGURATIONS

Refer to Figure 6-1B.

1. Slide chassis out.
2. Remove sample lines from the sample cell assembly.
3. Remove the two screws holding the motor/source assembly to the optical bench plate.
4. Remove the two screws holding the end cap/optical filter assembly and sample cell assembly to the detector. Gently move the motor/source assembly away from the detector. The sample cell assembly, end cap/optical filter assembly and o-rings will now be free.
5. Rinse the cell with acetone. If this does not remove all foreign matter, use a soft brush. Do not use any metallic object inside the cell.
6. After all matter has been removed, rinse the cell with distilled water and allow to air dry. Do not use towels.
7. Inspect the cell inside by holding it up to a bright light. If particles are seen, repeat Steps 5 and 6 as often as necessary.
8. After cleaning cell, examine o-rings between the detector and sample cell assembly, and between the sample cell assembly and end cap/optical filters assembly, and the compression gaskets between the end cap/optical filters assembly and plate assembly, replace If damaged.
9. Remove any contaminants from windows with a lint free cloth soaked in acetone. Do not use alcohol or other solvents. Allow to air dry.
10. To install the cells, replace the two retaining screws holding the end cap/optical filter assembly and sample cell assembly to the detector. Verify that the o-rings

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seat properly. Move the motor/source assembly back into position. Verify that the compression gaskets seat properly.

11. Replace the two screws which hold the motor/source assembly to the optical bench plate. Do not overtighten.
12. Install the sample lines.
13. Check for leaks as instructed in Section 2.8. Take corrective action if necessary.
14. Replace desiccant if required (see Section 6.2).
15. Perform source balance and source alignment adjustments per Sections 5.6 and 5.7.

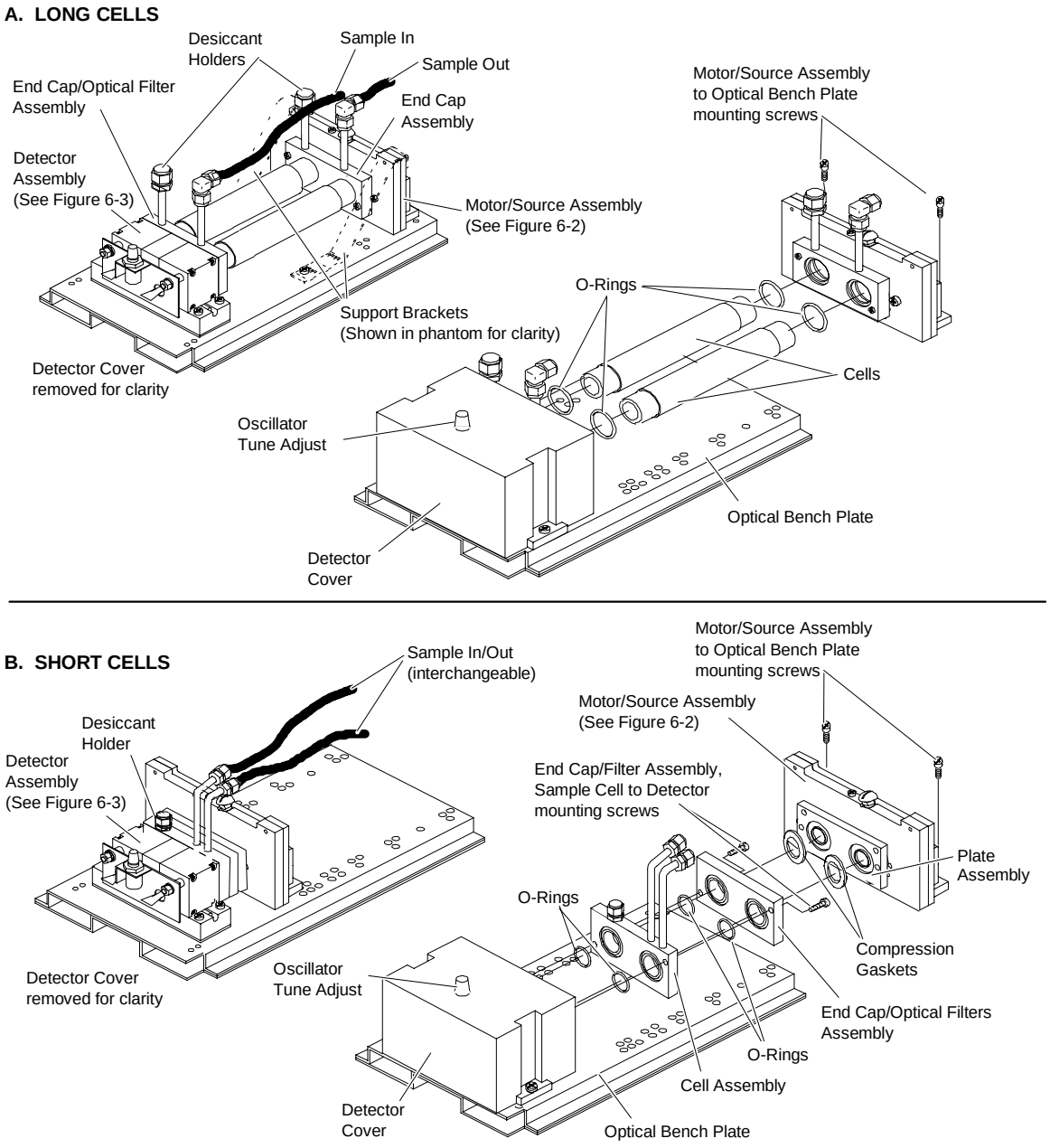


FIGURE 6-1. CELL REPLACEMENT

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GAS	DESICCANT	PART
CO_2	Cardoxide	096218
CO	$Mg(ClO_4)_2$	096217
H_2O	$Mg(ClO_4)_2$	096217
SOS	$Mg(ClO_4)_2$	096217
CH_4	$Mg(ClO_4)_2$	096217
Hexane	$Mg(ClO_4)_2$	096217
$CO + CO_2$	Cardoxide + $Mg(ClO_4)_2$	096217/096218

TABLE 6-1. TYPES OF DESICCANT

6.2 CELL DESICCANT

The reference cell may use a flowing reference. If so, desiccant is required.

