Rosemount Analytical

Model 890
UV SO_2 Analyzer

INSTRUCTION MANUAL

748239-H

NOTICE

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

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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 890 UV SO_2 Analyzer should be thoroughly familiar with and strictly follow the instructions in this manual. **Save these instructions.**

If this equipment is used in a manner not specified in these instructions, protective systems may be impaired.

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: 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 Section 2.8.

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

WARNING: PARTS INTEGRITY

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

WARNING: INTERNAL ULTRAVIOLET LIGHT HAZARD

Ultraviolet light from the source lamp can cause permanent eye damage. Do not look at the UV source for prolonged periods. Use of UV filtering glasses is recommended.

WARNING: HIGH PRESSURE GAS CYLINDERS

This analyzer requires periodic calibration with known zero and standard gases. See General Precautions for Handling and Storing High Pressure Cylinders, at the rear of this manual.

⚠ *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.

SPECIFICATIONS - GENERAL

CATALOG NUMBER	193505
RANGE (FULLSCALE)	Standard: 0 to 50, 0 to 5000 ppm SO_2 at atmospheric pressure
OPERATING TEMPERATURE	32°F to 104°F (0°C to 40°C)
REPEATABILITY	≤1% of fullscale
ZERO DRIFT1	±2% of fullscale per week
SPAN DRIFT1	±2% of fullscale per week
NOISE	≤1% of fullscale
RESPONSE TIME (ELECTRONIC)	Variable, 90% of fullscale in 0.5 sec. To 20 sec, field selectable (Application dependent)
SENSITIVITY	≤0.1 ppm SO_2
INTERFERENT REJECTION	Discrimination ratio for NO_2 is 1000:1
ANALOG OUTPUT	Standard: 0 to 5 VDC and 0 to 20 mA/4 to 20 mA DC, isolated (maximum load 700 ohms)
LINEARIZATION	Keypad entered coefficients for linearizing 1, 2 or (all) 3 ranges
POWER REQUIREMENTS:	115/230 VAC ±10%, 50/60 Hz, 350 Watts

SPECIFICATIONS - SAMPLE

SAMPLE CELL	12.0 inches (305 mm) long, 110 cc volume
MATERIALS IN CONTACT WITH SAMPLE	
WINDOWS	Suprasil II
CELLS	Pyrex
TUBING	FEP Teflon
FITTINGS	316 stainless steel
O-RINGS	Viton-A
SAMPLE PRESSURE	Maximum 10 psig (69 kPa)

1 Performance specifications based on ambient temperature shifts of less than 20 Fahrenheit degrees (11 Celsius degrees) per hour.

SPECIFICATIONS - PHYSICAL

ENCLOSURE	General purpose for installation in weather-protected area. Optional purge kit per Type Z, ANSI/NFPA 496-1989[1]
DIMENSIONS	8.7 x 19 x 24 inches (221 x 483 x 610 mm) H x W x D
WEIGHT	65 lbs. (30 kg)

SPECIFICATIONS - OPTIONS

ALARM [2]	Two single point, field programmable high or low, deadband up to 20% of fullscale
ALARM RELAY CONTACTS	Two Form C contact rated 3A, 125/250 VAC or 5A, 30 VDC (resistive)
CALIBRATION GAS CONTROL	Two front panel actuated contact closures
RELAY OUTPUTS	Two Form C contact rated 3A, 125/250 VAC or 5A, 30 VDC (resistive)
AUTO ZERO/SPAN	Four form C contact closures, rated 3A, 125/250 VAC or 5A, 30 VDC (resistive), field programmable frequency and duration of closure
RELAY OUTPUTS	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 INPUT/OUTPUT	Three remotely changeable ranges with positive identification.
RANGE CHANGE	Binary or decimal, field selectable.
AUTO ZERO/SPAN	Auto Cal request and status.
RELAY OUTPUTS	Eight form A contact 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

1 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 recommendation.

2 Fail-safe jumper configuration.

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 890 UV SO2 Analyzer instruction materials are available. Contact Customer Service or the local representative to order.

748239 Instruction Manual (this document)

COMPLIANCES

The Model 890 UV SO_2 Analyzer, catalog number 193505, is intended for sampling only non-hazardous gases in non-hazardous locations. When equipped with the optional Type Z Purge Kit (PN 624446), this analyzer is approved for use in Class I, Division 2, Groups B, C, and D hazardous locations and use indoor non-hazardous locations when sampling flammable gases.

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

97-C209

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

NOTES

1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The Model 890 Ultraviolet Analyzer is designed to determine continuously the concentration of SO_2 in a flowing gaseous mixture. The analyzer is capable of measurement in the 50 to 5,000 ppm range.

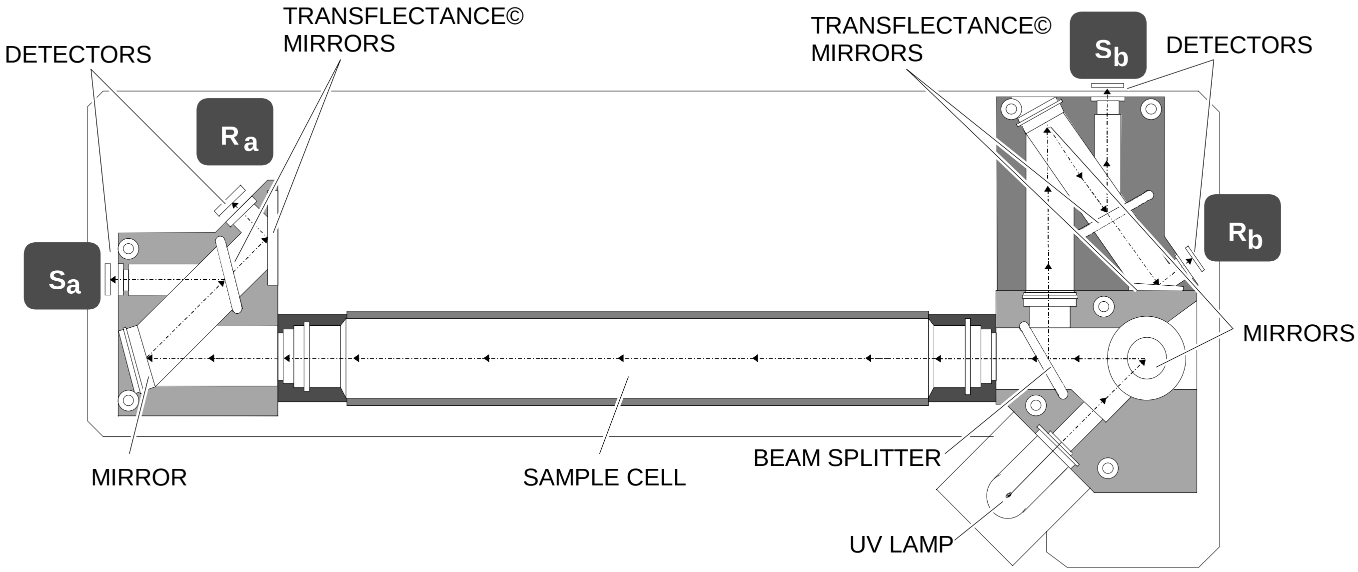


FIGURE 1-1. MODEL 890 OPTICAL BENCH

OPTICAL BENCH

The ultraviolet source emits a pulsed (30 Hz) beam of energy. This energy is split by a beam splitter, each beam being directed to pairs of detectors before and after the sample cell.

One of the unique features of the Model 890 is the use of spectrally selective, “Transflectance”© mirrors. These mirrors isolate the sample and reference spectral passbands for the detectors. They reflect energy below a wavelength region and transmit the remaining, higher wavelengths, all with much lower energy loss than the more commonly used bandpass interference filters.

Four detectors are used in this system, two before the sample cell (sample before [S_b] and reference before [R_b]) and two after (sample after [S_a] and reference after [R_a]).

S_b and S_a receive energy 265 to 310 nm wavelength region, R_b and R_a in the 310 to 355 nm region.

These four detectors measure SO_2 concentration and correct for NO_2 interference and UV lamp fluctuations. The difference between detector determinations is the SO_2 concentration, following this formula:

$$SO_2 = [f(R_b)-S_b]-[f(R_a)-S_a]$$

where:

Ra, Rb, Sa, Sb = signals from those detectors so identified

f = attenuation factor for the reference signal, adjusted to compensate for NO_2 interference.

The sample gas is introduced to the sample cell, and the component of interest absorbs ultraviolet energy in proportion to the concentration in the gas. The difference between the signals of the detectors located at both ends of the sample cell determines the concentration of SO_2 in the sample.

Additionally, the adjacent (non-SO_2-absorbing) reference wavelengths are used as a baseline for measurement and correction of sample interferent components, particularly NO_2.

Readout is on a 16-character, LED-backlighted liquid crystal display. SO_2 concentration data is presented in parts per million, percent of composition, or percent of fullscale. Additionally, 0 to +5 VDC output for a potentiometric (voltage) recorder and 0 to 20 mA or 4 to 20 mA isolated current output (maximum load 700 ohms) are provided as standard.

A case heater with fan assembly maintains proper operating temperature.

LINEARIZATION

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 890 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.

AUTO ZERO/SPAN

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

CALIBRATION GAS CONTROL

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

REMOTE RANGE I/O

An optional remote range input/output is available.

AIR PURGE KIT

Air purge kit, when installed with user-supplied components, meets Type Z requirements of standard ANSI/NFPA 496-1993 for installation in Class I, Division 2 locations as defined in the National Electrical Code (ANSI/NFPA 70) when sampling nonflammable gases. If the analyzer is used to sample a flammable gas, it must be protected by a continuous dilution purge system per standard ANSI/NFPA 496-1993, Chapter 6, or IEC publication 79-2-1983, Section Three. (Consult factory for further information.)

NOTES

2 UNPACKING AND INSTALLATION

2.1 CHECK FOR SHIPPING DAMAGE

Examine the shipping carton and contents carefully for any signs of damage. Save the carton and packing material until the analyzer is operational. If carton or contents damage (either external or concealed) is discovered, notify the carrier immediately.

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 654853.

If equipped with PN 624446 optional 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 496-1993, 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 496-1993, Chapter 6. Consult factory for recommendations concerning minimum purge flow requirements for your particular application.

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 set up to operate on 115 VAC, 50/60 Hz electric power. For operation on 230 VAC, 50/60 Hz the installer must position voltage select switches S1 and S2 located on power supply board to the 230 VAC position (see Figure 2-1).

Power consumption is 350 watts.

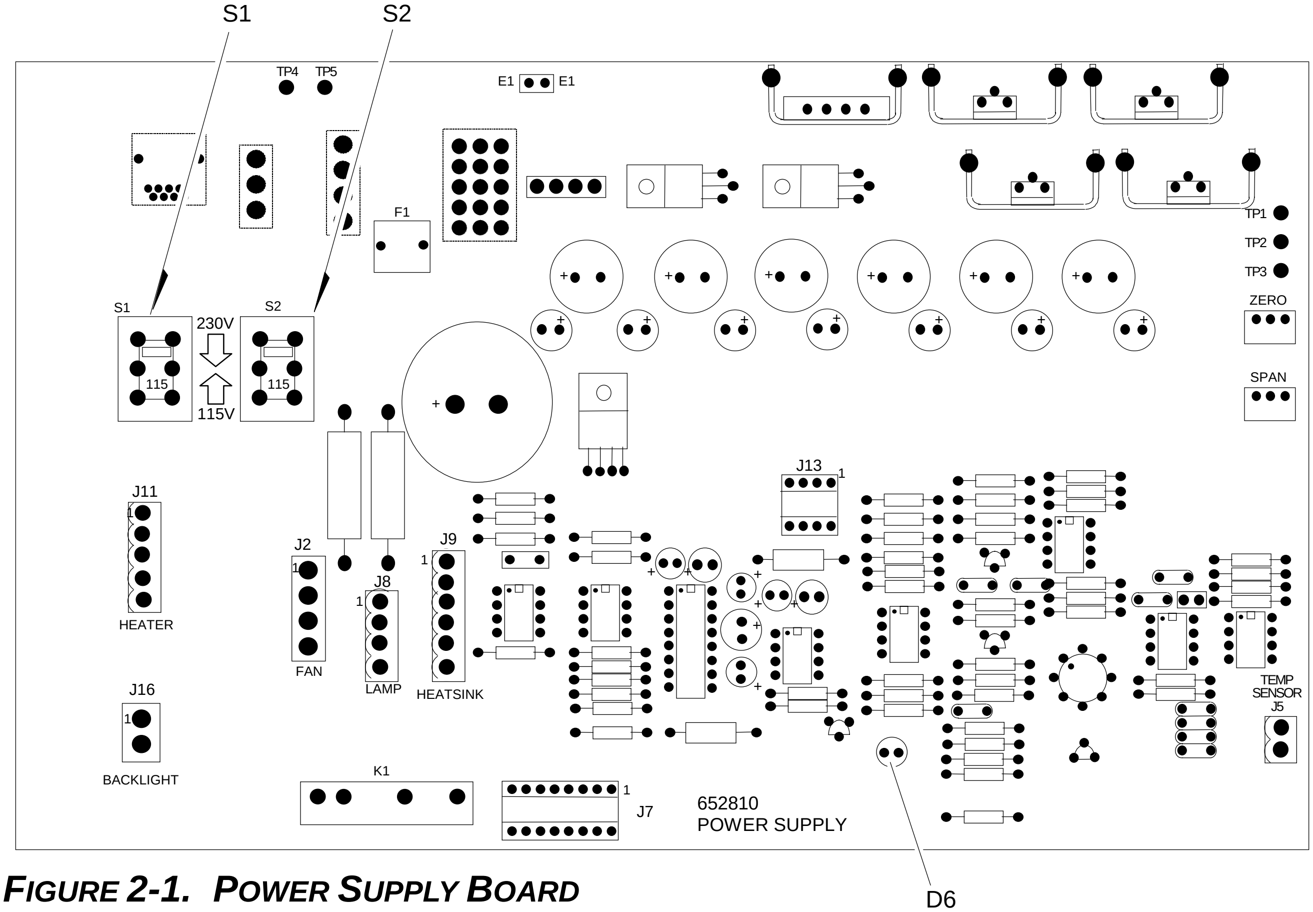


FIGURE 2-1. POWER SUPPLY BOARD

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
CURRENT OUTPUT	899329

Remove the rear cover to access the terminals. Route each cable through the cable gland and connect to appropriate connector or terminal strip as shown in Drawings 654853 and 652715. Then, tighten the gland.

