BA02164C/66/EN/01.21

Valid as of version
HC12
(Device firmware)

Operating Instruction
SS500e/SS2000e/SS3000e
TDLAS Gas Analyzer

Class I, Division 2, Groups B, C & D, T3C (T3 with heaters)

Endress+Hauser
People for Process Automation

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1 - INTRODUCTION

Endress+Hauser’s SS500e/SS2000e/SS3000e products are high-speed, diode laser-based extractive gas analyzers designed for extremely reliable monitoring of moisture and carbon dioxide in natural gas applications. To ensure that the gas analyzer performs as specified, it is important to closely review the installation and operation sections of this manual. This manual contains a comprehensive overview of the SS500e/SS2000e/SS3000e gas analyzer and step-by-step instructions on:

- Inspecting the gas analyzer and sample conditioning system (SCS)
- Installing the gas analyzer and SCS
- Starting up the SCS
- Troubleshooting the system

Who Should Read This Manual

This manual should be read and referenced by anyone installing, operating or having direct contact with the gas analyzer.

How to Use This Manual

Take a moment to familiarize yourself with this Operator’s Manual by reading the **"Table of Contents"**.

There are a number of options and accessories available for the SS500e/SS2000e/SS3000e gas analyzers. This manual has been written to address the most common options and accessories. Images, tables and charts have been included to provide a visual understanding of the gas analyzer and its functions. Special symbols are also used to provide the user with key information regarding the system configuration and/or operation. Pay close attention to this information.

General Warnings and Cautions

Instructional icons are provided in this manual and on the gas analyzer to alert the user of potential hazards, important information and valuable tips. Following are the symbols and associated warning and caution types to observe when servicing the gas analyzer. Some of these symbols are provided for instructional purposes only and are not labeled on the system.

Safety warning label

The warning label shown below will be affixed to the front side of all gas analyzer enclosures that contain sample gas.

Hazards may vary by stream composition. One or more of the following conditions may apply.

Flammable. *Gases used in the processing of this gas analyzer may be extremely flammable. Any work in a hazardous area must be carefully controlled to avoid creating any possible ignition sources (e.g., heat, arching, sparking, etc.).*

Toxins. *Endress+Hauser gas analyzers measure a variety of gases, including high-level H_2S. Follow all safety protocols governing toxic gases and potential leaks.*

Inhalation. *Inhaling toxic gases or fumes may cause physical damage or death.*

Technicians are expected to follow all safety protocols established by the customer that are necessary for servicing or operating the gas analyzer. This may include, but is not limited to, lockout/tag-out procedures, toxic gas monitoring protocols, PPE requirements, hot work permits and other precautions that address safety concerns related to performing service or operation on process equipment located in hazardous areas.

Equipment labels

*Warning statement for **hazardous voltage**. Contact may cause electric shock or burn. Turn off and lock out system before servicing.*

WARNING
DO NOT EXCEED 10 PSIG
IN SAMPLE CELL

Failure to follow all directions may result in damage to the gas analyzer or cause incorrect readings.

Removal of this label from the measurement cell will void the gas analyzer warranty.

Instructional symbols

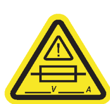
Failure to follow all directions may result in damage or malfunction of the gas analyzer.

General notes and important information concerning the installation and operation of the gas analyzer.

***INVISIBLE LASER RADIATION** - Avoid exposure to beam. Class 3b Radiation Product. Refer servicing to the manufacturer-qualified personnel.*

Failure to follow all directions or substitution of components may result in explosion.

Failure to follow all directions may result in fire.



Maximum voltage and current specifications for the fuse closest to label.

Conventions used in this manual

In addition to the symbols and instructional information, this electronic manual is created with "hot links" to enable the user to quickly navigate between different sections within the manual. These links include table, figure and section references and are identified by a pointing finger cursor when rolling over the text. Simply click on the link to navigate to the associated reference.

About the Gas Analyzers

Endress+Hauser gas analyzers are tunable diode laser (TDL) absorption spectrometers operating in the near- to short-wavelength infrared. Each compact sensor consists of a TDL light source, sample cell and detector specifically configured to enable high sensitivity measurement of a particular component within the presences of other gas phase constituents in the stream. The sensor is controlled by microprocessor-based electronics with embedded software that incorporates advanced operational and data processing algorithms.

Sample conditioning system

A sample conditioning system is included with the system that has been specifically designed to deliver an optimum sample stream that is representative of the process systems stream at the time of sampling. Most SS500e/SS2000e/SS3000e gas analyzer systems are configured for use at extractive natural gas sampling stations. Refer to "Sample Conditioning System" on page 4-1 for more information.

Differences between the SS500e, SS2000e, and SS3000e

The SS500e and SS2000e are single-channel gas analyzers used predominantly for measuring H_2O or CO_2 in pipeline natural gas. The SS2000e is a higher resolution version of the SS500e (for performance specifications, see Table A–1 on page A–1, Table A–2 on page A–2, Table A–3 on page A–3 or Table A–4 on page A–4). The SS3000e is a dual-channel version of the SS2000e and is usually configured to measure H_2O and /or CO_2 in the same or separate pipeline natural gas sample streams (for performance specifications, see Table A–5 on page A–5). Refer to the following chart for an illustration of possible system configurations for the SS3000e.

Channel A	Channel B
H_2O	H_2O
H_2O	CO_2
CO_2	CO_2

How the Gas Analyzers Work

The SS500e/SS2000e/SS3000e gas analyzers employ tunable diode laser absorption spectroscopy (TDLAS) to detect the presence of trace substances in process gases. Absorption spectroscopy is a widely used technique for sensitive trace species detection. Because the measurement is made in the volume of the gas, the response is much faster, more accurate and significantly more reliable than traditional surface-based sensors that are subject to surface contamination.

In its simplest form, a diode laser absorption spectrometer typically consists of a sample cell with a mirror at one end, and a mirror or window at the opposite end, through which the laser beam can pass (refer to Figure 1–1). The laser beam enters the cell and reflects off the mirror(s) making one or more trips through the sample gas and eventually exiting the cell where the remaining beam intensity is measured by a detector. With the SS500e/SS2000e/SS3000e gas analyzers, sample gas flows continuously through the sample cell ensuring that the sample is always representative of the flow in the main pipe.

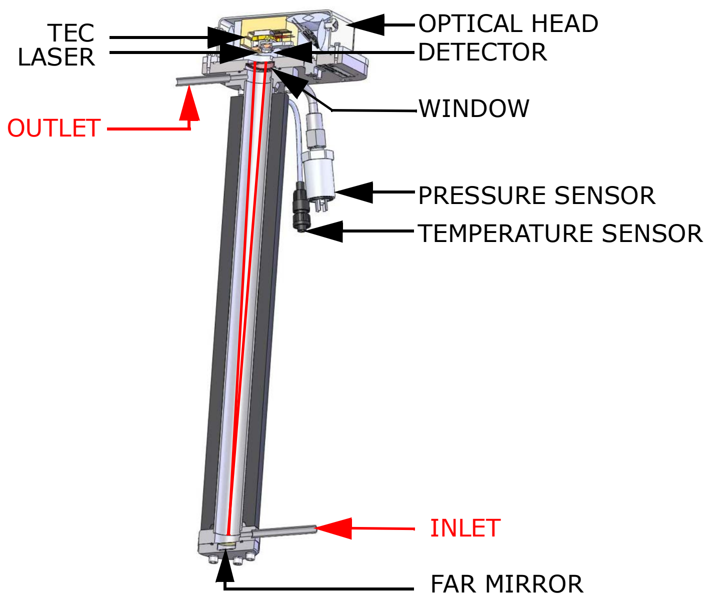


Figure 1–1 *Schematic of a typical laser diode absorption spectrometer*

Due to their inherent structure, the molecules in the sample gas each have characteristic natural frequencies (or resonances). When the output of the laser is tuned to one of those natural frequencies, the molecules with that particular resonance will absorb energy from the incident beam. That is, as the beam of incident intensity, $I_0(\lambda)$, passes through the sample, attenuation occurs via absorption by the trace gas with absorption cross section $\sigma(\lambda)$. According to the Beer-Lambert absorption law, the intensity remaining, $I(\lambda)$, as measured by the detector at the end of the beam path of length I (cell length x number of passes), is given by

$$I(\lambda) = I_0(\lambda)\exp[-\sigma(\lambda)lN] , \tag{1}$$

where N represents the species concentration. Thus, the ratio of the absorption measured when the laser is tuned on-resonance versus off-resonance is directly proportional to the number of molecules of that particular species in the beam path, or

$$N = \frac{-1}{\sigma(\lambda)l}\ln\left[\frac{I(\lambda)}{I_0(\lambda)}\right] , \tag{2}$$

Figure 1–2 shows the typical raw data (in arbitrary units [a.u.]) from a laser absorption spectrometer scan including the incident laser intensity, $I_0(\lambda)$, and the transmitted intensity, $I(\lambda)$, for a clean system and one with contaminated mirrors (shown to illustrate the system's relative insensitivity to mirror contamination). The positive slope of raw data results from ramping the current to tune the laser, which not only increases the wavelength with current, but also causes the corresponding output power to increase. By normalizing the signal by the incident intensity, any laser output fluctuations are canceled, and a typical, yet more pronounced, absorption profile results (refer to Figure 1–3).

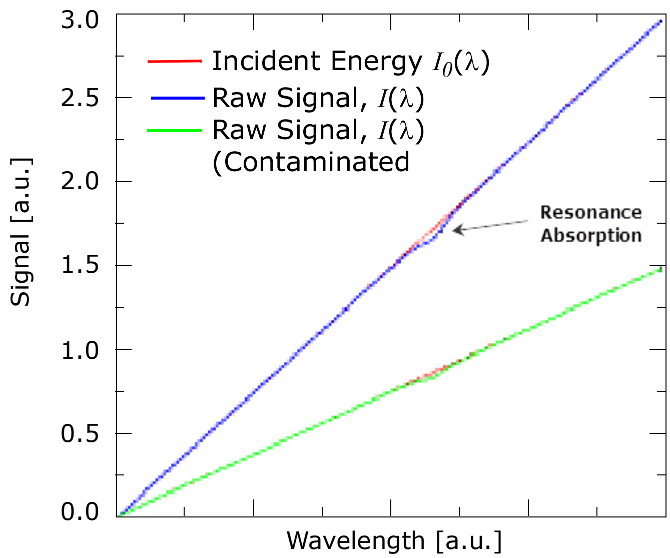


Figure 1–2 *Typical raw signal from a laser diode absorption spectrometer with and without mirror contamination*

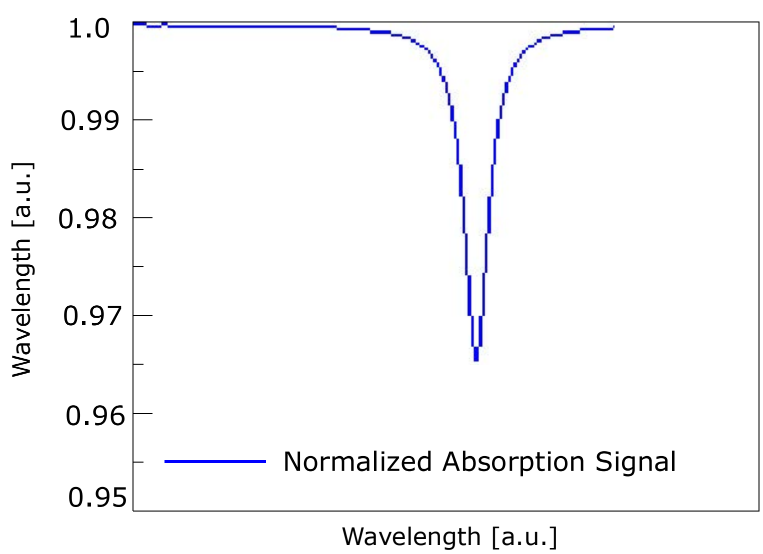


Figure 1–3 *Typical normalized absorption signal from a laser diode absorption spectrometer*

Note that contamination of the mirrors results solely in lower overall signal. However, by tuning the laser off-resonance as well as on-resonance and normalizing the data, the technique self calibrates every scan resulting in measurements that are unaffected by mirror contamination.

Wavelength modulation spectroscopy (WMS) signal detection

Endress+Hauser takes the fundamental absorption spectroscopy concept a step further by using a sophisticated signal detection technique called wavelength modulation spectroscopy (WMS). When employing WMS, the laser drive current is modulated with a kHz sine wave as the laser is rapidly tuned. A lock-in amplifier is then used to detect the harmonic component of the signal that is at twice the modulation frequency (2*f*) (refer to Figure 1–4). This phase-sensitive detection enables the filtering of low-frequency noise caused by turbulence in the sample gas, temperature and/or pressure fluctuations, low-frequency noise in the laser beam or thermal noise in the detector.

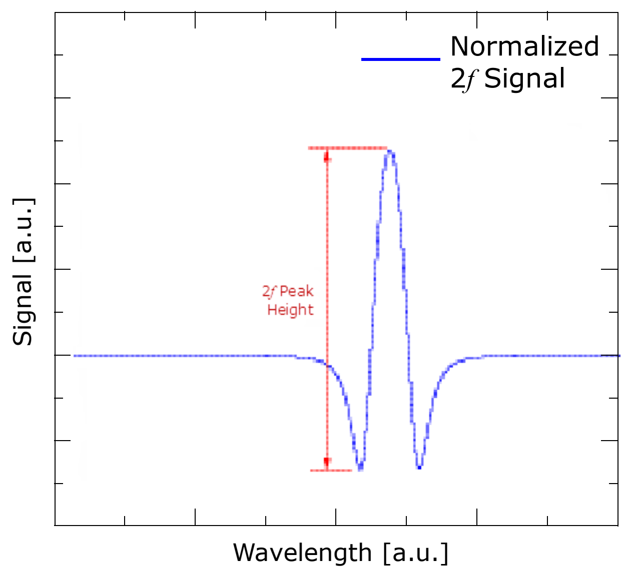


Figure 1–4 *Typical normalized 2f signal; species concentration is proportional to the peak height*

With the resulting low-noise signal and use of fast post-processing algorithms, reliable parts per million (ppm) or parts per billion (ppb) detection levels are possible (depending on target and background species) at real-time response rates (on the order of 1 second).

All Endress+Hauser TDL gas analyzers employ a similar design and hardware platform. Measuring different trace gases in various mixed hydrocarbon background streams is accomplished by selecting a different optimum diode laser wavelength between 700 to 3000 nm, which provides the least amount of sensitivity to background stream variations.

Getting Familiar with the Gas Analyzer

Endress+Hauser' SS500e/SS2000e/SS3000e gas analyzers are typically comprised of two main enclosures; the gas analyzer electronics and the sample conditioning system (SCS) (refer to Figure 1–5). See Appendix A for system drawings.

On the front panel of the gas analyzer, the keypad and LCD display serve as the user interface to the gas analyzer. Internally, the control electronics drive the laser, collect the signal, analyze the spectra and provide measurement output signals.

Housed inside the SCS are the measurement cell and heater along with flow devices to control flow and pressure for the measurement cell and the bypass loop.

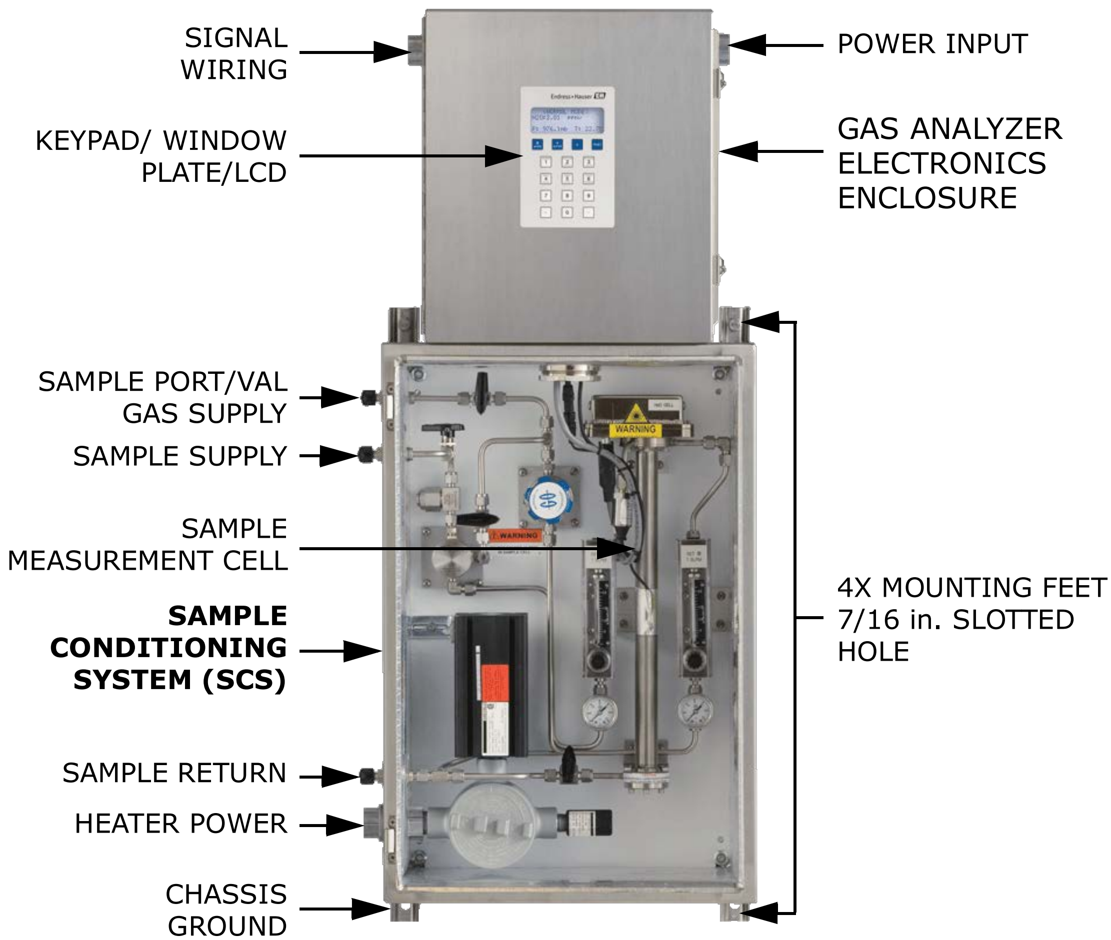


Figure 1–5 *SS500e/SS2000e architecture overview*

Power is connected to the gas analyzer from an external power source through the top of the enclosure. The measurement cell along with flow devices to control flow and pressure for the measurement cell and the bypass loop are mounted inside the SCS enclosure. Refer to “Sample Conditioning System” on page 4-1 for more information on the SCS.

Inside the SS500e/SS2000e/SS3000e gas analyzer electronics enclosure is the electronics assembly. Refer to Figure 1–6 through Figure 1–8 for views of the AC electronics assemblies and DC electronics assemblies.

The circled area in Figure 1–6 highlights the optional RS-232C to RS-485 converter. For gas analyzers configured with an RS-232C connection only, the converter is not installed on the electronic assembly, which will use different cables for connections.

SS3000e gas analyzer

Endress+Hauser’s SS3000e is a dual-channel gas analyzer used for moisture (H_2O) and carbon dioxide (CO_2) detection. The sensor analyzes the components of a gas sample using tunable laser diode absorption spectroscopy (TDLAS). This allows the TDLAS to determine the concentration of contaminants in the gas sample without coming into physical contact with the stream.

Fuse specifications

Fuses are located on the electronics control board, as shown in Figure 1–6 through Figure 1–9.

If you need to replace a fuse, use only the same type and rating of fuse as the original as listed in Table 1–1.

Table 1–1 *Fuse specifications*

DWG Ref.	Voltage	Description	Rating
F1	120 VAC	Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC/0.8 A
	240 VAC	Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC/0.5 A
F2	24 VDC	Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC/1.6 A

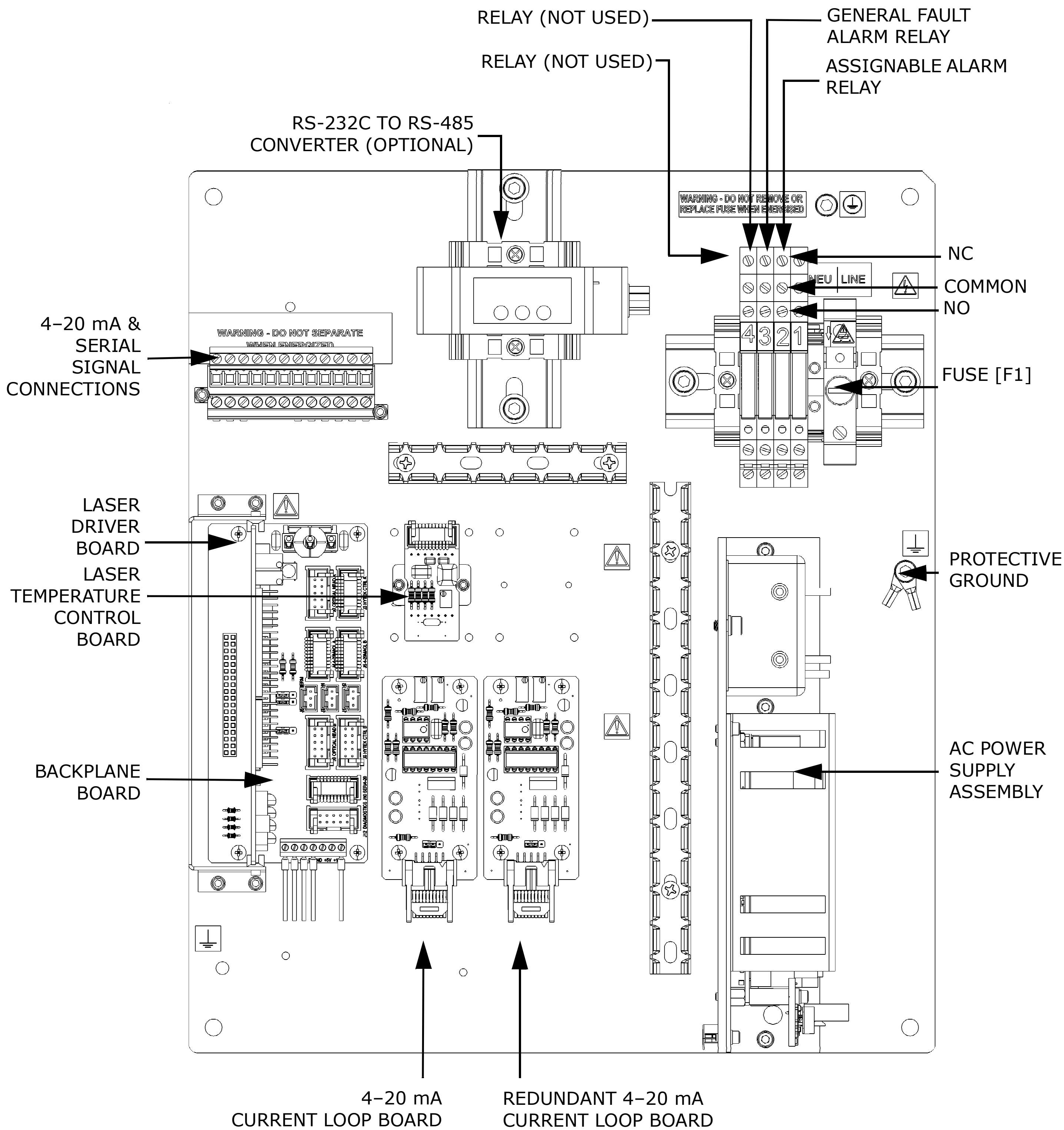


Figure 1–6 *Electronics control board (AC) for single-channel systems (SS500e/SS2000e) with RS-232C to RS-485 converter*