A desiccant holder is used on the inlet and outlets to keep moisture from entering the reference cell (see Figure 6-1). The desiccant should be replaced each time the cell is opened. To determine the type of desiccant used, refer to Table 6-1. Before inserting desiccant, purge cell with dry inert gas (i.e., N_2).

6.3 SOURCE REPLACEMENT

Refer to Figure 6-2. Sources are marked with the resistance value, for example, 11.5 - 11.6 in matched pairs. Install the higher value as the reference source.

Note:

Observe how the parts are disassembled so that the reverse procedure can be used for reassembly.

1. Loosen the two screws on the front of the case and slide the front panel forward.
2. Remove the two screws holding the source housing to the chopper housing.
3. Remove the two screws holding the source to the source housing. Note how the source is mounted. There is a front and back side.
4. If replacing the source, insure that its orientation is exactly the same as the old one. Each source is marked on the back. Install the source with the higher designation at the reference site.
5. Reverse the procedure outlined above to reinstall the new source assembly, ensuring teflon spacers are in place and the screws have not been overtightened. Sources are ceramic and can crack or break under excessive pressure.

6.4 SOURCE BALANCE SHUTTER ADJUSTMENT

When the sources are replaced, follow the Source Balance Procedure in Section 5.6 to adjust the source balance shutter.

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6.5 CHOPPER MOTOR ASSEMBLY (P/N 652605)

To remove the chopper motor assembly, do the following :

6.5.1 LONG CELL CONFIGURATIONS

1. Refer to Figure 6-1A. Remove the two screws holding the motor/source assembly (with the end cap assembly attached) to the optical bench base plate. Support the cells and gently slide the motor/source assembly away from the cells.
2. Remove the two screws holding the end cap assembly to the motor/source assembly.
3. Refer to Figure 6-2. Remove chopper cover.
4. Remove chopper blade.
5. Remove two screws from rear of motor and remove motor.

6.5.2 SHORT CELL CONFIGURATIONS

1. Refer to Figure 6-1B. Remove the two screws holding the motor/source assembly (with the plate assembly attached) to the optical bench base plate. Gently slide the motor/source assembly away from the cells.
2. Remove the two screws holding the plate assembly to the motor/source assembly.
3. Refer to Figure 6-2. Remove chopper cover.
4. Remove chopper blade.
5. Remove two screws from rear of motor and remove motor.

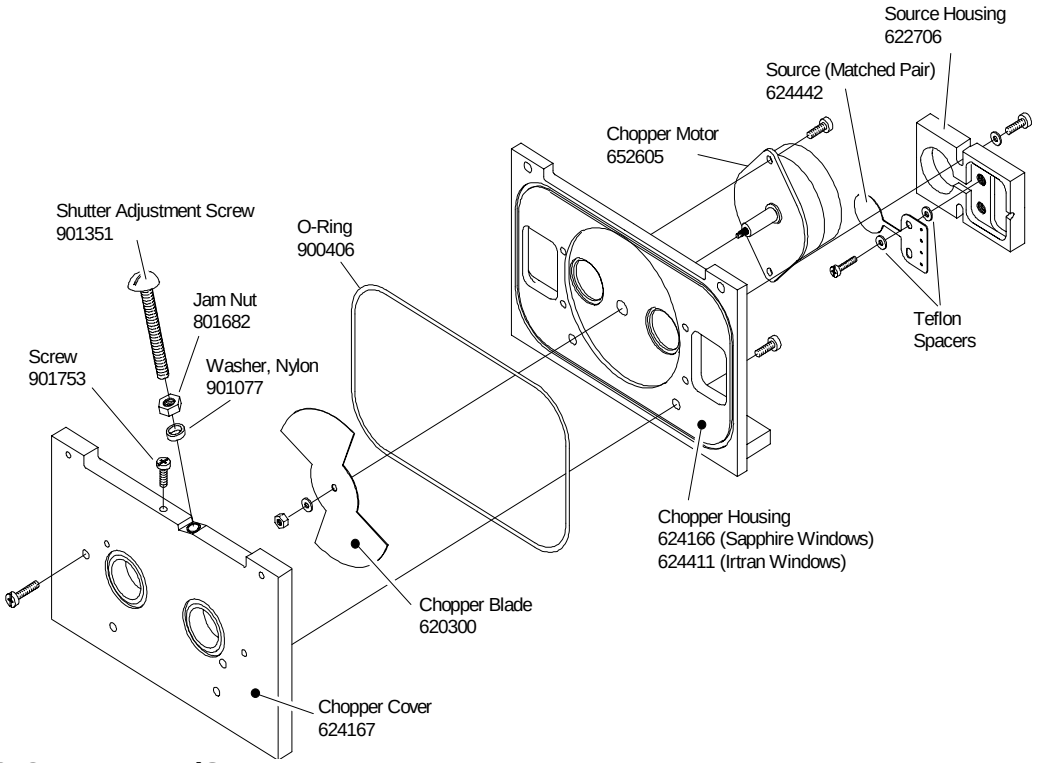


FIGURE 6-2. MOTOR/SOURCE ASSEMBLY

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6.6. MICRO BOARD REPLACEMENT

All calibration constants and settings stored in non-volatile memory must be changed when the Micro Board is replaced. These procedures are given in Section 3.

