OPERATION AND MAINTENANCE

MANUAL FOR INFRARED ANALYZERS

MODELS 100, 200, 300

gasanalyzers.com

California Analytical Instruments, Inc.

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Website: www.gasanalyzers.com

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1. INTRODUCTION

1.1. Overview

Thank you, and congratulations! You have just purchased one of the most reliable gas analyzers in the world. Before using the analyzer, please familiarize yourself with its operation by reading this manual. If you have any questions, please do not hesitate to call California Analytical Instruments for assistance. We want you to be a member of our thousands of satisfied customers.

1.2. Unpacking Instructions

Open the shipping container and carefully remove the analyzer from the packing materials. Inspect the instrument for any sign of damage. Remove the retaining screws and lift off the cover panel. Visually check for loose parts or connectors that are not properly seated. If all internal components appear to be normal replace the cover and secure it with the screws previously removed.

1.3. Reporting Damage

Should there be any apparent damage either to the inside or outside of the instrument due to shipping or handling, notify the shipper immediately. The shipping container or packing materials should be retained for inspection by the shipper.

1.4. Contact Information

California Analytical Instruments, Inc.
1312 West Grove Avenue
Orange, CA 92865
714 974-5560
Fax 714 921-2531
Website: www.gasanalyzers.com

1.5. Warranty Certificate

Subject to the exceptions and upon the conditions stated below, California Analytical Instruments (CAI) warrants that the products sold under this sales order shall be free from defects in workmanship and materials for one year after delivery of the product to the original Buyer by CAI and if any such product should prove to be defective within such one year period, CAI agrees, at its option, either (i) to correct by repair or, at CAI's election, by replacement with equivalent product any such defective product, provided that investigation and factory inspection discloses that such defect developed under normal and proper uses, or (ii) to refund the purchase price. The exceptions and conditions mentioned above are as follows:

a) components or accessories manufactured by CAI that by their nature, are not intended to, or will not function for one year are warranted only to give reasonable service for a reasonable time; which constitutes reasonable time and reasonable services shall be determined solely by CAI. A complete list of such components and accessories is maintained at the factory;

b) CAI makes no warranty with respect to components or accessories not manufactured by it; in the event of defect in any such component or accessory CAI will give reasonable assistance to Buyer in obtaining from the respective manufacturer whatever adjustment is authorized by the manufacturer's warranty;

c) any product claimed to be defective must be returned to the factory transportation charges prepaid and CAI will return the repaired or replaced product freight collect;

d) if the product claimed to be defective requires on-site repair, such warranty labor will be provided at no charge; however, transportation and living expenses will be charged to Buyer;

e) if the product is a consumable or the like, it is warranted only to conform to the quantity and content and for the period (but not in excess of one year) stated on the label at the time of delivery or 90 days;

f) CAI may from time to time provide a special printed warranty with respect to a certain product, and where applicable, such warranty shall be deemed incorporated herein by reference;

g) CAI shall be released from all obligations under all warranties, either expressed or implied, if any product covered hereby is repaired or modified by persons other than its own authorized service personnel unless such repair by others is made with the written consent of CAI.

IT IS EXPRESSLY AGREED THAT THE ABOVE WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND OF THE WARRANTY OF MERCHANTABILITY AND THAT CAI SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND OR FROM ANY CAUSE WHATSOEVER ARISING OUT OF THE MANUFACTURE USE, SALE, HANDLING, REPAIR, MAINTENANCE OR REPLACEMENT OF ANY OF THE PRODUCTS SOLD UNDER THIS SALES ORDER. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THAT THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE.

Representations and warranties made by any person, including dealers and representatives of CAI, which are inconsistent, or in conflict with the terms of this warranty, shall not be binding upon CAI unless reduced to writing and approved by an expressly authorized officer of CAI.

2. FEATURES AND PRINCIPLES OF OPERATION

2.1. Description

The Model 100 single component, the Model 200 dual component, and the Model 300 three component infrared analyzers all incorporate a single-beam photometric system and a detector with a microflow sensor assuring high reliability, sensitivity, accuracy and stability. Depending upon the configuration, the analyzer may have one, two, or three optical benches within one case. The microflow detector is a sealed unit filled with the same gas as the component of interest (CO, CO_2, and CH_4). The length of the sample cell determines the most sensitive range for each component.

2.2. Features-General

High stability is provided by an improved photometric system, which assures less influence due to contamination of the measuring cell and higher long-term stability than conventional dual-beam analyzers.

- A dual-chamber type detector effectively minimizes influence due to concomitant gas components.
- A microflow sensor within the detector features high reliability, long service life, very low noise, and excellent resistance to vibration.
- The easily serviced single-beam photometric system does not require delicate adjustmen of the optical-balance.
- Simple construction assures reliable performance.
- Modular component design simplifies maintenance. Independent elements are easily removed for maintenance.
- Low Power Consumption - The instruments are of energy-saving design with power consumption as low as 30 VA.

2.3. Infrared Gas Analyzers

The infrared gas analyzer measures gas concentration based on the principle that each type of gas component shows a unique absorption line spectrum in the infrared region.

The instrument consists of an infrared light source, a chopper, a measuring cell, and a detector filled with a gas mixture containing the gas component to be measured. The operating principle of the instrument is described with reference to Figure 2-1. The infrared light source emits infrared light in all directions. The light emitted forward is transmitted and reflected into the detectors.

The infrared light emitted backward is reflected by a reflecting surface and is added to the infrared light emitted forward. Arranged between the infrared light source and measuring cell is a chopper blade which rotates to modulate the infrared light beam at regular frequency. The modulated infrared light beam thus formed passes through the measuring cell filled with a sample gas where the light energy is partially absorbed or attenuated before it reaches the front chamber of the detector. Both the front and rear chambers of the detector are filled with the gas component to be measured.

The infrared light energy is partially absorbed in the front chamber and residual light is absorbed in the rear chamber, thereby increasing pressure in both chambers. Since the detector is designed to produce a pressure difference between the front and rear chambers, a slight gas flow is produced through a path connecting these chambers with each other.

This slight flow is converted into an AC electrical signal by a microflow sensor arranged in the path connecting the chambers with each other. The AC signal is amplified and rectified to a DC voltage supplied to the output terminals and indicator (Figure 2-4). Figure 2-2 shows the detector output signal with the greatest amplitude when zero gas is flowing in the measuring cell. Amplitude is reduced as the concentration of measured gas component increases (Figure 2-3)

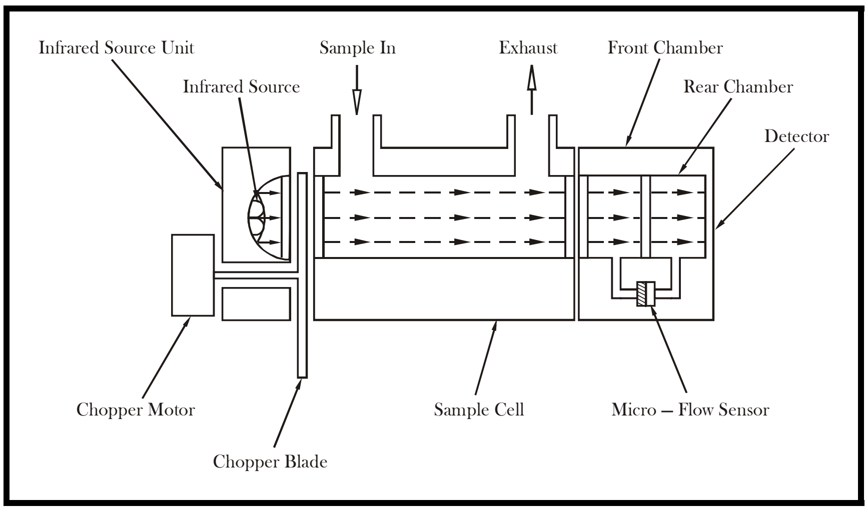
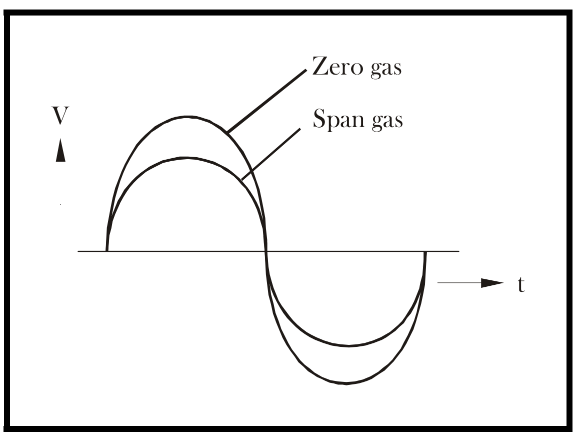


Figure 2-1 Single NDIR Analyzer



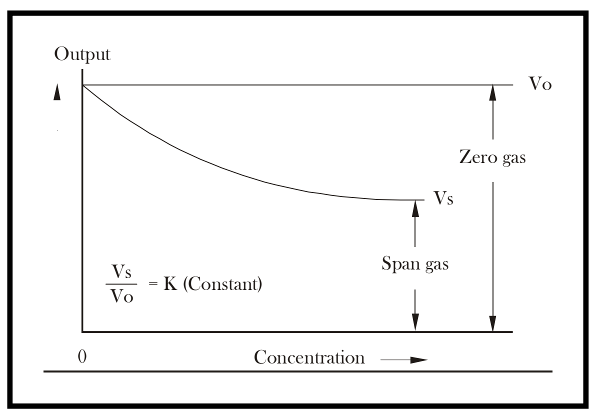


Figure 2-2 Detector Output Signal

Figure 2-3 Absorption Characteristic of Detector

2.4. Interference Gases

Whenever a sample gas contains a gas component that has an absorption spectrum that overlaps the spectrum of the gas to be measured, that gas is commonly referred to as an interference gas. The Microflow Detector was specifically designed to minimize the effect of interference gases. When these gases are present, the pressure rises in the front and rear chamber of the detector cancel each other minimizing any response to the interference gases.

2.5. Electronics

The sinusoidal output signal of the detector's microflow sensor is transmitted to the AC amplifiers on the main circuit board. The signal frequency is related to the rate of the beam-interrupting chopper blade. The signal amplitude is related to the measured gas concentrations in the sample cell.

This signal is amplified by successive AC amplifiers and then demodulated and filtered. The resulting DC signal is further amplified and fed into two output buffer amplifiers. The DC signal output of the printed circuit board is the input to a microprocessor based Digital Display Module. Here it is digitized and linearized for digital display

The digitized information is then fed to a D/A Converter so it can be isolated and converted to a 0-10 VDC or 4-20 mA output. This output (along with optional alarm contacts) is sent to the 28-pin output connector located on the rear panel of the analyzer for customer connection.

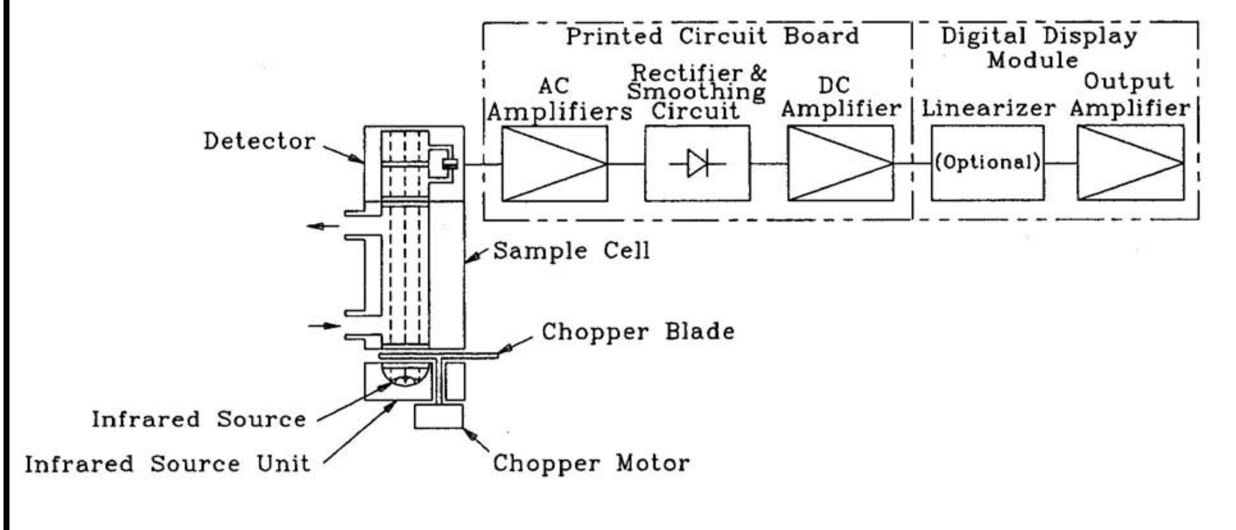


Figure 2-4 Block Diagram

2.5.1. Alarm Contacts (Optional)

The analyzer provides four separate Alarm Relay Contacts for each Infrared Component. These are “Dry” contacts and are as follows:

a) 2 for each component - form “C” @ 5 AMP (N.O., COM)

b) 2 for each component - form "A" @ 5 AMP (N.O., COM)

NOTE: Each Alarm is actuated by its own individual Set Point Control. Contact the factory for setting information.

2.6. Oxygen Measurement Options

Note: High-pressure oxygen is very dangerous. Virtually any material will burn in it, possibly explosively. It is essential that all persons using this analyzer are aware of the dangers of oxygen, and take all appropriate precautions.

2.6.1. Paramagnetic Oxygen Option

The Paramagnetic Oxygen Analyzer (PMA) is a thermally stable instrument designed primarily for, but not necessarily limited to, stationary use. The operation of the analyzer is based upon the principle of the magneto-dynamic oxygen cell, the most accurate and reliable cell for determining the oxygen content of a gas mixture from 0-100 percent volume oxygen.

The analyzer measures the paramagnetic susceptibility of the sample gas by means of a magneto-dynamic type-measuring cell. The measuring cell consists of a dumbbell of diamagnetic material, which is temperature controlled electronically at 50^{o} C. The higher the oxygen concentration, the farther the dumbbell is deflected from its rest position. This deflection is detected by an optical system connected to an amplifier. Surrounding the dumbbell is a coil of wire. A current is passed through this coil to return the dumbbell to its original position. The current applied is linearly proportional to the percent oxygen concentration in the sample gas. This concentration is displayed on a digital panel meter.

The paramagnetic oxygen option features

- Quick Response (2 Sec)
- High Stability
- Temperature Controlled
- Multiple Ranges
- Low Interference to Other Gases
- No Routine Cell Maintenance
- Linear Output

2.6.2. Galvanic Fuel Cell Oxygen Option

This analyzer option utilizes a low cost fuel cell to determine the percent level of oxygen contained in the sample gas. The oxygen level is displayed on a digital panel meter.

The fuel cell contains a cathode, anode, and an electrolyte. A permeable membrane holds the electrolyte in the cell. The sample flows over the membrane and oxygen diffuses in to the fuel cell where it reacts with the electrolyte. This reaction produces an electrical current, which is directly proportional to the concentration of oxygen in the gaseous mixture surrounding the cell. The current output is linear with an absolute zero. In the absence of oxygen, the fuel cell produces no current.

The Galvanic Fuel Cell Features

- Low Cost
- Compact
- Reliable
- Fast Response (5 Sec)
- Multiple Ranges
- Linear Output
- Digital Concentration Display

3. INSTALLATION

3.1. General

The instrument is designed for industrial applications. These installation instructions are for a typical site. Any questions regarding specific installation situations should be directed to Technical Service of California Analytical Instruments, Inc.

3.2. Site and Mounting

NOTE: The following precautions must be carefully observed:

1. Select a site free from direct sunlight, radiation from a high temperature surface, or abrupt temperature variations.
2. This analyzer is not suitable for installation outdoors.
3. Select a site where the air is clean. Avoid exposing the instrument to corrosive or combustible gases.
4. The instrument must not be subject to severe vibration. If severe vibration is present, use isolation mounts.
5. The instrument is designed for rack mounting. Optional rack mount slides are available.
6. Do not install near equipment emitting electromagnetic interference (EMI).

NOTE: A rear supporting brace or equivalent is required if the optional rack mount slides were not purchased.

3.3. Electrical

All wiring is connected at the rear of the instrument. The connect outputs, etc. are shown in Table 3-1 on the following page. The AC power is connected to the power/fuse/switch as shown below in Figure 3-1.

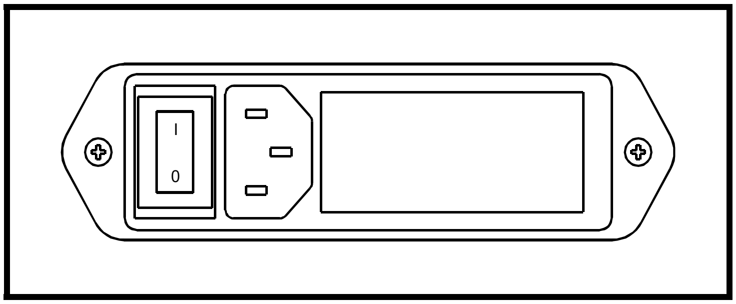


Figure 3-1 AC Power Switch, Connector, and Fuse.

NOTE: A defective ground may affect the operation of the instrument. The output voltages are connected per Table 3-1. Shielded wiring is recommended for output signals.

CAUTION: Electromagnetic interference (EMI) may affect the operation of the instrument. Do not install the instrument near electrical noise (such as high frequency furnaces, electric welding machines, etc.). If the instrument must be installed at such locations, a separate power line must be used. Noise from a relay or solenoid valve should be controlled by the use of an EMI suppressor (RC circuit) across the power wiring close to the noise-generating component (see Figure 3-2).

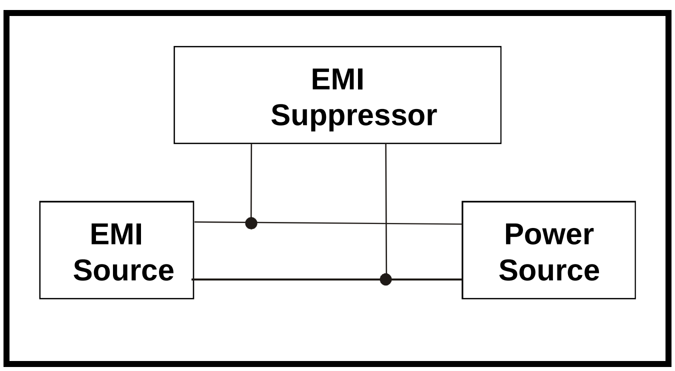


Figure 3-2 EMI Suppressor.

NOTE: The EMI Suppressor must be located close to the noise source.

3.4. I/O Signal Connections

The following tables provide the Output & Control Signals available at the 28 Pin connector located on the analyzer rear panel.

NOTE:

For analyzers delivered prior to Dec. 97 (S/N xxH12100 & lower), use Table 3-1.

For analyzers delivered after Dec. 97 (S/N xxJ01001 & higher), use Table 3-2.

Table 3-1 I/O Connections for S/N xxH12100 and lower

Model 100, 200, 300 with Texmate

Pin #	Outputs (Voltage or Current)	Channel
1	Positive	1st
2	Negative	1st
3	Positive	2nd
4	Negative	2nd
5	Positive	3rd
6	Negative	3rd
	Controls for remote	
7	N/A	1st
8	Range 2 Select (GND IN)	1st
9	Range 3 Select (GND IN)	1st
10	Ground Out	1st
	Channel 2 as an Infrared Analyzer	
11	N/A	2nd
12	Range 2 Select (GND IN)	2nd
13	Range 3 Select (GND IN)	2nd
14	Ground Out	2nd
	Channel 3 as an Infrared Analyzer	
15	N/A	3rd
16	Range 2 Select (GND IN)	3rd
17	Range 3 Select (GND IN)	3rd
18	Ground Out	3rd
	Channel 2 or 3 as a O^2 Fuel Cell	
19	Range 2 Select (GND IN)	2nd or 3rd
20	Range 3 Select (GND IN)	2nd or 3rd
21	Ground Out	2nd or 3rd
22	Positive 15 Volt remote ID	2nd or 3rd
	Channel 2 or 3 as a O^2 Paramagnetic	
23	Range 1 Select (Positive 5 Volt in)	2nd or 3rd
24	Range 2 Select (Positive 5 Volt in)	2nd or 3rd
25	Positive 5 Volt out	2nd or 3rd
26	Positive 5 Volt Remote ID	2nd or 3rd
27	Circuit Ground	2nd or 3rd
28	Not used	
	Note: The IR's Default is range 4 (No selection initiates range 4). If Range 2 Select and Range 3 Select are energized by ground inputs simultaneously then Range 1 will be initiated.	

