BA02189C/66/EN/02.23
70207462

Products Solutions Services

Operating Instructions
SS2100i-1 TDLAS Gas Analyzer

ATEX/IECEx/UKEX: Zone 1

Endress+Hauser
People for Process Automation

Table of Contents

1 About this document

1.1 Warnings

Structure of Information	Meaning
WARNING **Causes (/consequences)** Consequences of non-compliance (if applicable) ▸ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation can result in a fatal or serious injury.
CAUTION **Causes (/consequences)** Consequences of non-compliance (if applicable) ▸ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.
NOTICE **Cause/situation** Consequences of non-compliance (if applicable) ▸ Action/note	This symbol alerts you to situations which may result in damage to property.

Table 1. Warnings

1.2 Symbols on the device

Symbol	Description
	The Laser Radiation symbol is used to alert the user to the danger of exposure to hazardous visible and invisible laser radiation when using the analyzer.
	The High Voltage symbol that alerts people to the presence of electric potential large enough to cause injury or damage. In certain industries, high voltage refers to voltage above a certain threshold. Equipment and conductors that carry high voltage warrant special safety requirements and procedures.
Intertek	The ETL Listed Mark provides proof of product compliance with North American safety standards. Authorities Having Jurisdiction (AHJ) and code officials across the US and Canada accept the ETL Listed Mark as proof of product compliance to published industry standards.
	The WEEE symbol indicates that the product should not be discarded as unsorted waste but must be sent to separate collection facilities for recovery and recycling.
CE	The CE Marking indicates conformity with health, safety, and environmental protection standards for products sold within the European economic area (EEA).

Table 2. Symbols

1.3 U.S. export compliance

The policy of Endress+Hauser is in strict compliance with U.S. export control laws as detailed in the website of the Bureau of Industry and Security at the U.S. Department of Commerce.

2 Introduction

The Endress+Hauser SS2100i-1 product is a high-speed, diode laser-based extractive analyzer designed for reliable monitoring of very low (trace) to standard concentrations of specific components in various background gases. It is important to closely review the installation and operation sections of this manual to ensure the analyzer performs as specified. This manual contains a comprehensive overview of the SS2100i-1 analyzer and step-by-step instructions for:

- Inspecting the analyzer
- Mounting and installing the analyzer
- Troubleshooting the system

2.1 How to use this manual

Take a moment to familiarize yourself with this Operating Instruction by reading the Table of Contents.

Some options and accessories are available for the SS2100i-1 analyzers. This manual addresses the most common options and accessories.

Images, tables, and charts are included to provide a visual understanding of the analyzer and its functions. Special symbols are used to provide the user with key information regarding the system configuration and/or operation. Pay close attention to this information.

2.1.1 Who should read this manual

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

2.1.2 Conventions used in this manual

In addition to the symbols and instructional information, this 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 are identified by a pointing finger cursor when rolling over the text. Simply click on the link to navigate to the associated reference.

2.2 General warnings and cautions

Instructional icons are provided in this manual and on the SS2100i-1 unit 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 analyzer. Some of these symbols are provided for instructional purposes only and are not labeled on the system.

2.2.1 Safety warning label

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

Figure 1. Safety warning label

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

Symbol	Description
	**Flammable**. Gases used in the processing of this 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, arcing, sparking, etc.).
	**Toxins**. Endress+Hauser 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.

Table 3. Safety warnings

CAUTION

- Technicians are expected to follow all safety protocols established by the customer that are necessary for servicing or operating the analyzer. This may include, but is not limited to, lockout/tag-out procedures, toxic gas monitoring protocols, personal protective equipment (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.

2.2.2 Equipment labels

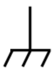
Symbol	Description
	Warning statement for **hazardous voltage**. Contact may cause electric shock or burn. Turn off and lock out system before servicing.
	Failure to follow all directions may result in damage or malfunction of the analyzer.
	Maximum voltage and current specifications for the fuse closest to label.
	**PROTECTIVE EARTH GROUND** – Symbol indicates the connection point of the ground wire from the main power source.
	**FUNCTIONAL EARTH GROUND** – Symbol indicates grounding points intended primarily for troubleshooting.

Table 4. Equipment labels

2.2.3 Instructional symbols

Symbol	Description
	General notes and important information concerning the installation and operation of the analyzer.
	Failure to follow all directions may result in fire.
	**INVISIBLE LASER RADIATION** – Avoid exposure to beam. Class 3b Radiation Product. Refer servicing to the manufacturer-qualified personnel.
	Failure to follow all directions may result in damage or malfunction of the analyzer.
	Maximum voltage and current specifications for fuses.

Table 5. Instructional symbols

2.2.4 Special safety symbols used on the equipment

Special safety symbols and labeling are used on the equipment to alert the user to potential hazards and important information associated with the analyzer. Every symbol and label has significant meaning that should be heeded.

Symbol	Description
WARNING - DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED FUSE: 5X20MM, T, L, 250VAC, 1AMP	**ENERGIZED FUSE WARNING** – Do not remove or replace fuse when energized.
CAUTION CLASS 3B INVISIBLE LASER RADIATION WHEN OPEN AVOID EXPOSURE TO THE BEAM	**INVISIBLE LASER RADIATION** – Avoid exposure to beam. Class 3b Radiation Product. Refer servicing to the manufacturer or qualified personnel.
	**DO NOT REMOVE** – Removal of the seal and/or disassembly of pieces traversed by label voids the warranty.
	**CLASS 1 LASER PRODUCT** – Invisible laser radiation when open. Avoid direct exposure to the beam.
	**CLASS 3B LASER PRODUCT** – Invisible laser radiation. Avoid direct exposure to beam. Class 3b laser product.
	**CLASS 3B LASER WARNING** – Class 3B invisible laser radiation when open. Avoid direct exposure to the beam.

Table 6. Special safety symbols

2.3 Manufacturer address

Endress+Hauser
11027 Arrow Route
Rancho Cucamonga, CA 91730
United States
www.endress.com

2.4 About the gas analyzers

The SS2100i-1 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.

2.4.1 Sample conditioning system

The analyzer may be integrated with a sample conditioning system (SCS) that is specifically designed to meet the sample condition requirements for the analyzer while preserving sample integrity and minimizing sample lag time. Refer to the SCS Operating Instruction for more information.

2.4.2 Determining firmware version

When the analyzer is powered on for the first time, the firmware version will display on the system LCD for approximately seven seconds. Refer to Powering Up the Analyzer in the Description of Device Parameters for this analyzer for operational instructions. The firmware version for each analyzer is also listed on the analyzer calibration certificate.

2.5 How the analyzers work

The SS2100i-1 analyzers employ tunable diode laser absorption spectroscopy (TDLAS) to measure the concentration of single compounds in gas mixtures. 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 2. 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 SS2100i-1 analyzers, sample gas flows continuously through the sample cell ensuring that the sample is always representative of the flow in the main pipe.

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 l (cell length x number of passes), is given by $I(\lambda) = I_0(\lambda)\exp[-\sigma(\lambda)lN]$, 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

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

Figure 3 shows the typical raw data 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 intensity 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 4.

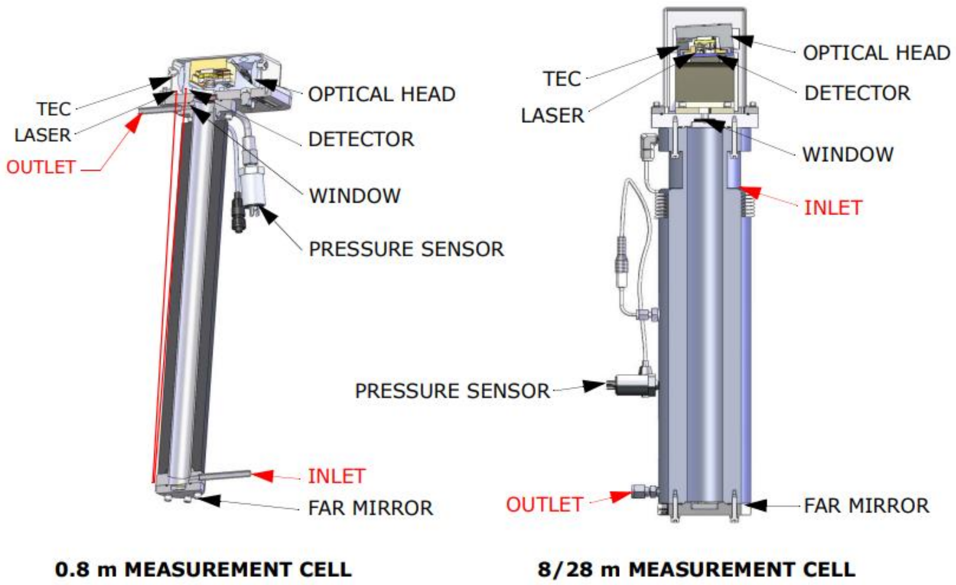


Figure 2. Schematic of a typical tunable diode laser absorption spectrometer

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.

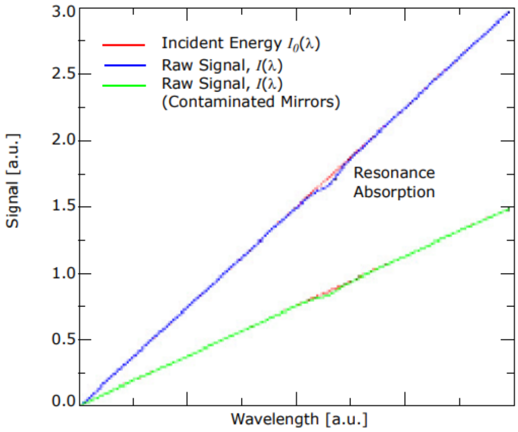


Figure 3. Typical raw signal from a laser diode absorption spectrometer with and without mirror contamination

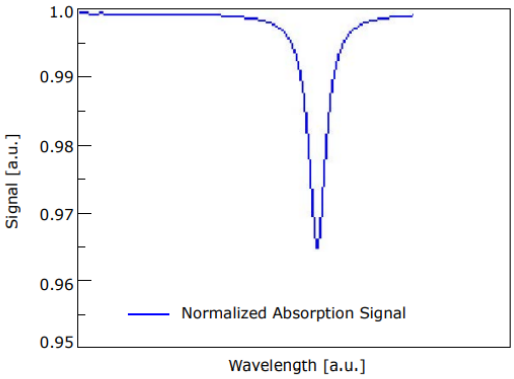


Figure 4. Typical normalized absorption signal from a laser diode absorption spectrometer

2.6 Differential TDLAS

Similar to TDLAS, this technology involves subtracting two spectrums from one another. A "dry" spectrum, a response from the sample when the analyte of interest has been completely removed, is subtracted from the "wet" spectrum, a response from the sample when the analyte is present. The remainder is a spectrum of the pure analyte. This technology is used for very low or trace measurements and is also useful when the background matrix changes over time.

2.6.1 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*), as shown in Figure 5. 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.

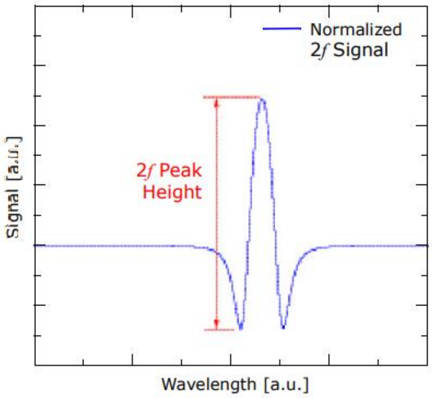


Figure 5. Typical normalized 2f signal; species concentration is proportional to the peak height

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 TDLAS gas analyzers employ the same 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.

2.7 Getting familiar with the SS2100i-1

The SS2100i-1 consists of a single enclosure containing two electrical assembly panels. Figure 6 shows the front, rear, and bottom of the analyzer.

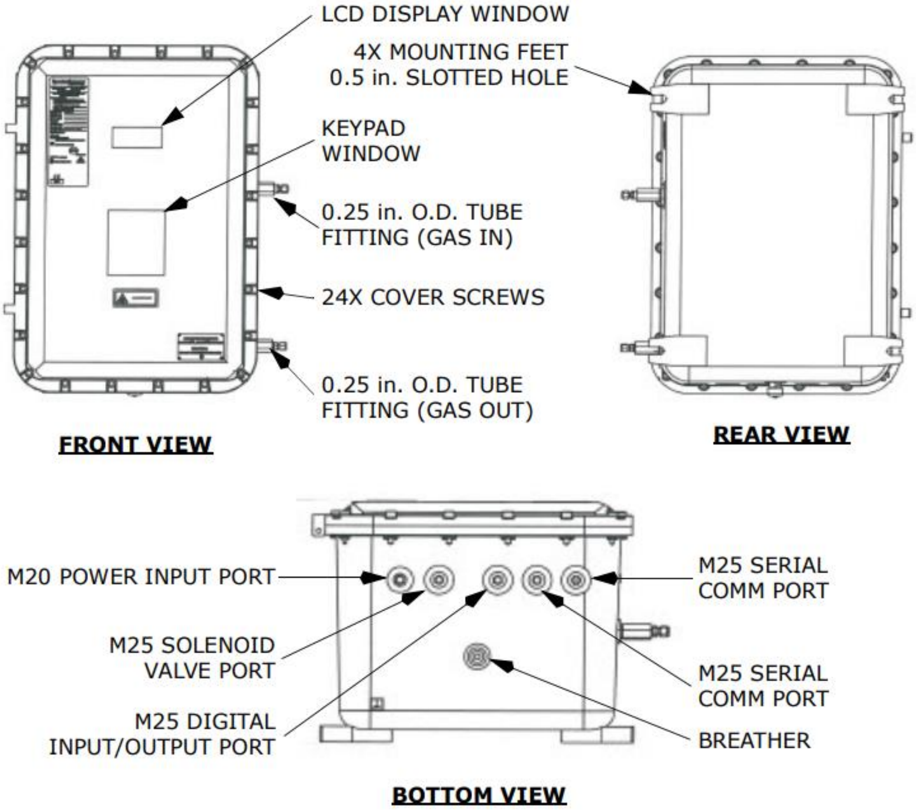


Figure 6. External features of the analyzer

CAUTION

- Only compound barrier seal glands (known as potted glands) should be installed on this system.

On the front cover, the keypad and LCD display serve as the user interface to the analyzer. Power and signal connections are made via access ports on the bottom of the analyzer. Tube fittings on the right side are for sample supply and return connections. Four sturdy feet on the back of the enclosure serve as attachment points for mounting the analyzer.

The upper and lower levels for the analyzer are shown in Figure 7 (8/28 m sample cell), Figure 8 (0.8 m sample cell), or Figure 9 (0.1 m sample cell). The top level is the electronics panel assembly, shown in Figure 10, The lower level is the sample cell panel assembly shown in Figure 11 (8/28 m sample cell), Figure 12 (0.8 m sample cell), or Figure 13 (0.1 m sample cell).

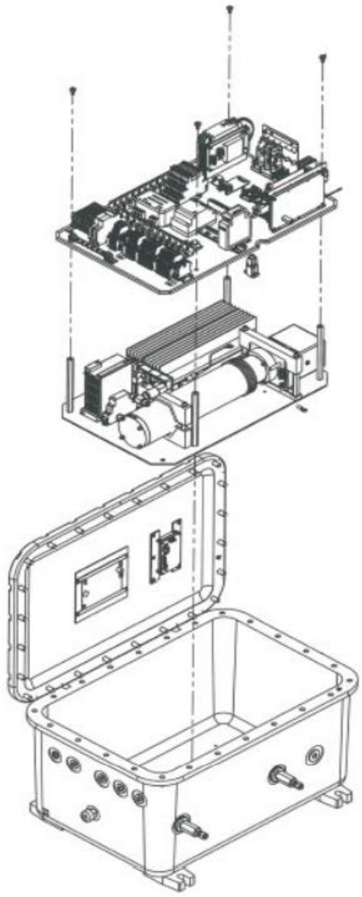


Figure 7. Upper and lower levels of analyzer assembly (8/28 m sample cell)

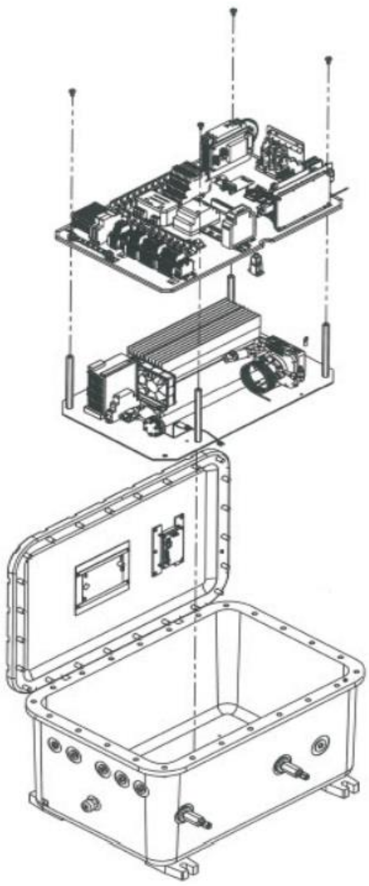


Figure 8. Upper and lower levels of analyzer assembly (0.8 m sample cell)

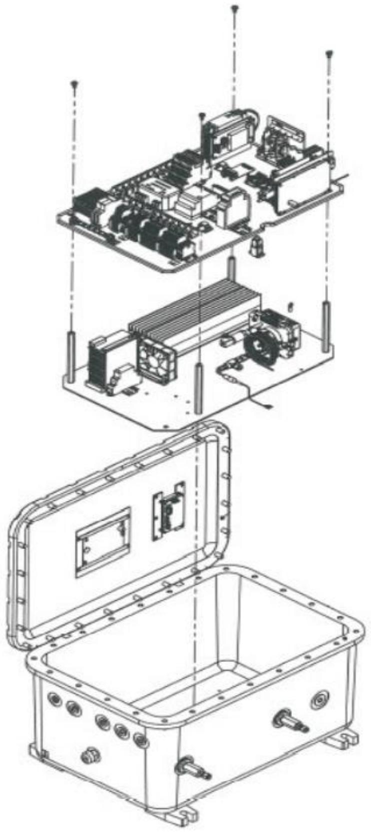


Figure 9. Upper and lower levels of analyzer assembly (0.1 m sample cell)

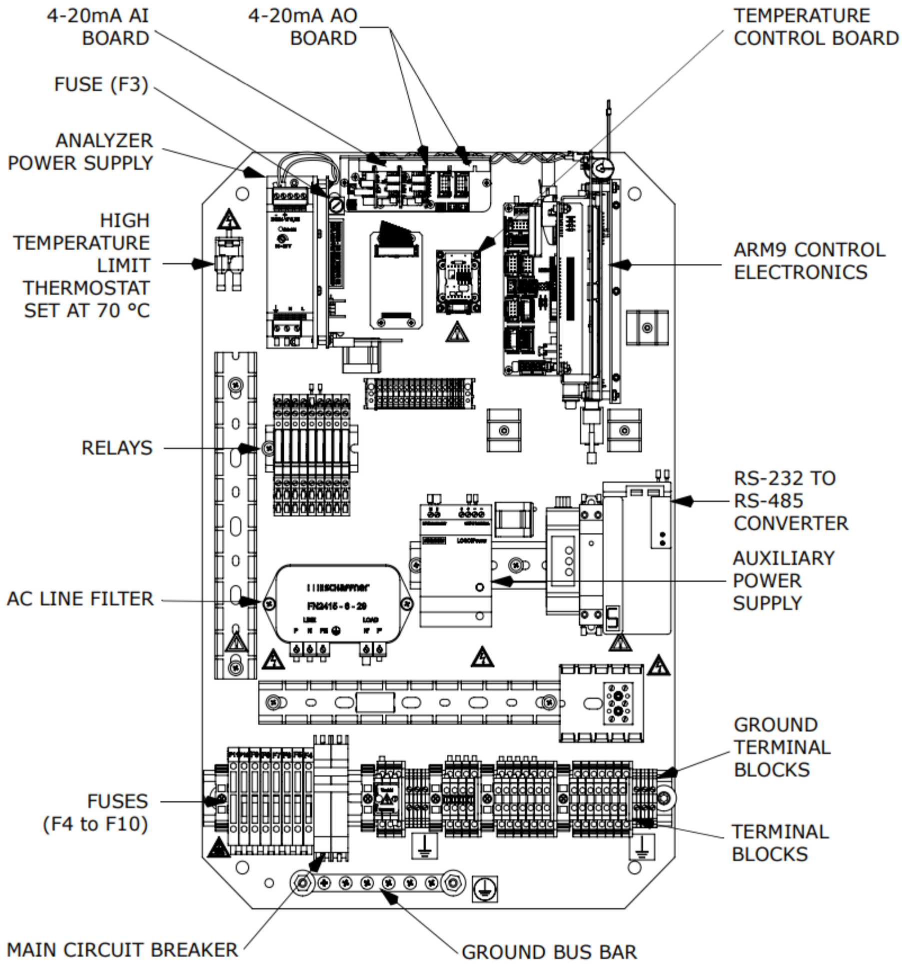


Figure 10. Components on electronics panel assembly (upper level)

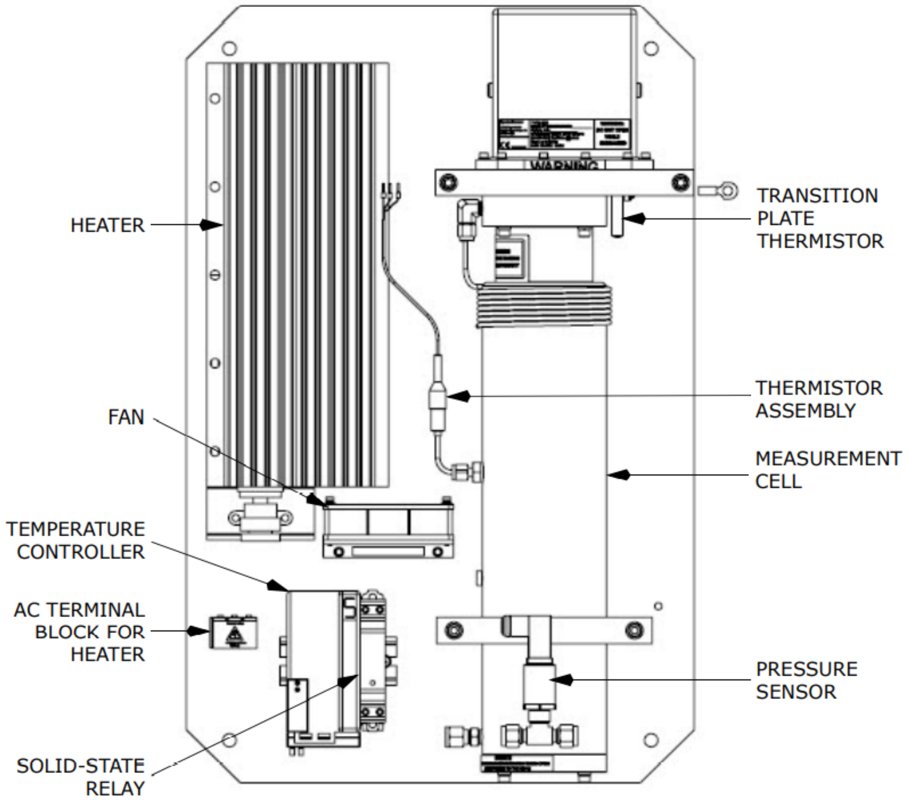


Figure 11. Components on sample cell panel assembly (8/28 m sample cell) (lower level)

