Ideal Vacuum



OUR PRODUCTS DEVELOP TOMORROW'S TECHNOLOGIES™

EXPLORAVAC MAX™

USER MANUAL



EVM-10092025 - V 1.2.7.2

WARRANTY

Ideal Vacuum warrants, to the original purchaser this product to be free from defects in workmanship and materials for a period of 1 year from the original delivery date. The liability of Ideal Vacuum, under this warranty is limited to servicing, adjusting, repairing or replacing any unit or component part which, at Ideal Vacuum's sole discretion, is determined to have failed during normal, intended use. This warranty does not cover improper installation, process related damage, product use in any way other than defined in this manual, or any misuse, abuse, negligence, accident, or customer modification to the product.

Prior to returning any product, we require that you contact us by phone or email to determine if the issue can be resolved quickly. A technical support representative will work with you to resolve the problem. If the issue cannot be resolved in that manner, we will issue an RMA number and provide product return instructions.

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CUSTOMER SERVICE AND SUPPORT

If you have any questions concerning the installation or operation of this equipment, or if you need warranty or repair service, please contact us. Customer Service and Technical Support is available weekdays, from 8am-5pm, Mountain Time.

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GENERAL SAFETY

IMPORTANT SAFETY INFORMATION

Thank you for purchasing this equipment from Ideal Vacuum Products. We want you to operate it safely.



- **Read this manual and all associated equipment manuals before installing or operating this equipment. Failure to follow the warnings and instructions may result in serious injury or equipment damage.**
- **Keep this manual in a safe location for future reference.**
- **This equipment should only be installed and operated by trained, qualified personnel, wearing appropriate protective equipment.**
- **Follow all codes that regulate the installation and operation of this equipment.**

WARNING SYMBOLS AND DEFINITIONS



This is the universal safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER	**Indicates an imminently hazardous situation that, if not avoided, will result in death or severe injury.**
WARNING	**Indicates an imminently hazardous situation that, if not avoided, could result in death or severe injury.**
CAUTION	**Indicates a potentially hazardous situation that, if not avoided, could result in moderate or minor injury. It may also be used to alert against unsafe practices.**
NOTICE	**Indicates a potentially hazardous situation that, if not avoided, could result in equipment or property damage.**
NOTE	**Indicates helpful tips and recommendations, as well as information for efficient, trouble-free operation.**

Internationally recognized safety symbols may be used with safety warnings to specify the type of hazard or a safety protocol to follow. For example:



Indicates an electric shock hazard



Indicates safety glasses are required

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SAFETY FOR VIEWING WINDOWS AND DOORS

DANGER





Implosion/explosion hazard. Failure to follow ALL instructions and safety precautions can result in serious injury or death.

CAUTION





Always wear protective equipment, including safety glasses and gloves. Exercise care when working with any vacuum component.

All viewing windows, doors, or ports are inherently fragile. Exercise great care when handling, mounting and when using a chamber with a viewing window. Below are specific warnings and special precautions needed for safely installing and using a viewing window.

VISUAL INSPECTION

Visually inspect the window upon receipt and check regularly for scratches or any irregularity. Even small scratches can cause a weak spot in the window causing failure. Keep hard objects away from the window. Use only a soft cloth or lens tissue for cleaning.

MOUNTING AND ASSEMBLY

Carefully follow all mounting and reassembly instructions if you are replacing or servicing the window pane. Strictly adhere to the bolt torque specifications and tightening order pattern. Over-tightening of bolts DOES NOT produce a more leak-proof seal. Overtightening, or failure to properly reassemble a viewing window assembly could cause internal strain buildup in the window material resulting in failure.

POSITIVE PRESSURE

NEVER subject a viewing window equipped chamber to positive internal pressure. The viewing window is designed and rated for vacuum ONLY. Chamber pressures in excess of ambient atmosphere could cause the viewing window assembly to fail catastrophically.

TEMPERATURE CHANGES AND THERMAL SHOCK

The fragile nature of the window makes it susceptible to thermal shock. Rapid temperature changes under vacuum, hot or cold, can cause failure. Bakeout or cooling is permissible within the temperature rating of the Viton® O-ring seals. Keep chamber temperature change rates to <10° C/min (<18° F/min).

If directing a laser beam through the window, make sure the laser's wavelength can be reasonably transmitted through the window's material. Directing a laser through the window of a wavelength the window material absorbs, or focusing a laser of any wavelength within the window medium, will cause a steep thermal gradient extending outward from the point of incidence. This could result in localized weakening or fracturing of the window.

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1. SYSTEM OVERVIEW

The ExploraVAC™ MAX system series is Ideal Vacuum's premier compact TVAC test chamber product line. ExploraVAC MAX systems are fully integrated, self-contained, touch screen controlled, precise instruments. ExploraVAC MAX systems are designed for vacuum only, and should not be used for pressures above ambient atmosphere. Numerous options, including UL 508A certification, allow the user to individualize the ExploraVAC MAX system for their unique process requirements, whether for prototype device testing, material synthesis and conditioning, pressure and temperature control experiments, or other environmental simulation.

All ExploraVAC MAX systems include a fully-enclosed, lighted, insulated cubic 24" interior welded aluminum vacuum chamber. A large rectangular viewing window is incorporated into the quick-latch door. The chamber is permanently housed in a robust, mobile equipment cabinet. ISO 200 ports are incorporated into the left and right sides of the chamber. These large ports may be blanked, used as ISO 200 ports, or the user may choose an ISO 200 plate with a variety of smaller feedthrough ports (i.e., KF, CF, ISO flanges) for sensors or specialty equipment.

The enlosed cabinet houses an Edwards dry scroll nXDSi or multi roots nXRi roughing pump coupled with our Delta-P™ system protection valve, pneumatic valves, an onboard compressor, and necessary plumbing. Vented side and back panels are easily removed for system service.

The back of the cabinet holds a bulkhead feedthrough panel for chamber venting, pump exhaust and a purge gas option. A DB-15 I/O connector for controlling user supplied external equipment and ethernet are also standard.

Depending on the configuration, the cabinet might include our CommandValve™ butterfly throttle valves for accurate pressure control. Various platen heating and cooling options from -170°C to 375°C are available. Accurate temperature control can be maintained to within ± 0.5°C. A chamber wall heating option is also available that allows chamber bakeout to 140°C with fan-forced cooling for quicker cycle times. The purge gas option allows pressurized gas such as high purity oxygen or other water-free gas to be precisely regulated and injected into the chamber. The high vacuum turbo pump option (Pfeiffer HiPace 300, 450, or 700) adds a dual convection and ion gauge controller, additional gauges, valves and piping. Up to four mass flow controllers are also possible for processes that require precise gas injection.

PID controllers and gauges are installed as required for the selected options. System functions, including pump and valve sequencing for efficient pump down cycles, and safety interlocks for preventing equipment damage, are managed by a PLC. The front accessible, built-in, NEMA style enclosure houses the electronics needed for system operation.

ExploraVAC MAX instruments are controlled from a front-mounted, touch screen display console running our proprietary **AutoExplor™** software. The ExploraVAC MAX system includes a 1 year premium version of AutoExplor that has the ability to create, run, save and repeat complex system recipes. It can also log, store, and retrieve real-time system generated data. The premium version also includes AutoExplor IP Client, which gives the software the ability to be used as a host that can manage multiple external network clients, and AutoExplor API (application programming interface), which allows a scientist or programmer to integrate an ExploraVAC instrument into their existing software test suite without using AutoExplor's software interface. The premium version must be renewed annually or it reverts to a non-expiring basic version which allows only manual system operation and data streaming.

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2. INSTALLATION

2.1 EQUIPMENT LOCATION

DANGER

Do not use in damp, wet, or hazardous locations where flammable, corrosive, or toxic gases or vapors are present.

WARNING

If the process uses non-inert gases or produces noxious fumes, pump exhaust and chamber vents must be safely routed and evacuated away from personnel work areas.

This equipment requires indoor installation in a relatively clean environment on a flat, sturdy floor. The machine's footprint is 34.2 in. (869 mm) wide, 38.0 in. (965 mm) deep, 79.5 in. (202 cm) high. For systems with a Huber external heating and cooling system, refer to the printed datasheet in the manual or the USB file for the footprint of your individual build.

Minimum clearances of 3 feet in the front and 1 foot on all sides is required to allow for electronics access and for proper ventilation and equipment cooling. It is recommended to allow additional space around the instrument, at least 3 feet on all sides, for easier periodic maintenance and more convenient service.

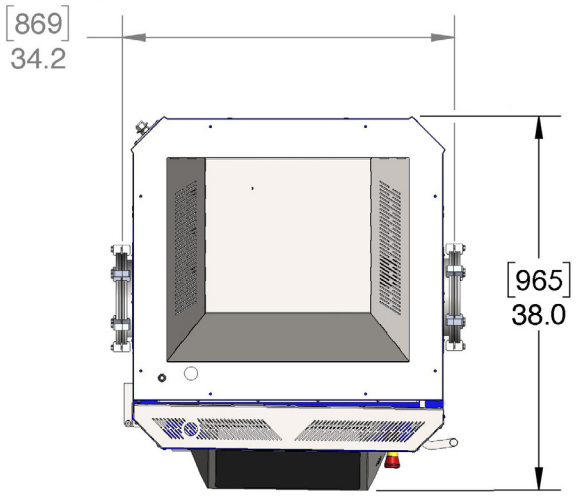


Figure 1 - System footprint

Side	Minimum Clearance (in.)	Maintenance Clearance (in.)
Front (A)	36	36
Sides (B)	12	36
Back (C)	12	36
Top	12	24
Overall width (w)	58	106
Overall depth (d)	86	110

Table 1 - Required and recommended clearances

2.2 WHAT IS INCLUDED

- The ExploraVAC Max system
- Hardware pack with four (4) vibration dampening levelling feet, 4mm & 10mm hex wrenches
- Printed manual, system specific data and performance sheets
- Electrical schematics and electronics Bill of Materials (inside control panel door)
- USB drive with digital copies of all printed materials and all sub-system manuals.
- Heat transfer fluid, a filling tube, and funnel (platen chiller equipped systems only)
- External Huber heating/cooling system (when applicable)

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2.3 UNCRATE AND POSITION

NOTE

Upon receipt, check for any obvious shipping damage. Immediately contact Ideal Vacuum at 505-872-0037 if you suspect any damage.

