Drawings and calibration graphs not included. (see full manual)

Instructions 015-748250-J

Rosemount Analytical

Model 880A
Non-Dispersive Infrared Analyzer

Instruction Manual

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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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List of Drawings

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% of fullscale per 24 hours; ±2% of fullscale per week
Span Drift:*	±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. ◊

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

** Irtran is a trademark of Eastman Kodak Co.

*** Pyrex is a registered trademark of Corning Glass Works.

**** Teflon and Viton are registered trademarks of E.I. du Pont de Nemours & Co., Inc.

◊ 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.

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.

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.

Isolated 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.

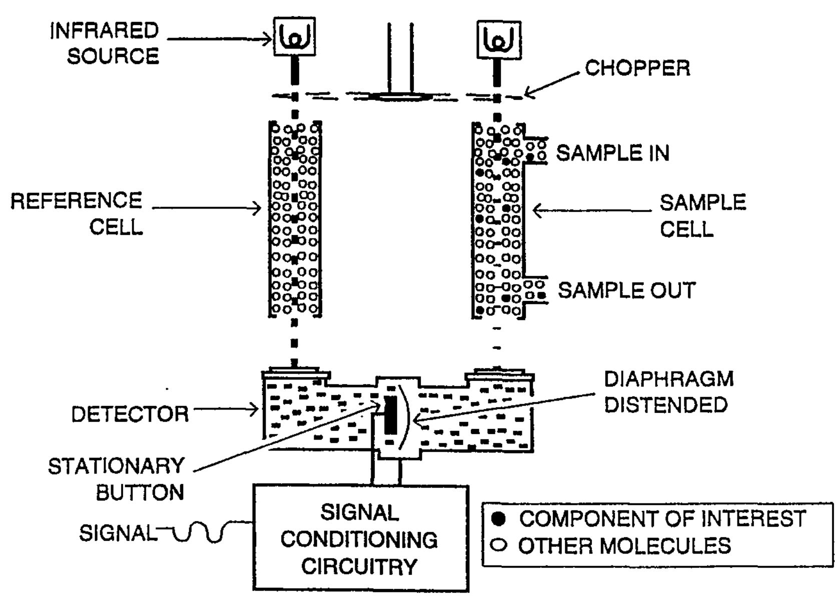


Figure 1-1. Model 880A Detection System

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.

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.

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.

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.

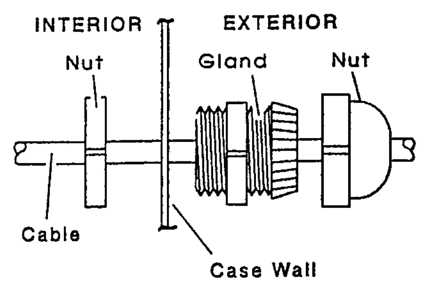


Figure 2-3 Cable Gland Connection

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

Isolated 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.

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.

*Registered Trademark of Nupro Co., Willoughby, Ohio.

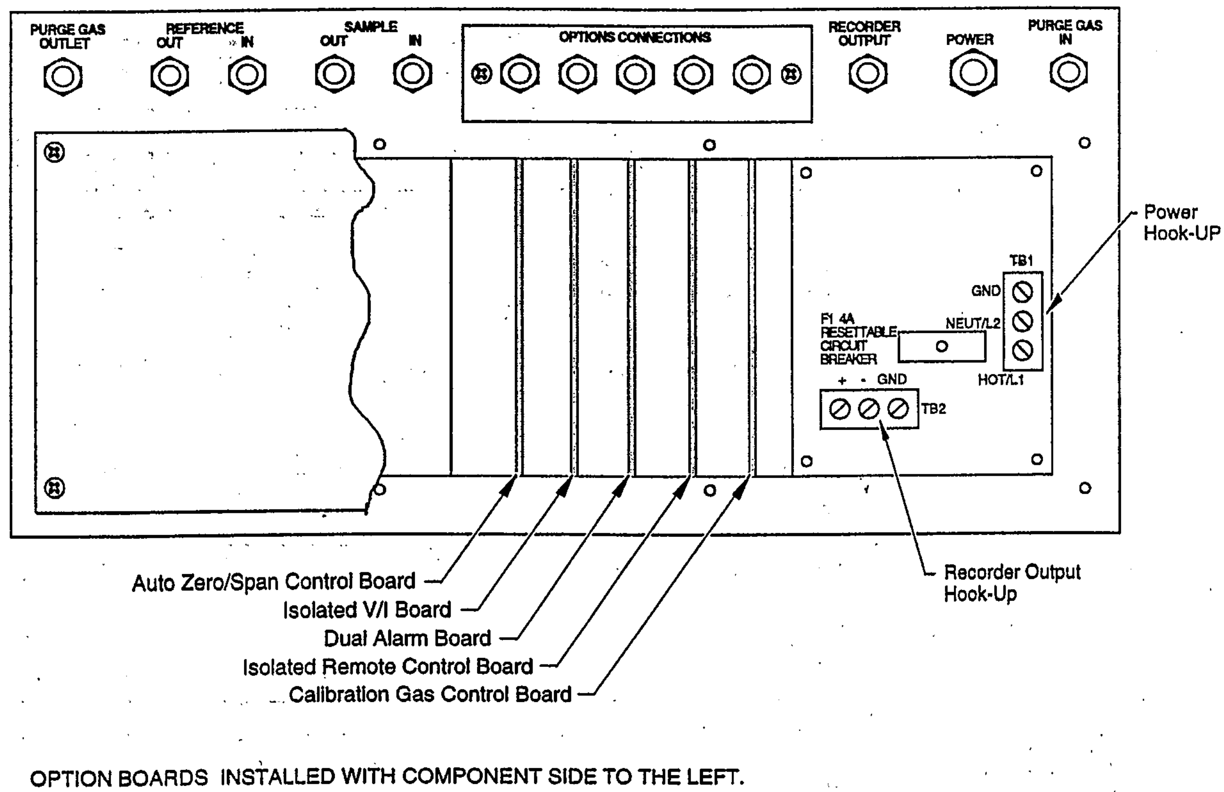


Figure 2-4. Rear View of Model 880A

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).

