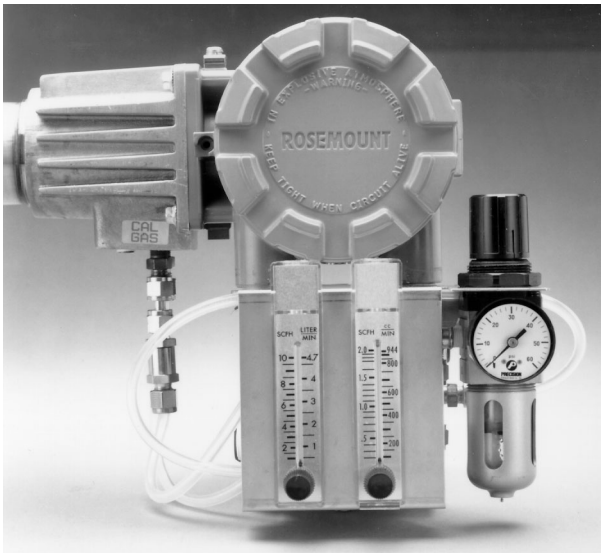
Instruction Manual
IB-106-340AC Rev. 1.1
April 2001

SPS 4000

Single Probe
Autocalibration Sequencer



ROSEMOUNT® Analytical

http://www.processanalytic.com

EMERSON™ Process Management

ESSENTIAL INSTRUCTIONS
READ THIS PAGE BEFORE PROCEEDING!

Rosemount Analytical designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you **MUST properly install, use, and maintain them** to ensure they continue to operate within their normal specifications. The following instructions **MUST be adhered to** and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- **Read all instructions** prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, **contact your Rosemount Analytical representative** for clarification.
- **Follow all warnings, cautions, and instructions** marked on and supplied with the product.
- **Inform and educate your personnel in the proper installation, operation, and maintenance of the product**.
- **Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes**. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, **use qualified personnel** to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, **and VOID YOUR WARRANTY**. Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- **Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury**.

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

Emerson Process Management

Rosemount Analytical Inc.
Process Analytic Division
1201 N. Main St.
Orrville, OH 44667-0901
T (330) 682-9010
F (330) 684-4434
e-mail: gas.csc@EmersonProcess.com

http://www.processanalytic.com

EMERSON™
Process Management

HIGHLIGHTS OF CHANGES

Effective Feb., 1999 Rev. 1.0

Page	Summary
Page 1-1	Added note concerning the Oxymitter 5000.
Page 1-2	Added the Oxymitter 5000 to the product matrix in Table 1-1. Removed the disposable gas bottles and flow regulators from the product matrix in Table 1-1 and created Table 1-2 to distinguish these components as separate order items because the calibration gas bottles cannot be shipped via airfreight.
Page 7-1	Added Table 7-2 to list the calibration gas bottles and flow regulators as replacement parts.

Effective April, 2001 Rev. 1.1

Page	Summary
Page 7-1	Table 7-1; changed part number of solenoid, items 24 and 30.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

PREFACE

The purpose of this manual is to provide information concerning the components, functions, installation and maintenance of the SPS 4000 Single Probe Autocalibration Sequencer.

Some sections may describe equipment not used in your configuration. The user should become thoroughly familiar with the operation of this module before operating it. Read this instruction manual completely.

DEFINITIONS

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this publication.

WARNING

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in injury, death, or long-term health hazards of personnel.

CAUTION

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in damage to or destruction of equipment, or loss of effectiveness.

NOTE

Highlights an essential operating procedure, condition, or statement.

⏚ : EARTH (GROUND) TERMINAL

⏚ : PROTECTIVE CONDUCTOR TERMINAL

⚠ : RISK OF ELECTRICAL SHOCK

⚠ : WARNING: REFER TO INSTRUCTION BULLETIN

NOTE TO USERS

The number in the lower right corner of each illustration in this publication is a manual illustration number. It is not a part number, and is not related to the illustration in any technical manner.

IMPORTANT

SAFETY INSTRUCTIONS FOR THE WIRING AND INSTALLATION OF THIS APPARATUS

The following safety instructions apply specifically to all EU member states. They should be strictly adhered to in order to assure compliance with the Low Voltage Directive. Non-EU states should also comply with the following unless superseded by local or National Standards.

1. Adequate earth connections should be made to all earthing points, internal and external, where provided.

2. After installation or troubleshooting, all safety covers and safety grounds must be replaced. The integrity of all earth terminals must be maintained at all times.

3. Mains supply cords should comply with the requirements of IEC227 or IEC245.

4. All wiring shall be suitable for use in an ambient temperature of greater than 75°C.

5. All cable glands used should be of such internal dimensions as to provide adequate cable anchorage.

6. To ensure safe operation of this equipment, connection to the mains supply should only be made through a circuit breaker which will disconnect all circuits carrying conductors during a fault situation. The circuit breaker may also include a mechanically operated isolating switch. If not, then another means of disconnecting the equipment from the supply must be provided and clearly marked as such. Circuit breakers or switches must comply with a recognized standard such as IEC947. All wiring must conform with any local standards.

7. Where equipment or covers are marked with the symbol to the right, hazardous voltages are likely to be present beneath. These covers should only be removed when power is removed from the equipment — and then only by trained service personnel.

8. Where equipment or covers are marked with the symbol to the right, there is a danger from hot surfaces beneath. These covers should only be removed by trained service personnel when power is removed from the equipment. Certain surfaces may remain hot to the touch.

9. Where equipment or covers are marked with the symbol to the right, refer to the Operator Manual for instructions.

10. All graphical symbols used in this product are from one or more of the following standards: EN61010-1, IEC417, and ISO3864.

SECTION 1
DESCRIPTION AND SPECIFICATIONS

NOTE

The SPS 4000 Single Probe Autocalibration Sequencer operates exactly the same with either the Oxymitter 4000 Oxygen Transmitter or the Oxymitter 5000 Oxygen Transmitter with FOUNDATION fieldbus Communications. Any references to the Oxymitter 4000 throughout this instruction bulletin also include the Oxymitter 5000. When referred to an instruction bulletin for more information, reference IB-106-340 for the Oxymitter 4000 and IB-106-340-FB for the Oxymitter 5000.

1-1 COMPONENT CHECKLIST

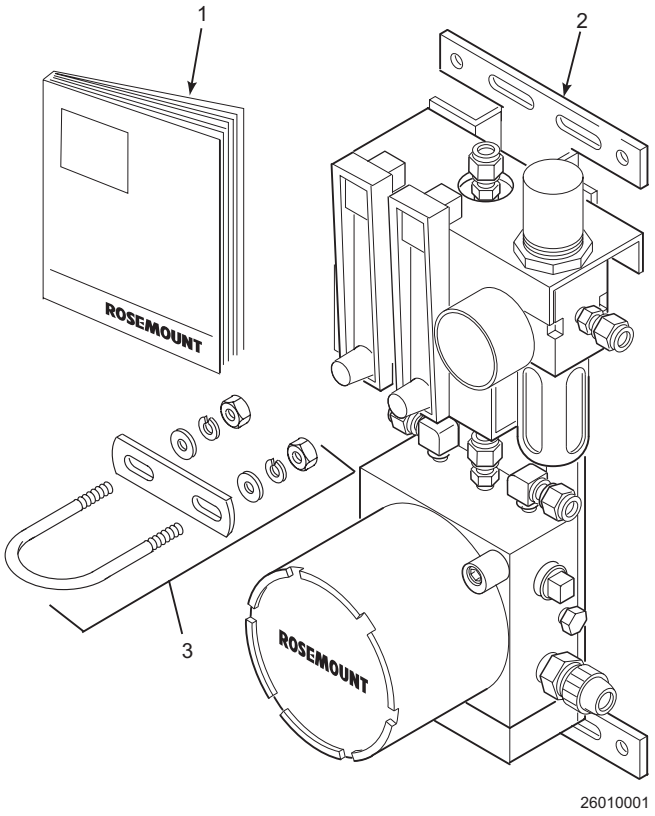
A typical SPS 4000 Single Probe Autocalibration Sequencer should contain the items shown in Figure 1-1. Record the part number, serial number, and order number for the SPS 4000 on the first page of this manual.

Also, use the product matrix in Table 1-1 to compare your order number against your unit. The first part of the matrix defines the model. The last part defines the various options and features of the sequencer. Ensure the features and options specified by your order number are on or included with the unit.

1-2 OVERVIEW

The SPS 4000 provides the capability of performing automatic, timed or on demand, calibrations of a single Oxymitter 4000 without sending a technician to the probe site.

The SPS 4000 can be mounted either directly to an In situ Oxymitter 4000 or at a remote location if space is limited. See Figure 1-2. However, this instruction bulletin only covers remote mounted sequencers. For information regarding integrally mounted sequencers, refer to the Oxymitter 4000 Oxygen Transmitter Instruction Bulletin. For information on equipping your existing Oxymitter 4000 with an integrally mounted SPS 4000, contact Rosemount.



1. Instruction Bulletin
2. SPS 4000 (shown with optional reference air components)
3. Optional Mounting Hardware (for pipe mounting)

Figure 1-1. Typical SPS 4000 Package

Table 1-1. Product Matrix

SPS 4000 B	Autocalibration System for Oxymitter 4000 or Oxymitter 5000. Mounted separate from the probe.

SPS 4000 Autocalibration System - Instruction Bulletin

Code	Oxygen Analyzer System
20	Used with Oxymitter 4000 or Oxymitter 5000 system (remote mounted only)

Code	Reference Air
1	No reference air required(1)
2	Reference air provided

Code	Fittings and Tubing(2)
1	Brass Fittings, Teflon Tubing
2	Stainless Steel Fittings and Tubing

Code	Electrical Classification
10	NEMA 4X
20	Hazardous Area Classifications - Cenelec EExd IIB + H2(3)
30	Hazardous Area Classifications (Class I, Div. I, Group B,C,D) - PENDING(3)

SPS 4000 B	20	1	1	10	Example

Notes:
(1)Reference air is recommended with 9 ft (2.74 m) and 12 ft (3.66 m) long probes. Reference air is also recommended when ambient air may not contain the normal 20.95% O_2, such as when the probe is mounted into a positive pressure duct with leaks or where there is a process unit nearby with leaks.