1. The system is shipped fully assembled in a palletized crate.
2. Unscrew and remove the crate top and sides to expose the instrument. Keep the crate for possible future use.
3. Remove both side panels. The quarter-turn panel fasteners use the included 4mm hex wrench.
4. Unscrew the four (4) 3/8” lag bolts which secure the machine to the pallet. Use a 9/16” wrench or impact driver. The bolts are located inside the bottom rail, close to the corners.
5. Replace the side panels.
6. Lift the instrument from above using the lifting eyes and remove it from the shipping pallet.
7. Lower the instrument to the floor and roll it to its predetermined location.

⚠ CAUTION

The ExploraVAC system is top heavy. If lifting from below with a forklift, make sure forks extend past the opposite side of the instrument.

⚠ CAUTION

Seismic restraints may be required if the system is installed in a seismically active area. Consult with a structural engineer to determine code requirements and if restraint hardware is needed.

NOTE

If the ExploraVAC is too tall to go through a doorway, reduce system height by temporarily removing the turbo pump. See the Turbo Pump replacement service manual located on the USB drive included with the system.

2.4 INSTALL LEVELLING FEET (OPTIONAL)

To change the casters to levelling feet:

1. Lift the machine from the front or back with a pallet jack.
2. Remove the two side covers using the 4mm hex wrench.
3. Remove the casters using a wrench or ratchet with 3/4” or 19mm deep socket.
4. Replace with the levelling feet. Use two (2) 3/4” or 19mm wrenches to tighten.
5. Replace the side panels.
6. Gently lower the pallet jack.
7. Level the system side-to-side and front-to-back.

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2.5 CONNECT POWER

⚠WARNING

Electrical hookup of this equipment must be by a licensed, qualified electrician. All wiring must be completed in accordance with national and local codes. USE COPPER WIRE ONLY.

ExploraVAC Standard systems require 208-240 VAC, 50/60 Hz, single phase power (2 hot legs and ground). A nameplate above the main power input specifies the system's voltage and current requirements (Sec. 3.3, p. 14). The input wire gauge must be rated for the maximum current.

NOTICE

Verify the supply voltage. Energizing the system at a higher voltage than the system rating will cause damage and void the warranty.

If power is obtained from two legs of a three phase supply, both hot wires MUST be at the same voltage. Do not use the "Wild" leg of a 240V, 3 phase Delta configured system as one of the hot legs. For 208V Wye three phase systems (all three legs are the same voltage), use any two legs.

The ExploraVAC system should always be wired to its own supply circuit, and through an appropriately sized service disconnect, fusible or non-fusible, for system lockout and maintenance. An appropriate input cable (armored or SJ type) and strain connector are customer supplied.

Remove the right side Power Input Panel with a Phillips #2 screwdriver (6 screws).

1. Once the 3 internal input wires are exposed, remove the small round splice cap on the power input side of each tap/splice.
2. Prepare the panel with the appropriate (1-1/2" or 1" conduit) connector or strain relief (kellums).
3. Strip 3/4" from each of the 3 power input wires.
4. Pass the input power cable through the panel.
5. Use a 1/8" hex wrench to secure each input wire. Use the table below for proper tightening torque of the tap/splice bolts.
6. Replace the cap on each tap/splice, then carefully push the wires into the stand, and screw down the input panel.
7. Connect the power input cable to the facility service disconnect.

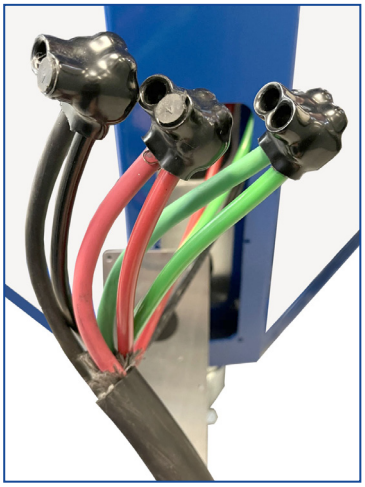


Figure 2 - Input tap/splices

Wire Size	2	4	6	8	10
Torque (in-lb)	45	45	45	45	40

Table 2 - Tightening torque for tap/splices

2.6 COMMISSION PLATEN RECIRCULATING FLUID SYSTEM

For TCube Edge equipped ExploraVAC systems, see Sec. 3.12, p. 19 for instructions.

For Huber Unistat equipped ExploraVAC systems, see the Huber Unistat Installation Guide and the Huber Unistat Operation Manual.

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3. SYSTEM INFORMATION

3.1 TECHNICAL SPECIFICATIONS

This manual contains general ExploraVAC MAX system information and descriptions of the various available system specific options.

Technical specifications, equipment options, and performance test data specific for your built-to-order ExploraVAC system are provided in both printed and digital formats.

The following three sections illustrate the major ExploraVAC MAX system components. Depending on the options selected for your system, some illustrated components may not be installed.

3.2 ENCLOSURE COMPONENTS

The NEMA style enclosure contains all the necessary electronics and connections for the system. The figure below shows all the major electronic components in any system. Your system configuration determines which components are included.

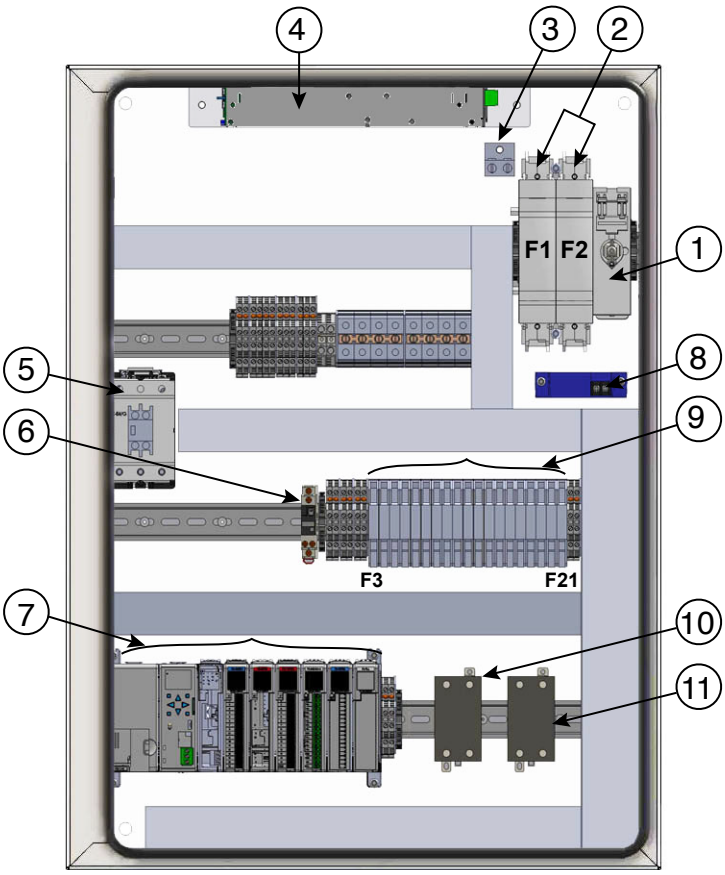


Figure 3 - Main electronic components

Item	Description
1	Main power switch/disconnect
2	Fused “hot” input power terminals
3	Ground lug
4	24/48 VDC power supply
5	Main power relay
6	Onboard air compressor relay
7	Programmable logic control (PLC)
8	Current sensing transducer
9	Fuse block for all subsystems
10	Platen heater relay
11	Chamber heater relay