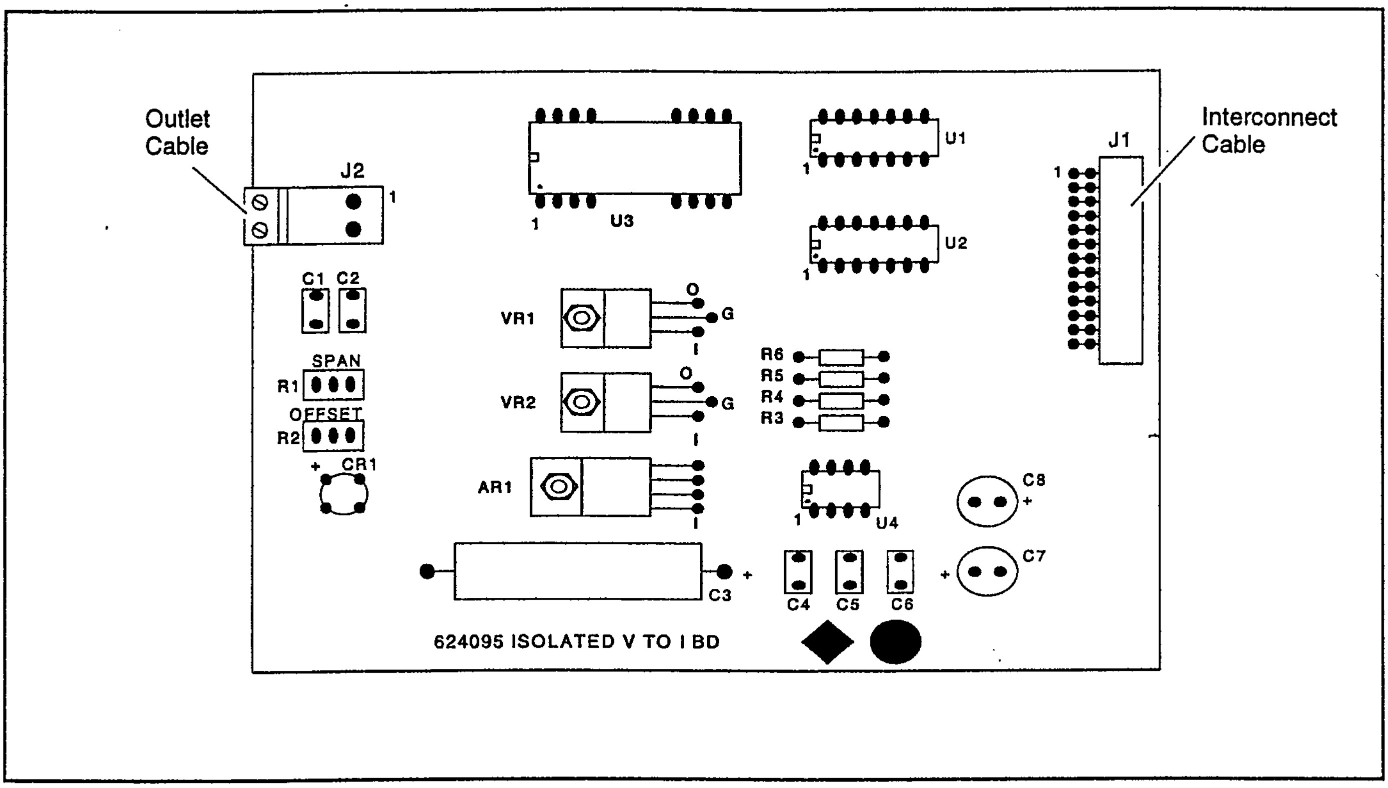


Figure 2-6. Current Output Connections

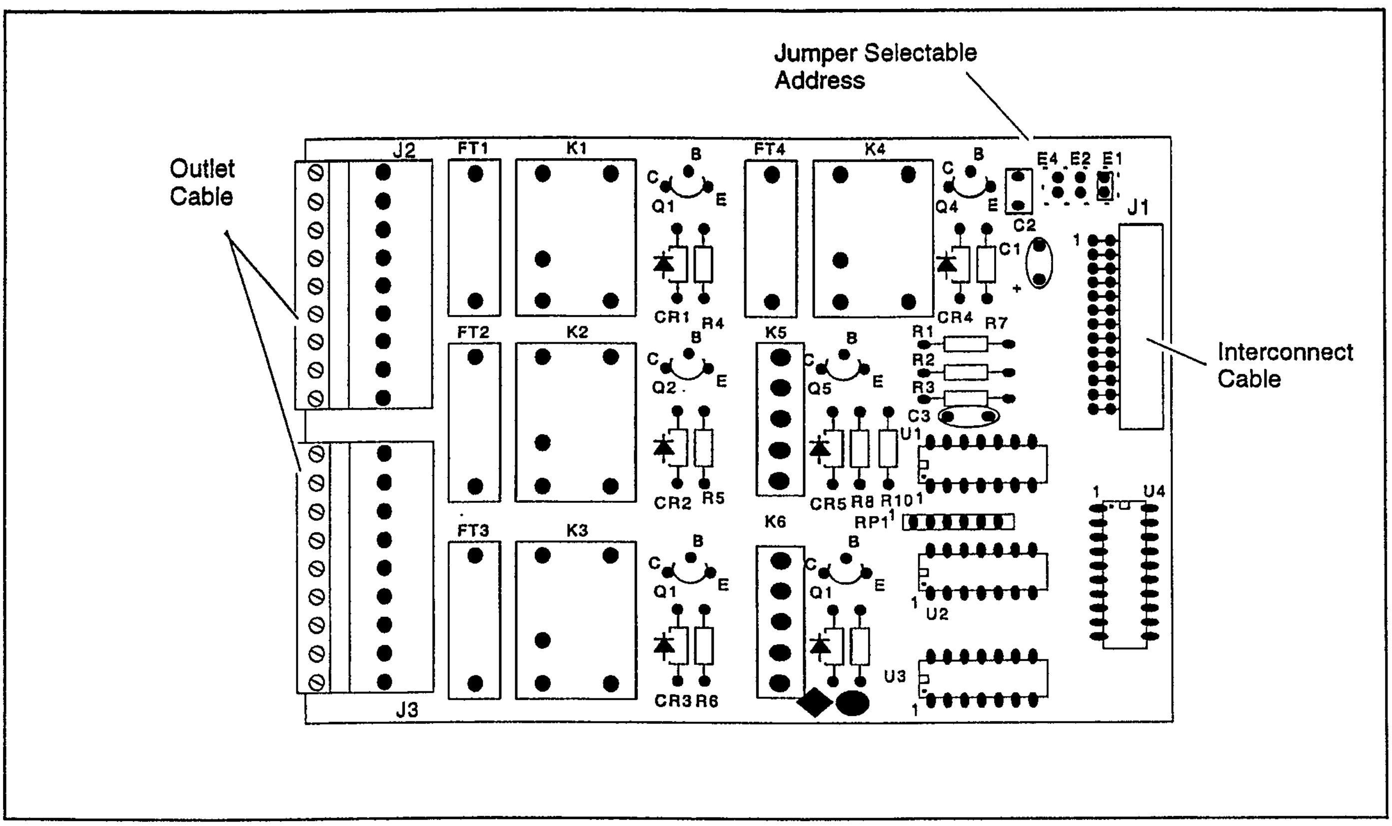


Figure 2-7. Auto Zero/Span Board Connections

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.

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.

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.

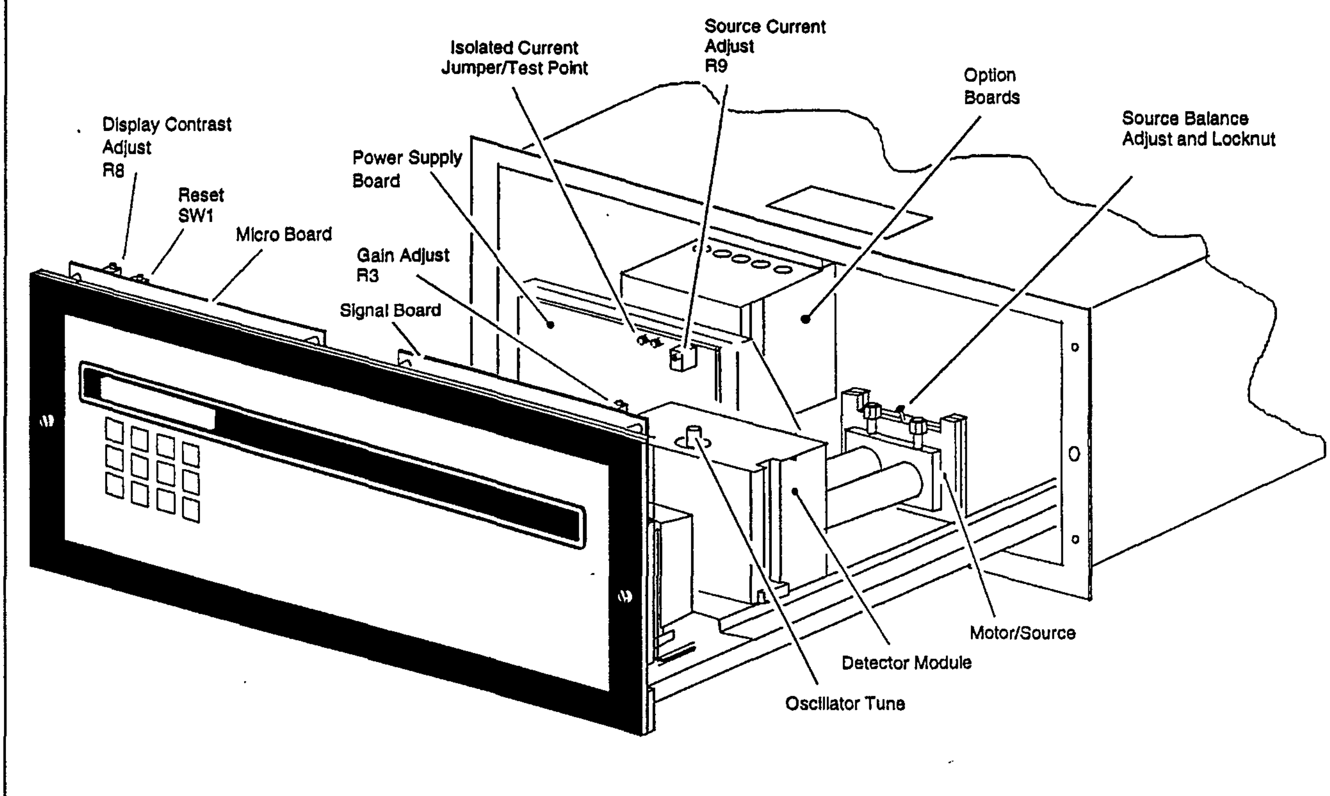
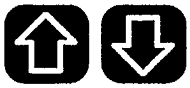


Figure 3.1 Model 880A Adjustments

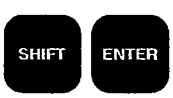


The up and down arrow keys are used to modify the data in the display. Depress either the up or down arrow to change the values displayed above the cursor. When used in one of the editing modes, SHIFT ↑ causes the highest value allowed in a function to be displayed. SHIFT ↓ causes the lowest value to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

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.



