BA02179C/66/EN/01.21
70193557
2021-12-31

Operating Instructions

Raman Rxn5

Endress+Hauser
People for Process Automation

Table of Contents

1 About this document

1.1 Warnings

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

Table 1. Warnings

1.2 Symbols on the device

Symbol	Description
	The Laser Radiation symbol is used to alert the user to the danger of exposure to hazardous visible laser radiation when using the Raman Rxn5 Analyzer system.
	The High Voltage symbol that alerts people to the presence of electric potential large enough to cause injury or damage. In certain industries, high voltage refers to voltage above a certain threshold. Equipment and conductors that carry high voltage warrant special safety requirements and procedures.
	The ETL Listed Mark provides proof of product compliance with North American safety standards. Authorities Having Jurisdiction(AHJ) and code officials across the US and Canada accept the ETL Listed Mark as proof of product compliance to published industry standards.
	The WEEE symbol indicates that the product should not be discarded as unsorted waste but must be sent to separate collection facilities for recovery and recycling.
	The CE Marking indicates conformity with health, safety, and environmental protection standards for products sold within the European Economic Area (EEA).

Table 2. Symbols

1.3 U.S. export compliance

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

1.4 Glossary

Term	Description
A/D	Analog/Digital
AC	Alternating Current
AHJ	Authorities Having Jurisdiction
amp	Ampere
ANSI	American National Standards Institute
ATEX	Atmosphère explosible (explosive atmosphere)
AWG	American Wire Gauge
°C	Celsius
CAT	Category
CCD	Charge Coupled Device
CFM	Cubic Feet per Minute
cm	Centimeter
COM	Communications
CSA	Canadian Electrical Code
DAQ	Data Acquisition
DC	Direct Current
DCS	Distributed Control System
DHCP	Dynamic Host Configuration Protocol
EEA	European Economic Area
EU	European Union
FNPT	Female National Pipe Thread
G	Gas
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
I/O	Input/Output
IEC	International Electrotechnical Commission
IP	Internet Protocol
IPA	Isopropyl Alcohol
IS	Intrinsically Safe
ISA	International Society of Automation
LED	Light Emitting Diode
mA	Milliampere
MAX	Maximum
mW	Milliwatt
Nd	Neodymium
NEC	National Electrical Code
NPT	National Pipe Thread

Term	Description
OPC	Open Platform Communications
PCB	Printed Circuit Board
psi	Pounds per Square Inch
psig	Pounds per Square Inch Gauge
RPM	Revolutions Per Minute
SATA	Serial ATA
SCFM	Standard Cubic Feet per Minute
SF6	Sulfur Hexafluoride
TCP	Transmission Control Protocol
UI	User Interface
UL	Underwriters Laboratories
USB	Universal Serial Bus
V	Volt
VAC	Volts Alternating Current
VDC	Volts Direct Current
VGA	Video Graphic Array
W	Watt
WEEE	Waste Electrical and Electronic Equipment
YAG	Yttrium Aluminum Garnet

Table 3. Glossary

2 Basic safety instruction

2.1 Requirements for personnel

- Installation, commissioning, operation, and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- Technical personnel must be authorized by the plant operator to carry out the specified activities.
- Electrical connections may be performed only by an electrical technician.
- Technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Faults at the measuring point may only be rectified by authorized trained personnel. Repairs not described in this document must be carried out only directly at the manufacturer's site or by the service organization.

2.2 Designated use

The Raman Rxn5 Analyzer is designed for use in the following applications:

- Chemical composition measurements of gases and some liquids in a process development environment. The Raman Rxn5 is particularly suited for use for measuring the composition gases at the input and output of the following process units and processes that are often found in refineries, ammonia plants, methanol plants, captive and merchant hydrogen plants, and LNG liquefaction and regasification terminals:
  - Steam methane reformers
  - Partial oxidation reformers
  - Coal, petcoke, biomass, and waste gasifiers
  - Primary and secondary shift converters
  - Acid gas removal
  - Methanators
  - Ammonia and methanol synthesis loops
  - Hydrotreaters
  - Hydrocrackers
  - Rundown to LNG storage tanks
  - Mixed refrigerant composition optimization

Use of the device for any purpose other than that described, poses a threat to the safety of people and of the entire measuring system and is not permitted.

2.3 Electrical safety

As the user, you are responsible for complying with the following safety conditions:

- Installation guidelines.
- Local standards and regulations electromagnetic compatibility.
- The product has been tested for electromagnetic compatibility in accordance with the applicable international standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been properly connected.

2.4 Operational safety

Before commissioning the entire measuring point:

1. Verify that all connections are correct.
2. Ensure that electrical cables and hose connections are undamaged.
3. Do not operate damaged products, and protect them against unintentional operation.
4. Label damaged products as defective.

During operation:

1. If faults cannot be rectified: products must be taken out of service and protected against unintentional operation.
2. Keep the door closed when not carrying out service and maintenance work.

⚠ CAUTION

Activities while the analyzer is in operation introduce risk of exposure to measured materials.

- ▶ Follow standard procedures for limiting exposure to chemical or biological materials.
- ▶ Follow workplace policies on personal protective equipment including wearing protective clothing, goggles and gloves and limiting physical access to analyzer location.
- ▶ Clean any spills using the appropriate site policies on cleaning procedures.

2.5 Product safety

The product is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. The relevant regulations and international standards have been observed. Devices connected to the analyzer must comply with the applicable safety standards.

2.6 Important safeguards

- Do not use the Raman Rxn5 for anything other than its intended use.
- Do not drape the power cord over counters or on hot surfaces.
- Do not open the enclosure of the Raman Rxn5 while it is actively collecting data.
- Do not look directly into the laser beam.
- Do not stare or focus a laser in a diffused direction.
- Do not point a laser at a mirrored surface.
- Do not leave attached and unused probes uncapped or unblocked.
- Avoid shiny surfaces and always use a laser beam block.

2.7 Health and safety considerations

It is the user's responsibility to understand and comply with all applicable safety regulations. These will be variable based on the installation location of the instrument. Endress+Hauser takes no responsibility for determining the safe use of the instrument based on this qualification procedure.

The following actions and laser safety precautions must always be observed while using the Raman Rxn5:

- The Raman Rxn5 is a Center for Devices and Radiological Health (CDRH) Class 3B device. The user should wear appropriate eye protection.
- The Raman Rxn5 should only be used in a location with a suitable and stable power supply.
- If an interlock is required, all entryways to the room or area housing the Raman Rxn5 analyzer must be fitted with warning signs on doors into the Class 3B area.

2.8 Safety and handling notice

Raman Rxn5 analyzers incorporate a 532 nm laser excitation source. Take the following precautions when handling the analyzer and probes when the laser is **ON**:

- Turn **OFF** the laser power (using the laser on/off key for the appropriate channel, located on the front of Raman Rxn5) before making fiber connections and probe inspections.
- Do not look directly into the fiber probe output (when the optic is disconnected) or the output (window) of any probes.

NOTICE

- ▶ Handle probes and cables with care. Fiber cables should NOT be kinked and should be routed to maintain minimum bend radii (~6 inches). Permanent damage to the cables may result if they are bent beyond the minimum radius.

2.9 Laser safety

Laser light presents special safety hazards not associated with other light sources. All laser users, and others present, need to be aware of the special properties and dangers involved in laser radiation. Familiarity with the Raman Rxn5 and the properties of intense laser radiation will aid in the safe operation of the Raman Rxn5. The Raman Rxn5 may contain one to four 532 nm lasers. Refer to your system specification information to determine how many lasers you have and which channels they are associated with. The combination of intense monochromatic light concentrated in a small area means that, under certain conditions, exposure to laser light is potentially hazardous. In workplace environments, a laser safety program provides environmental, training, and safety controls which may reduce the risk of laser-related injuries and/or workplace damage. For more assistance with taking appropriate precautions and setting the proper controls when dealing with lasers and their hazards, refer to the most current version of ANSI for Safe Use of Lasers Z136.1. The Raman Rxn5 analyzer has hardware safety controls to reduce the risk of laser-based injuries including an interlock and a spring-loaded protective cap covering the laser output of the fiber-optic cables.

The beam is routed from the bottom panel of the instrument via a fiber optic cable using an industial quality electrooptic connector. In the unlikely event that the fiber optic probecable is removed, the interlock is overridden, and the spring-loaded protective cap is overridden, there will be a laser beam exiting the analyzer unit. The beam emerges from a fiber with core diameter of 103 µm and numerical aperture (NA) of 0.29”.

Table 4 provides the fiber core size and mode and the nominal ocular hazard distance equation for the case of laser exiting directly from the analyzer unit.

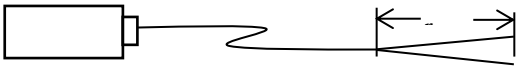
Base Unit Used	Fiber Core Size and Mode	Nominal Ocular Hazard Distance (NOHD) Equation
		
Rxn5 Standard	103 µm multi-mode (NA =0.29)	$r_{NOHD} = 1.7/NA\ (\Phi/\pi MPE)^{1/2}$ multimode equation
MPE at 532 nm continuous viewing – 1 x 10^{-3} W·cm^{-2}		
Φ = Maximum Power in Watts (W)		

Table 4. Laser safety

Another nominal hazard zone calculation needs to be performed to account for the scenario when the analyzer is equipped with a probe. Depending upon the probe utilized, the beam diameter, numerical aperture of the fiber optical cable to the probehead and focusing characteristics of the probehead, the nominal hazard zone calculation will change depending upon if the potential exposure point is at the tip of the probe or at a broken optical fiber. Refer to the specifications section in the pertinent Endress+Hauser Raman probe operating instructions for the appropriate information to complete the nominal hazard zone calculations pertaining to other exposure points.

⚠ CAUTION

- Laser beams can cause ignition of certain substances such as volatile chemicals. The two possible mechanisms for ignition are direct heating of the sample to a point causing ignition and the heating of a contaminant (such as dust) to a critical point leading to ignition of the sample.

⚠ WARNING

- The Raman Rxn5 uses a Class 3B laser as defined in ANSI Z136.1. Direct eye contact with the output beam from the laser will cause severe damage and possible blindness.
- Use of controls or adjustments or performance of procedures other than those specified in this manual may result in hazardous radiation exposure.

For more assistance on appropriate precautions and setting the proper controls when dealing with lasers and their hazards, refer to the most current version of ANSI for Safe Use of Lasers Z136.1.

2.9.1 Optical safety

The Raman Rxn5 is outfitted with one to four Class 3B lasers. Always be aware of the initial direction and possible scattering paths of the laser. The use of OD3 safety glasses is highly recommended for a 532 nm excitation wavelength.

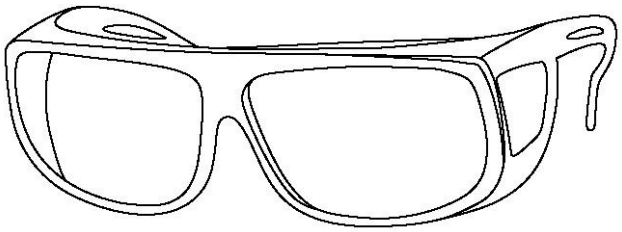


Figure 1. Laser safety glasses

2.9.2 Electrical safety

The Raman Rxn5 utilizes AC and DC voltages inside the enclosure. Do not disassemble the laser enclosure as there are no serviceable parts inside the laser assembly. Only qualified personnel familiar with high voltage electronics should open the system enclosure to perform necessary maintenance or service.

2.9.3 CDRH compliance

The Raman Rxn5 is designed and built to meet the laser performance requirements of 21 Code of Federal Regulations (CFR), Chapter I, Subchapter (J) and is registered with the CDRH.

2.9.3.1 Protective housing

The Raman Rxn5 is enclosed in a protective housing to prevent human access in excess of the limits of Class I radiation as specified in U.S. 21 CFR Section 1040.10 (f) (1) except for the output, which is Class 3B.

2.9.3.2 Remote interlock connector

The Raman Rxn5 is supplied with a remote interlock connector for each channel. These connectors allow the operator to utilize an external interlock circuit in conjunction with Raman Rxn5 operations. Design and function of an external interlock circuit should meet the capability and intent of the most current revision of the ANSI Z136.1 Standard. No laser radiation for a particular channel is emitted unless both the fiber and remote interlock connectors are connected.

2.9.3.3 Compliance labels

The Raman Rxn5 analyzer is certified to comply with the U.S. Federal Regulation 21 CFR, Chapter I, Subchapter (J), as administered by the CDRH.

2.9.4 WEEE directive compliance

The Raman Rxn5 complies with the Waste Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU. The WEEE Symbol shown below is placed on all WEEE-compliant assemblies.

Figure 2. WEEE symbol

If no other means of disposal are available, Endress+Hauser offers a “Take Back” disposal program at no cost. To participate in the “Take Back” disposal program, please contact the Endress+Hauser Service Department at support.kosi@endress.com.

2.9.5 Specific conditions of use

1. The fiber optic cable linking the laser output to any Raman probe shall be installed so that the minimum bend radius specified by the cable manufacturer is not exceeded.
2. Where it is necessary to monitor the process level to ensure that the optical beam is not exposed to a potentially explosive atmosphere, the devices used to monitor the level shall be intrinsically safe or classed as simple apparatus, and be installed so as to provide a fault tolerance of 2 for category 1 equipment. The functional safety of this arrangement has not been assessed as part of this certification and it is the responsibility of the installer or user to ensure that an appropriate mechanism is in place.
3. The user shall purge the enclosure prior to start-up and upon loss of pressurization in accordance with the instructions marks on the Raman Rxn5 enclosure. An appropriate means of isolation shall be provided by the user, appropriately certified for the area of use and correctly installed.
4. Where Intrinsically Safe (IS) Galvanic Isolators are added to the main enclosure in order to produce IS signals to external apparatus not covered by this certification, the IS galvanic Isolators shall have an ambient working temperature upper limit of at least 60˚C. The IS parameters pertaining to these isolators shall be conveyed to the user in an appropriate manner. The IS nature of any such circuits has not been assessed as part of this certification and this certificate is not to be taken as indication that these IS circuits comply with relevant requirements.

2.10 Explosion hazard safety

The Raman Rxn5 is designed for use in potentially explosive atmospheres with an output designed for use in explosive atmospheres when purged per the procedures detailed in *Section 7.13* and *Section 7.14*. Usage parameter limits vary based upon the processed material and probe head used.

The Raman Rxn5 must be installed following all federal, state, and local codes for equipment located in a potentially explosive area classified as Class 1, Division 2, or Zone 2. The protective gas shall not exceed 40˚C at the inlet to the Raman Rxn5.

2.11 Construction materials

Materials used in the construction of the Raman Rxn5 enclosure, including all sealing materials, are compatible with the chemicals that the enclosure would typically encounter in the field. The enclosure surfaces have been designed and evaluated to ensure that they do not present hazards such as static buildup.

2.12 Protective gas

See *Installation* in Chapter 7 for warnings and information on the protective gas supply.

3 Product description

3.1 System overview

The Raman Rxn5 Analyzer is a turnkey laser-based Raman analyzer developed for applications in the petrochemical market. In these applications, the Raman Rxn5 analyzer produces spectra that resemble a chromatogram from a Gas Chromatography (GC) system, which can be analyzed using similar univariate methods commonly used in the analysis of chromatographic data. The Raman Rxn5 analyzer can be used to determine the composition of gas mixtures, but without the need for any valves, ovens, columns, or carrier gases that lead to the higher operational expense of GC systems.

Fiber-optic probes (for both gases and liquids) are used to interface the Raman Rxn5 analyzer to the process sample. The Raman Rxn5 features four independent probes operating simultaneously, replacing the need for mechanical stream switching often used in multi-stream analyses with a single instrument. In addition, the analyzer allows for the application of four independent software methods for analyzing different stream compositions. In essence, it represents four analyzers in one unit.

The Raman Rxn5 analyzer and can measure gas mixtures containing several components, with concentrations as low as 0.1 vol%. Typical gases that can be analyzed inlcude: H_2, N_2, O_2, CO, CO_2, H_2S, CH_4, C_2H_4, C_2H_6, Cl_2, F_2, HF, BF_3, SO_2, and NH_3. In addition, the Raman Rxn5 has a wide linear dynamic range and can measure components at levels typically from 0.1 mol % up to 100 mol%.

The Raman Rxn5 analyzer incorporates a flat screen, touch-sensitive display that is utilized for all user interactions. A simple tap with a finger is the equivalent of a mouse click.

3.1.1 Raman spectroscopy

In Raman spectroscopy, a sample is excited with a laser source of a specific wavelength, or color. The laser light is often transmitted to the sample via a fiber-optic cables and an optical probe Laser excitation causes the sample molecules to vibrate and absorb some of the laser energy, which causes some light to be re-emitted from the sample at lower energy levels, or wavelengths (colors), than that of the laser excitation source. This Raman-shifted light is carried back to the Raman Rxn5 through a separate fiber optic for analysis. Each chemical species in the gas sample can scatter one or more discrete wavelengths, or colors, of light. The number of colors and their intensity are unique to each chemical species. Each peak in a Raman spectrum corresponds to a different wavelength of light (Figure 3).

3.1.2 Lasers

The unique design of the Raman Rxn5 contains up to four lasers and four sample probes, each operating independently. This allows the analyzer to measure four separate samples simultaneously. Inside the analyzer, each of the four lasers launches light into a discrete fiber optic patch cable, which is routed to one of four I/O panels on the bottom of the analyzer. At each I/O panel, this patch cable is coupled to one side of the main fiber optic transport cable by way of an industrial hybrid connector, which delivers the laser to the sampling probe for sample excitation. The Raman shifted light is then collected in the probe and coupled to a separate fiber optic for transport back to the analyzer, where it is coupled to a separate patch cable inside the analyzer for delivery to the detection module. All four returns from the sampling probes are multiplexed into one connector at the detection module for analysis.

3.1.3 Detection module

The Raman Rxn5 detection module is where the collected Raman scattered light from the sample is measured. There are four analysis channels in the Raman Rxn5 detection module, one for each of the four streams. The Raman scattered light from these four streams enters the detection module where it is dispersed onto four separate regions of a Charge Coupled Device (CCD) array in a similar manner to how a prism breaks up light into separate colors. The Raman Rxn5 detection module measures the intensities of the various colors of light that make up the Raman light collected from the sample. The X-axis of the Raman spectrum represents the different color components of the Raman scattered light and the Y-axis represents the intensities of these colors.

The native data format that the CCD outputs to the system software is simply number of Analog/Digital (A/D) counts (intensity) for a given X-axis region of the CCD. We need to correlate these X-axis regions to the colors of light that are impinged upon them. This is where wavelength calibration comes into play. Nested under the detection module is a wavelength calibration module. In addition to the four stream analysis channels, there are two calibration channels presented to two additional regions on the CCD array. For each sample acquisition, a wavelength calibration module

emits light that is collected onto these additional calibration regions. The atomic emission light source in the wavelength calibration module contains many discrete colors that are extremely stable. Since the exact wavelength, or color, is known for the discrete color lines emitted by the module, it is possible to correlate a CCD camera region with a particular wavelength of light, which is used to analyze the Raman spectrum.

The X-axis of an Raman spectrum is most commonly displayed in units of Raman shift (cm -1), which represents the energy difference between the wavelength of the excitation source and the wavelength of each Raman-scattered peak. Therefore, it is necessary to accurately calibrate the exact wavelength of the laser source. The Raman peak of one or more of the chemicals that are known to be present in the sample is used to calculate the exact wavelength of the laser, which represents '0' on the Raman shift X-axis.

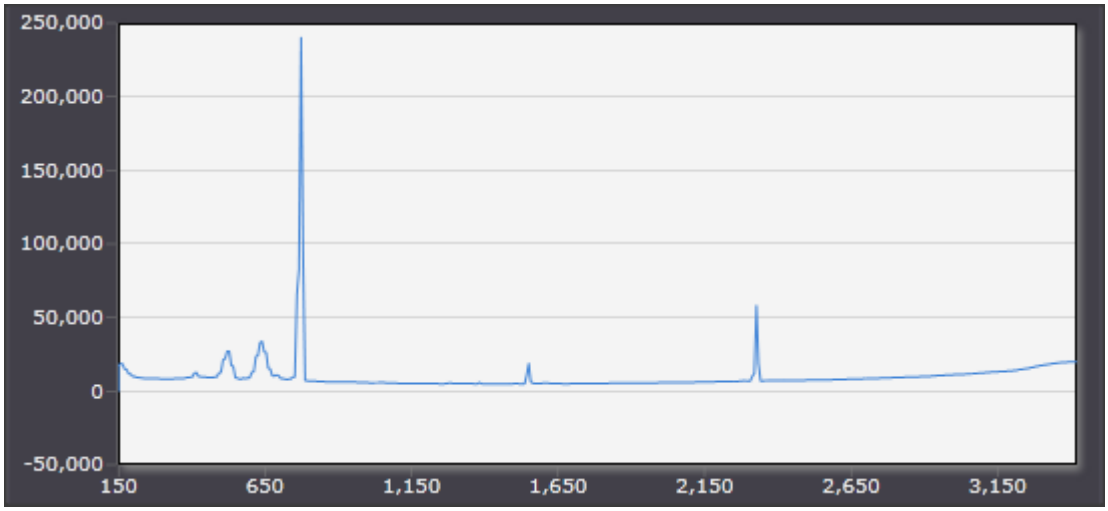


Figure 3. Typical spectrum from a Raman Rxn5 analyzer

3.2 Product Design

3.2.1 Raman Rxn5 Analyzer exterior

The exterior of the Raman Rxn5 consists of a painted steel (or optional 316 Stainless Steel) enclosure.

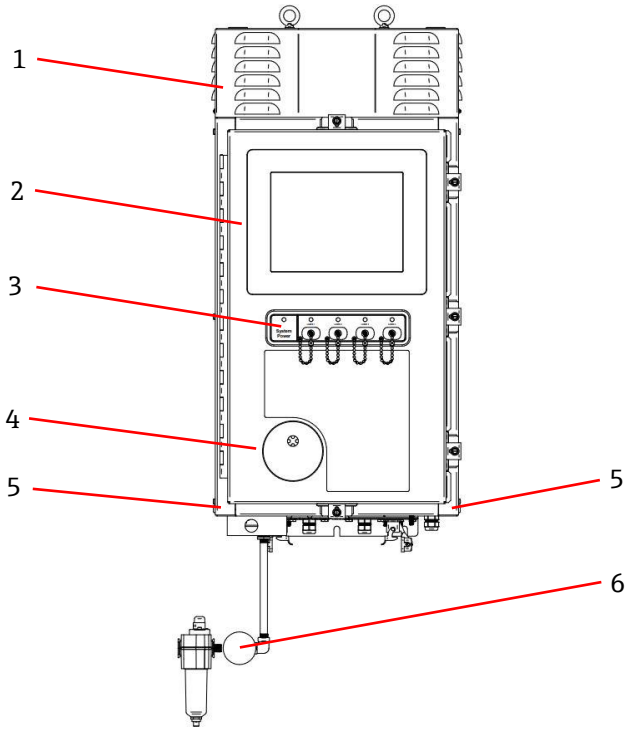


Figure 4. Exterior of the Raman Rxn5 analyzer

#	Name	Description
1	Cooling Exhaust Vent Shroud	Cooling air exhausts through the vents in this cover. Do not block.
2	Touchscreen Monitor	The built in in Raman RunTime interface and touchscreen monitor.
3	Switch Indicator Panel and Laser On/Off Keys	▪ **System power indicator.** Green and steady indicates system is powered and operating normally. Red and fast flashing indicates system is powered, but internal temperature is too warm (take action). Red and slow flashing indicates that the system is too cold. Red and slow is normal upon startup in colder environments. ▪ **Laser on/off keys and indicators.** Magnetically coupled switches control laser power for each channel. Switches are lockout/tagout compatible. Yellow indicators for each channel indicate if laser on.
4	Purge Indicator	A Green indicator light that indicates that the pressure inside the enclosure is above 0.20” water column.
5	Cooling Air Inlet	Cooling air enters in this location in both sides of enclosure. Do not block.
6	Purge Valve and Purge Air Conditioning	The dilution and leakage compensation includes two modes: ▪ **High Flow Dilution.** The dial on the valve should be turned so the slot in the dial is horizontal and lined up with the “ON” position. This position is used to purge enclosure of potentially hazardous gases prior to power-up. Dilution time is >9.5 minutes. ▪ **Leakage Compensation Mode.** After manual dilution has been performed, the valve can be switched to this mode by turning the dial so the slot in the dial is vertical. This position is used to reduce purge air consumption after initial dilution.

Table 5. Raman Rxn5 analyzer interior view

3.2.2 Raman Rxn5 Analyzer interior features

Interior features within the Raman Rxn5 analyzer are shown below:

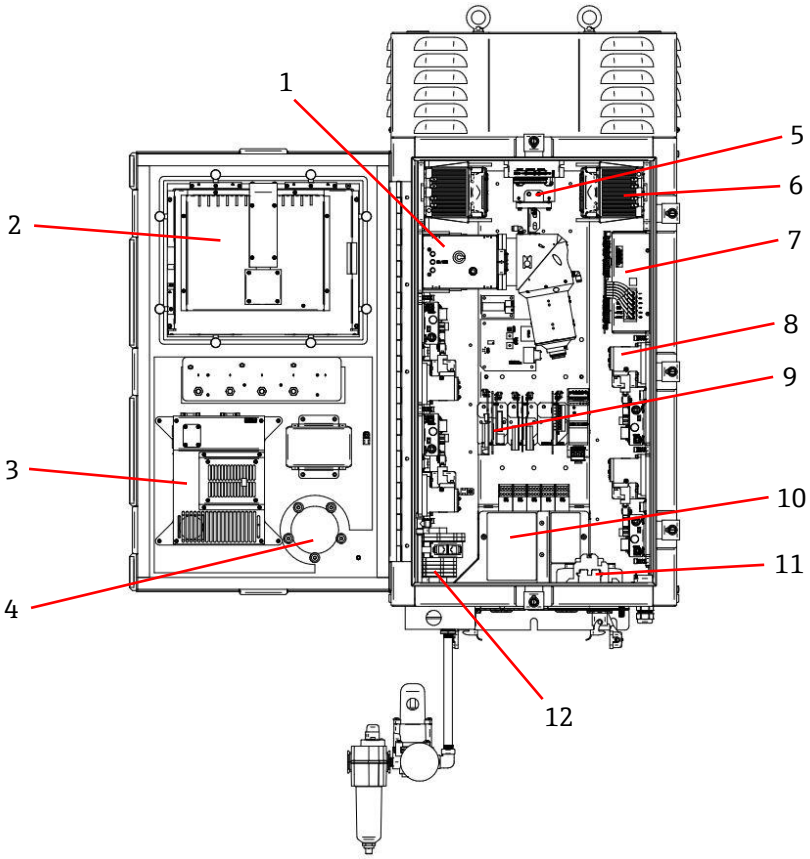


Figure 5. Raman Rxn5 analyzer interior view

#	Name	Description
1	Detection Module	The location where collected Raman scattered light from the sample is analyzed. There are four analysis channels in the detection module.
2	Touchscreen Monitor	Touchscreen monitor for Raman RunTime interface.
3	Embedded Controller	System controller with Raman RunTime.
4	Relief Valve	Monitors internal enclosure purge pressure and provides enclosure over-pressure relief valve. A **Green** indicator light that indicates that the pressure inside the enclosure is above 0.20" water column.
5	Motor Controller	A device that regulates the speed and direction of the cooling fan motor.
6	Coolers	Peltier cooling devices to remove waste heat from electronics inside the enclosure.
7	Power Supply	Main power supply which provides DC power for all electronics inside the enclosure.
8	Lasers (4)	The Rxn5 includes up to four lasers, depending on configuration ordered.
9	Control Electronics	Analyzer internal sensor signal conditioning and digitization electronics. Thermal control electronics and IS barrier power supply also reside here.
10	Intrinsically Safe IO Area	Probe fiber interlock and temperature/pressure sensor connection area.
11	AC Mains Distribution	Customer supplied mains power is connected here. Mains power is distributed to additional internal components via factory installed terminal blocks and wiring.
12	Non-IS Low Voltage IO Area	Connection area for: Qty 2 RS-485 Modbus RTU, Qty 2 TCP/IP for Modbus TCP and/or remote control, Qty 4 24VDC sampling valve driver.

Table 6. Raman Rxn5 analyzer interior view

4 Incoming product acceptance and product identification

4.1 Incoming acceptance

1. Verify that the packaging is undamaged. Notify the supplier of any damage to the packaging. Keep the damaged packaging until the issue has been resolved.
2. Verify that the contents are undamaged. Notify the supplier of any damage to the delivery contents. Keep the damaged goods until the issue has been resolved.
3. Check that the delivery is complete and nothing is missing. Compare the shipping documents with your order.
4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture. The original packaging offers the best protection. Make sure to comply with the permitted ambient conditions.

If you have any questions, please contact your supplier or your local sales center.

NOTICE

Incorrect transportation can damage the analyzer

▶ Always use a lifting truck or a fork-lift to transport the analyzer.

4.1.1 Nameplate

The nameplate located on the rear of the analyzer provides the following information about your device:

- Manufactuer Contact Information
- Laser Radiation Notice
- Electric Shock Notice
- Model Number
- Serial Number
- Wavelength
- Maximum Power
- Build Month
- Build Year
- Patent Information
- Certification Information

Compare the information on the nameplate with the order.

4.1.2 Identifying the product

The serial number of your product can be found in the following locations:

- On the nameplate.
- In the delivery papers.

4.1.3 Manufacturer address

Endress+Hauser, 371 Parkland Plaza, Ann Arbor, MI 48103 USA

4.2 Scope of delivery

The scope of delivery comprises:

- Raman Rxn5 analyzer in the configuration ordered
- Raman Rxn5 Operating Instructions (electronic copy)
- Raman Rxn5 Certificate of Product Performance (electronic copy)
- Local declarations of conformity, if applicable (electronic copy)
- Certificates for hazardous zone use, if applicable (electronic copy)
- Raman Rxn5 optional accessories, if applicable

If you have any queries: Please contact your supplier or local sales center.

4.3 Certificates and approvals

The Raman Rxn family of base analyzer units are CE-marked as being compliant with the low-voltage safety directive, as well as applicable laser eye/skin safety standards 21 CFR 1040 LVS [low voltage safety] directive 2014/35/EU, EMC [electromagnetic compatibility] directive 2014/30/EU and IEC 60825-1 laser safety standard.

The Raman Rxn5 is designed for use in potentially explosive atmospheres with an output designed for use in explosive atmospheres. Usage parameter limits vary based upon the processed material and probehead used.

The Raman Rxn5 must be installed following all federal, state, and local codes for equipment located in a potentially explosive area classified as Class 1, Division 2 or Zone 2. The protective gas shall not exceed 40°C at the inlet to the Raman Rxn5.

5 Installation

5.1 Sampling probe fiber optic connection

NOTICE

- Endress+Hauser offers a *Service Kit, Rxn5, Fiberoptics and Hand Tools (p/n 2013270)*, which is intended for diagnosing and servicing the major field-serviceable optical paths and components of the Raman Rxn5 system. It is also intended to diagnose and identify components that may require replacement or factory service.

Two I/O panels on the Raman Rxn5 each provide sampling probe connections for two of the four channels available. The gray locking connector is the hybrid fiber optic connector that contains both the excitation and collection fiber optics as well as the electrical laser interlock. Exercise appropriate care when making these connections to ensure clean fiber optic connections. See *Cleaning an optical fiber* in *Section 10.14* for more information.

⚠ CAUTION

- When installing the probe *in situ*, the user must provide the strain relief to the fiber optic cable at the probe installation location.

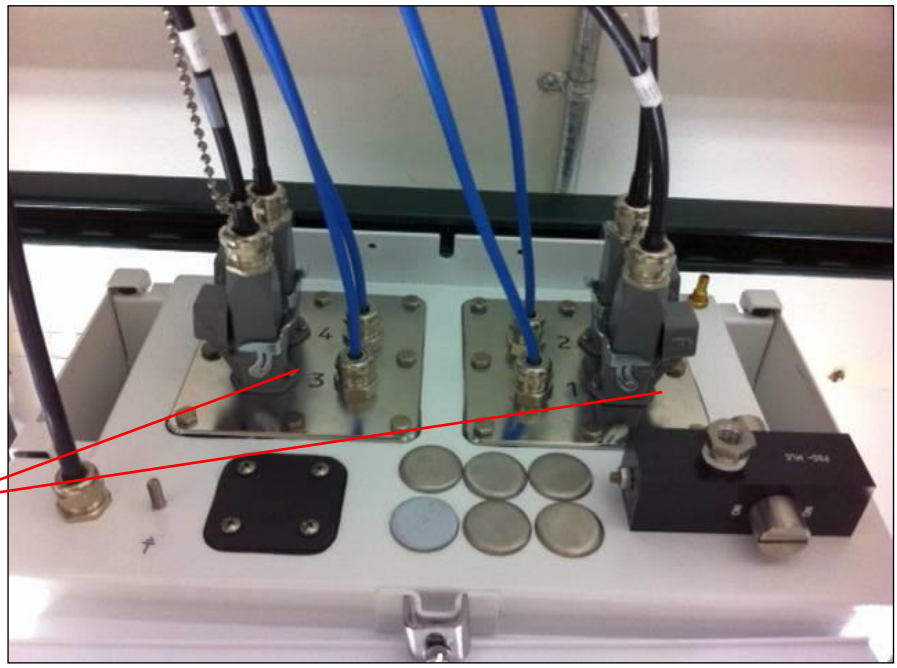


Figure 6. I/O panels provide sampling probe connections

5.2 Sample temperature and pressure sensors

In certain applications, each sampling probe is complemented with two environmental sensors—sample temperature and pressure sensors. These sensors are installed into the sampling system adjacent to each sampling probe. The sensors have 4 – 20 mA outputs and their ranges are configured to order.

The sensors are interfaced to the analyzer by up to four IS barriers—one per channel. One IS barrier interfaces to a temperature sensor and a pressure sensor. The IS barriers are installed on the lower DIN rail to the left of the electrical laser interlock IS barrier. The left most IS barrier is for channel 1's sensors with 2, 3, and 4 following from left to right. The terminal hook-up is detailed in *Installation instructions for intrinsically safe temperature and pressure sensors* in *Section 7.11.3*, Step 8. The electrical cables are installed through the appropriate cable gland (see Figure 8).

Figure 7. IS barriers

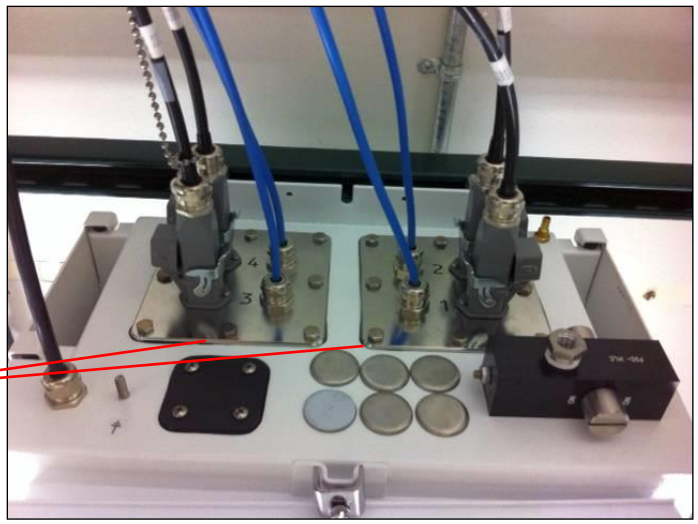


Figure 8. Temperature and pressure cable glands

5.3 Sample solenoid valve driver

⚠ CAUTION

- The following outputs are extra low voltage circuits and are not intrinsically safe. These outputs must be terminated in a non-hazardous location.

The Raman Rxn5 is configured with an optional solenoid driver to drive up to four solenoids at the sampling system. One solenoid per stream can be driven, the timing of which is configured to order and set up at the factory. Each output provides 24 VDC at 0.5A max (12 W max). The maximum wire size the terminal blocks will accept is 18 American Wire Gauge (AWG). The channel number and polarity are labeled on the terminal blocks detailed in *Non-I.S. communications and I/O wiring* in *Section 7.10*. It is the installer's responsibility to route solenoid power cables from the terminal blocks to the sampling solenoid valves through approved glands.

5.4 COM port

The Raman Rxn5 system can be configured at the factory to communicate with the customer's Distributed Control System (DCS) via Modbus over RS-485. Endress+Hauser will provide the Modbus map. It is the installer's responsibility to route the communications cable from the computer to the DCS interface through an approved gland. The pinout for the Raman Rxn5 RS-485 COM port is labeled on the terminal blocks and referenced on the IS shield label.

NOTICE

- Consult with the factory for proper terminal resistor settings. See *Specification Raman Rxn5 Modbus (p/n 2015814)* for more information.

5.5 Ethernet ports

Two Ethernet ports are provided. The Raman Rxn5 can also communicate with the customer's DCS via Modbus over TCP/IP. An RJ-45 connector is provided on the terminal block DIN rail. See *Section 7.10* for details.

NOTICE

- Consult with the factory for proper terminal resistor settings. See the *Specification Raman Rxn5 Modbus (p/n 2015814)* for more information.

5.6 Purge alarm

A purge alarm is provided to indicate positive pressure in the enclosure. There are two connections on the I/O terminal blocks.

5.7 Purge indicator and valve system

The purge indicator installed on the Raman Rxn5 analyzer is of the Z-Purge variety from Purge Solutions, Inc. The indicator is certified for use in Division 2/Zone 2 hazardous areas. The Z-purge indicator has a **Green** indicator light that indicates that the pressure inside the enclosure is above 0.20" water column. The indicator provides a dry contact alarm relay for a remote alarm if needed; it is the installer's and/or customer's responsibility to interface to the alarm contacts.

The Z-Purge indicator is paired with a Purge Solutions manual leakage compensation valve. There are two modes of operation for the valve—dilution and leakage compensation. For a high flow dilution, the dial on the valve should be turned so the slot in the dial is horizontal and lined up with the "ON" position. Once the manual dilution has been performed for the specified time, the valve may be switched to the leakage compensation mode by turning the dial so the slot in the dial is vertical. Leakage compensation mode allows the enclosure to remain pressurized with a much smaller usage of purge air after the manual dilution has occurred.

Please refer to the Purge Solutions CYCLOPS Y&Z Purge Indicator User's Manual for more detailed information.

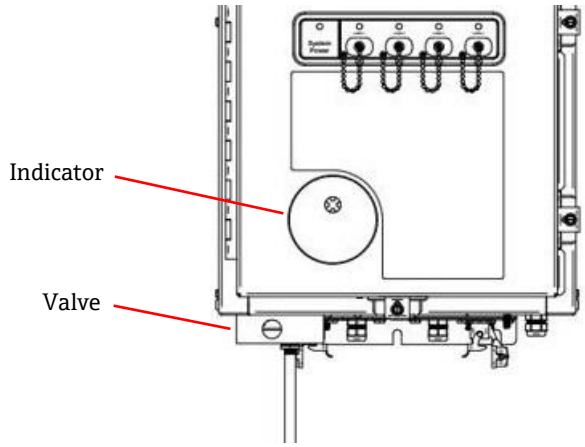


Figure 9. Z-Purge indicator and the purge solutions manual leakage compensation valve

5.7.1 Air supply requirements

- **Inlet Fitting.** ¼-18 NPT.
- **ISA Grade.** Hydrocarbon free.
- **Water and Oil Free.** -40°C dew-point.
- **Particle Size.** 5 micron maximum.
- **Pressure Range.** 50 – 120 PSI.
- **Max Flow Rate for Purging.** 2.0 SCFM.
- **Max Flow Rate for Leakage Compensation.** 0.75 SCFM.

5.7.2 Installation

The Raman Rxn5 is shipped without the purge regulator and filter assembly installed. It is the installer's responsibility to install the purge regulator and filter assembly and interface the purge air supply to the assembly. The inlet to the filter is ¼-18 NPT. Appropriate thread sealant must be used.

