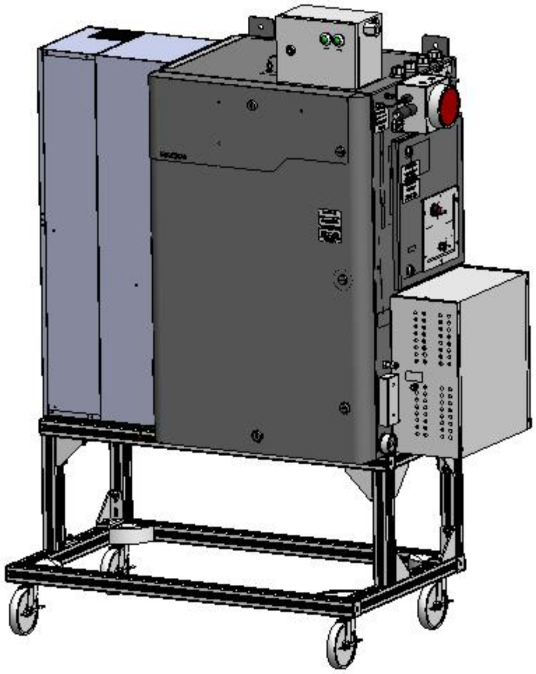


MAX300-RTG Installation/Hardware Manual

823518 Rev K, May 2019

Notice

Material contained in this manual is proprietary information and the property of Extrel CMS, LLC and is to be used only for the purpose of understanding and operating this product.

Specifications are subject to change without notice.

For Further Information or Assistance Contact:

Extrel CMS, LLC
575 Epsilon Drive, Suite 2
Pittsburgh, PA 15238

General Information:	Telephone:	412-963-7530
	Fax:	412-963-6578
	Email:	info@extrel.com
Technical Support:	Telephone:	412-967-5754
	Email:	support@extrel.com
Sales:	Telephone:	412-963-7530
	Email:	sales@extrel.com
Web Page:	http://www.extrel.com/	

Introduction 5

Introduction

The MAX300™-RTG process mass spectrometer is a versatile real-time process analyzer capable of fully automatic operation. It can handle a wide range of applications for quantitative analysis of gases and vapors, as well as monitor multiple components in any one stream and analyze up to 128 streams (including calibration gases).

This document is intended to inform the customer of the necessary preparations for successful installation. As Extrel CMS does not generally inspect a site prior to installation, it is extremely important to provide the necessary support for the instrument to avoid significant delays. All utilities and environmental requirements discussed in this document are the responsibility of the customer. Please note, depending on which options were purchased, specific accommodations will be required; refer to the purchase order for clarification.

Installation Requirements

In order for Extrel CMS to assist with the successful installation and operation of the MAX300-RTG, the customer must:

- Complete the Pre-installation Checklist found in *Appendix A.*
- Fax or email to Extrel CMS any legal documents required for access to the site.
- Allocate time for any training programs required for site access.
- Prepare a suitable site for the instrument.
- Provide and install the required utilities.
- Install vent and sample lines and the vacuum system exhaust.
- Obtain and install required calibration gases.
- Install the compressed air plumbing for the purge systems
- Install wiring or fiber for instrument control.
- Install wiring for external communications options.

Shelter Requirements

The MAX300-RTG may be located outdoors provided no direct exposure to any weather conditions exist. A shelter with a 9 ft. (2.75 m) roof, with 7 ft. (2.1 m) vertical clearance, and at least three sides is required. Although, a fully enclosed and appropriately designed analyzer shelter is recommended. All environmental requirements must be maintained for proper operation of the analyzer. Electrical power and signal wiring to the instrument must be consistent with instrument conditions and meet all applicable local building codes. When considering an air conditioner for the instrumentation housing it is important to keep in mind the heat dissipation and ambient temperature ranges of the instrument (See Table 1). Any air conditioner and filter installed in the shelter must be kept clean, unblocked and allow for adequate air circulation.

Table 1: Temperature considerations for instrument housing.

Type	Range
Heat Dissipation	10,200 Btu/hour, A/C:6000 Btu/hour 3 Kilowatts, A/C: 1.8 Kilowatts
Ambient Temperature Range	-4ºF (-20ºC) to 122ºF (50ºC) A/C cold start ≥ 54ºF (12ºC)

Area Classification Options

The MAX300-RTG analyzer can be configured for use in these hazardous locations:

IECEx/ATEX Category 2 (Zone 1), Gas group IIC or IIB+H2, Temperature code T4 or T3

IECEx/ATEX Category 3 (Zone 2), Gas group IIC, Temperature code T4 or T3

Class I Division 1, Group BCD, Temperature code T4 or T3

Class I Division 2, Group ABCD, Temperature code T4 or T3

It is imperative to ensure that the appropriate analyzer option is chosen for installation in the hazardous location.

Please refer to the Safety section of this manual for more information.

Specifications

Power requirements:

- 115V 60 hz option: 115(+/- 10%) VAC, 60 Hz, single phase, two 20 amp circuits required

- 115V 50/60 hz option: 115(+/- 10%) VAC, 50/60 Hz, single phase, two 20 amp circuits required
- 230V option: 230(+/- 10%) VAC, 50/60 Hz, single phase, one 20 amp circuit required

Ambient temperature: -20°C to 50°C

Purge/pressurization gas requirements:

- Purge/pressurization gas - Clean, dry instrument quality air or inert gas
- Zone 1/Div 1 units: 620 – 793 kPa (90 – 115 psig), 300 LPM (10.6 SCFM) purge, 80 LPM (2.8 SCFM) continuous
- Zone 2/Div 2 units: 414 – 793 kPa (60 – 115 psig), 142 LPM (5 SCFM) continuous

T rating: T4 (135°C) or optional T3 (200°C)

Maximum surface temperature: 130°C for T4 units, 190°C for T3 units

Tool required for opening enclosure doors: Screwdriver, flat blade, 9 mm (3/8”) wide

Weight: 182 kg (400 lbs) approximately (option dependent)

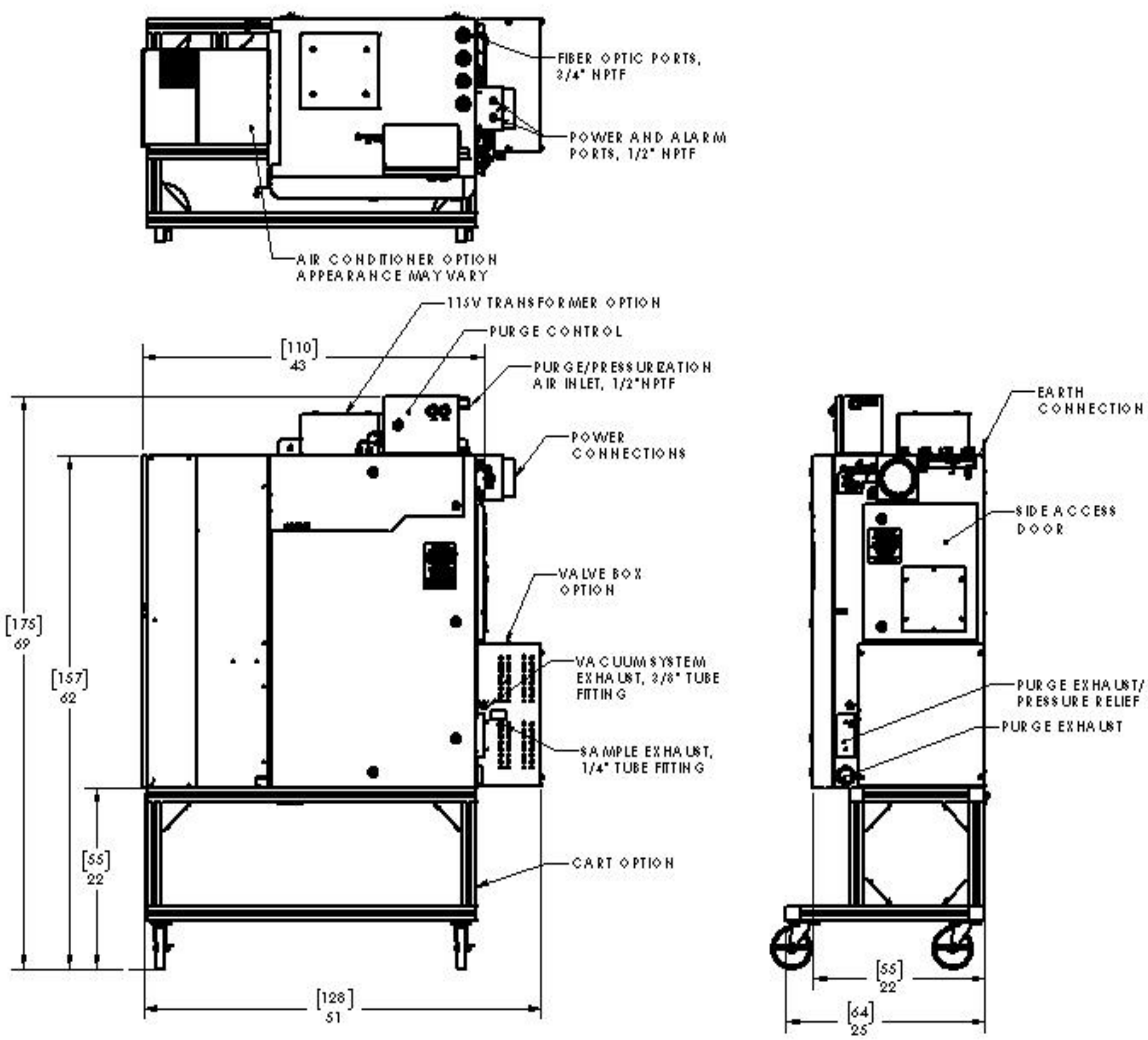


Figure 1: Layout of the ATEX/IECx Zone 1/Class I Div 1 unit (230V or 115V), with cart option

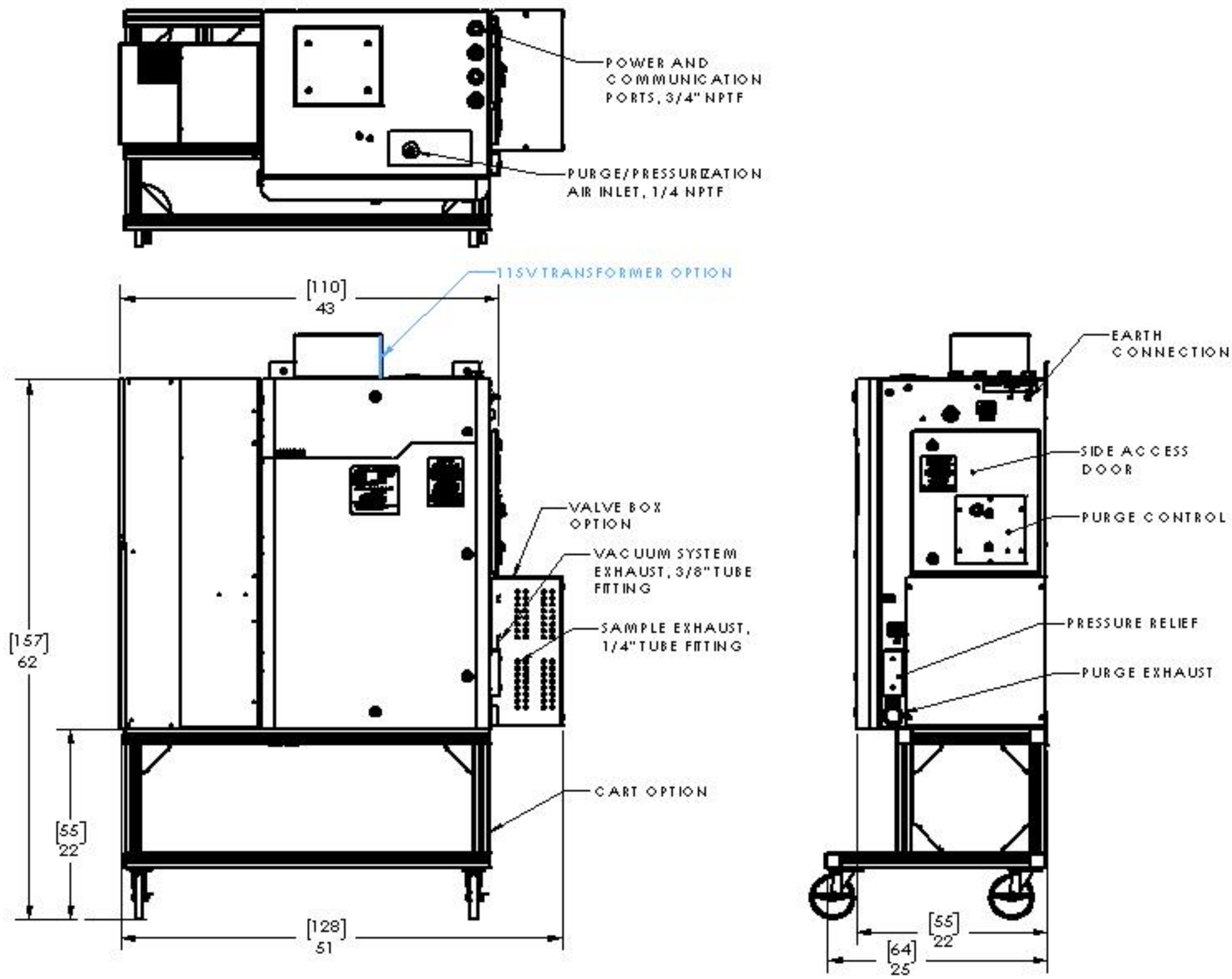


Figure 2: Layout of the ATEX/IECEx Zone 2 /Class I Div 2 unit (230V or 115V), with cart option

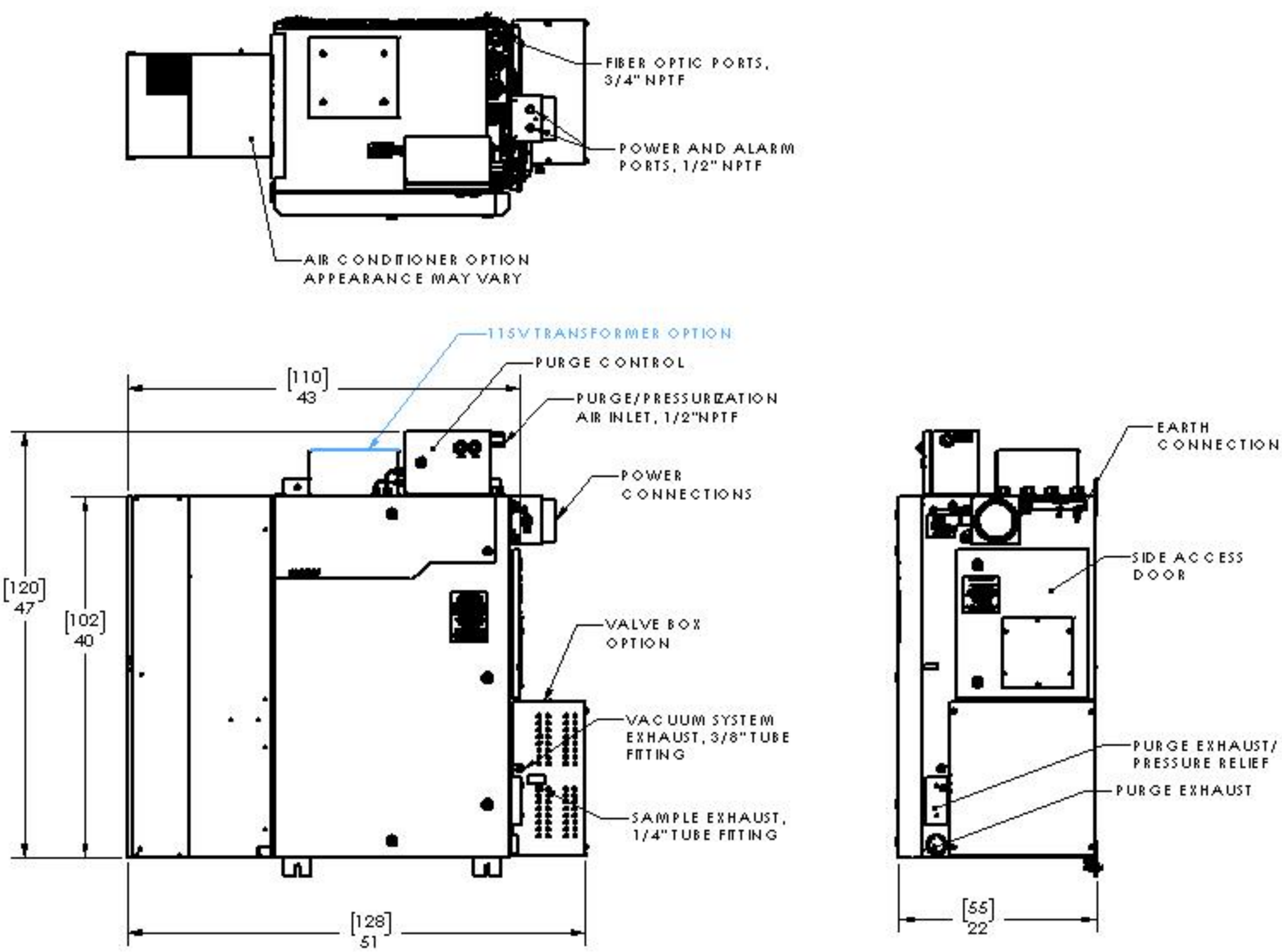


Figure 3: Layout of the ATEX/IECEx Zone 1/Class I Div 1 unit (230V or 115V), without cart option

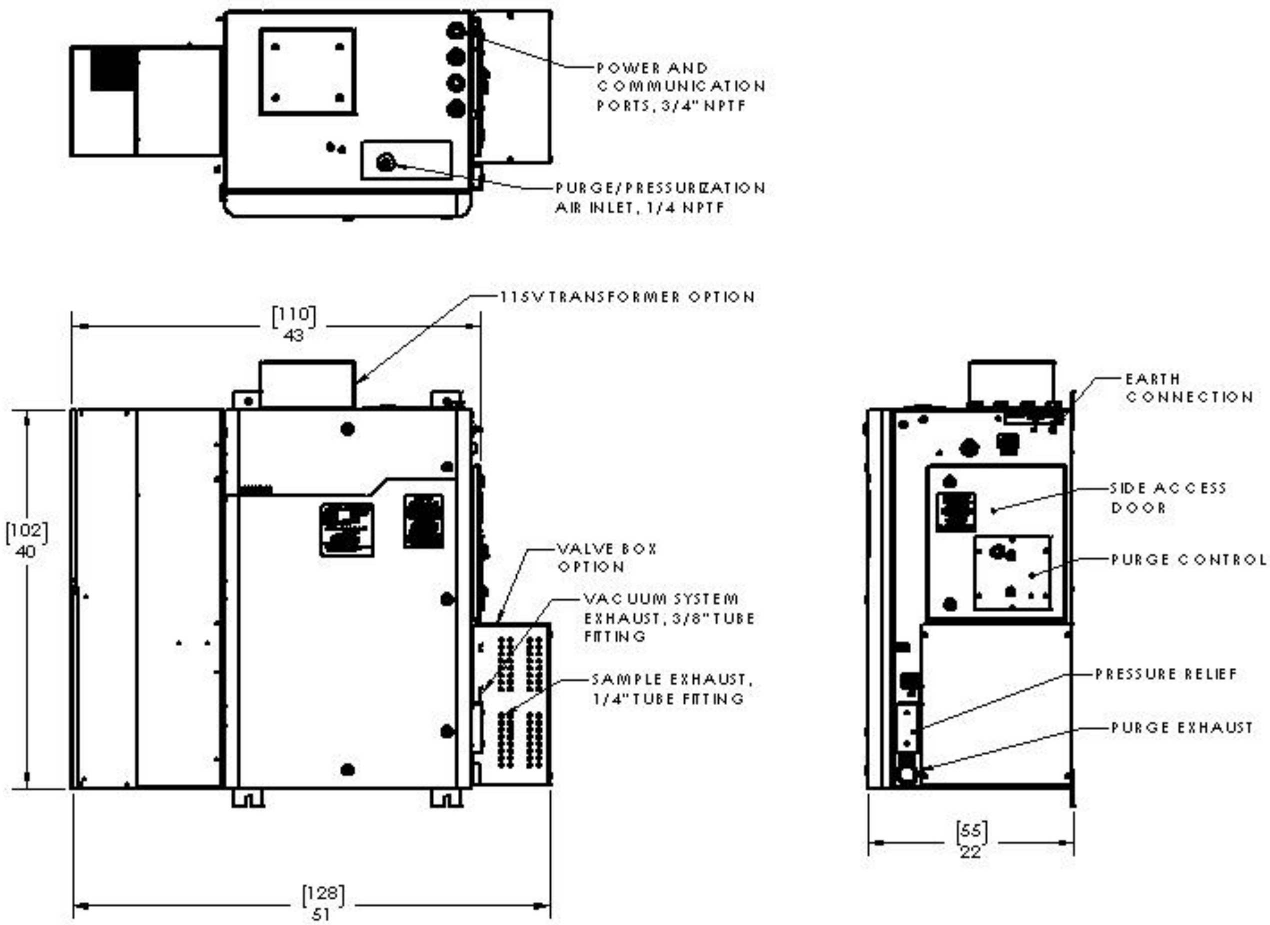


Figure 4: Layout of the ATEX/IECEx Zone 2/Class I Div 2 unit (230V or 115V), without cart option