Table 3-2 I/O Signal Connections for S/N xxJ01001 & higher

Model 100, 200, 300 with Texmate

Pin #	Outputs (Voltage or Current)	Channel
1	Positive	1st
2	Negative	1st
3	Positive	2nd
4	Negative	2nd
5	Positive	3rd
6	Negative	3rd
	Remote controls for bench # 1	
7	Range 1 Select (GND IN)	1st
8	Range 2 Select (GND IN)	1st
9	Range 3 Select (GND IN)	1st
10	Range 4 Select (GND IN)	1st
11	Control (OUT)	
12	Ground	
	Remote controls for bench # 2	
13	Range 1 Select (GND IN)	2nd
14	Range 2 Select (GND IN)	2nd
15	Range 3 Select (GND IN)	2nd
16	Range 4 Select (GND IN)	2nd
17	Control (OUT)	
18	Ground	
	Remote controls for bench # 3	
19	Range 1 Select (GND IN)	3rd
20	Range 2 Select (GND IN)	3rd
21	Range 3 Select (GND IN)	3rd
22	Range 4 Select (GND IN)	3rd
23	Control (OUT)	3rd
24	Ground	3rd
25	Not used	
26	Not used	
27	Not used	
28	Not used	

Note: The IR's Default is range 4 (No selection initiates range 4).

Table 3-3 Optional Alarm Contact Connections

Model 100, 200, 300 — Alarm Contacts

Note: All contacts are "DRY"

	High Alarms (1st Component)				
Pin #	**State**	**Form**	**Rating**	**Set Point I.D.**	**Factory Setting**
1	N.O. #1	C	5 Amp/115 VAC	SP_2	95% FS
2	N.C.	C	5 Amp/115 VAC	SP_2	95% FS
3	COM	Return	5 Amp/115 VAC		
4	N.O. #2	A	5 Amp/115 VAC	SP_4	90% FS
	Low Alarms (1st Component)				
5	N.O. #1	C	5 Amp/115 VAC	SP_1	5% FS
6	N.C.	C	5 Amp/115 VAC	SP_1	5% FS
7	COM	Return	5 Amp/115 VAC		
8	N.O. #2	A	5 Amp/115 VAC	SP_3	10% FS
	High Alarms (2nd Component)				
9	N.O. #1	C	5 Amp/115 VAC	SP_2	95% FS
10	N.C.	C	5 Amp/115 VAC	SP_2	95% FS
11	COM	Return	5 Amp/115 VAC		
12	N.O. #2	A	5 Amp/115 VAC	SP_4	90% FS
	Low Alarms (2nd Component)				
13	N.O. #1	C	5 Amp/115 VAC	SP_1	5% FS
14	N.C.	C	5 Amp/115 VAC	SP_1	5% FS
15	COM	Return	5 Amp/115 VAC		
16	N.O. #2	A	5 Amp/115 VAC	SP_3	10% FS
	High Alarms (3rd Component)				
17	N.O. #1	C	5 Amp/115 VAC	SP_2	95% FS
18	N.C.	C	5 Amp/115 VAC	SP_2	95% FS
19	COM	Return	5 Amp/115 VAC		
20	N.O. #2	A	5 Amp/115 VAC	SP_4	90% FS
	Low Alarms (3rd Component)				
21	N.O. #1	C	5 Amp/115 VAC	SP_1	5% FS
22	N.C.	C	5 Amp/115 VAC	SP_1	5% FS
23	COM	Return	5 Amp/115 VAC		
24	N.O. #2	A	5 Amp/115 VAC	SP_3	10% FS
25	Not used				
26	Not used				
27	Not used				
28	Not used				

Note: Consult Factory for other Configurations.

Table 3-4 Twenty Eight Conductor Cable Color Chart

Pin Number	Wire Color	Wire Color Abbreviation
1	DARK BROWN	DK BR
2	RED	RD
3	ORANGE	OR
4	YELLOW	YL
5	GREEN	GR
6	LIGHT BLUE	LT BL
7	VIOLET	VI
8	GRAY	GY
9	WHITE	WH
10	BLACK	BK
11	LIGHT BROWN	LT BR
12	PINK	PN
13	BLUE	BL
14	LIGHT GREEN	LT GR
15	WHITE/BLACK	WH/BK
16	WHITE/RED	WH/RD
17	WHITE/GREEN	WH/GN
18	WHITE/YELLOW	WHNL
19	WHITE/BLUE	WH/BL
20	WHITE/BROWN	WH/BR
21	WHITE/ORANGE	WH/OR
22	WHITE/GRAY	WH/GR
23	WHITE/VIOLET	WH/I
24	WHITE/PINK	WH/PN
25	WHITE/LIGHT GRAY	WH/LT GY
26	BLACK/RED	BK/RD
27	BLACK/ORANGE	BK/OR
28	BLACK/BROWN	BK/BR

3.5. Required Gases

- Nitrogen (zero gas) and/or instrument air in a pressurized cylinder.

Note: Both must be free of organic carbon compounds (C) if CO, CO_2, CH_4, etc. are a measured component, as well as other contaminants such as moisture, hydrocarbons, etc.

- A standard span gas(es) near full-scale concentration (typically 80-95% of the analyzer's measured range) with a nitrogen balance in (a) pressurized certified cylinder(s).

3.6. Gas Handling Equipment

1. Pressure regulators for zero and span gas cylinders.
2. Corrosive resistant gas tubing.
3. Flow meter with valve (0-2 LPM).

3.7. Gas Connections

The tubing from the sampling system to the gas analyzer should be made from corrosive resistant material such as Teflon ®, or stainless steel. Even when the gases being sampled are non-corrosive, rubber or soft vinyl tubing should not be used since readings may be inaccurate due to gas absorption into the piping material. To obtain fast response, the tube should be as short as possible. Optimum tube internal diameter is 0.16 inch (4 mm). Couplings to the instrument are ¼-inch tube.

NOTE: Be sure tubing and joints are clean. Dust entering the instrument may cause it to malfunction.

3.8. Sampling Requirements

3.8.1. Filtration

Dust must be completely eliminated. Use filters as necessary. The filter must be capable of removing particles larger than one micron.

3.8.2. Condensation

Dew point of the sample gases must be lower than the ambient temperature to prevent accidental condensation within the instrument. When water vapor is present, pass the sample through a dehumidifier to reduce the dew point to about 20^{o} C.

If the sample contains an acid mist, use an acid mist filter, cooler, or similar device to remove all traces of the mist.

NOTE: Teflon® is a registered trademark of E. I. du Pont de Nemours and Company.

3.8.3. Presence of Corrosive Gases

Useful service life of the instrument will be shortened if high concentrations of corrosive gases such as Cl_2, F_2, HCI, etc. are present in the sample gas.

3.8.4. Gas Temperature

When measuring high temperature gases ensure that, the maximum temperature of the sample does not exceed 122^o F (50^o C).

3.8.5. Flow Rate

The gas entering the instrument should flow at a rate between 0.5 to 2 liters/min (LPM).

Note: If the analyzer has a paramagnetic oxygen sensor, the minimum acceptable flow rate is 1.0 LPM.

3.8.6. Influence of Atmospheric Carbon Dioxide (CO_2) and Purging

When measuring low levels of CO_2, the atmospheric CO_2 at the installation site must be constant and at a minimum. Atmospheric CO_2 can penetrate the instrument, resulting in measurement errors. When a source of CO_2 is located near the instrument site, or atmospheric concentration varies widely, the instrument should be purged with CO_2 free instrument air or nitrogen (N_2). The purging gas must be dry and dust free, and should flow at about 1 L/min.

3.8.7. Sample Gas Outlet

A sample-gas outlet fitting is located on the rear panel (¼-inch tube). Pressure at this outlet must be kept at the atmospheric level. This gas should be vented from the instrument.

4. OPERATION

4.1. Description & Function of Components

4.1.1. Model 100 Analyzer Front Panel

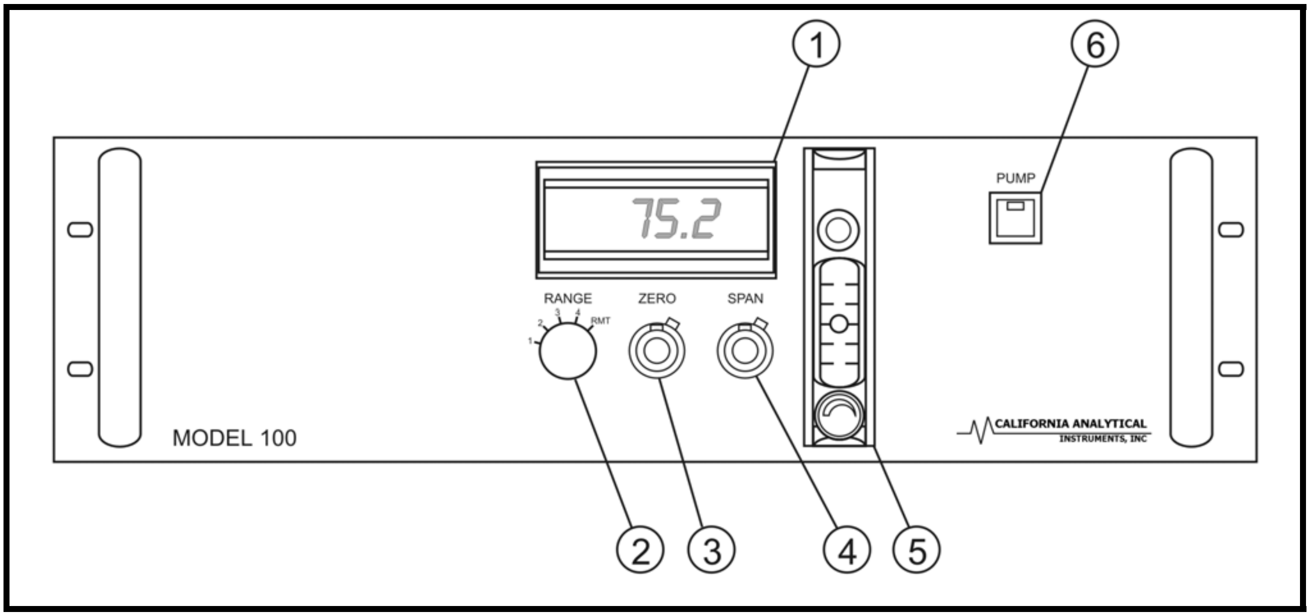


Figure 4-1 Model 100 Analyzer Front Panel

1)	**Indicator Digital Display:**
	Displays output from the infrared gas analyzer in direct engineering units
2)	**Range Switch:**
	Used for measuring range selection
3)	**Zero Control:**
	Used for adjusting the zero level of the instrument while flowing zero gas
4)	**Span Control:**
	Used for adjusting span of the instrument while flowing span gas
5)	**Flow meter:**
	Optional
6)	**Pump Switch:**
	Optional

4.1.2. Model 100 Analyzer Rear Panel

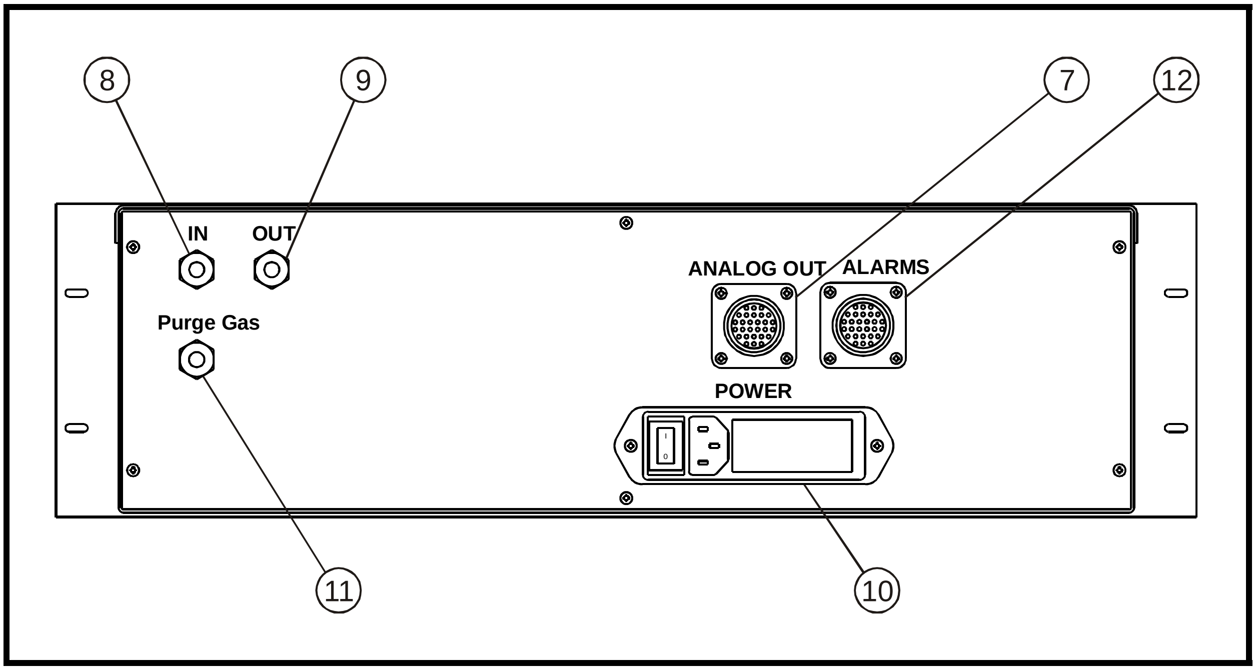


Figure 4-2 Model 100 Analyzer Rear Panel

7)	**Analog Output Connector:**
	Control and Output Data
8)	**Sample Gas Inlet:**
	For introducing sample gas into the infrared gas analyzer. (¼" tube)
9)	**Sample Gas Outlet:**
	For exhausting sample gas. (¼" tube)
10)	**Power Connector, On/Off Switch, Fuse**
11)	**Purge Gas Inlet**
	Optional
12)	**Alarm Output Connector**
	Optional

4.1.3. Model 200 Analyzer Front Panel

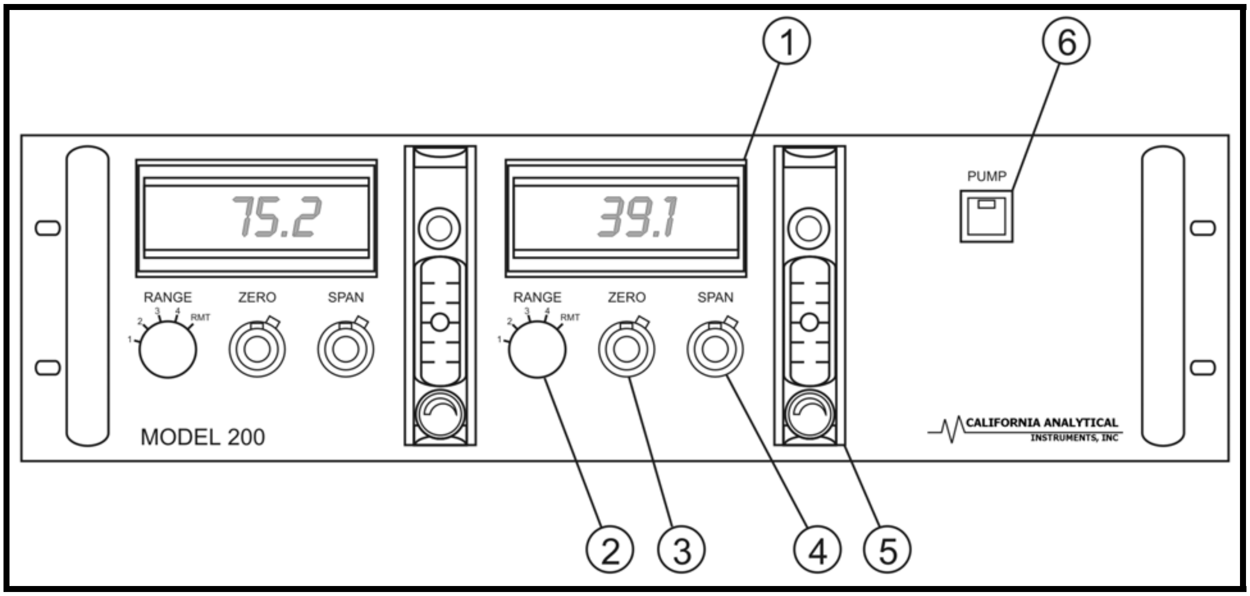


Figure 4-3 Model 200 Analyzer Front Panel

1)	**Indicator Digital Display:**
	Displays output from the infrared gas analyzer in direct engineering units
2)	**Range Switch:**
	Used for measuring range selection
3)	**Zero Control:**
	Used for adjusting the zero level of the instrument while flowing zero gas
4)	**Span Control:**
	Used for adjusting span of the instrument while flowing span gas
5)	**Flow meter:**
	Optional
6)	**Pump Switch:**
	Optional

4.1.4. Model 200 Analyzer Rear Panel

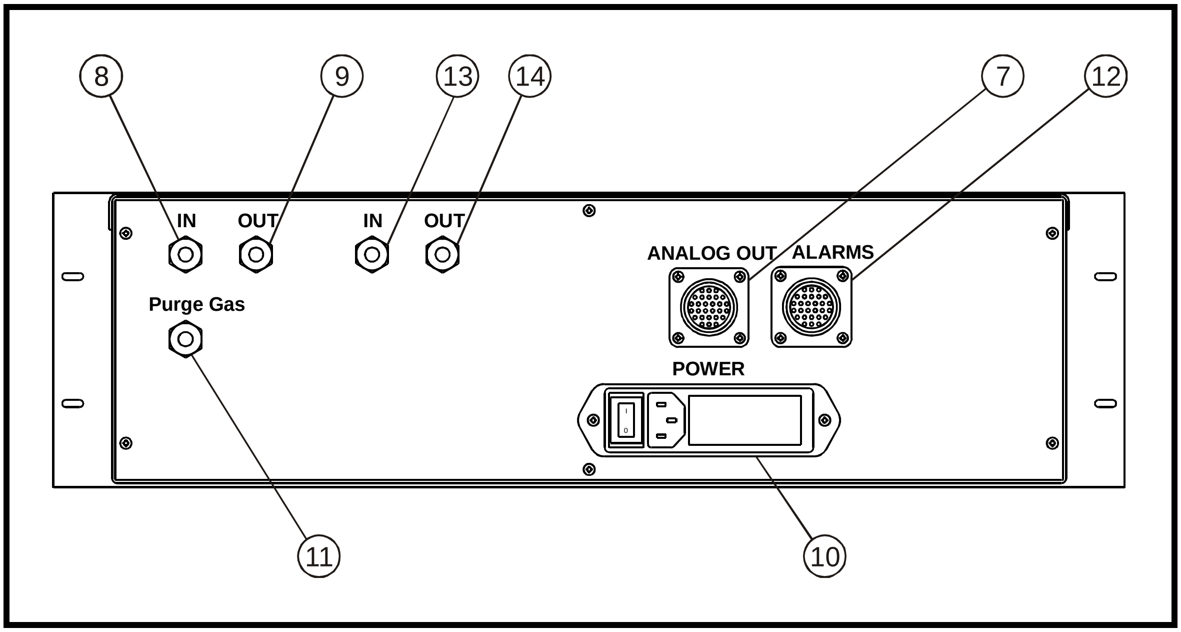


Figure 4-4 Model 200 Analyzer Rear Panel

7)	**Analog Output Connector:**
	Control and Output Data
8)	**Sample Gas Inlet:**
	For introducing sample gas into the infrared gas analyzer (¼” tube)
9)	**Sample Gas Outlet:**
	For exhausting sample gas. (¼” tube)
10)	**Power Connector, On/Off Switch, Fuse**
11)	**Optional Purge Gas Inlet**
	Optional
12	**Alarm Output Connector:**
	Optional
13)	**Sample Gas Inlet:**
	Optional
14	**Sample Gas Outlet:**
	Optional

