Operating Instruction
SS2100 Trace Moisture TDLAS Gas Analyzer

Class I, Division 2 Group A, B, C, D T3 / T3C
Class I, Zone 2 IIC T3 / T3C
Type 4X, IP66

Endress+Hauser
People for Process Automation

Product/Firmware Matrix

PRODUCT MODEL	HC12 Firmware	FS Firmware	NS Firmware
SS2100, SS2100a, SS2100i-1, SS2100i-2	Not used	Used for differential analyzers	Used for non-differential analyzers
2-Pack/3-Pack	Used on right-side analyzer electronics	Used on left-side analyzer electronics	Not used
SS1000, SS500, SS500e, SS500XP, SS2000, SS2000e, SS2000XP, SS3000, SS3000e	Used	Not used	Not used

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1 - Introduction

Endress+Hauser’s SS2100 Trace Moisture analyzer is a high-speed, diode laser-based extractive analyzer designed for extremely reliable monitoring of very low (trace) concentrations of moisture in natural gas. In order to ensure that the analyzer performs as specified, it is important to closely review the installation and operation sections of this manual. This manual contains a comprehensive overview of the SS2100 Trace Moisture analyzer through step-by-step instructions for installing and maintaining the system hardware.

For instruction on operating the analyzer through firmware programming, please consult the Description of Device Parameters.

Who Should Read This Manual

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

How to Use This Manual

Take a moment to familiarize yourself with the contents of this manual by reading the **Table of Contents**.

There are a number of options and accessories available for the SS2100 analyzers. This manual has been written to address the most common options and accessories. Images, tables and charts have been included to provide a visual understanding of the analyzer and its functions. Special symbols are also used to provide the user with key information regarding the system configuration and/or operation. Pay close attention to this information.

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 are identified by a pointing finger cursor when rolling over the text. Simply click on the link to navigate to the associated reference.

General Cautions and Symbols

Instructional icons are provided in this manual and on the SS2100 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.

Safety warning label

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

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

***Flammable**. Gases used in the processing of this 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.*

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.

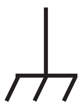
Equipment labels

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

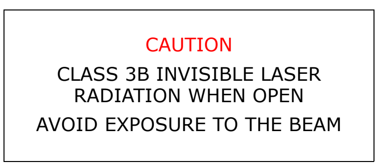
Failure to follow all directions may result in damage or malfunction of the analyzer.

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.*



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

Removing label from measurement cell optical head will void analyzer warranty.

Instructional symbols

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.

Manufacturer Address

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

About the Gas Analyzers

The SS2100 analyzers are tunable diode laser (TDL) absorption spectrometers operating in the near- to short-wavelength infrared. Each compact sensor consists of a TDL light source, sample cell and detector specifically configured to enable high sensitivity measurement of a particular component within the presences of other gas phase constituents in the stream. The sensor is controlled by microprocessor-based electronics with embedded software that incorporates advanced operational and data processing algorithms.

Sample Conditioning System (SCS)

A sample conditioning system (SCS) is included with the analyzer. The SCS has been specifically designed to deliver an optimum sample stream that is representative of the process systems stream at the time of sampling. Most SS2100 analyzers are configured for use at extractive natural gas sampling stations.

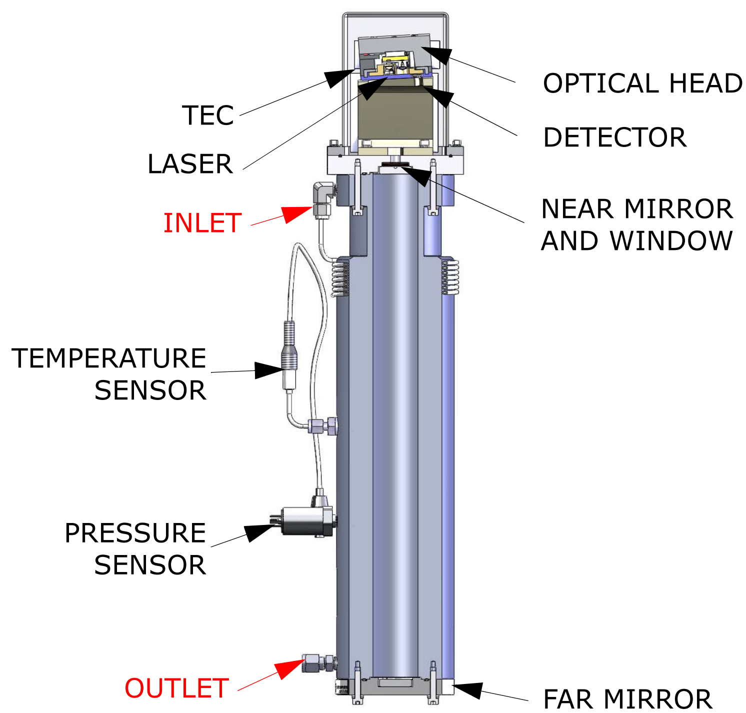
Determining firmware version

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.

How the Analyzers Work

The SS2100 analyzers employ SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) to detect the presence of trace substances in process gases. Absorption spectroscopy is a widely used technique for sensitive trace species detection. Because the measurement is made in the volume of the gas, the response is much faster, more accurate and significantly more reliable than traditional surface-based sensors that are subject to surface contamination.

In its simplest form, a diode laser absorption spectrometer typically consists of a sample cell with a mirror at one end, and a mirror or window at the opposite end, through which the laser beam can pass. Figure 1–1 on page 1–5 shows an 8 m cell cross-section with indicators for standard components and access. The laser beam enters the cell and reflects off the mirror(s) making one or more passes through the sample gas and eventually exiting the cell where the remaining beam intensity is measured by a detector. With the SS2100 analyzers, sample gas flows continuously through the sample cell ensuring that the sample is always representative of the flow in the main pipe.



8 m Measurement Cell

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

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

$$I(\lambda) = I_0(\lambda)\exp[-\sigma(\lambda)lN] \quad , \qquad (1)$$

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

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

Figure 1–2 on page 1–7 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 1–3 on page 1–7.

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.

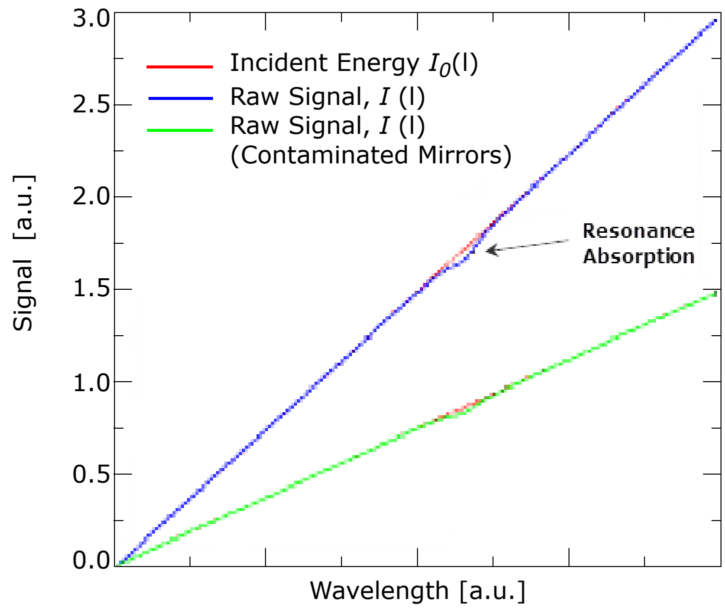


Figure 1–2 *Typical raw signal from a laser diode absorption spectrometer with and without mirror contamination*

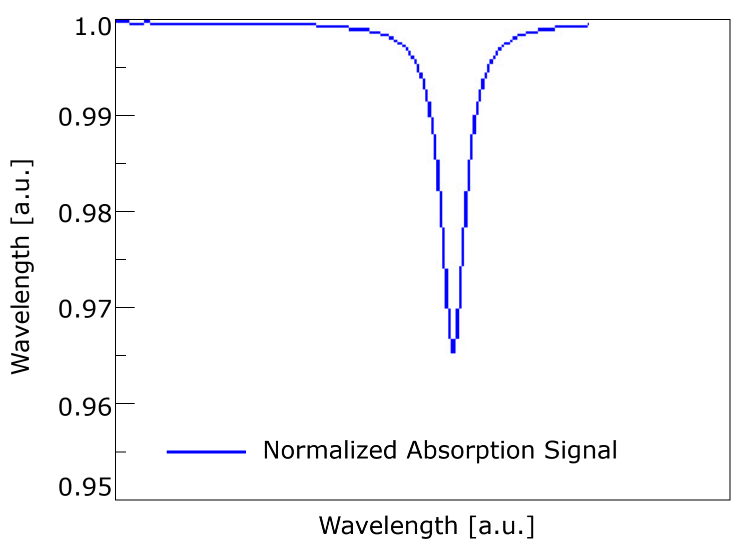


Figure 1–3 *Typical normalized absorption signal from a laser diode absorption spectrometer*

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 1–4 below. This phase-sensitive detection enables the filtering of low-frequency noise caused by turbulence in the sample gas, temperature and/or pressure fluctuations, low-frequency noise in the laser beam or thermal noise in the detector.

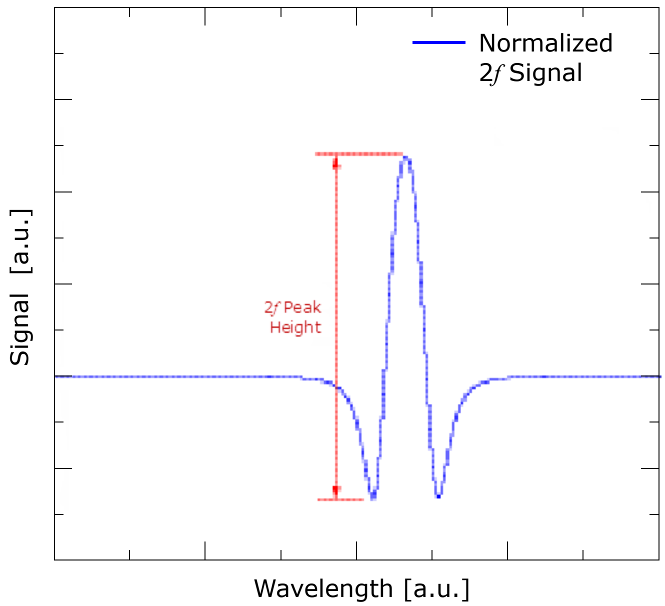


Figure 1–4 *Typical normalized 2f signal; species concentration is proportional to the peak height*

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

Measuring different trace gases in various mixed hydrocarbon background streams is accomplished by selecting a different optimum diode laser wavelength between 700 to 3000 nm, which provides the least amount of sensitivity to background stream variations.

Getting Familiar with the Analyzer

Figure 1–5 below shows a sample SS2100 analyzer from a front view. The analyzer is typically comprised of two main enclosures; the analyzer electronics and the Sample Conditioning System (SCS). On the front panel of the analyzer electronics, the keypad and LCD display serve as the user interface to the analyzer. Some systems may also have an optional keypad cover. The analyzer control electronics drive the laser, collect the signal, analyze the spectra and provide measurement output signals. This manual provides the components overview and installation requirements for connecting the SS2100 electronics.

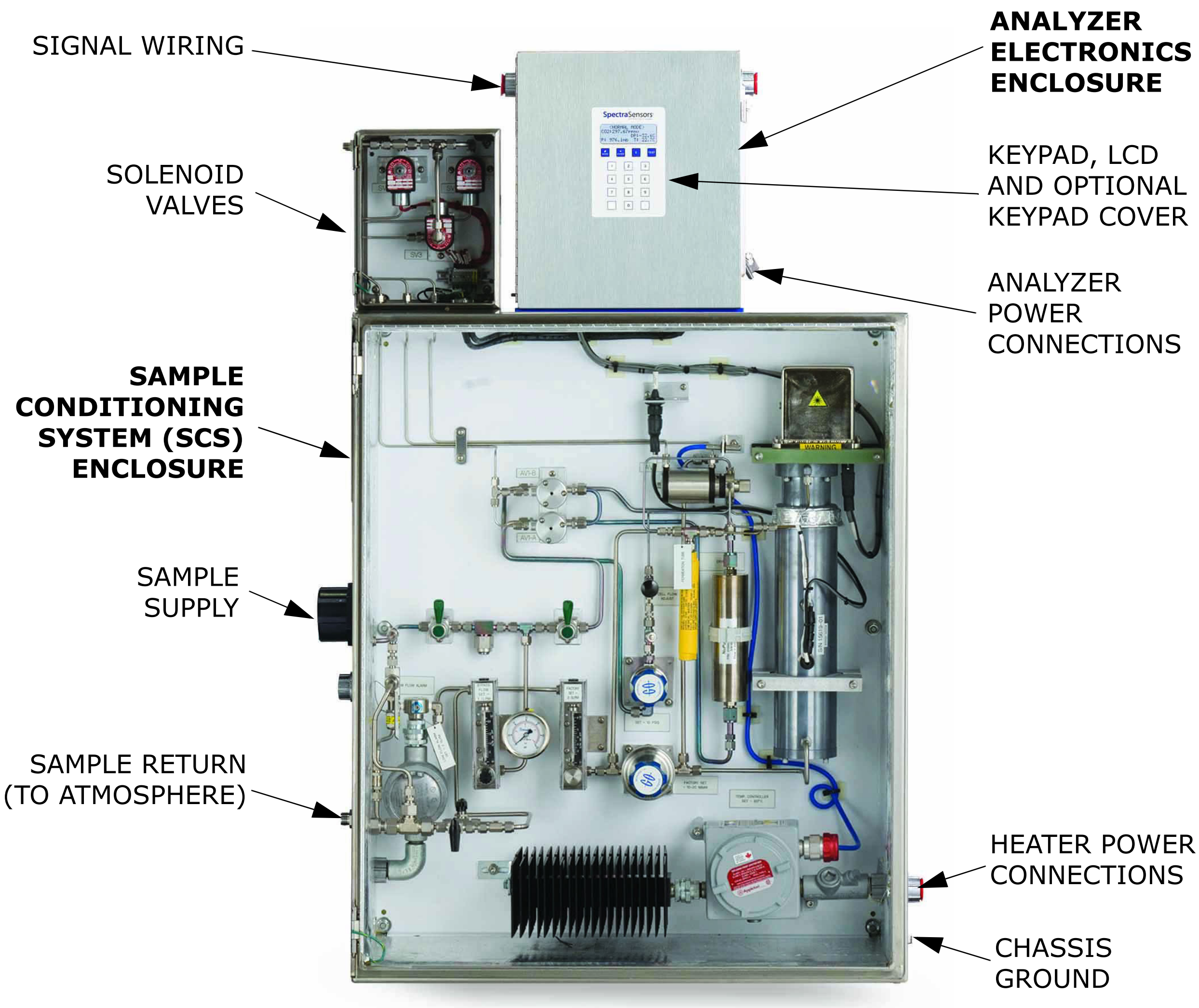


Figure 1–5 *SS2100 analyzer architecture*

Housed inside the SCS are the measurement cell and heater along with flow devices to control flow and pressure for the measurement cell and the bypass loop. Refer to “Sample Conditioning System” on page 4-1.

Power is connected to the analyzer from a 120 VAC, 240 VAC power source or optionally a 24 VDC power source. Sample supply/return air are connected on the opposite side of the enclosure.

Inside the analyzer electronics enclosure is the electronics assembly, as shown in Figure 1–6 below and Figure 1–7 on page 1–11.

Fuses are located on the electronics control board, as shown in Figure 1–6 below and Figure 1–7 on page 1–11.

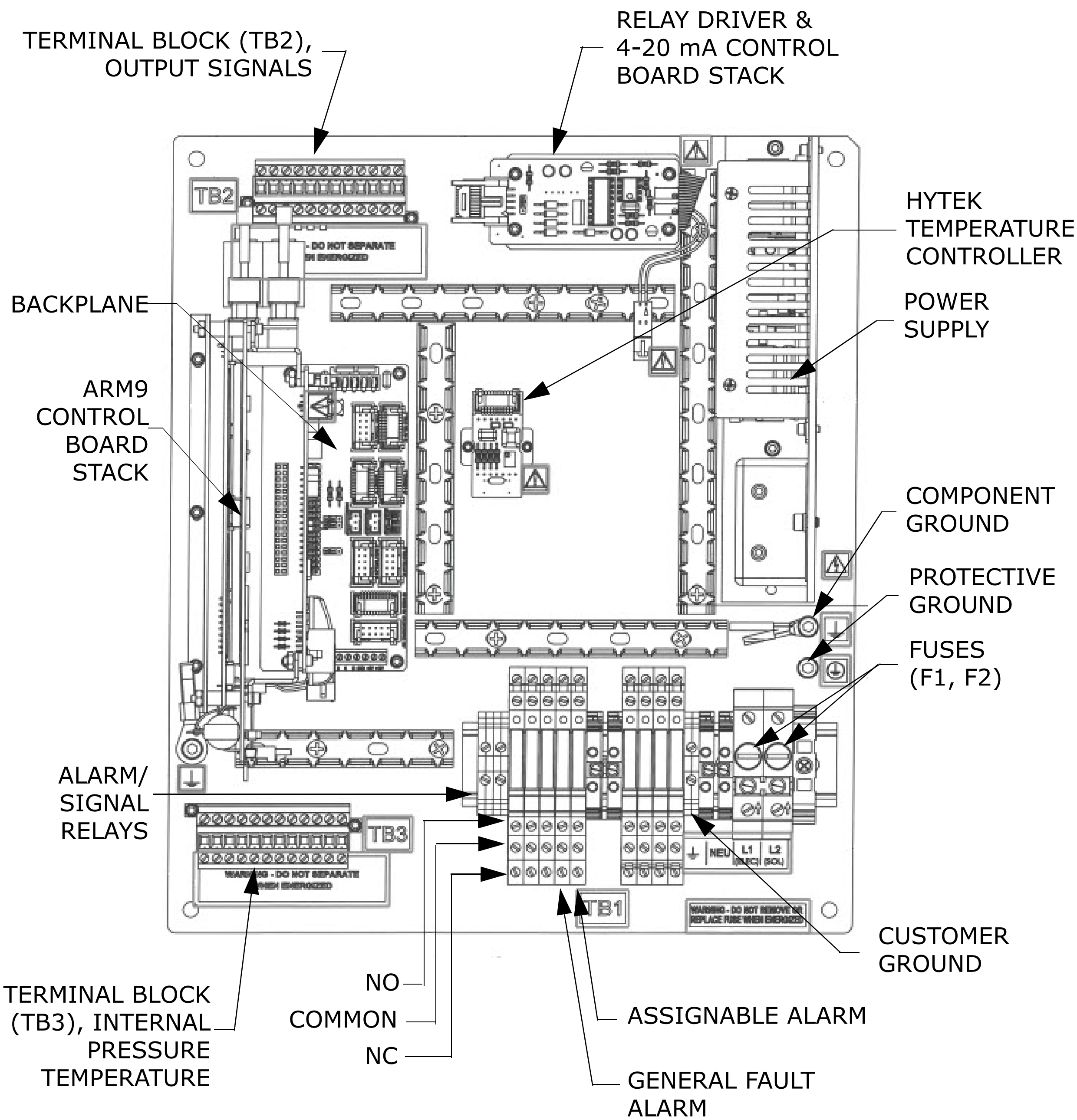


Figure 1–6 *SS2100 electronics control board (AC) showing signal terminal block and alarm relays*