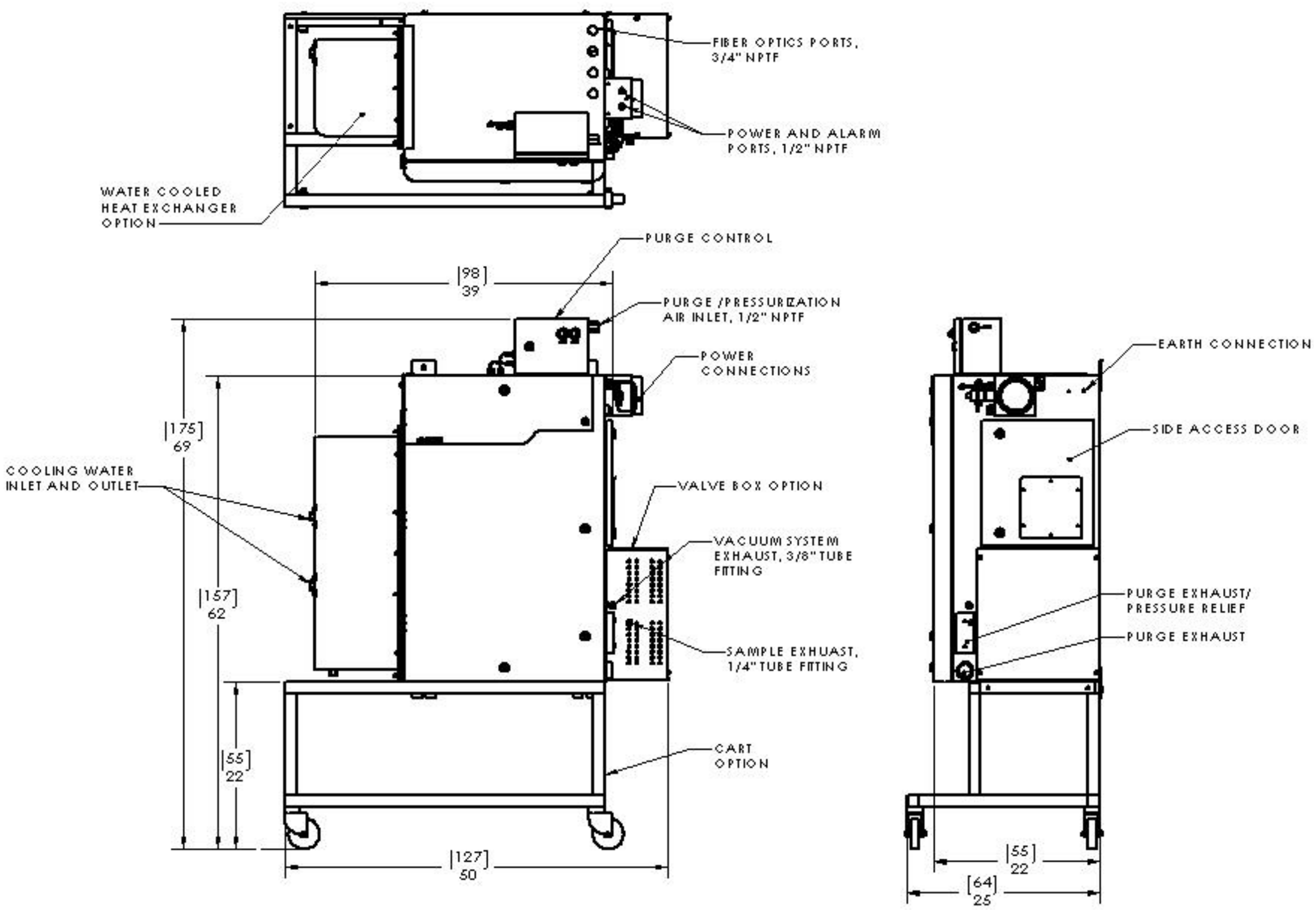


Figure 5: Layout of the ATEX/IECEx Zone 1/Class I Div 1 unit (230V or 115V) with water cooled heat exchanger and cart option

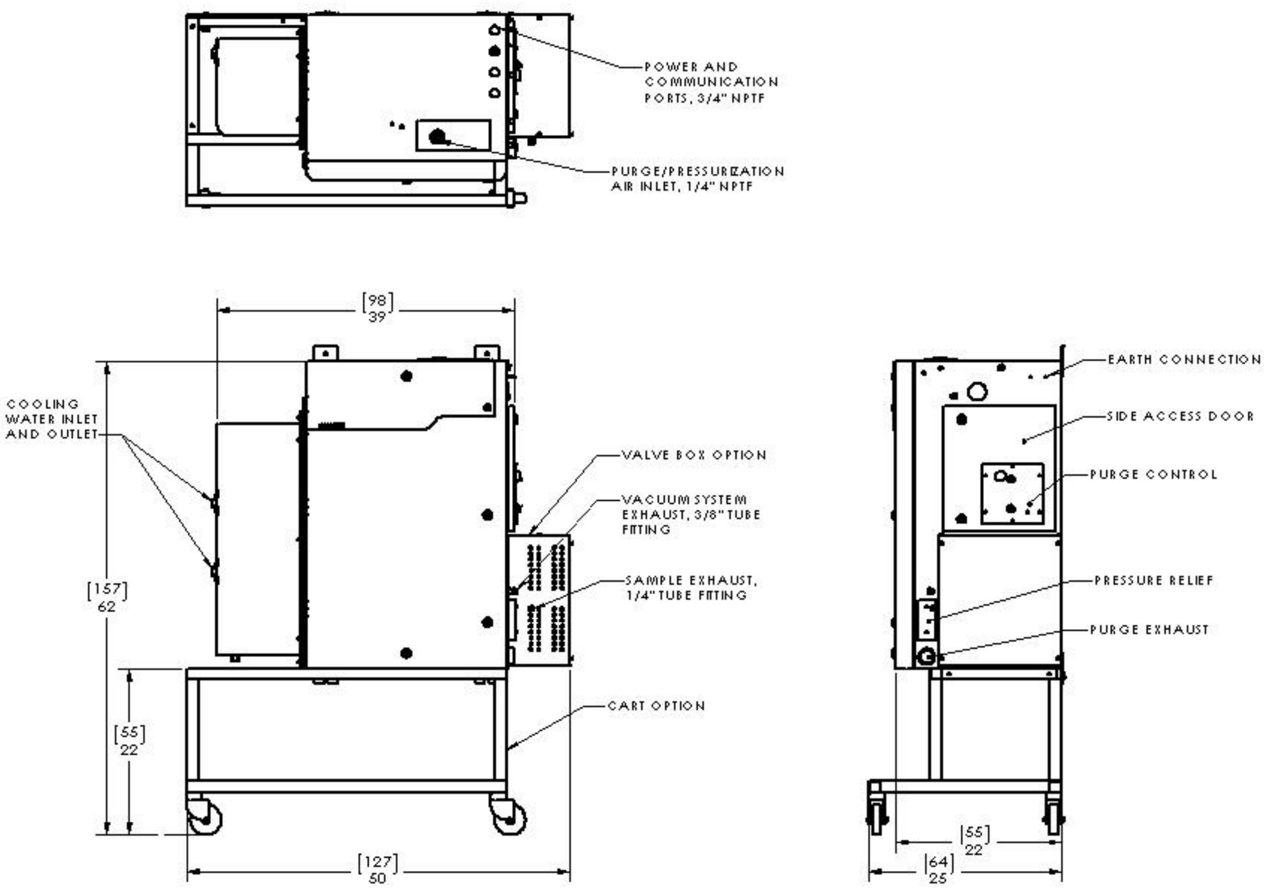


Figure 6: Layout of the ATEX/IECEx Zone 2/Class I Div 2 unit (230V or 115V), with water cooled heat exchanger and cart option

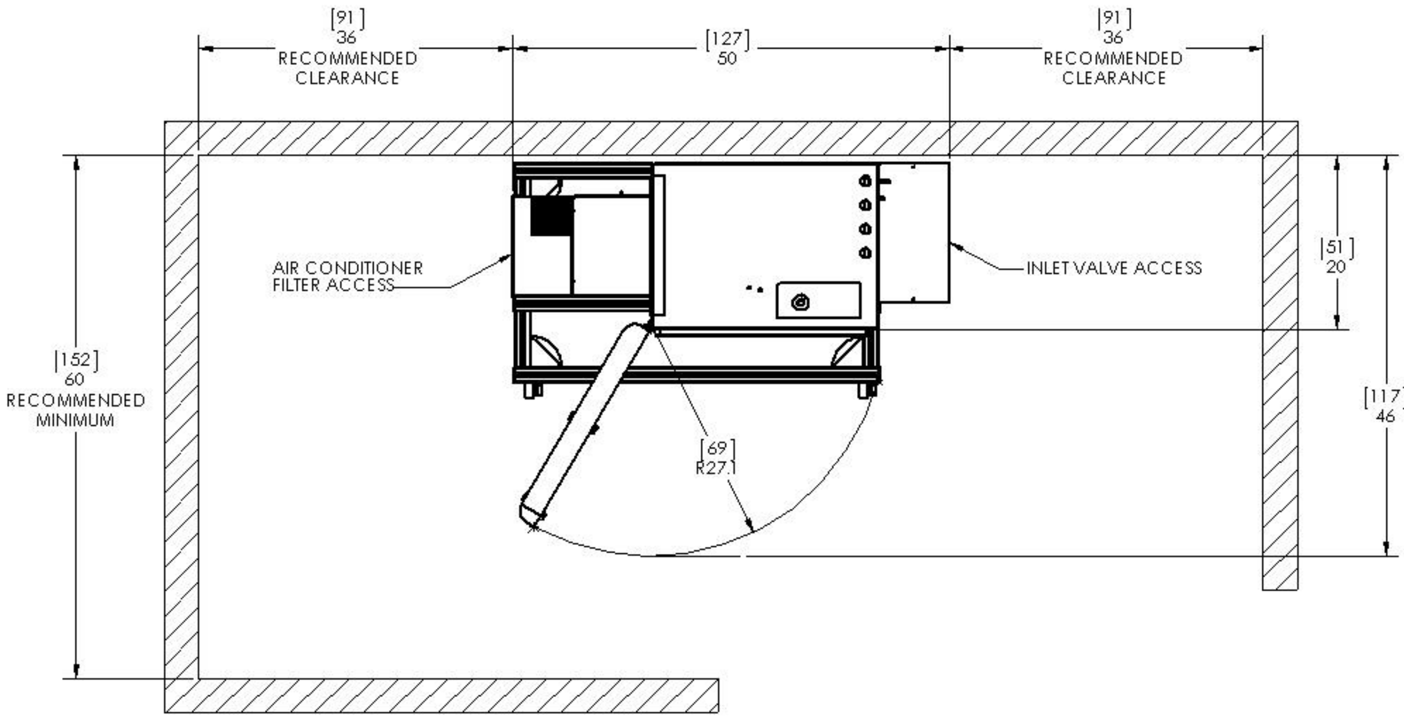


Figure 7: Installation Clearances

Safety

Model Definitions and Marking

MAX300-RTG is available in several models that are suitable for installation in various hazardous areas. It is the responsibility of the user to ensure that the appropriate model has been chosen for a particular hazardous location. Below is a listing of the models and the parameters that apply.

ATEX/IECEX Category 2 (Zone 1) models:

MAX300-RTG-Z1CF – II 2 G Ex db ib mb pxb IIC T4 Gb

MAX300-RTG-Z1C - II 2 G Ex db ib pxb IIC T4 Gb

MAX300-RTG-Z1BF - II 2 G Ex db ib mb pxb IIB+H2 T4 Gb

MAX300-RTG-Z1B - II 2 G Ex db ib pxb IIB+H2 T4 Gb

MAX300-RTG-Z1CFT3 – II 2 G Ex db ib mb pxb IIC T3 Gb

MAX300-RTG-Z1CT3 - II 2 G Ex db ib pxb IIC T3 Gb

MAX300-RTG-Z1BFT3 - II 2 G Ex db ib mb pxb IIB+H2 T3 Gb

MAX300-RTG-Z1BT3 - II 2 G Ex db ib pxb IIB+H2 T3 Gb

Certificate number: IECEx ETL 17.0031X, ITS17ATEX11959X

Tamb	-20°C to 50°C
Internal free volume	436 L
Purging gas	Air or inert
Minimum overpressure	0.50 mbar
Normal overpressure	2.5 mbar
Maximum overpressure	5 mbar
Maximum leakage rate	50 L/m
Minimum purge flow rate	300 NL/m
Minimum purge time	12 m
Minimum continuous dilution flow rate	80 NL/m
Supply pressure	4 to 8 bar
Enclosure with a containment system	Limited internal source of release
Maximum sample flow rate	0.034 L/m
Maximum sample supply pressure	20 PSIG

ATEX/IECEX Category 3 (Zone 2) models :

MAX300-RTG-Z2CF – II 3 G Ex ib mb pzc IIC T4 Gc

MAX300-RTG-Z2CFIQ – II 3 G Ex ib mb nA nC pzc IIC T4 Gc

MAX300-RTG-Z2C – II 3 G Ex ib pzc IIC T4 Gc

MAX300-RTG-Z2CIQ – II 3 G Ex ib nA nC pzc IIC T4 Gc

MAX300-RTG-Z2CFH – II 3 G Ex db ib mb pzc IIC T4 Gc

MAX300-RTG-Z2CFHIQ – II 3 G Ex db ib mb nA nC pzc IIC T4 Gc

MAX300-RTG-Z2CH – II 3 G Ex db ib pzc IIC T4 Gc

MAX300-RTG-Z2CHIQ – II 3 G Ex db ib nA nC pzc IIC T4 Gc

MAX300-RTG-Z2CFHT3 – II 3 G Ex db ib mb pzc IIC T3 Gc

MAX300-RTG-Z2CFHIQT3 – II 3 G Ex db ib mb nA nC pzc IIC T3 Gc

MAX300-RTG-Z2CHT3 – II 3 G Ex db ib pzc IIC T3 Gc

MAX300-RTG-Z2CHIQT3 – II 3 G Ex db ib nA nC pzc IIC T3 Gc

Certificate number: IECEx ETL 17.0031X, ITS17ATEX11959X

Tamb	-20°C to 50°C
Internal free volume	436 L
Purging gas	Air or inert
Minimum overpressure	0.25 mbar
Normal overpressure	2.5 mbar
Maximum overpressure	5 mbar
Maximum leakage rate	50 L/m
Minimum purge flow rate	142 NL/m
Minimum purge time	12 m
Minimum continuous dilution flow rate	142 NL/m
Supply pressure	4 to 8 bar
Enclosure with a containment system	No release
Maximum sample flow rate	0.034 L/m
Maximum sample supply pressure	20 PSIG

North American Class I Division 1 models:

MAX300-RTG-D1B -

Class I Division 1 groups BCD

ETL Listing Control Number: 5009393

Pressurization type X

Temperature Class T4

MAX300-RTG-D1BT3 -

Class I Division 1 groups BCD

ETL Listing Control Number: 5009393

Pressurization type X

Temperature Class T3

North American Class I Division 2 models:

MAX300-RTG-D2A -

Class I Division 2 groups ABCD

ETL Listing Control Number: 5009393

Pressurization type Z

Temperature Class T4

MAX300-RTG-D2AT3-

Class I Division 2 groups ABCD

ETL Listing Control Number: 5009393

Pressurization type Z

Temperature Class T3

Warnings

WARNING – Pressurized enclosure – When ignitable combustible materials are present, the MAX300 enclosure must not be opened until a cooldown period of 5 minutes is observed. Power must not be restored after enclosure has been opened until unit has been properly purged. ATEX/IECEx Category 2 (Zone 1) and Class I Div 1 models are equipped with a purge/pressurization device that automatically connects power after an appropriate purge interval, and disconnects power upon loss of pressurization. ATEX/IECEx Category 3 (Zone 2) and Class I Div 2 models are equipped with a manual pressurization device that requires a 12 minute minimum purge prior to connecting power. This device is equipped with pressurization loss switch contacts and indicators.

AVERTISSEMENT – Enceinte sous pression – En présence de matières combustibles inflammables, l'enceinte MAX300 ne doit pas être utilisée avant qu'une période de refroidissement de 5 minutes se soit écoulée. Après l'ouverture de l'enceinte, l'alimentation électrique ne doit pas être rétablie avant la vidange appropriée de l'appareil. Les modèles ATEX/IECEx de catégorie 2 (zone 1) et de classe I, division 1 sont munis d'un dispositif de vidange/pressurisation qui remet automatiquement l'alimentation électrique après un délai de vidange appropriée, et coupe l'alimentation après une dépressurisation. Les modèles ATEX/IECEx de catégorie 3 (zone 2) et de classe I, division 2 sont munis d'un dispositif de pressurisation manuel qui requiert une vidange au moins 12 minutes avant le branchement de l'alimentation électrique. Cet appareil est pourvu d'interrupteurs de contact et d'indicateurs de dépressurisation.

WARNING - Substitution of components of the MAX300 unit may impair suitability for hazardous locations. Contact Extrel CMS technical support prior to component substitution.

AVERTISSEMENT - La substitution de composants de l'unité MAX300 peut compromettre sa capacité à bien fonctionner dans des endroits dangereux. Communiquez avec le soutien technique Extrel CMS avant d'effectuer la substitution de tout composant.

WARNING - It is the user's responsibility to ensure that this unit is installed and used in a safe manner, in accordance with applicable national and local safety standards.

AVERTISSEMENT - Il incombe à l'utilisateur de s'assurer que cet appareil est installé et utilisé de façon sécuritaire, conformément aux normes de sécurité nationales et locales applicables.

WARNING – Potential electrostatic charging hazard

When cleaning the exterior painted surface of the unit in a hazardous area, use a damp cloth to avoid potential electrostatic charging.

AVERTISSEMENT – Danger potentiel de charge électrostatique

Au moment de nettoyer la surface extérieure peinte de l'appareil dans une zone dangereuse, utiliser un chiffon humide pour éviter tout risque de charge électrostatique.

WARNING – Piping of the protective gas (air) to the enclosure shall be protected against mechanical damage.

AVERTISSEMENT – La tuyauterie du gaz protecteur (air) vers l'enceinte doit être protégée des dommages mécaniques.

WARNING – For power connections to the unit, use wire suitable for use at a temperature of 80°C or higher.

AVERTISSEMENT – Pour les connexions électriques vers l'appareil, utiliser un fil convenant à des températures égales ou supérieures à 80 °C.

WARNING – This unit contains a lithium backup battery, used to supply power to the computer real-time clock. The battery circuit is intrinsically safe and requires no maintenance. The battery is not user serviceable – contact Extrel CMS technical support for more information.

AVERTISSEMENT – Cet appareil comporte une pile de secours au lithium, qui sert à alimenter l'horloge en temps réel de l'ordinateur. Le circuit de la pile est intrinsèquement sûr et ne nécessite aucun entretien. La pile ne peut être réparée par l’utilisateur; communiquez avec le soutien technique Extrel CMS pour plus de renseignements.

WARNING – The gas inlet to the mass spectrometer includes a “containment system” that allows sample gas to be safely introduced. Replacement of any inlet parts must be done using new Extrel approved components while carefully following the instructions in this manual. Contact Extrel CMS technical support for more information**.**

AVERTISSEMENT – L’entrée de gaz au spectromètre de masse comprend un « système de confinement » qui permet à l’échantillon de gaz d’être ajouté en toute sécurité. En cas de remplacement de toute pièce d’entrée, il faut utiliser des composants neufs approuvés Extrel et respecter à la lettre les instructions du présent manuel. Communiquez avec le soutien technique Extrel CMS pour plus de renseignements.

WARNING – If unit is equipped with external communications disconnect box (see page 38), nothing is to be installed within 50 mm of flameproof enclosure joint.

AVERTISSEMENT – Si l’appareil est muni d’un boîtier sectionneur pour communications externes (voir page 38), rien ne doit être installé à moins de 50 mm du joint de l’enceinte ignifuge.

WARNING – If unit is purged with inert gas instead of compressed air, it may be an asphyxiation hazard.

AVERTISSEMENT – Lors de l’utilisation de gaz inerte comme gas de protection, il pourrait y avoir un risque d’asphyxie.

ATEX/IECEx Category 2 (Zone 1) and Class I Div 1

This unit is intended for use in ATEX/IEC Category 2 (Zone 1) or Class I Division 1 locations. It is designed for group IIC or groups ABCD hazards (IIB+H2 or BCD with communications box option), where the hazardous area is non-mining (above ground) and the hazard is caused by flammable gases or vapors.

The instrument is made suitable for hazardous locations via a purge and pressurization technique, known as “px” or “x” purge. This design allows purge gas, also known as the protective gas, to be admitted into the enclosure from a safe source. The interior of the enclosure is maintained at a pressure above atmospheric pressure. This overpressure prevents entry of the possibly hazardous atmosphere that surrounds the unit and allows the use of electrical devices inside the unit while in hazardous locations. If these conditions are met, the control device will apply power within the instrument's enclosure.

In the event that the control unit senses a failure, power to the enclosure is automatically disconnected. The failure sensed may be due to interruption of air flow, an air supply pressure decrease below minimum, or the enclosure overpressure not being maintained.

The purge and pressurization system is controlled by a Control Unit (CU), a pneumatic logic circuit, which is the heart of the system. Once the main power and purge gas has been successfully installed on the mass spectrometer, the purge and pressurization system can be started. When the purge gas supply is first turned on, the purge cycle will begin. Although the unit is wired to the main power source, no electrical power is established within the enclosure. For power to be established within the enclosure, the control unit must determine if the purge gas has adequate pressure and if the enclosure over pressure is sufficient. Also, the purge gas will flow for a set time interval to ensure that any hazardous gases within the enclosure are purged.

The purge system controls electrical power to devices inside the enclosure, and provides two flow rates of protective gas. The initial flow, during which power has not yet been connected, is to ensure that the enclosure is free of hazardous materials that may have been introduced from the outside atmosphere prior to startup. This initial flow rate is set at a minimum of 300 Nl/minute (10.6 SCFM) and the system must sustain at least this rate for a minimum of 12 minutes. Upon successful completion of the main purge cycle, the system is designed to turn on electrical power, and maintain an internal pressure in the enclosure of at least 2.5 mbar (1.1" H2O) with a constant minimum flow rate of 80 Nl/minute (2.8 SCFM). The purpose of this is to ensure that the pressure within the enclosure is always higher than that of the surrounding atmosphere.

Because the instrument may contain parts that may be above the ignition temperature of the surrounding atmosphere, i.e. T4 of 135° C, (T3 200°C option available) the enclosure must not be opened, even when de-energized, until 10 minutes have elapsed. The delay ensures that the hot parts have cooled well below the ignition temperature.

In Zone 1/Div 1 areas, any wiring into the enclosure, communications wiring for example, must be disconnected in the event of purge failure or power loss, unless it is intrinsically safe wiring. Fiber optic communications is recommended wherever practical. As an alternative to fiber optics, a communications option is available.

This option consists of an independent flameproof enclosure for user connections, which is wired to the main enclosure.

ATEX/IECEx Category 3 (Zone 2) and Class I Div 2

This unit is intended for use in ATEX/IEC Category 3 (Zone 2) or Class I Division 2 locations. It is designed for use with group IIC or groups ABCD hazards, where the hazardous area is non-mining (above ground) and the hazard is caused by flammable gases or vapors.