4.1.5. Model 300 Analyzer Front Panel

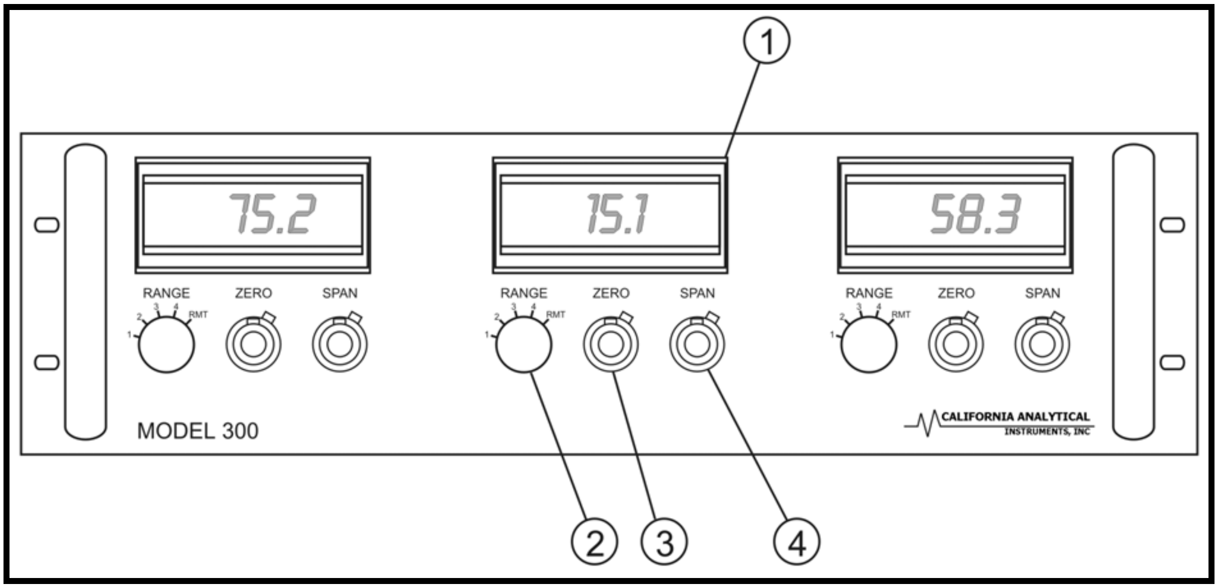


Figure 4-5 Model 300 Analyzer Front Panel

1)	**Indicator Digital Display:**
	Displays output from the infrared gas analyzer in direct engineering units
2)	**Range Switch:**
	Used for measuring range selection
3)	**Zero Control:**
	Used for adjusting the zero level of the instrument while flowing zero gas
4)	**Span Control:**
	Used for adjusting span of the instrument while flowing span gas

4.1.6. Model 300 Analyzer Rear Panel

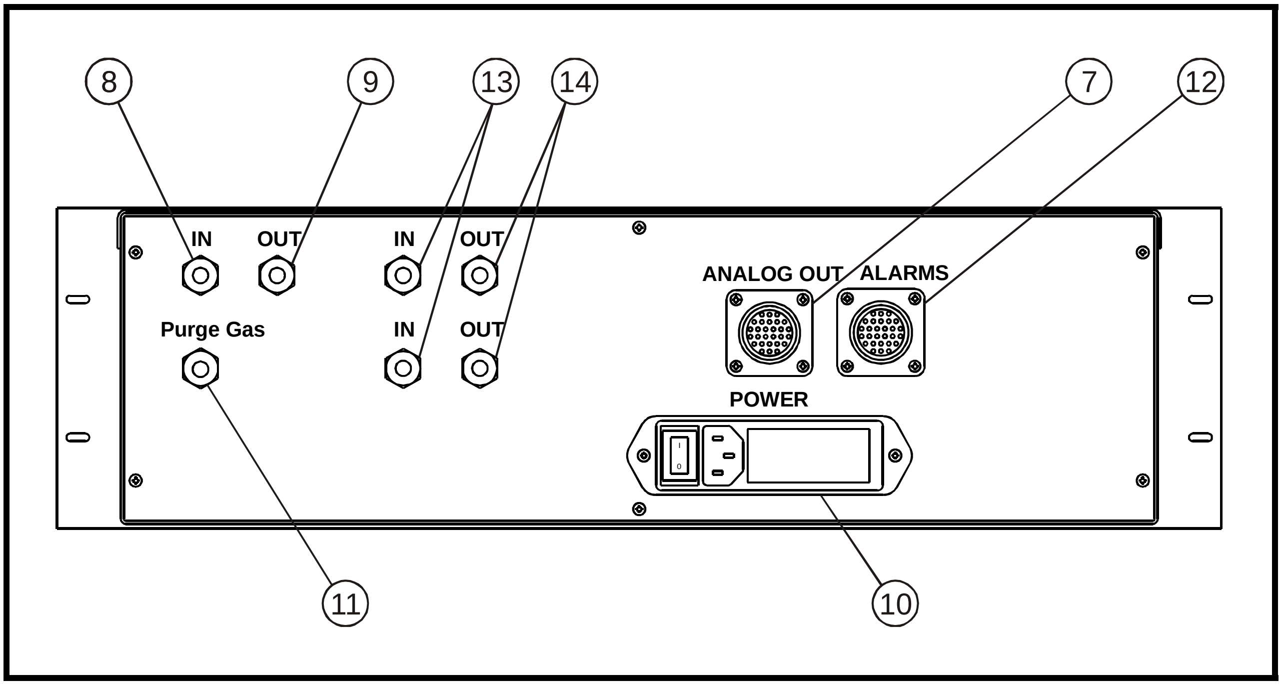


Figure 4-6 Model 300 Analyzer Rear Panel

7)	**Analog Output Connector:**
	Control and Output Data.
8)	**Sample Gas Inlet:**
	For introducing sample gas into the infrared gas analyzer (¼" tube).
9)	**Sample Gas Outlet:**
	For exhausting sample gas (¼" tube).
10)	**Power Connector, On/Off Switch, Fuse**
11	**Purge Gas Inlet**
	Optional
12	**Alarm Output Connector**
	Optional
13	**Sample Gas Inlets**
	Optional
14	**Sample Gas Outlets**
	Optional

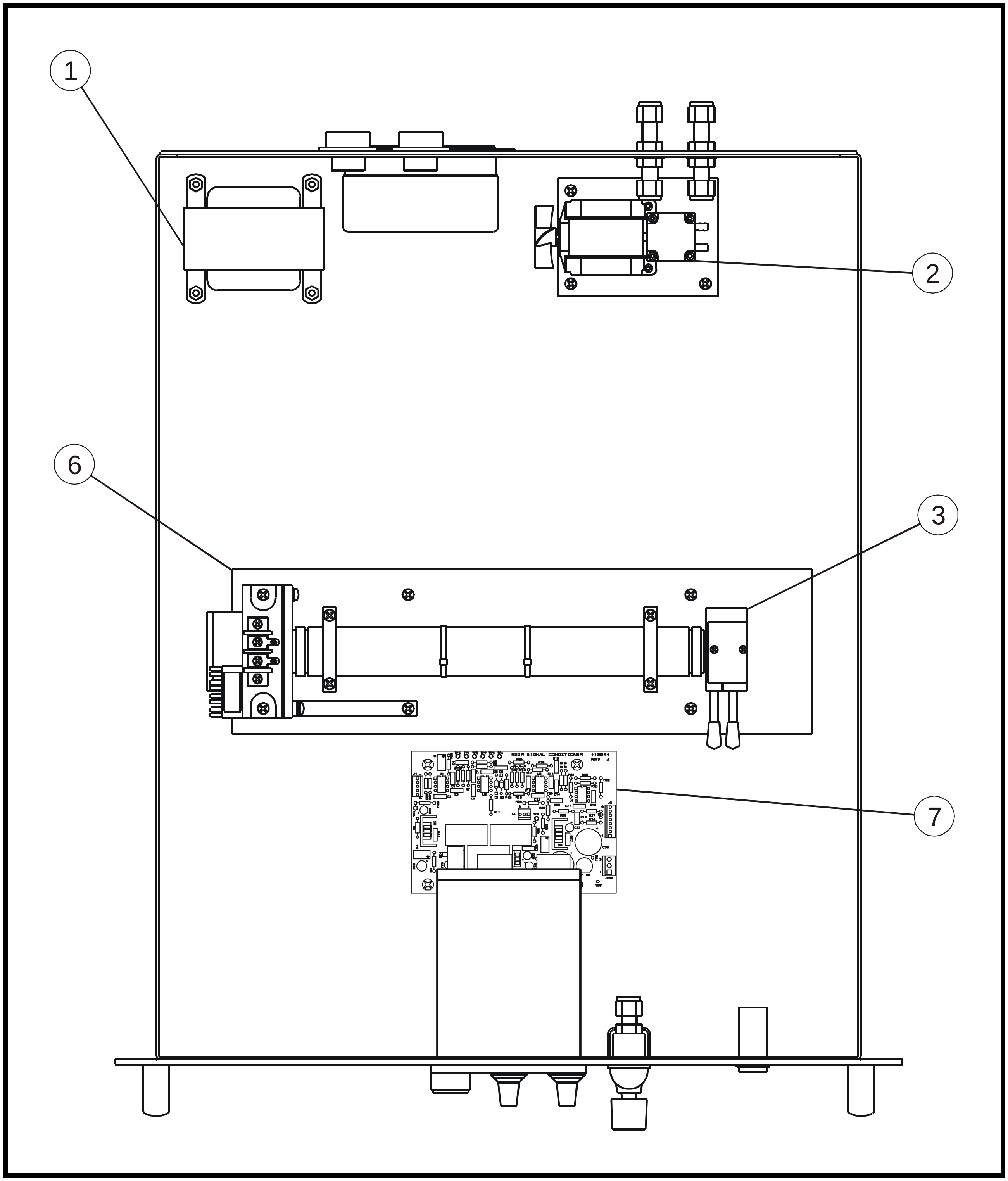


Figure 4-7 Model 100 Interior Layout – With Sample Gas Pump

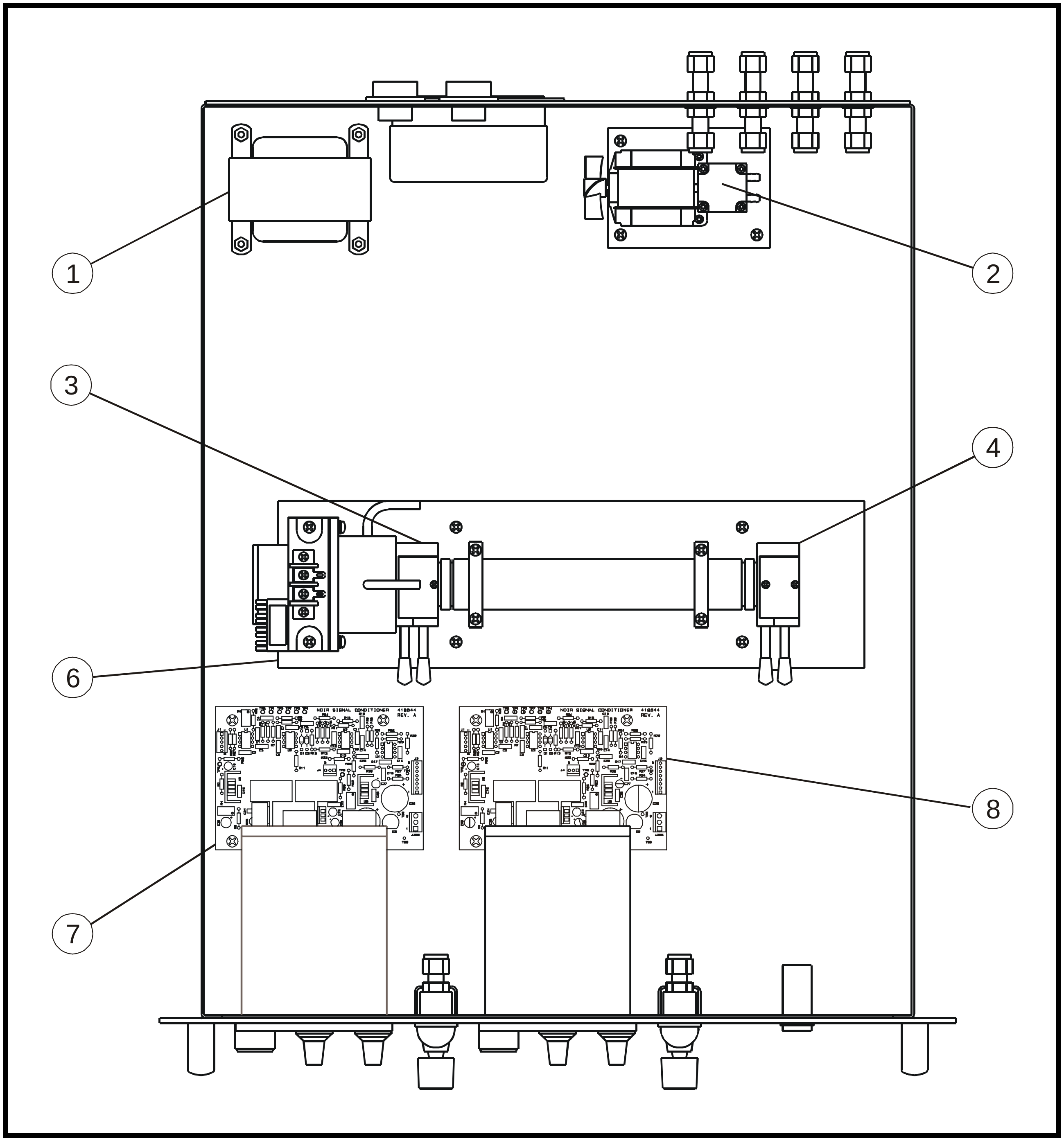


Figure 4-8 Model 200 Interior Layout – Stacked Cell IR's – With Sample Gas Pump

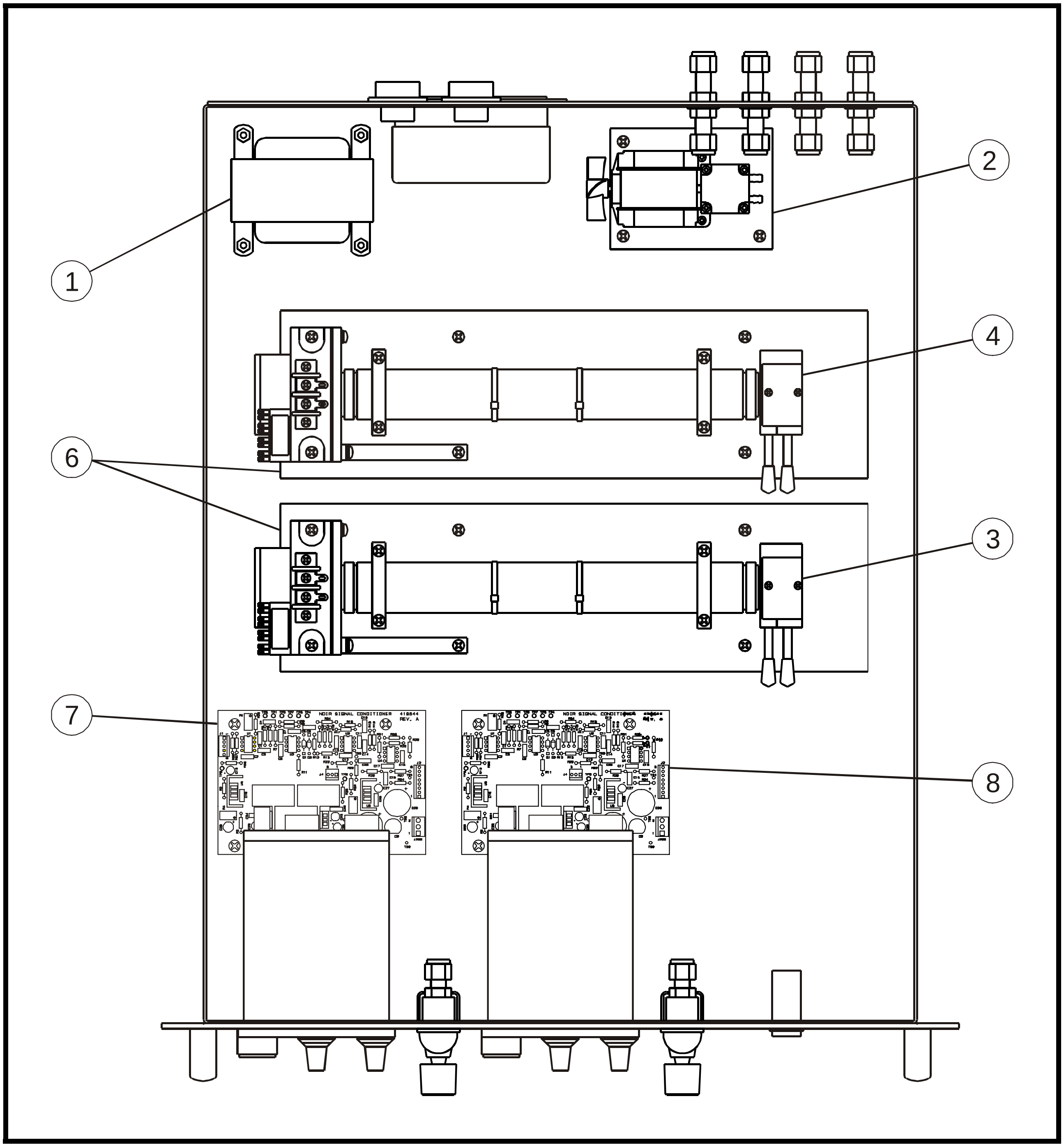


Figure 4-9 Model 200 Interior Layout – Two (2) Independent Optical Benches – With Sample Gas Pump