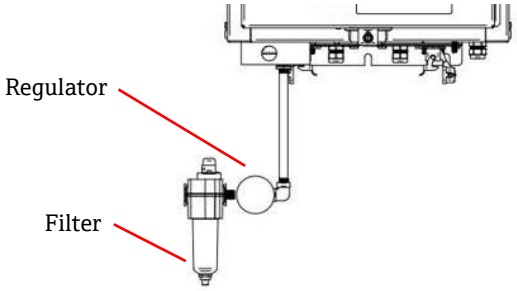


Figure 10. Purge regulator and filter assembly

5.7.3 Operation

The purge regulator has been pre-set at the factory to 2.0 psi during the high flow dilution. It may be necessary to reset the operating pressure at installation. The normal operating range for the regulator is 2.0 – 2.5 psi during high flow dilution (ON position). Operating in the pressure range will ensure appropriate air flow into the enclosure.

Follow these steps for power application after commissioning and the analyzer is ready to be put into service:

1. Tighten the door clamps in five places with a flat blade screwdriver or 3/8" nut driver to ensure a proper seal. See Figure 11.

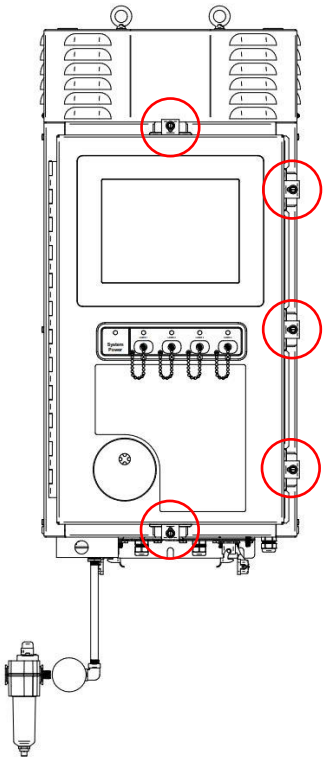


Figure 11. Door clamps

2. Apply purge air to inlet filter assembly.
3. Turn the dial on the purge valve to the **ON** position.
4. Purge for a minimum of 9.5 minutes.
5. Apply power to the analyzer and observe the indicator light. If the indicator light does not turn **ON**, immediately power down the system and check for air leaks in the door seal and cable glands. Restart at step 4.
6. Turn the valve to the leakage compensation position and observe the indicator light. In the leakage compensation position, the knob on the purge valve will have its slot positioned 90 degrees from the **ON** label.

5.8 Thermal control

Heat removal is a challenge in all devices that consume electrical power. The major power consuming and heat producing components in the Raman Rxn5 are conductively cooled through their heat sinks into plenums on either side of the analyzer into the external ambient environment (Figure 12). The external fan pulls air through each plenum and over all heat sinks. This design maximizes heat removal from the devices and minimizes reliance on active devices to remove heat from the enclosure.

⚠ CAUTION

- It is crucial that the plenum covers remain installed at all times except for heat sink cleaning; their removal causes no air to be moved across the heat sinks and devices may overheat. The covers may be removed for no more than five minutes for cleaning.

Figure 12. Heat sinks on the side of the Raman Rxn5

The Raman Rxn5 is specified to operate in ambient temperatures between −20° C and +50° C. The Raman Rxn5 has a sophisticated microprocessor-based thermal control system to regulate its internal temperature. Not only does the system regulate internal temperature, it also controls power to several key components inside the Raman Rxn5.

The nominal setpoint for thermal control is 35° C. The sensor used in the feedback loop for the thermal control algorithm is mounted inside the detection module and is referred to as the “grating” temperature sensor.

Between ambient temperatures of ~15° C and 33° C, the system will regulate its internal temperature at 35° C.

Above ambient temperatures of ~33° C, the system internal temperature will simply track external temperature with a delta of + 2 − 3° C.

Below temperatures of ~15° C, the system will simply track external temperature with a delta of ~ + 20° C.

The levers the thermal control system uses to control its internal temperature are the main fan speed at the top of the enclosure and the two internal Heating, Ventilation, and Air Conditioning (HVAC) modules (Figure 13). The fan speed is controlled by a feed-forward function based on external air temperature.

At external temperatures of 15° C and below, the fan will be turned off. At temperatures of 33° C and above, the fan will operate at maximum speed. The fan speed will increase linearly from off to full speed between external temperatures of 15 and 33° C. The fan speed provides coarse thermal control and the internal HVAC modules provide fine tuning of the internal temperature.

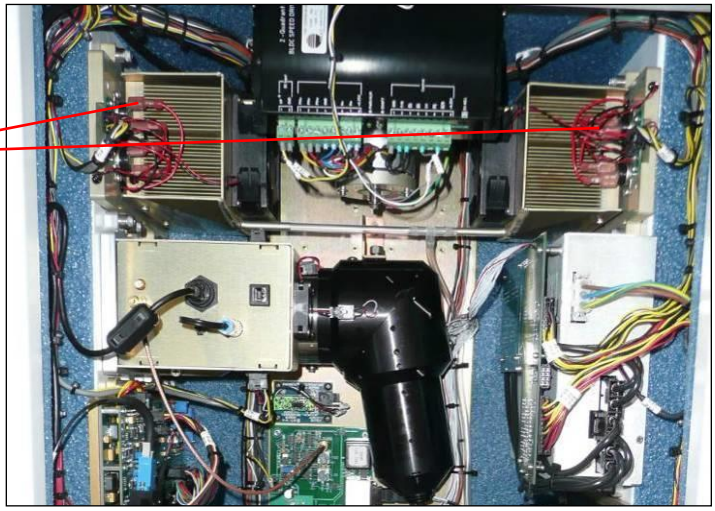


Figure 13. HVAC modules

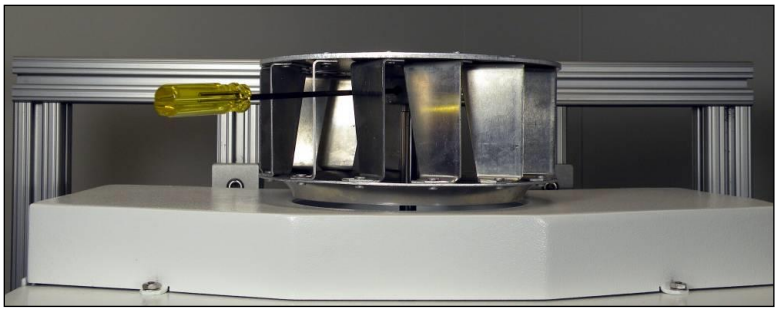


Figure 14. Top-mounted fan impeller with shroud removed

Figure 15. The fan housing or shroud

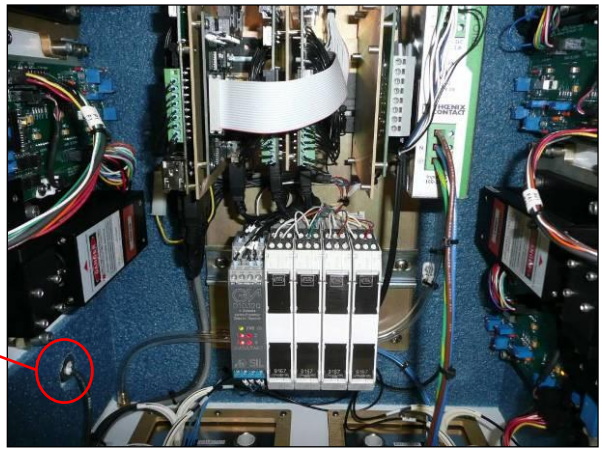


Figure 16. External temperature sensor mounted in bottom of left plenum

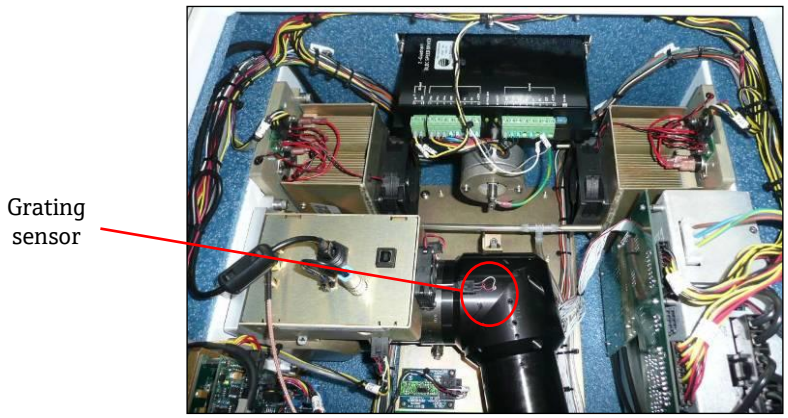


Figure 17. Grating sensor for thermal control

5.8.1 Electrical power control

The Raman Rxn5 thermal control system maintains power application to modules that may be temperature sensitive. The thermal control system has control over the electrical power of the following components: lasers, detection module and touch screen monitor. The computer/hard drive, Universal Serial Bus (USB) hub, purge indicator, calibration board, and all other miscellaneous electronic devices are always on if the systems is powered. The HVAC modules are controlled by the temperature control servo loop and can be turned on or off at any time by the control loop.

Upon a cold start, only the lasers will be selectively powered up, while power is immediately applied to the remaining components. The requirement for the lasers to be powered is that their base plate temperatures must be greater than 0° C. Upon a cold start in ambient conditions less than 0° C, the system will enter a warming-up state where the red indicator Light Emitting Diode (LED) on the front of the analyzer will flash slowly (1 Hertz) and the system heaters will be turned on. Once all laser base plate temperatures have reached 0° C, then power will be applied to all lasers and the indicator LED will stop flashing red and turn solid green.

In addition to the cold start power application rules, the thermal control system can turn off power to the lasers, detection module and HVAC modules if their base plate temperatures are too high. The upper temperature limit for the laser base plates, detection module base plate and HVAC base plates is 75° C. If one of these devices has been powered down because of an over-temperature event, the indicator LED on the front of the analyzer will flash red (2 Hertz). Currently, the system software does not indicate if the power has been turned off to any of these modules, so the only indication is manual inspection of the base plate temperatures in the software diagnostic panel.

6 Electrical connection

6.1 Raman Rxn5 system interfaces

The laser control electronics and coolers are powered on with the system.

6.1.1 System power light

The system power light (Figure 18) may be in one of the following three states:

Status	Description
Green and steady	The system is powered and operating normally.
Red and fast flashing	The system is powered but the temperature is too warm. Take action to correct.
Red and slow flashing	The system is warming up.

Table 7. Power light

6.1.2 Laser ON/Off keys

The four laser on/off keys (Figure 18) are magnetically-coupled switches that can put the laser in standby mode and remove power to diode.

The laser lights may be in one of the following two states:

Status	Description
Yellow and steady	The laser interlock is closed, the diode is on and active.
Off	The laser interlock is open and the diode is off.

Table 8. Laser ON/OFF keys

The system features a lock out tag out system. A laser key may be removed and a customer-supplied lock inserted below it. When the lock is in place, the laser key may not be inserted, preventing power to that laser.

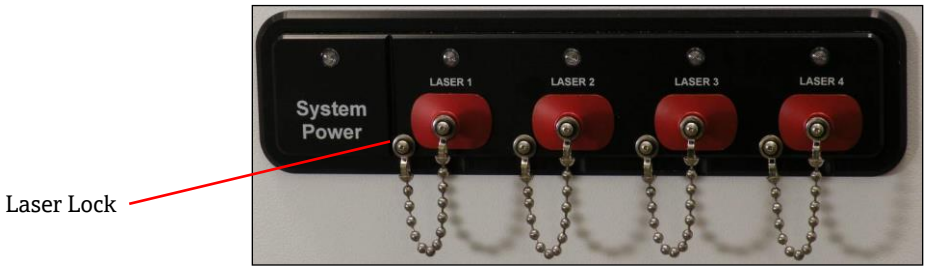


Figure 18. System power light and laser on/off keys

6.1.3 Purge indicator

The CYCLOPS purge indicator is shown is shown in Figure 4 and Figure 19. The light will be on if there is positive purge pressure. For more information, refer to *Purge indicactor and valve system* in Section 5.7.

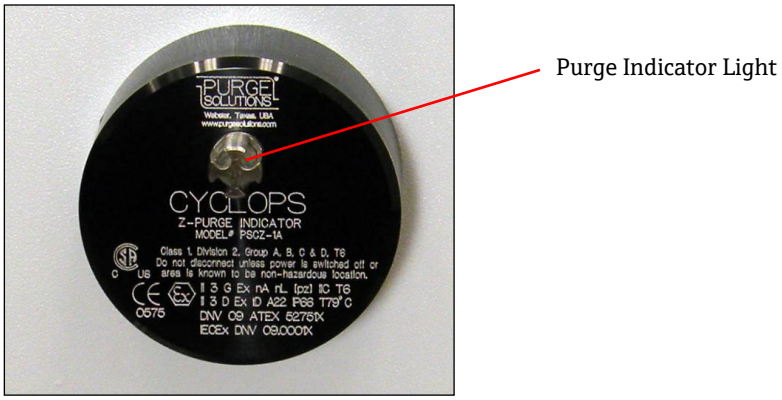


Figure 19. Purge indicator

6.1.4 Glands and connectors on the bottom of the Raman Rxn5

Figure 20 shows the temperature and pressure glands for all four channels is shown below, the fiber optic connectors for all four channels, as well as the Alternating Current (AC) power input, the ground stud, the purge valve, and gauge.

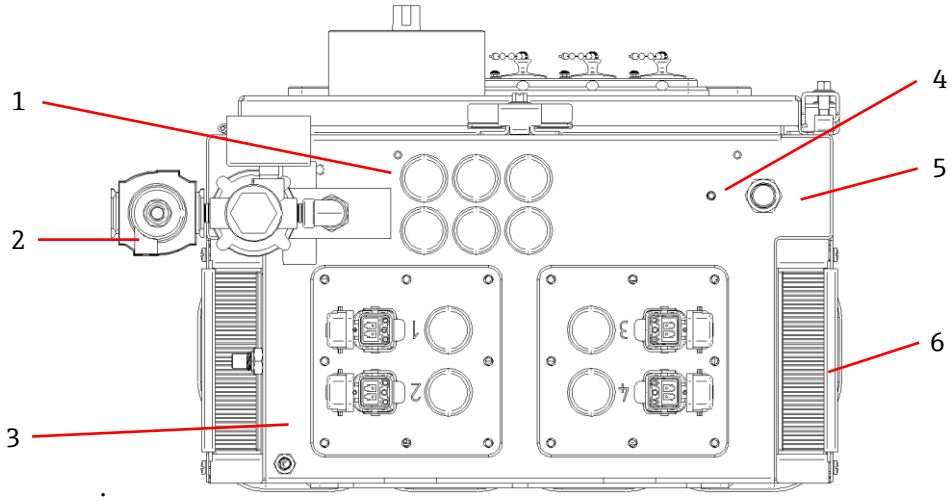


Figure 20. Glands and connectors on the bottom of the Raman Rxn5

#	Name	Description
1	Low voltage IO location	Six holes for low voltage communications and process control wiring. Cord grips provided by customer and shall meet local electrical and hazardous area safety standards.
2	Purge air inlet	¼" NPT connection point for purge air supply.
3	Intrinsically safe IO location	IO panels include up to four electro-optical connectors for sampling probes and cord grips for sample environmental sensors.
4	Earth ground stud	¼-20 x .75" enclosure earth ground stud.
5	AC mains inlet	Cord grip location for AC mains power connection.
6	Cooling air inlet	A cooling air inlet on each side of the enclosure. Do not block.

Table 9. Raman Rxn5 analyzer bottom view

6.2 Desiccant modules and condensate drain

The Raman Rxn5 system contains two silica gel desiccant modules and a condensate drain system (Figure 21). The drain system is a water trap design, initially filled with non-toxic baby oil.

If the humidity approaches dew point, an internal relative humidity monitor will raise a warning. At this point, you should replace the desiccant modules.

In addition, if condensate comes out of the port, the internal humidity is too high and the desiccant cartridges (Figure 22) should be replaced (*Section 10.12*) or recycled. The desiccant cartridges are blue when they are initially activated and will turn pink when they are no longer able to absorb moisture. The desiccant cartridges may be recycled by heating in a microwave oven for 15 – 20 seconds or until blue again.

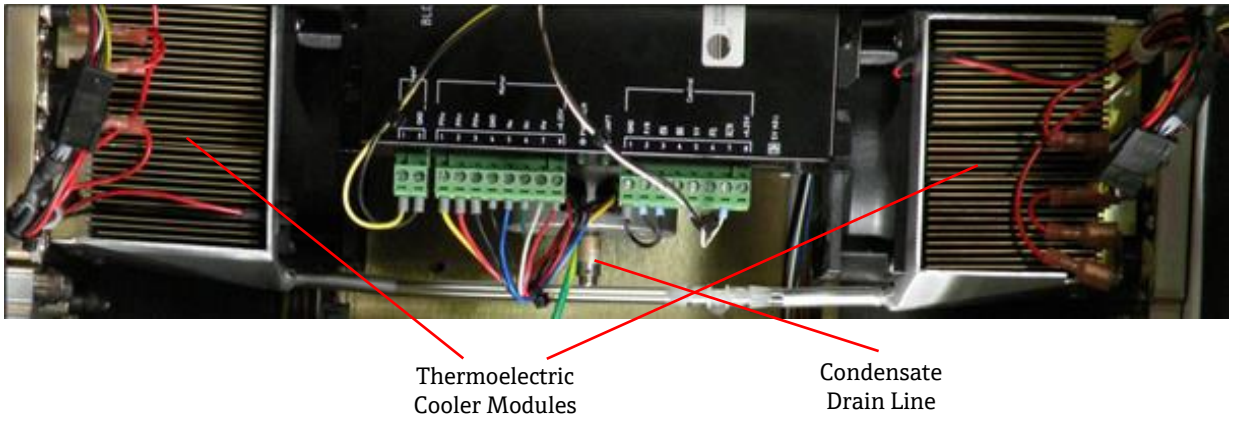


Figure 21. Condensate drain system

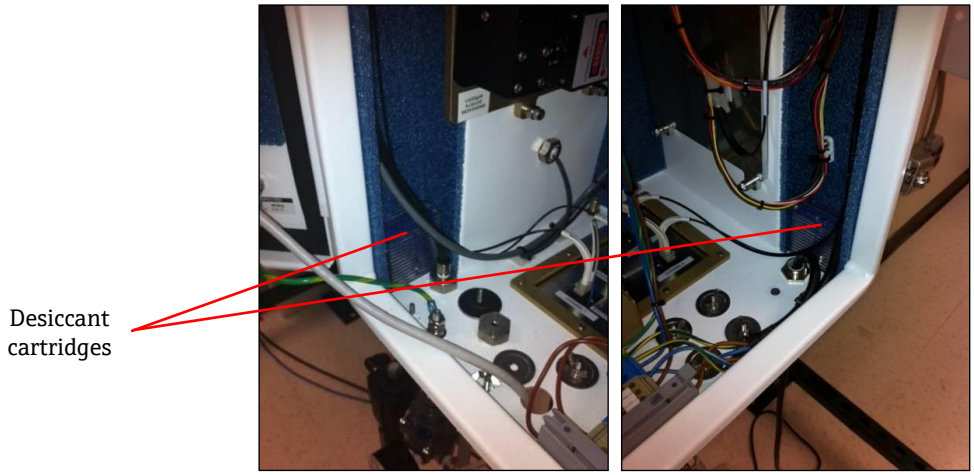


Figure 22. Desiccant cartridges

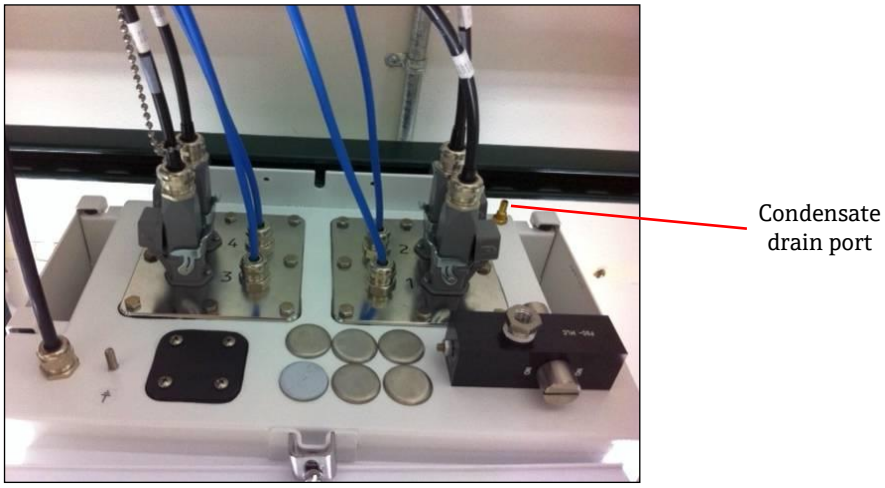


Figure 23. Condensate drain port

6.3 AC mains power distribution

Incoming power is brought into the analyzer through an approved gland on the bottom right side of the analyzer. AC power is installed to the analyzer by a customer installer per applicable local codes.

The Raman Rxn5 can accept single phase AC voltages between 90-264 VAC and 47-63 Hertz (Hz). The enclosure must be grounded according to local codes using the ground stud on the external enclosure adjacent to the power entry cable gland (Figure 20).

The Raman Rxn5 is supplied with a 10A C-Curve circuit breaker, Automation Direct, WMZT1C10. Power wires shall be installed to the right hand side of the terminal blocks (Figure 24). The enclosure MUST be grounded using the ground stud provided adjacent to the power entry gland (Figure 20). An optional grounding cable may be connected to any **Green** terminal block on the DIN rail. As long as the enclosure is properly grounded at the external ground stud, the ground terminal blocks will pick up good ground through the enclosure.

The incoming AC power is routed first through two thermal snap switches at the rear of the DIN rail. The thermal switches will open if the enclosure internal air temperature rises above 57 deg C. The main purpose of the thermal protection is to ensure that the IS barriers used for I/O will not be subjected to temperatures higher than they are rated for. If the instrument has shut down because one or both of the thermal snap switches has opened, the instrument will not be powered regardless of whether power is applied to the analyzer.

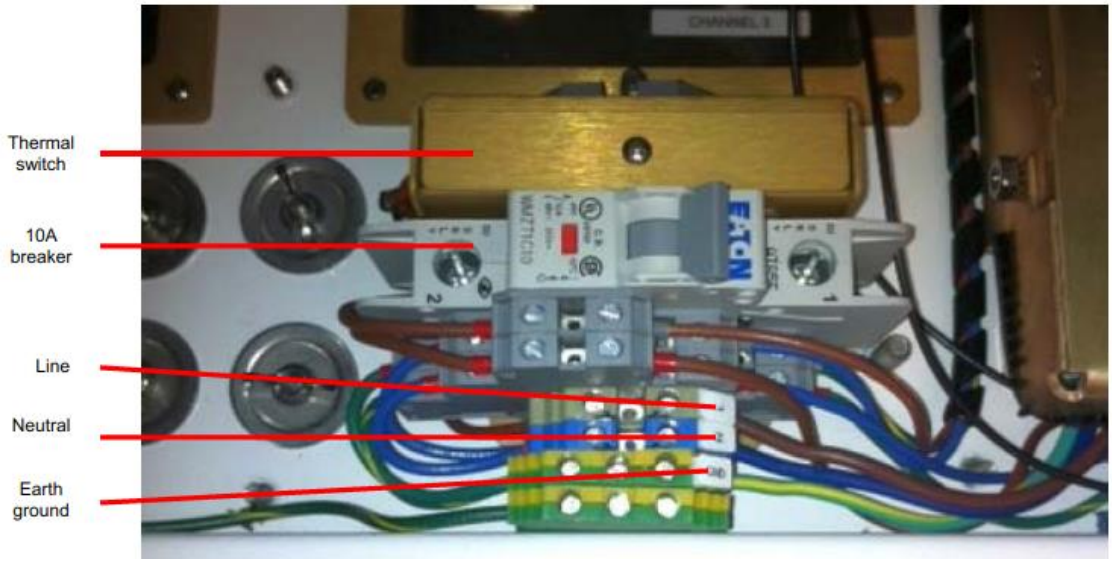


Figure 24. AC mains DIN rail distribution

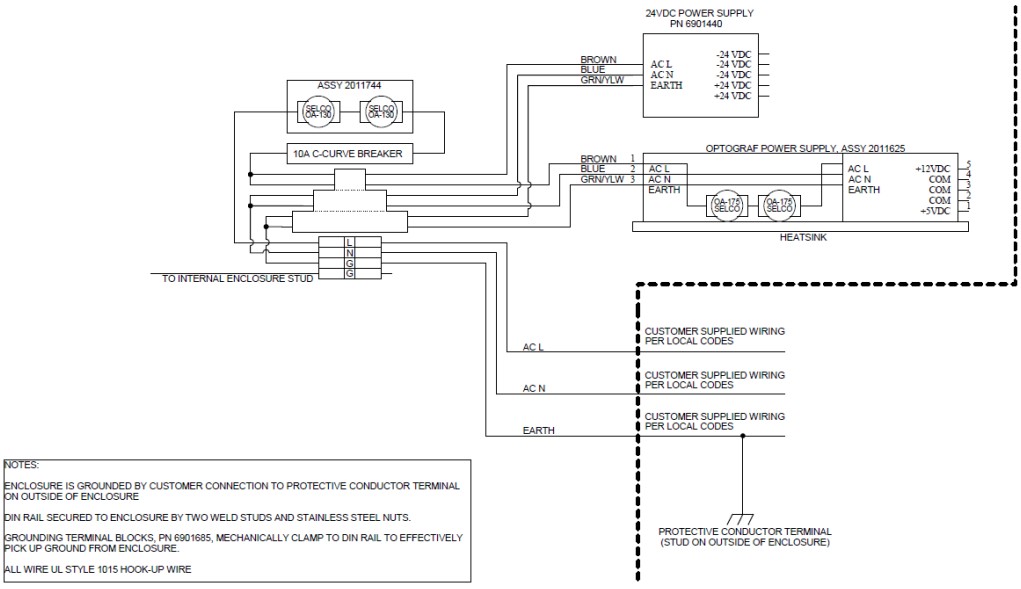


Figure 25. Schematic, AC mains distribution

6.4 Main power supply low voltage distribution

The main power supply provides 12 VDC and 5 VDC to the main sub-systems. The low voltage output from the power supply is immediately fed into printed circuit board assembly attached to the top of the power supply. The printed circuit board then distributes the low voltage to the sub-assemblies. The thermal control system has control over the power distribution for key items based on environmental conditions, which are described in detail in *Thermal control* in *Section 5.8*.

Figure 26. Printed circuit board assembly attached to the top of the power supply

6.5 24 VDC low voltage power distribution

The 24 VDC power supply resides on the upper DIN rail on the back panel of the Raman Rxn5. The 24 VDC power supply is a supplementary power supply and only powers three sub-systems: the electrical interlock IS barriers, the temperature, and pressure sensor IS barriers and the optional external sample solenoid driver.

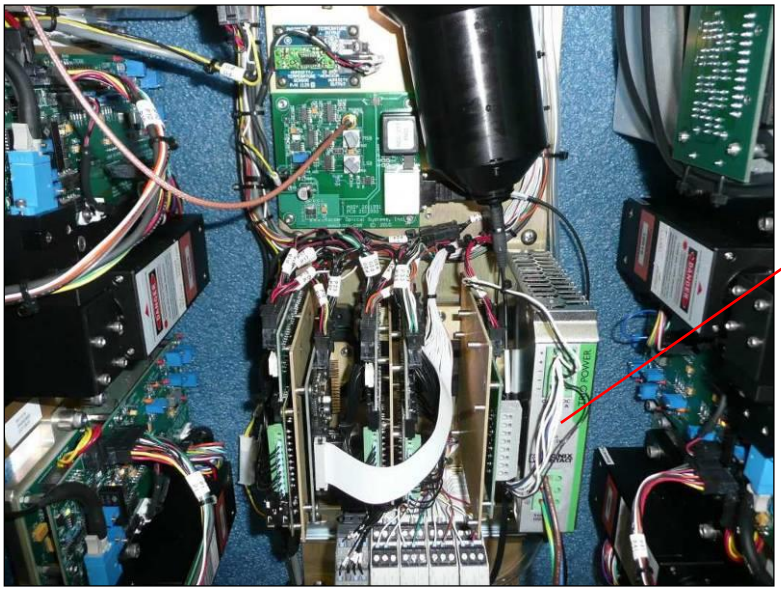


Figure 27. 24 VDC power supply

6.6 Electrical laser interlock

A key safety feature of the Raman Rxn5 is the electrical laser interlock system. To meet several laser safety standard requirements, such as EN60825 and ANSI Z136.1, an interlock must be provided to protect operators from unsafe laser radiation exposure. The lasers employed in the Raman Rxn5 analyzer are considered Class 3B lasers; the laser output power must be less than 500 mW to be classified as a Class 3B laser.

Endress+Hauser lasers typically emit around 150 mW, which is not harmful to skin, but can be harmful to the eye. Therefore, if an operator were to unplug the fiber optic connector at the I/O panel without first pulling the laser switch, a system must be in place to turn the laser off. In addition, if a fiber optic cable were to be severed somewhere between the Raman Rxn5 and the sample system, an explosion hazard may be present as a result of a severed cable. Also, an indicator must be present at the sampling probe to indicate that the laser is on.

Our laser systems use a low-voltage current loop that must be closed in order for the laser to emit light. Endress+Hauser's fiber optic cables are hybrid, i.e., they contain two fiber optics and two copper wires.

⚠ CAUTION

- When installing the probe *in situ*, the user must provide the strain relief to the fiber optic cable at the probe installation location.

Each of the Endress+Hauser probes contains a small Printed Circuit Board (PCB) with a resistor and an indicator LED. The current loop begins with an isolated DC-DC converter on the laser and current travels from this supply to the relay side of a GM International D1032Q switch repeater IS barrier and back to the source laser DC-DC converter.

The switch repeater IS barrier then sources a low voltage current loop on the hazardous side and current runs to the I/O panel, through the transport fiber optic, through the sampling probe indicator LED and back along the same path is a second copper wire for return back to the IS barrier source. The IS barrier repeats the status of the external interlock loop on its relay contacts to the loop generated by the internal laser. If the external loop is opened for any reason, the internal loop will open causing the laser to turn off.

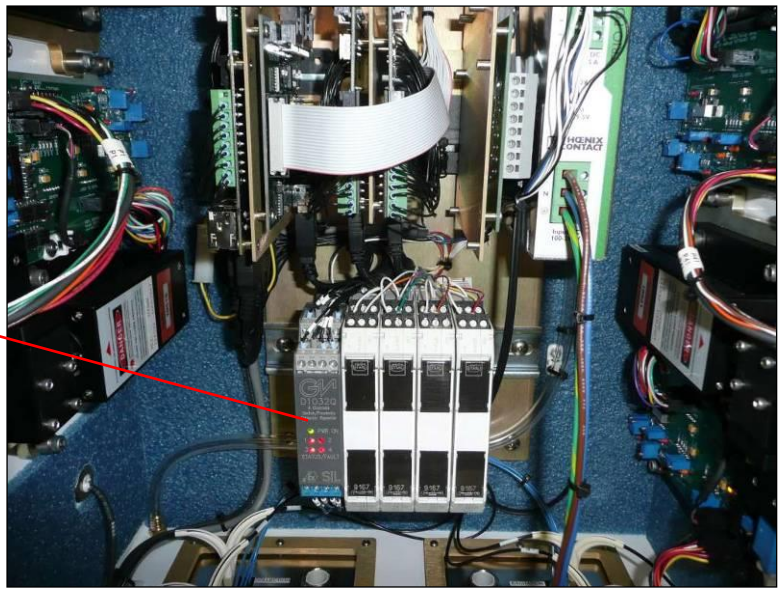


Figure 28. IS barrier

6.7 USB bus

The detection module, thermal controller, sensor Data Acquisition (DAQ) systems, touch screen monitor and USB hub all operate on the USB bus generated by the single board computer.

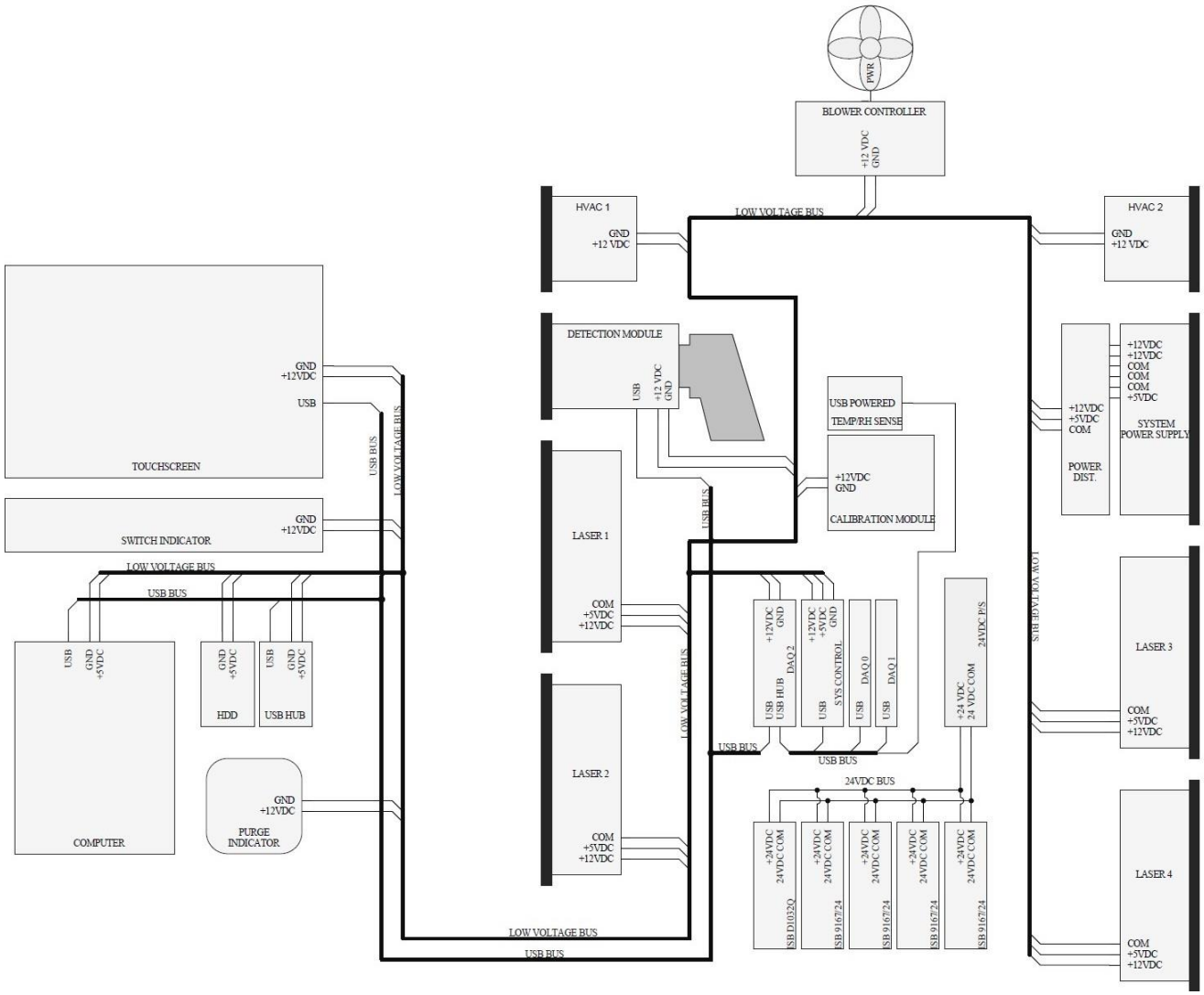


Figure 29. Schematic, low voltage power, and USB distribution

6.8 Probes and fiber optics

NOTICE

- Endress+Hauser offers an *Service Kit, Raman Rxn5, Fiberoptics and Hand Tools (p/n 2013270)*, which is intended for diagnosing and servicing the major field-serviceable optical paths and components of the Raman Rxn5 system. It is also intended to diagnose and identify components that may require replacement or factory service.
- See the *Rxn-30 Probe Operations Manual (p/n 2010884)*, *Rxn-40 Probe Operations Manual (p/n 2011722)*, and *Rxn-41 Probe Operations Manual (p/n 2016453)* for more information.

7 Commissioning

7.1 Safety considerations

Familiarity with the Raman Rxn5 analyzer and the properties of intense laser radiation will aid in the safe operation of the Raman Rxn5. The Raman Rxn5 contains a frequency doubled Nd:YAG laser with Class 3B output beam.

Raman Rxn5 users are advised to follow the recommendations described in the most current revision of ANSI Z136.1. Raman Rxn5 users outside of the United States are encouraged to follow the recommendations described in whichever document provides guidance in laser safety for the area in which they are working.

7.1.1 Protective gas

The protective gas shall be essentially free of contaminants or foreign matter and shall contain no more than trace amounts of flammable gas or vapor. If using compressed air, the air intake of the compressor must be located in a non-hazardous zone. The temperature of the protective gas shall not exceed 40°C.

⚠ WARNING

- The protective gas supply shall have an alarm that is located at a constantly attended location.
- Power must not be restored after enclosure has been opened until enclosure has been purged for 9.5 minutes with a minimum pressure of 2.0 psi as read at the inlet regulator.
- FOLLOW INSTRUCTIONS BEFORE CLOSING THE PROTECTIVE GAS SUPPLY VALVE.

If the protective gas supply to this enclosure has an isolation valve, that valve must have the following label:

Warning – PROTECTIVE GAS SUPPLY VALVE – This valve must be kept open unless the area atmosphere is known to be below the ignitable concentration of combustible materials, or unless all equipment within the protected enclosure is de-energized.

NOTICE

- The protective gas pressure shall be set between 2.0 psi and 2.5 psi at the inlet regulator. Pressure below 2.0 psi will result in inadequate purge rates.
- Pressure above 2.5 psi may result in exceeding the maximum rated overpressure as specified on the nameplate.
- Inlet pressure must be monitored at all times during the purging operation.

7.1.2 Pressurizing system

Refer to the Purge Solutions CYCLOPS Y&Z Purge Indicator User's Manual for additional information on installation, operating, and maintenance instructions for the pressurizing system. For ease of use it is recommended that the installation instructions found in this section be utilized.

7.2 Preparing for installation

When determining where to install the analyzer, include the following location criteria:

- Protection from rain, direct sunlight, and temperature extremes.
- Protection from exposure to corrosive gas.
- Protection from dust and static electricity.
- Space of at least 450 mm (18 in.) around the bottom of the analyzer.
- Space of at least 6 inches on the sides and top to allow access for cleaning the heat sinks and cooling impeller maintenance.
- Operating temperature range of -20 to 50° C.
- Storage temperature range of -30 to 60° C.
- Relative humidity 0 to 90%, non-condensing.

7.3 Recommended tools and equipment

The following tools and equipment are recommended for installation of the Raman Rxn5 analyzer:

- #2 Phillips screwdriver.
- 3/16-inch flat blade screwdriver.
- 6-inch adjustable wrench.
- 4 3/8-16 channel nuts with springs.
- Unistrut p/n A1008.
- 2 plate unistrut mounts.
- P/n 2011690 (supplied with Raman Rxn5 base unit).
- 2 mounting bolts.
- P/n 2011607 (supplied with Raman Rxn5 base unit).
- 2 plate unistrut lower mounts.
- P/n 2011692 (supplied with Raman Rxn5 base unit).
- 2 flat washers for 3/8” bolt diameter.
- 2 hex head cap screws 3/8-16 x 150.

7.4 Unpacking the Raman Rxn5 Analyzer

It is recommended that the Raman Rxn5 be unpackaged in front of the location where the Raman Rxn5 will be wall mounted. If the Raman Rxn5 is unpackaged in a separate location and transported to the wall mounting location, the Raman Rxn5 should be transported laying on its back with the touchscreen panel pointing up. See *Lifting the Raman Rxn5 Analyzer* in *Section 7.5* for more information.

To unpack the Raman Rxn5 analyzer:

1. Stand the box up following the labels on the box. Make sure the arrows are pointing up.
2. Cut the banding off the box.
3. Slide the box up and off the Raman Rxn5 analyzer. The analyzer will remain standing in the foam bottom as shown in Figure 30.
4. Save the packaging for future use.