The instrument is made suitable for hazardous locations via a purge and pressurization technique, known as “pz” or “z” purge. This design allows purge gas, also known as a protective gas, to be admitted into the enclosure from a safe source. The interior of the enclosure is maintained at a pressure above atmospheric pressure. This overpressure prevents entry of the possibly hazardous atmosphere that surrounds the unit and allows the use of electrical devices inside the unit while in hazardous locations. In the event that the control device senses a failure, a failure indicator is enabled at the unit, and a failure switch contact closes, which the user may wire to a remote indicator. The failure sensed may be due to interruption of air flow, an air supply pressure decrease below minimum, or the enclosure overpressure not being maintained.

The purge and pressurization system is controlled by a Control Unit (CU), a pneumatic logic circuit, which is the heart of the system. Once the main power and purge gas has been successfully installed on the mass spectrometer, the purge and pressurization system can be started. When the purge gas supply is first turned on, the purge indicator on the control unit indicates proper purge, and a steady flow of air begins within the enclosure. After allowing purge/pressurization gas to flow for 12 minutes, power may be connected to the unit. The purge system allows at least 142 NL/m (5 SCFM) to flow through the enclosure at all times, maintaining an internal pressure within the enclosure of at least 2.5 mbar (1” H2O). If this internal pressure is not maintained, the purge indicator on the unit shows a fault, and a dry contact switch closes, which the user may connect to a remote alarm if desired.

Because the instrument may contain parts that may be above the ignition temperature of the surrounding atmosphere, i.e. T4 of 135°C (T3 200°C option available), the enclosure must not be opened even when de-energized until 5 minutes have elapsed. The delay ensures that the hot parts have cooled well below the ignition temperature.

In Zone 2/Div 2 areas, communications wiring connections are made at the communications board, located inside the side access door of the enclosure.

Application Suitability

The following materials are used in the construction of MAX300 mass spectrometer systems. If substances that will adversely affect any of these materials are present in the surrounding environment, please consult Extrel CMS for further guidance.

Stainless steel

Mild steel

Brass

Aluminum

Nylon

Polyurethane

Acrylic

Polycarbonate

Silicone rubber

Nitrile rubber

This equipment is designed for use under normal industrial conditions of ambient temperature, humidity, and vibration. Please consult with Extrel CMS before installing this equipment in conditions that may cause stresses beyond normal industrial conditions.

Installation

The enclosure system shall be installed in accordance with relevant standards, such as EN 60079-14, and any national or local codes of practice that are in force. It is the user's responsibility to ensure this unit is installed and used in a safe manner, in accordance with national and local standards.

Pressurization gas supply

The gas supply, air or inert gas,to the pressurization system of hazardous locations units must be clean, non-flammable, and free from water, oil, and particulates (if air, it is generally referred to as instrument quality air). Solid particles must be filtered to 1 micron maximum, with a dew point of -40°C. The supply must be regulated to a pressure less than the maximum inlet pressure, 115 PSIG (8 bar), and above the minimum inlet pressure, 90 PSIG (6 bar) for X purge units and 60 PSIG (4 bar) for Z purge units, and to a pressure that is sufficient to sustain the initial purge flow rate of

300 NL/minute (Zone 1 and Div 1), or a continuous flow rate of at least 142 NL/minute (Zone 2 and Div 2). It is good practice to allow for at least 30% additional gas volume. The supply pipe work and associated valves must be sized to deliver the appropriate amount of gas during the purging phase of operation, and maintain more than the minimum supply pressure, 90 PSIG (6 bar) or 60 PSIG (4 bar), at the input to the purge system during purging. Prior to connecting the gas supply to the purge and pressurization system, flush the supply pipe work with clean gas to remove any debris that may have been introduced into the pipe work during installation. Refer to figures 1 through 6.

Note: The air supply temperature must not exceed 40°C (104°F).

Sample Gas Supply

The sample gas supply connected to the unit must not exceed 20 PSIG (1.36 bar) at any time. It is the responsibility of the user to ensure that if a pressure limitation facility is used, then it shall comply with the requirements of 2014/34/EU or other applicable national or local standards, and that proper assessment of fault condition has been applied. Failure to do so may invalidate the certification of this product.

AC Power Requirements

- The MAX300-RTG has three power input voltage options available – 230VAC 50/60 hz, 115VAC 60 hz, and 115VAC 50/60 hz. As shown in Figures 6 through 9, the 230VAC model will require a single dedicated 20 Amp circuit, while the 115VAC models require **TWO** independent 20 Amp circuits. Electrical power & signal wiring must be consistent with EN/IEC 60069-14, the NEC, or other national or local codes as appropriate.
- For power connections to the unit, wire suitable for use at a temperature of 80°C or higher must be used.
- Power connections to Zone 1 or Div 1 units (pxb/X purge) are made within the flameproof box on the side of the pressurized enclosure. Approved, sealed glands and conduit must be used. Refer to figures 1,3,8, and 9.
- A manual or automatic power disconnect that removes power from the unit is required to be installed near the unit. The disconnect must be suitable for the area classification.
- Cable/conduit glands used for power and communications entry into the unit must be sealed to maintain overpressure in the enclosure. They must have a minimum IP rating of 4X, and must be in compliance with local and national regulations.

Refer to Figures 8-12.

MAX300-RTG Electrical Connection Diagrams

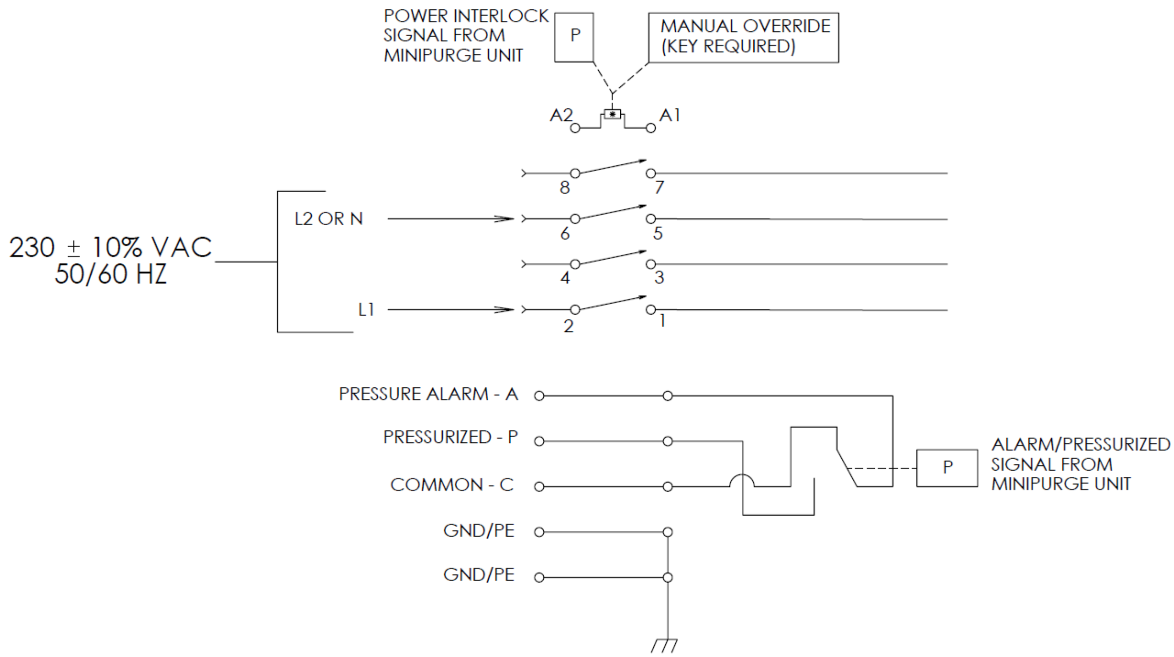


Figure 8: Power connection diagram, Zone 1/Div 1 units, 230VAC

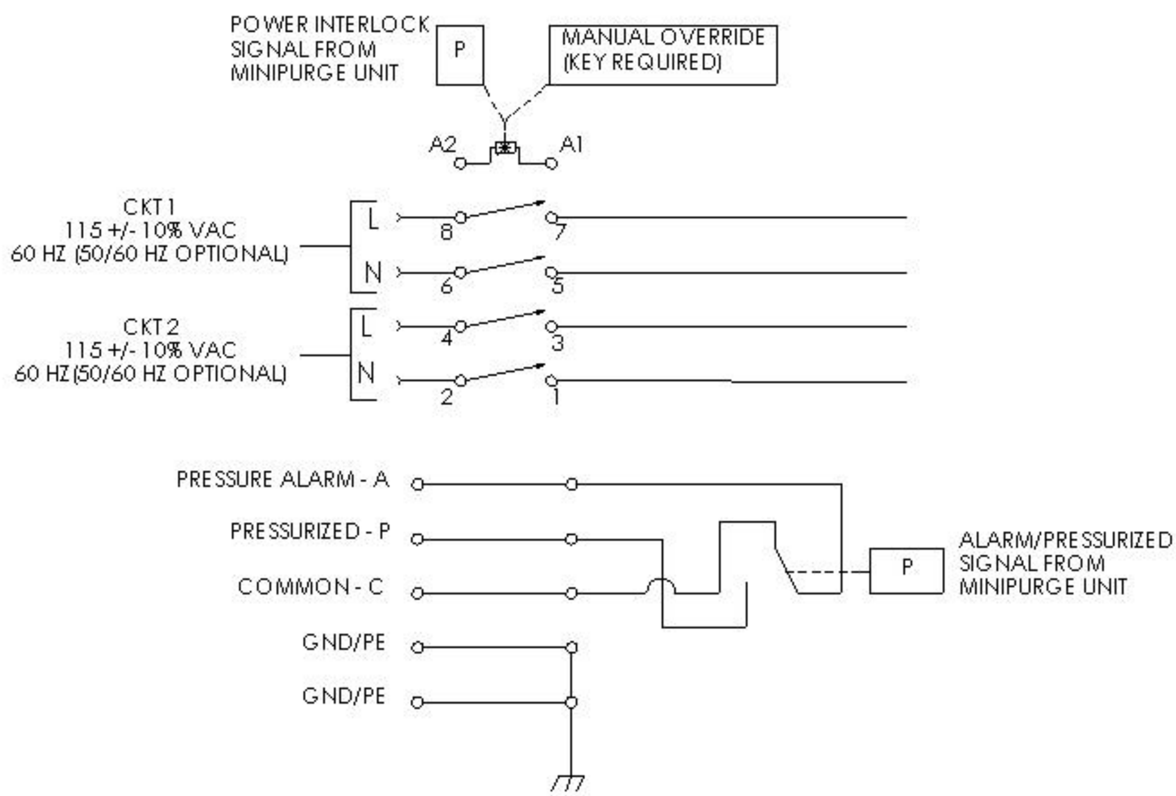


Figure 9: Power connection diagram, Zone 1/Div 1 units, 115VAC

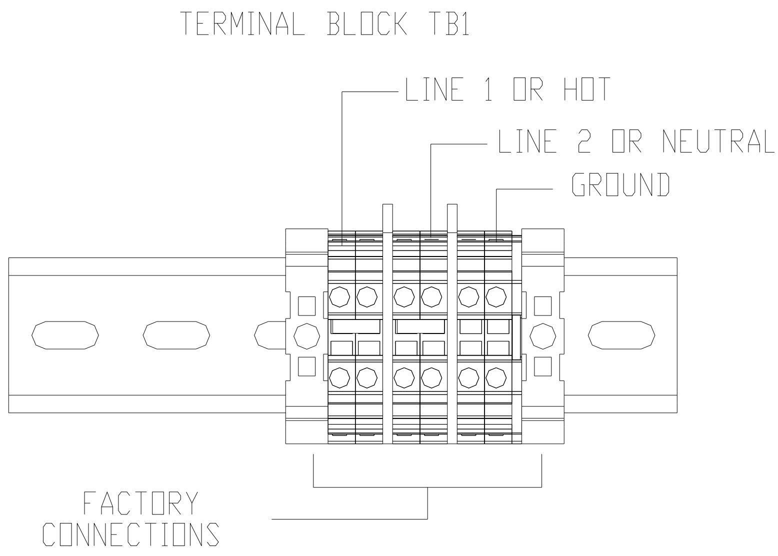


Figure 10: Power connection diagram, Zone 2/Div 2 units, 230VAC

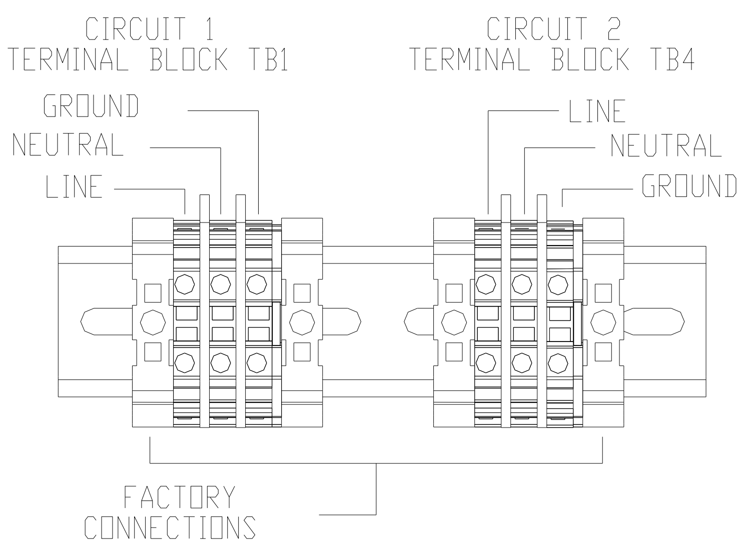


Figure 11: Power connection diagram, Zone 2/Div 2 units, 115VAC

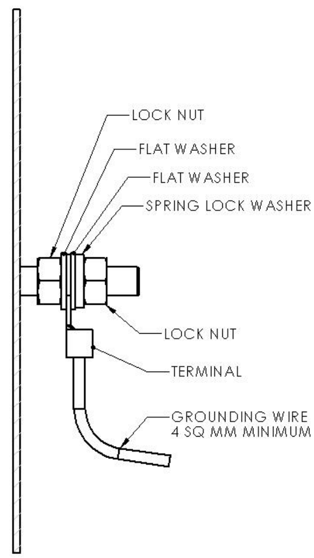


Figure 12: Earth connection diagram

Earthing

An earth connection point is provided on the external surface of the pressurized enclosure, and on the external communication disconnect box option. Refer to figures 1 through 6. These connections must be used to join the instrument's metalwork to the earth-ground plane. The external earth wire must be protected so that it cannot become accidentally loosened or damaged by twisting. It must be sized in accordance with local rules for electrical installations and must not be smaller in area than 4 square millimeters (7894 circular mils).

The purpose of these connections is to direct any electrical current, internally or externally generated, into an external ground rod that will eliminate or minimize any damage to personnel and equipment. In order to achieve the redirection of current, the resistance between the earth-ground connection and the external earth-ground lug must be kept below 0.1 ohms. The hardware shown in Figure 12 is supplied with the unit.

Plumbing Connections

Sample Lines

The MAX300-RTG is a gas analyzer and requires the sample to be delivered in a vapor phase. A heat traced sample line, if needed, must be provided by the customer. All sample lines connecting to the instrument must conform to all local safety regulations and be of a material compatible with the sample stream.

The MAX300-RTG with direct inlet is equipped with a flow status switch which indicates failure if the flow falls below 50 cc/min. The recommended sample flow is approximately 100 cc/min; however this will vary depending upon length and size of the tubing used for plumbing; therefore flow meters are not required. Please refer to the following figures for location of the flow switch.

Table 3: Flow approximations for different type of valves

Types of Valves	(Approximate) Recommended Flow
Rotary: 1/16” 16 ports 1/8” 16 ports	100 cc/min
Pneumatic/Solenoid	100 cc/min
FAST Valve: 40/80/120 160 port	100 cc/min
Sub Ambient Sampling	See note below

Note: The Sub Ambient Sampling assembly does not contain a flow switch due to the fact that the actual gas flow will not activate the flow switch.

Rotary Valve Inlets

The recommended tubing size from the sample and calibration gases to the mass spectrometer is 1/16” OD, 0.030 ID stainless steel tubing with compression fitting. Using the recommended tubing will help minimize sampling delays. Please see Figures 13 – 19 below for plumbing sample lines and connections.

Please refer to a diagram of the valve, Figure 16. When viewed from the plumbing side of the valve, the ports are identified as follows:

> The common outlet port is segregated from the other ports, and is nearest the valve actuator.
>
> Inlet ports are arranged in the row next to the common outlet. Inlet port #1 is the next position CCW from the common outlet port, and inlet ports are

numbered in sequence CCW. Inlet ports use fittings with short nuts, and are equipped with filter unions.

Outlet ports are positioned in the row farthest from the common outlet port. Outlet port #1 is the next position CW from inlet port #1, and outlet ports are numbered in sequence CCW. Outlet ports use fittings with long nuts.

When plumbed for continuous flow operation, this valve allow sample gas to flow continuously from inlet to outlet, ensuring that fresh sample gas is available at the mass spectrometer at all times. When this port is selected for sampling, the gas is routed to the mass spectrometer instead of to the outlet port. In cases where continuous flow is not desired, such as for ports with calibration gases connected, the outlets should remain plugged. Valve(s) are shipped with plugs installed in both inlets and outlets.

Refer to the following diagrams for information on rotary valve options.