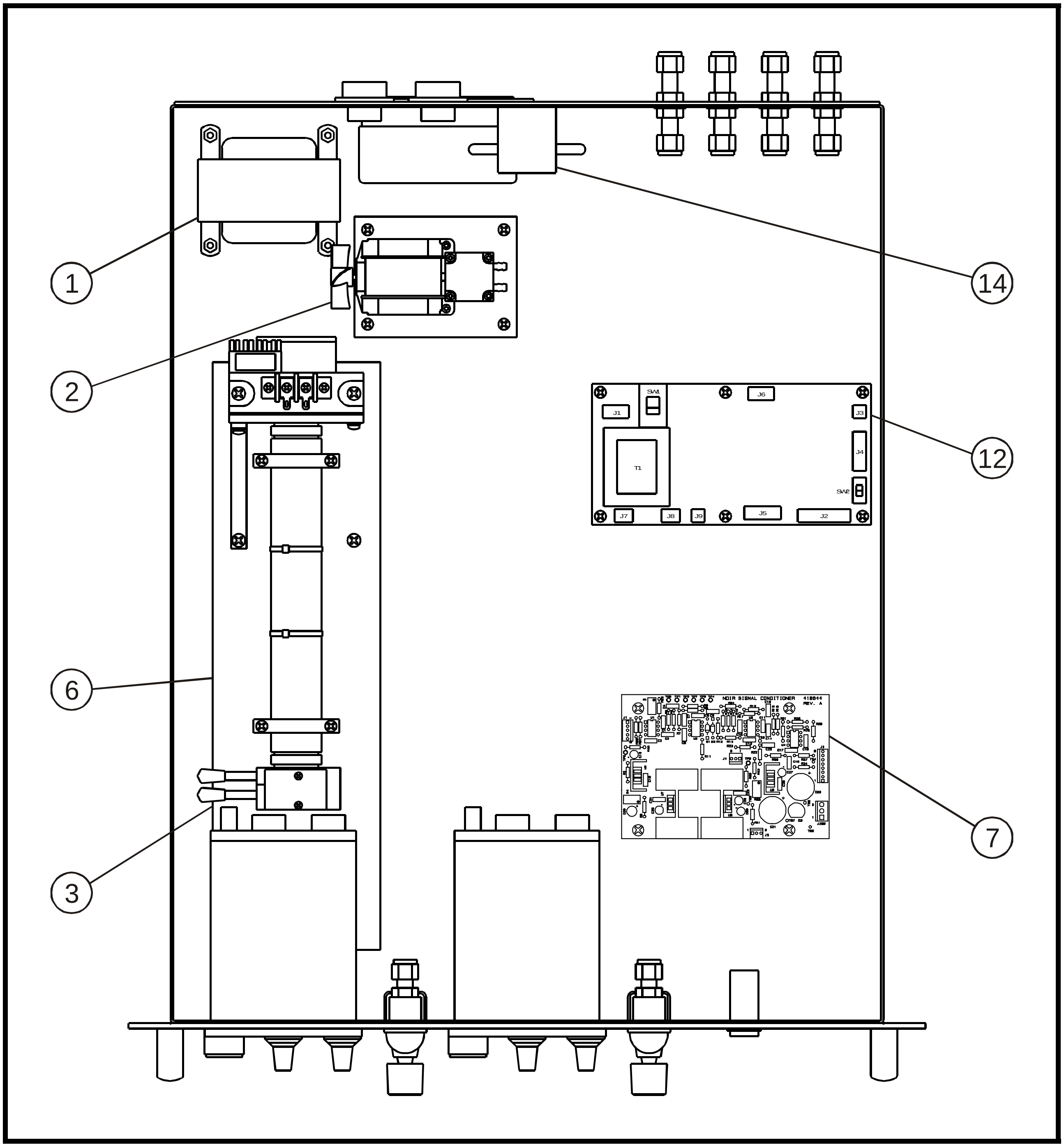


Figure 4-10 Model 200 – Single IR, Fuel Cell O_2 – With Sample Gas Pump

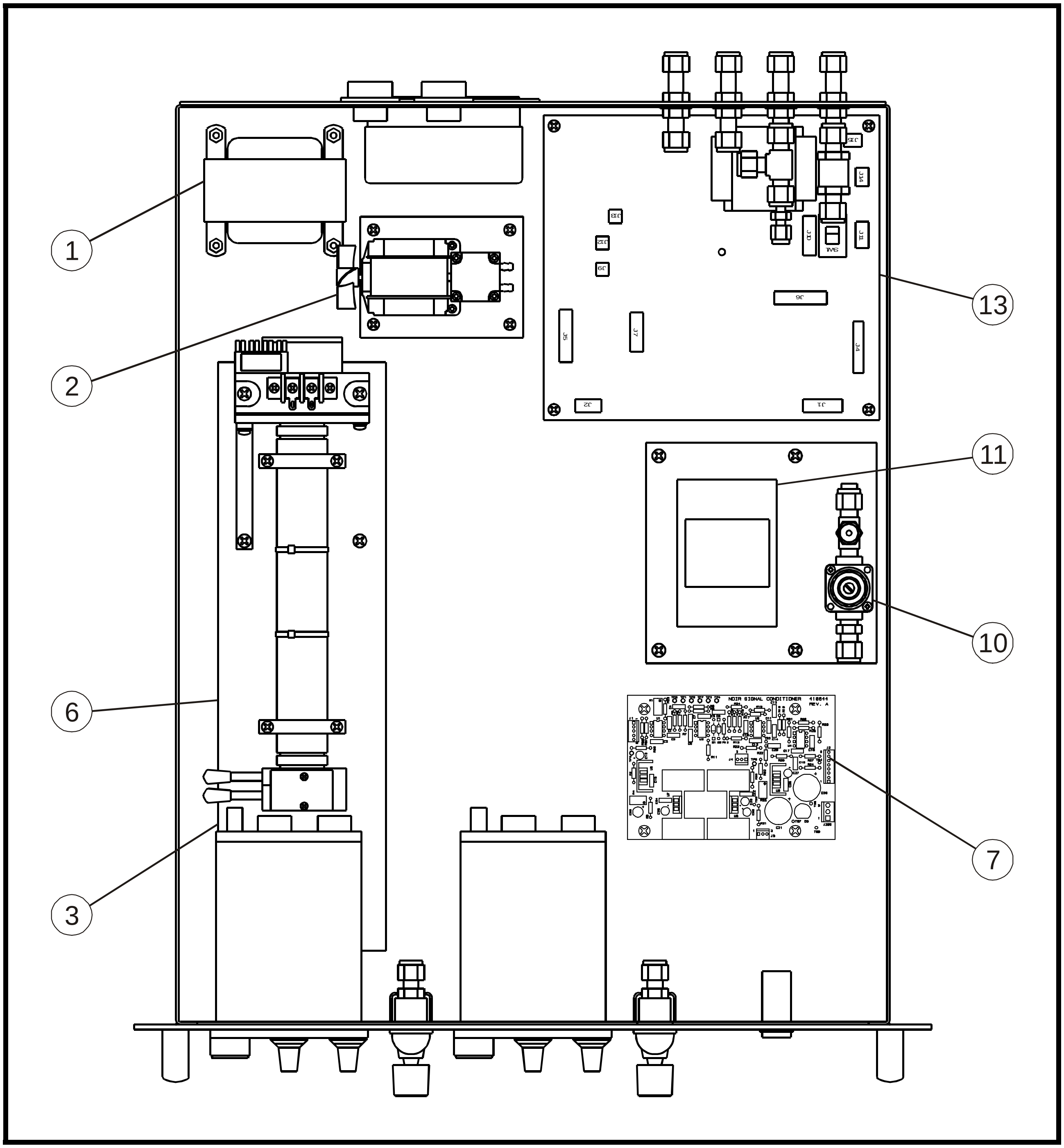


Figure 4-11 Model 200 Interior Layout – Single IR, Paramagnetic O_2 – With Sample Gas Pump

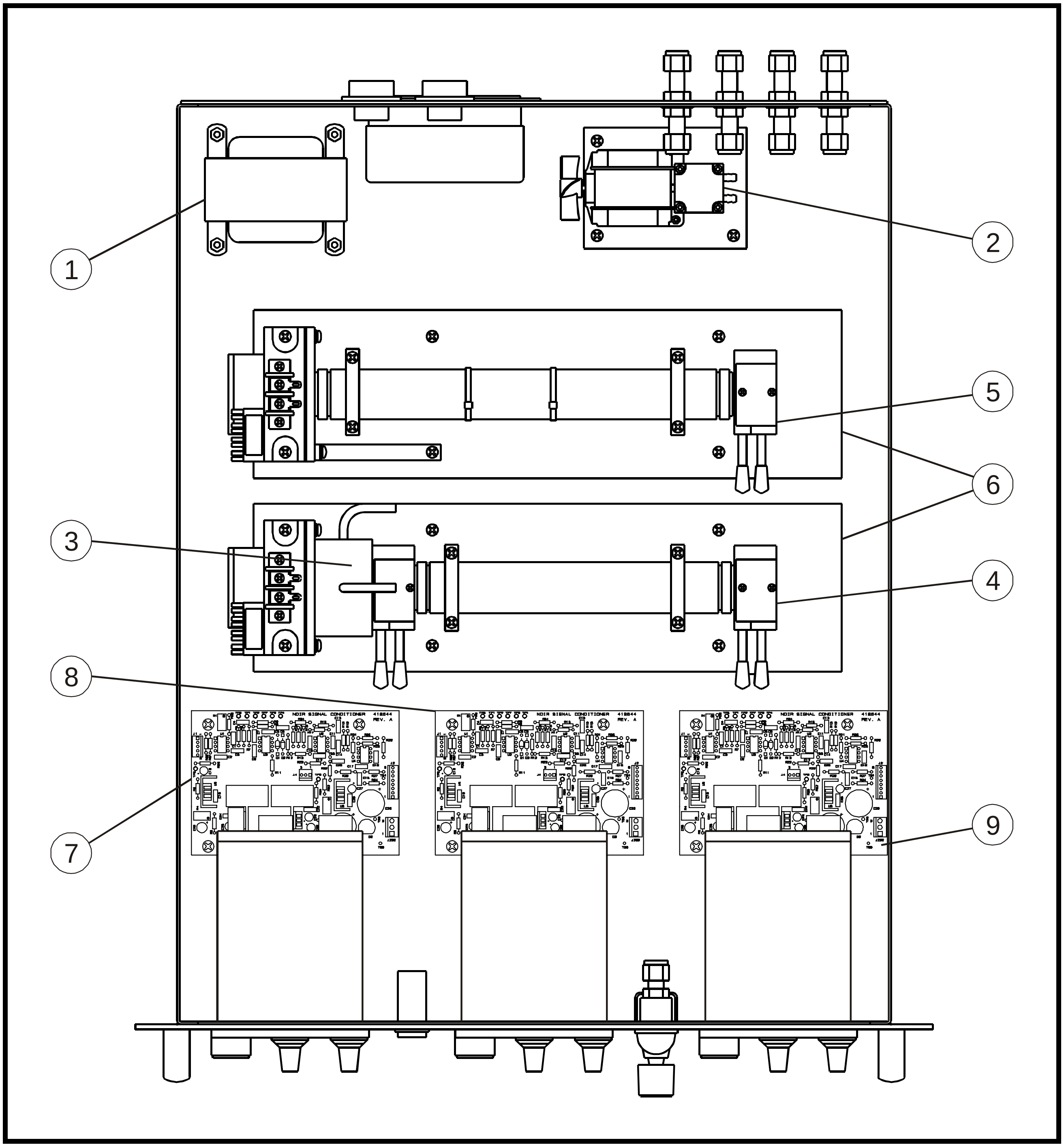


Figure 4-12 Model 300 Interior Layout – Three (3) IR's – With Sample Gas Pump

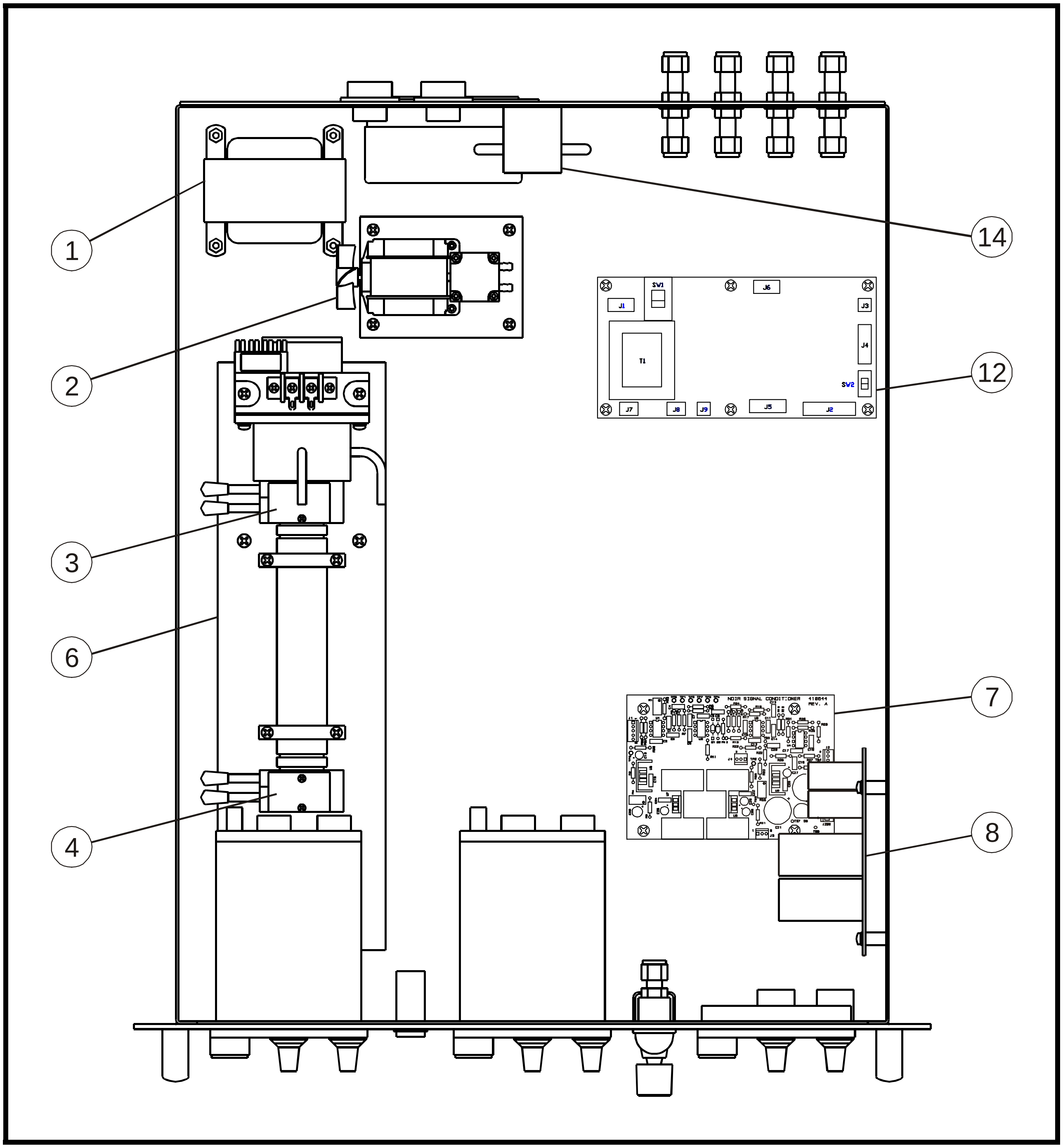


Figure 4-13 Model 300 Interior Layout – Two (2) Stacked Cell IR's, Fuel Cell O_2 – With Sample Gas Pump

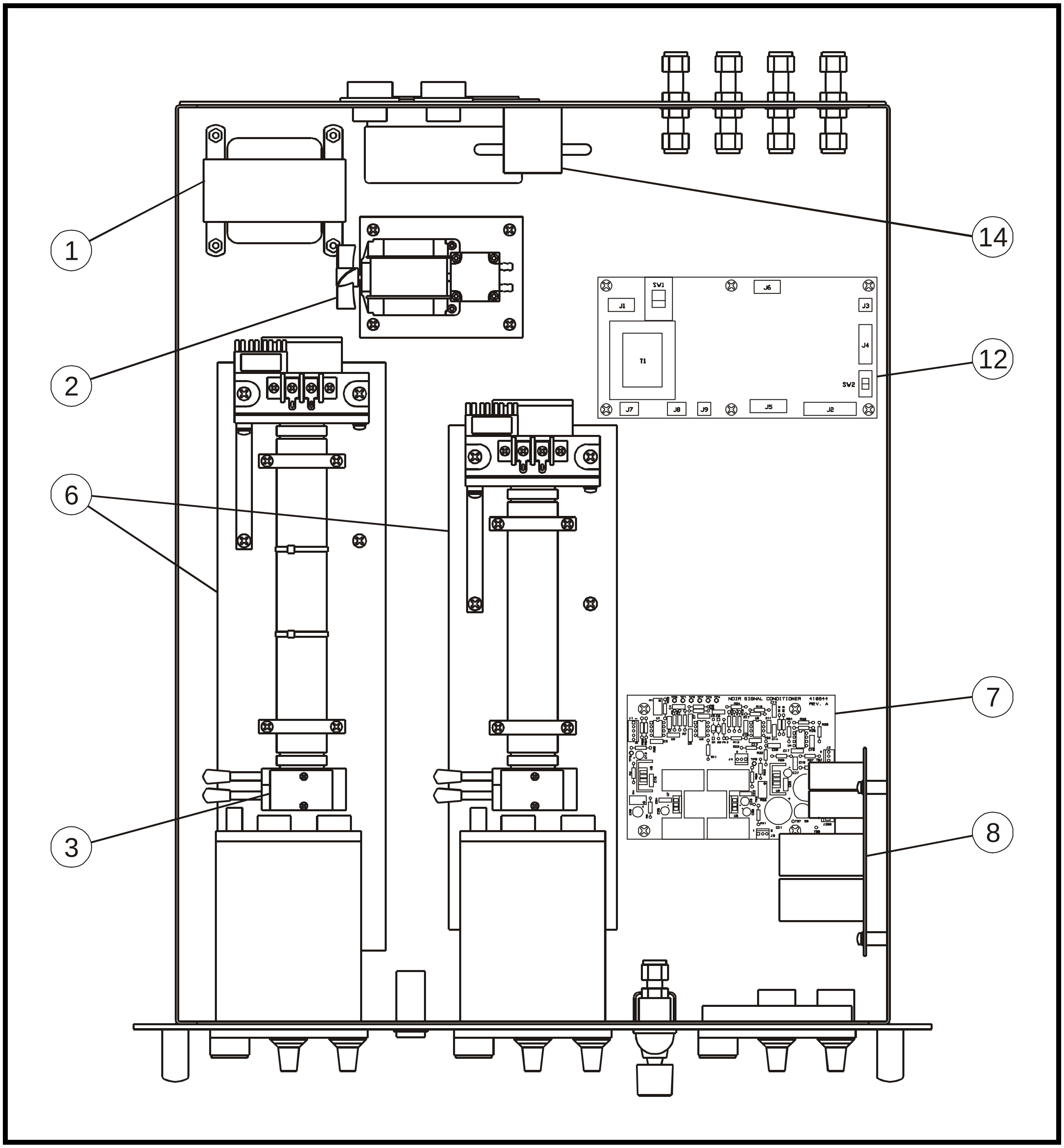


Figure 4-14 Model 300 Interior Layout – Two (2) Independent IR's, Fuel Cell O_2 – With Sample Gas Pump

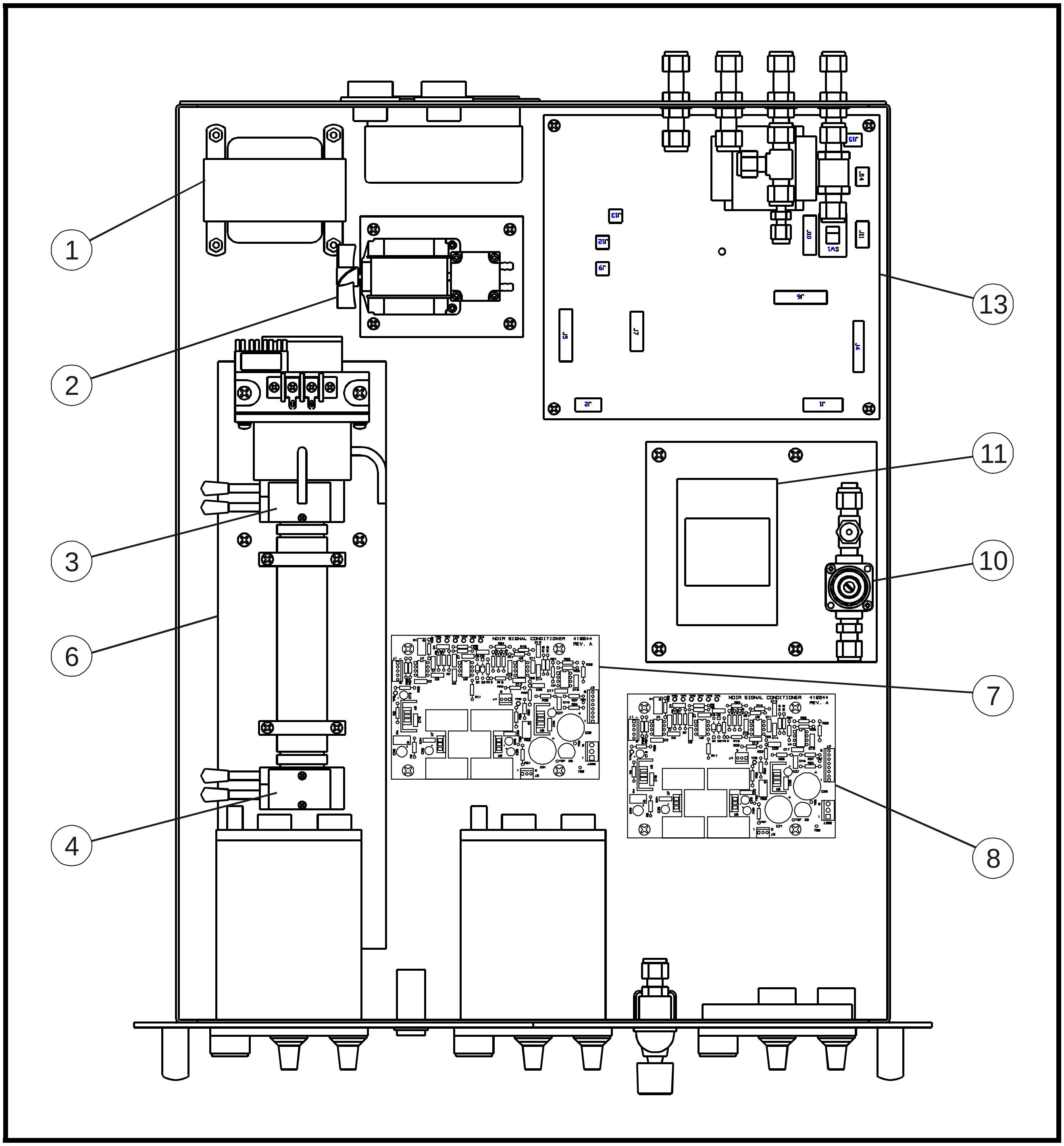


Figure 4-15 Model 300 Interior Layout – Two (2) Stacked Cell IR's, Paramagnetic O_2 – With Sample Gas Pump