Additionally, the ZERO potentiometer and the three SPAN potentiometers must be resynchronized with software. To resynchronize the ZERO potentiometer follow the steps listed below:

1. Follow the instructions in Section 3-8 for standard analyzer or Section 3-13 for analyzer with Calibration Gas Control option and access the [ZR=X.X PS=XX%] display.
2. Press SHIFT then ↓.
3. Proceed with the ZERO calibration.
4. The SPAN potentiometer must be re- synchronized for all three ranges as follows:
5. Choose the first range by selecting a range using the range parameters in Figure 3-6.
6. Follow the instructions in Section 3-9 for standard analyzer or Section 3-14 for analyzer with Auto ZERO/SPAN option and access the [X.XX XX % 100] display.
7. Press SHIFT then ↓.

Proceed with the SPAN calibration.

6.7 DETECTOR REPLACEMENT

6.7.1 REMOVAL - LONG CELL CONFIGURATIONS

Refer to Figure 6-3A.

1. Slide chassis out.
2. Remove sample lines from the end cap assembly and end cap/optical filter assembly.
3. Remove detector cover.
4. While supporting the cells, remove the four screws holding the detector assembly to the optical bench base plate.. The detector assembly, detector heater, detector plate, cells and o-rings are now free
5. Disconnect ribbon cables.
6. Remove oscillator board.

Refer to Figure 6-3C.

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7. Remove the two screws holding the end cap/optical filter assembly to the detector assembly. The end cap/optical filter assembly and o-rings are now free.
8. Remove the two screws holding detector to detector base.
9. Detector, detector pad and detector base are now free.

6.7.2 REMOVAL - SHORT CELL CONFIGURATIONS

Refer to Figure 6-3B.

1. Slide chassis out.
2. Remove the sample lines from the sample cell.
3. Remove detector cover.
4. Remove the four screws holding the detector assembly to the optical bench base plate. The detector assembly (with cell and end cap/optical filter assembly attached), detector heater, detector plate and o-rings (between end cap/optical filter assembly and plate assembly) are free.
5. Disconnect ribbon cables.
6. Remove oscillator board.

Refer to Figure 6-3C.

7. Remove the two screws holding the end cap/filter assembly and cell to the detector assembly. The cell, end cap/optical filter assembly and o-rings are now free.
8. Remove the two screws holding detector to detector base.
9. Detector, detector pad and detector base are now free.

6.7.3 DETECTOR INSTALLATION

1. Replace detector by reversing the removal process.

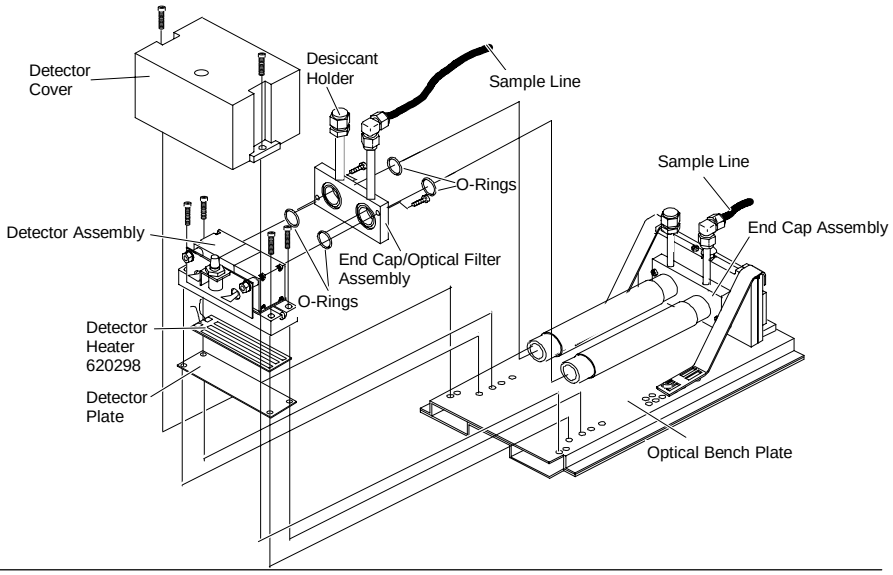
Note:

When replacing detector, insure that the thermal fuse and temperature sensor mounted in the base plate are in good thermal contact with the base plate.

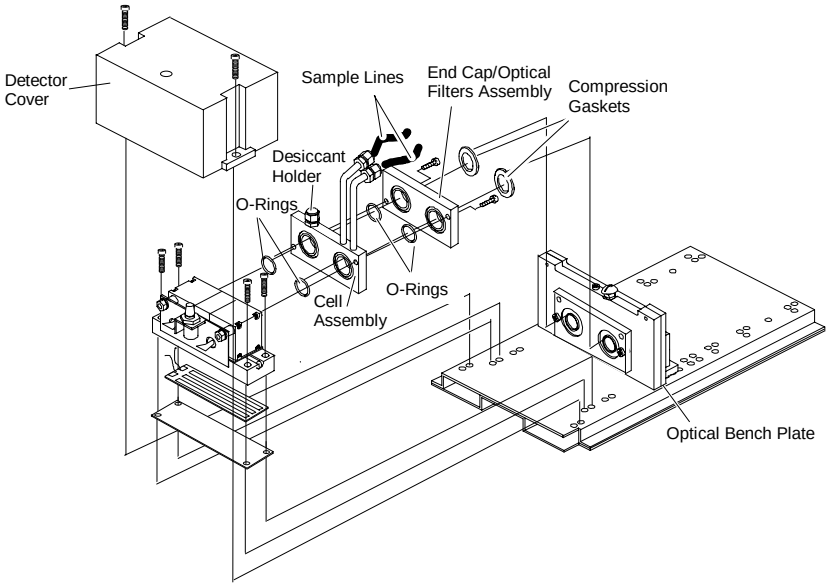
2. Adjust source balance shutter and align source (see Sections 5.6 and 5.7).