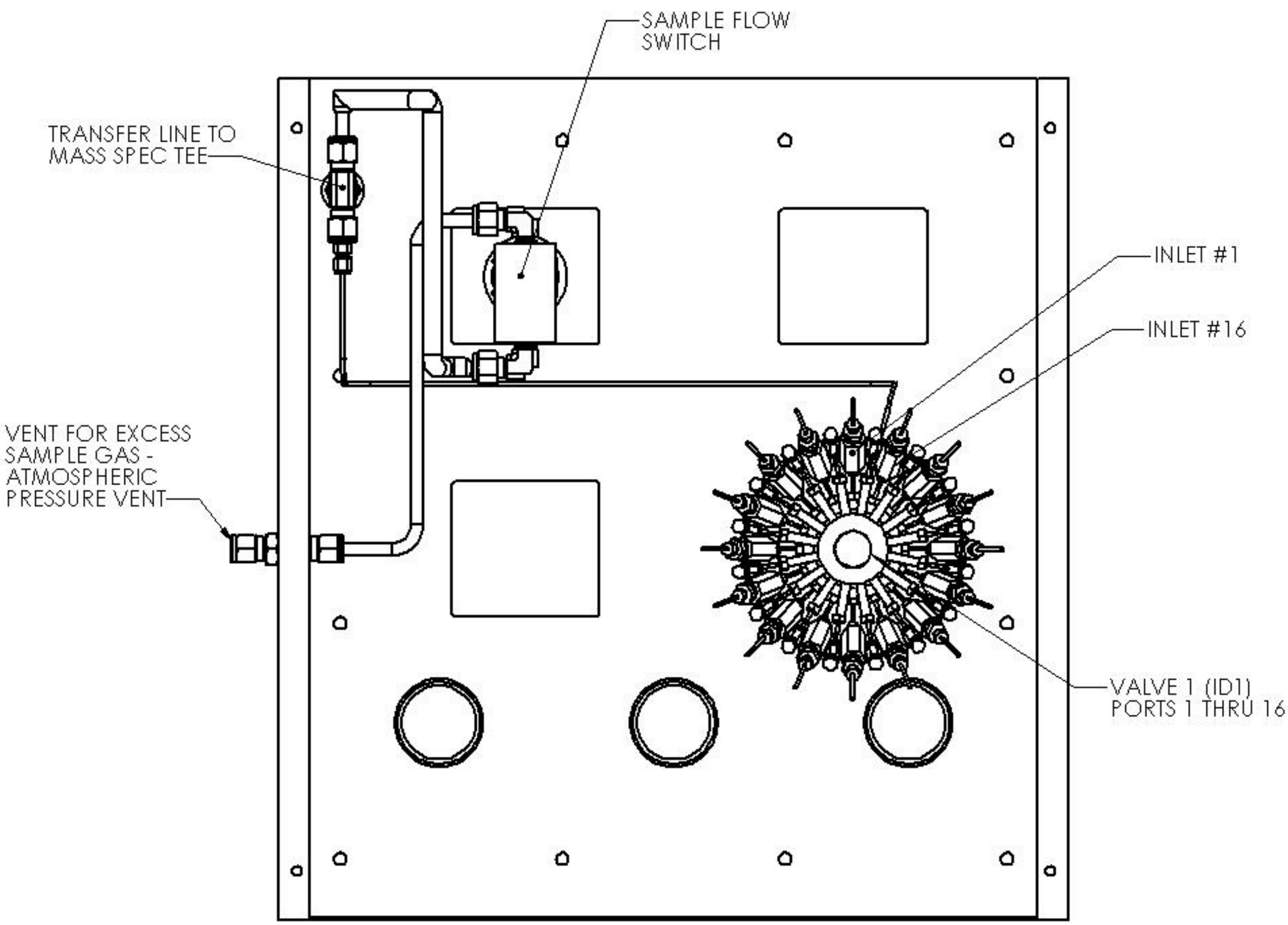


Figure 13: Diagram of 16 port rotary valve inlet

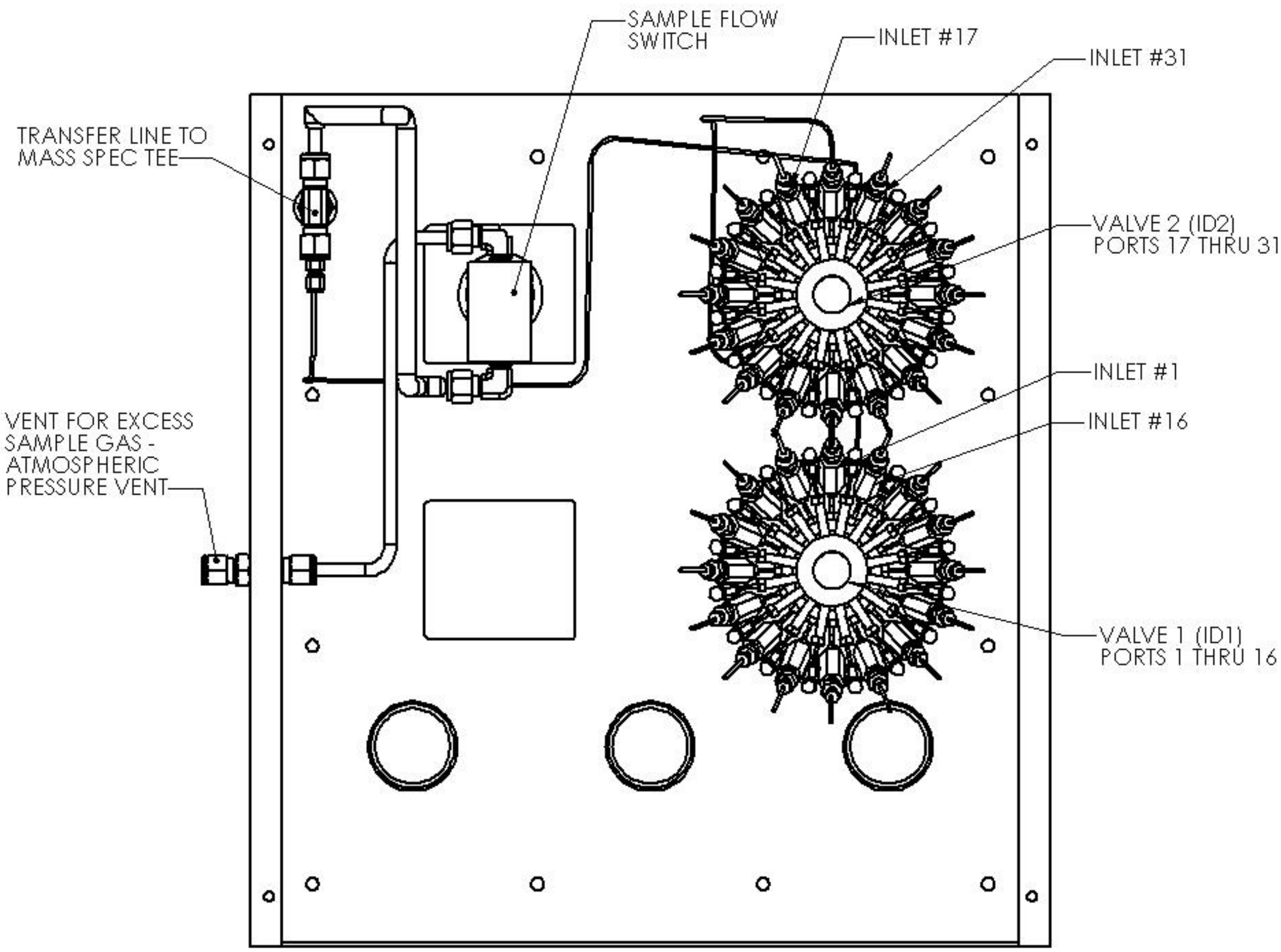
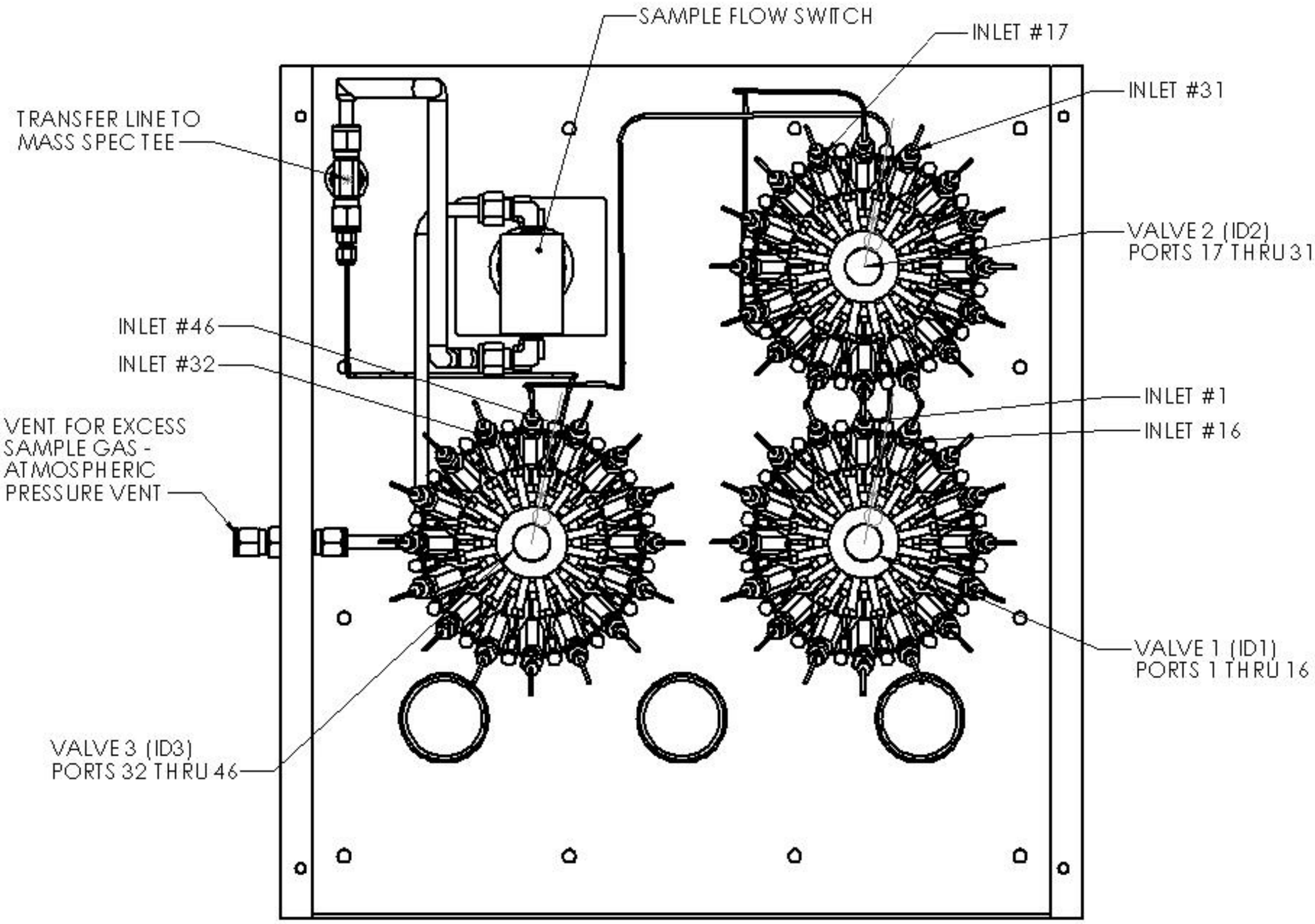


Figure 14: Diagram of 31 port rotary valve inlet

The common outlet of valve 1 is plumbed to the inlet port #1 of valve 2. The common outlet of valve 2 is plumbed to the transfer line tee.

Figure 15: Diagram of 46 port rotary valve inlet



The common outlet of valve 1 is plumbed to inlet port #1 of valve 2. The common outlet of valve 2 is plumbed to inlet port #1 of valve 3. The common outlet of valve 3 is plumbed to the transfer line tee.

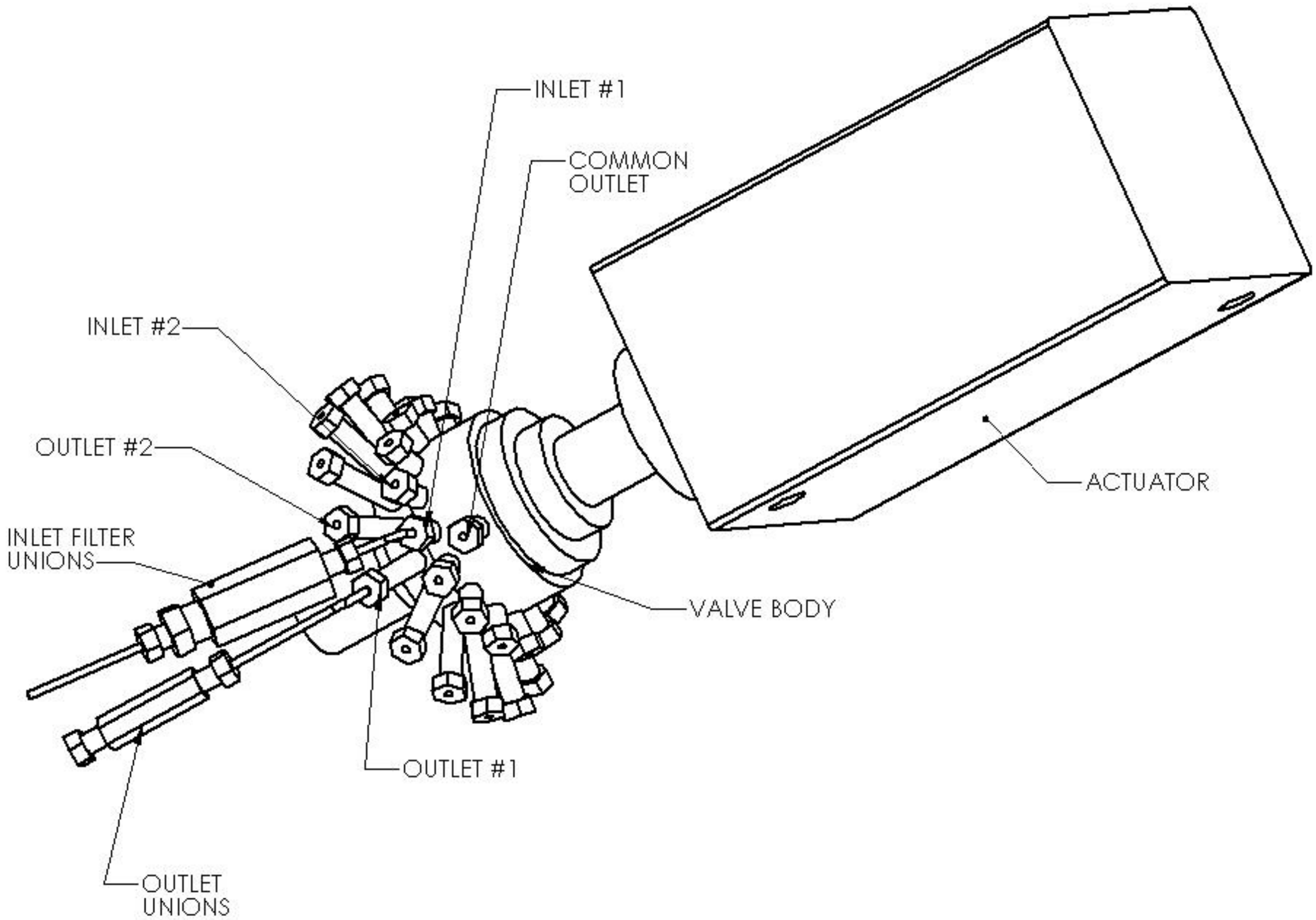


Figure 16: 16 port rotary valve details

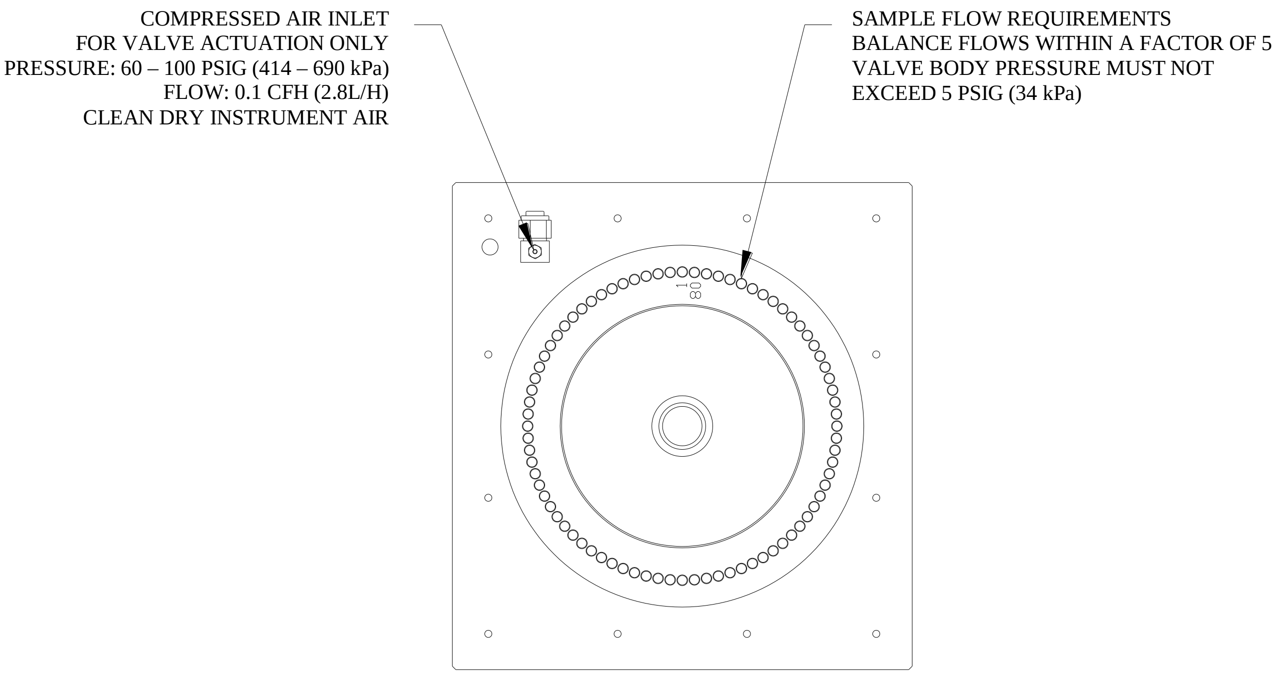


Figure 17: FastValve (40/80/120/160 port valve option) – for use with non-explosive sample

Calibration Gases

Calibration Gas Connections

The customer must connect the calibration gas cylinders to the MAX300-RTG without contamination. Details of the connection may vary depending on the valve option installed. Figure 18 below depicts the recommended hardware for connecting calibration gas cylinders to the MAX300-RTG.

A common configuration is Valco rotary valves using 1/16” fittings. Each cylinder of calibration gas requires:

- High quality, low outlet pressure, two stage regulator with a stainless steel diaphragm and appropriate CGA fitting. Please contact your gas supplier for special considerations such as corrosive gases.
- 1/16" O.D. x 0.030" I.D. stainless steel tubing. Length as required to route plumbing from MAX300-RTG to the gas storage area.
- 1/16" Valco nuts, ferrules, and plugs (supplied with the valve kit).

- Valco in-line filters (supplied with the valve kit).

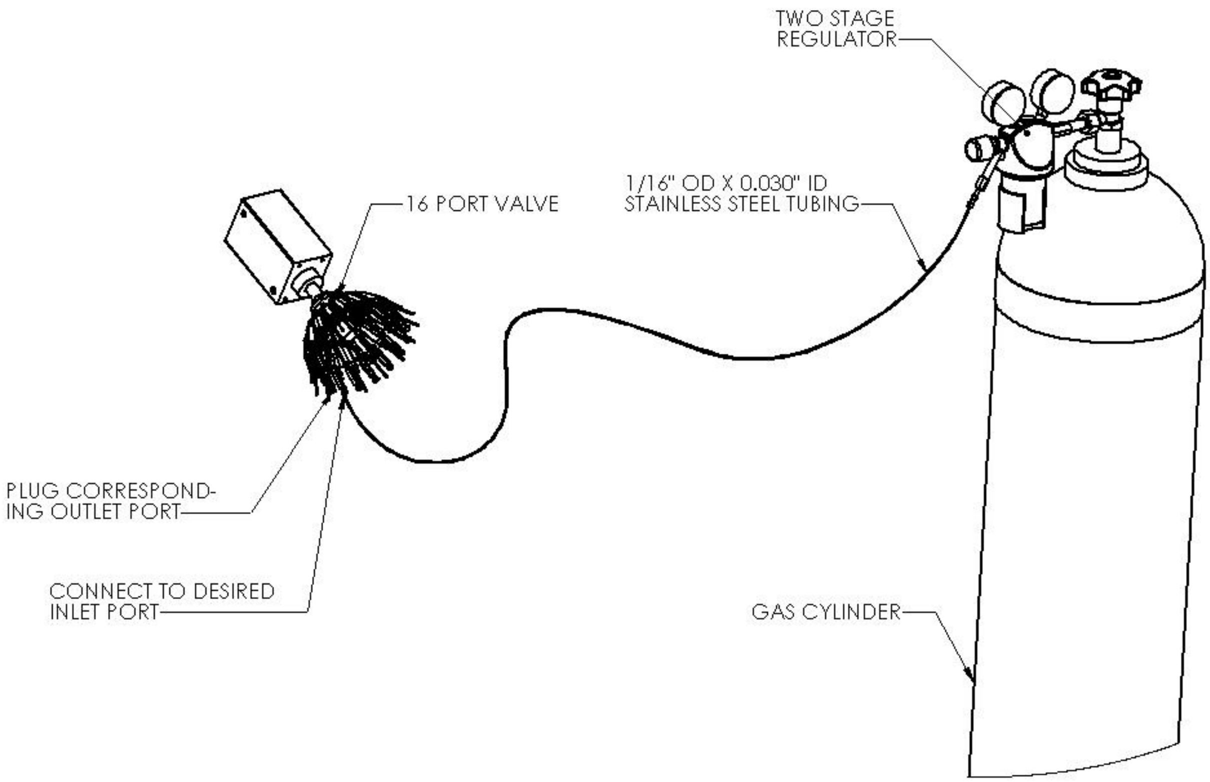


Figure 18: Calibration Gas Connection

Calibration Gas Composition

Calibration gases must be suitable for the process stream. It is recommended that an Extrel CMS application chemist is consulted prior to start-up for help in selecting gas standards. Gas cylinders for housing calibration gases are typically 40 - 50 L or 1 - 2 ft^3, 9in diameter, 56in long, and filled to 2000 PSIG. If the vapor pressure of a component limits the pressure in the cylinder, a larger cylinder may be required to increase the cylinder lifetime.

In general, three different classes of mixtures are used in calibration. The following are Extrel CMS' recommendations for purity and grade:

1. **Pure gases:** Should be at least 99.999% pure, where the gas contains no more than 10 ppm total impurities. For multiplier detector applications, the gas should be 99.9999% pure.
2. **Binary mixtures:** These two gas mixtures should be at least 99.999% pure. The accuracy of the reported concentrations is not critical unless the binary is also to be used for sensitivity calibration. This would occur primarily when a particular component is not stable in the multiblend mixture. If this is the case, the sensitivity calibration for that component may be performed in the binary gas instead.
3. **Multiblend mixtures:** Are intended to simulate the process stream. Consequently, they should be as free of impurities as possible and be certified to at least +/-2% relative accuracy.

Vent Lines

A “Flow By” configuration is when the sampling valve is plumbed for continuous flow on all sample lines; this is so a fresh sample is delivered to the instrument for analyzing (see Figures 13 - 16). The streams being analyzed have a separate vent; 1/4” compression fitting, connection.

The vacuum system vent has a 3/8” compression fitting. The vacuum system exhaust may contain small amounts of vacuum pump oil as well as sample (See Figures 1 - 6).

Note: Sample vent lines must be direct atmospheric pressure vents.

External Communications

External Communications Options

- OPC Server (Object Linking and Embedding [***O***LE] for ***P***rocess ***C***ontrol)
- Modbus Master
- Modbus Slave
- DCS (***D***istributed ***C***ontrol ***S***ystem)
- 4-20 mA
- Relay

External Communications Disconnect Box

This external communications disconnect box option is used in Category 2 (Zone 1) and Div 1 applications, in cases where fiber optics communications is not practical. The box contains user wiring connections, and is equipped with devices that disconnect user wires from the purged enclosure in the event of pressurization failure. Refer to Figure 19.

- The type of flameproof box will differ, depending on communications options and gas group. The box depicted in figure 19 is suitable for IIB + Hydrogen (Group B). Consult Extrel CMS for Gas group IIC (Group A) applications.
- With this option, Extrel CMS may supply appropriate glands, conduit connections, and flexible conduit to connect the pressurized enclosure to the flameproof box. The gland at the pressurized enclosure end is rated at least IP4X and is able to maintain pressure within the enclosure. The gland at the flameproof box end is appropriate for the hazardous location.
- With this option, Extrel CMS supplies approved conduit plugs for unused conduit holes in the flameproof box. These plugs may be replaced with user supplied glands as necessary to handle communications wiring. It is the user's responsibility to ensure the glands are approved for use in the hazardous location where the box is installed. Note that all conduit holes must have either an approved gland or approved plug installed.
- Nothing is to be installed within 50 mm of the joints of the flameproof enclosure, to avoid having any devices in the flame path.
- Refer to Figures 1 through 6 for enclosure conduit fitting locations.
- With this option, in Zone 1/Div 1 units, all wiring shall meet applicable standards, and each wire entering the enclosure must either be intrinsically safe, or automatically disconnected when loss of pressurization in the enclosure occurs.

- Conduit connections between the mass spectrometer enclosure and the communications disconnect box, as well as other user connections to the communications box, must be properly installed and sealed as per local hazardous location codes.
    - For US/Canada locations, the conduit and fittings must be listed components rated for Class I, Division 1 Groups B,C,D or better.
    - For IECEx and ATEX locations, the conduit and fittings must hold ATEX and IECEx certificates with Ex d IIB+H2 rating or better, and be used within its conditions of use.

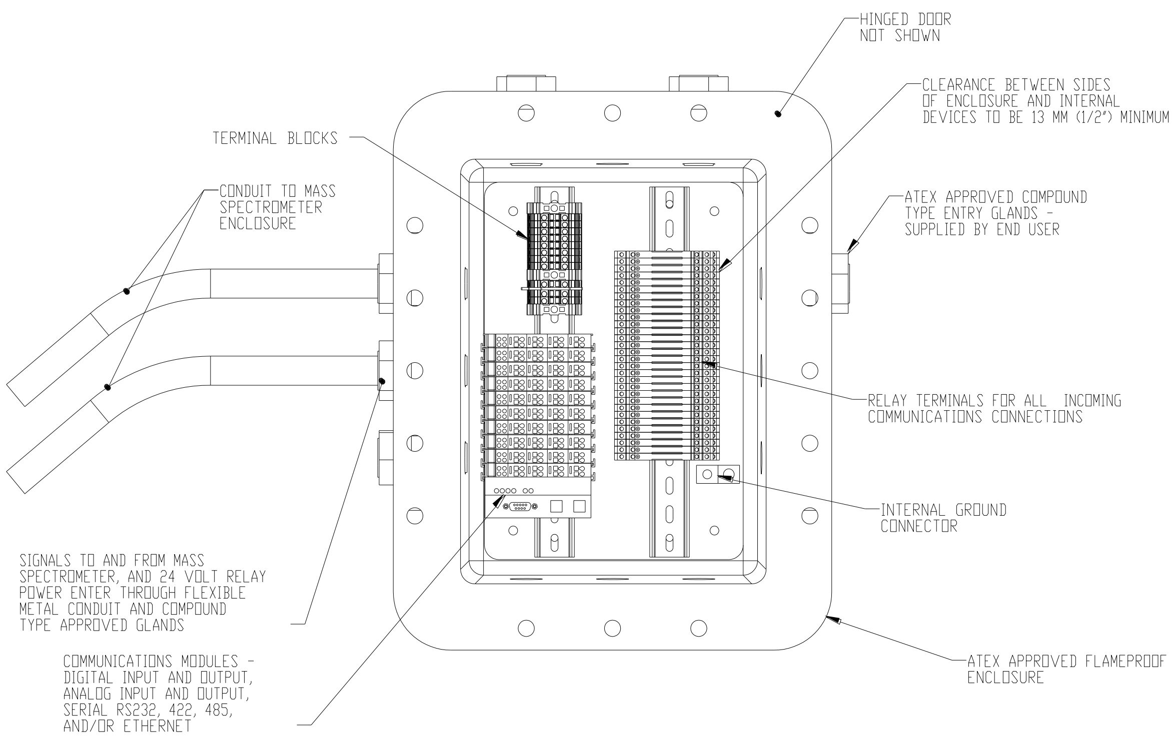


Figure 19: External communications disconnect box option

External Communications Circuit Board – Zone 2 and Div 2 only

The external communications circuit board is installed in all Zone 2 and Div 2 units, and as an option in Zone 1 /Div 1 units.