2)Customer to pipe from remote SPS 4000 to probe.

3)Hazardous area classifications require stainless steel fittings and tubing.

Table 1-2. Calibration Components

Part Number	Description
1A99119G01	Two disposable calibration gas bottles—0.4% and 8% O_2, balance nitrogen—550 liters each, includes bottle rack*
1A99119G02	Two flow regulators for calibration gas bottles

*Calibration gas bottles cannot be shipped via airfreight.

When the bottles are used with “CALIBRATION RECOMMENDED” features, the bottles should provide 2 to 3 years of calibrations in normal service.

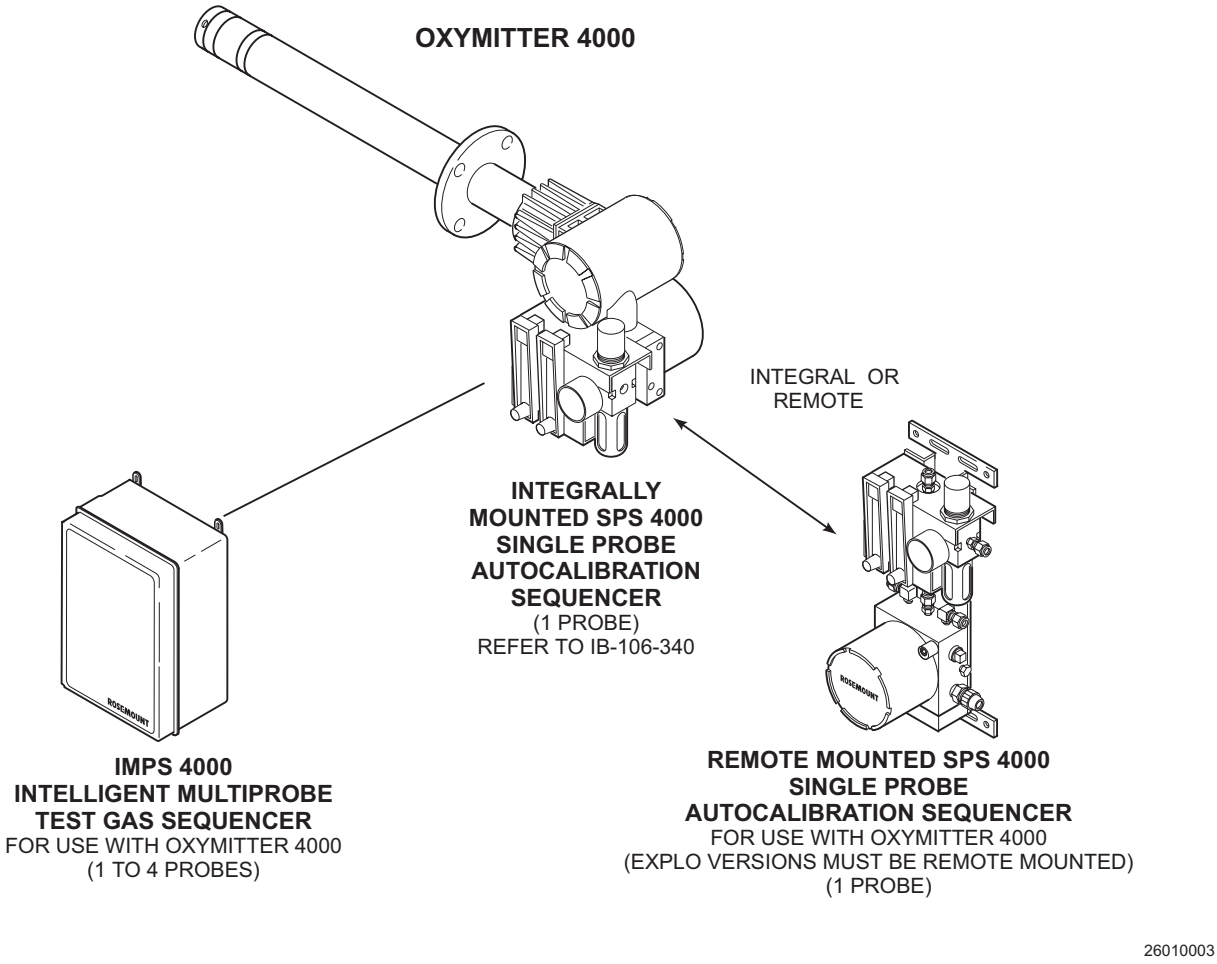


Figure 1-2. Autocalibration System Installation Options

In addition to the SPS 4000, multiprobe sequencers are also available as shown in Figure 1-2. Rosemount has offered multiprobe autocalibration sequencer systems for many years. These autocalibration systems are most cost effective for boilers and other combustion processes that utilize many probes. Users with only one probe per combustion process can now take advantage of Rosemount's autocalibration capability by utilizing the SPS 4000.

1-3 SPECIFICATIONS

Mounting	Integral to Oxymitter 4000 Remote from Oxymitter 4000
Materials of Construction	
Manifold/electronics enclosure	Aluminum
Mounting brackets	316 stainless steel (SS)
Pneumatic fittings	1/8 in. brass NPT (SS optional)
Pneumatic tubing	1/4 in. Teflon (SS optional)
Assembly hardware	Galvanized and stainless steel
Humidity range	100% relative humidity
Ambient temperature range	-40° to 149°F (-40° to 65°C)
Electrical classification	NEMA 4X (IP56)
Explosion-proof option (both pending)	CENELEC EExd IIB + H2 (Class 1, Div. 1, Group B, C, D)
Electrical feedthroughs	1/2 in. NPT
Input power	90 to 250VAC, 50/60Hz
Power consumption	5VA maximum
External electrical noise	EN 50 082-2, includes 4KV electrostatic discharge
Handshake signal to/from Oxymitter 4000 (self-powered)	5V (5mA maximum)
Cal initiate contact input from control room	5 to 30VDC, Form A (SPST) (one “In-Cal”, one “Cal Failed”)
Cabling distance between SPS 4000 and Oxymitter 4000	Maximum 1000 ft (303 m)
Piping distance between SPS 4000 and Oxymitter 4000	Maximum 300 ft (91 m)
Approximate shipping weight	10 lbs (4.5 kg)

CE Fisher-Rosemount has satisfied all obligations coming from the European legislation to harmonize the product requirements in Europe.

1-4 PHYSICAL DESCRIPTION

The main components of the SPS 4000 are described in the following paragraphs and illustrated in Figure 1-3.

a. Manifold

The manifold provides a mounting platform for the circuit board(s) and terminations and contains the electrical feedthroughs. Also, calibration gases are piped into and sequenced through solenoids mounted on the manifold.

b. Calibration Gas Solenoids

The calibration gas solenoids sequence the calibration gases. One solenoid controls calibration gas 1 (high calibration gas), and the other controls calibration gas 2 (low calibration gas). The solenoids activate and deactivate to allow the calibration gases to flow between the sequencer and Oxymitter 4000.

c. Pressure Switch

The pressure switch detects if the pressure of a calibration gas is low, which can be caused by an empty gas bottle, a disconnected gas line, etc. Calibration is prohibited when calibration gas pressure is low.

d. Power Supply Board

This board converts the incoming line voltage from AC to DC for use by the solenoids, terminations, and the programmable logic device. The power supply board also has a 5 A, 250 V, slow blow fuse.

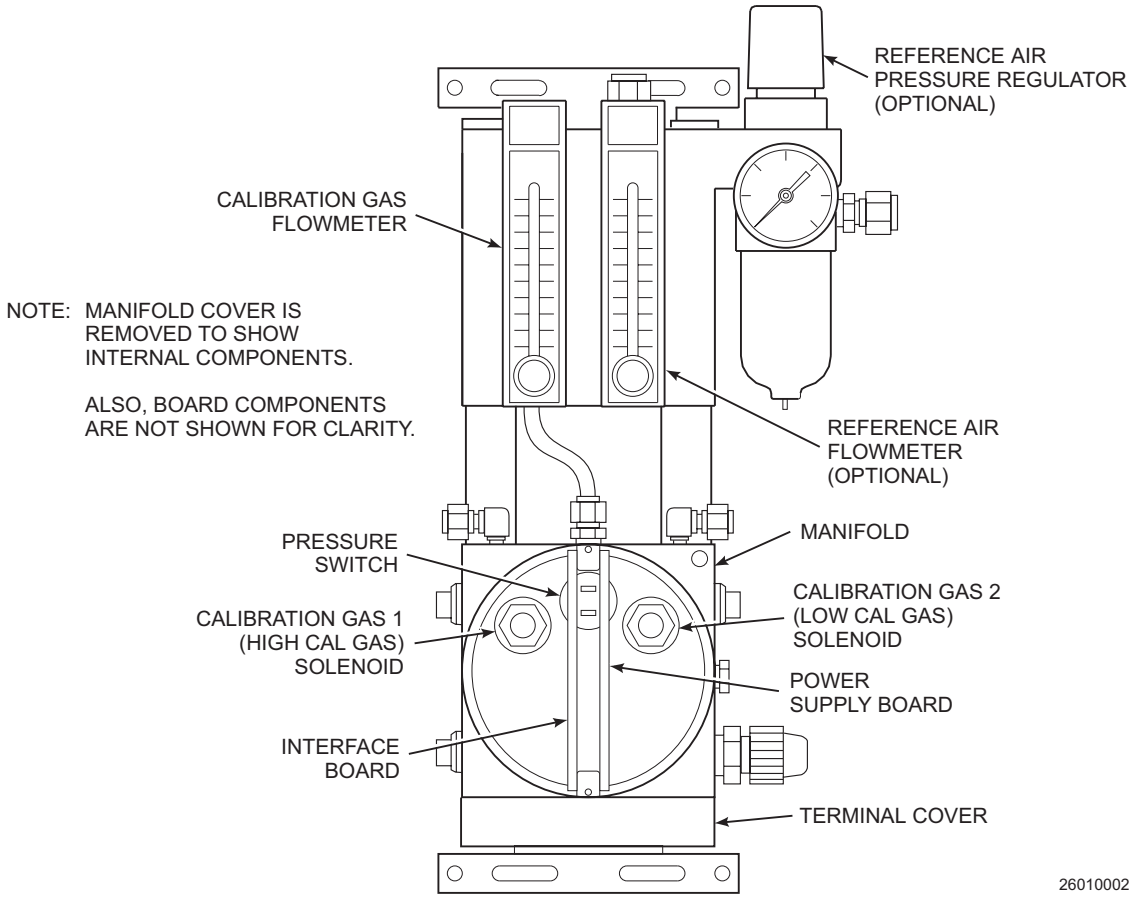


Figure 1-3. SPS 4000 Components

e. Interface Board

The interface board contains a programmable logic device (PLD) that has the electronics to energize and deenergize the solenoids based on a signal from the Oxymitter 4000.

f. Calibration Gas Flowmeter

The calibration gas flowmeter indicates the flow rate of calibration gas flowing to the Oxymitter 4000.

g. Reference Air Flowmeter (Optional)

The reference air flowmeter indicates the amount of reference air continuously flowing to the Oxymitter 4000.

h. Pressure Regulator (Optional)

The pressure regulator ensures the instrument air (reference air) flowing to the Oxymitter 4000 is at a constant pressure [20 psi (138 kPa)]. The regulator also has a filter to remove particulates in the reference air and a drain valve to bleed the moisture that collects in the filter bowl.

i. Terminal Strip

The terminal strip housed within the terminal cover provides convenient access for all signal and power user connections.