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A. LONG CELLS



B. SHORT CELLS



C. DETECTOR ASSEMBLY

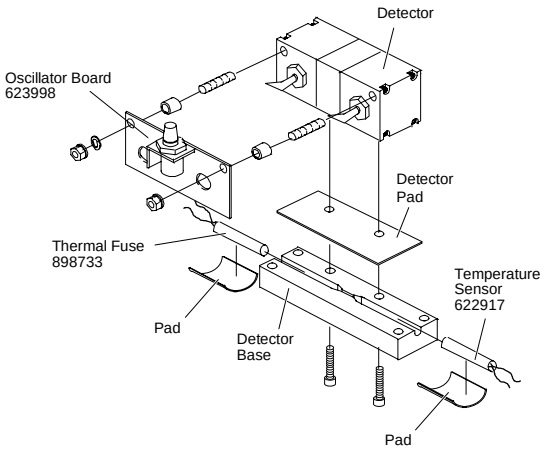


FIGURE 6-3. DETECTOR REPLACEMENT

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6.8 ELECTRONIC CIRCUITRY

6.8.1 OSCILLATOR CIRCUIT BOARD AND ASSOCIATED ELEMENTS OF AMPLITUDE-MODULATION CIRCUIT

In the Oscillator Circuit (Drawing 623995) the 10 MHz carrier wave is generated by a crystal-controlled radio-frequency oscillator using crystal Y1 and transistors Q1 and Q2.

The modulation circuit is driven by the detector, the sensing element of the analyzer. Mechanical functioning of the detector is explained in Section 4.4. Considered electronically, the detector is a two-plate variable capacitor. The modulator is coupled inductively, through one winding of inductance T1, to the oscillator. Amplitude of the 10 MHz carrier thus varies with the 5 Hz modulation signal.

6.8.2 FUNCTIONING OF MODULATION SYSTEM IN TUNE MODE

Preparatory to oscillator tuning, access Oscillator Tune (OT=XX) in the Diagnostic Display (Figure 3-7). In this mode the display indicates the rms value of the halfwave-rectified carrier. The tank circuit is now adjusted in the following two-step sequence:

Tuning: Initially, the OSC TUNE adjustment is set somewhat counterclockwise from its correct setting. Then, it is rotated clockwise to move the slug into the core, thus increasing inductance and decreasing resonant fre-quency. The adjustment is set for maximum obtainable reading. At this setting, tank-circuit resonant frequency is the same as oscillator frequency (i.e., nominal 10 MHz). See Resonance Curve Number 1, Figure 5-2B.

Detuning: By counterclockwise rotation of the OSC TUNE adjustment, the slug is partially withdrawn from the core, thus de-creasing inductance and increasing resonant frequency. The adjustment is set so reading decreases to between 75 % and 80 % of the maximum obtainable value noted in Step 1, above. See Resonance Curve Number 2, Figure 5-2B. This curve has the same shape as that obtained in Step 1, immediately preceding, but is displaced to the right.

6.8.3 FUNCTIONING OF MODULATION SYSTEM IN OPERATING MODE

Overall sensitivity of the analyzer system may now be checked by placing SPAN gas in the sample beam to simulate absorption of sample-beam energy and thus provide the maximum obtainable 5 Hz detector-output signal.

During that portion of the chopping cycle, while the chopper is not blocking the sample and reference beams, the diaphragm distends away from the metal button, thus decreasing detector capacitance and shifting the tank-circuit resonance curve to the right. At the moment the diaphragm reaches maximum distention, the curve reaches the position of Curve 3, Figure 5-3B.

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The diaphragm now pulses cyclically, causing the resonance curve to move continuously back and forth within the limits defined by Curves 2 and 3 of Figure 5-2B. Carrier amplitude decreases as the curve moves to the right and increases as it moves to the left. Thus, the response characteristics of the system depend on the location of Curve 2. Position of this curve depends on the degree of tank-circuit detuning used.

By detuning to 75% to 80% of the maximum obtainable carrier amplitude and operating on the portion of the curve thus obtained, maximum slope yields highest sensitivity and minimum curvature provides best linearity.

6.8.4 RADIO-FREQUENCY DEMODULATOR

The amplitude-modulated 10 MHz carrier from the detector/oscillator circuit is applied to the radio-frequency demodulator. This circuit is a voltage-doubler type rectifier utilizing diodes CR1, CR2, CR3, CR4 and capacitor C7. The circuit gives approximately double the output voltage of a conventional halfwave rectifier. This result is obtained by charging a capacitor during the normally wasted half-cycle, and then discharging it in series with the output voltage during the next half-cycle.

6.8.5 SIGNAL BOARD (DWG 624085)

The 5 Hz sinewave detector signal goes through an AC amplifier U1A and associated resistor. The output signal goes through bandpass filter network U2 and U4 to remove harmonics and distortion. The signal next goes through a precision signal rectifier U3 and Q1 and then through low pass filter U5. This output goes through an RC low pass filter R29, C13 and U7 and then to inverting buffer amplifier U8 with zero control U11.

The signal goes through a range amplifier consisting of eight bit DAC U9 and the amplifier U10.

The GAIN is digitally controlled via U15, U16 and U18 resulting in a selectable digital GAIN of X1, X2, X4 and X8.

The span is controlled for the three ranges with SPAN 1 (U12), SPAN 2 (U13) and SPAN 3 (U14).

The eight-channel multiplexer (U17) selects the input signals by commands applied to the switch driver and feeds the selected signal to pin two of J2.

6.8.6 POWER SUPPLY BOARD (DWG 655137)

The power supply board supplies the different voltages to the various boards. Additionally, the power supply board includes an adjustable source driver circuit, a chopper motor driver circuit, a proportional temperature controller circuit and a DC to AC converter for backlight.