Communications connections are made through the communications circuit board on the right side of the enclosure behind the access door/purge panel. External communications wiring exits the enclosure by way of the conduit connections (3/4 inch NPT) on the top of the enclosure. Figure 16 is a diagram of the circuit board to aid in making physical connections for external communications.

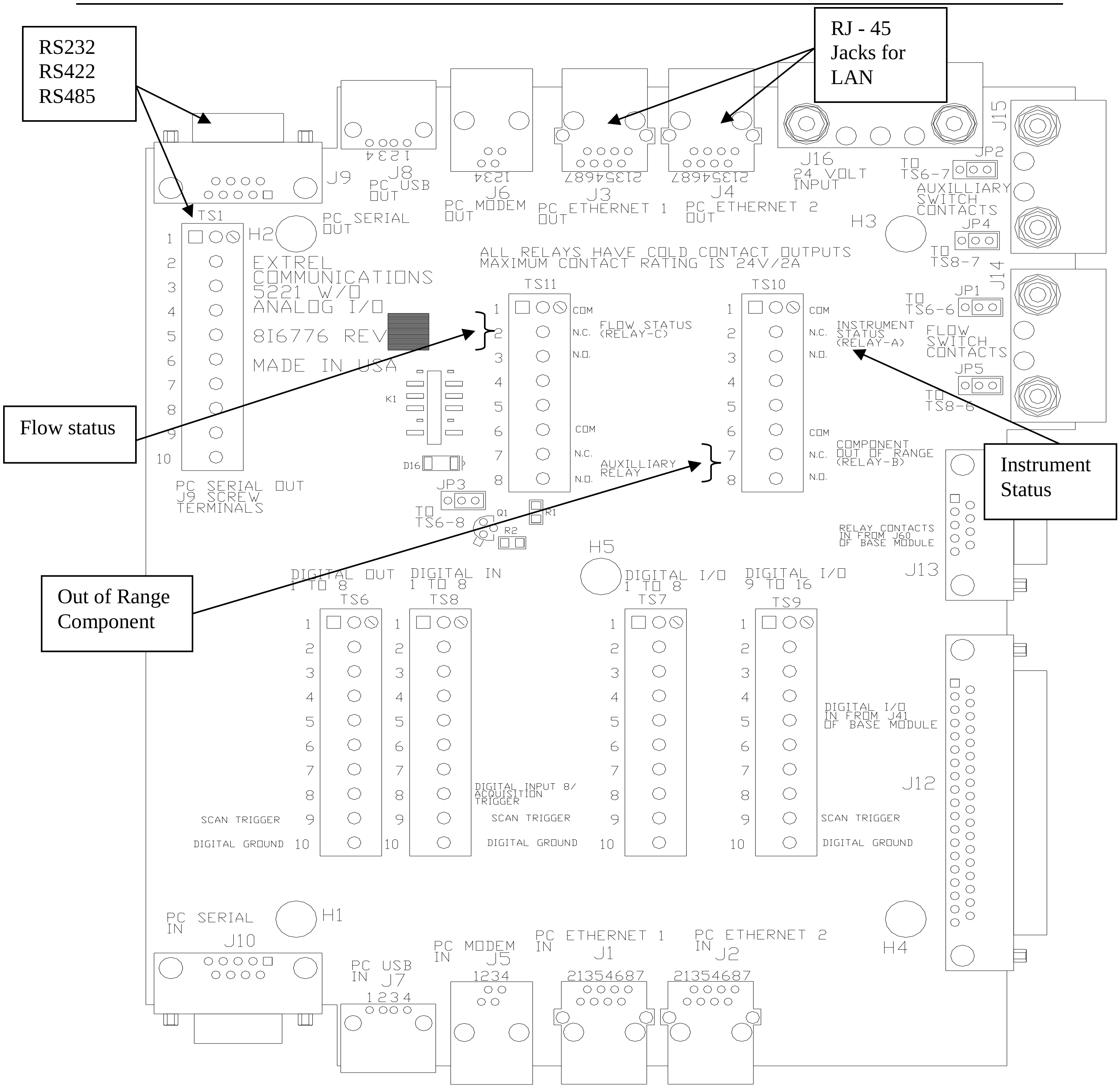


Figure 20: External Communications Circuit Board

Ethernet Connections to Server PC

Physical connections are made to the external communications circuit board. The connectors are RJ - 45 jacks located along the top edge of the board and labeled J3 and J4. If a screw terminal connection is required for this line you will need an adapter.

Status Connections

Relays rated for 24V/2A are assigned to track the status of certain internal parameters (See Figure 16).

- **Flow Status**: Sample flow loss contacts are available at TS11 terminals 1 (COM), 2 (N.C.), and 3 (N.O).
- **Instrument Status**: A relay is available at TS10 terminals 1 (COM), 2 (N.C.), and 3 (N.O).
- **Component Out Of Range**: A relay is available at TS10 terminals 6 (COM), 7 (N.C.), and 8 (N.O).

RS232 - RS422 – RS485 Serial Connections

A DB-9 connector is provided at J9. If screw terminals for this connection are preferred, the serial lines are duplicated at TS1. This connection is most often configured as a “Modbus” communications link. The default type of serial port is RS232, however, RS422 and RS485 are options.

External Communications Options

OPC

OPC stands for Object Linking and Embedding [OLE] for *P*rocess *C*ontrol. Support for OLE is built into the Windows® operating systems. OPC treats data as collections of objects to be shared by applications supporting the OLE specification. OPC provides extensions to OLE to support process control data sharing. The MAX300-RTG’s implementation of OPC communication option, an OPC server**,** is accessed on the local network via the instrument’s Ethernet port.

Questor Modbus

The Modbus protocol, developed by Modicon Corporation, is a communication protocol for the software. The MAX300-RTG is capable of acting as Master and/or Slave type of device on any available serial port on the embedded server. If the Modbus TCP/IP option is purchased, the Questor™5 Modbus communication will be carried out through the same Ethernet connections as used for the Questor5 LAN connection to the server PC.

The Modbus interface connections are accomplished by connecting to the terminal block inside the external communications box. The Modbus protocol supports RTU (remote terminal unit) transmission mode. This serial connection comes from the designated serial port or the server PC.

Table 4: Modbus Serial Connection

Pin	RS232	RS422/RS485 4 wire: internal wiring	RS422/RS485 4 wire: Customers connection	RS485 2 wire: internal wiring	RS485 2 wire: Customers connection
1					
2	RX	RD(A)-	TD(A)-	RX	TX
3	TX	TD(B)+	RD(B)+	TX	RX
4	RXA-	GND	GND	GND	GND
5					
6		GND	GND	GND	GND
7		RD(B)+	TD(B)+		
8		TD(A)-	RD(A)-		
9					
10	Not used	Not used		Not Used	

Table 5: Modbus Serial Connection Switch

Switch	RS232	RS422 (4 wire)	RS485 (4 wire)	RS-485 (2 wire)
1	-	RS422	RS485	RS485
2	-	Echo ON	Echo ON	Echo ON
3	-	4 wire	4 wire	2 wire
4	-	4 wire	4 wire	2 wire

4-20mA and Digital I/O

The MAX300-RTG can be equipped with a Fieldbus I/O system capable of accepting a variety of modules that communicate with external devices. These modules and Bus coupler are mounted on a DIN rail located behind the access door. Some possible I/O options include:

- **Analog Inputs:** 4-20mA
- **Analog Outputs:** 4-20mA
- **Digital Inputs:** 24VDC
- **Relay Outputs:** Contact ratings vary with the module installed

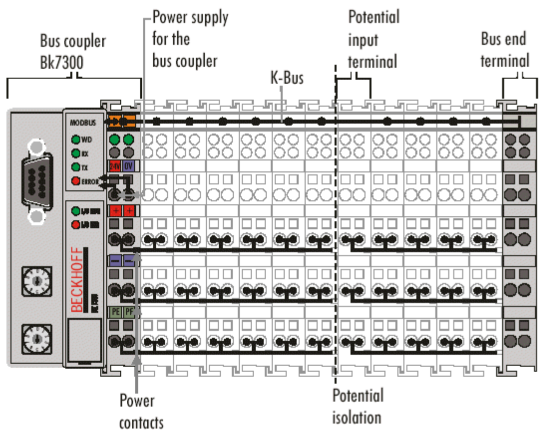


Figure 21: Bus Coupler

The BK7300 in Figure 21 connects the server PC with the electronic terminal blocks. Modules can be added in any combination meeting the user's needs. There is a physical limitation within the MAX300-RTG enclosure of twenty-eight modules. One unit consists of one Bus Coupler, any number of (1 to 64 modules) terminals, and one end terminal. The communication to the Bus Coupler is via Modbus. The analyzer controller acts as the Modbus Master, and the Bus Coupler acts as a Modbus Slave.

4-20mA Analog Inputs and Outputs

The 4-20mA communications option is used to send or receive data over a loop of wire where the current in the loop is proportional to the signal being transmitted. This mode of communications is most often used over long distances, in an environment that might otherwise induce electrical noise in the cable. Data is scaled so that 4mA represents zero and 20mA represents full scale. The MAX300-RTG software is capable of using this method to transmit data and instrument parameters to external monitors or controllers. The software can also use this method to receive parameters or instructions from an external source.

Each 4-20mA loop is known as a channel and can be configured separately. The default conversion of digital to analog (or analog to digital) data divides the 4-20mA range into discreet data steps where zero will correspond to 4mA and 4095 will correspond to 20mA. Physical access to this communication channel is via terminals on modules installed on a fieldbus I/O system. The communication loops are supported with the KL4021 module and KL4022.

4-20mA Analog Inputs: KL3012 and KL3022

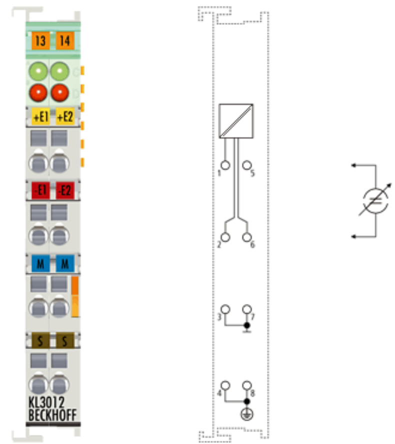


Figure 22: KL3012

The KL3012 and KL3022 analog input terminals handle signals in the range from 0 to 20mA. The current is digitized to a resolution of twelve bits and is transmitted in electronically isolated form to a higher-level automation device. The KL3012 and KL3022 versions combine two channels in one housing. Any open lead or overload condition is detected and the terminal status is relayed to the controller. The run LEDs give indication of data exchange with the Bus Coupler. Error LEDs indicate an overload or a broken wire.

4-20mA Output: KL4021 and KL4022 Modules

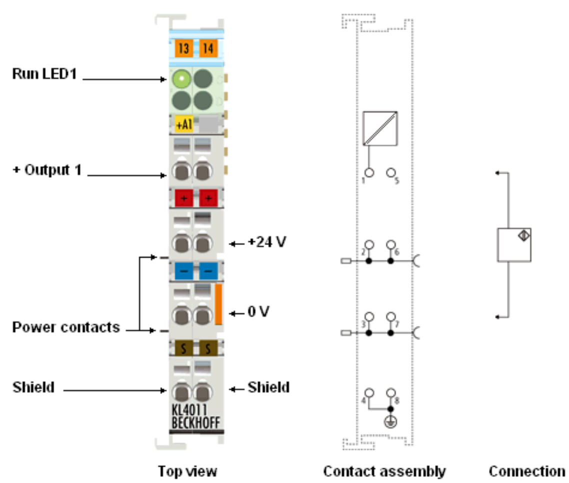


Figure 23: KL4021 module

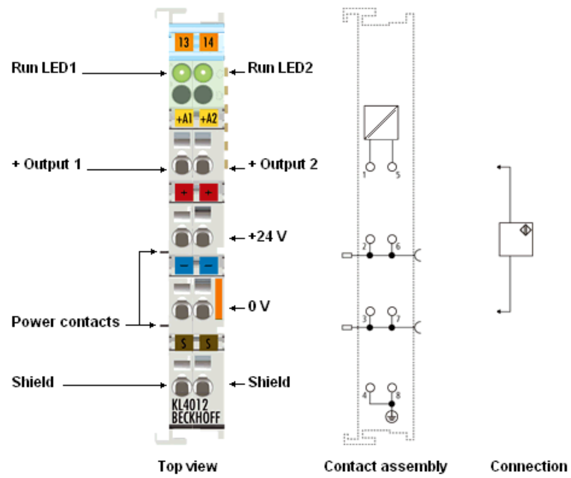


Figure 24: KL4022 Module

Both the KL4021 and KL4022 analog output terminals generate signals in the range from 4 to 20mA. The power is electrically isolated and supplied to the process level with a resolution of twelve bits. The KL4021 is the single-channel variant particularly suitable for signals with electrically isolated ground potentials. The KL4022 version combines two channels in one housing. In both cases, the run LED gives an indication of the data exchange with the Bus Coupler.

Digital I/O

The Digital **Output** in the *Digital I/O* communications option controls the state of relays the user can connect to external alarms, monitors, controllers or other devices. The triggers controlling these relays can be various types of alarm conditions or instrument parameters. A common relay type is single pole double throw (SPDT) with contacts rated at 125VAC/30VDC with a maximum switched current of 5A.

The Digital **Input** in the *Digital I/O* communications provides MAX300-RTG with the ability to monitor digital input signals that conform to the “IEC 61131-2, type 1” specification. A digital “0” is –3 to 5V and a digital “1” is 15 to 30V. The inputs are supplied in individually configurable eight bit blocks.

KL1408 – (8) digital input, 24VDC

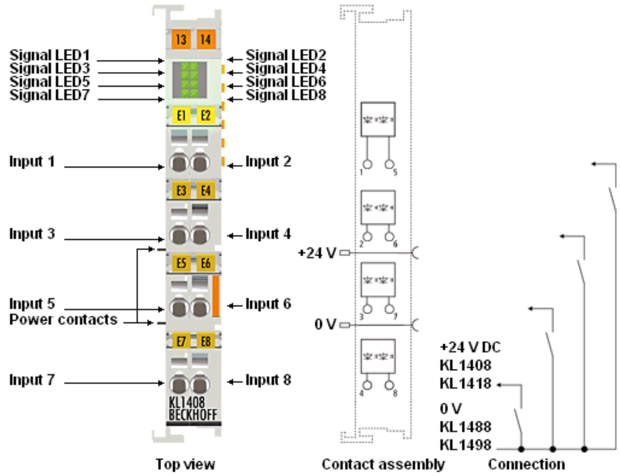


Figure 25: KL1408 Digital Input

The digital input terminals KL1408 (positive switching) acquire the binary control signals from the process level and transmit them, in electrically isolated form, to the server PC via the Beckhoff Bus Coupler. The Bus Terminals contain eight channels indicating their signal state via light emitting diodes. They are particularly suitable for space-saving use in control cabinets. With the single-ended connection technique, a multi-channel sensor can be connected in the smallest space with minimum wiring. The reference ground for all inputs is 0V.

Relay Output

KL2612 (2) Relays

Relay modules provide two relays per module. The KL2612 output terminal has two relays connected to the power contacts, suitable for use up to 230VAC that can generally be used for switching devices requiring main power. The Bus Terminal indicates its signal state via a light emitting diode.

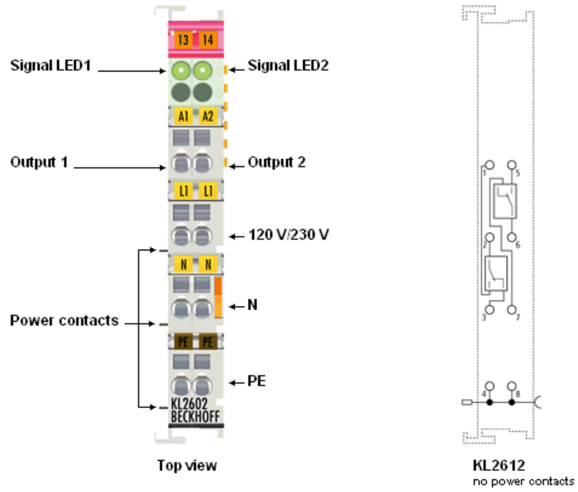


Figure 26: KL2612 Output Terminal

Distributed Control System (DCS)

The DCS, Distributed Control Systems, communications option enables the MAX300-RTG to be controlled by way of digital input from a user's industrial process control system. DCS will assign a number as "script" of MAX300-RTG actions to be implemented when received. The standard implementation for DCS is via the Digital Input modules in the 4-20mA and Digital I/O options.

External control of the operation of the MAX300-RTG is accomplished through the use of the DCS option. When this option is implemented, the Questor5 software may be configured so that steps in a pre-programmed sequence are commanded by the value of an input parameter, i.e. a trigger. The MAX300-RTG's Questor5 software may be configured to use one, or several, of seven different types of triggers.

- Digital Inputs
- Analog Inputs
- OPC Inputs Tags
- Modbus Slave Holding Registers
- Modbus Slave Coil Status
- Modbus Master Holding Registers
- Modbus Master Coil Status

The DCS option is implemented at the factory by modifying internal configuration files to reflect the purchase of the DCS control option and by installing the appropriate optional control hardware. Additional hardware is required for all DCS control sources noted above except for OPC. In the case of digital and analog inputs, the Beckhoff Bus Terminal and appropriate input and output terminals needed to be installed in the MAX300-RTG in addition to a serial port in the server to control Bus Terminal. Any of the four modbus control options also require an additional serial port to be installed in the server with the exception of OPC.

- Beckhoff KL1408 Digital Input Terminal(s)
- Beckhoff KL2612 Relay Outputs Terminal(s)
- Beckhoff KL3022 Analog Input Terminal(s)
- Beckhoff KL4022 Analog Output Terminal(s)

Instrument Start-up

General Start-up Procedure

The MAX300-RTG is shipped with the vacuum system roughing pump oil removed. The pump must be filled with the supplied bottle of oil prior to start-up of the instrument. To load the roughing pump oil:

- Remove the fill port plug from the top of the pump (refer to Figure 29, page 52)
- Pour oil into the pump until visible-half way up the sight glass
- Re-install the fill port plug
-

Caution: There may be slightly more oil in the bottle than necessary to fill the pump. Do not overfill.

Once verified that the sample lines, calibration lines, and purge plumbing are properly installed, the instrument may be turned on. Connect the MAX300-RTG's power input to a power source of the specified electrical frequency, current, and voltage (115V or 230V). The connections must be suitable for the classification of the area in which the equipment is installed. All connections should be secured to their electronic modules.

Power inside the unit is controlled by three main power distribution switches located at the upper right of the enclosure (refer to Figure 28, page 51). The top switch controls the air conditioner, pumps and vacuum system, the middle switch controls the electronics, and the bottom switch controls the heaters. In normal operation, all switches will be left in the ON position when the door to the enclosure is closed. These switches also act as circuit breakers and can be reset by cycling from OFF to ON.

If the area is known to be non-hazardous:

- Make sure it is safe to apply power to the instrument
- On Zone 1/Div 1 units, turn the override key to the “override” (on) position

- Turn the main power switch to the ON position
- Verify that the turbo pump has come up to speed and no leak in the vent valve is present by ensuring the green LED on the turbo pump is lit prior to turning on the electronics (see LED conditions below). If the instrument will be operated for some time with the door open, it can be safely operated with the heater switch turned off. For optimum instrument performance, the heater switch must be on before closing the door.

LED	Symbol	LED status	Display	Meaning
Green	I	Off	———	currentless
		On, flashing		"Pumping Station OFF", rotation speed ≤ 60 min^{-1}
		On, invers flashing		"Pumping Station ON", set rotation speed not attained
		On, constantly		"Pumping Station ON", set rotation speed attained
		On, blinking		"Pumping Station OFF", rotation speed > 60 min^{-1}
Yellow	△	Off	———	no warning
		On, constantly		Warning
Red	ϟ	Off	———	no malfunction
		On, constantly		Malfunction

- The roughing pump oil level must be checked to ensure no bubbles are present, indicating a possible vacuum leak
- Close the door and purge the enclosure once the system is operating normally
- If the purge status indicator does not turn green, check the enclosure for leaks and air supply for sufficient pressure
- If the area is hazardous:
- Before applying power to the unit, turn on the three switches inside the upper right of the enclosure
- Close the front and side doors
- Begin the purge cycle. For Zone 1/Div 1 units, the purge control unit will automatically connect power after purging duration is complete. For Zone 2/Div 2 units, apply power to the unit only after the initial purge time of 12 minutes is complete
- For Zone 1/Div 1 units, both yellow and green indicators will be visible when air is connected. If there is difficulty obtaining either indicator, ensure that all door latches are tight, and all ports into the enclosure are sealed. If necessary, refer to the purge control documents supplied with the unit.
- For Zone 2/Div 2 units, the green indicator will be visible when compressed air is connected. If there is difficulty obtaining a green indicator, ensure that all door latches are tight, and all ports into the enclosure are sealed. If necessary, refer to the purge control documents supplied with the unit.