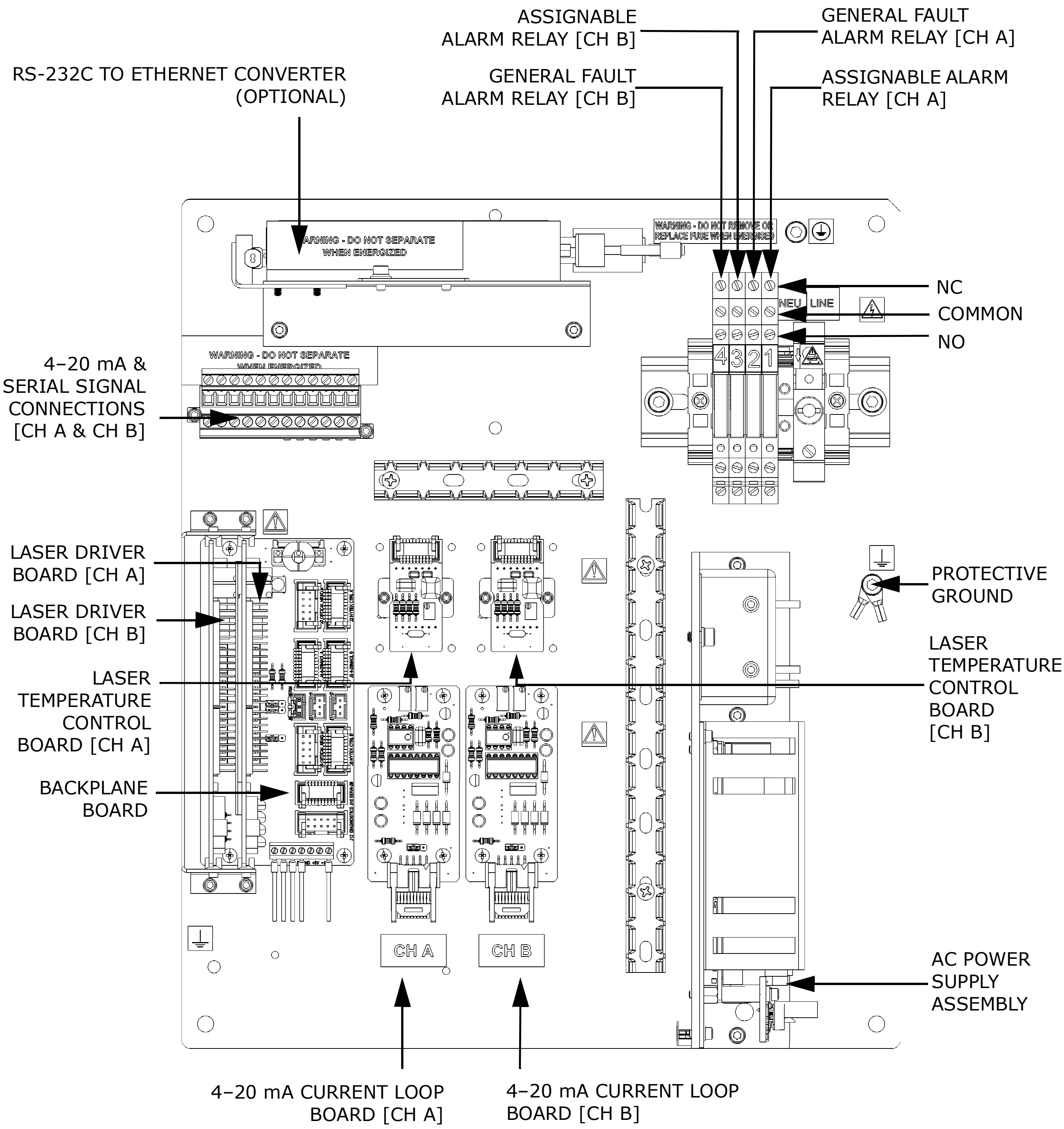


Figure 1–7 *Electronics control board (AC) for dual-channel systems (SS3000e) with RS-232C to Ethernet converter*

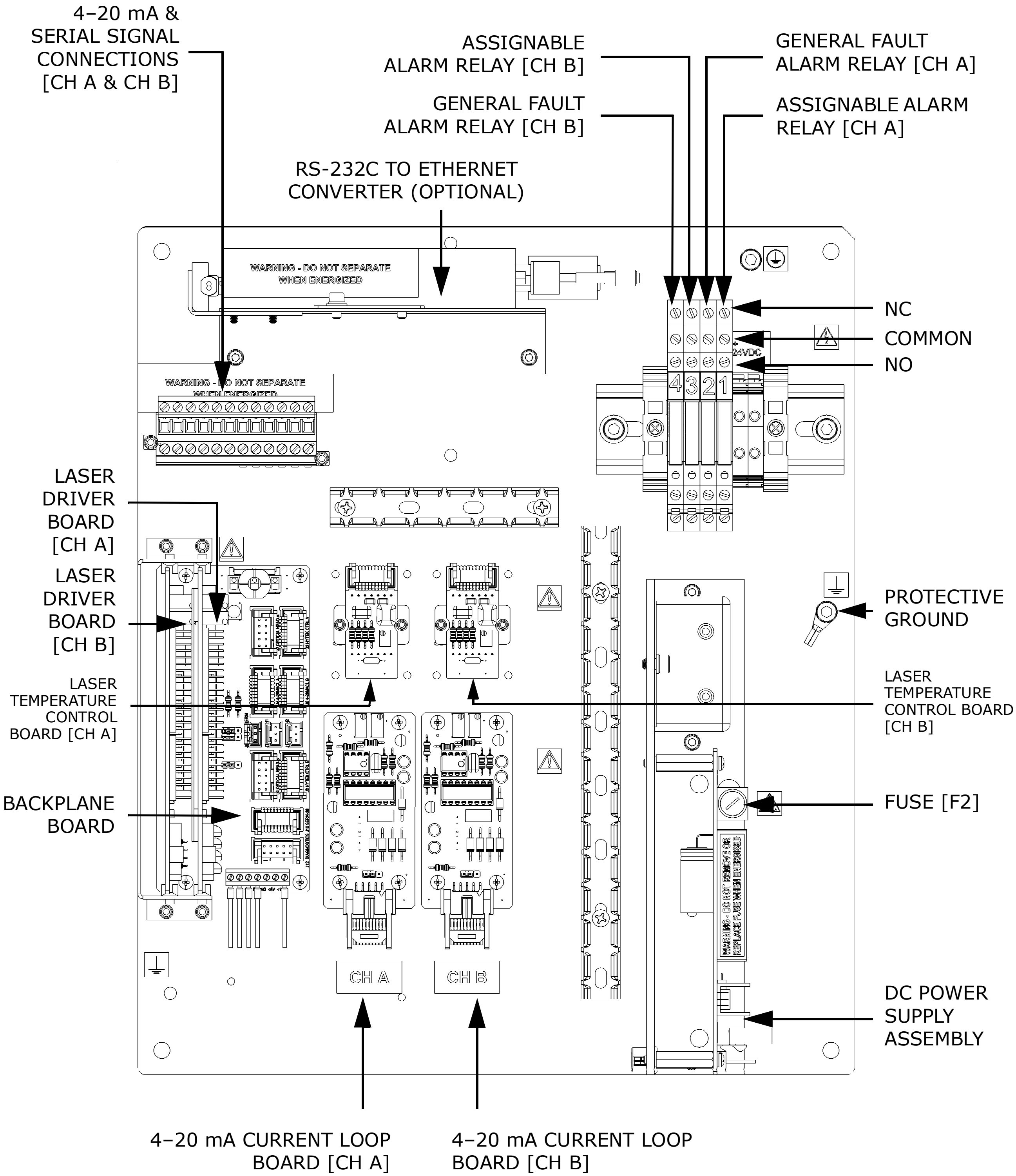


Figure 1–8 *Electronics control board (DC) for dual-channel systems (SS3000e) with RS-232C to Ethernet converter*

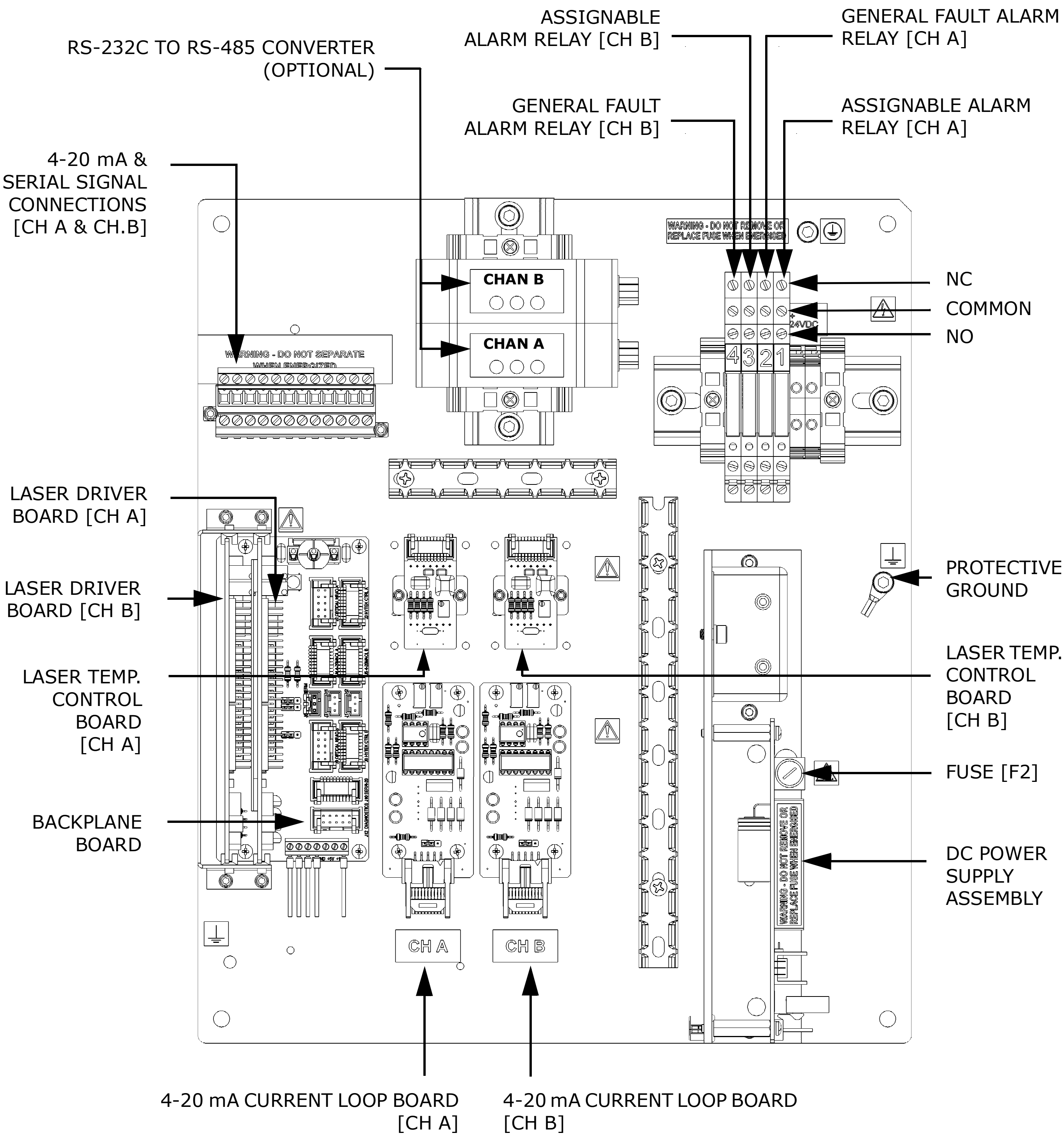


Figure 1–9 *Electronics control board (DC) for dual-channel systems (SS3000e) with RS-232C to RS-485 converter*

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2 - SAFETY

Potential Risks Affecting Personnel

This section addresses the appropriate actions to undertake when faced with hazardous situations during or before service of the gas analyzer. It is not possible to list all potential hazards within this document. The user is responsible for identifying and mitigating any potential hazards present when servicing the gas analyzer.

Technicians are expected to follow all safety protocols established by the customer that are necessary for servicing the gas analyzer. This may include, but is not limited to, lockout/tag-out procedures, toxic gas monitoring protocols, personal protection equipment (PPE) requirements, hot work permits and other precautions that address safety concerns related to performing service on process equipment located in hazardous areas.

Mitigating risks

Refer to the instructions for each situation listed below to mitigate associated risks.

Exposure to process gases

1. Shut off the process gas to the gas analyzer before any service that would require opening a part of the sample plumbing.
2. Purge the system with nitrogen.
3. Shut off the nitrogen purge before opening any part of the sample system.

Exposure to toxic gas (H_2S)

Follow the procedure below if there has been any suspected leak from the sample system and accumulated SCS enclosure.

1. Purge the SCS enclosure to remove any potentially toxic gas.
2. Test the H_2S levels of the SCS enclosure using the port from the safety purge kit to ensure the purge has cleared any toxic gas.
3. If no gas leak is detected, open the SCS enclosure door.

Follow all safety protocols governing toxic gases and potential leaks.

Electrocution hazard

1. Shut off power at the main disconnect external to the gas analyzer.

Complete this action before performing any service that requires working near the main input power or disconnecting any wiring or other electrical components.

2. Open enclosure door.

If service must be performed with power engaged (gain adjustment, etc.):

1. Note any live electrical components and avoid any contact with them.
2. Only use tools with a safety rating for protection against accidental contact with voltage up to 1000 V (IEC 900, ASTF-F1505-04, VDE 0682/201).

Explosion hazard

Any work in a hazardous area must be carefully controlled to avoid creating any possible ignition sources (e.g., heat, arcing, sparking, etc.). All tools must be appropriate for the area and hazards present. Electrical connections must not be made or broken with power on (to avoid arcing).

3 - INSTALLATION

This section describes the processes used to initially install and configure your SS500e/SS2000e/SS3000e. Once the gas analyzer arrives, take a few minutes to examine the contents of the container and this manual before installing the unit.

Endress+Hauser Class I Division 2 gas analyzers use a non-incendive protection method, and as such all portions of the local installation codes apply. The maximum allowed inductance to resistance ratio (L/R ratio) for the field wiring interface must be less than 25 µH/Ω. The maximum total loop capacitance shall be 0.27 microfarads.

What Should be Included in the Shipping Box

The contents of the crate should include:

- The Endress+Hauser SS500e, SS2000e or SS3000e
- User instructions; Operator's Manuals and other operational instructions as necessary
- One (SS500e or SS2000e) or two (SS3000e) external serial cable(s) to connect the gas analyzer to a computer
- Additional accessories or options as ordered

If any of these contents are missing, contact your sales representative. Refer to **"Service"** on page B-23.

Inspecting the Gas Analyzer and SCS

Unpack and place the unit on a flat surface. Carefully inspect all enclosures for dents, dings, or general damage. Inspect the inlet and outlet connections for damage, such as bent tubing. Report any damage to the carrier.

Avoid jolting the instrument by dropping it or banging it against a hard surface. This action may disturb the optical alignment.

Lifting/carrying the gas analyzer

Before removing the crate, move the gas analyzer crate as close as possible to the final location.

Lift the gas analyzer by the mounting brackets using at least two individuals and distribute the weight among personnel to avoid injury. Never lift the gas analyzer by the electronics enclosure. Always carry the load, 34 kg (75 lbs.) to

45 Kg (100 lbs.), using one of the following points/methods (refer to Figure 3–1).

- Mounting point brackets
- Support beneath (best used when employing a forklift)

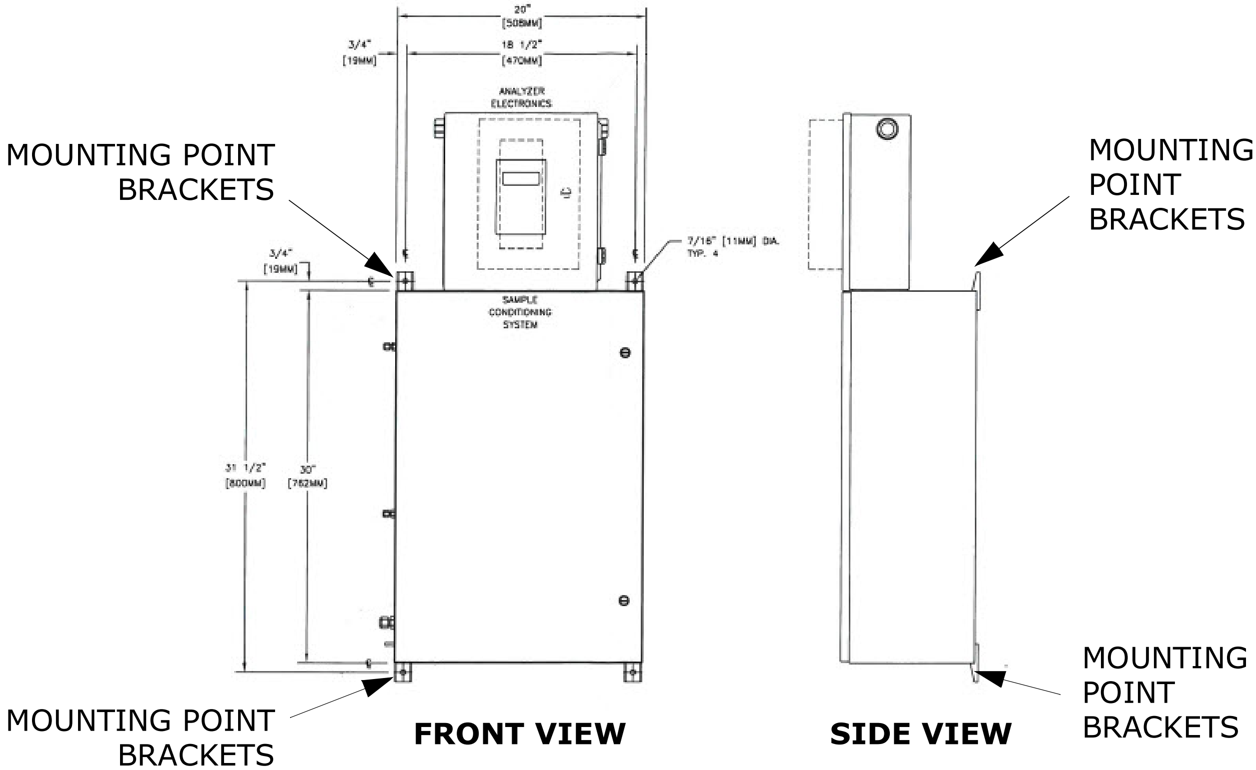


Figure 3–1 *Gas analyzer carrying points/methods*

Installing the Gas Analyzer and SCS

Installing the gas analyzer is relatively easy requiring only a few steps that, when carefully followed, will ensure proper mounting and connection. This section includes:

- Hardware and tools for installationMounting the Gas Analyzer
- Connecting Electrical Power to the Gas Analyzer
- Connecting the Output Signals and Alarms
- Connecting the Gas Lines

Hardware and tools for installation

Depending on the particular model, the configuration of accessories and options ordered, you may need the following hardware and tools to complete the installation process.

Hardware

- 3/8 in. bolts and nuts
- Stainless steel tubing (using 1/4 in. O.D. x 0.035 in. wall thickness, seamless stainless steel tubing is recommended)
- Conduit

Tools

- Hand drill and bits
- Tape measure
- Level
- Pencil
- Socket wrench set
- Screw driver
- Crescent wrench
- 9/16 in. open-end wrench

Mounting the Gas Analyzer

The SS500e/SS2000e/SS3000e gas analyzer is manufactured for wall or Unistrut® (or equivalent) metal framing installations. Refer to the layout diagrams in Appendix A for detailed mounting dimensions.

When mounting the gas analyzer, be sure not to position the instrument so that it is difficult to operate adjacent devices. Allow 1 m (3 feet) of room in front of the gas analyzer and any switches.

It is critical to mount the gas analyzer so that the inlet and outlet lines reach the inlet and outlet connections on the chassis while still maintaining flexibility so that the sample lines are not under excessive stress.

To mount the gas analyzer

1. Select a suitable location to mount the gas analyzer. Choose a shaded area or use an optional gas analyzer hood (or equivalent) to minimize sun exposure.

Endress+Hauser gas analyzers are designed for operation within the specified ambient temperature range of –20 °C to 50 °C (–4 °F to 122 °F). Intense sun exposure in some areas may cause the gas analyzer temperature to exceed the maximum.

2. Locate the mounting holes on your unit.
3. For wall installations, mark the centers of the top mounting holes.
4. Drill the appropriate size holes for the screws you are using.
5. Hold the gas analyzer in place and fasten with the top screws.
6. Repeat for the bottom mounting holes.

Once all four screws are tightened the gas analyzer should be very secure and ready for the electrical connections.

Connecting Electrical Power to the Gas Analyzer

The gas analyzer will be configured for 100 to 240 VAC @ 50/60 Hz single phase input or optionally 18 to 24 VDC input. Check the manufacturing data label or the terminal block labels to determine the power input requirements. All work must be performed by personnel qualified in electrical conduit installation. Conduit seals should be used where appropriate in compliance with local regulations.

***Hazardous voltage and risk of electric shock**. Before attaching the wiring to the gas analyzer, make sure all power to the wires is off.*

Careful consideration should be taken when grounding. Properly ground the unit by connecting ground leads to the grounding studs provided throughout the system that are labeled with the ground symbol ⏚.

Interconnection of the gas analyzer enclosure and cell enclosure shall be accomplished using wiring methods approved for Class I, Division 2 hazardous locations as per the Canadian Electrical Code (CEC) Appendix J and the National Electric Code (NEC) Article 501. The installer is responsible for complying with all local installation codes.

Endress+Hauser Class I, Division 2 gas analyzers use a non-incendiary protection method, as such, all relevant portions of the local installation codes apply. Please refer to Appendix F12 of the Canadian Electrical Code (CEC), Part 1 and any other standards applicable to the installation.

Depending on the gas analyzer configuration, the electrical wiring can typically be connected to the gas analyzer through a conduit hub located at the upper right of the electronics enclosure.

Protective chassis and ground connections

Before connecting any electrical signal or power, the protective and chassis grounds must be connected. Requirements for the protective and chassis grounds are as follows:

- The protective and chassis grounds must be of equal or greater size than any other current-carrying conductors, including the heater located in the SCS.
- The protective and chassis grounds must remain connected until all other wiring is removed.
- If the protective and chassis ground is insulated, it must use the green/yellow color.

For the protective ground locations on AC electronics, refer to Figure 1–6 and Figure 1–7. For the protective ground locations on DC electronics, refer to Figure 1–8 and Figure 1–9. The chassis ground connection is typically located on the lower cabinet (SCS). Refer to **"Sample Conditioning System"** on page 4-1.

To connect electrical power to the gas analyzer

1. Open the electronics enclosure door. Take care not to disturb the electrical assembly inside.

__Hazardous voltage and risk of electric shock__. Failure to properly ground the gas analyzer may create a high-voltage shock hazard.

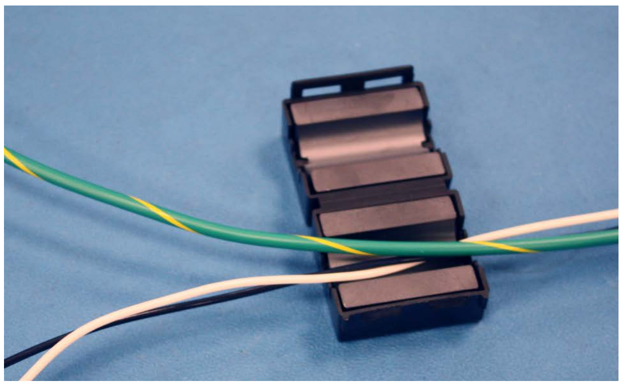
2. Run conduit from the power distribution panel to the conduit hub on the electronics enclosure labeled for the gas analyzer power input.

Conduit seals should be used where appropriate in compliance with local regulations.

Because the breaker in the power distribution panel or switch will be the primary means of disconnecting the power from the gas analyzer, the power distribution panel should be located in close proximity to the equipment and within easy reach of the operator.

An approved switch or circuit breaker rated for 15 amps should be used and clearly marked as the disconnecting device for the gas analyzer.

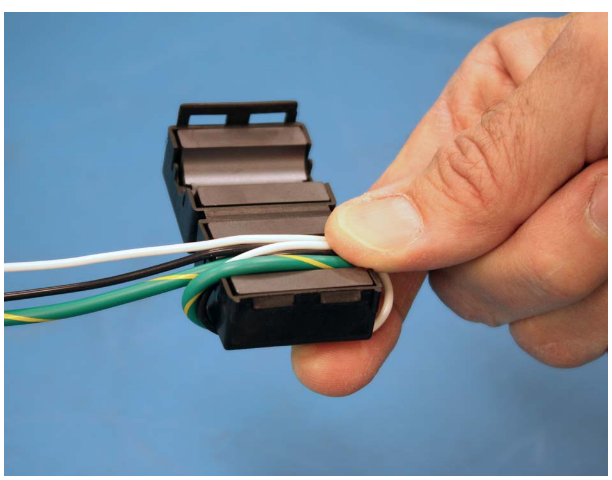
3. For AC systems, pull ground, neutral and hot wires (#14 AWG minimum) into the electronics enclosure. For DC systems, pull ground, plus and minus wires.
4. In keeping with best practices, run the wires through the provided ferrite as shown below.



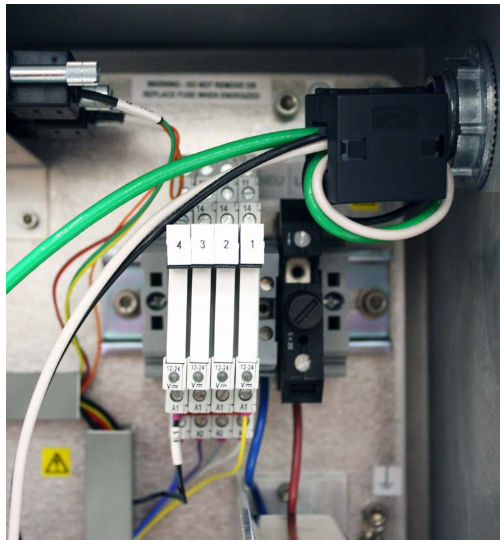
Proper installation and use of the provided ferrite is required for electromagnetic immunity rating.

The ferrite is fragile and will break if dropped. Use caution when handling.