2.4.1 LINE POWER CONNECTIONS

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 to it via a 3-wire flexible power cord, minimum 18 AWG (max. O.D. 0.480", min. O.D. 0.270") through hole “F” (refer to Drawing 654853) utilizing the connector gland (PN 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 (PN 654008) for bench top use, 2) the power cord only (PN 634061), or 3) the four feet only (PN 634958). If the instrument is permanently mounted in an open panel or rack, use electrical metal tubing or conduit.

Refer to Figure 2-2 and Drawings 654853, 652715 and 656139. 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<D%0> the chassis, no excess power cable slack is necessary.

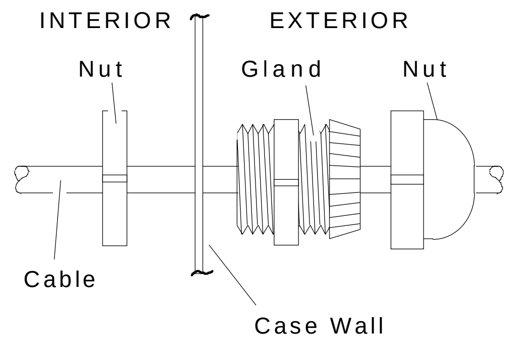


FIGURE 2-2. CABLE GLAND CONNECTION

2.4.2 RECORDER CONNECTIONS

Recorder connections are made to the rear panel. Refer to Drawings 654853, 652715 and 656139. Route the recorder cable through the cable gland 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 ohms

2.5 SAMPLE INLET/OUTLET CONNECTIONS

The standard Model 890 is intended for atmospheric pressure operation only, and must be vented to either the atmosphere or a collection destination at atmospheric pressure. Sample inlet and outlet connections are located on the rear panel. All connections are 1/4-inch ferrule-type compression fittings. See Drawing 654853.

2.6 CALIBRATION GAS REQUIREMENTS

Analyzer calibration consists of setting a zero point and one or more upscale points.

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

WARNING: POSSIBLE EXPLOSION HAZARD

This analyzer is 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 the analyzer, the sample containment system must be 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 that the system is in leak proof condition.

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

The following test is designed for sample pressure up to 10 psig (69 kPa).

1. Supply air or inert gas such as nitrogen at 10 psig (69 kPa) to analyzer via a flow indicator with a range of 0 to 250 cc/min and set flow rate at 125 cc/min to the sample inlet.
2. Seal off sample outlet with a cap.
3. Use a suitable test liquid such as SNOOP* (PN 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.

Note

Do not allow test liquid to contaminate cell or detectors and UV source windows. Should this occur, follow instructions in subsection 6.1 to clean the cell.

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.

Assume that two cell volumes are required to flush any cell. Approximate flushing time for the Model 890's 12-inch cell at atmospheric sampling pressure (i.e., the outlet of the cell venting to atmosphere) is approximately 12 seconds.

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).

2.10 OPTION BOARDS

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

2.10.1 ALARM CONNECTIONS

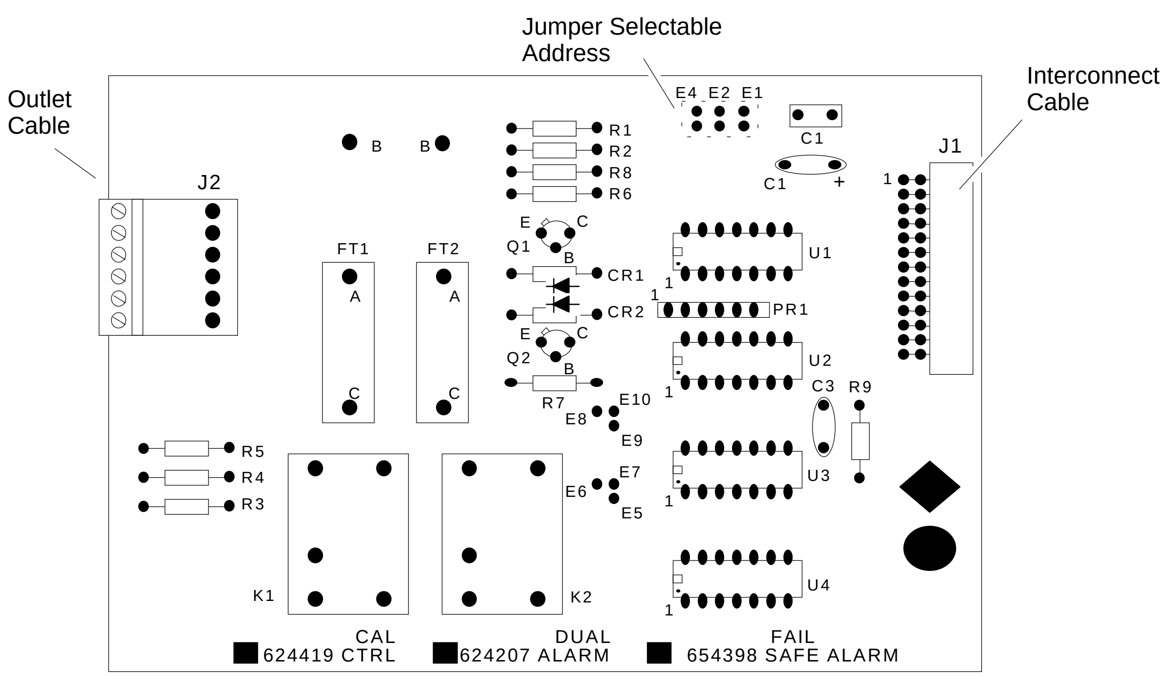
Refer to Figure 2-3 and Drawings 652715 and 656139. Connect cable (customer supplied) to the 6-pin connector J2. The Dual Alarm Option consists of two form C contacts rated 3A-125/250 VAC or 5A-30 VDC (resistive).

Run the cable through the cable gland and tighten once the connector has been secured (Figure 2-2).

2.10.2 CALIBRATION GAS CONTROL CONNECTIONS

Refer to Figure 2-3 and Drawings 652715 and 656139. Connect cable (customer supplied) to the 6-pin connector J2. The Cal. Gas Control Option 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 (Figure 2-2).



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 2-3. CALIBRATION GAS CONTROL AND ALARM CONNECTIONS

2.10.3 AUTO ZERO/SPAN CONNECTIONS

Refer to Figure 2-4 and Drawings 652715 and 656139. Connect cable (customer supplied) to the 9-pin connectors J2 and J3. The Auto Zero/Span Option 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 (Figure 2-2).

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

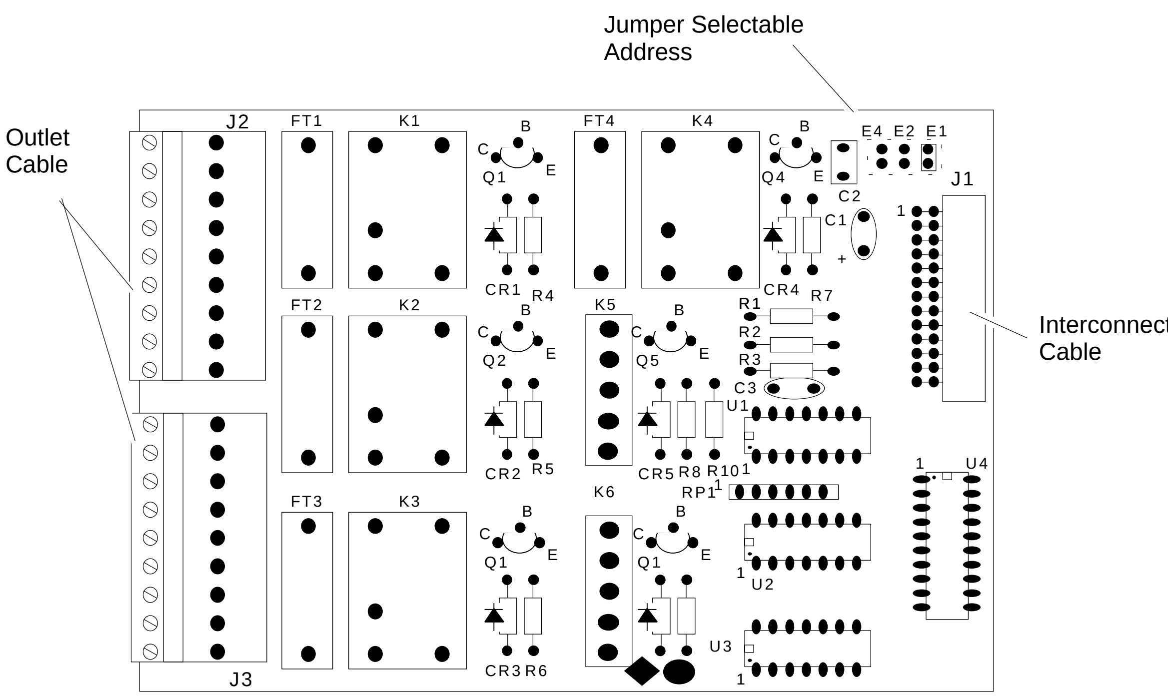


FIGURE 2-4. AUTO ZERO/SPAN CONNECTIONS

2.10.4 REMOTE INPUT/ OUTPUT CONNECTIONS

Refer to Figure 2-5 and Drawings 652715 and 656139. 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 2-2).

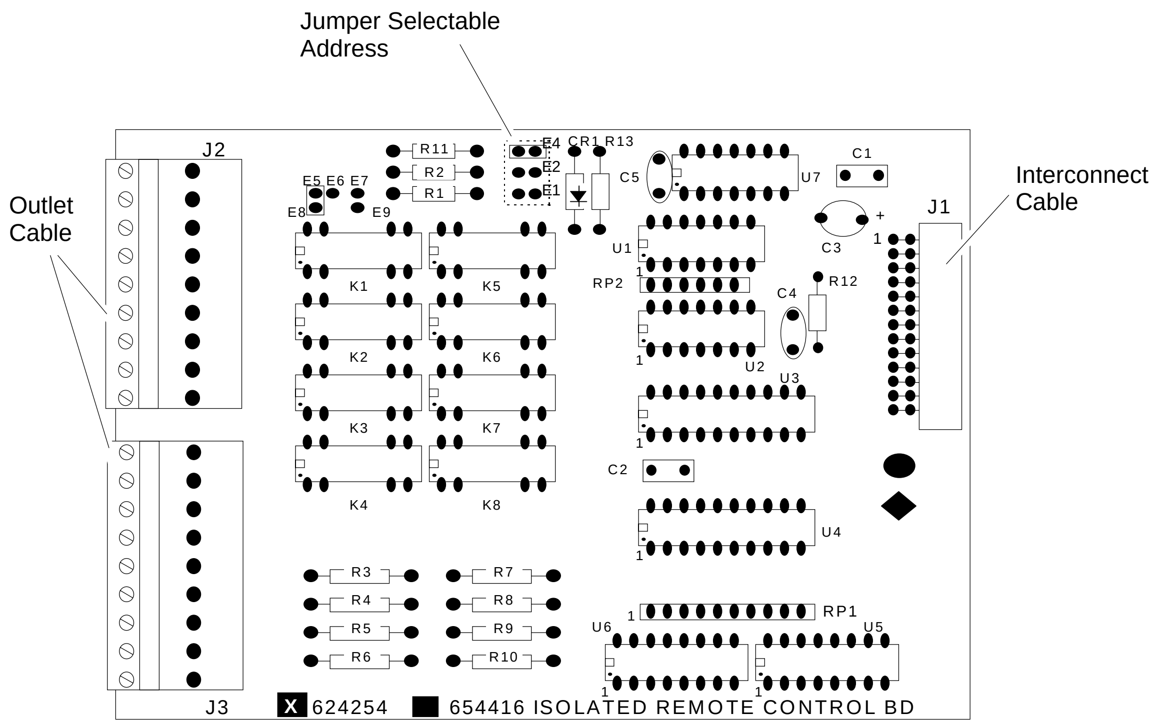


FIGURE 2-5. REMOTE INPUT/OUTPUT OPTIONS

2.11 ORDERING OPTION KITS

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

- 624422 Isolated Remote Control Kit
- 624207 Dual Alarm Kit
- 654398 Fail Safe Dual Alarm Kit
- 624424 Auto Zero/Span Control Kit
- 624426 Calibration Gas Control 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 in the card guides and follow the wiring directions in section 2.10. There are five connectors on the interconnect cable. It is important for the slot to be connected to the correct connector on the interconnect cable.

To install any of the above kits, the Common Parts Kit, PN 624414, must be ordered if not originally ordered with the analyzer. This kit consists of a card cage which mounts in the rear of the case and three interconnect cables that plug in as shown on Drawings 652715 and 656911. Once this kit is installed, it need not be ordered again for other kits.

NOTES

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 (D6) is ON. Refer to Figure 2-1.

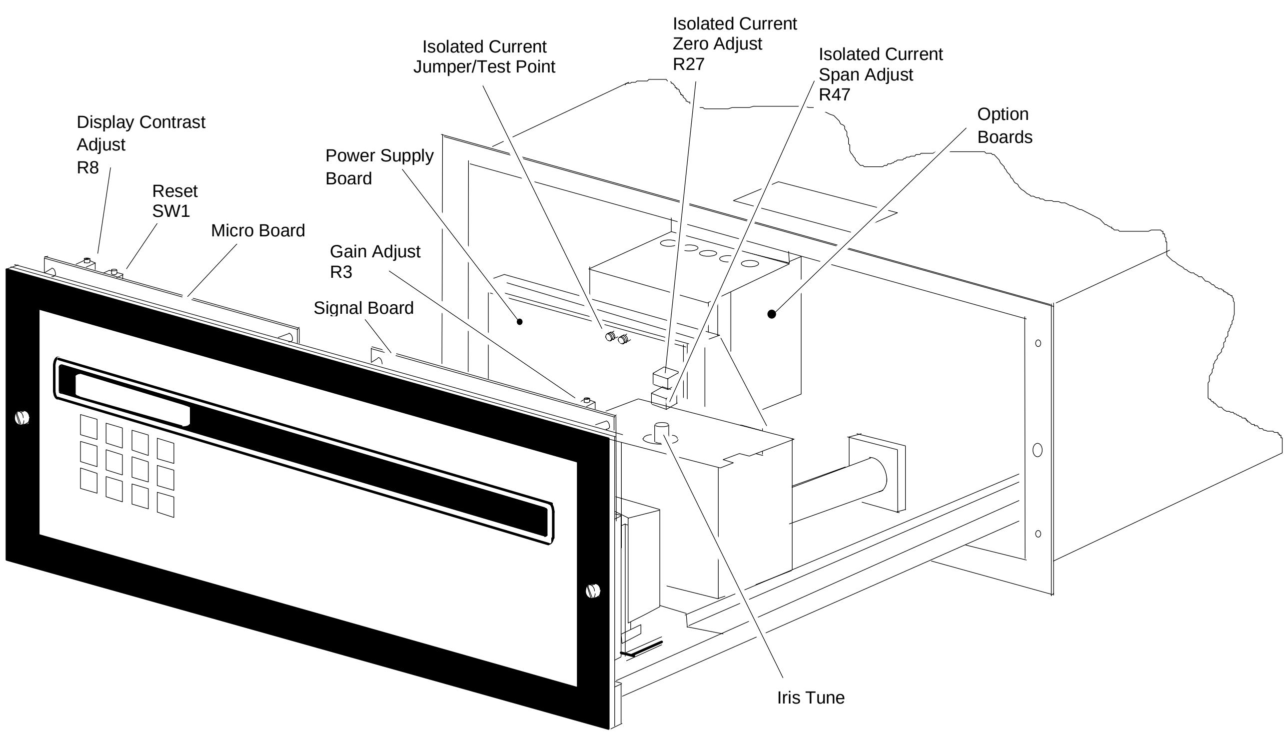


FIGURE 3-1 MODEL 890 ADJUSTMENTS

3.3 SOFTWARE/COUNTDOWN

When power is first applied to the Model 890 analyzer, the display will read [INITIALIZING]. Next, the display will show the current software version number, [VERSION X.XX].