Table 3 - Electronic component descriptions

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3.3 EXTERNAL COMPONENTS

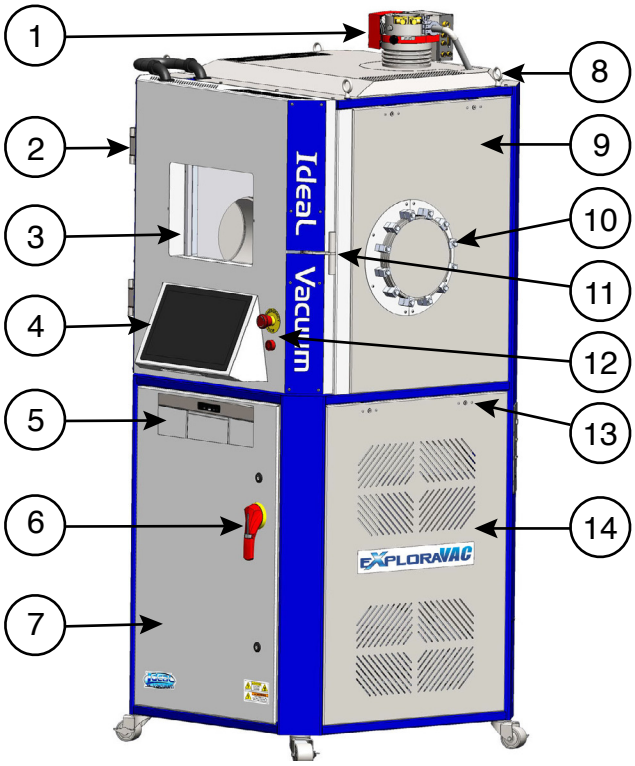


Figure 4 - Front components

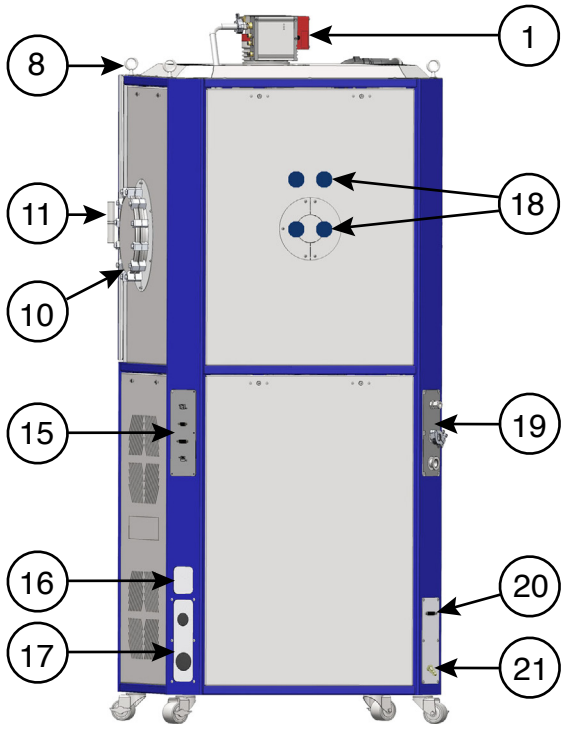


Figure 5 - Rear components

Item	Description
1	Turbo pump (high vac option)
2	Heavy-duty stainless steel door hinge
3	Chamber door with viewing window and LED chamber lighting
4	Touch screen control console
5	3U rack mount for mini computer and pressure gauge controller
6	Main power disconnect switch
7	NEMA style electronics enclosure
8	Lifting rings (x4)
9	Fully enclosed insulated chamber
10	ISO-K 200 port for user feedthroughs (x2)
11	Quick-latch insulated chamber door
12	Emergency stop switch & alert buzzer
13	Quarter-turn panel fasteners
14	Vented side panel
15	Digital feedthrough panel
16	Electrical nameplate
17	Power cable input feedthrough panel
18	KF-40 inlet/outlet ports for LN_2 or Huber options (if one or two platens installed)
19	Exhaust, vent and purge panel
20	Huber I/O connection (if installed)
21	Quick connect air fitting for house air (option)

Table 4 - Exterior component descriptions

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3.4 INTERNAL COMPONENTS

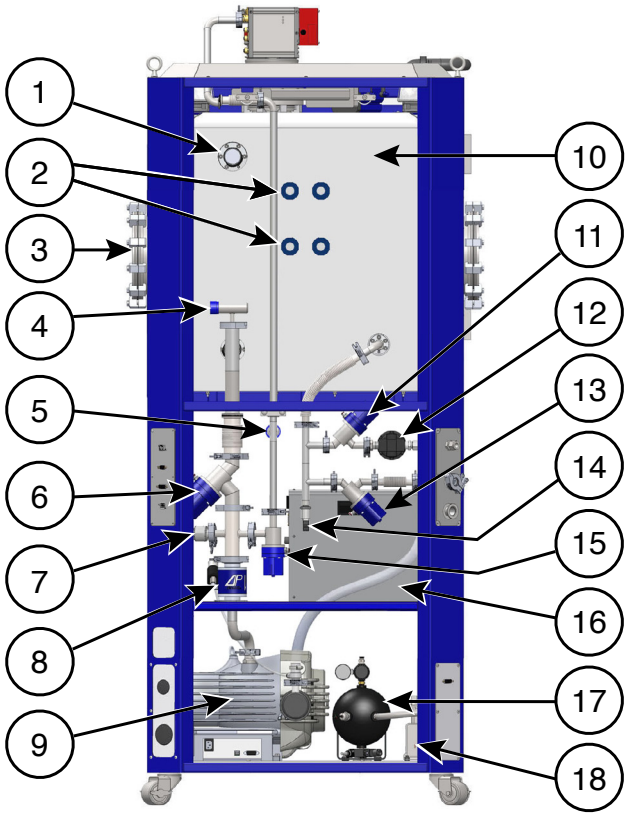


Figure 6 - Back view, high vac with purge and TCube options

Item	Description
1	KF-40 thermocouple port
2	KF-40 inlet/outlet ports for LN_2 or Huber options (if one or two platens installed)
3	ISO-K 200 port for user feedthroughs (x2)
4	Chamber convection-enhanced Pirani pressure gauge
5	Foreline convection-enhanced Pirani pressure gauge
6	Roughing line valve (pneumatic or electronic)
7	Roughing line peizo gauge
8	Delta-P system protection valve
9	nXDSi or nXRi dry roughing pump
10	Fully insulated 24” aluminum chamber
11	Purge valve (pneumatic or electronic)
12	Purge gas manifold regulator
13	Vent valve (pneumatic or electronic)
14	Manifold overpressure sensor
15	Foreline convection-enhanced pressure gauge
16	TCube Edge (if installed)
17	Air reservoir tank for compressor
18	Air Compressor for pneumatic valves

Table 5 - Interior component descriptions

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3.5 BLOCK DIAGRAM

The figure below shows the major ExploraVAC MAX system components in schematic form. Refer to the table for a description of each component.

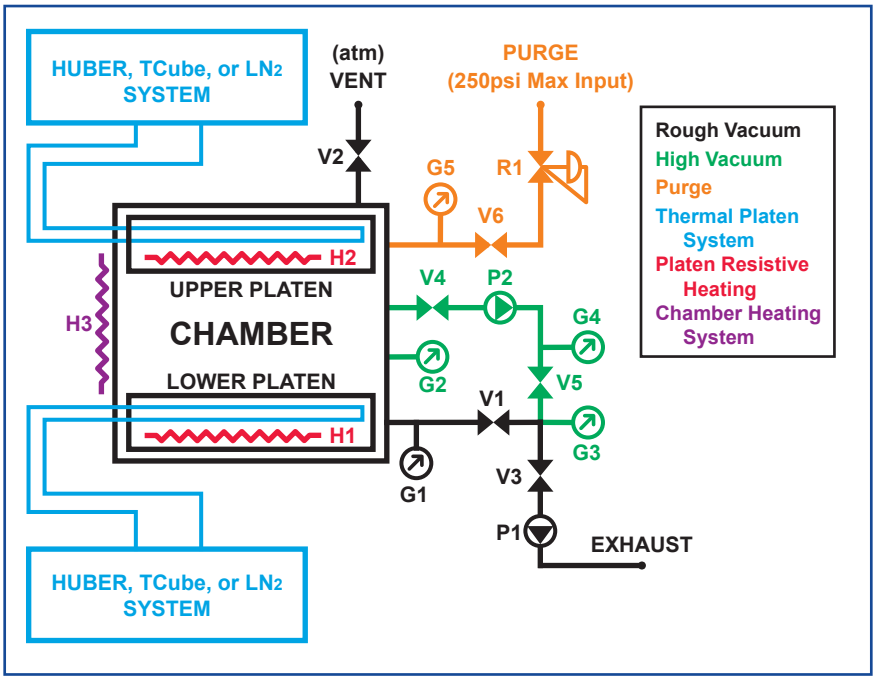


Figure 7 - System block diagram

Item	Description
G1	Chamber convection-enhanced Pirani pressure gauge
G2	Chamber micro ion gauge
G3	Roughing line piezo gauge
G4	Foreline convection-enhanced Pirani pressure gauge
G5	Pressure transducer
H1	Platen heater or lower platen heater
H2	Upper platen heater
H3	Chamber wall heater
P1	Edwards nXDSi or nXRi dry scroll pump
P2	Pfeiffer HiPace 300, 450, or 700 turbo pump
V1	Roughing/pressure control valve
V2	Vent/pressure control valve
V3	Delta-P system protection valve
V4	Gate Valve
V5	Turbo foreline valve
V6	Purge control valve
R1	Purge line regulator

Table 6 - ExploraVAC MAX systems block diagram

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3.6 PRESSURE GAUGES

System pressure is displayed on the pressure gauge located below the touch screen console and in the AutoExplor pressure setpoint controller (Sec. 4.4.1, p. 26).

Roughing-only systems have a Granville-Phillips 475 Convectron gauge controller installed. It displays chamber pressure which it obtains from the chamber-mounted convection-enhanced Pirani gauge. It relays pressure data to the system's PLC.

All turbo pump equipped high vacuum systems have an MKS GP 358 Micro-Ion High Vacuum Gauge Controller which displays chamber and foreline pressure from two convection gauges. An MKS GP 355 Micro-Ion Hot Cathode Vacuum Gauge displays chamber pressure when in high vacuum. When convection gauge pressure is too low, the display reads zero. When the ion gauge pressure is too high, its display is off. A piezo gauge in the roughing line provides pressure information to the PLC to help optimize high vacuum efficiency. Its pressure is not displayed.



Figure 8 - Granville-Phillips 475



Figure 9 - MKS GP 358

3.7 VALVES

ExploraVAC MAX systems use pneumatic and/or a combination of pneumatic and smart CommandValve™ throttling butterfly valves. Systems which include the pressure control option use CommandValves to precisely vary or maintain constant chamber pressure.