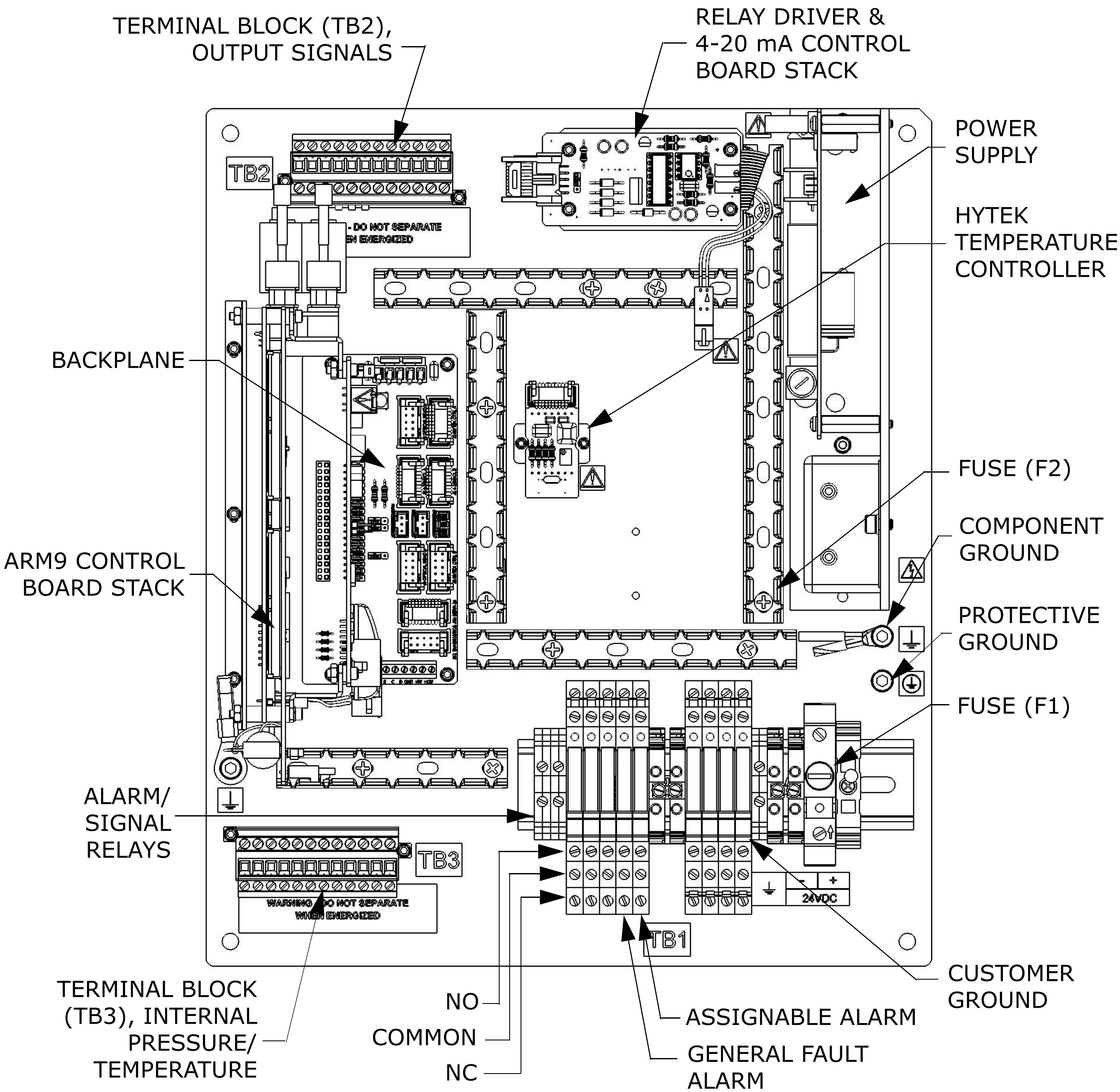


Figure 1–7 *SS2100 electronics control board (DC) showing signal terminal block and alarm relays*

If you need to replace a fuse, use only the same type and rating of fuse as the original as listed in Table 1–1. Refer to ***"Replacing a Fuse"*** *on page B-6.*

Select the replacement solenoid fuse (F2) based on the number of solenoids installed on the analyzer.

Table 1–1 *Fuse specifications*

Drawing	Reference	Voltage	Description	Rating
Figure 1–6	F1	120 VAC	1 Solenoid, Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 0.25 A
			2 Solenoids, Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 0.4 A
			3 Solenoids, Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 0.8 A
	F2		Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 0.8 A
	F1	240 VAC	1 Solenoid, Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 0.125 A
			2 Solenoids, Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 0.25 A
			3 Solenoids, Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 0.4 A
	F2		Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 0.5 A
Figure 1–7	F1	24 VDC	1 Solenoid, Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 0.63 A
			2 Solenoid, Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 1.25 A
			3 Solenoid, Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 2.0 A
	F2		Miniature Fuse, 5 x 20 mm, Time Delay	250 VAC 1.6 A

2 - Safety

Potential Risks Affecting Personnel

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

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, personal protective equipment (PPE) requirements, hot work permits and other precautions that address safety concerns related to performing service on process equipment located in hazardous areas.

Mitigating risks

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

Exposure to process gases

1. Shut off the process gas to the 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.

Electrocution hazard

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

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

2. Open enclosure door.

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

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

Explosion hazard

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

3 - Installation

This chapter describes the processes used to initially install your SS2100. Once the analyzer arrives, you should take a few minutes to examine the contents of the container before installing the unit.

Endress+Hauser Class I Division 2 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 safety of the analyzer is the responsibility of the installer and the organization he/she represents.

What Should be Included in the Shipping Box

The contents of the crates should include:

- The Endress+Hauser SS2100 analyzer
- A document CD, which includes this manual and other system manuals and documents
- One external serial cable
- Additional accessories or options as ordered

If any of these contents are missing, refer to **"Service"** on page B-19.

Inspecting the Analyzer

Before removing the crate, make sure that analyzer is placed in close proximity to the installation site. Refer to **"Lifting/carrying the analyzer"** on page 3-3.

Remove top and sides of crate and carefully inspect all enclosures for dents, dings or general damage. Inspect the supply and return connections for damage. Report any damage to the carrier.

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

The analyzer may be configured with additional accessories and options. If there is any discrepancy with the order, refer to **"Service"** on page B-19.

Installing the Analyzer

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

- Hardware and Tools for Installation
- Mounting the Analyzer
- Connecting Electrical Power to the Analyzer
- Connecting Electrical Power to the Enclosure Heater
- Connecting the Signals and Alarms
- Connecting the Gas Lines

Hardware and Tools for Installation

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

Hardware

- Mounting hardware (e.g., spring nuts, 3/8 in. x 1-1/2 in. machine screws and nuts)

Bolts or screws used for wall-mounting the SS2100 must be able to support four times the weight of the instrument (approximately 90 to 130 kg or 200 to 300 lbs).

- Stainless steel tubing (Using 1/4 in. O.D. x 0.035 in. wall thickness, seamless stainless steel tubing is recommended)
- 3/4 in. conduit
- 3/4 in. conduit hubs

Additional hardware and materials that may be needed throughout the installation process include:

- Membrane separator filter (if not included)
- Pressure regulator (if not included)
- Source of plant nitrogen gas (4 SCFH) for purge unit(s), if applicable

Tools

- Hand drill and bits
- Tape measure

- Level
- Pencil
- 9/16 in. socket wrench
- 9/16 in. open-end wrench
- Screwdriver

Mounting the Analyzer

The SS2100 is manufactured for wall installations. The analyzer is constructed with four mounting brackets, two on the top of the sampling conditioning system (SCS) cabinet and two on the bottom. Refer to the layout diagrams in Appendix A for detailed mounting dimensions.

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

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

Lifting/carrying the analyzer

Due to the analyzer's size and weight (configurations can weigh approximately 90 to 130 kg [200 to 300 lbs] with Sample System), the use of a forklift, pallet jack, etc. to lift and/or move the analyzer is recommended. If the analyzer is to be lifted by hand, designate multiple individuals and distribute the weight among personnel to avoid injury. Never lift the analyzer by the electronics enclosure. Always carry the load using one of the following points/methods (refer to Figure 3–1 on page 3–4):

- Mounting points
- Support beneath instrument (best used when employing a forklift)

Ensure all equipment used for lifting/moving the analyzer is rated for the weight load.

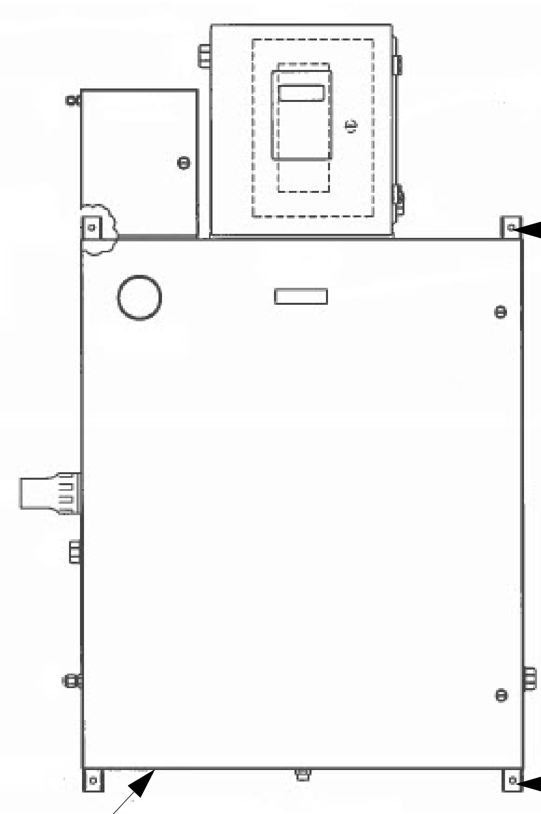


Figure 3–1 *Lifting points for the SS2100 Trace Moisture analyzer*

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 to the fully mounted analyzer. Refer to **"Lifting/carrying the analyzer"** on page 3-3.

Endress+Hauser 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.

2. Locate the mounting holes on your unit. Refer to drawings in Appendix A.
3. 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.

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

Connecting Electrical Power to the Analyzer

Depending on your configuration, your analyzer will be configured for 120 VAC or 240 VAC at 50/60 Hz single-phase input, or optionally for 24 VDC input. Check the rating label to determine the power input requirements. All work must be performed by qualified personnel. Conduit seals should be used where appropriate in compliance with local regulations.

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

The 120 VAC or 240 VAC power option is designed for single phase electric power only. The single pole input fuse protection is not designed for split phase electric power input.

Interconnection of the analyzer enclosure and cell enclosure shall be accomplished using wiring methods approved for Class I, Division 2 hazardous locations as per the Canadian Electrical Code (CEC) Appendix J and the National Electric Code (NEC) Article 501.

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

The electrical power for the SS2100 Trace Moisture analyzer is connected through the conduit hub at the lower right side of the electronics enclosure and the signal wiring is connected through the upper left side of the electronics enclosure. Refer to Appendix A for system drawings.

Units with an enclosure heater will have an additional power connection through a conduit hub located at the bottom right of the heated enclosure (see **“Connecting Electrical Power to the Enclosure Heater”** on page 3-8).

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
- Insulated protective and chassis ground wiring 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 12 AWG (4 mm2)

Color coding

Green-and-yellow insulation shall only be used for:

- Protective earth conductors
- Protective bonding conductors
- Potential equalization conductors for safety purposes
- Functional earth

To connect electrical power to the analyzer

1. Open the SS2100 analyzer electronics enclosure door. Take care not to disturb the electrical assembly inside.

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

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

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

3. Pull power wire and terminate on respective terminals. Refer to the wiring diagrams in Appendix A.

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 should be located in close proximity to the equipment and within easy reach of the operator.

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

4. For AC systems, pull ground, neutral and hot wires into the electronics enclosure.

For DC systems, pull ground, plus and minus wires.

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

6. For 120 VAC or 240 VAC single-phase power connections, attach the wires to the power terminal block by connecting the neutral wire to the terminal marked “NEU” and the hot wire to the terminal marked “F2,” as shown in Figure 3–2. Connect the ground wire to the safety ground terminal marked with the ⏚ symbol.

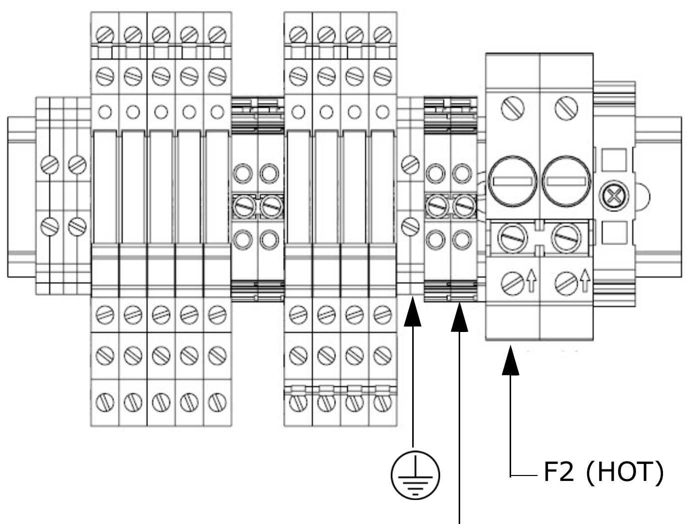


Figure 3–2 *AC single phase (120 VAC/240 VAC) connection terminal block in analyzer electronics enclosure*

Connecting power to F2 also powers solenoids, if included.

For DC systems, connect the minus wire to the terminal marked "-," and the positive wire to the terminal marked "+," as shown in Figure 3–3.

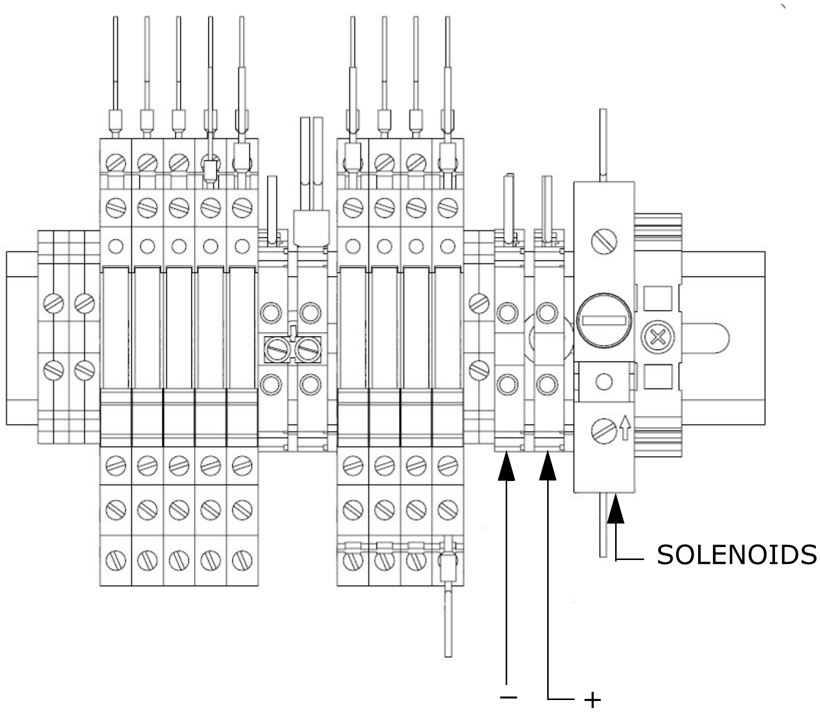


Figure 3–3 *DC connection (24 VDC) terminal block in analyzer electronics enclosure*

7. Close and tighten the analyzer electronics enclosure door.

Field Interface Loads (Solenoid Valves)

The SS2100 must be connected to a certified solenoid having a temperature code of T4 at a maximum ambient temperature of +55 °C (+131 °F).

Connecting Electrical Power to the Enclosure Heater

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

To connect electrical power to the enclosure heater

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

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

2. Open the power terminal box inside the heated enclosure, as shown in Figure 3–4. The black, white brown and green wires are shown for reference.

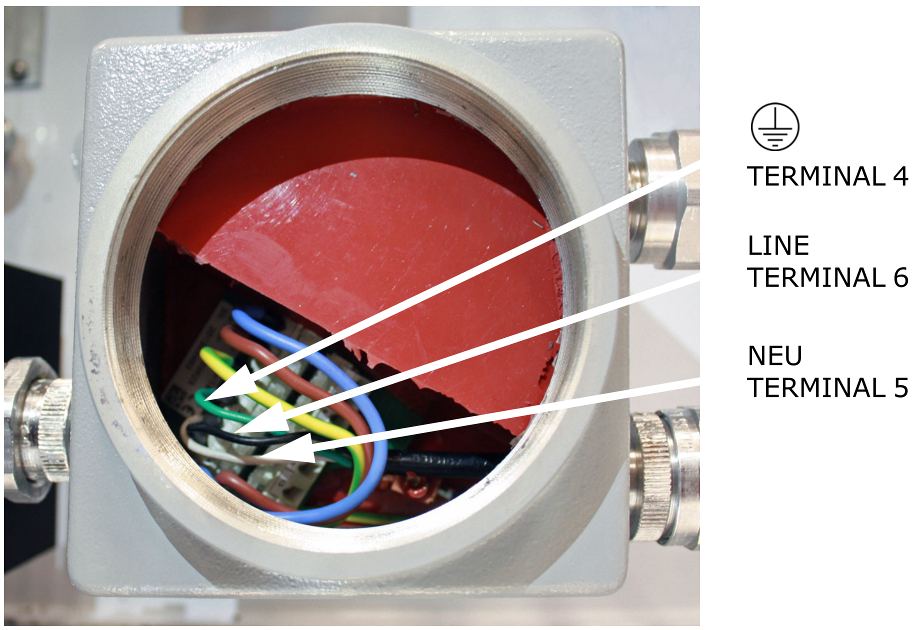


Figure 3–4 *AC connection terminal block for enclosure heater*

3. Run conduit from the power distribution panel to the conduit hub on the lower right side of the heated enclosure labeled for power input. Refer to **"Application of Conduit Lubricant"** on page 3-10.

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

Because the breaker in the power distribution panel or switch will be the primary means of disconnecting the power from the analyzer, the power distribution panel or switch should be located in close proximity to the equipment and within easy reach of the operator. A switch or circuit breaker shall not interrupt a protective earth ground.

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

4. Pull ground, neutral and line (hot) wire (#14 AWG minimum) into the power terminal box inside the heated enclosure.
5. Strip back the jacket and/or insulation of the wires just enough to connect to the power terminal block.
6. Attach the neutral and hot wires to the power terminal by connecting the neutral wire to terminal 5, the line (hot) wire to terminal 6 and the ground wire ⏚ to terminal 4 as shown in Figure 3–4 on page 3–9.
7. Close the power terminal box and latch the heated enclosure door.

Application of Conduit Lubricant

To ensure proper installation, using STL8 lubricant on all conduit screw thread and its taped opening is recommended.

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

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

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 STL8 lubricant on the male threaded surface (at least five threads wide). Refer to Figure 3–5 on page 3–11.