A countdown timer ([WARM UP-WAIT YY], where YY are countdown seconds) displays the lamp warm up time before it is turned on. If after two 80-second countdown sequences, the UV lamp is not sufficiently heated, the display will read [UV LAMP ERROR]. See Table 5-1 for error explanation.

3.4 FRONT PANEL CONTROLS AND INDICATORS

3.4.1 DISPLAY

The display consists of a 16-character 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.

3.4.2 FUNCTION KEYS

The Model 890 has twelve function keys (Figure 3-2). Each key must be pressed firmly for one second to insure that the microprocessor recognizes the keystroke. The definitions for these keys are as follows:

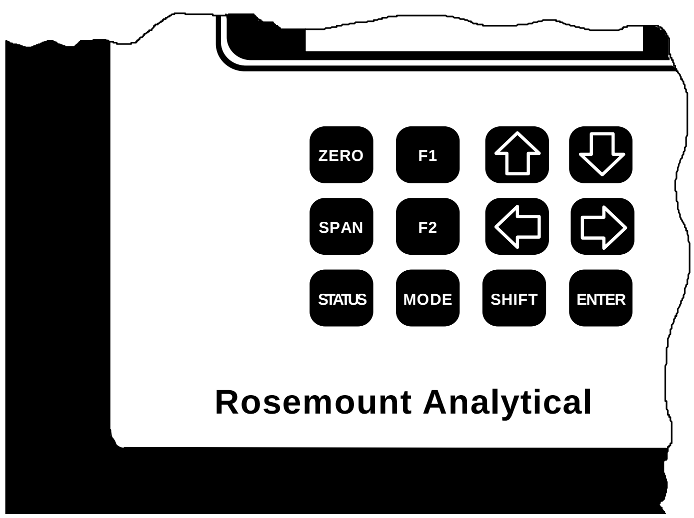


FIGURE 3-2. MODEL 890 KEYPAD

ZERO To activate the manual zero calibration of the analyzer.

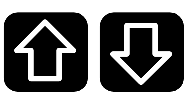
SPAN To activate the manual span calibration of the analyzer.

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

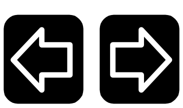
SHIFT Used in conjunction with left and right or up and down arrows, F1, F2 and ENTER keys. Pressing the SHIFT key in any display except Run Mode, Zero Setting, Span Setting and Status causes a ↑ to be displayed at the far right position. Pressing → will then move the cursor 16 characters to the right, 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.

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

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.

3.4.3 USER-PR+OGRAMMABLE 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 the F1 key. This will reprogram the F1 key to the new display.

3.4.4 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.

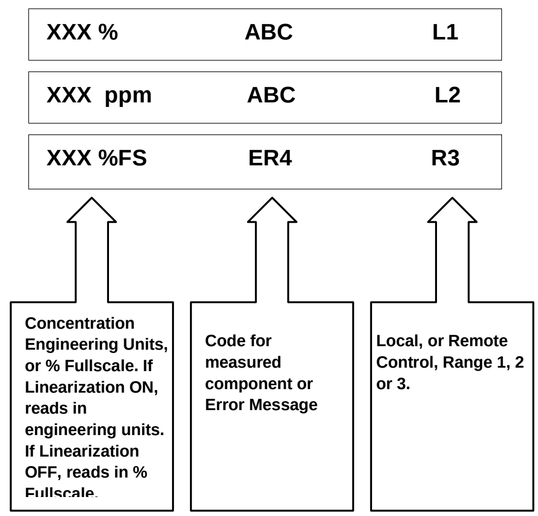


FIGURE 3-3. RUN MODE DISPLAY

3.4.5 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.

3.5 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, DIAGNOSTICS, LINEARIZER, ALARM, CURRENT 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.

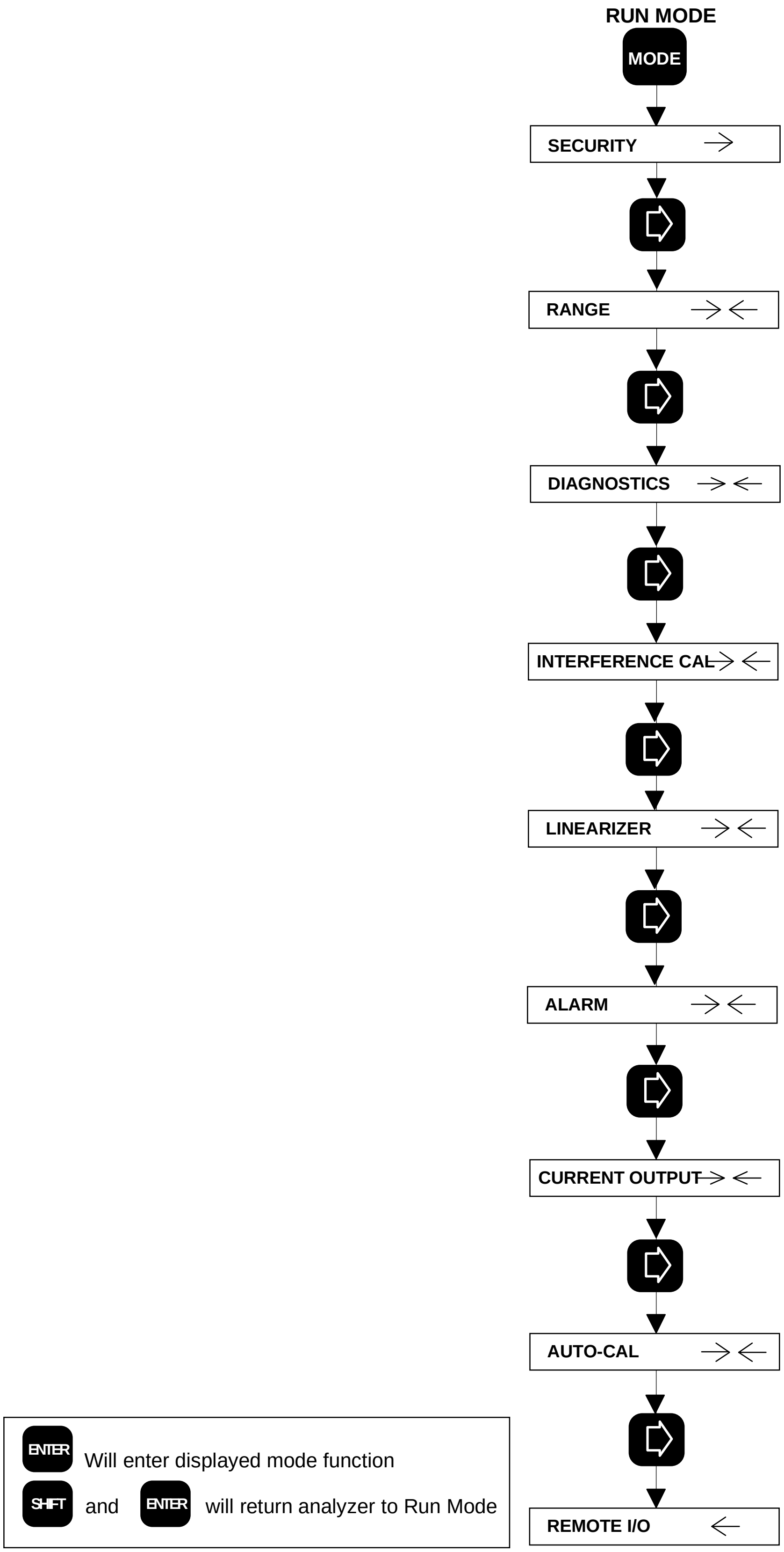


FIGURE 3-4. LOGIC FLOW CHART

3.6 SECURITY CODE

See Figure 3-5. The Model 890 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 "890"

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 (890) through the following steps:

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

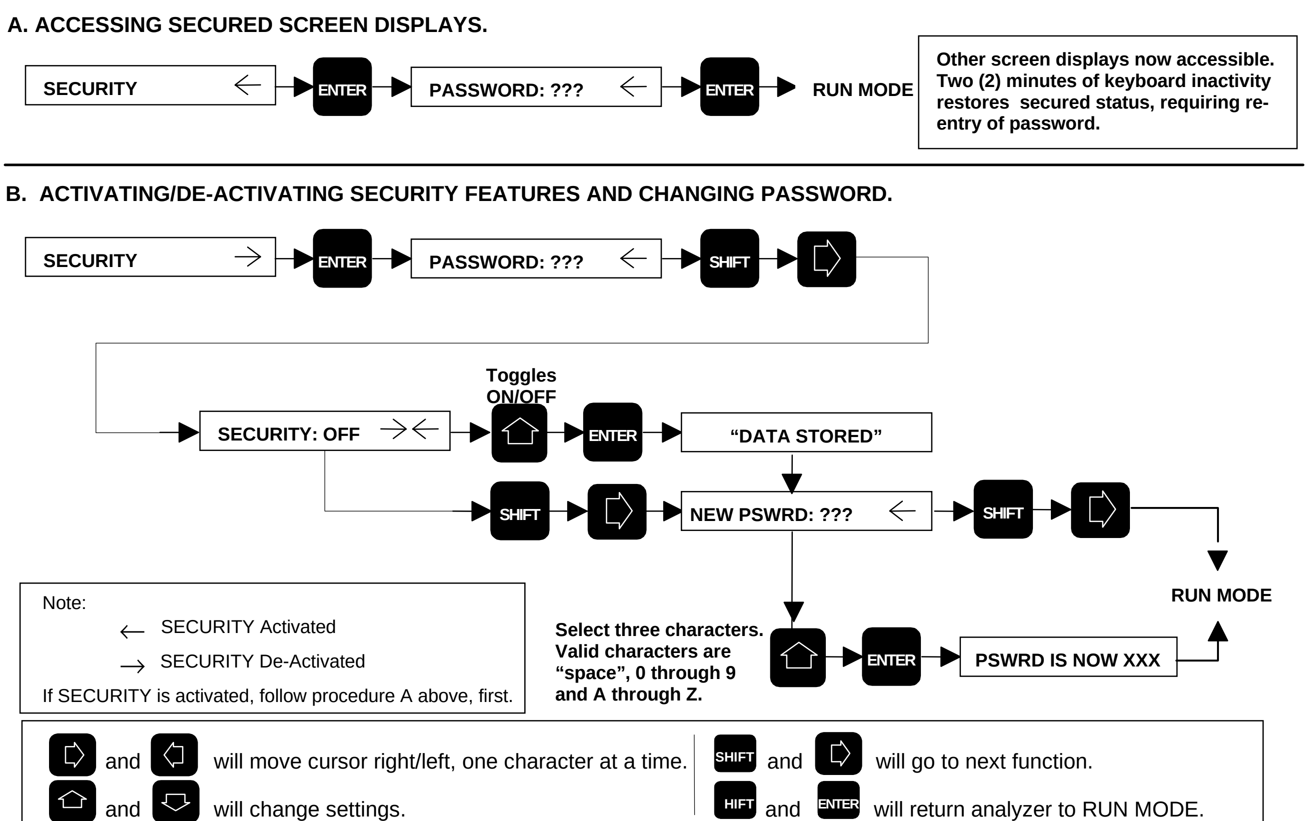
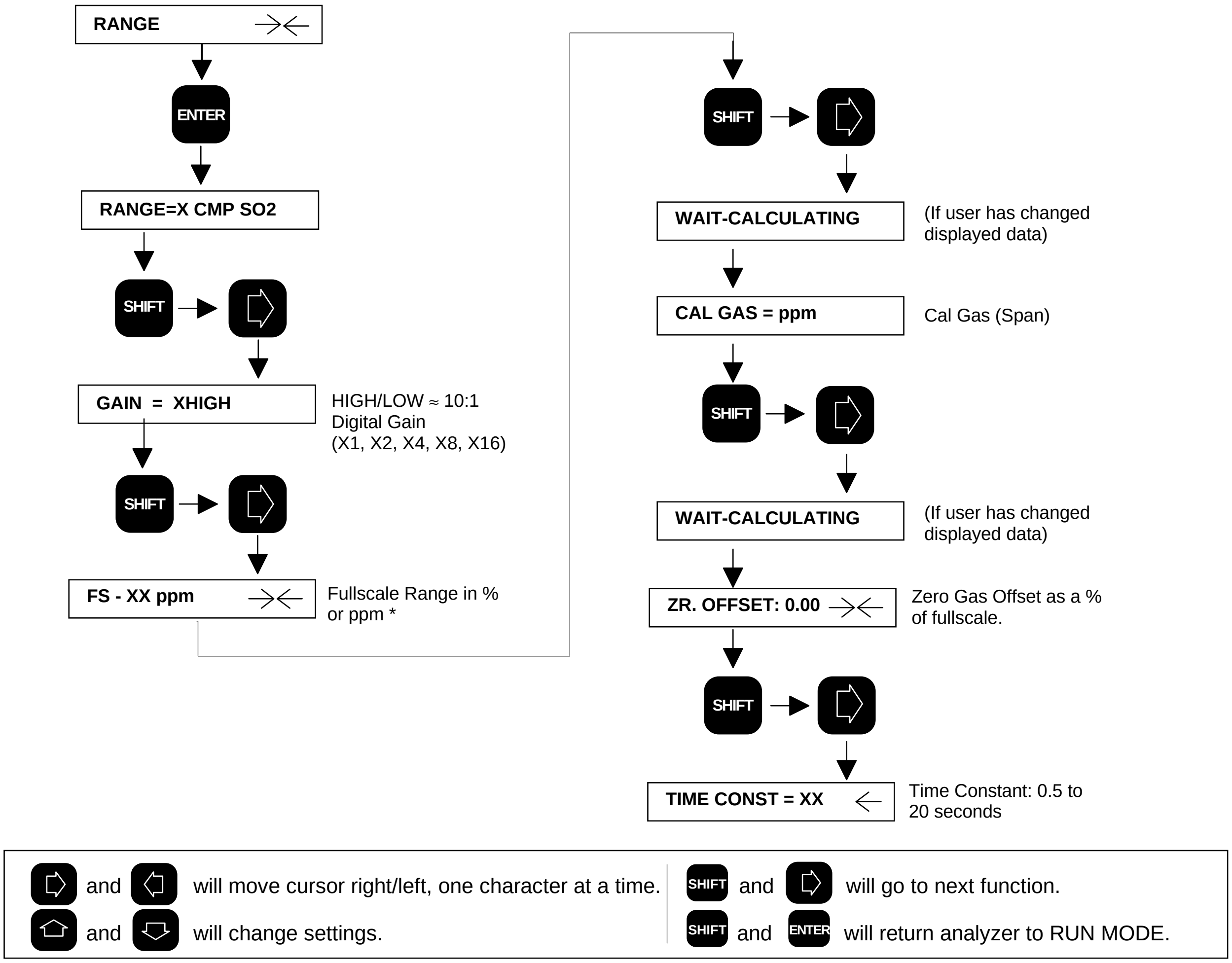