1-5 THEORY OF OPERATION

The Oxymitter 4000 is one of the few instruments found in industry that permit the permanent piping of a calibration standard into the probe. Most instruments measuring pressure, flow, or temperature require that a calibration standard be brought to the instrument or that the instrument be taken to the calibration source in the instrument shop.

The permanent calibration gas connections allow for auto-calibrations to occur without operator intervention. The following paragraphs describe how an Oxymitter 4000 is autocalibrated when used with the SPS 4000.

a. In addition to the calibration methods available via the Oxymitter 4000 keypad, HART communicator, AMS software, or a remote contact, the SPS 4000 works in conjunction with the Oxymitter 4000's CAL RECOMMENDED feature to perform an autocalibration. This feature automatically per-forms an impedance check every hour on the Oxymitter 4000. If a calibration is recommended and its contact output signal is set for "handshaking" with the sequencer, the Oxymitter 4000 sends a signal to the sequencer. The sequencer automatically performs a calibration upon receiving the signal.

Thus, no human interface is required for the automatic calibration to take place.

b. When a calibration is required, the Oxymitter 4000 sends a signal to the programmable logic device (PLD) on the interface board of the sequencer. The PLD energizes the calibration gas 1 (high O2) solenoid. Calibration gas 1 then flows through the sequencer to the Oxymitter 4000. The Oxymitter 4000 measures the oxygen content of calibration gas 1 and sends a signal to the sequencer indicating that it received the gas. When the sequencer receives the signal, the PLD deenergizes the calibration gas 1 solenoid.

c. Next, the PLD energizes the calibration gas 2 (low O2) solenoid, and calibration gas 2 then flows through the sequencer to the Oxymitter 4000. The Oxymitter 4000 measures the oxygen content of calibration gas 2 and sends a signal to the sequencer indicating that it received the gas. After measuring the two calibration gases, the Oxymitter 4000 automatically makes an internal calibration adjustment and sends the signal to the sequencer. When the sequencer receives the signal, the PLD deenergizes the calibration gas 2 solenoid.

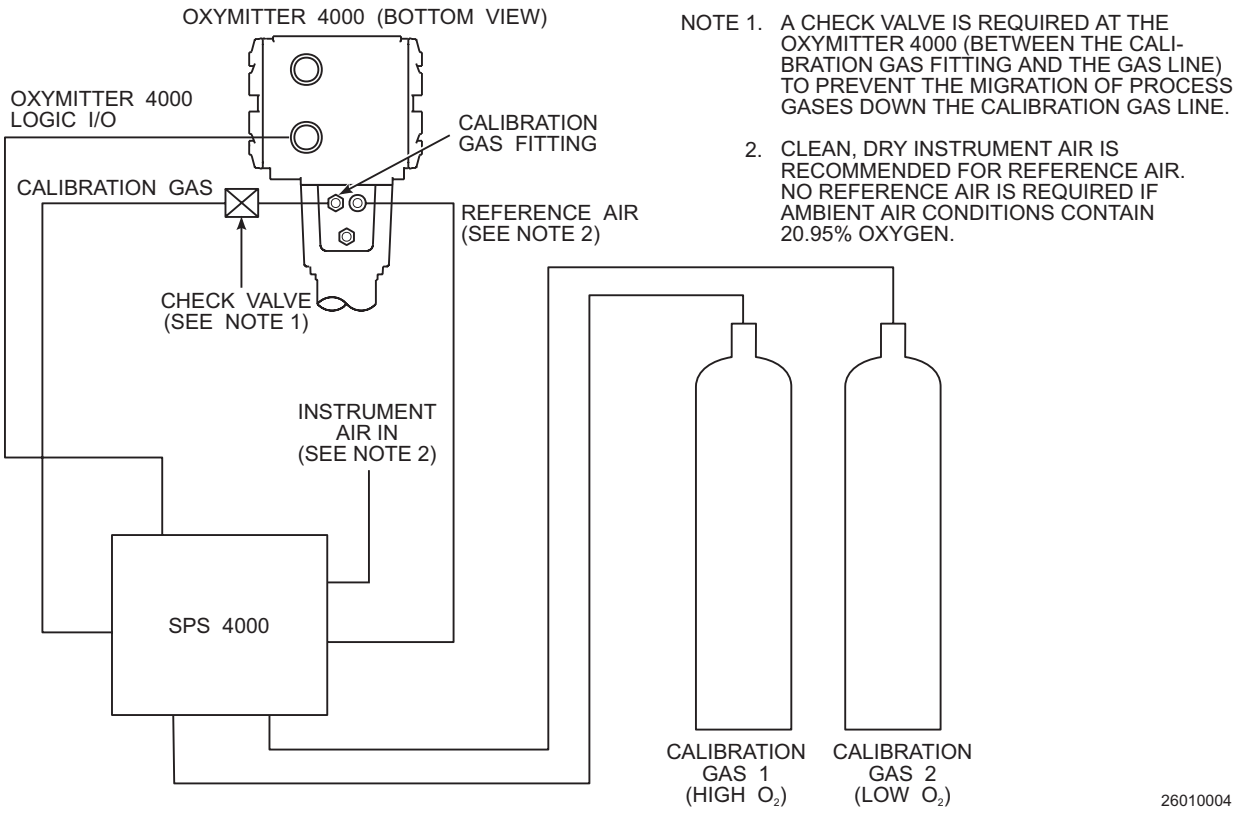


Figure 1-4. SPS 4000 Calibration Setup

SECTION 2
INSTALLATION

2-1 OVERVIEW

This section describes the installation of the SPS 4000.

WARNING

Before starting to install this equipment, read the "Safety Instructions for the Wiring and Installation of this Apparatus" at the front of this Instruction Bulletin. Failure to follow the safety instructions could result in injury or death.

WARNING

Install all protective equipment covers and safety ground leads after installation. Failure to install covers and ground leads could result in serious injury or death.

2-2 MECHANICAL INSTALLATION

The outline drawing in Figure 2-1 shows mounting centers and clearances of the SPS 4000. The unit is designed to mount on a wall, bulkhead, or pipe. Ensure the unit is installed according to the following specifications.

a. Install the unit no further than 300 ft (91 m) from the Oxymitter 4000 and no further than 1000 ft (303 m) from the electronics package or any customer-supplied remote input or relay output connections in the control room.

b. Locate the unit where the ambient temperature is between -40° and 149°F (-40° and 65°C).

2-3 GAS CONNECTIONS

Use the following procedure to connect the calibration gases and reference air.

a. Reference Air (Figure 2-1)

1. For units with the optional reference air components, connect the instrument air supply to the IN port of the pressure regulator.
2. The pressure regulator is factory set at 20 psi (138 kPa). If necessary, readjust by turning the knob on the top of the regulator until the desired pressure is obtained.
3. Next, connect the reference air from the upper 1/4 in. tube fitting on the reference air flowmeter to the REF GAS port on the Oxymitter 4000.

b. Calibration Gas (Figure 2-1)

1. Connect O2 calibration gas 1 (high calibration gas) to the HIGH CAL GAS IN 1/4 in. tube fitting on the top of the manifold. Ensure the calibration gas pressure is set at 20 psi (138 kPa).

CAUTION

Instrument air is not recommended for the high calibration gas. Do not use 100% nitrogen as a low gas (zero gas). It is suggested that the low (zero) gas be between 0.4% and 2.0% O2. Do not use gases with hydrocarbon concentrations of more than 40 parts per million. Failure to use proper gases will result in erroneous readings.

2. Connect O2 calibration gas 2 (low calibration gas) to the LOW CAL GAS IN 1/4 in. tube fitting on the top of the manifold. Ensure the calibration gas pressure is set at 20 psi (138 kPa).
3. Connect the calibration gas from the upper 1/4 in. tube fitting on the calibration gas flowmeter to the check valve connected to the CAL GAS port on the Oxymitter 4000.