5. Wrap the wires tightly around the ferrite as shown below.



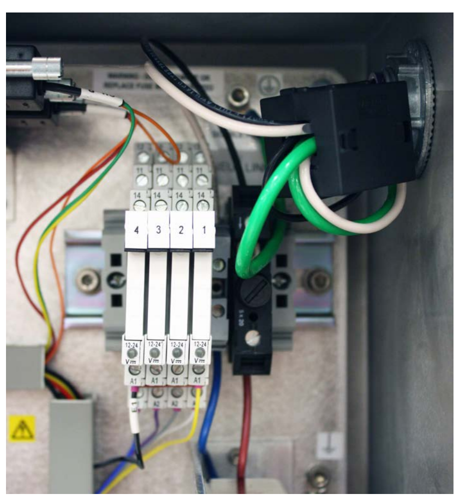
6. Make sure the ferrite ends up as close to the entry point of the wires as possible, as shown below.



7. Strip back the jacket and/or insulation of the wires just enough to connect to the power terminal block.

8. For AC systems, attach the neutral and hot wires to the power terminal block by connecting the neutral wire to the terminal marked "NEU," the hot wire to the terminal marked "LINE,", as shown in Figure 3–2.
   For DC systems, connect the negative wire to the terminal marked "–," and the positive wire to the terminal marked "+," as shown in Figure 3–2.

9. Connect the ground wire to the ground screw marked ⏚. Refer to the illustration below.



10. Close and tighten the electronics enclosure door.

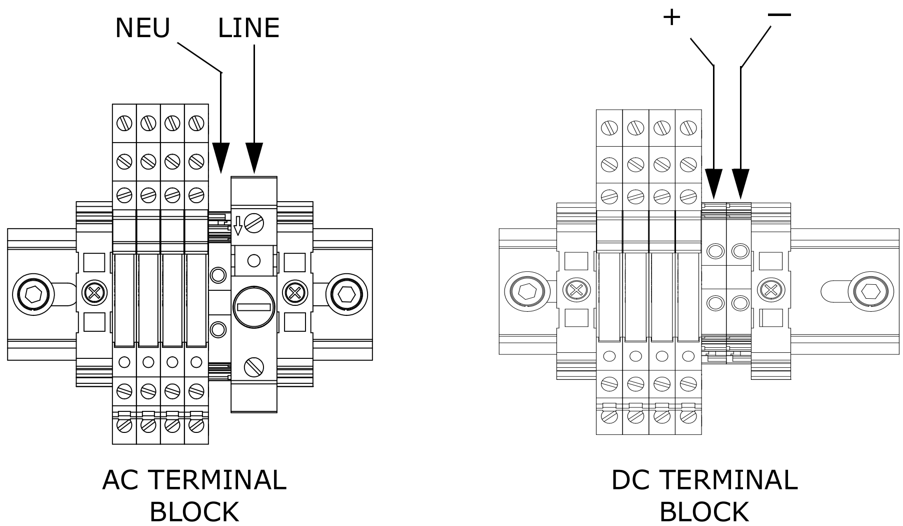


Figure 3–2 *AC and DC connection terminal blocks in electronics enclosure*

Connecting Electrical Power to the Enclosure Heater

Units with an enclosure heater will have an additional power connection through a conduit hub located at the bottom left of the enclosure.

To connect electrical power to the enclosure heater

1. Open the heated enclosure door. Take care not to disturb anything inside.

Hazardous voltage and risk of electric shock*. Failure to properly ground the gas analyzer may create a high-voltage shock hazard.*

2. Open the power terminal box inside the heated enclosure, as shown in Figure 3–3.

*DO NOT connect to the '**NC**' terminal. This will prevent the thermostat from functioning and cause the gas analyzer system to overheat.*

3. Run conduit from the power distribution panel to the conduit hub on the lower left side of the heated enclosure labeled for the heater

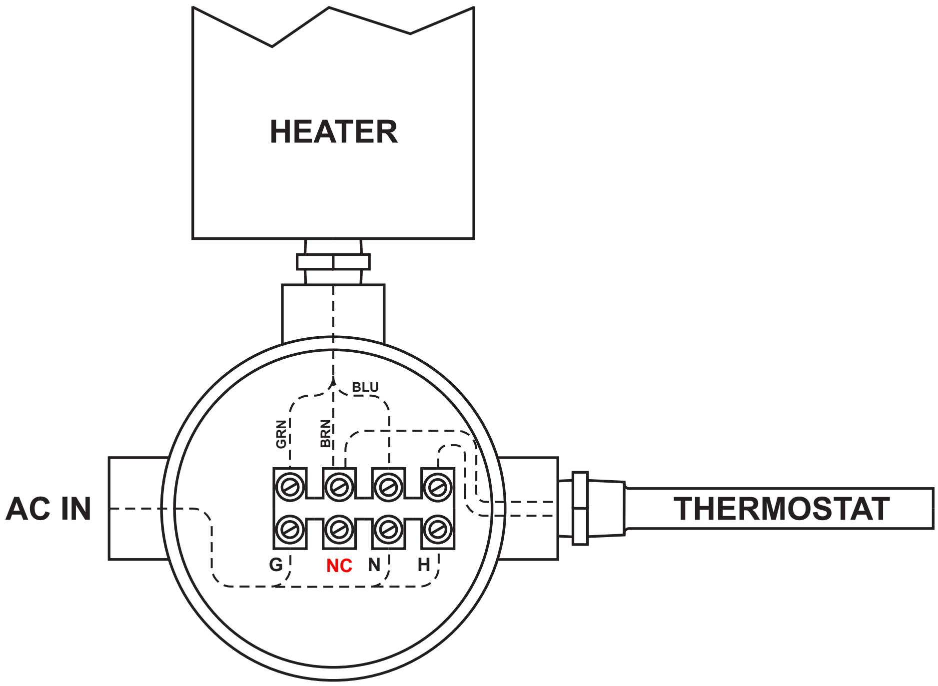


Figure 3–3 *AC connection terminal block for enclosure heater*

power input. Refer to **"Application of Conduit Lubricant"** on page 3-10.

Conduit seals should be used where appropriate in compliance with local regulations.

Because the breaker in the power distribution panel or switch will be the primary means of disconnecting the power from the heater, the power distribution panel should be located in close proximity to the equipment and within easy reach of the operator.

An approved switch or circuit breaker rated for 15 amps should be used and clearly marked as the disconnecting device for the heater.

4. Pull ground, neutral and hot wires (#14 AWG minimum) into the power terminal box inside the heated enclosure.
5. Strip back the jacket and/or insulation of the wires just enough to connect to the power terminal block.

6. Attach the neutral and hot wires to the power terminal by connecting the neutral wire to the terminal marked "N," the hot wire to the terminal marked "H," as shown in Figure 3–3.
7. Connect the ground wire to the ground terminal marked "G" or ⏚.
8. Close the power terminal box.
9. Close and latch the heated enclosure door.

Application of Conduit Lubricant

To ensure proper installation, Endress+Hauser recommends using STL8 lubricant on all conduit screw thread and its tapped opening.

STL8 Screw Thread Lubricant is a lithium based, anti-galling substance with excellent adhesion that maintains rain-tightness and grounding continuity between conduit fittings. This lubricant has proven very effective between parts made of dissimilar metals, and is stable in temperatures from -20 °F to +300 °F.

Do not use this lubricant on exposed current-carrying parts.

1. Holding the fitting piece at one end, generously apply the STL8 lubricant on the male threaded surface (at least five threads wide) as shown below.

Figure 3–4 *Applying conduit lubricant*

2. Screw the female pipe thread onto the male fitting until the lubricated threads are engaged.

Eyes*: May cause minor irritation.*

Skin*: May cause minor irritation.*

Ingestion*: Relatively non-toxic. Ingestion may result in a laxative effect. Ingestion of substantial quantities may cause lithium toxicity.*

Connecting the Output Signals and Alarms

The 4–20 mA current loop and serial output(s) are supplied from the mating terminal block (TB2) located inside the gas analyzer electronics enclosure as shown in Figure 1–6, Figure 1–7, Figure 1–8, or Figure 1–9. In addition, two digital outputs per channel connected to SPDT relays are also provided.

The relay for the **General Fault Alarm** is configured to be fail-safe (or normally energized) so the dry contact will open in the event of power loss or **General Fault Alarm**. Thus, the cable for the **General Fault Alarm** should be wired to the common and normally open (NO) terminals.

The standard configuration provides RS-232C output; however, optional converters are available to provide RS-485 or Ethernet output. By default, the 4–20 mA current loop output is factory set to source current.

*The 4–20 mA current loop output is factory set to source current. To change the 4–20 mA current loop output from source to sink, see **“To change a 4–20 mA board from source to sink”** on page 3-17.*

Connections can be made with customer-supplied cables for the current loop(s), alarm(s) and serial/Ethernet connections. Standard CAT5e Ethernet cable with male RJ-45 termination is required to connect to the optional RS-232C to Ethernet converter. Consult the wiring diagrams in Appendix B.

***Hazardous voltage and risk of electric shock**. Be sure power to the gas analyzer is turned off before opening the electronics enclosure and making any connections.*

To connect the output signals

1. Disconnect power to the gas analyzer and open the electronics enclosure cover. Take care not to disturb the electrical assembly inside.
2. Run conduit from the signal/alarm receiving station to the conduit hub on the electronics enclosure labeled for signal connections.

Conduit seals should be used where appropriate in compliance with local regulations.

3. Pull the customer-supplied cable(s) for the current loop(s), alarm(s) and serial/Ethernet connections through the conduit into the electronics enclosure.

4. In keeping with best practices, run the wires through the provided ferrite.

Proper installation and use of the provided ferrite is required for electromagnetic immunity rating.

5. Wrap the wires tightly around the ferrite making sure the ferrite ends up as close to the entry point of the wires as possible, as shown in Figure 3–2.
6. Strip back the jacket and insulation of the current loop and serial cables just enough to connect to the mating terminal block (TB2), shown in Figure 3–5. The mating terminal block can be pulled up and removed from its base to make the cable connection process easier.

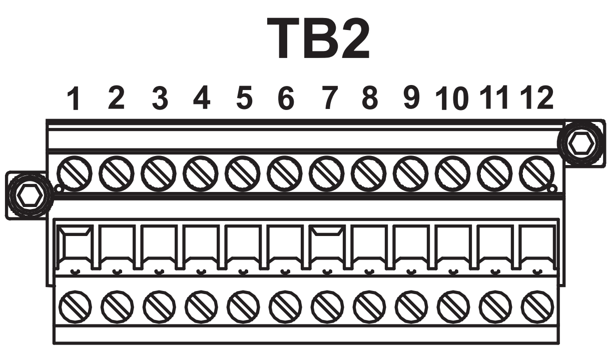


Figure 3–5 *Mating terminal block (TB2) in electronics enclosure for connecting signal cables*

7. Connect the 4–20 mA current loop and serial signal wires to the appropriate terminals, as indicated in Table 3–1, Table 3–2 or Table 3–3.
8. For systems with an optional RS-232C to Ethernet converter, plug the male RJ-45 connector directly into the converter.
9. Reinsert the mating terminal block (TB2) into its base and verify that each connection is secure.
10. Close and tighten the electronics enclosure cover.
11. To complete the connections, attach the other end of the current loop wires to a current loop receiver and each serial/Ethernet cable to a serial/Ethernet port on your computer.

Table 3–1 *Output signal connections (RS-232C configuration)*

Terminal	Description	Notes [1]
1	RS-232 CH A RX	
2	RS-232 CH A TX	
3	RS-232 CH A GND	
4	RS-232 CH B RX	
5	RS-232 CH B TX	
6	RS-232 CH B GND	
7	4–20 mA CH A (+)	Output # 1 Always CH A
8	4–20 mA CH A (–)	
9	4–20 mA CH A GND	
10	4–20 mA CH B (+)	Output #2 CH A for SS500e/SS200e CH B for SS3000e
11	4–20 mA CH B (–)	
12	4–20 mA CH B GND	

1. Also applies to Ethernet configuration.

Table 3–2 *Output signal connections (RS-485 configuration)*

Terminal	Description	Notes [1]
1	RS-485 CH A TD B (+)	
2	RS-485 CH A TD A (–)	
3	RS-485 CH A GND	
4	RS-485 CH B TD B (+)	
5	RS-485 CH B TD A (–)	
6	RS-485 CH B GND	
7	4–20 mA CH A (+)	Output # 1 Always CH A
8	4–20 mA CH A (–)	
9	4–20 mA CH A GND	
10	4–20 mA CH B (+)	Output #2 CH A for SS500e/SS200e CH B for SS3000e
11	4–20 mA CH B (–)	
12	4–20 mA CH B GND	

1. Also applies to Ethernet configuration.

Table 3–3 *Output signal connections (Ethernet configuration)*

Terminal	Description
1	NC
2	NC
3	NC
4	NC
5	NC
6	NC
7	4–20 mA CH A (+)
8	4–20 mA CH A (–)
9	4–20 mA CH A GND
10	4–20 mA CH B (+)
11	4–20 mA CH B (–)
12	4–20 mA CH B GND

Configuring the Optional RS-232C/RS-485 Converter

The optional Optically Isolated RS-232C to RS-485 converter is configured for two-wire RS-485. DIP switches on the side of the converter can be used to set time-out and termination, as indicated in Table 3–4.

RS-232C must be set to 9600 (default), whereas the RS-485 should be set to match the network settings.

Table 3–4 *Output signal connections (two-wire RS-485 configuration)*

	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	Time-out [1] (ms)	R11 (KΩ)
RS-485 2-Wire Half Duplex	ON	ON	ON	ON						
120 Ω Built-in Termination					ON					
External or no Termination					OFF					
1200 Baud						OFF	OFF	OFF	8.330 [2]	820
2400 Baud						OFF	OFF	ON	4.160	
4800 Baud						OFF	ON	OFF	2.080	
9600 Baud						ON	OFF	OFF	1.040	
19.2K Baud						ON	ON	ON	0.580	
38.4K Baud						OFF	OFF	OFF	0.260 [2]	27
57.6K Baud						OFF	OFF	OFF	0.176 [2]	16
115.2K Baud						OFF	OFF	OFF	0.087 [2]	8.2

1. Time-out selections are equal to one character time at the indicated baud rate.
2. To achieve this time-out, an appropriate through-hole resistor must be placed in the R11 location on the PCB.

Configuring the Optional RS-232C/Ethernet Converter

The optional RS-232C to Ethernet Converter provides a standard RJ-45 connection. Refer to Figure 3–6 for an illustration of a RJ-45 connector and pin identification. Cable pin-outs for standard and crossover cables are listed in Table 3–5 and Table 3–6, respectively. For additional information about the configuration and use of the RS-232C to Ethernet converter, refer to “Ethernet Serial Server” on page 5-1.

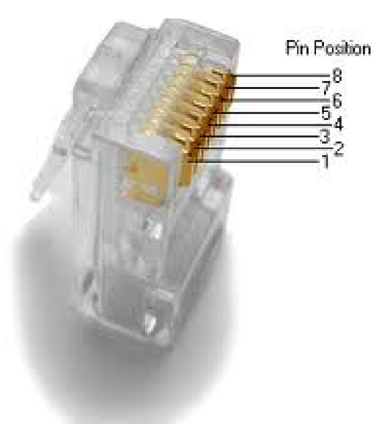


Figure 3–6 *RJ-45 Connector*

Standard Ethernet cable connection (straight-through) is used to connect devices of different types (e.g., switch to computer). Crossover cable is used to connect devices of the same type (e.g., switch to switch).

Table 3–5 *Standard Ethernet cable RJ-45 pin-out*

Signal	Wire Color	RJ-45 Pin
TX (+)	White-Green	1
TX (-)	Green	2
RX (+)	White-Orange	3
NC	Blue	4
NC	White-Blue	5
RX (–)	Orange	6
NC	White-Brown	7
NC	Brown	8

RJ-45 Pin	Wire Color
1	White-Green
2	Green
3	White-Orange
4	Blue
5	White-Blue
6	Orange
7	White-Brown
8	Brown

Table 3–6 *Crossover Ethernet cable RJ-45 pin-out*

Wire Color	RJ-45 Pin
White-Green	1
Green	2
White-Orange	3
Blue	4
White-Blue	5
Orange	6
White-Brown	7
Brown	8

RJ-45 Pin	Wire Color
1	White-Green
2	Green
3	White-Orange
4	Blue
5	White-Blue
6	Orange
7	White-Brown
8	Brown

Changing the 4–20 mA Current Loop Mode

*Changing the current loop mode may negate specific hazardous area certifications. Refer to **"Service"** on page B-23 to connect with Service support for details.*

By default, the 4–20 mA current loop output is factory set to source current. In some instances it may be necessary to change the 4–20 mA current loop output in the field from source to sink. The work must be performed by personnel qualified in electronics assembly.

To change a 4–20 mA board from source to sink

1. Disconnect power to the gas analyzer and open the electronics enclosure cover. Take care not to disturb the electrical assembly inside.
2. Locate the 4–20 mA board(s) on the electronics assembly panel in the center of the electronics enclosure, as shown in Figure 1–6, Figure 1–7, Figure 1–8, or Figure 1–9.
3. Remove the jumper (JMP1) connecting the center pin to pin A. Refer to Figure 3–7.

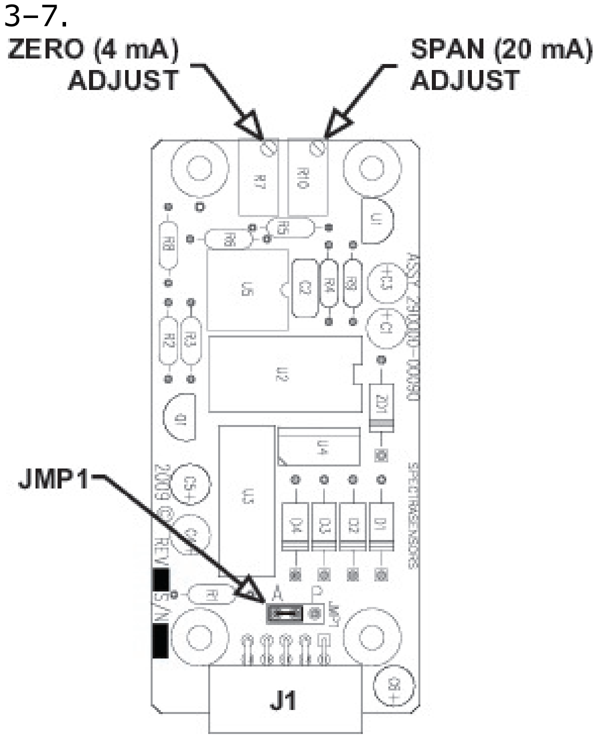


Figure 3–7 *4–20 mA output board*

4. For 4–20 mA sink, carefully replace the jumper (JMP1) connecting the center pin to pin P.

Needle nose pliers may be required to remove the jumper.

5. Reconnect power to the gas analyzer. Confirm the 4 mA (minimum) and 20 mA (maximum) points.
6. Close and tighten the electronics enclosure cover. Follow the programming instructions below.

To scale the current loop signal

1. Make sure the current loop to be adjusted is connected and the receiver is set for the 4–20 mA board to source the current.
2. Set the current loop output to 4 mA by setting the **4–20 mA % Test** parameter to zero (see **"To change parameters in Mode 2 or Mode 3"** in the Device Parameters, HC12).

<CH A SET PARAMETER>
4–20 mA % Test
101
Enter a % (101=Off)

3. Adjust the receiver calibration control to read the appropriate value. The current loop output of 4 mA corresponds to the concentration value set by the **4 mA Value** parameter.
4. Set the current loop output to 20 mA by setting the **4–20 mA % Test** parameter to 100.
5. Adjust the receiver calibration control to read the appropriate value. The current loop output of 20 mA corresponds to the concentration value set by the **20 mA Value** parameter.
6. If desired, repeat by setting the **4–20 mA % Test** parameter, *R*, to any value between 0 and 100 and confirm that the output, i, agrees with $i = R(20\text{ mA} - 4\text{ mA}) + 4\text{ mA}$.
7. When finished, reset the **4–20 mA % Test** parameter to "101."

For more information on the gas analyzer programming, refer to the Device Parameters.

Connecting the Gas Lines

Once you have verified that the gas analyzer is properly wired, you are ready to connect the sample supply and sample return. Consult the layout and flow diagrams in Appendix A for guidance. All work must be performed by technicians qualified in instrument tubing.

Using 1/4 in. O.D x 0.035 in. wall thickness, seamless stainless steel tubing is recommended.

Process samples may contain hazardous material in potentially flammable and/or toxic concentrations. Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the sample contents before installing the SCS.

To connect the sample supply line

1. First, confirm that the sample probe is correctly installed at the process supply tap and that the sample probe isolation valve is closed.

The process sample at the sample tap may be at a high pressure. Use extreme caution when operating the sample probe isolation valve and field pressure reducing regulator.

All valves, regulators, switches, etc. should be operated in accordance with site lock-out/tag-out procedures.

2. Also confirm that the field pressure reducing station is installed properly at the sample probe and that the pressure regulator at the field pressure reducing station is closed (adjustment knob turned fully counter-clockwise).
3. Check that the relief valve vent line is properly installed from the field pressure reducing station to the low pressure flare or atmospheric vent connection.
4. Determine appropriate tubing route from the field pressure reducing station to the SCS.
5. Run stainless steel tubing from the field pressure reducing station to the sample supply port of the SCS. Bend tubing using industrial grade benders, check tubing fit to ensure proper seating between the tubing and fittings. Fully ream all tubing ends. Blow out the lines

for 10 to 15 seconds with clean, dry nitrogen or air prior to making the connection.

6. Connect the inlet tube to the SCS using the 1/4 in. stainless steel compression-type fitting provided.
7. Tighten all new fittings 1-1/4 turns with a wrench from finger tight. For connections with previously swaged ferrules, thread the nut to the previously pulled up position, then tighten slightly with a wrench. Secure tubing to appropriate structural supports as required.
8. Check all connections for gas leaks. Using a liquid leak detector is recommended.

Do not exceed 0.7 barg or 1700 mbar (10 psig) in sample cell. Damage to cell may result.

To connect the sample return

1. Confirm that the low pressure flare or atmospheric vent header shut-off valve is closed.

All valves, regulators, switches, etc. should be operated in accordance with site lock-out/tag-out procedures.

2. Determine appropriate tubing route from the SCS to the low-pressure flare or atmospheric vent header.
3. Run stainless steel tubing from the sample return port to the low pressure flare or atmospheric vent header connection. Bend tubing using industrial grade benders, check tubing fit to ensure proper seating between the tubing and fittings. Fully ream all tubing ends. Blow out the lines for 10 to 15 seconds with clean, dry nitrogen or air prior to making the connection.
4. Connect the sample return tube to the SCS using the 1/2 in. stainless steel compression-type fitting provided.
5. Tighten all new fittings 1-1/4 turns with a wrench from finger tight.
   a. For connections with previously swaged ferrules, thread the nut to the previously pulled up position, then tighten slightly with a wrench. Secure tubing to appropriate structural supports as required.
6. Check all connections for gas leaks. Using a liquid leak detector is recommended.

4 - Sample Conditioning System

Personnel should have a thorough understanding of the operation of the gas analyzer and the procedures presented here before operating the sample conditioning system (SCS).

The process sample at the sample tap may be at a high pressure. A pressure reducing regulator is located at the sample tap to reduce the sample pressure and allow operation of the SCS at a low pressure. Use extreme caution when operating the sample probe isolation valve and field pressure reducing regulator.

About the SCS

SS500e/SS2000e/SS3000e systems is typically ordered with an integral SCS. Each SCS has been specifically designed to deliver a sample stream to the gas analyzer that is representative of the process stream at the time of sampling. To ensure the integrity of the sample stream and its analysis, care must be taken to install and operate the SCS properly. Therefore, any personnel intending to operate or service the gas analyzer and SCS should have a thorough understanding of the process application and the design of the gas analyzer and SCS.

Most problems experienced with sample systems tend to result from operating the system differently than intended. In some cases, the actual process conditions may be different than originally specified (e.g., flow rates, presence of contaminants, particulates, or condensables that may only exist under upset conditions). By understanding the application and the design of the system, most issues can be avoided altogether or easily diagnosed and corrected to ensure successful normal operation.

For SS500e/SS2000e/SS3000e Gas Analyzer systems, Natural Gas refers to low pressure gas typically consisting of a mixture of methane (CH_4) and heavier hydrocarbons. A typical Natural Gas composition is listed in Table A–6 on page A–16.

*The SS500e/SS2000e/SS3000e Gas Analyzer system has been calibrated specifically for the type of background stream listed in the Calibration Certificate. Significant deviations from the specified stream composition may result in erroneous readings. If your stream composition differs significantly from the composition listed, your system may have undergone custom calibration. Refer to **"Service"** on page B-23 to connect with Service.*

Typical SCS Component Overview

All Endress+Hauser TDL gas analyzers are designed for extractive sampling rather than in situ applications. This allows for sample conditioning, filtration, temperature, pressure and flow control to protect the optical components of the system, and provides for ease of maintenance without shutting down the process.

Some of the typical components used in the SCS will be described in this section. The SCS for your gas analyzer may not use all of these components, and may also include additional special devices not discussed here.

For questions regarding your SCS, please refer to ***"Service"*** *on page B-23.*

Sample probe

A sample probe is used to provide a representative sample of any process stream. This sample can only be made if the stream is in a vapor phase. Mixed liquid/vapor streams must be avoided, so the location of the sample probe is critical in many processes.