FIGURE 3-5. SECURITY MODE



* % of fullscale if linearizer is OFF, % of composition or ppm if linearizer is ON

FIGURE 3-6. RANGE MODE

3.7 RANGE PARAMETERS

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).

LINEARIZATION

The Model 890 permits entry of different sets of linearizing coefficients (Section 3.13) for each range. Or, if desired, one set of linearizing coefficients may be used for all three ranges when the dynamic range ratio is 3:1 or less. If only one set of coefficients is used, this set should always be entered in Range 3. Coefficients placed in Range 3 will automatically be used for Range A (All).

COMPONENT OF INTEREST

UV methodology may be used for measuring a variety of components. Although the Model 890 is configured for SO_2 analysis, other designations have been designed into the software for display. This 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.

Note

Any designation other than SO_2 will have no effect on the analyzer's performance. It assumes that SO_2 is being measured.

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 5.7). 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 SO_2 and range 3 is 0 to 500 ppm SO_2, then the respective gains will usually be 8 and 1. If 5000 ppm is being measured, gain is x1 and the instrument is set for Low.

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 fullscale value in the RANGE, FS screen [FS = XXXX ppm] that is less than the CAL GAS value entered in the [CAL GAS = XXXX] screen. Conversely, the user cannot enter a vlue in the [CAL CAS = XXXX] screen that is larger than the fullscale value entered in the [FS = XXXX ppm) screen.

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 75% to 100% of fullscale.**

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.

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.

3.8 ANALYZER DIAGNOSTICS

Diagnostics are selectable through the MODE function. This function allows the source current, detector signals (samples S_A and S_B, references R_A and R_B), +5 V, +15 V, +12 V, and -15 V values to be displayed. It is recommended that the values for samples S_A and S_B and , references R_A and R_b be recorded for future reference to help track lamp life. See Figure 3-7.

3.9 ZERO CALIBRATION

The Model 890 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 for at least one minute.) Then press ENTER (display notes [CALCULATING ZERO]). Zero is then set for all three ranges, and the analyzer returns to Run Mode.

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 one and a half 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, for at least two minutes.

3. To calibrate the zero setting for the analyzer for each range desired, press ZERO and then press ENTER.

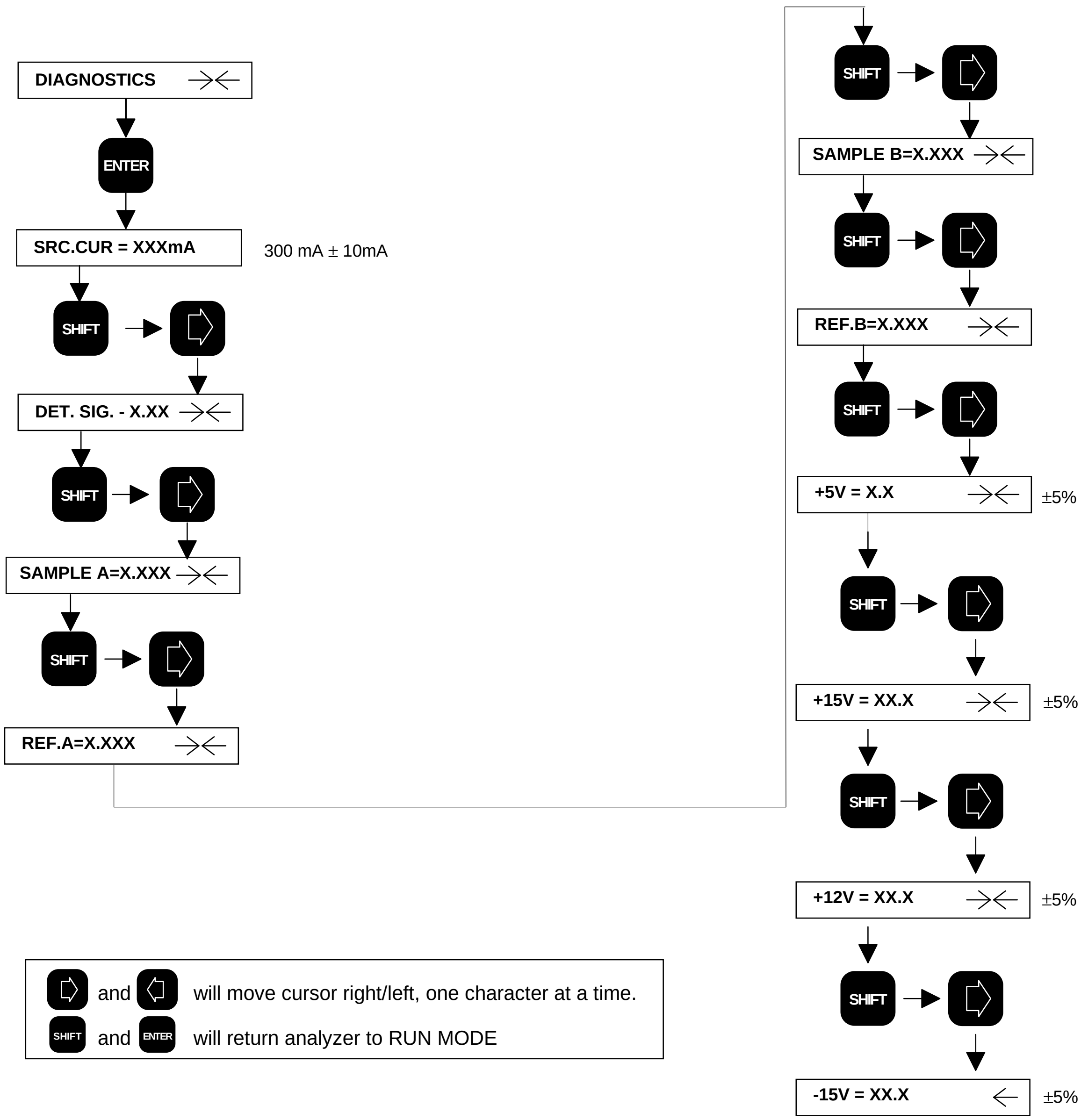


FIGURE 3-7. DIAGNOSTICS MODE

3.10 ZERO CALIBRATION FOR THE ANALYZER WITH THE CAL GAS CONTROL OPTION

The Calibration Gas Control Option 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/OFF when activated. Simply press ZERO to open the appropriate valve, thus allowing the zero gas to flow through the instrument. Pressing ENTER will initiate the calibration process. At the conclusion of calibration, the valve is closed and the instrument returns to RUN mode.

Note

For instruments with Cal Gas Option or Auto Zero/Span Option, press ENTER to perform the selected calibraation. 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 Cal Gas Control Option:

1. Allow system to warm up a minimum of one hour.
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, for at least two minutes.
3. To calibrate the zero setting for the analyzer, press ZERO and then ENTER.

3.11 SPAN CALIBRATION

The Model 890 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 →], 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.

Note

Press SHIFT-ENTER instead of ENTER to maintain previous calibration settings and exit Span without calibrating.

Note

For instruments with the Calibration Gas Control or Auto Zero/Span, press ENTER to perform the new calibration. Both ENTER and SHIFT/ENTER will turn off the relay for the solenoid valve.

Note

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 one and one half 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, for at least two minutes.
3. To calibrate, press SPAN and then ENTER.

3.12 SPAN CALIBRATION FOR THE ANALYZER WITH THE CAL GAS CONTROL OPTION

The Calibration Gas Control Option 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/OFF when activated. Simply press SPAN to open the appropriate valve, thus allowing the zero gas to flow through the instrument. Pressing ENTER will 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.

3.13 LINEARIZATION

The Model 890 Analyzer can be operated in linear and non-linear mode. Linearization can be toggled ON/OFF with the ↑ or ↓ key in the Linearization Mode Screen (see Figure 3-8 and Table 3-1). 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).

Note

SO_2 ranges from 0 to 50 ppm to 0 to 200 ppm are linear within ±1% accuracy, and do not require correction (although their linearities are improved with the fourth order polynomial corrections). The uncorrected 0 to 5000 ppm range is very non-linear, but is corrected to better than ±1% of fullscale with a fourth order polynomial.

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.

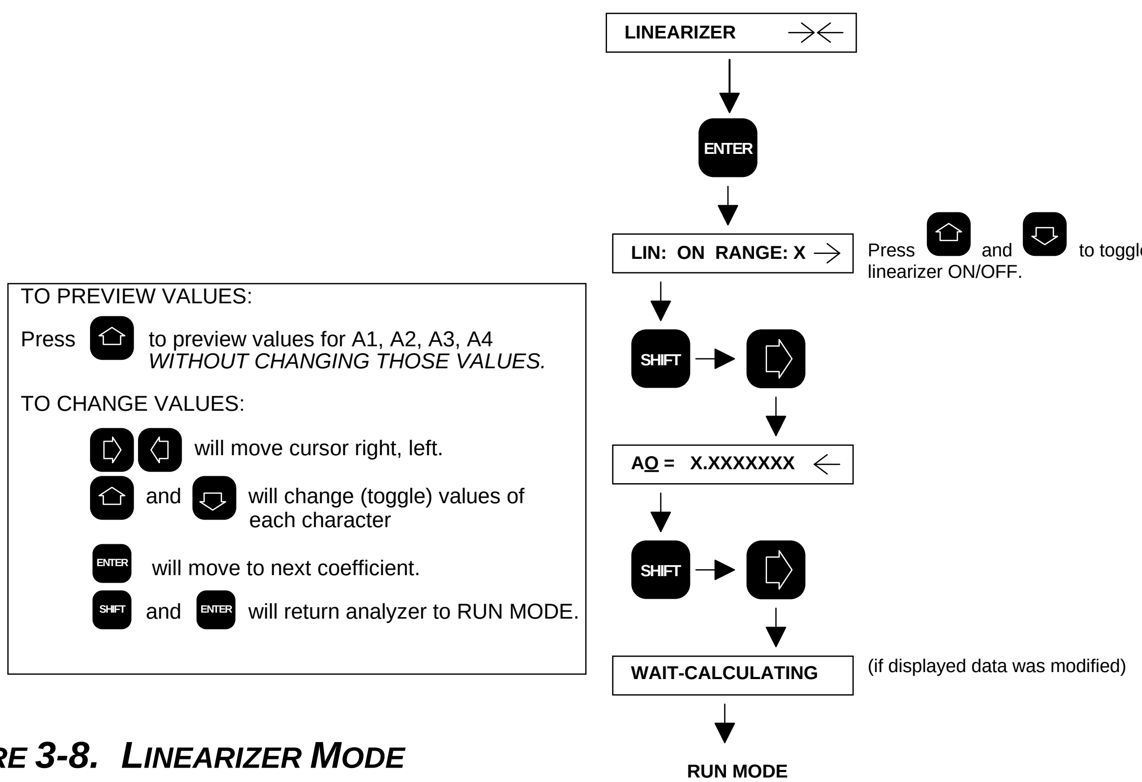


FIGURE 3-8. LINEARIZER MODE

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).

FULLSCALE	A0	A1	A2	A3	A4
50 PPM	0.00016	0.96898	0.06899	-0.08882	0.05043
100 PPM	-0.00015	0.95033	0.07541	-0.01677	-0.00861
250 PPM	0.00014	0.92430	0.05284	0.06604	-0.04362
500 PPM	0.00023	0.87214	0.03032	0.20556	-0.10857
1000 PPM	0.00012	0.76590	0.11188	0.18932	-0.06724
2500 PPM	0.00003	0.53242	0.31440	-0.12316	0.27611
5000 PPM	0.00071	0.00859	2.28880	-1.02406	2.71778

TABLE 3-1. LINEARIZATION COEFFICIENTS, STANDARD RANGES

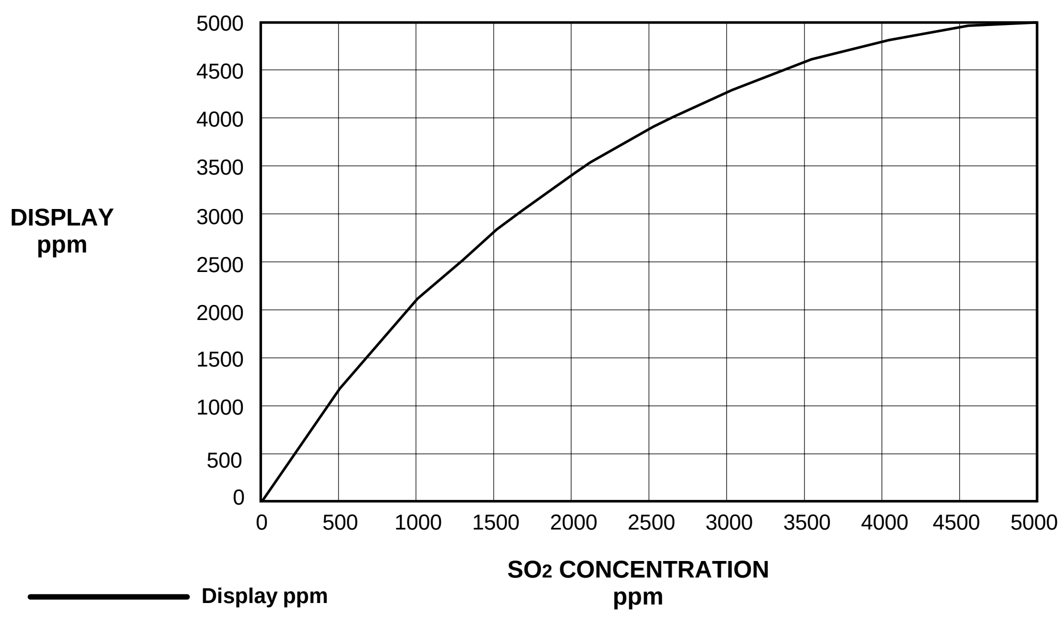


FIGURE 3-9. TYPICAL APPLICATION LINEARIZATION CURVE

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.