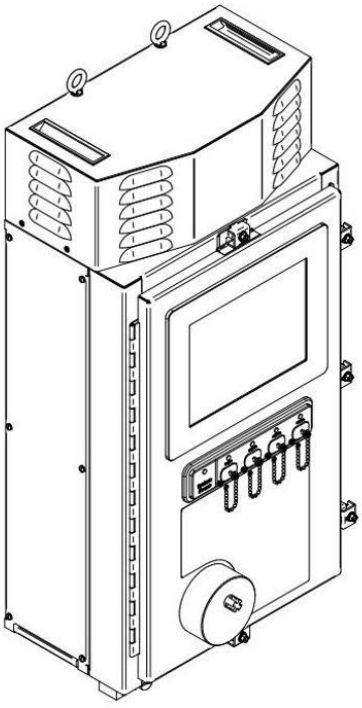


Figure 30. View of the Raman Rxn5 after the box is removed

7.5 Lifting the Raman Rxn5 Analyzer

The Raman Rxn5 may be lifted by mechanical means using the two lifting rings shown in Figure 31. The Raman Rxn5 may also be lifted by two persons using the lift points shown in Figure 31. If the Raman Rxn5 is carried by two persons from one location to another, it is recommended to lay the Raman Rxn5 on its back with the touchscreen pointing up, with a person on each side of the Raman Rxn5 grasping the bottom edge of the enclosure with both hands.

⚠ WARNING

- The Raman Rxn5 weighs 135 lbs and requires two persons for lifting.

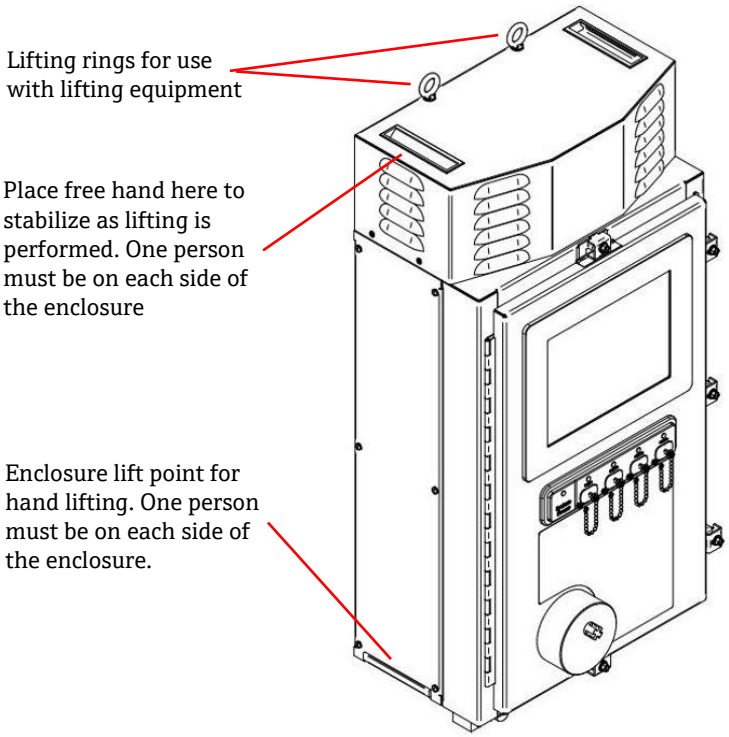


Figure 31. Lifting the Raman Rxn5

7.6 Installation drawings

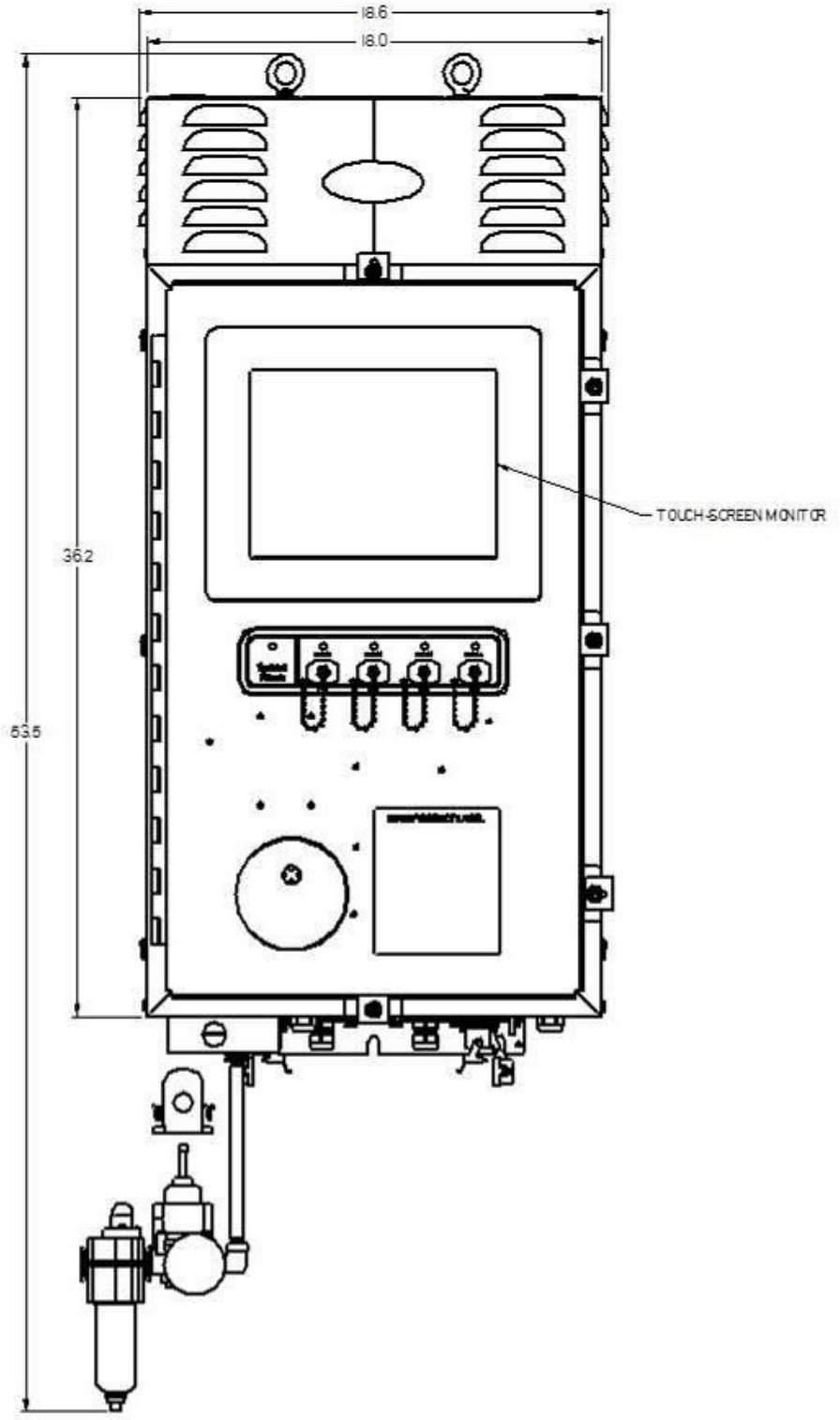


Figure 32. Front view

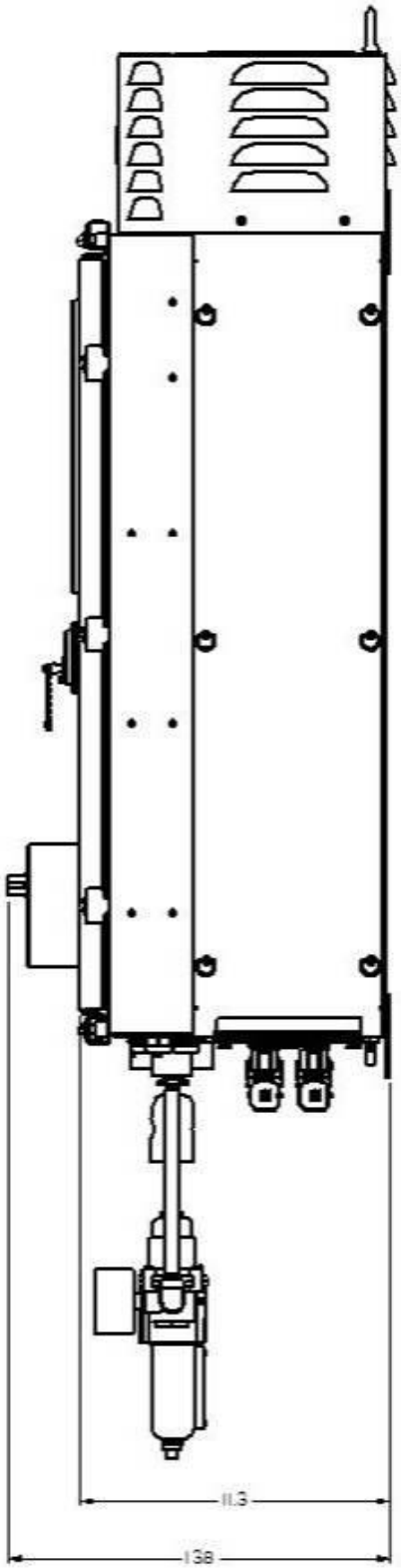


Figure 33. Side view

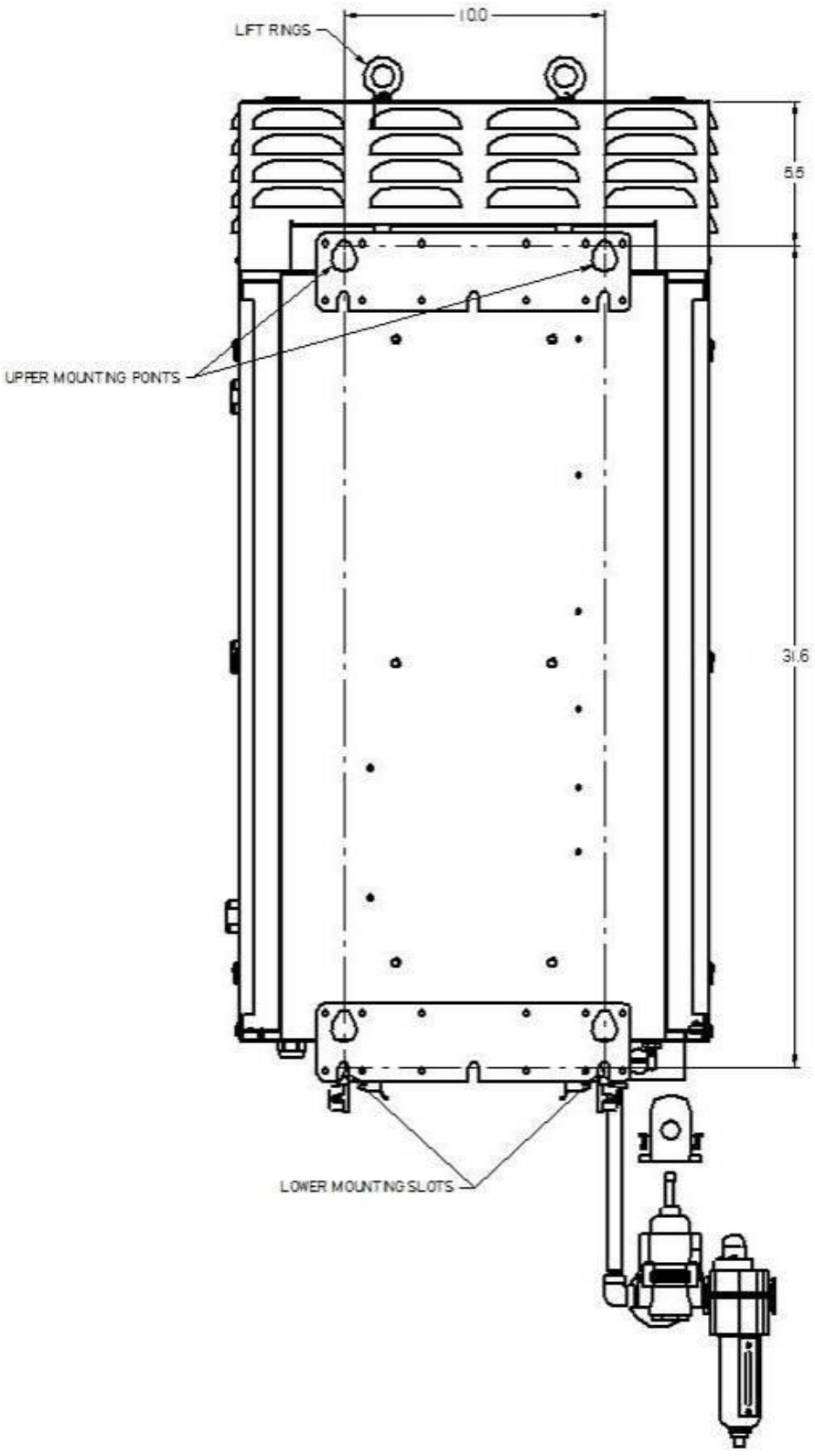


Figure 34. Rear view

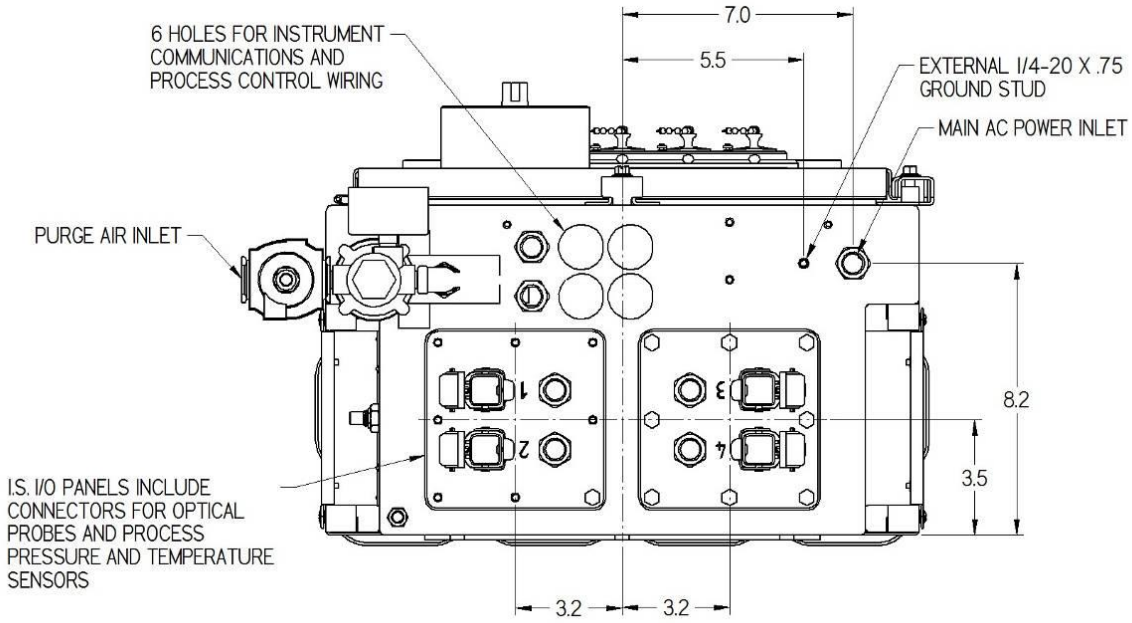


Figure 35. Bottom view

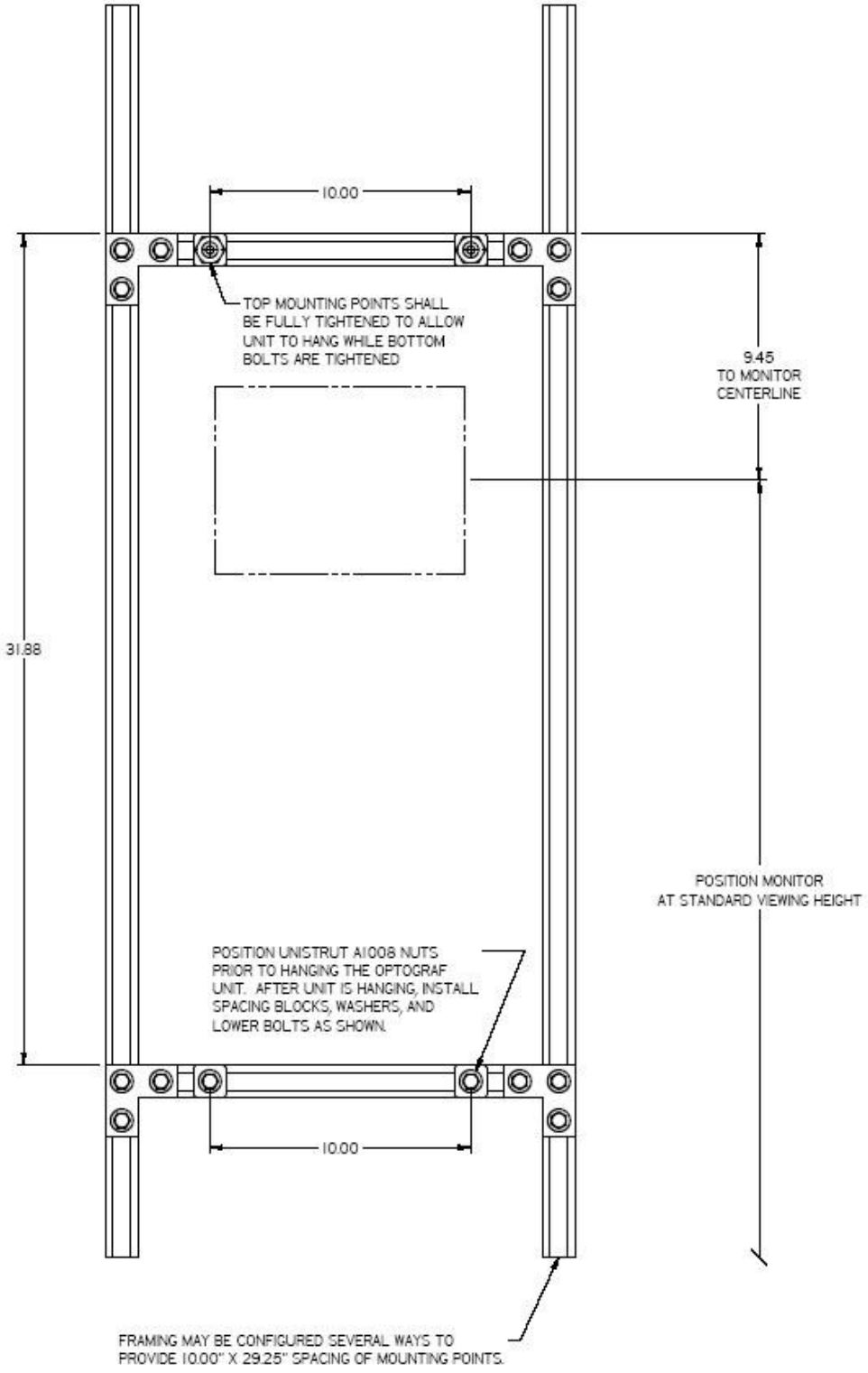


Figure 36. Hardware positioning for Raman Rxn5 mounting

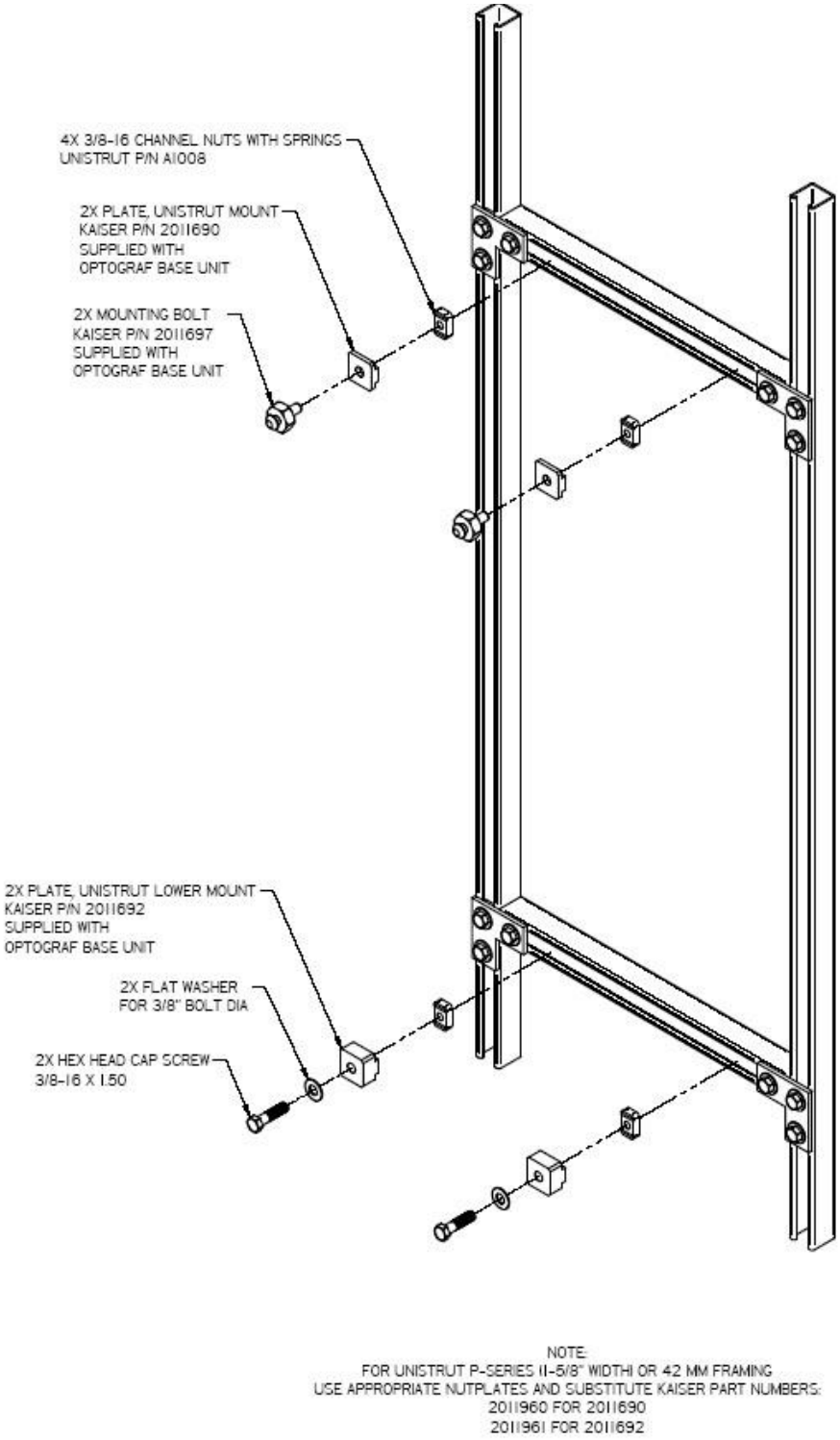


Figure 37. Mounting details

7.7 Wall mounting the Raman Rxn5 Analyzer

The mounting structure must be constructed as shown in Figures 36, 38, and 39, with upper mounting bolts fully tightened and properly spaced. Nut plates for the lower mounting points should be pre-installed. The unit should be lifted so that the upper mounting bolts engage in the upper mounting features. Install lower spacer plates, washers, and bolts.

⚠ WARNING

- Six (6) inch clearance is required on either side as well as the top of the analyzer to allow access to heatsinks and removal of top cover.

Wall mounting instructions (see Figures 34, 36-38):

1. Do not set the Raman Rxn5 analyzer on the purge inlet or connectors. Instead, use the packing base or lay the Raman Rxn5 on its back with the touchscreen pointing up.
2. Using the lift points, as detailed in Figure 34, hang the Raman Rxn5 from the Endress+Hauser mounting bolts (p/n 2011697, previously installed to the Unistrut framing) such that the tear drop shape cutouts on the rear of the enclosure engage the mounting bolts per Figure 38.
3. Secure the lower mounting bolts.

⚠ WARNING

- Stand or kneel to the side of the Raman Rxn5, not below it, while securing the lower mounting bolts.

Figure 38. Cutouts on rear of enclosure engage the mounting bolts

7.8 Main power wiring

Installations in the United States shall be done in accordance with the National Electrical Code (NFPA 70). Installations in Canada shall be done in accordance with the Canadian Electrical Code (CSA C22.1).

The Raman Rxn5 employs an internal 10A circuit breaker in series with the line conductor for internal overcurrent protection. An easily reached switch or circuit breaker must be installed external to the Raman Rxn5 and must be marked as the disconnecting device for the Raman Rxn5. The disconnecting means must interrupt both current-carrying conductors (line and neutral) and must NOT interrupt the protective conductor (ground).

The Protective Conductor Terminal is located on the bottom of the enclosure adjacent to the power entry cable gland. This terminal must be connected to earth ground.

⚠ WARNING

- To reduce the risk of electric shock, this equipment must be used with a grounding-type plug that has a third (grounding) pin. Do not operate the Raman Rxn5 without ground connection.

The main power connection specifications are listed below:

Item	Description
Supply voltage range	90-264 VAC
Supply frequency range	47-63 Hz
Max inrush current	30 Amps
Max steady-state current	7.0 Amps
Cable jacket diameter	6-12 mm
Conductor gauge range	22-10 AWG
Conductor stripping length	9 mm
Max cable service loop (internal to Raman Rxn5)	12 inches

Table 10. Main power connection specifications

⚠ CAUTION

- This unit must be properly grounded and bonded at all times.

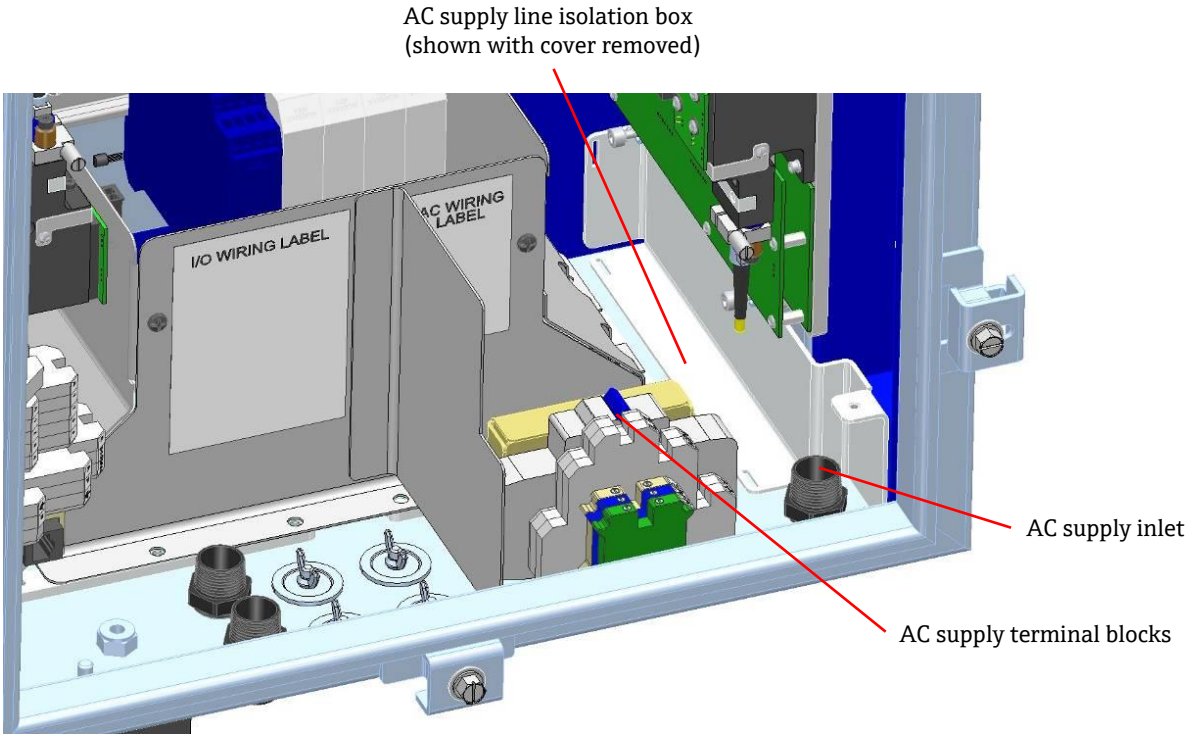


Figure 39. View of AC supply wiring area

Refer to Figure 39 when connecting the Raman Rxn5 to line power.

1. Remove the AC supply line isolation cover so that the AC wiring area is accessible.
2. Route AC power to into the Raman Rxn5 unit through the bottom right liquid-tight strain relief, as indicated in Figure 39.
3. Strip the jacketing from the AC supply line so that there is a minimum of ¼” showing above the top of the liquid tight strain relief.
4. Tighten strain relief so that it seals to the cable jacket.
5. Trim end of supply line cable so that there is a maximum service loop of 12” remaining in the Raman Rxn5 after connection.
6. Strip jacketing to provide a minimum of 4” of individual conductors to allow for connection. Individual conductors shall remain fully insulated.
7. Strip insulation from each conductor to a length of 9mm to allow for termination.
8. Attach the individual conductors to the appropriate terminal blocks. Terminal blocks are color coded and labeled. Line is labeled “L”, Neutral is labeled “N” and Ground is labeled with a ground symbol.
9. Tighten the terminal block screws to 7 in-lbs of torque.
10. Route excess wiring into AC supply line isolation box and reinstall cover.

7.9 Connectors and glands

The main connectors and glands on the Raman Rxn5 analyzer are shown in Figure 40 below:

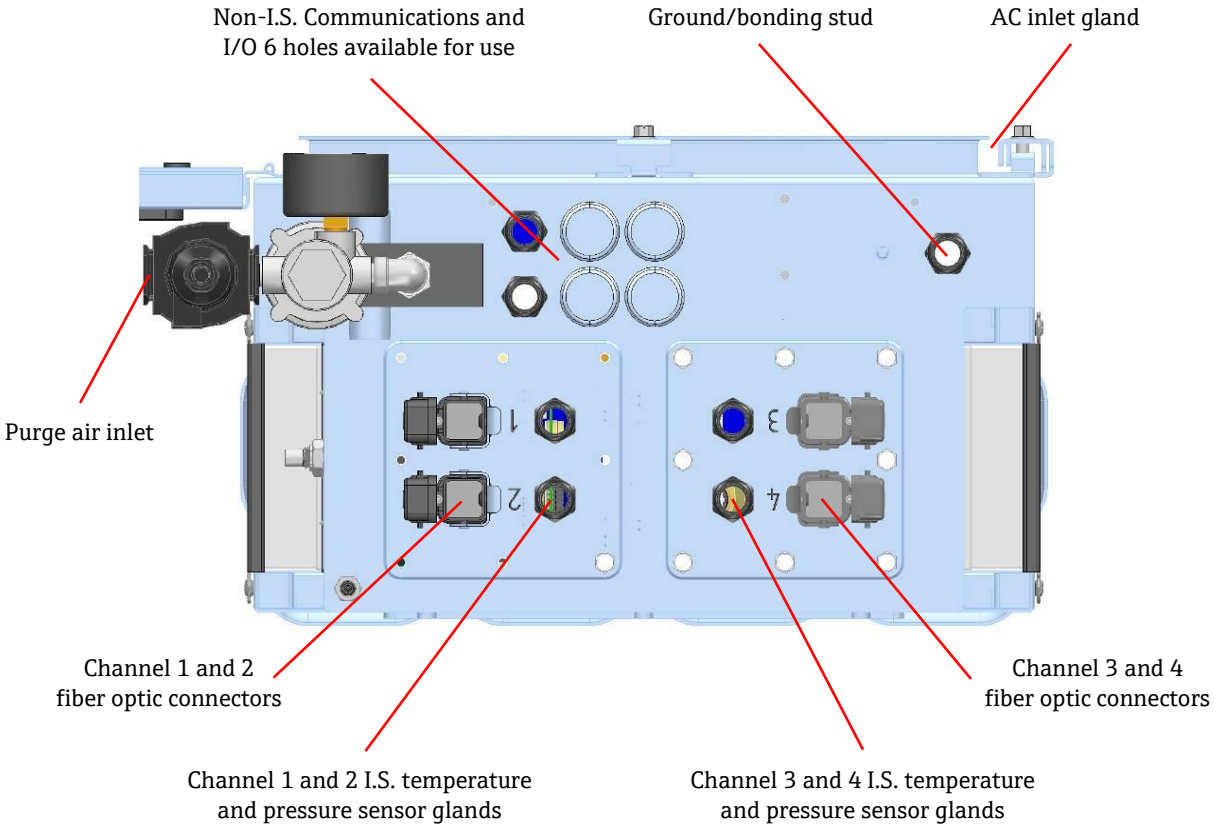


Figure 40. Bottom view with connector and gland labels

7.10 Non-I.S. communications and I/O wiring

The I/O connection points are shown in Figure 41:

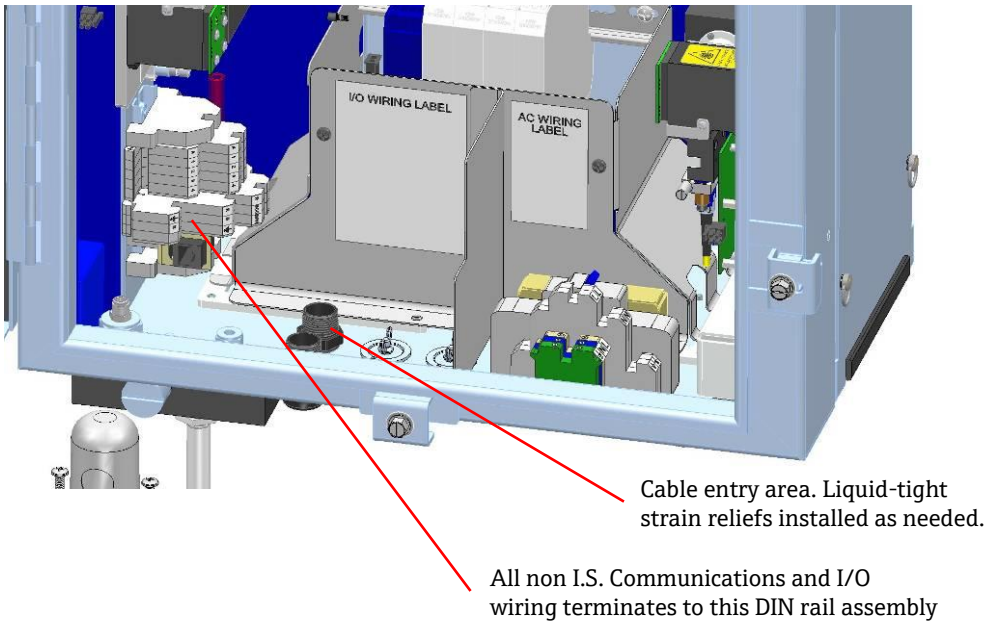


Figure 41. Internal view of non-I.S. communications and I/O wiring area

The Raman Rxn5 supports the following non-I.S. communications and I/O:

- Relay loop for purge pressure alarm.

  The purge indicator installed on the Raman Rxn5 analyzer is of the Z-Purge variety from Purge Solutions, Inc. The indicator is certified for use in Division 2/Zone 2 hazardous areas. The Z-purge indicator has a **Green** indicator light that indicates that the pressure inside the enclosure is above 0.20" water column. The indicator provides a dry contact alarm relay for a remote alarm if needed and is rated for a maximum voltage of 30 VDC; it is the installer's and/or customer's responsibility to interface to the alarm contacts.

- Quantity 2, Modbus over RS-485 (2-wire + ground) communication to DCS. See the *Raman Rxn5 Modbus Communication Specification (p/n 2015814)* for more information.
- Quantity 2, Modbus over TCP/IP via RJ45 Connector. See the *Raman Rxn5 Modbus Communication Specification (p/n 2015814)* for more information.
- Four (4) points of 24 VDC (12 W max per channel) programmable output for driving solenoid valves in the sampling system. Must be configured at the factory and is application-specific.

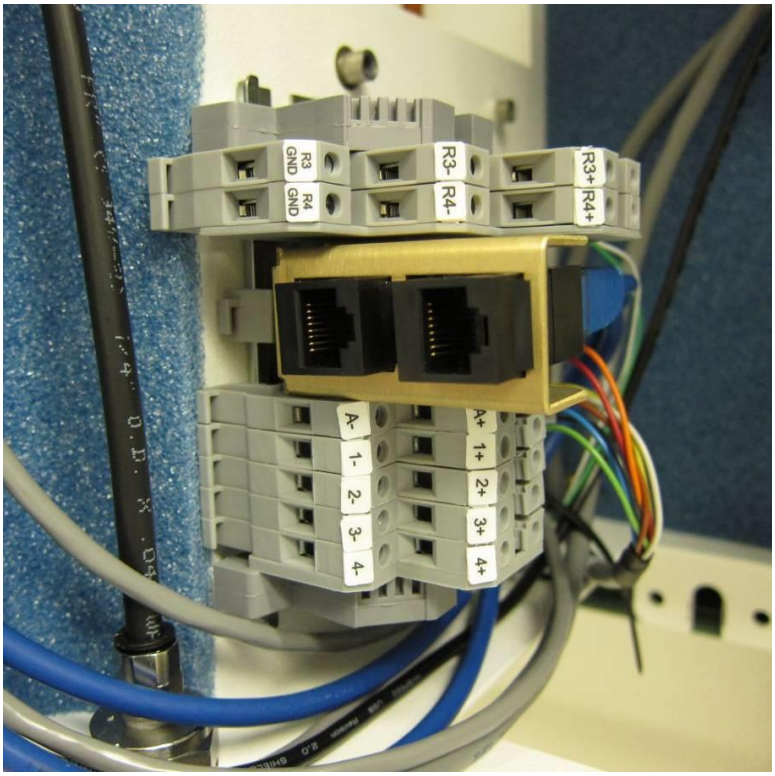


Figure 42. Connection points for non I.S. communications and I/O wiring

The available connections and points of termination are summarized in Table 11:

Labels	Description	Signal Levels
R3+, R3-, R3 GND	RS-485 Comm to DCS	-7 VDC to +12 VDC
R4+, R4-, R4 GND	RS-485 Comm to DCS	-7 VDC to +12 VDC
No Labels	RJ45 (Qty 2) Optional TCP/IP to DCS or Analyzer Remove Control	+/- 2.5 VDC per Twisted Pair
A+, A-	Purge Alarm	30 VCD, 150 mA Max
1+, 1-	Sampling Output 1	24 VDC, 0.5 A Max
2+, 2-	Sampling Output 2	24 VDC, 0.5 A Max
3+, 3-	Sampling Output 3	24 VDC, 0.5 A Max
4+, 4-	Sampling Output 4	24 VDC, 0.5 A Max

Table 11. I/O Connections and points of termination

7.10.1 Installation instructions for non I.S. communications and I/O wiring

1. Route I/O wiring into the Raman Rxn5 unit through the six liquid-tight strain reliefs as indicated in Figure 39.
2. For 24 VDC sample valve drivers and purge indicator alarm loop:
   - Use wire gauge: stranded 22 – 10 AWG or use appropriate ferrules.
   - Strip the jacketing of the installed wiring so that there is a minimum of ¼" showing above the top of the liquid tight strain relief.
   - Trim end of cables so that there is a maximum service loop of 12" remaining in the Raman Rxn5 after connection.
   - Strip jacketing to provide a minimum of 1.5" of individual conductors to allow for connection. Individual conductors shall remain fully insulated.
   - Strip insulation from each conductor to a length of 9mm to allow for termination.
   - Insert the individual conductors to the appropriate terminal blocks as indicated in Table 11.
   - Tighten terminal block screws to 7 in-lbs of torque.
   - Tighten strain reliefs so that they are sealed to the cable jacket.
3. For RS-485 communication to DCS:
   - Use wire gauge: stranded 22 – 12 AWG or use appropriate ferrules.
   - Strip the jacketing of the installed wiring so that there is a minimum of ¼" showing above the top of the liquid tight strain relief.
   - Trim end of cables so that there is a maximum service loop of 12" remaining in the Raman Rxn5 after connection.
   - Strip jacketing to provide a minimum of 1.5" of individual conductors to allow for connection. Individual conductors shall remain fully insulated.
   - Attach the individual conductors to the appropriate terminal blocks as indicated in Table 11.
   - Tighten terminal block screws to 4.5 in-lbs of torque.
   - Tighten strain relief so that they are sealed to the cable jacket.
4. For TCP/IP communication to DCS:
   - Use wire: CAT5 Ethernet cable. Connector: RJ45 with standard Ethernet punch down.
   - Run CAT5 Ethernet cable through liquid-tight strain relief.
   - Punch down RJ45 connector to CAT5 Ethernet cable per standard.
   - Tighten strain relief so that they are sealed to the cable jacket.
5. For purge pressure alarm connection. Maximum voltage: 30 VDC.
   - Use wire gauge: stranded 22 – 18 AWG or use appropriate ferrules.
   - Strip the jacketing installed wiring so that there is a minimum of ¼" showing above the top of the liquid tight strain relief.
   - Trim end of cables so that there is a maximum service loop of 12" remaining in the Raman Rxn5 after connection.
   - Strip jacketing to provide a minimum of 6" of individual conductors to allow for connection. Individual conductors shall remain fully insulated.
   - Strip insulation from each conductor to a length of 9mm to allow for termination.
   - Attach the individual conductors to the appropriate IS barrier terminal blocks.
   - Tighten terminal block screws to 7 in-lbs of torque.
   - Tighten strain reliefs so that they are sealed to the cable jacket.