Contact Service to provide the temperature, pressure and complete stream composition of the process stream for advise and recommendations regarding locating the sample point. Please refer to ***"Service"*** *on page B-23.*

A representative sample of the process can only be taken away from the wall of the process piping. Also, dirt and liquids tend to accumulate close to the walls of the piping, especially near the bottom of horizontal runs of pipe. Therefore, Endress+Hauser recommends probes that fit well into the pipe. These may be removable to protect the probe from pipeline "pigging".

Sample regulators at the probe

The pressure of the sample gas is usually reduced at or very close to the sample probe, sometimes in the probe itself, to reduce the sample transport lag time to deliver the sample to the gas analyzer. A guard filter is typically used to protect the regulator from larger particulates in the sample.

Refer to Figure 4–1 that shows the interface of the probe and the gas analyzer system. The gas analyzer system provided by Endress+Hauser is represented by the blue dashed outline. The probe and field pressure reducing station may also be supplied by Endress+Hauser, but is separate from the gas analyzer system.

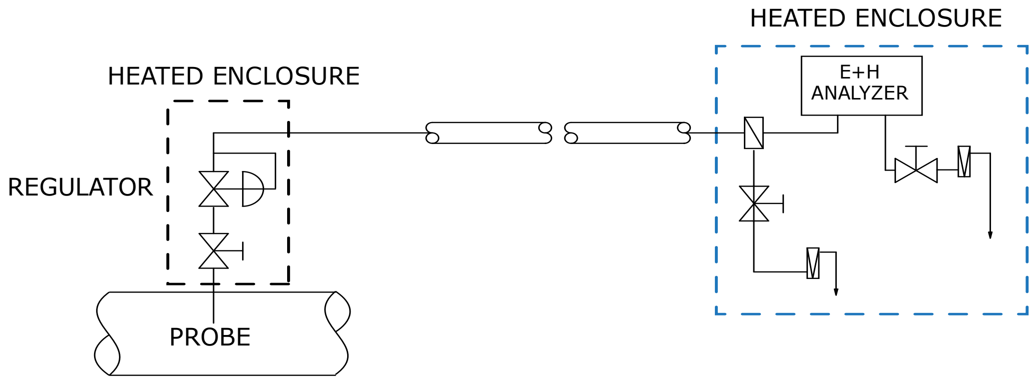


Figure 4–1 *Probe to gas analyzer interface*

Sample conditioning system filters

The sample system is equipped with a membrane separator, which is ideal for the removal of relatively small amounts of liquid present on a continuous basis (i.e., aerosols and suspended liquids). If two-phase fluids and free-flowing liquids flow through the gas analyzer and sample system, it may flood and require cleaning. Permanent damage from liquid flooding is not likely.

A guard filter is typically installed at the inlet to the SCS with a fine element to protect the flow controllers, flow meters and pressure regulators from fine particulates.

A bypass filter with a fritted metal, glass fiber or polymetric membrane filter may also be in place to remove larger quantities of particulates or entrained liquids and mists. Some filters may fit with liquid knock-out traps to protect the system from free liquids.

Accumulation of liquids in the guard and bypass filters or a steady flow of liquid from a liquid knock-out trap should be investigated and corrected immediately as this is generally an abnormal condition.

Sample regulator heaters

In most applications, the process sample is at high pressure. When the pressure is reduced, the sample cools due to the Joule-Thompson effect.[1] The amount of cooling varies greatly depending on the application, but oftentimes must be offset using a heated sample regulator to prevent condensation of some sample components. Sample probe regulators can be electrically or

1 Named for James Prescott Joule and William Thomson, the Joules-Thompson effect describes the increase or decrease in temperature that accompanies the expansion of gas without production of work or transfer of heat. The cooling occurs because work must be done to overcome the long-range attraction between the gas molecules as they move farther apart. (www.britannica.com)

steam heated. Some probes have the pressure reducing valve parts inserted into the process piping, so that the Joule-Thompson cooling is offset by warming from the flowing sample. Note that for these probes to work correctly, the process gas must be flowing anytime the sample is flowing or liquid condensation may collect in the sample transport line, or even freeze up the sample probe regulator. Refer to Appendix A for the proper regulator pressure setting.

Sample transport tubing

Sample transport tubing must be made of an appropriate material, which may be coated, and of an appropriate diameter for the application. Many times the sample transport tubing must be heat-traced to prevent sample condensation or to prevent fluctuations in measurement due to changes in ambient temperature. Refer to Appendix A for recommended sample transport tubing specifications.

Sample bypass flow control

A sample bypass flow control valve and flow meters are usually provided to maintain a flow of fresh sample to the SCS even during system shut-down. The flow control valve is typically a needle valve and should be closed very gently and carefully if used to shut off flow completely to avoid damaging the valve. If the bypass flow meter has a glass tube, perform an occasional check for evidence of liquid in the tube. If liquid is found in the bypass or sample cell flow meter tubes, investigate and correct immediately.

SCS pressure regulator

All Endress+Hauser' TDL cells are limited to a maximum 10 PSIG pressure. To ensure that this pressure is not exceeded, a pressure regulator is provided inside the sample system. Refer to Appendix A for the correct pressure setting for this regulator.

Sample cell flow controller

A sample cell flow controller is normally provided with the SCS. Typically a flow control needle valve and flow meter similar to the sample bypass are used, but in some cases a differential flow controller is used. As with the bypass flow control valve, if the flow control needle valve and flow meter must be used for sample shut-off, close the valve gently and carefully to avoid damage.

Validation systems

Validation of the gas analyzer performance can be accomplished by comparison to other gas analyzers, portable measurement devices, or by validation using a cylinder standard.

Refer to Appendix A for details of the validation system used in your system.

Sample return/vent

Tunable diode laser spectroscopy is inherently sensitive to sample pressure in the measurement cell, so the gas analyzers are calibrated for a range of sample pressures. Most applications benefit from operation at low pressures instead of high pressures. Sometimes the gas analyzer is designed to vent the sample to atmosphere or an atmospheric pressure return system. Return to a flare or other sample return must recognize the pressure limitations of the cell and also the calibration of the gas analyzer.

To start the SCS heater

Many gas analyzer systems have heated SCS enclosures. In many cases, this is only to avoid condensation of sample components.

When starting up the heated SCS, follow the general guidelines below:

1. Energize power to the SCS and allow it to warm up to a level close to the SCS sample temperature set-point.
2. Start the sample flow and set to the specified flow rates.
3. Allow the system temperature to stabilize.
4. Energize power to the gas analyzer controller and ignore any error messages that are seen on the display during the temperature stabilization period.
5. Once the gas analyzer has been allowed to thermally stabilize, be sure to enable Peak Tracking and any other software features as directed in the chapter called "Operating the Gas Analyzer" in the Device Parameters.

Checking the SCS Installation

The integral SCS is factory set with the appropriate pressures, flow rates, and enclosure temperature, as indicated in the system drawings (refer to Appendix A). However, before operating the system for the first time, a careful check of the installation of the entire SCS from the sample probe to the return vent is recommended. Endress+Hauser also recommends purging the transport line to confirm there is no dust, particulates or liquids that were trapped during installation.

To perform SCS installation checks

1. Confirm that the sample probe is correctly installed at the process supply tap and that the sample probe isolation valve is closed.
2. Confirm that the field pressure reducing station is installed properly at the sample probe.

3. Confirm that the relief valve vent line is properly installed from the field pressure reducing station or the SCS to the low pressure flare or atmospheric vent connection.
4. If applicable, confirm that the sample probe and field pressure reducing station are properly traced and insulated without any exposed surfaces.
5. If applicable, confirm that the field run electric-traced sample transport tubing is installed correctly (no exposed tubing or pockets), terminated properly at each end, and that each line has been purged clean and pressure tested.
6. Confirm that all valves are closed and all switches are off.
7. Confirm that the AC power is available to the electrically traced sample tubing (if applicable), gas analyzer, and SCS, but that the local switches are off.
8. Confirm that the field analog and alarm signal wiring is interconnected properly.
9. Confirm that the low pressure flare or atmospheric vent is properly connected.
10. Confirm that the gas analyzer house atmospheric vent is properly installed, if applicable.
11. Confirm that all sample system tubing has been thoroughly leak checked.

Starting up the SCS

After the SCS installation has been thoroughly checked, you are ready to begin preparing for initial SCS startup.

To prepare for SCS startup

1. Confirm that all AC power switches for the gas analyzer and SCS are off.
2. If applicable, apply AC power to the electric heat-traced sample transport tubing at the tracer control system.

Personnel should have a thorough understanding of the operation of the heat tracer power supply and control system, if applicable, before operating the SCS.

3. If applicable, confirm that the sample supply line electric heat tracer temperature controller is set and that the sample supply line tracer is heating to the appropriate temperature.
4. Confirm that the sample probe isolation valve is closed.

5. Confirm that the pressure regulator at the field pressure reducing station is closed (adjustment knob turned fully counterclockwise).
6. Confirm that all sample system shut-off valves are closed.
7. Confirm that the sample bypass and gas analyzer flow meter control valves are gently closed (adjustment knob turned clockwise).

Do not over-tighten the control valves or damage could occur.

To start up the field pressure reducing station

The process sample at the sample tap may be at a high pressure. Use extreme caution when operating the sample probe isolation valve and field pressure reducing regulator.

1. Disconnect the sample transport tubing at the SCS and temporarily run to a new, safe location (vent or flare).
2. Open the low pressure flare or atmospheric vent header shut-off valve, if applicable, for the relief valve vent from the field pressure reducing station.

The low pressure flare or atmospheric vent header shut-off valve must be "car-sealed" open and tagged as a relief valve vent so that this valve will not be closed unless the SCS is not in operation.

3. Slowly open the sample probe process shut-off valve at the sample supply tap.
4. Slowly open the pressure regulator at the field pressure reducing station (adjustment knob turned clockwise) and set the pressure regulator to the specified pressure. Refer to the system drawings in Appendix A.
5. Blow sample through the sample transport tubing to flare or safe vent to ensure that dirt or liquids are not in the sample tubing.
6. Reconnect the sample transport tubing and set the pressure regulator to the specified pressure.

To start up the sample bypass stream on process sample

1. Ensure the low pressure flare or atmospheric vent header shut-off valve is opened for the bypass flow effluent from the SCS.

2. Open the sample supply shut-off valve.
3. Open the bypass flow meter control valve to establish sample flow from the sample probe and set the flow meter control valve to the specified value. Refer to the system drawings in Appendix A.

Do not open the cell flow meter at this point.

4. Confirm that the sample supply pressure is set to the approximate pressure specified under flowing conditions. Refer to the system drawings in Appendix A.

Make sure that no liquid, solids, etc. are flowing through the bypass by viewing the flow meter. If substances are present, shut down the system and purge the lines.

Although the exact supply pressure set-point is not critical, the pressure at the sample system should be within 5 PSIG of the specified supply pressure set-point. There may be a difference between the pressure readings at the sample tap and inside the SCS due to the pressure drop in the sample transport line under flowing conditions. If the pressure at the SCS under flowing conditions is not sufficiently close to the specified set-point, it will be necessary to readjust the pressure regulator set-point at the field pressure reducing station to provide the required supply pressure with the specified sample bypass flow.

To start up the gas analyzer on process sample

This procedure can be completed during the system warm-up process. Refer to the system drawings in Appendix A for all recommended settings.

1. Ensure the low pressure flare or atmospheric vent header shut-off valve is opened for the sample flow effluent from the SCS.
2. Open the sample flow meter control valve(s) to approximately the specified flow for each measurement cell. Refer to the system drawings in Appendix A.
3. If required, adjust each sample pressure regulator to the specified set-point for each measurement cell.
4. Adjust the sample flow meter control valve(s) to the specified flows for the measurement cells.

The adjustment set-points of the gas analyzer flow meters and pressure regulators will be iterative and may require multiple adjustments until the final set-points are obtained.

The gas analyzer system has been designed for the sample flow rate specified. A lower than specified sample flow rate may adversely affect gas analyzer performance. If you are unable to attain the specified sample flow rate, refer to ***"Service"*** *on page B-23.*

5. Confirm the sample flow and pressure set-points and re-adjust the control valve(s) and pressure regulator to the specified set-points, if necessary.
6. Confirm the sample bypass flow and re-adjust the control valve to the specified set-point, if necessary. The SCS is now operating with the process sample.
7. Power up the gas analyzer according to the procedure given under **"Powering Up the Gas Analyzer"** in the Device Parameters.
8. After sufficient warm-up time, if applicable, confirm that the sample system enclosure is heated to the specified temperature by observing the temperature reading on the gas analyzer display.

Shutting Down the SCS

Situations may occur that require the shutdown of some or all of the SCS. These circumstances may include short-term shutdown for repairs or parts replacements, for example, or a long-term shutdown of the system for packing and storing.

Process samples may contain hazardous material in potentially flammable and/or toxic concentrations. Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the sample contents before operating the SCS.

The process sample at the sample tap is at a high pressure. A pressure reducing regulator is located at the sample tap to reduce the sample pressure and enable operation of the SCS at a low pressure. Use extreme caution when operating the sample probe isolation valve and field pressure reducing regulator.

All valves, regulators, switches, etc. should be operated in accordance with site lock-out/tag-out procedures.

To isolate the measurement sample cell for short-term shutdown

The gas analyzer can be isolated from the primary sample bypass section for short-term shutdown or maintenance of the gas analyzer while allowing the sample bypass flow to continue in a steady-state mode.

Due to the high pressure of the process sample, it is advisable to allow the sample bypass flow to continue during short-term isolation of the gas analyzer. Continuing sample bypass flow allows the field pressure regulator to continue normal operation without possible overpressure and activation of the relief valve in the event the pressure regulator leaks when the downstream flow is discontinued.

1. Close the sample flow meter control valve(s) (adjustment knob turned clockwise) for each measurement channel. Do not over-tighten the control valve(s) or damage could occur.
2. Allow any residual gas to flow out of the measurement cells.

***Never** purge the gas analyzer with air or nitrogen while the system is powered up.*

3. Close the low pressure flare or atmospheric vent header shut-off valve for the effluent from each measurement cell.

If the system will not be out of service for an extended period, Endress+Hauser advises that power remain applied to the sample transport line electric tracer and the sample system enclosure heater, if applicable.

To isolate the SCS for short-term shutdown

The SCS can be isolated from the process sample tap for short-term shutdown or maintenance of the SCS without requiring the shutdown of the field pressure reducing station.

Process samples may contain hazardous material in potentially flammable and/or toxic concentrations. Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the sample contents before operating the SCS.

Although the pressure reducing regulator at the process sample tap is designed for "bubble-tight" shut off, this condition may not occur after the system has been in operation for an extended period. Isolation of the SCS from the field pressure regulator will discontinue sample flow and may cause the pressure at the outlet of the field pressure regulator to slowly increase if "bubble-tight" shut off of the pressure regulator does not occur. The slow pressure increase will continue until the pressure set-point of the relief valve is reached and the excess pressure is vented by the relief valve. To prevent this, isolate the sample at the probe or vent the sample to a safe location.

1. Isolate the gas analyzer from the bypass following the procedure under **"To isolate the measurement sample cell for short-term shutdown"** on page 4-10.
2. Close the sample supply shut-off valve to the SCS.
3. Allow the sample bypass to flow until all residual gas has dissipated from the lines as indicated by no flow on the sample bypass flow meter.
4. Close the low pressure flare or atmospheric vent header shut-off valve for the effluent from the sample bypass.
5. Turn off power to the gas analyzer.

If the system will not be out of service for an extended period, Endress+Hauser advises that power remain applied to the sample transport line electric tracer and the sample system enclosure heater, if applicable.

To isolate the process sample tap for long-term shutdown

If the SCS is to be out of service for an extended period, the SCS must be isolated at the process sample tap.

The process sample at the sample tap may be at a high pressure. A pressure reducing regulator is located at the sample tap to reduce the sample pressure and allow operation of the SCS at a low pressure. Use extreme caution when operating the sample probe isolation valve and field pressure reducing regulator.

The sample transport line must be vented to the low pressure flare or atmospheric vent header through the bypass flow meter to avoid pressure surges. The procedure given in the following steps can be followed regardless of whether or not the SCS has been isolated from the process tap as described in the previous section.

All valves, regulators, switches, etc. should be operated in accordance with site lock-out/tag-out procedures.

1. Isolate the gas analyzer from the bypass following the procedure under **"To isolate the measurement sample cell for short-term shutdown"** on page 4-10.
2. Confirm flow in the sample bypass flow meter (the actual flow is not critical).
3. Close the sample probe process shut-off valve at the sample supply process tap.
4. Allow pressure in the field pressure reducing regulator to dissipate until only a low residual pressure is indicated on the pressure gauge at the field station.
5. Close the field pressure reducing regulator (adjustment knob turned fully counterclockwise).
6. Close the low pressure flare or atmospheric vent header shut-off valve for the relief valve vent from the field pressure regulator.
7. Close the sample supply shut-off valve to the SCS.
8. Leave the sample bypass flow meter control valve open.
9. Close the low pressure flare or atmospheric vent header shut-off valve for the effluent from the sample bypass.
10. Turn off power to the gas analyzer.
11. Turn off the AC power to the SCS heater and the sample tracer, if applicable, at the power distribution panel.

Although power could be shut off to the sample supply electric tracer, it is advisable to allow this line to remain heated unless the SCS is to be out of service for an extended period or maintenance is required on the line.

5 - Ethernet Serial Server

Endress+Hauser SS500e/SS2000e/SS3000e gas analyzers operate with the Vlinx **ESP902 Ethernet Serial Server** that provides Serial-to-Ethernet conversion. The following information is provided for additional instruction for installing and configuring the ESP902 Ethernet Serial Server.

The instructions contained in this chapter assume operation will be conducted by a user with experience in network configuration.

Software Installation

1. Connect a standard Ethernet cable to the ESP902 unit if connecting to your network, or a crossover cable if connecting directly to a computer.
   a. The default IP address is 192.168.0.1.
2. Insert the software CD (or download from the manufacturer's website - http://www.bb-elec.com/ESP90x_Software.asp; from the "Software" list select 'Vlinx Vx.x.x.x Software'). The software should autostart into the installation wizard.
3. Follow the on-screen installation wizard to install the Vlinx ESP Manager software.

Configuration

1. From the computer, click Start\Programs\B&B Electronics\Vlinx\ESP Servers\Vlinx ESP Manager.
   a. A search for the attached ESP902 device should autostart on startup.

The device must reside on the same subnet to be seen by the Vlinx ESP Manager software for first-time discovery.

2. Double-click on the device name from the unit list.
3. Use the Vlinx ESP Manager software to configure the unit for network information, serial device configurations, timeouts, etc.
   a. The default password = <blank>.
   b. Reboot as necessary.

Virtual COM Port Installation

If it is necessary to access the instrument Ethernet data so that it appears to be from a serial port, use the following steps:

1. From the computer, click **Start\Programs\B&B Electronics\Vlinx\Install Virtual COM**.
2. Search for all devices.
   a. The device must be in the same subnet. If not, type the specific IP address.
3. Double-click on the device name from the unit list.

Verify that you have administrative rights and disable firewalls for Windows XP/Vista.

The device must reside on the same subnet to be seen by the Vlinx ESP Manager software for first-time discovery.

4. Follow the on-screen instructions and install to a COM number. COM 5 or above is typically used to limit interference with existing real COM ports.
5. Use HyperTerminal to verify that the VCOM just created can be opened.

Connecting to SS500e/SS2000e/SS3000e without Software Setup

Use the following procedure to connect to the SS500e, SS2000e, or SS3000e gas analyzer using the VLINX Ethernet Serial Server when accessing the manufacturer software is not an option.

These instructions assume that the user computer is using a version of Windows operating system (i.e., 2000, XP, Vista, etc.).

1. Connect a crossover cable to the Ethernet port on your computer and attach the other end to the Ethernet Server.
2. The default IP address for the Ethernet Server is 192.168.0.1. If your computer is already assigned an IP address on the same subnet (192.168.0.xxx), then go directly to step 4. (If step 4 does not work, you are probably not on the same subnet.)

3. For a Windows computer, use the following steps as a guideline (these steps may vary slightly depending on your specific set up):
   a. Go to Network Connections\Local Area Connection\Properties.
   b. Highlight Internet Protocol (TCP/IP) and click **Properties**.
   c. Set an IP address on the same subnet, 192.168.0.xxx (e.g., 192.168.0.10), and a subnet mask of 255.255.255.0.
   d. Click on **OK**.
4. Open a web browser and type in the default IP address of the Ethernet Server, 192.168.0.1.
5. Press **ENTER**. A web page from the Ethernet Server will display with all the necessary settings to configure it for your network.
6. When finished, click **SAVE**.
7. For details, refer to the B&B Electronics manual for the ESP902 Serial Server.

Firewall Ports

Refer to Table 5-1 for ports to open in firewall.

Table 5-1 *Ports to open in firewall*

Ports	Function
5300	Heartbeat and configuration setting in TCP mode (i.e., pair tunneling mode)
8888	Vlinx update
8889	Configuration setting in UDP mode
8890	Vlinx monitor
4000/4001 [1]	VCOM

1. Port 4000 is used for CH A data. Port 4001 is used for CH B data.

Additional Information

For more information, please contact the equipment manufacturer:

B & B Electronics Manufacturing Company

707 Dayton Road
P.O. Box 1040
Ottawa, IL 61350
815-433-5100
www.bb-elec.com
orders@bb-elec.com
support@bb-elec.com

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Appendix A: Specifications

Table A–1 *SS500e H_2O gas analyzer specifications*

Performance	
Concentration [1]	38 to 422 ppmv (2 to 20 lbs/MMscf) 38 to 1055 ppmv (2 to 50 lbs/MMscf) 38 to 2110 ppmv (2 to 100 lbs/MMscf)
Repeatability	± 10 ppmv (± 0.5 lb/MMSCF) or ± 2% of reading
Response time [2]	0.25 to 2 seconds (dependent on flow rate and sample system volume)
Application Data	
Environmental Temperature Range	-20 to 50 °C (-4 to 122 °F) -10 to 60 °C (15 to 140 °F) - *Optional*
Environmental Relative Humidity	Maximum of 95% relative humidity, non-condensing
Altitude	Up to 4000 m
Maximum Cell Pressure	70 kPaG (10 psig)
Sample Cell Pressure Range	700 to 1400 mbara 700 to 1700 mbara - *Optional*
Sample Flow Rate	0.5 to 1.0 LPM (1 to 2 scfh)
Contaminant Sensitivity	None for gas phase glycol, methanol, amines, hydrogen sulfides or mercaptans.
Electrical & Communications	
Input Voltages [3]	100 to 240 VAC, 50/60 Hz 18 to 24 VDC - *Optional*
Digital Outputs Contact Rating (Inductive Load)	2, General Fault and Assignable Alarm AC: 15 250V, 3 A NO contact, 1.5 A NC contact DC: 13 24V, 1 A NO contact and NC contact
Current (unheated)	1 A max @ 120 VAC, 1.6 A max @ 24 VDC
Current (optional condens. protection heater)	2 A max @ 120 VAC
Communication	**Analog**: Two 4–20mA Isolated, 1200 ohms @ 24 VDC max load **Serial**: RS-232C - *Standard*, RS-485 and Ethernet - *Optional* **Protocol**: Modbus Gould RTU, Daniel RTU or ASCII
LCD Display	Concentration, cell pressure, temperature alarms and diagnostics
Physical Specifications	
Size	973 mm H x 406 mm W x 231 mm D (38.3 in. H x 16 in. W x 9.06 in. D)
Weight	Approximately 34 Kg (75 lbs)
Sample Cell Construction	316L Series Polished Stainless Steel
Certification	
Area Classification	CSA Class I, Division 2, Groups B, C & D; Temp code T3C (T3 with heaters)

1. Consult factory for alternative ranges.
2. Software adjustable.
3. Supply voltage not to exceed ± 10% of nominal. Transient over-voltages according to Over-voltage Category II.