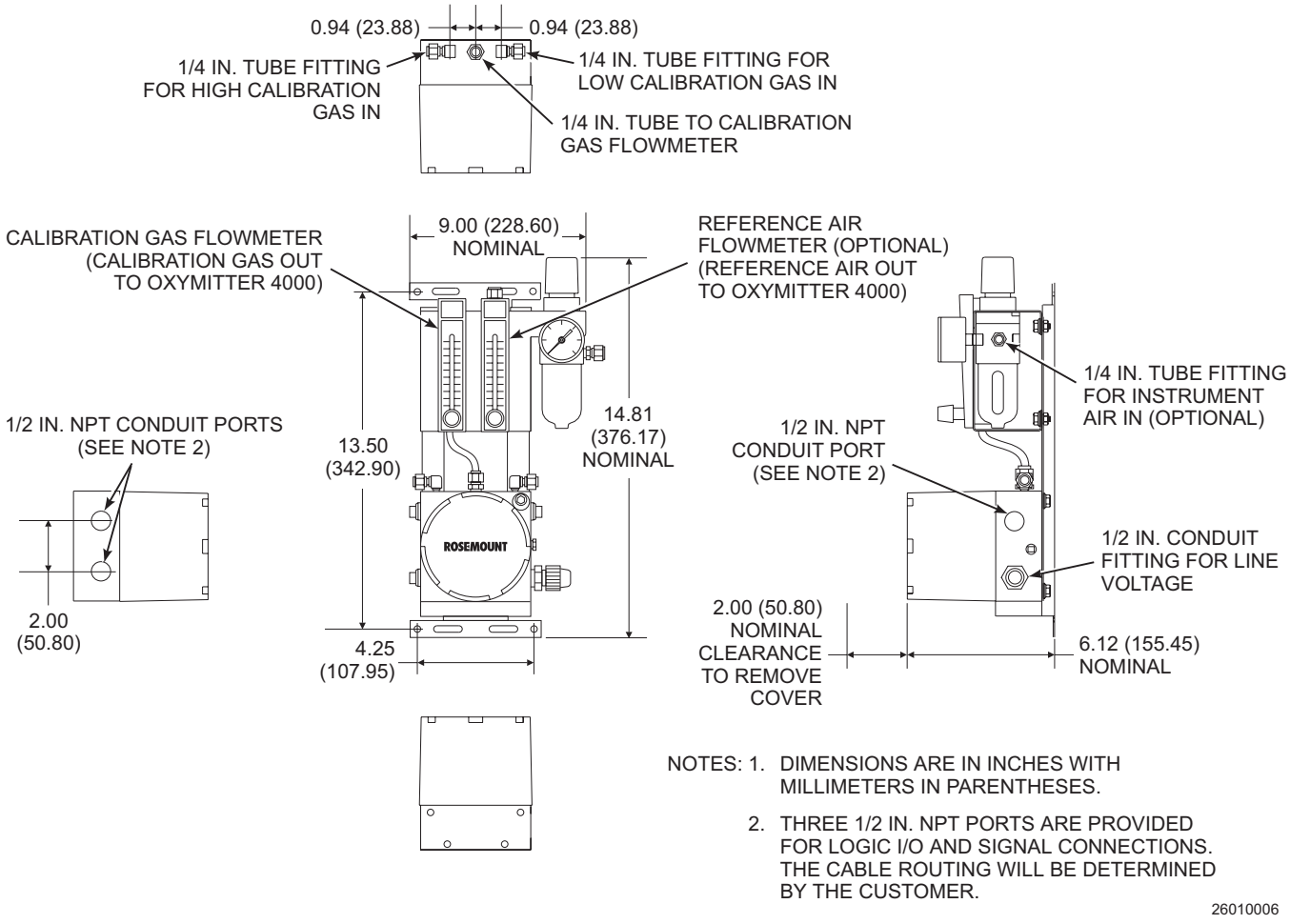


Figure 2-1. Installation

2-4 ELECTRICAL CONNECTIONS

All wiring must conform to local and national codes. Use the following procedure to connect an SPS 4000 to an Oxymitter 4000.

WARNING

Disconnect and lock out power before connecting the unit to the power supply.

NOTE

Ensure the Oxymitter 4000 is set up to handshake with the sequencer by configuring the logic I/O to mode 8. Refer to the Oxymitter 4000 Oxygen Transmitter Instruction Bulletin for more information.

a. Remove screws (20, Figure 4-1) securing terminal cover (19) and remove the cover.

b. Route the line voltage leads into the manifold through the lower 1/2 in. conduit fitting on the right side of the manifold (Figure 2-1) and out through the bottom of the manifold. Connect the incoming 90 to 250 VAC, 50/60 Hz line voltage leads to the terminal strip as indicated in Figure 2-2.

c. Route the handshake logic I/O wires through one of the 1/2 in. NPT conduit ports on the manifold (Figure 2-1) and out through the bottom of the manifold. Connect the 5V (5 mA maximum) logic I/O leads from the Oxymitter 4000 to the terminal strip as indicated in Figure 2-2.

d. To set up the SPS 4000 to initiate a calibration from a remote location, route the 5 VDC calibration initiate contact input through one of the 1/2 in. NPT conduit ports on the manifold (Figure 2-1) and out through the bottom of the manifold. Connect the input leads to the terminal strip as shown in Figure 2-2.

e. Relay output connections are available on the unit to signal when the Oxymitter 4000 is in calibration or when calibration failed. Relay outputs can be connected to either indicator lights or a computer interface. The relay contacts are capable of handling a 5 to 30 VDC maximum power source. The cabling requirement is 1000 ft (303 m) maximum. Route the relay output wires through one of the 1/2 in. NPT conduit ports on the manifold (Figure 2-1) and out through the bottom of the manifold. Connect the relay output wires to the terminal strip as shown in Figure 2-2.

f. Once all connections are made, install terminal cover (19, Figure 4-1) and secure with screws (20).

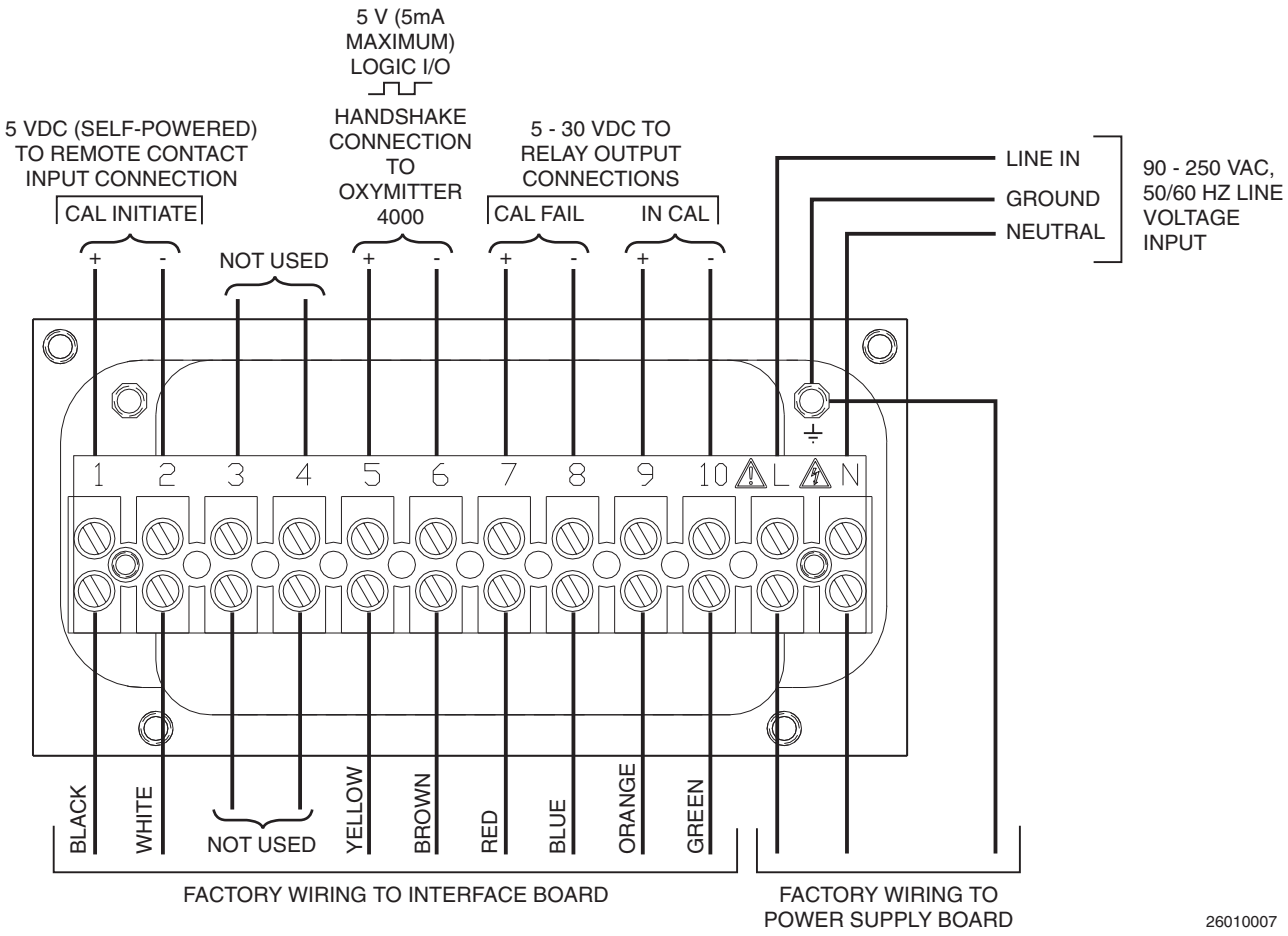


Figure 2-2. Electrical Connections

SECTION 3
OPERATION

3-1 OVERVIEW

This section specifies the requirements to set up an Oxymitter 4000 calibration and how to verify the calibration gas flow setup. It also explains the differences between automatic and semi-automatic calibrations and how to initiate them.

3-2 CALIBRATION REQUIREMENTS

a. Two tanks of precision calibration gas mixtures are required. Recommended calibration gases are nominally 0.4% and 8.0% oxygen in nitrogen.

CAUTION

Do not use 100% nitrogen as a low gas (zero gas). It is suggested that gas for the low (zero) be between 0.4% and 2.0% O2. Do not use gases with hydrocarbon concentrations of more than 40 parts per million. Failure to use proper gases will result in erroneous readings.

In addition to the optional disposable gas bottles available from Rosemount, two additional sources of calibrated gas mixtures are:

LIQUID CARBONIC GAS CORP.
SPECIALTY GAS LABORATORIES

700 South Alameda Street
Los Angeles, California 90058
213/585-2154

767 Industrial Road
San Carlos, California 94070
415/592-7303

9950 Chemical Road
Pasadena, Texas 77507
713/474-4141

12054 S.W. Doty Avenue
Chicago, Illinois 60628
312/568-8840

603 Bergen Street
Harrison, New Jersey 07029
201/485-1995

255 Brimley Road
Scarborough, Ontario, Canada
416/266-3161

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.
SCOTT SPECIALTY GASES

2600 Cajon Blvd.
San Bernardino, California 92411
714/887-2571
TWX: 910-390-1159

1290 Combermere Street
Troy, Michigan 48084
314/589-2950

Route 611
Plumsteadville, Pennsylvania 18949
215/766-8861
TWX: 510-665-9344

2616 South Loop West
Suite 100
Houston, Texas 77054
713/669-0469

b. A check valve is required at the Oxymitter 4000 (between the calibration fitting and the gas line) to prevent the migration of process gases down the calibration gas line.