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 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

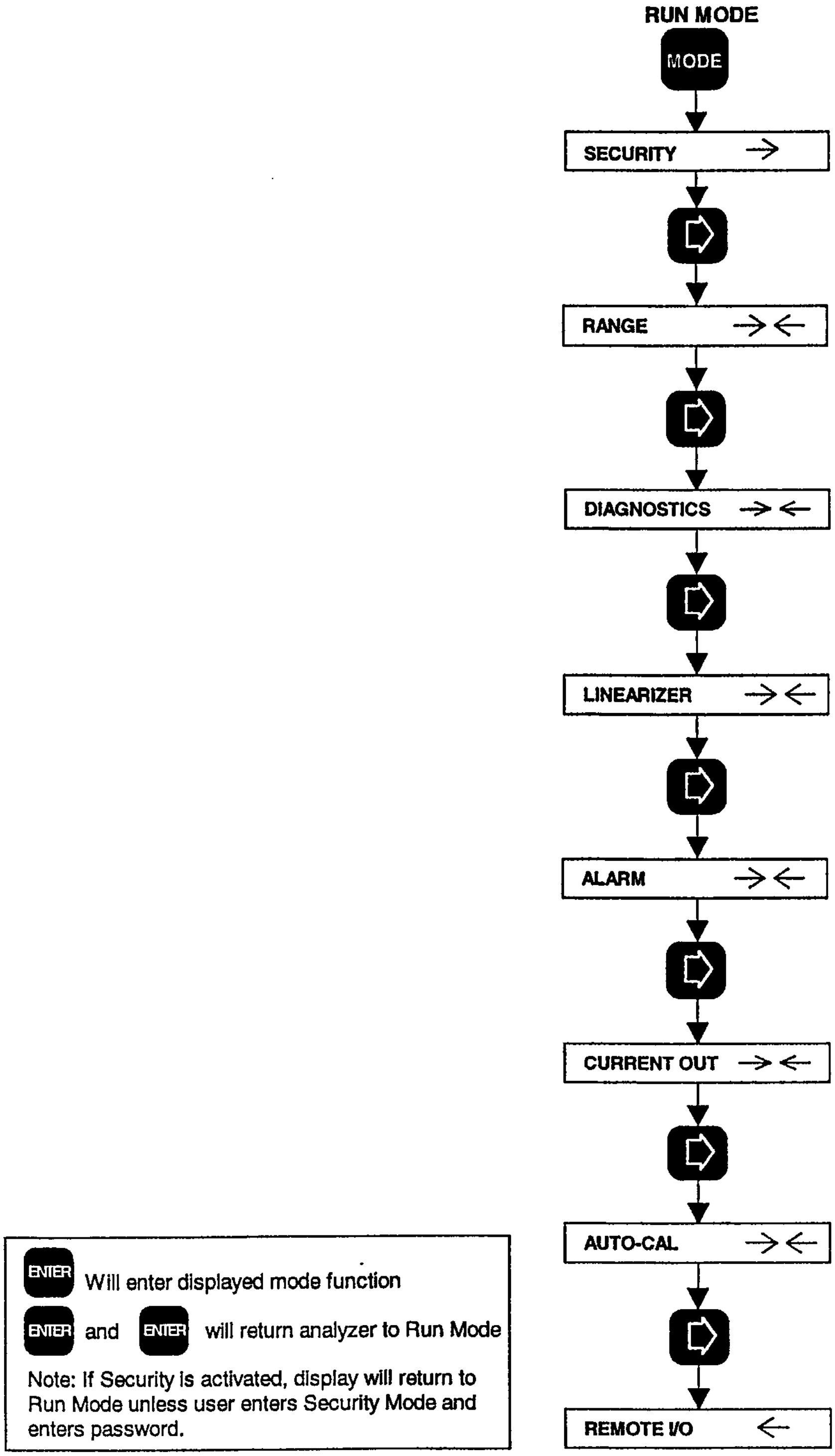


Figure 3-4. Logic Flow Chart

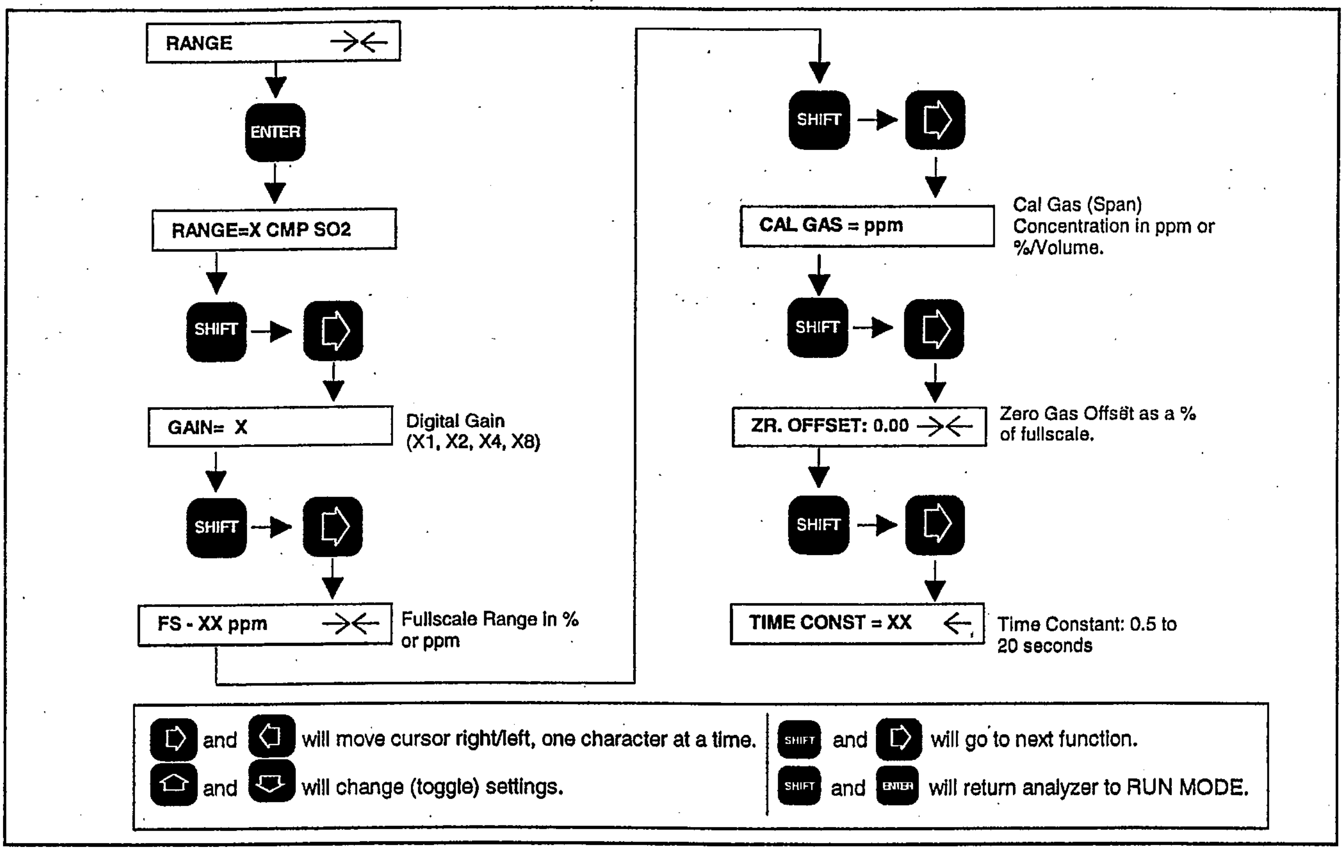


Figure 3-6. Range Mode

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).

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.