Systems which do not include the pressure control option, use pneumatic valves exclusively. Ideal Vacuum Super-Seal™ bellows valves are used for the roughing and chamber vent lines. In high vacuum systems, the turbo foreline valve and the gate valve between the turbo pump and chamber are also pneumatic. A small, quiet, onboard air compressor with reservoir tank is used on systems with pneumatic valves.

Also included is our unique Delta-P™ system protection valve. If the system is under vacuum and a power interruption occurs, this normally open valve immediately closes and vents the roughing pump. It prevents the migration of contaminants (e.g., scroll pump tip seal particles) into the vacuum system, preserves the chamber vacuum, protects the turbo pump from damage, and stops undesirable material from being swept into the system when the pump restarts.

The Delta-P valve's vent is plumbed into the system exhaust line. This ensures that undesirable gases are not introduced into the personnel work area (when the ExploraVac's exhaust is connected to a facility exhaust system (Sec. 3.9, p. 17).

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3.8 DIGITAL FEEDTHROUGH PANEL

The digital feedthrough panel at the right rear of the system has four connectors. The network connector (ethernet) can be used to operate the ExploraVAC MAX from a remote computer. The Windows Remote Desktop application can be used to access the AutoExplor software running on the system's onboard mini computer. The ethernet connection can also be used by the AutoExplor IP Client and the AutoExplor API (see the AutoExplor software manual).

The RS-232 port is for future expansion and is not used.

The AUX I/O female DB15 connector on the panel can be used to connect and switch up to two pieces of user supplied external equipment. The AUX icon in the Manual Devices section of the AutoExplor Home page allows the user to turn the AUX relays on and off for operating outboard connected equipment (Sec. 4.3.7, p. 24). Using a breakout box, the user can connect and control equipment through the relays.

The USB service port is used solely by IVP.

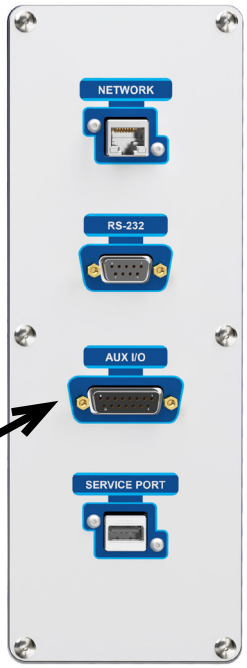


Figure 10 - Digital feedthrough panel

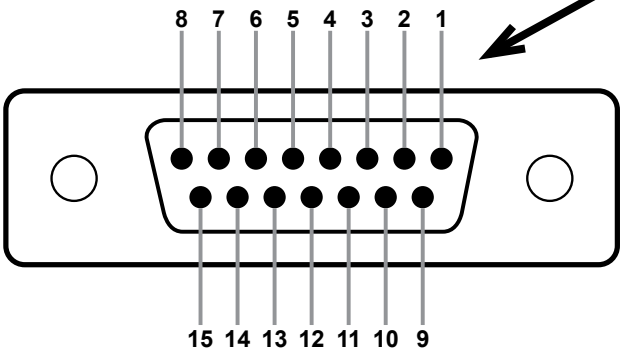


Figure 11 - Auxilliary I/O connector

Pin	Name	Functionality
1	0 V	
2		
3	Ground	
4	24 VDC Input	Toggles Aux 1 Relay On
5	24 VDC Input	Toggles Aux 1 Relay Off
6	24 VDC Input	IVP Use Only
7	24 VDC Output	Aux 2 Output, 1 Amp (software only)
8		
9		
10	Aux 1 Common	Fused at 2 Amps
11	Aux 1 NO	NO Relay Active when Aux 1 is On
12	Aux 1 NC	NC Relay Active when Aux 1 is Off
13	RS232	IVP Use Only
14	RS232	IVP Use Only
15	RS232	IVP Use Only

Table 7 - Aux connector pinout

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3.9 EXHAUST/VENT PANEL

NOTICE

Vent and purge aperatures are exposed to vacuum. Particulates can be sucked in and damage the system. Use filters on the vent and exhaust to prevent system damage.

The exhaust/vent panel, at the left rear of the system, has two KF flanged piping connections. The KF-25 flange is for roughing pump exhaust. The second, smaller KF-16 flange is the chamber vent port. These ports can be left open, or used to connect to facility exhaust to evacuate pump gas (particularly corrosive gases) away from the personnel work area.

If the system is equipped with the purge gas option, a 1/2" OD tubing Swagelok® bulkhead fitting is installed. This option allows a user to introduce high-purity, oxygen or dry gas into the chamber instead of air (Sec. 4.3.5, p. 23)



Figure 12 - Exhaust/ Vent/Purge Panel

3.10 SAMPLE THERMOCOUPLES

For ExploraVAC MAX instruments equipped with a platen, a platen temp (PT) thermocouple is embedded into the platen and connected from below and/or the back of the chamber. A standard four Type-K thermocouple feedthrough for collecting sample temperatures is also provided and connected to the KF-40 port on the back of the chamber. Temperature data from all four thermocouples is collected and displayed as sample readouts in the AutoExplor software (SAMP1 - SAMP 4). Any one of the four thermocouples can also be used by the PLATEN TEMP setpoint controller (Sec. 4.4.4, p. 30).

A thermocouple expansion module with 16 Type-T or Type-K thermocouples (16TC) is available as an option for those who require more than four sample temperature readings. The 16TC option replaces the standard four sample thermocouples. Expansion module thermocouples are displayed as additional sample readouts in the AutoExplor software (SAMP1 - SAMP16). The first four may be used in the PLATEN TEMP setpoint controller (Sec. 4.4.2, p. 28).

NOTICE

Do not allow thermocouple wires to contact a hot platen. The insulation will melt resulting in incorrect temperature readings.

3.11 CHAMBER HEATER (OPTION)

The chamber wall heating option adds 6000W of heating power (2W/in^2) to the walls and top of the chamber. This option provides a maximum wall temperature rise rate of 2°C/min. The wall heater elements are insulated with special ceramic fiber to aid heater efficiency and to keep the instrument's exterior cool. The CHAMBER TEMP setpoint controller, with ramp rate and soak parameters, operates this feature (Sec.4.4.3, p. 31). Maximum chamber temperature depends on system seals. The hard limit is 150°C for Viton, and 200°C for silicone seals.

Chamber heating is not available in combination with the dual platen option (Sec. 3.12, p. 18).

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3.12 PLATEN (OPTION)

Single bottom mounted or dual top and bottom mounted platen options are available. Platens are 23” square, constructed from 6061-T6 aluminum plate for fast, even heating and cooling cycles, and have a standard 1” threaded (1/4”-20) breadboard patten for mounting test items. Platens are thermally isolated from the chamber. An embedded platen thermocouple measures each platen’s temperature and relays it to the system’s PLC. Single platen systems are controlled by the AutoExplor PLATEN TEMP setpoint controller (Sec. 4.4.2, p. 28). On dual platen systems, the controllers are named UPPER PLATEN and LOWER PLATEN.

There are several platen heating and/or cooling configurations available. Any platen configuration can maintain accurate temperature control to within ± 0.5°C.

Electrically Heated Platens Only:

Electric (resistive) heater elements, with 5000 Watts of heating power and a power density of 9.5 W/in^2 are embedded into the platen. Temperatures to 375°C are possible (400°C is the absolute hard limit). Electrical power for the platen heaters is supplied directly by the ExploraVAC.

Electrically Heated and Liquid Nitrogen Cooled Platens:

Platens with the cryogenic cooling option are built with both electric heaters and platen circulating tubes in which liquid nitrogen (LN_2) is flowed. This platen configuration has the widest possible temperature range (-170°C to 375°C). See the LN_2 Cooling Option User Manual.

Huber Unistat Refrigerated Heating Circulators:

Platens with embedded circulating tubes are connected in a closed loop to an external Huber Unistat refrigerated heating circulator system. When a Huber Unistat is used to heat and cool a dual platen system, the two platen inlet tubes are connected together in parallel. The outlet tubes are connected similarly. Thermal fluid is pumped through the platen tubes to achieve the desired temperature. Several Huber models are available, each with a different heating and cooling capacity. The Huber model is selected based on the user’s requirements prior to the build.

All Huber systems require a separate electrical power feed and are controlled via a signal cable that connects to the ExploraVAC’s Huber I/O port (Sec. 3.3, Fig. 5, item 18, p. 12).

Huber Unistat Refrigerated Heating Circulator Options							
Model	Min Temp.	Max. Temp.	Max. Heating Capacity	Max Cooling Capacity	Voltage (VAC)	Phases	Current
405	-40 °C	225 °C	3 KW	1.1 kW	208-240	1	17 A
705	-60 °C	225 °C	3 kW	0.6 kW	208-240	1	20 A
815	-70 °C	225 °C	2.6 kW	1.5 kW	440-480	3	13 A

Table 8 - Huber Unistat refrigerated heating circulator options

The temperature extremes cited are for non-loaded systems. System performance may decrease depending on the thermal load. The platen specifications of your ExploraVAC MAX instrument are found in the datasheets and performance graphs supplied with your system. For Huber system installation and commissioning see the Huber Unistat Installation Guide and the Huber Unistat Operation Manual.

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TCube Edge™ Thermoelectric Recirculating Heating Chiller:

The TCube Edge system is the most economical platen heating and cooling option. It has a temperature range from 0°C to 65°C and a heating/cooling capacity of 460 W. The TCube is mounted inside the ExploraVAC cabinet and connects in a closed loop to a platen with embedded circulating tubes. Inexpensive thermal fluid (50/50 ethylene glycol) is pumped through the platen tubes to achieve the desired temperature.