7.10.2 Purge inlet connection and purge alarm connection

The purge indicator installed on the Raman Rxn5 analyzer is of the Z-Purge variety from Purge Solutions, Inc. The indicator is certified for use in Division 2/Zone 2 hazardous areas. The Z-purge indicator has a **Green** indicator light that indicates that the pressure inside the enclosure is above 0.20" water column. The indicator provides a dry contact alarm relay for a remote alarm if needed; it is the installer's and/or customer's responsibility to interface to the alarm contacts.

7.11 Intrinsically safe wiring installation

The Raman Rxn5 supports the following Intrinsically Safe I/O:

7.11.1 Input for up to four temperature and pressure 4-20 mA transducers

A set of sensors, one temperature sensor and one pressure sensor, is used per active stream on the Raman Rxn5. Each set is interfaced to the Raman Rxn5 using a four conductor cable; two conductors are used for the temperature sensor and two conductors are used for the pressure sensor as shown in Figure 40.

These circuits are protected by 4-20 mA current loop repeater IS barriers. The electrical interfaces are made directly to the Intrinsic Safety Barrier (IS) barrier terminals. The GM International D1014D IS Barrier is standard equipment. The Stahl 9167/21-11-00 or GM International D5014D may be substituted as alternatives.

7.11.2 Fiber breakage detection safety loop

The fiber optic for each channel contains a two wire current loop that will detect if the fiber optic has been severed. The interruption of the current loop will cause the laser for the affected channel to be turned off. The current loop is integrated into the hybrid fiber optic connecting the Raman Rxn5 to its sampling probes. The fiber breakage detection current loop is protected by a switch repeater IS barrier. The GM International D1032Q Intrinsic Safety Barrier (IS) barrier is standard equipment. The connections between the IS barrier and the I/O panels internal to the Raman Rxn5 have been pre-wired at the factory; no end user wiring is necessary.

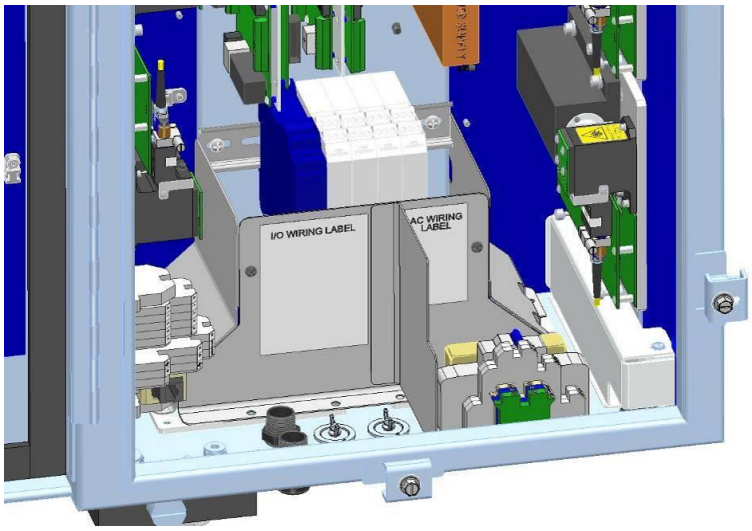


Figure 43. View of I.S. wiring area with shield in place

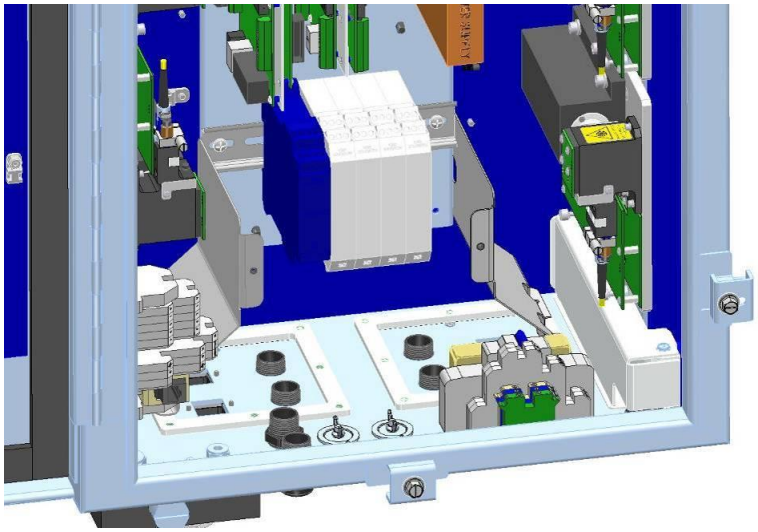


Figure 44. View of I.S. wiring area with shield removed

Refer to Figure 40 for I.S. wiring connections.

7.11.3 Installation instructions for intrinsically safe temperature and pressure sensors

Refer to control drawing 2012682 for installation guidelines of intrinsically safe temperature and pressure circuits.

1. Remove the barrier protecting the Intrinsically Safe wiring area.
2. Route temperature and pressure multi-conductor cable into the Raman Rxn5 through the appropriately numbered liquid tight strain relief.
3. Use wire gauge: stranded 22 – 14 AWG or use appropriate ferrules.
4. Strip the jacketing of the installed wiring so that there is a minimum of ¼" showing above the top of the liquid tight strain relief.
5. Trim end of cables so that there is a maximum service loop of 12" remaining in the Raman Rxn5 after connection.
6. Strip jacketing to provide a minimum of 1.5" of individual conductors to allow for connection. Individual conductors shall remain fully insulated.
7. Strip insulation from each conductor to a length of 9mm to allow for termination.
8. Attach the individual conductors to the appropriate IS barrier terminals

   For the GM International D1014D (Standard):

   - **Terminal 10:** Temperature Sensor +
   - **Terminal 11:** Temperature Sensor –
   - **Terminal 14:** Pressure Sensor +
   - **Terminal 15:** Pressure Sensor –

   For the Stahl 9167/23-11-00 IS Barrier (Alternate)

   - **Terminal 10:** Temperature Sensor +
   - **Terminal 11:** Temperature Sensor –
   - **Terminal 14:** Pressure Sensor +
   - **Terminal 15:** Pressure Sensor –

   For the GM International D5014D (Alternate)

   - **Terminal 7:** Temperature Sensor +
   - **Terminal 8:** Temperature Sensor –
   - **Terminal 9:** Pressure Sensor +
   - **Terminal 10:** Pressure Sensor –
9. Tighten terminal block screws to 7 in-lbs of torque.
10. Tighten strain reliefs so that they are sealed to the cable jacket.
11. Install the barrier for protection of the Intrinsically Safe wiring area taking care to keep all service loops contained within the barrier as the cover is installed.

7.11.4 Installation instructions for intrinsically safe probe fiber breakage detection circuit

Refer to drawing 4002396 for installation guidelines of the intrinsically safe probe circuit. There are no end-user connections inside the Raman Rxn5 to be made for this circuit. The circuit is contained with the hybrid fiber optic connecting the Raman Rxn5 to the sampling probe and is active upon latching of the fiber optic cable hybrid connector to the Raman Rxn5 fiber optic receptacle shown in Figure 40.

1. Ensure the magnetic key for the channel to be connected is pulled from the Switch indicator panel, shown in Figure 45.

Figure 45. Switch indicator panel

2. Release latch from the hybrid fiber optic receptacle on the Raman Rxn5 Analyzer.
3. Follow the instructions provided in *Cleaning an optical cable* in *Section 10.14* for proper cleaning of the fiber optics.
4. After cleaning, fiber optic index matching gel must be applied to the fiber optic tips prior to installation. Only a very small amount of matching gel on the tip of each fiber optic is necessary.
5. Hinge spring loaded cover from the Raman Rxn5 receptacle and insert hybrid fiber optic connector into the Raman Rxn5 receptacle.
6. Engage latch to lock the fiber optic connector into the receptacle.
7. Insert magnetic key for appropriate channel.

7.12 Purge inlet connection

The Z-Purge indicator is paired with a Purge Solutions manual leakage compensation valve. There are two modes of operation for the valve: purging and leakage compensation. For purging, the dial on the valve should be turned so the slot in the dial is horizontal and lined up with the “ON” position. Once the purging has been performed for the specified time, the valve may be switched to the leakage compensation mode by turning the dial so the slot in the dial is vertical. Leakage compensation mode allows the enclosure to remain pressurized with a much smaller usage of air after the purging has occurred.

Please refer to the *Purge Solutions CYCLOPS Y&Z Purge Indicator User’s Manual* for more detailed information.

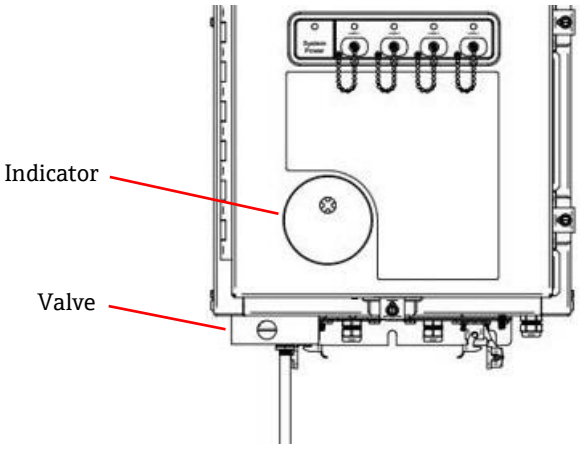


Figure 46. Purge inlet connection

The Raman Rxn5 is shipped without the purge regulator and filter assembly installed. It is the installer’s responsibility to install the purge regulator and filter assembly and interface the air supply to the assembly. The inlet to the filter is ¼-18 NPT. Use appropriate thread sealant.

7.12.1 Air supply requirements

- Inlet fitting is ¼-18 NPT.
- ISA grade hydrocarbon free.
- Water and oil free, -40°C dew-point.
- 5 micron maximum particle size.
- Pressure range is 50 – 120 psi.
- Max flow rate for purging is 2.0 SCFM.
- Max flow rate for leakage compensation is 0.75 SCFM.

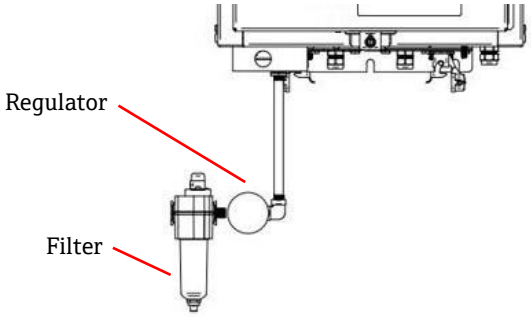


Figure 47. Purge regulator and filter assembly

NOTICE

- ▶ Commissioning of the system is required to validate that the protective gas supply system is functioning properly after initial installation. This procedure must be followed after initial installation and after any maintenance operation requiring removal or replacement of protective gas system components.
- ▶ The procedure must be followed after initial commissioning is complete and any operation requiring opening the enclosure is performed. This procedure must be followed prior to re-energizing the system.

7.13 Commissioning

Commissioning is required to verify that the air supply will provide an adequate flow during purging and that the minimum internal overpressure is maintained when in the leakage compensation mode (the dial on the valve is turned so the slot in the dial is vertical).

1. Verify that a flammable atmosphere is not present.
2. Tighten door clamps in five places with a flat blade screwdriver or 3/8” nut driver to ensure proper seal.
3. Verify cable glands on all I/O connections are tight.
4. Apply protective gas to inlet filter assembly.
5. Turn the dial on the valve so the slot is in the horizontal **ON** position.
6. Verify that the regulator pressure is no less than 2.0 psi. If the pressure is less than 1.5 psi, adjust to obtain 1.5 psi and tighten the locknut. If this pressure cannot be obtained then there is excessive pressure drop in the air supply lines and either the supply pressure must be increased or larger air lines installed.
7. Apply power to analyzer and verify the indicator light is **Green**.
8. Turn the dial on the valve so the slot is vertical **OFF** position.
9. Verify the indicator light is still **Green**. If the indicator is no longer green, then there is excessive leakage from the enclosure. The source of the leakage must be found and corrected.

7.14 Operation

The purge regulator has been pre-set at the factory to 2.15 psi during the purging. It may be necessary to reset the operating pressure at installation. The normal operating range for the regulator is 2.0 – 2.5 psi during purging (**ON** position). Operating in the pressure range will ensure appropriate air flow into the enclosure.

After commissioning has taken place, any time the enclosure has been opened, before being put into service, take the following steps:

1. Tighten the door clamps in five places with a flat blade screwdriver or 3/8” nut driver to ensure a proper seal.
2. Apply air to inlet filter assembly.
3. Turn the dial on the valve to the **ON** position.
4. Purge for a minimum of 9.5 minutes.
5. Apply power to analyzer and observe the indicator light. If the indicator light turns on, turn the valve to the leakage compensation position if desired and observe the indicator light.
6. If at any time, the indicator light does not light up, there is a leak and power should be removed from the analyzer while the source of the leak is found and corrected and the 9.5 minute purge should be repeated before re-applying power.

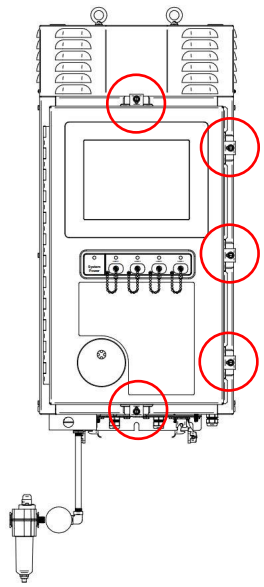


Figure 48. Door closure points

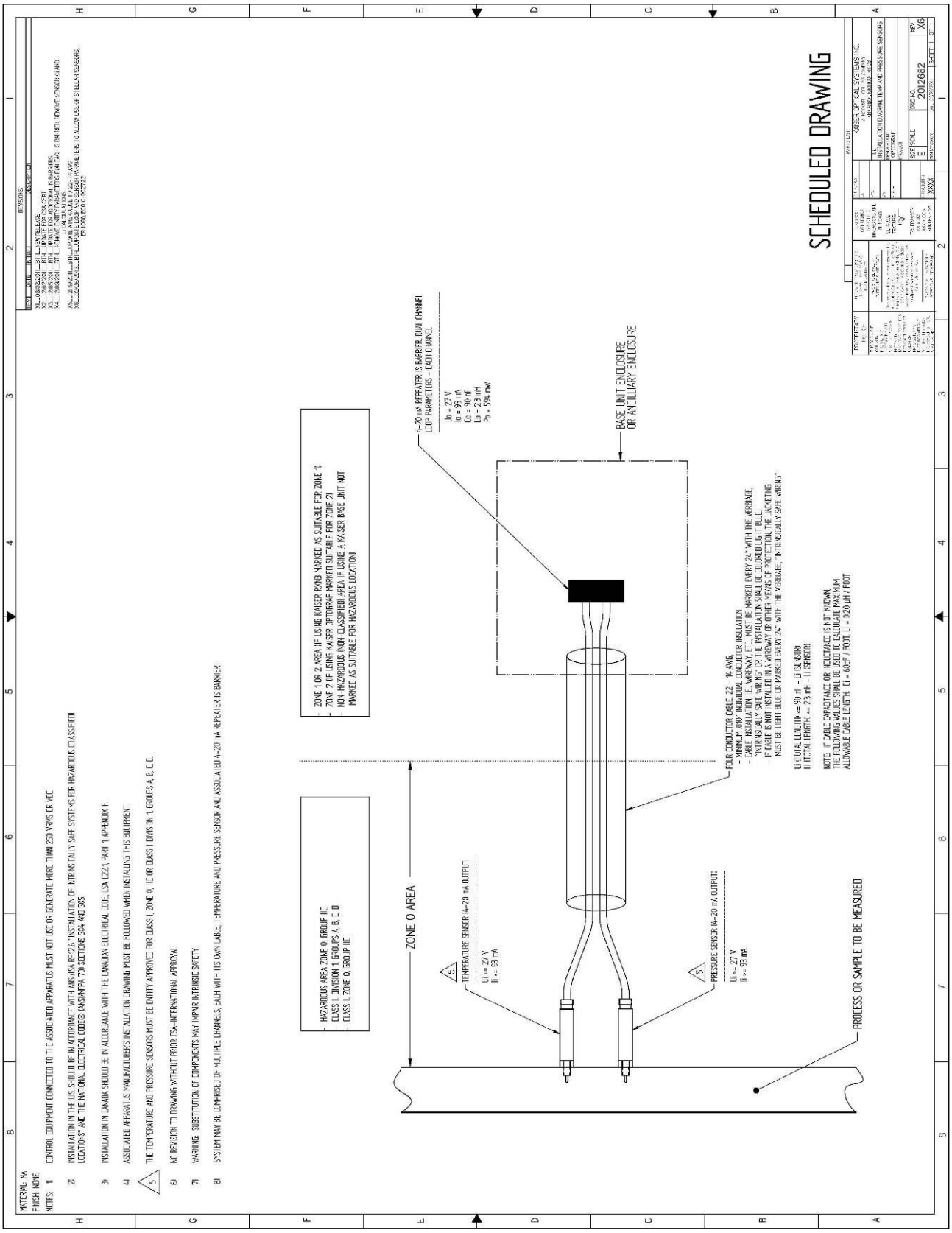


Figure 49. Control drawing for temperature and pressure I.S. circuit (p/n 2012682)

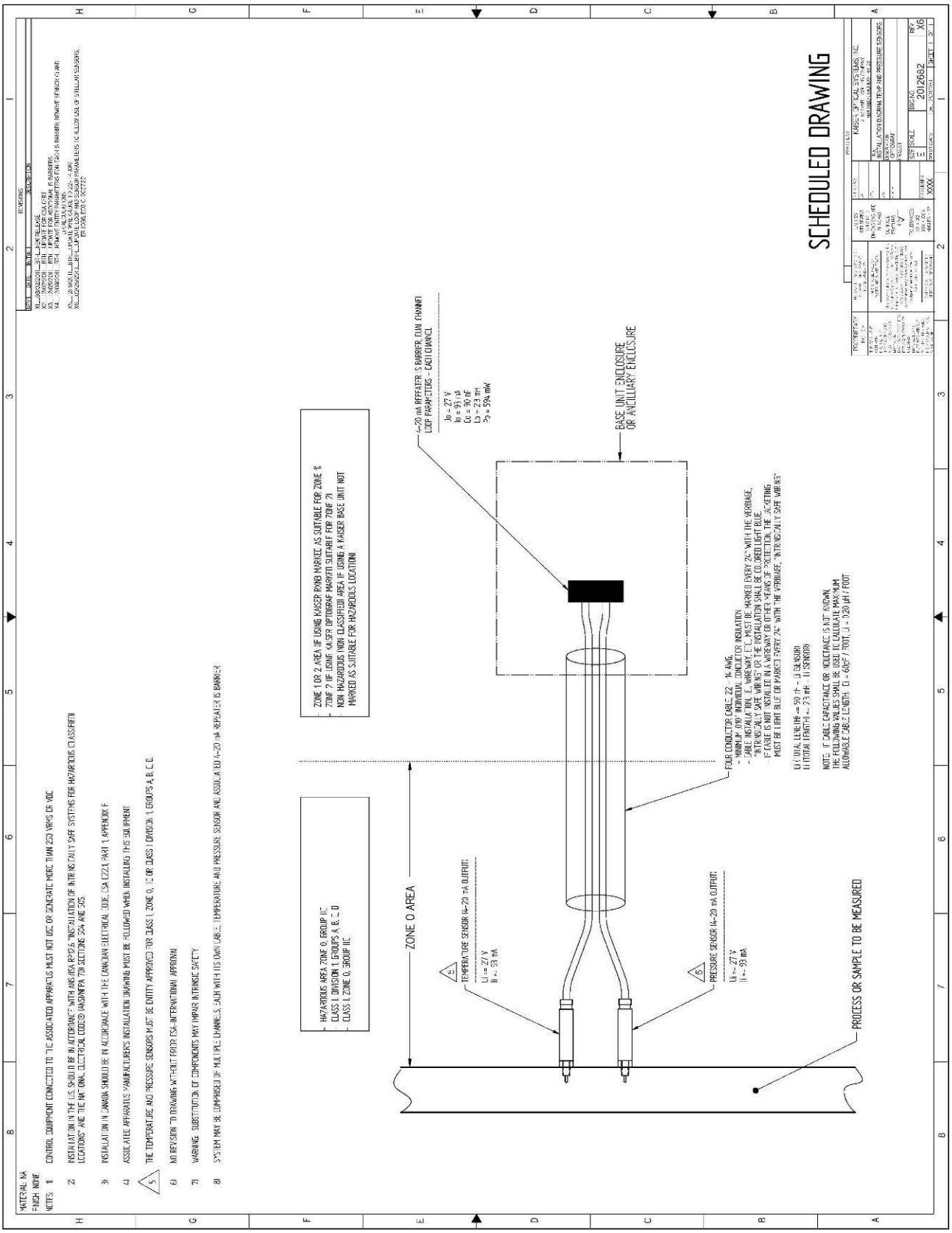


Figure 50. Control drawing for probe I.S. circuit (p/n 4002396)

8 Operation

8.1 Introduction

The Raman Rxn5 analyzer control system enables you to view the composition analysis for each of four channels, calibrate and validate each channel, view trends, and view the status of the analyzer and each stream. You can view data on all four streams at once or view detailed data for one particular stream.

The Raman Rxn5 analyzer incorporates a flat screen, touch-sensitive display that is utilized for all user interactions. A simple tap with a finger is the equivalent of a mouse click. To achieve the equivalent of a click-and-drag with a mouse, press firmly on the display with a fingertip and drag the finger across the display while maintaining firm pressure. Throughout this manual, we will refer to a mouse click as a "tap" and a mouse click-and-drag as "press and drag."

NOTICE

- Conduct a normal shutdown and de-energize the system prior to isolation of the protective gas from the enclosure.

8.2 Raman Rxn5 main screen

The main screen of the user interface displays the most recent results for each of the four streams. See Figure 51. Each stream's data is displayed in a separate quadrant.

The quadrant display for a given stream shows the percent of each component in that stream as determined from the last sample taken for that stream, as well as optional derived values such as Gross Heating Value and Wobbe Index. The time stamp of the last sample is also displayed. The **Options** menu provides access to system settings, diagnostics, and calibration.

Finally, a large indicator in the lower left corner of each quadrant displays the current sampling status of that stream. The indicator will display Ready with an orange background when a stream is ready to collect data, Disabled when a stream has been disabled, and Prepare when the Raman Rxn5 analyzer is preparing a sample for acquisition.

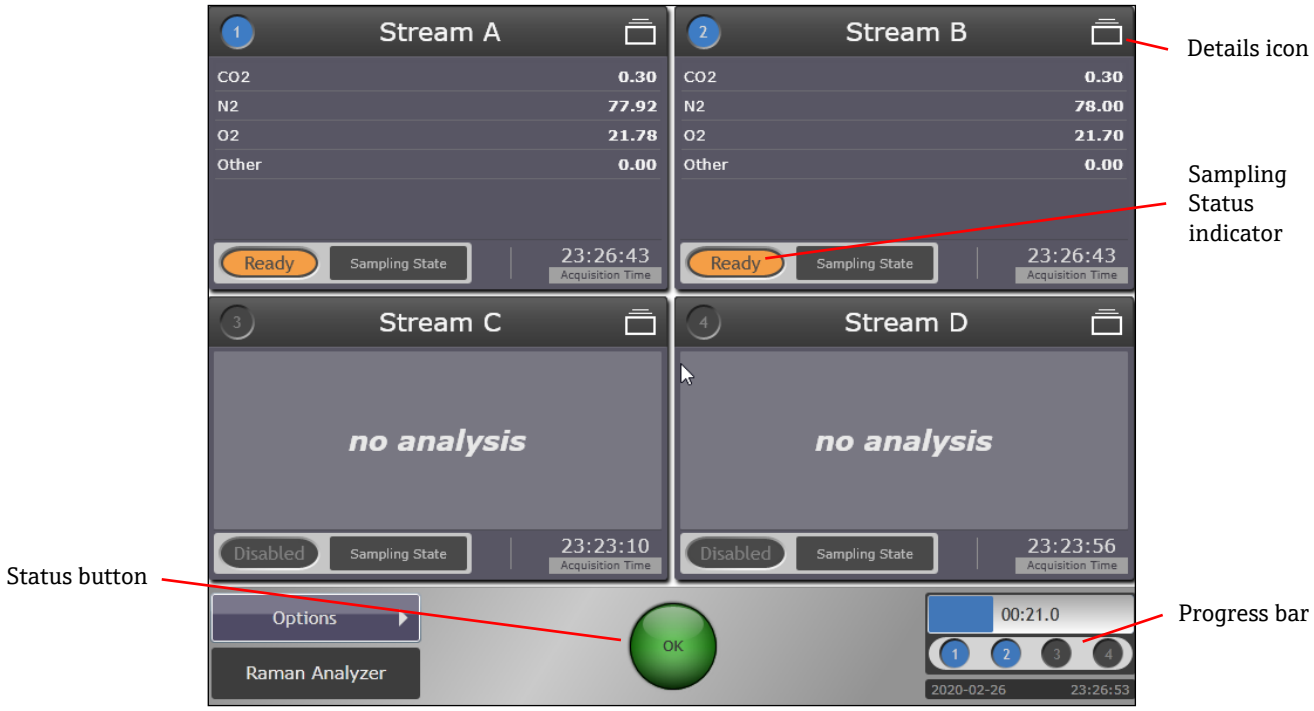


Figure 51. Raman Rxn5 main screen

8.3 Raman Rxn5 status indicators

Raman Rxn5 Status Button

The **Status** button is located at the center bottom of both the Main Screen and the Stream Detail View. See Figure 51 and 54. **Green** (OK) indicates the status is normal, **Yellow** (Warning) indicates at least one item is in a warning state while no items are in an error state, and **Red** (Error) indicates at least one item is in an error state.

Touch the **Status** button to display additional information on the analyzer status. Figure 52 shows the Analyzer Status screen that appears. To exit this screen, click the **X** at the top left of the Analyzer Status screen.

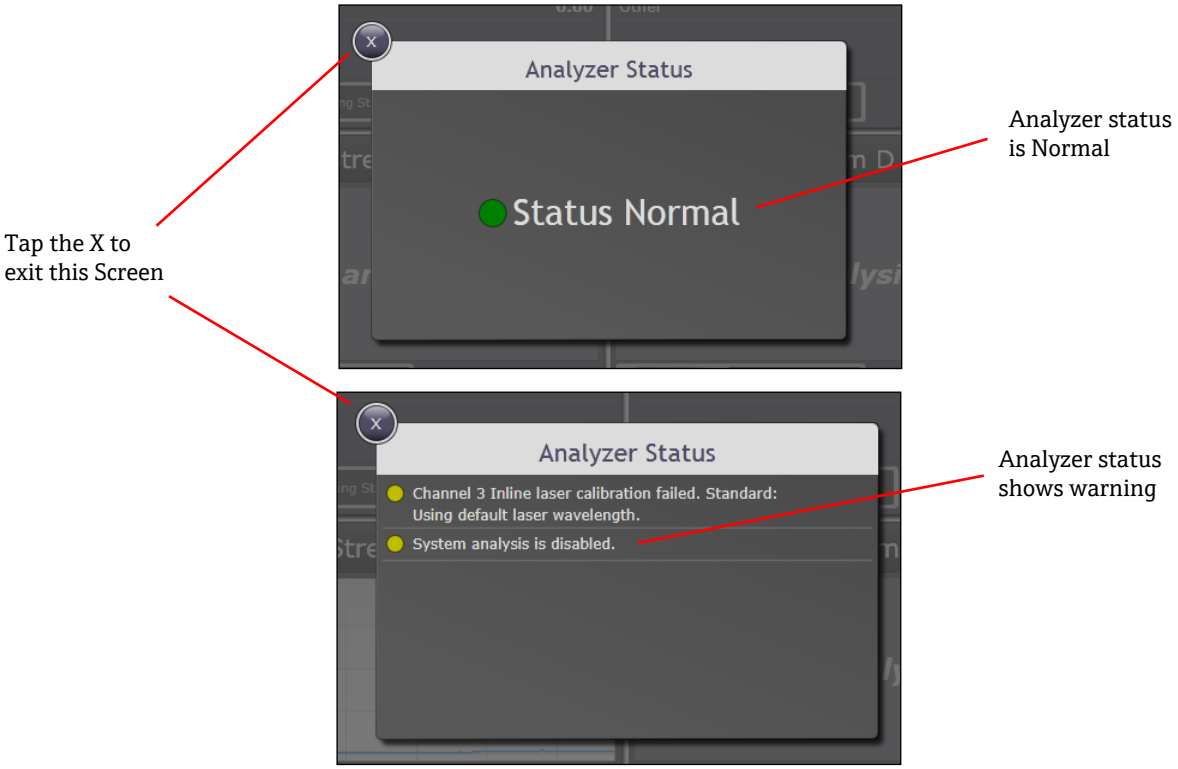


Figure 52. Examples of the analyzer status screen

Raman Rxn5 Progress Bar

The Raman Rxn5 progress bar (Figure 53) is shown in the lower right corner of both the Main Screen and the Detail View. The status bar continually updates to display the time remaining in the current acquisition.

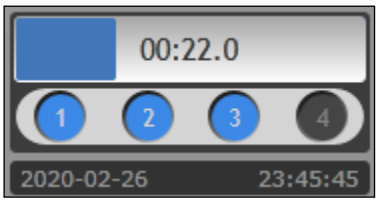


Figure 53. Progress bar

8.4 Raman Rxn5 stream detail view

The Stream Detail View (Figure 54) displays additional details for a particular stream. Each section of the Stream Detail View is discussed below.

To access the Stream Detail View, from the Main Screen (Figure 51), click the **Details** icon (see Figure 51). The Stream Detail View has three tabs: Analysis, Sampling, and Settings, which are described in the following sections.

To return to the Main Screen, click the **Quadrants** icon in the upper left corner of the Stream Detail View (see Figure 54).

8.4.1 Stream detail – analysis tab

The Analysis tab is shown in Figure 54. The Analysis tab shows the analysis numbers from the last acquisition and the spectrum from that acquisition. The current probe pressure and current probe temperature are updated continually and displayed in the center of the screen.

Detector saturation is also shown. Detector saturation increases as sample pressure increases (in gas phase). Detector saturation is used to optimize the performance of the analyzer.

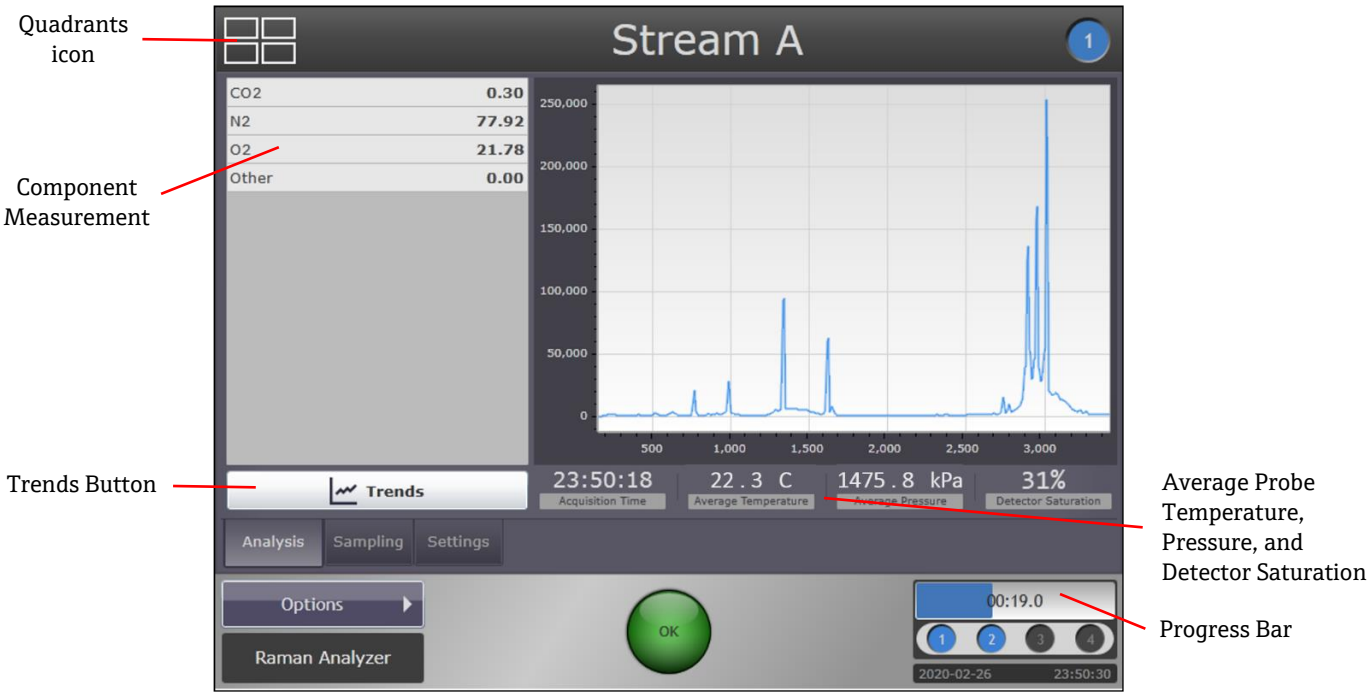


Figure 54. Stream detail – analysis tab

8.4.1.1 Stream detail – trends function

The Trends View is shown in Figure 55. The Trends function displays a trend chart of the stream components for the time period selected in the History pull-down option. Select a Principal trend and (optionally) a Comparison trend.

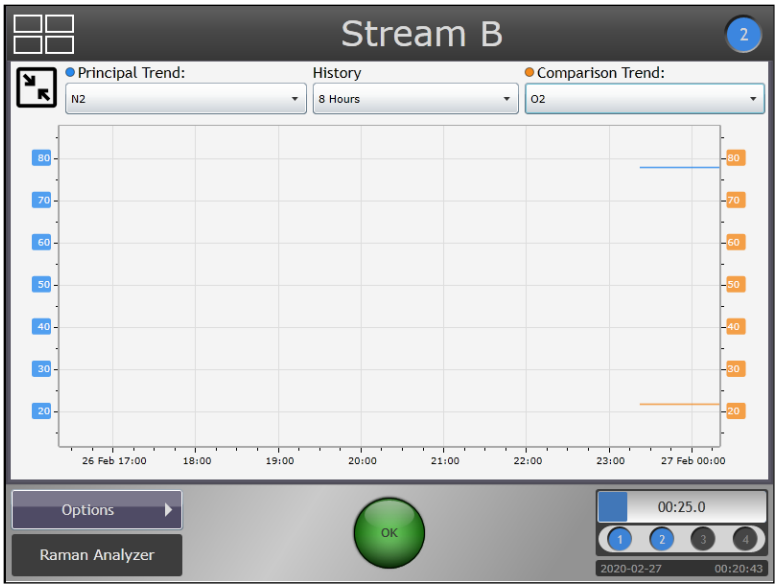


Figure 55. Stream detail – trends tab

8.4.1.2 History

Press and drag the down arrow to select the time period you want to view, from 8 hours up to 10 days.

8.4.1.3 *Principal trend*

Press and drag the down arrow to select the principal trend you want to view.

8.4.1.4 *Comparison trend*

Press and drag the down arrow to select the comparison trend you want to view (optional). This option can only be selected if a Principal trend item has been chosen.

8.4.2 Stream detail – sampling tab

The Sampling tab enables advanced users to configure the coordination of the Raman Rxn5 analyzer Control System with the Sampling System. You can define individual Sampling States (States sub-tab) and you can set up Analysis Sampling Sequences (Control sub-tab) using those states. Each Stream is configured independently.

8.4.2.1 *States sub-tab – creating sampling states*

Advanced users can create, modify, and delete Sampling States as well as Sampling Output signals within the states. Sampling States are mutually exclusive. The Sampling States sub-tab is shown in Figure 56.

Each Sampling State consists of one or more Sampling Output signals. Each Sampling Output signal consists of a Signal to Send (True or False) and the Time to Wait (a pause in seconds or minutes before sending the next signal) for up to four digital outputs.

Figure 56. Sampling states tab showing states sub-tab

To create a new Sampling State, click the **New State** button (see Figure 56). Using the on-screen keyboard, enter a meaningful name (for example, “Stream to Bypass”) for the new state. Click **Enter**. To rename or delete a state, select it by tapping its row and then clicking the **Rename** button or the **Delete** button (see Figure 56).

To create a new Sampling Output signal for a particular state, click the **Add** button. For each Sampling Output signal, select either True or False and if, desired, select a Time To Wait by clicking the **Up** or **Down** arrows just below (Figure 57).

To remove a Sampling Output signal, first tap the row to select the signal you want to remove and then click the **Remove** button. A confirmation dialog appears. Click **OK** to remove the Sampling Output signal.

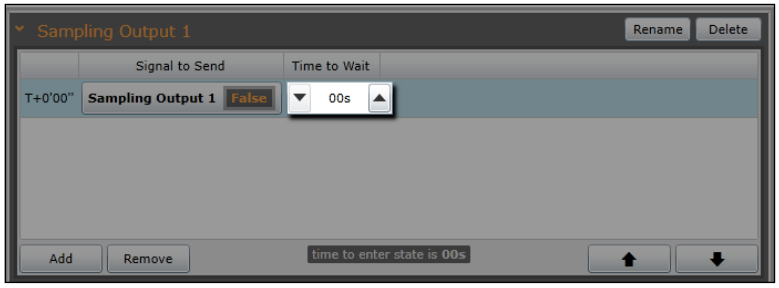


Figure 57. Time to wait selection arrows

8.4.2.2 *Control sub-tab – managing sampling sequences*

The Control sub-tab (Figure 58) enables advanced users to configure the analysis sampling sequence including the order of the sampling states and the hold time (in seconds or minutes), which is the amount of time for the sampling system to remain in a given state.

Figure 58. Sampling tab showing the control sub-tab

Idle State (Figure 58) is the state between one cycle and the next during live analysis. Generally, analysis is continuous, and you will not need to change the Idle State setting from its default state of <none>. If you do need to set the Idle State, press and drag the corresponding down arrow to select the desired state. (The State was created on the States sub-tab.)

Default State (Figure 58) is the state a stream goes into when it is disabled. Press and drag the corresponding down arrow to select the Default State. (The State was created on the States sub-tab.) You may want to use Best Practice guidelines to select the Default State, for example, to best conserve the product when the stream is disabled.

8.4.3 Stream detail – settings tab

The Settings Tab is shown in Figure 59.

8.4.3.1 *Methods*

All methods available for this stream are displayed on the left half of the Stream Detail screen (Figure 60). Enabling the check box on the left of a method will cause that method to process collected data and present results.

8.4.3.2 *Analysis*

The Analysis drop-down list allows the advanced user to set the analysis state of each stream. Options include Disabled, Enabled (online), and Enabled (offline). Disabled stops analysis from occurring for that stream. Enabled starts analysis for the stream. The enabled option means results will be available to an external DCS if it has been configured. The enabled (offline) option will not send results to an external DCS. The enabled (offline) feature would normally be used while servicing an instrument.

8.4.3.3 Analysis parameters

The Analysis Parameters section of the screen allows for creation and configuration of some advanced analysis features of RunTime and is beyond the scope of this document.