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6.8.7 ADAPTER BOARD (DWG 624127)

The adapter board which includes a circuit breaker is used for line power distribution. The adapter board also serves as an interface board for all the option boards and provides the recorder output on TB2.

6.8.8 MICRO BOARD (DWG 623782)

The Micro Board is a self-contained circuit assembly which includes an advanced microprocessor and multiple I/O functions with a complete analog domain consisting of analog-to-digital converters and digital-to-analog converters. Multiple output registers allow the transmission of digital data to and from the board under program control. The circuit board can be used alone or in conjunction with I/O boards that satisfy special interfacing requirements such as the following:

1. Current output
2. Bi-directional remote range change board
3. Dual alarm assembly
4. Auto ZERO/SPAN
5. Calibration Gas Control

The microprocessor is configured with various memory arrangements depending on the application: RAM, PROM, EEPROM. The 64K memory is available for all memory functions. A selective arrangement allows rotating memory on specific boundaries. The board is configured with an analog domain that allows the processing of analog signals directly with a 12-bit plus sign ADC. In addition, two independent DAC's, each 12 bytes wide, allow the presentation of analog voltages for peripheral functions immediately.

6.8.9 CASE HEATER TEMPERATURE CONTROL BOARD (DWG 624003)

This is a proportional temperature controller, which works on a variable time method.

Resistors' R7, R8, R9, R10, R11 and the sensor form a bridge which feeds a comparator, AR1. AR1 operates in an ON/OFF mode to drive transistor Q3. The sensor is a resistor with a positive temperature coefficient (1.925 ohms/°C).

The resistance is 500 ohms at 0°C. Resistors R1 through R6, Q1, Q2 and C1 provide the circuit for the time proportioning action; C1 charges until the voltage on C1 reaches 9.0 V. Q1 then discharges C1, and the charging process repeats itself. The emitter of Q2 follows the voltage on C1, which is essentially a sawtooth. This is injected into the bridge, which causes the setpoint to bump on a variable time basis. Q3 (Through LED CR1) triggers optical coupler U1 which gates TRIAC (U2). U2 allows fullwave VAC to flow through the case heater element.

6.8.10 DUAL ALARM/CALIBRATION GAS CONTROL BOARD (DWG 624204)

This board is used for both dual alarm and calibration gas control, depending on the position of the jumper in the jumper-selectable address. This is a peripheral circuit

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function which communicates with the computer via an 8-bit buss arrangement. This option consists of two form C contacts rated 3A-125/250 VAC or 5A-30 VDC (resistive). This circuit board satisfies a dual alarm requirement, as it provides two medium power relays that can be independently controlled from the central processor. Also, the board can be used to connect user-supplied solenoid valves to zero and span calibration gases for one-man calibration. Provision is made to assign a specific address in the range 0 through 7 using jumpers.

6.8.11 ISOLATED REMOTE INPUT/OUTPUT BOARD (DWG 624251)

The remote range change board is a peripheral circuit function which communicates with the computer via an 8-bit buss arrangement. This assembly provides isolated two-way communication between the host instrument and external user devices. Provision is made to assign a specific address in the range 0 through 7 using jumpers.

6.8.12 AUTO ZERO/SPAN BOARD (DWG 624599)

The auto ZERO/SPAN board is a peripheral circuit function which communicates with the computer via an 8-bit bus. With the appropriate software it satisfies the auto ZERO/SPAN requirement. The assembly provides six form C relay contact outputs, four of which are suitable for medium power requirements, the remaining two are relegated to alarm or indicator functions. Snubbers are provided for the medium power relays. Provision is made to assign a specific address in the range 0 through 7 using jumpers.

6.8.13 CURRENT OUTPUT BOARD (DWG 624092)

This board changes the instrument voltage output to an isolated current output for use with external recorders or data gathering systems.

6.8.14 AUTO RANGE CHANGE

This option couples the Isolated Remote Input/Output Board and the Alarm Board into a single function. When the alarm setpoint is triggered, the remote I/O board will automatically change ranges according to preset configurations.

	JUMPER CONFIGURATION	
OPTION BOARD	ADDRESS	FUNCTION
Dual Alarm	E1 + E2	E5-E7, E9-E10
Dual Alarm - Fail Safe	E1 + E2	E6-E7, E8-E10
Calibration Gas Control	E1 + E4	E5-E7, E9-E10
Auto Zero/Span	E1	----------
Isolated Remote I/O	E4	----------

TABLE 6-2. JUMPER CONFIGURATIONS FOR OPTION BOARDS

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7 REPLACEMENT PARTS

The following parts are recommended for routine maintenance and troubleshooting of the Model 880A Analyzer. If the troubleshooting procedures do not resolve the problem, contact your local Rosemount Analytical service office. A list of Rosemount Analytical Service Centers is located in the back of this manual. Figures 7-1, 7-2, and 7-3 show locations of components and assemblies.

CAUTION: PARTS INTEGRITY

Tampering or unauthorized substitution of components may adversely affect safety of this product. Use only factory-documented components for repair.

7.1 CIRCUIT BOARD REPLACEMENT POLICY

In most situations involving a malfunction of a circuit board, it is more practical to replace the board than to attempt isolation and replacement of the individual component. The cost of test and replacement will exceed the cost of a rebuilt assembly. As standard policy, rebuilt boards are available on an exchange basis.

Because of the exchange policy covering circuit boards the following list does not include individual electronic components. If circumstances necessitate replacement of an individual component, which can be identified by inspection or from the schematic diagrams, obtain the replacement component from a local source of supply.

7.2 SELECTED REPLACEMENT PARTS

While the following sections list parts which are common to all Model 880A applications, the ***configuration number*** is required when ordering parts which are specific to an individual application. The configuration number (8803-XX or 8804-XX) is on the Data Sheet in the rear of this manual.

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7.2.1 MODEL 880A COMMON PARTS

Reference Figure 7-1.