The ExploraVAC is shipped dry. The TCube's thermal fluid reservoir must be filled before use. Thermal fluid and a funnel are included with the system.

NOTICE **Use care when filling. Wipe spilled fluid off surfaces immediately.**

To commission the TCube Edge:



1. Remove the ExploraVAC's left side panel with a 4mm or 5/16" hex wrench.
2. Unscrew the TCube fill port cap. Use the supplied funnel and slowly pour approximately 1 liter of fluid into the tank until the fluid reaches the upper fill line on the tank. Do not overfill. Replace the cap.
3. Energize the ExploraVAC and press the AutoExplor POWER button (Sec. 4.3.1, p. 21).
4. Set the PLATEN TEMP controller's setpoint to 15°C (60°F) and press the PLATEN TEMP controller icon (Sec. 4.4.2, p. 28). This starts fluid circulation.
5. If AutoExplor generates a notification (bottom of page) that the thermal fluid is low, carefully and slowly add fluid to the TCube until the message disappears and the AutoExplor status indicates normal.
6. When the PLATEN TEMP reaches 15°C (60°F), turn off the PLATEN TEMP controller.
7. Replace the ExploraVAC panel. The system is ready for use.
8. See the TCube Edge User Manual on the USB drive for draining instructions.

⚠ CAUTION **The TCube fluid is rated to 65°C. Do not run chamber heating above 70°C for longer than one hour without first draining the TCube, or unless the PLATEN TEMP controller is active.**

For systems with chamber heating and a TCube platen heating and cooling system:

In order to run chamber heating above 70°C for extended periods, use one of the methods below.

1. Set the PLATEN TEMP setpoint to 65°C and turn the controller on (Sec. 4.4.2, p. 28). The TCube will keep the platen at a safe temperature indefinitely.
2. Drain the TCube fluid before baking out for a long time above 70°C.

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4. SYSTEM OPERATION

Once the unit is physically in place, secured, and power is connected, the system may be energized and used immediately.

The ExploraVAC MAX system is controlled by AutoExplor software, run by an onboard Windows mini computer.

This manual provides a brief overview of basic AutoExplor subsystem operations and how to use the setpoint controllers. Read the AutoExplor Software manual for additional information about using AutoExplor automation recipes and other advanced AutoExplor capabilities. The manual is preloaded onto the system.

NOTE

The chamber is shipped under rough vacuum to keep it clean and must be vented before the door can be opened (Sec. 4.3.4, p. 22).

4.1 MAIN POWER SWITCH/DISCONNECT



Rotate the main power switch/system disconnect on the face of the cabinet to energize the system. When the handle is horizontal, the system is energized, the onboard computer automatically turns on, and the AutoExplor software starts up.

Turn on the Huber system (if present).

4.2 AUTOEXPLOR SOFTWARE HOME PAGE



When AutoExplor starts, the Home page is presented. This page has six sections: (1) Menus, (2) Manual Controls, (3) Setpoint Controllers and Readouts, (4) Running Graph, (5) Device Tiles, and (6) Status Bar. The user can manually control all system functions from the Home page, including operating all subsystems, and programming device setpoints. This page includes a live graph, device monitoring and system notifications.

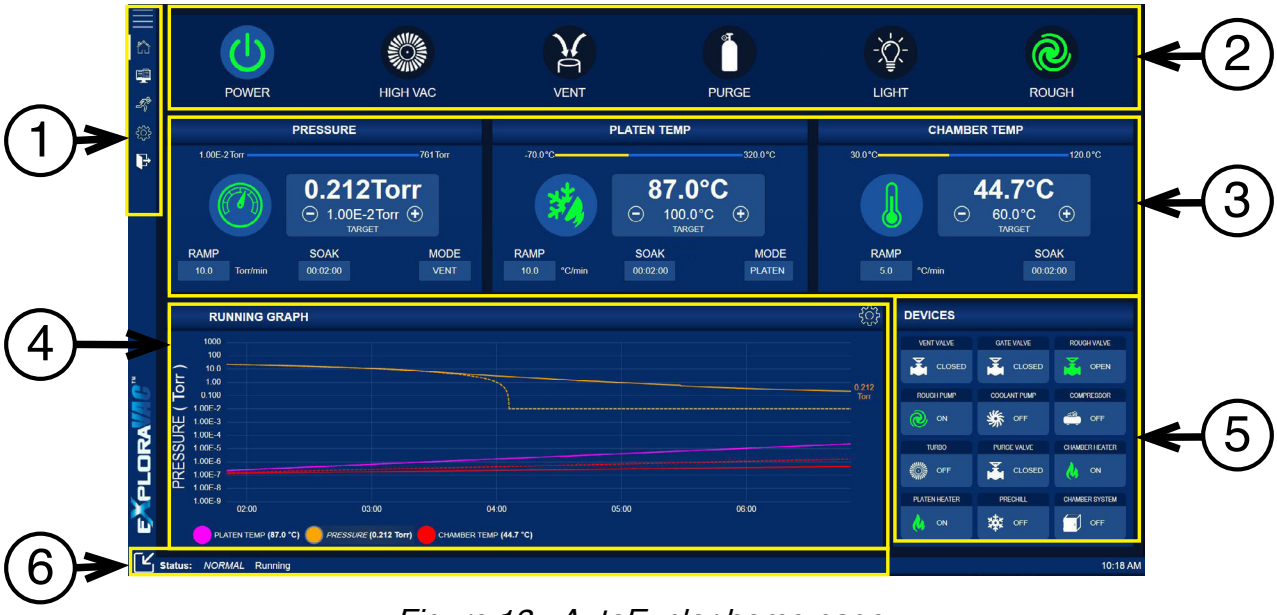


Figure 13 - AutoExplor home page

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4.3 MANUAL CONTROLS

② The home page manual controls section allows you to power the system and turn subsystems on and off. Depending on system configuration, some icons may not be present. Some systems may have custom icons. When a manual control icon is pressed or clicked, that subsystem turns on. A green icon indicates that the subsystem is on. Below, the power and roughing pump are on.



AutoExplor protects system equipment by sequencing operations. For example, if HIGH VAC is turned on, but the roughing pump (ROUGH) is not on, the software turns on the roughing pump first. Its icon turns green. The HIGH VAC icon blinks green to indicate the turbo pump is in standby mode. When the chamber's crossover pressure threshold is reached, the turbo pump gate valve opens, and the HIGH VAC icon turns green.

ExploraVAC MAX will not allow a subsystem to turn on, or a valve to actuate when a competing subsystem is operating. A white icon indicates that the subsystem may be engaged. A gray icon indicates that the subsystem is unavailable for selection. For example, the VENT and PURGE icons are gray when the system is in high vacuum (Sec. 4.3.3, p. 22).

4.3.1 POWER



To use AutoExplor, the POWER icon must first be turned on.

When pressed, the POWER icon turns green. All valves remain in their normally closed states and the PLC initializes. The system enters a standby state, ready to perform a process. If the POWER icon is pressed while any subsystems are running, the icon blinks red for 3 seconds. During this interval, the system systematically closes appropriate valves, turns off any devices that are on, removes power to the pumps, then turns off the system. AutoExplor remains running.

4.3.2 ROUGH



When pressed, the ROUGH icon turns green. The roughing pump energizes, the roughing valve opens, and the chamber begins to pump down. The chamber ultimately reaches a pressure of $2x10^{-2}$ Torr or less.

If the system is in roughing mode and the ROUGH icon is pressed, the roughing valve closes and the roughing pump turns off. This allows the chamber to remain under vacuum. The POWER icon remains on (green).

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4.3.3 HIGH VAC (OPTION)



The HIGH VAC icon is present on turbo pump equipped systems.

If the ROUGH icon is on (green), and the roughing pressure is at or below the crossover pressure threshold (factory set at 2 Torr), pressing the HIGH VAC icon initiates high vacuum mode and the HIGH VAC icon turns green.

If the roughing pump is off, or the pressure is above the crossover pressure threshold when HIGH VAC is pressed, the HIGH VAC icon blinks green indicating the system is in standby to go to high vacuum.

System logic is optimized for speed and determines when the turbo pump begins spinning up during roughing.

Once the crossover pressure threshold is reached, the roughing valve closes, the foreline and gate valves open, and chamber pressure goes into high vacuum.

The ROUGH icon cannot be turned off, and neither VENT nor PURGE can be activated when the system is in high vacuum.

When in high vacuum mode, turning off the HIGH VAC icon (by pressing it while it's green) closes all valves and turns off the turbo and roughing pumps. The chamber remains under vacuum. However, the pressure will slowly rise due to O-ring permeation and outgassing.

4.3.4 VENT



Venting is allowed only when the turbo and roughing pumps are off. If the system is in high vacuum mode, the HIGH VAC icon must be turned off before venting is possible. In no case can venting occur while HIGH VAC is on.

If the VENT icon is pressed while either the ROUGH or PURGE icon is on, the VENT icon will blink green. The roughing pump and/or purge will be turned off. Then the vent valve will be opened. Venting will continue and the VENT icon will remain green until it is pressed again to turn it off, one of the pump switches is activated, or the system is shut down.

When either the ROUGH or HIGH VAC icon is pressed, the vent valve will close and the selected pump sequence will be initiated.

NOTICE

If the chamber is vented with air when the platen is below 0°C, ice will form on the platen. Bring the platen up to room temperature and let it dry naturally. Alternatively, to avoid roughing pump or gauge damage, turn on the pump's gas ballast valve and pump the chamber. See the nXDSi or nXRi pump manual for instructions.