A typical calibration setup for the Oxymitter 4000 is shown in Figure 1-4.

3-3 CALIBRATION GAS FLOW SETUP

After installing the SPS 4000 as described in Section 2, calibrate the Oxymitter 4000 to verify SPS 4000 operation and the communication link between the sequencer and Oxymitter 4000.

a. Verify that both calibration gases are connected to the SPS 4000. Also verify that the pressure regulators on both calibration gas bottles are set to 20 psig (138 kPa gage).

b. Initiate a semi-automatic calibration using one of the methods specified in paragraph 3-5.

NOTE

Only set the calibration gas flowmeter upon initial installation and after changing the diffusion element in the Oxymitter 4000. Refer to the flowmeter adjustments in Section 4 for more information.

c. As the Oxymitter 4000 and SPS 4000 apply the first calibration gas, set the calibration gas flowmeter to 5 scfh. During the application of the second calibration gas, verify that the flowmeter reads 5 scfh. If not, adjust the pressure regulator on the second calibration gas bottle so the 5 scfh flow is provided.

3-4 AUTOMATIC CALIBRATION

Automatic calibrations require no operator action and can be performed through the Oxymitter 4000 CAL RECOMMENDED feature or through scheduled time intervals that can be programmed through the HART/AMS for the Oxymitter 4000. In addition, the calibration gases must be permanently piped to the Oxymitter 4000.

a. CAL RECOMMENDED

If the Oxymitter 4000 is configured for handshake mode with the SPS 4000, the Oxymitter 4000 can initiate a calibration by sending a signal to the sequencer when the CAL RECOMMENDED LED activates. To enable handshake mode, the Oxymitter 4000 logic I/O must be set for mode 8.

Handshake mode is configured at the factory or can be accessed through HART/AMS. Refer to the logic I/O information in the HART/AMS section of the Oxymitter 4000 Oxygen Transmitter Instruction Bulletin for more information.

b. Timed Interval

An automatic calibration can also be programmed to occur at a specific time interval, in hours, using the HART communicator or AMS software. Refer to the HART/AMS section of the Oxymitter 4000 Oxygen Transmitter Instruction Bulletin for this procedure.

3-5 SEMI-AUTOMATIC CALIBRATION

Semi-automatic calibrations are operator initiated and can be performed using the Oxymitter 4000 keypad, HART handheld communicator/ AMS software, or a remote contact. In addition, the calibration gases must be permanently piped to the Oxymitter 4000.

a. Oxymitter 4000 Keypad

A semi-automatic calibration can be initiated by pressing the CAL button on the Oxymitter 4000 keypad. For more information, refer to the Oxymitter 4000 Oxygen Transmitter Instruction Bulletin.

b. HART Handheld Communicator/AMS Software

A semi-automatic calibration can be initiated by connecting the HART handheld communicator, or AMS software, to the Oxymitter 4000 4-20 mA signal line and using the HART communicator keypad or computer keyboard to access the applicable calibration menu. Refer to the Oxymitter 4000 Oxygen Transmitter Instruction Bulletin or the available HART documentation for more information.

c. Remote Contact

A semi-automatic calibration can be initiated using a remote contact such as a customer's control system. The remote contact processes the calibration command on a PC and sends the signal to the Oxymitter 4000. For more information on remote-site calibrations, refer to the documentation for the system in use.

SECTION 4
MAINTENANCE AND SERVICE

4-1 OVERVIEW

This section describes service and routine maintenance of the SPS 4000. Replacement parts referenced are available from Rosemount. Refer to Section VI for part numbers and ordering information.

WARNING

Install all protective equipment covers and safety ground leads after equipment repair or service. Failure to install covers and ground leads could result in serious injury or death.

4-2 FUSE REPLACEMENT

The SPS 4000 has a fuse on the power supply board. Refer to Table 7-1 for replacement fuse specifications. Perform the following procedure to check or replace the fuse.

WARNING

Disconnect and lock out power before working on any electrical components.

a. Turn off power to the system.

b. Remove screw (22, Figure 4-1) securing manifold cover lock (21) and remove the lock.

c. Remove manifold cover (28).

d. Remove fuseholder (26) by pushing in the top and turning 1/4 turn counterclockwise. Remove fuse (25).

e. After checking or replacing fuse (25), install fuseholder (26) by pushing in the top and turning 1/4 turn clockwise.

f. Install manifold cover (28) and secure with manifold cover lock (21) and screw (22).

4-3 BOARD REPLACEMENT

Perform the following procedure to replace power supply board (23, Figure 4-1) or interface board (31).

WARNING

Disconnect and lock out power before working on any electrical components.

a. Turn off power to the system.

b. Remove screw (22) securing manifold cover lock (21) and remove the lock.

c. Remove manifold cover (28).

d. Remove two screws (32) attaching spacers (35) to manifold (38).

e. Being careful not to disconnect the board wiring, carefully lift power supply board (23) and interface board (31) from manifold (38) and set aside. Do not lose o-rings (36) from the bottom of spacers (35).

f. For the board to be replaced, tag all leads to simplify installation.

g. If replacing the power supply board, refer to Figure 4-2. Remove the line voltage input leads from connector J7. Also, unplug calibration gas 1 solenoid leads from connector J5, calibration gas 2 solenoid leads from connector J4, and pressure switch leads from connector J2.

h. If replacing the interface board, refer to Figure 4-2. Remove the CAL INITIATE leads from connector J3, CAL FAIL and IN CAL leads from connector J4, and logic I/O handshake connection from connector J5.

i. Remove stop nuts (33, Figure 4-1), washers (34), and screws (37) securing power supply board (23) and interface board (31) to spacers (35).

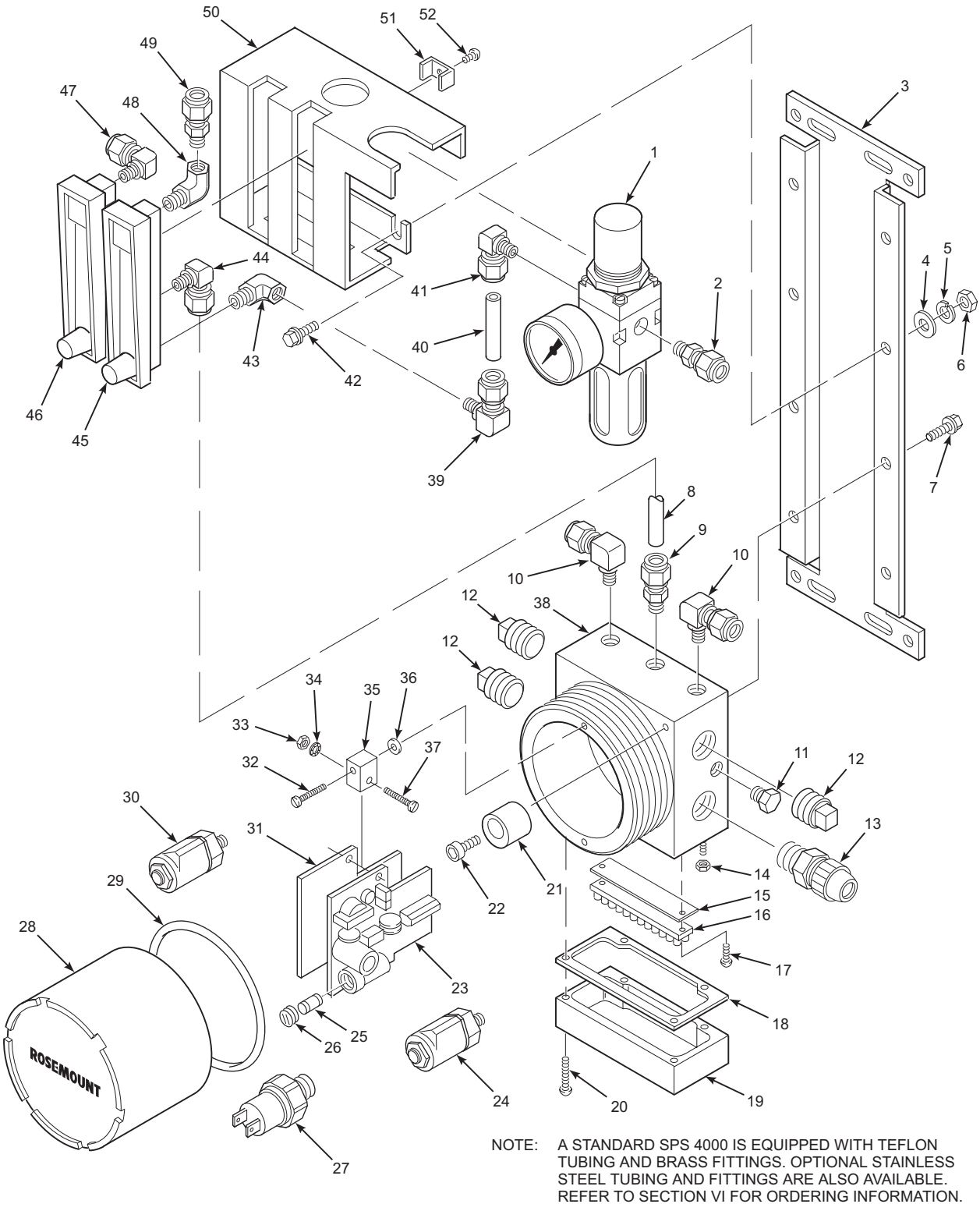


Figure 4-1. SPS 4000, Exploded View

LEGEND FOR FIGURE 4-1

1. Reference Air Pressure Regulator (Optional)
2. Straight Fitting
3. Mounting Bracket
4. Flat Washer
5. Lockwasher
6. Hex Nut
7. Screw
8. Tube
9. Straight Fitting
10. Elbow Fitting
11. Hex Head Plug
12. Square Head Plug
13. Conduit Fitting
14. Ground Nut
15. Terminal Base
16. Terminal Strip
17. Screw
18. Terminal Cover Gasket
19. Terminal Cover
20. Screw
21. Manifold Cover Lock
22. Screw
23. Power Supply Board
24. Calibration Gas 2 Solenoid
25. Fuse
26. Fuseholder
27. Pressure Switch
28. Manifold Cover
29. O-Ring
30. Calibration Gas 1 Solenoid
31. Interface Board
32. Screw
33. Stop Nut
34. Washer
35. Spacer
36. O-Ring
37. Screw
38. Manifold
39. Elbow Fitting (Optional)
40. Tubing (Optional)
41. Elbow Fitting (Optional)
42. Screw
43. Elbow Street Fitting (Optional)
44. Elbow Fitting
45. Reference Air Flowmeter (Optional)
46. Calibration Gas Flowmeter
47. Elbow Fitting
48. Elbow Street Fitting (Optional)
49. Straight Fitting (Optional)
50. Flowmeter Bracket
51. Bracket
52. Screw

j. Carefully separate boards (23 and 31).