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).

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**

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.
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.

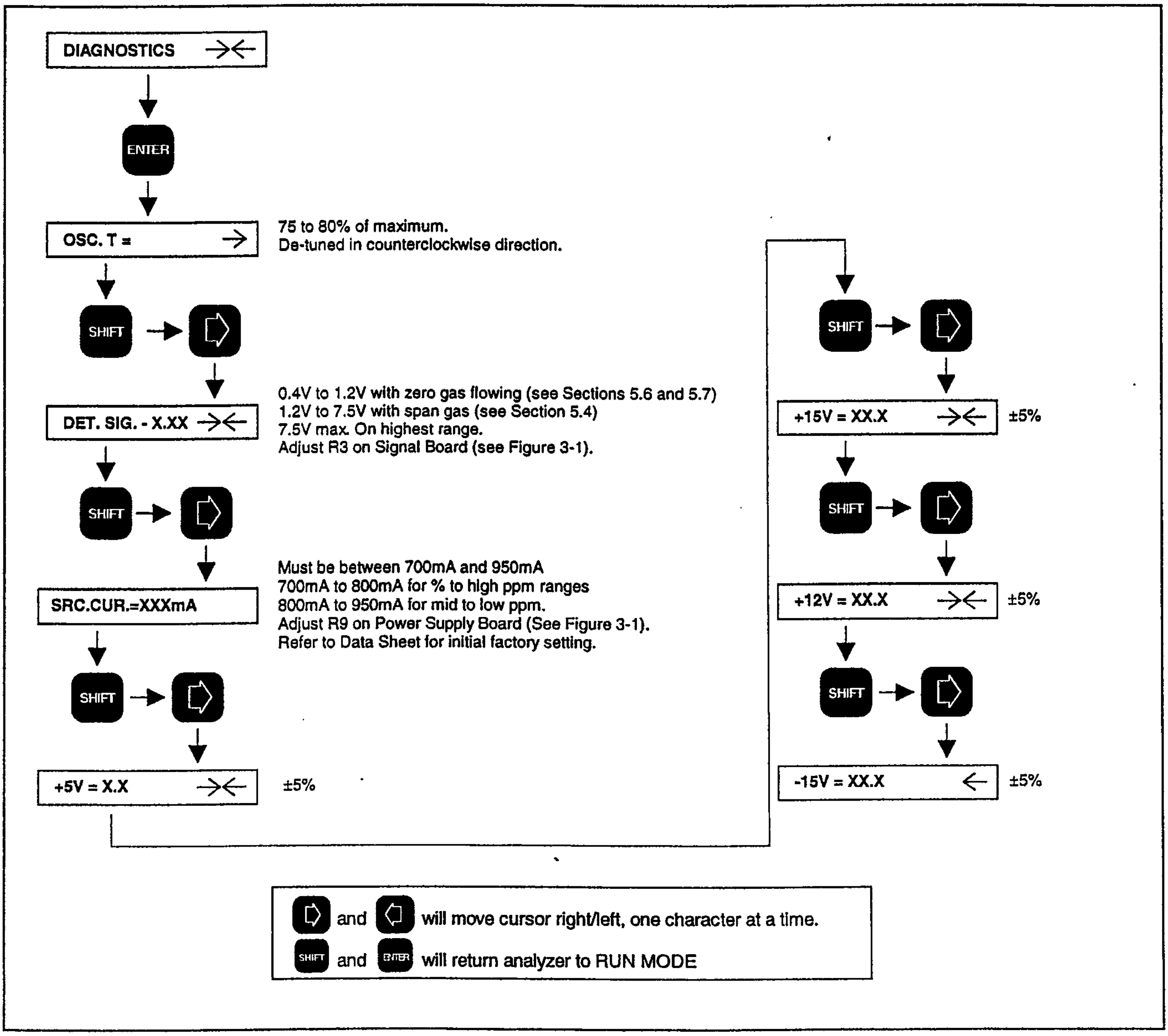
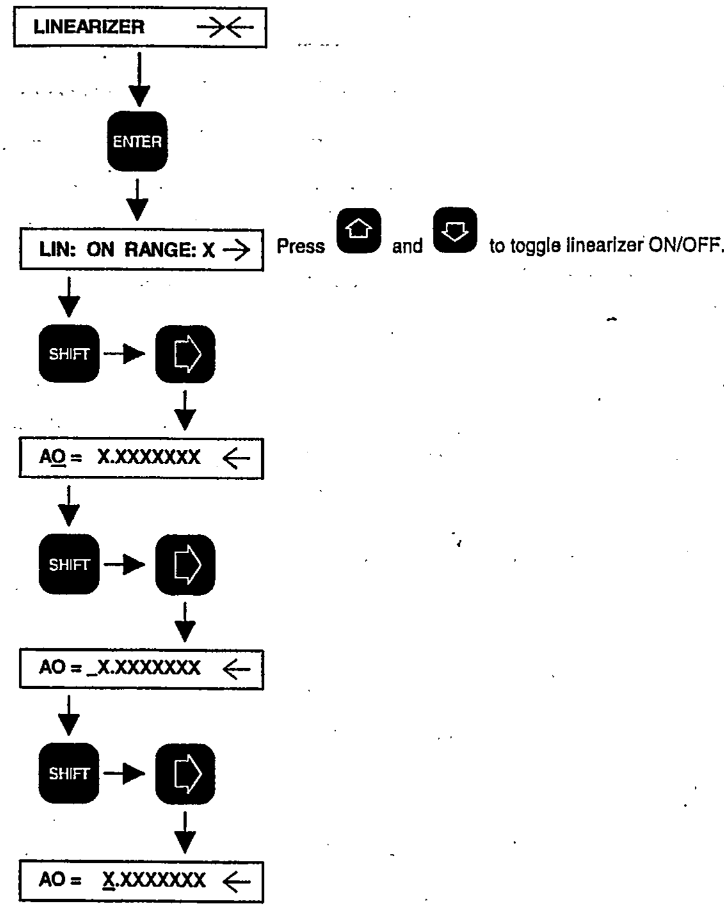