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4.3.5 PURGE (OPTION)



The PURGE icon is present on systems equipped with the purge gas option.

This option allows a user to introduce high-purity, oxygen, or dry gas into the chamber instead of air. Gas pressure into the system must be regulated to no more than 250 PSIG. The system limits purge gas pressure into the chamber to 0.5 PSI, and will automatically shut off PURGE if chamber pressure exceeds +0.5 PSIG.

The HIGH VAC icon must be turned off before purging is possible.

NOTE

Before the purge option is activated, it is recommended to evacuate the chamber prior to filling it with any kind of purge gas.

For non-pressure controlled systems:

The PURGE switch behaves like the VENT switch.

If the PURGE switch is pressed when ROUGH VACUUM or VENT is on, the PURGE switch blinks green, turns off the roughing pump or vent, then opens the purge valve. Purging continues and the PURGE switch remains on until it is switched off or one of the pumps is activated.

When either the ROUGH VACUUM or HIGH VACUUM switch is pressed, the purge gas valve closes and the selected pump sequence is initiated.

For pressure controlled systems:

When an ExploraVAC MAX system is equipped with both the purge gas and pressure control options, AutoExplor includes a MODE option in the pressure setpoint controller (Sec. 4.4.1, p. 27). In the MODE field, the user can choose PURGE to use purge gas rather than vent air to maintain the chamber pressure at a setpoint higher than the roughing pump's ultimate pressure.

Active Purging for pressure controlled systems:

When both the purge gas and pressure control options are installed, the system can also perform "active" purging. Unlike standard purging or venting as described above, active purging allows the roughing pump to remain pumping while simultaneously flowing purge gas into the chamber. With active purging, constant chamber pressure can be maintained to within ± 2%.



To engage active purging, select ***actprg*** in the pressure controller MODE popup and enter a setpoint pressure. When the pressure setpoint controller is turned on (the icon is pressed), the roughing pump evacuates the chamber to the desired setpoint pressure. Once the setpoint pressure is reached, the system continues roughing while simultaneously flowing purge gas into the chamber. Constant chamber pressure is maintained.

Turning off the ROUGH icon turns off both purging and the roughing pump.

Turning off the PURGE icon alone stops active purging but leave the roughing pump on.

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4.3.6 LIGHT



When the LIGHT icon is pressed, chamber illumination is turned on. Protected LEDs shine through the chamber door viewing port and bathe the entire interior in 5000k light. With the light on, the user can more easily examine the process or experiment in progress.

4.3.7 AUX



There are two AUX icons (AUX 1 and AUX2). Each AUX can turn on and off a piece of outboard equipment.

Auxilliary equipment is switched through the DB15 auxilliary I/O connector on the digital feedthrough panel at the back of the ExploraVAC cabinet. See Sec. 3.8, p. 16 for the auxilliary connector pinouts.

4.3.8 CUSTOM



If present, the CUSTOM icon operates equipment requested by the customer and not included as a standard option. Custom icons are named for their purpose. The connection and function of CUSTOM icons are detailed in the Appendix or in a separate document.

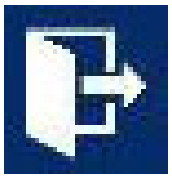
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4.3.9 SYSTEM SHUTDOWN



Press the Power icon to turn off all operating devices. This initiates a sequential, deliberate, shutdown in the following order:

1. Gate valve, then all other valves close.
2. The turbo, then the roughing pump turns off.
3. All other devices turn off.
4. The Power icon turns off.



Once all devices are off, it is good practice to exit the AutoExplor program and power down the computer normally before de-energizing the ExploraVAC MAX system.

Select the Exit Program icon in the menus (top left of screen) to turn off the AutoExplor software. You will be at the Windows desktop.

Once the computer shuts down, it is safe to turn off the main power disconnect switch and de-energize the system.

4.3.10 EMERGENCY STOP SWITCH



DO NOT USE EMERGENCY STOP TO TURN OFF THE SYSTEM UNLESS ABSOLUTELY NECESSARY.

Press the Power switch to initiate an ordered system shutdown.

If the EMERGENCY STOP is engaged at any time, the system immediately closes all the pneumatic valves, protecting the turbo, then all subsystems are de-energized.

The mini computer and the AutoExplor software will continue to operate when the emergency stop is engaged.

In full versions of AutoExplor, the data logs are saved up until the moment when the emergency stop switch is used. The availability of these logs can assist the user with system diagnostics. See the AutoExplor User Manual for more information about logs.

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4.4 SETPOINT CONTROLLERS AND READOUTS

③ This section allows you to enter setpoints, ramp rates, and soak times for the controllable subsystems. Depending on the system, these could include pressure, platen temperature, and/or chamber temperature. The Additional Readouts box, which shows data such as sample temperatures is also found here. If an ExploraVAC MAX system has all three controllers, then the Additional Readouts box is viewed by swiping left. When a setpoint controller icon is pressed, appropriate devices are energized and the controller icon becomes green. Below, both the pressure and platen temperature controllers are on.

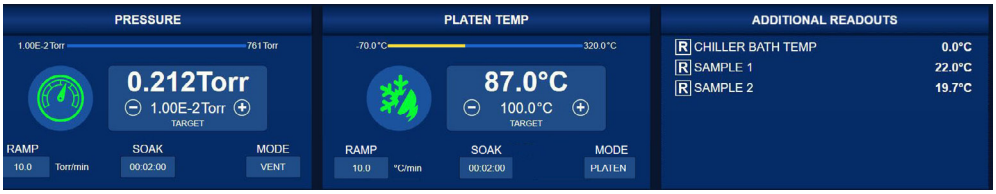


Figure 14 - Home page setpoint controllers

4.4.1 PRESSURE SETPOINT CONTROLLER (OPTION)



PRESSURE CONTROL WORKS IN THE ROUGH VACUUM RANGE ONLY. The pressure setpoint controller is available on ExploraVAC MAX systems equipped with the pressure control option. It can be used for altitude simulation where pressure is varied at a defined rate, or for experiments or processes that require accurate maintained pressure above the roughing pump's ultimate vacuum pressure. A combination of the IVP CommandValve's throttling and venting or purging is used to achieve precise pressure control.

The setpoint pressure is the target pressure for the system to obtain, then maintain for a specified duration. Once a setpoint is reached and the system settles, setpoint accuracy is ± 0.5%.

The pressure setpoint controller can have any of its parameters adjusted at any time. However, high vacuum must be turned off manually before the pressure controller can be turned on. When the pressure setpoint controller icon is pressed, its icon turns green, the system automatically turns off venting or purging, then pressure control is turned on.

Changing the Pressure Measurement Units:

In the controller box, the largest white text displays the current pressure. Press the current value to open a window that allows the measurement units to be changed. Below, the current pressure is being changed from Torr to altitude (ft.).



Figure 15 - Changing pressure measurement units

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Changing the Setpoint Value:

The setpoint (target) pressure value is displayed just below the current pressure. Press the current value to open a window where a numerical pressure value is entered. Below, a new target pressure of 200 Torr is chosen. Press the ⊕ or ⊖ button to change the setpoint incrementally.

If a target pressure outside the system limit is entered, the pressure reverts to the closest allowable value.

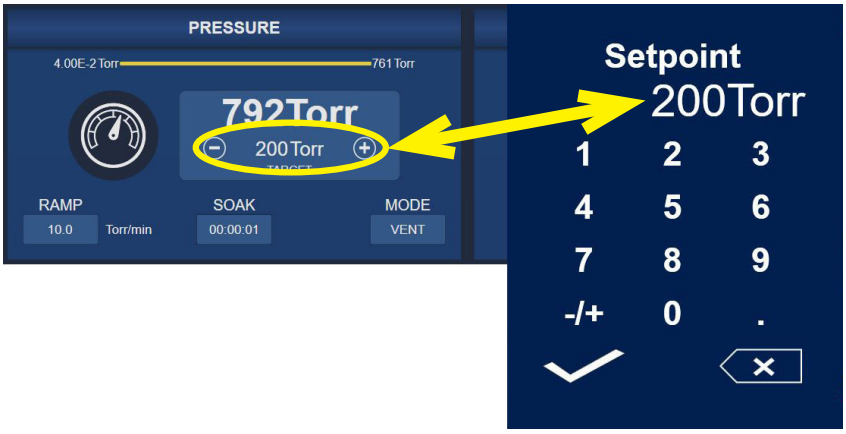


Figure 16 - Changing pressure setpoint value

Changing the Ramp Rate:

Ramp rate is the speed at which the chamber goes from its current pressure to the desired pressure. Ramp rate is often used for altitude simulation, where a test item is subjected to faster or slower ramp rates. Ramp rate is measured in units/min. The rate is limited by chamber size and pump speed. The ExploraVAC MAX 24” chamber with an nXDS20i roughing pump has a maximum possible ramp rate of approximately 25,000 ft/min.For processes, a 24” chamber achieves an ultimate pressure of 20 mTorr in 25 minutes.

To change the ramp rate, press the RAMP tile at the bottom of the pressure controller box. A window pops up where a numerical pressure value is entered. The ramp rate is in the current measurement units per minute. The ramp rate can also be set to MAX, which forces the system to get to the setpoint pressure as quickly as possible. Where a numerical ramp rate is a linear function, the MAX rate is a curve.

Changing the Soak Duration:

Soak is the amount of time, after the setpoint pressure is reached, that the setpoint pressure is maintained. When the soak time has elapsed, valves are closed and the roughing pump is turned off. Press the SOAK tile to enter a soak time. Select the time in hours, minutes, and seconds or press D:H:M to change to days, hours, and minutes. The maximum soak duration is 99 days. If no soak time is specified, the system continues at the setpoint until it is turned off manually.