k. Connect replacement board to board (23 or 31).

l. Install screws (37), washers (34), and stop nuts (33) to secure interface board (31) and power supply board (23) to spacers (35).

m. Install all applicable leads in the appropriate locations on the power supply board or interface board as shown in Figure 4-2.

n. Install power supply board (23, Figure 4-1) and interface board (31) into manifold (38). Align spacers (35) with the mounting holes on the manifold and secure with screws (32). Ensure o-rings (36) are installed between the spacers and the manifold surface.

o. Install manifold cover (28) and secure with manifold cover lock (21) and screw (22).

4-4 SOLENOID REPLACEMENT

Use this procedure to replace either calibration gas 1 (high calibration gas) solenoid (30, Figure 4-1) or calibration gas 2 (low calibration gas) solenoid (24).

WARNING

Disconnect and lock out power before working on any electrical components.

a. Turn off power to the system.

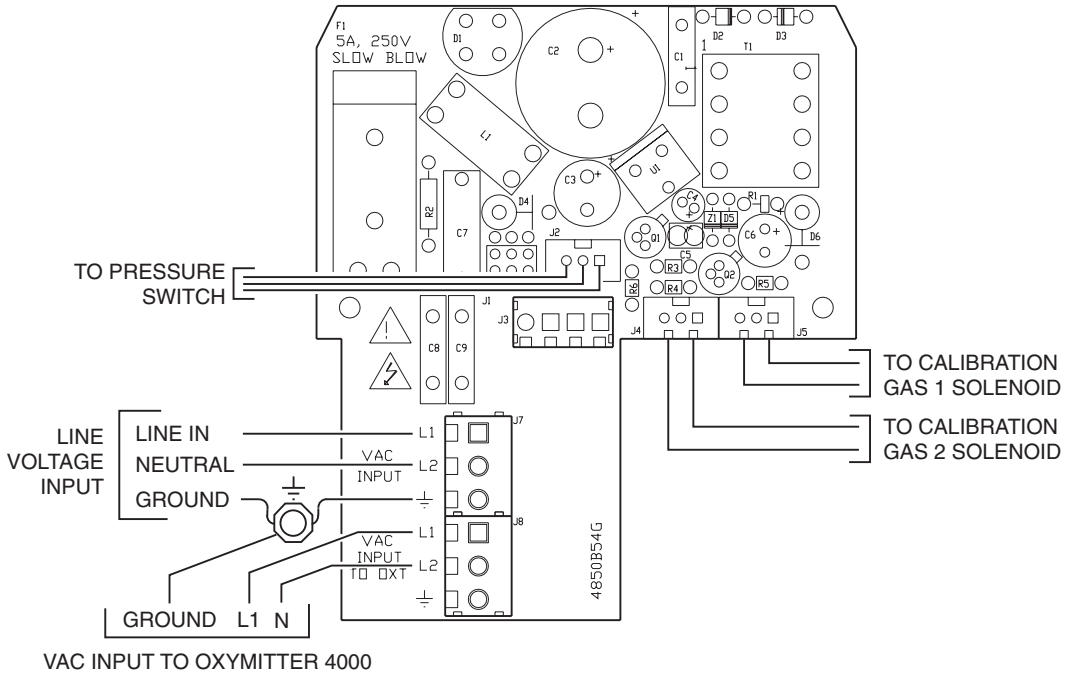
b. Shut off the calibration gases at the cylinders.

c. Remove screw (22) securing manifold cover lock (21) and remove the lock.

d. Remove manifold cover (28).

e. Remove two screws (32) attaching spacers (35) to manifold (38).

POWER SUPPLY BOARD



INTERFACE BOARD

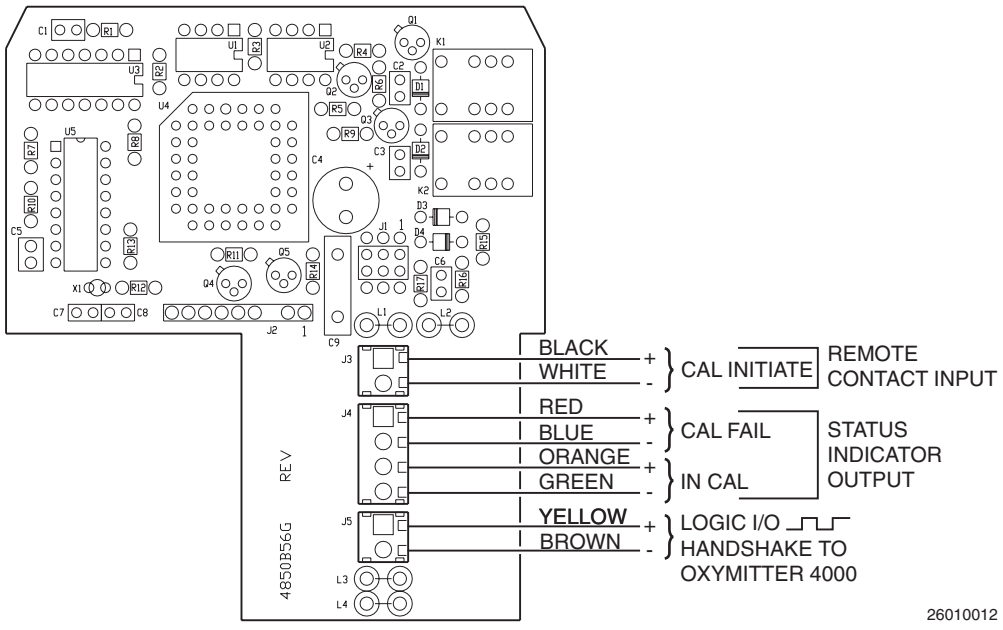


Figure 4-2. Board Connections

f. Being careful not to disconnect the board wiring, carefully lift the board and spacer assembly from manifold (38) and set aside. Do not lose o-rings (36) from the bottom of spacers (35).

g. Tag and unplug solenoid (30 or 24) leads from power supply board (23). Refer to Figure 4-2. Calibration gas 1 solenoid wires connect to connector J5, and calibration gas 2 solenoid wires connect to connector J4.

h. Remove the top nut of solenoid (30 or 24) securing the coil assembly and washer to the base. Remove the coil assembly, including the leads, and washer. Place a 13/16 in. deep socket over the solenoid base and remove.

CAUTION

When installing a solenoid, do not overtighten. Damage to the solenoid may occur.

i. Install the new solenoid base. Be careful not to overtighten. Install the new washer and coil assembly and secure with the top nut. Connect the leads to the proper connector on power supply board (23). Refer to Figure 4-2 if necessary.

j. Carefully install the board and spacer assembly into manifold (38, Figure 4-1) by aligning spacers (35) with the mounting holes on the manifold and securing with screws (32). Ensure o-rings (36) are installed between the spacers and the manifold surface.

k. Install manifold cover (28), and secure with manifold cover lock (21) and screw (22).

l. Turn on the calibration gases at the cylinders.

4-5 PRESSURE SWITCH REPLACEMENT

Use the following procedure to replace pressure switch (27, Figure 4-1).

a. Turn off power to the system.

b. Shut off the calibration gases at the cylinders.

c. Remove screw (22) securing manifold cover lock (21) and remove the lock.

d. Remove manifold cover (28).

e. Remove two screws (32) attaching spacers (35) to manifold (38).

f. Being careful not to disconnect the board wiring, carefully lift the board and spacer assembly from manifold (38) and set aside. Do not lose o-rings (36) from the bottom of spacers (35).

g. Tag and remove the leads from pressure switch (27).

h. Place a 1-1/16 in. 6-point socket over pressure switch (27) and remove.

CAUTION

When installing the pressure switch, do not overtighten. Damage to the solenoid may occur.

i. Install new pressure switch (27). Be careful not to overtighten. Connect the leads to the proper terminals on the pressure switch.

j. Carefully install the board and spacer assembly into manifold (38, Figure 4-1) by aligning spacers (35) with the mounting holes on the manifold and securing with screws (32). Ensure o-rings (36) are installed between the spacers and the manifold surface.

k. Install manifold cover (28), and secure with manifold cover lock (21) and screw (22).

l. Turn on the calibration gases at the cylinders.

4-6 CHECK VALVE REPLACEMENT

The check valve may stick or become plugged over time. Replace when necessary. If condensation deposits are noted upon removal, consider insulating the check valve.

4-7 PRESSURE REGULATOR (OPTIONAL) MAINTENANCE

a. Pressure Adjustments

Reference air pressure regulator (1, Figure 4-1) is factory set to 20 psi (138 kPa). Adjust using the knob on top of the pressure regulator if necessary.

WARNING

Do not use fingers to release valve stem. The valve may release air at high pressures and cause injury.

b. Condensation Drain

To drain excess moisture from the filter bowl of reference air pressure regulator (1), use a screwdriver or comparable tool to periodically release the valve stem on the bottom of the pressure regulator.

4-8 FLOWMETER ADJUSTMENTS

a. Calibration Gas Flowmeter

Calibration gas flowmeter (46, Figure 4-1) regulates the calibration gas flow and must be set to 5 scfh. However, only adjust the flowmeter to 5 scfh after placing a new diffusion element on the end of the Oxymitter 4000. Adjusting the flowmeter at any other time can pressurize the cell and bias the calibration.