Figure 3–5 *Applying conduit lubricant*

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

Connecting the Signals and Alarms

The 4-20 mA current loop and serial output are connected to a mating terminal block (TB2) located inside the analyzer electronics enclosure (refer to Figure 1–6 on page 1–10 and Figure 1–7 on page 1–11). By default, the 4-20 mA current loop outputs are factory set to source current.

The 4-20 mA current loop output is factory set to source current. To change the 4-20 mA current loop output from source to sink, ***"To change the 4-20 mA board from source to sink"*** *on page 3-15.*

The Assignable Alarm and General Fault Alarm trigger SPDT relays are located inside the analyzer electronics enclosure as shown in Figure 1–6 on page 1–10 and Figure 1–7 on page 1–11. The relay for the Assignable Alarm is configured by default to be the normally de-energized Concentra Low Alarm with the dry contact changing state on alarm. Refer to **"DO Alarm Setup"** in the Description of Device Parameters to change the Assignable Alarm configuration.

The Assignable Alarm output can be wired for OPEN or CLOSED depending on which terminals are used normally open (NO) or normally closed (NC).

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

Connections can be made with customer-supplied cables for the current loops and alarms and factory-supplied cables for the serial connections. Consult the wiring diagram in Appendix A.

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

See Figure 1–6 on page 1–10 and Figure 1–7 on page 1–11 for locating fuses. If you need to replace a fuse, use only the same type and rating of fuse as the original as listed in Table 1–1.

Refer to the Description of Device Parameters for more information on system programming and operation.

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

To connect the signal and alarm cables

1. Disconnect power from the analyzer and open the electronics enclosure cover. Take care not to disturb the electrical assembly inside.

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

2. Run conduit from the signal/alarm receiving station to the conduit hub in the upper left-hand corner of the electronics enclosure labeled for signal input/output. Refer to **“Application of Conduit Lubricant”** on page 3-10 and to the analyzer drawings in Appendix A.

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

3. Pull the customer-supplied cables for the current loop, alarms, digital input, Ethernet and the serial cable serial cable through the conduit into the electronics enclosure. (No connections are required for the analyzer to run and function properly. Only make connections for signals that will be used for communication with the analyzer.)

The external serial cable included in the shipping container is provided for service and troubleshooting purposes and is not intended for permanent installation.

4. Strip back the jacket and insulation of the current loop output and serial cables just enough to connect to the mating terminal block, shown in Figure 3–6. The mating terminal block can be pulled up and removed from its base to make the cable connection process easier.

TB2

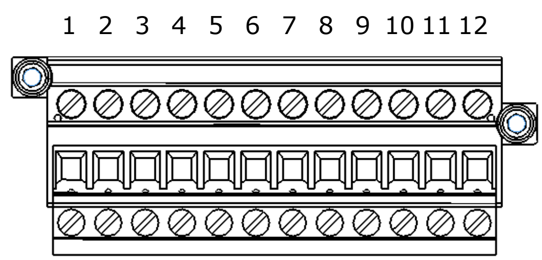


Figure 3–6 *Mating terminal block (TB2) in electronics enclosure for connecting signal cables*

5. Connect the 4-20 mA current loop output wires to the appropriate terminals, as indicated in Table 3–1.
6. Connect the serial cable wires to the appropriate terminals according to Table 3–1 on page 3–14. For reference, Table 3–1 also shows the corresponding pin numbers for configuring a nine-pin Sub-D connector for connection to a computer serial port.
7. Re-insert the mating terminal block into its base and verify that each connection is secure.
8. Strip back the jacket and insulation of the alarm cables just enough to connect to the alarm relays.
9. Connect the cable for the General Fault Alarm to the common and normally open (NO) terminals on the corresponding relay shown in Figure 1–6 on page 1–10 or Figure 1–7 on page 1–11.
10. Connect the cable for the Assignable Alarm to the common and NO or normally closed (NC) terminals (for OPEN or CLOSED, respectively, when activated) on the corresponding relay shown in Figure 1–6 on page 1–10 or Figure 1–7 on page 1–11.

Table 3–1 *Input/output signal connections*

Terminal	Description	D-Conn	Color
1	Serial RX	Pin-3	Black
2	Serial TX	Pin-2	Red
3	COM Serial Ground	Pin-5	Shield
4	N/C		
5	N/C		
6	N/C		
7	Current Loop + (CH A)		
8	Current Loop - (CH A)		
9	Current Loop + (CH B)		
10	Current Loop - (CH B)		
11	Digital Input		
12	Digital Input		

NOTE: N/C = No connection

11. Close and tighten the electronics enclosure cover.

12. To complete the connections, connect the other end of the current loop wires to a current loop receiver, the external serial cable to a serial port on your computer and the alarm cables to the appropriate alarm monitors.

Changing the 4-20 mA Current Loop Mode

*Changing of the current loop mode may negate specific hazardous area certifications. Contact **"Service Repair Order"** on page B-19 for details.*

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

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

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

1. Disconnect power from and open the electronics enclosure cover. Take care not to disturb the electrical assembly inside.
2. Locate the relay control board in the upper right of the electronics enclosure, as shown in Figure 1–6 on page 1–10 or Figure 1–7 on page 1–11.
3. Remove the jumper (JMP1), shown in Figure 3–7, connecting the center hole to point "A."

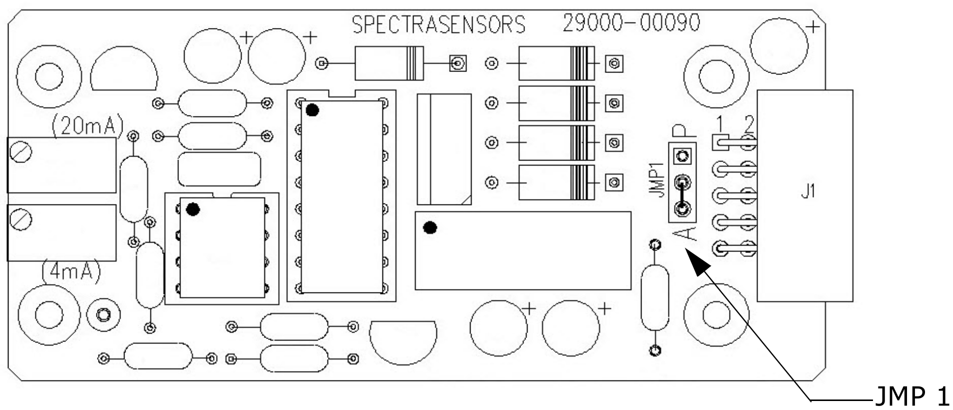


Figure 3–7 *Analyzer 4-20 mA board*

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

Needle nose pliers may be required to remove the jumper.

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

Calibrating the analog output

1. Connect a calibrator and digital multi-meter into the circuit.
2. On the analyzer keypad, press **#2** (**Mode 2**), the password (3142) and *.

3. Continue pressing the * key until the **4-20 mA Test** parameter displays.

```
<SET PARAMETER MODE>
AO 4-20 mA Test
0.00000
Enter a value (%)
```

4. Enter the desired percentage of full scale and press *.
   a. Set 4-20 mA Test = 0; this displays the 4 mA on the AO circuit when **#5** (**Mode 5**) is pressed.
   b. Set 4-20 mA Test = 50; this displays the 12 mA on the AO circuit when **#5** is pressed.
   c. Set 4-20 mA Test = 100; this displays the 20 mA on the AO circuit when **#5** is pressed.

Testing and adjusting the 4-20 mA zero and span

1. Press **#5** (**Mode 5**) and note the **4-20 mA Test** parameter setting displayed on the analyzer.

```
<TEST 4-20MA MODE>

4-20 mA output is at
0.0% or 4.0mA
```

2. Adjust the potentiometers on the end of the board to change the zero and span readings. Refer to Figure 3–7 on page 3–15.
3. Press **#** and **1** to return to Normal Mode.

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

Connecting the Gas Lines

Once you have verified that the analyzer is functional and that the analyzer circuit is de-energized, you are ready to connect the sample supply, sample return, and instrument air supply gas lines. Consult the drawings in Appendix A for guidance.

All work must be performed by technicians qualified in pneumatic tubing.

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

Using coated 1/4 in. O.D x 0.035 in. wall thickness, seamless stainless steel tubing is recommended. Refer to Appendix A for supply and return port locations.

Instrument air

Specific ventilation may be required depending on application and analyzer configuration. For example, if air-operated valves are used in the analyzer, they should be supplied with instrument air or nitrogen filtered with a 5 micron particulate filter. If there is lubrication oil, aerosols or other liquids in the air, these must be removed using an appropriate coalescing filter. Pressure should be set within the range indicated on the analyzer tag at the instrument air inlet. Refer to the specifications and system drawings in Appendix A. If no setting is listed, pressure should be maintained between 65 PSIG and 150 PSIG.

There are no special requirements for ventilation of the analyzer.

Refer to Appendix B for more information related to maintenance or troubleshooting.

To connect the sample supply line

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

Consult sample probe manufacturer instructions for proper installation procedures.

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

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

2. Also, confirm that the field pressure reducing station is installed properly at the sample probe and that the pressure regulator at the

field pressure reducing station is closed (adjustment knob turned fully counterclockwise).

3. Check that the relief valve vent line is properly installed from the field pressure reducing station to the low pressure flare or atmospheric vent connection.
4. Determine appropriate tubing route from the field pressure reducing station to the SCS.
5. Run stainless steel tubing from the field pressure reducing station (set for the specified supply pressure, refer to the drawings in Appendix A) to the sample supply port of the SCS.
6. Bend tubing using industrial grade benders and check tubing fit to ensure proper seating between the tubing and fittings.
7. Fully ream all tubing ends. Blow out the line for 10 to 15 seconds with clean, dry nitrogen or air prior to making the connection.
8. Connect the sample supply tube to the SCS using the 1/4 in. stainless steel compression-type fitting provided.
9. 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.
10. Check all connections for gas leaks. Using a liquid leak detector is recommended.

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

To connect the sample returns

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

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

2. Determine appropriate tubing route from the SCS to the low pressure flare or atmospheric vent header.
3. Run stainless steel tubing from the sample return ports to the low pressure flare or atmospheric vent header connection.
4. Bend tubing using industrial grade benders and check tubing fit to ensure proper seating between the tubing and fittings.

5. Fully ream all tubing ends. Blow out the line for 10 to 15 seconds with clean, dry nitrogen or air prior to making the connection.
6. Connect the sample return tubes to the SCS using the 1/4 in. stainless steel compression-type fittings provided.
7. Tighten all new fittings 1-1/4 turns with a wrench from finger tight. For connections with previously swaged ferrules, thread the nut to the previously pulled up position, then tighten slightly with a wrench. Secure tubing to appropriate structural supports as required.
8. Check all connections for gas leaks. Using a liquid leak detector is recommended.

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

Conditioning the SCS Tubing

Newly installed systems invariably have some trace contaminants and/or are intended for measuring trace amounts of gas constituents that tend to cling to system walls resulting erroneous readings if the constituents are not in equilibrium with the system walls. Therefore, once the analyzer and SCS are completely connected, the entire system (i.e., from the sample source valve to the vent or return) should be conditioned by flowing sample gas through the system for up to 12 hours (or until the reading stabilizes) after the system is powered up and before actual readings are taken. Progress of the system conditioning can be monitored via the gas concentration readings. Once the gas constituents have reached equilibrium with the system walls, the readings should stabilize. For more information on the sample conditioning system, refer to **"Sample Conditioning System"** on page 4-1.

Heat trace bundle sleeve (optional)

The heat trace bundle sleeve, manufactured by others, is an option for the Endress+Hauser analyzer. Refer to Figure A–7 on page A–9 and Figure A–9 on page A–11.

The following is provided if heat trace is ordered for the analyzer SCS:

- A bundle sleeve for the heat trace bundle to enter the SCS.
- A conduit hub to allow the heat trace cable to be routed to the exterior of the SCS enclosure for power connection.
- A 1/4 in. tube bulkhead to interconnect the tube in the bundle to the SCS.

The customer is responsible for installing the heated tube bundle according to the heat trace bundle sleeve manufacturer's instructions.

All electrical connections must be made in a junction box supplied by the customer and installed external to the SCS enclosure per site requirements.

Heated Line Seal Installation

The heat-shrinkable entry seal Model NUS-4X supplied by Endress+Hauser provides a waterproof fitting where the heat trace bundle enters the sample conditioning system (SCS) enclosure. This seal consists of a three-part assembly; a rigid plastic nylon nut, an O-Ring and the heat-shrinkable molded area.

Tools needed

- Spanner wrench
- Heat gun
- RTV sealant
- Cable cutter

Use the following instructions to install this seal.

1. From the inside of the enclosure, place the rigid plastic nylon threaded nut through the access hole to the exterior so that the nut flanged end is up against the inside of the enclosure.
2. From the outside, place the O-Ring over the nut threaded end and position against the enclosure.
3. Screw the shrinkable, internally threaded nose onto the rigid nut and tighten using an appropriate sized spanner wrench.

Inserting the heat trace bundle

Refer to the manufacturer's website for information on inserting the heat trace bundle.

4 - Sample Conditioning System

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

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

About the SCS

The Sample Conditioning System (SCS) has been specifically designed for the application to deliver a vapor sample free of particulates and liquids to the analyzer that is representative of the process. The SCS is also designed to deliver a vapor sample at the optimal temperature, pressure and flow rate to the measurement cell. To ensure the integrity of the measurement, personnel operating or maintaining the analyzer must have a thorough knowledge of the design and function of the SCS.

Most problems experienced with sample systems result from operating the system outside of its design conditions. Process upsets, unknown or unexpectedly high concentrations of liquids or particulate contaminants, high or low sample pressures or temperatures can cause excessive maintenance, failure of the SCS, or damage to the analyzer measurement cell. By understanding the function and limitations of each component in the SCS, and performing regular monitoring of the system function, most problems can be avoided or diagnosed and corrected to ensure successful normal operation.

Typical SCS Component Overview

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

Some of the typical components used in the SCS will be described in this section. Please refer to Appendix A for system drawings for your analyzer configuration.

*For questions regarding your SCS, please contact Endress+Hauser Service. Refer to **“Service”** on page B-19.*

Sample Conditioning System Filters

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

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

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

Sample Transport Tubing

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

Sample Bypass Flow Control

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

SCS Pressure Regulator

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

Sample Flow Controller

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

Sample Dryer

All trace measurement applications require the use of a dryer. Typically, these devices are switched into the flowing sample going to the measurement cell to remove the trace moisture component. A spectrum of the sample gas free of H_2O is acquired and saved in the analyzer controller memory. This is the "Dry" spectrum. The dryer is then bypassed and the sample spectrum is acquired with H_2O in the sample. This is the "Wet" spectrum. The analyzer controller subtracts the Dry spectrum from the Wet spectrum and the concentration of trace moisture is measured. The same Dry spectrum is typically used for 10 to 30 minutes, depending on logic programmed into the controller before a new Dry spectrum is acquired.

The automatic valves that control switching the sample stream into the dryer or bypassing the dryer are pneumatically operated valves.

Validation Systems

System validation is accomplished in the SS2100 Trace Moisture analyzer by the use of a permeation device. Refer to **"Permeation Validation"** on page 5-1.

Sample Return/Vent

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

SCS Heaters

All trace gas measurement analyzers have heated SCS enclosures. One reason for this is to avoid condensation of sample components. In cases such as trace measurements, temperature stability of the sample measurement cell is critical to the measurement. In these applications, the temperature control is very precise and a PID temperature controller is used to maintain very close tolerance on the temperature of the system.

To start up the heated trace SCS

1. Energize power to the SCS and allow it to warm up to a level close to the SCS sample temperature setpoint.
2. Start the sample flow.
3. Allow the system temperature to stabilize for a **minimum of 5 - 8 hours**, preferably overnight.

4. Energize power to the analyzer controller and ignore any error messages that are seen on the display during the temperature stabilization period.
5. Once the analyzer has been allowed to thermally stabilize, be sure to enable Peak Tracking and any other software features as directed in the Description of Device Parameters.

Checking the SCS Installation

The integral SCS is factory set with the appropriate pressures, flow rates, and enclosure temperature, as indicated in the drawings referenced in Appendix A. However, before operating the system for the first time, a careful check of the installation of the entire SCS from the sample probe to the flare/vent is recommended. Purging the transport line to confirm that no dust, particulates or liquids were trapped during installation is recommended.

To perform SCS installation checks

1. If a sample probe is used with the system, confirm that the sample probe is correctly installed at the process supply tap and that the sample probe isolation valve is closed.
2. If a field pressure reducing station is used with this analyzer, confirm that the field pressure reducing station is installed properly at the sample probe.

An optional sample probe and/or field pressure reducing station may be provided by Endress+Hauser or through a third party. This is not included in a standard configuration.

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

8. Confirm that the low pressure flare or atmospheric vent is properly connected, if applicable.
9. Confirm that the analyzer house atmospheric vent is properly installed.
10. Confirm that all sample system tubing has been thoroughly leak checked.

Starting Up the SCS

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

To prepare for SCS startup

1. Confirm that all AC power switches for the analyzer and SCS are off.
2. Apply power to the electric-traced sample transport tubing at the tracer control system.

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

3. If applicable, confirm that the sample supply line electric tracer temperature controller at the tracer control system is set to the temperature specified on the drawings in Appendix A and that the sample supply line tracer is heating to the appropriate temperature.
4. Confirm that the sample probe isolation valve is closed.
5. Confirm that the pressure regulator at the field pressure reducing station is closed (adjustment knob turned fully counterclockwise).
6. Confirm that all sample system shut-off valves are closed.

*Please refer to **"Permeation Validation"** on page 5-1 for additional information.*

7. Confirm that the sample bypass and analyzer flow meter control valves are gently closed (adjustment knob turned clockwise).

Do not overtighten the control valves or damage could occur.

To start up the field pressure reducing station

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

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

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

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

To start up the sample bypass stream on process sample

1. Ensure the low pressure flare or atmospheric vent header shut-off valve is opened for the bypass flow effluent from the SCS.
2. Open the sample supply shut-off valve.
3. Open the bypass flow meter control valve to establish sample flow from the sample probe and set the flow meter control valve to the specified value. Refer to Figure A–2 on page A–4 and Figure A–7 on page A–9.
4. Confirm that the sample supply pressure under flowing conditions is set to the approximate specified pressure. Refer to the sample drawings in Appendix A.

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

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

To start up the analyzer on process sample

This procedure can be completed during the system warm-up process.

1. Ensure the low pressure flare or atmospheric vent header shut-off valve is opened for the sample flow effluent from the SCS.
2. Open the cell supply and cell return shut-off valves. Refer to Figure 4–1 below.