657849	LCD Display
655135	Power Supply Board
898724	Power Amplifier
622700	Resistor Assembly
622751	Transformer
623785	Micro Board
624088	Signal Board

7.2.2 CASE HEATER TEMPERATURE CONTROL ASSEMBLY (OPTION)

Reference Figure 7-2.

624006	Temperature Control Board
622917	Temperature Sensor
624433	Thermal Fuse
622733	Fan
622732	Heater

7.2.3 OPTICAL BENCH

Reference Figures 6-2, 6-3, and 7-3.

623998	Oscillator Board
898733	Detector Thermal Fuse
622917	Detector Temperature Sensor
620298	Detector Heater
652605	Chopper Motor
624442	Source (Matched Pair)

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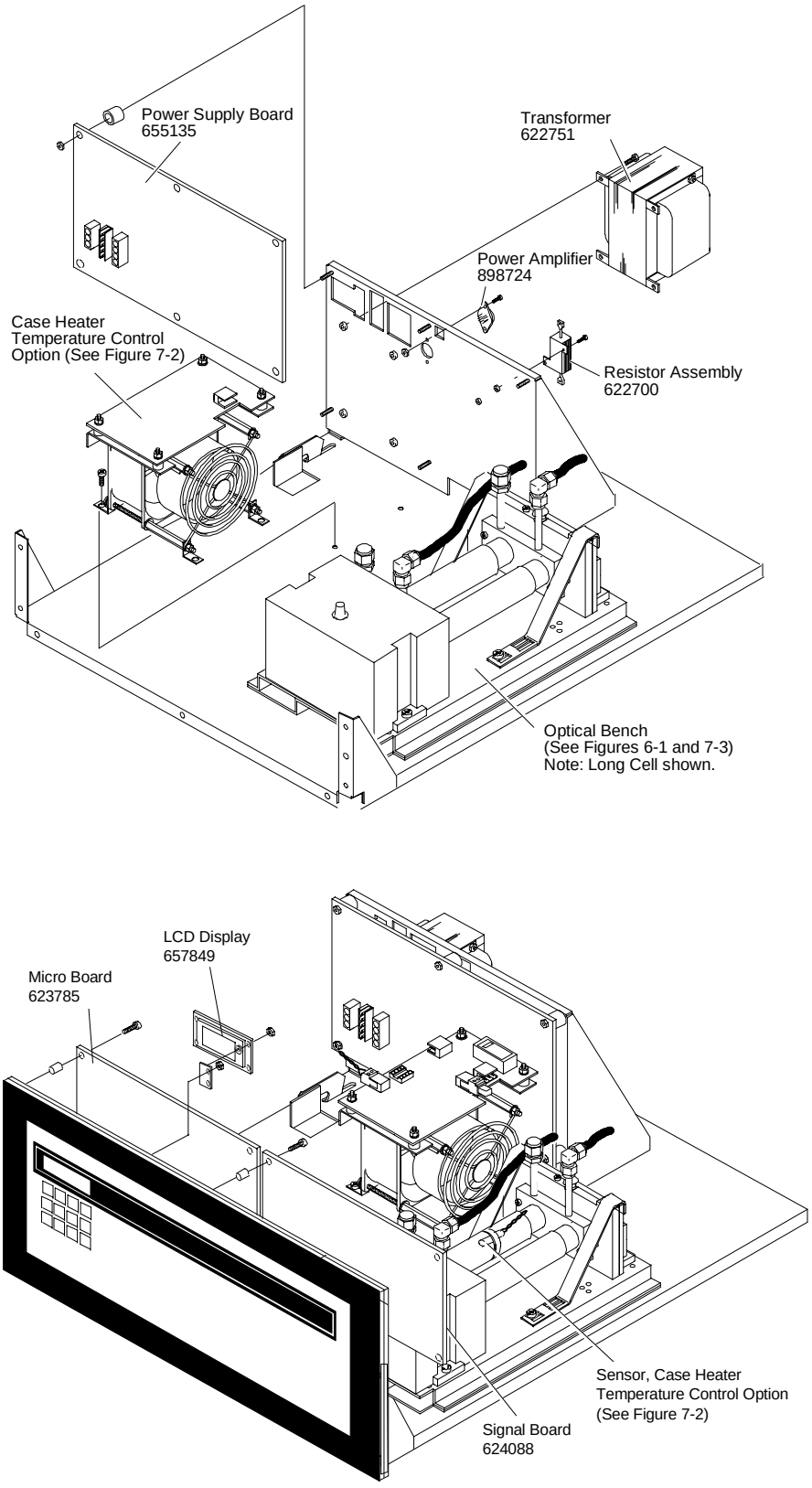