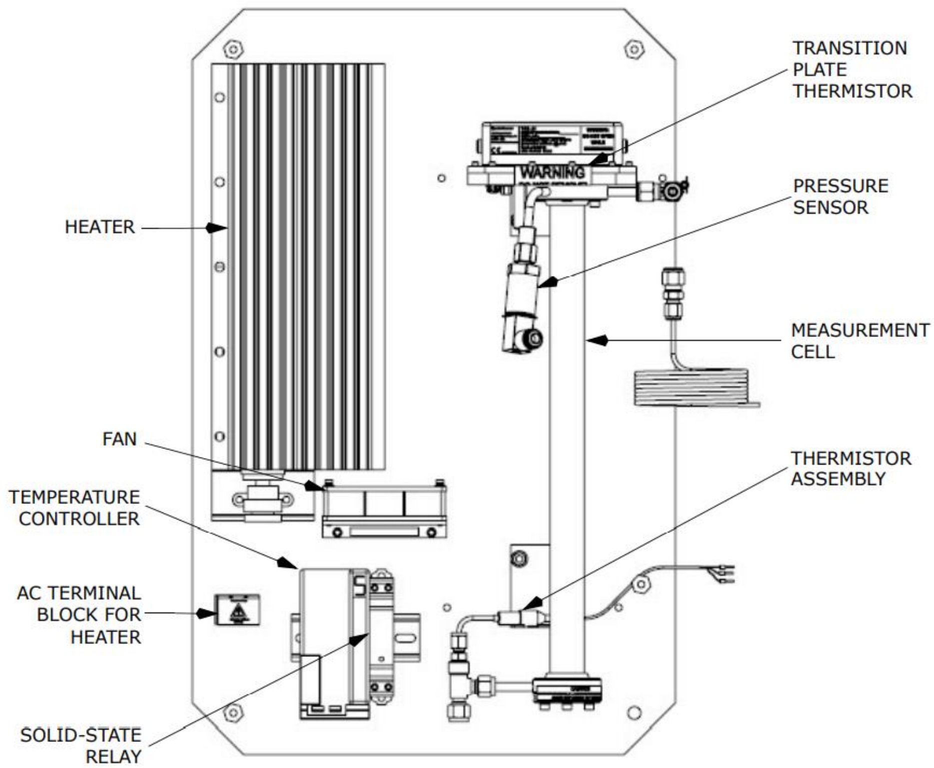


Figure 12. Components on sample cell panel assembly (0.8 m sample cell) (lower level)

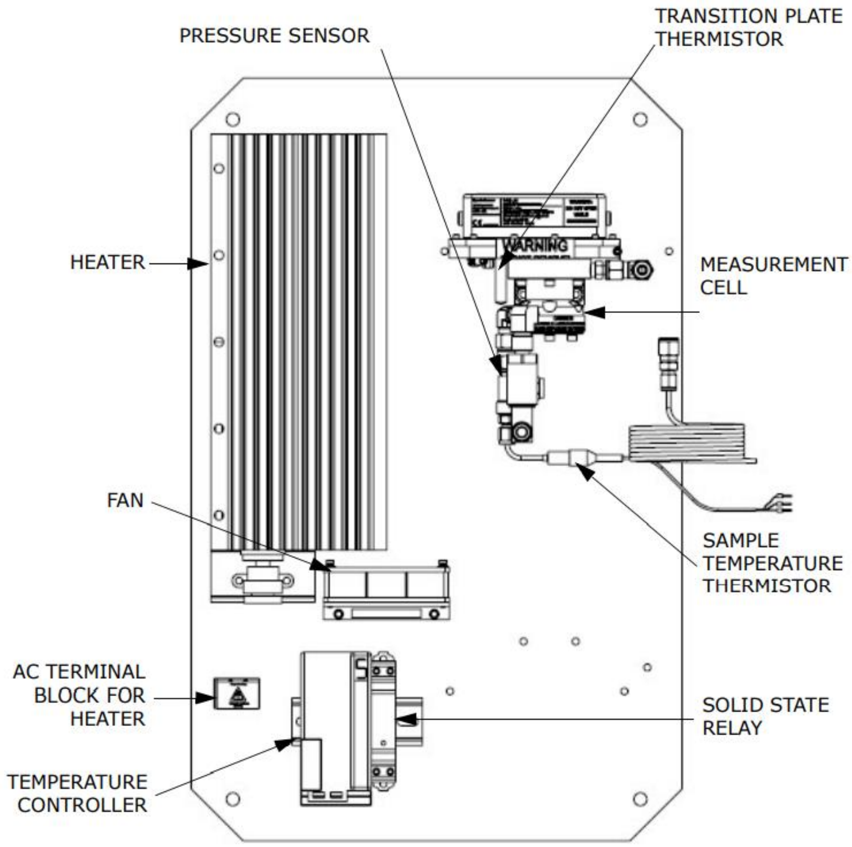


Figure 13. Components on sample cell panel assembly (0.1 m sample cell) (lower level)

On the upper level (electronics panel assembly), the analyzer power supply provides power to the analyzer control electronics and relays controlling valves. The analyzer control electronics drive the laser, collect the signal and analyze the spectra. Powered relays control valves while unpowered relays serve as alarm contacts. An AC line filter is used to condition the input power.

The relay control board serves as the interface between the analyzer control electronics and the relays whereas the temperature control board controls the thermo-electric (TEC) cooler that maintains the laser temperature inside the sample cell optical head. An optically-isolated RS-232 to RS-422/485 converter takes the inherent RS-232 serial output of the laser control electronics and converts it to RS-485.

The auxiliary switch-mode power supply provides power to the heater temperature controller (located on the bottom level) and the RS-232/RS-485 converter. The power supply is rated for 1.3 A at 24 VDC output at ambient temperatures $T_a \leq 60$ °C. For higher temperatures 60 °C < $T_a \leq 70$ °C, the output power is reduced by 2.5%/°C. The operational state is indicated by LEDs on the front face, where green means the output voltage is on and within specification, and red means the output voltage is on but below specification.

The thermostat in the upper left corner prevents the temperature inside the enclosure from getting too hot. The thermostat is preset at the factory to open the heater circuit if the temperature inside the analyzer enclosure exceeds 70 ± 4 °C. The heater circuit will remain open until the manual reset button (located between the two wire terminals) on the thermostat is pressed or the temperature drops approximately 30% below the setpoint.

A DIN rail at the bottom of the upper level holds fused terminal blocks, the main breaker, and terminal blocks for all external connections.

On the lower level, the measurement cell is the actual TDLAS spectrometer through which the gas sample flows. The measurement cell is equipped with a pressure sensor and thermistor to monitor the thermodynamic conditions of the sample. A heater maintains the inside of the analyzer enclosure at a constant temperature and is controlled by the temperature controller via the solid-state relay.

⚠ CAUTION

▶ See Figure 10 to locate fuses. If you need to replace a fuse, use only the same type and rating of fuse as the original as listed in Table 7 or Table 8. For re-order part numbers, refer to Appendix C → 🗎.

Drawing Reference	Description	Rating
F3	Miniature fuse, 5 x 20 mm, time delay	250 VAC/1.6 A
F4[1]	Miniature fuse, 5 x 20 mm, time delay	250 VAC/0.5 A
F5[1], F6[1], F7[1], F8[1]	Miniature fuse, 5 x 20 mm, time delay	250 VAC/0.1 A
F9 [1]	Miniature fuse, 5 x 20 mm, time delay	250 VAC/1 .0 A
F10 [1]	Miniature fuse, 5 x 20 mm, time delay	250 VAC/1.2 A

Table 7. Fuse specifications for 240 VAC systems

[1]Housed in fused terminal blocks. Illuminated LED indicates blown fuse.

Drawing Reference	Description	Rating
F3	Miniature fuse, 5 x 20 mm, time delay	250 VAC/1.6 A
F4[1]	Miniature fuse, 5 x 20 mm, time delay	250 VAC/0.5 A
F5[1], F6[1], F7[1], F8[1]	Miniature fuse, 5 x 20 mm, time delay	250 VAC/0.1 A
F9 [1]	Miniature fuse, 5 x 20 mm, time delay	250 VAC/1.0 A
F10 [1]	Miniature fuse, 5 x 20 mm, time delay	250 VAC/2.0 A

Table 8. Fuse specifications for 120 VAC systems

[1]Housed in fused terminal blocks. Illuminated LED indicates blown fuse.

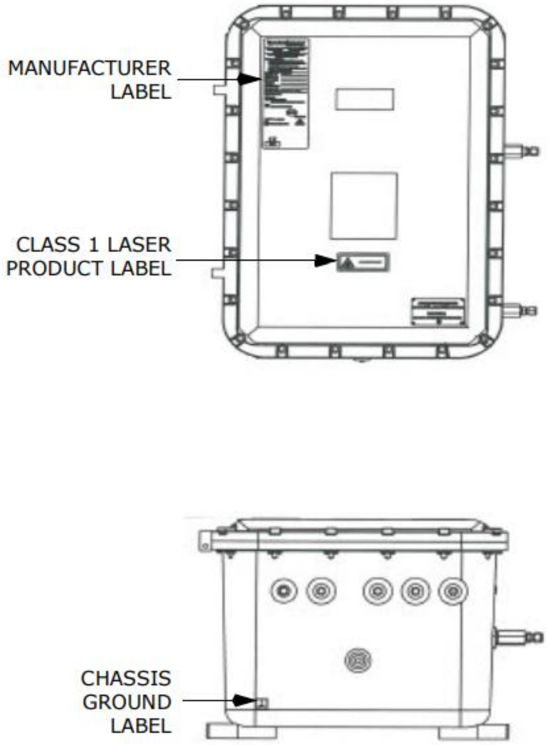


Figure 14. Label placement on exterior of enclosure

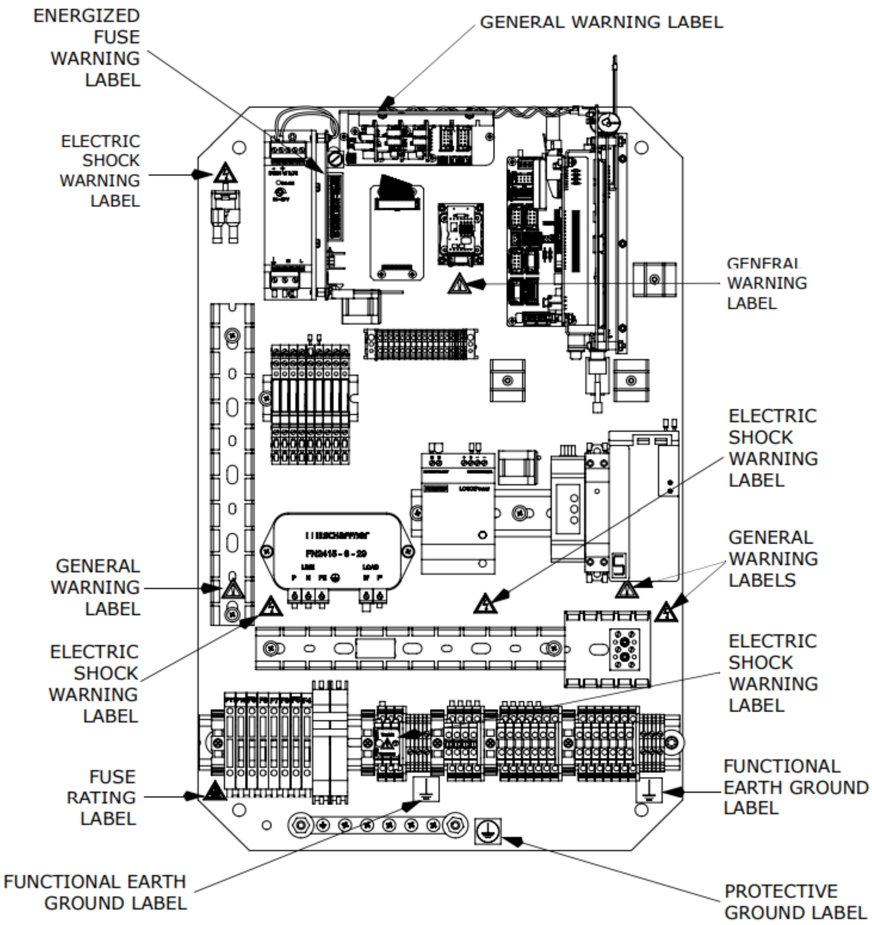


Figure 15. Label placement on electronics panel assembly (upper level)

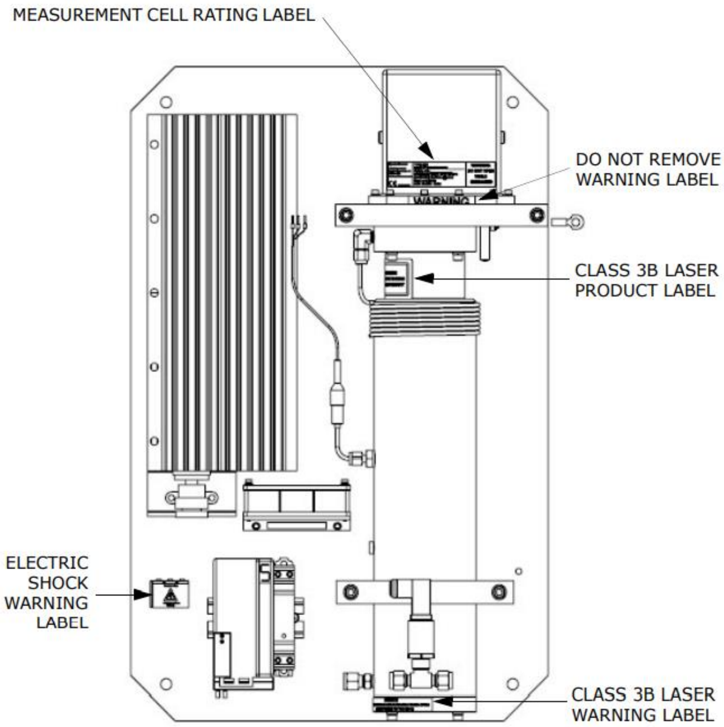


Figure 16. Label placement on sample cell panel assembly (8/28 m sample cell) (lower level)

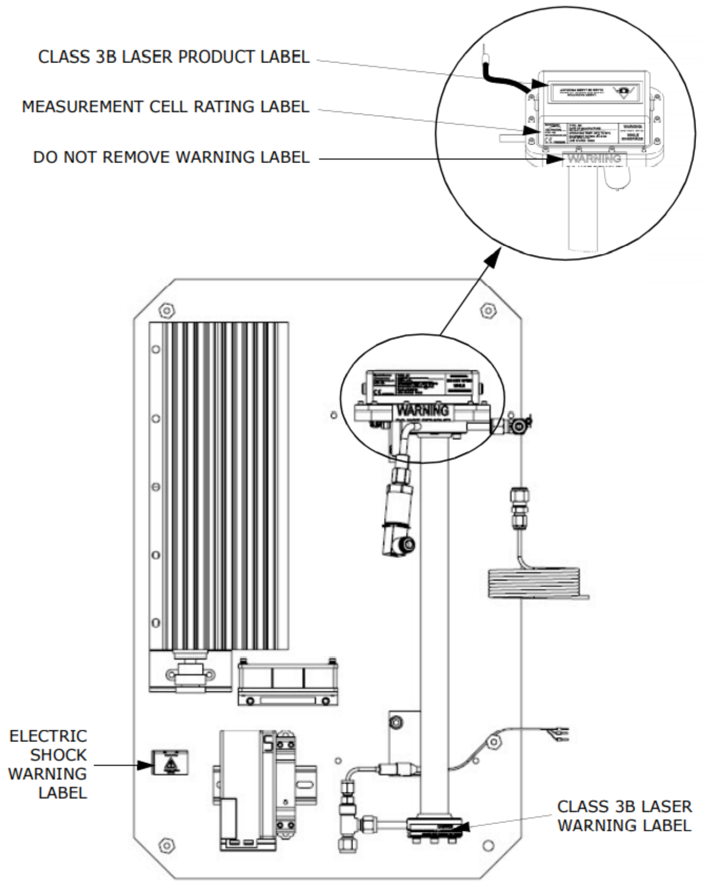


Figure 17. Label placement on sample cell panel assembly (0.8 m sample cell) (lower level)

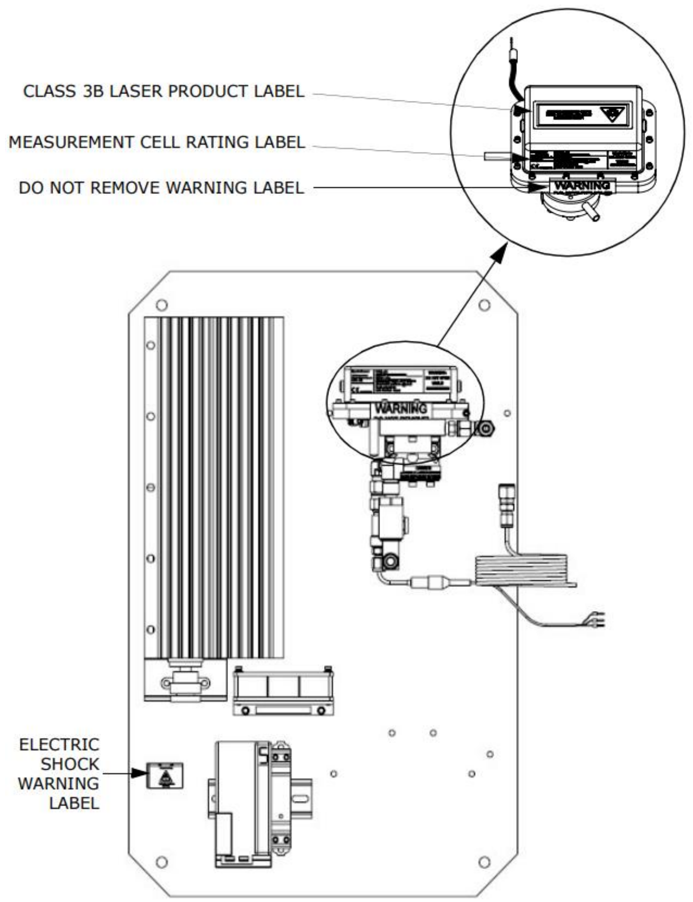


Figure 18. Label placement on sample cell panel assembly (0.1 m sample cell) (lower level)

3 Safety

3.1 Potential risks affecting personnel

This section addresses the appropriate actions to undertake when faced with hazardous situations during or before service of the 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 analyzer.

⚠ CAUTION

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

3.1.1 Mitigating risks

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

3.1.1.1 Exposure to process gases

1. Shut off the process gas to the 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.

3.1.1.2 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.

⚠ CAUTION

- Follow all safety protocols governing toxic gases and potential leaks.

3.1.1.3 Electrocution hazard

⚠ CAUTION

- Complete step 1 before performing any service that requires working near the main input power or disconnecting any wiring or other electrical components.

1. Shut off power at the main disconnect external to the analyzer.
2. Open enclosure door.

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

3. Note any live electrical components and avoid any contact with them.
4. 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).

3.1.2 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).

4 Installation

This section describes the processes used to initially install and configure your SS2100i-1. Once the analyzer arrives, take a few minutes to examine the contents before installing the unit.

CAUTION

- ▶ Endress+Hauser's Class 1 Division II 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.

4.1 What should be included in the shipping box

The contents of the crate should include:

- The Endress+Hauser SS2100i-1 analyzer
- Document CD or USB; includes this Operating Instruction and the AMS100 software and instruction
- Tooling Kit (1100002156), which includes a serial converter cable for service and diagnostic purposes

NOTICE

- ▶ For software drivers and operational instructions, refer to the manufacturer's website: http://www.ftdichip.com/.

If any of these contents are missing, contact Service. Refer to Service → 🖹.

4.2 Inspecting the analyzer

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.

CAUTION

- ▶ Avoid jolting the instrument by dropping it or banging it against a hard surface, which may disturb the optical alignment.

4.3 Hardware and tools for installation

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

4.3.1 Hardware

- Mounting hardware used for wall-mounting the SS2100i-1 must be able to support four times the weight of the instrument (86 kg [190 lbs.]) not including the sample system)
- Stainless steel tubing using 6.35 mm (0.25 in.) O.D. x 0.889 mm (0.035 in.) wall thickness, seamless 316L stainless steel electropolish tubing is recommended)
- Mounting frame, or sturdy structure, designed with a safety factor of 4 (3500 N maximum load)

4.3.2 Tools

- 8 mm Allen wrench
- 8 mm ball point hex L-key
- 10 mm ball point hex L-key
- 5/32 in. high torque ball point hex L-key
- 7/64 in. stainless steel ball point hex L-key
- 9/16 in. angle double open-end wrench: 15 and 75 degree
- 11/16 in. extra-long thin-head double open-end wrench
- RS-485 – USB converter (P/N 3100002220)

4.4 Mounting the analyzer

Refer to Appendix A → 🖹 for analyzer mounting dimensions.

NOTICE

- When mounting the analyzer, be sure not to position the instrument so that it is not difficult to operate adjacent devices. Allow 1 meter (3 feet) of room in front of the analyzer and position the analyzer no further than 10 meters (33 feet) from any associated scrubber.
- Endress+Hauser's analyzers are designed for operation within the specified ambient temperature range. Intense sun exposure in some areas may cause the analyzer temperature to exceed the maximum. Endress+Hauser recommends minimizing full sun exposure to the analyzer.

4.4.1 Lifting the analyzer

Before removing the crate, move the analyzer crate as close as possible to the final location. Due to the analyzer's weight (approximately 86 Kg [190 lbs]), Endress+Hauser recommends the use of a forklift, pallet jack, etc. to lift and/or move the analyzer. If the analyzer is to be lifted by hand, designate multiple individuals to lift by the mounting brackets, and distribute the weight among personnel to avoid injury.