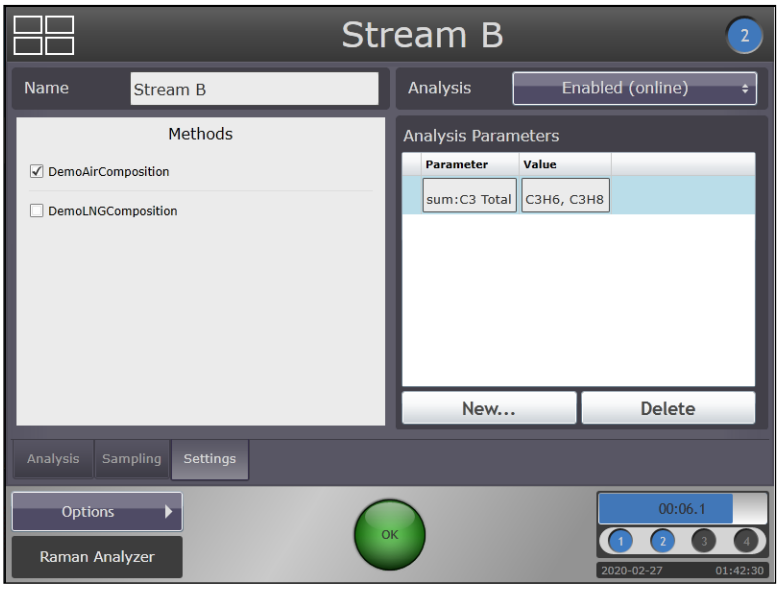


Figure 59. Stream detail – settings tab

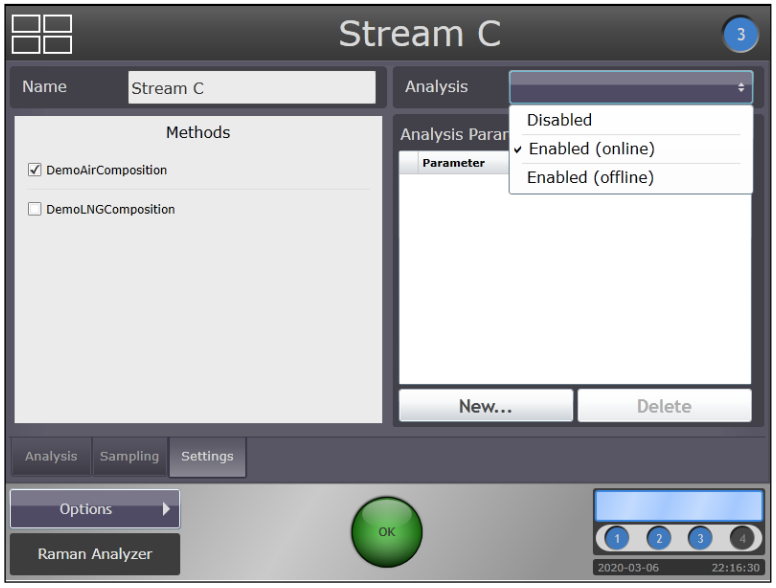


Figure 60. Stream detail – settings tab

8.5 System settings

To access the System Settings, select **Options > System** from the Main Screen. The System Settings screen appears (Figure 61). System Settings has seven tabs (described below): General, Analysis, Automation, Network, Date & Time, Security, and Update.

8.5.1 General tab

The **General** tab for System Settings is shown in Figure 61.

The **Instrument Name** field displays the name of the analyzer and allows the user to change the instrument name.

The **Analysis** setting allows an advanced user to enable or disable analysis for all channels of the instrument.

The **Calibrate Touch Screen** button allows the operator to calibrate the touch screen of the instrument.

The **Restart** button allows the operator to restart the controller.

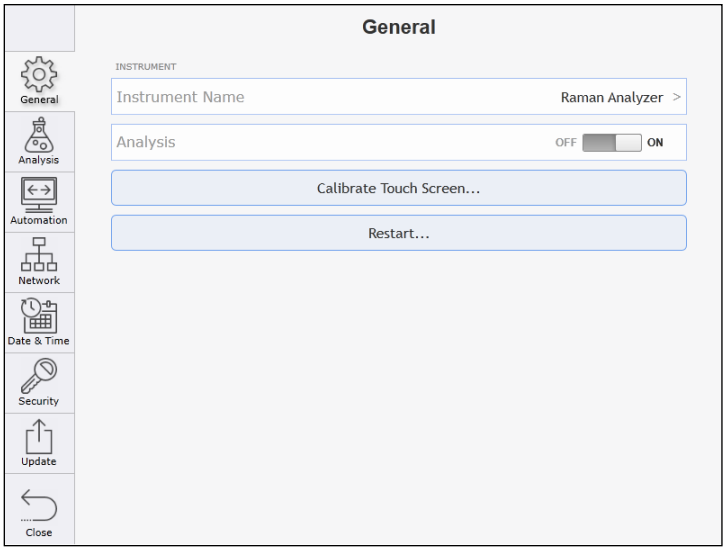


Figure 61. System settings – general page

8.5.2 Analysis tab

The Analysis tab for System Settings is shown in Figure 62. The Analysis tab enables the user to manage the methods installed on the analyzer or adjust the Acquisition parameters. Under the Methods tab, selecting one of the listed methods displays the method components (Figure 63). On this page, the method name can be changed, the method can be deleted from the system, and reporting of individual components can be turned off. Under the Acquisitions tab (Figure 64), the total acquisition time for sampling, calibration, and verification can be adjusted. Automated exposure control in the system software ensures that the hardware settings are adjusted as necessary.

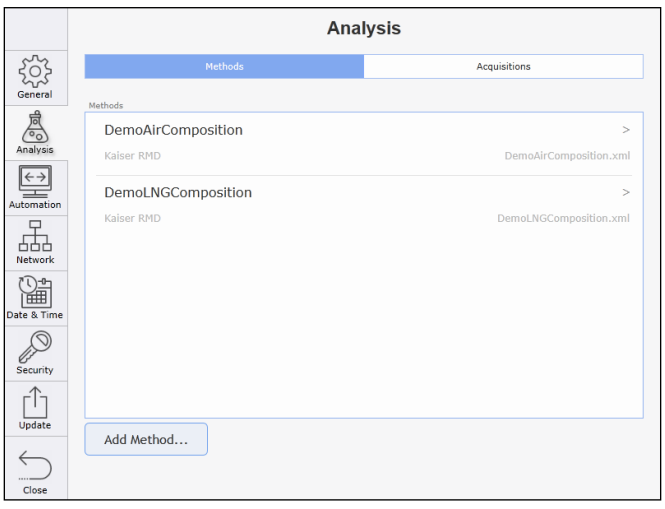


Figure 62. System settings – analysis tab

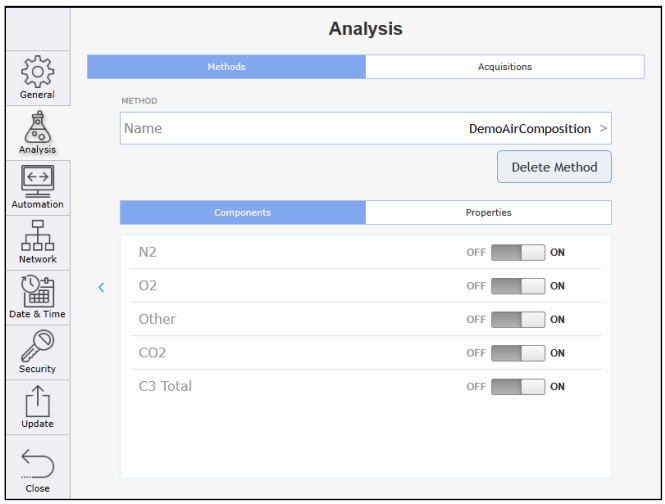


Figure 63. System analysis – method components page

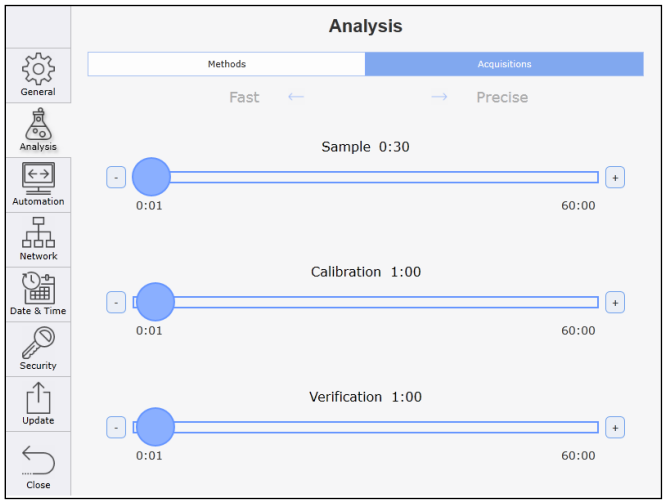


Figure 64. System analysis – acquisitions page

8.5.3 Automation tab

The Automation tab for System Settings is shown in Figure 65. This tab allows the user to configure the interface between the analyzer and an external computer. The OPC page provides configuration options for an OPC interface. The Modbus page provides configuration options for a Modbus interface (Figure 66). Modbus output can be configured independently for each channel of the analyzer. Once the components and derived values for a channel have been selected, the Channel Map tab provides the details of the assigned Modbus registers for each component (Figure 67).

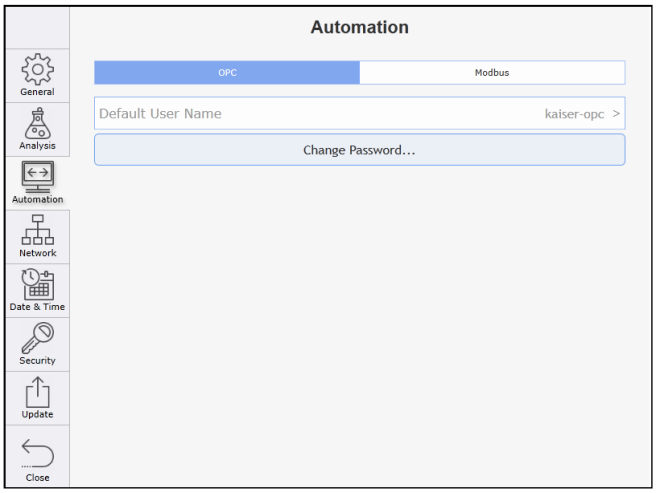


Figure 65. System settings – automation tab – OPC

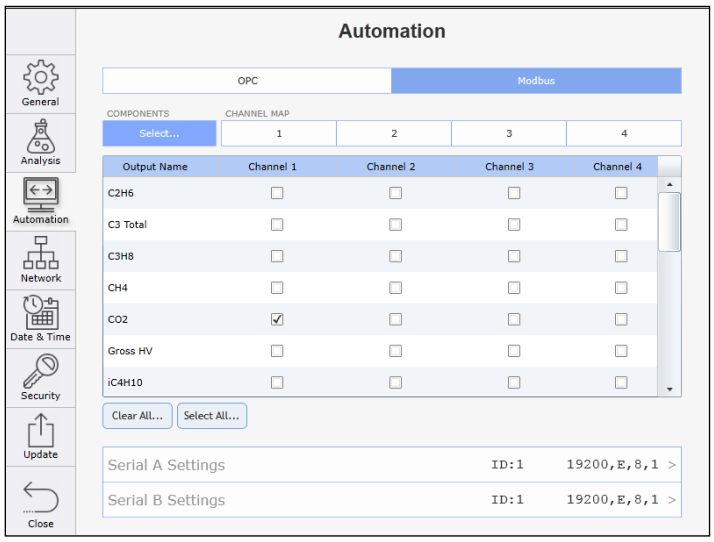


Figure 66. System settings – automation tab – modbus

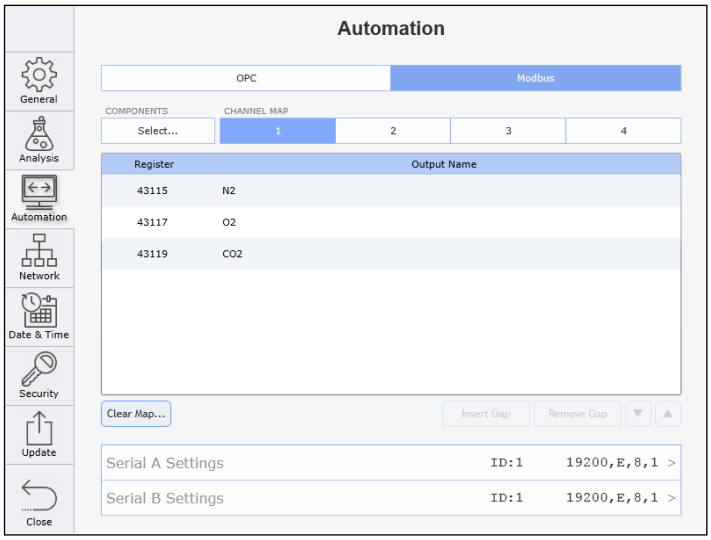


Figure 67. System settings – automation tab – modbus channel map

8.5.4 Network tab

The Network tab for System Settings is shown in Figure 68 and Figure 69. The Network tab allows for configuration of the communication options between the analyzer and a host network. Both Dynamic Host Configuration Protocol (DHCP) and Static options ae provided.

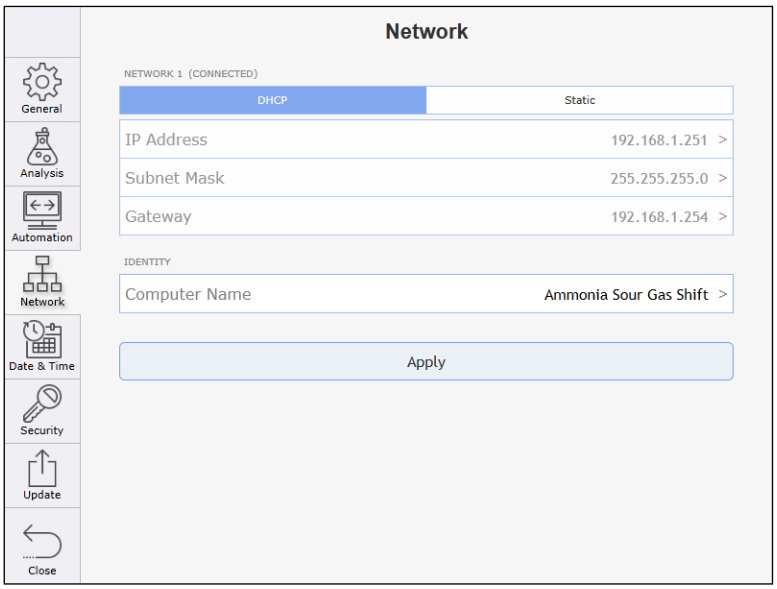


Figure 68. System settings – network tab – DHCP

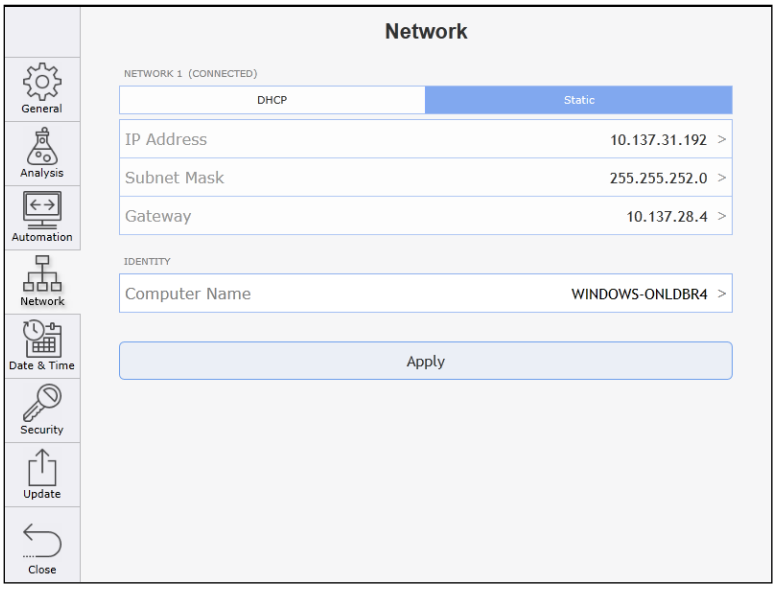


Figure 69. System settings – network tab – static

8.5.5 Date & time tab

The Date & Time tab for System Settings is shown in Figure 70. The Date & Time tab allows for setting the local date and time of the analyzer. If the option 'Set Date and Time Automatically' is enabled, the user can provide a time server address on the network to which the analyzer is connected. The Time Zone tab (Figure 71) allows the user to set the time zone for the analyzer location.

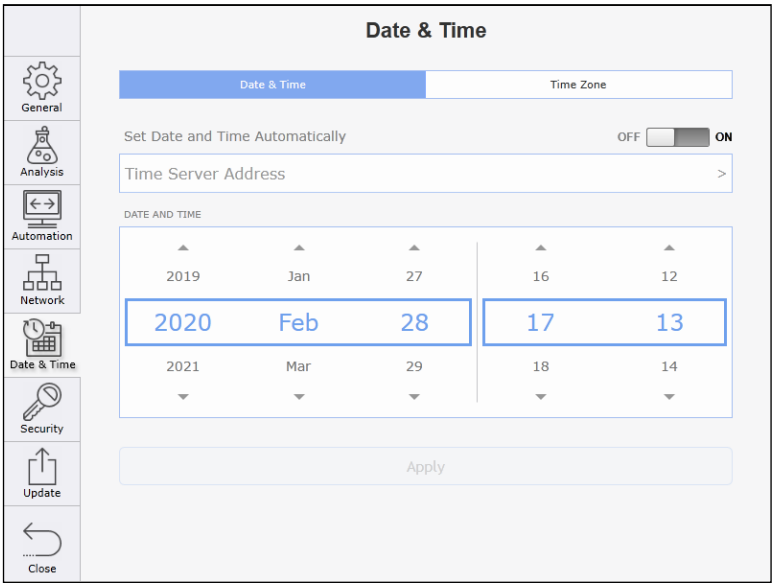


Figure 70. System settings – date & time tab

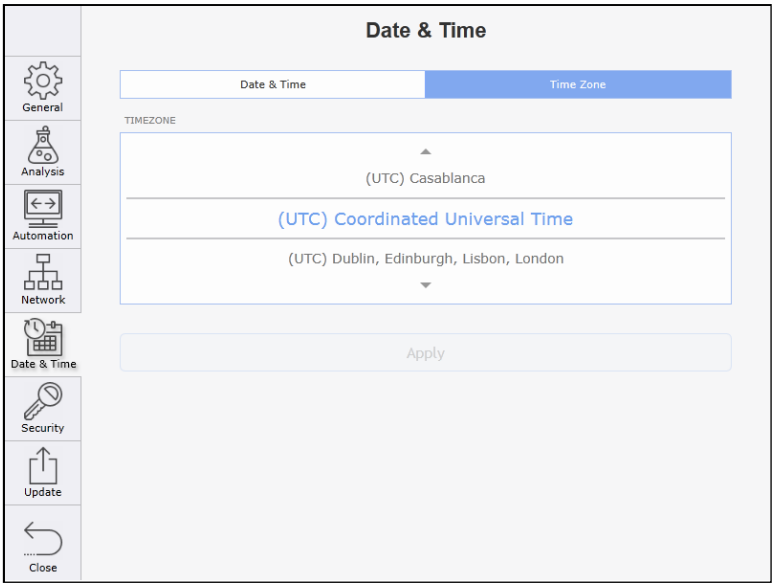


Figure 71. System settings – date & time – time zone tab

8.5.6 Security tab

The Security tab for System Settings is shown in Figure 72. This tab allows the user to enable system security, control user access by adding specific users to the analyzer, each with a unique password and specific privilege levels. Privilege levels disable access to certain analyzer functions without the use of a proper password entry. Any function that has restricted access is identified by a blue overlay and a small **Locked** icon (Figure 73). Attempting to access these restricted functions displays a password entry dialog. Access is only granted if a proper password is entered.

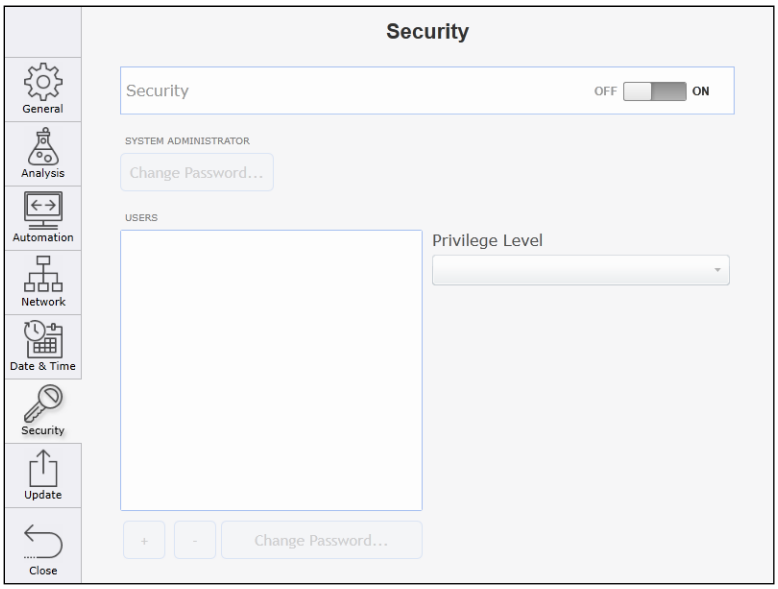


Figure 72. System settings – security tab

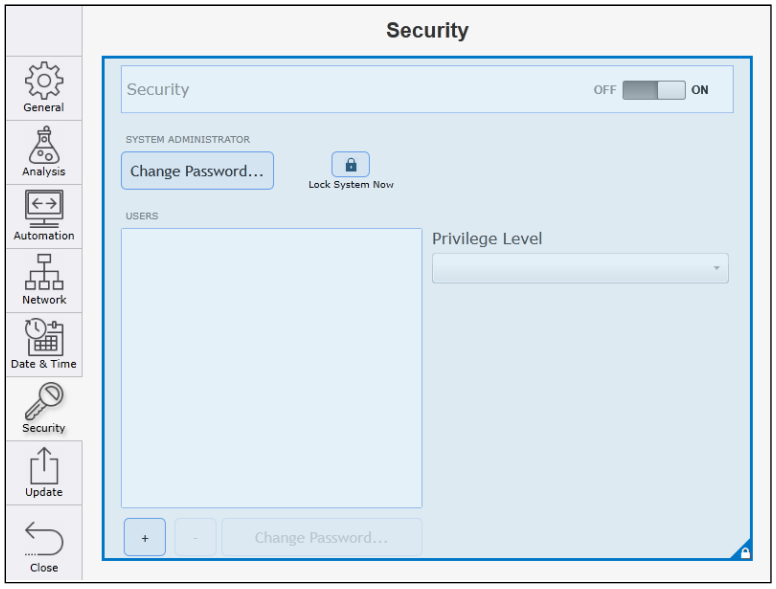


Figure 73. System settings – security enabled

8.5.7 Update tab

The Update tab for System Settings is shown in Figure 74. This tab allows the user to choose and install software updates. Software updates must be either on a flash drive or on the host computer drive if the system is accessed remotely using a web browser.

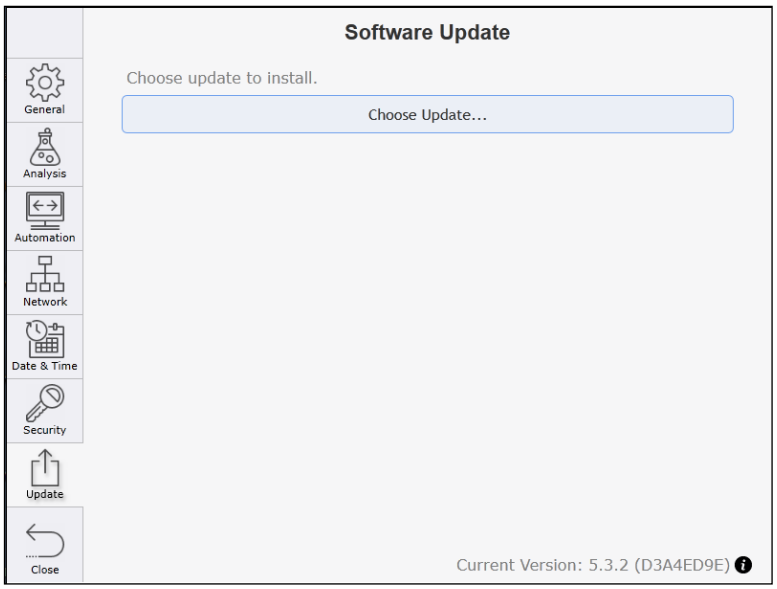


Figure 74. System settings – update tab

8.6 System diagnostics

To access the System Diagnostics, click **Options > Diagnostics** from the Main Screen. The System Diagnostics screen appears (Figure 75) with the System Environment tab open by default. This screen enables you to access information on the system environment and trends. You can also export system data. The System Diagnostics screen has three tabs, which are described below: Environment, Trends, and Export.

8.6.1 Environment tab

From the System Diagnostics screen, click the **Environment** tab to display information about the system environment. The Environment screen (Figure 75) displays information about the system environment from various sensors within the analyzer. The values are grouped into System-wide information and Channel specific information.

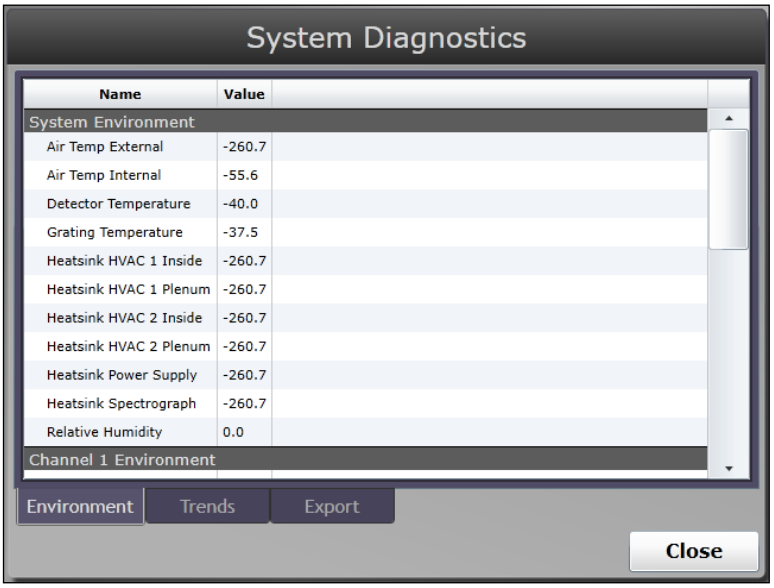


Figure 75. System diagnostics – environment tab

8.6.2 Trends tab

From the System Diagnostics screen, click the **Trends** tab to display trend information. The Trends screen (Figure 76) displays a trend chart for the period of time you select–from 8 hours up to 10 days. To view data, select a Principal Trend from the pulldown menu and (optionally) a Comparison trend. Principal trend units are displayed on the left ordinate axis, and Comparison trend units on the right ordinate axis, and are color coded with plot lines.

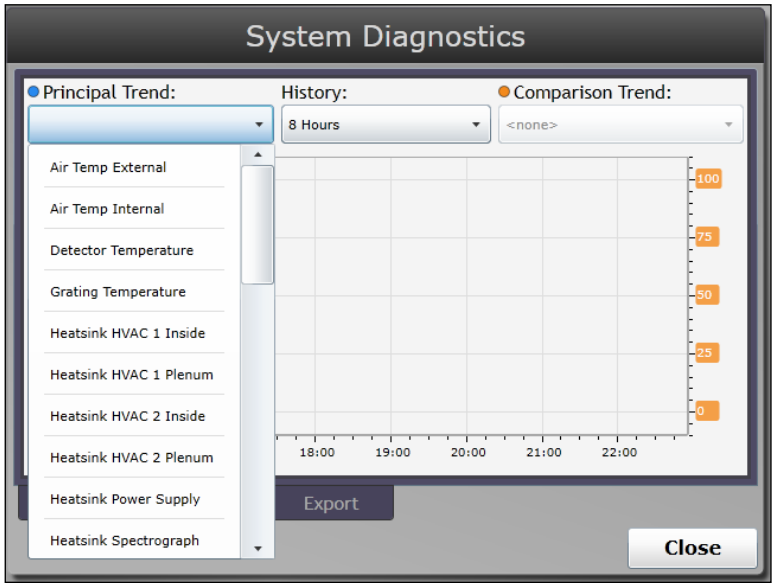


Figure 76. System diagnostics – trends tab

8.6.3 Export tab

From the System Diagnostics screen, click the **Export** tab (Figure 77) to export system information. When opened, the Export screen provides information on the existing data archive including the date of the previous export and the types of data that were included. This existing export can be Saved from the dialog, or a New export can be created.

To save the existing archive:

1. From the System Diagnostics Export tab, click **Save**. Exports are saved to an external flash drive. If no flash drive is currently inserted into the instrument, a prompt to insert one is displayed. Once the drive is recognized, the File Download screen appears. If the analyzer is being accessed remotely on a web browser via an external computer, the export can be saved to a folder on any of the drives on the external computer instead of using the flash drive. Navigate to the desired folder.
2. Click **Save**.

The archive is saved.

NOTICE

▶ Performing an export will delete the archive created by any previous export.

To create a new data export archive:

1. From the System Diagnostics Export tab, click **New**, then select the Destination Folder (Figure 77) and touch the ‘Select Folder’ button. The Export Data screen appears (Figure 79).
2. Select the radio button next to the type of export desired (**Basic**, **Diagnostic**, or **Full**).
3. Click inside the box containing the number in the “Restrict data to the last XX days” section of the dialog to enter the desired number of prior days of data to include.
4. Click the **Export** button.

A new data export archive is saved (Figure 80) with the current system date (Figure 81).

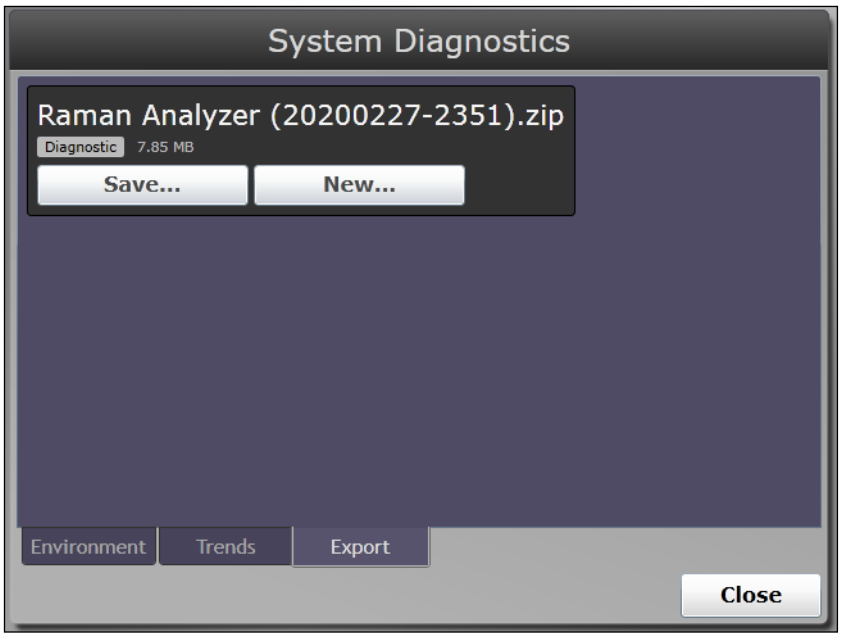


Figure 77. System diagnostics – export tab

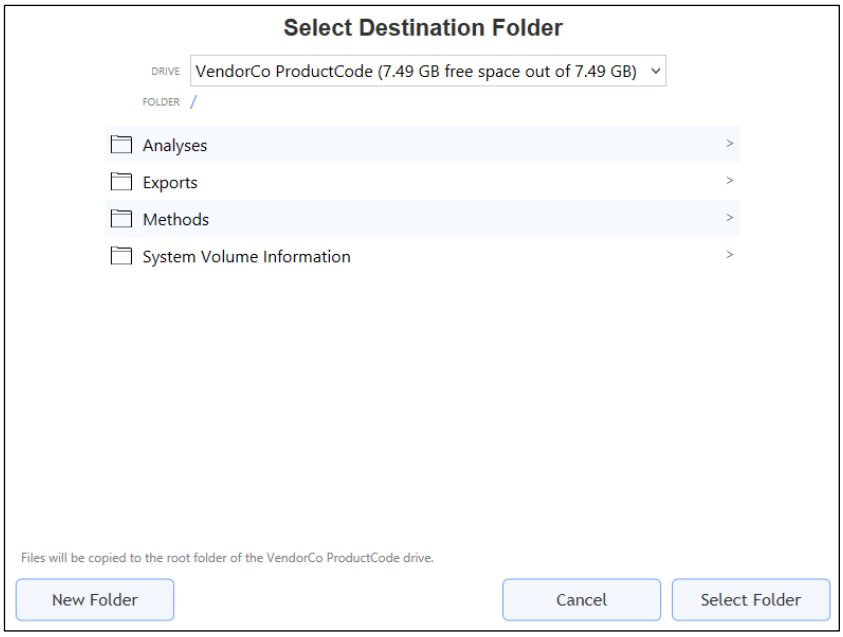


Figure 78. System diagnostics – file download screen

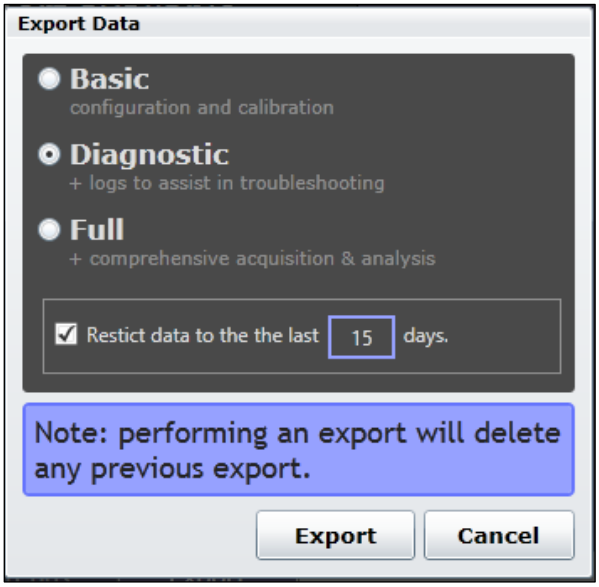


Figure 79. System diagnostics – export data configuration options

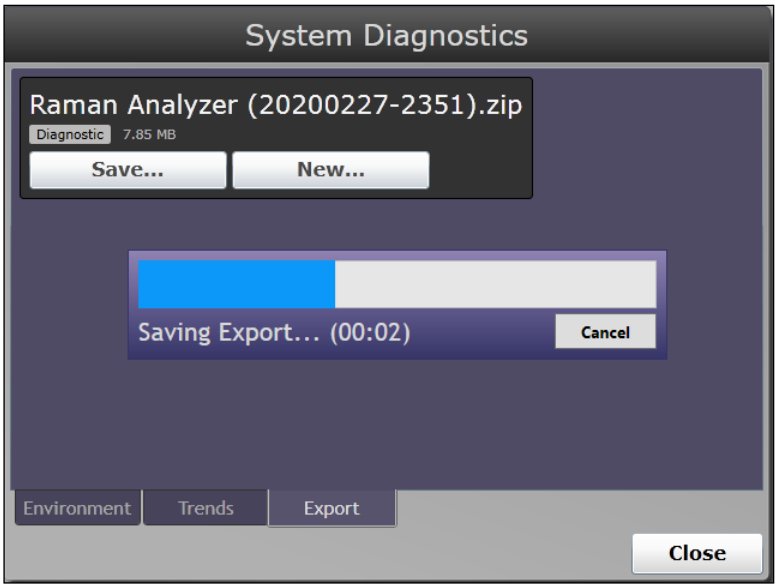


Figure 80. System diagnostics – saving the export

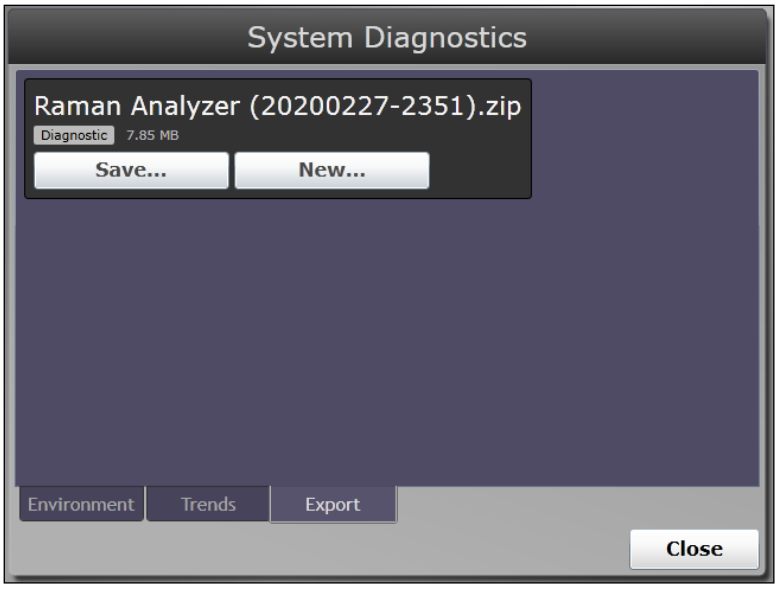


Figure 81. Save the exported file

8.7 Verifying an existing calibration

Prior to verifying any channel, the overall system must be disabled, as described in *General tab* in *Section 8.5.1* and shown in Figure 61. To perform a new calibration or verify the existing calibration for a channel, select **Options > Calibration**.

The Calibrations screen appears (Figure 82). The Calibrations screen shows each channel, the when each channel was calibrated or verified, the result (Pass or Fail), and an option to select the Details of each calibration. Function buttons on the lower right are used to run a new verification or calibration. Running a new Calibration is typically recommended only when a Verification fails. The **Gas References** button on the lower left is used to input the known values of the calibration gas for each channel (provided with the calibration bottle).

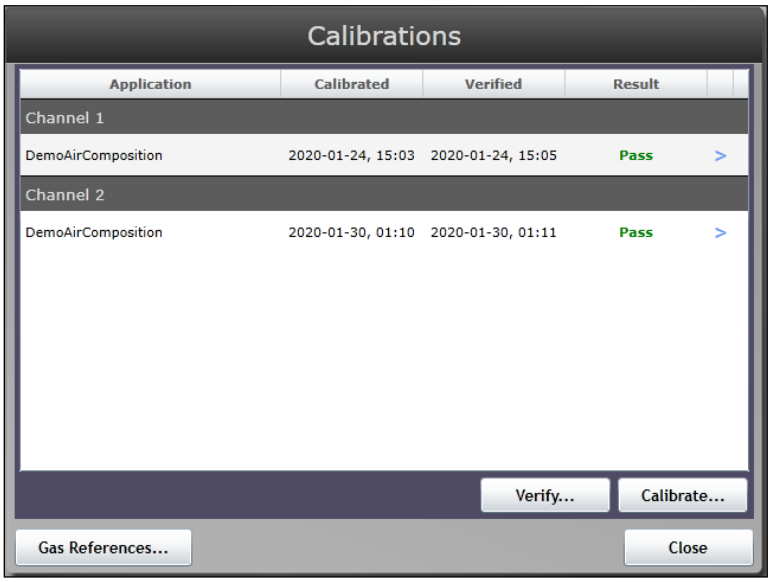


Figure 82. Calibrations

8.7.1 To view the details of a calibration

1. Click **>** (Figure 82) on the right side of the screen to select the calibration details you wish to view. The Calibration Details screen (Figure 83) appears showing the Verification Results tab. The Verification Results tab displays more specific detail on the components of the verification.
2. Click the **Verification Spectrum** tab to view the verification spectrum (Figure 84).
3. Click the **Calibration Spectrum** tab to view the calibration spectrum (Figure 85).
4. Click **Back** to return to the Calibration screen.