Figure 3-7. Diagnostic Mode



TO PREVIEW VALUES:

Press [ENTER] to preview values for A1, A2, A3, A4 *WITHOUT CHANGING THOSE VALUES.*

TO CHANGE VALUES:

- [→] will move cursor right
- [↑] and [↓] will change (toggle) values of each character (Blank space after "=" indicates the sign of the coefficient).
- [ENTER] will move to next coefficient.
- [SHIFT] and [ENTER] will return analyzer to RUN MODE.

Figure 3-8. Linearizer Mode

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.

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.

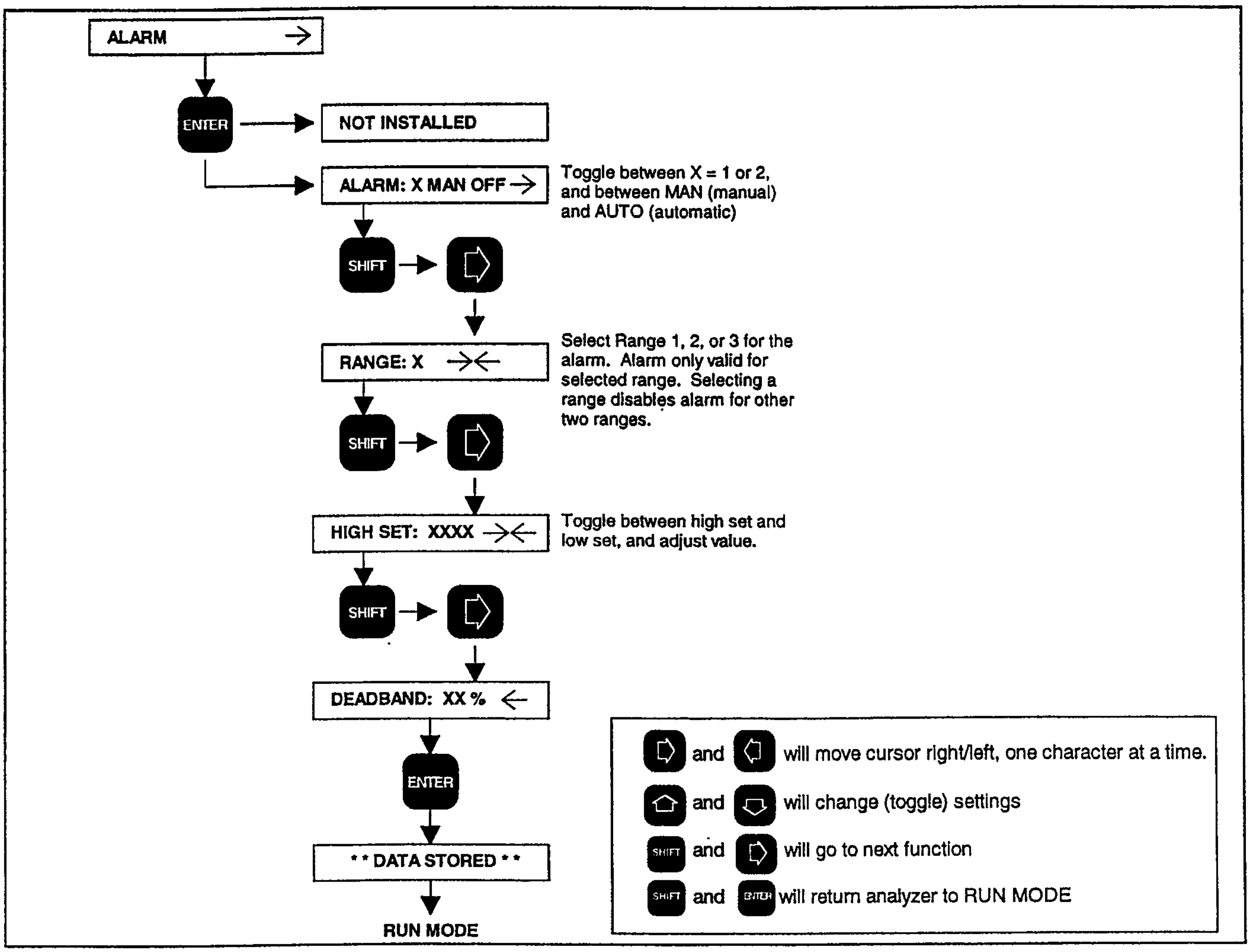


Figure 3-11. Alarm

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.