4.4.2 To mount the analyzer

1. Select a suitable location to mount the analyzer. Choose a shaded area or use an optional analyzer hood (or equivalent) to minimize sun exposure.
2. Locate the mounting feet on your unit.
3. For wall installations, mark the centers of the top mounting holes.
4. Drill the appropriate size holes for the screws or concrete studs you are using.
5. Hold the analyzer in place and fasten with the top screws.
6. Repeat for the bottom mounting holes.
7. Secure all designated attachment points.

Once all designated attachment points are securely fastened, the analyzer should be ready for the electrical connections.

4.5 Opening and closing analyzer enclosure cover

⚠ CAUTION

- Care must be taken to avoid damaging the enclosure cover and body mating surfaces that form a machined flame path (gap $\leq$ 0.05 mm, roughness $\leq$ 6 μm). Contact Service if the surfaces are damaged to the extent they no longer meet the above specifications. Refer to Service → 🖹.

4.5.1 To open the analyzer enclosure cover

1. Using an 8 mm Allen wrench or driver, remove each cover screw completely.
2. Place cover screws in a safe place to protect against damage or loss.
3. Gently open cover by pulling on the edge opposite the hinges.

4.5.2 To close the analyzer enclosure cover

1. Gently close the enclosure cover, replace the cover screws, and tighten each to 40 N-m.

⚠ CAUTION

- All cover screws must always be tightened completely and may be replaced only with screws of the same type (ISO 4762/DIN 912) and material (Stainless Steel Grade A2-70). Ultimate Racing UR 0905 Copper Anti-Seize Lubricant or equivalent on cover screw threads to prevent galling unless glands are used.

4.6 Connecting the solenoid valves

NOTICE

- Solenoid valves are used on differential analyzer systems only, not on non-differential systems. Contact Service for any questions or clarifications. Refer to to Service → 🗎.

Differential systems require solenoid valves to switch between process flow and flow that has been scrubbed of the analyte. The solenoids switch the flow either directly, as shown in Figure 19, or via instrument air driving pneumatic valves, as shown in Figure 20, Figure 21, and Figure 22. Refer to Differential TDLAS → 🗎.

For systems performing differential measurements that do not have a factory installed sample system, the cables connecting the solenoid valve(s) to the electronics must be installed. All work should be performed by personnel qualified in electrical installation.

NOTICE

- Pay special attention to systems measuring especially reactive or adherent species. Because of the reactive or adherent nature of such species, accurate measurement of their concentration may be compromised somewhat by adsorption, desorption, or reaction with wetted surfaces. Special coatings are available to minimize these effects.
- Use an appropriate sample conditioning system that has been specifically designed to deliver a sample stream that is representative of the process stream at the time of sampling with the system to assure that the analyzer is receiving sample gas that can be correctly measured.

Figure 19 is a schematic of a typical basic differential setup for installations where no instrument air is available to drive pneumatic valves. A more preferable setup is shown in Figure 20 where only one solenoid is required in favor of more reliable pneumatic valves. Systems set up for autovalidation with one gas require two solenoids, as shown in Figure 21, whereas autovalidation with two gases requires four solenoids, as shown in Figure 22.

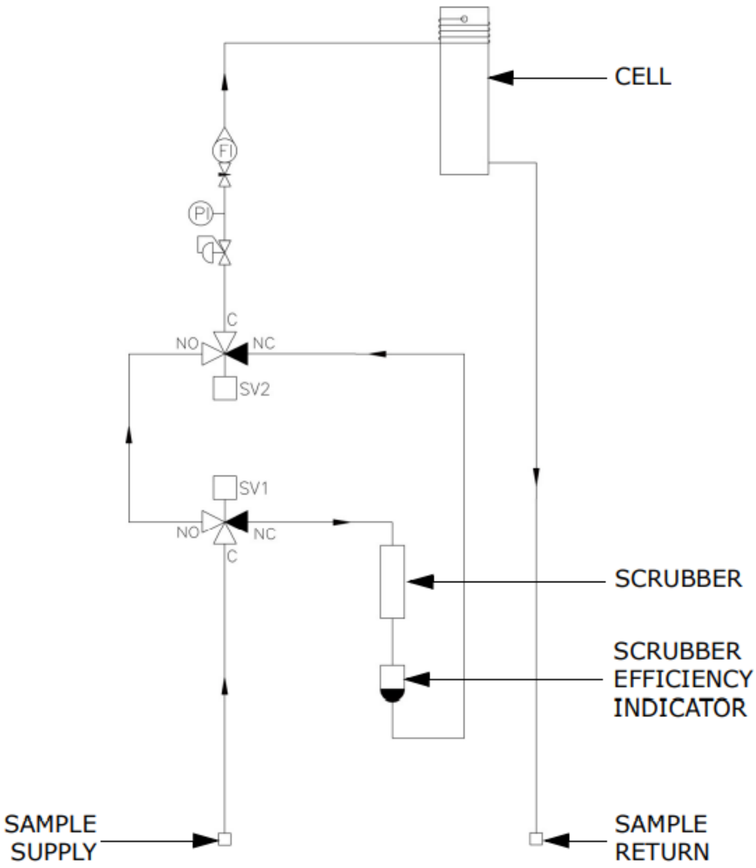


Figure 19. Basic differential system with two solenoid valves

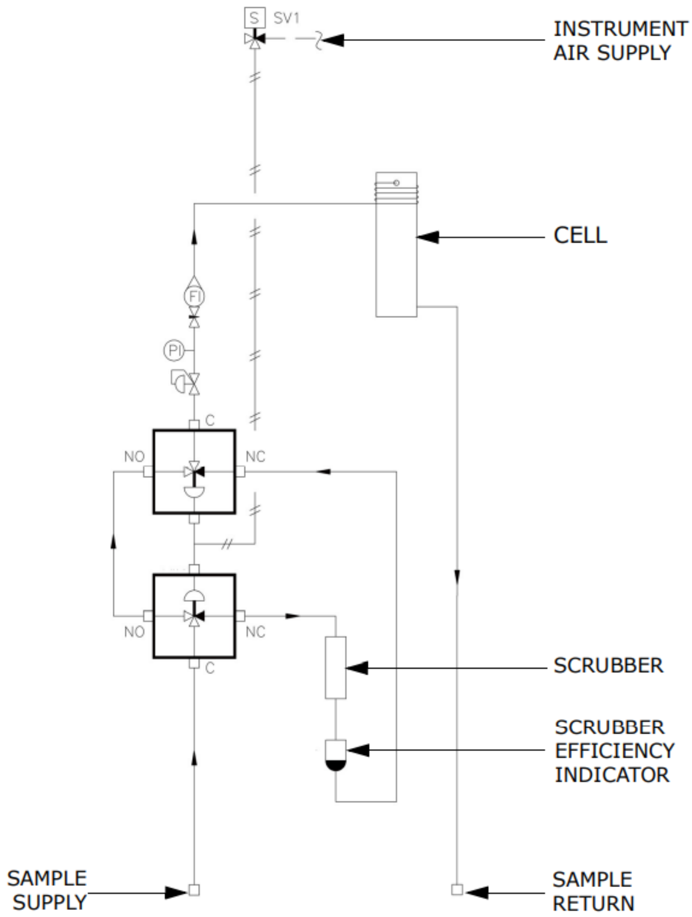


Figure 20. Preferred basic differential system with one solenoid valve driving two pneumatic valves

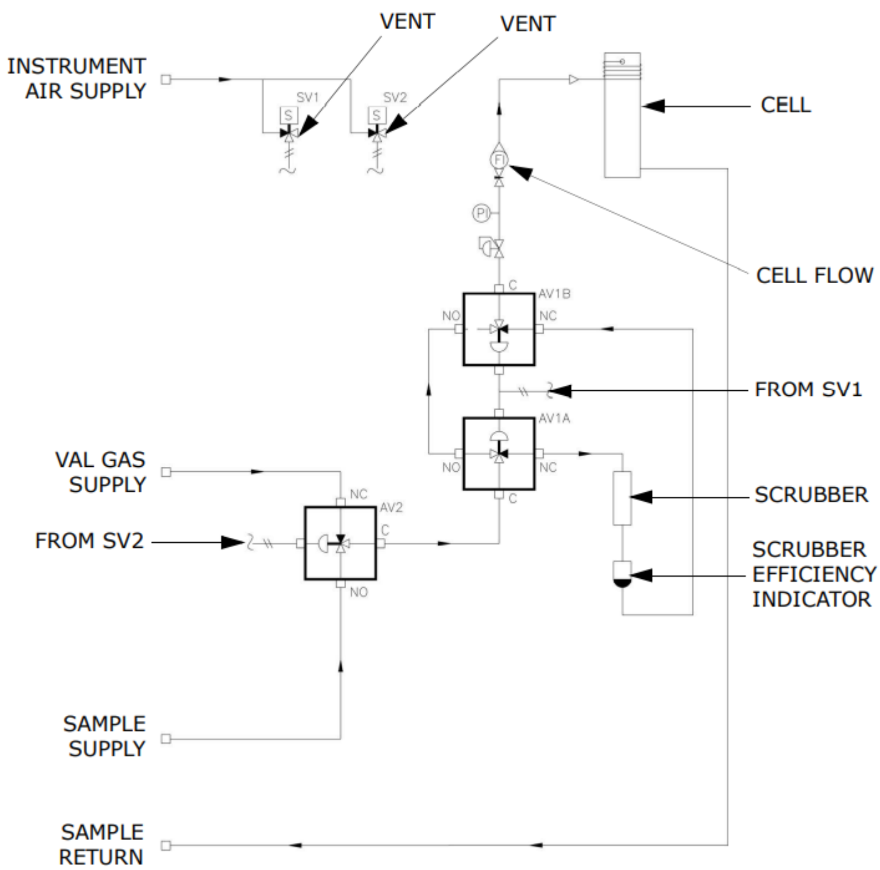


Figure 21. Differential system with single autovalidation requiring two solenoid valves driving three pneumatic valves

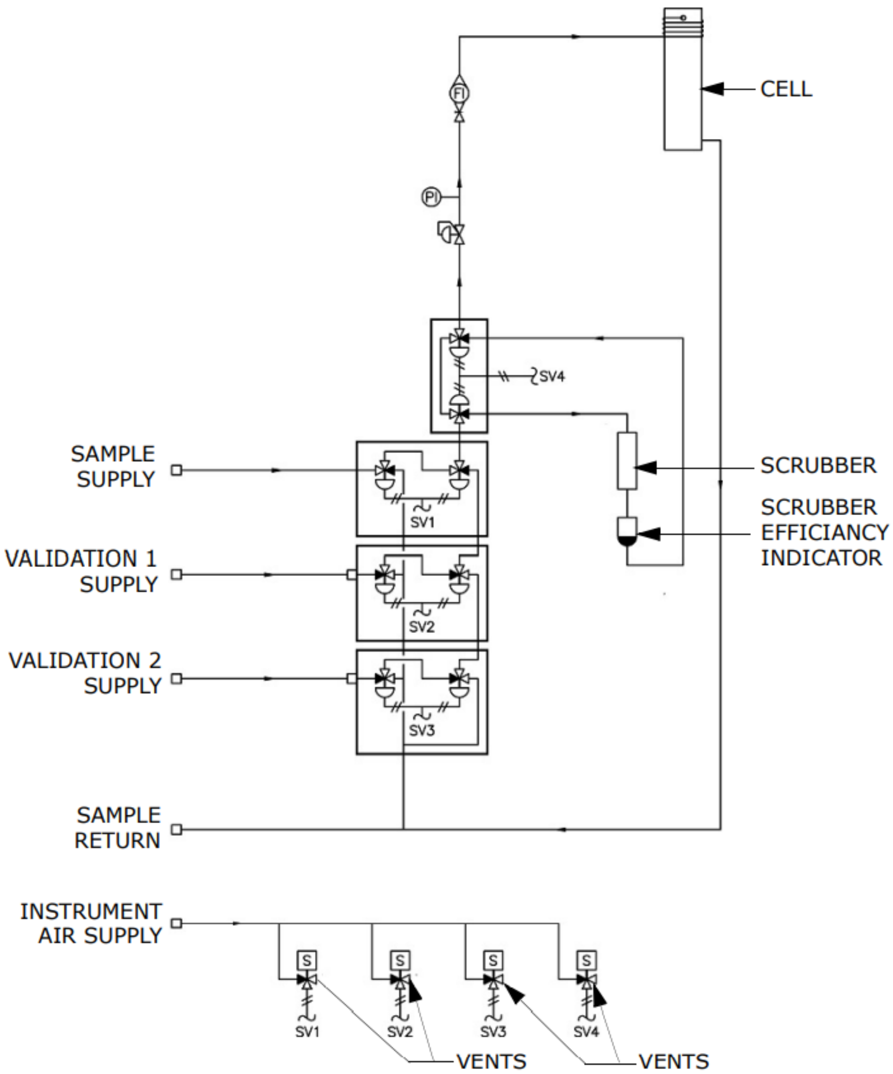


Figure 22. Differential system with dual autovalidation requiring four solenoid valves driving eight pneumatic valves

CAUTION

- Certified glands and cables should be used where appropriate in compliance with local regulations

WARNING

Hazardous voltage and risk of electric shock.

- Turn off and lock out system power before opening the electronics enclosure and making any connections.

CAUTION

- Be sure to use solenoid valves rated for the output voltage of the relays on your system. Failure to do so may result in fire.

4.6.1 To connect the solenoid valves

1. Open the analyzer enclosure cover according to the procedure in section 4.5.1 → 🗎 to gain access to the field interface terminal block.
2. Using a compound barrier seal gland (assembled per manufacturer instructions), screw the gland into the M25 access port on the bottom left of the enclosure. Make sure the STL8 lubricant is applied to the thread before the gland is installed. Refer to section 4.7.3 → 🗎.
3. Pull the solenoid valve cables into the electronics enclosure.
4. Strip back the jacket and insulation of the solenoid valve cables just enough to connect to the appropriate terminals on the field interface terminal block for your particular sample conditioning scheme, as indicated in Table 9 below.

NOTICE

▶ For valve configurations refer to Figure 19 through Figure 22.

⚠ CAUTION

▶ To avoid risk of a short circuit between adjacent connectors in terminal blocks, ensure each wire uses a single compression-type ferrule.

Figure	SOV	Description	Terminal	Relay Rating I_{th}
Figure 19	S1	Scrubber Solenoid	1	6 A
	S2		2	
	–	No Connection	3	
			4	
Figure 20	S1	Scrubber Solenoid	1	
			2	
Figure 21	S1	Scrubber Solenoid	1	6 A
			2	
	S2	Val 1 Solenoid	5	
			6	
Figure 22	S1	Scrubber Solenoid	1	
			2	
	S2	Main/Val Solenoid	3	
			4	
	S3	Val 1 Solenoid	5	
			6	
	S4	Val 2 Solenoid	7	
			8	

Table 9. Terminal block (X2) solenoid valve connections

5. Verify that each connection is secure.
6. Close the analyzer enclosure cover according to the procedure in section 4.5.2 → 🗎.

4.7 Connecting electrical power to the analyzer

The analyzer will be configured for 120 or 240 VAC at 50/60 Hz single phase input. Refer to the electrical schematics in Appendix D for field wiring terminations. All work should be performed by personnel qualified in electrical installation.

WARNING

- **Hazardous voltage and risk of electric shock**. Turn off and lock out system power before opening the electronics enclosure and making any connections.

CAUTION

- Careful consideration should be taken when grounding. Properly ground the unit by connecting the ground lead to the ground bus bar in the system labeled with the ground symbol.
- Certified compound barrier seal glands shall be used; cables used shall comply with electrical code, standards, suitable for the glands and meet the local regulations.
- Use copper conductors only.

The electrical power and the signal wiring for the SS2100i-1 analyzer is connected through the conduit hub at the bottom of the electronics enclosure.

4.7.1 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 include the following:

- Protective and chassis grounds must be of equal or greater size than any other current-carrying conductors, including the heater located in the sample conditioning system
- Protective and chassis grounds to remain connected until all other wiring is removed
- If the protective and chassis ground is insulated, it must use the green/yellow color
- Protective grounding wire current carrying capacity must be at minimum the same as the main supply
- Earth bonding/chassis ground shall be at least 4 mm^2 (12 AWG)

Refer to Figure 10 and Figure 23 below for the protective and chassis ground locations.

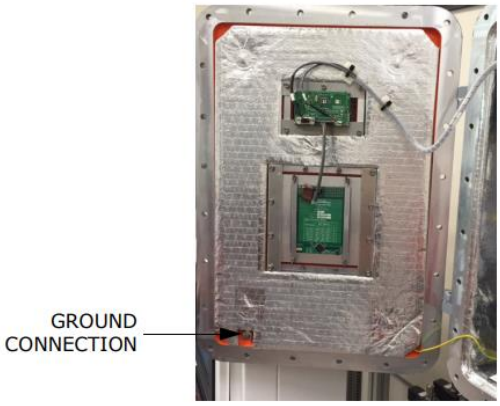


Figure 23. Enclosure door (inside view)

4.7.2 To connect electrical power to the analyzer

1. Open the analyzer enclosure cover according to the procedure in section 4.5.1 → 🖹 to gain access to the field interface terminal block.
2. Install an appropriate compound barrier seal gland per manufacturing instructions provided with the gland into the M20 access port on the bottom left of the enclosure. Refer to section 4.7.3 → 🖹
3. Run cable from the power distribution panel to the gland.

CAUTION

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

NOTICE

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

4. Pull ground, neutral, and hot wires (1.5 mm², #14 AWG minimum) into the analyzer enclosure.
5. Strip back the jacket and/or insulation of the wires just enough to connect to the power terminal blocks (X1).
6. Attach the neutral and hot wires to the power terminal blocks by connecting the neutral wire to terminal X1-2, the hot wire to terminal X1-1, as shown in Figure 24.
7. Connect the ground wire to the ground bus bar marked ⏚.

WARNING

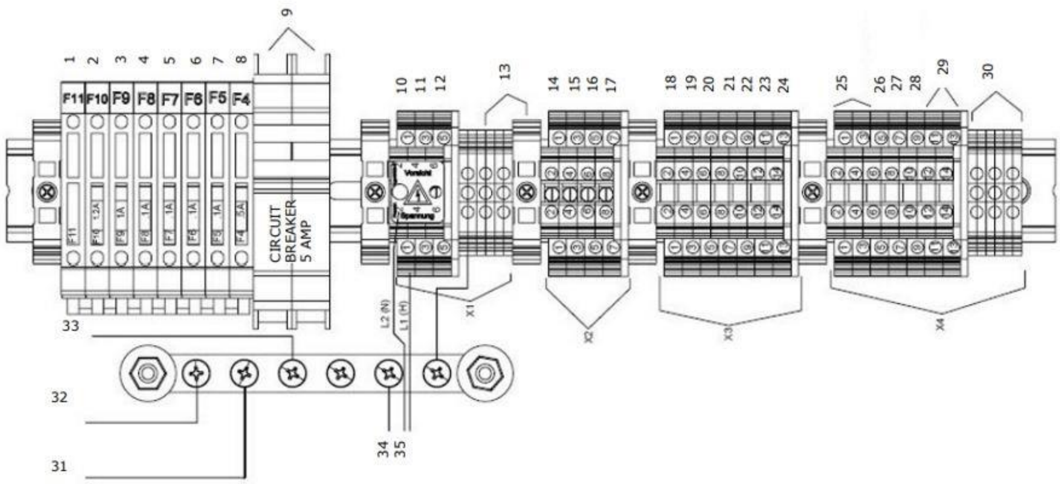
- **Hazardous voltage and risk of electric shock**. Failure to properly ground the analyzer may create a high-voltage shock hazard.

8. Verify that each connection is secure.

CAUTION

- Ensure that the conductors of different cross-sectional areas are not connected into one terminal unless they are first secured with a single compression-type ferrule. Also, to avoid risk of a short circuit between adjacent connectors in terminal blocks, ensure each wire uses a single compression-type ferrule.

9. Close the analyzer enclosure cover according to the procedure in section 4.5.2 → 🗎.



1 Spare
2 To Temp Limit Sw Heater
3 To ABB Power Supply (G3)
4 To K4-14
5 To K3-14
6 To K2-14
7 To K1-14
8 To ABB Power Supply (G3)
9 To AC Filter
10 To Circuit Breaker Terminals 1,2
11 Heater Neutral Terminal 4
12 AC, Filter Terminal 6
13 Ground Terminals
14 Scrubber Terminal 1,2 (SV1,SV2)
15 N.O. Connection (N/C)
16 VAL 1 Terminal 5,6
17 VAL 2 Terminal 7,8
18 HI Alarm CH2 TO Customer Terminal 1,2
19 General Alarm to Customer Terminal 3,4
20 VAL Fail to Customer Terminal 5,6
21 VAL 1 Active to Customer Terminal 7,8
22 VAL 2 Active to Customer Terminal 9,10
23 Flow Switch from Customer Terminal 11,12
24 VAL REQ from Customer Terminal 13,14
25 RS-485 Output Terminals 1,2,3,4
26 CH A 4-20 mA Output Terminal 5,6
27 CH B 4-20 mA Output Terminal 7,8
28 4-20 mA Input Terminal 9,10
29 Ethernet Output Terminal 11,12,13,14
30 4-20 mA and Serial Cable Ground Terminals
31 From Enclosure Ground Stud
32 From Enclosure Door Ground Stud
33 From Heater Ground Stud
34 PE
35 Incoming Power

Figure 24. Field interface terminal block for connection of input power and input/output signals

4.7.3 Application of gland lubricant

To ensure proper installation, Endress+Hauser recommends using STL8 screw thread lubricant or equivalent on all 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 gland fittings. This lubricant has proven very effective between parts made of dissimilar metals, and is stable in temperatures from −6 °C (−20 °F) to +149 °C (+300 °F).

NOTICE

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

⚠ CAUTION

- **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.

1. Holding the fitting piece at one end, generously apply the lubricant on the male threaded surface (at least five threads wide) as shown in Figure 25.

Figure 25. Applying lubricant to threads

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

4.8 Connecting the signals and alarms

The 4-20 mA AI, 4-20 mA AO, serial, and Ethernet outputs are connected to terminal block (X4), as shown in Figure 24. In addition, seven digital inputs/outputs connected to SPDT relays through terminal block (X3) are also provided.

NOTICE

- 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 section 4.11.1 → 🗎.

The relays for the alarms are configured to be fail-safe (or normally energized) so the dry contacts will open in the event of power loss. Thus, the alarms are wired to be normally closed (NC) when the analyzer is running.