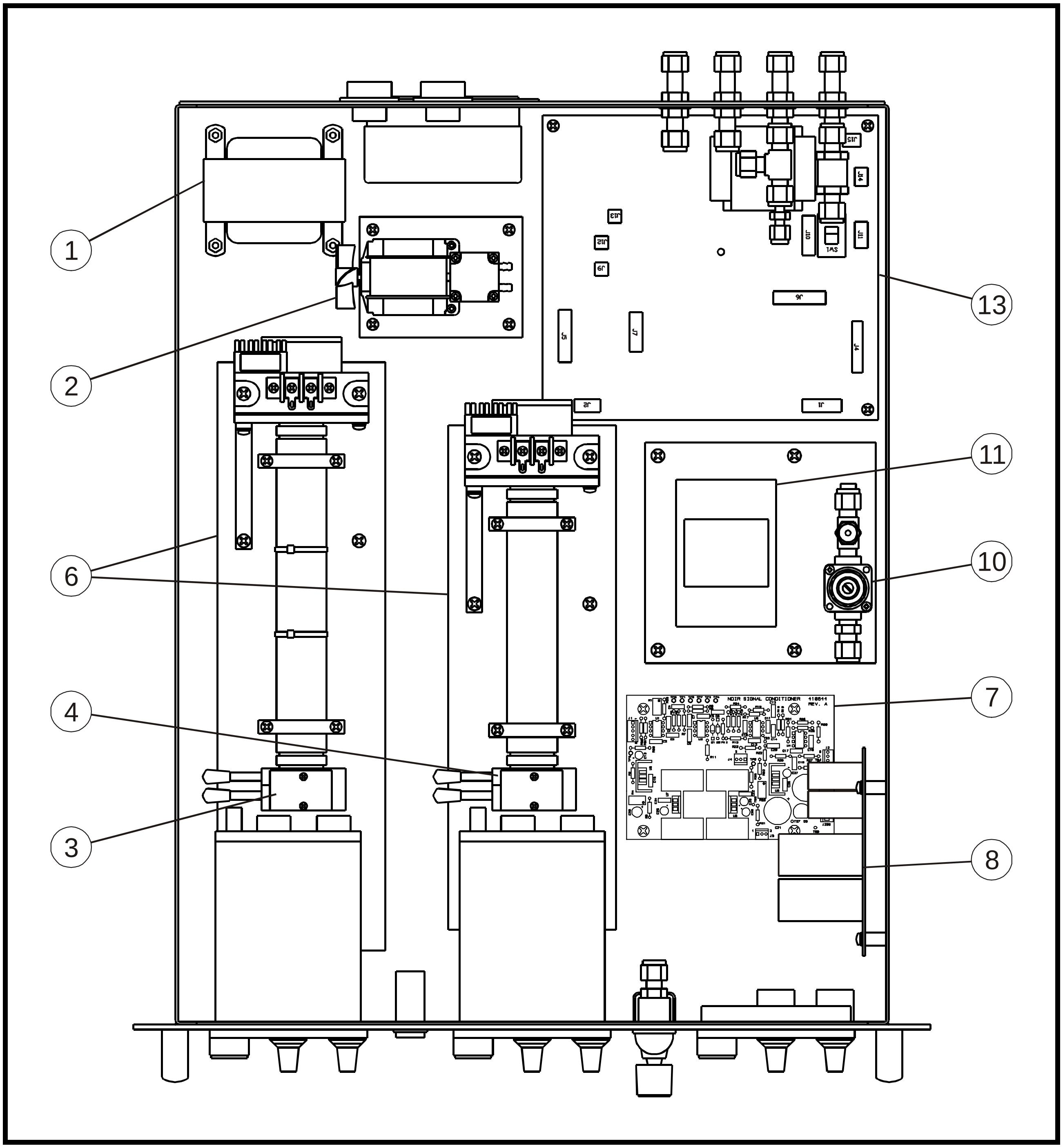


Figure 4-16 Model 300 Interior Layout – Two (2) Independent IR's, Paramagnetic O_2 – With Sample Gas Pump

4.1.7. Interior Layout Component Identification

1**)**	**Power Transformer:**
	For supplying power to the main circuit board and optical bench
2)	**Sample Pump:**
	Optional
3)	**Optical Bench for 1st Component:**
	Measuring section of the infrared gas analyzer
4)	**Optics for 2nd Component**
5)	**Optics for 3rd Component**
6)	**Mounting Plate(s) for Optical Bench(es)**
7)	**Main Circuit Board for 1st Component**
8)	**Main Circuit Board 2nd Component**
9)	**Main Circuit Board for 3rd Component**
10)	**Relief Valve: (Paramagnetic Only)**
11)	**Paramagnetic Oxygen Sensor**
12)	**Circuit Board for Fuel Cell**
13)	**Circuit Board For Paramagnetic O_2**
14)	**Fuel Cell Oxygen Sensor**

4.2. Preparations for Operation

4.2.1. External Wiring

Make sure that the external wires have been connected as described in Section 3 Installation.

4.2.2. External Piping

Review Section 3, 3-4 through 3-7.

4.3. Operation & Calibration

4.3.1. Power On:

Turn on the power switch (located on the rear panel). The digital panel meters should illuminate. Allow the instrument to warm up for approximately one hour. It is preferable, but not essential, that zero gas flow through the instrument at a rate of about 1 L/min. Adjust the zero control on the front panel until the digital meter (or analog output) is exactly at zero.

Note: To achieve final stability, the analyzer may require an additional warm-up period of up to four hours (depending on variables in the analyzer's environment).

4.3.2. Zero Adjustment:

After the warm-up period, flow zero gas (see Section 3, 3.4 – Required Gases) through the instrument at a rate of about 1 L/min. Adjust the zero control on the front panel until the digital meter (or analog output) is exactly at zero. Nitrogen or "Zero Air" may be used for NDIR components.

4.3.3. Span Adjustment:

Flow span gas through the instrument at about 1 L/min. Adjust the span controls on the front panel until the digital meter or analog output is reading the value corresponding to the span gas concentrations.

Note: Span gas concentration should not be less than 80% of the range to be spanned.

4.3.4. Alarm Set Point and Control Programming Instructions

With power applied to the analyzer, locate the front-panel display meter and the three buttons on the faceplate. One will be marked "**PROGRAM**", one will be a "**DOWN ARROW**" and one will be an "**UP ARROW**".

The first four sub-menus that will appear are [**SP_1** thru **SP_4**). These program routines permit the user to set the activation point for each individual alarm. (The readout for the set point is expressed in actual "engineering units" or as a "percentage of full scale", depending on how the analyzer was configured to display the measured concentration by the factory when the analyzer was originally shipped.)

Simultaneously pressing the "**PROGRAM**" and "**DOWN ARROW**: buttons and then releasing them will permit entry into the "**SET POINT**" programming mode. The first submenu will appear and the display will toggle back and forth from [**SP_1**] and the set point value. Set the alarms activation point to the desired value by pressing the "**UP** or **DOWN ARROW**" while the display is toggled to the set point value. Press and release the "**PROGRAM**" button one time to advance to the next sub-menu [**SP_2**]. Repeat the procedure for setting [**SP_2**], [**SP_3**], [**SP_4**].

Press the "**PROGRAM**" button five more times to return to the normal measurement display mode.

NOTE: The alarms are set at the factory so that [SP_1] and [SP_2] function as "LOW ALARMS" and [SP_3] and [SP_4] act as "HIGH ALARMS". If you wish to change tie operation of the alarm relays to function differently than the way they were originally set please contact California Analytical Instruments, Inc.

4.3.5. Start-Up and Routine Maintenance:

Prepare and check the sample system. Adjust the flow of sample gas to about 1 L/min. The instrument should show a meter indication. The infrared gas analyzer is designed for extended operation and may be left switched on continuously.

4.4. Oxygen Analyzer Operation and Calibration

Note: High-pressure oxygen is very dangerous. Virtually any material will burn in it, possibly explosively. It is essential that all persons using this analyzer are aware of the dangers of oxygen, and take all appropriate precautions.

4.4.1. Power On:

Turn on the power switch located on the rear panel. The digital panel meters should illuminate. Allow the instrument to warm up for approximately one hour. It is preferable, but not essential, that zero gas flow through the instrument during warm-up.

NOTE: DO NOT introduce the sample gas UNTIL the analyzer has warmed-up. This will help prevent condensation from forming in the sample cell.

4.4.2. Calibration:

a) Zero Adjustment: After the one-hour warm-up period, flow zero gas (see Section 3.4 – Required Gases) through the instrument at a rate of about 1 L/min. Adjust the zero control on the front panel until the digital meter (or analog output) is exactly at zero. Nitrogen is the preferred Zero Gas.

Note: To achieve final stability, the analyzer may require an additional warm-up period of up to four hours (depending on variables in the analyzer's environment).

b) Span Adjustment: Flow span gas through the instrument at about 1 L/min. Adjust the span controls on the front panel until the digital meter or analog output is reading the value corresponding to the span gas concentrations.

Note: Span gas concentration should not be less than 80% of the range to be spanned.

Note: On the 0-25% range of the analyzer ambient air may be used as span gas. Simply adjust the span pot to 20.9% O_2 value while sample pump is flowing normal ambient air to the analyzer.

c) Start-Up & Routine Maintenance: Prepare and check the sample system. Adjust the flow of sample gas to about 1 L/min. The instrument should show a meter indication. The infrared gas analyzer is designed for extended operation and may be left switched on continuously.

Note: See supplemental oxygen manual for additional information.

5. MAINTENANCE

5.1. Zero and Span Calibration

The zero and span levels should be checked and/or calibrated daily or as often as required. (Refer to paragraphs 4.3.2 and 4.3.3).

5.2. Cleaning of the Optical Bench Measuring Cell (Infrared Analyzers Only)

Dust or water droplets entering the measuring cell may cause drift due to contamination. When it is impossible to adjust the zero level with the zero control mounted on the front panel, check the measuring cell for contamination. If contamination is present, check the sampling system, especially the filters, to eliminate the source of contamination. Periodic maintenance is generally not required. Cleaning is accomplished by use of a cleaning agent (such as isopropyl alcohol or household glass cleaner) and a non-abrasive, lint-free cloth or tissue.

5.3. Optical Bench Configuration

Infrared analyzers may be configured with three types of optical benches: with a pipe cell; with a block cell; or with both a pipe cell and a block cell (see Table 5-1))

Table 5-1 Optical Bench Configuration

Optical Bench Type	Illustration	Paragraph
Pipe Cell (Cell length: 64 mm, 125 mm, or 250 mm).	Figure 5-1 This figure illustrates the pipe cell	5.3.1 describes the disassembly cleaning and reassembly
Block Cell (Cell length: 4 mm, 8 mm, 16 mm or 32 mm)	Figure 5-2 This figure illustrates the block cell.	5.3.2 describes the disassembly cleaning and reassembly
Combination	Figure 5-3 This illustrates the combination assembly.	5.3.3 describes the disassembly cleaning and reassembly

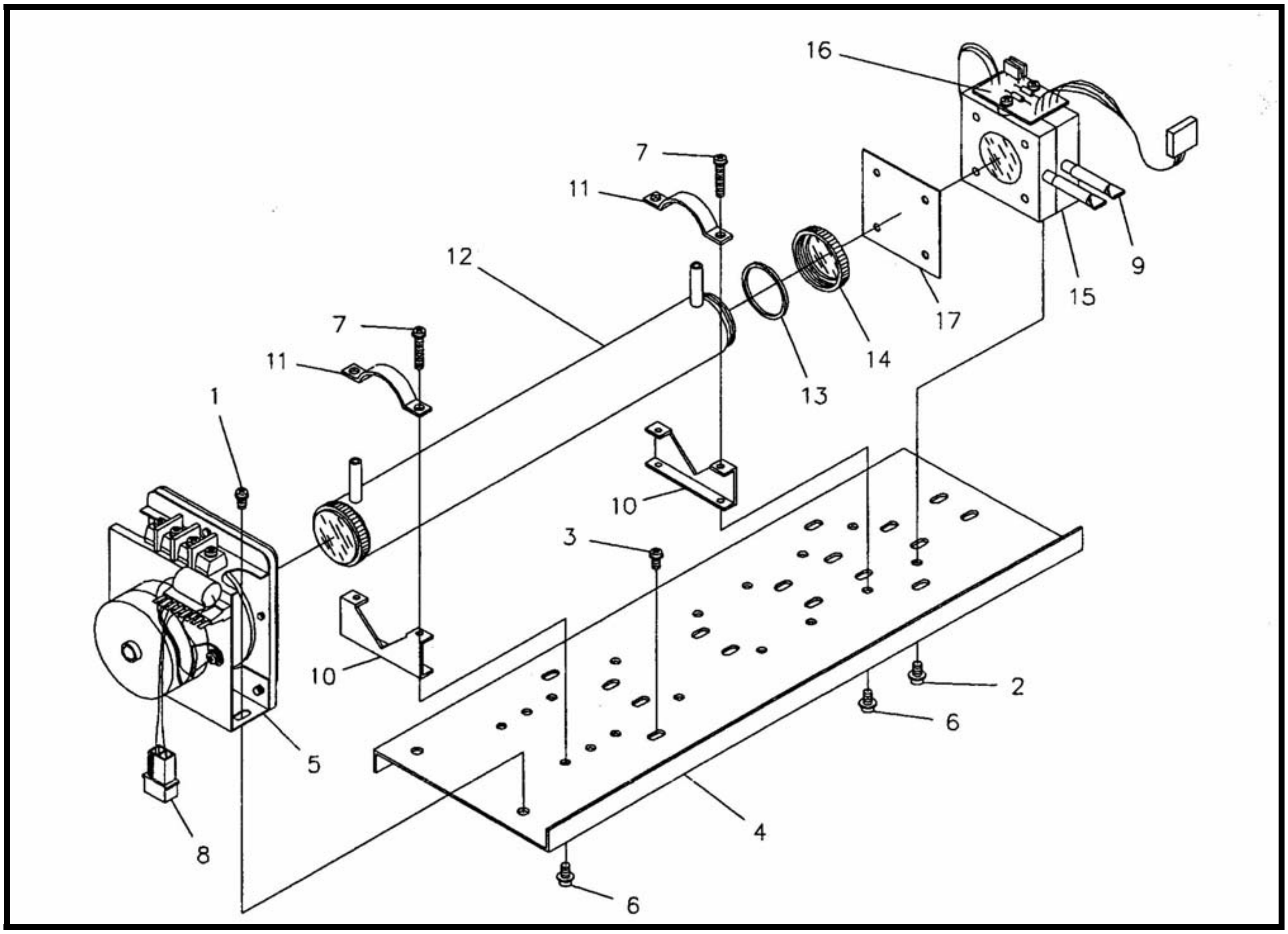


Figure 5-1 Optical Bench with Pipe Sample Cell

Item	Description	Item	Description
1-3	Screw (M4)	11	Clamp
4	Base	12	Pipe sample cell
5	Infrared source unit	13	O-Ring
6-7	Screw (M4)	14	Window
8	Connector	15	Detector
9	Sealed tubes	16	Bridge circuit board
10	Support	17	Optical filter (if installed)

Note: Pipe cell foil liner not shown

5.3.1. Removal of Pipe Cell

(Figure 5-1)

a) Discontinue the sample gas flow. When it contains harmful gas, purge the measuring cell sufficiently with zero gas.

b) Turn the power switch to OFF.

c) After loosening the retaining screws on the sides of the top cover, lift off top cover and locate the pipe cell.

d) Disconnect the sample gas inlet and outlet tubes from the measuring cell.

e) After loosening (do not remove) the two screws (No. 1 in Figure 5-1) which are used for securing the infrared light source unit (No. 5 in Figure 5-1) to the base plate, shift the infrared light source away from the pipe cell (No. 12 in Figure 5-1) to form a gap.

f) After removing the pipe cell retainer screws (No. 7 in Figure 5-1), remove the retaining clamps (No. 11 in Figure 5-1).

g) Carefully remove the cell from the optical bench and remove both windows (right-hand threaded) (No. 14 in Figure 5-1).

h) At this time, inspect the O-Ring (No. 13 in Figure 5-1) for signs of deterioration. Replace if necessary.

i) The CaF_2 window is bonded to the window holder. Inspect and clean the windows as necessary using cotton swabs and a suitable cleaning solution.

Alcohol or an alcohol-based glass cleaner is a suitable cleaning solution. A soft cloth or tissue that will not deposit lint should be used to clean the liner & windows.

j) The pipe cells contain a reflective metal foil liner (not shown in Figure 5-1) to enhance the light energy through put in the cell. Normally it is not necessary to remove the liner for cleaning; however, the liner should be removed if the cell is subjected to grossly excessive moisture. If necessary, clean both sides of the liner and the inside of the pipe cell. If the liner has been subjected to a corrosive substance, it should be replaced. In either case, ensure that the small gas holes in the liner are aligned with the gas fittings at both ends of the pipe cell before reassembling the windows.

k) The pipe cell can be re-assembled by following the reverse of the disassembly procedures. In re-assembly, reserve gaps of approximately 0.5 mm between the infrared light source unit and cell and between the cell and detector, respectively. Larger gaps are undesirable.