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.)

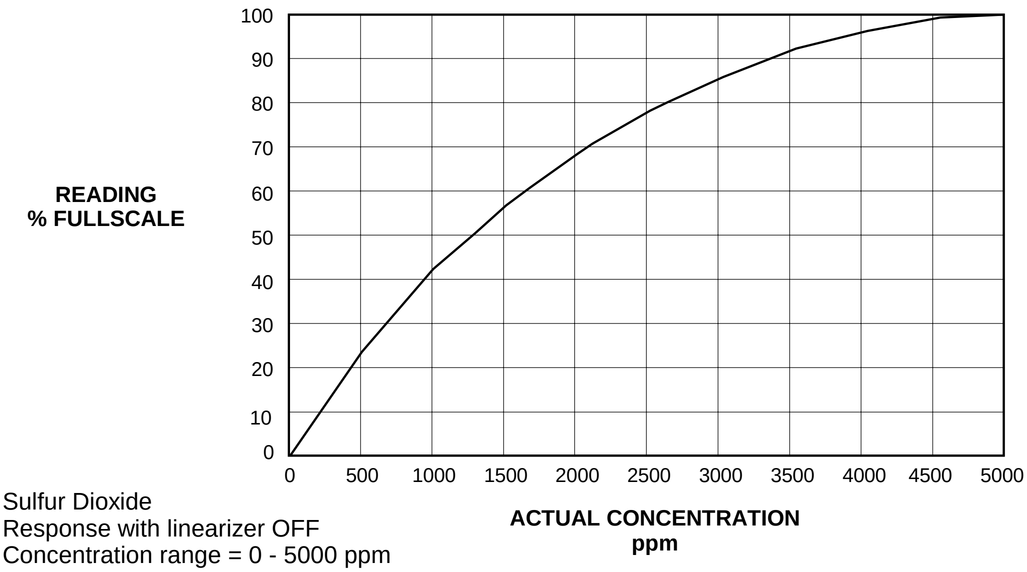
These data points can be obtained with an accurate gas divider or other flow mixing device. Before calculating coefficients, the data must be normalized to ranges of 0 to 1 units for both % and concentration readings. Then the axis must be reversed as illustrated in Figures 3-10 and 3-11. A multiple 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:

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

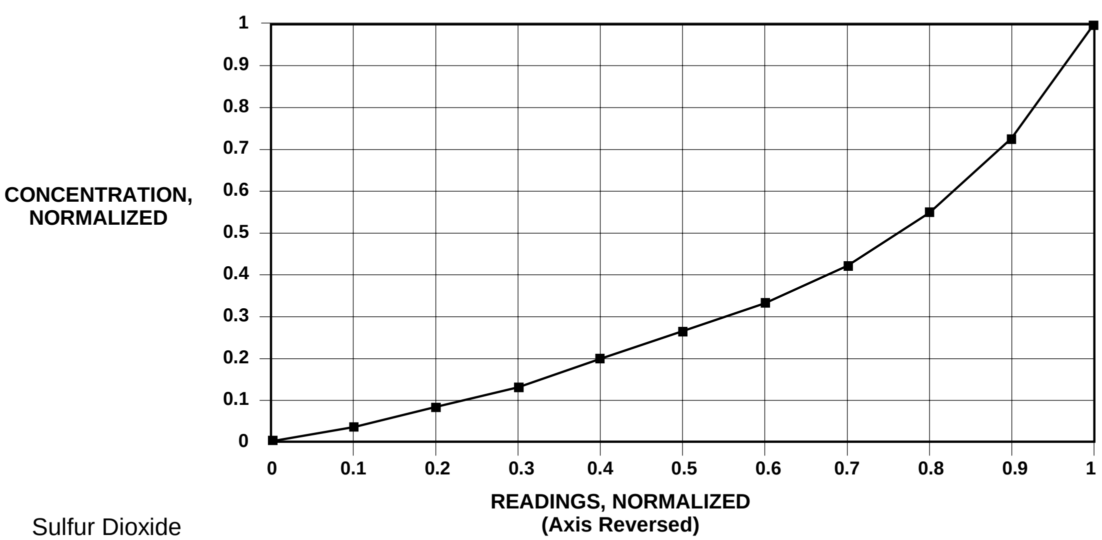
After taking the data points, the user may determine coefficients for user-specific gas by either using any program capable of calculating a fourth order curve fit or calling the factory to have the specific coefficients calculated.

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.



Sulfur Dioxide
Response with linearizer OFF
Concentration range = 0 - 5000 ppm

FIGURE 3-10. CONCENTRATION CURVE



Sulfur Dioxide
Concentration range = 0 - 5000 ppm

FIGURE 3-11. CURVE, NORMALIZED

3.14 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 3-12).

The Status Display 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.

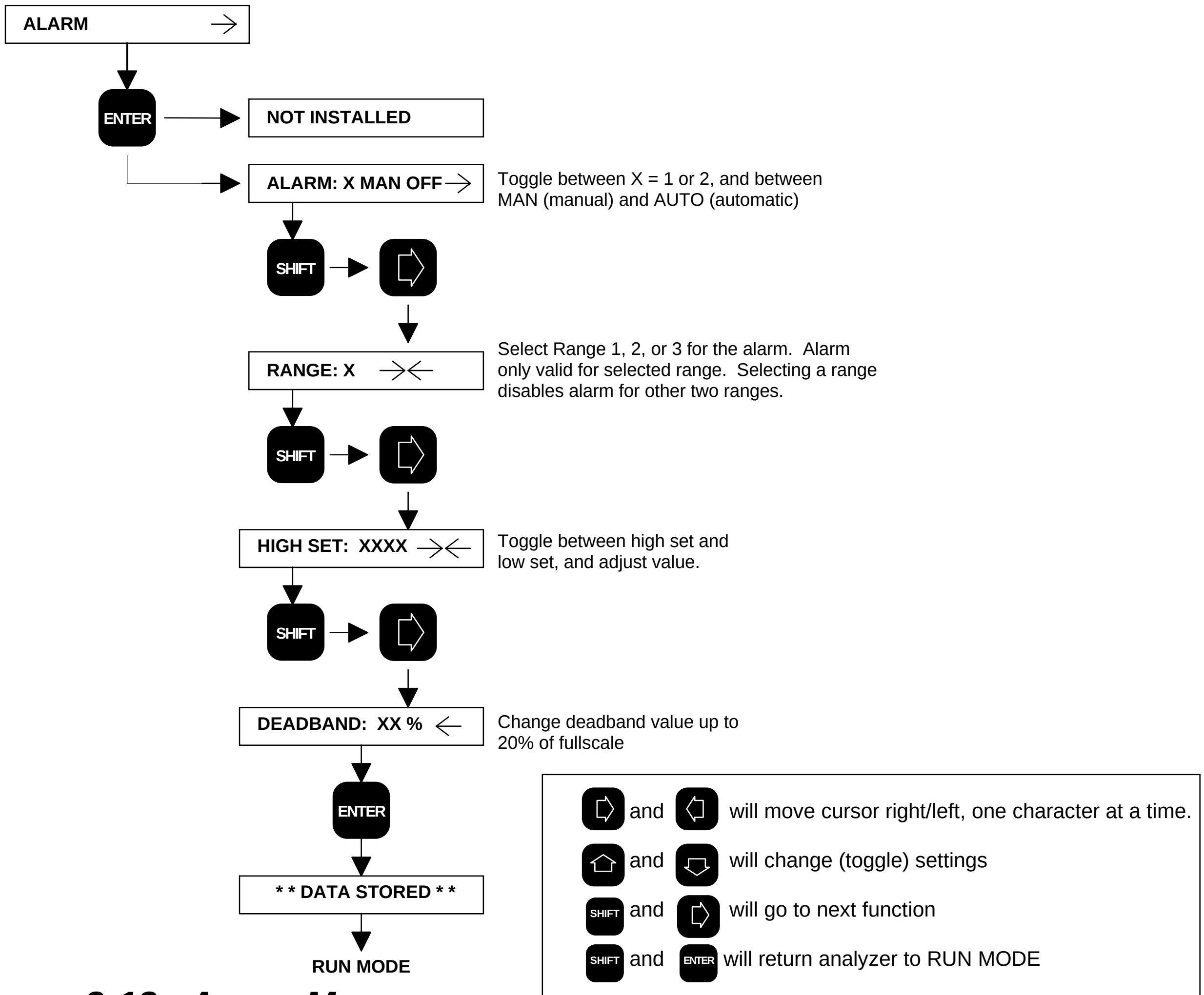


FIGURE 3-12. ALARM MODE

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.

3.14.1 STATUS DISPLAY

Refer to Figure 3-13. 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-R1 SP POT LMTS]
[E2-R2 SP POT LMTS]
[E3-R3 SP POT 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}]
[CAL-CTL PRESENT]
[AUTOCAL: ON/OFF]
[CURRENT 0/4 SP ON/OFF]

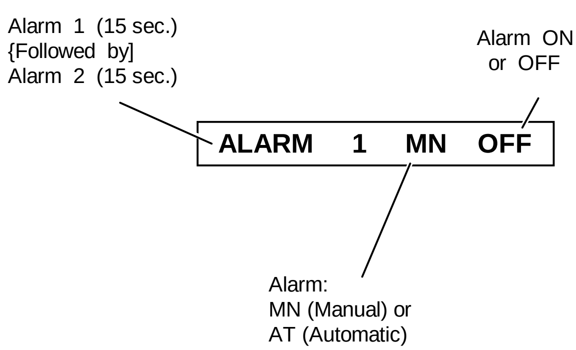
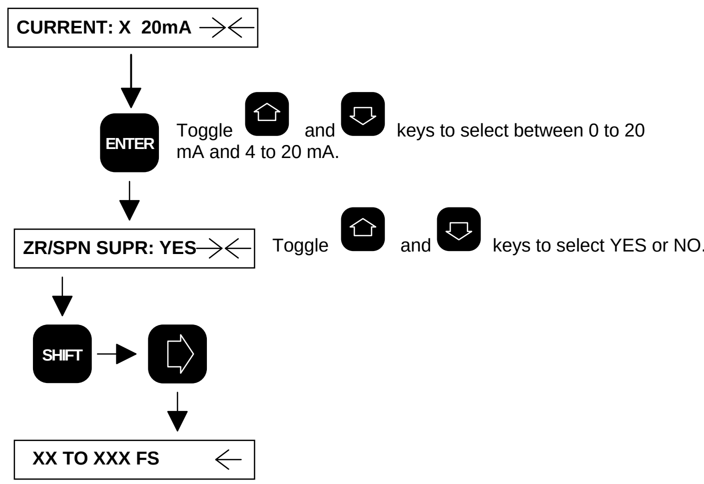


FIGURE 3-13. STATUS DISPLAY

3.15 CURRENT OUTPUT

The Model 890 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. Refer to Figure 3-14.



Note: Current Output is factory set at 4 to 20 mA. If an adjustment is needed, Zero and Span pots are located on the Power Supply Board.

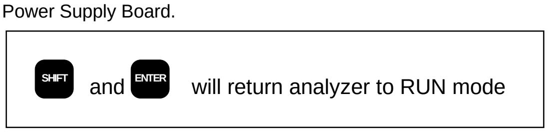


FIGURE 3-14. CURRENT OUTPUT MODE

3.16 AUTO ZERO/SPAN

Refer to Figure 3-15. 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 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.