FIGURE 7-1. MODEL 880A ASSEMBLY

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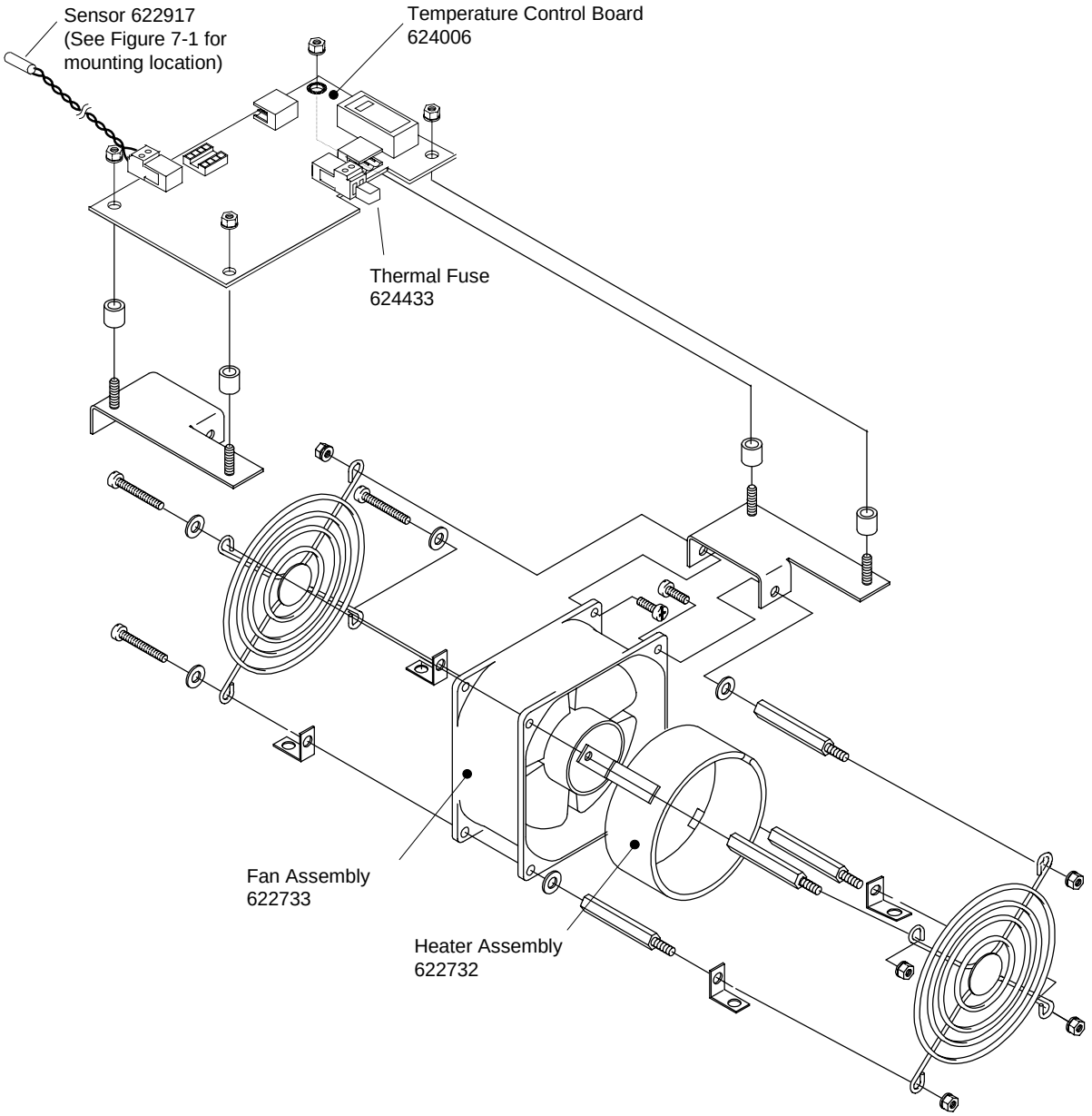
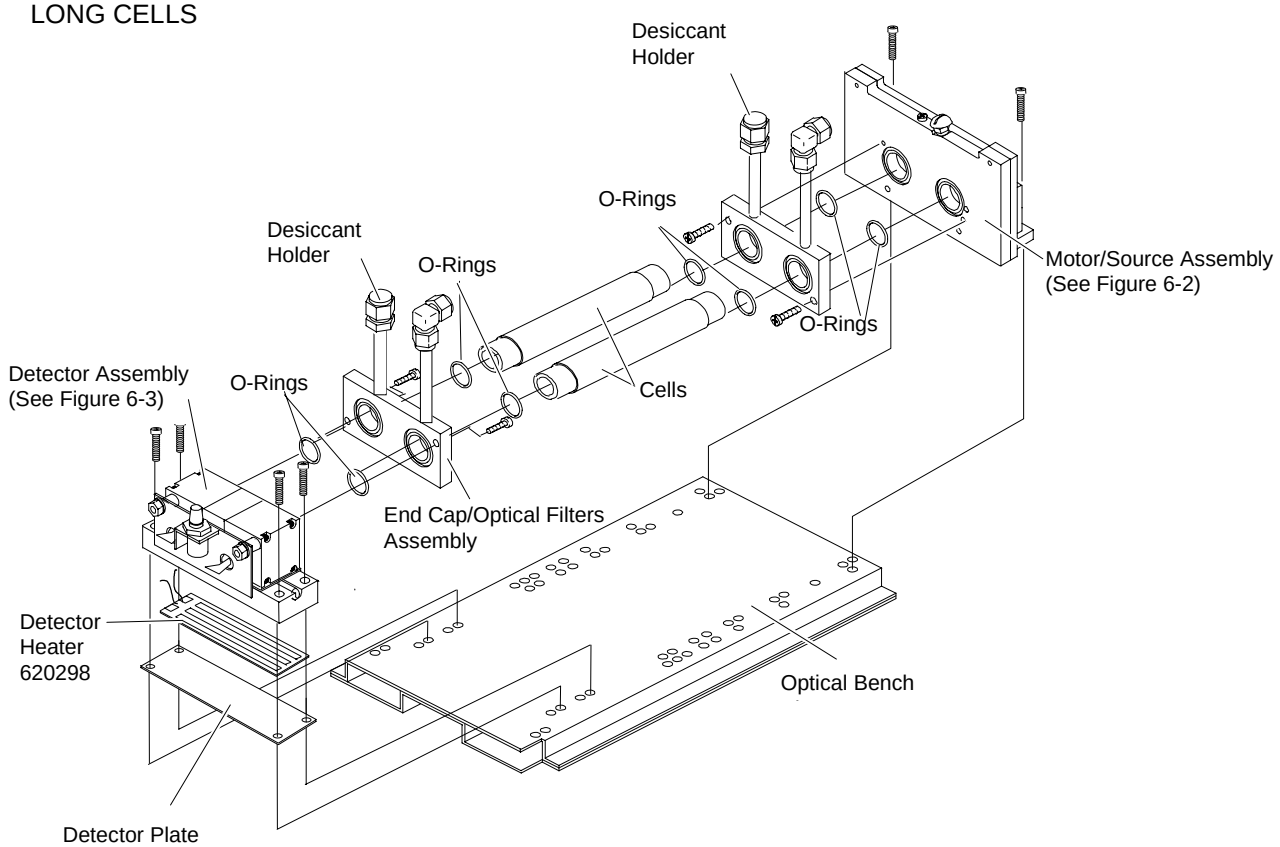