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.

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

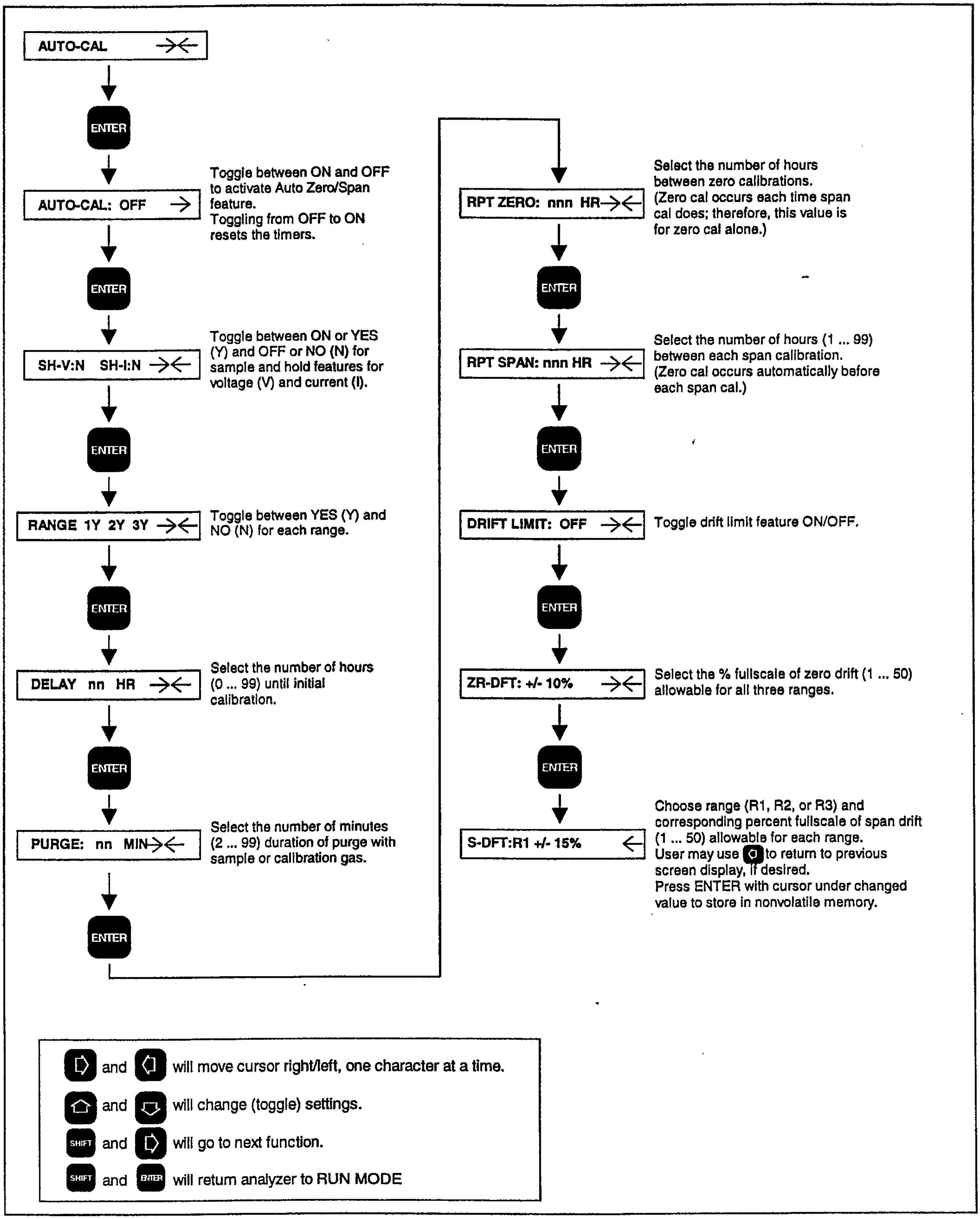


Figure 3-14. Auto Zero/Span

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

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.

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.

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.

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.

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]	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.
ER2	[E2-SPAN #2 LMTS]	
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

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.
3. 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.
4. 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.
5. 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.

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 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. Retighten the locking nut. Ensure that the display does not change.

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.

CAUTION
TEMPERATURE
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. Retighten 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.

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:

**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.
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

GAS	DESICCANT	PART NUMBER
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.

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.

6.7 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.

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).

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 frequency. 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.

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 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.

Option Board	Jumper Configuration	
	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

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.

WARNING
COMPONENT 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.