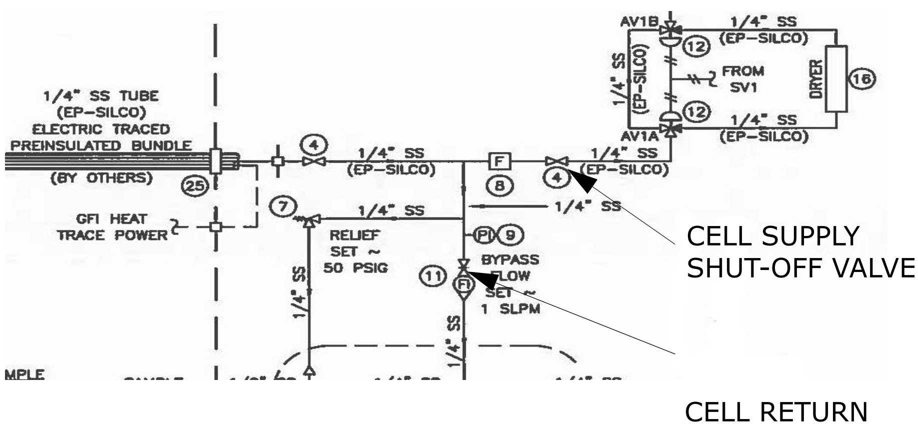


Figure 4–1 *Cell supply and cell return shut-off valves*

*DO NOT adjust the pressure regulator, flow controllers or temperature of the sample conditioning system (SCS) if red-tagged or the calibration of the validation flow will be lost. If you suspect the settings of the sample conditioning system have been altered, refer to **"Service"** on page B-19.*

3. If required, adjust the sample pressure regulator to the specified setpoint for each measurement cell.

4. If required, adjust the sample flow meter control valve(s) to the specified flows for the measurement cells.
5. Confirm the sample bypass flow and readjust the control valve to the specified setpoint, if necessary. The SCS is now operating with the process sample.
6. Power up the analyzers according to the procedure provided under **"To power up the analyzer"** in the Description of Device Parameters.
7. After sufficient warm-up time, confirm that the sample system enclosure is heated to the specified temperature by observing the temperature reading on the analyzer display.

To start up the sample system heater

1. Turn on AC power to the sample system heater. The system door should remain closed during the entire start-up procedure.
2. Monitor the SCS enclosure thermometer during the warm-up period for **5-8 hours** to confirm that the sample system enclosure temperature does not exceed 149 °F (65 °C).

Allow the system a ***minimum of*** **5-8 hours** *(preferably overnight) to ensure stabilization. During this time, the system will display a variety of alarms - this is normal. If the alarms do not resolve themselves by the end of the warm-up period, refer to the Description of Device Parameters for reset instructions. If assistance is still needed, contact Service. Refer to* ***"Service"*** *on page B-19.*

If the SCS enclosure temperature exceeds 149 °F (65 °C), damage to the system could occur. ***Shut down the system immediately****.*

The entire analyzer system is calibrated for operation at the enclosure temperature specified. Measurements should be considered valid only when the enclosure is at the specified temperature.

Shutting Down the SCS

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

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

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

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

To isolate the measurement sample cell for short-term shutdown

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

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

1. Close the sample flow meter control valve(s) (adjustment knob turned clockwise) for each measurement channel. Do not over-tighten the control valve(s) or damage could occur.
2. Close the cell supply and cell return shut-off valves. Refer to Figure 4–1 on page 4–7.
3. Allow any residual gas to flow out of the measurement cells.

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

4. Close the bypass supply shut-off valve. Refer to Figure 4–1 on page 7.

If the system will not be out of service for an extended period, it is advised that power remain applied to the sample transport line electric tracer and the sample system enclosure heater.

To isolate the SCS for short-term shutdown

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

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

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

1. Isolate the analyzer from the bypass following the procedure under **"To isolate the measurement sample cell for short-term shutdown"** on page 4-9.
2. Close the sample supply shut-off valve to the SCS.
3. Allow the sample bypass to flow until all residual gas has dissipated from the lines as indicated by no flow on the sample bypass flow meter.
4. Close the low pressure flare or atmospheric vent header shut-off valve for the effluent from the sample return.
5. Turn off power to the analyzer.

If the system will not be out of service for an extended period, it is advised that power remain applied to the sample transport line electric tracer and the sample system enclosure heater.

To isolate the process sample tap for long-term shutdown

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

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

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

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

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

11. Turn off the AC power to the SCS heater and the sample tracer at the power distribution panel.

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

To purge the analyzer for shipment/relocation

If the analyzer is configured for differential measurements, purge the system with power "on" to ensure dry and wet portions of SCS are properly purged.

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

Periodic SCS Maintenance

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

The status of the SCS should be checked regularly to confirm proper operation (pressures, flows, etc.) and detect potential problems or failures before damage occurs. If maintenance is required, isolate the part of the system to be serviced by following the appropriate procedure under **"Shutting Down the SCS"** on page 4-8.

All filter elements should be checked periodically for loading. Obstruction of a filter element can be observed by a decreasing supply pressure or bypass flow. If loading of a filter is observed, the filter should be cleaned and the filter element replaced. Refer to **“To check filters”** on page 4-14 and **“Replacing the Filter”** on page B-5 for instruction. After observation for some time, a regular schedule can be determined for replacement of filter elements.

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

Preventive and Demand SCS Maintenance

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

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

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

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

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

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

Regular SCS Status Check

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

Do not leave the SCS door open any longer than absolutely necessary. Endress+Hauser recommends <u>no more than 60 seconds</u>. Opening the door may affect the temperature reading until the temperature is stabilized.

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

To check filters

1. Shut down the system following the procedure in **"Shutting Down the SCS"** on page 4-8.
2. Inspect, repair or replace the filter as required. Refer to **"Replacing the Filter"** on page B-5.

For additional information, contact Service. Refer to ***"Service"*** *on page B-19.*

3. Restart the system following the procedure in **"Starting Up the SCS"** on page 4-5.

Heat trace bundle sleeve (optional)

The Heat Trace Bundle Sleeve, manufactured by others, is an option for the Endress+Hauser analyzer. Refer to Figure A–9 on page A–11.

Removing the heat trace bundle

If heat trace has been installed for the analyzer SCS:

1. Turn off external power to the heat trace bundle.
2. Disconnect the heat trace bundle wiring at the customer provided junction box.
3. Carefully remove the heat trace bundle from the SCS cabinet.

5 - Permeation Validation

The permeation rate and resultant water content of the validation flow have been carefully calibrated at the factory (refer to Appendix A for the calibrated output of the validation flow). DO NOT adjust the pressure regulator, flow controllers or temperature of the sample conditioning system (SCS) if red-tagged or the calibration of the validation flow will be lost. If you suspect the settings of the sample conditioning system have been altered, refer to ***"Service"** on page B-19.*

Validation Method

Endress+Hauser uses a permeation validation system to validate low moisture measurements.

Permeation validation systems provide a convenient and reliable method of validating the performance of the analyzer, without the need for elaborate blending systems and certified standards that might be impossible to obtain in the field. The analyzer accuracy and repeatability is not based on, certified or tested using the installed permeation device, however. Endress+Hauser has found that permeation devices generally do not generate more stable, repeatable or accurate trace moisture mixes than the dynamic dilution stations used in our factory to calibrate the analyzer.

Permeation Validation for Trace Moisture (0 to 10 ppm H_2O) Analyzers

The concentration measured during calibration, C_p, is related to the certified permeation rate of the device, R_p, by a system constant, K_p, using the equation:

$$K_p = C_p/R_p$$

This equation requires that the following conditions be met:

- Sample temperature is stable and equal to the temperature at calibration
- Sample flow is stable and equal to the flow at calibration
- Sample pressure at the permeation device is stable and equal to the pressure at calibration

*Due to the required conditions, the sample flow pressure regulator, flow control valve and needle valve are factory set and should not be adjusted in the field. The flow components in the sample system are marked with red tags and the message: **FACTORY SET - DO NOT FIELD ADJUST**. The components have been set to give the required flow rate at the conditions described in the drawings provided with the analyzer. Changing any of these settings voids the certification of the permeation system and changes the measured concentration during validation.*

The sample flow meters are NOT intended to be used for setting the flows in the field. The measurement accuracy of the flow meters is not sufficient to reproduce the factory flow rates in the event the flow rates are inadvertently changed or require a change.

Setting the K_p value

The system constant Kp is determined at the factory when the analyzer is calibrated. Using the system constant, the permeation device can be replaced with another permeation device using a different permeation rate, and the correct new permeation concentration will be calculated by the analyzer software. The system constant Kp will be consistent over the life of the analyzer provided the temperature, sample flow rate and pressure of the system are not changed from the factory settings. Refer to the Description of Device Parameters for information on calculating and resetting the Kp value.

Validation of Trace Moisture Measurements Using Permeation Devices

For trace moisture systems, Endress+Hauser employs a patented G-CAL® permeation tube.

The permeation device is designed to continuously release a fixed rate of analyte, approximately 2000 ng/min at 50 °C. Refer to Figure 5–1 on page 5–3 for a schematic diagram of the permeation tube. The analyte released is continuously mixed with the dry process gas at 3000 sccm during validation mode (refer to settings for **Mode 7** in the analyzer Description of Device Parameters). This will result in a calibration mixture of C_p in parts per million (ppm) by volume, as long as return pressure is at atmospheric pressure.

The permeation device connects to a "T" assembly between port 6 and 3 of the six-way valve (refer to Figure 5–2 on page 5–4). During normal operating conditions, a portion of the process gas return from the sample cell flows through one end of the "T" and carries the excess moisture or analyte released from the permeation assembly back to vent. When the system is switched to

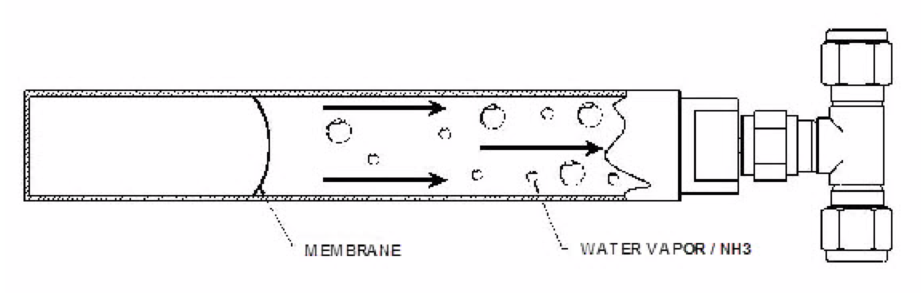


Figure 5–1 *Schematic of permeation tube*

validation (refer to settings for **Mode 7** in the analyzer Description of Device Parameters), the six-way valve changes positions allowing the dry process gas (flowing at
3000 sccm) through the "T" in the opposite direction, carrying the mixed gas into the sample cell.

The concentration of pollutant obtained in ppm by volume may be computed using the following formula:

$$C = \frac{KxP}{F}$$

K (Water) = 1.358

where:

- C = concentration of ppm in volume
- F = carrier gas flow rate in ML/minute at 1atm and 25C
- P = permeation rate of the G-CAL assembly in nanograms/minute at the temperature of the G-CAL (environment temperature)

The entire flow system is maintained at constant elevated temperature (typically 50 °C to 60 °C or 122 °F to 140 °F).The constant temperature not only minimizes species adsorption/desorption and prevents condensation, but in combination with the regulated sample supply pressure and controlled flow rates, ensures a constant mixture of C_p in parts per million (ppm) by volume.

The entire analyzer system is calibrated for operation at the enclosure temperature and sample flow rate specified. Measurements should be considered valid only when the enclosure is at the specified temperature and sample flow rate. After opening the sample system enclosure door to check settings, allow at least 1 to 2 hours for the temperature to re-stabilize before validating.

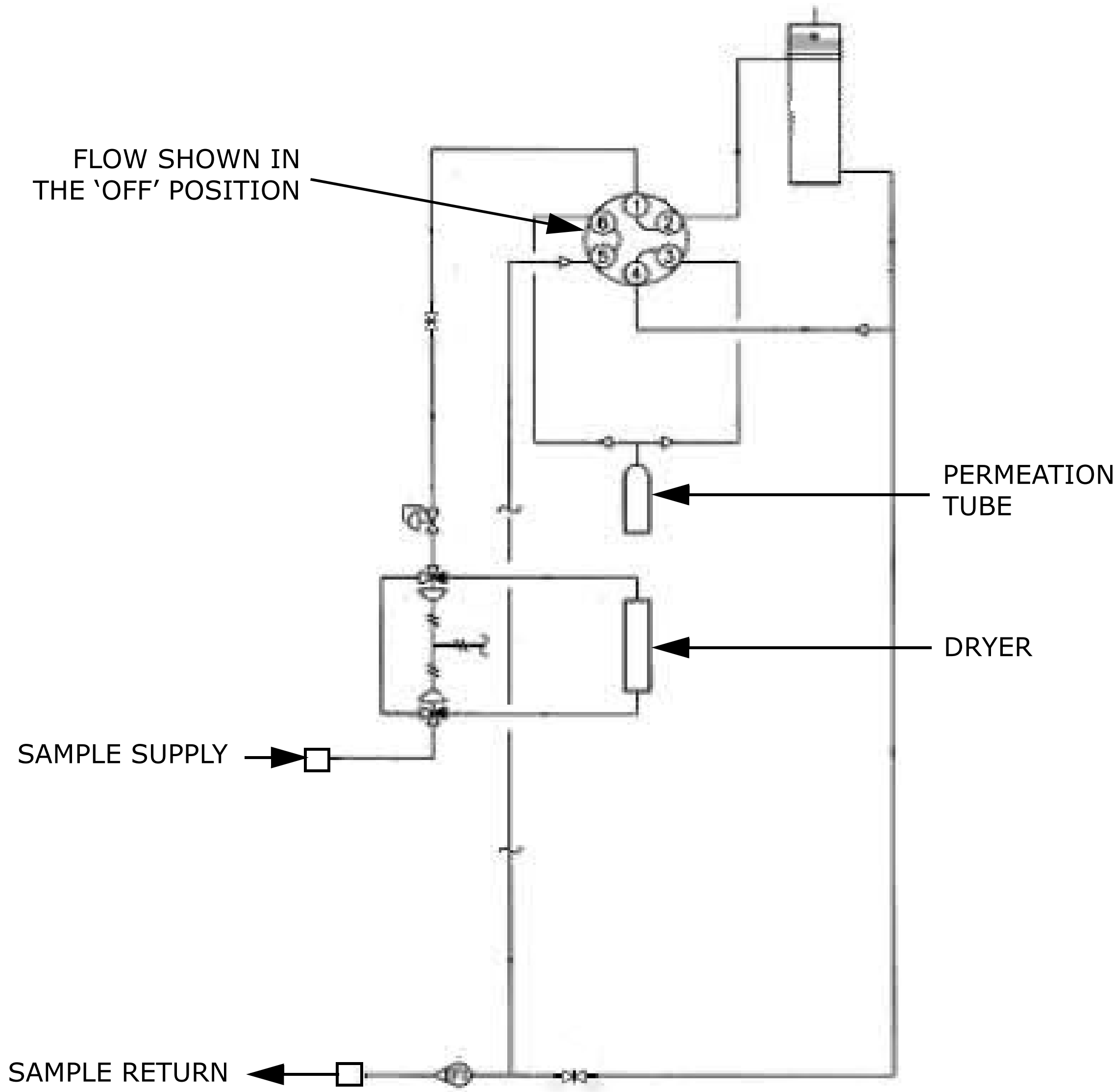


Figure 5–2 *Typical sample system for differential measurement with permeation tube validation capability*

Replacing the Permeation Device

The permeation device has a certification period of one year. The device may be used longer than this period if a factory certified validation concentration (C_p) is not required. Over time the permeation tube will lose the water contained inside and the validation concentration will begin to drop steadily. At this point, the permeation tube must be replaced.

To replace the permeation device

1. Open the SCS door and block in the sample flow using the diaphragm valve upstream of the dryer.

The flow through the sample bypass may be maintained, if desired.

2. While watching the cell flow meter, allow all flow to come to zero.
3. Block in the sample cell vent to prevent backflow into the cell and permeation device.
4. Loosen the connections on the inlet and outlet of the permeation device.
5. Remove the permeation device.
6. Install the new permeation device, carefully tightening the connections once in place.

Make a note of the permeation rate in ng/min (Rp) shown in the vendor certification provided with the permeation device.

7. From the analyzer keypad, press **#2**, enter the customer password (3142) and press the ***** key.
8. Continue pressing the ***** key until the Val Perm Rate R_p parameter displays.
9. Enter the new R_p and press *****.

*If recalculation is required, refer **"To recalculate the system constant"** in the Description of Device Parameters.*

10. Press **#1** to return to Normal Measurement Mode.
11. Open the cell vent valve.
12. Open the sample inlet valve.
13. Close the SCS door.

The sample system will require ***5 to 8 hours*** *to stabilize the temperature of the new permeation device. Endress+Hauser does NOT recommend validating the analyzer during the temperature stabilization period. New permeation devices may take up to 21 days to fully stabilize the validation concentration. It may be necessary to increase the Validation Allowance parameter setting during this period to prevent Validation Fail alarms. Refer to the parameter settings in the firmware operations chapter of the Description of Device Parameters for instructions. If a stable validation concentration is not reached within 21 days, please contact Service, refer to* ***"Service"*** *on page B-19.*

Permeation Device Storage

The permeation device should be stored in a sheltered environment that is temperature controlled above -0 °C (32 °F), and should not be exposed to direct sun, rain, snow, condensing humidity or corrosive environments.

Appendix A: Specifications

Table A–1 *SS2100 trace moisture analyzer specifications*

Performance	
Concentration [1]	Refer to Calibration Report
Repeatability	Refer to Calibration Report
Measurement Update Time	Typically less than 20 seconds
Periodic Scrubber Cycle Duration [2]	90 seconds
Application Data	
Environmental Temperature Range/Sample Cell Temperature Range	-20 °C to 50 °C (-4 °F to 122 °F) 10 °C to 60 °C (14 °F to 140 °F) — *Optional*
Heated SCS Enclosure Temperature	50 °C (122 °F) 60 °C (140 °F) — *Optional*
Permeation Device Storage	Temperature controlled above -0 °C (32 °F) No exposure to direct sun, rain, snow, condensing humidity or corrosive environments
Sample Inlet Pressure	207 kPaG (30 PSIG) to panel
Cell Pressure Range	800 to 1200 mbar 950 to 1700 mbar — *Optional*
Sample Flow Rate [2]	0.5 to 4 SLPM (0.02 to 0.1 SCFM)
Electrical & Communications	
Input Voltages [3]	120 or 240 VAC ±10%, 50 to 60 Hz, 260W (2 power connections) — *Standard* 18 to 24 VDC, 1.6 A maximum + 200 W AC Heater power — *Optional*
Maximum Current	2 A maximum at 120 VAC 1 A maximum at 240 VAC 1.6 A maximum at 24 VDC
DO Contact Rating (Inductive Load)	250 VAC, 3 A N.O. contact, 1.5 A N.C. contact 24 VDC, 1 A N.O. and N.C. contact
Communication	**Analog**: (2) isolated 4-20 mA output, 1200 ohms at 24 VDC maximum **Serial**: RS-232C and Ethernet **Protocol**: Modbus Gould RTU, Daniel RTU or ASCII
Digital Output	Quantity 5: Concentration Alarm, General Fault, Validation Fail [2], Validation 1 Active [2] and Validation 2 Active [2]
LCD Display	Concentration, cell pressure, temperature, diagnostics

1. Consult Sales for alternative ranges.
2. Application dependent.
3. Supply voltage not to exceed ±10% of nominal. Transient over-voltages according to Over Voltage Category II.