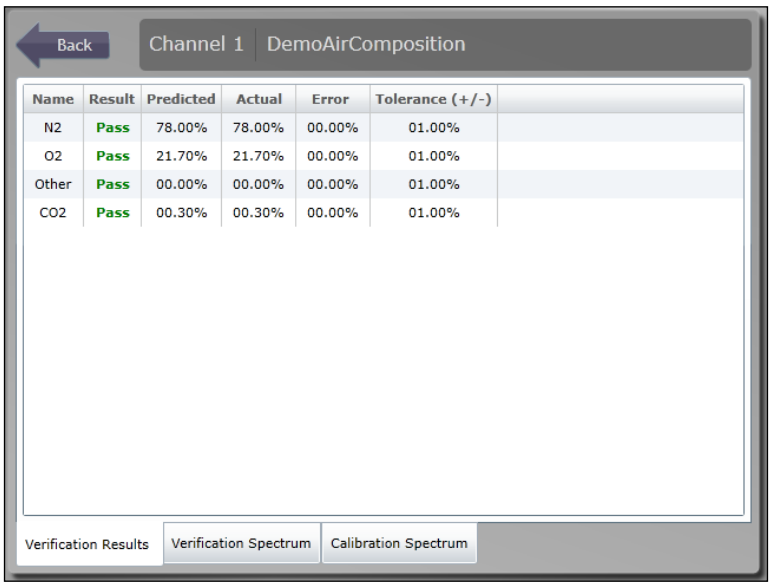


Figure 83. Calibration details – scores tab

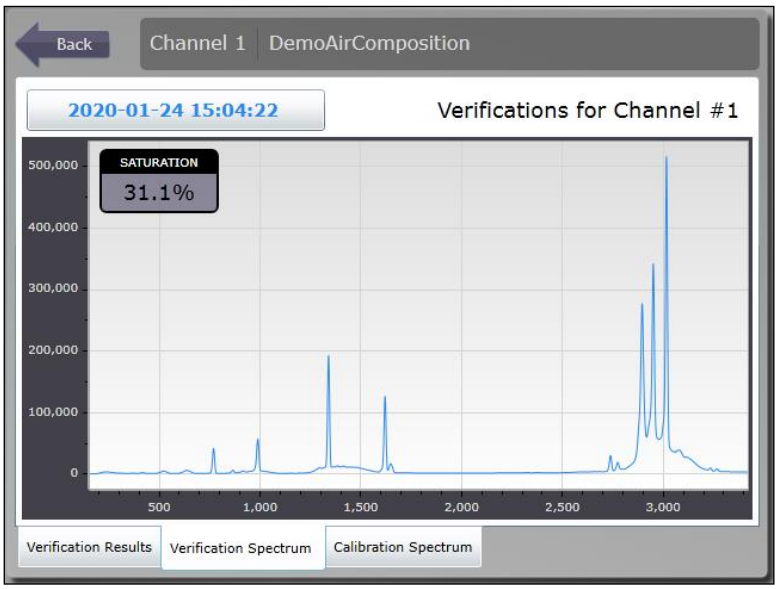


Figure 84. Calibration details – verification spectrum tab

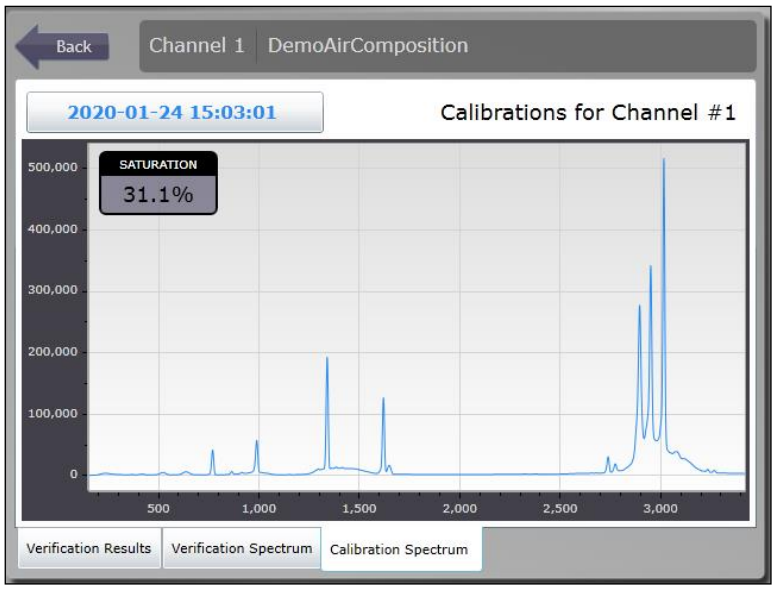


Figure 85. Calibration details – calibration spectrum tab

8.7.2 To verify a channel

1. Click the **Verify** button on the Calibrations Screen (Figure 82).
2. On the Verification Parameters dialog that appears (Figure 86), choose a **Channel**, **Method**, and **Reference**. The selected channel will be highlighted in blue. Click **Continue**.

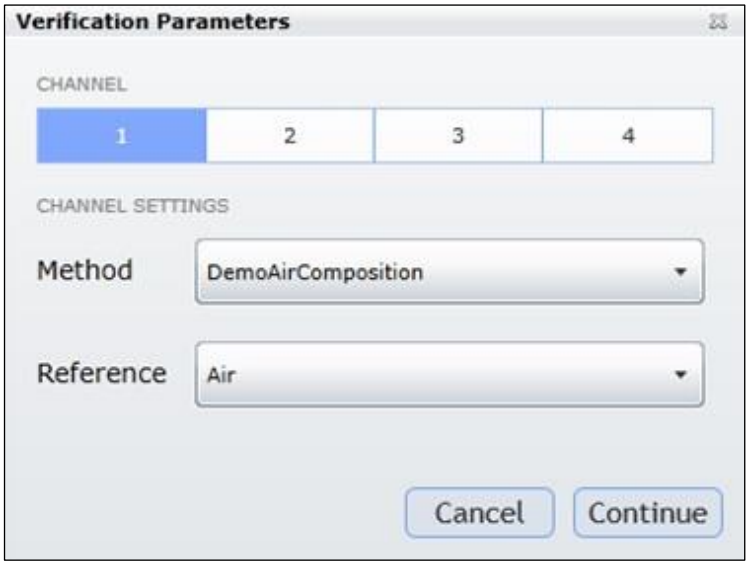


Figure 86. Verification parameters

The Verifying screen appears indicating the progress of the verification.

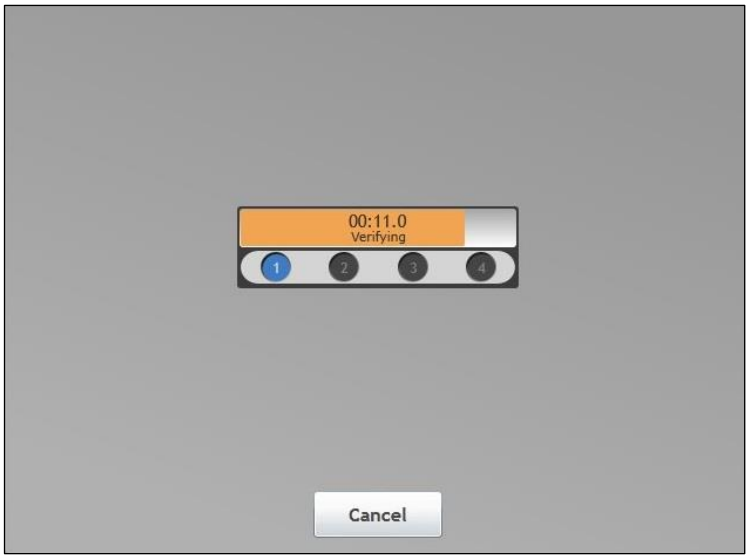


Figure 87. Verification in progress

3. When the verification is complete, the Calibrations screen (Figure 88) appears showing the results of the verification.
4. (Optional) You may also click **>** for any channel to view its verification scores, verification spectrum, or associated calibration spectrum. See Figure 89. Click **Back** to return to the Calibrations screen.
5. From the Calibrations screen, click the **Close** button to return to the main User Interface (UI) screen. The validation is now complete, and the system returns to sampling.

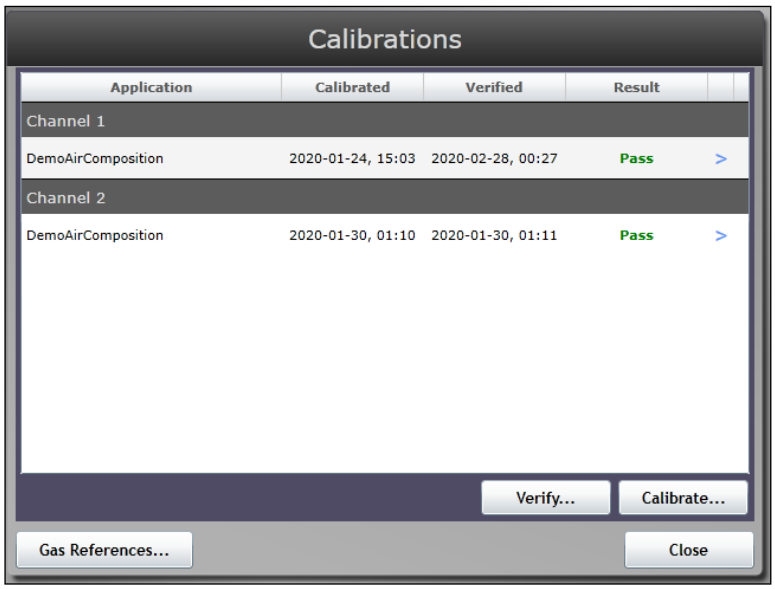


Figure 88. Verification updated

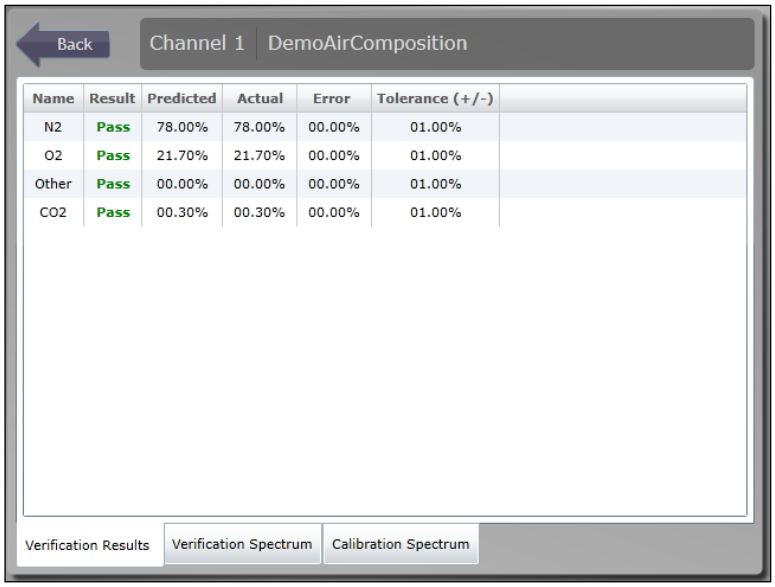


Figure 89. Verification updated

8.7.3 Calibrate a channel

1. Prior to performing a calibration for the first time on a channel, a method and appropriate reference gas must be selected for that channel (Figure 90).
2. Click the **Calibrate** button on the Calibrations screen (Figure 88).
3. On the Calibration dialog that appears (Figure 90), choose a Channel, Method, and Reference. The selected channel will be highlighted in blue.
4. If the Reference Gas composition does not contain the correct components for the Method, an error message will occur (Figure 91). Select the correct reference to remove the error message.

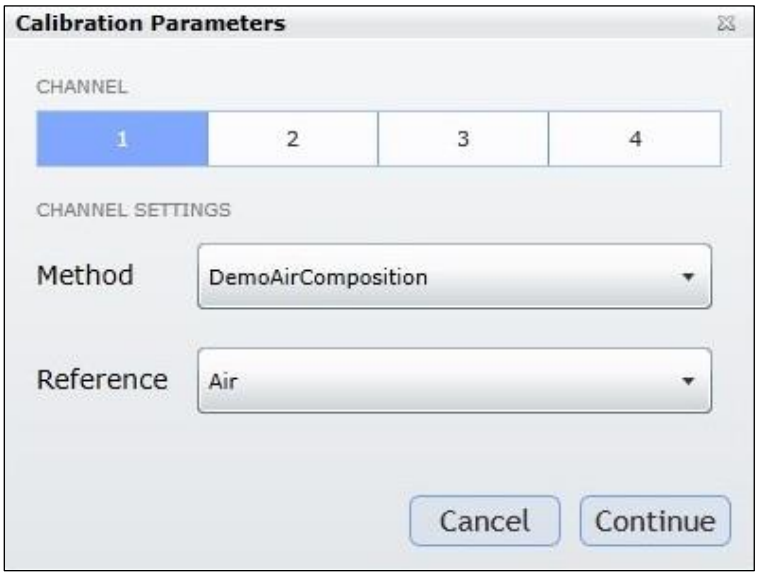


Figure 90. Calibration parameters dialog

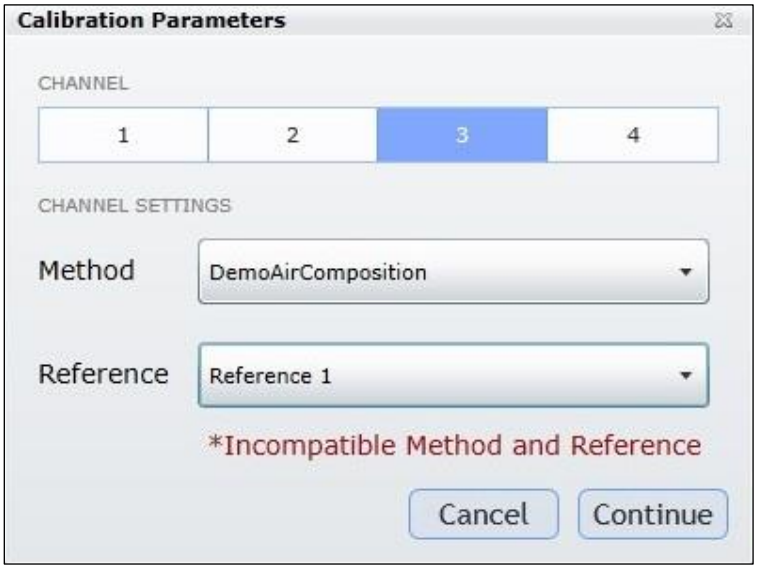


Figure 91. Incompatible reference error for a method

5. To begin the Calibration process, click **Continue** in the Calibration Parameters dialog (Figure 90). The Calibration progress screen (Figure 92) appears, showing the progress of the calibration.

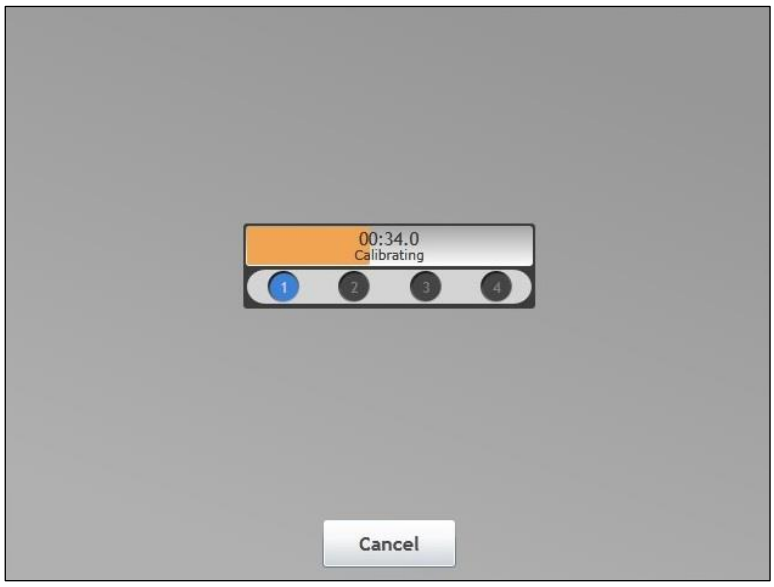


Figure 92. Calibration process screen

6. When the calibration is complete, the Calibrations screen (Figure 93) appears showing the results of the calibration. The Result state of a newly calibrated channel is 'Unverified', as shown in the Result column in Figure 93. The new calibration needs to be verified to complete the process. Follow the steps outlined in *To verify a channel* in *Section 8.7.2* to verify the channel.
7. (Optional) You may also click **>** for any channel to view its calibration scores, verification spectrum, or calibration spectrum. See Figure 89. Click **Back** to return to the Calibrations screen.

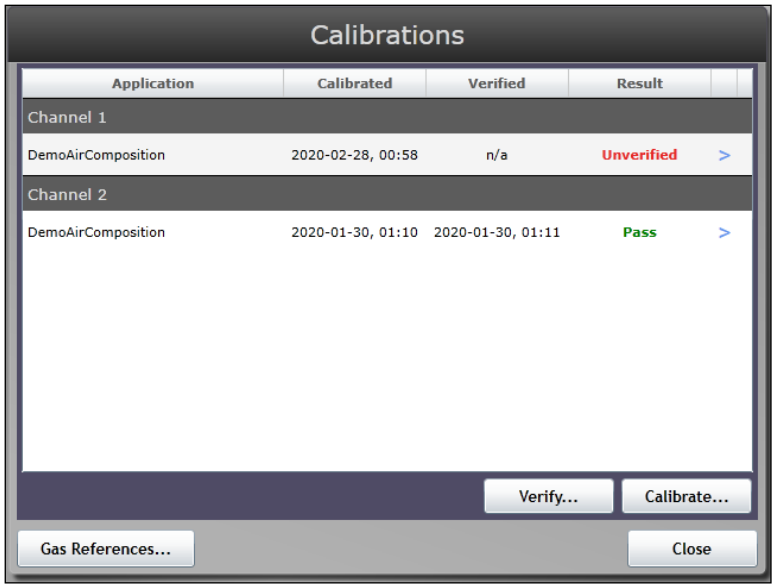


Figure 93. Calibration updated and verification required

8. From the Calibrations screen, click the **Close** button to return to the main UI screen. The calibration is now complete. The system must be re-enabled in order to return to its normal sampling cycle, as described in *General tab* in *Section 8.5.1* and shown in Figure 82.
9. Replacing a Calibration Bottle. When an existing calibration gas bottle is being replaced, pressing the **Gas References** button (Figure 88) allows the user to update the reference or calibration gas composition for the channel(s) using that gas.
10. Click an existing gas cylinder from the list to edit its composition (Figure 94).
11. In the Set Composition entry dialog (Figure 95), click the **% Composition** box for each gas in the list and enter the composition values from the new calibration gas cylinder. When this process is completed, make sure that the Total value at the bottom of the dialog is 100. Click **Save** to update this Reference gas.

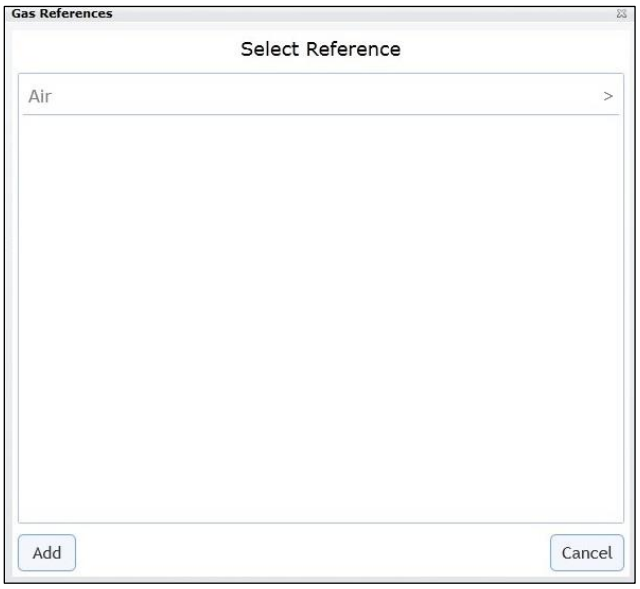


Figure 94. Select gas reference dialog

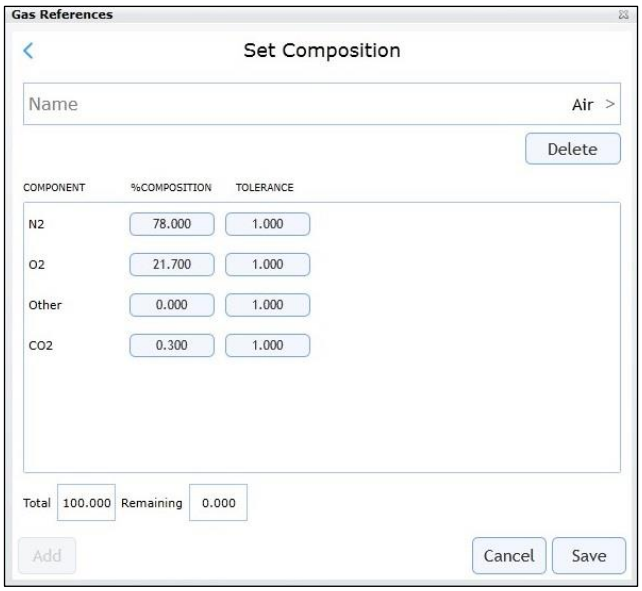


Figure 95. Reference gas composition entry dialog

12. Adding a New Calibration Gas. When a new method is added to a channel, a compatible Reference gas must be created for that method. Pressing the **Add** button from the Gas References dialog (Figure 94) displays the Select Target Method dialog (Figure 96), which allows the user to create a reference gas and enter its composition from the calibration gas cylinder.
13. Select the new method from the list in the Select Target Method dialog. This opens a Set Composition dialog (Figure 97) and creates a component list from all the components in the selected method. By default, all composition values are 0.000 mol %.
14. In the Set Composition entry dialog, click **Name** to enter in a new name for the reference gas.
15. Click the **% Composition** box for each gas in the list and enter the composition values from the new calibration gas cylinder. When this process is completed, make sure that the Total value at the bottom of the dialog is 100 (Figure 98).

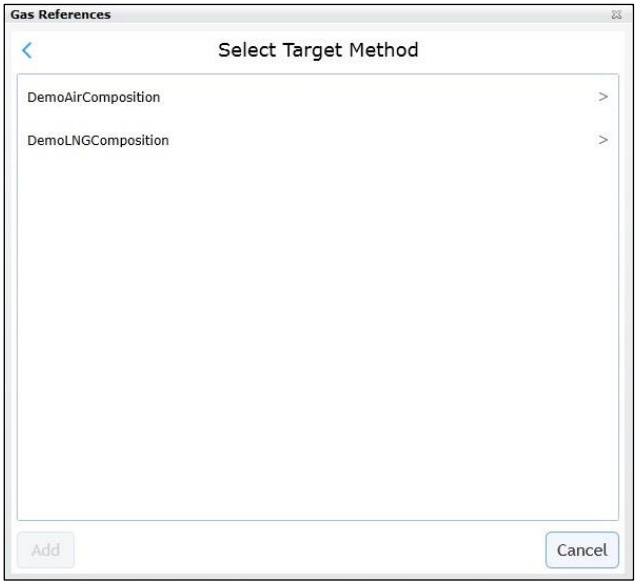


Figure 96. Select gas reference dialog

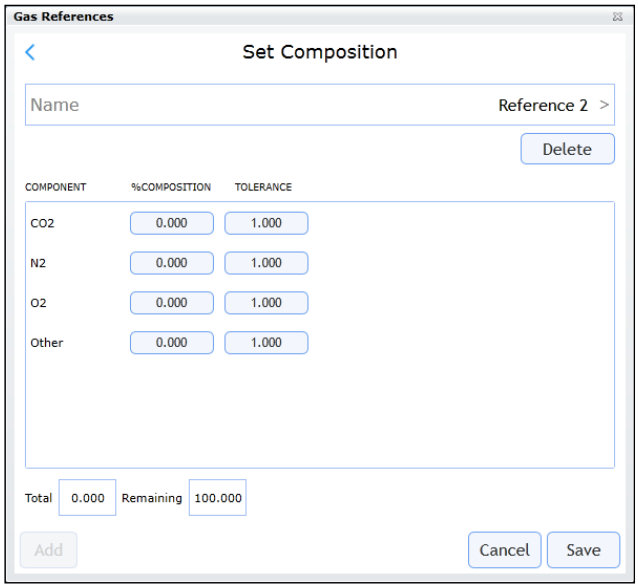


Figure 97. Reference gas composition entry dialog

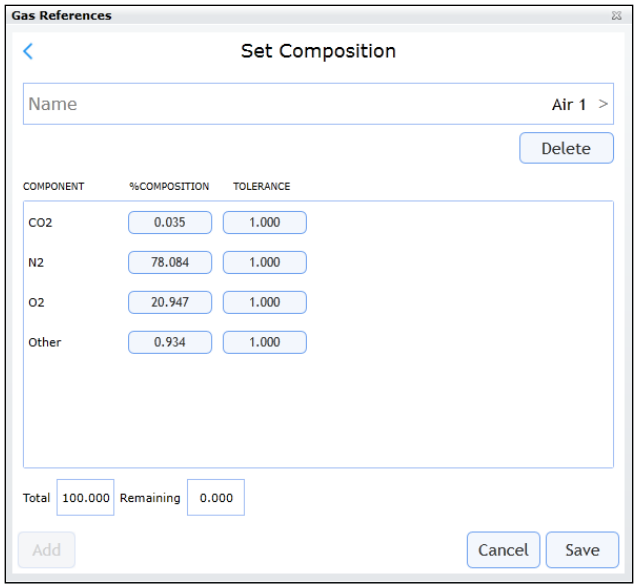


Figure 98. Reference gas composition entry dialog

16. Click **Save** to update this Reference gas. The new method will appear in the Gas References dialog (Figure 99) and in the pull-down menu for Reference in the Calibration Parameters dialog (Figure 100).

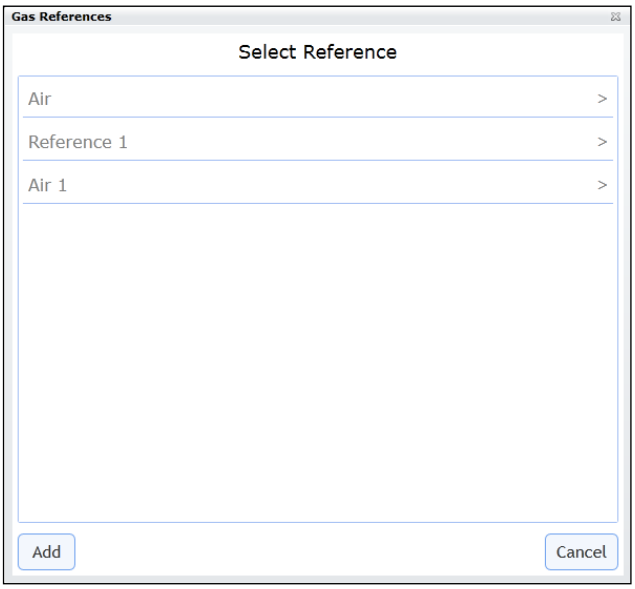


Figure 99. Select gas reference dialog with new reference gas

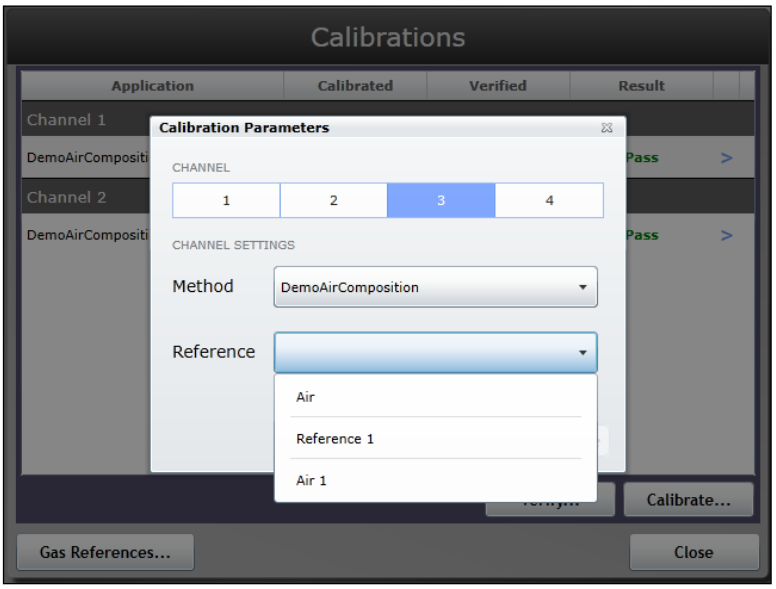


Figure 100. Select gas reference dialog

9 Diagnostics and troubleshooting

This section provides solutions to problems you may encounter as you work with the Raman Rxn5.

NOTICE

- Endress+Hauser offers an *Raman Rxn5 Optical Service Kit (p/n 2013270)*, which is intended for diagnosing and servicing the major field-serviceable optical paths and components of the Raman Rxn5 system. It is also intended to diagnose and identify components that may require replacement or factory service.

9.1 Diagnostics

Several hardware diagnostics are available in the Raman Rxn5 control software. To access the systems diagnostics, select **Options > Diagnostics** from the Main Screen. The following are the available diagnostics and their expected ranges. The system software will assert warnings and errors to the user and the DCS (if configured) at the detailed thresholds.

Diagnostic	Warning Threshold	Error Threshold	Expected Value
Air Temp External	48 °C	50 °C	-20 °C – +50 °C
Air Temp Internal	50 °C	55 °C	0 °C – 55 °C
Grating Temperature	53 °C	55 °C	0 °C – 55 °C
Heatsink HVAC 1 (left) Inside	N/A	N/A	At external > 30 °C Plenum minus 15 °C – 20 °C
Heatsink HVAC 1 (left) Plenum	73 °C	75 °C	At external < 25 °C Inside minus 15 °C – 20 °C
Heatsink HVAC 2 (left) Inside	N/A	N/A	At external > 35 °C Plenum minus 15 °C – 20 °C
Heatsink HVAC 2 (left) Plenum	73 °C	75 °C	At external < 25 °C Inside minus 15 °C – 20 °C
Heatsink Power Supply	73 °C		5 °C – 20 °C over external
Heatsink Spectrograph	58 °C	60 °C	5 °C – 8 °C over external
Relative Humidity	65%	85%	–
Channel <ch> Laser Diode Current	2.1 A	N/A	1.0A – 2.1A
Channel <ch> Laser Heatsink	63 °C	65 °C	2 °C – 5 °C over external
Channel <ch> Laser Power Out	N/A	N/A	130 mW to 170 mW
Channel <ch> Sample Pressure	N/A	N/A	–
Channel <ch> Sample Temperature	N/A	N/A	–

Table 12. Hardware diagnostics

In addition to diagnostics shown in the **Options > Diagnostics** screen, the software may produce the following diagnostic warnings and alarms during operation.

Diagnostic	Warning Threshold	Error Threshold	Expected Value
Detector Temperature too High	> -40 ˚C	> -38 ˚C	Not shown unless warning or error
Detector Temperature too Low	< -40 ˚C	< -42 ˚C	Not shown unless warning or error
Detector Saturation (Signal Strength) too High	> 80%	> 90%	30% – 80%
Detector Saturation (Signal Strength) too Low	NA	< 2%	30% – 80%
Warnings			
Blower Alarm: The cooling fan is not working properly. The analyzer might overheat.			
Inline Wavelength Calibration Warning. Neon pixel fill below warning level.			
Channel <ch> Inline wavelength calibration failed. Using default wavelength calibration.			
Channel <ch> Inline laser calibration failed. Using default laser wavelength.			
Channel <ch>: <analysis> calibration does not perform within tolerance.			
Channel <ch>: <analysis> calibration has not been verified in more than <x> days.			
System analysis is disabled.			

Table 13. Diagnostic warnings and alarms

9.2 Troubleshooting

9.2.1 Probe fouling

Probe fouling due to sample contamination can be a persistent problem in the absence of sound sample preparation. Typically, probe fouling presents itself with a rising baseline as shown in Figure 101.

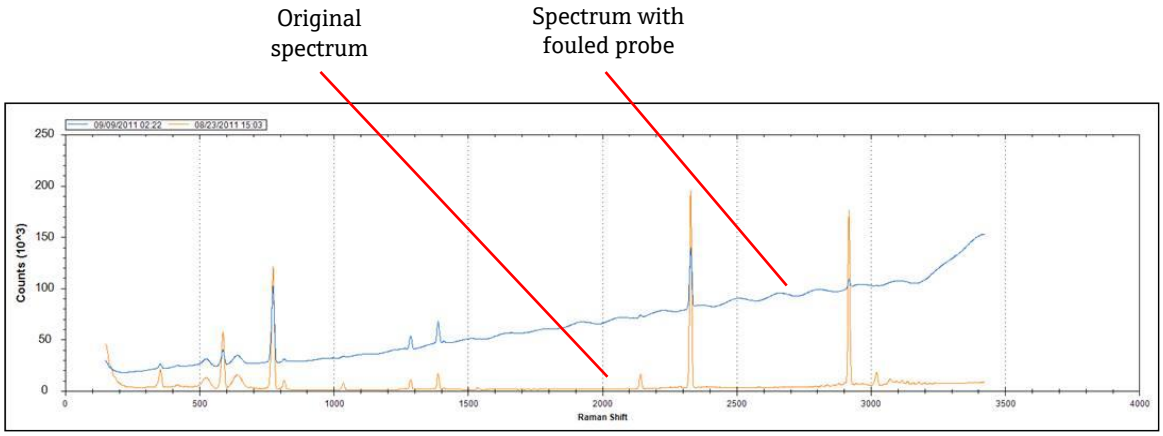


Figure 101. Spectrum with fouled probe

If contamination is suspected, first turn off the laser for the contaminated probe at the switch panel. Remove the probe from the process and clean its window and mirror using the procedures detailed in *Cleaning a probe window and mirror* in *Section 10.15*. If the problem persists after cleaning, it is likely that the probe optical surfaces have been damaged and the probe should be returned to Endress+Hauser for repair.

9.2.2 Low signal level

The software may display a warning or an error that the detector saturation is too low.

First check the sample pressure—the Raman signal is directly proportional to the sample pressure.

If the pressure is suitable, analyze the spectrum for probe fouling.

If probe fouling is not present, check the system diagnostic for laser power.

If laser power is good, check the laser delivery fiber optic train for power transmission. For a 150 mW laser, at least 100 mW should be delivered to the probe through its fiber optic. To check this, remove and clean the fiber cable at the probe interface before checking power levels.

9.2.3 High signal level

The software may display a warning or an error that the detector saturation is too high.

This is likely due to an increase in the sample pressure. Check that the sample pressure is in range.

9.2.4 Failing inline wavelength calibration

The system may display an error stating the inline wavelength calibration has failed and it is reverting to the factory calibration.

First check whether or not it coincides with a pixel fill alarm for the neon. If the system is failing this, the most likely scenario is that the neon board has failed. To verify, remove the fiber connector from the calibration module and, using a mirror, look for **Red** light to appear at the fiber optic connector for 2 to 3 seconds at the beginning of each acquisition. If the light isn't turning on, replace the calibration module.

9.2.5 Failing inline laser calibration

The system may display an error stating the inline laser calibration is failing.

First check the spectrum for probe fouling.

Next, check the gas sample peak that has been assigned for laser calibration and make sure the assigned peak is present in the spectrum, and is strong.

Check if backup component peaks have been assigned to be used when the species for the primary calibration peak is not present in the gas stream. Ensure that these backup component(s) are present, or expected to be present, in the stream at sufficient concentration to produce a strong peak for laser calibration.

9.2.6 Laser drive current too high

The software may display a warning stating that the laser diode current is too high.

The laser is beginning to fail and plans should be made to replace the laser (*Section 10.8*). As a laser ages, the drive current required for a given power output will rise to the point where the drive electronics have reached current limit and the output power will begin to fall. As power levels begin to fall, Raman signal intensity will fall proportionally. The application will determine how much signal drop it can handle before affecting the accuracy of the predictions.

9.2.7 Excessive vibration (blower)

If the bearing in the fan motor is starting to fail, the first sign will be excessive vibration transmitted through the analyzer. The analyzer can withstand the vibration, but the fan motor must be replaced (*Section 10.3*) before it seizes rendering the cooling system ineffective.

9.2.8 Internal temperature too high

The software may display an error stating that the internal or grating temperature is too high.

If the software is not asserting that the external temperature is too high, then it is possible the either the fan speed has been compromised OR the airflow in one or both plenums has been restricted OR one or both of the HVAC units has failed.

First, look at the system diagnostic for the internal and plenum HVAC temperatures. The HVAC units should be able to maintain a 15 ˚C delta (plenum temp – inside temp) when in full cool mode (external temperature > 33 ˚C). If the deltas are much less than 15 ˚C, one or both HVAC units are likely in need of replacement.

Second, remove both plenum covers and check for fouled heat sinks. If necessary, clean the heat sinks with compressed air or water and re-install the plenum covers.

Third, check the fan motor for excessive vibration indicating wear and Revolutions Per Minute (RPM) loss.

9.2.9 Detector temperature too high

The software may display a warning or error that the detector temperature is too high.

The CCD array in the detection module is not being properly cooled.

Check for normal ambient temperature operating conditions.

Check for heat sink restrictions.

Check for normal thermal control diagnostics.

If the thermal control system is operating normally, then it is likely that the detection module needs to be replaced (*Section 10.13*).

9.2.10 Relative humidity too high

The software may display a warning or error that the relative humidity is too high or condensate may be exiting the drain port.

Check to make sure the purge air supply is dry within specification.

Then, check the desiccant cartridges inside the analyzer. If they are pink, they should be replaced (*Section 10.12*).

10 Maintenance

This section is a reference for personnel who service the Raman Rxn5. It describes how to replace the hard drive, the monitor, the detection module, the impeller, a laser, the motor controller, the fan motor, a cooler module, and the main power supply. This section also explains how to clean the heat sink fins and how to clean an optical fiber.

⚠ CAUTION

- The computer should be shut down from the System Settings screen (select **Options > System**) before power is removed from the analyzer.

10.1 Replacing the motor controller

To Remove the Motor Controller

1. Shut down the computer and then power down the analyzer.

Figure 102. Remove electrical connectons

2. Remove the 3 electrical connections in front. Note where each connector is attached.
3. Remove the nuts on the stud above the motor controller.
4. Pull out the motor controller.

To Reinstall the Motor Controller

1. Note the wires coming from the back of the motor. Connect these wires to the connection labeled MOTOR. Make this motor connection first to ensure that it is correct.
2. Reattach the nuts on the stud above the motor controller.
3. Reconnect the three (3) electrical connections in front.