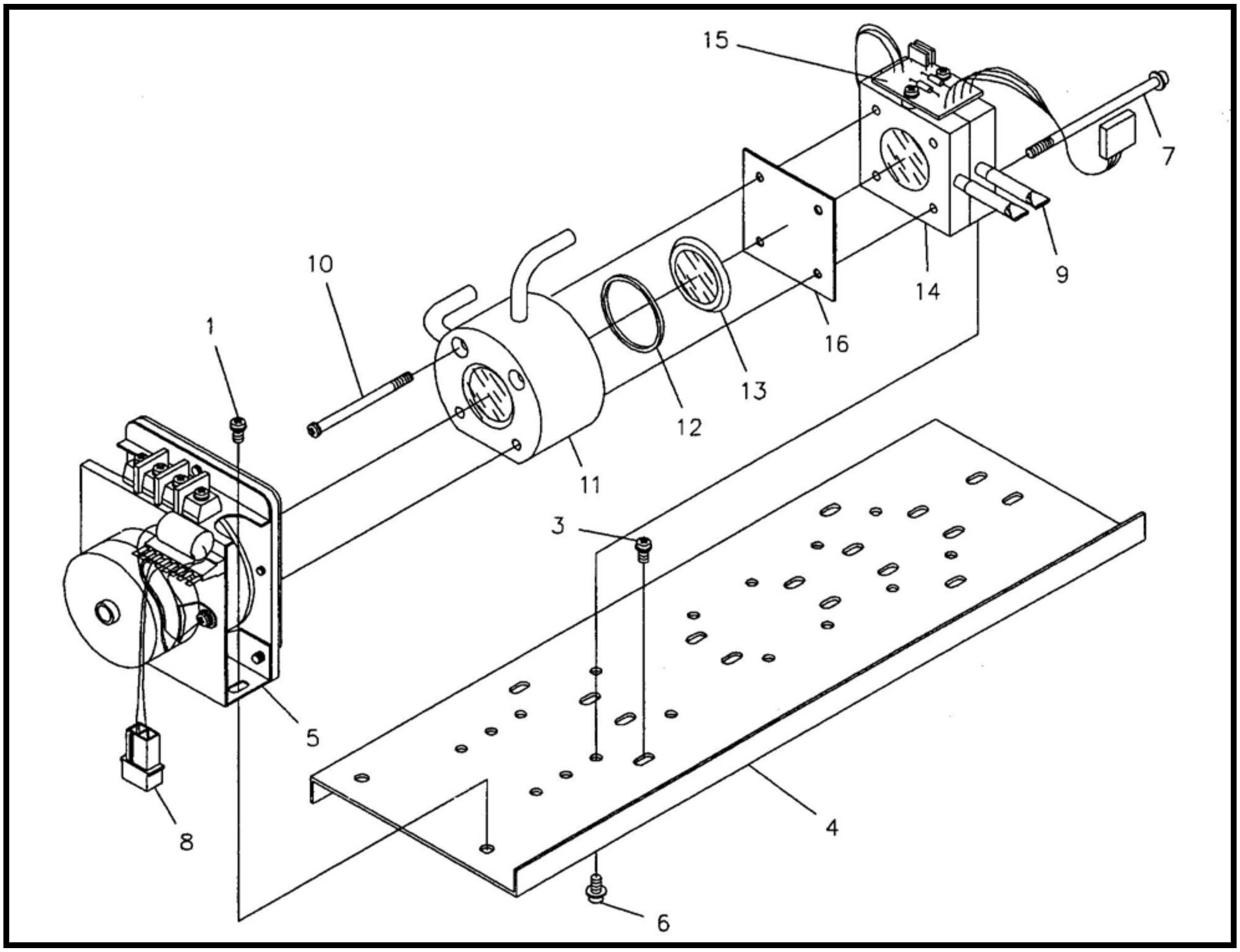


Figure 5-2 Optical Bench with Block Sample Cell

Item	Description	Item	Description
1-3	Screw (M4)	10	Screw (Flat Head)
4	Base	11	Block sample cell
5	Infrared source unit	12	O-Ring
6	Screw (M4)	13	Window
7	Screw (Round or Pan Head)	14	Detector
8	Connector	15	Bridge circuit board
9	Sealed tubes	16	Optical filter (if installed)

5.3.2. Removal of Block Cell

(Figure 5-2)

a) Discontinue the sample gas flow. When it contains harmful gas, purge the measuring cell sufficiently with zero gas.

b) Turn the power switch to OFF.

c) After loosening the retaining screws on the sides of the top cover, lift off the top cover and locate the block cell.

d) Disconnect the sample gas inlet and outlet tubes from the measuring cell.

e) Disconnect the detector output-cable-connector from the main circuit board.

f) Remove the two screws (No. 7 in Figure 5-2) attaching the detector to the infrared light source assembly and remove the detector from the optical bench. The cell is removed together with the detector as a unit.

g) While holding the detector in the palm of your hand, remove the two flat-head screws (No. 10 in figure 5-2) which fix the cell to the detector.

Note: The cell window (No. 10 in figure 5-2) is loose and is only retained by the clamping action between the detector and the block sample cell. Take care not to drop the window when separating the block cell from the detector.

h) Clean the cell interior and CaF_2 windows using a soft cloth or tissue (see Note on previous page). Inspect the O-Ring for flatness or deterioration and replace if necessary.

i) The block cell can be re-assembled by following the reverse of the disassembly procedures. Note the orientation of the loose window and 0-ring during disassembly.

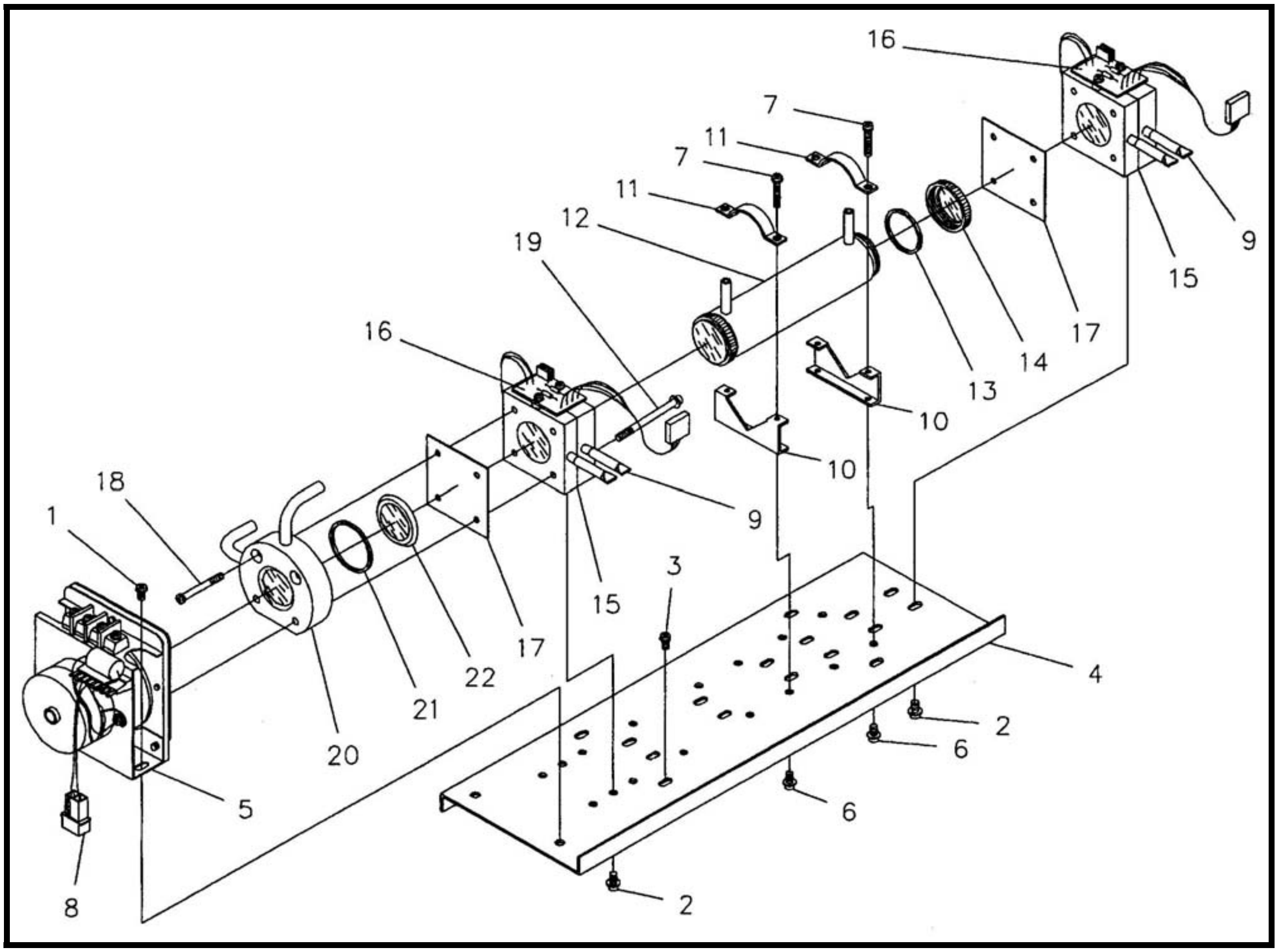


Figure 5-3 Optical Bench with Pipe and Block Type Sample Cells

Item	Description	Item	Description
1-3	Screw (M4)	13	O-Ring
4	Base	14	Window
5	Infrared source unit	15	Detector
6	Screw (M4)	16	Bridge circuit board
7	Screw	17	Optical filter (if installed
8	Connector	18	Screw (Flat Head)
9	Sealed tubes	19	Screw (Round or Flat Head)
10	Support	20	Block Sample Cell
11	Clamp	21	0-Ring
12	Pipe sample cell	22	Window

5.3.3. Disassembly of Combination Pipe & Block Type Cells

(Figure 5-3)

a) Discontinue the sample gas flow. When it contains harmful gas, purge the measuring cell sufficiently with zero gas.

b) Turn OFF the power switch.

c) After loosening the retaining screws on the sides of the top cover, lift off top cover and locate the block cell.

d) Disconnect the inlet and outlet tube from both measuring cells.

e) Disconnect the wires from the two terminal screws of the infrared source unit and unplug the 2-pin connector (No. 8 in figure 5-3) from the chopper motor.

f) Disconnect the block cell's detector output-cable-connector from the main circuit board.

g) Remove the two screws (No. 1 in figure 5-3) that secure the infrared source unit to the base.

h) Remove the sub-assembly consisting of the source unit, block cell, and detector.

i) Remove the two screws (No. 19 in figure 5-3) that secure the detector to the infrared source then separate the detector and block cell from the infrared source unit.

j) While holding the detector in the palm of your hand, remove the two flat-head screws (No. 18 in figure 5-3) which fix the cell to the detector.

Note: the cell window (No. 10 in figure 5-2) is loose and is only retained by the clamping action between the detector and the block ample cell Take care not to drop the window when separating the block cell from the detector.

k) Clean the cell interior and CaF_2 windows using a soft cloth or tissue (see Note on previous page). Inspect the O-Ring for flatness or deterioration and replace if necessary.

l) The block cell can be re-assembled by following the reverse of the disassembly procedures. Note the orientation of the loose window and 0-ring during disassembly.

Note: Before re-installing the infrared source unit, block cell and detector sub-assembly you should first remove and clean the pipe cell.

m) Remove the pipe cell retaining screws (No. 7 in figure 5-3)

n) Remove the retaining clamps (No. 11 in figure 5-3).

o) Lift the pipe cell out of its two supports (No. 10. in figure 5-3) and remove both windows (right-hand threaded) (No. 14 in figure 5-3).

p) At this time, inspect the O-Ring (No. 13 in Figure 5-1) for signs of deterioration. Replace if necessary.

q) The CaF_2 window is bonded to the window holder. Inspect and clean the windows as necessary using cotton swabs and a suitable cleaning solution.

Alcohol or an alcohol-based glass cleaner is a suitable cleaning solution. A soft cloth or tissue that will not deposit lint should be used to clean the liner & windows.

r) The pipe cells contain a reflective metal foil liner (not shown in Figure 5-1) to enhance the light energy through put in the cell. Normally it is not necessary to remove the liner for cleaning; however, the liner should be removed if the cell is subjected to grossly excessive moisture. If necessary, clean both sides of the liner and the inside of the pipe cell. If the liner has been subjected to a corrosive substance, it should be replaced. In either case, ensure that the small gas holes in the liner are aligned with the gas fittings at both ends of the pipe cell before reassembling the windows.

s) The pipe cell can be re-assembled and installed by placing it in its supports and securing with its retaining brackets.

Note: Before tightening the retaining brackets, be certain that a gap of approximately 0.5-1.0 mm exists between the pipe cell and the pipe cell detector.

t) Reinstall the infrared source unit, block cell and detector sub-assembly by performing steps e, f, g, h, and I in reverse, being sure to leave a slight gap of approximately 0.5-1.0 mm between the back of the block cell and the front pipe-cell window.

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6. DESIGN AND FUNCTION OF ELECTRONIC CIRCUITRY

6.1. AC Signal Processing (NDIR'S only)

The concentration of the measured gas component is converted into an AC electric signal by the microflow sensor contained inside the detector assembly (see Section 2 for details). This signal is amplified by AC amplifier *U1* on the main circuit board. The amplified AC signal can be checked at TP-2 with an oscilloscope. The output of *U1* is further amplified by AC amplifier *U2: B*. The output of *U2: A* is adjusted to approximately 12 Volts peak-to-peak (pp) at TP-2 by R1 while zero gas is flowing. The amplitude of this 10-Hertz AC signal reduces as the concentration of the measured component increases.

The AC signal is fed into rectifier *U2: B*, whose output is further smoothed and filtered by U3: *A*. The output of *U3: A* can be observed at TP-7 as a DC voltage of approximately +2.2 VDC with zero gas flowing. The voltage will decrease as the measured concentration increases.

6.2. DC Signal Processing

The DC signal is applied to the final amplifier *U4*. The output of this amplifier is a DC signal that is representative of gas concentration, where zero (0) VDC is equal to zero (0) ppm and 1.70 VDC is approximately equal to the full-scale value of the highest range.

The output of the main amplifier PC board is then fed into the microprocessor based digital display for linearization and selection of each range. A 0-10 VDC or 4-20 mA output is provided by the display module and is wired to the output connector on the back of the analyzer.

7. ADJUSTMENTS CHECKS AND REPAIRS

7.1. Adjustment of Detector Voltage (NDIR'S only)

Note: Adjustment is required if detector or main PC board is replaced.

The detector operating voltage is specified on the detector below the serialization number and type designation. The voltage supplied to the detector can be measured between TP-6 (+) and TP-5 (common). Adjust R4 to achieve the voltage specified on the detector to within 0.01 VDC.

WARNING: The detector may be damaged if the applied voltage is excessive. For this reason, it is recommended to leave J1 disconnected until after the voltage has been adjusted whenever the detector or circuit board has been replaced.

7.2. Coarse Gain Adjustment

Note: Adjustment is required if detector or main PC board is replaced.

a) Connect a DC Voltmeter between TP-3 (+) and TP-5 common. With zero gas flowing, adjust R1 until a DC voltage of 0 Volts is obtained.

Note: If zero (0) VDC is not achievable at TP-3, perform the following:

- ***Connect a DC voltmeter to the TP-1 (+) and TP-5 common.***
- ***Adjust R1 fully counterclockwise.***
- ***Test, select, and install a resistor into the now vacant position of R36 or R37 (one or the other but not both) as required to achieve a voltage of 0 VDC ± 1.0 VDC.***
- ***Repeat step 7.2 a)***

b) Adjust the front panel zero potentiometer for a zero reading on the digital display while the zero gas is still flowing.

c) Flow a span gas into the analyzer and adjust the front panel span-potentiometer for an appropriate reading on the digital display.

d) Verify that both zero and span potentiometers indicate 4.00 - 6.00 on their respective dials. Readjust R1 as required for slightly higher or lower peak-to-peak amplitude.

7.3. Check and Repair Detector

(No. 15 in Figure 5-1)

7.3.1. Problem:

Microflow sensor broken, bridge resistor defective or gas leak in detector.

7.3.2. Symptom:

Zero adjustment impossible.

7.3.3. Check and/or replace:

a) The microflow sensor and bridge resistors (No. 16 in Figure 5-1) are normal when DC voltages of about 1.5 to 2V are measured between bridge circuit board terminals numbered 1-3 and between terminals numbered 2-3, respectively, and the difference between these voltages is a few tenths of a volt.

b) Connect an oscilloscope between main circuit board check terminals TP-5 (common) and TP-1. When main circuit board, infrared light source unit and chopper are normal (see item a)), but AC waveform (approximately 10 Hz) is not observable at TP-1, gas is leaking in the detector and the detector should be replaced.

c) When check in item a) (above) indicates abnormal voltage, turn the power switch to OFF, and disconnect detector connector J1 between the bridge resistor PC board and the main PC board.

d) Check the microflow sensor for its resistance. Measure resistance values between terminals 1-3 and between terminals 2-3, respectively, on the bridge circuit board. When the resistance values are about 25 to 50 ohms, the microflow sensor is normal, but the bridge resistor is defective. If the resistance is infinite, the microflow sensor is faulty.

e) Replacement: Replace the detector with a new one (refer to 5.2). If the instrument is using the pipe cell, the detector is attached to the optical bench from below. Remove the four screws (No. 3 of Figures 5-1 and 5-3) that secure the base (No. 4 of Figures 5-1 and 5-3) to access the detectors retaining screws (No. 2 of figures 5-1 and 5-3).

f) After the detector has been replaced, adjust the detector voltage to the specified value.

g) Adjust zero and span.

7.4. Check and Repair Infrared Light Source Unit

(No. 5 in Figure 5-1)

7.4.1. Problem:

A faulty infrared light source or a leaky gas seal.

7.4.2. Symptom:

The unit reads off scale or the output is unstable.

7.4.3. Check and/or replace:

a) After turning the power switch to OFF and disconnecting the lead wires from the two terminal screws, measure the resistance between the two terminals. The resistance should normally be about 38 ohms. If the resistance is infinite, the infrared light source is faulty (Output drifts in the negative direction as resistance decreases).

b) When indicator output drifts due to influence from atmosphere in spite of normal operations of the detector and main circuit board, gas may be leaking into the infrared light source unit.

Note: In the case of a low-concentration CO_2 analyzer, the indicator output may fluctuate due to atmospheric CO_2 penetrating the gaps in the optical bench. This would be normal and not necessarily indicative of a problem. Purge the analyzer case with N_2 gas.

c) Replacement: After disconnecting wires from the two terminal screws and motor connector, remove the two screws that are used to attach the infrared light source unit to the optical bench. The light source assembly can be replaced, referring to Figure 5-1 or Figure 5-2.

d) After replacement of the infrared light source unit, adjust the zero level and span.

7.5. Check and Replace Chopper

(See Figure 2-1)

7.5.1. Problem:

Rotation abnormal.

7.5.2. Symptom:

Indicator output unstable or unresponsive.

7.5.3. Check and/or replace:

a) With the power switch turned ON, listen for a frictional noise from the chopper blade. If noise can be heard, it is necessary to adjust the chopper blade so that no contact is made with other parts. Remove the infrared light source assembly and detach the protective cover for access to the chopper blade. Take care not to damage the blade, as it is made of thin material. No adjustment is required as long as the output is normal.

b) If the motor shaft does not rotate after energizing the instrument, disconnect the power supply connector from the motor and check to see if AC 100 Volts is supplied to the connector on the power supply side. When power is supplied but the motor shaft does not rotate, check the shaft and blade sector for an obstruction. When the motor does not rotate, and there is no abnormal contact on the shaft or sector blade, the motor itself is defective.

c) Replacement: When the motor is defective, the infrared light source assembly must be replaced (refer to 7.2).

7.6. Check and Repair Measuring Cell

Detector Window and Infrared Light Source Window

7.6.1. Problem:

Cell and window badly contaminated.

7.6.2. Symptom:

Zero adjustment impossible.

7.6.3. Check and or replace:

After removing the measuring cell, check the cell and windows for contamination. If contaminated, remove contaminant with a soft cloth and alcohol. Take care not to damage the windows since they are fragile. For details, refer to section 5.2 of this manual.

7.7. Check and Repair Tubing Trouble

7.7.1. Problem:

Tubing loosened, disconnected, contaminated, or restricted.

7.7.2. Symptom

Indicator output unstable or response is too to slow.

7.7.3. Check and/or replace:

a) When tubing is disconnected or loosened, firmly reconnect it.

b) When tubing is contaminated or restricted, disconnect it and blow out contaminants with high-pressure air, or replace the tubing.