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

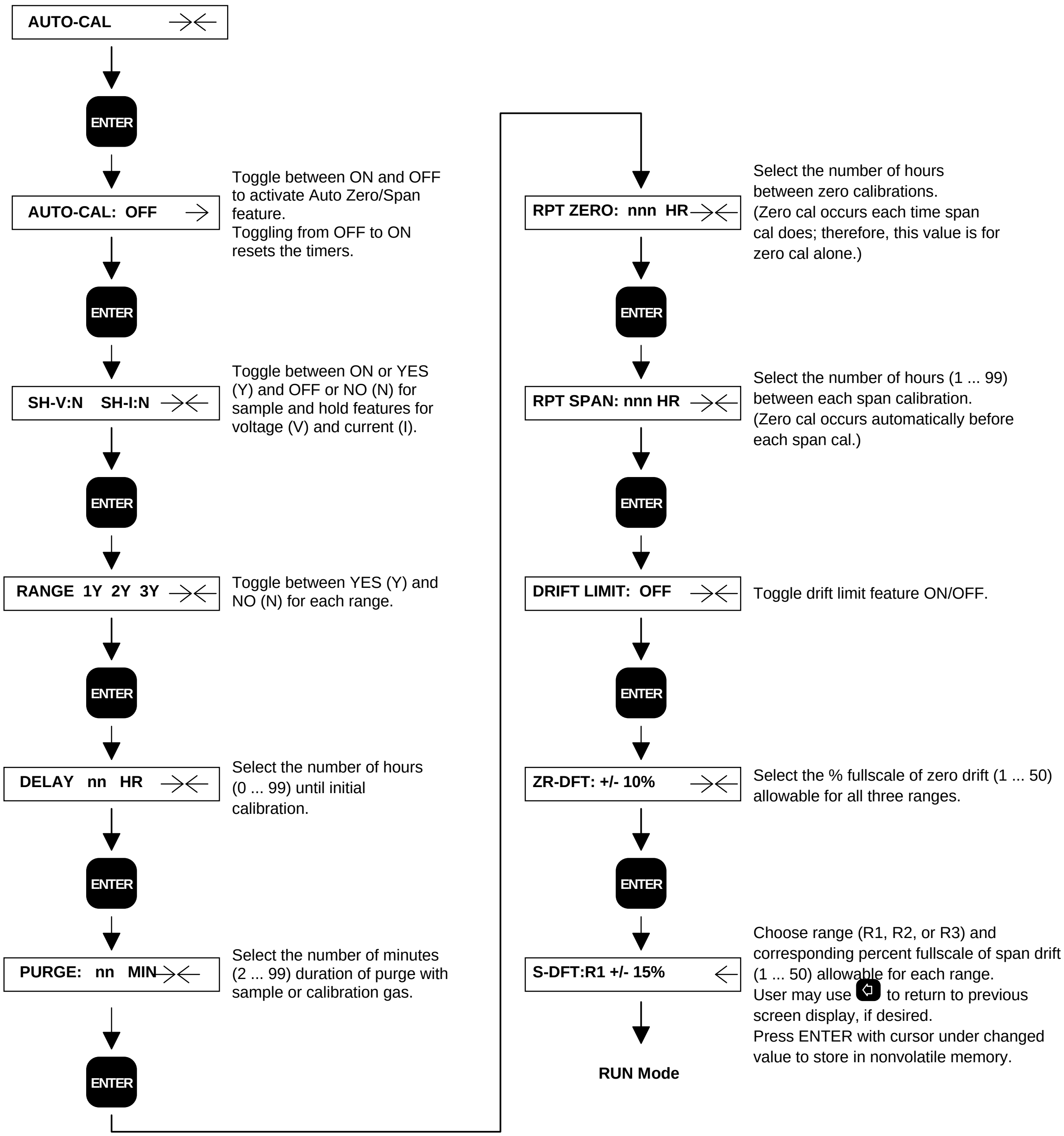
In order to engage the Auto-Cal function with the Remote Range I/O, the Auto-Cal function must be disabled by toggling AUTO-CAL to OFF in the [AUTO-CAL:OFF] display.

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% ←].

The reference span or zero calibration is the first calibration after the drift feature is toggled to "ON" in the DRIFT LIMIT display or the first calibration after a range is reset from "N" (off) to "Y" (on) in the [Range: 1Y 2Y 3Y] display if the DRIFT LIMIT has been toggled to ON in the [DRIFT LIMIT: ON] display.



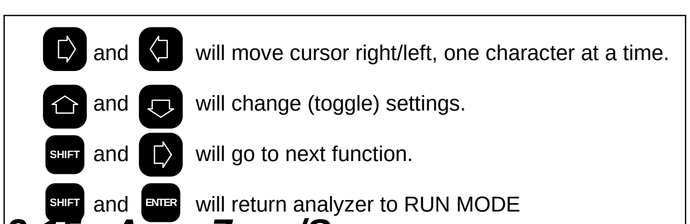


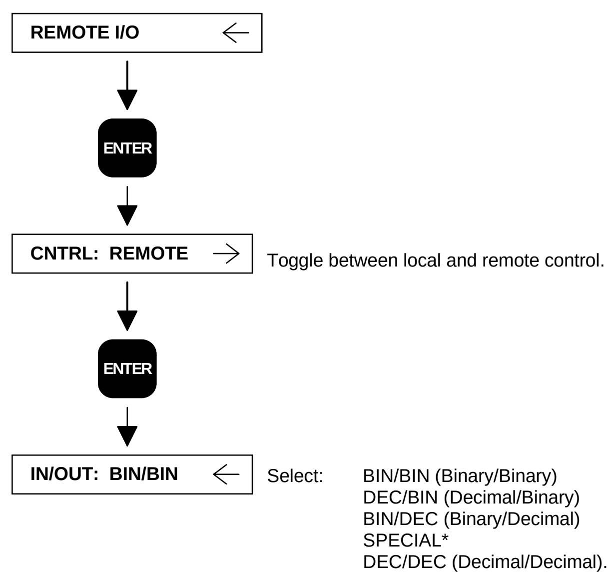
FIGURE 3-15. AUTO ZERO/SPAN

3.17 REMOTE RANGE INPUT/OUTPUT

Refer to Figure 3-16. The Model 890 Analyzer has optional remote input/output 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 3-2 and 3-3 for explanations of BIN (binary) and DEC (decimal).

When SPECIAL is selected, only autocal status and remote/local status on bits 6 and 7, 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.



* Specials are not recommended for general purpose use and are made custom; consult factory.

- → and ← will move cursor right/left, one character at a time.
- ↑ and ↓ will change (toggle) settings.
- SHIFT and → will go to next function.
- SHIFT and ENTER will return analyzer to RUN MODE

FIGURE 3-16. REMOTE INPUT/OUTPUT

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

3.18 INTERFERENCE BALANCE

The Model 890 analyzer may be calibrated for a dynamic interferent gas rejection ratio of up to 1000:1 for samples containing single, binary or multiple interferents. This calibration is initially done at the factory, and generally is a one-time adjustment.

Re-adjustment in the field should be done only if: (1) The optical filters are replaced or (2) the sample stream composition has changed drastically from the orginal composition.

The balance adjustment is an electronic adjustment. If the interference setting is changed, the balance potentiometer can be used to balance the system. This is a fine adjustment.

If more adjustment than the potentiometer can provide is necessary, the iris can be used to balance the system to zero. See Section 5.2.

NOTES

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 3.9 and 3.11). Next supply sample gas through the instrument. The Model 890 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 potentiometer 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 890 will retain settings during prolonged shutdown. Recalibrate the instrument upon restart.

4.4 DETECTION SYSTEM THEORY

The single-cell, multiple-wavelength "Transflectance" measurement bench provides a number of unique advantages over conventional ultraviolet photometers. Increased radiation transmission at the measurement, reference and interferent compensation wavelengths provides 4 to 5 times the energy transmitted in conventional benches employing optical filters. This increase yields an extremely stable, sensitive and drift-free analysis.

The Model 890 employs a pulsed UV lamp with peak wavelength generation from 225 to 650 nanometers. The pulsed lamp eliminates the requirement for a mechanical chopper and the attendant noise and stability problems.

Additionally, this pulsing action (50% duty cycle) enhances the source life.

Next, a collimating mirror is used to focus and direct the pulsed UV energy. Just prior to entering the sample cell, a planar, non-position-sensitive beam splitter is utilized to direct 50 percent of the transmitted energy to the first detector block assembly.

In the detector block, transflective mirrors with selective wavelength reflection characteristics are used instead of optical filters. These mirrors further isolate the radiation into the required measurement and reference wavelengths, and reflect it onto a matched set of silicon photodiode detector assemblies.

A second detector block, located just after the sample cell, is an exact duplicate of the first. This dual detector array allows the signal processing circuitry to yield a highly sensitive and accurate SO_2 analysis.

Additionally, utilizing this same technique on a second set of adjacent wavelengths, allows accurate measurement and elimination of the effects of absorption by interferent gas or gases such as nitrogen dioxide.

Coupled with the four-detector, multiple wavelength analysis technique described above, a unique detector output signal integration and de-integration signal processing scheme allows a continuous on-line correction of dark current and electronic noise errors. This effectively resets the electronic zero every 30 milliseconds, and yields a measurement which is virtually free of instability and drift. See Figure 4-1.

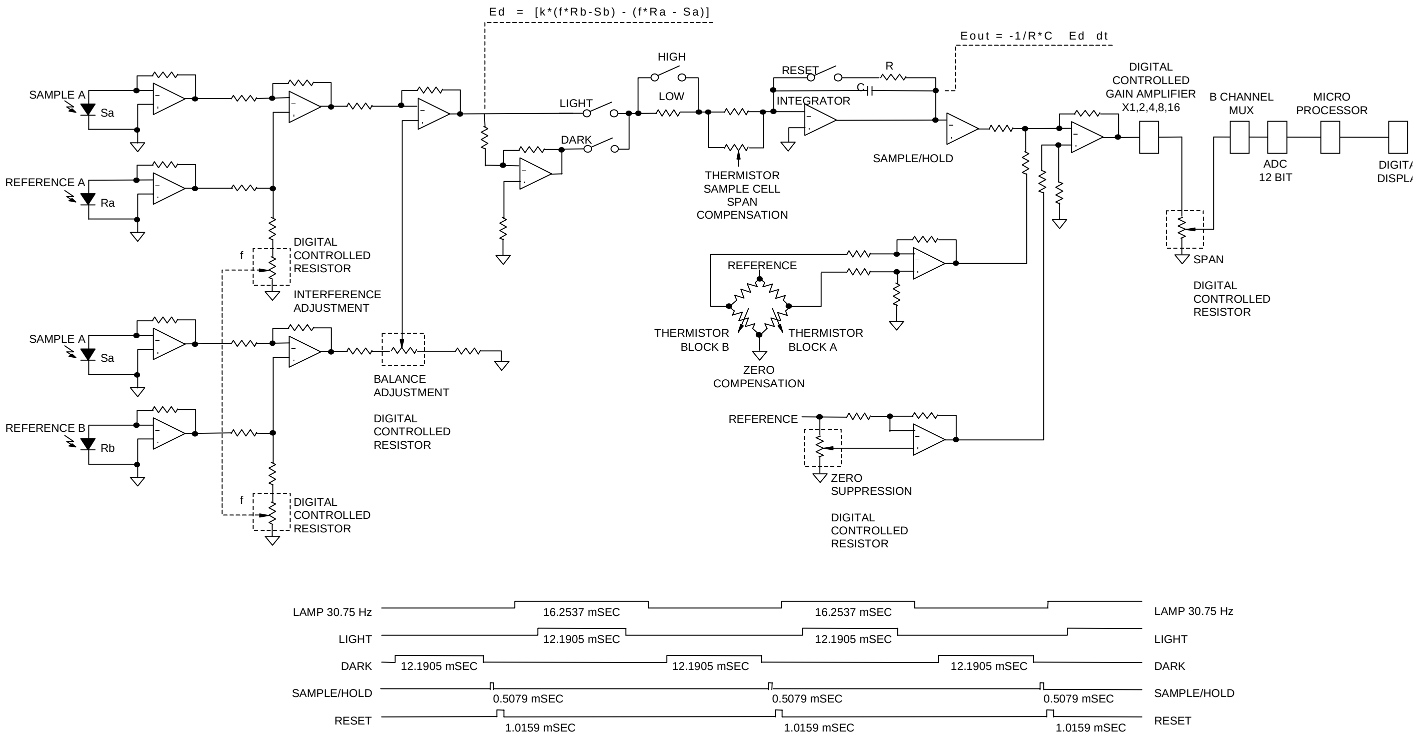


FIGURE 4-1. MODEL 890 TIMING DIAGRAM

NOTES

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 5.6 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 potentiometer cannot compensate. System must be balanced with iris adjustment. See Section 5.2.
ER1	[E1-R1 SP POT LMT]	
ER2	[E2-R2 SP POT LMT]	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-R3 SP POT LMT]	
ER4	[E4-ADC SATURATED]	Signal into ADC is greater than fullscale rating. Refer to Figure 3-7 and reduce the digital GAIN setting by one value, i.e. 16 TO 8, 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.
ER6	[E6-SPAN DRIFT]	Span drift limit exceeded. To clear, recalibrate or toggle the drift limit OFF and then ON.
ER7	[E7-GAIN TOO HIGH]	The combination of the preamplifier gain setting (HIGH/LOW) and the gain setting in the RANGE sub-menu is producing too high of a signal. Reduce gain.
[UV LAMP ERROR]		UV lamp source current is low, generally indicating lamp replacement.

Note

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

TABLE 5-1. ERROR CODE SUMMARY

Note

When using the DIAGNOSTICS screen to help make hardware adjustments, set the analyzer GAIN to X1 Low. This prevents the ADC from being in saturation, resulting in an erroneous value in the DIAGNOSTICS screen.

5.2 IRIS BALANCE ADJUSTMENT

This mechanical adjustment is provided to balance the system. The adjustment is done using the DIAGNOSTICS screen "Detector Signal". With zero gas flowing through the sample cell, adjust the Detector Signal to 0.00 ±0.1 by moving the iris. See Figure 6-2 for location of iris.

5.3 VOLTAGE CHECKS

Refer to Section 3.8 and verify that the voltages for the detector signal, lamp current, and three power supplies are correct.

5.4 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 3.11 (standard analyzer) or 3.12 (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 must be adjusted. (The ideal span potentiometer setting is 50%.) Note the final value of the PS (potentiometer status) for Step 4.
2. Exit to 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, 8, or 16. 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.

   Additionally, the HIGH/LOW gain setting may be toggled to achieve an approximate 10:1 ratio.
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.

5.5 CASE HEATER

The electronics for the fan and heater are located on the Power Supply Board.

5.6 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

NOTES

6 ROUTINE SERVICING

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.

WARNING: INTERNAL ULTRAVIOLET LIGHT HAZARD

Ultraviolet light from the source lamp can cause permanent eye damage. Do not look at the UV source for prolonged periods. Use of UV filtering glasses is recommended.

6.1 CELL REMOVAL, CLEANING AND REPLACEMENT

If the sampling system should break down or moisture, solids or other contaminates are introduced, cell will require cleaning.

CELL CLEANING

1. Disconnect power to the analyzer.
2. Pull the chassis out of the analyzer case and locate the optical bench. See Figures 6-1 and 6-2.
3. Refer to Figure 6-2. Remove block A. Remove the cell

Note

The cell interior is glass. Handle the cell with caution to avoid damaging or breaking it.

4. Note the orientation of the caps and the inlet outlet tubes. The two guide pins on the blocks must match up as well as the tubing. Remove the four screws securing the inlet and outlet end caps.
5. Remove the cell by pulling it out of the end caps.

CAUTION: FLAMMABLE AND TOXIC CHEMICAL

Acetone is highly flammable and moderately toxic. Use only in a well ventilated, flame-free, non-smoking location.

Avoid prolonged inhalation of vapors, headache, dizziness and irritation of the eyes, nose and throat may occur.

Avoid contact with skin, mild irritation may occur.

Use rubber gloves and eye protection when using acetone.

6. Clean the cell and end cap windows with an appropriate solution, such as acetone, followed by alcohol and distilled water rinses. Blow surfaces dry with nitrogen.
7. Reassemble the cell by realigning the end caps and replacing the screws.
8. Check the condition of the o-rings, replace if deformed or damaged.
9. Reassemble the cell into block A.