Consult the wiring diagrams in Appendix D. All work should be performed by personnel qualified in electrical installation.

⚠ CAUTION

- Certified compound barrier seal glands shall be used; cables used shall comply with electrical code, standards, suitable for the glands and meet the local regulations.

⚠ WARNING

- **Hazardous voltage and risk of electric shock**. Turn off and lock out system power before opening the electronics enclosure and making any connections.

4.8.1 To connect the signal and alarm cables

1. Open the enclosure cover according to the procedure in section 4.5.1 → 🗎 to gain access to the field interface terminal block.

2. Install compound barrier seal glands into the three M25 access ports on the bottom right of the enclosure. Refer to section 4.7.3 →.
3. Pull the cables for the alarm outputs and validation request input through the first (from left) gland, the cables for the 4-20 mA AI and 4-20 mA AO through the second gland and the cable for serial or Ethernet communication through the third gland and into the enclosure.
4. Strip back the jacket and insulation of the 4-20 mA AI, 4-20, mA AO, and serial or Ethernet cables just enough to connect to the terminals of block (X4).

⚠ CAUTION

- ▶ To avoid risk of a short circuit between adjacent connectors in terminal blocks, add a single compression-type ferrule on each wire prior to connecting to block (X4).

5. Connect the 4-20 mA AI, 4-20 mA AO, and serial or Ethernet wires to the appropriate terminals as shown below.

Terminal	Description	Service USB converter wire color		
1	RS-485 or TD A (−)	Yellow		
2	RS-485 or TD B (+)	Orange		
3	Serial Ground	Black		
4	N/C			
5	4-20 mA AO CH A (+)			
6	4-20 mA AO CH A (−)			
7	4-20 mA AO CH B (+)			
8	4-20 mA AO CH B (−)			
9	4-20 mA AI (+)	**RJ45 Pin #**	**Wire Color (T568B) Cat5(e)**	
10	4-20 mA AI (−)			
11	Ethernet Tx+ (BI_DA+)	1	White/orange	
12	Ethernet Tx− (BI_DA−)	2	Orange	
13	Ethernet Rx+ (BI_DB+)	3	White/green	
14	Ethernet Rx− (BI_DB−)	6	Green	
G	Serial Shield Ground			
G	4-20 mA CH A Shield GND			
G	4-20 mA CH B Shield GND			

Table 10. Terminal block (X4) input/output signal connections

NOTICE

- ▶ The description “N/C” means no connection.
- ▶ Ignore markings on the DB9 cable and follow the color code referenced in Table 10 only.

6. Strip back the jacket and insulation of the alarm output and validation request input cables just enough to connect to the terminals of block (X3).
7. Connect the alarm output and validation request input wires to the appropriate terminals, as indicated in Table 11.

Terminal	Description
1 and 2	High Concentration Alarm
3 and 4	General Fault Alarm
5 and 6	Validation Fail Alarm
7 and 8	Validation 1 Active
9 and 10	Validation 2 Active
11 and 12	Future Use
13 and 14	Validation Request Input

Table 11. Terminal block (X3) input/output signal connections

8. Verify that each connection is secure.
9. Close the analyzer enclosure cover according to the procedure in section 4.5.2 →.

10. To complete the connections, connect the other end of the current loop wires to a current loop receiver, the serial or Ethernet to a serial or Ethernet port on a computer, the alarm cables to appropriate alarm monitors and the validation request input to a switch.

4.9 Configuring the RS-232/RS-485 converter

The Optically Isolated RS-232-to-RS-485 Converter is configured for two-wire RS-485. DIP switches on the side of the converter, shown in Figure 26, can be used to set time-out and termination, as indicated in Table 12. With the default setting of 9600 baud, the converter will generally work for baud rates of 9600 and higher.

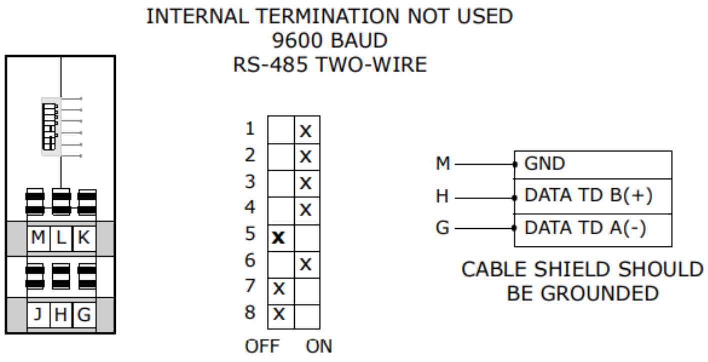


Figure 26. Optically isolated RS-232-to-RS-485 converter DIP switches

Item	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	Timeout [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

Table 12. Output signal connections (two-wire RS-485 configuration)

[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 converter PCB.

4.10 Connecting the gas lines

Once you have verified that the analyzer is properly wired, you are ready to connect the sample supply and sample return lines. All work should be performed by technicians qualified in pneumatic tubing.

Endress+Hauser recommends using 6.35 mm (0.25 in.) O.D. x 0.889 mm (0.035 in.) wall thickness, seamless stainless steel tubing. If the analyzer includes a factory installed sample system, see the system drawings for tubing sizes and attachment points.

NOTICE

- For systems with integrated sample conditioning systems, refer to the Sample Conditioning System (SCS) Operating Instructions.

4.10.1 To connect the sample supply and return lines

1. Connect the supply and return tubes to the analyzer using the stainless steel compression-type fittings provided.
2. 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.
3. Check all connections for gas leaks.

⚠ CAUTION

▶ Do not exceed 10 PSIG (0.7 barg) in sample cell. Damage to cell may result.

4.11 Changing the 4-20 mA current loop mode

⚠ CAUTION

▶ Changing the current loop mode may negate specific hazardous area certifications. Contact Service for details. Refer to to Service → 🖹.

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 should be performed by personnel qualified in electronics assembly.

⚠ WARNING

Hazardous voltage and risk of electric shock.

▶ Turn off and lock out system power before opening the electronics enclosure and servicing.

4.11.1 To change the 4-20 mA board from source to sink

1. Disconnect power to the analyzer.
2. Open the analyzer enclosure cover according to the procedure in section 4.5.1 → 🖹 to gain access to the electronics panel.
3. Locate the 4-20 mA current loop board in the upper middle of the electronics panel, as shown in Figure 10.
4. Remove the jumper (JMP1), shown in Figure 27 below, and connect the center pin to point "A".

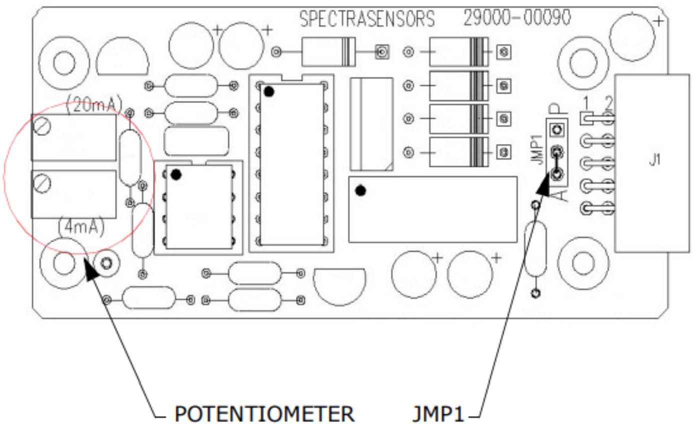


Figure 27. Analyzer 4-20 mA board

5. For 4-20 mA sink, carefully replace the jumper to connect the center hole with point "P".

NOTICE

▶ Needle nose pliers may be required to remove the jumper.

6. Reconnect power to the analyzer. Confirm the 4 mA (minimum) and 20 mA (maximum) points (refer to the appropriate Description of Device Parameters for Scaling and Calibrating the Current Loop Signal).
7. Close the analyzer enclosure cover according to the procedure in section 4.5.2 → 🖹.

5 Appendix A: Specifications

5.1 SS2100i-1 analyzer specifications

5.1.1 Performance

Name	Description
Concentration[1]	See analyzer calibration report
Repeatability	See analyzer calibration report
Measurement time[2]	Typically less than 20 seconds

Table 13. Performance

5.1.2 Application data

Name	Description
Environmental temperature range	Standard: –20 °C to 50 °C (–4 °F to 122 °F)
Heated enclosure temperature	45 °C to 55 °C (113 °F to 131 °F)
Environmental relative humidity	5% to 95%, non-condensing
Altitude	Up to 2000 m (6,550 ft.)
Sample cell operating pressure	Standard: 800 to 1200 mbara (11.6 to 17.4 PSIA) Optional: 950 to 1700 mbara (13.8 to 24.6 PSIA)
Maximum cell pressure	< 10 PSIG (0.7 barg) to cell
Sample flow rate[1]	0.5 to 4 SLPM (0.02 to 0.1 SCFM)
Contaminant sensitivity	None for gas phase glycol, methanol, amines, or mercaptans

Table 14. Application data

5.1.3 Electrical and communications

Name	Description
Input power, maximum[3]	120 or 240 VAC ± 10%, 50/60 Hz—Standard; ~300 W
Analog communication	Isolated Analog channels, 1200 ohms at 24 VDC maximum Outputs: Quantity (2) 4-20 mA (measurement value) Input: Quantity (1) 4-20 mA (pipeline pressure)[2]
Serial communications	Standard: Ethernet, RS-485 half-duplex
Digital signals[2]	Outputs: Quantity (5) Hi/Lo Alarm, General Fault, Validation Fail, Validation 1 Active, Validation 2 Active Inputs: Quantity (2) Flow Alarm, Validation Request
Protocol	Modbus Gould RTU, Daniel RTU, or ASCII
Diagnostic value examples	Detector power (optics health), spectrum reference comparison and peak tracking (spectrum quality), cell pressure and temperature (overall system health)
LCD display	Concentration, cell pressure, cell temperature, and diagnostics

Table 15. Electrical and communications

[1] Consult factory for alternative ranges.

[2] Application dependent.

[3] Supply voltage not to exceed ±10 % of nominal. Transient over-voltages according to Over Voltage category II.

5.1.4 Physical specifications

Name	Description
Electronics enclosure	IP66 copper-free aluminum with marine environment RAL 7001 gray polyurethane enamel finish; approximately 300 mm final thickness
Analyzer dimensions[1]	670 mm H x 580 mm W x 377 mm D (26.3 in. H x 23 in. W x 14.8 in. D)
Analyzer weight [1]	Approximately 86 kg (190 lbs)
Sample cell construction	Standard: 316L series polished stainless steel
Number of sample cells	1 per analyzer

Table 16. Physical specifications

[1] Consult system drawings for analyzers with sample conditioning systems.

5.1.5 Analyzer certifications

Name	Description
Certification	CE, UKEX, ATEX and IECEx: CE UKCA Ex II 2G, Ex db IIB+H2 T4 GB
Analyzer assembly (non-certified)	Ex II 2G, Ex db eb mb, IIB+H2 T3 Gb

Table 17. Analyzer certifications

NOTICE

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

5.2 Exd accessory conditions of use

All accessories listed in the table below shall comply with the latest IEC/EN 60079-0 and IEC/EN 60079-1 in addition to the following conditions:

Accessory Type	Rating	Note
Stopper Plug	Exd, Zone 1	▪ Stopping plugs shall be assembled in such a way that their protrusion from an associated enclosure is not increased. ▪ Installer must ensure the stopping plug ingress protection matches the ingress protection rating of the associated enclosure, IP66.
Reducer/Adapter	Exd, Zone 1	▪ Adapter/reducers shall be assembled in such a way that their protrusion from an associated enclosure is not increased. ▪ Installer must ensure the stopping plug ingress matches the ingress protection of the rating of the associated enclosure, IP66. ▪ For direct entry Exd applications, only one adapter/reducer shall be used per cable entry. ▪ The female connection thread of a Thread Conversion Adapter shall “step” not more than two “sizes” up in the case of a thread gender change.
Breather/Drainer	Exd, Zone 1	▪ The breather/drainer shall be suitable for bottom entry application only. ▪ It is the user’s responsibility to ensure that the ingress protection level of an associated enclosure is maintained at the interface, IP66. ▪ Breather/drainer specified shall meet the following requirements: ○ Exd enclosures with an internal volume 75 L $\leq$ V $\leq$ 175 L ○ Exd enclosure reference pressure 40 bar maximum
Cable Gland(s)	Exd, Zone 1	▪ Compound Barrier Cable Glands shall be specified for use with our analyzer Exd enclosure. ▪ Compound Barrier Cable Glands shall carry a minimum IP66 ingress protection level.

Table 18. Exd accessory conditions of use

5.2.1 Outline and mounting diagram

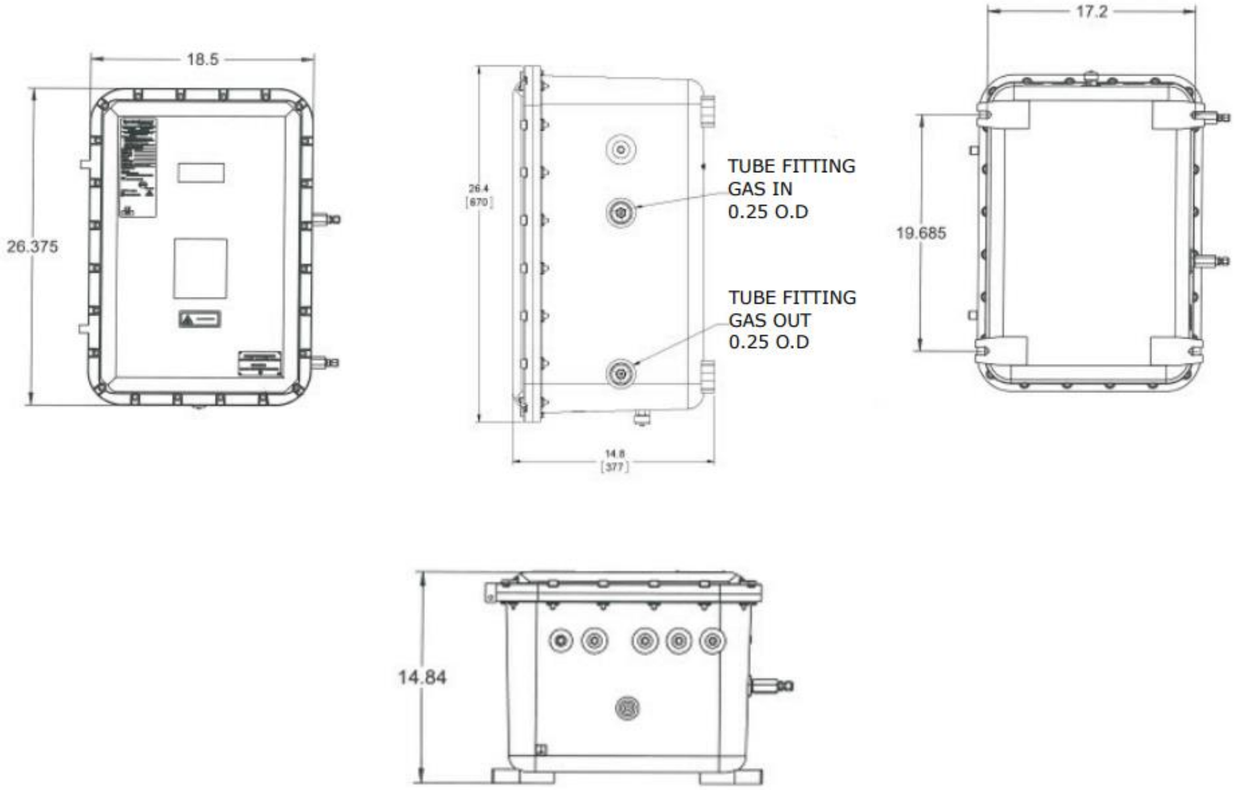


Figure 28. Outline and mounting diagram

6 Appendix B: Maintenance and troubleshooting

⚠ WARNING

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

⚠ CAUTION

- 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.

This section presents recommendations and solutions to common problems including gas leaks, excessive sampling gas temperatures and pressures, electrical noise, and contamination. For any issues related to the sample conditioning system (SCS), please refer to the SCS Operating Instruction.

Contact Service if your analyzer is demonstrating other issues. Refer to to Service → 🗎.

6.1 Gas leaks

A common cause of erroneous measurements is outside air leaking into the sample supply line. It is recommended supply lines be periodically leak-tested, especially if the analyzer has been relocated or has been replaced or returned to the factory for service and the supply lines have been reconnected.

⚠ CAUTION

- 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 6.35 mm (0.25 in.) O.D. x 0.889 mm (0.035 in.) wall thickness, seamless 316L stainless steel electropolish tubing is recommended.

⚠ CAUTION

- 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 operating the analyzer.

6.2 Excessive gas temperatures and pressures

The embedded software is designed to produce accurate measurements only within the allowable cell operating range (see Table 13).

NOTICE

- The cell temperature operating range for analyzers that are equipped with heated enclosures is equal to the enclosure temperature setpoint ±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.

NOTICE

- If the pressure, temperature, or any other readings on the LCD appear suspect, they should be checked against the specifications (see Table 13).

6.3 Electrical noise

High levels of electrical noise can interfere with laser operation and cause it to become unstable. Always connect the analyzer to a properly grounded power source. Refer to section 4.7.1 → 🗎 protective chassis and ground connections.

6.4 Contamination

Contamination and long exposure to high humidity are valid reasons for periodically cleaning the gas sample transport lines. Contamination in the gas sample transport 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 analyzer is designed to withstand some contamination, it is recommended to always keep the sample transport lines as contamination free as possible.

6.4.1 To keep the sample transport lines clean

1. If mirror contamination is suspected, see section 6.5 → 🗎 to clean the mirrors.
2. Turn off the sample valve at the tap in accordance with site lock-out, tag-out rules.
3. Disconnect the gas sample transport line from the sample supply port of the analyzer.
4. Wash the sample transport line with isopropyl alcohol or acetone and blow dry with mild pressure from a dry air or nitrogen source.
5. Once the sample transport line is completely free of solvent, reconnect the gas sample transport line to the sample supply port of the analyzer.
6. Check all connections for gas leaks. Using a liquid leak detector is recommended.

6.4.2 Mirror contamination

If contamination makes its way into the cell and accumulates on the internal optics, a **Laser Power Low Alarm** fault will result.

6.5 Cleaning the mirrors

Contact Service if mirror contamination is suspected in your SS2100i-1 analyzer. Refer to to Service → 🗎. If advised to do so, use the following procedure.

⚠ CAUTION

▶ This procedure should be used ONLY when necessary and is not part of routine maintenance. Refer to Service before cleaning mirrors to avoid compromising the system warranty.

⚠ WARNING

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

6.5.1 Tools and supplies

- Lens cleaning cloth (Cole-Parmer® EW-33677-00 TEXWIPE® Alphawipe® Low-Particulate Clean Room Wipes or equivalent)
- Reagent-grade isopropyl alcohol (Cole-Parmer® EW-88361-80 or equivalent)

⚠ CAUTION

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

- Small drop dispenser bottle (Nalgene® 2414 FEP Drop Dispenser Bottle or equivalent)
- Hemostat (Fisherbrand™ 13-812-24 Rochester-Pean Serrated Forceps)
- Bulb blower or dry compressed air/nitrogen
- Torque wrench (3/16 in., 7/16 in. fittings)
- O-Rings (refer to Table 28 for specific part number)
- Permanent ink marker
- Non-outgassing grease
- Flashlight

6.5.2 To determine the type of mirror being used for the system cell

Before determining whether to clean or replace the mirror, identify the type of measurement cell being used in the analyzer. There are four types of measurement cells; 0.1 m, 0.8 m, 8 m, and 28 m. Refer to Figure 29 below.

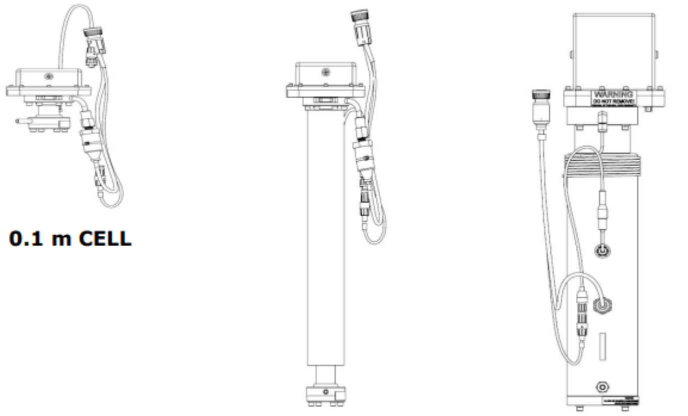


Figure 29. Measurement cell types

Measurement cells will come equipped with either a glass or stainless steel mirror. The stainless steel mirrors are used with 0.1 m and 0.8 m measurement cells only and 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 can be used on any size cell.

1. Feel at the bottom of the cell for the engraved "X" marking. Refer to Figure 30 below.

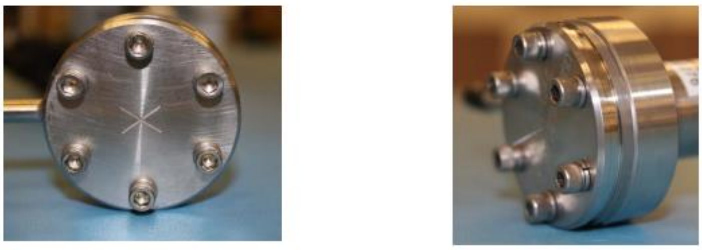


Figure 30. Stainless steel mirror marking

   - If the bottom surface is smooth, a glass mirror is being used.
   - If the bottom surface is rough or engraved, or a groove on the side of the mirror is detected, a stainless steel mirror is being used.

⚠ CAUTION

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

2. To clean the mirror, refer to the instructions in section 6.5.7 → to clean the class mirror. For replacement, refer to the instructions in section 6.5.8 →.

6.5.3 To remove the electronics assembly

To clean or replace the measurement cell mirror, the electronics assembly must first be removed.

1. Power down the analyzer following the procedure outlined in the Description of Device Parameters titled Powering Down the Analyzer.
2. Close isolation valves to stop flow of process gas through the analyzer.

⚠ CAUTION

▶ Failure to complete this step could result in the release of toxic gases, which could harm personnel and/or trigger an explosion.

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

⚠ CAUTION

- 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 operating the analyzer.