Table A–2 *SS2000e H_2O gas analyzer specifications*

Performance	
Concentration [1]	0 to 422 ppmv (0.5 to 20 lbs/MMscf) 0 to 1055 ppmv (0.5 to 50 lbs/MMscf) 0 to 2110 ppmv (0.5 to 100 lbs/MMscf)
Repeatability	±4 ppmv (± 0.2 lb/MMscf) or ± 2% of reading
Response time [2]	0.25 to 2 seconds (dependent on flow rate and sample system volume)
Application Data	
Environmental Temperature Range	-20 to 50 °C (-4 to 122 °F) -10 to 60 °C (15 to 140 °F) - *Optional*
Environmental Relative Humidity	Maximum of 95% relative humidity, non-condensing
Altitude	Up to 4000 m
Maximum Cell Pressure	70 kPaG (10 psig)
Sample Cell Pressure Range	700 to 1400 mbara 700 to 1700 mbara - *Optional*
Sample Flow Rate	0.5 to 1.0 LPM (1 to 2 scfh)
Contaminant Sensitivity	None for gas phase glycol, methanol, amines, hydrogen sulfides or mercaptans.
Electrical & Communications	
Input Voltages [3]	100 to 240 VAC, 50/60 Hz 18 to 24 VDC - *Optional*
Digital Outputs Contact Rating (Inductive Load)	2, General Fault and Assignable Alarm AC: 15 250V, 3 A NO contact, 1.5 A NC contact DC: 13 24V, 1 A NO contact and NC contact
Current (unheated)	1 A max @ 120 VAC, 1.6 A max @ 24 VDC
Current (optional condens. protection heater)	2 A max @ 120 VAC
Communication	**Analog**: (2) 4–20 mA Isolated, 1200 ohms @ 24 VDC max load **Serial**: RS-232C - *Standard*, RS-485 and Ethernet - *Optional* **Protocol**: Modbus Gould RTU, Daniel RTU or ASCII
LCD Display	Concentration, cell pressure, temperature, alarms and diagnostics
Physical Specifications	
Size	973 mm H x 406 mm W x 229 mm D (38.3 in. H x 16 in. W x 9 in. D)
Weight	Approximately 34 Kg (75 lbs)
Sample Cell Construction	316L Series Polished Stainless Steel
Certification	
Area Classification	Class I, Division 2, Groups B, C & D; Temp code T3C (T3 with heaters)

1. Consult factory for alternative ranges.
2. Software adjustable.
3. Supply voltage not to exceed ± 10% of nominal. Transient over-voltages according to Over-voltage Category II.

Table A–3 *SS2000e CO_2 gas analyzer specifications*

Performance	
Concentration [1]	0 to 5%, 0 to 10%, 0 to 20%
Repeatability	± 400 ppmv or ± 2% of reading
Response time [2]	0.25 to 2 seconds (dependent on flow rate and sample system volume)
Application Data	
Environmental Temperature Range	-20 to 50 °C (-4 to 122 °F) -10 to 60 °C (15 to 140 °F)- *Optional*
Environmental Relative Humidity	Maximum of 95% relative humidity, non-condensing
Altitude	Up to 4000 m
Maximum Cell Pressure	70 kPaG (10 psig)
Sample Cell Pressure Range	700 to 1400 mbara 700 to 1700 mbara - *Optional*
Sample Flow Rate	0.5 to 1.0 LPM (1 to 2 scfh)
Contaminant Sensitivity	None for gas phase glycol, methanol, amines, hydrogen sulfides or mercaptans.
Electrical & Communications	
Input Voltages [3]	100 to 240 VAC, 50/60 Hz 18 to 24 VDC - *Optional*
Digital Outputs Contact Rating (Inductive Load)	2, General Fault and Assignable Alarm AC: 15 250V, 3 A NO contact, 1.5 A NC contact DC: 13 24V, 1 A NO contact and NC contact
Current (unheated)	1 A max @ 120 VAC, 1.6 A max @ 24 VDC
Current (optional condens. protection heater)	2 A max @ 120 VAC
Communication	**Analog**: (2) 4–20 mA Isolated, 1200 ohms @ 24 VDC max load **Serial**: RS-232C - *Standard*, RS-485 and Ethernet - *Optional* **Protocol**: Modbus Gould RTU, Daniel RTU or ASCII
LCD Display	Concentration, cell pressure, temperature, alarms and diagnostics
Physical Specifications	
Size	973 mm H x 406 mm W x 229 mm D (38.3 in. H x 16 in. W x 9 in. D)
Weight	Approximately 34 Kg (75 lbs)
Sample Cell Construction	316L Series Polished Stainless Steel
Certification	
Area Classification	Class I, Division 2, Groups B, C & D; Temp code T3C (T3 with heaters)

1. Consult factory for alternative ranges.
2. Software adjustable.
3. Supply voltage not to exceed ± 10% of nominal. Transient over-voltages according to Over-voltage Category II.

Table A–4 *SS3000e H_2O/H_2O gas analyzer specifications*

Performance	
Concentration [1]	0 to 422 ppmv (0.5 to 20 lbs/MMscf) 0 to 1055 ppmv (0.5 to 50 lbs/MMscf) 0 to 2110 ppmv (0.5 to 100 lbs/MMscf)
Repeatability	± 4 ppmv (± 0.2 lb/MMscf) or ± 2% of reading
Response time[2]	0.25 to 2 seconds (dependent on flow rate and sample system volume)
Application Data	
Environmental Temperature Range	-20 to 50 °C (-4 to 122 °F) -10 to 60 °C (15 to 140 °F) - *Optional*
Environmental Relative Humidity	Maximum of 95% relative humidity, non-condensing
Altitude	Up to 4000 m
Maximum Cell Pressure	70 kPaG (10 psig)
Sample Cell Pressure Range	700 to 1400 mbara 700 to 1700 mbara - *Optional*
Sample Flow Rate	0.5 to 1.0 LPM (1 to 2 scfh)
Contaminant Sensitivity	None for gas phase glycol, methanol, amines, hydrogen sulfides or mercaptans.
Electrical & Communications	
Input Voltages[3]	100 to 240 VAC, 50/60 Hz 18 to 24 VDC - *Optional*
Digital Outputs Contact Rating (Inductive Load)	2, General Fault and Assignable Alarm AC: 15 250V, 3 A NO contact, 1.5 A NC contact DC: 13 24V, 1 A NO contact and NC contact
Current (unheated)	1 A max @ 120 VAC,1.6 A max @ 24 VDC
Current (optional condens. protection heater)	2 A max @ 120 VAC
Communication	**Analog**: (2) 4–20 mA Isolated, 1200 ohms @ 24 VDC max load **Serial**: RS-232C - *Standard*, RS-485 and Ethernet - *Optional* **Protocol**: Modbus Gould RTU, Daniel RTU or ASCII
LCD Display	Concentration, cell pressure, temperature, alarms and diagnostic
Physical Specifications	
Size	1074 mm H x 508 mm W x 281 mm D (42.3 in. H x 20 in. W x 11.06 in. D)
Weight	Approximately 45 Kg (100 lbs)
Sample Cell Construction	316L Series Polished Stainless Steel
Certification	
CSA	Class I, Division 2, Groups B, C & D; Temp code T3C (T3 with heaters)

1. Consult factory for alternative ranges.
2. Software adjustable.
3. Supply voltage not to exceed ± 10% of nominal. Transient over-voltages according to Over-voltage Category II.

Table A–5 *SS3000e H_2O/CO_2 gas analyzer specifications*

Performance	
Concentration (H_2O)[1]	0 to 422 ppmv (0.5 to 20 lbs/MMscf) 0 to 1055 ppmv (0.5 to 50 lbs/MMscf) 0 to 2110 ppmv (0.5 to 100 lbs/MMscf)
Repeatability (H_2O)	± 4 ppmv (± 0.2 lb/MMSCF) or± 2% of reading
Concentration (CO_2)[a]	0 to 5%, 0 to 10%, 0 to 20%
Repeatability (CO_2)	± 400 ppmv or ± 2% of reading
Response time[2]	0.25 to 2 seconds (dependent on flow rate and sample system volume)
Application Data	
Environmental Temperature Range	-20 to 50 °C (-4 to 122 °F) -10 to 60 °C (15 to 140 °F) - *Optional*
Environmental Relative Humidity	Maximum of 95% relative humidity, non-condensing
Altitude	Up to 4000 m
Maximum Cell Pressure	70 kPaG (10 psig)
Sample Cell Pressure Range	700 to 1400 mbara 700 to 1700 mbara - *Optional*
Sample Flow Rate	0.5 to 1.0 LPM (1 to 2 scfh)
Contaminant Sensitivity	None for gas phase glycol, methanol, amines, hydrogen sulfides or mercaptans.
Electrical & Communications	
Input Voltages [3]	100 to 240 VAC, 50/60 Hz 18 to 24 VDC - *Optional*
Digital Outputs Contact Rating (Inductive Load)	2, General Fault and Assignable Alarm AC: 15 250 V, 3 A NO contact, 1.5 A NC contact DC: 13 24 V, 1 A NO contact and NC contact
Current (unheated)	1 A max @ 120 VAC, 1.6 A max @ 24 VDC
Current (optional condens. protection heater)	2 A max @ 120 VAC
Communication	**Analog**: (2) 4–20mA Isolated, 1200 ohms @ 24 VDC max load **Serial**: RS-232C - *Standard*, RS-485 and Ethernet - *Optional* **Protocol**: Modbus Gould RTU, Daniel RTU or ASCII
LCD Display	Concentration, cell pressure, temperature, alarms & diagnostics
Physical Specifications	
Size	1074 mm H x 508 mm W x 281 mm D (42.3 in. H x 20 in. W x 11.06 in. D)
Weight	Approximately 38.6 Kg (85 lbs)
Sample Cell Construction	316L Series Polished Stainless Steel
Certification	
CSA	Class I, Division 2, Groups B, C & D; Temp code T3C (T3 with heaters)

1. Consult factory for alternative ranges.
2. Software adjustable.
3. Supply voltage not to exceed ± 10% of nominal. Transient over-voltages according to Over-voltage Category II.

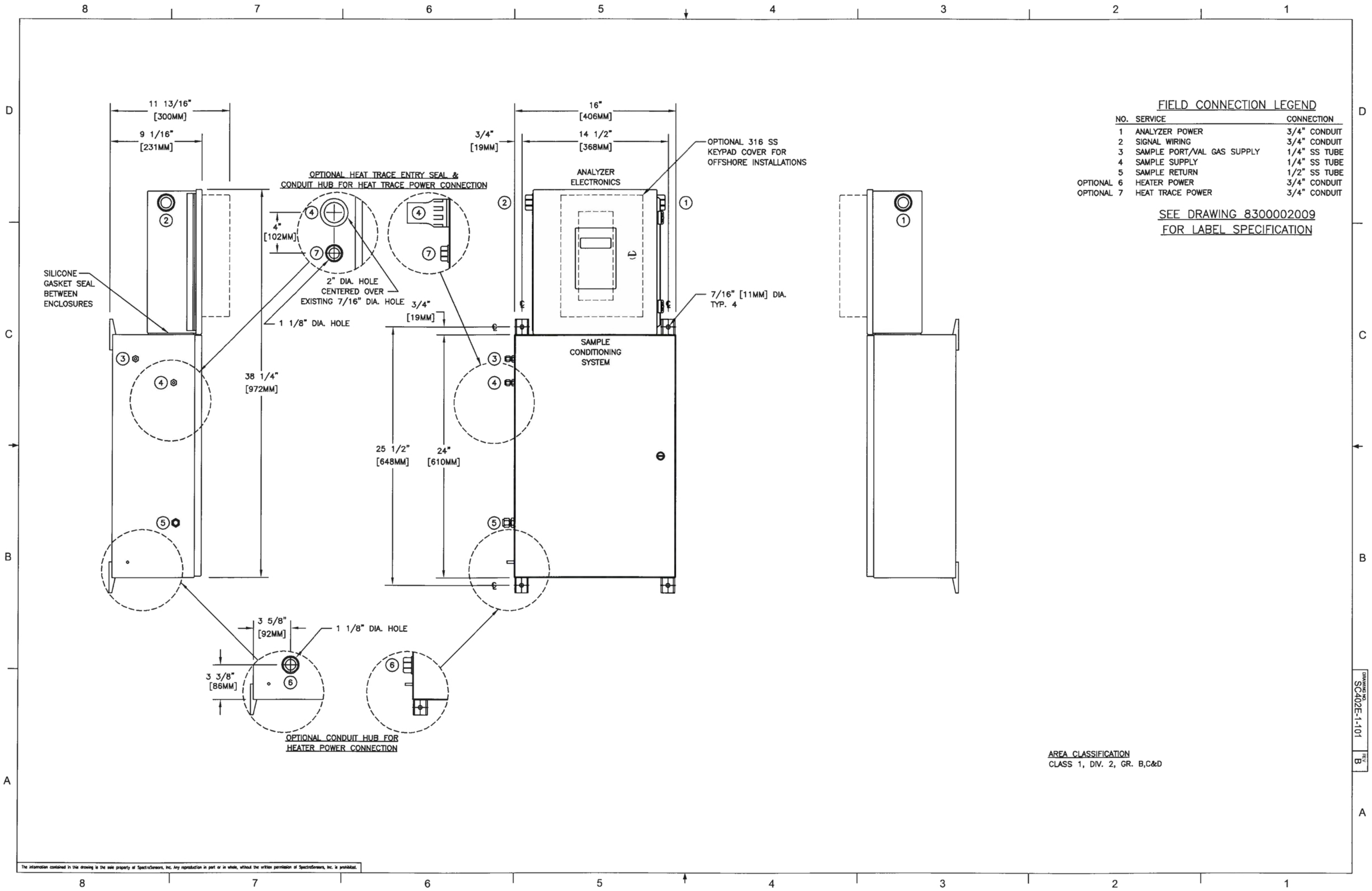
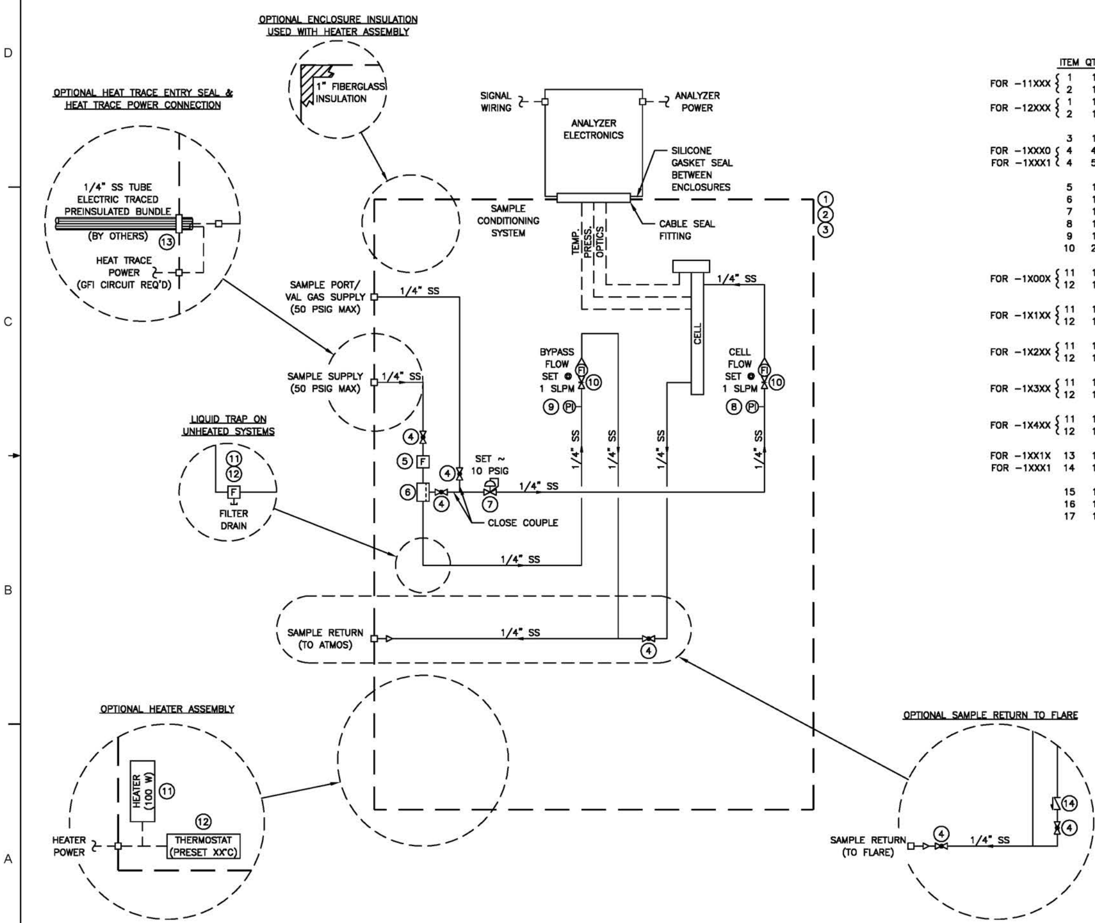


Figure A–1 *SS500e/SS2000e analyzer system outline and mounting dimensions*



BILL OF MATERIALS

	ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NO.	SSI PART NO.
FOR −11XXX	1	1	ASSY, SHS ENCLOSURE, E−SERIES, 24X16, 304	SPECTRASENSORS	8000002545	8000002545
	2	1	MOUNTING BRACKET KIT (SS)	HOFFMAN	CMFKSS	1400400001
FOR −12XXX	1	1	ASSY, SHS ENCLOSURE, E−SERIES, 24X16, 316	SPECTRASENSORS	8000002546	8000002546
	2	1	MOUNTING BRACKET KIT (SS)	HOFFMAN	CMFKSS	1400400001
	3	1	PANEL, SHS, E−SERIES, 24x16	SPECTRASENSORS	1400002253	1400002253
FOR −1XXX0	4	4	BALL VALVE, 1/4" TF (SS)	SWAGELOK	SS−42GS4	61303042S4
FOR −1XXX1	4	5	BALL VALVE, 1/4" TF (SS)	SWAGELOK	SS−42GS4	61303042S4
	5	1	FILTER (TEE−TYPE), 7 MICRON, 1/4" TF (SS)	SWAGELOK	SS−4TF−7	6101520074
	6	1	MEMBRANE SEPARATOR, 1/4" FNPT (SS)	A+ CORP	120−005−SS	6101671208
	7	1	REG, PRES, 0−25PSI, 0.07CV, SS, MTR	NEON CONTROLS	10−221B2−2AF2	6100002767
	8	1	PRESS. GAUGE (1.5"), 30 PSIG, 1/8" MNPT (SS)	MCDANIEL	SBL	6100002004
	9	1	PRESS. GAUGE (1.5"), 60 PSIG, 1/8" MNPT (SS)	MCDANIEL	SCL	6200000006
	10	2	FLOWMETER (W/VALVE), 2 SLPM, 1/4" FNPT (SS)	KING	74C123G081123810	6134100274
FOR −1X00X	11	1	FILTER (GLASS BOWL), 1/4" FNPT (SS)	UFS/HEADLINE	117G	6101510004
	12	1	FILTER ELEMENT, MICROFIBER	UFS/HEADLINE	12−32−70K	6101614001
FOR −1X1XX	11	1	HEATER (DIV. 1), 100 W, 120 VAC	INTERTEC	CNA100T3−120V	5300002017
	12	1	THERMOSTAT (DIV. 1), PRESET 20°C	INTERTEC	TS 20A	1400400120
FOR −1X2XX	11	1	HEATER (DIV. 1), 100 W, 240 VAC	INTERTEC	CNA100T3−240V	5300002018
	12	1	THERMOSTAT (DIV. 1), PRESET 20°C	INTERTEC	TS 20A	1400400120
FOR −1X3XX	11	1	HEATER (DIV. 1), 100 W, 120 VAC	INTERTEC	CNA100T3−120V	5300002017
	12	1	THERMOSTAT (DIV. 1), PRESET 40°C	INTERTEC	TS 40A	5500002009
FOR −1X4XX	11	1	HEATER (DIV. 1), 100 W, 240 VAC	INTERTEC	CNA100T3−240V	5300002018
	12	1	THERMOSTAT (DIV. 1), PRESET 40°C	INTERTEC	TS 40A	5500002009
FOR −1XX1X	13	1	HEAT TRACE ENTRY SEAL, 2.10" ID	INTERTEC	ISS4S	6100002161
FOR −1XXX1	14	1	CHECK VALVE, 1/3 PSI, 1/4" TF (SS)	SWAGELOK	SS−4C−1/3	6130504C13
	15	1	CONDUIT,OUTLET,T,1/2NPTF,W TERM BLOCK	CROUSE−HINDS	EABT16 TB14	2800002177
	16	1	STANDOFF,MF,1/2X2",1/4−20,ALUM	McMASTER−CARR	93505A200	1300002432
	17	1	NIPPLE, CLOSED, ALUM, 1/2"X1 1/8"	McMASTER−CARR	44665K171	6100002671