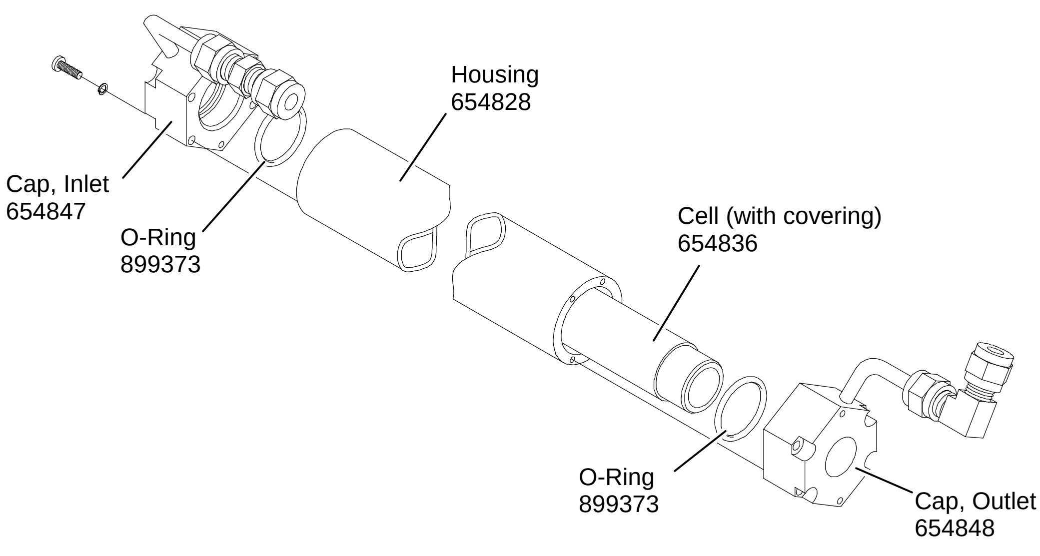


FIGURE 6-1. SAMPLE CELL ASSEMBLY

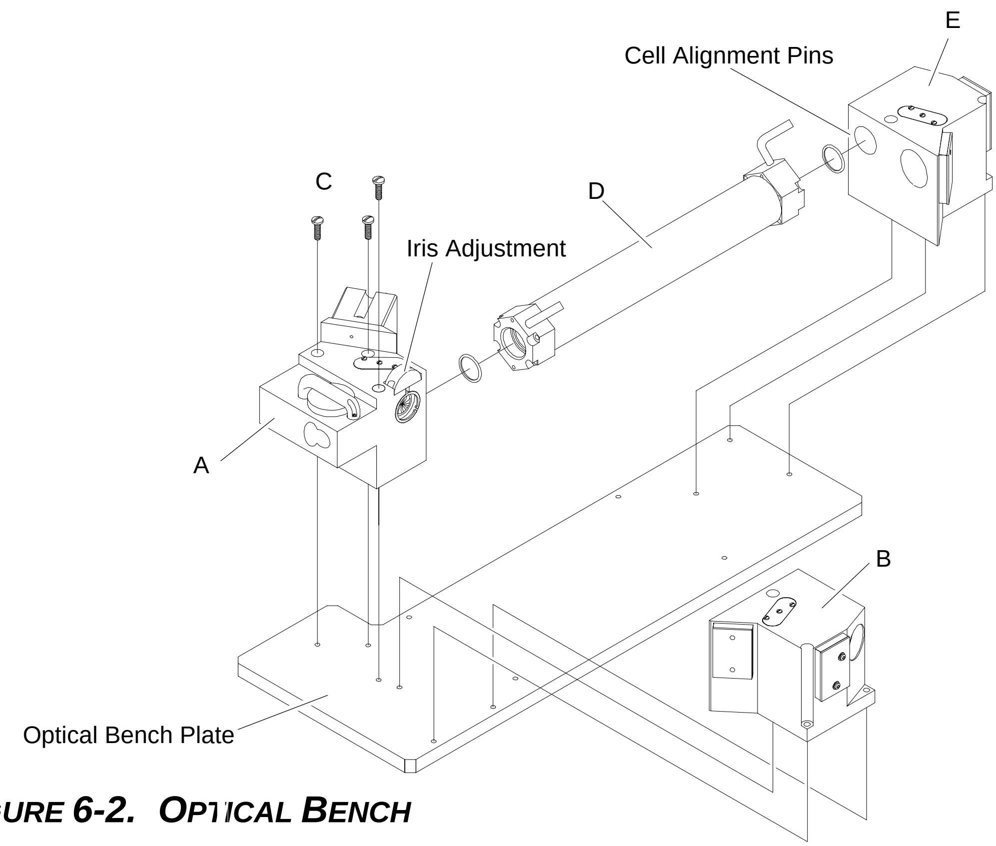


FIGURE 6-2. OPTICAL BENCH

6.2 LAMP REPLACEMENT

The ultraviolet lamp is an expendable item and its replacement requires realignment.

Note

Contaminants from oil, dust and fingerprints will reduce the energy and stability of the lamp. Use clean rubber gloves while handling the lamp. If the lamp becomes soiled, clean with acetone, rinse with alcohol and then distilled water. Blow dry with nitrogen.

CAUTION: FLAMMABLE AND TOXIC CHEMICAL

Acetone is highly flammable and moderately toxic. Use only in a well ventilated, flame-free, non-smoking location.

Avoid prolonged inhalation of vapors, headache, dizziness and irritation of the eyes, nose and throat may occur.

Avoid contact with skin, mild irritation may occur. Use rubber gloves and eye protection when using acetone.

REPLACEMENT

1. Disconnect power to the analyzer.
2. Pull out chassis from case and locate the optical bench.
3. Refer to Figure 6-2. Remove the three screws, item C, securing item A.
4. Note the orientation of the cell on the alignment pins. Hold the cell (item D), while removing the block (item A). Place the cell on the optical bench plate.
5. Refer to Figure 6-3. Unplug the lamp wiring connector from the Power Supply Board. *DO NOT REMOVE THE SOCKET*.
6. Note the orientation of the assembled lamp housing. Remove the three screws, item A, holding the lamp assembly to the block.
7. Refer to Figure 6-4. Remove the two screws, item A. Loosen the screw marked item B, and remove the lamp from the housing.
8. Remove the two springs marked item C.
9. Remove the clamp marked item D.
10. Place the clamp on the new lamp, and secure 1.1 inches from the center of the square aperture (centerline, marked item E). Do not overtighten.
11. Install the lamp with the two springs in the mounting.
12. Insert the lamp in the housing and secure with the two screws (position the clamp rod, marked item F, through the back of the housing as the lamp is inserted.
13. Reassemble the lamp assembly on the block, and reinstall the block on the optical bench. Verify that the o-rings are in place.
14. Place the orange lamp plug from the old lamp onto the new lamp, and plug into Power Supply Board.

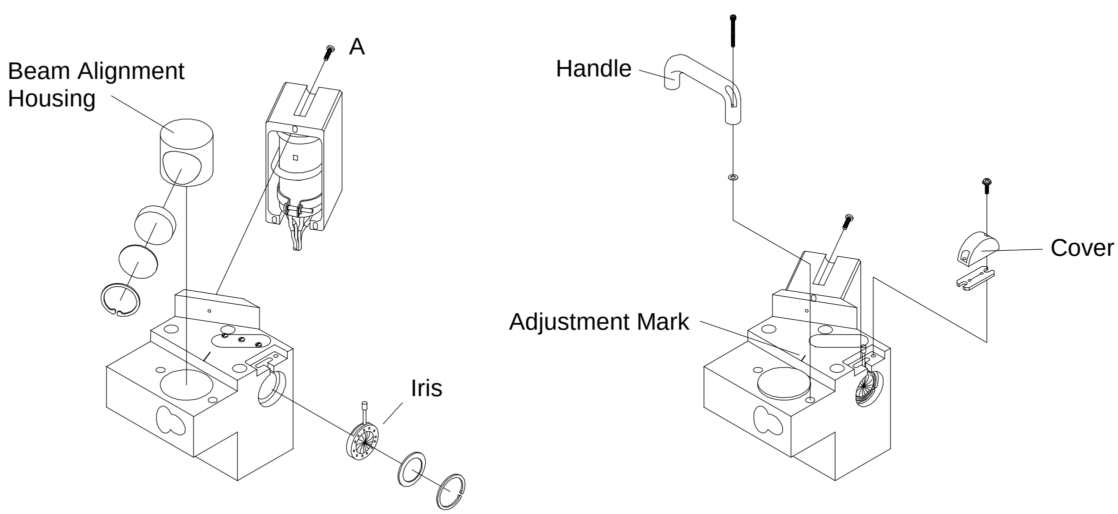


FIGURE 6-3. DETECTOR BLOCK

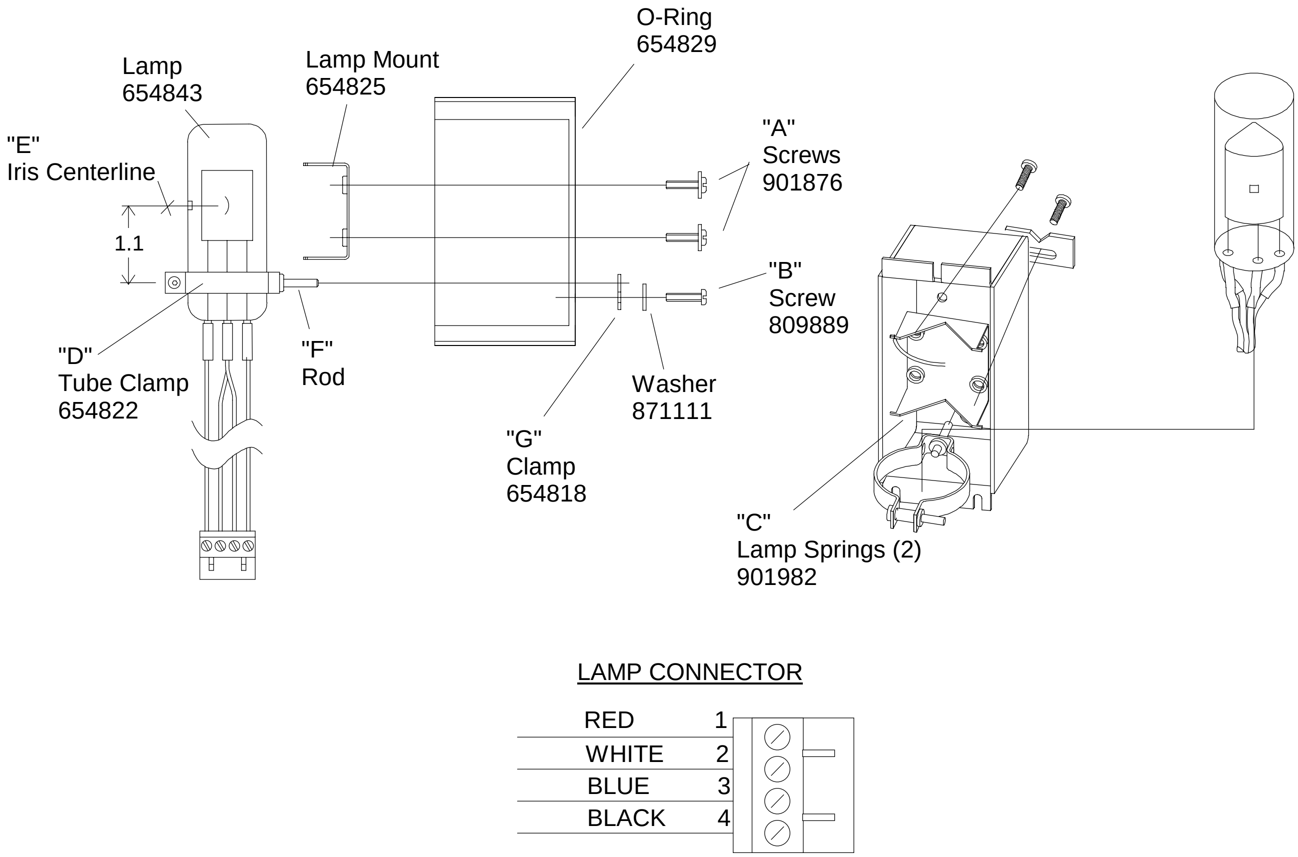


FIGURE 6-4. LAMP HOUSING

6.2.1 LAMP REALIGNMENT

After replacing the UV lamp, three items associated with the optical bench must be adjusted: Lamp, beam alignment, and iris. The procedure for these adjustments follows:

1. See Figure 6-4. The lamp can be moved vertically and horizontally by adjusting the clamp rod (item F). The lamp clamp (item G), secures the position of the clamp rod once alignment is done.
2. See Figure 6-3. Loosen the three screws (item A) to allow vertical adjustment of the lamp housing.
3. Power up the analyzer for a minimum of 15 minutes.
4. Set the analyzer to Range 3, and the gain to "1 low."
5. Enter DIAGNOSTICS mode, verify that source current is 300 mA ±10 mA and all power voltages are +5, +12, +15 and -15V (each ±5%).
6. Display the "Sample A" screen (still in DIAGNOSTICS mode). Adjust the horizontal and vertical positions of the lamp and lamp housing until a maximum reading is displayed. Secure the lamp clamp (Figure 6-4, item G) and tighten the three lamp housing screws (Figure 6-3, item A).

7. Refer to Figure 6-3. Loosen the spring-loaded handle mounting screws to allow for beam alignment adjustments. Note the adjustment mark on the block and beam alignment housing.
8. Rotate the beam alignment housing to obtain the maximum signal. (The marks already present just show the proper starting point.)
9. Display the Detector Signal screen in DIAGNOSTICS mode, and adjust the iris for 0 mV ±5 mV. The cover (Figure 6-3) protects the iris from accidental movement.
10. In RANGE mode, set the gain to "1 high" and repeat step 9 for 0 mV ±10 mV.
11. In DIAGNOSTICS mode, verify the detector signals are the following (for a new lamp):

    Sample A = 5 V ±0.7 V
    Sample B = Sample A ±200 mV
    Reference A = 75 to 85% of Sample B
    Reference B = Reference A ±200 mV

12. Press SHIFT and ENTER to return to RUN mode.

This concludes lamp alignment and balance of the system.

Restore the original settings for the ranges and calibrate the analyzer.