4. Open the enclosure cover.

⚠ CAUTION

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

5. Remove the keypad and display control cable from the clips at the top of the enclosure. Refer to Figure 31.
6. Disconnect the optical head cable.
7. Disconnect the temperature/pressure cables by removing the green connector block.
8. Slide the wire duct cover at the left of the enclosure towards the top and disconnect the heater power terminal.
9. Disconnect the Watlow controller.
10. Remove the four mounting screws from the four corners of the electronics panel and set them aside. You are now ready to remove the electronics panel.
11. Gently pull the electronics panel towards you, away from the enclosure, tilting the panel forward slightly to lift up and over the wires connected at the base of the enclosure.
12. Support the electronics panel without completely removing it from the enclosure. Refer to Figure 32.
13. Depending on the measurement cell installed in your system, refer to either section 6.5.5 → to remove the cell and mirror assembly (28 m/8 m) or section 6.5.6 → to remove the mirror assembly (0.8 m/0.1 m).

6.5.4 To replace the electronics assembly

1. Replace electronics assembly panel, lifting, and tilting backwards towards the back of the enclosure to clear cables at the base.

NOTICE

- While replacing electronics assembly panel, gently pull all wires from measurement cell panel forward into the analyzer enclosure along the notched openings so that connections can be made after panel is securely in place.

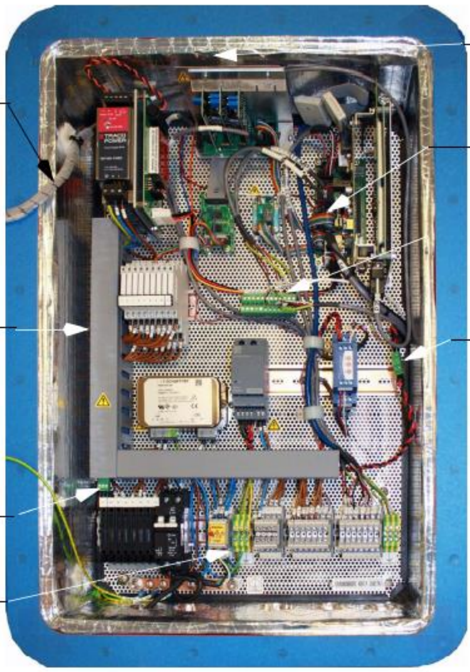


Figure 31. Electronics assembly panel

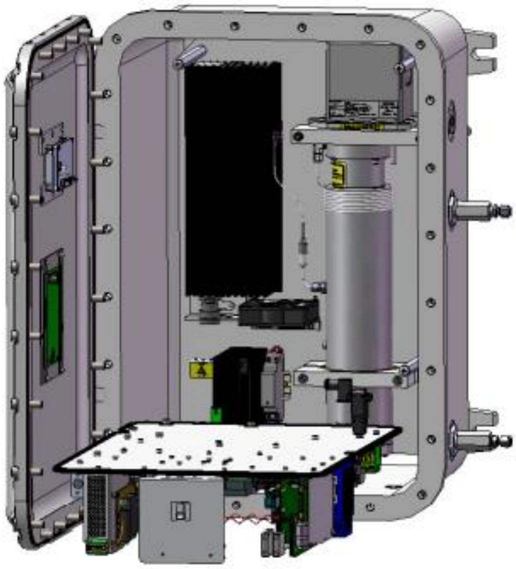


Figure 32. Lowered top-level electronics assembly exposing the sample panel

2. Reconnect cables on the electronics assembly panel.
   - Slide the wire duct cover at the left of the enclosure towards the top and connect the heater power terminal.
   - Connect the 24 VDC harness for the Watlow controller.
   - Connect the temperature/pressure cables by replacing the green connector block.
   - Connect the optical head cable to the backplane.

⚠ CAUTION

- ▶ The optical head cable connector will fit in several different openings. Make sure the correct outlet is used. Refer to Figure 33 below.

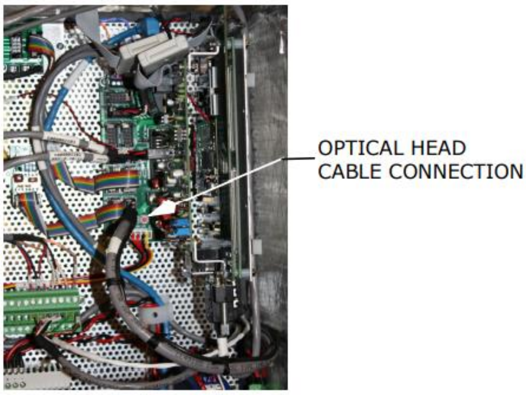


Figure 33. Optical head cable connection

   - Replace the keypad and display control cable in the clips at the top of the enclosure.
3. Close the enclosure cover.
4. Open the isolation valves to begin flow of process gas through the analyzer.
5. Power up the analyzer (refer to the appropriate chapter in the Description of Device Parameters for this analyzer for instructions).

6.5.5 To remove the cell and mirror assembly (28 m/8 m)

NOTICE

- ▶ Only the 28 m and 8 m cells need to be removed from the system to accommodate mirror cleaning.
- ▶ Endress+Hauser recommends having two individuals available to perform this part of the procedure.
- ▶ Connections on the cell assembly panel may be potted. Be sure to have the proper tools on hand prior to disconnecting.

From the sample cell panel:

1. While supporting the electronics assembly panel, disconnect the cell to analyzer outlet.
2. Disconnect the cell inlet.
3. Disconnect the thermistor probe using a 7/16 in. wrench.
4. Disconnect the thermistor from heater terminals (S1, R1).
5. Disconnect the ground screw from the back of the enclosure. The cell should be free from cable connections.
6. Remove the lower cell bracket using a 3/16 in. wrench.
7. Remove the upper cell bracket using a 3/16 in. wrench.

⚠ CAUTION

▶ Hold the cell firmly to the back of the enclosure while removing the final bracket to avoid dropping the cell.

8. Remove the cell gently being careful not to catch the measurement cell on loose wires.

NOTICE

▶ Because the system is heated, the cell may be hot to the touch. Use caution when removing the cell from the system.

9. Carefully mark the orientation of the mirror assembly on the cell body using a permanent ink marker.

⚠ CAUTION

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

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

⚠ WARNING

▶ The sample cell assembly contains a low-power, 20 mW maximum, 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.

⚠ CAUTION

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

11. Refer to section 6.5.7 → 🗎 to clean the class mirror or section 6.5.8 → 🗎 to replace the stainless steel mirror.

6.5.6 To remove the mirror assembly (0.8 m/0.1 m)

The measurement cell *does not* need to be removed in order to clean the mirror. With the cell in place, continue with the following steps.

NOTICE

▶ Endress+Hauser recommends having two individuals available to perform this part of the procedure.

1. While supporting the electronics assembly panel, carefully mark the orientation of the mirror assembly on the cell body using a permanent ink marker.

⚠ CAUTION

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

2. Gently remove the mirror assembly from the cell by removing the six (6) socket-head cap screws and set on a clean, stable, and flat surface.

⚠ WARNING

▶ The sample cell assembly contains a low-power, 20 mW maximum, 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.

⚠ CAUTION

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

3. Proceed to the instructions in section 6.5.7 → 🗎 to clean the class mirror or section 6.5.8 → 🗎 to replace the stainless steel mirror.

6.5.7 To clean the glass mirror

1. For the 28 m and 8 m cells, look inside the sample cell at the top mirror using a flashlight to ensure that there is no contamination on the top mirror. For 0.8 m and 0.1 m cells, proceed to the step 3.

⚠ CAUTION

- ▶ Endress+Hauser does not recommend cleaning the top mirror. Refer to to Service → 🖹 if the top mirror is visibly contaminated.

2. Remove dust and other large particles of debris from the lower mirror using a bulb blower or dry compressed air/nitrogen.

⚠ CAUTION

- ▶ Pressurized gas duster products are not recommended as the propellant may deposit liquid droplets onto the optic surface.

3. Put on clean acetone-impenetrable gloves.
4. 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.”
5. Place a few drops of isopropyl alcohol onto the mirror and rotate the mirror to spread the liquid evenly across the mirror surface.
6. 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.

⚠ CAUTION

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

7. 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.
8. Replace the O-Ring adding a very thin layer of grease and ensuring it is properly seated.
9. Carefully replace the mirror assembly onto the cell in the same orientation as previously marked.
10. Tighten the 4 socket-head cap screws evenly with a torque wrench to 30 in-lbs (28 m or 8 m measurement cell) or 13 in-lbs (0.1 m or 0.8 m measurement cell).

6.5.8 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.

⚠ CAUTION

- ▶ If stainless steel mirrors are replacing another version of mirror in the field, such as glass, the analyzer may need to be returned to the factory for re-calibration to ensure optimal cell function. Refer to to Service → 🖹.

1. After the mirror has been removed (refer to section 6.5.6 → 🖹), confirm the need to replace mirror due to contamination. If yes, set mirror aside.
2. Put on clean acetone-impenetrable gloves.
3. Obtain the new stainless steel mirror. Refer to Figure 34 below.

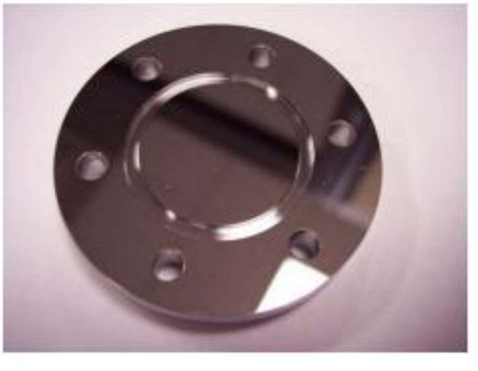


Figure 34. Stainless steel mirror; mirror side up

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

6.5.9 To reassemble the system

After cleaning or replacing the cell mirror, use the following instructions to replace the 28 m and 8 m cells.

1. Replace the measurement cell on the backplane of the sample cell panel assembly. Ensure the cell is seated on the lip of the mounting rail at the back of the panel.
2. Replace the upper cell bracket using a 3/16 in. wrench.

⚠ CAUTION

▶ Hold the cell firmly to the back of the enclosure until the upper cell bracket is securely in place.

3. Replace the lower cell bracket using a 3/16 in. wrench.
4. Connect the ground screw to the back of the enclosure.

NOTICE

▶ Use grease as needed to create potted connections.

5. Connect the thermistor to the heater terminals (S1, R1).
6. Connect the thermistor probe using a 7/16 in. wrench.
7. Connect the cell inlet.
8. Connect the cell to analyzer outlet.
9. Replace the electronics assembly. Refer to the steps in section 6.5.4 → to reconnect cables on the electronics assembly panel.

6.6 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:

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

6.6.1 Tools and supplies

The following tools are recommended for the procedure provided.

- Acetone-impenetrable gloves (North NOR CE412W Nitrile Chemsoft™ CE Cleanroom Gloves or equivalent)
- 9/16 in. wrench
- 7/8 in. wrench
- 9/64 in. Allen wrench
- Flat-head screwdriver
- Phillips-head screwdriver
- Metal pick
- Military grade stainless steel PFTE tape (or equivalent)
- Dry nitrogen
- Isopropyl alcohol

⚠ CAUTION

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

6.6.2 To replace the pressure sensor

Use the following instruction to replace a 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 Description of Device Parameters for this analyzer for Powering down the analyzer.
5. Access the lower level panel assembly. See section 6.5.3 → to remove the electronics assembly. An interior view of the lower level is shown in Figure 35.
6. Remove the wire harness from the pressure sensor harness cap using a 1/8 in. x 2-1/2 in. flat-head screw driver turning counterclockwise as shown in Figure 36.

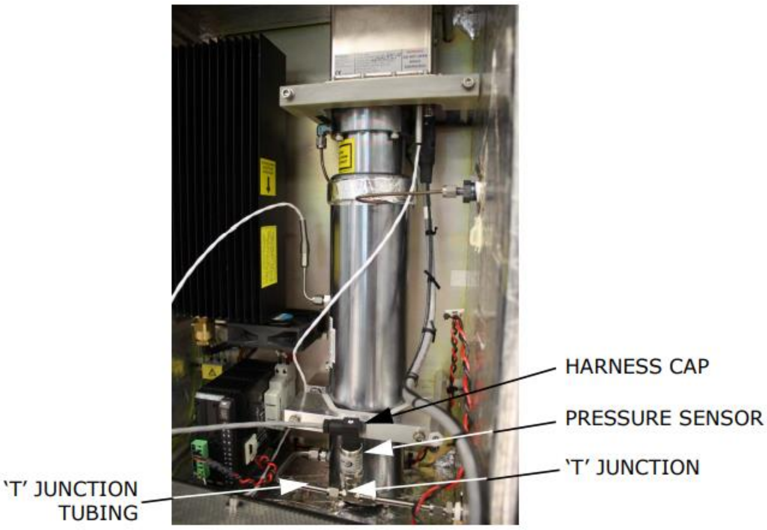


Figure 35. Cell cabinet interior (lower level) with 28 m cell

Figure 36. Removing the screw from the harness cap

7. Remove the black wire harness cap from the sensor as shown in Figure 37 below.

Figure 37. Removing the harness cap

NOTICE

▶ The harness cap will remain connected to the pressure sensor cable via the terminal block on the upper level panel. Do not disconnect from the terminal block.

8. Use a 7/8 in. or adjustable wrench to remove the pressure sensor to be replaced as shown in Figure 38 below.

Figure 38. Removing the pressure sensor

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

⚠ CAUTION

▶ Use caution when removing the pressure sensor to avoid bending the tubing.

10. Remove excess seal tape from the 'T' junction.

⚠ CAUTION

▶ Threads at the 'T' junction showing signs of galling indicate a possible leak. Refer to to Service → 🖹. to arrange for repair.

11. Check for tape fragments inside the 'T' junction and remove with a pick.
12. Remove the new pressure sensor from the packaging. Retain the black connector cap on the sensor to protect the pins. **Do not remove the cap**.
13. 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 39 below.

Figure 39. Replacing seal tape

14. Insert the new pressure sensor onto the ‘T’ junction.
15. Hand tighten the pressure sensor clockwise on the ‘T’ junction until it is no longer moving freely.
16. Turn the sensor clockwise with a 7/8 in. or adjustable wrench until tight. Two or three threads on the pressure sensor should still be visible.
17. Remove the black harness cap from the pressure sensor and discard.

NOTICE

▶ If a new cable is required, do not discard the new harness cap. Connect the new harness/cable to the new pressure sensor.

18. Place the pressure sensor harness cap on the top of the pressure sensor over the pins, applying light pressure until the cap snaps in place. Refer to Figure 40 below.

⚠ CAUTION

▶ Do not force connection or pins may be damaged.

Figure 40. New pressure sensor installed

⚠ CAUTION

▶ Make sure the black connector at the top of the pressure sensor is facing parallel to the junction tubing to facilitate connection. Refer to Figure 40 above.

19. Secure the black harness cap on the pressure sensor by tightening the screw on the top of the cap using a 1/8 in. x 2-1/2 in. flat-head screwdriver.
20. Replace the upper level panel making sure to keep wires in channels so that they are not pinched between the panel and the enclosure sides. Refer to the steps in section 6.5.4 → 🗎 to reconnect cables on the electronics assembly panel.
21. Close the analyzer enclosure cover according to the procedure in section 4.5.2 → 🗎.
22. Conduct a leak test to determine that the new pressure sensor is not leaking.

⚠ CAUTION

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

NOTICE

▶ Contact Service for any questions related to leak testing the pressure sensor. Refer to to Service → 🗎.

23. Turn the system power on. Refer to the Description of Device Parameters for this analyzer for Powering up the analyzer.

24. Run a validation on the analyzer. Refer to the Description of Device Parameters for instructions on Validating the Analyzer.

- If the system passes, the pressure sensor replacement is successful.
- Contact Service if the system does not pass.

6.7 Flame arrestor replacement and safety

The analyzer system comes equipped with a protective covering over the flame arrestors and tubing that runs from the analyzer electronics to the SCS. Refer to the analyzer system drawings to locate the protective enclosure for your analyzer; the location of which can vary by customer configuration.

6.7.1 Tools required

- 7/16 in. angle double open-end wrench
- 9/16 in. angle double open-end wrench
- 7/8 in. wrench

6.7.2 To replace the flame arrestors

1. Ensure all safety requirements have been met and any necessary protective gear and tools are being used.

⚠ CAUTION

▶ Review the potential health effects in section 6.8 → before removing insulation.

2. Purge the system following the instructions provided in steps 1 through 8 in section 6.12.1 →.
3. Remove the screws holding the protective cover in place and lift up on the cover to remove from the enclosure.
4. Remove the insulation packed inside the enclosure and place in a clean, dry area. Refer to Figure 41.

Figure 41. Unpacking enclosure insulation

5. Disassemble the tubing using a 9/16 in. wrench. Refer to Figure 42 below.

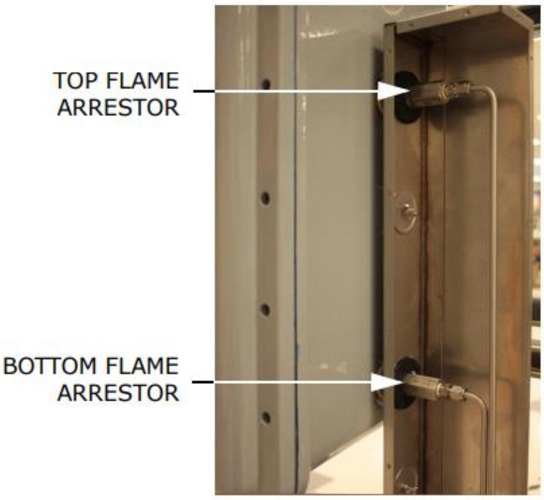


Figure 42. Flame arrestor positions inside enclosure

6. Remove the flame arrestor using a 7/8 in. wrench. Refer to Figure 43 below.
   After the seal is broken, the flame arrestor can be loosened by hand and removed.

Figure 43. Removing the flame arrestor

7. Insert the new flame arrestor ensuring its proper seating inside the washer.
8. Tighten the flame arrestor by hand turning clockwise. Use the hook spanner wrench to fully tighten.
9. Reassemble SCS tubing and conduct a leak test.
10. Repack the insulation into the enclosure and replace the cover.
11. Replace screws to secure the enclosure cover.

6.8 Potential health effects

The flame arrestor enclosure is packed with insulation material that can cause health issues if inhaled, exposed to bare skin or in direct contact with eyes. Please follow the safety procedures for unpacking this enclosure to access the flame arrestors and review the following potential health effects of the insulation material before beginning maintenance on the flame arrestors.

- **Eyes:** Direct contact with eye can cause mechanical irritation.
- **Skin:** The material (when in wet state or as a dust) is not chemically harmful if it comes in contact with the skin and is not immediately washed off. However, direct contact of dust and mineral wool fibers with skin can cause skin irritation (mechanical) and itchiness.
- **Ingestion:** No known effects.
- **Inhalation:** Inhalation of dust can cause nose, throat, lungs, and upper respiratory tract irritation. Persons exposed to dust may be forced to leave area because of nuisance conditions such as coughing, sneezing, and nasal irritation.
- **Chronic:** Persons with chronic or systemic skin or eye disease should use precautions and wear all personal protective equipment when working with this product.

6.8.1 Transport information

U.S. DOT Information: Not a hazardous material per DOT shipping requirements. Not classified or regulated.

6.8.2 Regulatory information

- **Canadian Regulations:** WHMIS D2B: All components of this product are included in the Canadian Domestic Substances List (DSL) or the Canadian Non-Domestic Substances List (NDSL).
- **USA Regulations:** All ingredients of this product are included in the U.S. Environmental Protection Agency's Toxic Substances Control Act Chemical Substance Inventory.

Material	IARC	NTP
Man Made Vitreous Fiber	Group 3	None

Table 19. Carcinogenicity classification of ingredients

In October 2001, the International Agency for Research on Cancer (IARC) classified mineral wool fibers (rock or slag) as Group 3 (not classifiable as to carcinogenicity to humans). IARC noted specifically: "no evidence of increased risks of lung cancer or mesothelioma (cancer of the lining of the body cavities) from occupational exposures during manufacture of these materials, and inadequate evidence overall of any cancer risk." this was a reversal of the IARC finding in 1987 of a Group 2B designation (possibly carcinogenic to humans) based on earlier studies in which animals were injected with large quantities of slag wool fibers.

6.8.3 Other information

Condition	NFPA Ratings	HMIS Ratings	Personal Protection
Health	0	0	Use eye and skin protection. Use NIOSH/MSHA-approved respiratory protection when necessary.
Fire	0	0	
Reactivity	0	0	
Other	N/A		

Table 20. Information for handling and identification of chemical hazards

Legend:

0 = Minimal hazard

1 = Slight hazard

2 = Moderate hazard

3 = Serious hazard

4 = Severe hazard

6.9 Peak tracking reset procedure

The 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 **PeakTk Restart Alarm** is displayed, the peak tracking function should be reset. Refer to the Description of Device Parameters for this analyzer for instruction.

6.10 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 21 below before contacting Service (refer to to Service → 🖹).

Symptom	Response
Non-Operation (at start up)	Is the power connected to both the analyzer and power source? Is the switch on?
Non-Operation (after start up)	Is the power source good? (120 to 240 VAC ± 10% at 50/60 Hz).
	Check fuse(s). If bad, replace with equivalent fuse.
	Is the power connected to both the analyzer and power source? Is the switch on?
	Is the power source good? (120/240 VAC ± 10% at 50/60 Hz).
	Check fuse(s). If bad, replace with equivalent fuse.
	Contact Service for information.
Laser Power Low Alarm	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.**
	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.
	Refer to the Description of Device Parameters for instructions to capture diagnostic data and submit as instructed by Service.
	Possible alignment problem. Contact a service representative for information.
	Possible mirror contamination issue. Contact Service for information. If advised to do so, clean the mirrors. Refer to section 6.5 → 🖹.
Pressure Low Alarm or Pressure High Alarm	Check that the actual pressure in the sample cell is within specification.
	If the pressure reading is incorrect: • Check that the pressure/temperature cable on the bottom of the electronics enclosure is tight. • Check the connector on the pressure sensor. • Check the pressure connector on the backplane board.
Temp Low Alarm or Temp High Alarm fault	Check that the actual temperature in the sample cell is within specification. For systems with a heated enclosure, check that the temperature in the sample cell is within +/-5 °C of the specified enclosure temperature.
	If the temperature reading is incorrect, • Check that the pressure/temperature cable on the bottom of the electronics enclosure is tight. • Check the connector on the cell temperature sensor. • Check the temperature connector on the backplane board. **NOTE**: A temperature reading greater than 150 °C indicates a short circuit on the temperature sensor leads; a reading of less than -40 °C indicates an open circuit).
System stuck in Fit Delta Exceeds Limit restart for greater than 30 minutes	Contact Service for information.
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.
	Check for 5 VDC on red wires, 12 VDC on yellow wires, and 24 VDC on orange wires from power supply.
	Check connections on the display communication and power cables.