Changing the Mode:

For pressure controlled systems with the purge gas option, a MODE field is available and has three options: vent, purge and actprg (active purge). MODE is used to select between the vent (atmosphere) and purge lines to allow gas into the chamber when the setpoint pressure is higher than the current chamber pressure. In the active purge mode, the roughing pump continues pumping while purge gas is simultaneously flowed into the chamber (Sec. 4.3.5, p. 23).

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4.4.2 PLATEN TEMPERATURE CONTROLLER (OPTION)



The PLATEN TEMP setpoint controller is present on single platen systems. This controller is used to adjust the heating and cooling of the platen and behaves like the pressure controller. On dual platen systems there are separate UPPER PLATEN and LOWER PLATEN controllers.

Select the current value to change the temperature units: Celsius or Fahrenheit.

The ramp rate is displayed in degrees per minute. Soak time is measured exactly the same as with the pressure controller. If no soak time is specified, the system continues at the setpoint until it is turned off manually. The ExploraVAC MAX platen temperature ramp rate limit varies depending on the system's configuration. The ramp rate can be set to MAX, which forces the system to get to the setpoint temperature as quickly as possible. Where a set ramp rate is a linear function, the MAX rate is a curve. For systems with heater elements and a refrigerated cooling platen, the chiller is used to cool the platen more quickly once it naturally cools below 60°C. Chamber pressure greatly effects the platen's ramp rate.

Changing the Mode:

The PLATEN TEMP MODE field is used to select the thermocouple that the PLATEN TEMP setpoint controller uses. There are five mode options: PLATEN, SAMP1, SAMP2, SAMP3, or SAMP 4. By default, the thermocouple embedded in the platen is used by the setpoint controller (PLATEN mode). This mode works well when a test object is directly attached to the platen.

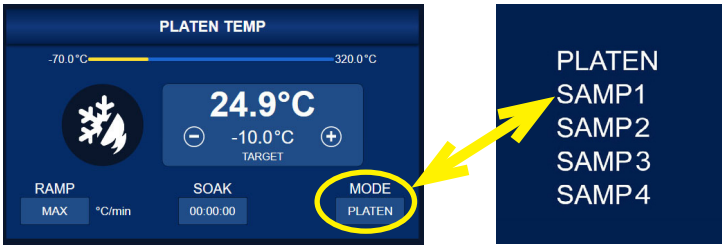


Figure 17 - Changing platen temp mode

When a test object is fixtured or otherwise at some distance from the platen, the platen and test object may be at different temperatures. This can be due to the delayed heat transfer from the platen to the object, or because the object is far enough away from the platen that it stabilizes at a different temperature than the platen. This is referred to as a delayed system.

While it may be possible to experimentally determine the platen setpoint temperature required for the object to achieve the desired stable temperature, a more precise, repeatable, and faster method is to change the mode to one of the SAMP modes. Selecting the SAMP 1, 2, 3 or 4 modes changes the thermocouple used by the PLATEN TEMP controller to one of the sample thermocouples (SAMP 1 and SAMP2 correspond to the two thermocouples factory routed through the chamber feedthrough). The selected SAMP thermocouple is attached directly to the test object.

Note that when using the sample mode, if there is a significant system delay between the platen and test object temperatures, considerable temperature overshoot of the test object can occur. Suggestions are provided on the following page for how to avoid significant temperature overshoot.

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Shown below is a graph of a delayed system controlled by the “SAMP1” mode. The controller is set to the MAX rate at the desired object setpoint temperature.

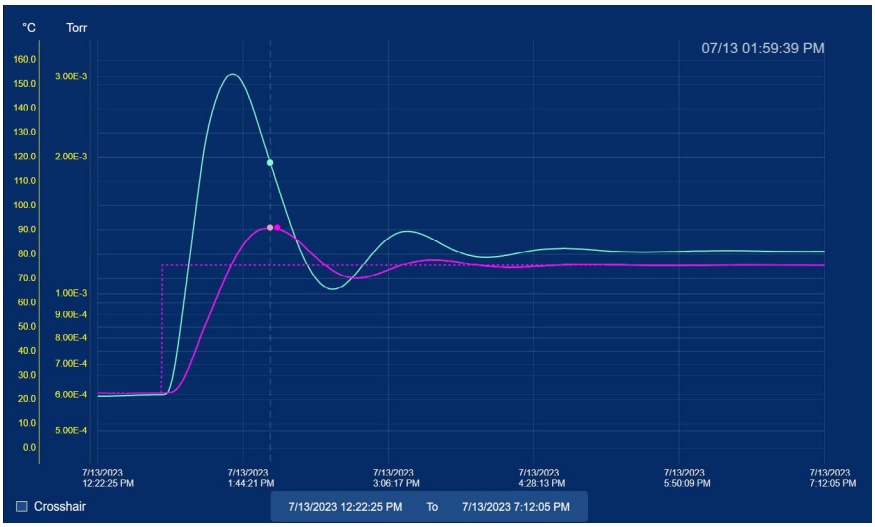


Figure 18 - Sample mode with platen at MAX rate

The lighter line shows platen temperature. The darker line shows the test object temperature. Here, the platen continues heating at the MAX rate until the object reaches the setpoint. Because of the excess platen heat transferred to the object after the setpoint is reached, the object experiences a temperature overshoot of 15°C and it takes 3 hours for the object temperature to stabilize.

A better technique is to use AutoExplor’s recipe capability and make at least two steps: First ramp the temperature at the MAX rate to a setpoint lower than the object target temperature. Then, use a slower ramp rate to get to the desired temperature setpoint. The graph below illustrates the technique. Here, the transition setpoint temperature is set at 15°C below the object’s target temperature. This is the amount of overshoot that was experienced in the example above.

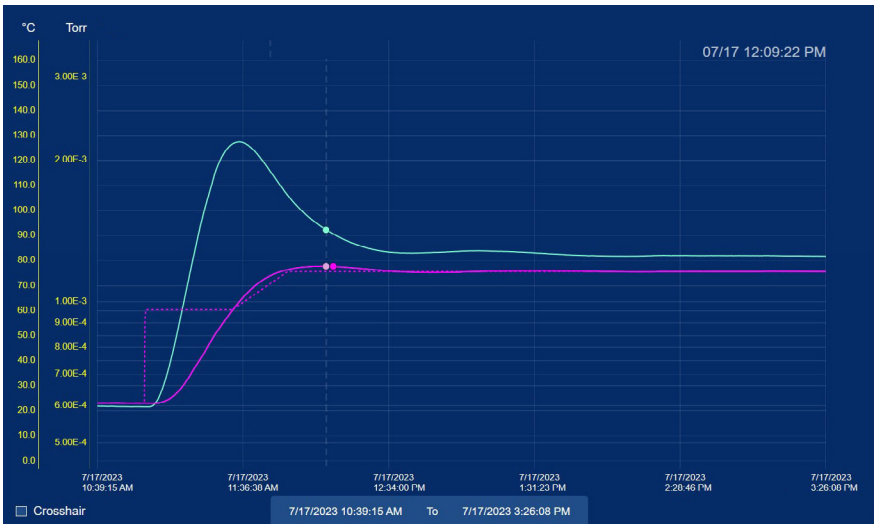


Figure 19 - Sample mode using two step rates

Now, the maximum platen temperature is decreased and its starts cooling much faster. This reduces and slows the amount of heat transferred into the object. The result is an overshoot of only 2°C and a temperature stabilization time of roughly 50 minutes.

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NOTICE

When using the PLATEN TEMP sample mode, the platen necessarily gets hotter than the desired object setpoint temperature. Sometimes it can get significantly hotter. A poorly mounted thermocouple can cause the platen to runaway trying to heat the object to the setpoint. Make sure the sample thermocouple is well mounted and is reading correctly.

To help protect the test object, use the warning and fail limits (AutoExplor Manual - Controller Settings, Sec. 7.2) to set the maximum platen temperature at a value not to exceed a temperature that would damage the test object. This will force the platen controller to shut down in the event that the platen is running away trying to heat the sample.

4.4.3 CHAMBER TEMPERATURE CONTROLLER (OPTION)



The Chamber Temperature setpoint controller is available on ExploraVAC MAX chambers with the chamber heating option. This temperature setpoint controller behaves the same as platen temperature controller. The chamber temperature ramp rate limit is approximately 2°C/min. Like the platen temperature controller, the chamber temperature ramp rate can also be set to MAX.

4.4.4 ADDITIONAL READOUTS

The home page Additional Readouts box displays the chamber pressure and thermocouple temperature information which the user cannot directly change. Readouts are represented with an R inside a square. Readouts may include sample thermocouple temperatures (for systems with a platen), and chamber pressure (for systems without pressure control).

For ExploraVAC MAX systems with all three controllers (i.e., pressure, platen temperature, and chamber temperature, or pressure, upper platen, and lower platen), the Additional Readouts box will normally be hidden from view.

Swipe left on the controllers section to reveal the Additional Readouts box.
Swipe right to conceal.

SAMPLE 1 through SAMPLE 4 thermocouples can be used by the PLATEN TEMP controller (Sec. 4.4.2, p. 28).