10.2 Replacing a cooler module

To Remove the Cooler Module

1. Shut down the computer and then power down the analyzer.
2. Remove the motor controller (*Section 10.1*).

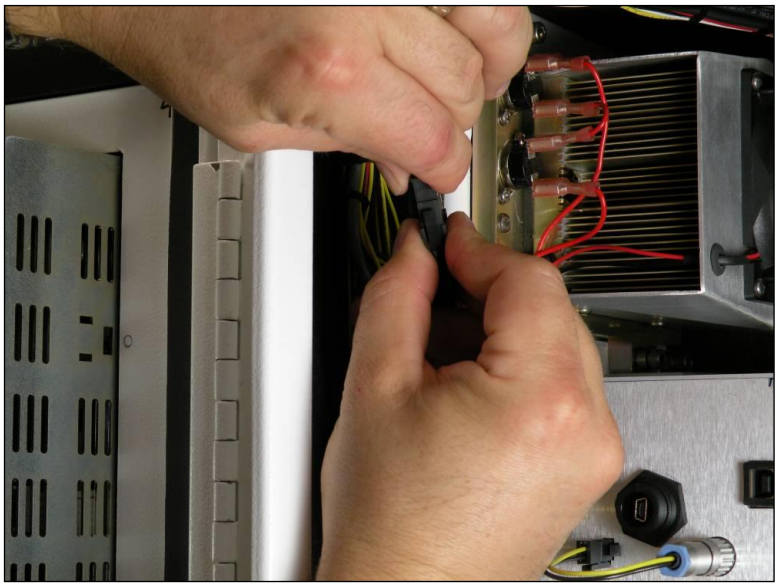


Figure 103. Disconnect electrical connection

3. Disconnect the electrical connection at the front of the analyzer (Figure 103).

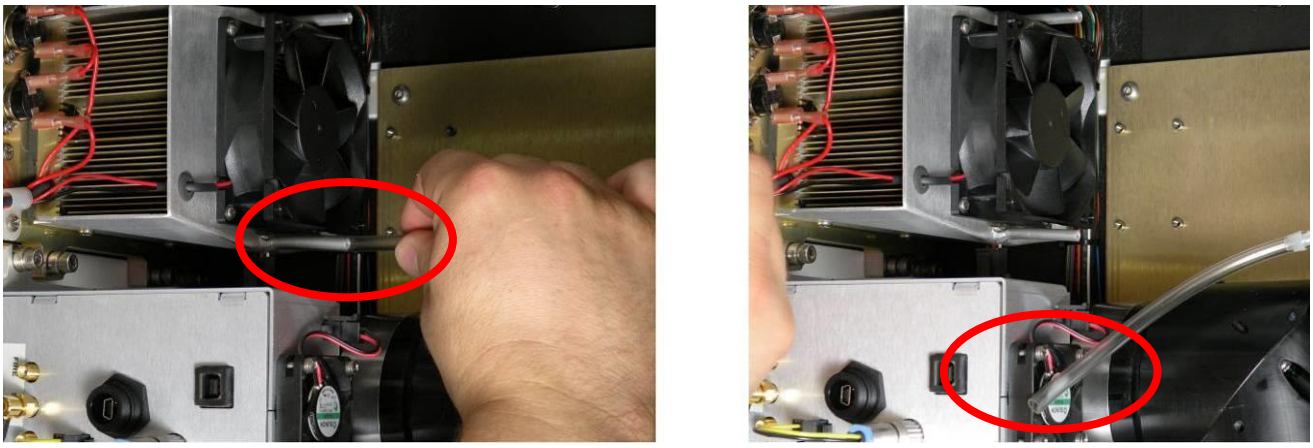


Figure 104. Disconnect condensate drain line

4. Disconnect the condensate drain line (Figure 104).

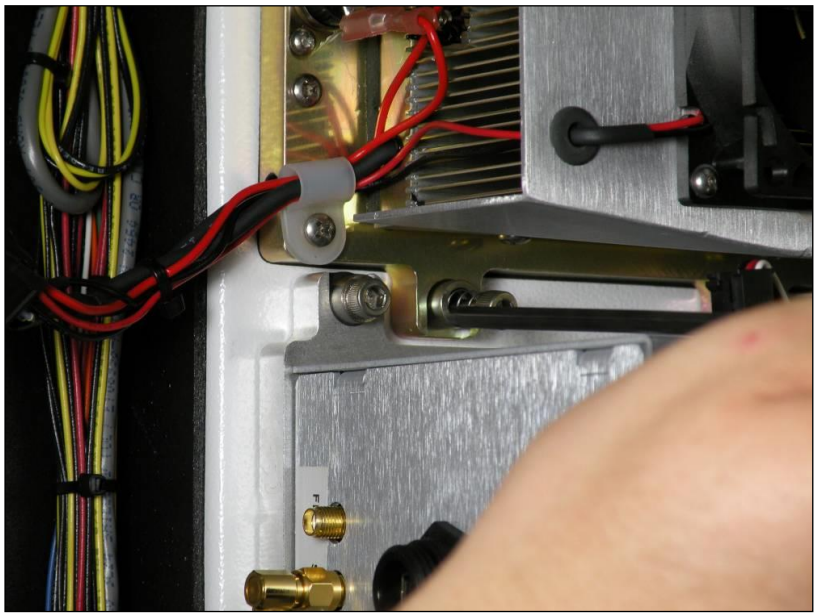


Figure 105. Loosen screws

5. Loosen four screws: 2 on top and 2 on the bottom (Figure 105).

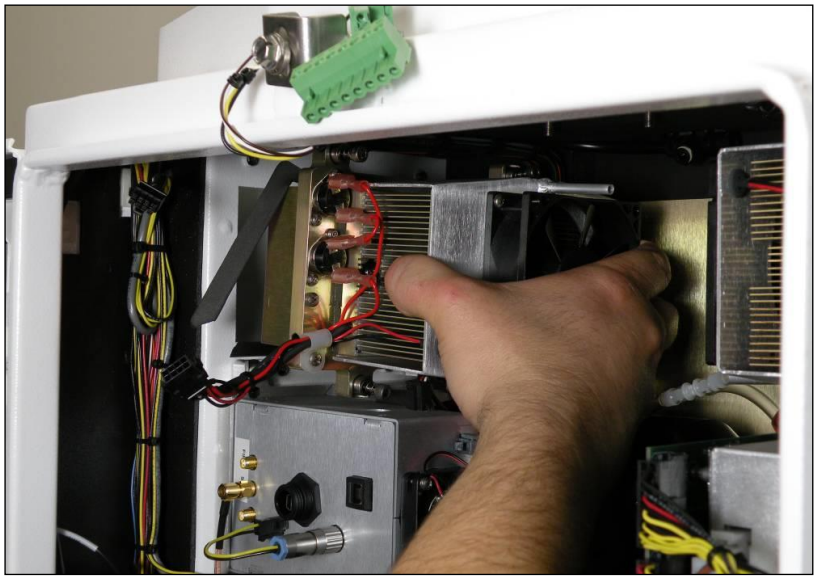


Figure 106. Removing cooler module

6. Pull the cooler module towards the center of the analyzer and then remove it (Figure 106).

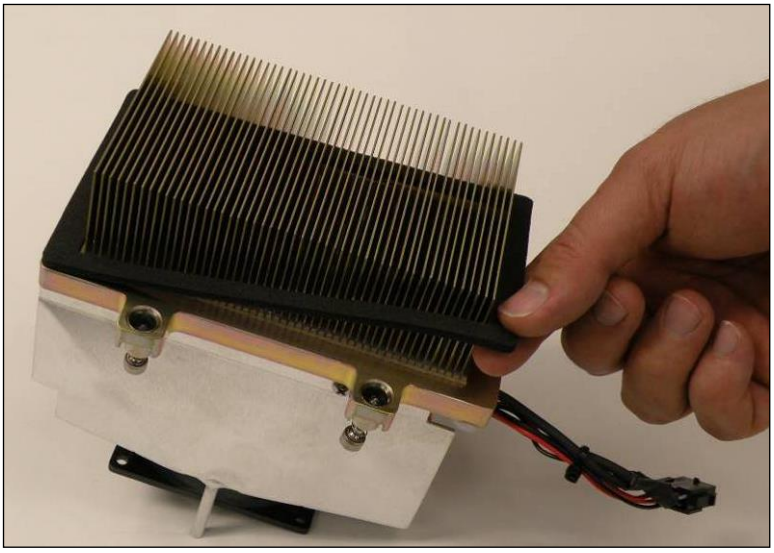


Figure 107. Removing the gasket

7. Remove the gasket (Figure 107).

To Install a new cooler module

1. Install a new gasket over the heat sink.
2. Insert the cooler module into the analyzer.
3. Reattach 4 screws: 2 on top a/nd 2 on the bottom.
4. Reconnect the condensate drain line.
5. Reconnect the electrical connection.
6. Replace the motor controller (*Section 10.1*).

10.3 Replacing the fan motor

To Remove the Fan Motor

1. Shut down the computer and then power down the analyzer.
2. Remove the impeller (*Section 10.6*).
3. Remove the motor controller (*Section 10.1*).

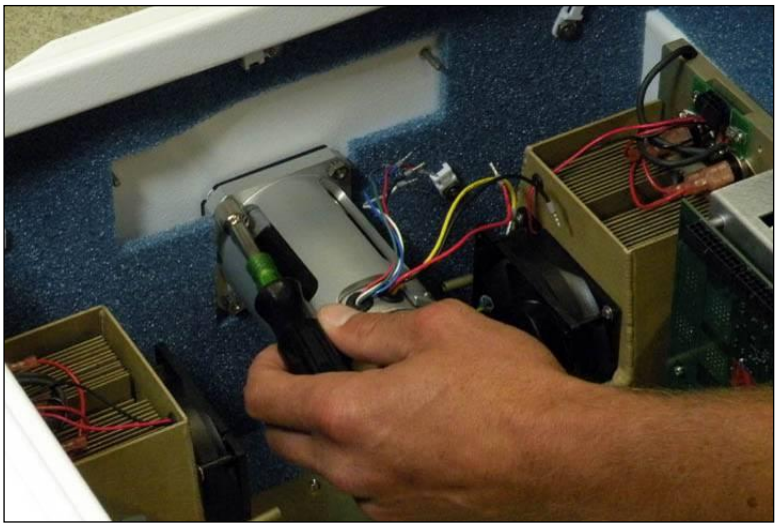


Figure 108. Remove motor controller

4. Use a 3/8” nut driver to remove the four nuts in the back (Figure 108).

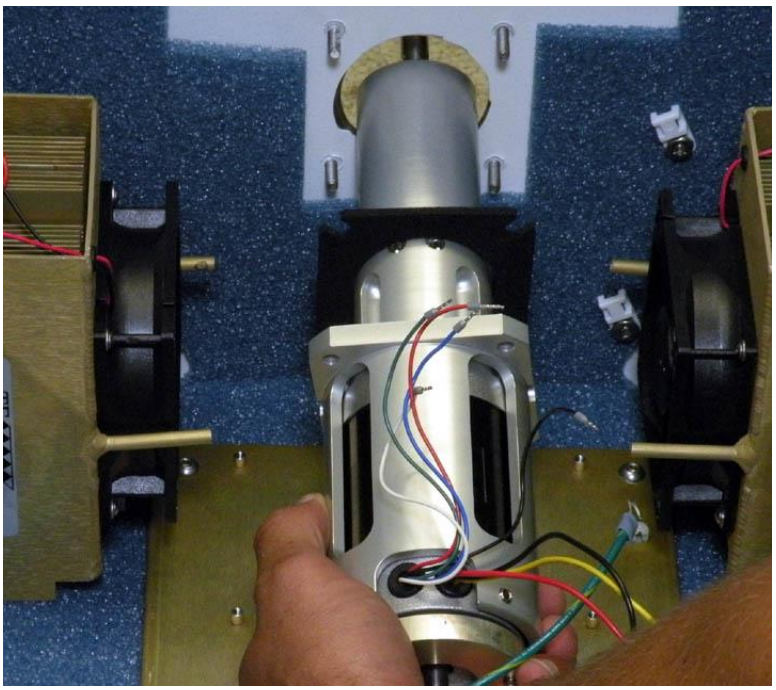


Figure 109. Sliding motor assembly and gasket

5. Slide the motor assembly and the gasket down and out (Figure 109).

To Install a New Fan Motor

1. Insert the motor assembly into the analyzer.
2. Use a 3/8” nut driver to install the four nuts to the motor assembly.
3. Reinstall the motor controller.
4. Reinstall the impeller.

10.4 Cleaning the heat sink fins

The heat sink fins are located on either side of the analyzer.

1. Shut down the computer and then power down the analyzer.

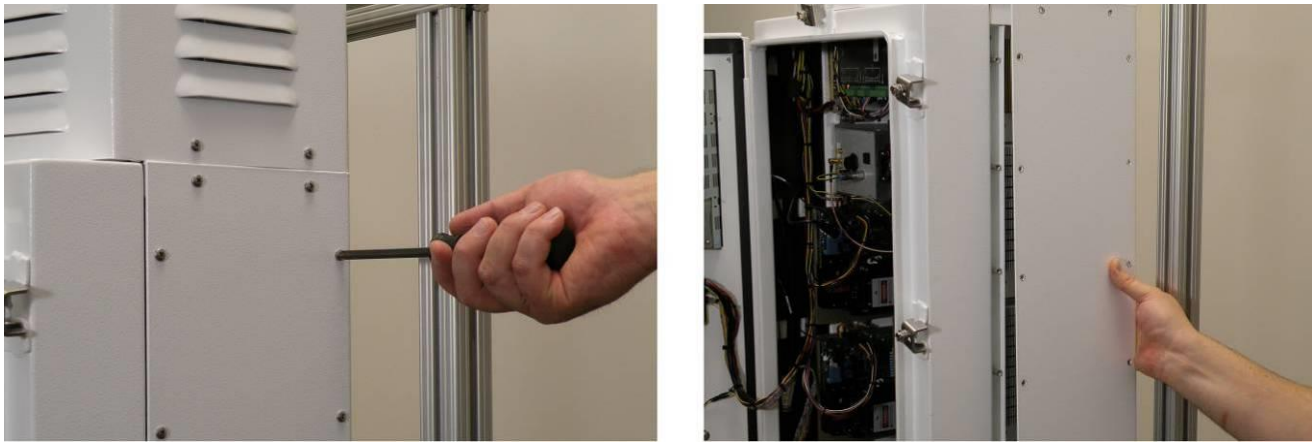


Figure 110. Removing screws and side cover

2. Remove 14 screws on the side panels and then remove the side cover (Figure 110).

Figure 111. Cleaning heat sinks with compressed air or water

3. Blow compressed air or spray water on the exposed heat sinks to clean them (Figure 111).
4. Replace the side cover.

10.5 Replacing the monitor

To Remove the Monitor

1. Power down the analyzer.

Figure 112. Disconnecting cables from monitor

2. Disconnect the power, video, USB, and ground wire connections from the monitor inside the door (Figure 112).

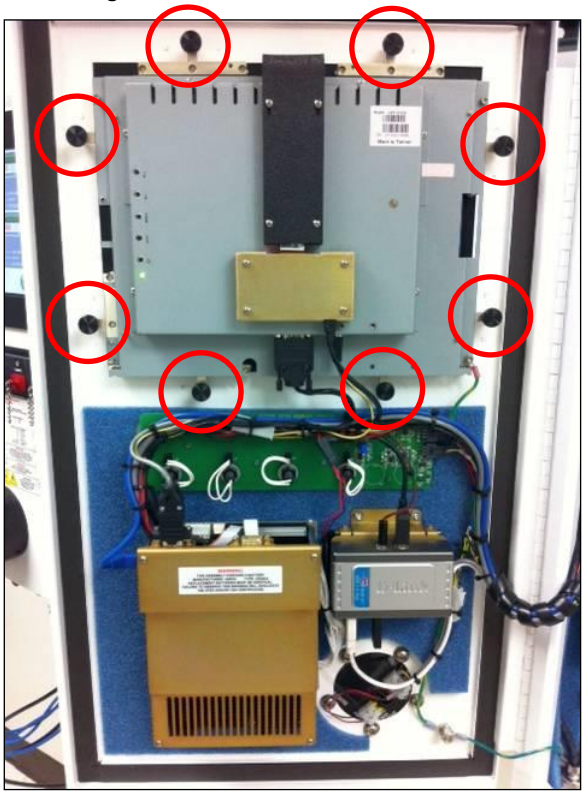


Figure 113. Remove retaining clamps

3. Use fingers to remove the retaining clamps around the perimeter of the monitor (Figure 60).

Figure 114. Removing monitor

4. Remove the monitor through the front of the analyzer door (Figure 114).

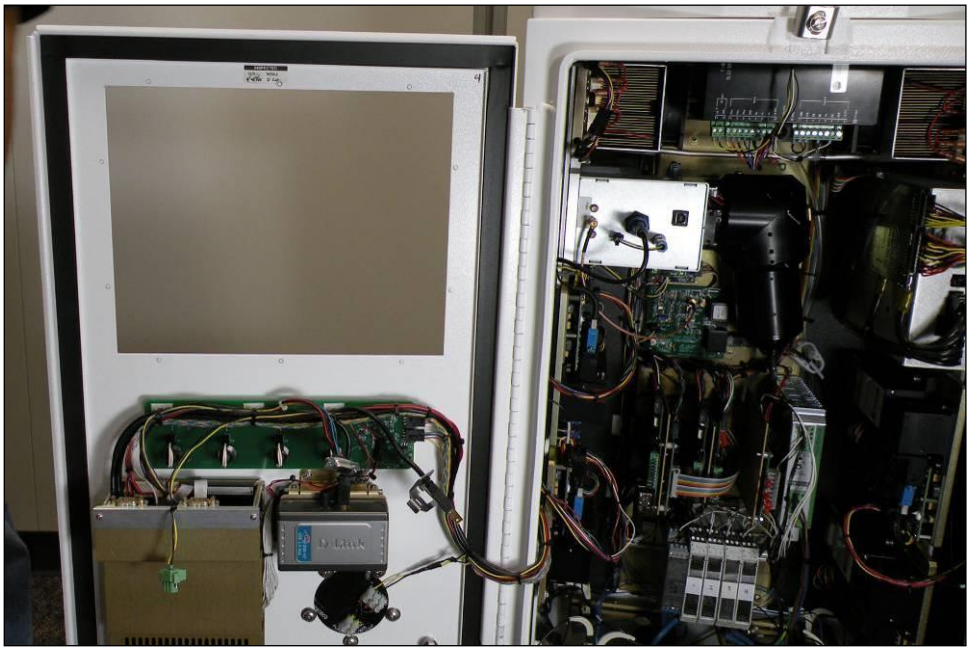


Figure 115. View with monitor removed

5. View with monitor removed (Figure 115).

To Reinstall the Monitor

The gasket is integral to the monitor so there is no need to replace it.

1. Insert the monitor into the analyzer from the front.
2. Reinstall the retaining clamps around the perimeter of the monitor. Do not overtighten.
3. Reconnect the power, video, USB, and ground connections to the monitor inside the door.

10.6 Replacing the Impeller

The impeller is located at the top of the analyzer. The impeller is covered by the shroud, which has two lift rings on top.

To Remove the Impeller

1. Shut down the computer and then power down the analyzer.

Figure 116. Removing lift rings and side screws

2. Remove the 2 lift rings from the top and the 2 screws on either side (Figure 116).

Figure 117. Remove shroud

3. Remove the shroud (Figure 117).

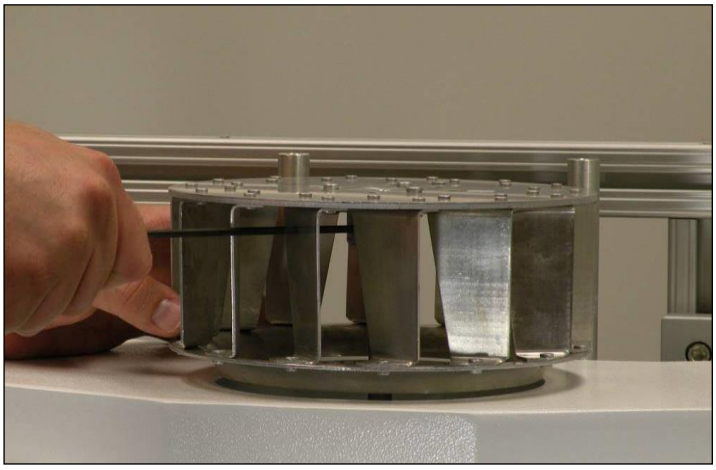


Figure 118. Loosen set screws

4. Using a 1/8” ball driver, go in through the impeller blades and loosen the 2 set screws (Figure 118).

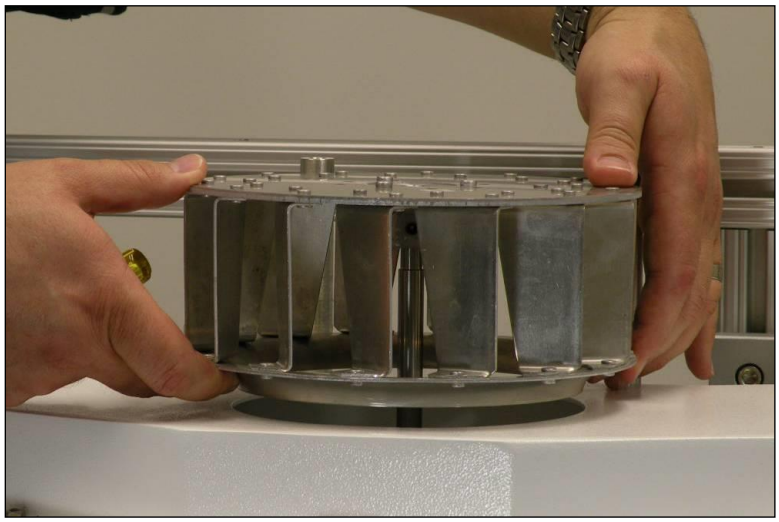


Figure 119. Removing impeller

5. Slide off the impeller from the top (Figure 119).

To Replace the Impeller

1. Apply threadlocker, such as Loctite 222, to the threads of the set screws.
2. Line up the set screw with the detent on the fan motor shaft.

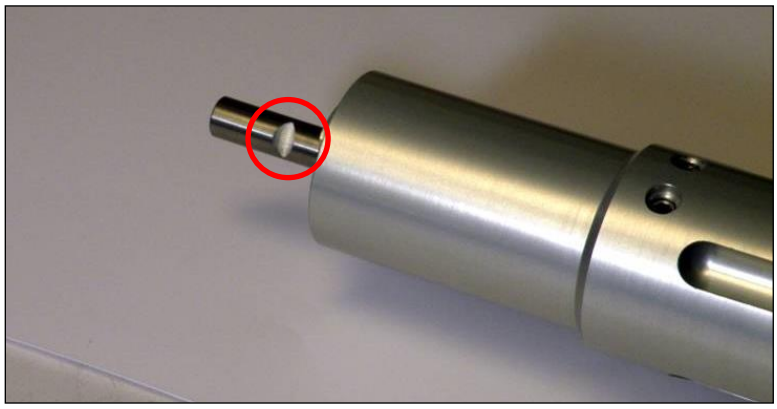


Figure 120. The detent on the fan motor shaft

3. Using a 1/8” ball driver, go in through the impeller blades and tighten the set screw. Ensure that one of the set screws is engaged into the detent.
4. Tighten the second set screw.
5. Replace the shroud.
6. Replace the two lift rings on the top and the two screws on either side.

10.7 Replacing the main power supply

To Remove the Power Supply

1. Shut down the computer and then power down the analyzer.

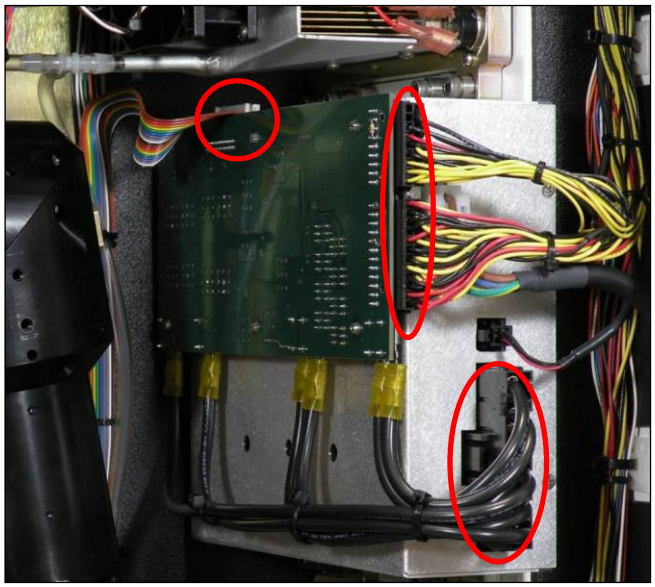


Figure 121. Five connectors to remove

2. Disconnect five electrical connectors—2 on the circuit board, 2 on the power supply, and 1 on top in the back. Do NOT remove the large black connector on the bottom of the power supply (Figure 121).

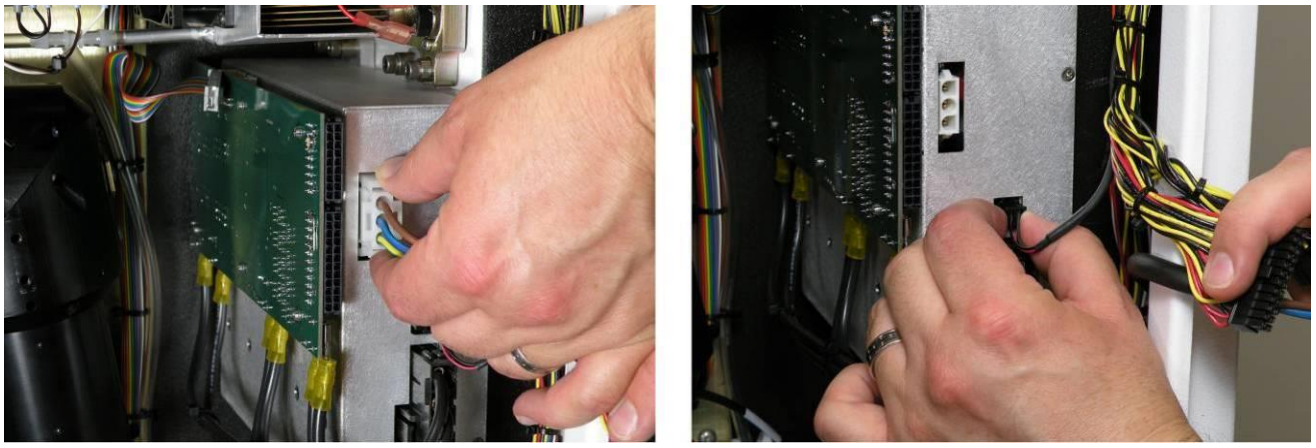


Figure 122. Remove connectors from power supply

3. Remove the connectors from the power supply (Figure 122).

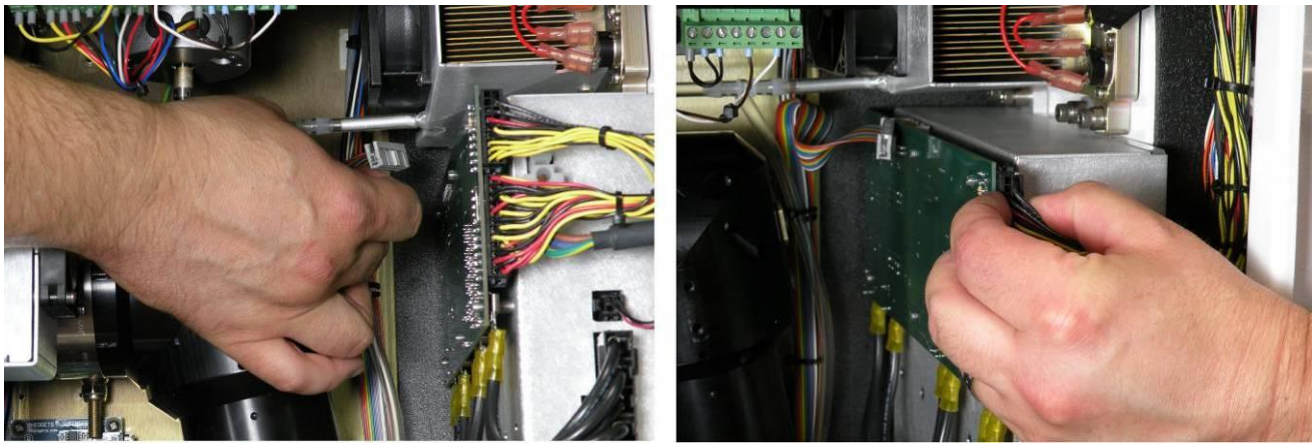


Figure 123. Remove connectors from circuit board

4. Remove the connectors from the circuit board (Figure 123).

Figure 124. Loosen mounting screws

5. Loosen four mounting screws—two on top and two on the bottom (Figure 124).

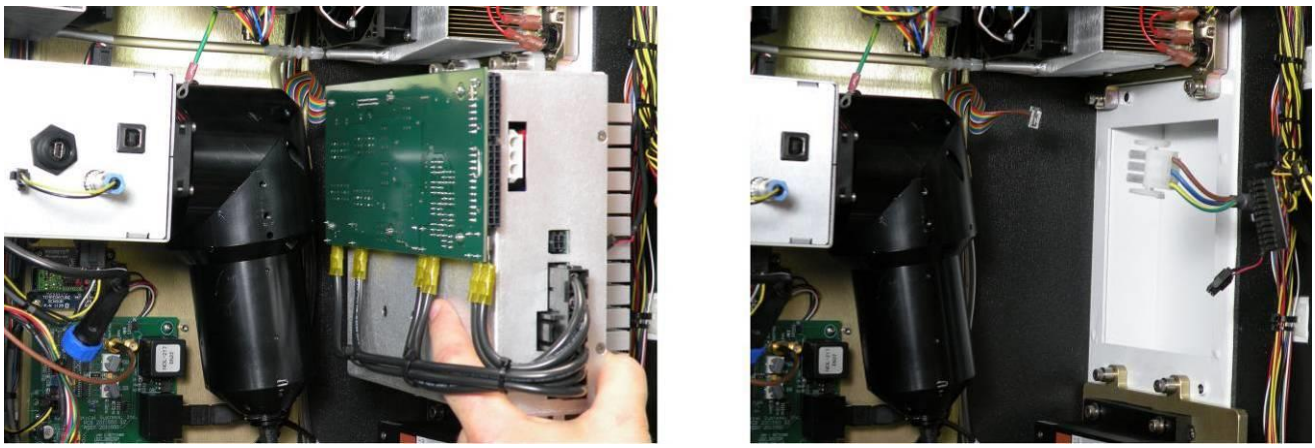


Figure 125. Pull out power supply

6. Pull power supply towards center of analyzer so the heat sink clears the plenum. Then remove the power supply (Figure 125).

To install a New Power Supply

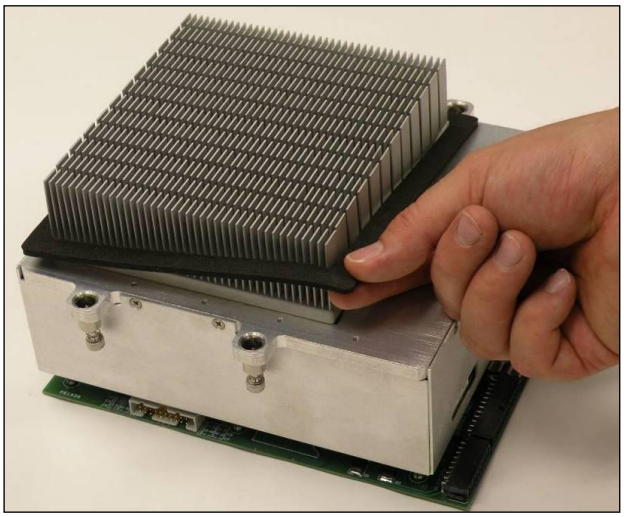


Figure 126. Replace gasket on heat sink

1. Replace the sealing gasket over the heat sink (Figure 126).
2. Insert the power supply into the analyzer.
3. Reattach the four mounting screws: 2 on the top and 2 on the bottom of the unit.
4. Reconnect the five electrical connectors: 2 on the circuit board, 2 on the power supply, and 1 on top in the back.

10.8 Replacing a laser

There are four lasers in the Raman Rxn5 analyzer—two on each side. You can replace one or more, as needed.

⚠ CAUTION

- Limit the bend radii of fibers to 2” on internal fibers.

Take care not to kink the fibers.

Take care to keep the fibers clean.

To Remove a Laser

1. Shut down the computer and then power down the analyzer.

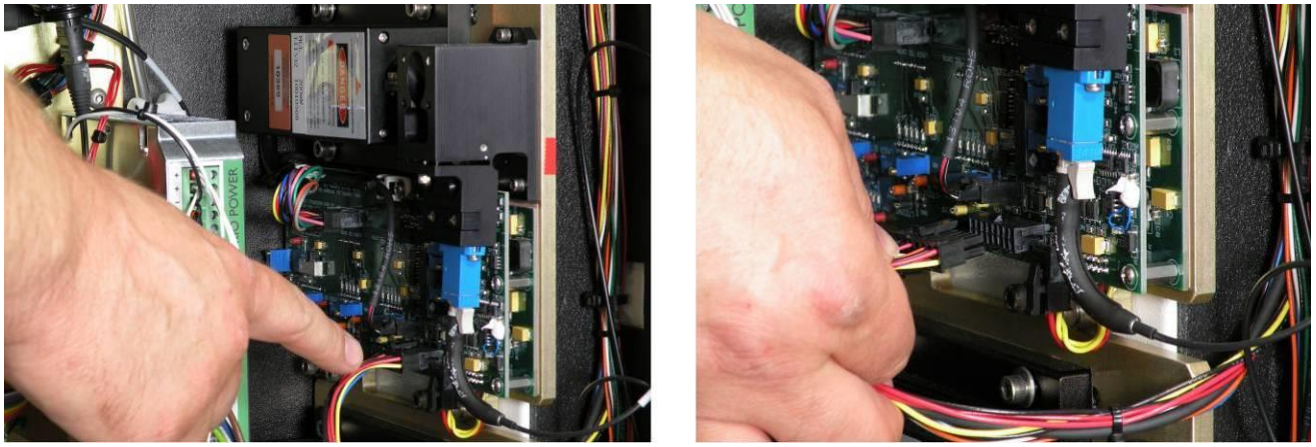


Figure 127. Remove electrical connection

2. Remove the electrical connection (Figure 127).

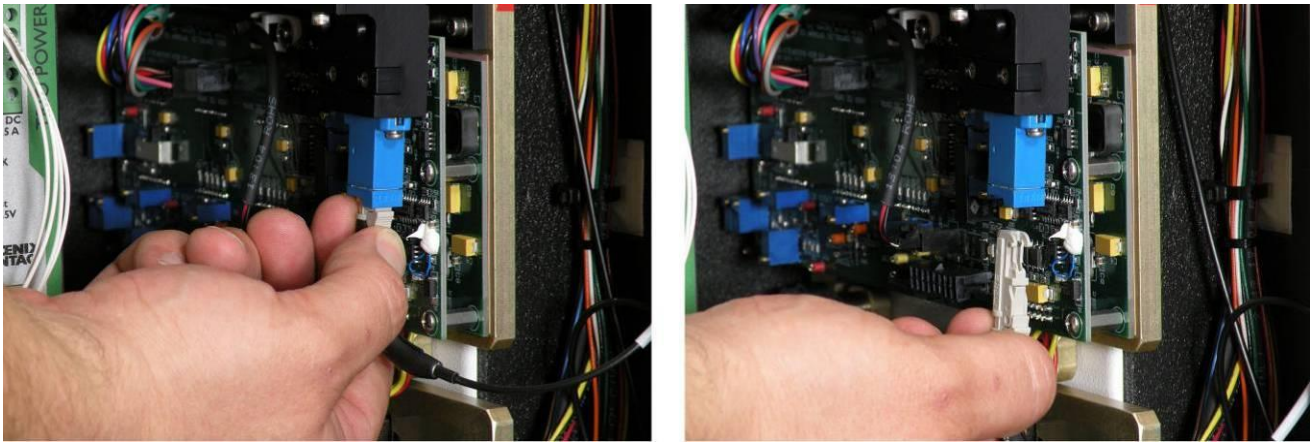


Figure 128. Remove fiber connection

3. Remove the fiber connection. Push in the white clip and pull down. Take care not to kink the fiber (Figure 128).

Figure 129. Loosen retaining screws

4. Loosen the 4 retaining screws (Figure 129).

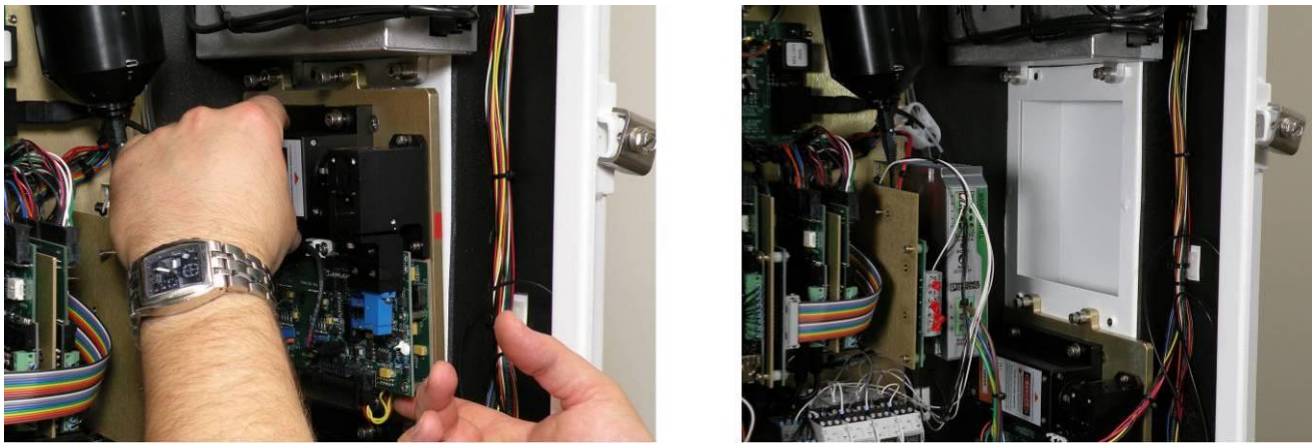


Figure 130. Remove laser module

5. Pull towards the center of the analyzer so the heat sink clears the plenum. Then remove (Figure 130).
6. Remove the old gasket.

To Reinstall a Laser

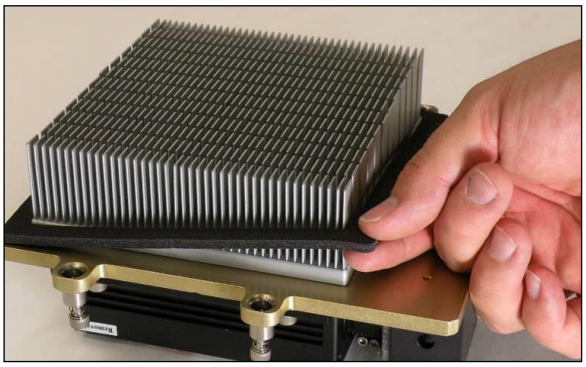


Figure 131. Install laser gasket

1. Install a new gasket onto the new laser (Figure 131).
2. Insert the laser into the plenum.
3. Reattach the 4 retaining screws — 2 on the top and 2 on the bottom.
4. Reattach the fiber connection. Take care not to kink the fiber.
5. Reconnect the electrical connection.

10.9 Replacing the computer assembly

The computer assembly is located on the interior of the enclosure door and is secured with four Phillips head screws. See Figure 5. You will first remove the wiring connections attached to the computer, and then remove the computer assembly from the Raman Rxn5. Figure 132 shows a closeup of the computer assembly.

NOTICE

- If the computer assembly in your Raman Rxn5 is not attached with four screws, or appears different than shown, please contact your local Raman Rxn5 support center for instructions.

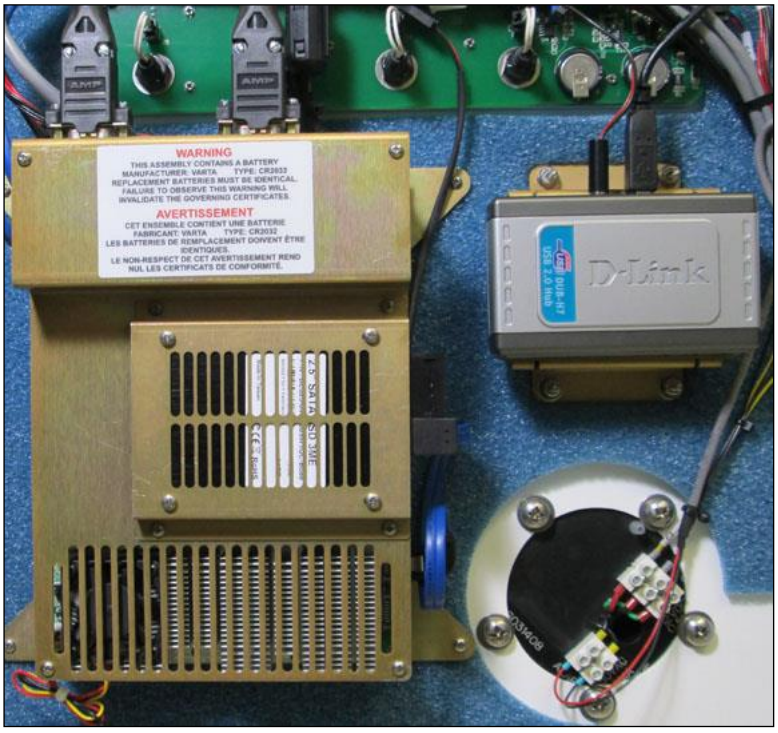


Figure 132. Computer assembly

To Remove the Computer

First remove the existing cable connections as follows:

1. Power down the analyzer.
2. Unscrew and unplug the serial cables from the top serial ports, noting which cable is attached to the left most serial port for reassembly later. Unplug the RJ45 cables from the Ethernet connectors on the left side of the computer (Figure 133), noting which cable is attached to the top connector for reassembly later.