In applications with a heavy dust loading, the O_2 probe diffusion element may become plugged over time, causing a slower speed of response. The best way to detect a plugged diffusion element is to note the time it takes the Oxymitter 4000 to return to the normal process reading after the last calibration gas is removed and the calibration gas line is blocked off. A plugged element also can be indicated by a slightly lower reading on the flowmeter.

Change the diffusion element when the calibration gas flowmeter reads slightly lower during calibration or when the response time to the process flue gases becomes very slow. Each time the diffusion element is changed, reset the calibration gas flowmeter to 5 scfh and calibrate the Oxymitter 4000. For more information on changing the diffusion element, refer to the instruction bulletin for the Oxymitter 4000 in use.

b. Reference Air Flowmeter (Optional)

Reference air flowmeter (45) regulates the reference air and must be set to 2 scfh. Adjust the flow with the knob on the bottom of the reference air flowmeter when necessary.

4-9 FLOWMETER REPLACEMENT

Use this procedure to replace either reference air flowmeter (45, Figure 4-1) or calibration gas flowmeter (46).

a. Turn off power to the system.

b. Shut off the calibration gases at the cylinders.

c. Loosen, but do not remove, four screws (42) securing flowmeter bracket (50) to mounting bracket (3).

d. Flex the bottom of flowmeter bracket (50) downward and away to disengage and remove the flowmeter bracket from mounting bracket (3).

e. For reference air flowmeter (45), remove pressure regulator (1) by disconnecting tubing (40) from elbow fitting (39). Also, disconnect the tubing between the Oxymitter 4000 and sequencer from straight fitting (49).

For calibration gas flowmeter (46), disconnect the tubing between the Oxymitter 4000 and the sequencer at elbow fitting (47). Also, disconnect tube (8) from elbow fitting (44).

f. Remove screws (52) and bracket (51) securing flowmeter (45 or 46) to flowmeter bracket (50).

g. Remove flowmeter (45 or 46), with installed fittings, from flowmeter bracket (50).

h. For reference air flowmeter (45), remove elbow street fittings (43 and 48). It is not necessary to remove fittings (39 and 49) from the street fittings.

For calibration gas flowmeter (46), remove elbow fittings (44 and 47).

i. Apply pipe thread sealant to the threads of top fitting (48 or 47) and bottom fitting (43 or 44) and install fittings into new flowmeter (45 or 46).

j. Position flowmeter (45 or 46) into flowmeter bracket (50) and secure with bracket (51) and screw (52).

k. For reference air flowmeter (45), connect tubing (40) to elbow fitting (39) and install pressure regulator (1). Also, connect the tubing between the Oxymitter 4000 and sequencer to straight fitting (49).

For calibration gas flowmeter (46), connect tube (8) to elbow fitting (44) and connect the gas tubing between the Oxymitter 4000 and sequencer to elbow fitting (47).

l. Slide the top slots of flowmeter bracket (50) onto screws (42). Flex the bottom of the bracket downward and toward mounting bracket (3) to engage the bottom bracket slots and screws. Tighten screws.

m. Turn on the calibration gases at the cylinders.

SECTION 5
TROUBLESHOOTING

5-1 OVERVIEW

This section describes the SPS 4000 troubleshooting procedures. Additional troubleshooting information can be found in the Oxymitter 4000 Oxygen Transmitter Instruction Bulletin.

WARNING

Install all protective equipment covers and safety ground leads after troubleshooting. Failure to replace covers and ground leads could result in serious injury or death.

5-2 SPS 4000 TROUBLESHOOTING

Use the CAL FAIL and IN CAL relay outputs to identify possible SPS faults.

a. If a calibration was not successfully completed, the SPS 4000 sends a CAL FAIL contact indication to the control room. To determine if the SPS 4000 caused the failed calibration, go to the Oxymitter 4000 site to view the keypad. Or, access the HART/AMS menus. For more information on HART/AMS, refer to the HART/AMS section in the Oxymitter 4000 Oxygen Transmitter Instruction Bulletin.

1. If no alarms are indicated on the keypad or in the HART/AMS STATUS sub-menu, the calibration did not fail because of an Oxymitter 4000 fault. Therefore, a calibration gas flow problem occurred. Refer to Table 5-1 or Figure 5-1 to troubleshoot the SPS 4000.

2. If the LAST CAL FAILED alarm is indicated on the keypad or in the HART/AMS STATUS sub-menu, the failure is due to either a bad Oxymitter 4000 cell or a calibration gas flow problem.

   (a) Verify your calibration setup per paragraph 2-3 in Section 2, INSTAL-LATION; Section 3, OPERATION; and paragraph 4-8 in Section 4, MAINTENANCE AND SERVICE.

   (b) Perform another calibration and monitor the process. If the calibration fails before both calibration gases finish sequencing, a gas flow problem exists. Refer to Table 5-1 or Figure 5-1 to troubleshoot the SPS 4000.

   If the calibration setup is correct and the Oxymitter 4000 indicates an invalid slope fault (fault 12) before the gases are purged and a last calibration failed fault (fault 14) after the gases are purged, replace the Oxymitter 4000 cell per the Oxymitter 4000 Oxygen Transmitter Instruction Bulletin.

b. If a semi-automatic or manual calibration is being performed but no 5 - 30 VDC relay output contact (IN CAL or CAL FAIL) is being received by the control room, the interface board relays are malfunctioning. Replace the interface board per paragraph 4-3 in Section 4, MAINTENANCE AND SERVICE.

NOTE

If the unit is performing frequent auto-calibrations, investigate at the Oxymitter 4000 site or using HART/AMS. This condition may indicate an aging cell in the Oxymitter 4000.

5

Table 5-1. SPS 4000 Fault Finding

Symptom	Check	Fault	Remedy
No calibration gas flow	Wiring	Improper wire connections, loose connections, or damaged wiring	Properly connect wiring or secure loose wiring connections; replace damaged wiring if necessary.
	Logic I/O	Oxymitter 4000 logic I/O not set for calibration handshaking with SPS 4000	Set logic I/O to mode 8 via HART/AMS.
	Calibration gas lines between cylinders and manifold	Clogged calibration gas line	Replace clogged calibration gas line.
	Calibration gas flowmeter knob	Flowmeter knob not turned counterclockwise to allow flow	Turn calibration gas flowmeter knob counterclockwise to allow calibration gas to flow.
	Calibration gas line between manifold and calibration gas flowmeter	Clogged calibration gas line	Replace clogged calibration gas line.
	Fuse on power supply board	Blown fuse	Replace fuse per paragraph 4-2.
	Interface board option	Interface board not sending signals	Replace interface board per paragraph 4-3.
	Check valve	Clogged check valve	Replace check valve per paragraph 4-6.
	Calibration gas line between calibration gas flowmeter and check valve	Clogged calibration gas line	Replace calibration gas line.
	Calibration gas flowmeter	Clogged flowmeter	Replace flowmeter per paragraph 4-9.
	Power supply output	Power supply failure	Replace power supply board per paragraph 4-3.
	Solenoid	Solenoid failure	Replace solenoid per paragraph 4-4.
	Pressure switch	Pressure switch failure	Replace pressure switch per paragraph 4-5.

SYMPTOM — NO CALIBRATION GAS FLOW

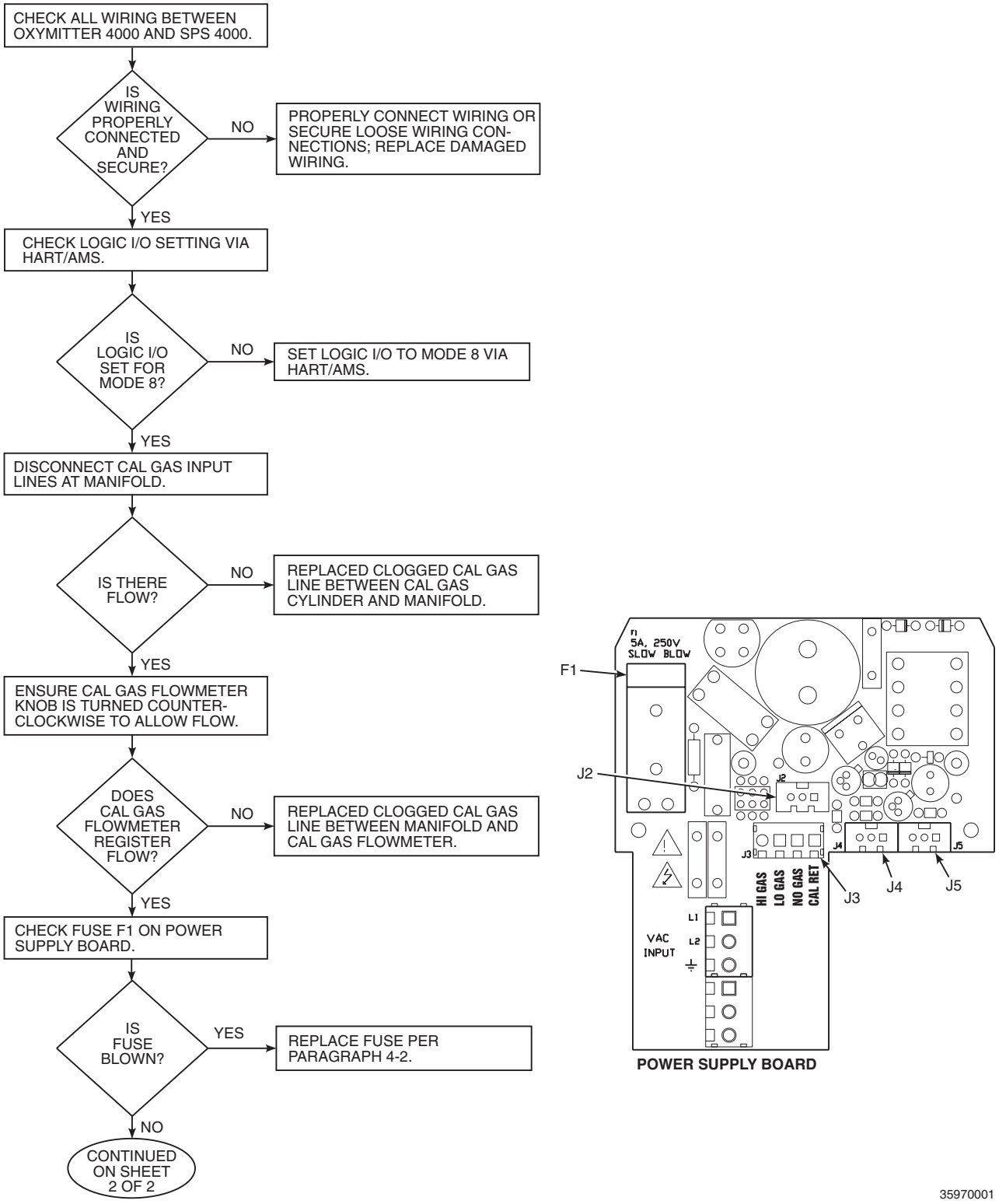


Figure 5-1. SPS 4000 Troubleshooting Flowchart (Sheet 1 of 2)