FIGURE 7-2. CASE HEATER TEMPERATURE CONTROL ASSEMBLY

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LONG CELLS



SHORT CELLS

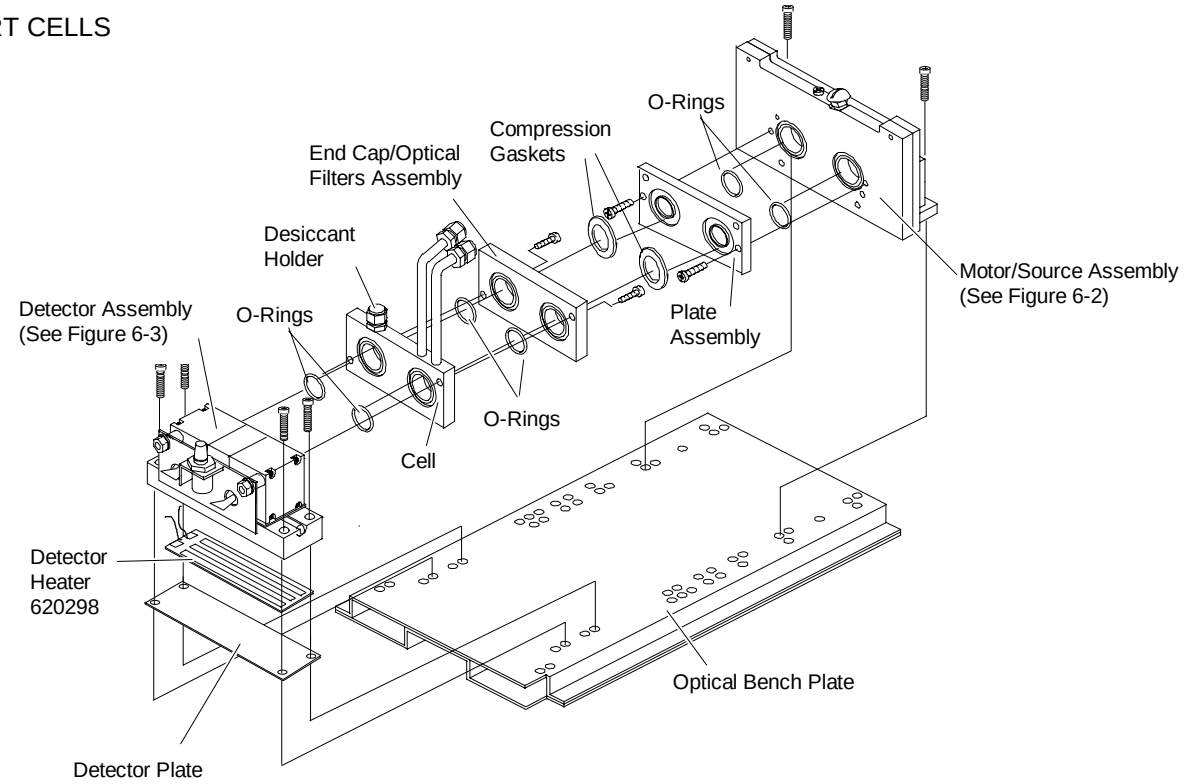


FIGURE 7-3. OPTICAL BENCH

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NOTES

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GENERAL PRECAUTIONS FOR HANDLING AND STORING HIGH PRESSURE GAS CYLINDERS

Edited from selected paragraphs of the Compressed Gas Association's "Handbook of Compressed Gases" published in 1981
Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, Virginia 22202
Used by Permission

1. Never drop cylinders or permit them to strike each other violently.
2. Cylinders may be stored in the open, but in such cases, should be protected against extremes of weather and, to prevent rusting, from the dampness of the ground. Cylinders should be stored in the shade when located in areas where extreme temperatures are prevalent.
3. The valve protection cap should be left on each cylinder until it has been secured against a wall or bench, or placed in a cylinder stand, and is ready to be used.
4. Avoid dragging, rolling, or sliding cylinders, even for a short distance; they should be moved by using a suitable hand-truck.
5. Never tamper with safety devices in valves or cylinders.
6. Do not store full and empty cylinders together. Serious suckback can occur when an empty cylinder is attached to a pressurized system.
7. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). A flame should never be permitted to come in contact with any part of a compressed gas cylinder.
8. Do not place cylinders where they may become part of an electric circuit. When electric arc welding, precautions must be taken to prevent striking an arc against the cylinder.

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Contact your local Rosemount Sales and Service office for service support.

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Rosemount Analytical Inc.
Process Analytical Division
Customer Service Center
1-800-433-6076

RETURNING PARTS TO THE FACTORY

Before returning parts, contact the Customer Service Center and request a Returned Materials Authorization (RMA) number. Please have the following information when you call: *Model Number, Serial Number, and Purchase Order Number or Sales Order Number.*

Prior authorization by the factory must be obtained before returned materials will be accepted. Unauthorized returns will be returned to the sender, freight collect.

When returning any product or component that has been exposed to a toxic, corrosive or other hazardous material or used in such a hazardous environment, the user must attach an appropriate Material Safety Data Sheet (M.S.D.S.) or a written certification that the material has been decontaminated, disinfected and/or detoxified.

Return to:

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4125 East La Palma Avenue
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