Table A-1 *SS2100 trace moisture analyzer specifications (Continued)*

Physical Specifications	
Size (typical) [1]	(1285 mm H x 600 to 920 mm W x 394 mm D) with Sample System (50.6 in. H x 24 to 36 in. W x 15.5 in. D)
Weight (typical) [1]	90 to 130 kg (200 to 300 lbs) with Sample System
Electronics and Sample System Enclosure	Built with NEMA 4X 304 or 316L stainless steel enclosure
Sample Cell Construction	316L Series polished stainless steel — *standard*
Area Classification	
Analyzer with Sample Conditioning System (SCS)	Class I, Division 2 Group A, B, C, D T3 / T3C Class I, Zone 2 IIC T3 / T3C Type 4X, IP66

1. Application dependent.

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

Configurations requiring optional accessories, e.g., probe assemblies, with specific characteristics must meet manufacturer specifications.

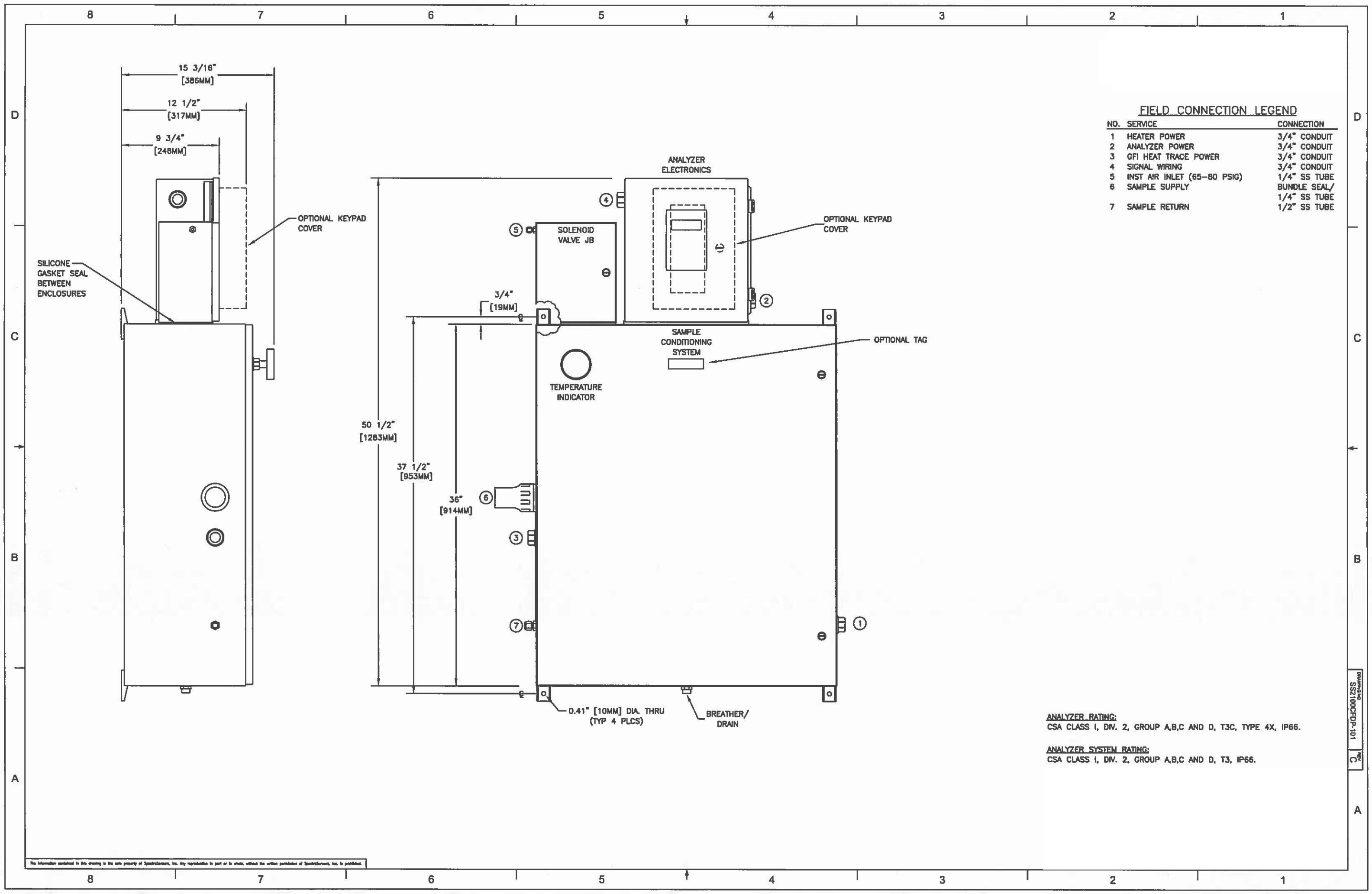


Figure A–1 *Outline schematic (front view) of SS2100 for trace moisture analyzer (solenoids to side of electronics)*

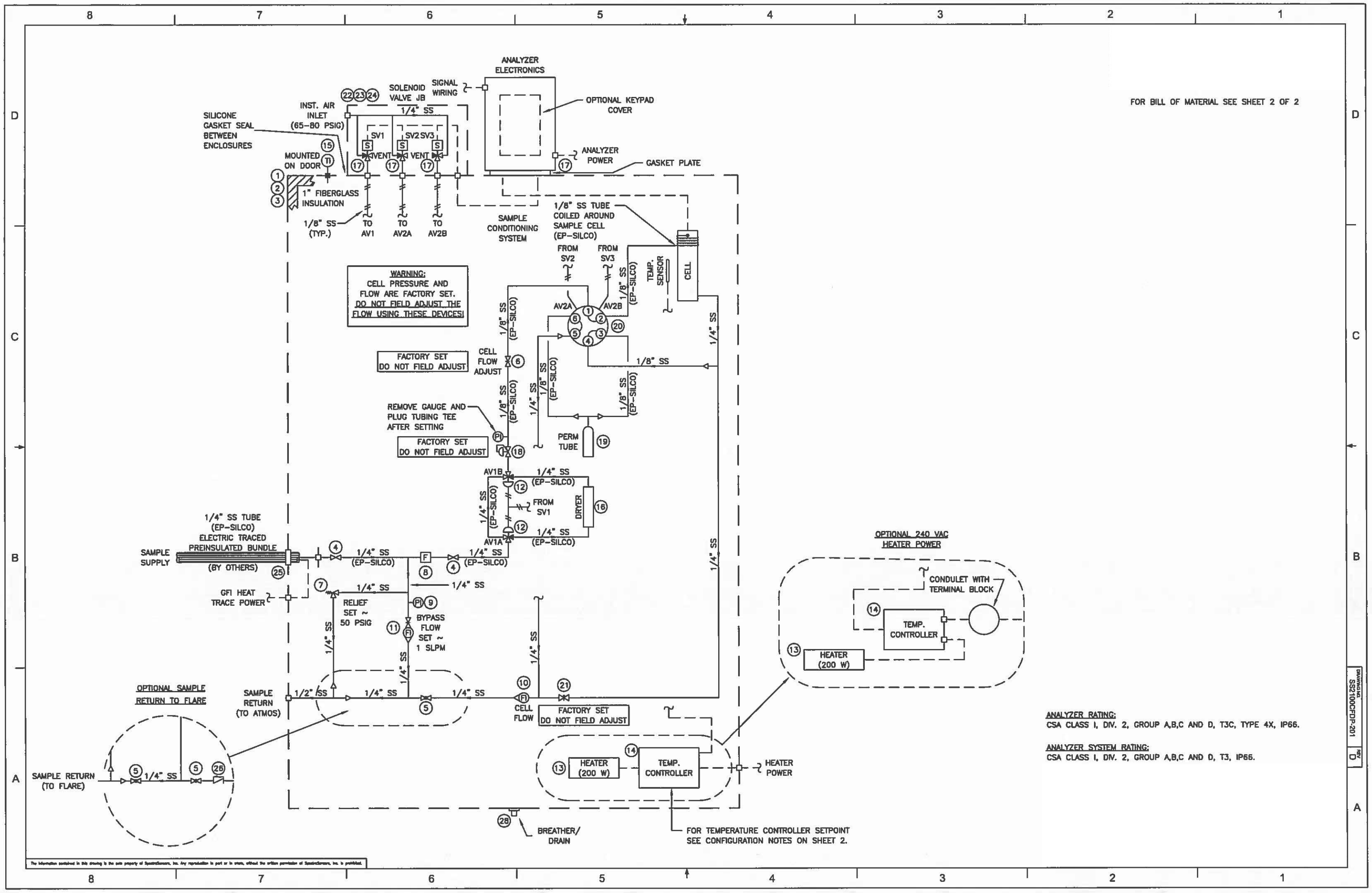


Figure A–2 *Flow schematic of SS2100 for trace moisture analyzer (solenoids to side of electronics)*

SOV VOLTAGE BASED ON POWER SUPPLIED TO ANALYZER ELETRONICS

SEE CONFIGURATION NOTES

BILL OF MATERIALS

AIR ACTUATED VALVE DIFFERENTIAL/1–PT AIR ACTUATED VALVE VALIDATION (50°C AMBIENT)

(SEE SHT 1)

	ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NO.	SSI PART NO.
FOR –1X1X0–4XXXXXX	17	3	SOL. VALVE (3/2 WAY), 120 VAC, 1/8" FNPT (SS)	BURKERT	98124074	6131401004
FOR –2X1X0–4XXXXXX	17	3	SOL. VALVE (3/2 WAY), 240 VAC, 1/8" FNPT (SS)	BURKERT	98123905	6131401003
FOR –3X1X0–4XXXXXX	17	3	SOL. VALVE (3/2 WAY), 24 VDC, 1/8" FNPT (SS)	BURKERT	456658	6131401002

AIR ACTUATED VALVE DIFFERENTIAL/1–PT AIR ACTUATED VALVE VALIDATION (60°C AMBIENT)

(SEE SHT 1)

	ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NO.	SSI PART NO.
FOR –1X2X0–4XXXXXX	17	3	SOL. VALVE (3/2 WAY), 120 VAC, 1/8" FNPT (SS)	ASCO	EFHB8320G041–120/60VAC	6100002778
FOR –2X2X0–4XXXXXX	17	3	SOL. VALVE (3/2 WAY), 240 VAC, 1/8" FNPT (SS)	ASCO	EFHT8320G045–240/60VAC	6100002779
FOR –3X2X0–4XXXXXX	17	3	SOL. VALVE (3/2 WAY), 24 VDC, 1/8" FNPT (SS)	ASCO	EV8314G301	6100002777

CONFIGURATION NOTES:

1. DIGITS IN NUMBER STRING SHOWN CORRESPOND TO OPTIONS SELECTED DURING SYSTEM CONFIGURATION.

   SS2100–XXXXXX–XXXXX–4XXXXXX

   SAMPLE CONDITIONING SYSTEM OPTIONS

2. TEMPERATURE CONTROLLER SETPOINT DETERMINED BY OPTION SELECTED IN CONFIGURATION STRING SHOWN BELOW.

   SS2100–XXXXXX–XXXXX–4XXXXXX

   AMBIENT TEMPERATURE OPTION
   1 = 50° C TEMPERATURE CONTROLLER SETPOINT
   2 = 60° C TEMPERATURE CONTROLLER SETPOINT

SEE CONFIGURATION NOTES

BILL OF MATERIALS

		ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NO.	SSI PART NO.
	FOR –41XXXXX FOR –42XXXXX	1	1	ENCLOSURE (NEMA 4X, SS), 36"X30"X12"	HOFFMAN	CSD363012SS	14005363
		2	1				
		3	1				
	FOR –43XXXXX FOR –44XXXXX FOR –45XXXXX FOR –46XXXXX	1	1	ENCLOSURE (NEMA 4X, 316LSS), 36"X30"X12"	HOFFMAN	CSD363012SS6	1400002166
		2	1	MOUNTING BRACKET KIT (SS)	HOFFMAN	CMFKSS	1400400001
		3	1	MOUNTING PANEL (PAINTED STEEL), 34.2"X28.2"	HOFFMAN	CP3630	1400436300
		4	2	DIAPHRAGM VALVE, 1/4" TF (SS)	SWAGELOK	SS–DLS4	6100002066
	FOR –4XX1XXX	5	1				
	FOR –4XX2XXX	5	2	BALL VALVE, 1/4" TF (SS)	SWAGELOK	SS–42GS4	61303042S4
		6	1	NEEDLE VALVE, 1/8" TF (SS/SULF)	SPECTRASENSORS	6200002498	6200002498
				RELIEF VALVE, 10–250PSIG, 1/4 TF (SS–MTR)	DK TECH	V63–D–4T–L–S	6100002636
				FILTER (TEE–TYPE), 7 MICRON, 1/4" TF (SS/SULF)	SPECTRASENSORS	6200002203	6200002203
		9	1	PRESS. GAUGE (1.5"), 60 PSIG, 1/8" MNPT (SS)	MCDANIEL	SCL	6200000006
	FOR –4X1XXXX			FLOWMETER (NO VALVE), 6 SLPM, 1/4" FNPT (SS)	KING	74C123G081523830	6100002181
				FLOWMETER (W/VALVE), 2 SLPM, 1/4" FNPT (SS)	KING	74C123G081123810	6134100274
	FOR –4X2XXXX	10	1	FLOWMETER (ARM,NO VLV),6 SLPM,1/4"FNPT (SS)	KING	7101063005A2	6100002410
		11	1	FLOWMETER (ARM, W/VLV),2.6 SLPM,1/4"FNPT (SS)	KING	7101361003A2	6100002373
				AIR–OP VALVE (3–WAY), 1/4" TF (SS)	SWAGELOK	SS–4BY–W4–1C	6100002287
120 VAC, 50° SETPOINT	FOR –41XXXXX FOR –43XXXXX FOR –45XXXXX			HEATER (DIV. 1), 200 W, 120 VAC	INTERTEC	CPA–200T3100–120V	1400402310
				TEMP. CONTROLLER (DIV. 1), SET AT 50°C, 120 VAC	INTERTEC	TC CD E1 S J–50°C HFCI–SC0002	5300002004
120 VAC, 60° SETPOINT	FOR –41XXXXX FOR –43XXXXX FOR –45XXXXX	13	1	HEATER (DIV. 1), 200 W, 120 VAC	INTERTEC	CPA200T3100–120V	1400402310
		14	1	TEMP. CONTROLLER (DIV. 1), SET AT 60°C, 120 VAC	INTERTEC	TC CD E1 S J–60°C HFCI–SC0004	5300002005
240 VAC, 50° SETPOINT	FOR –42XXXXX FOR –44XXXXX FOR –46XXXXX	13	1	HEATER (IECEX/ATEX/CSA), 200 W, 240 VAC	INTERTEC	CP VARITHERM DPA200T340BI–230V	EX5300000008
		14	1	TEMP. CONTROLLER (Z1/D2), SMART, 240 VAC	INTERTEC	TC ATEX D E 01 SJ HFCI–S–0015	EX5300000005
240 VAC, 60° SETPOINT	FOR –42XXXXX FOR –44XXXXX FOR –46XXXXX	13	1	HEATER (IECEX/ATEX/CSA), 200 W, 240 VAC	INTERTEC	CP VARITHERM DPA200T340BI–230V	EX5300000008
		14	1	TEMP. CONTROLLER (DIV 1), DIG, 60°C, 240 VAC	INTERTEC	TC CD E1 S J–60°C HFCI–SC0092	5300002034
		15	1	PT (SS)	REOTEMP	AA–040–1–D43–TG	
				SAMPLE DRYER, 1/4" VCR (SS)	NUPURE	01000–VCR–HC–PF	6101811014
			1	PRESS. REGULATOR, 25 PSIG,1/4"FNPT(SS/SN2000)	NEON CONTROLS	10–221B2–2AF2–SI	6200002582
		19	1	PERM TUBE, H2O, 2036NG/M AT 50C, 1/4" VCR	VICI	GC23–7322–C50–VCR	1300002289
			1	VALVE, ROTARY 6 WAY, 316 SS, 1/8" PORTS	VALCO	AL6UWE	6100002407
		21	1	METERING VALVE, 1/4" TF (316SS)	SWAGELOK	SS–1VS4	6130301VS4
	FOR –41XXXXX FOR –42XXXXX	22	1	ENCLOSURE (NEMA 4X, SS), 10"X8"X6"	HOFFMAN	LHC252015SS	1400002331
	FOR –43XXXXX FOR –44XXXXX FOR –45XXXXX FOR –46XXXXX	22	1	ENCLOSURE (NEMA 4X, 316LSS), 10"X8"X6"	HOFFMAN	LHC252015SS6	1400002340
		23	1	MOUNTING PANEL (PAINTED STEEL), 9.09"X7.13"	HOFFMAN	LP2520	1400002332
		24	1	GASKET, SOLENOID VALVE JUNCTION BOX ENCL.	SPECTRASENSORS	1300002296	1300002296
		25	1	TUBE BUNDLE SHRINK SLEEVE, 2.10" ID	NU–TECH	NUS–4X	6100002161
	FOR –4XX2XXX	26	1	CHECK VALVE, 1/3 PSI, 1/4" TF (SS)	SWAGELOK	SS–4C–1/3	6130504C13
		27	1	GASKET, PLATE, SS2100	SPECTRASENSORS	0900002195	0900002195
		28	1	BREATHER DRAIN, TYPE BE,M25,ZONE1/DIV1	HLS	BE.25.S.NT	EX1300000036

ANALYZER RATING:
CSA CLASS I, DIV. 2, GROUP A,B,C AND D, T3C, TYPE 4X, IP66.

ANALYZER SYSTEM RATING:
CSA CLASS I, DIV. 2, GROUP A,B,C AND D, T3, IP66.