***Figure A–2** SS500e/SS2000e analyzer system sample system schematic*

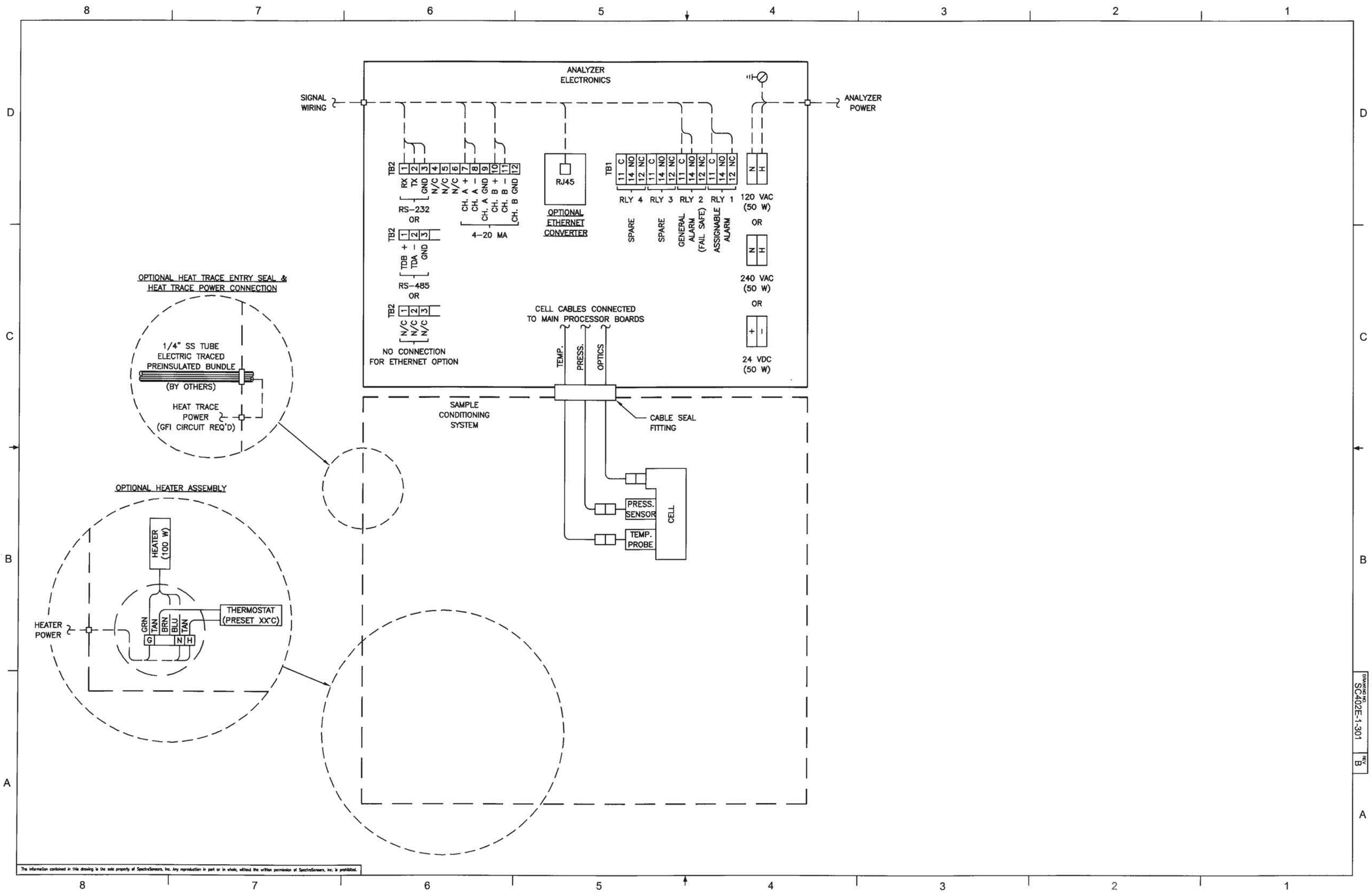


Figure A–3 *SS500e/SS2000e analyzer system power and signal wiring diagram*

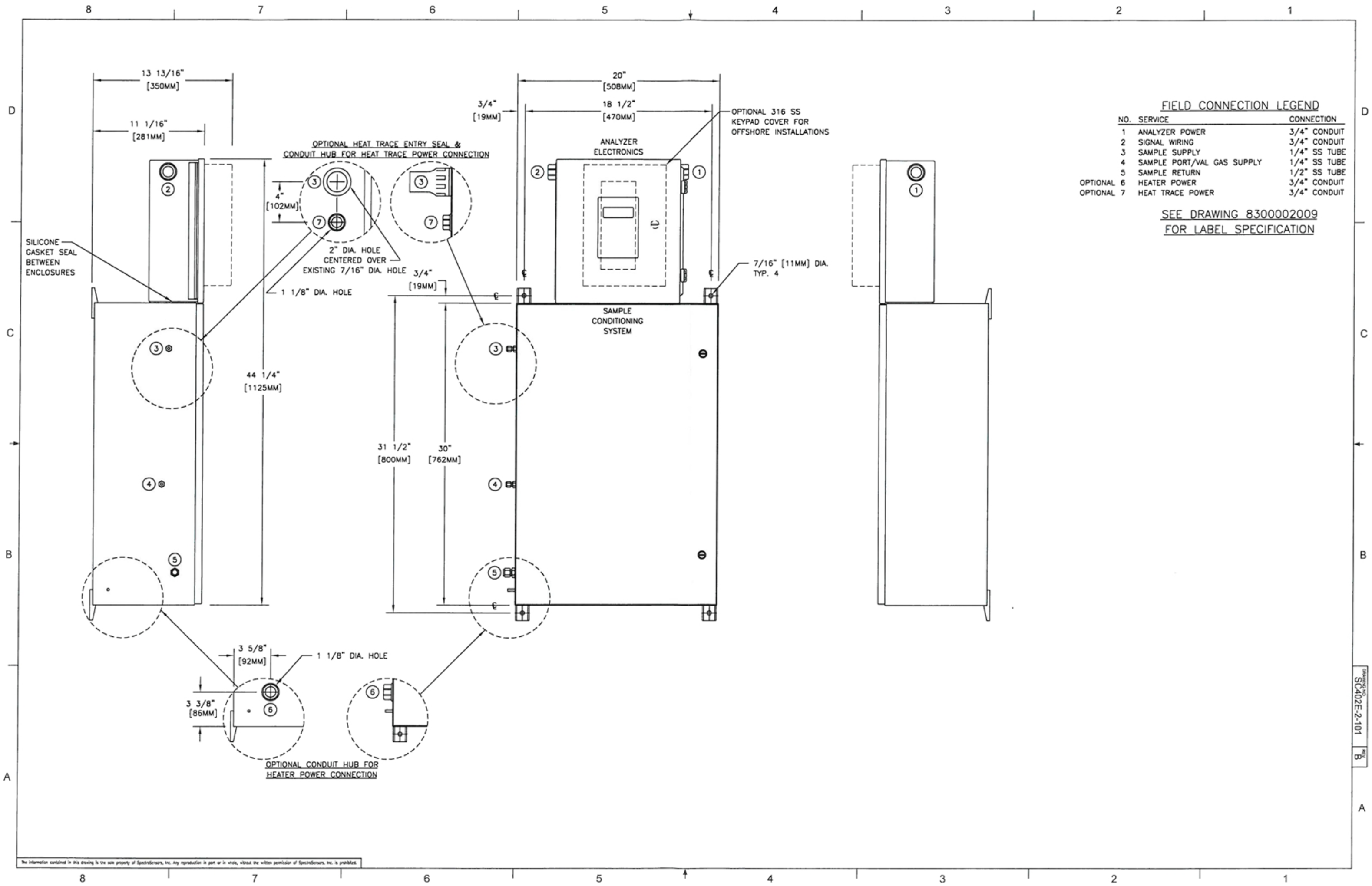
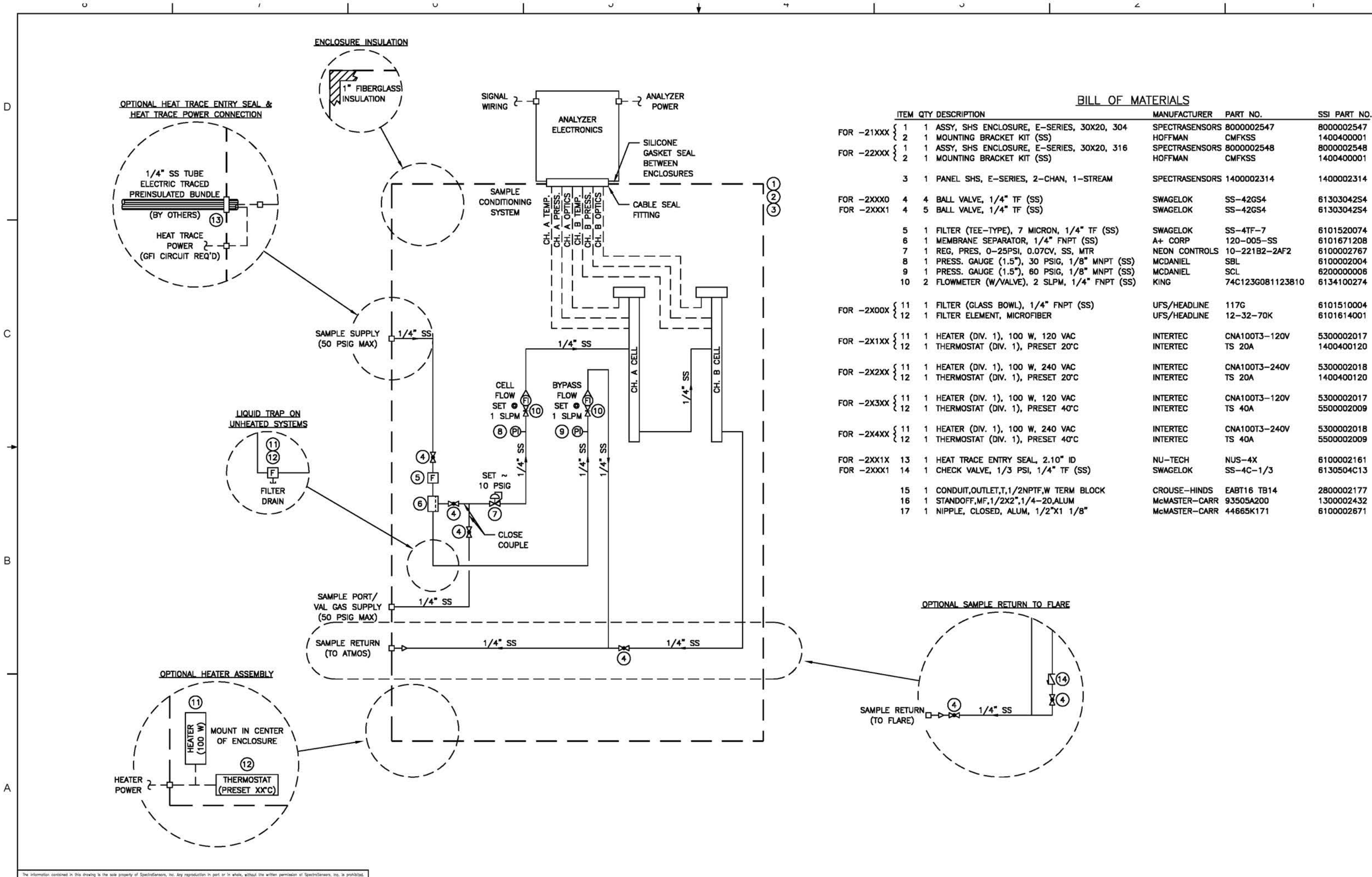


Figure A–4 *SS3000e single stream analyzer system outline and mounting dimensions*



BILL OF MATERIALS

	ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NO.	SSI PART NO.
FOR −21XXX	1	1	ASSY, SHS ENCLOSURE, E−SERIES, 30X20, 304	SPECTRASENSORS	8000002547	8000002547
	2	1	MOUNTING BRACKET KIT (SS)	HOFFMAN	CMFKSS	1400400001
FOR −22XXX	1	1	ASSY, SHS ENCLOSURE, E−SERIES, 30X20, 316	SPECTRASENSORS	8000002548	8000002548
	2	1	MOUNTING BRACKET KIT (SS)	HOFFMAN	CMFKSS	1400400001
	3	1	PANEL SHS, E−SERIES, 2−CHAN, 1−STREAM	SPECTRASENSORS	1400002314	1400002314
FOR −2XXX0	4	4	BALL VALVE, 1/4" TF (SS)	SWAGELOK	SS−42GS4	61303042S4
FOR −2XXX1	4	5	BALL VALVE, 1/4" TF (SS)	SWAGELOK	SS−42GS4	61303042S4
	5	1	FILTER (TEE−TYPE), 7 MICRON, 1/4" TF (SS)	SWAGELOK	SS−4TF−7	6101520074
	6	1	MEMBRANE SEPARATOR, 1/4" FNPT (SS)	A+ CORP	120−005−SS	6101671208
	7	1	REG, PRES, 0−25PSI, 0.07CV, SS, MTR	NEON CONTROLS	10−221B2−2AF2	6100002767
	8	1	PRESS. GAUGE (1.5"), 30 PSIG, 1/8" MNPT (SS)	MCDANIEL	SBL	6100002004
	9	1	PRESS. GAUGE (1.5"), 60 PSIG, 1/8" MNPT (SS)	MCDANIEL	SCL	6200000006
	10	2	FLOWMETER (W/VALVE), 2 SLPM, 1/4" FNPT (SS)	KING	74C123G081123810	6134100274
FOR −2X00X	11	1	FILTER (GLASS BOWL), 1/4" FNPT (SS)	UFS/HEADLINE	117G	6101510004
	12	1	FILTER ELEMENT, MICROFIBER	UFS/HEADLINE	12−32−70K	6101614001
FOR −2X1XX	11	1	HEATER (DIV. 1), 100 W, 120 VAC	INTERTEC	CNA100T3−120V	5300002017
	12	1	THERMOSTAT (DIV. 1), PRESET 20°C	INTERTEC	TS 20A	1400400120
FOR −2X2XX	11	1	HEATER (DIV. 1), 100 W, 240 VAC	INTERTEC	CNA100T3−240V	5300002018
	12	1	THERMOSTAT (DIV. 1), PRESET 20°C	INTERTEC	TS 20A	1400400120
FOR −2X3XX	11	1	HEATER (DIV. 1), 100 W, 120 VAC	INTERTEC	CNA100T3−120V	5300002017
	12	1	THERMOSTAT (DIV. 1), PRESET 40°C	INTERTEC	TS 40A	5500002009
FOR −2X4XX	11	1	HEATER (DIV. 1), 100 W, 240 VAC	INTERTEC	CNA100T3−240V	5300002018
	12	1	THERMOSTAT (DIV. 1), PRESET 40°C	INTERTEC	TS 40A	5500002009
FOR −2XX1X	13	1	HEAT TRACE ENTRY SEAL, 2.10" ID	NU−TECH	NUS−4X	6100002161
FOR −2XXX1	14	1	CHECK VALVE, 1/3 PSI, 1/4" TF (SS)	SWAGELOK	SS−4C−1/3	6130504C13
	15	1	CONDUIT,OUTLET,T,1/2NPTF,W TERM BLOCK	CROUSE−HINDS	EABT16 TB14	2800002177
	16	1	STANDOFF,MF,1/2X2",1/4−20,ALUM	McMASTER−CARR	93505A200	1300002432
	17	1	NIPPLE, CLOSED, ALUM, 1/2"X1 1/8"	McMASTER−CARR	44665K171	6100002671

Figure A–5 *SS3000e single stream analyzer system sample system schematic*

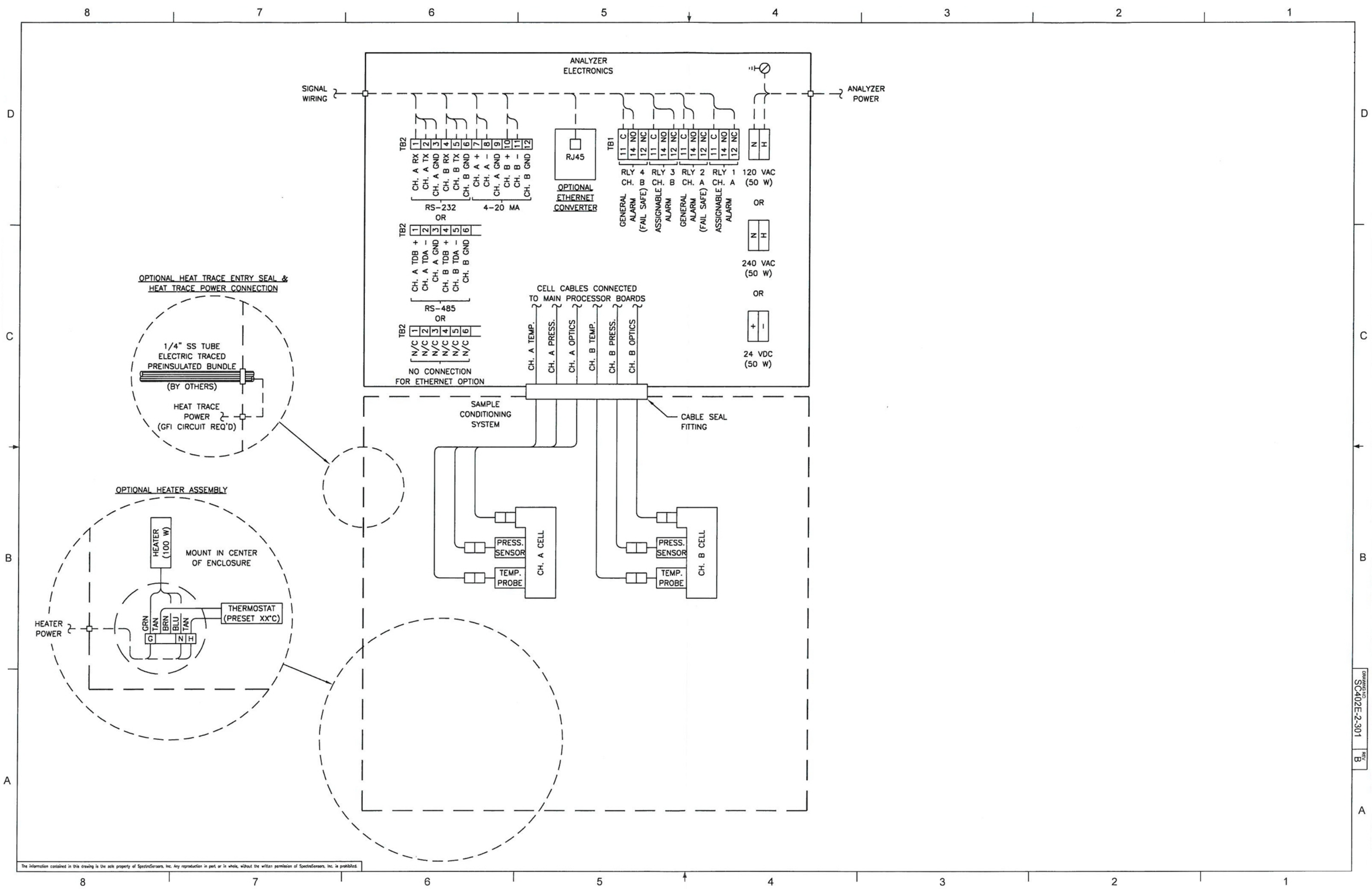


Figure A–6 *SS3000e single stream analyzer system power and signal wiring*

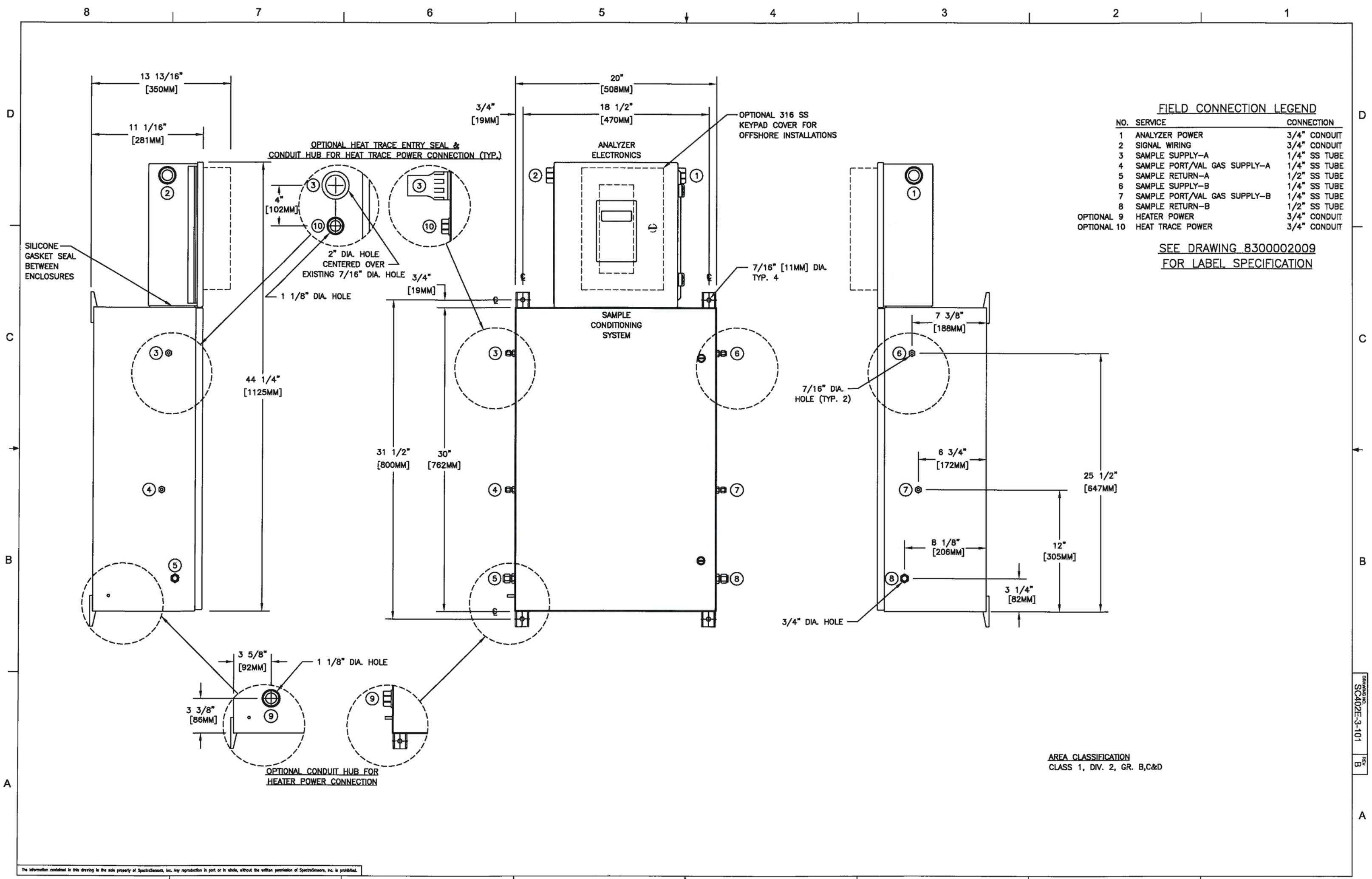


Figure A–7 *SS3000e dual stream analyzer system outline and mounting dimensions*

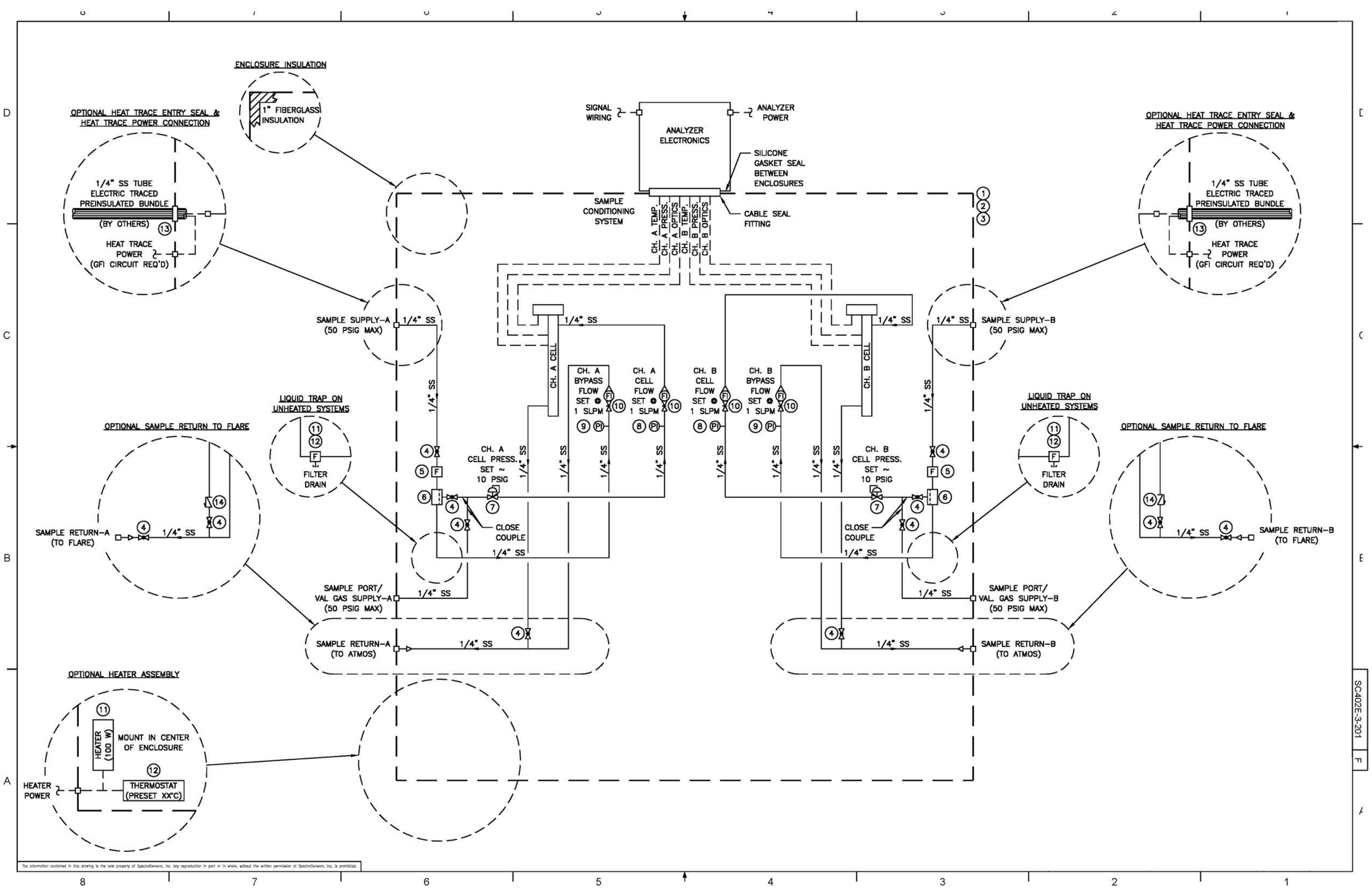


Figure A–8 *SS3000e dual stream analyzer system sample system schematic (sheet 1 of 2)*

BILL OF MATERIALS

	ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NO.	SSI PART NO.
FOR −31XXX	1	1	ASSY, SHS ENCLOSURE, E−SERIES, 30X20, 304	SPECTRASENSORS	8000002547	8000002547
	2	1	MOUNTING BRACKET KIT (SS)	HOFFMAN	CMFKSS	1400400001
FOR −32XXX	1	1	ASSY, SHS ENCLOSURE, E−SERIES, 30X20, 316	SPECTRASENSORS	8000002548	8000002548
	2	1	MOUNTING BRACKET KIT (SS)	HOFFMAN	CMFKSS	1400400001
	3	1	PANEL, SHS, E−SERIES, 2−CHAN, 2−STREAM	SPECTRASENSORS	SPECTRASENSORS	1400002254
FOR −3XXX0	4	8	BALL VALVE, 1/4" TF (SS)	SWAGELOK	SS−42GS4	61303042S4
FOR −3XXX2	4	10	BALL VALVE, 1/4" TF (SS)	SWAGELOK	SS−42GS4	61303042S4
	5	2	FILTER (TEE−TYPE), 7 MICRON, 1/4" TF (SS)	SWAGELOK	SS−4TF−7	6101520074
	6	2	MEMBRANE SEPARATOR, 1/4" FNPT (SS)	A+ CORP	120−005−SS	6101671208
	7	2	REG, PRES, 0−25PSI, 0.07CV, SS, MTR	NEON CONTROLS	10−221B2−2AF2	6100002767
	8	2	PRESS. GAUGE (1.5"), 30 PSIG, 1/8" MNPT (SS)	MCDANIEL	SBL	6100002004
	9	2	PRESS. GAUGE (1.5"), 60 PSIG, 1/8" MNPT (SS)	MCDANIEL	SCL	6200000006
	10	4	FLOWMETER (W/VALVE), 2 SLPM, 1/4" FNPT (SS)	KING	74C123G081123810	6134100274
FOR −3X00X	11	2	FILTER (GLASS BOWL), 1/4" FNPT (SS)	UFS/HEADLINE	117G	6101510004
	12	2	FILTER ELEMENT, MICROFIBER	UFS/HEADLINE	12−32−70K	6101614001
FOR −3X1XX	11	1	HEATER (DIV. 1), 100 W, 120 VAC	INTERTEC	CNA100T3−120V	5300002017
	12	1	THERMOSTAT (DIV. 1), PRESET 20°C	INTERTEC	TS 20A	1400400120
FOR −3X2XX	11	1	HEATER (DIV. 1), 100 W, 240 VAC	INTERTEC	CNA100T3−240V	5300002018
	12	1	THERMOSTAT (DIV. 1), PRESET 20°C	INTERTEC	TS 20A	1400400120
FOR −3X3XX	11	1	HEATER (DIV. 1), 100 W, 120 VAC	INTERTEC	CNA100T3−120V	5300002017
	12	1	THERMOSTAT (DIV. 1), PRESET 40°C	INTERTEC	TS 40A	5500002009
FOR −3X4XX	11	1	HEATER (DIV. 1), 100 W, 240 VAC	INTERTEC	CNA100T3−240V	5300002018
	12	1	THERMOSTAT (DIV. 1), PRESET 40°C	INTERTEC	TS 40A	5500002009
FOR −3XX1X	13	2	HEAT TRACE ENTRY SEAL, 2.10" ID	NU−TECH	NUS−4X	6100002161
FOR −3XXX2	14	2	CHECK VALVE, 1/3 PSI, 1/4" TF (SS)	SWAGELOK	SS−4C−1/3	6130504C13
	15	1	CONDUIT,OUTLET,T,1/2NPTF,W TERM BLOCK	CROUSE−HINDS	EABT16 TB14	2800002177
	16	1	STANDOFF,MF,1/2X2",1/4−20,ALUM	McMASTER−CARR	93505A200	1300002432
	17	1	NIPPLE, CLOSED, ALUM, 1/2"X1 1/8"	McMASTER−CARR	44665K171	6100002671