6.3 CLEANING OPTICAL COMPONENTS

The Model 890 contains several types of optical and glass surfaces. Those should never be touched, even when the components requires cleaning. When handling these components, always wear powder-free latex gloves or finger cots, and hold them only by the edges. *NEVER BREATH ON THE SURFACE AS A METHOD OF CLEANING.*

To ensure an optical component is actually clean, hold the surface to reflect light. If the surface appears clean, it probably is.

After an optical component has been cleaned, immediately install it into its holder to avoid damage or contamination. If an optic must be stored, do so in clean optical cleaning paper.

6.3.1 SPECTRALLY SELECTIVE MIRRORS

Each of these mirrors has a small dot on the *un-coated* side. Do not remove this dot.

To clean, carefully wet the entire mirror with cleaning fluid, rinse with deionized water while still wet, and blow dry with clean, dry nitrogen or dry, oil-free air.

If after repeated attempts, the mirror still appears contaminated, wet the mirror with cleaning fluid, and gently rub with a clean wet optical cleaning tissue. Rinse and blow dry. Repeat if necessary.

6.3.2 BEAM SPLITTER/FOCUSING MIRRORS

The procedure for cleaning the beam splitter and focusing mirrors is the same as Section 6.3.1 except: ***Under no circumstances should the surfaces be rubbed.*** These surfaces are very fragile and easily damaged by mechanical cleaning, degrading the performance of the component. Cleaning must be accomplished chemically.

6.3.3 SOURCE ENVELOPE

The source envelope may be cleaned with cleaning fluid and rinsed with deionized water, and may be rubbed with optical cleaning tissue if necessary. After cleaning, rinse the lamp with alcohol and deionized water, and blow dry with nitrogen or dry, oil-free air.

6.3.4 END CAPS

Clean the sample cell end caps in the same manner as the spectrally selective mirrors (Section 6.3.1). After cleaning, heat the end caps (with a heat source such as a heat gun) to ensure that no moisture remains trapped after re-assembly.

6.4 ELECTRONIC CIRCUITRY

6.4.1 POWER SUPPLY BOARD

The Power Supply Board provides voltages required by the various circuit boards (+5 V, ±15 V, -12 V). In addition, it provides: a) constant current to drive the UV lamp; b) constant voltages for the lamp heater; c) proportional temperature control for the case heater; and d) circuitry for the isolated current output.

6.4.2 SIGNAL BOARD

The Signal Board provides the processing of the four detector signals and timing for the pulsed UV lamp, and includes the integrator. The Signal Board includes: a) The Zero Suppression circuit; b) the Span adjustment; c) temperature compensation for Zero and Span; d) the programmable gain amplifier; and e) the 8-channel multiplexer for processing the different signals.

6.4.3 PREAMPLIFIER BOARD

There are four identical Preamplifier Boards, one for each detector. The board contains the silicon photodiode detector, which converts the UV radiation into a current, and an amplifier that converts the current into voltage.

6.4.4 ADAPTER BOARD

The Adapter Board (which includes a circuit breaker) is for line power distribution. The Adapter Board also serves as an interface board for all the option boards and provides the recorder output (TB2).

6.4.5 MICRO BOARD

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 board can be used alone or in conjunction with I/O boards that satisfy interfacing requirements such as the following:

Bi-directional Remote Range I/O Board.
Dual Alarm
Auto Zero/Span
Calibration Gas Control

The board is configured with an analog domain that allows the processing of analog signals directly with a 12-bit, plus sign ADC. Also, two independent DACs, each 12-bits wide, allow the presentation of analog voltages for peripheral functions immediately.

MICRO BOARD REPLACEMENT

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

6.4.6 CASE HEATER TEMPERATURE CONTROL

The Case Heater Control is included on the Power Supply Board. The setpoint is 47°C.

The sensor is a resistor with a positive temperature coefficient (1.925 ohms/°C). The resistance is 500 ohms at 0°C.

6.4.7 DUAL ALARM/CALIBRATION GAS CONTROL BOARD (OPTION)

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 function which communicates with the computer via an 8-bit bus 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 for assigning a specific address in the range 0 through 7 using jumpers. See Table 6-1.

6.4.8 ISOLATED REMOTE RANGE I/O BOARD (OPTION)

The Remote Range I/O Board is a peripheral circuit function which communicates with the computer via an 8-bit bus arrangement. This 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. See Table 6-1.

6.4.9 AUTO ZERO/SPAN BOARD (OPTION)

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. It provides six form C relay contact outputs, four of which are suitable for medium power requirements, the remaining two are relegated to alarm of 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. The auto-cal request bit is level triggered and therefore, the request line must be brought low before the analyzer completes the auto-cal process. See Table 6-1.

OPTION	ADDRESS CONFIGURATION	FUNCTION CONFIGURATION
DUAL ALARM	E1 + E2	E5-E7, E9-E10
DUAL ALARM - FAIL SAFE	E1 + E2	E5-E7, E8-E10
CAL GAS CONTROL	E1 + E4	E5-E7, E9-E10
AUTO ZERO/SPAN	E1	---
ISOLATED REMOTE I/O	E4	---

TABLE 6-1. JUMPER CONFIGURATION FOR OPTIONS

NOTES

7 REPLACEMENT PARTS

WARNING: PARTS INTEGRITY

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

The following parts are recommended for routine maintenance and troubleshooting of the Model 890 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 and 7-2 show locations of components and assemblies.

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

Note

Recommended spare parts are for minimum downtime service. Not all spare parts are required for normal (1 year) maintenance. The Deuterium Lamp is a consumable item, warranty terms 90 days from date of shipment.

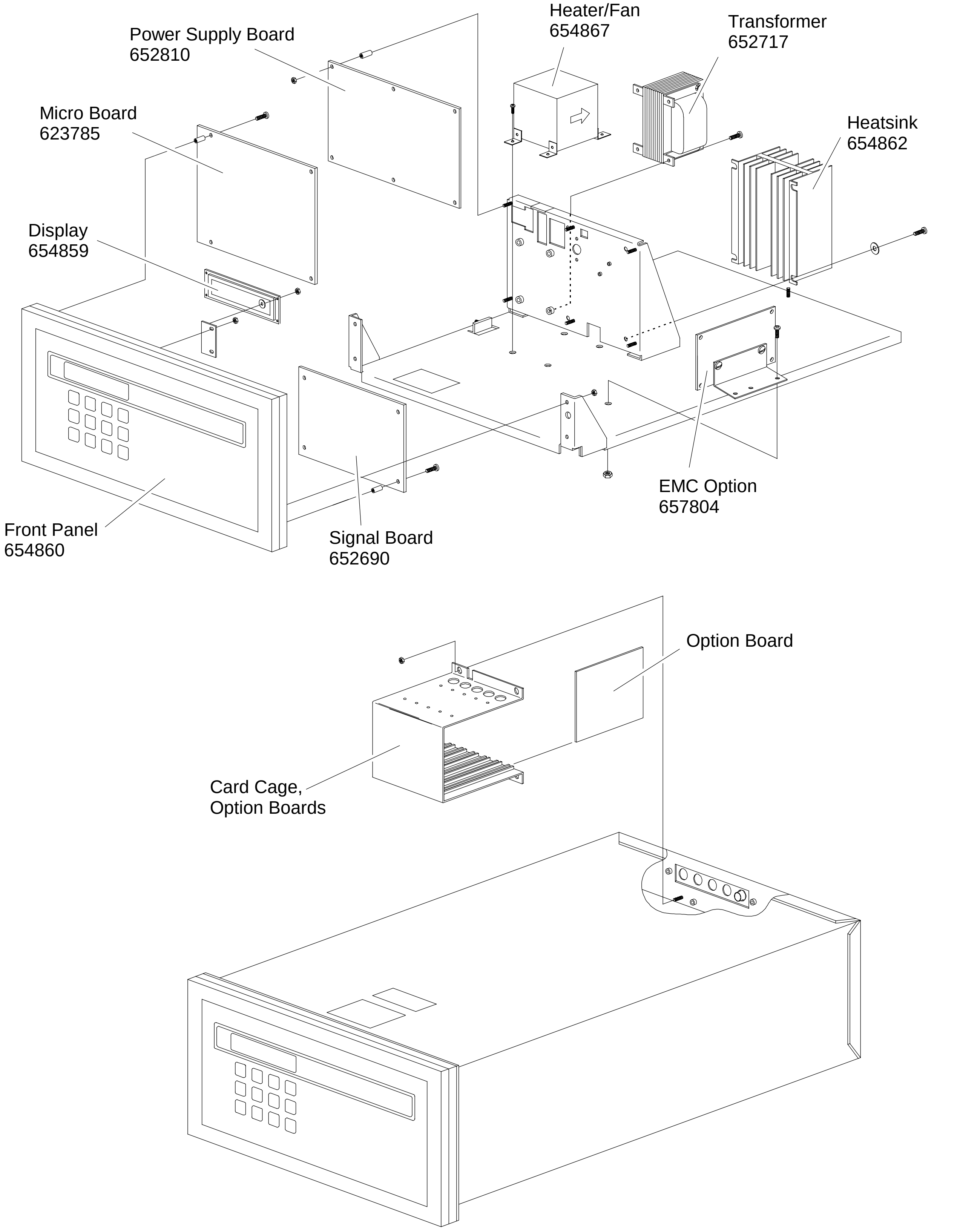
PART NO.	DESCRIPTION	QTY
622917	Temperature Sensor, Case Heater	1
623785	Microprocessor PCB	1
654869	Fuse, Thermal	1
652690	Signal Processor PCB, SO_2	1
652810	Power Supply PCB	1
652860	Preamp/Detector PCB, SO_2	1
654843	Deuterium Lamp	2
654868	Temperature Sensor, Compensation, Optical Block	1
656135	Preamp/Detector PCB, Cl_2	1
656136	Signal Processor PCB, Cl_2	1
899373	O-Ring, Cell End Cap	6
901948	Fuse, Normal Blow	2

7.3 LAMP REPLACEMENT

The ultraviolet lamp is a consumable part that has an average lifetime of 6 months. When the lamp reaches 50 % intensity, it should be replaced. See Figure 7-3 for a lamp life vs. intensity chart.

The instrument's software monitors the UV lamp source current during power-up and every five minutes during normal operation. If for any reason, including lamp failure, the source current falls below a preset value, the [UV LAMP ERROR] message will appear on the display.

The user can access all setup screens, including the Diagnostics screen. When the error condition is corrected (generally by replacing the lamp (see Section 6.2), the unit returns to normal operation.



The Card Cage and Option Board shown for reference only.

FIGURE 7-1. MODEL 890 COMPONENT LOCATIONS

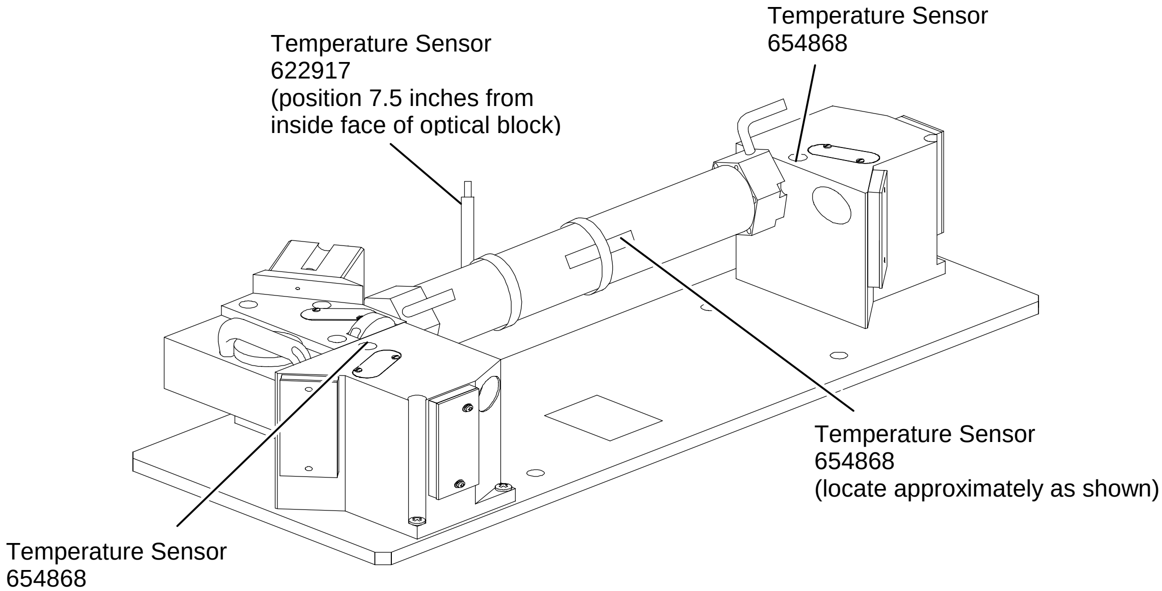


FIGURE 7-2. OPTICAL BENCH - SENSOR LOCATIONS

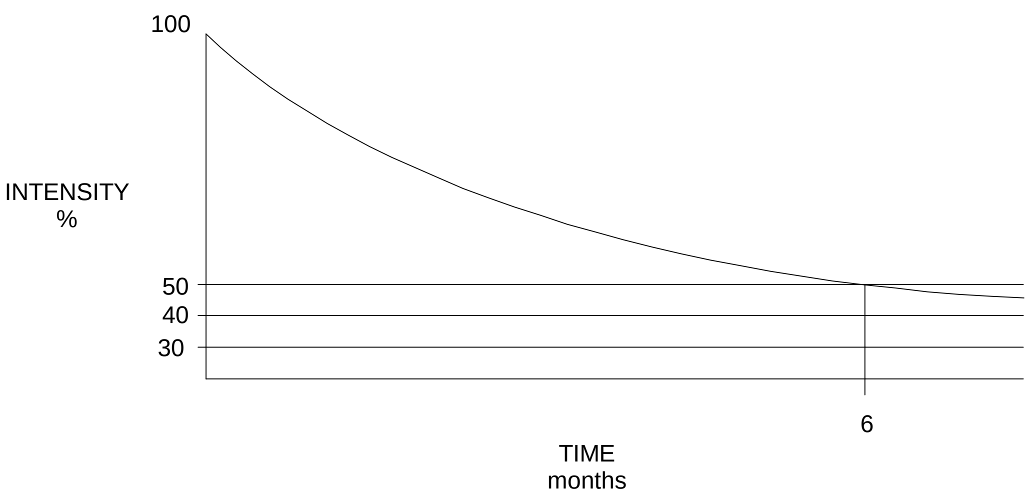


FIGURE 7-3. UV LAMP LIFE VS. INTENSITY