DRAWING NO. SS2100CFDP-201 REV D

Figure A–3 Flow schematic of SS2100 for trace moisture analyzer (solenoids to side of electronics) (Bill of Materials)

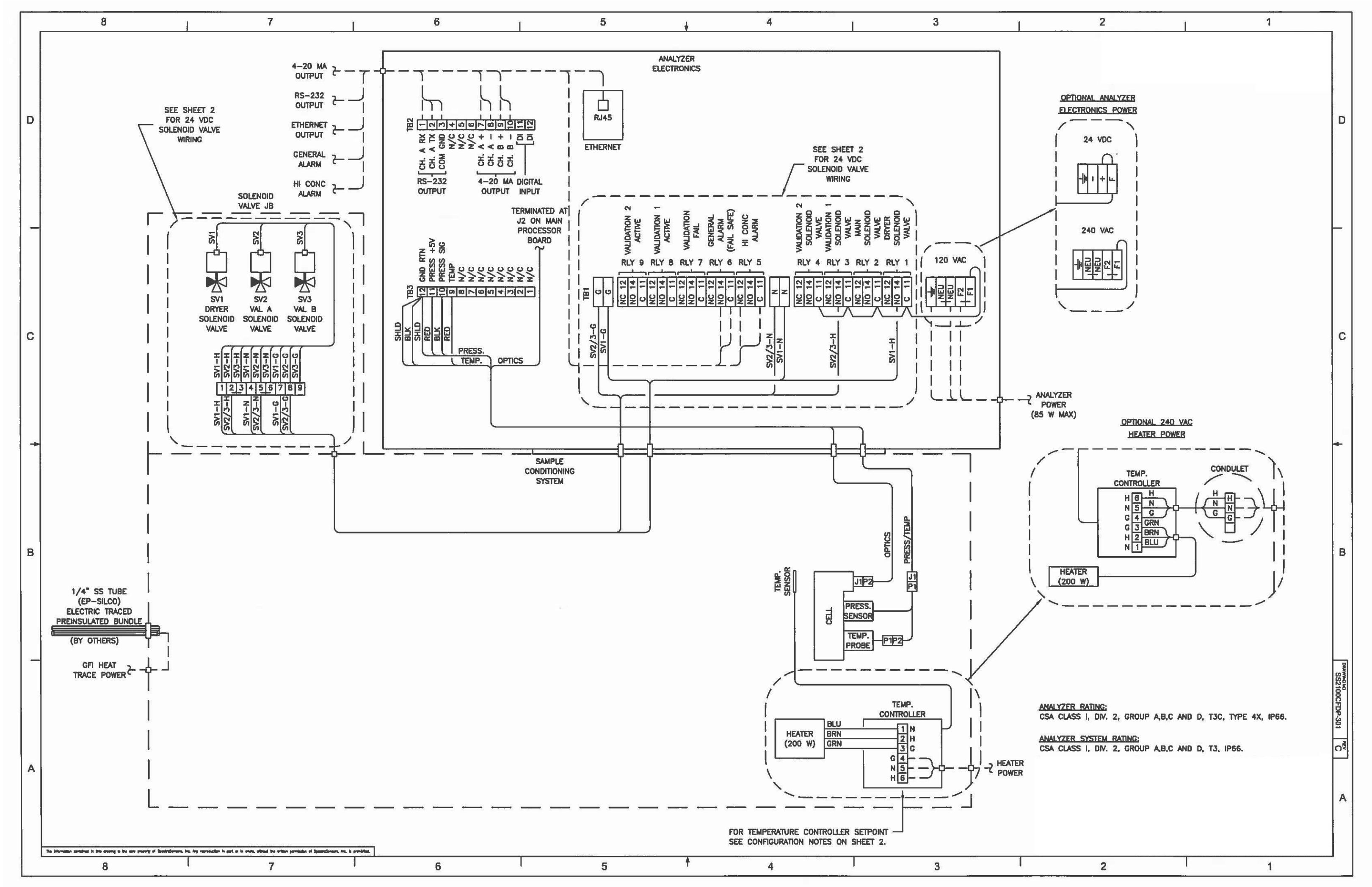


Figure A–4 *Wiring Diagram of SS2100 for trace moisture analyzer (solenoids to side of electronics)*

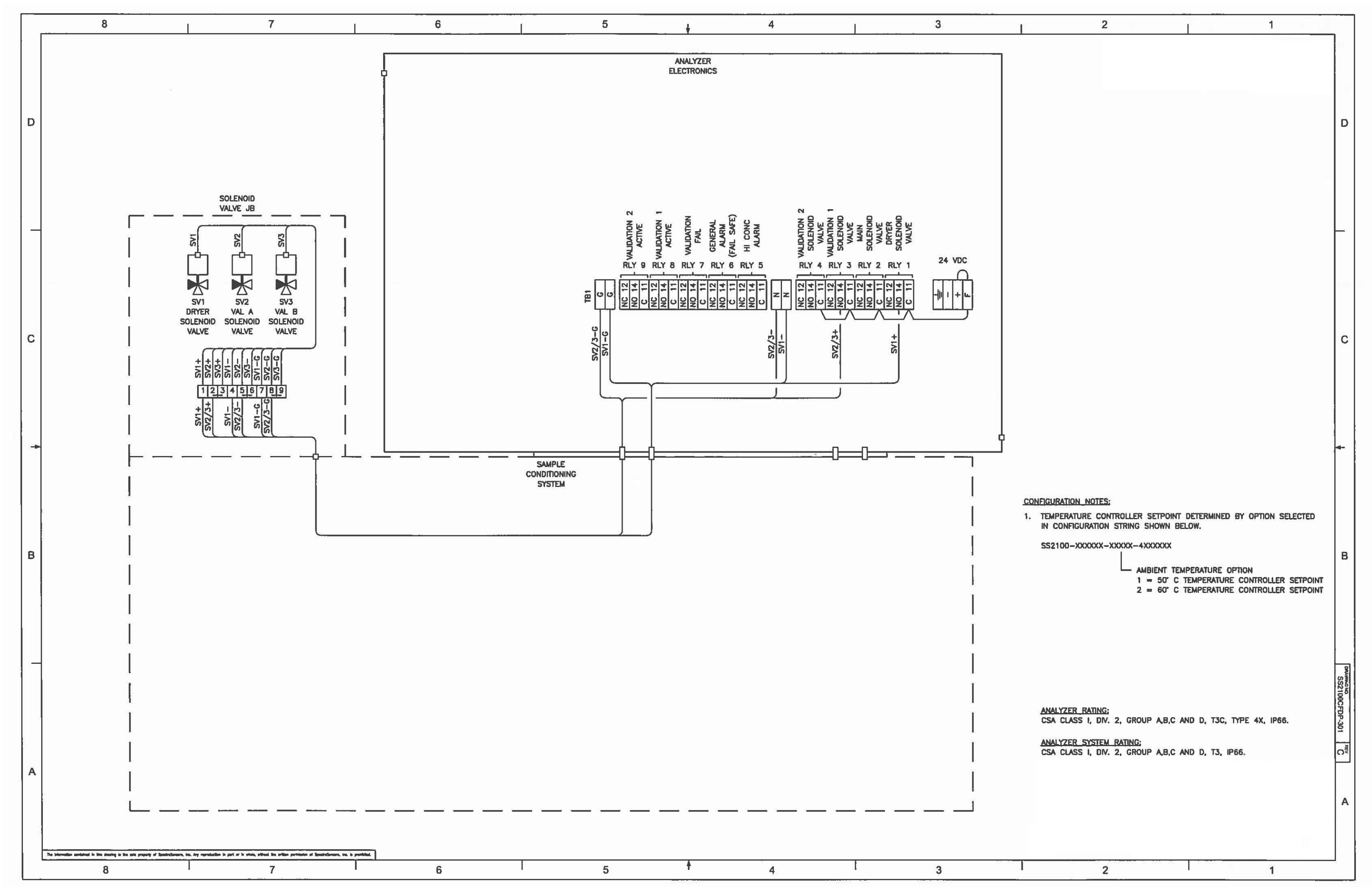


Figure A–5 *Electrical schematic of SS2100 for trace moisture analyzer (solenoids to side of electronics)*

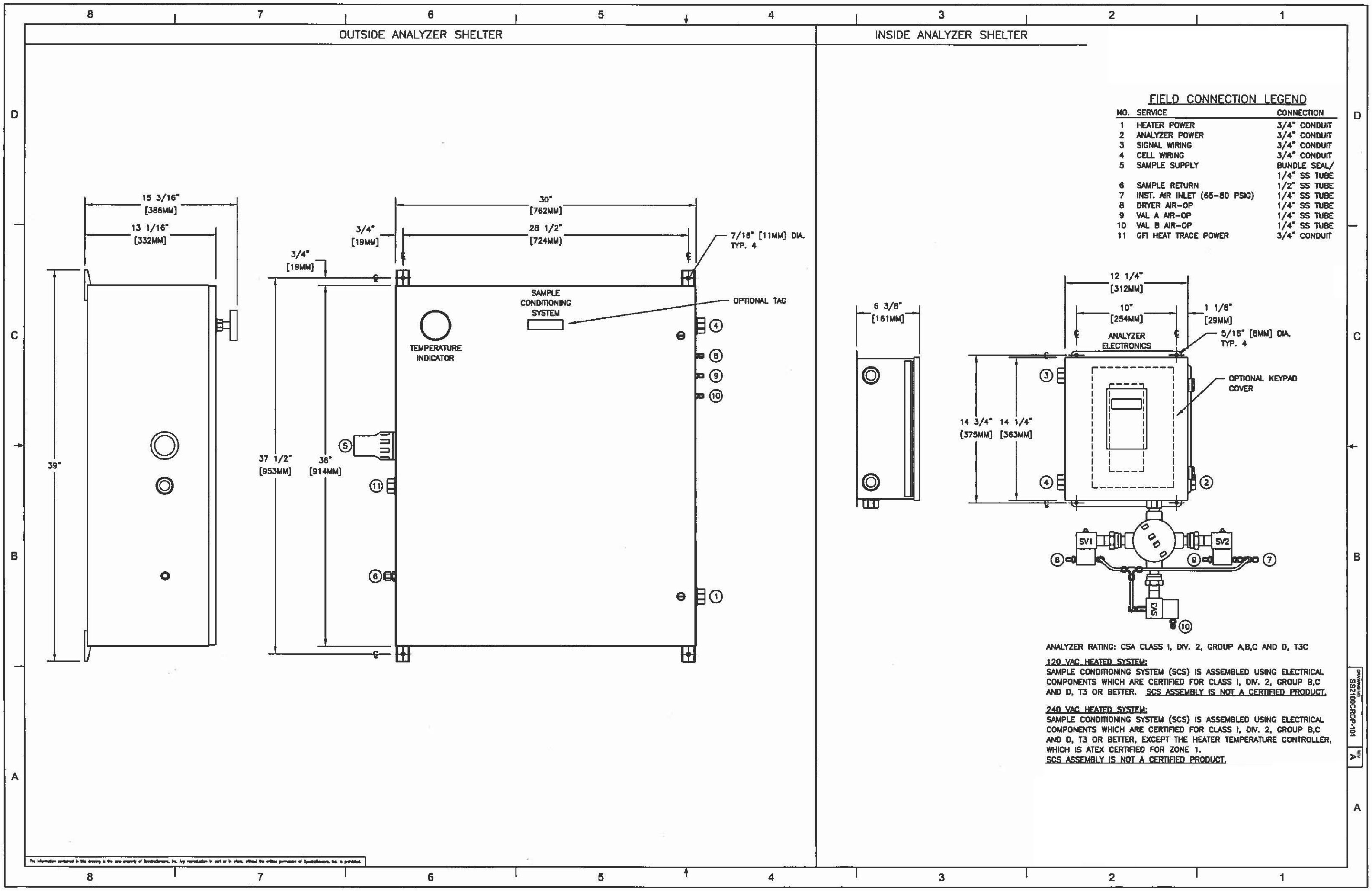


Figure A–6 *Remote mount configuration: Outline schematic (front view) of SS2100 for trace moisture analyzer (solenoids below electronics)*

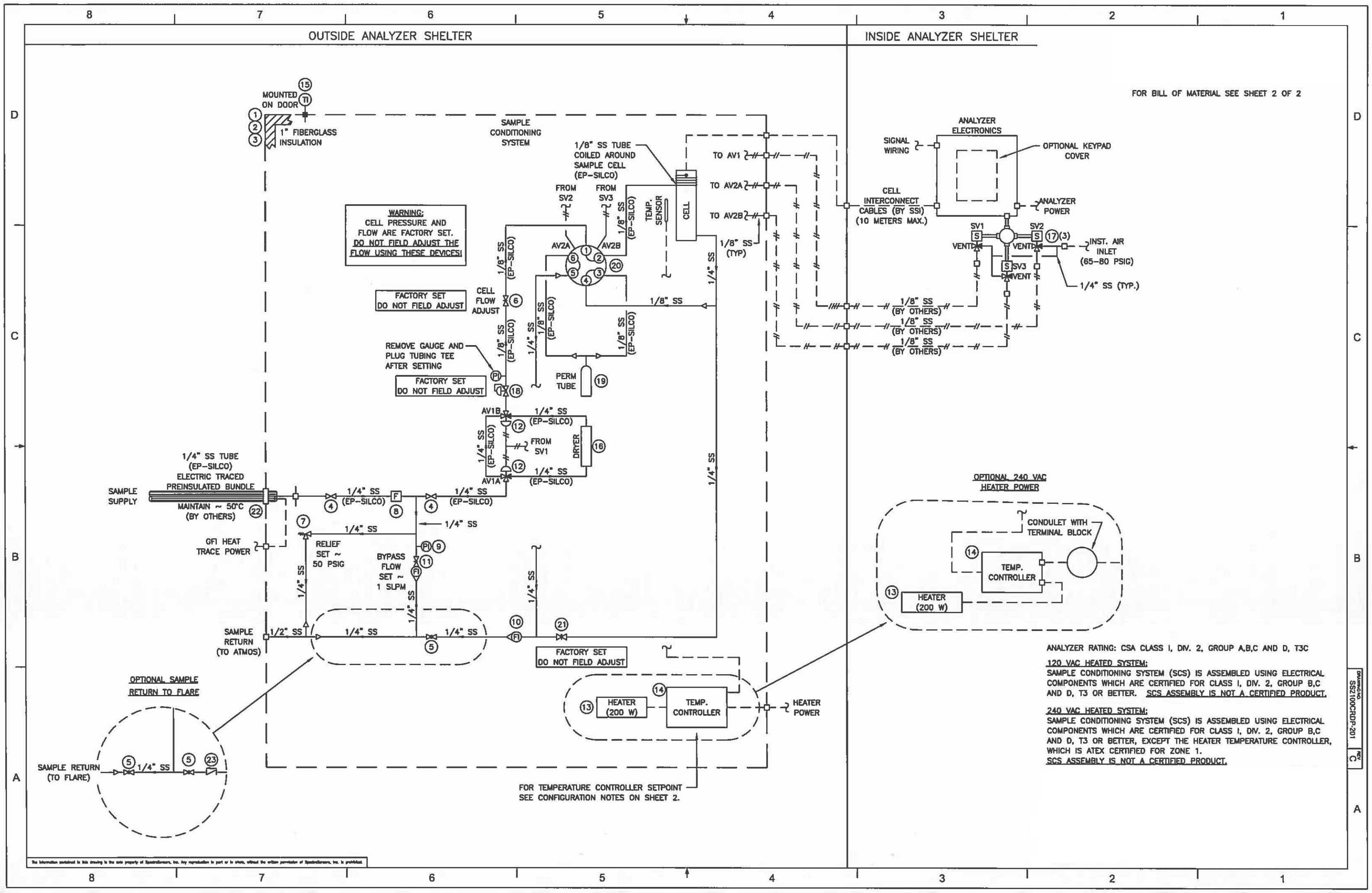


Figure A–7 Remote mount configuration: Flow schematic of SS2100 for trace moisture analyzer (solenoids below electronics)

CONFIGURATION NOTES:

1. DIGITS IN NUMBER STRING SHOWN CORRESPOND TO OPTIONS SELECTED DURING SYSTEM CONFIGURATION.

   SS2100–XXXXXX–XXXXX–4XXXXXX
   └ SAMPLE CONDITIONING SYSTEM OPTIONS

2. TEMPERATURE CONTROLLER SETPOINT DETERMINED BY OPTION SELECTED IN CONFIGURATION STRING SHOWN BELOW.

   SS2100–XXXXXX–XXXXX–4XXXXXX
   └ AMBIENT TEMPERATURE OPTION
   1 = 50° C TEMPERATURE CONTROLLER SETPOINT
   2 = 60° C TEMPERATURE CONTROLLER SETPOINT

SEE CONFIGURATION NOTES

BILL OF MATERIALS

	ITEM	QTY	DESCRIPTION	MANUFACTURER	PART NO.	SSI PART NO.
FOR –41XXXXX FOR –42XXXXX	1	1	ENCLOSURE (NEMA 4X, SS), 36"X30"X12"	HOFFMAN	CSD363012SS	1400536306
	2	1	MOUNTING BRACKET KIT (SS)	HOFFMAN	CMFKSS	1400400001
	3	1	MOUNTING PANEL (PAINTED STEEL), 34.2"X28.2"	HOFFMAN	CP3630	1400436300
FOR –43XXXXX FOR –44XXXXX FOR –45XXXXX FOR –46XXXXX	1	1	ENCLOSURE (NEMA 4X, 316LSS), 36"X30"X12"	HOFFMAN	CSD363012SS6	1400002168
	2	1	MOUNTING BRACKET KIT (SS)	HOFFMAN	CMFKSS	1400400001
	3	1	MOUNTING PANEL (PAINTED STEEL), 34.2"X28.2"	HOFFMAN	CP3630	1400436300
	4	2	DIAPHRAGM VALVE, 1/4" TF (SS)	SWAGELOK	SS–DLS4	6100002066
FOR –4XX1XXX	5	1	BALL VALVE, 1/4" TF (SS)	SWAGELOK	SS–42GS4	61303042S4
FOR –4XX2XXX	5	2	BALL VALVE, 1/4" TF (SS)	SWAGELOK	SS–42GS4	61303042S4
	6	1	NEEDLE VALVE, 1/8" TF (SS/SULF)	SPECTRASENSORS	6200002498	6200002498
	7	1	RELIEF VALVE, 10–250PSIG, 1/4 TF (SS–MTR)	DK TECH	V63–D–4T–L–S	6100002838
	8	1	FILTER (TEE–TYPE), 7 MICRON, 1/4" TF (SS/SULF)	SPECTRASENSORS	6200002203	6200002203
	9	1	PRESS. GAUGE (1.5"), 60 PSIG, 1/8" MNPT (SS)	MCDANIEL	SCL	6200000006
FOR –4X1XXXX	10	1	FLOWMETER (NO VALVE), 6 SLPM, 1/4" FNPT (SS)	KING	74C123G081523830	6100002181
	11	1	FLOWMETER (W/VALVE), 2 SLPM, 1/4" FNPT (SS)	KING	74C123G081123810	6134100274
FOR –4X2XXXX	10	1	FLOWMETER (ARM,NO VLV),6 SLPM,1/4"FNPT (SS)	KING	7101063005A2	6100002410
	11	1	FLOWMETER (ARM, W/VLV),2.6 SLPM,1/4"FNPT (SS)	KING	7101361003A2	6100002373
	12	2	AIR–OP VALVE (3–WAY), 1/4" TF (SS)	SWAGELOK	SS–4BY–W4–1C	6100002287
120 VAC, 50° SETPOINT: FOR –41XXXXX FOR –43XXXXX FOR –45XXXXX	13	1	HEATER (DIV. 1), 200 W, 120 VAC	INTERTEC	CPA–200T3100–120V	1400402310
	14	1	TEMP. CONTROLLER (DIV. 1), SET AT 50°C, 120 VAC	INTERTEC	TC CD E1 S J–50°C HFCI–SC0002	5300002004
120 VAC, 60° SETPOINT: FOR –41XXXXX FOR –43XXXXX FOR –45XXXXX	13	1	HEATER (DIV. 1), 200 W, 120 VAC	INTERTEC	CPA200T3100–120V	1400402310
	14	1	TEMP. CONTROLLER (DIV. 1), SET AT 60°C, 120 VAC	INTERTEC	TC CD E1 S J–60°C HFCI–SC0004	5300002005
240 VAC, 50° SETPOINT: FOR –42XXXXX FOR –44XXXXX FOR –46XXXXX	13	1	HEATER (IECEX/ATEX/CSA), 200 W, 240 VAC	INTERTEC	CP VARITHERM DPA200T340BI–230V	EX5300000008
	14	1	TEMP. CONTROLLER (DIV 1), SMART, 240 VAC	INTERTEC	TC CD E1 S J–50°C HFCI–S–0015	EX5300000005
240 VAC, 60° SETPOINT: FOR –42XXXXX FOR –44XXXXX FOR –46XXXXX	13	1	HEATER (IECEX/ATEX/CSA), 200 W, 240 VAC	INTERTEC	CP VARITHERM DPA200T340BI–230V	EX5300000008
	14	1	TEMP. CONTROLLER (DIV 1), DIG, 60°C, 240 VAC	INTERTEC	TC CD E1 S J–60°C HFCI–SC0092	5300002034
	15	1	TEMP. GAUGE (3"), 200°F, 4" STEM, 1/2" NPT (SS)	REOTEMP	AA–040–1–D43–TG	55032340B6
	16	1	SAMPLE DRYER, 1/4" VCR (SS)	NUPURE	01000–VCR–HC–PF	6101811014
SOV VOLTAGE BASED ON POWER SUPPLIED TO ANALYZER ELECT.	17	3	SOL. VALVE (3/2 WAY), 120 VAC, 1/8" FNPT (SS)	BURKERT	98124074	6131401004
	17	3	SOL. VALVE (3/2 WAY), 240 VAC, 1/8" FNPT (SS)	BURKERT	98123905	6131401003
	17	3	SOL. VALVE (3/2 WAY), 24 VDC, 1/8" FNPT (SS)	BURKERT	456658	6131401002
	18	1	PRESS. REGULATOR, 25 PSIG, 1/8" FNPT (SS/SULF)	GO	PR1–1A11A3D111SULF	6200002299
	19	1	PERM TUBE, H2O, 2038NG/M AT 50C, 1/4" VCR	VICI	GC23–7322–C50–VCR	1300002289
	20	1	VALVE, ROTARY 6 WAY, 316 SS, 1/8" PORTS	VALCO	AL6UWE	6100002407
	21	1	METERING VALVE, 1/4" TF (316SS)	SWAGELOK	SS–1VS4	6130301VS4
	22	1	TUBE BUNDLE SHRINK SLEEVE, 2.10" ID	NU–TECH	NUS–4X	6100002161
FOR –4XX2XXX	23	1	CHECK VALVE, 1/3 PSI, 1/4" TF (SS)	SWAGELOK	SS–4C–1/3	6130504C13

ANALYZER RATING: CSA CLASS I, DIV. 2, GROUP A,B,C AND D, T3C

120 VAC HEATED SYSTEM:
SAMPLE CONDITIONING SYSTEM (SCS) IS ASSEMBLED USING ELECTRICAL COMPONENTS WHICH ARE CERTIFIED FOR CLASS I, DIV. 2, GROUP B,C AND D, T3 OR BETTER. SCS ASSEMBLY IS NOT A CERTIFIED PRODUCT.