7.8. Check and Repair Main Circuit Board

7.8.1. Power Supply Circuit Checks:

a) Check transformer secondary voltages: Transformer secondary voltages should be approximately 17 VAC and 100 VAC.

b) Check positive power supply voltage: check positive power supply voltage across TP-5 (-) and TP-8 (+). The voltage is adjusted by R33; it normally should be 14 VDC ± 0.3V.

c) Check the other power supply across pin 6 of J2 (+) and TP-5. The voltage should be +12 VDC (± 0.1V).

d) Negative power supply voltage: check the negative power supply voltage across pin 8 of J2 (+) and TP-5 (-). The Voltage should be 12 VDC (± 0.1V).

e) Detector voltage: check the detector voltage across terminals TP-6 (+) and TP-5 (-). The voltage should be at the level specified on the detector. Adjust R4 as necessary.

7.9. Check and Repair Amplifier Circuit

The amplifier circuits should be checked after making sure that the power supply circuit is operating properly (Section 8.6.1).

7.9.1. Amplifier Circuit Checks:

a) Connect an oscilloscope across check terminals TP-2 (+) and TP-5 (-) and observe the AC wave form. While zero gas is flowing, the amplitude of the waveform should be approximately 12 Volt peak-to-peak as shown below. This can be adjusted with R1 on the main board; however, a contaminated cell can cause a reduction in amplitude. ***Note: Check cell first for contamination and clean if necessary.***

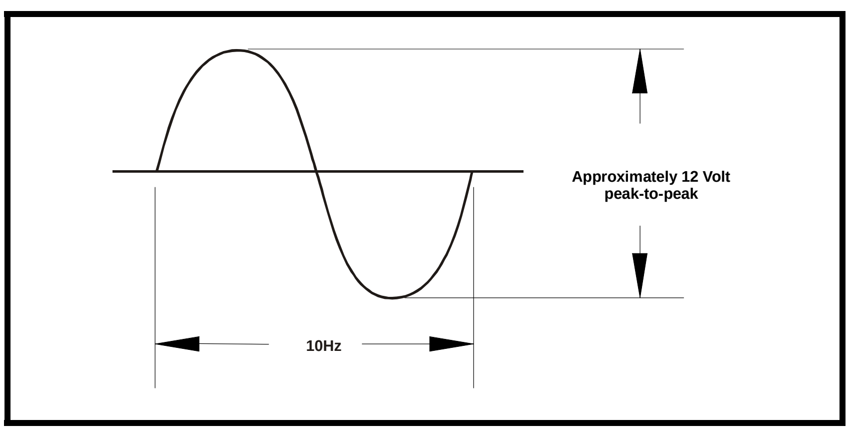

Figure 7-1 Amplifier Circuit AC Wave Form

b) If an AC waveform cannot be observed in step a) above, observe the AC waveform across terminals TP-1 (+) and TP-5 (-). If an AC waveform of 10 Hz and “peak-to-peak” amplitude of 20 to 50 mv is observed, AC amplifier U1 is normal and AC amplifier U2 is defective.

c) If an AC Waveform is not observed across terminals TP-1 (+) and TP-5 (-), check the detector per section 7.1 of this manual.

8. APPENDIX A

8.1. Trouble Shooting Flow Charts

A 1 No Display or Change Of Indicated Value

A 2 Zero Adjustment Impossible

A 3 Indicator Reading Unstable (Display or Analog Output)

A 4 Response Too Slow

A-5 Resetting at Zero Too Slow

A-6 Excessive Drift

A-1 No Display or no Change of Indicated Value

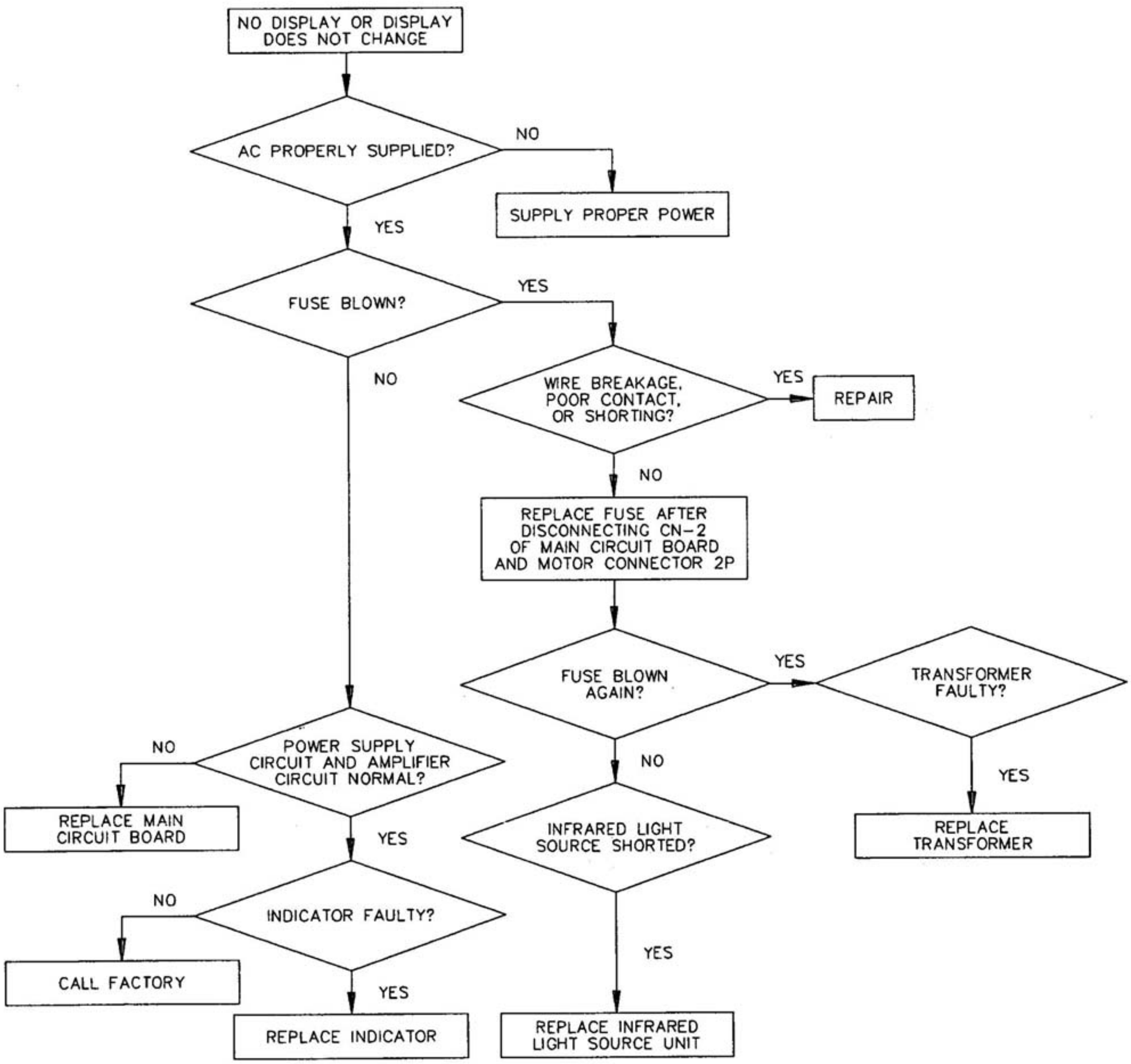

Figure 8-1 A 1 No Display or Change Of Indicated Value

A-2 Zero Adjustment Impossible

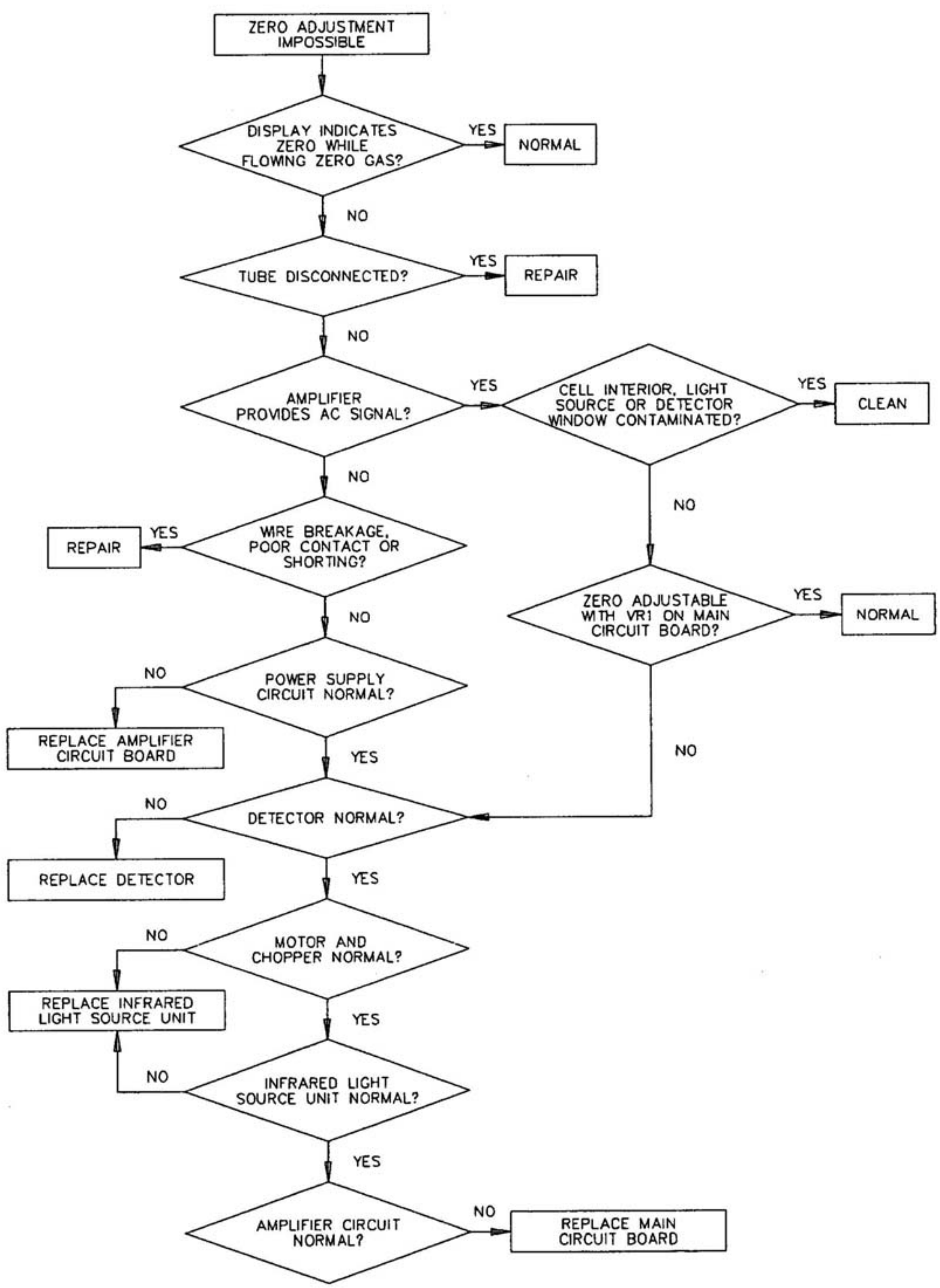

Figure 8-2 A-2 Zero Adjustment Impossible

A-3 Indicator Reading Unstable (Display or Analog Output)

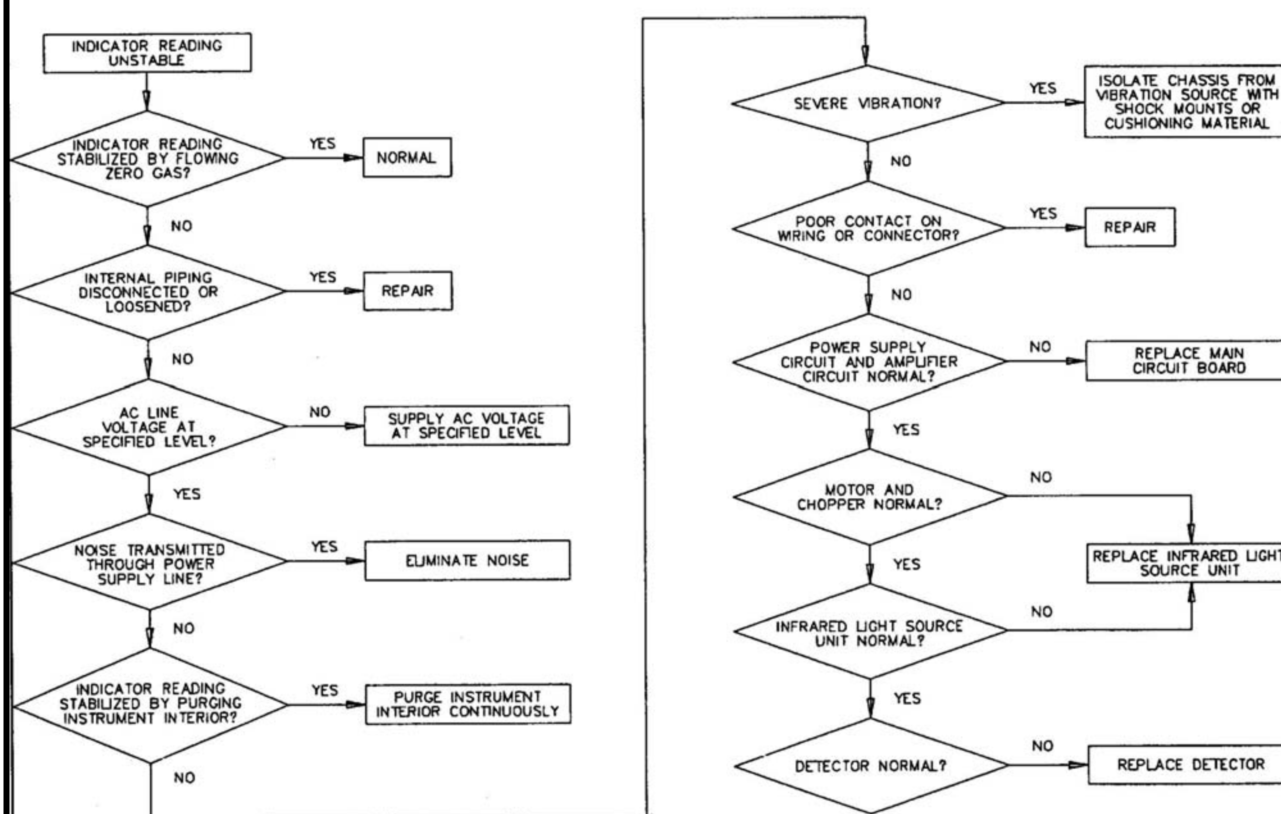

Figure 8-3 Indictor Reading Unstable (Display or Analog Output)