MAX300-RTG Hardware Maintenance

Overview

The MAX300-RTG, quadrupole process mass spectrometer, is designed for operation by users with no previous mass spectrometer experience. The analyzer performs the ionization, mass filtering, and detection of specified gas and vapor components. The enclosure includes vacuum pumps (both mechanical and turbomolecular), the quadrupole controller (QC), and the vacuum chamber. The onboard computer operates the mass spectrometer, calculates derived values, and manages external communications.

The vacuum chamber has five all metal sealed high vacuum ports to connect components to the chamber. The ionizer assembly, detector, and turbomolecular pump use 4-1/2 inch flanges to connect to the chamber. The RF (electrical) connection for the quadrupole is a 3-3/8 inch flange on the top of the chamber. A port for the vacuum gauge is on the chamber side, in line with the turbo pump. To ensure proper operation, maintenance of the mass spectrometer hardware is required.

Venting the Vacuum System

Required Tools

- (1) Flat blade screwdriver, ¼ inch

To perform maintenance on the pumps or components within the vacuum chamber, the system must be cooled down and vented.

1. With the control software, choose *Control Parameters* under the *Configuration Tab*
2. To turn off the *Filaments, Multiplier,* and *Ion Gauge,* remove the check in the boxes next to them
3. Under *Ionizer*, note the original temperature and set the *Temperature Set Point* to 0ºC
4. Set the sample inlet valve to a stream not containing condensable components. The zero gas is usually suitable.
5. On the transfer line heater control panel, switch off the transfer line heater
6. Unplug the heater, which is bolted to the ionizer flange and plugged into a plastic connector directly behind the ionizer, Figure 27, page 51

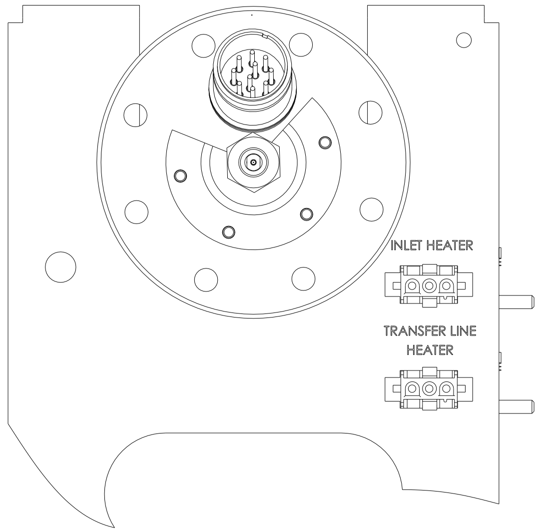


Figure 27: Ionizer Flange

7. Open *Instrument Status* and monitor the ionizer temperature
8. When the ionizer temperature is below 100°C, remove the electronics power by unchecking the box for *Power* in the *Control Parameters* section of the *Configuration Tab*
9. Turn off the pumps via the *Vac System & AC* switch visible in Figure 28 below
10. Turn off the *Heater* switch also visible in Figure 28

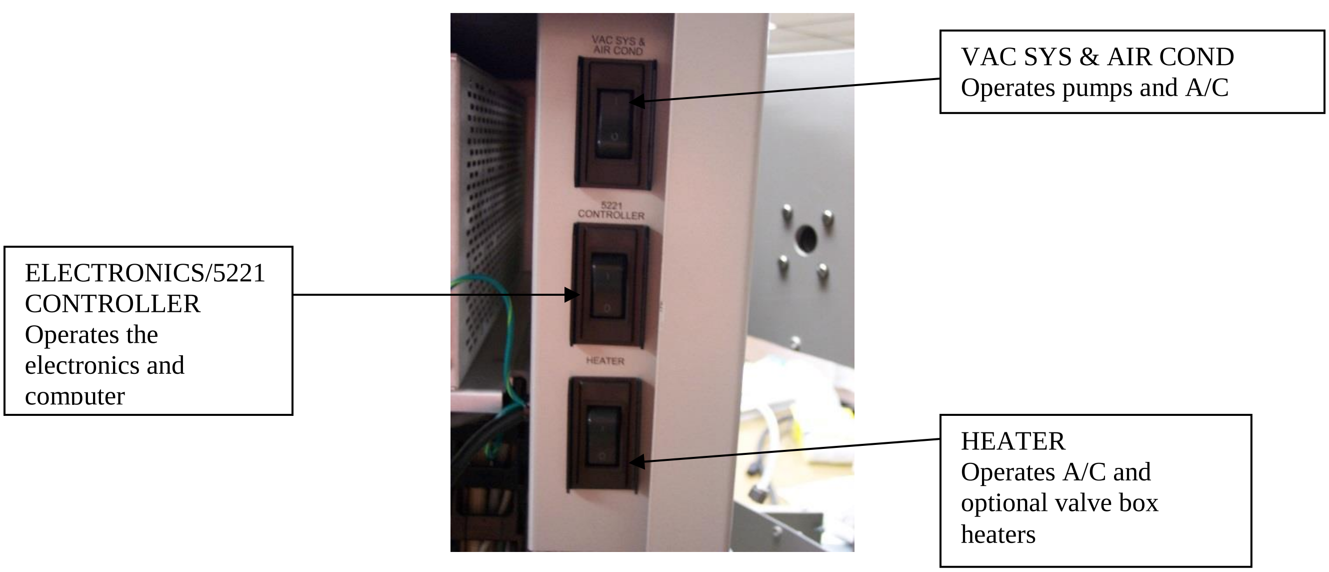


Figure 28: Enclosure Switches

Vacuum Pumps

To maintain a high level of vacuum within the chamber, a rotary vane mechanical pump and a turbomolecular pump are used. The turbo pump is connected directly to the vacuum chamber, while a mechanical (roughing; fore) pump is connected to the turbo pump. The standard system is provided with a turbo pump and a rotary vane pump. Figure 29 shows the location of these components.

Note: Pump vendor and/or specifications are subject to change without notice.

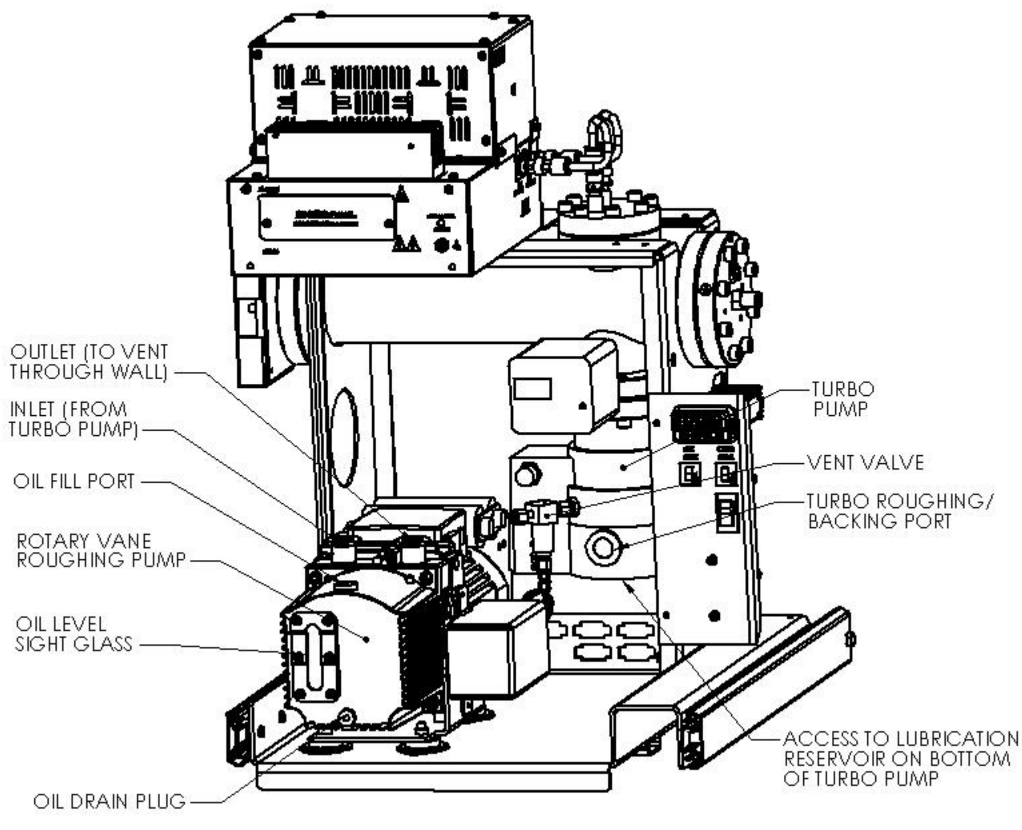


Figure 29: Pump Configuration on VacTrac

Pump Maintenance

Note: Pump oil is considered a hazardous material and requires proper disposal procedures that conform to local regulations.

Turbomolecular Vacuum Pump

Required Tools

- (2) Flat Blade Screwdrivers
- (1) Turbo pump oil wick replacement (Part #819916)
- (1)Turbo pump service tool
- (1) Small mirror (optional)

The turbo pump oil should be changed at least every year, as recommended by the manufacturer. Before changing the turbo pump oil, vent the vacuum system as described on page 50. The oil is changed by replacing a self-contained oil wick, included in the spare parts kit. Remove the rubber feet from the bottom of the turbo pump by unscrewing and discarding them. Engage the holes in the plastic plate on the bottom of the pump, Figure 30 below, with the pins on the provided service tool and unscrew the plate. The seal is made by an o-ring and the plate should be removable by hand. Wipe the plate clean of old oil using a lint free cloth and set aside.

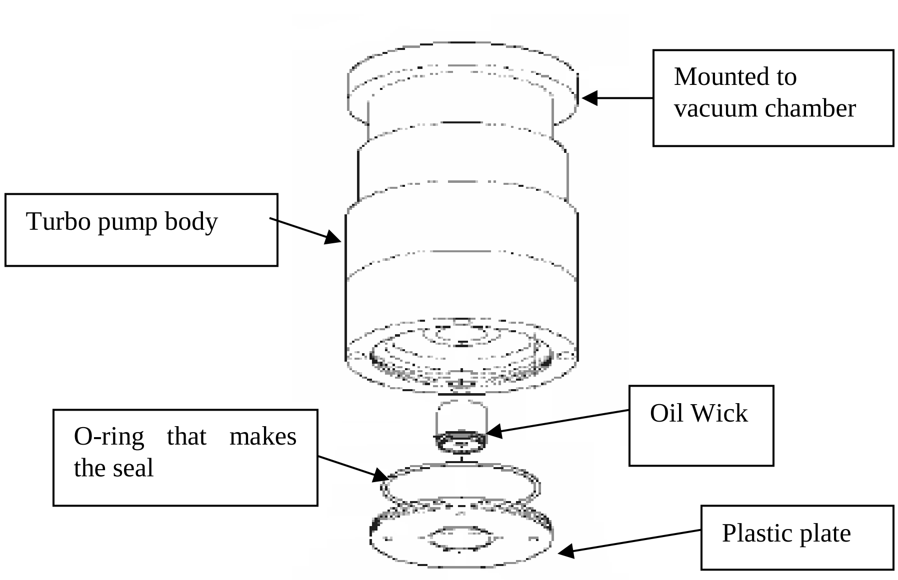


Figure 30: Turbo Pump

The lubricating oil for the pump is contained in an absorbent felt cup oil wick mounted in a plastic housing fitted into the bottom of the pump. The housing has a groove near the exposed end that can be used to pry it out of its recess. A small screwdriver is most often used for this procedure. When removing the oil wick, do not touch anything inside the turbo pump. Once the old oil reservoir is removed, wipe the old lubricant from the pump with a lint free cloth.

When inserting the new oil wick, take extreme care to not push it too far into the pump. This can result in pump failure. Insert the new oil wick into the bottom of the pump by seating it on the plastic plate until it is held in place by its o-ring. The lubricant reservoir is pre filled with the correct type and amount of oil. Do not add additional lubricant.

Screw the plastic plate back into the pump bottom. To avoid crossed threads, initially rotate this plate *counter* clockwise until a click is felt, and then reverse direction. If the plastic bottom is not properly seated, a leak could occur and result in pump failure.

For additional information or recommendations, please contact the manufacturer directly.

Mechanical Vacuum Pump

Required Tools

- (1) Oil Catch Pan
- (1) Flat Blade Screwdriver
- (1) 5mm Hex Key (Allen Wrench)
- (~500 ml) Roughing Pump Oil

Extrel CMS Technical Support recommends that the oil in the roughing pump for the MAX300-RTG be changed every six months or if the oil is darker than a light amber color. The rate of oil deterioration will vary depending on the application. The first step in this procedure is to vent the vacuum system as described on page 50.

Both the roughing pump and its oil will be hot (up to 80ºC). After venting the system, **disconnect the inlet line from the enclosure wall** and release the slide latch on the left side of the *VacTrac* assembly (refer to Figure 29, page 52). Pull the *VacTrac* out of the enclosure far enough to place a catch pan under the drain plug of the roughing pump. The capacity of this pan should be considerably larger than the 450 ml (2 cup) capacity of the pump, shown in Figure 31, below.

Figure 31: Roughing Pump

Using a 5mm hex key, remove the drain plug on the front of the pump to allow the oil to drain into the catch pan. Loosening the fill plug will speed oil drainage. Once the oil has drained out of the pump, re-install the drain plug and tighten it. Note the color of the oil. If any of the following colors are present, be sure to flush out all of the old oil during the oil change:

1. Yellow: Pump needs new oil (approximately six months of use)

2. Dark Yellow: The oil should have been changed a few months ago.

   If this is the color of the oil in a six month period, there may be a slight leak in the vacuum system. Check periodically to make sure that the oil does not change in color again.

3. Amber: A pump failure may be imminent. Check the pump oil every month.

Remove the oil fill plug located on top of the pump. Carefully pour new vacuum pump oil (appropriate for the pump and application) through the fill plug opening until the oil level in the site glass window is between the fill lines on the pump housing. Lastly, re-install the fill plug, remove the catch pan and properly dispose of the used pump oil.

Inlet Valves

Caution: Sample gas is routed from the sample selector valves to the mass spectrometer inlet flange through transfer tubing. This tubing forms part of the sample containment assembly, which is a component of the safety system of the unit. It must not be damaged or modified in any way. When accessing pumps, vacuum system, or electronics for system maintenance, ensure that this tubing is not kinked or damaged, as this can affect safety of the system. Please contact Extrel service with any questions.

In the most common configuration, the sample selection valve, the heated transfer line, and the inlet assembly deliver the sample stream to the instrument for analysis. The sample selection valve is used to select the sample stream to be analyzed while the transfer line connects the output of the desired stream to the pressure reduction system and the inlet assembly. The tee of the inlet is used to remove excess sample and decrease inlet clearing time. A small portion of the sample stream flows through the heated transfer line, into the inlet, and is admitted into the mass spectrometer. A flow switch (50 cc/min) is used to monitor for loss of sample flow at all times.

The transfer line, tee and inlet assembly can be heated to prevent condensation of stream components as the sample is transported into the mass spectrometer. The transfer line can heat the tubing from room temperature to 300°C. A heater located around the inlet heats the assembly. Alternative sample path components may be present, depending on the application and sample configuration.

The inlet requires no regular maintenance. The size of the fused silica inlet restrictor is dependent on the application. Particulates in the sample stream may clog the assembly and force it to be changed.

Changing the Inlet

Required Tools

- 3/4 inch Open End Wrench
- 5/8 inch Open End Wrench
- 9/16 inch Open End Wrench
- 3/16 inch Open End Wrench
- 9/64 inch Hex Key
- Ohm Meter

Warning – This inlet forms a “containment system” that allows sample gas to be safely introduced into the mass spectrometer. Replacement of the inlet must be done using new Extrel approved components while carefully

following the instructions given here. Please contact Extrel service with any questions.

The first step to changing the inlet is to properly vent and cool the vacuum system. Disconnect the *VacTrac* from the enclosure wall feed through and slide it out of the enclosure.

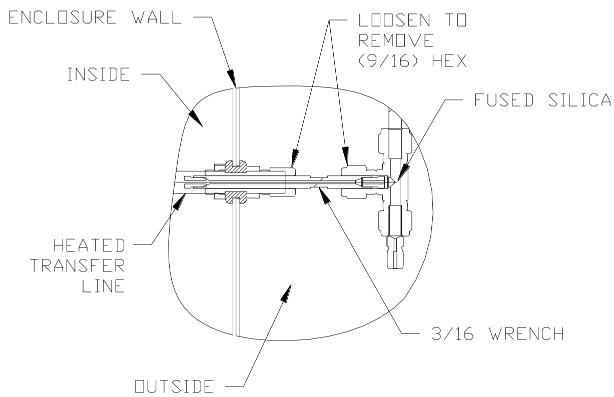


Figure 32: Inlet

The input end of the transfer line is held in place by two fitting nuts located in the external valve enclosure. Loosen the two nuts shown in Figure 32, above, and carefully slide the transfer line through the fitting on the enclosure wall. A short length of the fused silica restrictor will be visible. This is the sampling point for the mass spectrometer, so be careful to not clog or contaminate this critical region.

After sliding the *VacTrac* out of the enclosure, disconnect the transfer line heater's power and thermocouple connections. The heater power connector is located on the chamber support structure just below and behind the ionizer flange. The thermocouple connector is located on the back of the transfer line temperature controller located in the same area.

Remove the inlet heater from the ionizer mounting flange. The inlet heater is attached to the flange by four (9/64 Hex Key) screws at the base of the heater that thread directly onto the flange, shown in Figure 33.

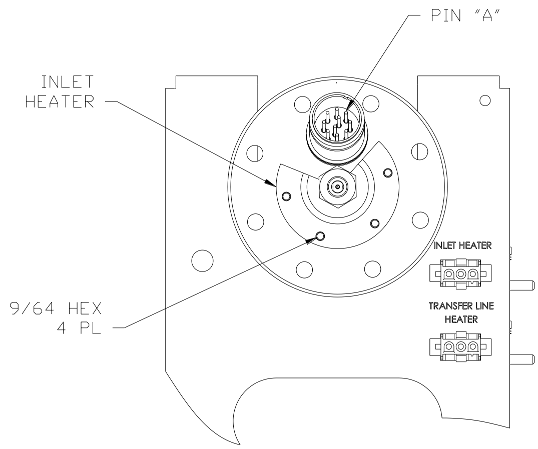


Figure 33: Inlet Mounting

Once the flange has cooled, remove the inlet by loosening the large central fitting on the ionizer flange. The hex closest to the flange (5/8 inch) is welded on. The outer hex nut (3/4 inch) can be rotated counterclockwise to loosen the fitting and remove the inlet. Be careful when loosing this fitting that the wrench does not contact the ten pin vacuum feedthrough and damage it.

Withdraw the inlet from the flange and remove the non-reusable metal gasket. A short length of the fused silica restrictor will be visible, as in Figure 34, below. Avoid clogging or contaminating this critical region.

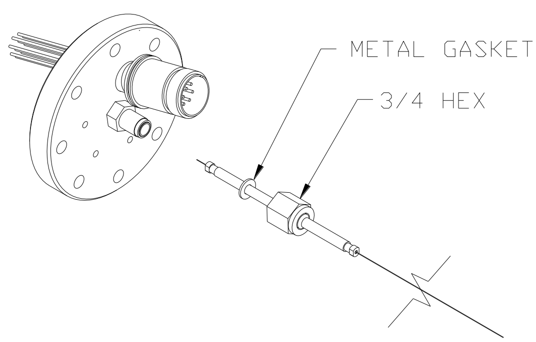


Figure 34: Inlet

Verify that the replacement inlet has a new metal gasket in place. Slide the end of the inlet into the flange fitting and tighten the nut ¼ turn past finger tight. Before finishing the installation of the sample line, check that the new inlet is not touching the ion region. Use an ohm meter to verify that pin “A” (refer to Figure 41, page 63) on the ionizer feedthrough is not shorted to ground. Replace the transfer line heater and thermocouple connectors. Reinstall the inlet heater onto the ionizer flange and plug its heater into the connector on the chamber support. Slide the *VacTrac* back into the enclosure and engage and lock the latch on the left side.

Thread the sampling end of the inlet through the fitting on the enclosure wall. Tighten the ¼ inch nut (9/16 hex) that secures the transfer line to the enclosure wall. Carefully insert the end of the transfer line into the sampling tee fitting until it stops and tighten the ¼ inch nut (9/16 hex) that secures it in place.

Sample Stream Rotary Inlet Valves

Sample introduction into the enclosure is performed by rotary valves. During the life of the rotary valve, a few common problems that may arise.

No flow

- A pressure of 5 PSIG above atmospheric pressure is usually sufficient to establish flow. Sampling sub atmospheric streams requires special techniques. If the sample line is not at sufficient pressure, the instrument will not register a flow.
- Each inlet to the rotary valve is equipped with a filter. If it becomes clogged, it can be temporarily removed to troubleshoot the no flow condition. Do not operate continuously without a filter. Any particulates present in the sample will shorten the valve’s life.
- If the actuator loses proper alignment with the valve body, it may resemble a blocked valve.

Valve will not rotate

- May result from an improperly connected valve actuator, either the DC power cord or the *Serial COM* cable (three pin push on connector) that commands the actuator
- A faulty valve actuator
- A valve rotor that has seized

Valve selects the wrong stream

- Indicates a problem with valve alignment. Refer to the *Multiposition Electric Actuator Instruction* manual for the procedure to align the valve
- A badly scored rotor will allow "cross talk" between adjacent streams

Analyzer Assembly

Contained within the vacuum chamber is the actual chamber assembly. This assembly consists of the ionizer, quadrupole mass filter, and detector, as shown in Figure 35 below.

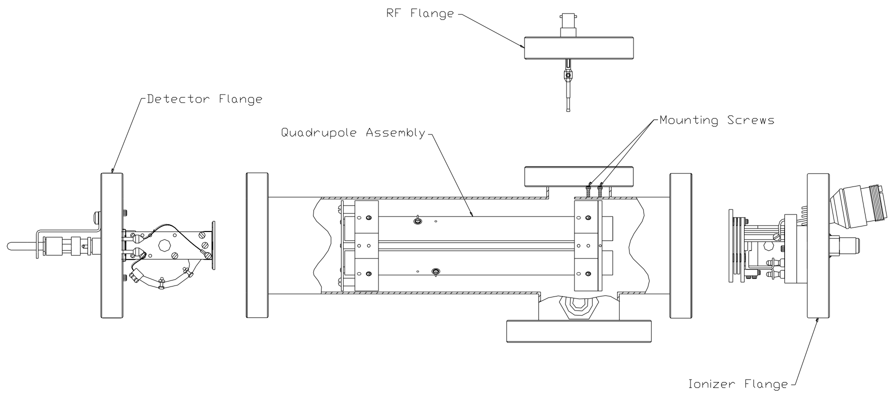


Figure 35: Analyzer Assembly

Ionizer and Filaments

The MAX300-RTG ionizer assembly, depicted in Figure 36, below, includes the most frequently serviced components of the ionizer into a single removable module. This module includes two filaments, the ion region, and the lens stack.