240 VAC HEATED SYSTEM:
SAMPLE CONDITIONING SYSTEM (SCS) IS ASSEMBLED USING ELECTRICAL COMPONENTS WHICH ARE CERTIFIED FOR CLASS I, DIV. 2, GROUP B,C AND D, T3 OR BETTER, EXCEPT THE HEATER TEMPERATURE CONTROLLER, WHICH IS ATEX CERTIFIED FOR ZONE 1.
SCS ASSEMBLY IS NOT A CERTIFIED PRODUCT.

DRAWING NO. SS2100CRDP-201 REV C

Figure A–8 *Remote mount configuration: Flow schematic of SS2100 for trace moisture analyzer (solenoids below electronics) (Bill of Materials)*

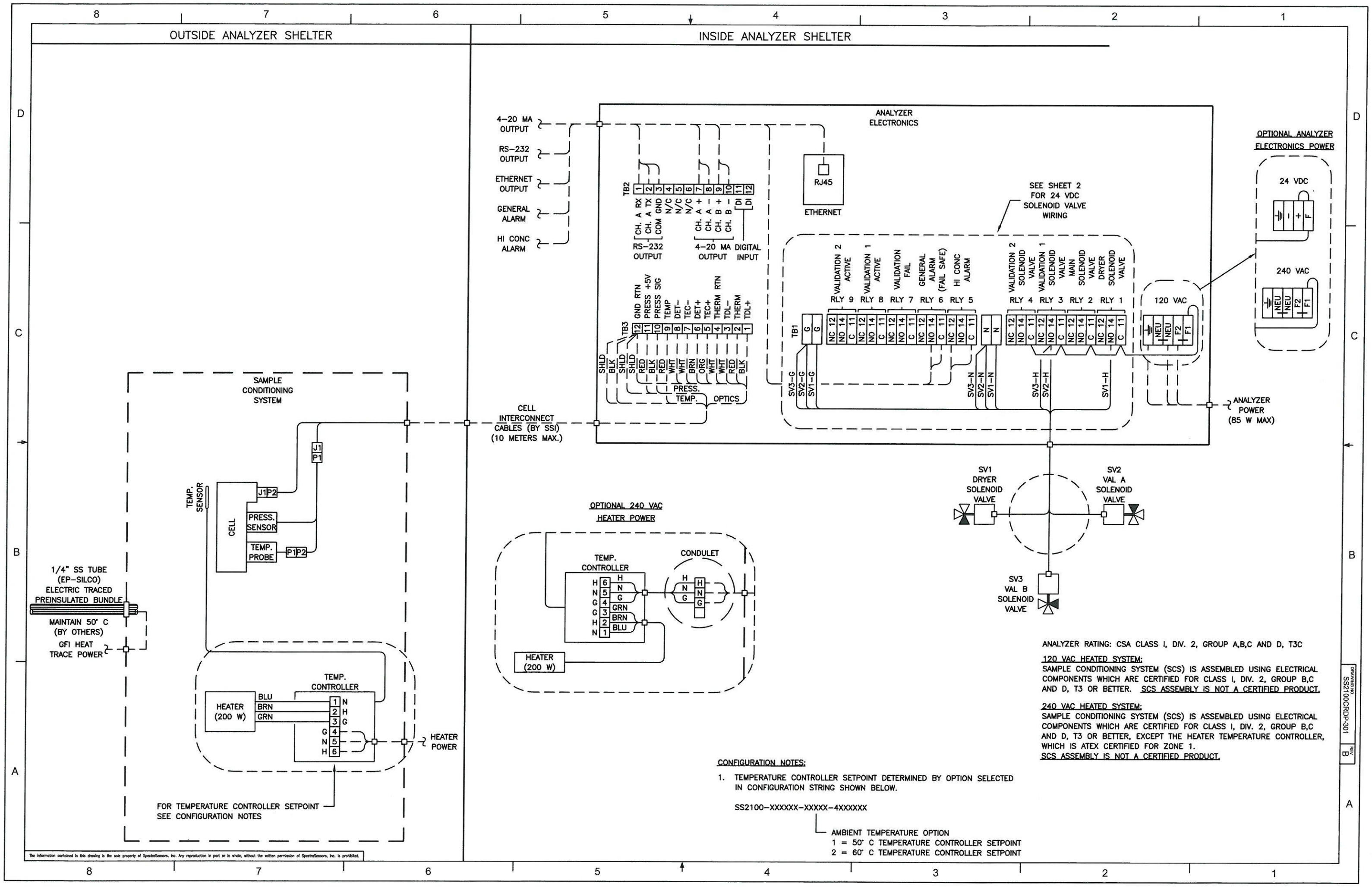


Figure A–9 *Remote mount configuration: Wiring schematic of SS2100 for trace moisture analyzer (solenoids below electronics)*

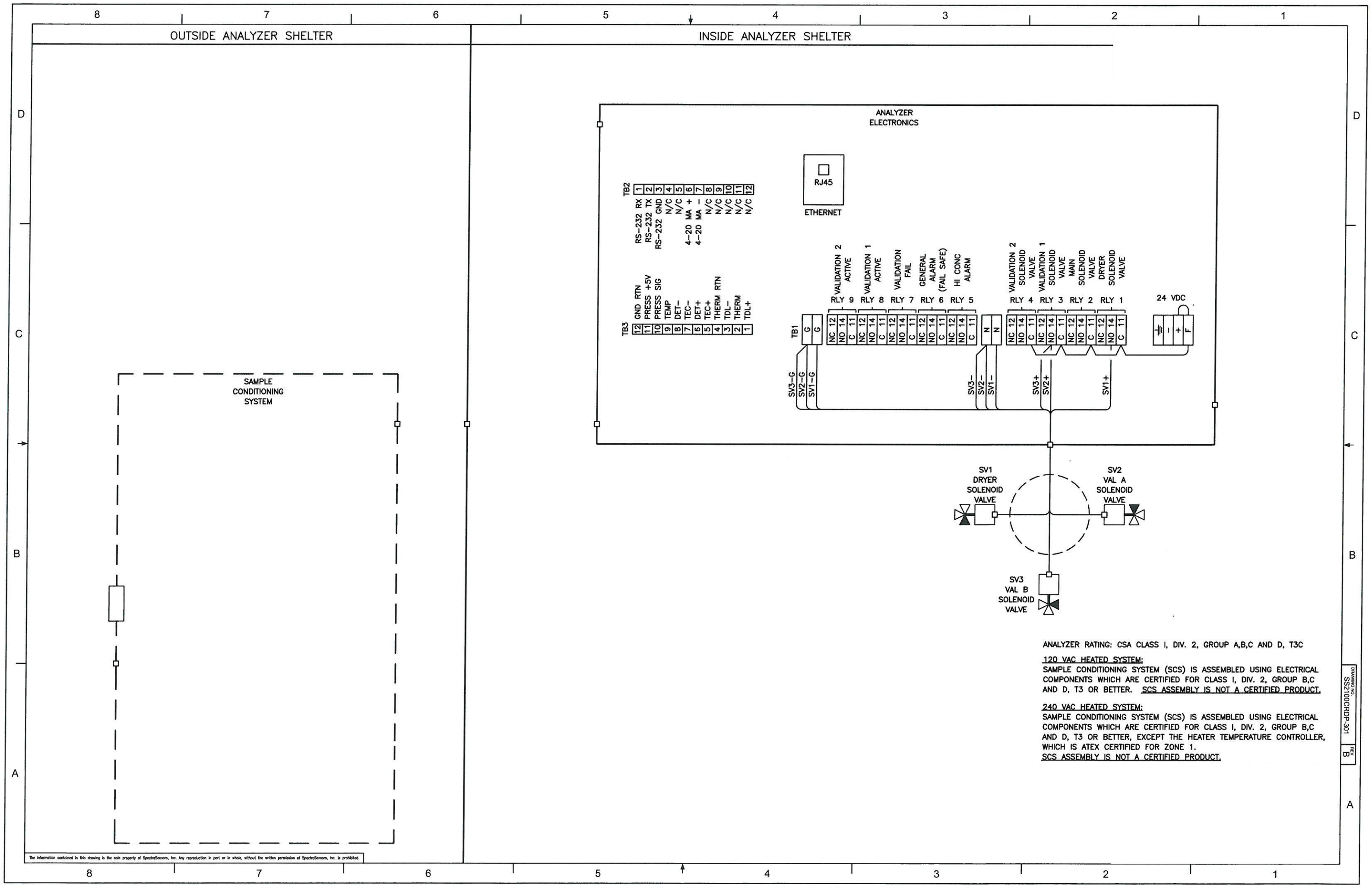


Figure A–10 *Remote mount configuration: Electrical schematic of SS2100 for trace moisture analyzer (solenoids below electronics)*

Spare Parts

Below is a list of spare parts for your customized analyzer with recommended quantities for 2 years of operation.

Due to a policy of continuous improvement, parts and part numbers may change without notice. When ordering, please specify the system serial number (SN) to ensure that the correct parts are identified.

Table A–2 *Replacement parts for trace moisture analyzer*

Part Number	Description	2 Year Quantity
Analyzer Electronics		
2900000460	Temperature Control Board [1]	-
2900000450	4-20 mA Current Loop Board	-
8000002693	Power Supply Assembly, 120/240 VAC 50/60 Hz [1]	-
8000002300	Power Supply Assembly, 24 VDC [1]	-
0190217106	External Serial Output Cable	-
0190230011	Keypad Assembly [1]	-
2460100002	Display Assembly [1]	-
2900000380	Relay Control Board [1]	-
4500002002	Relay, DC12 V SPDT 3 A/120 VAC [1]	-
0210117103	Temperature Sensor Assembly [1]	-
0219900006	Kit, Viton O-Rings and Screws for 2-Pass Cell[1]	1
0219900011	Kit, Fuse, AC/DC	1
Pressure Transducer Options		
5500002041	Pressure Sensor, 30 PSIA, 5 V, 1/8 in. MNPT DIN4365 NACE	1
6000002246	Cable, Pressure/Temperature, EXT, 32 in. [1]	1
General		
0219900007	Kit, Cleaning Tools, Optical Cell (USA/Canada only) [1]	1
0219900017	Kit, Cleaning Tools, Optical Cell, No Chemicals (International) [1]	1

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

Table A-2 *Replacement parts for trace moisture analyzer (Continued)*

Part Number	Description	2 Year Quantity
General (Continued)		
BA02192C	SS2100 Trace Moisture TDLAS Gas Analyzer Operating Instruction, additional copies	-
GP01177C	FS 5.16 Description of Device Parameters, additional copies	-
Sample Conditioning System		
6100002066	Diaphragm Valve, 1/4 in. Tube Fitting (SS), Swagelok SS-DSL4	-
61303042S4	Ball Valve, 1/4 in. Tube Fitting (SS), Swagelok SS-42GS4	-
6200002498	Needle Valve, 1/8 in. Tube Fitting (SS), Swagelok SS-ORS2-SLFNRT	-
6100002648	Relief Valve, Set at 50 PSIG, 1/4 in. Tube Fitting, (SS), Swagelok SS-4R3A-SETA	-
6200002203	Filter (Tee-Type), 7 micron, 1/4 in. Tube Fitting (SS), Swagelok SS-4TF-7-SLFNRT	-
6100002185	Filter Element and O-Ring, 7 micron	2
6100002455	Membrane Separator, Type 6, SS, w/ LB, Viton	-
6200000006	Pressure Gauge (1.5 in.), 60 PSIG, 1/8 in. MNPT (SS), McDaniel SCL	-
6100002181	Flow meter (no Valve), 6 SLPM, 1/4 in. FNPT (SS), King 74C123G081523830	-
6100002410	Flow Meter (Armored, no Valve), 6 SLPM, 1/4 in. FNPT (SS)	-
6100002373	Flow Meter (Armored with Valve), 2.6 SLPM, 1/4 in. FNPT (SS)	-
6134100274	Flow Meter (with Valve), 2 SLPM, 1/4 in. FNPT (SS), King 74C123G081123810	-
2800002041	Flow Meter Rebuild Kit, Viton	2
6100002287	Air-op Valve (3-Way), 1/4 in. TF (SS), Swagelok SS-4BY-W4-1C	1
1400402310	Heater (Division 1), 200 W, 120 VAC, Intertec CPA-200-T3-100-120V	-
EX5300000008	Heater (Division 1), 200 W, 240 VAC, Intertec DPA-200-T3-40-BI-240V	-
5300002049	Temperature Controller, Class I, Zone 1, Division 1, 50 °C, 120 VAC, WV189 Intertec HFCJ 0002, HFCJ-P 0003	

Table A-2 *Replacement parts for trace moisture analyzer (Continued)*

Part Number	Description	2 Year Quantity
Sample Conditioning System (Continued)		
5300002050	Temperature Controller, Class I, Zone 1, Division 1, 60 °C, 120 VAC, WV189 Intertec HFCJ 0002, HFCJ-P 0037	-
5300002051	Temperature Controller, Class I, Zone 1, Division 1, 50 °C, 230 VAC, WV189 Intertec HFCJ 0012, HFCJ-P 0003	-
5300002052	Temperature Controller, Class I, Zone 1, Division 1, 60 °C, 230 VAC, WV189 Intertec HFCJ 0012, HFCJ-P 0037	
55032340B6	Temperature Gauge (3 in.), 200 °F, 4 in. Stem, 1/2 in. NPT (SS), Reotemp AA-040-1-D43-TG	-
6101811014	Sample Dryer, 1/4 in. VCR, (SS), NuPure 01000-VCR-HC-PF	1
6131401004	Solenoid Valve, (3/2-Way), 1/8 in. FNPT (SS), 120 VAC, Burkert 98124074	1
6131401003	Solenoid Valve, (3/2-Way), 1/8 in. FNPT (SS), 240 VAC, Burkert 98123905	1
6131401002	Solenoid Valve, (3/2-Way), 1/8 in. FNPT (SS), 24 VDC, Burkert 456658	1
6200002299	Pressure Regulator, 25 PSIG, 1/8 in. FNPT (SS/SULF), Go PR1-1A11A3D111SULF	-
6100002407	Rotary Valve, 6-Way, 316 SS, 1/8 in. Ports, Valco AL6UWE	-
6130301VS4	Metering Valve, 1/4 in., Tube Fitting (316SS), Swagelok SS-1VS4	-
6130504C13	Check Valve, 1/3 PSI, 1/4 in., Tube Fitting (SS), Swagelok SS-4C-1/3	-
1300002289	Permeation Tube, H_2O, 2038 ng/m at 50 °C, 1/4 in. VCR, Vici GC23-7322-C50-VCR	

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Appendix B: Maintenance and Troubleshooting

This section presents recommendations and solutions to common problems, such as gas leaks, contamination, excessive sampling gas temperatures and pressures, and electrical noise along with instruction for basic maintenance tasks. If your analyzer demonstrates other issues, contact Service. Refer to **“Service”** on page B-19.

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

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

Gas Leaks

Probably the most common cause of erroneous measurements is outside air leaking into the sample supply line. It is recommended the 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.

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

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

Contamination

Contamination and long exposure to high humidity are valid reasons for periodically cleaning the gas sampling lines. Contamination in the gas sampling lines can potentially find its way to the sample cell and deposit on the optics or interfere with the measurement in some other way. Although the analyzer is designed to withstand some contamination, it is recommended to always keep the sampling lines as contamination free as possible.

To keep the sampling lines clean

1. Make sure that a filter (included with most systems) is installed ahead of the analyzer and operating normally. Replace, if necessary. If liquid enters the cell and accumulates on the internal optics, a **Laser Power too Low** fault will result.
2. If mirror contamination is suspected, see **"Cleaning the Mirrors"** on page B-3.
3. Turn off the sample valve at the tap in accordance with site lock-out, tag-out rules.
4. Disconnect the gas sampling line from the sample supply port of the analyzer.
5. Wash the sampling line with isopropyl alcohol or acetone and blow dry with mild pressure from a dry air or nitrogen source.
6. Once the sampling line is completely free of solvent, reconnect the gas sampling line to the sample supply port of the analyzer.
7. Check all connections for gas leaks. Using a liquid leak detector is recommended.

Excessive Sampling Gas Temperatures and Pressures

The embedded software is designed to produce accurate measurements only within the allowable cell operating range (see Table A–1 on page A–1).

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.

If the pressure, temperature, or any other readings on the LCD appear suspect, they should be checked against the specifications (see Table A–1 on page A–1).

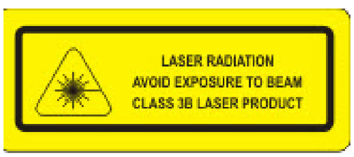
Electrical Noise

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.

Cleaning the Mirrors

If contamination makes its way into the cell and accumulates on the internal optics, a **Laser Power Low Alrm** fault will result. If mirror contamination is suspected, please refer to **"Service"** on page B-19 before attempting to clean the mirrors. If advised to do so, use the following procedure.

*This procedure should be used ONLY when necessary and is not part of routine maintenance. To avoid compromising the system warranty, contact service before cleaning mirrors. Refer to **"Service"** on page B-19.*



***INVISIBLE LASER RADIATION** — The sample cell assembly contains a low-power, 10 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.*

To clean the mirror, refer to the instructions **"To clean the mirrors"** on page B-4.