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)

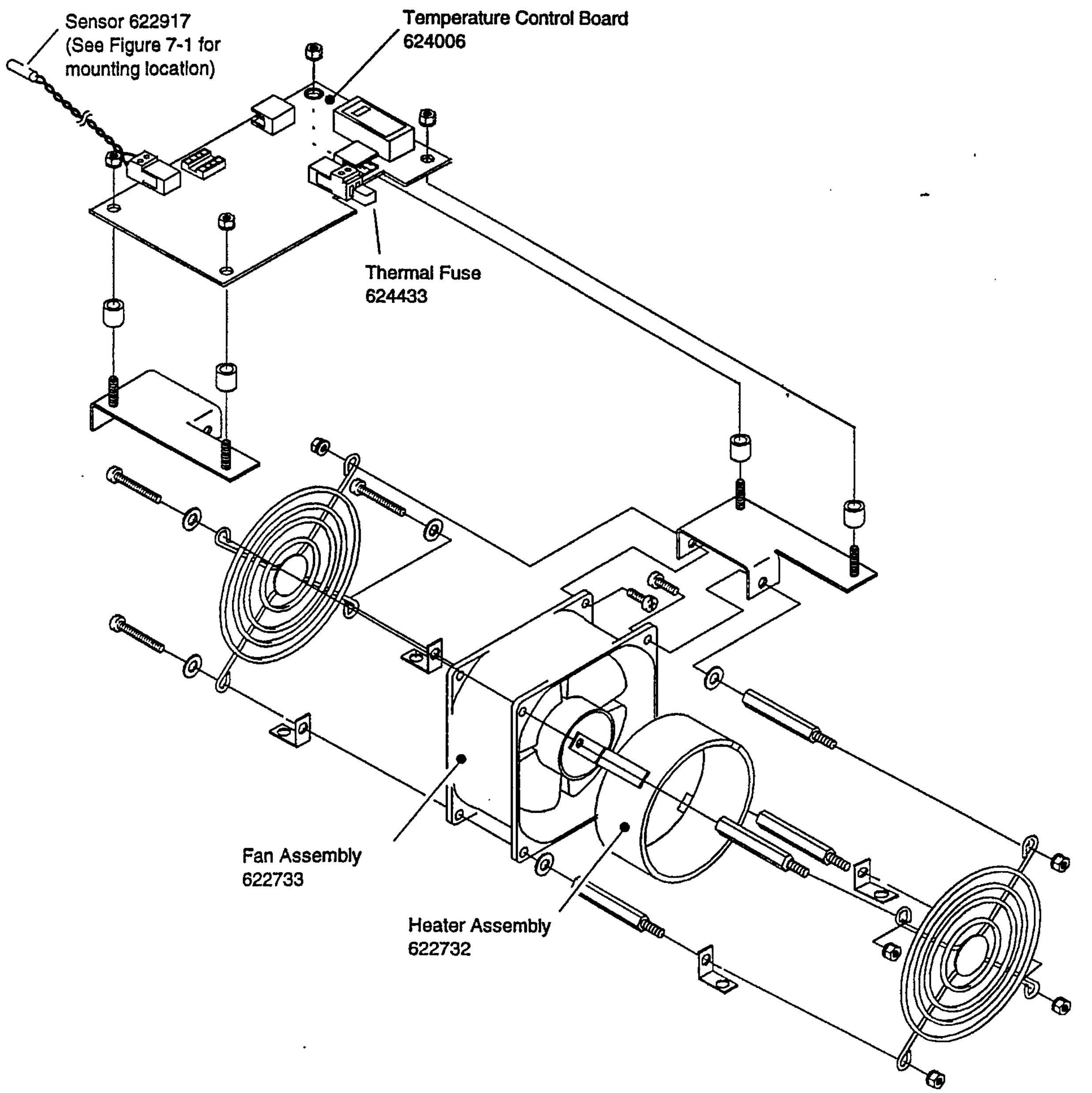


Figure 7-2. Case Heater Temperature Control Assembly

GENERAL PRECAUTIONS FOR HANDLING & STORING HIGH PRESSURE 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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600 South Harbor Boulevard • La Habra, California 90631 • (562) 690-7600 • FAX (562) 690-7127
February 1997 015-748525-C Printed in U.S.A.

WARRANTY

Goods and part(s) (excluding consumables) manufactured by Seller are warranted to be free from defects in workmanship and material under normal use and service for a period of twelve (12) months from the date of shipment by Seller. Consumables, glass electrodes, membranes, liquid junctions, electrolyte, o-rings, etc., are warranted to be free from defects in workmanship and material under normal use and service for a period of ninety (90) days from date of shipment by Seller. Goods, part(s) and consumables proven by Seller to be defective in workmanship and/or material shall be replaced or repaired, free of charge, F.O.B. Seller's factory provided that the goods, part(s) or consumables are returned to Seller's designated factory, transportation charges prepaid, within the twelve (12) month period of warranty in the case of goods and part(s), and in the case of consumables, within the ninety (90) day period of warranty. This warranty shall be in effect for replacement or repaired goods, part(s) and the remaining portion of the ninety (90) day warranty in the case of consumables. A defect in goods, part(s) and consumables of the commercial unit shall not operate to condemn such commercial unit when such goods, part(s) and consumables are capable of being renewed, repaired or replaced.

The Seller shall not be liable to the Buyer, or to any other person, for the loss or damage directly or indirectly, arising from the use of the equipment or goods, from breach of any warranty, or from any other cause. All other warranties, expressed or implied are hereby excluded.

IN CONSIDERATION OF THE HEREIN STATED PURCHASE PRICE OF THE GOODS, SELLER GRANTS ONLY THE ABOVE STATED EXPRESS WARRANTY. NO OTHER WARRANTIES ARE GRANTED INCLUDING, BUT NOT LIMITED TO, EXPRESS AND IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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Force Majeure. Seller shall not be liable for failure to perform due to labor strikes or acts beyond Seller's direct control.

ROSEMOUNT ANALYTICAL

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U.S.A.

To obtain field service on-site or to discuss a service problem, contact our National Response Center at: (800) 654-7768. They are available 24 hours, 7 days a week.

INTERNATIONAL

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

FACTORY

To obtain factory support for parts clarification, repairs and orders, contact:

Rosemount Analytical Inc.
600 South Harbor Boulevard
La Habra, California 90631
Phone: (562) 690-7600
Fax: (562) 690-7127

RETURNING PARTS TO THE FACTORY

Before returning parts, contact the Sales Order Department at (562) 690-7600 and request a Returned Materials Authorization (RMA) number. Please have the following information when you call:

- Model Number
- Serial Number
- Purchase Order or Sales Order

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 written certification that the material has been decontaminated, disinfected and/or detoxified.