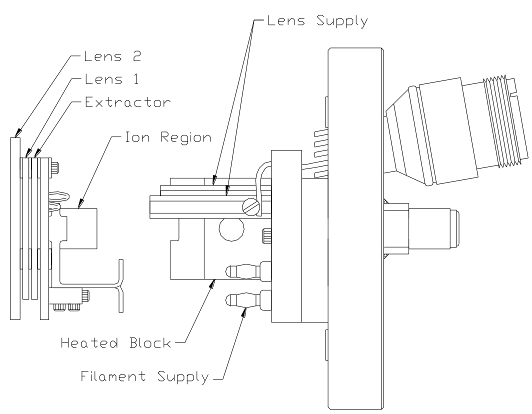


Figure 36: Ionizer

The ionizer assembly used in the MAX300-RTG has been designed for easy installation and servicing. Figure 37 below depicts the ionizer assembly mounted on the flange.

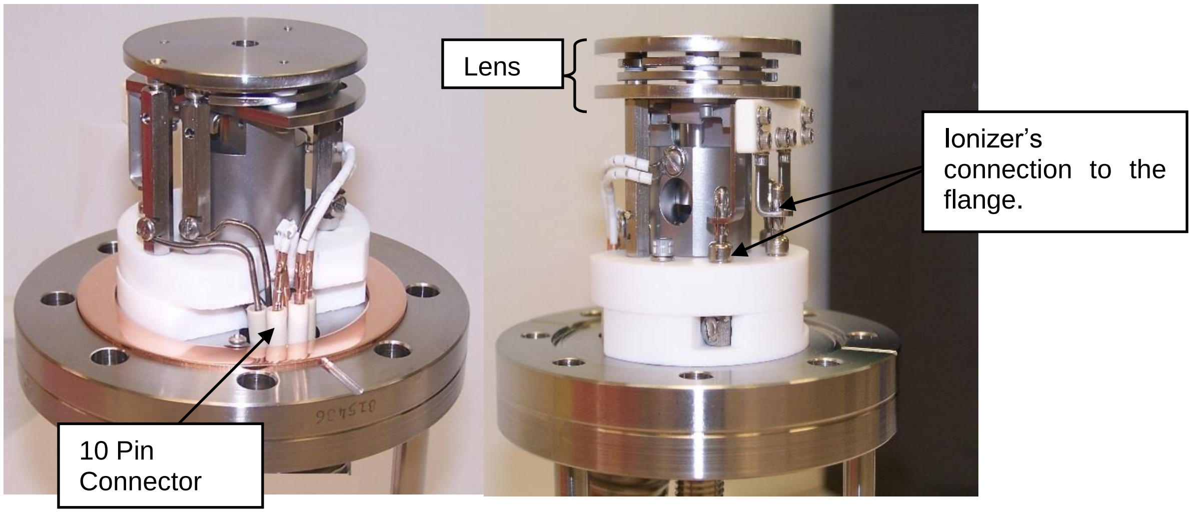


Figure 37: Ionizer Assembly Mounted on Flange

Tungsten or Yttria coated Iridium are available as the filament material. Two filaments are present in the assembly, located on each side of the ion volume. Only one filament is used at a time. When Filament 1 has reached the end of its useful life, Filament 2 will automatically be put into effect. However, the system will NOT transition automatically from Filament 2 to Filament 1. If both filaments have burned out, the entire ionizer assembly must be replaced.

Note: Because the ionizer may be hot and remain hot for several hours in a vacuum situation, caution should be taken when removing the ionizer assembly from the vacuum chamber.

Changing the Ionizer Assembly

The first step in changing the ionizer assembly is to vent the vacuum system. Following this, disconnect the ionizer connection cable and remove the inlet. It may be convenient (though not required) to remove the ionizer's inlet tube by loosening the large central fitting on the ionizer flange, Figures 38 and 39 below. The hex closest to the flange (5/8 inch) is welded on. The outer hex nut (3/4 inch) can be rotated counter clockwise to loosen the fitting and remove the inlet. Be careful when loosening this fitting that the wrenches do not contact the ten pin vacuum feedthrough and damage it. Set the inlet aside where it will stay clean.

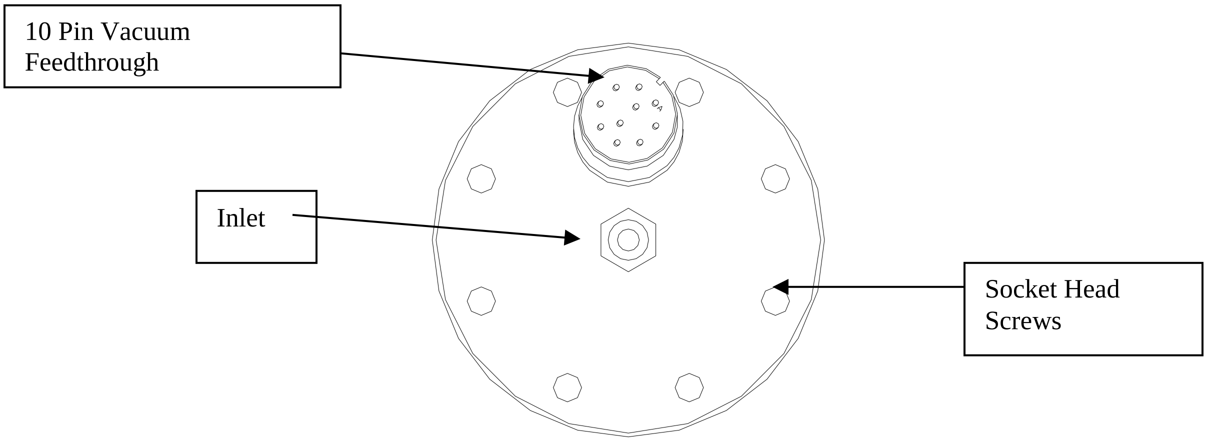


Figure 38: Ionizer Flange

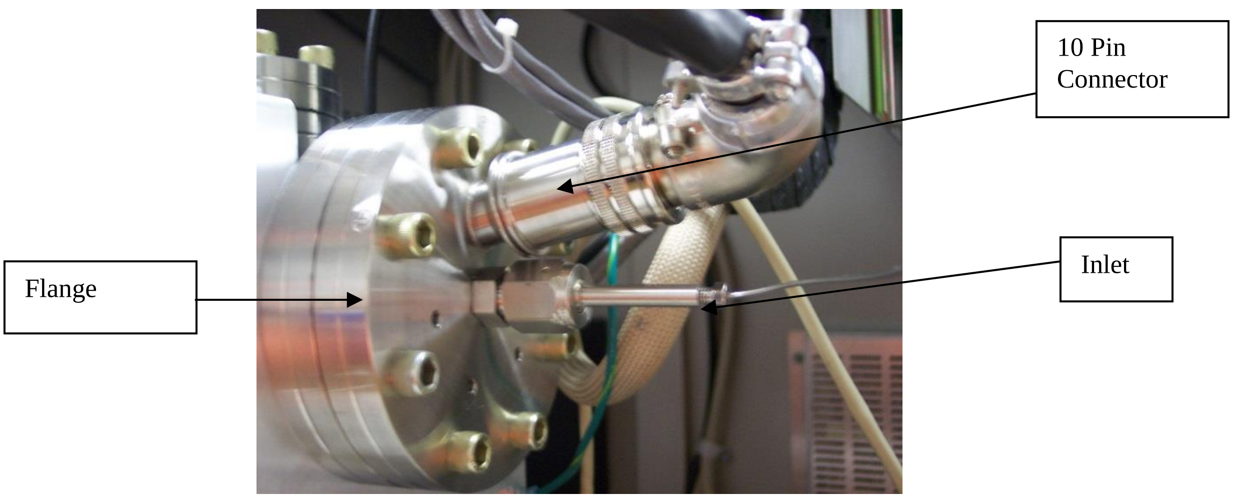


Figure 39: Ionizer Flange with Inlet and 10 Pin Connector

The ionizer flange is held to the chamber with eight socket head screws (1/4 inch hex key). Remove the flange and set it on a clean work surface. Remove and discard the nonreuseable copper gasket.

The ionizer assembly is held in place by spring loaded electrical connections. It can be removed by grasping the last lens and pulling the module straight from the flange. The new module is installed by inserting the central ion region into the flange mounted heated block, aligning the electrical connections and pushing it in place. If the assembly is properly installed, no gap should be visible between the fixed part of the ionizer block and the innermost plate of the ionizer. The total height of the assembly can be measured from the vacuum side of the flange and should be 2.50 inches (63.5 cm). If this dimension is more than 2.54 inches (64.67 cm), lens 2 will short to the quadrupole rods.

Using a new 4-1/2 inch copper gasket, install the ionizer flange onto the vacuum chamber. A threaded hole on one side of the electrical feedthrough, visible in Figure 40 below, can be used to hold the copper gasket in place. Install the bolts on the flange finger tight.

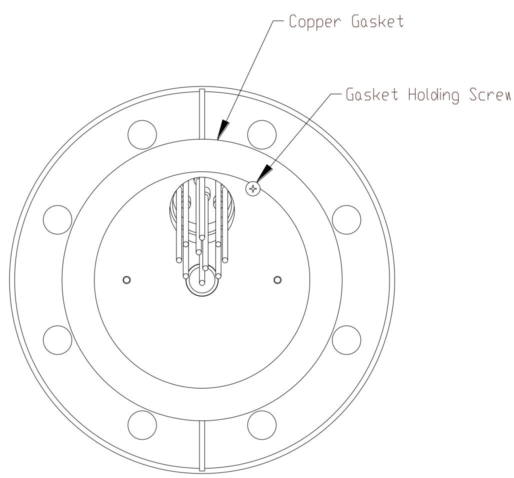


Figure 40: Reinstalling Ionizer Flange

Note: Never reuse a copper gasket. A scratch undetectable to the eye may be present and result in a vacuum chamber leak.

Use an ohm meter to verify proper installation of the ionizer before tightening the ionizer flange bolts. The filaments, thermocouple, and heaters will read low resistance when measured. Check all the pins for shorts to ground (the chamber) and to each other. Also check for a short between lens 2 and either of the quadrupole connections on the top of the chamber. If the quadrupole has been removed for service, postpone this step until it has been reinstalled. Figure 41, below, depicts the wiring for the ten pin vacuum feedthrough. Table 1, below, shows the function of each pin.

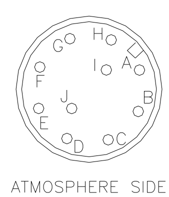


Figure 41: Inlet Flange 10 Pin feedthrough wiring

Table 1: 10-Pin Vacuum Feedthrough

Pin	Function
A	Thermocouple (+)
B	Extractor
C	Filament 1
D	Filament Common
E	Filament 2
F	Lens 2
G	Heater
H	Thermocouple (-)
I	Heater
J	Lens 1

When all the electrical tests have passed, tighten the flange bolts a little at a time in a cross pattern to keep the flanges parallel, prevent leaks, and keep the copper gasket from becoming warped.

Quadrupole Mass Filter

The mass filtering device used in the MAX300-IG is as the quadrupole. This component is located directly behind the ionizer and utilizes the vacuum chamber as both its enclosure and mounting structure. The quadrupole is comprised of four 3/4 inch (19mm) stainless steel rods and provides a mass range of 2 to 250,300, or 500 amu (configuration dependent).

Quadrupole Removal

Required Tools

- (1) 1/8 inch (3 mm) Flat Blade Screwdriver
- (1) ¼ inch Hex Key
- (1) 5/64 inch “Allen” or Hex key
- (1) Pair Lint Free or Nylon Gloves

Note: When handling any clean vacuum chamber components, lint free or nylon gloves must be worn.

Note: The following procedure needs to be read in its entirety before attempting to remove the quadrupole assembly.

Before removing the quadrupole, the vacuum system must be vented. Slide the *VacTrac* assembly out of the enclosure by disconnecting the inlet line from the enclosure wall and releasing the slide latch on the left slide of the *VacTrac* assembly. Disconnect the RF cables from the feedthrough flange on the top of the vacuum chamber shown in Figure 42, below, by pushing down, rotating ~1/4 turn counterclockwise, and then pulling. The RF connection flange assembly can then be detached from the vacuum chamber (1/4 inch hex key).

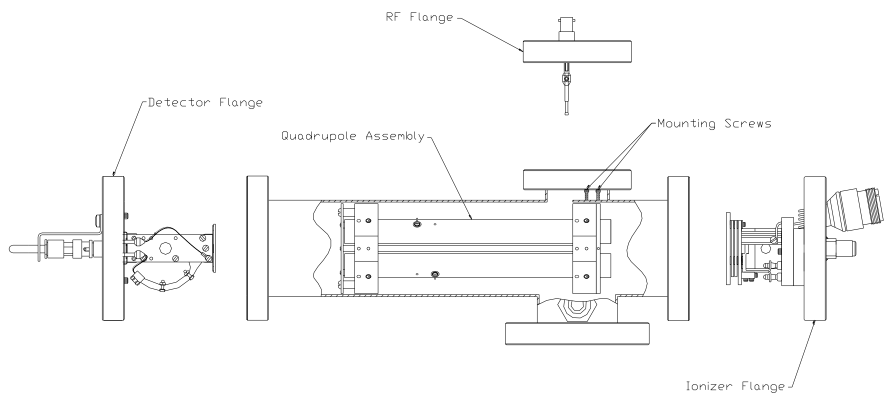


Figure 42: Quad Assembly and Vacuum Chamber

The quadrupole can be removed from either the ionizer end or detector end of the vacuum chamber. The detector end is nearest the wires that connect opposite poles. If the ionizer has also been removed for routine maintenance, the quadrupole can be pulled out the front of the chamber. If not, the assembly may be removed from the rear by detaching the detector mounting flange. In both cases, a 1/4 inch hex key is required.

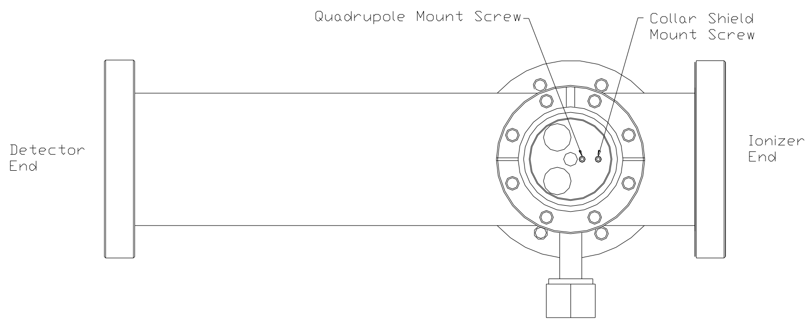


Figure 43: Quadrupole RF Connector Port

When looking down through the RF connector port of the chamber, as in Figure 43 above, the two 2-56 socket head screws (5/64 inch hex key) that secure the quadrupole mass filter assembly into the vacuum chamber are visible. By removing the collar shield screw and the quadrupole mount screw, the assembly can be pulled out of the chamber and placed in a clean area (a sheet of lint-free tissue paper placed on a level surface).

Note: do not force the quadrupole through the chamber! If it gets stuck, gently slide the assembly side to side and up and down until it is easily removed.

Quadrupole Collar Shield Disassembly

Required Tools

- (1) Pair Lint Free or Nylon Gloves
- (1) 1/8 inch (3mm) flat blade screwdriver

Once removed from the vacuum chamber, a partial disassembly of the quadrupole is necessary before cleaning. Place the quadrupole on a clean, level working surface before beginning the disassembly procedure.

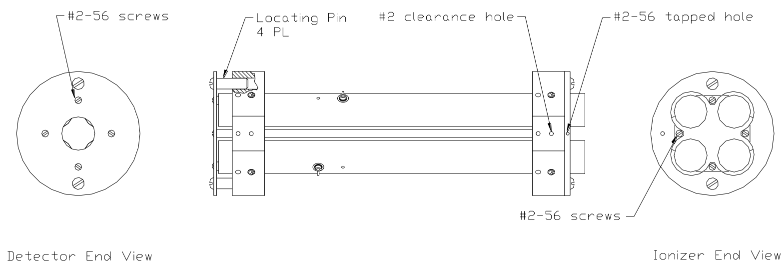


Figure 44: Quadrupole Collar Shield

Using the flat blade screwdriver, remove the four 2-56 pan head screws used to secure the ionizer end collar shield plate, visible on the right of Figure 44, above. Remove the collar shield by sliding the remaining components out of the detector end of the mass filter assembly. This is best performed by grasping the remaining collar shield plate and gently pulling. Locating pins are incorporated into the detector end plate to limit rotation of the assembly with respect to the quadrupole. These pins will pull out of the mass filter collar without any additional disassembly. (To clean the shield rod assembly, it is convenient to remove the four shield rods from the detector end by removing the remaining four pan head screws.) The wires connecting opposing poles can be left in place.

Note: **Under no circumstances** should the screws holding the quadrupole rods to the ceramic collars be removed, adjusted or checked for tightness.

Quadrupole Cleaning

Required Tools

- (1) ¾ to 1-inch diameter bottle brush with the wire "knot" removed from the end and the handle covered in plastic.
- (~5) Cotton Swabs
- Small amount of Pumice
- Small amount of Alconox
- Hair Dryer
- (2) Lint-free Tissue Paper Wipes
- (1) Pair Powder-free Latex Gloves
- A source of clean tap water
- Distilled water (most convenient in a lab style wash bottle)

Visible deposits will usually be confined to the first 3/4 inch (2 cm) at the ionizer end of the assembly, furthest from the wires that connect opposing poles.

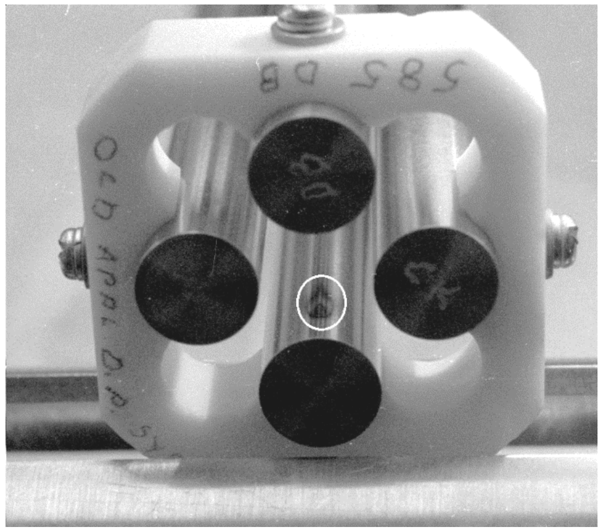


Figure 45: Visible Deposits

The highlighted area in Figure 45 above shows visible deposits on one of the poles. A similar deposit is present on the opposite pole. The most effective way of removing deposits from the quadrupole is to scrub the affected area with a cotton swab and paste of 95% pumice and 5% Alconox. Confine this scrubbing motion to the circumference of the poles, avoiding scrubbing in a longitudinal direction. **It is very important to avoid scratching the quadrupoles.**

When the deposits have been removed, the quadrupole will require a general overall scrubbing using the pumice and Alconox paste. Use a brush of 3/4 to 1 inch diameter inserted along the axis of the assembly. This brush should have the wire knot at the end removed and the handle covered in plastic. Clean the inside of the quad by *rotating* the brush.

Rinse the assembly thoroughly in tap water followed by distilled water. Watch for the formation of a uniform, continuous film of water. Formation of individual droplets indicates the presence of a hydrocarbon film and will require the assembly to be cleaned again. When cleaning is completed, dry completely with a warm oven or hair dryer and place on a clean surface for reassembly.

Quadrupole Reassembly and Vacuum Chamber Installation

Required Tools

- (1) 5/64 inch Hex Wrench
- (1) Pair Lint Free or Nylon Gloves
- (1) New 3-3/8" Copper Gasket
- (1) New 4-1/2" Copper Gasket
- (1) 1/4 inch Hex Key
- (1) 1/8 inch Flat Blade Screwdriver

With the quadrupole cleaned, the collar shield assembly will be re-attached and the quad installed into the vacuum system. An ohmmeter will verify that nothing is shorted to ground before the system is pumped back down.

To re-attach the collar shield assembly, slide the detector end plate with the rods attached into the quadrupole from the detector end. The locating pins must fit into the holes of the ceramic mounting collars as shown in Figure 46 below.

Use the four 2-56 pan head screws to attach the ionizer end plate to the free ends of the shield rods at the ionizer end of the quad. Be sure to orient this plate properly. The recessed area faces outward and the threaded hole in the edge is aligned with the pair of holes in one of the corners of the ceramic collar.

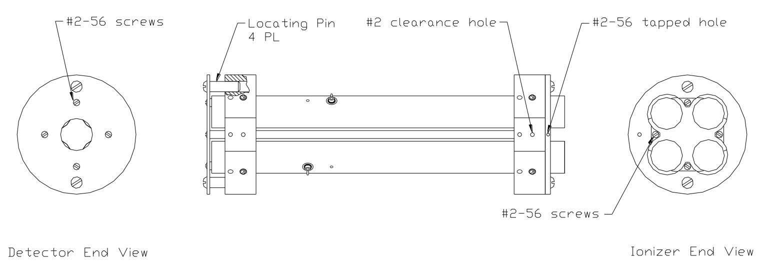


Figure 46: Locating Pins of Quadrupole

When this is completed, the quadrupole assembly can be inserted into the vacuum chamber. Be sure the ionizer end will face the ionizer and the detector end will face the end nearest wires connecting opposite poles. Also, rotate the quad assembly so the threaded hole in the edge of the ionizer end plate is on top.

As noted previously, the quadrupole is secured within the vacuum system by two screws. One screw engages the ceramic mounting collar and one threads into the collar shield rod assembly. The quad assembly must be slid far enough into the chamber so the holes in the chamber for these screws line up with the matching holes in the quad assembly. This can be observed by looking into the RF connection flange mounting port on top of the vacuum system.

A bird's eye view depicting the location of these holes is shown in Figure 47 below. Two 2-56 socket head screws with lock washers and the 5/64 inch hex wrench is needed to secure the assembly.