Tools and materials

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

To clean the mirrors

1. Power down the analyzer following the procedure outlined in **"Powering Down the Analyzer"** in the Description of Device Parameters for this analyzer.

The sample cell assembly contains a low-power, 20 mW maximum, CW Class 3b invisible laser with a wavelength between 800 to 3000 nm. Never open the sample cell flanges or the optical assembly unless the power is turned off.

2. Isolate the SCS from the process sample tap. Refer to **"To isolate the process sample tap for long-term shutdown"** on page 4-11.

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

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

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

4. Carefully mark the orientation of the mirror assembly with a permanent ink marker on the cell body.

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

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

The sample cell assembly contains a low-power, 20 mW maximum, CW Class 3b invisible laser with a wavelength between 800 to 3000 nm. Never open the sample cell flanges or the optical assembly unless the power is turned off.

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

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

Endress+Hauser does not recommend cleaning the top mirror. If the top mirror is visibly contaminated, refer to ***"Service"*** *on page B-19.*

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

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

12. Repeat with a clean sheet of lens cleaning cloth to remove the streak left by the first wipe. Repeat, if necessary, until there is no visible contamination on the mirror.
13. Carefully replace the mirror assembly onto the cell in the same orientation as previously marked.
14. Replace the O-Ring adding a very thin layer of grease. Ensure it is properly seated.
15. Tighten the socket-head cap screws evenly with a torque wrench to **30 in-lbs**.

Replacing the Filter

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

1. Power off the analyzer and close the sample supply valve.
2. Open the SCS enclosure door.
3. Unscrew the four screws with a 5/23 in. screwdriver from the base of the filter. Remove the filter unit from the analyzer for disassembly.
4. Unscrew and remove the filter cap.
5. Remove the top O-Ring.

6. Check if there are any contaminants or solid components blocking the metal filter.
7. Drain any contaminants found and clean with isopropyl alcohol.
8. Replace the top O-Ring.
9. Place the filter cap back into position and tighten.
10. Place the filter unit into the analyzer and tighten the base with the four screws.
11. Check upstream of membrane for liquid contamination and clean and dry out before opening the sample supply valve.

Replacing the Dryer

1. Power off the analyzer and close the sample supply valve.
2. Open the SCS enclosure door.
3. Using a wrench, loosen the female fitting at the top and bottom of the dryer.

The VCR metal gasket face seal fitting is currently used on low moisture systems only.

4. Remove the retainer clip gasket and place in a safe location.
5. Remove the dryer.
6. Secure the retainer clip gasket to the new dryer unit.
7. Insert the new dryer into the analyzer.

Refer to your analyzer's spare parts list or the ***"Service"*** *on page B-19 for ordering assistance.*

8. Connect the female nuts at the top and bottom of the dryer to finger tight.
9. Using a wrench, tighten the female nuts 1/8 in. turn from finger tight.

Replacing a Fuse

1. Power off the system and close the sample supply valve.
2. Open the electronics enclosure. Refer to Figure 1–6 on page 1–10 (AC) or Figure 1–7 on page 1–11 (DC) for fuse location.

3. Using a flat-head screwdriver, remove the fuse screw turning counterclockwise as shown in Figure B–1 below.

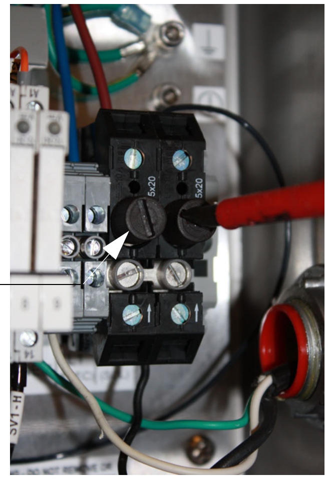


Figure B–1 *Unscrewing fuse cover*

4. Remove the fuse cover and fuse.
5. Remove the fuse from the cover and replace with a new fuse as shown in Figure B–2 below. Refer to Table 1–1 on page 1–12 for fuse specifications.

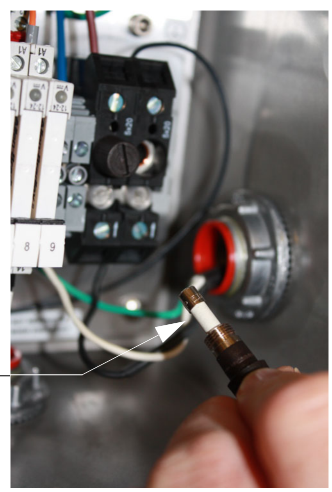


Figure B–2 *Replacing fuse*

6. Insert the new fuse into the screw cover and replace into the fuse opening.

7. Use the screwdriver to turn the fuse cover clockwise until tight. Do not overtighten.

Repeat steps for each fuse to be replaced.

8. Close enclosure door and apply power to the analyzer.

Replacing the Pressure Transducer on a 8 m cell

A pressure transducer 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 transducer not responding to pressure change
- Physical damage to the pressure transducer

Refer to the following information for replacing the pressure transducer.

Tools and materials

- 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 PTFE tape (or equivalent)
- Dry nitrogen
- Isopropyl alcohol

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

To replace the pressure transducer on a 8 m cell

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. Open the door to the SCS enclosure. Refer to Figure B–3 on page B–9.
6. Remove the optical cable harness using a flat-head screwdriver.
7. Disconnect the cell inlet using a 9/16 in. wrench.
8. Disconnect the cell outlet using a 9/16 in. wrench.
9. Disconnect the thermistor cable at the circular connector.
10. Remove the pressure transducer cable from the circular connector inside the enclosure.

    For newer model pressure transducers with quick-disconnects, detach the pressure transducer cable from the pressure sensor at the connector using a Phillips-head screwdriver. Do not remove the black connector from the cable inside the enclosure.

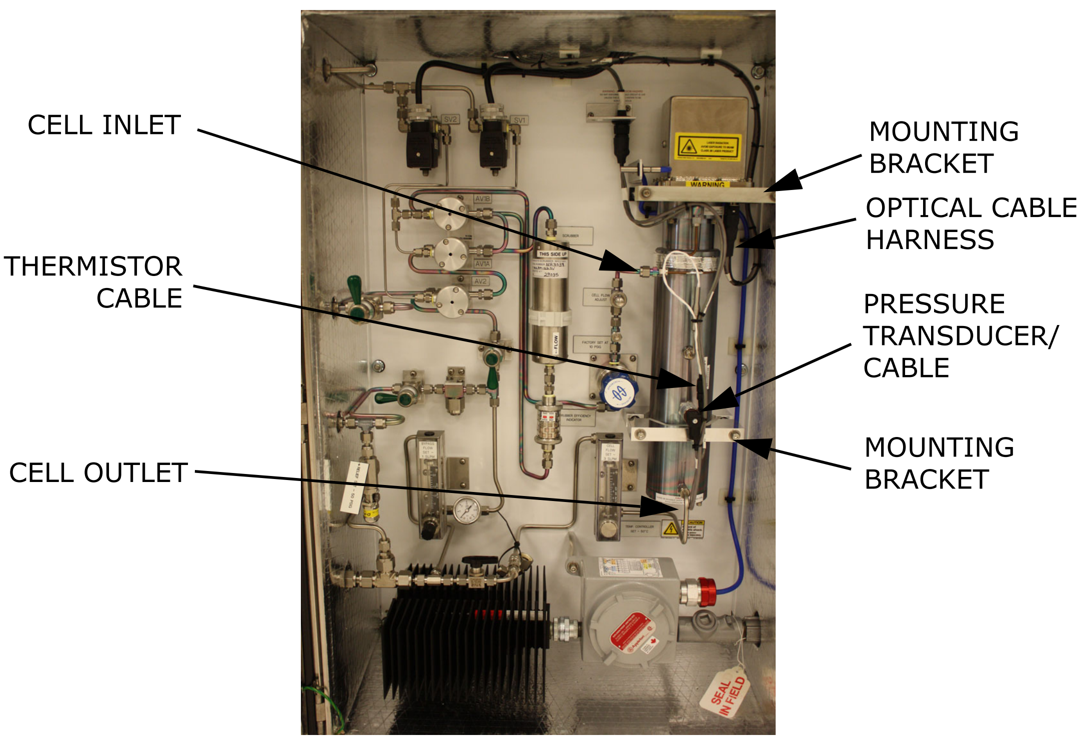


Figure B–3 *SCS cabinet interior*

11. Dismount the cell from the bracket by removing the four securing screws (two on top, two on the bottom) using a 9/64 in. Allen wrench. Place the measurement cell on a clean, flat surface with the pressure transducer facing up. Refer to Figure B–4 below.

Figure B–4 *Removed measurement cell with pressure transducer face up*

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

12. Holding the cell firmly with one hand, use a 7/8 in. wrench to remove the old (to be replaced) pressure transducer as shown in Figure B–5 below.

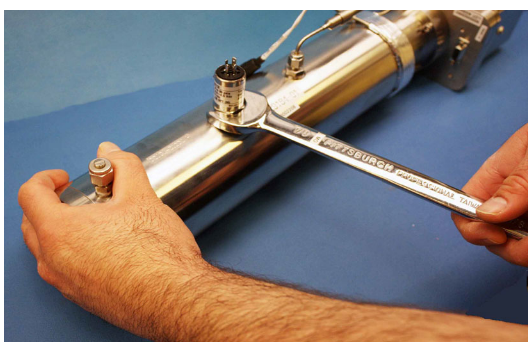


Figure B–5 *Removing the old pressure transducer*

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

13. Remove excess seal tape from the threads at the opening and check for galling. Refer to Figure B–6 on page B–11.

Tip the measurement cell forward so that any loose debris falls to the flat surface and not back inside the cell.

Figure B–6 *Removing excess seal tape from flange*

*Threads showing signs of galling indicate a possible leak. Refer to **"Service"** on page B-19 to arrange for repair.*

14. Put on acetone-impenetrable gloves and remove the mirror end cap from the cell using the 9/64 in. Allen wrench.

15. Check the mirror for any signs of debris, if found, refer to **"Cleaning the Mirrors"** on page B-3 to remove.

16. Check for tape fragments inside the cell and remove with a swab as shown in Figure B–7 below.

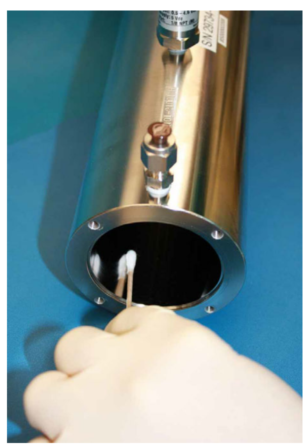


Figure B–7 *Removing excess seal tape from inside cell*

17. Remove the new pressure transducer from the packaging. Retain the black connector cap on the transducer — *do not remove*.

18. Wrap stainless steel PTFE tape around the threads at the top of the pressure transducer, beginning from the base of the threads to the top, approximately three times taking care to avoid covering the top opening. Refer to Figure B–8 on page B–12.

Figure B–8 *Replacing seal tape*

19. Holding the cell steady, insert the new pressure transducer into the threaded opening. Refer to Figure B–9 below.

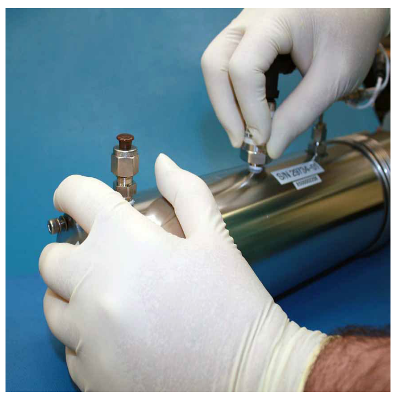


Figure B–9 *Replacing pressure transducer*

20. Hand tighten the pressure transducer clockwise into the opening until no longer moving freely.

21. Holding the cell in place, turn the transducer clockwise with a 7/8 in. wrench until tight. Two or three threads on the pressure transducer should still be visible.

Make sure the black connector at the end of the pressure transducer is facing towards the head or the base of the measurement cell to facilitate connection. Refer to Figure B–10 on page B–13.

Figure B–10 *New pressure transducer installed*

22. Remove the black connector from the pressure transducer and discard.

23. Connect the new harness/cable to the new pressure transducer.

If the newer model pressure transducer cable is currently installed in the SCS, a new cable may not be required. If no new cable is installed, re-attach the existing cable in place of step 27.

24. Remount the cell to the mounting brackets using a 9/64 in. Allen wrench with the pressure transducer facing out towards the cabinet door.

25. Reconnect the cell inlet and cell outlet using a 9/16 in. wrench.

26. Reconnect the thermistor connector.

27. Connect the new pressure transducer harness and cable to the circular connector.

28. Reconnect the optical cable harness.

29. Close the door to the SCS enclosure.

30. Conduct a leak test to determine that the new pressure transducer is not leaking.

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

*For any questions related to leak testing the pressure transducer, refer to **"Service"** on page B-19.*

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

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

   a. If the system passes, the pressure transducer replacement is successful.

   b. If the system does not pass, refer to **"Service"** on page B-19 for instruction.

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.

Instrument Problems

If the instrument does not appear to be hampered by issued described earlier in this chapter, refer to Table B–1 below before contacting service, refer to **"Service"** on page B-19.

Table B–1 *Potential instrument problems and their solutions*

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 or 240 VAC at 50 to 60 Hz, 24 VDC).
	Check fuse(s). If bad, replace with equivalent fuse. Refer to Table 1–1 on page 1–12.
	Refer to **"Service"** on page B-19.
Laser Power Low Alrm fault	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.

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

Symptom	Response
Laser Power Low Alrm fault (Continued)	Refer to the Description of Device Parameters for this analyzer to capture diagnostic data and send the file to Service. Refer to **"Service"** on page B-19 for service information.
	Possible alignment problem. Refer to **"Service"** on page B-19 for service information.
	Possible mirror contamination issue. Refer to **"Service"** on page B-19 for service information. If advised to do so, clean the mirrors by following the instructions under **"To clean the mirrors"** on page B-4.
Pressure Low Alarm or **Pressure High Alarm** fault	Check that the actual pressure in the measurement cell is within specification (Table A–1 on page A–1).
	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 transducer. Check the pressure connector on the backplane board.
Temp Low Alarm or **Temp High Alarm** fault	Check that the actual temperature in the measurement cell is within specification (Table A–1 on page A–1). For systems with a heated enclosure, check that the temperature in the measurement 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).

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

Symptom	Response
Power Fail	Refer to the Description of Device Parameters for your analyzer for instructions to capture diagnostic data and submit to Endress+Hauser. Refer to **"Service Repair Order"** on page B-19.
Null Fail	Refer to the Description of Device Parameters for your analyzer for instructions to capture diagnostic data and submit to Endress+Hauser. Refer to **"Service Repair Order"** on page B-19.
Spectrum Fail	Reset the Peak Tracking function. Refer to the Description of Device Parameters for your analyzer for instructions.
	Refer to the Description of Device Parameters for your analyzer for instructions to capture diagnostic data and submit to Endress+Hauser. Refer to **"Service Repair Order"** on page B-19.
Track Fail	Reset the Peak Tracking function. Refer to the Description of Device Parameters for your analyzer for instructions.
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.
System stuck in **Fit Delta Exceeds Limit** restart for greater than 30 minutes	Refer to **"Service"** on page B-19.
No reading on device connected to current loop	Make sure that connected device can accept a 4-20 mA signal. The analyzer is set to source current.
	Make sure the device is connected to the correct terminals (see Table 3–1 on page 3–14).
	Check the open circuit voltage (35 to 40 VDC) across the current loops terminals (see Table 3–1 on page 3–14).

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

Symptom	Response
No reading on device connected to current loop (Continued)	Replace the current loop device with a milliampere meter and look for current between 4 mA and 20 mA. A voltmeter connected across a 249 ohm resistor can be used instead of the milliampere meter; it should read between 1 and 5 volts.
Current loop is stuck at 4 mA or 20 mA	Check display for error message. If alarm has been triggered, reset the alarm.
	On the current loop board, check the voltage between the end of resistor R1 closest to the jumper and ground. If the concentration reading is high, the voltage should be near 1 VDC. If the concentration reading is low, the voltage should be near 4.7 VDC. If not, the problem is probably on the main electronics board. Return to the factory for service, refer to **“Service Repair Order”** on page B-19.
Reading seems to always be high by a fixed amount	Capture diagnostic data and send the file to Endress+Hauser (see **“To read diagnostic data with HyperTerminal”** in the Description of Device Parameters for this analyzer).
	Check connections on display communication and power cables.
Strange characters appear on front panel display	Check connections on display communication cable.
Pressing keys on front panel do not have specified effect	Check connections on keypad cable.
Reading seems to always be high by a fixed percentage	Capture diagnostic data and send the file to Endress+Hauser (see **“To read diagnostic data with HyperTerminal”** in the Description of Device Parameters for this analyzer).
Reading displays 0.0 or seems relatively low	Capture diagnostic data and send the file to Endress+Hauser (see **“To read diagnostic data with HyperTerminal”** in the Description of Device Parameters for this analyzer).

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

Symptom	Response
Reading is erratic or seems incorrect	Capture diagnostic data and send the file to Endress+Hauser (see **"To read diagnostic data with HyperTerminal"** in the Description of Device Parameters for this analyzer).
Reading goes to "0"	If **4-20 mA Alarm Action** is set to **2**, look on display for an error message (see **"To change parameters in Mode 2"** in the Description of Device Parameters for this analyzer).
	Gas concentration is equal to zero.
Reading goes to full scale	If **4-20 mA Alarm Action** is set to **1**, look on display for an error message (see **"To change parameters in Mode 2"** in the Description of Device Parameters for this analyzer).
	Gas concentration is greater than or equal to full scale value.
Serial output is displaying garbled data	Make sure the computer COM port is set for 19200 baud, 8 data bits, 1 stop bit, no parity, and no flow control.
Serial output is providing no data	Make sure the computer COM port is set for 19200 baud, 8 data bits, 1 stop bit, no parity, and no flow control.
	Be sure no other programs are using the COM port selected.
	Make sure the connections are good. Verify the correct pin connections with an ohmmeter.
	Make sure to select the correct COM port into which the cable is plugged.
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.
Not getting enough flow to the sample cell	Check the micro filter for contamination. Replace if necessary. Refer to **"Replacing the Filter"** on page B-5.
	Check if supply pressure is sufficient.

Service

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

Service Repair Order

If returning the unit is required, obtain a **Service Repair Order** (**SRO**) **Number** from Service before returning the analyzer to the factory. Your service representative 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 Rte.
Rancho Cucamonga, CA 91730-4866
United States of America
1-909-948-4100

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.

Renewity Returns

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

Packing

Endress+Hauser analyzer systems and auxiliary equipment are shipped from the factory in appropriate packaging. Packaging for this type of analyzer typically consists of a wooden crate. All inlets and vents are capped and protected when packaged prior to shipment.

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

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

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, 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, conduit 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). Refer to**“Service”** on page B-19 for any questions related to packaging.
13. If returning the analyzer to the factory, complete the Decontamination Form provided by Endress+Hauser and attach to the outside of the shipping package as instructed before shipping. Refer to **“Service Repair Order”** on page B-19 for the Decontamination Form.

Storage

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

Disclaimers

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

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.

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.

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