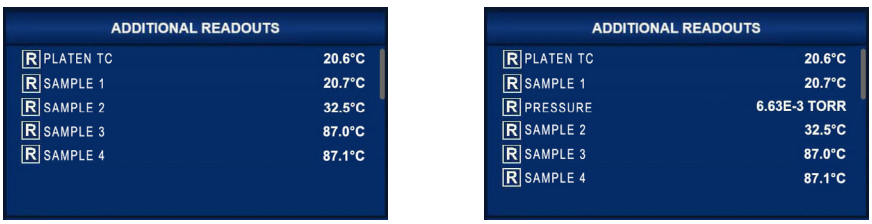


Figure 20 - Additional Readouts for systems with and without pressure control

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5. NOTIFICATIONS AND SERVICE

DANGER

Deenergize and lockout/tagout the system before removing cabinet panels or attempting to perform maintenance or service on the system. High voltage inside.

WARNING

Before performing maintenance or service, the chamber and platen must be brought to ambient pressure and temperature. Direct exposure to an extremely hot or cold platen or thermal lines could cause burns or frostbite.

CAUTION



Always wear protective equipment, including safety glasses and gloves when working with any vacuum system or component.

NOTE

The ExploraVAC MAX system is not field upgradeable. To add options, it must be reconfigured by Ideal Vacuum.

ExploraVAC MAX systems are built with premium components and quality engineering. Systems are designed to operate with very little user maintenance. To keep the system in top operating condition, perform all recommended maintenance and keep the instrument clean. Periodically wipe the exterior of the system with a damp rag and mild cleaning solution. Dust and remove any oil or dirt buildup inside the cabinet panels, on pumps, the compressor, fans, etc. Use isopropanol.

AutoExplor keeps accurate track of preventive maintenance intervals based on equipment sensors, switches, valve cycle counts, etc., and notifies the user when system service is due. For example, it notifies when scroll pump tip-seal replacements are needed and when sensor calibration is due.

AutoExplor immediately informs the user if a warning or failure occurs and turns off appropriate devices. Further, it generates detailed error messages and supplies specific troubleshooting information so that the issue can be corrected as soon as possible. This information is found in the Notification Center under the Settings menu.

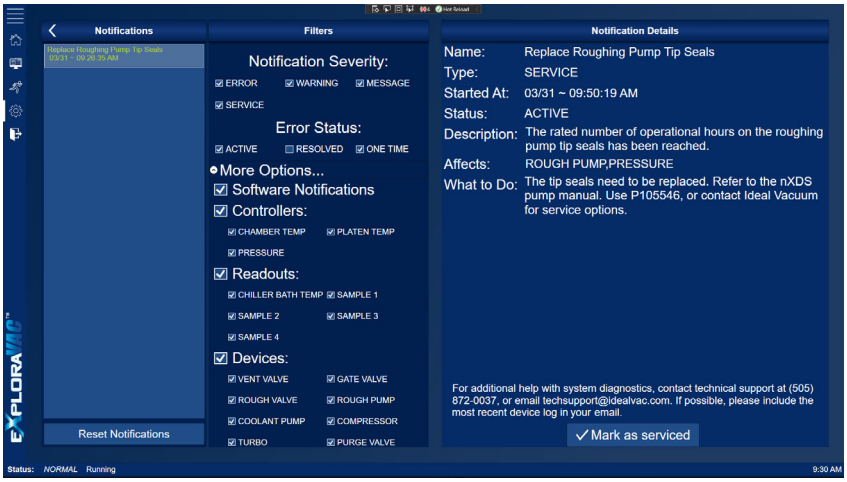


Figure 21 - Notification center

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5.1 SERVICE SCHEDULE

Below is a table of recommended preventive service intervals for ExploraVAC MAX devices. AutoExplor keeps track of these intervals and provides notifications when service is needed. For service or replacement procedures, see the product owner's manual. Find manuals either on the USB drive included with the ExploraVAC, or by part number at idealvac.com.

Item	Service Interval											
	Months							Hr	Cycles			
	1	3	12	24	48	60	120	20k	100k	500k	1.5M	2M
Edwards nXDSi Roughing Pump (All)			X									
Clean inlet strainer & external fan cover			X									
Replace exhaust filter			X									
Check & replace tip seals (as necessary)				X								
Replace pump- bearings						X						
Edwards nXRi Roughing Pump (All)			X									
Perform gas ballast drying procedure	X											
Clean inlet strainer & external fan cover			X									
Replace exhaust filter			X									
Replace pump- bearings						X						
Replace pump controller							X					
Pfeiffer HiPace 300, 450, or 700 Turbo Pump												
Replace operating fluid reservoir					X							
Replace rotor bearing					X							
Huber 405/705/815 System												
Check perforated sheet, clean as needed	X											
Thermal fluid inspection Replace as required	X											
Empty drip tray	X											
Check liquifier fins and hat-type strainer		X										
Check air filter mats		X										
Onboard Air Compressor												
Replace filter element			X									
IVP Super-Seal Pneumatic Valves												
Rebuild or replace											X	
IVP CommandValve												
Rebuild KF-16 or replace										X		
Rebuild KF-25 or replace										X		
IVP Delta-P Valve												
Rebuild or replace												X
IVP XactGauge Convection Gauges												
Rebuild or Replace KF-16							X					
Rebuild or Replace KF-25							X					
IVP UltraLock Gate Valve												
Rebuild or replace ISO 63 or ISO 100									X			
MKS GP 355 Micro-Ion Gauge												
Degas		X										
Replace								X				

Table 9 - Service and maintenance schedule

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6. RECOMMENDED LOCKOUT/TAGOUT PROCEDURE

The lockout/tagout (LOTO) procedure described below is meant to safeguard employees from the unexpected energization or startup of the instrument, or the release of hazardous energy during service or maintenance activities, when moving the unit within the facility, or when transporting it to another location.

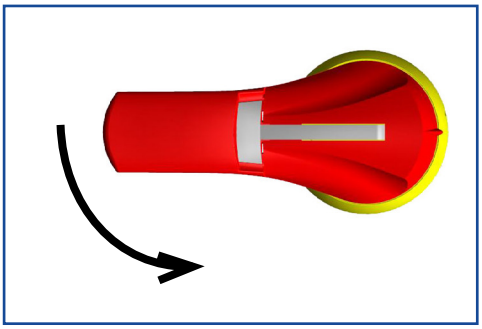
This procedure is recommended to safely disconnect the instrument from the facility electrically to eliminate the possibility of someone receiving an electrical shock, and to depressurize the onboard air tank used to activate pneumatic valves in the system.

It is the responsibility of your facility safety team to develop and implement your own company LOTO procedure which may be more robust than these recommendations.

1. Notify all appropriate personnel that the instrument will be offline for service, when that will happen, and for how long, or that it has gone offline due to a malfunction.

2. Make sure the instrument is not currently performing a critical operation.

3. Turn off the instrument by rotating its main power/disconnect switch counterclockwise to the off position.



4. Turn off facility power to the instrument from the dedicated disconnect or circuit breaker. Lockout and tag the disconnect. The person who is performing the service or decommissioning must sign, date, and write the reason the machine is out of service on the lockout tag.



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5. Remove the left side panel of the instrument. The quarter-turn fasteners use a 4mm hex wrench.

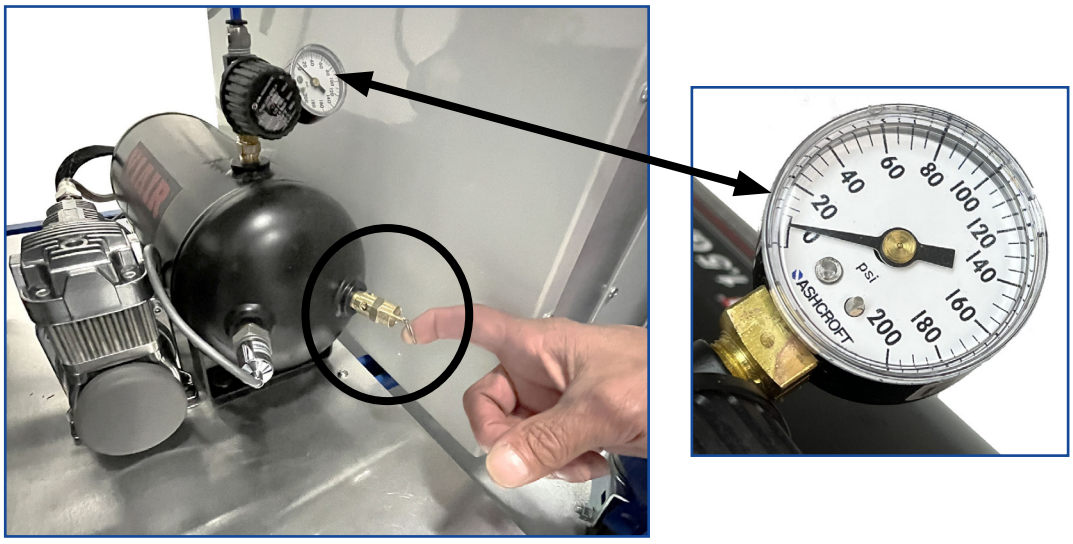


⚠ CAUTION

Wear safety glasses and hearing protection before depressurizing the air tank.

6. Find the black air tank at the bottom of the cabinet.

7. Pull the ring on the tank's pressure relief valve for about 5 seconds until the gauge read zero PSI. It will hiss loudly as it depressurizes.



8. Perform the maintenance or service.

9. When activities are completed, close and lock all panels.

10. Turn on the facility disconnect or circuit breaker. Only the person who did the lockout and signed the tag should remove it.

11. Notify all appropriate personnel that the instrument is back in service.

12. Run the instrument normally.

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7. APPENDIX

The datasheets on the following pages have the specifications of your built-to-order ExploraVAC system. Included are the actual test performance graphs of your instrument.

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