Symptom	Response
Strange characters appear on front panel display	Check connections on the display communication cable.
Pressing keys on front panel do not have specified effect	Check connections on the keypad cable.
Not getting enough flow to the sample cell	Check both the micro filter and membrane separator for contamination. Replace if necessary. Refer to the SCS Operating Instruction for instruction.
	Check if supply pressure is sufficient.
LCD does not update. Unit is locked up for more than 5 minutes	Switch off power, wait 30 seconds, and then switch power back on.
Current loop is stuck at 4 mA or 20 mA	Check display for error message. If alarm has been triggered, reset the alarm. Refer to the Description of Device Parameters for instruction on resetting alarms.
	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, it is probably the main electronics assembly board.
Reading seems to always be high by a fixed amount or percentage	Refer to the Description of Device Parameters for instructions to capture diagnostic data and submit as instructed by service.
Reading is erratic or seems incorrect	Check for contamination in the sample system, especially if the readings are much higher than expected.
	Refer to the Description of Device Parameters for instructions to capture diagnostic data and submit as instructed by Service.
Reading displays 0.0 or seems relatively low	Refer to the Description of Device Parameters for instructions to capture diagnostic data and submit as instructed by Service.
	Check that Peak Tracking is enabled. See To change parameters in Mode 2, then Peak Tracking in the firmware operations chapter of the Description of Device Parameters.
Reading goes to “0”	If **4-20 mA Alarm Action** is set to **1**, look on display for an error message. See To change parameters in Mode 2, then 4- 20mA Alarm Action in the firmware operations chapter of the Description of Device Parameters.
	Gas concentration is equal to zero.
Reading goes to full scale	If **4-20 mA Alarm Action** is set to **2**, look on display for an error message. See To change parameters in Mode 2, then 4- 20mA Alarm Action in the firmware operations chapter of the Description of Device Parameters.
	Gas concentration is greater than or equal to full scale value.
Serial output is displaying garbled or no 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 ohm meter.
	Make sure to select the correct COM port into which the cable is plugged.

Table 21. Potential instrument problems and their solutions

6.11 Service

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

6.11.1 Service repair order

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

Endress+Hauser
11027 Arrow Route
Rancho Cucamonga, CA 91730
United States

6.11.2 Before contacting service

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

- Analyzer serial number (SN)
- Diagnostic downloads using the procedures provided in the associated Description of Device Parameters 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.

6.12 Packing, shipping, and storage

Endress+Hauser's TDLAS Analyzer Systems 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 palletized crate. All inlets and vents are capped and protected when packaged for shipment. The system should be packed in the original packaging when shipped or stored for any length of time.

If the analyzer has been installed and or operated (even for purposes of a demonstration), the system should be decontaminated (purged with an inert gas) before powering down the analyzer.

⚠ CAUTION

- ▶ 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 analyzer.

6.12.1 To prepare the analyzer for shipment or storage

1. Shut off the process gas flow.
2. Allow all residual gas to dissipate from the lines.
3. Connect a purge supply (N_2) regulated to the specified sample supply pressure to the sample supply port.
4. Confirm that any valves controlling the sample flow effluent to the low pressure flare or atmospheric vent are open.
5. Turn on the purge supply and purge the system to clear any residual process gases. For differential systems, make sure to purge the scrubber/dryer for several dry cycles. If necessary, dry cycles can be initiated by pressing the **#** key followed by the **2** key to enter **Mode 2** and then pressing the **#** key followed by the **1** key to return to **Mode 1**.
6. Turn off the purge supply.
7. Allow all residual gas to dissipate from the lines.
8. Close any valves controlling the sample flow effluent to the low pressure flare or atmospheric vent.
9. Disconnect power to the system.
10. Disconnect all tubing and signal connections.

11. Cap all inlets, outlets, vents, or gland openings (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.
12. 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).
13. If returning the analyzer to the factory, contact Service for a Decontamination Form. Refer to to Service → 🖹. Attach the form to the outside of the shipping package as instructed before shipping.

6.13 Storage

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

6.14 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.

This manual contains information protected by copyright. No part of this guide may be photocopied or reproduced in any form without prior written consent from Endress+Hauser.

6.15 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's sole liability and Customer's sole and exclusive remedy for a breach of warranty is limited to Endress+Hauser's repair or replacement (at Endress+Hauser's sole option) of the product or part thereof which is returned at Customer's expense to Endress+Hauser's 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's standard repair charges shall be applicable in addition to all shipping expenses.

7 Appendix C: Analyzer parts

This chapter provides lists and illustrations of all field replaceable parts used in the SS2100i-1 analyzer. Due to a policy of continuous improvement, parts, and part numbers may change without notice.

Not all parts listed are included on every analyzer. When ordering, please specify the system serial number (S/N) to ensure that the correct parts are identified.

Figure Number	Reference Number	Part Number	Description
Figure 46	1	2100002097	One Phase Filter Model FN2415
Figure 45	2	4500002002	Relay, with Socket, C1D2, 6 A, DC12 V, SPDT
Figure 45	3	4500002014	Thermostat, Manual Reset, 2455RM
Figure 44	4	2900000460	PCB, Assembly, Hytek Controller, 28 Meter
Figure 44	5	2900000410	Assembly, PCB, Backplane, Relay/No Relay Option
Figure 46	6	8000002013	Assembly, Power Supply, Traco
Figure 44	7	2900000380	Assembly, PCB, Daughter, H_2S, ARM9
Figure 46	8	2900000450	Assembly, PCB, 4-20 mA, Dual Adjust, Low Noise
Figure 46	9	2900000420	Assembly, PCB, EAE-TDL, No Ethernet-Hybrid
Figure 44	10	EX4000000001	Power Supply, 100 to 240 VAC, 24 VDC / 1.3 A
Figure 46	11	8000002526	Assembly, Phycore-ARM9/LPC3180 and Carrier
Figure 46	12	2900000440	Assembly, Analog Input Board
Figure 46	13	3100002152	Signal Converter, RS-232 to RS-485, -40 °C to +80 °C

Table 22. Replacement parts for electronics panel assembly

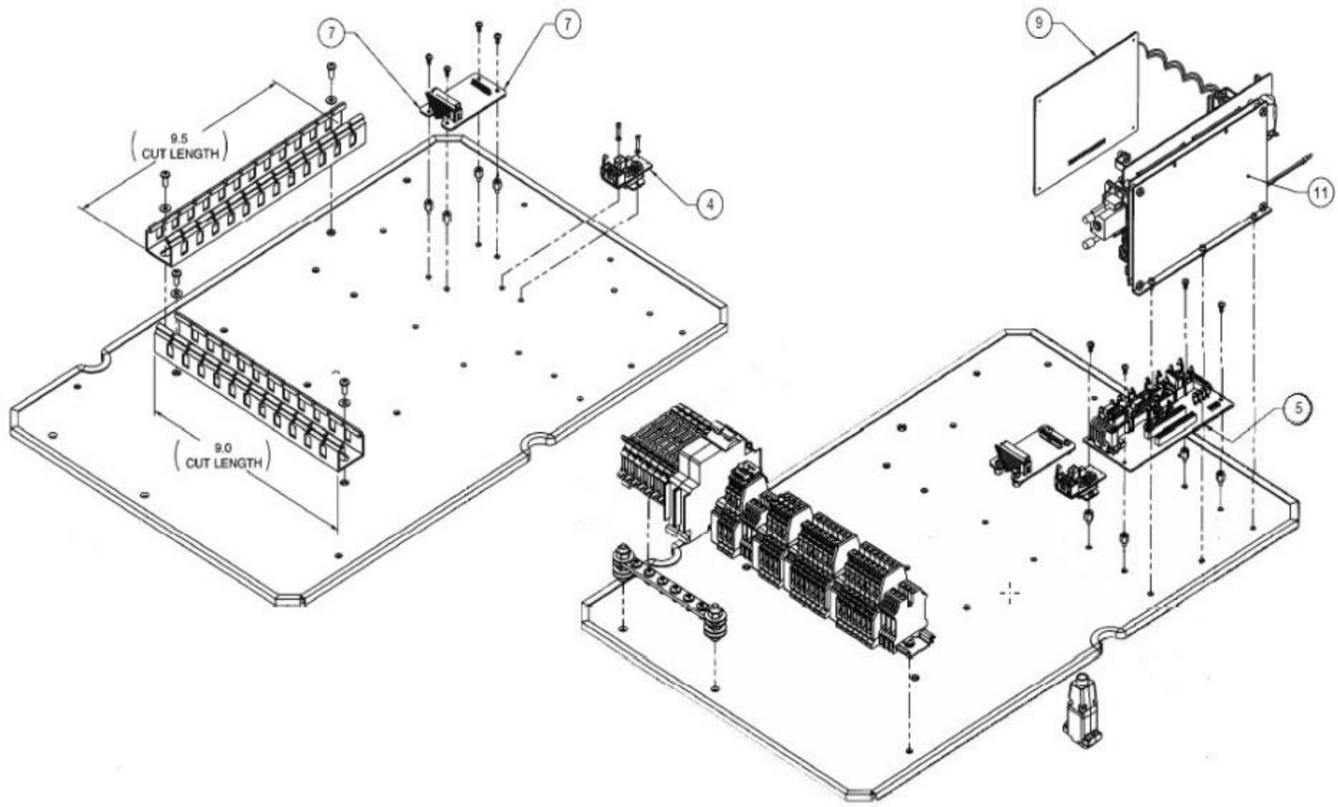


Figure 44. Electronics panel assembly parts

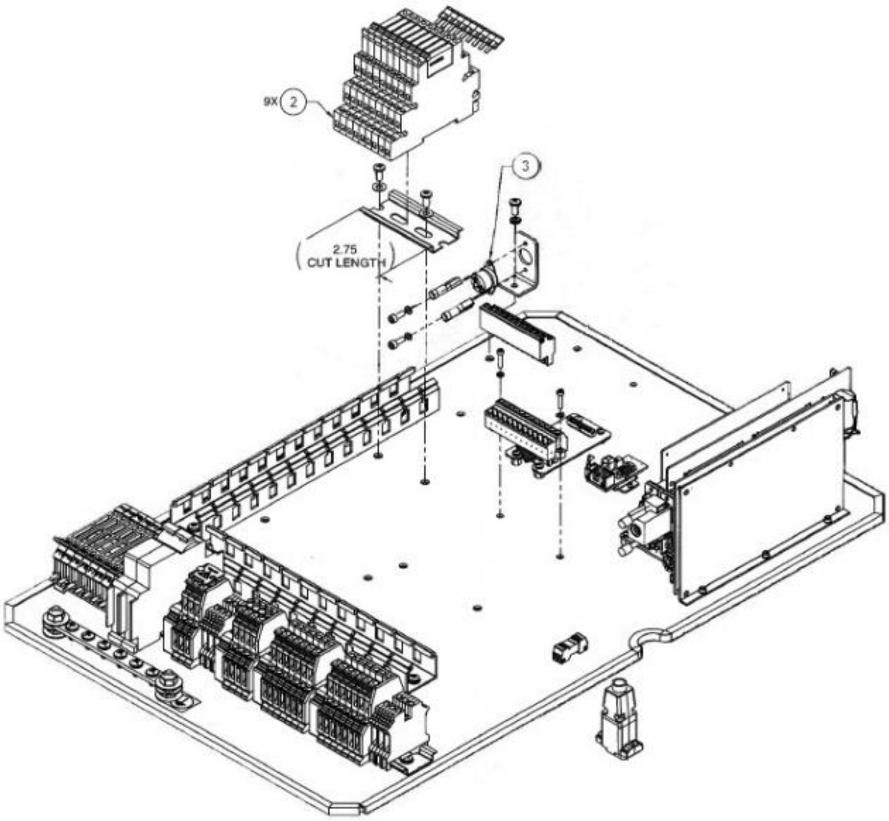


Figure 45. Electronics panel assembly parts (continued)

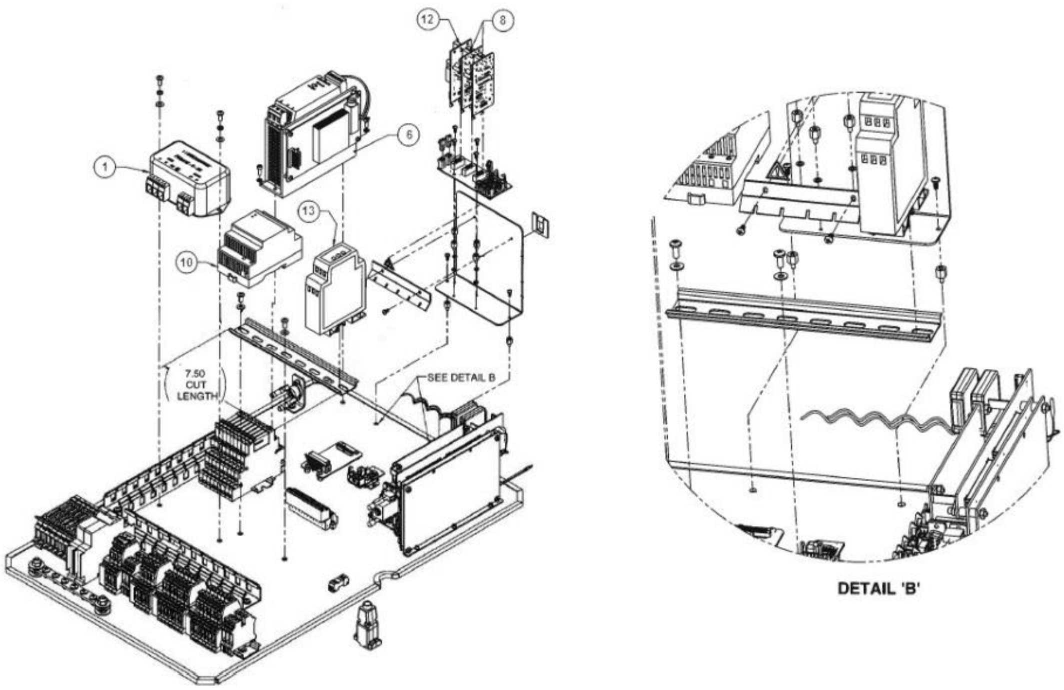


Figure 46. Electronics panel assembly parts (continued)

Figure Number	Reference Number	Part Number	Description
Figure 47	1	2100002087	Terminal Block, Double Deck, Gray
	2	2100002085	Terminal Block, Ground
	3	4500002015	Circuit Breaker, 9926 Series
	4	2100002086	Terminal Block Fuse, UK 5-HESILA 250, Un-500 V, In-6.3 A
	5	4500002010 [1]	Fuse, miniature, 5 x 20 mm, 0.5 A
	6	4500002011 [1]	Fuse, miniature, 5 x 20 mm, 0.1 A
	7	4500002012 [1]	Fuse, miniature, 5 x 20 mm, 1 A
	8	450000201 3 [1]	Fuse, miniature, 5 x 20 mm, 1.2 A

Table 23. Field interface terminal block assembly

[1] See Table 7 and Table 8 for fuse specifications.

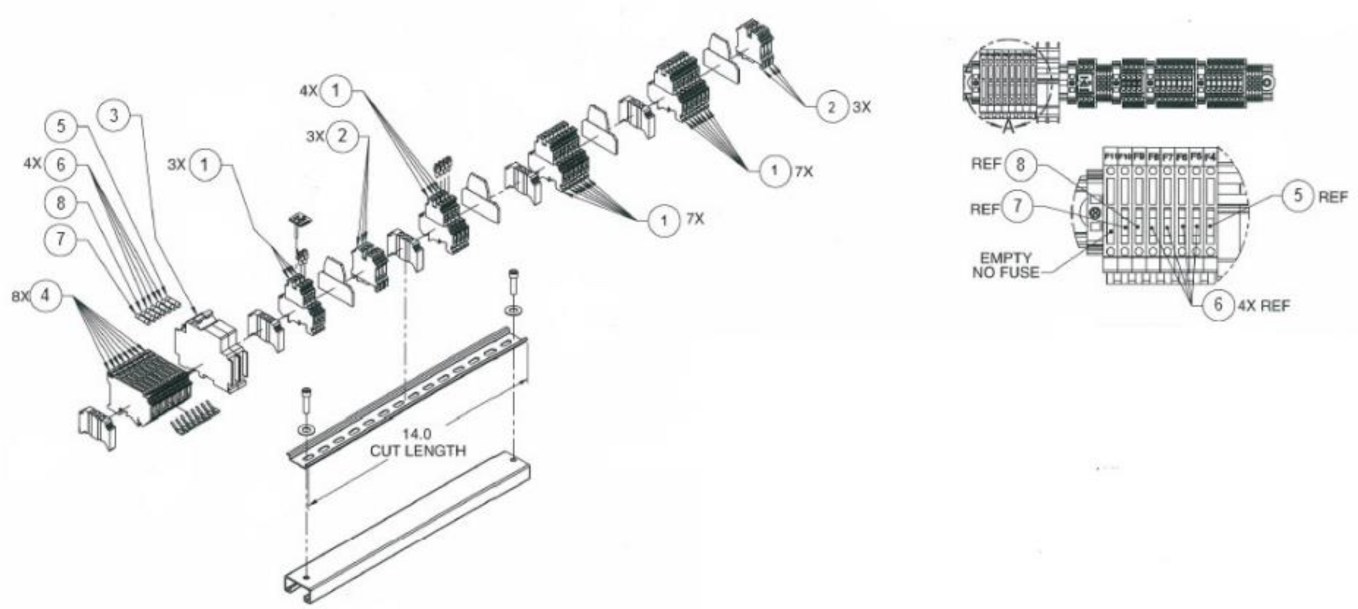


Figure 47. Field interface terminal block assembly

Figure Number	Reference Number	Part Number	Description
Figure 48	1	2800002063	Relay, 861 Solid State with Internal Heat Sink
	2	4000002038	Temperature Controller: Watlow EZ-Zone RM Rail Mount
	3	EX5300000001	Heater, 230 VAC, 200 W, EExd IIC T3
		EX5300000002	Heater, 120 VAC, 200 W, EExd IIC T3
	4	2400002085	DC Series Tubeaxial Cooling Fan, Model: D36T10
Figure 49	5	5500002041	Pressure Sensor, 30 PSIA, 5 V, 1/8 MNPT, DIN-43650C
	6	5500002017	Assembly, Thermistor Probe, 25 in. Long

Table 24. Replacement parts for 8/28 m sample cell panel assembly

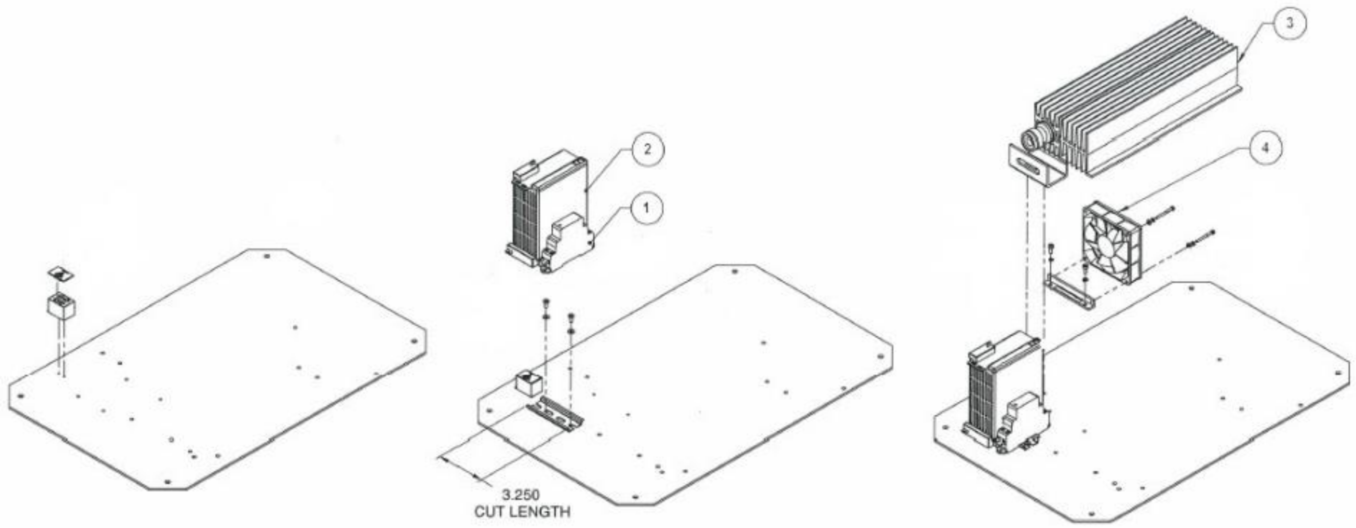


Figure 48. 8/28 m sample cell panel assembly parts

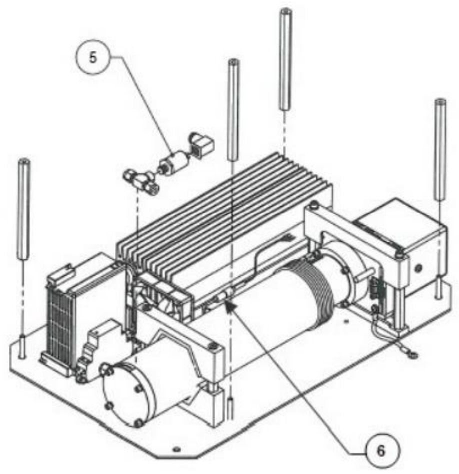


Figure 49. 8/28 m sample cell panel assembly parts (continued)

Figure Number	Reference Number	Part Number	Description
Figure 50	1	2800002063	Relay, 861 Solid State with Internal Heat Sink
	2	4000002038	Temperature Controller: Watlow EZ-Zone RM Rail Mount
	3	EX5300000001	Heater, 230 VAC, 200 W, EExd IIC T3
		EX5300000002	Heater, 120 VAC, 200 W, EExd IIC T3
	4	5500002041	Pressure Sensor, 30 PSIA, 5 V, 1/8 in. MNPT DIN4365, NACE [1]
	5	2400002085	DC Series Tubeaxial Cooling Fan, Model: D36T10
	6	6100222012	Connector, Male, 1/4 Swage, 1/8NPT, SS316
	7	5500002023	Assembly, Thermistor Probe, 30 in. Long
	8	0900002146	Stainless Steel Mirror (0.8 m Cell)

Table 25. Replacement parts for 0.8 m sample cell panel assembly

[1] 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 (https://www.endress.com/contact).