Figure 133. Remove RJ45 cables

3. Disconnect the cable harness from terminal J2 on the Printed Circuit Board (PCB). This is a latching connector with the release lever toward the left side of the computer assembly. The J2 connector is shown between the two ribbon cables in Figure 134.

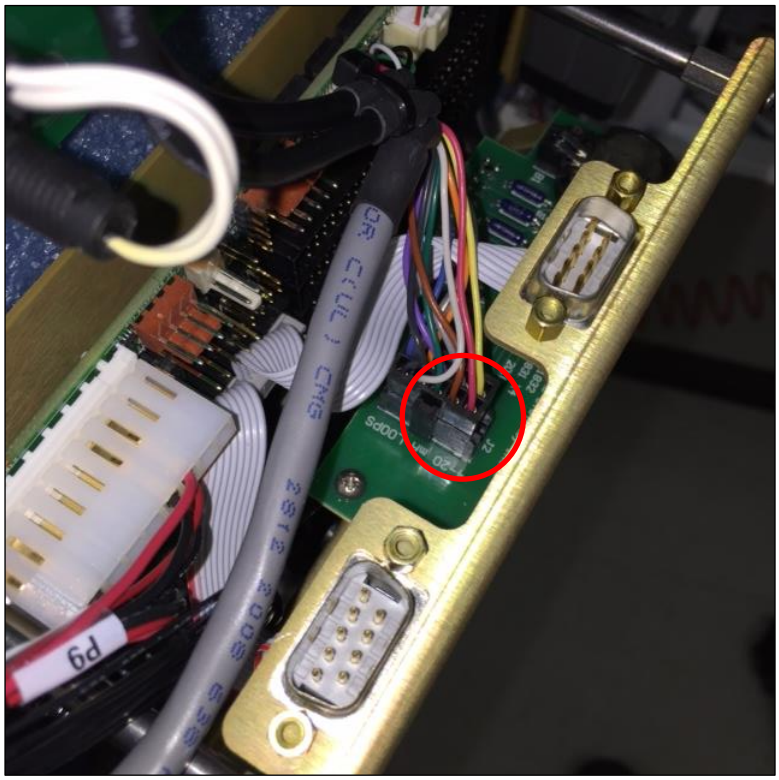


Figure 134. Disconnect cable harness from J2

4. Disconnect the black, multi-conductor Video Graphic Array (VGA) cable from the computer (Figure 135). The VGA cable connects to the black connector located approximately halfway down the left edge of the computer and labeled “VGA.”

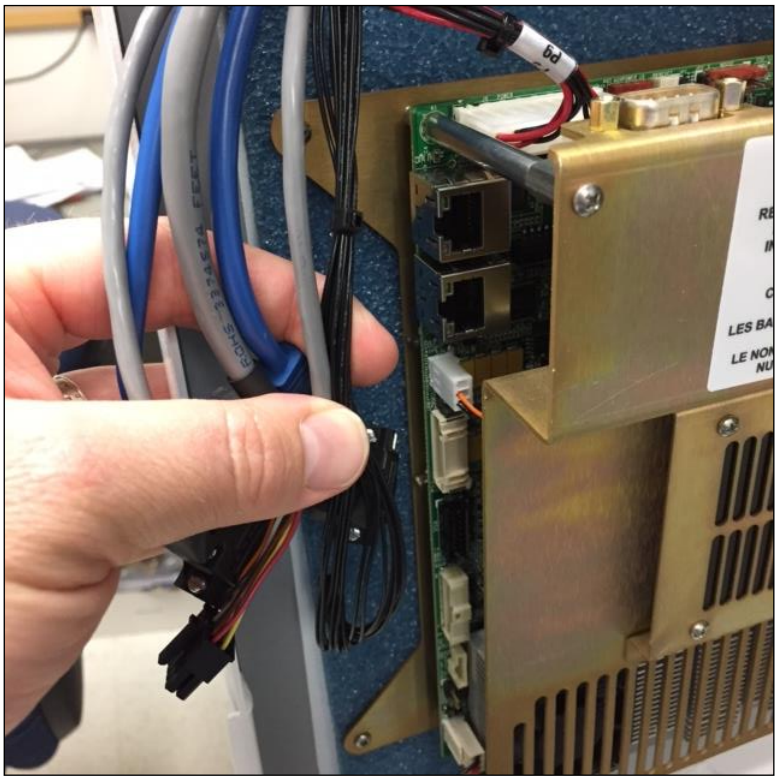


Figure 135. Disconnect VGA cable

5. Disconnect connector P9 (from the main harness) from the computer. P9 connects to port J30 on the top-left of the computer (Figure 136).

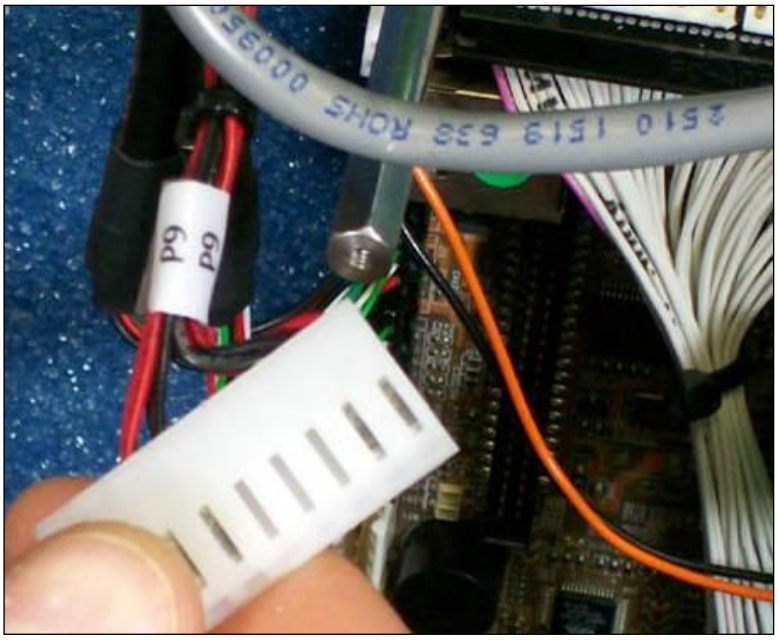


Figure 136. Disconnect connector P9

6. Disconnect the USB cable assembly from terminals J4 and J5 on the upper right side of computer (Figure 137). Press the **Connector** button and pull up on the cable. Do not force the connector as it means the button is not being pressed correctly.

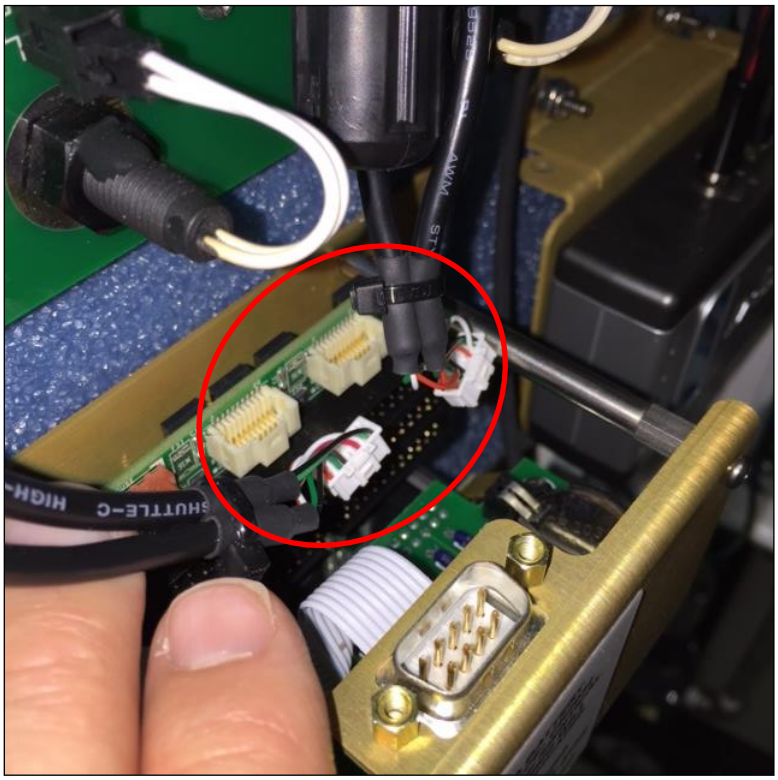


Figure 137. Disconnect USB cable assembly

7. Disconnect the hard drive power cable from the right side of the computer assembly (Figure 138).

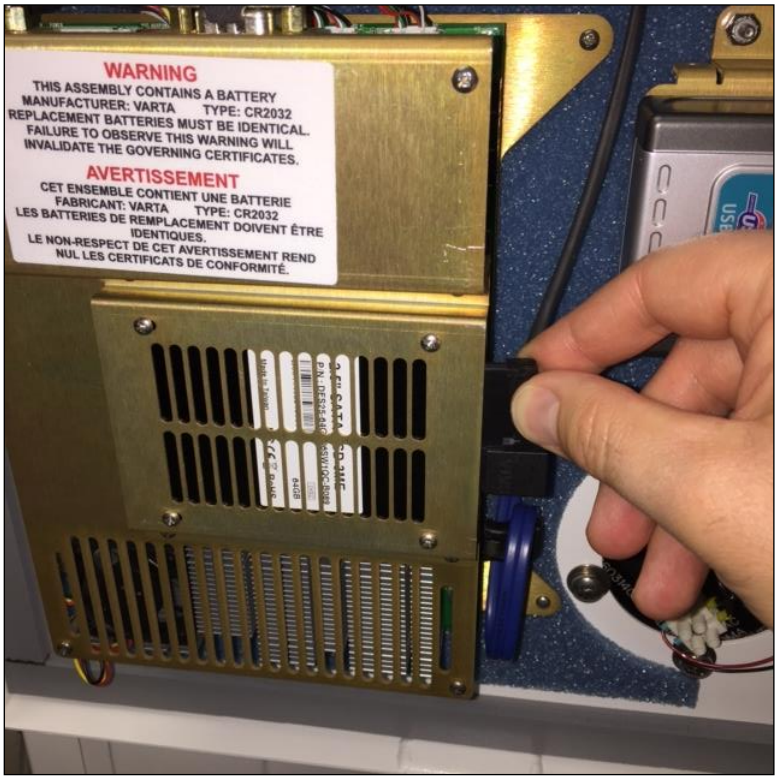


Figure 138. Disconnect hard drive power cable

Next, remove the computer assembly from the Raman Rxn5, as follows:

8. Remove four (4) pan head machine screws that attach the computer assembly to the Raman Rxn5 door (Figure 139). Pull the computer assembly from the Raman Rxn5.

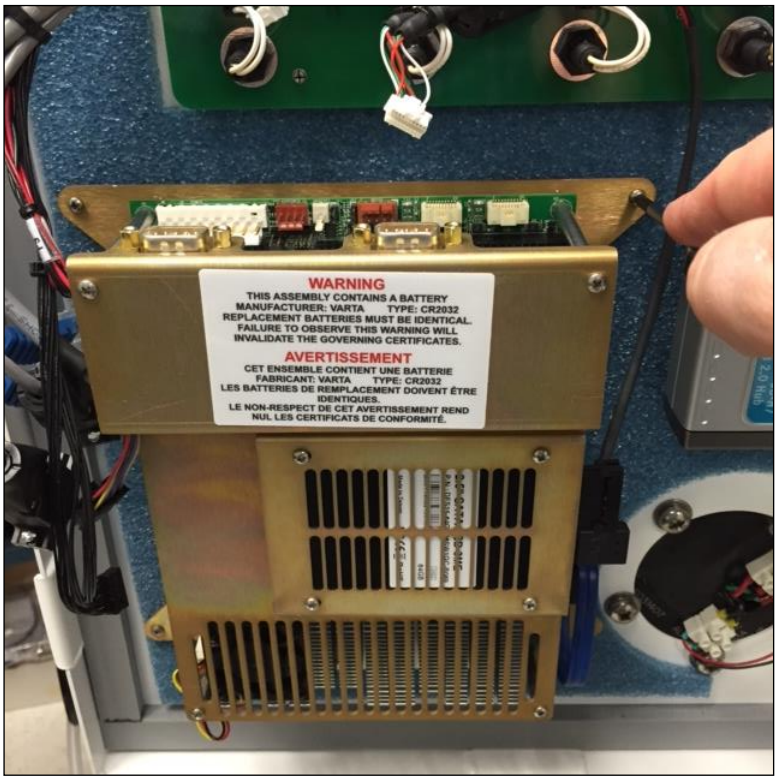


Figure 139. Remove pan head machine screws

To Replace the Computer Assembly

1. Locate the Raman Rxn5 computer replacement kit.
2. Follow the disassembly steps in reverse to install the new computer replacement kit to the Raman Rxn5.

10.10 Replacing the bios battery

⚠ WARNING

- Replacement batteries must be identical. Failure to observe this warning will invalidate the governing certificates. Manufacturer: Varta. Type: CR2032. Contact Endress+Hauser for replacement battery.

1. Shut down the computer and then power down the analyzer.
2. Remove the battery from the holder (Figure 140). The computer battery is located on the inside of the door.
3. Install the new battery with positive side up.

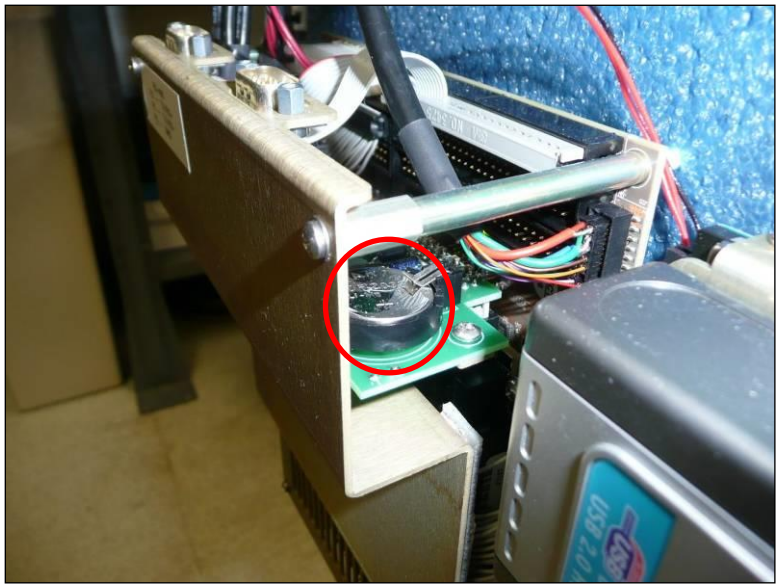


Figure 140. Computer battery

10.11 Replacing the hard drive

To Remove the Hard Drive

1. Shut down the computer, and then power down the analyzer.

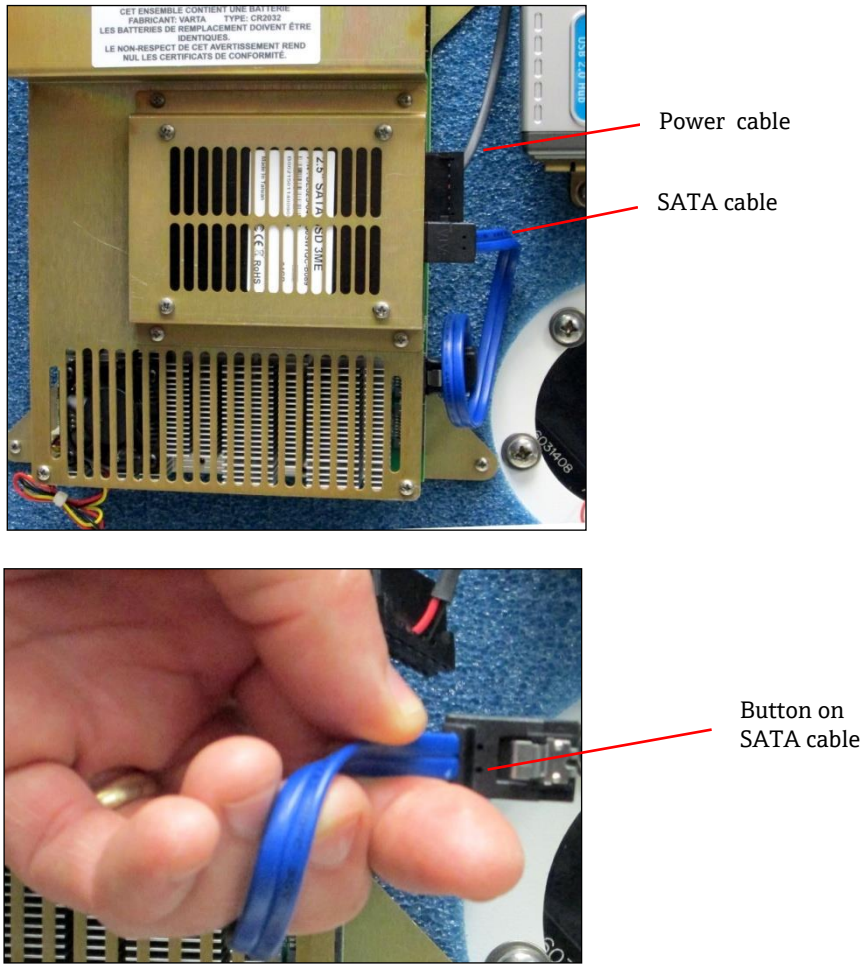


Figure 141. Remove SATA cable

2. Remove the SATA cable by pressing the button on the back and pulling out (Figure 141).

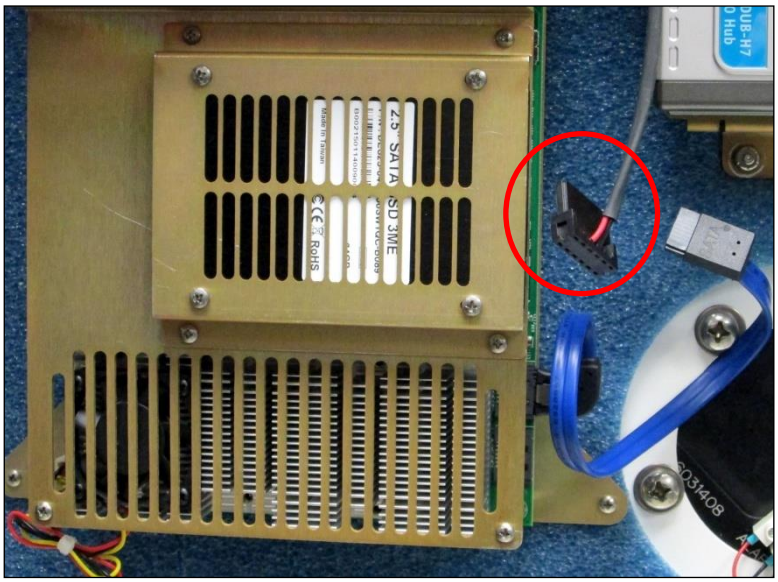


Figure 142. Remove power cable

3. Remove the power cable, which is the top cable in Figure 141.

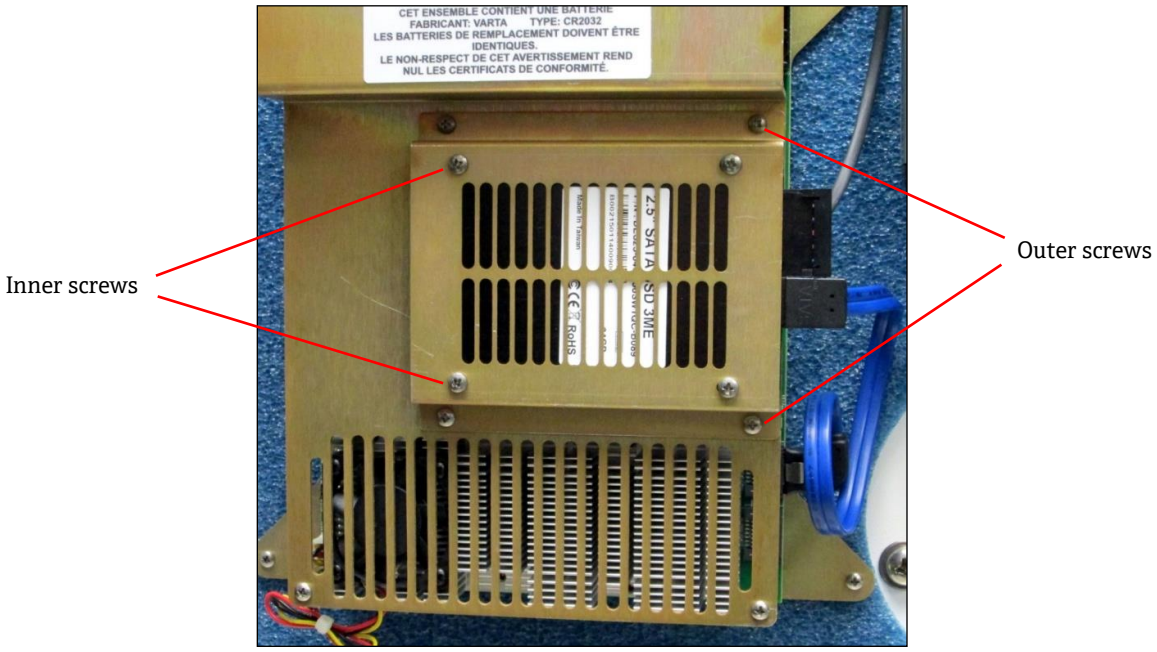


Figure 143. Remove outer and inner screws

4. Remove the four (4) outer screws to remove the hard drive from the computer (Figure 143).
5. Remove the four (4) inner screws to remove the hard drive from the sheet metal (Figure 143).

To Reinstall the Hard Drive

1. Reverse the steps above to reinstall a new hard drive.
2. Replace the four (4) outer screws and apply Loctite.
3. Replace the four (4) inner screws.
4. Replace the power cable.
5. Replace the SATA cable.

10.12 Replacing the desiccant cartridges

1. Shut down the computer and then power down the analyzer.
2. Simply remove the desiccant cartridges (Figure 144) and replace with new or recycled cartridges.

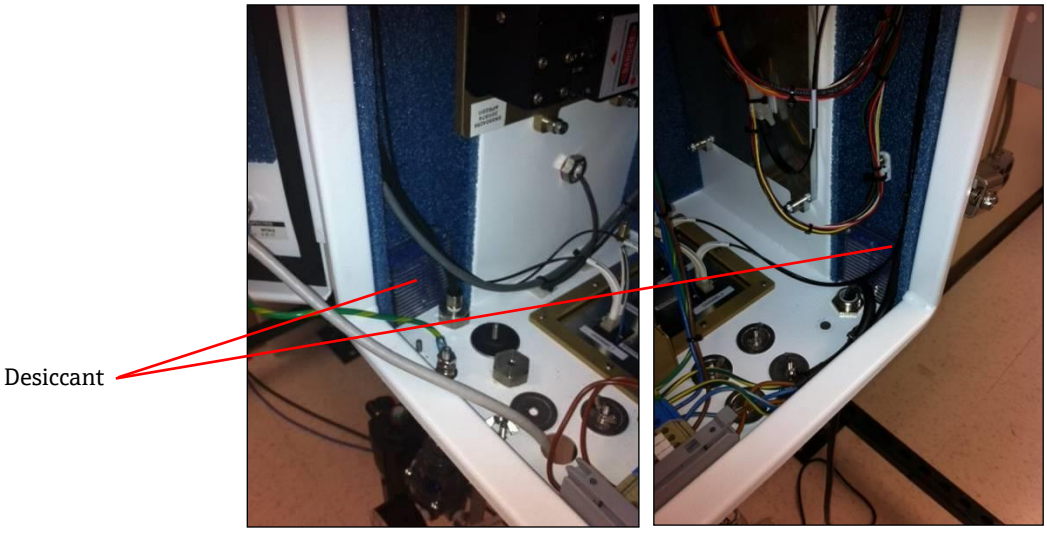


Figure 144. The desiccant cartridges

10.13 Replacing the detection module

⚠ CAUTION

- Limit the bend radii of fibers to 2” on internal fibers.

Take care not to kink the fibers.

Take care to keep the fibers clean.

To Remove the Detection Module

1. Shut down the computer and then power down the analyzer.

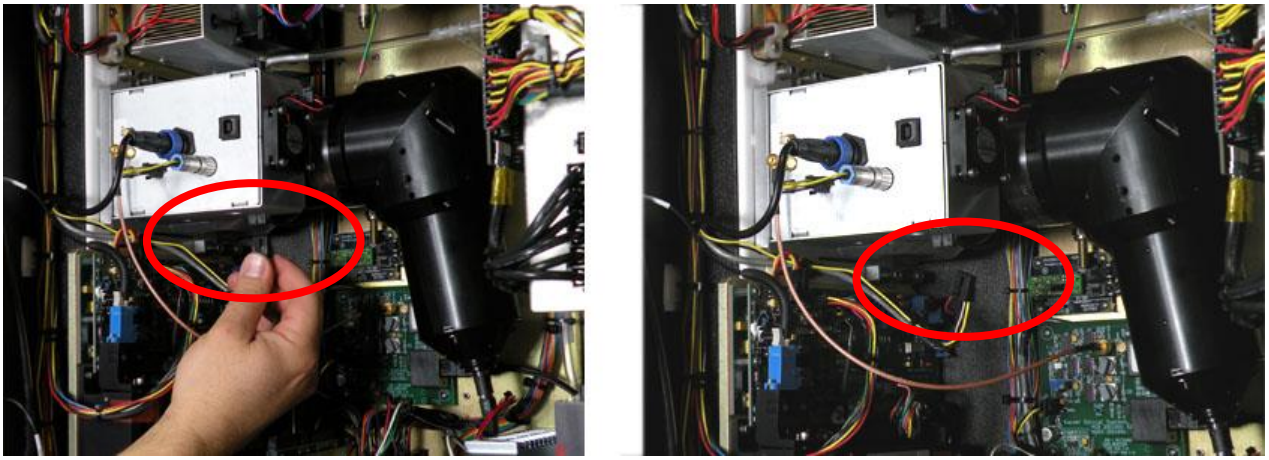


Figure 145. Remove electrical connection

2. Remove the electrical connection (Figure 145).

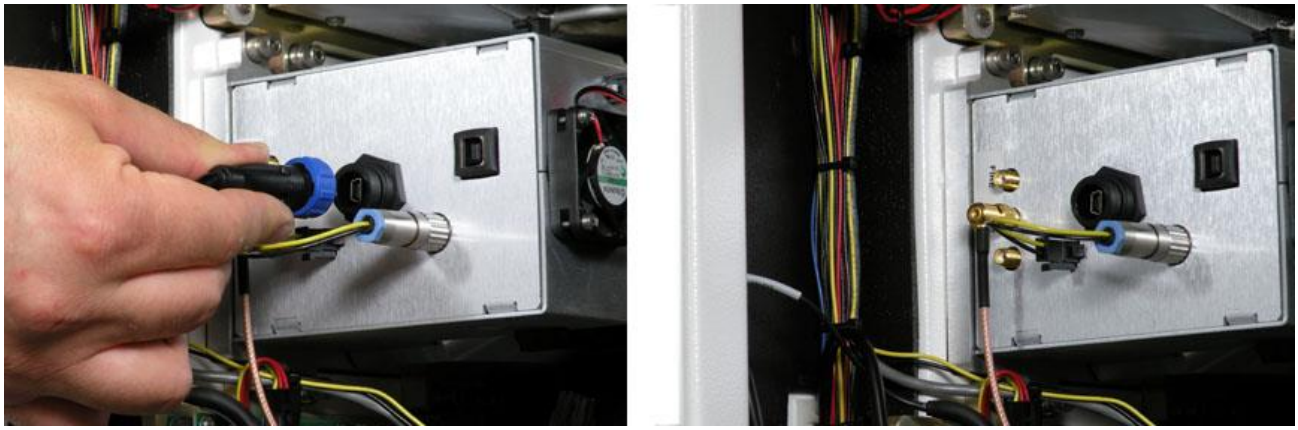


Figure 146. Remove USB connection

3. Remove the USB connection (Figure 146).

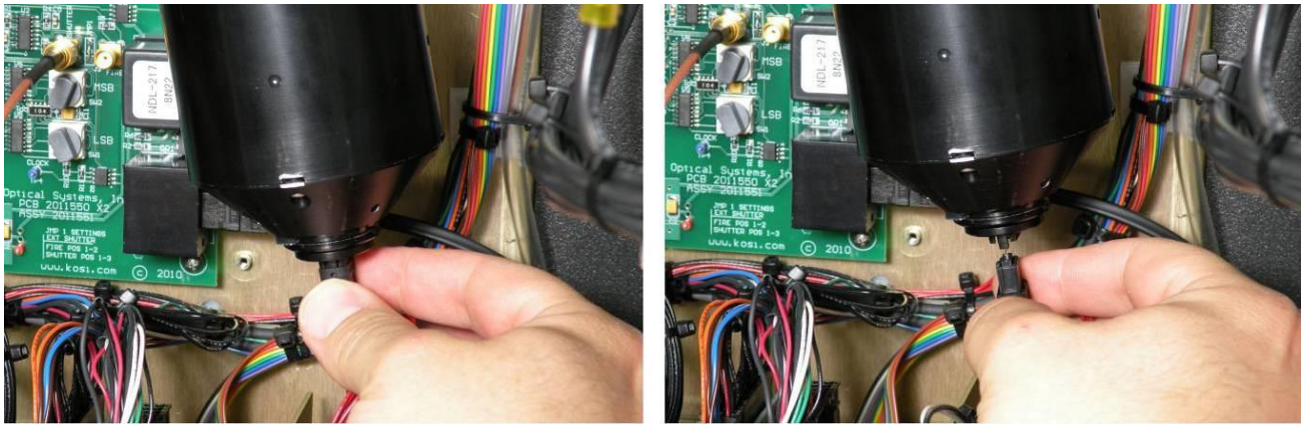


Figure 147. Remove fiber optic connection

4. Remove the fiber optic connection at the bottom of the detection module. Pull straight down (Figure 147).

NOTICE

- The fiber optic end holds a precision slit. Take care to ensure the fiber optic end is always held in the vertical orientation so the slit stays secured to the fiber optic end.

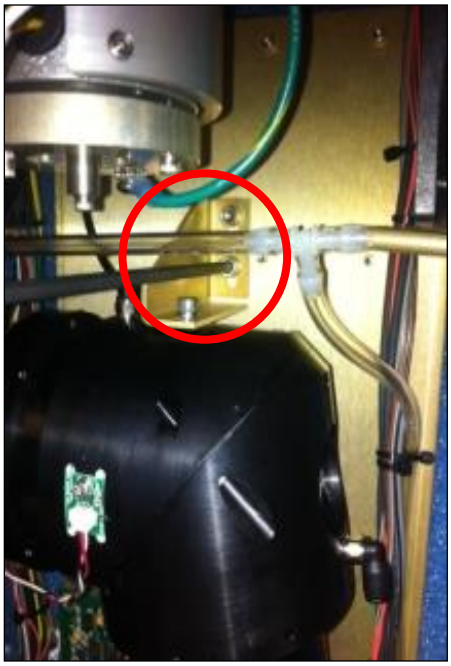


Figure 148. Remove support bracket

5. Remove the detection module support bracket (Figure 148).

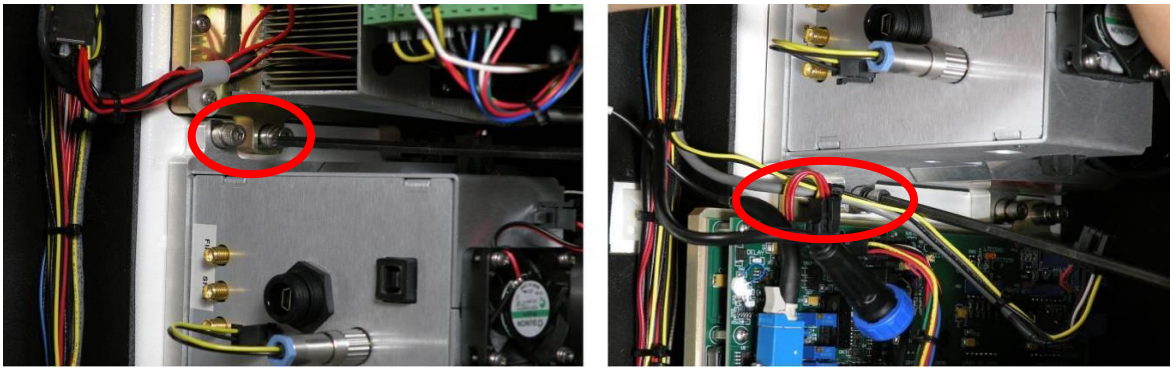


Figure 149. Loosen retaining screws

6. Loosen the four retaining screws (Figure 149). One of the retaining screws in the right photo is obscured by cables.

Figure 150. Remove detection module

7. Remove the detection module (Figure 150).

To Replace the Detection Module

1. Install a new gasket.
2. Insert the detection module into the analyzer.
3. Tighten the four retaining screws.
4. Install the detection module support bracket.
5. Reconnect the fiber optic connection at the bottom of the detection module. Push straight up.
6. Reconnect the USB connection.
7. Reconnect the electrical connection.

10.14 Cleaning an optical fiber

NOTICE

▶ Endress+Hauser offers an *Raman Rxn5 Optical Service Kit (p/n 2013270)*, which is intended for diagnosing and servicing the major field-serviceable optical paths and components of the Raman Rxn5 system. It is also intended to diagnose and identify components that may require replacement or factory service.

Degradation in the performance of the Raman Rxn5 analyzer can often be corrected simply by cleaning the optical fibers in the fiber optic cable.

If they are disconnected from the connection panel, the optical fibers may require occasional cleaning for optimum performance. Contaminants, such as airborne particulates or surrounding vapors, may collect on the fiber face. Laser radiation absorbed by the contaminants located on the fiber face can burn the fiber surface, shortening the life of the fiber optic cable. Contaminants on the optical surfaces can also degrade the apparent overall performance of the fiber-coupled laser by reducing optical throughput.

Fiber-cleaning devices are available from several commercial suppliers.

Alternatively, the fiber surfaces may be inspected and cleaned as follows:

1. Turn off the laser.
2. Carefully loosen the fiber restraint on the connection panel.
3. Carefully disconnect the optical fiber.
4. Inspect both the excitation and collection fiber ports to make sure the ceramic sleeve is not cracked or chipped.
5. Inspect the face of the optical fiber using a fiber-scope or a microscope. Illuminating the opposite end of the cable by back-illuminating the fiber face is very helpful. Dark deposits indicate the need for cleaning. Burn marks indicate that the fiber has been damaged. If this has occurred, contact the supplier for a replacement cable or polish the damaged face if expertise and equipment are available.
6. Moisten a clean lens tissue with reagent-grade acetone and gently wipe across the fiber optic face to remove any residue. Lay the tissue on a table. With light to moderate pressure, press the fiber end face onto the acetone-soaked section of tissue. Drag the ferrule across acetone section and continue to drag over dry section to remove any residual acetone. For internal patch cable cleaning, disconnect from connection panel and clean with acetone moistened cotton tipped applicator.

NOTICE

▶ For external probe fiber ferrule cleaning, moisten small section of a 4” x 4” lens tissue with acetone.

7. Inspect the clean face of the optical fiber. If a deposit is still obvious, repeat step 6. If the contaminant cannot be removed or additional damage is evident on the face of the fiber, contact Endress+Hauser or an authorized distributor for replacement.

10.15 Cleaning a probe window and mirror

NOTICE

- Endress+Hauser offers an *Raman Rxn5 Optical Service Kit (p/n 2013270)*, which is intended for diagnosing and servicing the major field-serviceable optical paths and components of the Raman Rxn5 system. It is also intended to diagnose and identify components that may require replacement or factory service.

Degradation in the performance of the Raman Rxn5 analyzer can often be corrected simply by cleaning the optical fibers in the fiber optic cable.

If they are disconnected from the connection panel, the optical fibers may require occasional cleaning for optimum performance. Contaminants, such as airborne particulates or surrounding vapors, may collect on the fiber face. Laser radiation absorbed by the contaminants located on the fiber face can burn the fiber surface, shortening the life of the fiber optic cable. Contaminants on the optical surfaces can also degrade the apparent overall performance of the fiber-coupled laser by reducing optical throughput.

NOTICE

Fiber-cleaning devices are available from several commercial suppliers.

Alternatively, the fiber surfaces may be inspected and cleaned as follows:

1. Turn off the laser.
2. Carefully loosen the fiber restraint on the connection panel.
3. Carefully disconnect the optical fiber.
4. Inspect both the excitation and collection fiber ports to make sure the ceramic sleeve is not cracked or chipped.
5. Inspect the face of the optical fiber using a fiber-scope or a microscope. Illuminating the opposite end of the cable by back-illuminating the fiber face is very helpful. Dark deposits indicate the need for cleaning. Burn marks indicate that the fiber has been damaged. If this has occurred, contact the supplier for a replacement cable or polish the damaged face if expertise and equipment are available.
6. Moisten a clean lens tissue with reagent-grade acetone and gently wipe across the fiber optic face to remove any residue. Tip: For external probe fiber ferrule cleaning, moisten small section of a 4” x 4” lens tissue with acetone. Lay the tissue on a table. With light to moderate pressure, press the fiber end face onto the acetone-soaked section of tissue. Drag the ferrule across acetone section and continue to drag over dry section to remove any residual acetone. For internal patch cable cleaning, disconnect from connection panel and clean with acetone moistened cotton tipped applicator.
7. Inspect the clean face of the optical fiber. If a deposit is still obvious, repeat step 6. If the contaminant cannot be removed or additional damage is evident on the face of the fiber, contact Endress+Hauser or an authorized distributor for replacement.

10.15.1 Cleaning a probe window and mirror

NOTICE

- See the *Rxn-30 Operations Manual (p/n 2010884)* for instruction on cleaning a probe window and mirror.

11 Repair

NOTICE

- For all service needs, please contact an approved Endress+Hauser service provider.

12 Technical data

12.1 Electrical and communications

Item	Description
Input Voltage	100 – 240VAC, 50-60 Hz standard
Communications	Serial: RS485 . Modbus TC/IP; OPC Optional
User Interface	Touch-screen color LCD display
Max Power	<300 watts max (startup), 200 watts typical
Sound Level (from operator's perspective)	60.1 dB Max, A-weighted

Table 14. Electrical and communications

12.2 Physical

Item	Description
Enclosure Type	Painted steel or optional 316 Stainless Steel, (IP56)
IEC 60529 rating (ingress protection)	IP56
Dimensions	18.0" wide x 32.85" high x 10.00" deep
Weight	~ 135 lbs
Number of Probes	Up to four (simultaneous operation)
Wetted materials (gas probe)	SS316, Teflon and sapphire (window to process), other metals optional
Operating Temperature (base unit)	-20 ˚C to 50 ˚C
Operating Temperature (cable and connector)	-40 ˚C to +80 ˚C
Operating Humidity	95% RH Non-condensing

Table 15. Physical

12.3 Purge air supply

Item	Description
Purge Air Maximum Temperature	40 ˚C
Purge Air Dewpoint	-40 ˚C
Purge Air Pressure Range	20 — 120 psi
Inlet Fitting	1/4-18 FNPT
Maximum Particle Size	5 microns
Max Flow Rate During Purge	2.0 SCFM
Max Flow Rate for Steady-State Operation	.75 CFM

Table 16. Purge air supply

12.4 Area classification and ratings

Item	Description
Environmental Temp Range	-20 ^{0}C — 50 ^{0}C

Table 17. Area classification and ratings

12.5 Certifications

Certifications	
IECEx Certificate Number: IECEx ITS 14.0014X	Hazardous Area Marking Code: Ex [ia op is Ga] [op sh Gb] pz IIC T4 Gc -20˚C to +50˚C
ATEX Certificate Number: ITS 11ATEX 17307X	Hazardous Area Marking Code: II 3 (2) (1) G Ex [ia op is Ga] [op sh Gb] pz IIC T4 Gc -20˚C to +50˚C
CSA Certificate Number: 2438730	Hazardous Area Marking Code: Ex [ia op is Ga] [op sh Gb] pz IIC T4 Gc Class I, Division 2; Groups B, C, D; T4

Table 18. Certifications

13 Index

www.addresses.endress.com

Endress+Hauser
People for Process Automation