SC402E-3-201 F

Figure A–9 *SS3000e dual stream analyzer system sample system schematic - parts list (sheet 2 of 2)*

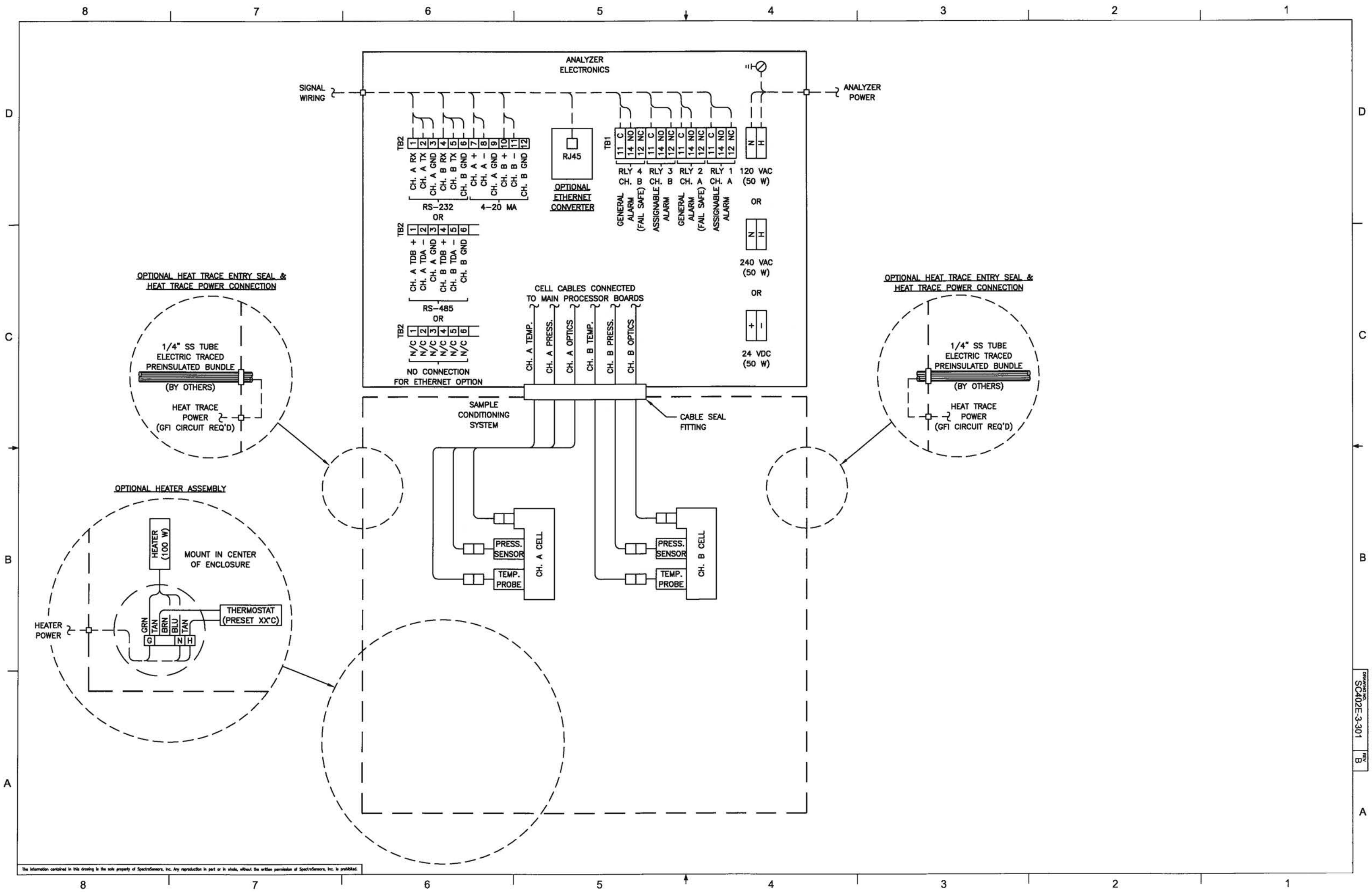


Figure A–10 SS3000e dual stream analyzer system power and signal wiring

Table A–6 *Typical natural gas stream composition*

Stream Component	Units	Typical Concentrations	
		Minimum	Maximum
Table 1 (Natural Gas Stream)			
Methane (C_1)	% mol	90	100
Ethane (C_2H_6)	% mol	0.0	7.0
Propane (C_3H_8)	% mol	0.0	2.0
Butanes (C_4H_{10})	% mol	0.0	1.0
Pentanes (C_5H_{12})	% mol	0.0	0.2
Hexanes and Heavier (C6+)	% mol	0.0	0.2
Carbon Dioxide (CO_2)	% mol	0.0	3.0
Nitrogen (N_2)	% mol	0.0	10
Hydrogen Sulfide (H_2S)	ppmv	0	300[1]
Table 2 (Rich Natural Gas Stream) [2]			
Methane (C_1)	% mol	50	100
Ethane (C_2H_6)	% mol	0.0	20
Propane (C_3H_8)	% mol	0.0	15
Butanes (C_4H_{10})	% mol	0.0	5.0
Pentanes (C_5H_{12})	% mol	0.0	2.0
Hexanes and Heavier (C6+)	% mol	0.0	2.0
Carbon Dioxide (CO_2)	% mol	0.0	20
Nitrogen (N_2)	% mol	0.0	20
Hydrogen Sulfide (H_2S)	% mol	0	5

1. For streams greater than 300 ppmv H_2S, additional hardware may be required for safety purposes.
2. Specific stream composition must be specified by customer.

Spare Parts

Below is a list of spare parts for the H_2O and/or CO_2 gas analyzer with recommended quantities for 2 years of operation.

Due to a policy of continuous improvement, parts and part numbers may change without notice. Not all parts listed are included on every gas analyzer. When ordering, please specify the system serial number (SN) to ensure that the correct parts are identified.

Table A–7 *Replacement parts for SS500e/SS2000e/SS3000e H_2O and/or CO_2 gas analyzers*

Part Number	Description	2 Year Quantity
Gas Analyzer		
2900000460	Temperature Control Board [1]	-
2900000450	4–20 mA Current Loop Board [1]	-
8000002693	Power Supply Assembly with Filter, 120/240 VAC 50/60 Hz [1]	-
8000002482	Power Supply Assembly with Filter, 24 VDC [1]	-
0190230011	Keypad Assembly [1]	-
0190231000	Display Assembly [1]	-
4500002002	Relay, with Socket, C1D2, 6 A, 12 VDC, SPDT[1]	-
3100002151	Filter, Power Line 120/240 VAC, 5 amps [1]	-
3100002152	RS-485 Converter, B&B Electronics 485LDRC9	-
3100002153	Ethernet Converter, 2-Channel, B&B Electronics ESP902	-
2400002088	Cable Gland/Seal, 9-Position, Roxtec RG00063090046 [1]	-
0219900005	Kit, Spares (O-Rings, Screws), Viton, 2-Pass Cell [1]	1
0219900011	Kit, Fuse, AC/DC	1
2892102022	O-Ring, Viton, AS5684-022	-
0900002146	Mirror, 0.8 m/0.1 m, Stainless Steel	-

1. Contact Endress+Hauser' Service department before attempting replacement. Replacing this component without technical support could cause damage to other components. For Service, refer to our website for the list of local sales channels in your area: *www.endress.com/contact*.

Table A-7 *Replacement parts for SS500e/SS2000e/SS3000e H_2O and/or CO_2 gas analyzers (Continued)*

Part Number	Description	2 Year Quantity
General		
0219900007	Kit, Mirror Cleaning (USA/Canada only) [1]	1
0219900017	Kit, Mirror Cleaning, No Chemicals (International) [1]	1
BA02164C	Operating Instruction, SS500e/SS2000e/SS3000e TDLAS Gas Analyzer, additional copies	-
GP01181C	Device Parameters, HC12, additional copies	-
Sample Conditioning System		
61303042S4	Ball Valve, 1/4 in. F (SS), Swagelok SS-42GS4	2
6101671208	Membrane Separator, 1/4 in. FNPT (SS), A+ Corp 120-005-SS	-
61016120X5	Membrane Replacement Filter, A+ Corp 120-5X5	2
6134100274	Flow Meter (with Valve), 2 SLPM, 1/4 in. FNPT (SS), King 74C123G081123810	-
2800002041	Rebuild Kit, Flow Meter, Viton, King 7430	-
6101520074	Filter (Tee-Type), 7 micron, 1/4 in. TF (SS), Swagelok SS-4TF-7	1
6100002186	Filter Element, 7 micron, Swagelok SS-4F-K4-7	2
6100002767	Pressure Regulator, 0-25 PSI, 0.07 CV, SS, MTR Neon Controls 10-221B2-2AF21A11A3D111	-
6100002004	Pressure Gauge (1.5 in.), 30 psig, 1/8 in. MNPT (SS), McDaniel SBL	-
6200000006	Pressure Gauge (1.5 in.), 60 psig, 1/8 in. MNPT (SS), McDaniel SCL	-
5300002017	Heater, 100 W, 120 VAC, Intertec CP Multitherm CNA100T3 - 120 V	-
5300002018	Heater, 100 W, 240 VAC, Intertec CP Multitherm CNA100T3 - 240 V	-
5500002009	Thermostat, 40 °C, C1D2 ABCD, 1/2 in. NPT	-
1400400120	Thermostat, 20 °C, C1D1 ABCD, 1/2 in. NPT	-

1. Contact Endress+Hauser’ Service department before attempting replacement. Replacing this component without technical support could cause damage to other components. For Service, refer to our website for the list of local sales channels in your area: www.endress.com/contact.

Table A-7 *Replacement parts for SS500e/SS2000e/SS3000e H_2O and/or CO_2 gas analyzers (Continued)*

Part Number	Description	2 Year Quantity
Sample Conditioning System		
6130504C13	Check Valve, 1/3 PSI, 1/4 in. TF (SS), Swagelok SS-4C-1/3	-
6101510004	Filter (Glass Bowl), 1/4 in. FNPT (SS), UFS/Headline 117G	-
6101614001	Filter Element, Microfiber, UFS/Headline 12-21-70K	2
Pressure Sensor		
6000002249	Cable Pressure Sensor, 40 in.	-
5500002016	Pressure Sensor, 30 PSIA, 5V, 1/8 in. MNPT DIN4365 NACE	-
6000002162	Harness, Optical Head Signal, Direct, 56 in.	-
6000002171	Harness, Temperature Sensor Signal, E-Series	-
Cables		
6000002113	Harness, Ethernet Signal, 2-Channel	-
6000002024	Assembly, Cable, Signal Output	-
6000002115	Harness, Power, RS-485, 2-Channel	-
6000002111	Harness, RS-485, Signal, 2-Channel	-
6000002116	Harness, Power, RS-485, 1-Channel	-
6000002110	Harness, RS-485 Signal, 1-Channel	-
6000002117	Harness, Power Supply Output, 21 in.	-
0190217205	Harness, Ribbon, 10 Conductor, 9 in.	-
0190217106	External Serial Output Cable	1

For a complete listing of new or updated certificates, please visit the product page at www.endress.com/contact.

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Appendix B: Troubleshooting & Maintenance

This chapter presents recommendations and solutions to issues that may be experienced during gas analyzer operation. If the problem being encountered is not referred to in this chapter, refer to **"Service"** on page B-23.

Class 3B invisible laser radiation possible when open. Avoid exposure to the beam. Never open the sample cell unless directed to do so by a service representative and the gas analyzer power is turned off.

The optical head has a seal and "WARNING" sticker to prevent inadvertent tampering with the device. Do not attempt to compromise the seal of the optical head assembly. Doing so will result in loss of device sensitivity and inaccurate measurement data. Repairs can then only be performed by the factory and are not covered under warranty.

Gas Leaks

Probably the most common cause of erroneous measurements is outside air leaking into the sample supply line. Periodically leak testing the supply lines is recommended, especially if the gas analyzer supply lines have been disconnected and reconnected due to relocation, replacement or returned to the factory for service.

Do not use plastic tubing of any kind for sample lines. Plastic tubing is permeable to moisture and other substances which can contaminate the sample stream. Using 1/4 in. O.D. x 0.035 in. wall thickness, seamless stainless steel tubing is recommended.

Process samples may contain hazardous material in potentially flammable and/or toxic concentrations. Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the sample contents before operating the SCS.

Contamination

Contamination and long exposure to high humidity are valid reasons for periodically cleaning the gas sampling lines. Contamination in the gas sampling lines can potentially find its way to the sample cell and deposit on the optics or interfere with the measurement in some other way. Although the gas analyzer is designed to withstand some contamination, it is recommended to always keep the sampling lines as free from contamination as possible. If mirror contamination is suspected, see **"Cleaning the Mirrors"** on page B-3.

To keep the sampling lines clean

1. Make sure that a filter or membrane separator is installed ahead of the gas analyzer and is operating normally. Replace the membrane or filter, if necessary (refer to **"Replacing the membrane separators"** on page B-15 or **"Replacing the filter"** on page B-15).

*If liquid enters the cell and accumulates on the internal optics, a **Laser Power too Low** fault will result.*

2. If mirror contamination is suspected, refer to **"Cleaning the Mirrors"** on page B-3.
3. Turn off the sample valve at the tap in accordance with site lock-out, tag-out rules.
4. Disconnect the gas sampling line from the sample supply port of the gas analyzer.
5. Wash the sampling line with a suitable solvent and blow dry with mild pressure from a dry air or nitrogen source.
6. Once the sampling line is completely free of solvent, reconnect the gas sampling line to the sample supply port of the gas analyzer.
7. Check all connections for gas leaks. Using a liquid leak detector is recommended.

Excessive Sampling Gas Temperatures and Pressures

The embedded software is designed to produce accurate measurements only within the allowable cell operating range. Refer to the system drawings in Appendix A and/or calibration report.

The cell temperature operating range for gas analyzers that are equipped with heated enclosures is equal to the enclosure temperature set-point ±5 °C.

Pressures and temperatures outside this range will trigger a **Pressure Low Alarm**, **Pressure High Alarm**, **Temp Low Alarm**, or **Temp High Alarm** fault.

If the pressure, temperature, or any other readings on the LCD appear suspect, they should be checked against the specifications. Refer to the system drawings in Appendix A and/or calibration report.

Electrical Noise

High levels of electrical noise can interfere with laser operation and cause it to become unstable. Always connect the gas analyzer to a properly grounded power source. Refer to **"Protective chassis and ground connections"** on page 3-5.

Cleaning the Mirrors

If contamination makes its way into the cell and accumulates on the internal optics, a **Power Fail** fault will result. If mirror contamination is suspected, please consult with **"Service"** on page B-23.

*Do not attempt to clean the cell mirror until you have consulted with Service and have been advised to do so. Please refer to **"Service"** on page B-23.*

The sample cell assembly contains a low-power, 10 mW MAX, CW Class 3b invisible laser with a wavelength between 750 to 3000 nm. Never open the sample cell flanges or the optical assembly unless the power is turned off.

Always handle the optical assembly by the edge of the mount. Never touch the coated surfaces of the mirror.

Tools and supplies:

- Lens cleaning cloth (Cole Parmer® EW-33677-00 TEXWIPE® Alphawipe® Low-Particulate Clean Room Wipes or equivalent)
- Reagent-grade isopropyl alcohol (ColeParmer® EW-88361-80 or equivalent)
- Small drop dispenser bottle (Nalgene® 2414 FEP Drop Dispenser Bottle or equivalent)
- Acetone-impenetrable gloves (North NOR CE412W Nitrile Chemsoft™ CE Cleanroom Gloves or equivalent)
- Hemostat (Fisherbrand™ 13-812-24 Rochester-Pean Serrated Forceps)
- Bulb blower or dry compressed air/nitrogen
- Torque wrench
- Permanent marker
- Flashlight

Determining the type of cell mirror

Measurement cells will come equipped with either a glass or stainless steel mirror. Before determining whether to clean or replace the mirror, identify the type of measurement cell being used in the gas analyzer. There are two types of measurement cells used with the SS500e/SS2000e/SS3000e;
0.1 m and 0.8 m (refer to Figure B–1).

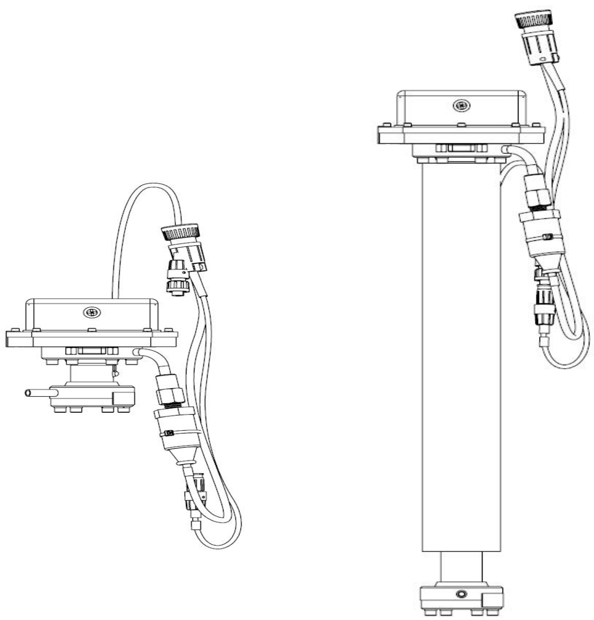
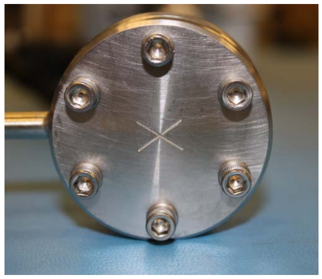


Figure B–1 *Measurement cell types*

The stainless steel mirrors are identified with either an “X” engraved on the outside bottom of the mirror or a groove around the rim of the mirror. Glass mirrors have no external markings. To determine the type of mirror being used for the system cell:

1. Feel at the bottom of the cell for the engraved “X” marking.



MIRROR MARKED
WITH 'X'

MIRROR GROOVED
RIM - SIDE VIEW

a. If the surface is smooth, a glass mirror is being used. Refer to Figure B–2.

Do not attempt to replace a glass mirror with a stainless steel mirror or system calibration may be adversely affected.

b. If the surface is rough, or an engraving is detected, a stainless steel mirror is being used.

To clean the mirror, refer to the instructions **"To clean the mirror"** on page B-5. To replace a stainless steel mirror, refer to the instructions for **"To replace the stainless steel mirror"** on page B-7.

To clean the mirror

1. Power down the gas analyzer following the procedure outlined in the section called **"Powering Down the Gas Analyzer"** in the Device Parameters.
2. Isolate the gas analyzer from the sample bypass flow by shutting off the appropriate valve(s) and/or pressure regulator. Follow the procedure outlined in **"To isolate the SCS for short-term shutdown"** on page 4-10.

All valves, regulators, switches, etc. should be operated in accordance with site lock-out/tag-out procedures.

3. If possible, purge the measurement cell with nitrogen for 10 minutes.

Process samples may contain hazardous material in potentially flammable and/or toxic concentrations. Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the sample contents before operating the SCS.

4. Carefully mark the orientation of the mirror assembly on the cell body.

Careful marking of the mirror orientation is critical to restoring system performance upon reassembly after cleaning.

5. Gently remove the mirror assembly from the cell by removing the socket-head cap screws and set on a clean, stable and flat surface.

The sample cell assembly contains a low-power, 10 mW MAX, CW Class 3b invisible laser with a wavelength between 750 to 3000 nm. Never open the sample cell flanges or the optical assembly unless the power is turned off.

Always handle the optical assembly by the edge of the mount. Never touch the coated surfaces of the mirror.

6. Look inside the sample cell at the top mirror using a flashlight to ensure that there is no contamination on the top mirror.

Endress+Hauser does not recommend cleaning the top mirror. If the top mirror is visibly contaminated. Refer to ***"Service"*** *on page B-23.*

7. Remove dust and other large particles of debris using a bulb blower or dry compressed air/nitrogen. Pressurized gas duster products are not recommended as the propellant may deposit liquid droplets onto the optic surface.
8. Put on clean acetone-impenetrable gloves.
9. Double fold a clean sheet of lens cleaning cloth and clamp near and along the fold with the hemostats or fingers to form a "brush."
10. Place a few drops of isopropyl alcohol onto the mirror and rotate the mirror to spread the liquid evenly across the mirror surface.

11. With gentle, uniform pressure, wipe the mirror from one edge to the other with the cleaning cloth only once and only in one direction to remove the contamination. Discard the cloth.

Never rub an optical surface, especially with dry tissues, as this can mar or scratch the coated surface.

12. Repeat with a clean sheet of lens cleaning cloth to remove the streak left by the first wipe. Repeat, if necessary, until there is no visible contamination on the mirror.
13. Carefully replace the mirror assembly onto the cell in the same orientation as previously marked making sure the O-Ring is properly seated.
14. Tighten the socket-head cap screws evenly with a torque wrench to 13 in-lbs.

To replace the stainless steel mirror

If your system has been configured with a stainless steel mirror in the 0.1 m or 0.8 m measurement cell, use the following instructions for replacing the mirror.

If a stainless steel mirror is planned to replace a glass mirror in the field, the gas analyzer may need to be returned to the factory for re-calibration to ensure optimal cell function. Refer to ***"Service"*** *on page B-23.*

1. Power down the gas analyzer following the procedure outlined in the section called **"Powering Down the Gas Analyzer"** in the Device Parameters.
2. Isolate the gas analyzer from the sample bypass flow by shutting off the appropriate valve(s) and/or pressure regulator.

All valves, regulators, switches, etc. should be operated in accordance with site lock-out/tag-out procedures.

3. If possible, purge the measurement cell with nitrogen for 10 minutes.

Process samples may contain hazardous material in potentially flammable and/or toxic concentrations. Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the sample contents before operating the SCS.

4. Gently remove the mirror assembly from the cell by removing the socket-head cap screws and set on a clean, stable and flat surface.

The sample cell assembly contains a low-power, 10 mW MAX, CW Class 3b invisible laser with a wavelength between 750 to 3000 nm. Never open the sample cell flanges or the optical assembly unless the power is turned off.

Always handle the optical assembly by the edge of the mount. Never touch the optical surfaces of the mirror.

5. Confirm need to replace mirror due to contamination. If yes, set mirror aside.
6. Put on clean acetone-impenetrable gloves.
7. Obtain the new stainless steel mirror. Refer to Figure B–3.

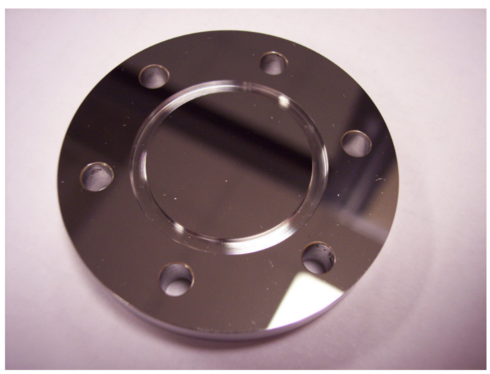


Figure B–3 *Stainless steel mirror; mirror side up*

8. Check the O-Ring.
   a. If a new O-Ring is needed, apply grease on fingertips and then to the new O-Ring.
   b. Place newly greased O-Ring into the groove around the outside of the mirror taking care not to touch the mirror surface.
9. Carefully place the new stainless steel mirror onto the cell making sure the O-Ring is properly seated.
10. Tighten the socket-head cap screws evenly with a torque wrench to 13 in-lbs.

Pressure Sensor Replacement

A pressure sensor may need to be replaced in the field as a result of one or more of the following conditions:

Use the following information to replace a pressure sensor:

- Loss of pressure reading
- Incorrect pressure reading
- Pressure sensor not responding to pressure change
- Physical damage to the pressure sensor

Tools and materials:

- 9/16 in. wrench
- 7/8 in. wrench
- 9/64 in. Hex key
- Flat-head screwdriver
- Phillips-head screwdriver
- Metal pick
- Military grade stainless steel PTFE tape (or equivalent)
- Dry nitrogen
- Isopropyl alcohol

Alcohol can be hazardous. Follow all safety precautions when in use and thoroughly wash hands prior to eating.

To replace the pressure sensor

1. Close the external flow of gas to the sample conditioning system (SCS) at the sample inlet.
2. Purge the system by connecting dry nitrogen to the sample inlet. Allow the SCS to purge for 5 to 10 minutes.
3. Close the nitrogen flow.
4. Power off the system. Refer to the Device Parameters for this gas analyzer for **"Powering down the gas analyzer"**.
5. Open the door to the gas analyzer. Refer to Figure B–4. In this view, the old model pressure sensor is pictured.