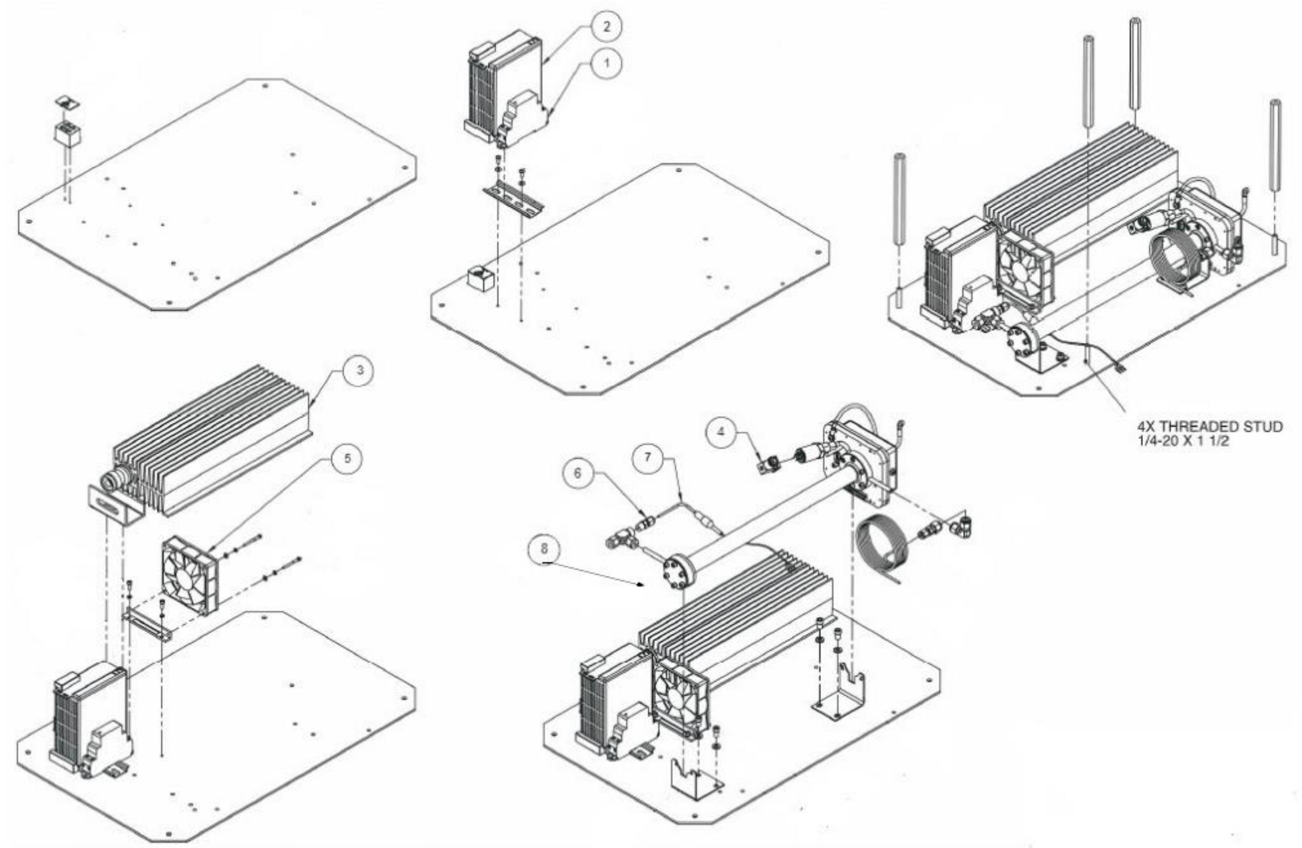


Figure 50. 0.8 m sample cell panel assembly parts

Figure Number	Reference Number	Part Number	Description
Figure 51	1	EX5300000001	Heater, 230 VAC, 200 WM EExd IIC T3
	2	4500002014	Thermostat, Manual Reset, 2455RM
	3	2400002105	Terminal Block, 4 Position, G 5/4
	4	2100002107	Terminal Block, Type MT 1, 5, Phoenix
	5	2400002104	Ground Terminal Block, Type MT 1,5PE
Figure 52	6	2400002085	DC Series Tubeaxial Cooling Fan, Model: D36T10
	7	5500002041	Pressure Sensor, 30 PSIA, 5 V, 1/8 in. MNPT DIN4365, NACE [1]
	8	5500002023	Assembly, Thermistor Probe, 30 in. Long
	9	6100002054	Coil, Heating, Formed, 28M Cell, STD SS
	10	0900002146	Stainless Steel Mirror (0.1 m Cell)

Table 26. Replacement parts for 0.1 m sample cell panel assembly

[1] 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 (https://www.endress.com/contact).

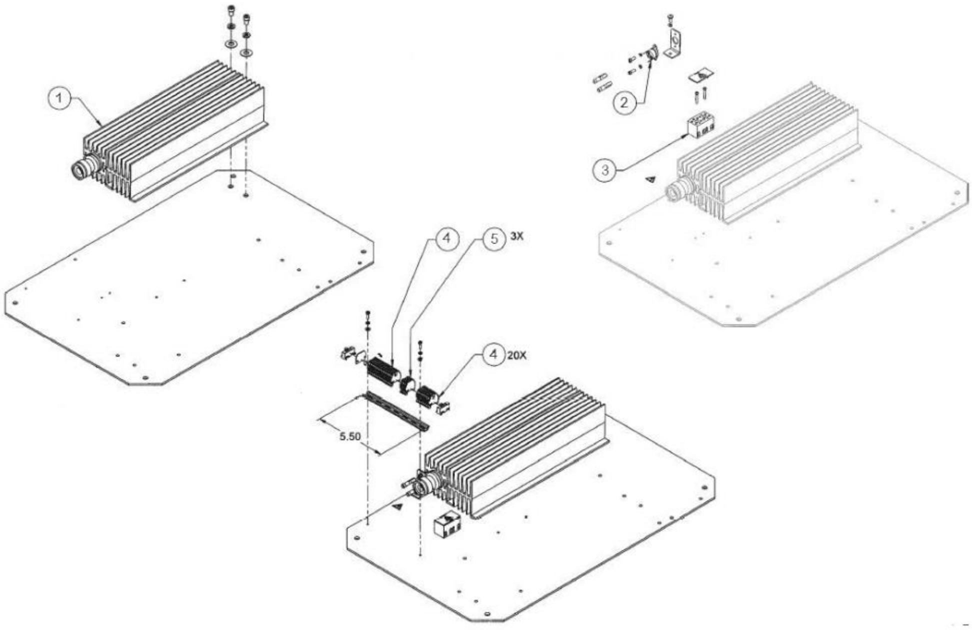


Figure 51. 0.1 m sample cell panel assembly parts

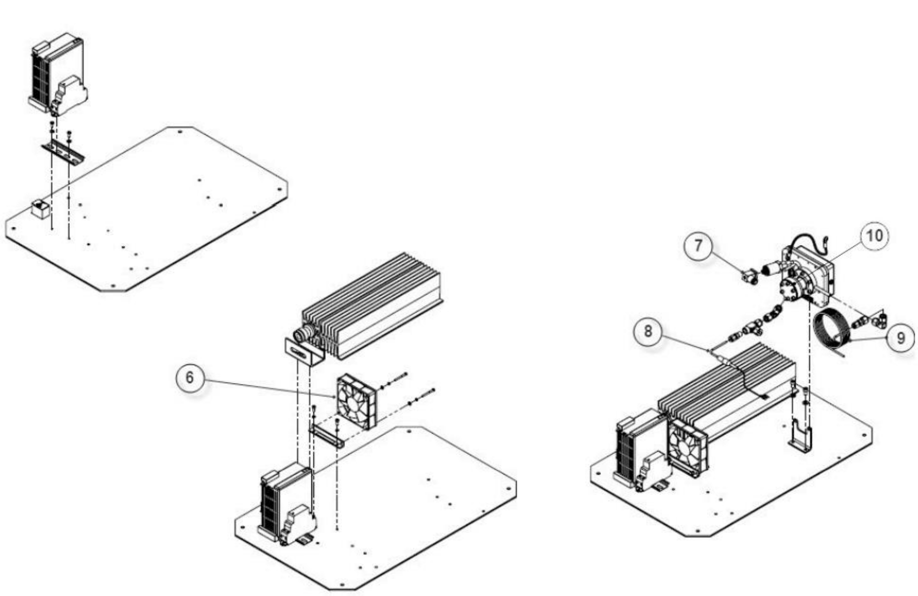


Figure 52. 0.1 m sample cell panel assembly parts (continued)

Figure Number	Reference Number	Part Number	Description
Figure 53	1	2400002161	Display, LCD, 20X4, Backlit, 5 V, Serial
	2	2400002157	Keypad, Touch Sensitive, 16KEYS
	3	EX1300000026	Flame Arrestor, 1/2 NPT x 1/4 NPT, SS, EExd
	4	EX1300000009	Flameproof Breather/Drainer, M20, Exd, ATEX/IECEx

Table 27. Replacement parts for electronics enclosure assembly

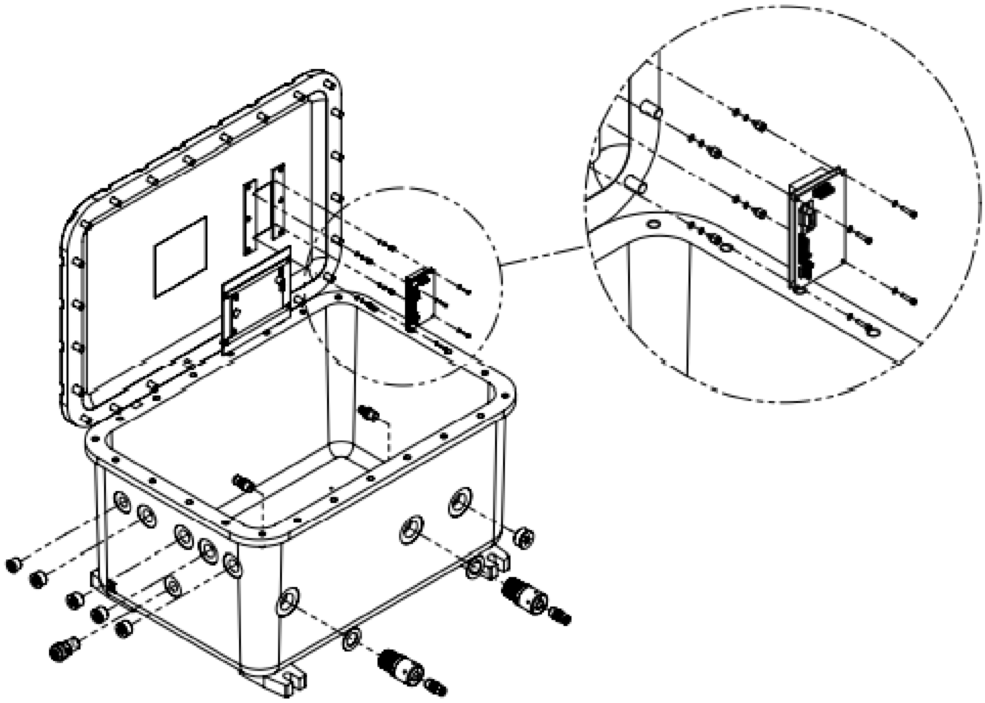


Figure 53. Analyzer enclosure assembly parts

Part Number	Description
5500002022	Transition Plate Thermistor
Cables	
6000002148	Assembly, Cable, Pressure Sensor, GP50, Cell Enclosure (all cell sizes)
6000002201	Cable, Pressure Sensor, GP50, 35 in.
6000002139	Assembly, Cable, Pressure Sensor, GP50, Electrical Enclosure (to Backplane Connector)
6000002146	Assembly, Cable Optical Head, EExd, Electrical Enclosure
6000002021	Assembly, Cable, Signal, Optical Head
6000002138	Assembly, Cable, Thermistor Cell, Electrical Enclosure
6000002203	Assembly, Cable Thermistor Cell, Backplane
6000002152	Assembly, Cable, Relay Interface, ARM9 (EExd ENCL)
6000002193	Assembly, Ethernet Cable, CAT5e
6000002189	Cable, Harness, Signal Output RS-232/4-20 mA
6000002261	Cable, Harness, Signal Output RS-232/4-20 mA 25 in.
6000002192	Assembly, Cable, 4-20 mA Input
6000002191	Assembly, Cable, 4-20 mA Output
6000002204	Assembly, Cable, AI Jumper, J8 TO J4
6000002158	Assembly, Cable, RS-232, M-M, Display, Data (EExd)
6000002159	Assembly, Cable, Power, Display (EExd)
0190217204	Cable, Power Supply Output, 14 in.
0190217208	Cable, TE Cooler
0190217205	Harness, Ribbon, 10 Conductor, 9 in.
Scrubber/Indicator (Differential Systems Only)	
8000002209	Kit, H_2S Scrubber/Indicator, 3 in. Diameter
8000002207	Kit, H_2S Scrubber/Indicator, 2 in. Diameter
8000002205	Kit, NH_3 Scrubber/Indicator, 3 in. Diameter
8000002224	Kit, NH_3 Scrubber/Indicator, 2 in. Diameter
8000002205	Kit, HCl Scrubber/Indicator, 3 in. Diameter
8000002224	Kit, HCl Scrubber/Indicator, 2 in. Diameter
6101811014	Dyer, NuPure
Hardware/Kits	
0219900006	Kit, Spares, (O-Rings, Screws), Viton, Cell
0219900005	Kit, Spares, (O-Rings, Screws), Viton, 0.8 m/0.1 m Cell
1300002427	Washer, Sealing, SS, M10
1300002425	Screw, Socket Head Cap, 304SS, M10x35
1300002426	Screw, Socket Head Cap, 304SS, M10x30
1100002209	Kit, SS2100i-1, M10x35 Bolts and M10 Washer
0219900007	Kit, Cleaning Tools, Optical Cell (USA/Canada) [1]
0219900017	Kit, Cleaning Tools, Optical Cell (International) [1]
1100002156	Tooling Kit (Installation/Maintenance)
General	
BA02189C	SS2100i-1 Operating Instruction, additional copies
GP01177C	Description of Device Parameters FS 5.16, additional copies
XA02687C	SS2100i-1 Safety Instruction, additional copies
GP01180C	Description of Device Parameters NS 5.14, additional copies

Table 28. Service parts

[1] 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 (https://www.endress.com/contact).