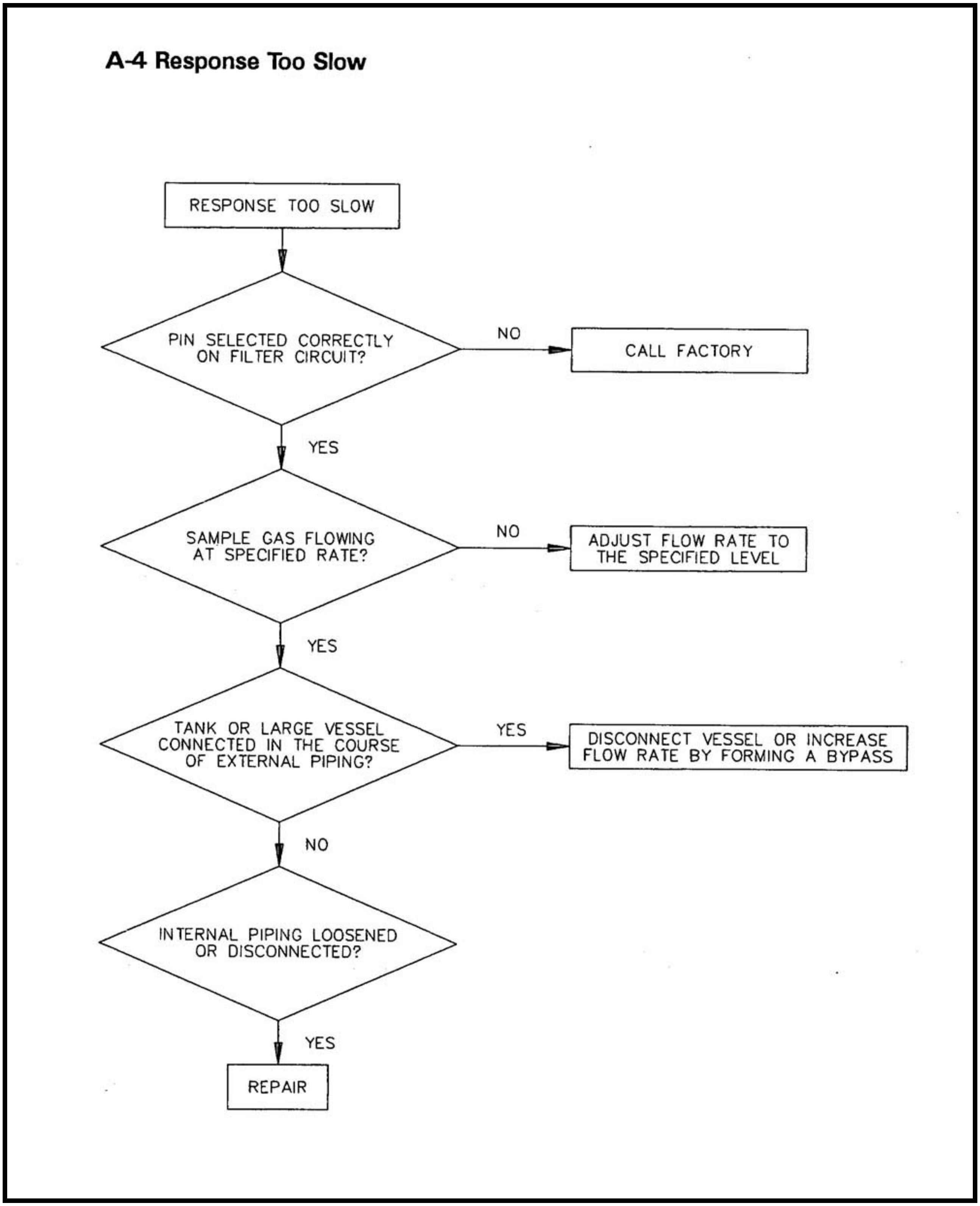

Figure 8-4 Response Too Slow

A-5 Resetting at ZERO Too Slow

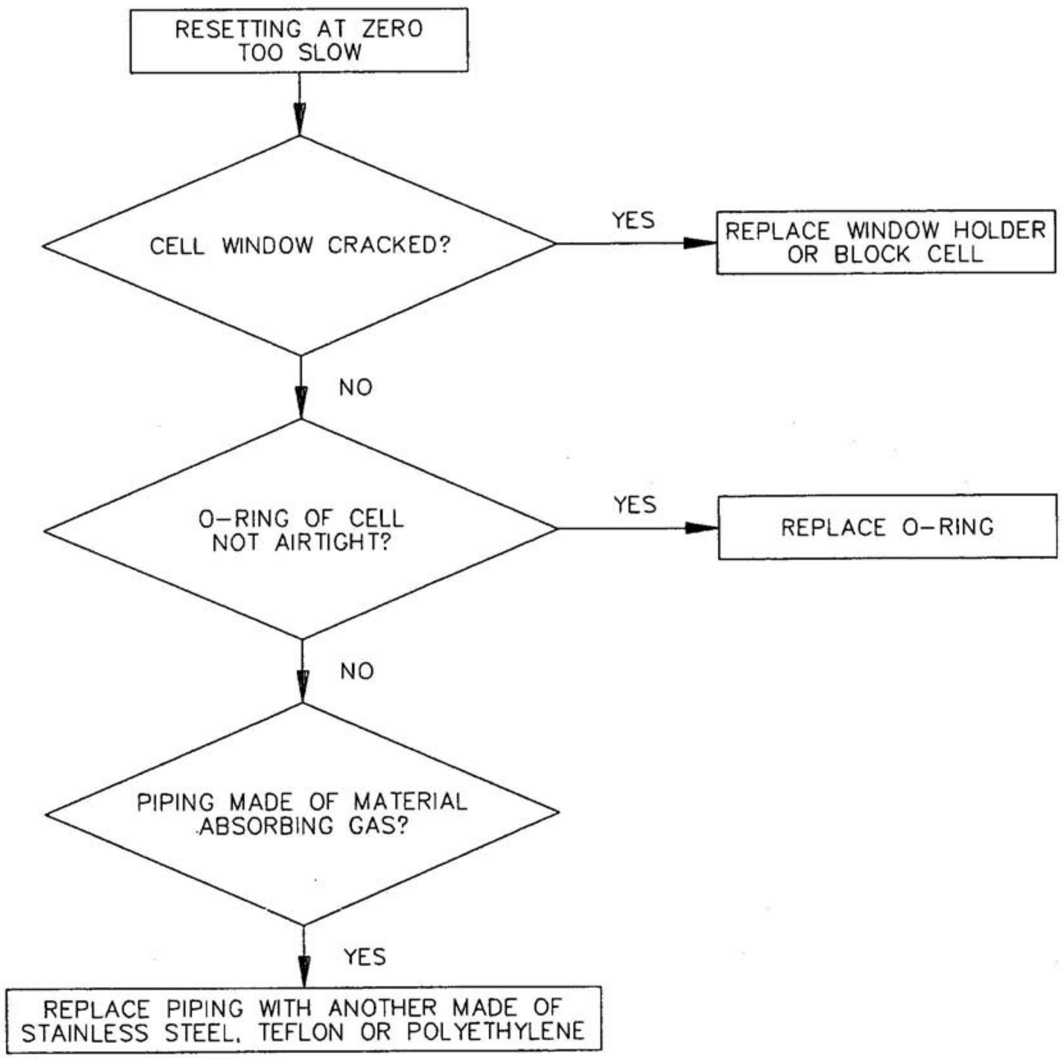

Figure 8-5 Resetting at Zero Too Slow

A-6 Excessive Drift

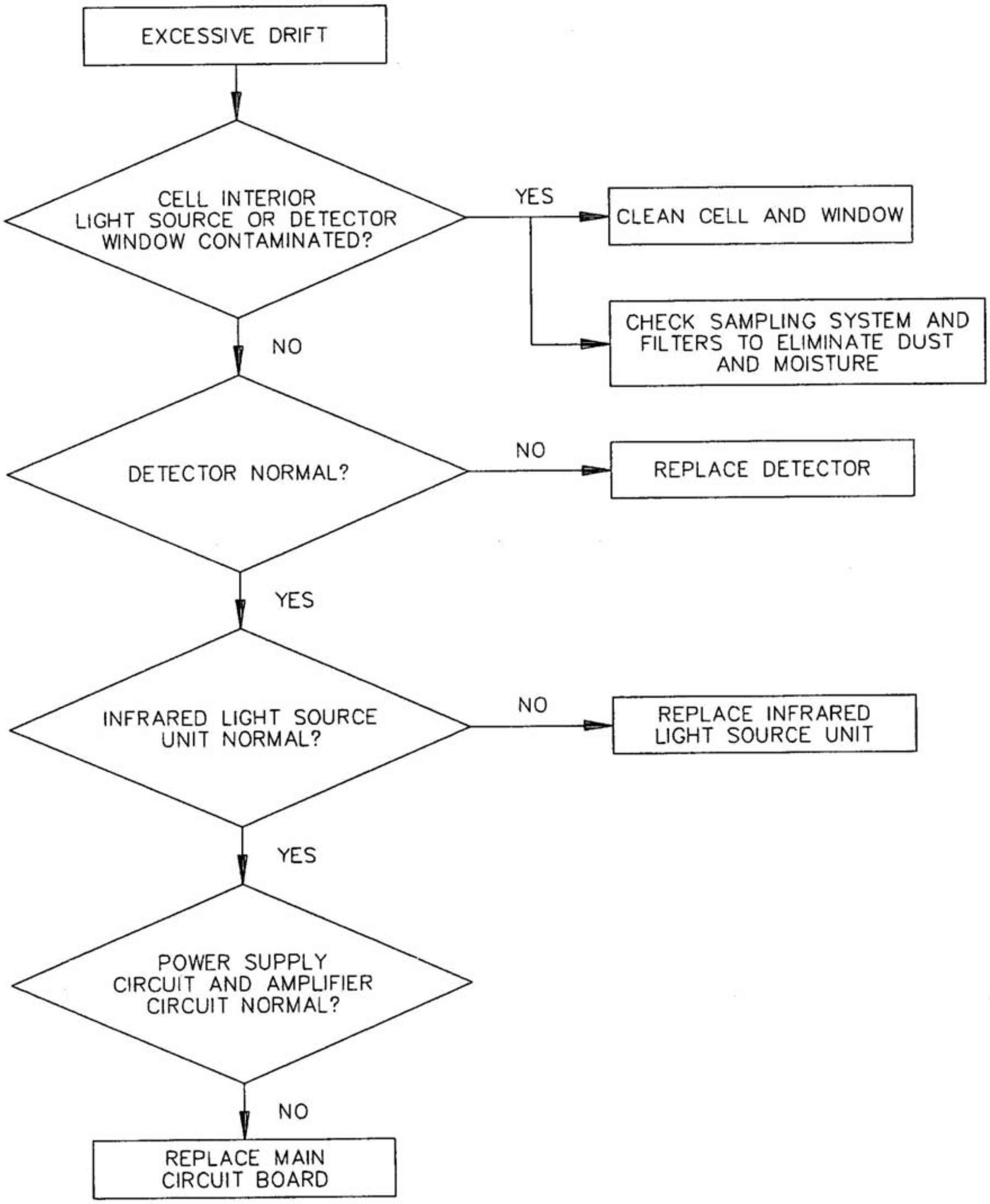

Figure 8-6 Excessive Drift

9. APPENDIX B

9.1. Mechanical & Electrical Drawings

B-1 Analyzer Front Panel Outline & Mounting Dimensions

B-2 Analyzer Top View Outline & Mounting Dimensions

B-3 NDIR Amplifier Schematic Diagram

B-3 NDIR Component Layout Drawing

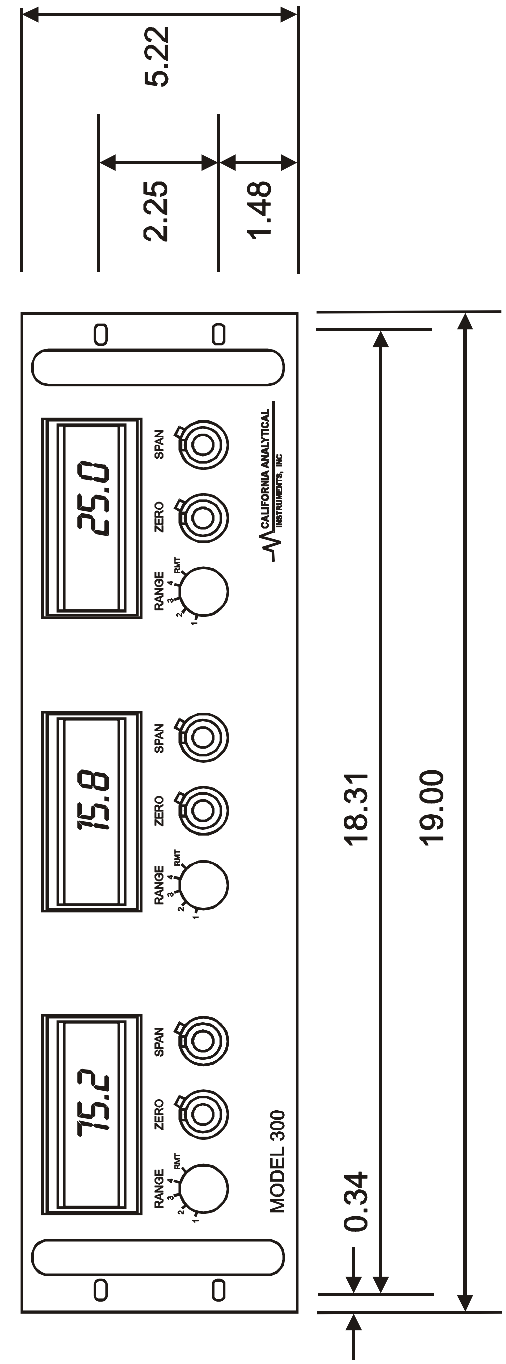

Figure 9-1 B-1 Analyzer Front Panel Outline & Mounting Dimensions

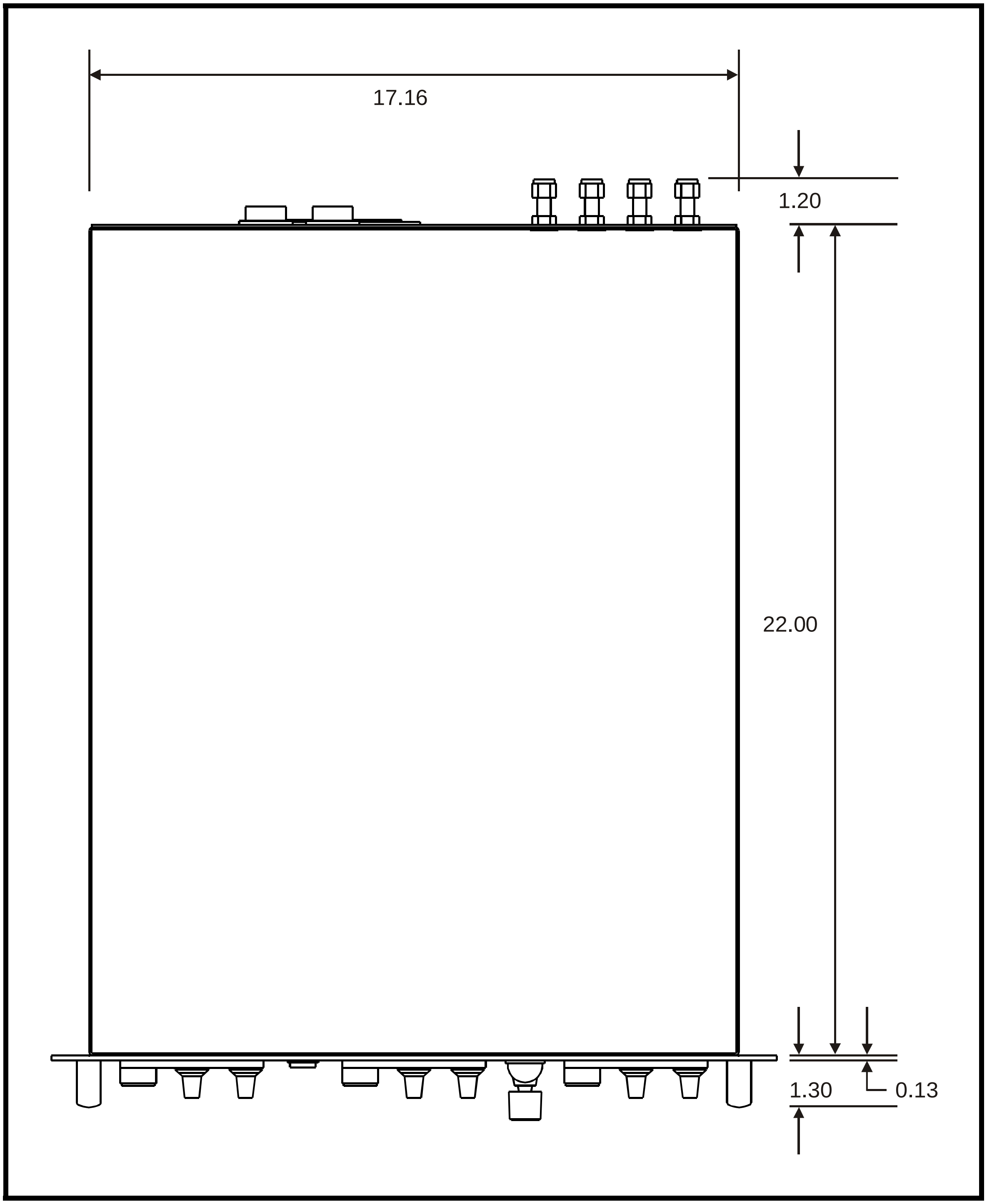

Figure 9-2 B-2 Analyzer Top View Outline & Mounting Dimensions

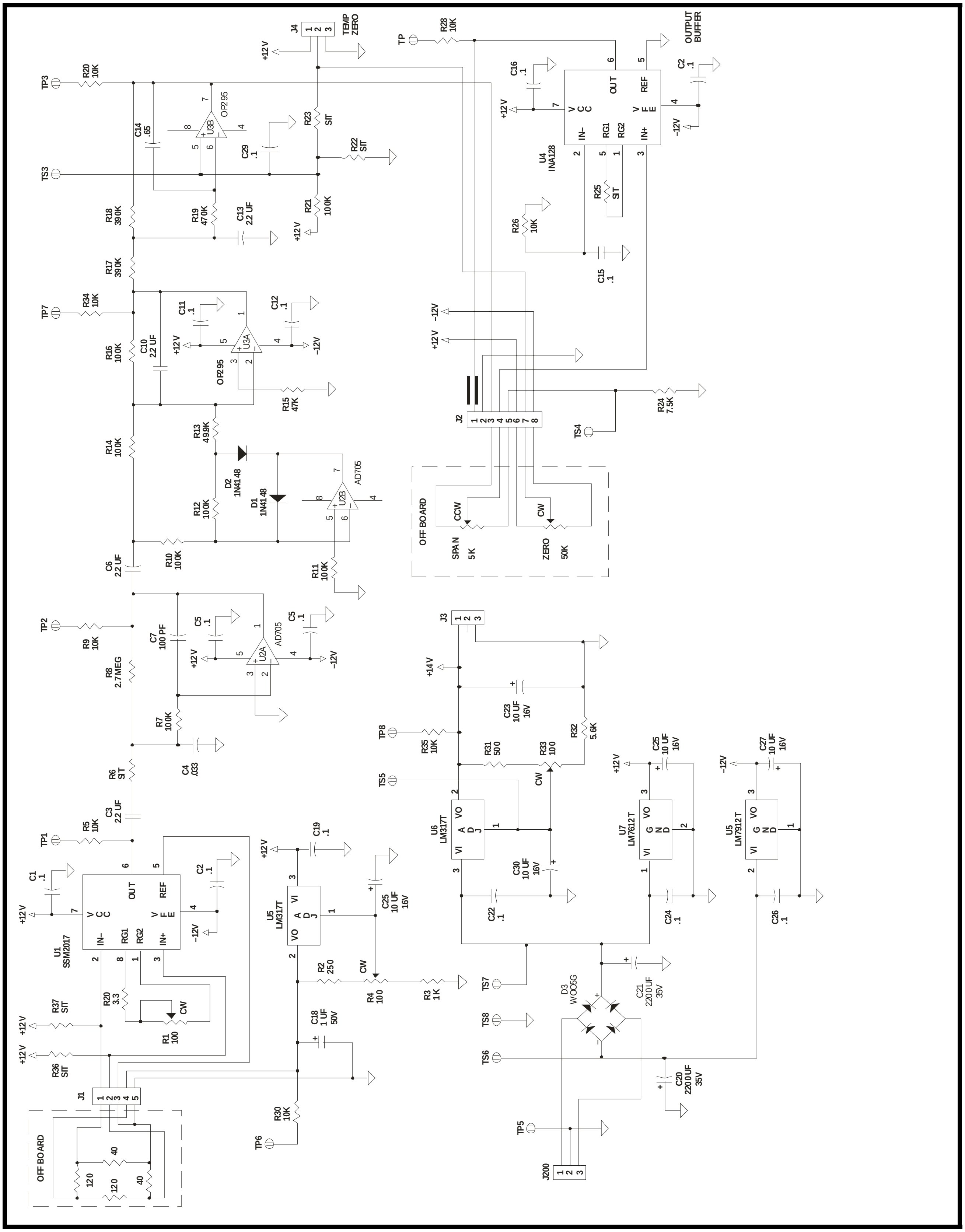

Figure 9-3 B-3 NDIR Amplifier Schematic Diagram

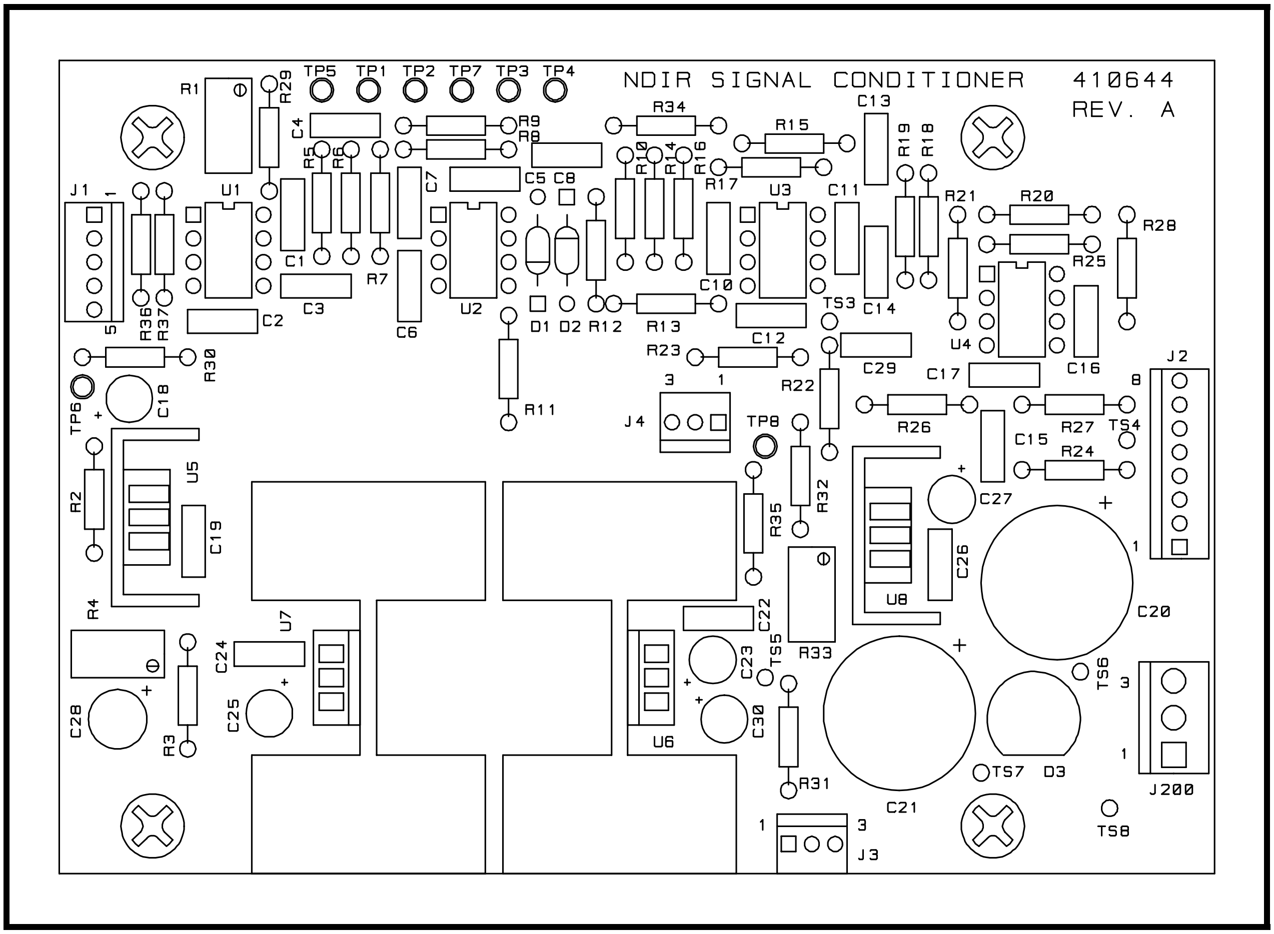

Figure 9-4 B-4 NDIR Component Layout Drawing