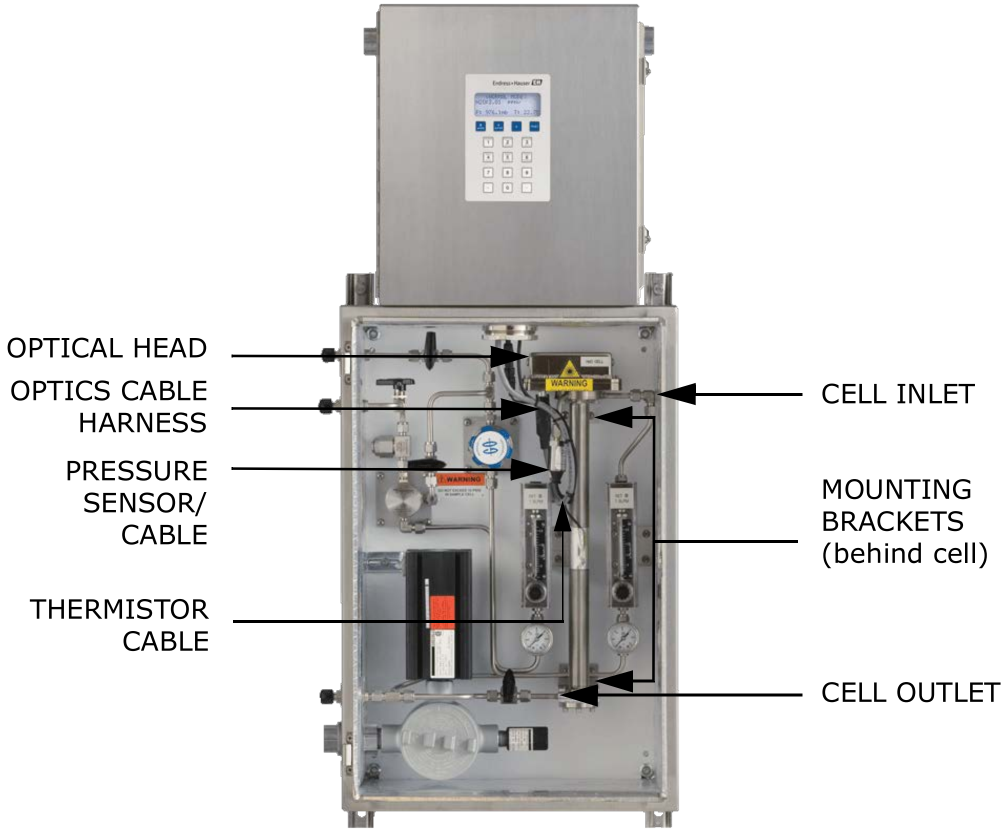


Figure B–4 *SS500e/SS2000e SCS cabinet interior*

6. Remove the optical cable harness using a flat-head screwdriver.
7. Disconnect the cell inlet using a 9/16 in. wrench.
8. Disconnect the cell outlet using a 9/16 in. wrench.
9. Disconnect the thermistor cable at the circular connector.
10. Remove the pressure sensor cable from the circular connector inside the enclosure.

    For new model pressure sensors with quick-disconnects, detach the pressure sensor cable from the pressure sensor at the connector using a Phillips-head screwdriver. Do not remove the black connector from the cable inside the enclosure.
11. Dismount the cell from the bracket by removing the four securing screws (two on top, two on the bottom) using a 9/64 in. Hex Key.
12. Place the measurement cell on a clean, flat surface with the pressure sensor facing up. Refer to Figure B–5.

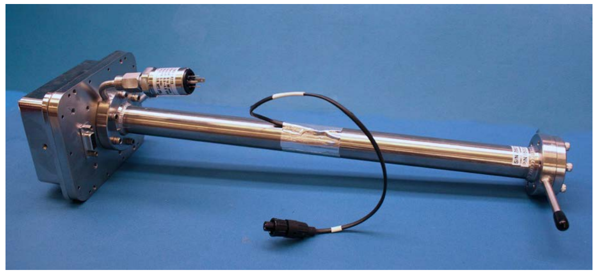


Figure B–5 *Removed measurement cell with pressure sensor face up*

Orient the measurement cell to avoid any debris from entering the cell.

13. Using a 9/16 in. wrench, secure the flange while using a 7/8 in. wrench to remove the old pressure sensor (refer to Figure B–6).

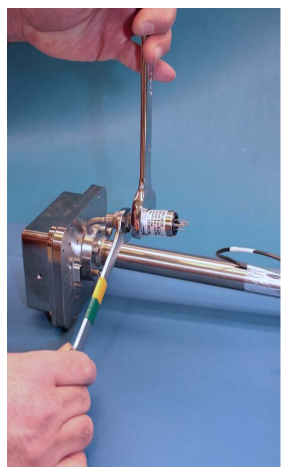


Figure B–6 *Removing the old pressure sensor*

a. Hold the wrench on the flange stable and parallel to the surface. Do not move.

b. Turn the 7/8 in. wrench counterclockwise to loosen the pressure sensor until it is able to be removed.

14. Remove excess seal tape from the flange opening and threads and check threads for galling (refer to Figure B–7).

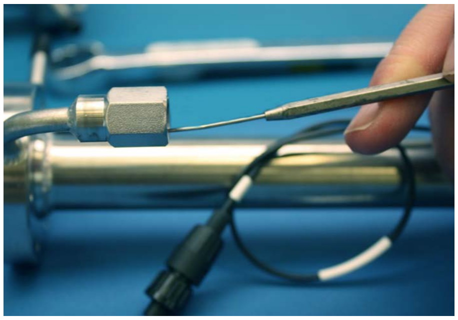


Figure B–7 *Removing excess seal tape from flange*

*Threads showing signs of galling indicate a possible leak. Refer to **"Service"** on page B-23 to arrange for repair.*

15. Remove the new pressure sensor from the packaging. Retain the black connector cap on the sensor - <u>do not remove</u>.

16. Wrap stainless steel PTFE tape around the threads at the top of the pressure sensor, beginning from the base of the threads to the top, approximately three times taking care to avoid covering the top opening (refer to Figure B–8).

Figure B–8 *Replacing seal tape*

17. Insert the new pressure sensor into the threaded flange keeping the sensor parallel to the surface for proper fitting.

18. Hand tighten the pressure sensor turning it counterclockwise into the flange until no longer moving freely (refer to Figure B–9).

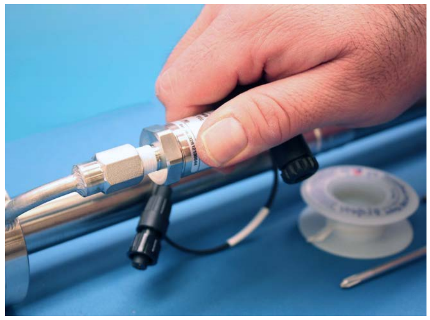


Figure B–9 *Replacing pressure sensor*

19. Using the 9/16 in. wrench to hold the flange in place, turn the sensor clockwise with a 7/8 in. wrench until tight. Two or three threads on the pressure sensor should still be visible.

Make sure the black connector at the bottom of the pressure sensor is facing up from the measurement cell, or forward towards the enclosure door. Refer to Figure B–10.

Figure B–10 *Newly installed pressure sensor positioning*

20. Remove the black connector from the pressure sensor and discard.

21. Connect the new harness/cable to the new pressure sensor.

If the new model pressure sensor cable is currently installed in the SCS, reattach the cable to the pressure sensor after the cell has been remounted.

22. Remount the cell to the mounting brackets using a 9/64 in. Hex Key with the pressure sensor facing forward.

23. Reinstall cell inlet and cell outlet using a 9/16 in. wrench.

24. Reconnect the thermistor connector.

25. Reconnect the optical cable harness.

26. Connect the new pressure sensor cable.

27. Close the door.

28. Conduct a leak test to determine that the new pressure sensor is not leaking.

Do not allow cell to exceed 10 PSIG or damage could occur.

*For any questions related to leak testing the pressure sensor, refer to **"Service"** on page B-23.*

29. Turn the system power on. Refer to the Device Parameters for this gas analyzer for **"Powering up the gas analyzer**.**"**

30. Run a validation on the gas analyzer. Refer to the Device Parameters for instructions to **"Start Validation**.**"**

- **a.** If the system passes, the pressure sensor replacement is successful.
- **b.** If the system does not pass, refer to**"Service"** on page B-23 for instruction.

Confirming the relief valve setting

Confirm that the relief valve at the field pressure reducing station has been set to the specified set-point. Refer to the gas analyzer drawings for the required settings.

1. Remove the relief valve from the pressure reducing regulator and connect to an adjustable pressure source.

Refer to the manufacturer's instructions for details related to setting the relief valve.

2. Re-install the relief valve.

3. Check all connections for gas leaks. Using a liquid leak detector is recommended.

Replacing the membrane separators

Use the following steps to replace a membrane separator, as necessary.

1. Close the sample supply valve.
2. Unscrew the cap from the membrane separator.

If the membrane filter is dry:

3. Check if there are any contaminants or discoloring of the white membrane. If yes, the filter should be replaced.
4. Remove the O-Ring and replace the membrane filter.
5. Replace the O-Ring on top of the membrane filter.
6. Place the cap back onto the membrane separator and tighten.
7. Check upstream of the membrane for liquid contamination and clean and dry out before re-opening the sample supply valve.

If liquid or contaminants are detected on the filter:

3. Drain any liquids and clean with isopropyl alcohol.
4. Clean any liquids or contaminants from the base of the membrane separator.
5. Replace the filter and the O-Ring.
6. Place the cap onto the membrane separator and tighten.
7. Check upstream of the membrane for liquid contamination and clean and dry out before re-opening the sample supply valve.

Replacing the filter

If necessary, use the following steps to replace the filter.

1. Close the sample supply valve.
2. Unscrew the four screws with a 5/23 in. screwdriver from the base of the filter. Remove the filter unit from the gas analyzer for disassembly.
3. Unscrew and remove the filter cap.
4. Remove the top O-Ring.
5. Check if there are any contaminants or solid components blocking the metal filter.
6. Drain any contaminants found and clean with isopropyl alcohol.
7. Replace the top O-Ring.
8. Place the filter cap back into position and tighten.

9. Place the filter unit into the gas analyzer and tighten the base with the four screws.
10. Check upstream of membrane for liquid contamination and clean and dry out before opening the sample supply valve.

Peak Tracking Reset Procedure

The gas analyzer's software is equipped with a peak tracking function that keeps the laser scan centered on the absorption peak. Under some circumstances, the peak tracking function can get lost and lock onto the wrong peak. If the difference between **PkDf** and **PkDl** is more than four (4), or **Track Fail Error** is displayed, the peak tracking function should be reset. Refer to the Device Parameters for this gas analyzer for instruction.

Periodic SCS Maintenance

Due to the chemical properties of the process samples, care must be taken to repair or replace components with proper materials of construction. Maintenance personnel should have a thorough knowledge and understanding of the chemical characteristics of the process before performing maintenance on the SCS.

The status of the SCS should be checked regularly to confirm proper operation (pressures, flows, etc.) and detect potential problems or failures before damage occurs. If maintenance is required, isolate the part of the system to be serviced by following the appropriate procedure under **"Shutting Down the SCS"** on page 4-9.

All filter elements should be checked periodically for loading. Obstruction of a filter element can be observed by a decreasing supply pressure or bypass flow. If loading of a filter is observed, the filter should be cleaned and the filter element replaced. Refer to **"Replacing the filter"** on page B-15. After observation for some time, a regular schedule can be determined for replacement of filter elements.

No other regularly scheduled maintenance should be required for the system.

Preventive and On-Demand SCS Maintenance

Due to the chemical properties of the process samples, care must be taken to repair or replace components with proper materials of construction. Maintenance personnel should have a thorough knowledge and understanding of the chemical characteristics of the process before performing maintenance on the SCS.

Preventive and on-demand maintenance will be required when components and parts deteriorate or fail as a result of continuous use. The performance of the entire SCS and individual components should be monitored regularly so that maintenance may be performed on a scheduled basis in order to prevent a failure that could take the system out of operation.

The SCS is designed for convenient removal and replacement of component parts. Complete spare components should always be available. In general, if a problem or failure occurs, the complete part should be removed and replaced to limit system down time. Some components may be repaired (replacement of seats and seals, etc.) and then reused.

If the sample supply line does not appear to completely clear during normal operation, it may be necessary to clean the sample transport line to remove any liquid that may adhere to the wall of the tubing. The sample transport line should be purged dry with air or nitrogen before the system is placed back in operation.

The gas analyzer must be taken out of service during any cleaning of the sample transport line.

If liquid makes it into the gas analyzer SCS, a filter element may become obstructed leading to a decreasing supply pressure or bypass flow. If obstruction of a filter is observed, the filter should be cleaned and the filter element replaced.

Regular SCS status check

1. Open the SCS door.
2. Read and record the flow meter settings while the gas is flowing.
3. Close the SCS door.

Do not leave the SCS door open any longer than absolutely necessary. Endress+Hauser recommends no more than 60 seconds.

4. Compare the current readings with the past readings to determine any variations. Reading levels should remain consistent.
5. If reading levels decrease, check the filters.

To check filters

1. Shut down the system following the procedure in **"Shutting Down the SCS"** on page 4-9.

2. Inspect, repair or replace the filter as required. Refer to **"Replacing the filter"** on page B-15.

*For additional information, refer to **"Service"** on page B-23.*

3. Restart the system following the procedure in **"Starting up the SCS"** on page 4-6.

Instrument Problems

If the instrument does not appear to be hampered by gas leaks, contamination, excessive sampling gas temperatures and pressures, or electrical noise, refer to Table B–1 before contacting your sales representative for service.

Table B–1 *Potential instrument problems and solutions*

Symptom	Response
Non-Operation (at start up)	Is the power connected to both the gas analyzer and power source? Is the switch on?
	Is the power source good? (100-250 VAC @ 50-60 Hz, 18-32 VDC).
	Check fuse(s). If bad, replace with equivalent amperage, slow-blow fuse.
	Refer to **"Service"** on page B-23.
Power Fail Error	Make sure that the gas analyzer is protected from extreme ambient temperature
	Possible alignment problem. Contact a factory sales representative for service information.
	Check the inlet and outlet tubes to see if they are under any stress. Remove the connections to the inlet and outlet tubes and see if the power goes up. Perhaps the existing tubing needs to be replaced with stainless steel flexible tubing.
	Turn gas analyzer off and check the hytek board for loose cables. **Do not disconnect or reconnect any optical head cables with the power connected.**

Table B–1 *Potential instrument problems and solutions (Continued)*

Symptom	Response
Power Fail Error (Continued)	Capture diagnostic data and send the file to Service (refer to **"To read diagnostic data with Hyper-Terminal"** in the Device Parameters).
	Possible mirror contamination issue. Refer to**"Service"** on page B-23. If advised to do so, clean the mirrors by following the instructions under **"To clean the mirror"** on page B-5.
	Refer to the Device Parameters for error message programming solutions.
Null Fail Error	Refer to the Device Parameters to verify a **Null Fail Error** fault.
	Move the jumper JMP1 on the electronics control board next to the pre-pot.
	Capture diagnostic data and send the file to Service (refer to **"To read diagnostic data with Hyper-Terminal"** in the Device Parameters).
Spectrum Fail Error	Turn off the power to the unit and check the optical head cables for a loose connection. **Do not disconnect or reconnect any optical head cables with the power connected.**
	Reset the peak tracking. Refer to the Device Parameters.
	Turn the gas analyzer off for 30 seconds and then turn it on again.
	Capture diagnostic data and send the file to Service (refer to **"To read diagnostic data with Hyper-Terminal"** in the Device Parameters).
PT Fail Error	Check that the actual pressure in the measurement cell is within specification (see Appendix A).
	If the pressure reading is incorrect, check that the pressure/temperature cable is tight. Check the connector on the pressure sensor. Check the pressure connector on the backplane board.

Table B–1 *Potential instrument problems and solutions (Continued)*

Symptom	Response
Track Fail Error	Refer to the Device Parameters for instruction on system faults.
	Reset the peak tracking. Refer to the Device Parameters.
Front panel display is not lit and no characters appear	Check for correct voltage on terminal block input. Observe polarity on DC powered units.
	Check for correct voltage after fuses.
Front panel display is not lit and no characters appear (Continued)	Check for 5 VDC on red wires, 12 VDC on yellow wires, and 24 VDC on orange wires from power supply (black wires are ground).
	Check connections on display communication and power cables.
Strange characters appear on front panel display	1) Make sure the EEProm is seated well. 2) Disconnect and reconnect the main board.
No reading on device connected to current loop	Make sure that connected device can accept a 4–20 mA signal. The gas analyzer is set to source current.
	Make sure the device is connected to the correct terminals on the green connector (see Figure 3–5 on page 3–12).
	Check the open circuit voltage (35 to 40 VDC) across the current loops terminals on the green connector (see Figure 3–5 on page 3–12).
	Replace the current loop device with a milliampere meter and look for current between 4 mA and 20 mA. A voltmeter connected across a 249-ohm resistor can be used instead of the milliampere meter; it should read between 1 and 5 volts.
Pressing keys on front panel do not have specified effect	Check connections on keypad cable.
Reading is erratic or seems incorrect	Check for contamination in the sample system, especially if the readings are much higher than expected.

Table B-1 *Potential instrument problems and solutions (Continued)*

Symptom	Response
Reading is erratic or seems incorrect (continued)	Capture diagnostic data and send the file to Service (refer to **“To read diagnostic data with Hyper-Terminal”** in the Device Parameters).
Reading goes to “0”	If **4-20 mA Alarm Action** is set to **0**, look on display for a fault message (refer to the Device Parameters for instruction on system faults and **“To change parameters in Mode 2”**).
	Gas concentration is equal to zero.
Current loop is stuck at 4 mA or 20 mA	Check display for fault message. If alarm has been triggered, reset the alarm. Refer to the Device Parameters.
	On the current loop board, check the voltage between the end of resistor R1 closest to the jumper and ground. If the concentration reading is high, the voltage should be near 1 VDC. If the concentration reading is low, the voltage should be near 4.7 VDC. If not, the problem is probably on the electronics control board. Please refer to **“Service”** on page B-23 to return the board to the factory for service.
Reading seems to always be low by a fixed amount	See **“Adjusting Gas Analyzer Reading to Match Specific Standard(s)”** in the Device Parameters.
	Capture diagnostic data and send the file to Service (refer to **“To read diagnostic data with Hyper-Terminal”** in the Device Parameters).
4–20 mA analog signal does not match the DCS/PLC (customer logging system); no 4–20 mA analog signal received or erratic 4–20 mA signal	Check to see if the 4–20 mA is responding from the gas analyzer. Refer to **“4–20 mA % Test”** in the Device Parameters.
Reading seems to always be high by a fixed amount	See **“Adjusting Gas Analyzer Reading to Match Specific Standard(s)”** in the Device Parameters.
	Capture diagnostic data and send the file to Service (refer to **“To read diagnostic data with Hyper-Terminal”** in the Device Parameters).

Table B-1 *Potential instrument problems and solutions (Continued)*

Symptom	Response
Reading goes to full scale	If **4–20 mA Alarm Action** is set to **1**, look on display for a fault message (refer to the Device Parameters for instruction on system faults and **“To change parameters in Mode 2”**).
	Gas concentration is greater than or equal to full scale value.
Serial Output is displaying garbled data	Make sure the computer COM port is set for 9600 baud, 8 data bits, 1 stop bit, no parity, and no flow control.
	Be sure no other programs are using the COM port selected.
	Make sure the connections are good. Verify the correct pin connections with an ohmmeter.
	Make sure to select the correct COM port into which the cable is plugged.
Serial output is providing no data	Make sure the connections are good. Verify the correct pin connections with an ohmmeter.
	Make sure to select the correct COM port into which the cable is plugged.
	Make sure the computer COM port is set for 9600 baud, 8 data bits, 1 stop bit, no parity, and no flow control.
	Be sure no other programs are using the COM port selected.
LCD does not update. Unit is locked up.	Switch off power, wait 30 seconds, and then switch power back on.
Improper temperature in the SCS	Check the wiring to the heater/controller. Refer to **“Connecting Electrical Power to the Enclosure Heater”** on page 3-8.
	Check and replace the temperature controller and heater.
Low pressure or flow	Check, clean and/or replace filters or membrane separators. Refer to **“Replacing the membrane separators”** on page B-15.
	Check and adjust the sample probe regulator.

Table B-1 *Potential instrument problems and solutions (Continued)*

Symptom	Response
Low pressure or flow (continued)	Check and clean the sample transport tubing.
	Check for leaks.
	Check the relief valve for proper setting. Refer to **"Confirming the relief valve setting"** on page B-14.
Liquids in the flow meter	Check the temperature for the SCS.
	Check the pressure and correct as necessary.
	Check the temperature on the sample tubing and correct as necessary (refer to the gas analyzer drawings in Appendix A).
Leaks (gas)	Use a liquid leak detector at all fittings.

Service

For Service, refer to our website for the list of local sales channels in your area: www.endress.com/contact.

Before contacting Service

Before contacting Services, prepare the following information to send with your inquiry:

- Diagnostic downloads using the procedures provided in the associated firmware manual or using AMS100 software from Endress+Hauser
- Contact information
- Description of the problem or questions

Access to the information above will greatly expedite our response to your technical request.

Service repair order

If returning the unit is required, obtain a **Service Repair Order** (**SRO**) **Number** from Customer Service before returning the gas analyzer to the factory. Your service representative can determine whether the gas analyzer can be serviced on site or should be returned to the factory. All returns should be shipped to:

Endress+Hauser

11027 Arrow Rte.
Rancho Cucamonga, CA 91730-4866
United States of America
1-909-948-4100

Renewity

Returns can also be made inside the USA through the Renewity system. From a computer, navigate to www.us.endress.com and complete the online form.

Packing

Endress+Hauser SS500e/SS2000e/SS3000e gas analyzers and auxiliary equipment are shipped from the factory in appropriate packaging. Depending on the size and weight, the packaging may consist of a cardboard-skinned container or a wooden crate. All inlets and vents are capped and protected when packaged for shipment.

If the equipment is to be shipped or stored for any length of time, it should be packed in the original packaging when shipped when shipped from the factory. If gas analyzer has been installed and or operated (even for purposes of a demonstration), the system should first be decontaminated (purged with an inert gas) before powering down the gas analyzer.

Process samples may contain hazardous material in potentially flammable and/or toxic concentrations. Personnel should have a thorough knowledge and understanding of the physical properties of the sample and prescribed safety precautions before installing, operating or maintaining the gas analyzer.

To purge the gas analyzer for shipment/relocation

1. Refer to the procedure**"To isolate the process sample tap for long-term shutdown"** on page 4-11.
2. Disconnect the sample tubing at the inlet to the gas analyzer. Refer to drawings in**"Specifications"** on page A-1.
3. Connect clean, dry nitrogen to the sample inlet. Set to 30 PSIG.
4. Open the low pressure flare or atmospheric vent header shut-off valve for the effluent from the sample bypass.
5. Allow the gas analyzer to purge for 20 minutes.
6. Shut off the nitrogen purge and disconnect.
7. Close the low pressure flare or atmospheric vent header shut-off valve for the effluent from the sample bypass.

To prepare the gas analyzer for shipment or storage

1. Follow the instructions **"To purge the gas analyzer for shipment/relocation"** above.
2. Disconnect power to the system.
3. Disconnect all tubing and signal connections.
4. Cap all inlets and outlets to prevent foreign material such as dust or water from entering the system) using the original fittings supplied as part of the packaging from the factory.
5. Pack the equipment in the original packaging in which it was shipped, if available. If the original packaging material is no longer available, the equipment should be adequately secured (to prevent excessive shock or vibration).
6. If returning the gas analyzer to the factory, complete the Decontamination Form provided by Endress+Hauser and attach to the outside of the shipping package as instructed before shipping. Refer to **“Service”** on page B-23.

Storage

The packaged gas analyzer should be stored in a sheltered environment that is temperature controlled between -20 °C (-4 °F) and 50 °C (122 °F), and should not be exposed to direct sun, rain, snow, condensing humidity or corrosive environments.

Disclaimers

Endress+Hauser accepts no responsibility for consequential damages arising from the use of this equipment. Liability is limited to replacement and/or repair of defective components.

Warranty

For a period of 18 months from date of shipment or 12 months in operation, whichever comes first, Endress+Hauser warrants that all products sold by it shall be free from defects in material and workmanship under normal use and service when correctly installed and maintained. Endress+Hauser’ sole liability and Customer’s sole and exclusive remedy for a breach of warranty is limited to Endress+Hauser’ repair or replacement (at Endress+Hauser’ sole option) of the product or part thereof which is returned at Customer’s expense to Endress+Hauser’ plant. This warranty shall apply only if Customer notifies Endress+Hauser in writing of the defective product promptly after the discovery of the defect and within the warranty period. Products may only be returned by Customer when accompanied by a return authorization reference number (SRO) issued by Endress+Hauser. Freight expenses for products returned by Customer will be prepaid by Customer. Endress+Hauser shall pay for shipment back to Customer for products repaired under warranty. For products returned for repair that are not covered under warranty, Endress+Hauser’ standard repair charges shall be applicable in addition to all shipping expenses.

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