8 Appendix D: Wiring diagrams

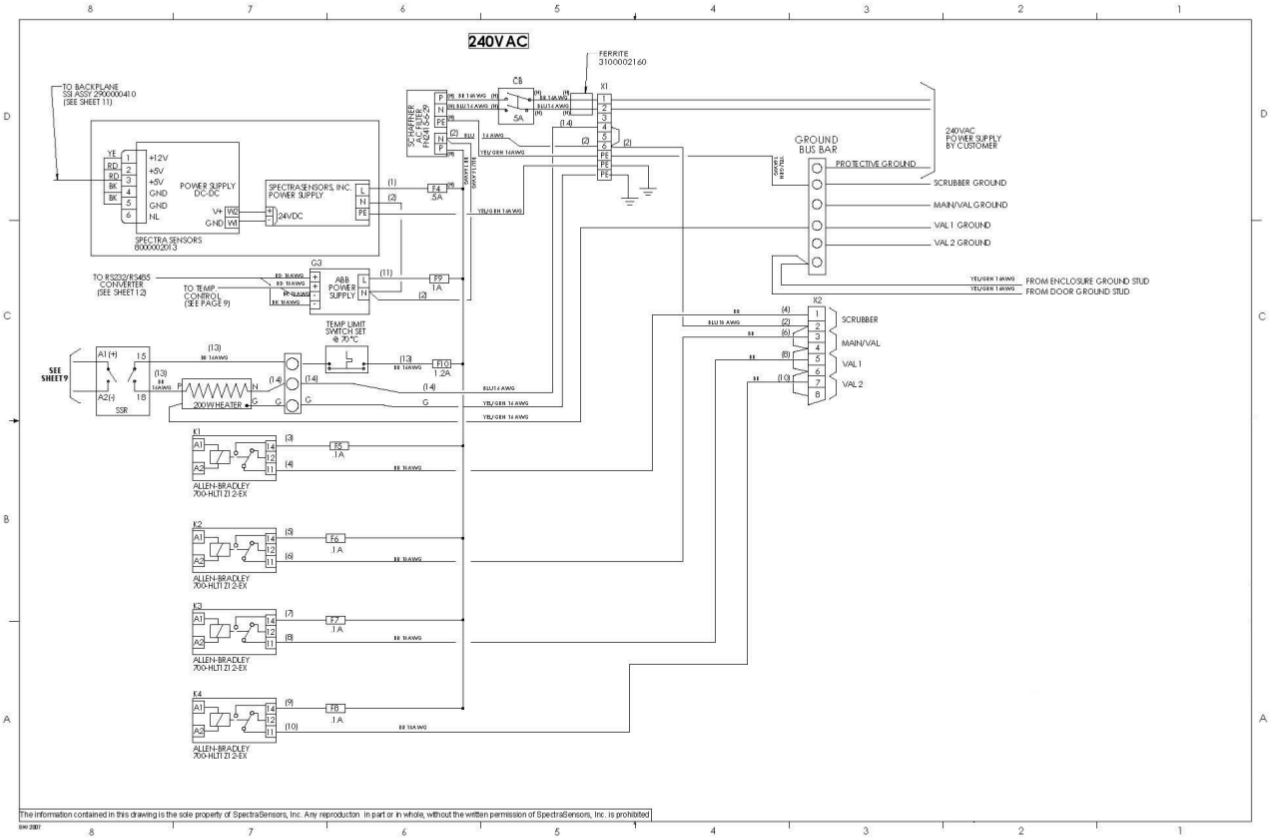


Figure 54. Wiring schematic of SS2100i-1 electronics power systems

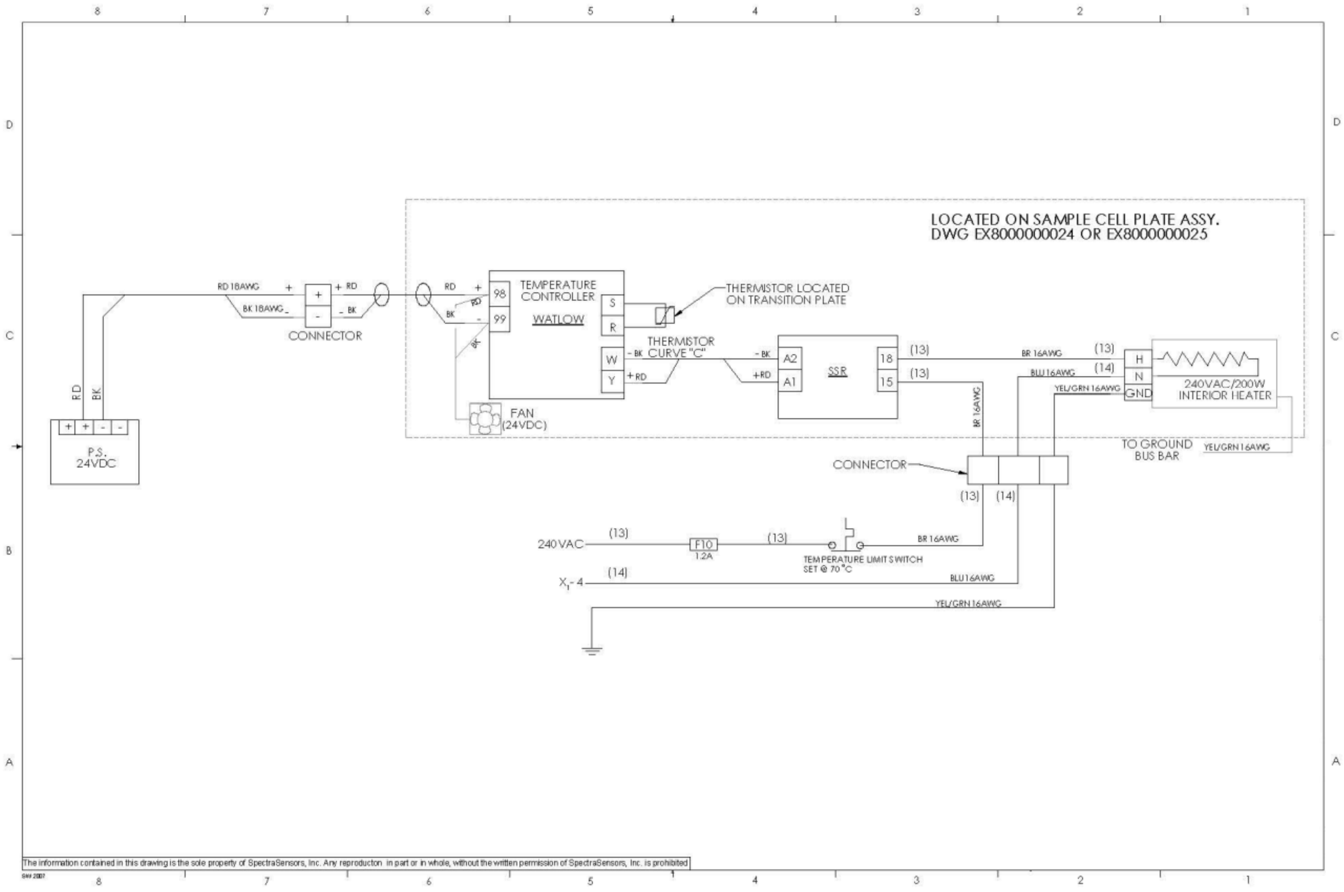


Figure 55. Wiring schematic of SS2100i-1 heater system

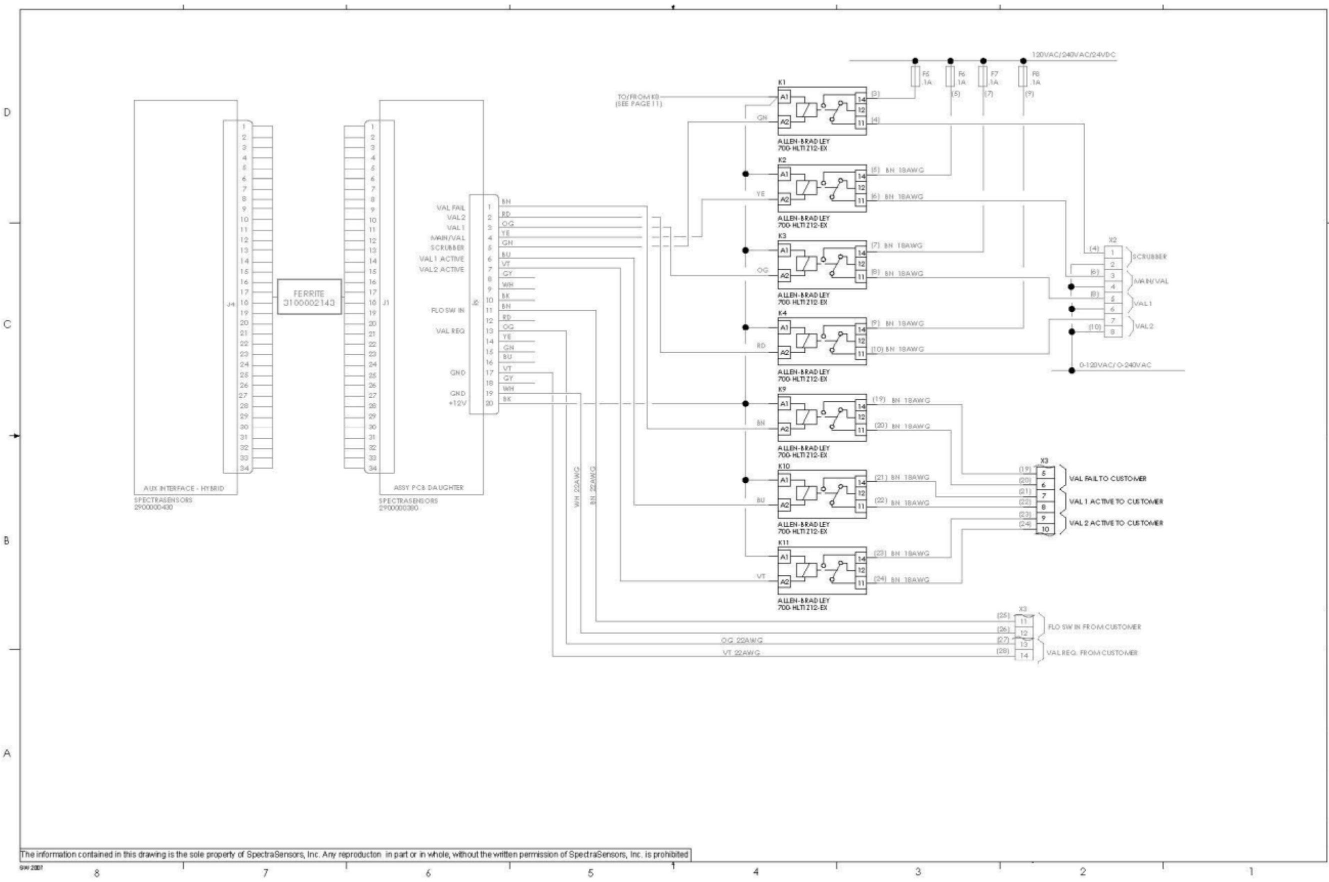


Figure 56. Wiring schematic of SS2100i-1 digital I/O

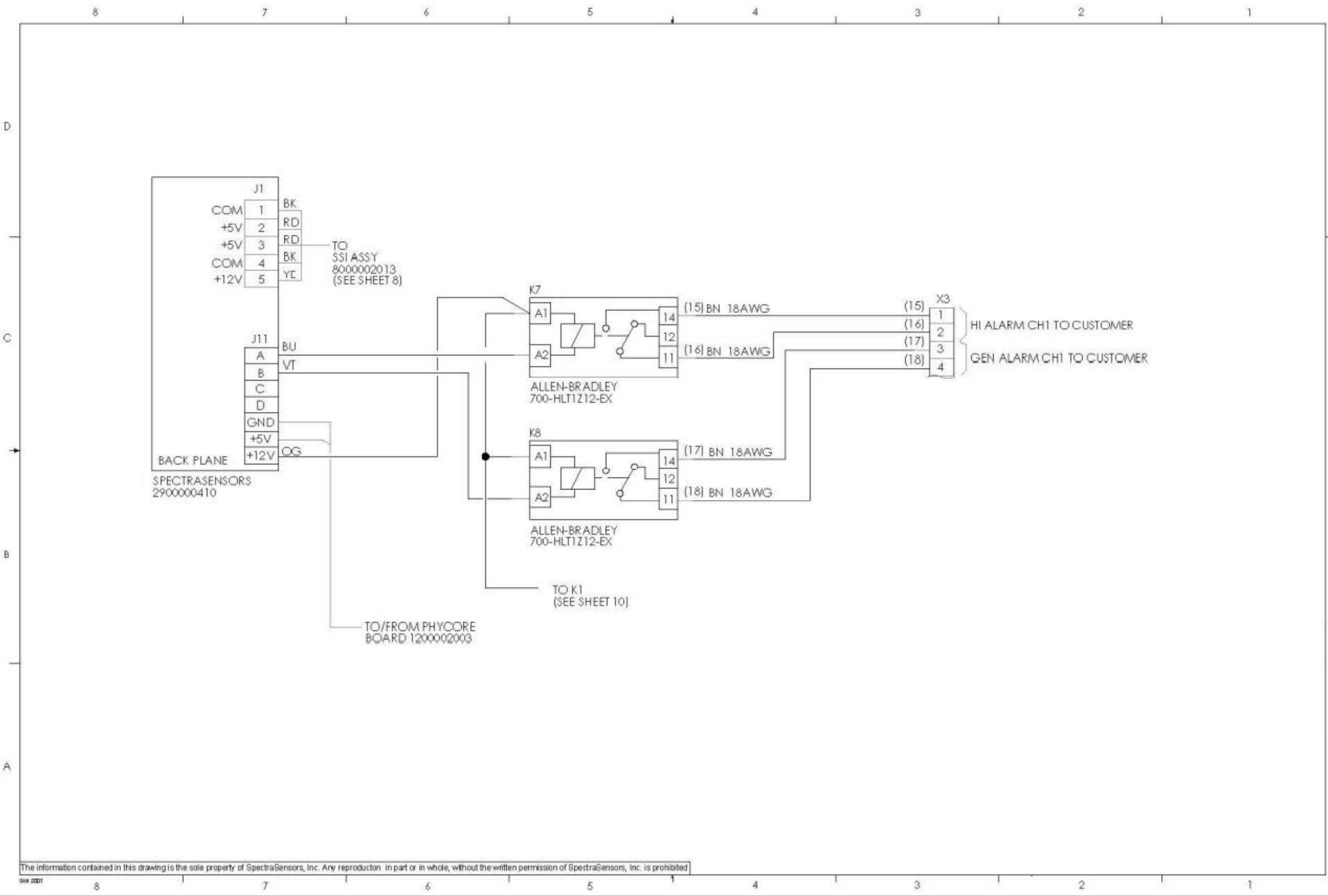
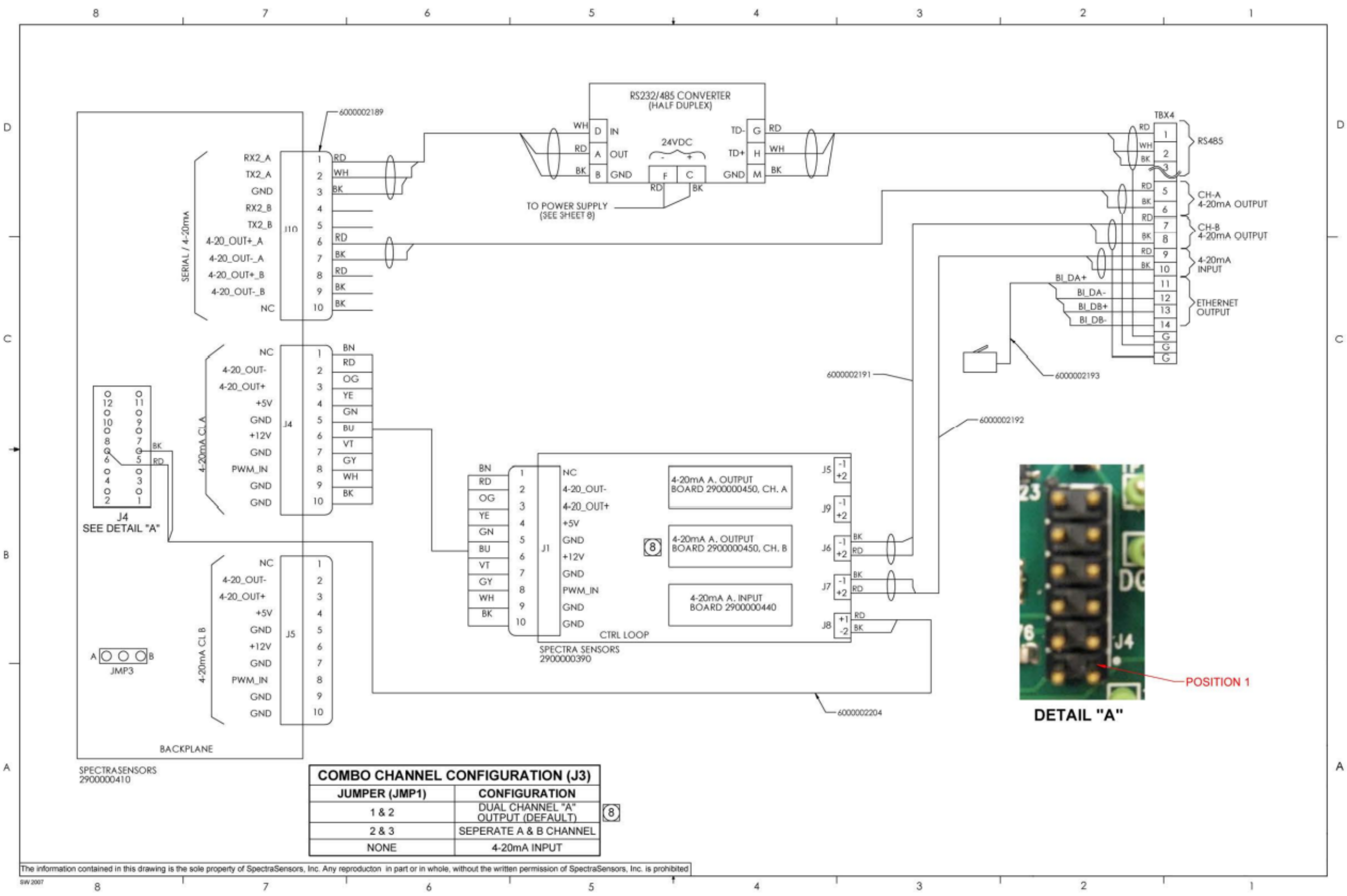


Figure 57. Wiring schematic of SS2100i-1 alarms



COMBO CHANNEL CONFIGURATION (J3)	
JUMPER (JMP1)	CONFIGURATION
1 & 2	DUAL CHANNEL "A" OUTPUT (DEFAULT)
2 & 3	SEPERATE A & B CHANNEL
NONE	4-20mA INPUT

Figure 58. Wiring schematic of SS2100i-1 serial and Ethernet signals

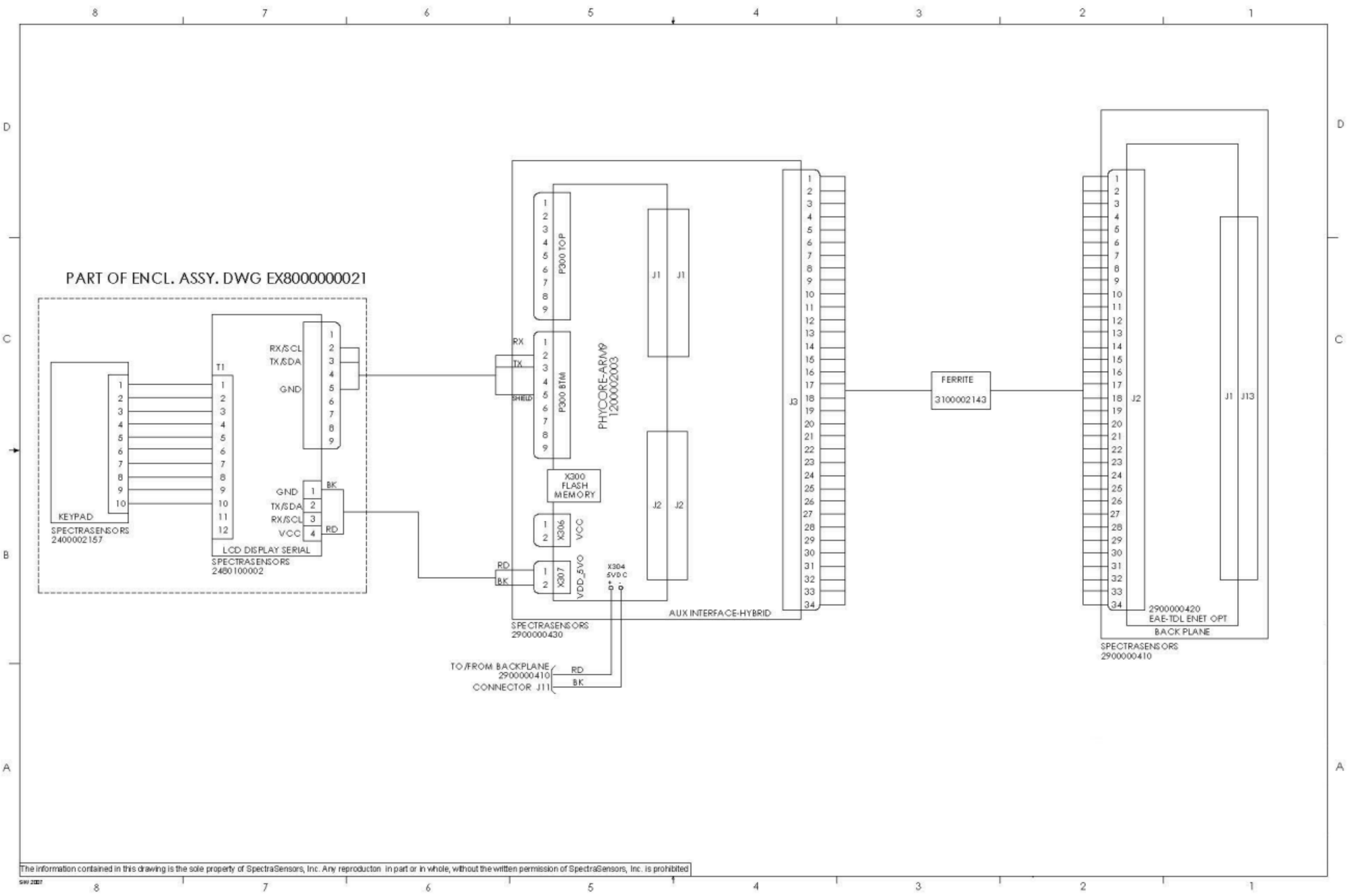


Figure 59. Wiring schematic of SS2100i-1 inter-card connections

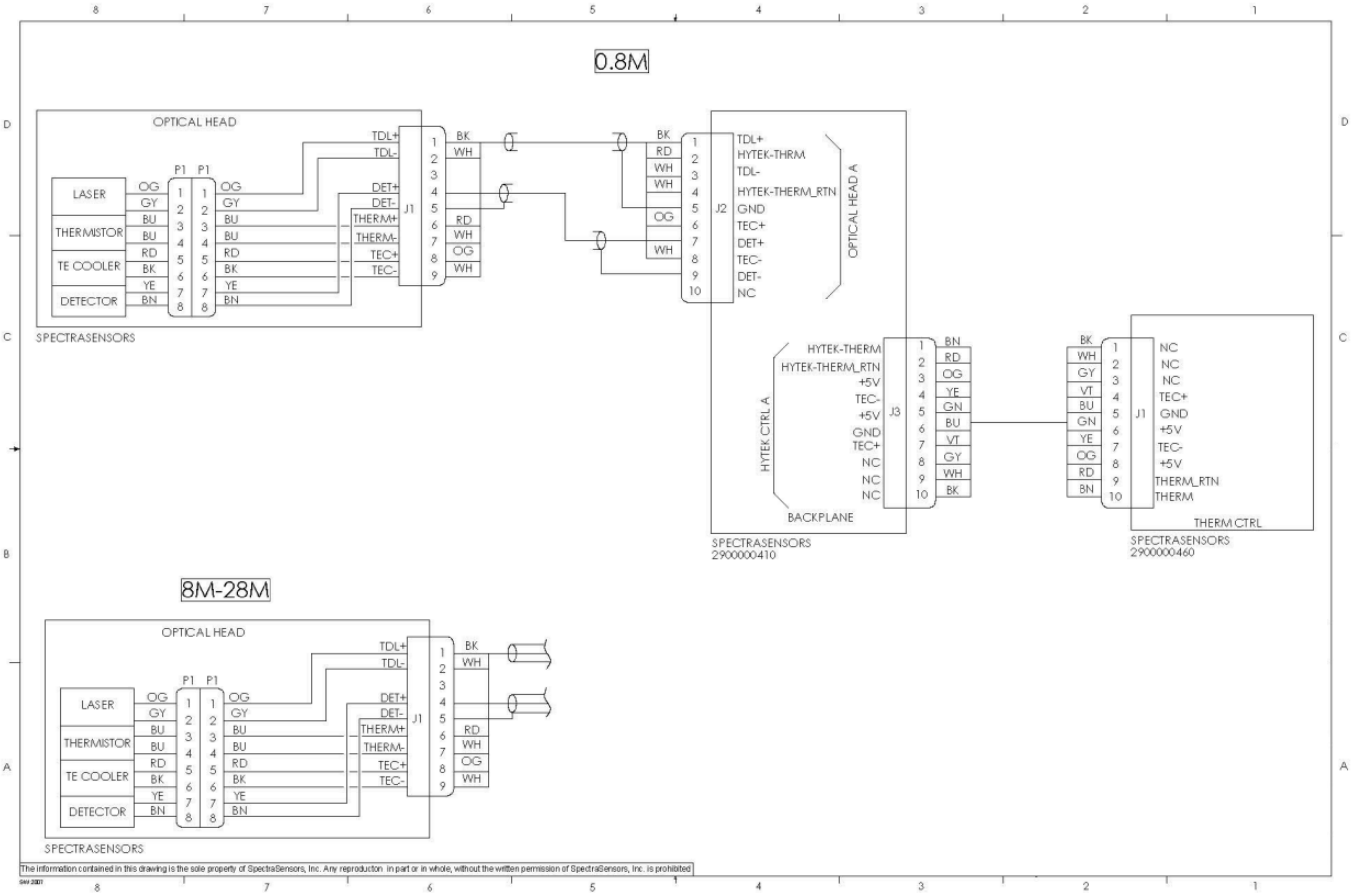


Figure 60. Wiring schematic of SS2100i-1 sample cell connections

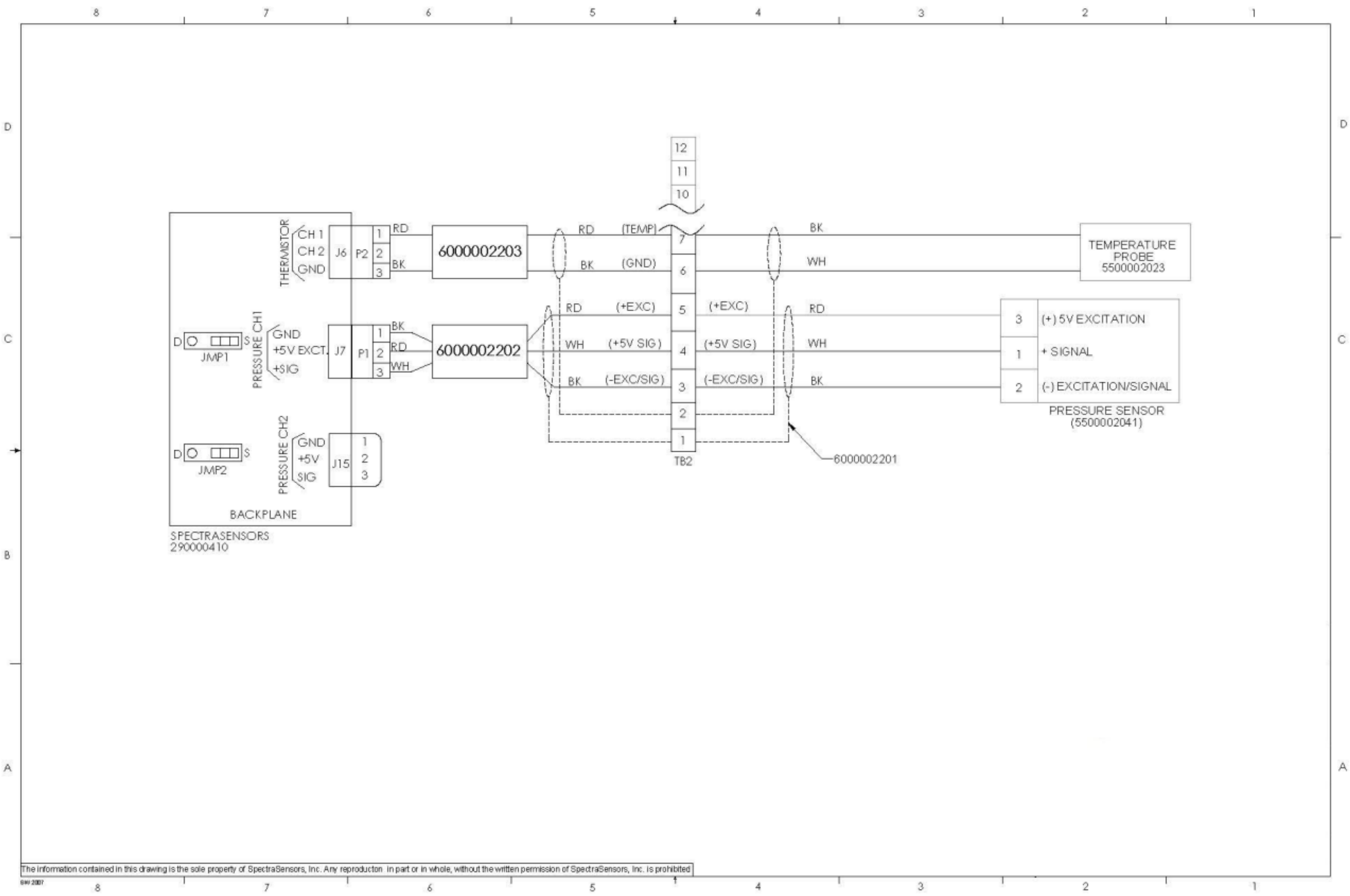


Figure 61. Wiring schematic of SS2100i-1 sample cell connections (continued)

www.addresses.endress.com

People for Process Automation