SYMPTOM — NO CALIBRATION GAS FLOW (CONTINUED)

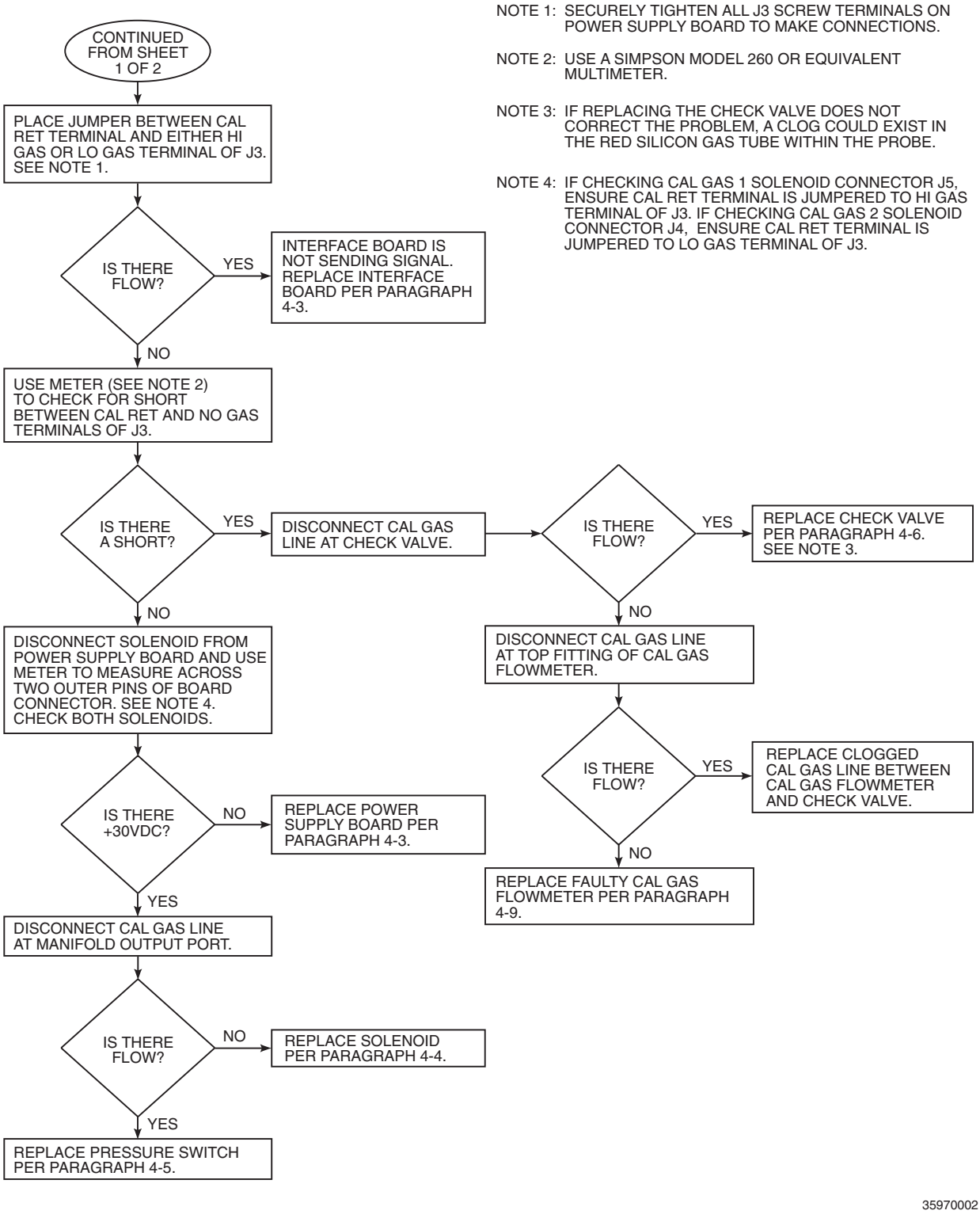


Figure 5-1. SPS 4000 Troubleshooting Flowchart (Sheet 2 of 2)

SECTION 6
RETURN OF MATERIAL

6-1 If factory repair of defective equipment is required, proceed as follows:

a. Secure a return authorization from a Rosemount Analytical Sales Office or Representative before returning the equipment. Equipment must be returned with complete identification in accordance with Rosemount instructions or it will not be accepted.

In no event will Rosemount be responsible for equipment returned without proper authorization and identification.

b. Carefully pack the defective unit in a sturdy box with sufficient shock absorbing material to ensure no additional damage occurs during shipping.

c. In a cover letter, describe completely:

1. The symptoms that determined the equipment is faulty.
2. The environment in which the equipment was operating (housing, weather, vibration, dust, etc.).
3. Site from where the equipment was removed.
4. Whether warranty or nonwarranty service is requested.
5. Complete shipping instructions for the return of the equipment.

d. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in a Rosemount Return Authorization, prepaid, to:

Rosemount Analytical Inc.
RMR Department
1201 N. Main Street
Orrville, Ohio 44667

If warranty service is requested, the defective unit will be carefully inspected and tested at the factory. If failure was due to conditions listed in the standard Rosemount warranty, the defective unit will be repaired or replaced at Rosemount's option, and an operating unit will be returned to the customer in accordance with shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

SECTION 7
REPLACEMENT PARTS

Table 7-1. SPS 4000 Replacement Parts

Figure and Index No.	Part Number	Description
Figure 1-4	6292A97H03	Check Valve
Figure 4-1, 29	1A99089H01	Cover O-ring
Figure 4-1, 46	771B635H01	Flowmeter Assembly, Calibration Gas
Figure 4-1, 45	771B635H02	Flowmeter Assembly, Reference Air (Optional)
Figure 4-1, 1	1A99094H01	Reference Air Pressure Regulator (Optional)
Figure 4-1, 25	1A97913H03	Fuse, 5A, 250V, 5 □ 20 mm, Slow Blow
Figure 4-1, 31	4850B56G01	Interface Board
Figure 4-1, 23	4850B54G01	Power Supply Board
Figure 4-1, 27	7305A67H01	Pressure Switch
Figure 4-1, 24 and 30	3D39435G01	Solenoid
Figure 4-1, 18	4850B75H01	Terminal Cover Gasket
Figure 4-1, 16	1A99147H01	Terminal Strip

Table 7-2. Calibration Replacement Parts

Figure and Index No.	Part Number	Description
Figure 1-4	1A99119G01	Calibration Gas Bottles — 0.4% and 8% O2, balance nitrogen — 550 liters each, includes bottle rack*
Figure 1-4	1A99119G02	Two flow regulators (for calibration gas bottles)

*Calibration gas bottles cannot be shipped via airfreight.

SECTION 8
INDEX

This index is an alphabetized listing of parts, terms, and procedures having to do with the Hazardous Area Oxygen/Combustibles Transmitter. Every item listed in this index refers to a location in the manual by one or more page numbers.

I

WARRANTY

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

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

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

Limitations of Remedy. SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY SHALL BE LIMITED TO REPAIR OR REPLACEMENT UNDER THE STANDARD WARRANTY CLAUSE. IN NO CASE, REGARDLESS OF THE FORM OF THE CAUSE OF ACTION, SHALL SELLER'S LIABILITY EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED BY SELLER GIVING RISE TO THE CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY EXTEND TO INCLUDE INCIDENTAL OR CONSEQUENTIAL DAMAGES. CONSEQUENTIAL DAMAGES SHALL INCLUDE, BUT ARE NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS, LOSS OF USE, LOSS OF REVENUE, COST OF CAPITAL AND DAMAGE OR LOSS OF OTHER PROPERTY OR EQUIPMENT. IN NO EVENT SHALL SELLER BE OBLIGATED TO INDEMNIFY BUYER IN ANY MANNER NOR SHALL SELLER BE LIABLE FOR PROPERTY DAMAGE AND/OR THIRD PARTY CLAIMS COVERED BY UMBRELLA INSURANCE AND/OR INDEMNITY COVERAGE PROVIDED TO BUYER, ITS ASSIGNS, AND EACH SUCCESSOR INTEREST TO THE GOODS PROVIDED HEREUNDER.

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

Instruction Manual
IB-106-340AC Rev. 1.1
April 2001

SPS 4000

SPS 4000

Part no. _____

Serial no. _____

Order no. _____

Emerson Process Management

Rosemount Analytical Inc.
Process Analytic Division
1201 N. Main St.
Orrville, OH 44667-0901
T (330) 682-9010
F (330) 684-4434
E gas.csc@emersonprocess.com

Fisher-Rosemount GmbH & Co.
Industriestrasse 1
63594 Hasselroth
Germany
T 49-6055-884 0
F 49-6055-884209

ASIA - PACIFIC
Fisher-Rosemount
Singapore Private Ltd.
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T 65-777-8211
F 65-777-0947

EUROPE, MIDDLE EAST, AFRICA
Fisher-Rosemount Ltd.
Heath Place
Bognor Regis
West Sussex PO22 9SH
England
T 44-1243-863121
F 44-1243-845354

LATIN AMERICA
Fisher - Rosemount
Av. das Americas
3333 sala 1004
Rio de Janeiro, RJ
Brazil 22631-003
T 55-21-2431-1882

http://www.processanalytic.com

EMERSON™
Process Management

© Rosemount Analytical Inc. 2001