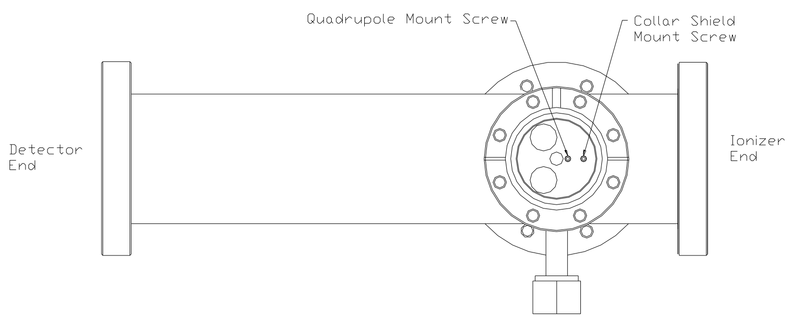


Figure 47: RF Connection Flange – Bird's Eye View

The RF connection flange assembly should then be installed onto the vacuum chamber with a new 3-3/8 inch copper gasket. The spring loaded contacts of the RF connection flange must make contact with the quadrupole rods, not the collar shield end plate or chamber. The vacuum feedthroughs on this flange, when properly installed, are offset toward the *detector* end of the chamber. Initially leave these screws finger tight.

Use the ohmmeter to check the continuity between the feedthrough contacts on the flange and the quadrupole rods and check for shorts to the chamber. Either the ionizer or the detector flange will have to be removed to accomplish this. Once verified that the electrical connections are correct, finish tightening the RF flange screws. The securing socket head screws (1/4" hex key) should be tightened in a crossing pattern that keeps the flanges parallel to each other.

If the ionizer mounting flange was removed, it should be re-installed using a new 4-1/2 inch copper gasket. The securing socket head screws will require a 1/4 inch hex wrench. Use the ohmmeter to check that the ionizer lenses are isolated from one another, the vacuum chamber, and the quadrupole. If the detector mounting flange was removed, it will need to be re-attached using a new 4-1/2 inch copper gasket and the 1/4 inch hex key for the securing socket head screws. Position the detector mounting flange so that the HV feedthrough is towards the *back* of the vacuum chamber. Use the ohmmeter to check that the detector connection feedthrough(s) are isolated from both the vacuum chamber and the quadrupole rods.

Detector

Two different detector options are offered. The standard detector is the faraday plate. This component, located directly after the quadrupole, collects the signal of the ions. An optional electron multiplier detector assembly is available for increased dynamic range. It is recommended that the standard faraday detector be wiped off occasionally, especially for dirty applications. Figure 48 below shows the faraday detector.

Figure 48: Faraday Detector

Electron Multiplier Removal and Replacement

Required Tools

- 1/4 inch Hex Key
- 3/32 inch Hex Key

Note: a "ball end" type is most convenient.

- (1) 4-1/2 inch Copper Gasket
- Pair Lint Free or Nylon Gloves
- #2 Phillips Screwdriver

Instruments equipped with the optional electron multiplier detector will require replacement of this component after the required gain can no longer be achieved. When this occurs, the vacuum system must first be vented. After venting, disconnect the inlet line from the enclosure wall and release the slide latch on the left slide of the *VacTrac* assembly and extend the *VacTrac* out of the enclosure. Remove the connection cables on the detector flange (the multiplier HV cable and the preamp cable). The preamp assembly is detached using the Phillips screwdriver to remove the two preamp securing screws. Figure 49, below, shows the preamp assembly.

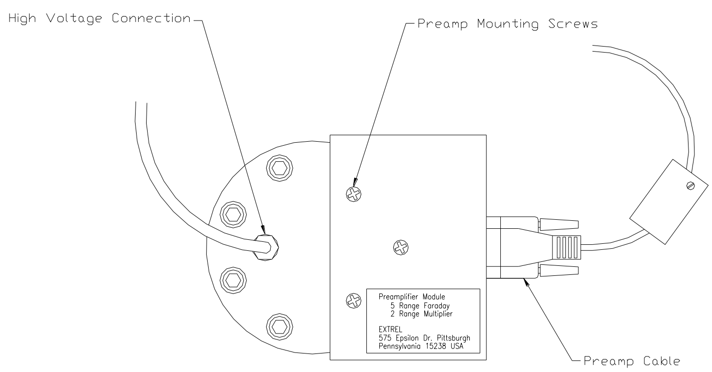


Figure 49: Preamp Assembly

The detector mounting flange can be detached from the vacuum chamber by removing the securing socket head screws using a 1/4inch hex key. Discard the old copper gasket.

Note: Care must be taken when removing this flange to not damage the detector assembly as the securing screws are removed. Support the flange as the last screw is taken out and pull the assembly straight back from the vacuum chamber.

The replacement multiplier (P/N 810670) is a completely assembled multiplier with all the wires attached and the extended faraday plate installed. Remove the old detector assembly and install the new one on the flange. Place the detector mounting flange onto a clean level working surface to begin the replacement procedure.

The electrical connections can be pulled straight off the flange feedthroughs. The multiplier is held to the flange with two 4-40 screws that can be removed with a 3/32inch hex key.

Install the new multiplier onto the flange in the same orientation as the old one using the 4-40 screws and connect the wires to the flange feedthroughs by pushing the connectors straight on. Refer to Figure 50, below, to verify that the wiring is correct.

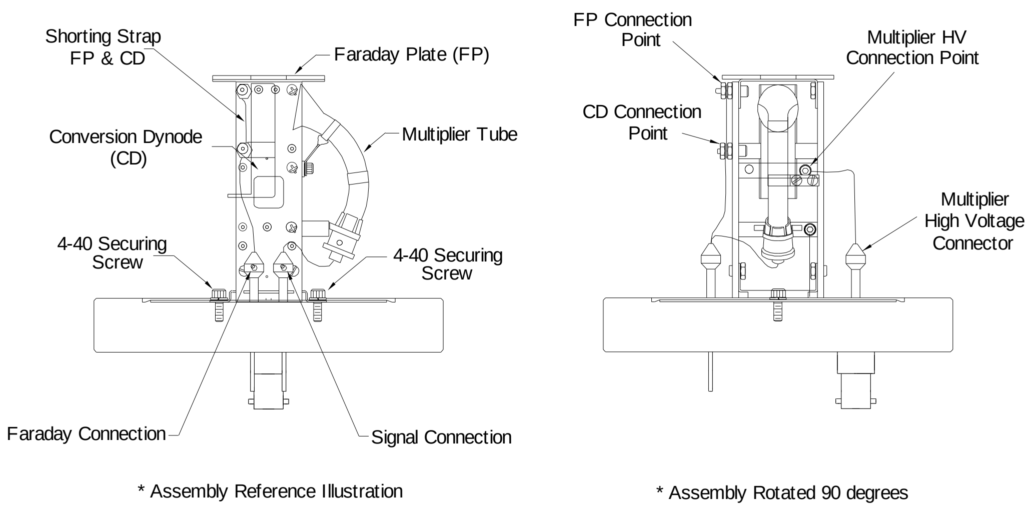


Figure 50: Multiplier Flange

Install the detector flange onto the vacuum chamber using a new 4-1/2inch copper gasket in the same orientation it was originally. There are two threaded holes on the flange that can be used to hold the copper gasket in place. Initially tighten the bolts finger tight. Use an ohm meter to verify that each of the three detector electrical leads is isolated from each other, from ground and from the quadrupole.

Note: It is normal for the high voltage connection to show 80 Megohms when measured to ground.

Once verified that the wiring is correct, tighten the flange bolts a little at a time in a cross pattern to keep the flanges parallel, prevent leaks, and keep the copper gasket from becoming warped. Start the turbo and roughing pump. When both are working correctly, attach the preamp to the flange and re-install the preamp and multiplier HV cables.

Vacuum Gauge

An ionization pressure gauge is installed above the turbo pump. This device allows the user to monitor the pressure in the ionizer region of the vacuum chamber through the control computer software. The ionization type vacuum gauge requires no regular maintenance. It has a spare filament built in that is selectable with a switch labeled *Filament Select*. When both filaments have burned out the gauge must be replaced.

Remaining Components in the Enclosure

In addition to the vacuum system components, the control electronics are also mounted in the enclosure, including the Quadrupole Controller (QC), the preamplifier, and the card cage with its modules.

Resonating the Quadrupole Power Supply (QC)

Required Tools

- Voltmeter capable of reading 10VDC (analog type preferred)
- Flat Blade Screwdriver
- #1 Phillips Screwdriver

Whenever the quadrupole has been removed from the vacuum chamber for cleaning, the quadrupole power supply will need to be resonated after the system is running again. This will indicate if a problem has occurred when the quadrupole was re-installed into the vacuum system as well as insure optimum performance of the instrument. The resonating procedure can be performed as soon as the system is running to validate installation. For optimum performance it should be repeated after the system has been running several hours and all components have reached thermal equilibrium. Figure 51, below, depicts the quadrupole controller.

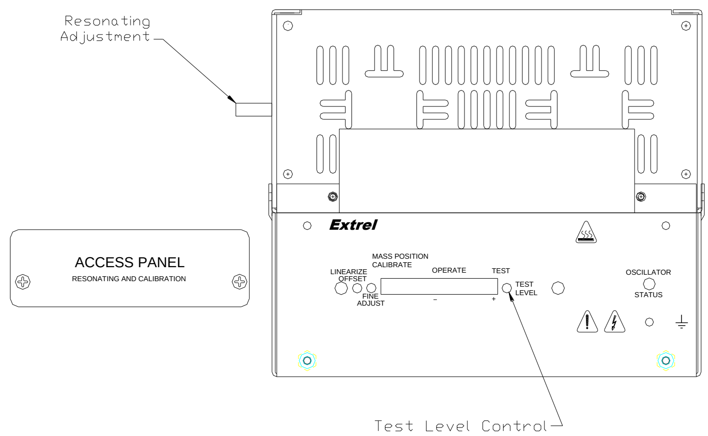


Figure 51: Quadrupole Controller (QC)

Note: The area must be non-hazardous for this procedure to be performed.

Using the controlling software, set the instrument to scan some small mass window (10 amu) in the range where the instrument is most often used.

To resonate the QC:

- Remove the access plate from the front of the QC labeled *Resonating and Calibration*
- Locate the switch on the front of the QC labeled *Test – Operate* and place it in the *Test* position
- Connect the voltmeter to the test points on either side of the switch. The positive lead connected to the right test point and the negative lead to the left one. The scale should be zero to 10VDC.
- Use a small screwdriver to rotate the control labeled *Test Level* to the full clockwise position
- The voltmeter should now show an indication of a few volts
- Using a flat blade screwdriver, slowly turn the Lucite rod (resonating adjustment) located on the side of the QC using a flat blade screwdriver until the indication on the voltmeter is maximized
- Disconnect the voltmeter
- Return the *Test Level* control to its full counter clockwise position
- Return the *Test – Operate* switch to the *Operate* position
- Install the access panel on the front of the QC

Note: Be sure not to turn the Lucite rod a full turn. The slit in the rod should be approximately 45° from vertical.

Data System

Data system (computer) maintenance consists of file management. The computer is mounted above the electronics chassis within the pressurized enclosure.

Air Conditioner

These units are equipped with an integral climate control system. Air conditioners are the standard cooling method. Depending upon model, the air conditioner uses Type R410A or R134A refrigerant. The condensate drain tube is on the rear or the bottom of the unit, and should be plumbed and routed to an appropriate atmospheric pressure drain. The air conditioner is equipped with an internal valve that allows condensation to drain periodically, therefore a drain trap is not required. In situations where cooling water is available, a water cooled heat exchanger is available as an option.
The air conditioner unit on the MAX300-RTG is rated at 5000 to 6000 BTUH, depending on model. Some models of air conditioners are interlocked with the front door of the enclosure. If the door is opened while the MAX300-RTG unit is running, the air conditioner compressor will turn off and the internal fans will remain running.

Caution – open the front door only when the area is known to be non-hazardous.

When the door is closed, the compressor will re-start. Note that if the door is open for only a short time, it may take a few minutes for the compressor to re-start. The only regular maintenance required on the air conditioning unit is regular cleaning of the external air filter to maintain sufficient air flow.

- **Compressor:** Requires no maintenance. It is hermetically sealed and properly lubricated for years of satisfactory operating service.
- **Refrigerant Loss:** Since this air conditioner is certified for use in hazardous locations, disassembly will void certification. To maintain certification and therefore safety, any air conditioner malfunction must be reported to Extrel CMS Technical Support.
- **Fans and Motors:** All bearings, shafts, etc. are lubricated for the life of the unit. The condenser blower and the evaporator blower are thermally protected to prevent over temperature conditions.
- **Condenser and Evaporator:** The coils are constructed of copper tubes with mechanically bonded aluminum fins, specially coated for corrosion resistance. While no maintenance is ordinarily required, the fins should be checked for the accumulation of dirt and debris. Periodic cleaning of dirt and debris from the outside fin surface may be required to maintain operating

performance. Care must be taken during cleaning to prevent damage to the coil fins.

Note: Even though the condenser coil is coated to resist deterioration, operation of this air conditioning unit in areas containing airborne caustics or chemicals can deteriorate filters and coils. Regular inspection is recommended when operating in these atmospheres.

- **Priming of Drain Hose:** Not required
- **Condenser Inlet Filter:** Proper maintenance of the inlet filter is required to assure normal operation of the air conditioner. If filter maintenance is delayed or ignored, the maximum ambient temperatures under which the unit is designed to operate will be decreased.

Filter Removal and Installation

- Locate the air filter on the side of the air conditioner unit.
- Some models require removal of the four screws retaining the filter frame. A T25 torx driver is required. Other models have a slide-out filter.
- Flush the filter with warm soapy water from the exhaust side to the intake side. Do not use solvents. After flushing, allow filter to drain completely before re-installing.
- Re-install the filter and filter frame.

It is impossible to recommend a filter cleaning interval due to the variety of air quality conditions. The amount and nature of airborne dust/dirt particles differ per location. It is recommended that when a fine layer of dust or lint is visible on the surface of the filter, it be removed and cleaned.

Do not run the air conditioner for extended periods of time with the inlet filter removed, to minimize dirt buildup on the condenser coils.

Exhaust air ducting

In some installations it may desirable to duct the hot air conditioner condenser exhaust through the wall of the analyzer house. Here are the requirements for ducting:

- Minimum duct diameter – 7 inches (18 cm)
- Maximum duct length – 20 feet (6 m)
- Duct material – smooth wall, rigid
- Elbows – maximum of two 90 degree elbows
- Exhaust termination – free area equal to cross section area of duct

Valve Box Heater (optional)

A heated valve box is optional on units with rotary valve inlets. This heater is power limited and is suitable for use in the hazardous locations for which the unit is designed. There are both T4 and T3 versions available. No regular heater maintenance is required. The heaters need no regular maintenance, but if the valve box is opened, ensure that the heater fins are free of dirt and debris.

The standard T4 heater option achieves an approximate temperature of 60°C within the valve box. The high temperature T4 heater option achieves an approximate temperature of 90°C within the valve box. The T3 heater option achieves an approximate temperature of 110°C within the valve box.

See figures below.

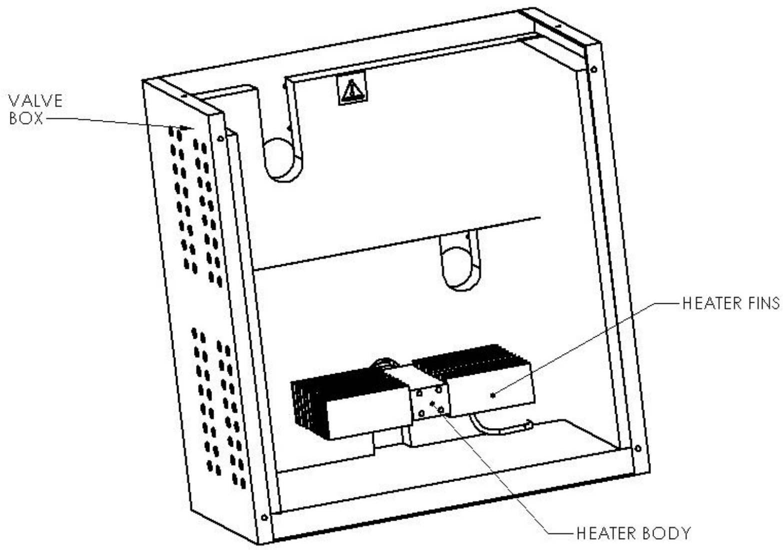


Figure 52: Valve Box Heater, T4, standard option

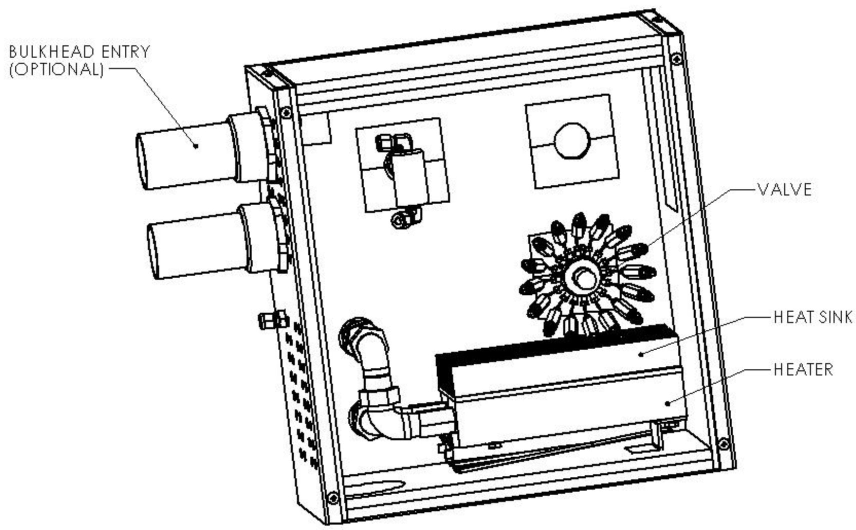


Figure 53: Valve Box Heater, high temperature T4 and T3 options

Corrosive Pump Option

In some applications, sample gases are corrosive. A corrosive pump option is available, where the turbomolecular and rotary vane pumps are protected by purging with a small continuous flow of an inert gas (nitrogen). This extends the life of the pumps in these conditions. In addition, the rotary pump is filled with a special corrosion resistant oil. Contact Extrel CMS Service for advice when sampling corrosive gases.

The flow of nitrogen is limited by the purge devices mounted to the pumps. Extrel recommends supplying nitrogen to the unit at 10 to 20 psig pressure. This results in a total nitrogen flow of 13 to 28 sccm.

The nitrogen purge fitting is located above the sample system exhaust on the side of the enclosure. The fitting is a ¼” tube compression fitting that accepts ¼” diameter tubing.

MAX300-RTG Preinstallation Checklist

Customer: ________________________________ Date: _____________

Location: __________________________________ Instrument: **MAX300-RTG**

____

1. Was any item damaged or missing during shipment? Yes___No___

    a. If yes, was it reported to shipping company? Yes___ No___

    b. Was it reported to Extrel (412-967-5754)? Yes___ No___

2. Do you have the appropriate MAX300-RTG Installation Manual? Yes___ No___

3. Has the enclosure been placed in its final position and does it have the proper clearances? Yes___No___

4. Is the instrument connected to the correct A/C power? Yes___ No___

5. If the enclosure is to be operated in purged mode, has a supply of instrument grade compressed air been connected to the purge inlet? Yes___No___N/A___

6. If the instrument enclosure is to be operated in purged mode, has the external purge loss alarm been connected? Yes___No___N/A___

7. Describe the network connection between the MAX300 and the Host PC.

    a. Direct network? Yes___ No___

    b. Both the Host PC and the Server connected to LAN? Yes___ No___

    c. Internet? Yes___ No___

8. If you have external communication options (ex: analog outputs / inputs, Modbus, DCS control etc.), are they connected to the instrument? Yes___No___N/A___

9. Will external services need to be provided via a VPN? Yes___No___N/A___

   a. If so is one set up? Yes___No___N/A___

   b. Does Extrel have any information regarding the VPN? Yes___No___N/A___
      (Please provide all information available regarding the VPN)

10. Has the roughing pump been filled with the proper oil? Yes___ No___

11. Do you have a list of the required calibrations gases, specified by Extrel? (Typically found in the final quotation, along with the stream analysis) Yes___ No___

   a. Do you have all of these required gases and appropriate regulators on site? Yes___ No___

   b. Do the component concentrations displayed on the individual bottles match those specified by Extrel exactly? Yes___No___

   c. Are all of these gases plumbed to the inlet valve(s) of the MAX300? Yes___No___

   d. Have all the fittings been checked for leaks? Yes___No___

12. Are all sample streams available? Yes___No___

   a. Are all of these streams capable of delivering 50 - 100 cc / min. through the MAX300 sampling inlet? Yes___No___

   b. Have all the sample streams been plumbed to the inlet valve(s) of the MAX300 and the fittings checked for leaks? Yes___No___

   c. Have the valve flow-by vents for all sample streams been plumbed to a suitable atmospheric pressure exhaust line or bulkhead? Yes___ No___

   d. If the sample stream is being delivered by tubing larger than 1/16" OD, has a flow-by been installed where the two different sizes are joined to ensure fresh sample and short clearing delays? Yes___No___N/A___

   e. Are all sample streams properly conditioned to remove any particulates and / or to prevent condensation? Yes___No___

13. Are all the spare parts (pump oil, copper gaskets, fittings, etc.) available? Yes___No____

14. Has all documentation required for on-site visits Yes___No___N/A___
(i.e., safety, insurance, etc.) been completed?

15. Is special clothing required? Yes___No___
(i.e., hard hat, steel toed shoes, flame-retardant overalls, etc.)
    a. If yes to above, will this clothing be provided? Yes___No___N/A___

16. Are there any restrictions regarding facial hair? Yes___ No___

17. Will technician be required to attend any advance safety training? Yes___No___N/A___

18. Will technician be required to sign any forms? Yes___No___N/A___
(i.e., work releases, waivers, hold harmless, etc.)
    a. If yes, have you included all the above forms for review by Extrel CMS LLC, along with this Installation Checklist? Yes___No___

Please reference the Extrel MAX300-_RTG Installation Manual for specific information regarding customer responsibility during installation / startup.

This form must be signed by the responsible individual, verifying that all necessary preparations have been made. If the Technical Support Representative arrives on-site and preparations are either incomplete or improper, the commissioning may be terminated. The customer will then be responsible for all additional cost necessary to complete the commissioning, and billed at current published rates.

Upon completion, please email support@extrel.com at least fourteen (14) days prior to scheduling. If possible, please include a map and / or directions for locating your facility, and information on available lodging.

Print Name:	Phone:
Customer Signature:	Date: