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EXPLORAVAC™

Automated Thermal Vacuum Chamber with Evactron® E50 Plasma Cleaner

USER MANUAL

Model: P1013547

EXV-PC-05282024- V 1.0.2.2

WARRANTY

Ideal Vacuum warrants to the original purchaser, this product to be free from defects in workmanship and materials for a period of one 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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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

VIEWING WINDOW SAFETY

DANGER

Implosion/explosion hazard. Read and follow ALL instructions and safety precautions.

CAUTION

An aluminum blanking cover is installed over the viewing port to protect the user from eye damage from UV radiation generated by the plasma arc. Do not remove the cover. Under no circusmstances should the system be used without the cover.

All viewing windows, doors, or ports are inherently fragile. 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.

Pressure

NEVER subject a viewing window equipped chamber to positive internal pressure greater than 0.5 psi. 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.

Ultraviolet Radiation

The plasma cleaning system produces large amounts of UV radiation. An aluminum blanking plate has been added to the port to protect the user from plasma cleaner emissions. The aluminum cover should not be removed and under no circumstances should the system be used without the cover.

1. INTRODUCTION

The ExploraVac™ model P1013547 thermal vacuum chamber instrument with Evactron plasma cleaning system is specifically designed for the semiconductor industry to assist in the failure analysis of chips or devices. During failure analysis, these devices, sometimes referred to a DUT's (Device Under Test), may become contaminated. In these cases, the DUT may be transferred into the Exploravac chamber where the Evactron plasma cleaning system is used to clean or remove the contamination.

The instrument is a pushbutton controlled, semi-automated, and self-contained environmental simulation system designed for vacuum only. It should not be used for pressures greater than 0.5 psi above ambient atmosphere. It is designed to operate from ambient atmosphere to 5 x 10^{-7} Torr.

This instrument features a 16 inch cubic welded stainless-steel vacuum chamber with a volume of 2.4 cubic feet. An Evactron E50 plasma cleaning system is built into the roof of the chamber and an adjustable heated platen shelf is mounted high in the chamber for optimal DUT plasma cleaning. Temperature is controlled by a dedicated controller located on the ExploraVac's control panel and is limited to a maximum of 60ºC. Below the heated platen are two adjustable slotted shelves for storage. The chamber features a hinged stainless steel door with a tempered glass viewport covered by an aluminum blanking cover. The cover protects the user from eye damage due to UV radiation generated by the plasma cleaner arc and should not be removed.

The ExploraVac base houses an Edwards nXR60i dry multi stage roots roughing vacuum pump, an undermounted Pfeiffer HiPace 300 turbo pump with TC400 controller, an IVP Delta-P system protection valve, pneumatic valves, an onboard air compressor, and necessary plumbing. Atmospheric venting and a purge gas port for injecting high purity or dry gas into the chamber are invcluded. Vented side and back panels are easily removed for system service.

Integrated MKS absolute piezo transducers in the vacuum lines and an Inficon MPG400 combination Pirani and cold cathode gauge in the chamber provide real time pressure measurements which are displayed on the control panel and used by the Exploravac to sequence valves for efficient test cycles. The user can control the standby speed of the turbo pump from the control panel to combat the gas load introduced by the cleaning process.

A PLC manages system functions, including pump and valve sequencing for efficient pump down cycles, and safety interlocks for preventing equipment damage. The front accessible, built-in, NEMA style enclosure, houses the electronics needed for system operation.

The Evactron plasma cleaning system has a separate interface and dedicated controller mounted to the Exploravac top plate that allows the user to vary all important plasma cleaning parameters and make and save cleaning recipes. The Exploravac instrument includes an interlock which does not allow the plasma cleaning system to operate above 1 Torr. The Evactron has a dedicated alternative gas port on top of the Plasma Radical Source (PRS) for introducing gas (other than air) into the plasma cleaner. A customer supplied two-stage regulator is used to limit gas pressure into the PRS to between 2 and 10 psi (2 psi recommended). The PRS does not require a large volume as the gas use rate is very low.

The ExploraVac system can be operated from a remote PC with our optional ***AutoExplor™*** software or AutoExplor API (application programming interface), which allows an advanced user to integrate the ExploraVac instrument into their existing software test suite. Note that special custom features for using the Evactron are not integrated with AutoExplor.

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.

The ExploraVAC system is a commercial/industrial product and is not intended for residential use The instrument requires indoor installation in a relatively clean environment on a flat, sturdy floor. The machine's footprint is 32 in. wide, 36 in. deep, and 69 in. tall and is designed to fit through a standard 36" x 80" doorway.

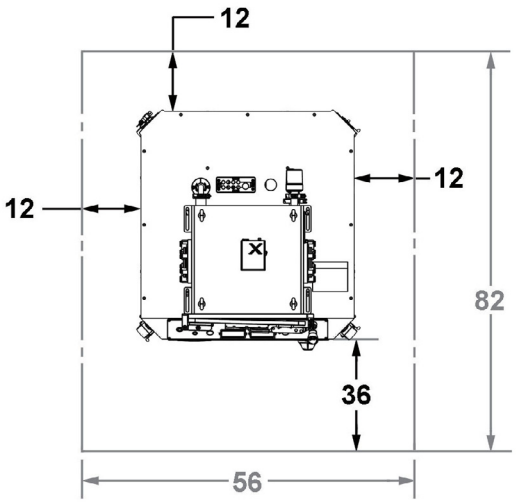


Figure 1 - System footprint

Side	Minimum Clearances
Front	3 ft.
Sides	1 ft.
Back	1 ft.
Top	1 ft.

Table 1 - Minimum required clearances

The system weighs approximately 800 lb. Make sure the floor can support the weight. A concrete floor is preferred to minimize noise and vibration.

A minimum of approximately 32 ft^2 is required to allow proper ingress to the electronics enclosure for ventilation and equipment cooling. It is desirable to allow extra space on the sides and back of the machine to allow for easier periodic maintenance and more convenient service.

2.2 WHAT IS INCLUDED

- The ExploraVAC instrument with integrated Evactron plasma cleaning system
- 4mm & 10mm hex wrenches
- ExploraVac printed manual with system specific data and performance sheets
- ExploraVac electrical schematics and electronics Bill of Materials (inside control panel door)
- Evactron plasma cleaner printed manuals
- USB drive with digital copies of all printed materials and all sub-system manuals.

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 Exploravac 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. Remove the instrument from the shipping pallet.

   Carefully lift the instrument off the pallet from below. Use a forklift from the side.

⚠ CAUTION

The ExploraVAC system is top heavy. Make sure forklift forks extend past the opposite side of the instrument before lifting from below. DO NOT LIFT FROM ABOVE.

Lower the instrument to the floor and roll it to its predetermined location. The instrument will fit through a standard doorway.

⚠ 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.

2.4 POWER CONNECTION

⚠ WARNING | **Electrical hookup of this equipment must be performed by a licensed, qualified electrician. All wiring must be completed in accordance with national and local codes.**

⚠ WARNING | **Use Copper Conductors Only!**

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

The ExploraVAC system requires 208-240 VAC, 50-60 Hz, three conductor, single phase power and requires a 30 Amp dedicated circuit. The nameplate above the main power input specifies the system's voltage and current requirements (Fig. 5, item 15, p. 12). The instrument is prewired with a 15 ft. power cable, exiting the stand from the back right, and terminated with an L6-30 power plug.

Power to the Evactron plasma cleaning system is supplied by the ExploraVac. It does not require a separate power feed.

Figure 2 - L6-30 power plug

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.

3. SYSTEM INFORMATION

3.1 TECHNICAL SPECIFICATIONS

The following four sections illustrate the major ExploraVAC P1013547 system components. Datasheets with technical specifications and performance test data specific to your built-to-order ExploraVAC system with plasma cleaner are provided in printed and digital formats.

3.2 CHAMBER

The system has a 16 x 16 x 16” cubic chamber with a mechanically and electrically integrated Evactron E50 plasma cleaning system. The E50’s radical source is installed through the chamber’s roof. A slide-out heated platen shelf is positioned at 2.0” from the chamber’s ceiling. It is adjustable up and down in 1 inch increments. Two adjustable slotted shelves, also adjustable in 1 inch increments, are located below the heated platen (See appendices for measured drawings).

An ISO-160 tempered glass viewing window is installed in the door. An aluminum blanking plate is mounted over the window on the outside of the chamber which eliminates the possibility of eye damage due to the UV radiation generated by the plasma cleaner emissions. Do not remove the aluminum cover.

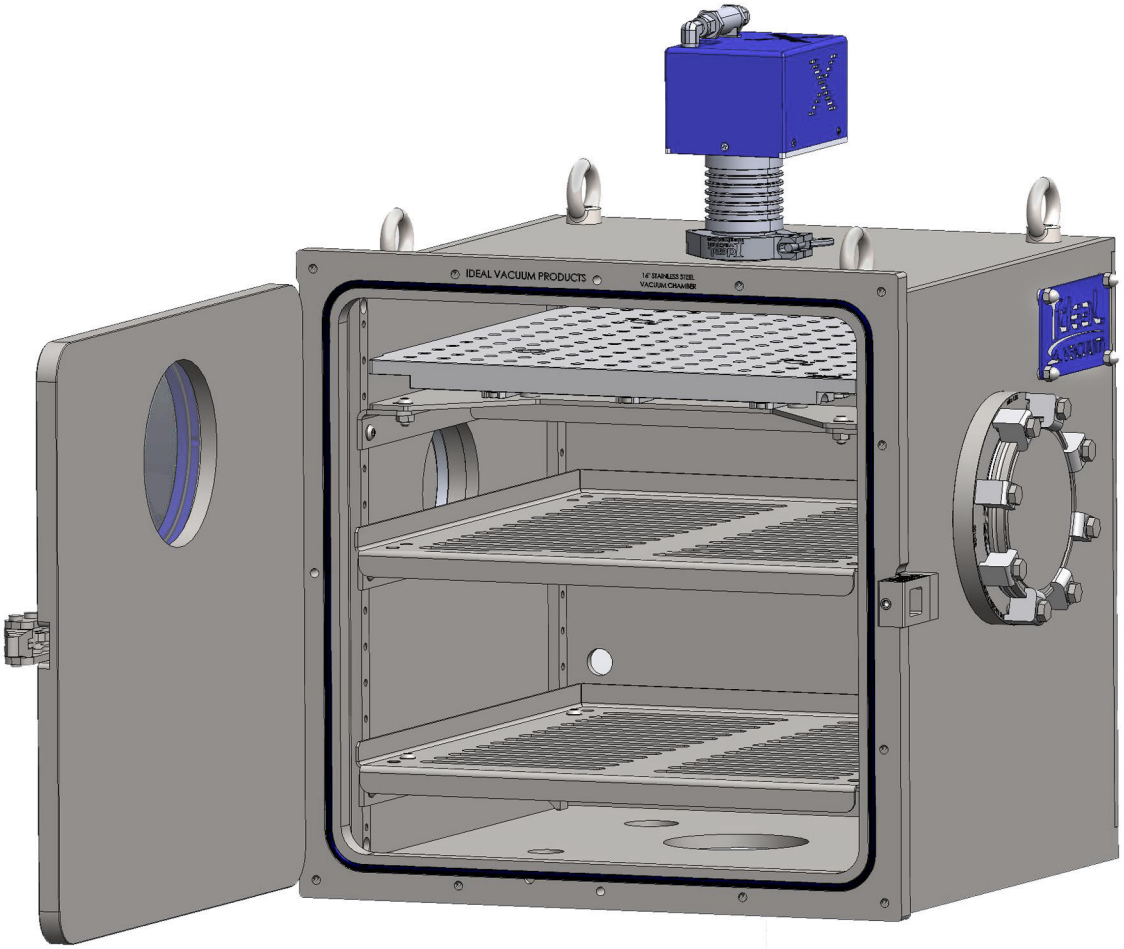


Figure 3 - Open chamber with heated platen, adjustable shelves, and E50 radical source

3.3 EXTERNAL COMPONENTS

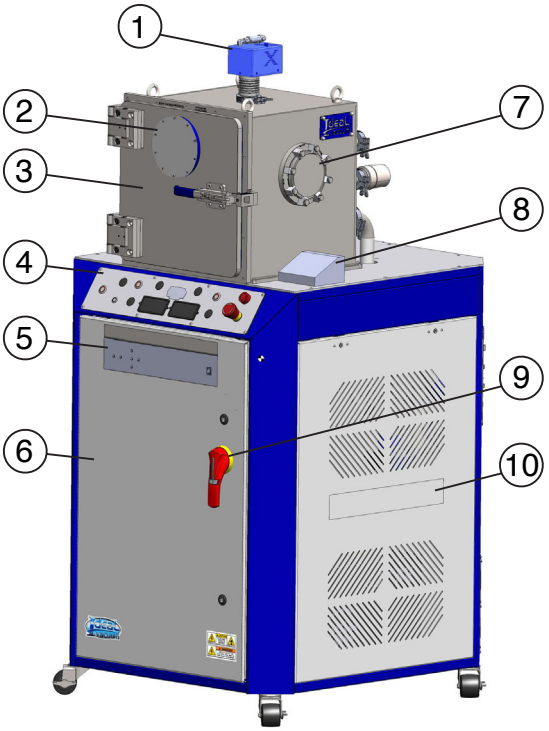


Figure 4 - Front components

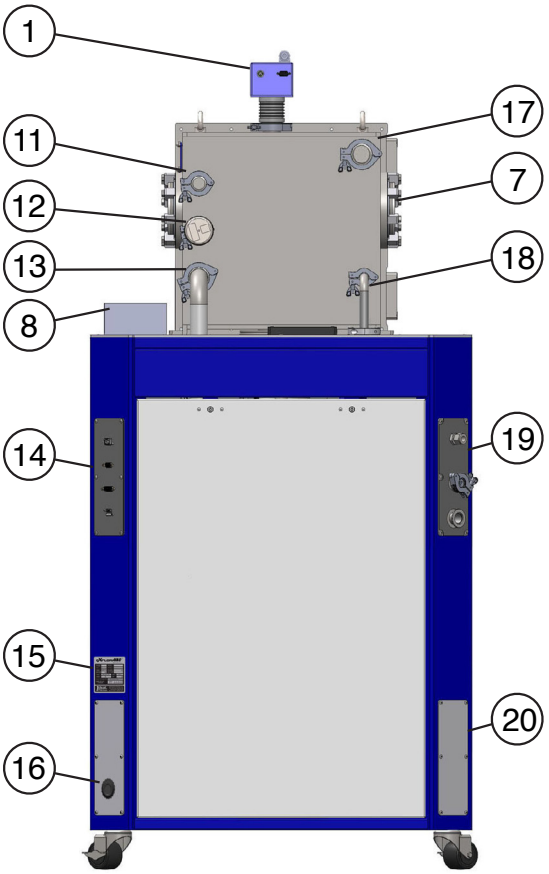


Figure 5 - Rear components

Item	Description
1	Evactron E50 plasma radical source (PRS) with alternate gas inlet, Swagelok® 1/4" OD tube fitting, and 0.5um filter.
2	HALO view non-illuminated ISO-160 viewing window with aluminum blanking cover
3	16x16x16" vacuum chamber w/hinged door
4	Control panel
5	Evactron E50 rack mount controller
6	NEMA style enclosure
7	ISO-100 port for user feedthroughs
8	Evactron E-TC touchpad controller
9	ExploraVac main power switch/disconnect
10	Side panel, vented, quick access
11	User port (blanked KF-25)
12	Chamber pressure gauge, Inficon MPG400 inverted magnetron Pirani and cold cathode
13	Roughing line
14	Digital feedthrough panel
15	Electrical nameplate
16	Power cable input panel
17	4 pair thermocouple feedthrough port (KF 40)
18	Vent and purge gas line
19	Pump exhaust, vent, and purge gas panel
20	Access panel

Table 2 - Exterior component descriptions

3.4 INTERNAL COMPONENTS

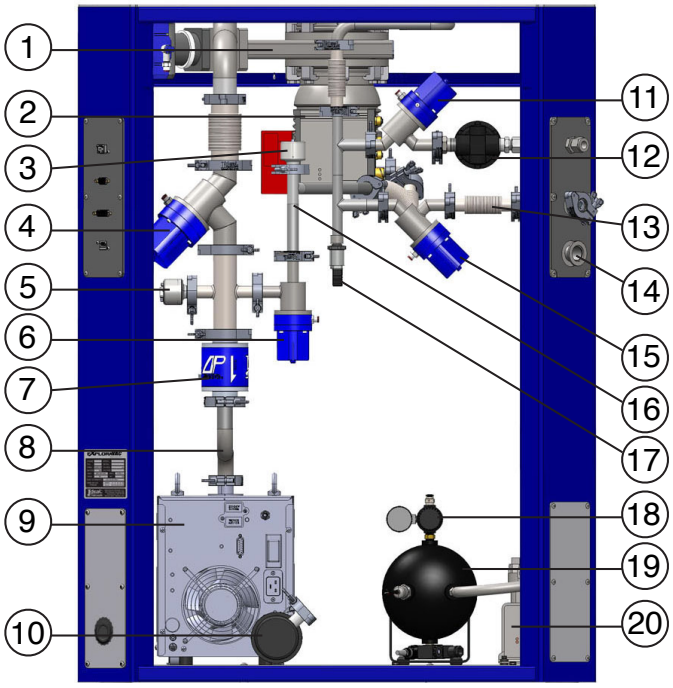


Figure 6 - Internal component locations

Item	Description
1	Turbo gate valve, ULTRALock ISO-100
2	Pfeiffer HiPace 300 Turbo pump with inlet screen and TC 400 Controller
3	Turbo foreline pressure gauge, MKS HPS 902B piezo transducer
4	Roughing line IVP SuperSeal inline pneumatic bellows valve, KF-40
5	Roughing line pressure gauge, MKS HPS 902B piezo transducer
6	Turbo foreline IVP SuperSeal right angle pneumatic bellows valve, KF-16
7	IVP Delta-P anti-suckback and vacuum system isolation valve, KF-40
8	Roughing vacuum line
9	Roughing pump, dry multi-stage roots, Edwards nXR60i
10	Pump exhaust with silencer, KF-25
11	Purge gas IVP SuperSeal inline pneumatic bellows valve, KF-16
12	Purge gas regulator, 0.5 psi nominal
13	Chamber vent line, KF-16
14	Pump exhaust port, KF-25
15	Pump exhaust IVP SuperSeal right angle pneumatic bellows valve, KF-16
16	Turbo foreline (backing line)
17	Purge/vent manifold over-pressure transmitter, ProSense SPT25
18	Compressor air tank regulator, 70 psi nominal
19	Compressor air tank, 2 gallon
20	Onboard air compressor, VIAIR

Table 3 - Interior component descriptions

3.5 CONTROL CONSOLE ELECTRICAL ENCLOSURE

The NEMA style enclosure contains all the necessary electronics and connections for the system. The figure below shows all the major electronic components. Schematics and the electronics Bill of Materials are provided inside the enclosure door.

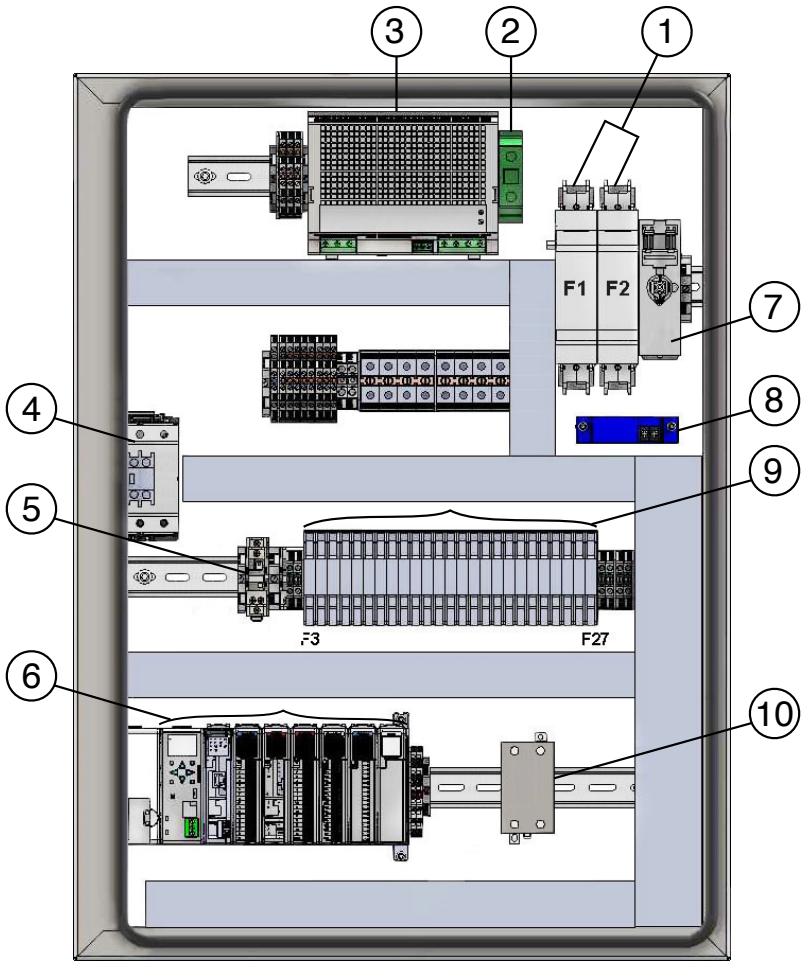


Figure 7 - Main electrical enclosure components

Item	Description
1	Fused “hot” input power terminals
2	Input ground terminal block
3	24 VDC power supply
4	Main power relay
5	Onboard compressor relay
6	Programmable logic control (PLC)
7	Main power switch/disconnect
8	AC current transducer
9	Fuse block for all subsystems
10	Silicon controlled rectifier (SCR) for heated platen shelf

Table 4 - Electrical component descriptions

3.5 BLOCK DIAGRAM

Figure 8, below, shows the major system components in schematic form. Refer to Table 5 for a description of each component.

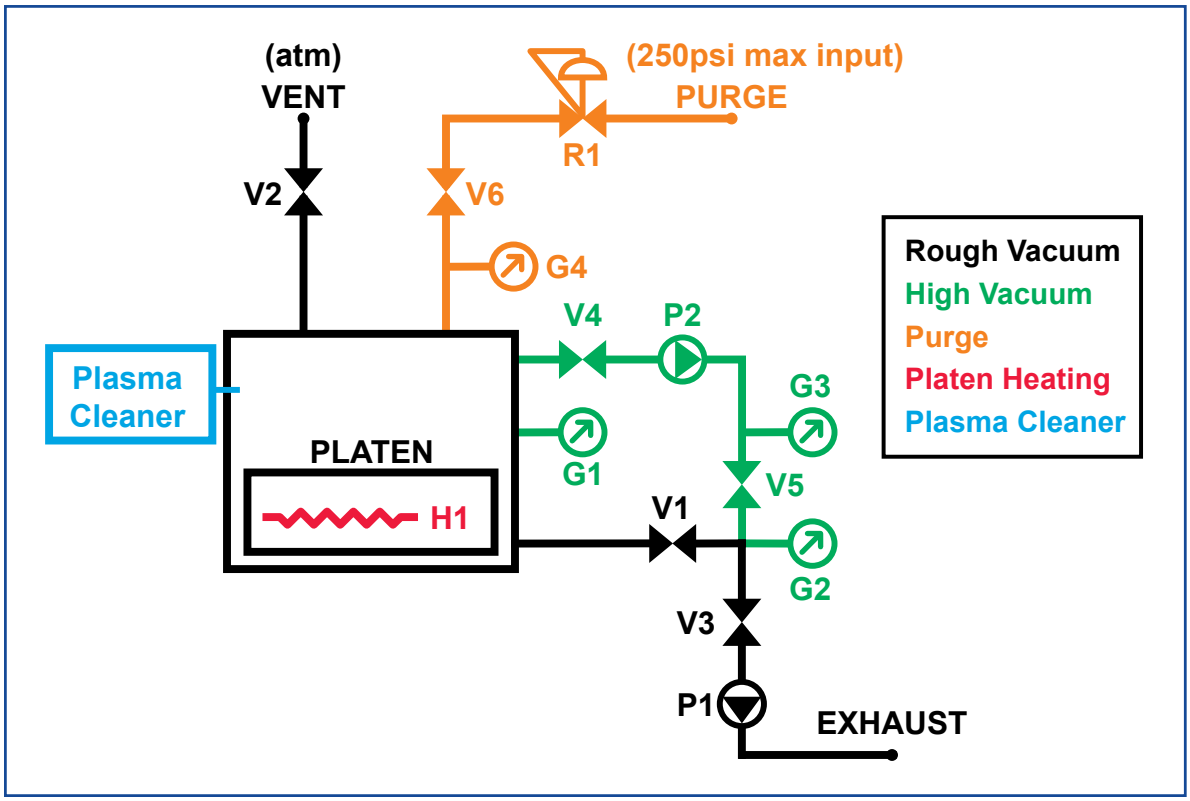


Figure 8 - System block diagram

Item	Description
V1	Roughing control valve
V2	Vent control valve
V3	Delta-P system protection valve
V4	Turbo gate valve
V5	Turbo foreline valve
V6	Purge control valve
P1	Edwards nXR60i dry multi-roots roughing pump
P2	Pfeiffer HiPace 300 turbo pump
G1	Chamber pressure gauge
G2	Roughing line pressure transducer
G3	Turbo foreline pressure transducer
G4	Purge/vent manifold over-pressure transmitter
R1	Purge line regulator
H1	Platen shelf heater

Table 5 - Block diagram descriptions

3.7 CONTROL PANEL

The system is manually operated by the illuminated, safety interlocked, push button switches on the control panel (Figure 9, below). These panel switches and setpoint controllers display current system conditions. Depending on the system function the user requests, the PLC will sequence valves, pumps, and the platen shelf to attain the requested state. For detailed information about switch and controller operations see Chap. 5, p. 24.

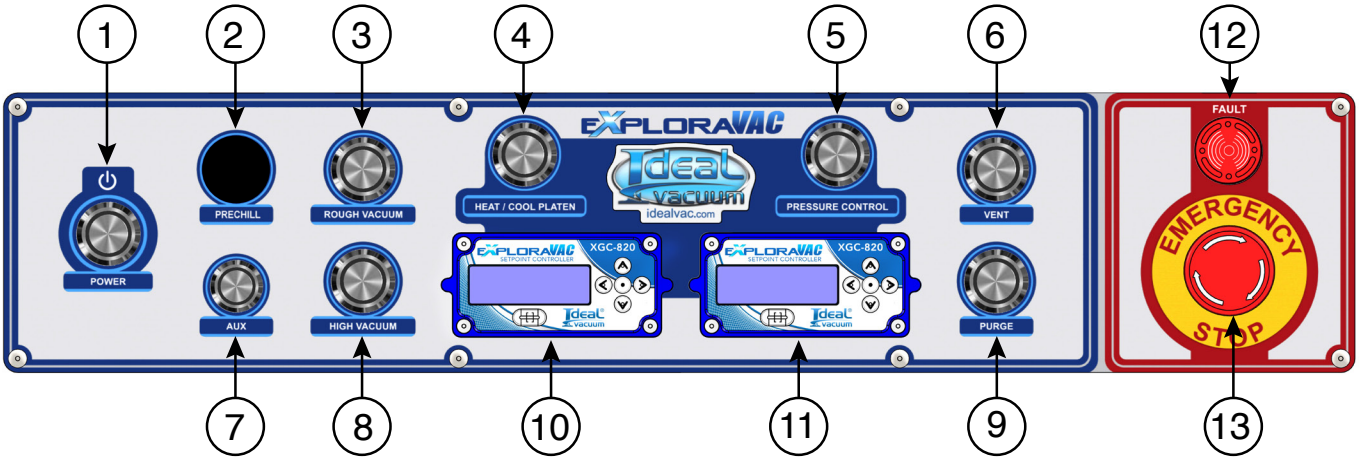


Figure 9 - Control panel layout

Item	Description
1	Power switch
2	Prechill switch (n/a, platen cooling not available on this model)
3	Roughing switch
4	Heat/cool platen switch
5	Pressure control (turbo standby) switch
6	Vent switch
7	Aux (accessory) switch
8	High vacuum switch
9	Purge switch
10	Temperature setpoint controller
11	Pressure gauge and turbo speed controller
12	Fault lamp with audible buzzer
13	Emergency stop switch

Table 6 - Control panel operators

3.8 PRESSURE GAUGES

Chamber pressure is obtained from the chamber-mounted Inficon MPG400 inverted magnetron Pirani and cold cathode combination gauge and displayed on the XGC-820 pressure gauge and turbo speed controller located on the control panel (Figure 11, below). MKS HPS 902B piezo transducers in the roughing and turbo backing lines provide pressure information to the PLC to ensure the proper sequencing of valves and help optimize high vacuum efficiency. Their pressures are not displayed. The ProSense SPT25 pressure transmitter, connected in the purge gas line is monitored by the PLC to ensure safe pressure is not exceeded.

Figure 10 - Inficon MPG400, MKS 902B, and ProSense SPT25

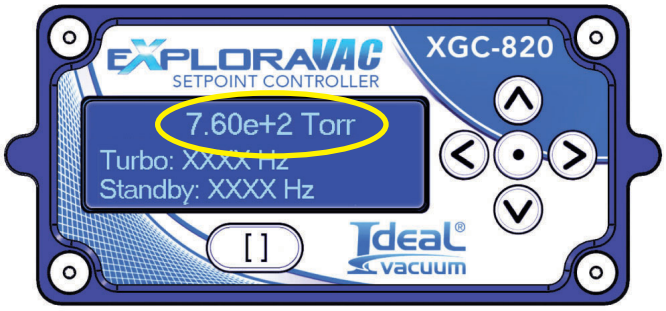


Figure 11 - XGC-820 pressure gauge and turbo speed controller

3.9 VALVES

This ExploraVAC system uses Ideal Vacuum Super-Seal pneumatic bellows valves. These valves are used for the roughing, turbo foreline, vent, and purge lines. An Ideal Vacuum ULTRALock pneumatic gate valve is used between the turbo pump and chamber. A small onboard air compressor with reservoir tank is used to supply air to the valves.

All systems include 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. This prevents the migration of contaminants 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's vent is plumbed into the ExploraVAC system exhaust line. This ensures that undesirable gases are not introduced into the personnel work area (when the ExploraVAC exhaust is connected to a facility exhaust system (Sec. 3.11, p. 19).

3.10 DIGITAL FEEDTHROUGH PANEL

The digital feedthrough panel at the right rear of the system is used to operate and control the ExploraVAC system from a connected computer using our AutoExplor software.

The computer connects to the DB9 RS232 serial port on the panel. A serial to USB adapter cable is available if the computer does not have a serial port (IVP part number P1012232).

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 switch on the control panel or in AutoExplor software turns the AUX relays on and off for operating outboard connected equipment.

The network and USB service ports are unused.

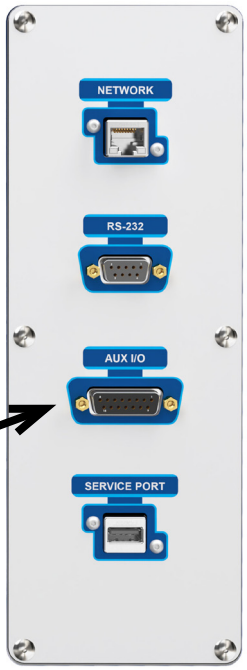


Figure 12 - Digital feedthrough panel

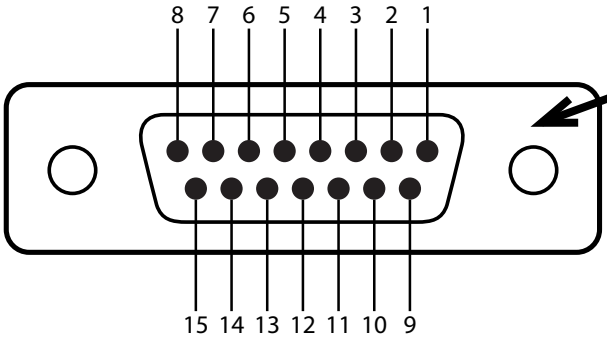


Figure 13 - Auxilliary I/O connector

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

3.11 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.

A Swagelok® bulkhead fitting is installed which accepts 1/2” OD tubing. This connection allows the user to inject high purity or dry gas into the chamber. Maximum allowable purge gas input pressure is 250 PSIG. Purge gas to the chamber is regulated to 0.5psi (Fig. 6, item 12, p. 13).

Figure 14 - Exhaust, vent, and purge panel

3.12 HEATED PLATEN SHELF

The heated platen shelf is made of a 6061-T6 aluminum plate with a standard 1" threaded (1/4"x20) breadboard pattern for mounting test objects. The platen has 2kW of embedded electric heating elements. These provide fast, even heating cycles. Heating rates are up to 8ºC/min. for non-loaded systems. Setpoint accuracy is within 0.3ºC, with 2.2 ºC overshoot. Note that system performance may decrease depending on the thermal load. Chamber pressure greatly effects the rate at which the platen can heat and cool.

The platen's built-in thermocouple is used for temperature measurements. Its temperature is controlled by the IVP XGC-820 temperature setpoint controller on the console control panel (Fig. 9, item 10, p. 16). The maximum temperature limit of the platen is 60ºC. Heating is turned on and off by the HEAT/COOL platen switch (Fig. 9, item 4, p. 16).

⚠ CAUTION

Platen can be up to 60°C (140°F.) Wear gloves when exchanging test items.

3.13 SAMPLE THERMOCOUPLES

A KF-40 port with a four K type thermocouple feedthrough for collecting sample temperatures is provided on the back of the chamber. Temperature data from all four thermocouples is collected and monitored by the Exploravac (Sec. 5.10, p. 27).

3.14 EVACTRON E50 PLASMA CLEANER

The Evactron plasma cleaning system is independently controlled through its own E-TC controller mounted on the ExploraVac top plate next to the chamber. The Evactron is energized when the Exploravac is turned on, and goes into a ready state.

Figure 15 - Evactron E-TC controller

The following three conditions must be met before plasma cleaning may commence:

1. The chamber pressure must be below 1 Torr (Sec. 5.11, p. 29).
2. The PRESSURE CONTROL (turbo standby) switch must be on (Sec. 5.8, p. 26).
3. The HEAT/COOL PLATEN switch must be off (Sec. 5.10, p. 27).

Please see the Evactron E50 user manuals located in the printed materials or the USB drive that came with the system for operation, cleaning strategies, alternate gases, and programming recipes.

4. PLASMA CLEANING QUICK START

Once the system has power connected, use these instructions to quickly begin using the plasma cleaning system.

1. Press the POWER button. It lights up green.

2. Verify that the HEAT/COOL PLATEN switch is off. It should be lit red.

3. Set/verify the desired turbo standby speed in the Pressure gauge and turbo speed controller (Sec. 5.11, p. 29).

4. Press the VENT or PURGE switch. It will light green.

   The chamber will reach ambient atmosphere in approximately 15 seconds.

5. Open the chamber door.
6. Insert test item(s).
7. Close chamber door.

8. Press the PRESSURE CONTROL (turbo standby) switch. It illuminates green.

   This sets the turbo speed to the standby speed setpoint when high vacuum is turned on.

9. Press the HIGH VACUUM switch.

   The system will turn off vent or purge, begin roughing, then automatically crossover to high vacuum, closing the roughing valve and opening the gate valve.

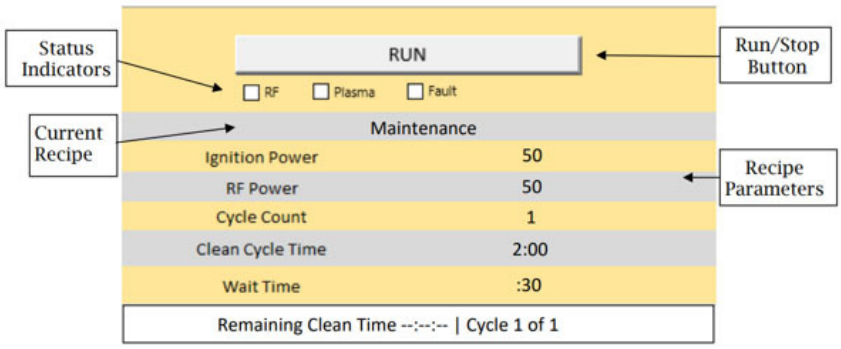
   The HIGH VACUUM switch will blink green/yellow indicating that the turbo is not running at 100% speed. This is correct since the PRESSURE CONTROL (turbo standby) switch is on.

   Note that if the PRESSURE CONTROL (turbo standby) switch is turned off now, the turbo will spin to full speed (plasma cleaning may not be used).

10. Verify that the chamber pressure is at the desired pressure for plasma cleaning.

    Pressure must be lower than 1 Torr.

11. Start the preprogrammed cleaning recipe on the Evactron E-TC.
    a. *The E50 radical source opens gas flow and an arc is struck*
    b. *Plasma cleaning commences.*
    c. *Once the cleaning recipe is finished, the E50 gas valve closes.*



12. Press the HIGH VACUUM switch to turn off high vacuum.

13. Press the VENT or PURGE switch.

    The roughing pump is automatically powered off.

    The chamber will reach ambient atmosphere in approximately 15 seconds.

14. Open the chamber door.
15. Remove test item(s).
16. Insert new test item(s).
17. Close chamber door.
18. Repeat or stop.

NOTE	**To maintain a clean, dry chamber, pump it down to rough vacuum between uses.**

5. OPERATION

Once the unit is physically in place, gas and exhaust lines are connected, and power is supplied, the system may be energized. Note that the chamber is shipped under rough vacuum and must be vented before the door can be opened (Sec. 5.6, p. 25). Button switches are illuminated red while in a standby state, and green when a device is on or running. Blinking, alternating, or other switch colors indicate various other conditions (Sec. 5.14, p. 31 and Sec. 5.15, p. 32).

Quick Start instructions begin on page 21.

5.1 MAIN POWER SWITCH/DISCONNECT

Rotate the main power switch/system disconnect on the face of the cabinet to energize the system. A separate power connection is not required to the Evactron E50 plasma cleaning system since it is powered by the Exploravac. When the red handle is horizontal, the system is energized.

5.2 POWER SWITCH

When the Main Power Disconnect is turned on, the POWER switch will light red. When pressed, the POWER switch will light green. All other switches will light red. All valves will be in their normally closed states. The PLC will initialize, the Evactron will power up, and the XGC-820 setpoint controllers will turn on. The system enters a standby state, ready to perform a process. If, while the system is running, the POWER switch is pressed, it will blink red for 3 seconds. During this time, the system will systematically shut appropriate valves, turn off any device that is on, including the Evactron, remove power to the pumps, then turn off.

5.3 AUX SWITCH

When pressed, the AUX switch will light green. The user's outboard equipment, connected to the AUX I/O relays on the digital feedthrough panel at the back of the ExploraVAC cabinet, will be powered on. (Sec. 3.10, p. 18).

5.4 ROUGH VACUUM SWITCH

When pressed, the ROUGH VACUUM switch will light green. The nXR60i roughing pump will energize, the roughing valve will open, and the chamber will begin to pump down. The chamber will ultimately reach a pressure of about $2x10^{-2}$ Torr (20 mTorr). The XGC-820 pressure gauge and turbo speed controller will display chamber pressure.

If the system is in roughing mode and the ROUGH VACUUM switch is turned off, the roughing valve will close and the roughing pump will turn off. This allows the chamber to remain under rough vacuum. The POWER switch will remain on (green).

5.5 HIGH VACUUM SWITCH

If the ROUGH VACUUM switch is on (green), and the roughing pressure is at or below the crossover threshold (factory set at 2 Torr), pressing the HIGH VACUUM icon will initiate high vacuum mode and the HIGH VACUUM icon will turn green.

If the roughing pump is off, or the pressure is above the crossover threshold when the HIGH VACUUM switch is pressed, it will blink 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 threshold is reached, the roughing valve closes, the foreline and gate valves open, and chamber pressure goes into high vacuum.

The ROUGH VACUUM 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 VACUUM icon closes all valves and turns off both the turbo and roughing pumps. The chamber remains under vacuum.

If the Evactron is not on, and the standby speed is not engaged, the turbo will rotate at its maximum speed and the chamber will reach the turbo's ultimate rated pressure (Sec. 5.11, p. 29)

If the Evactron is on, the final pressure that the chamber can reach is above the turbo pump's rated ultimate pressure, but still in high vacuum. The turbo cannot run at 100% speed with the gas load introduced by the Evactron. It will soon overheat and shut down to protect itself. The chamber pressure achieved depends on the gas load introduced by the Evactron plasma system and the turbo's standby speed, user programmed on the XGC-820 pressure gauge and turbo speed controller (Sec. 5.11, p. 29). Turn the turbo's standby speed on and off with the PRESSURE CONTROL (turbo standby) switch (Sec. 5.8, p. 26).

5.6 VENT SWITCH

Venting is allowed only when the turbo and roughing pumps are off. If the system is in high vacuum mode, the HIGH VACUUM switch must be turned off before venting is possible.Vent speed is approximately 15 seconds.

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

When either the ROUGH VACUUM or HIGH VACUUM switch is turned on, the vent valve will close and the selected pump sequence will be initiated.

5.7 PURGE SWITCH

The purge function allows the user to introduce high-purity or dry gas into the chamber instead of air. Filling the chamber with purge gas instead of venting with air can be useful to keep the chamber mostly free of water when exchanging items, thereby reducing chamber pump down cycle time. Purge speed (to atmospheric pressure) is approximately 15 seconds.

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 PSIG, and will automatically shut off PURGE if chamber pressure exceeds 1000 Torr.

The HIGH VACUUM switch must be turned off before purging is possible.

The PURGE switch behaves like the VENT switch.

If the PURGE switch is pressed when ROUGH VACUUM or VENT is on, the PURGE switch will blink green, turn off the roughing pump or vent, then open the purge valve. Purging will continue and the PURGE switch will remain 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 will close and the selected pump sequence will be initiated.

NOTE

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

5.8 PRESSURE CONTROL (TURBO STANDBY) SWITCH

The PRESSURE CONTROL (turbo standby) switch activates the standby turbo speed programmed by the XGC-820 pressure gauge and turbo speed controller (Sec. 5.11, p. 29).

When the PRESSURE CONTROL (turbo standby) switch is pressed, the system automatically turns off venting and purging and the PRESSURE CONTROL (turbo standby) switch lights green.

The PRESSURE CONTROL (turbo standby) switch must be on (green) before plasma cleaning can be used. This switch will light steady blue indicating HIGH VACUUM is off but the pressure is below 1 Torr. Plasma cleaning may be used when the switch is blue.

5.9 HEAT/COOL PLATEN SWITCH

The HEAT/COOL PLATEN switch turns on the heated platen shelf. When the HEAT/COOL PLATEN switch is pressed, the switch lights green.

The system immediately starts to heat the platen to the temperature saved in the temperature setpoint controller (Sec. 5.10, p. 27). Desired temperatures can be maintained to ± 0.3°C with 2.2°C overshoot at the setpoint temperature.

The HEAT/COOL PLATEN switch must be off (red) before plasma cleaning can be used.

5.10 TEMPERATURE SETPOINT CONTROLLER (OPTION)

The temperature setpoint controller is located below the HEAT/COOL PLATEN switch on the control panel. It is used to display and change the platen shelf setpoint temperature, ramp rate and soak time. This controller must be turned off for plamsa cleaning to be used.

Setpoint temperature is the temperature you want the platen to maintain.

Ramp rate is the speed with which the platen heats from its initial state to the setpoint value. The maximum ramp rate is approximately 8ºC/min. and can vary depending on the chamber pressure and various environmental factors. The ramp rate can be set to MAX, which forces the platen to get to temperature as quickly as possible. Where a set ramp rate is a linear function, the MAX rate will be a curve. Actual temperature performance graphs of your ExploraVac instrument are found in the printed datasheets and on the USB drive supplied with the system.

Soak is the amount of time after the setpoint temperature is reached that the temperature is maintained. When the soak time has elapsed, the platen heaters turn off. Platen temperature will naturally cool to ambient temperature and will decrease rapidly when the chamber door is opened.

The figure below shows the temperature controller's home page. The home page displays the current thermocouple temperature in the user's selected units, the setpoint temperature, and the ramp rate or soak time. The top right of the screen shows PLTN to show that this is the platen temperature controller. The temperature setpoint controller's flowchart is found on page 28.

The ExploraVac instrument includes 4 thermocouples which can be used to measure temperatures of items on top of the platen, or in other chamber areas. From the temperature controller's home page, press the right arrow. This toggles the page from the home page to a display of all five themocouple temperatures. Note that while plasma cleaning, the thermocouples will display erroneous data.

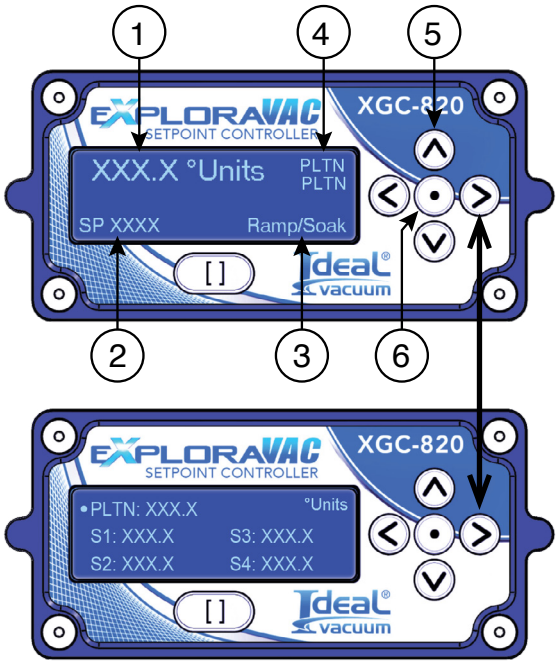


Figure 16 - Toggle between home page and themocouple temperatures page

Item	Description
1	Platen Temperature (in user selected units) (resolution of 0.1 degree)
2	Setpoint Temperature (in same units as platen temperature)
3	Ramp Rate or Soak Time (if a soak time is saved, ramp rate changes to soak time when setpoint temperature is reached. Otherwise, only ramp rate is displayed.
4	Platen Mode (indicates the thermocouple the controller is using. PLTN uses the thermocouple embedded in the platen. S1-S4 are the feedthrough thermocouples which could be attached to a sample or test object)
5	Arrow Buttons (used to negotiate through the menus)
6	Select/Enter Button (used to make a selection or save a parameter value)

Table 8 - Temperature controller display items

Temperature Controller Flowchart:

To negotiate the menu heirarchy:

- Press the center SELECT/ENTER button to go down (right) one tier.
- Press the LEFT ARROW button to go to the left (up) one tier.
- Press the UP or DOWN ARROW button to move vertically in the same tier.
- Press the UP or DOWN ARROW to increase or decrease a value.
- Press the SELECT/ENTER button to save a value.
- Arrows on the flowchart boxes below indicate which arrow buttons are active for that menu item.

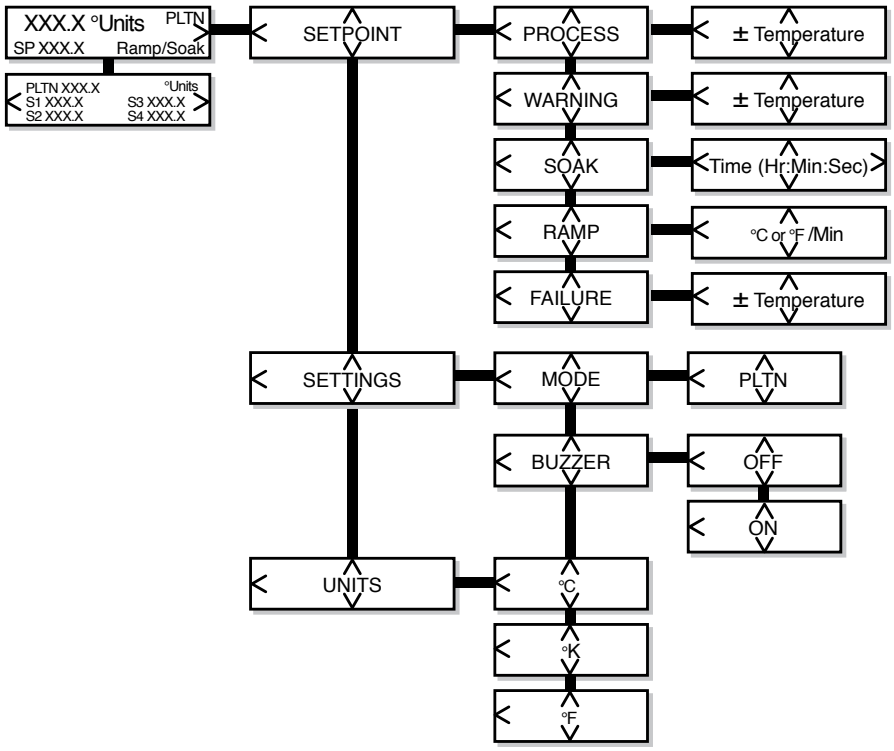


Figure 17 - Temperature controller menu flowchart

- PROCESS is the temperature for the system to maintain (the setpoint).
- WARNING is the temperature above the setpoint that the HEAT/COOL PLATEN switch will begin to blink green/yellow to indicate a potential problem. The platen will continue to operate.
- SOAK is the amount of time after reaching the setpoint that the temperature will be maintained.
- RAMP is the rate at which the temperature increases or decreases towards the setpoint (process).
- FAILURE is the temperature above the setpoint when the system will automatically shut off and alarm. This setting ensures that your sample or the system will not be damaged.

5.11 PRESSURE GAUGE AND TURBO SPEED SETPOINT CONTROLLER

The XGC-820 presure gauge and turbo speed setpoint controller is located below the PRESSURE CONTROL (turbo standby) switch on the control panel. It is used to display chamber pressure and to change the turbo standby speed.

The chamber pressure, in the user's selected units, is displayed in the top center of the screen.

Turbo shows the current frequency of the turbo pump's variable frequency drive in Hz. The maximum frequency is 1000 Hz. The frequency is directly proportional to the turbo's speed. At 1000 Hz, the turbo operates at 100% of its rotational speed, which is 15,000 rpm.

Because the turbo cannot run continuously at 100% speed when the Evactron is running and injecting gas into the chamber, it is necessary to reduce the turbo's speed so that it can keep up with the gas load without overheating or shutting down. This is accomplished with the Standby feature.

The Standby setpoint is the desired frequency (speed) of the turbo pump and is user defined through the controller. A Standby speed less than the turbo's maximum allows the turbo to run continuously with the increased Evactron gas load, albeit at a chamber pressure above the turbo's ultimate pressure capability.

See the flowchart on the next page to enter or change the Standby setpoint speed.

The Standby setpoint speed is turned on and off with the PRESSURE CONTROL (turbo standby) switch on the console (Sec. 5.8, p. 26). The allowable speed range is 200-1000 Hz.

When the PRESSURE CONTROL (turbo standby) switch is off, and HIGH VACUUM is selected, the turbo will rotate at its maximum speed (1000 Hz). When the PRESSURE CONTROL (turbo standby) switch is on, the turbo rotates at the Standby setpoint speed.

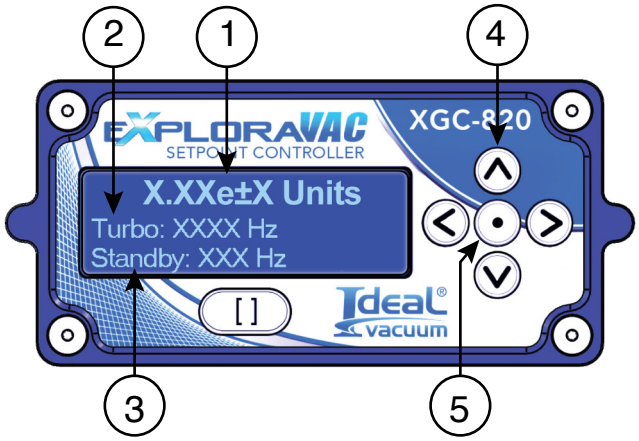


Figure 18 - Pressure gauge and turbo speed controller home page

Item	Description
1	Chamber pressure (in user selected units)
2	Turbo (displays current speed of turbo pump)
3	Standby setpoint (displays desired turbo speed when PRESSURE CONTROL/turbo standby switch is on).
4	Arrow Buttons (used to negotiate through the menus)
5	Select/Enter Button (used to make a selection or save a parameter value)

Table 9 - Pressure gauge and turbo speed controller display items

To negotiate the menu heirarchy:

- Press the center SELECT/ENTER button to go down (right) one tier.
- Press the LEFT ARROW button to go to the left (up) one tier.
- Press the UP or DOWN ARROW button to move vertically in the same tier.
- Press the UP or DOWN ARROW to increase or decrease a value.
- Press the SELECT/ENTER button to save a value.
- Arrows on the flowchart boxes below indicate which arrow buttons are active for that menu item.

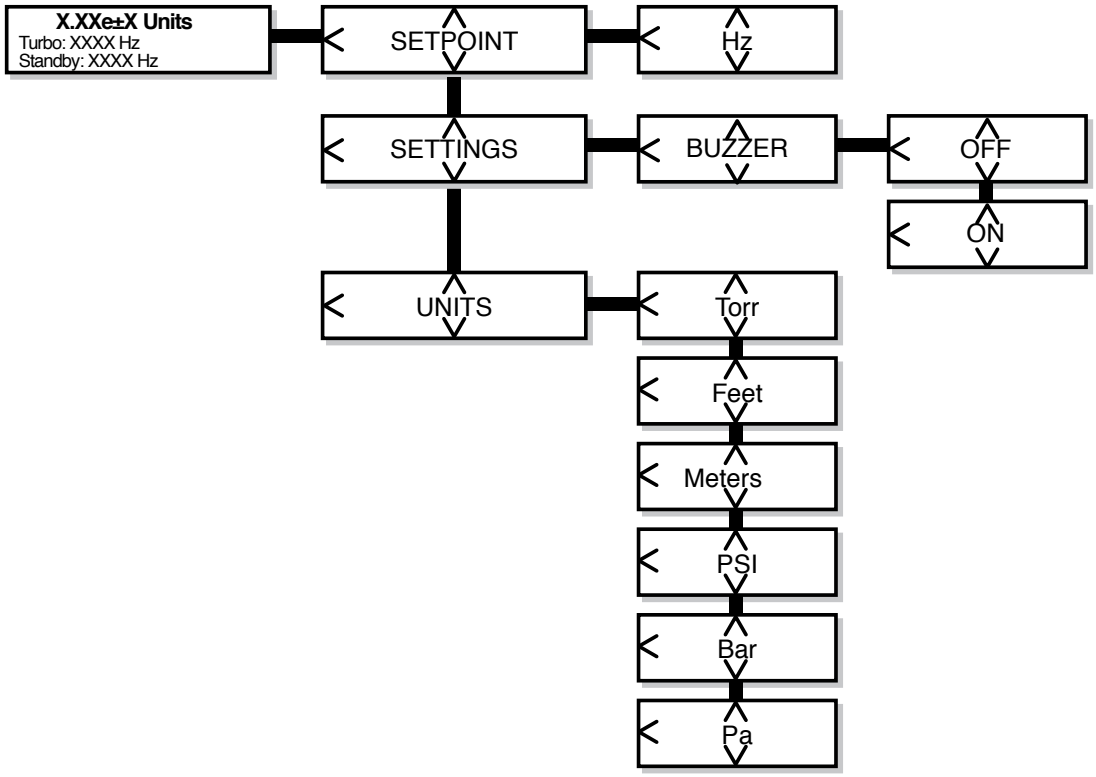


Figure 19 - Pressure gauge and turbo speed setpoint controller menu flowchart

5.12 SYSTEM SHUTDOWN

Use the POWER switch to safely turn off the system at any time. This initiates a sequential, deliberate, system shutdown in the following order:

1. Gate valve, then all other valves close.
2. The Evactron turns off.
3. The turbo, then the roughing pump turns off.
4. All control panel switches turn off.
5. The red POWER light remains on.

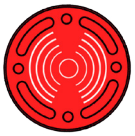
5.13 EMERGENCY STOP SWITCH

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 safely, including the Evactron.

5.14 FAULTS



The fault light will blink and an audible buzzer will sound when a fault condition occurs. The effected subsystem switch will blink red (see Sec. 4.14, below). If the fault is because a device exceeds its parameters (i.e., an over temperature situation), the fault may self-correct. If the fault is because of equipment failure, the fault will persist. The effected device will need to be corrected before it will function.

Failure	Switch Blinks Red/Fault Alarm Activates
Platen over temperature or thermocouple failure	Heat/Cool Platen
Chamber over pressure	Vent, Purge
Roughing pump over temperature	Rough, Pressure Control (turbo standby)
No air tank pressure	High Vacuum (Vent, Rough, Purge)

Table 10 - Faults and effected subsystem(s)

5.15 WARNINGS AND OTHER SUBSYSTEM CONDITIONS

The system provides additional visual feedback about the state of its subsystems and devices. When switches are not illuminated, power is off. When lighted red, the subsystem is in a standby state, ready to be turned on. When lighted green, a subsystem is on.

The information in the table below describes subsystem or device transitional conditions, warnings or fault indications.

Console Switch	Blinking Red	Blinking Green	Blinking Green/Yellow	Blinking Green/Red	Blinking Yellow	Steady Blue
Power	Powering off					
Rough	Rough pump temp. too high	Pump not starting	Rough pump temp. high			
High Vacuum		Standby for rough limit	Turbo spinning up	Turbo spinning up,gate valve closed	Coasting down	
Vent	Chamber over pressure	In vent mode, valve not open				
Purge	Chamber over pressure	In purge mode, valve not open				
Heat/Cool Platen	Over setpoint failure temp.		Over setpoint warning temp.			
Pressure Control (turbo standby)		When on and going to standby speed	On but standby speed not getting set			Turbo standby is enabled, HIGH VACUUM is not on

Table 11 - Other subsystem condition codes

6. SERVICE AND MAINTENANCE

DANGER

De-energize and lockout 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 must be vented and brought to ambient atmosphere.

CAUTION

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

NOTE

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

ExploraVAC systems are built with premium components and quality engineering. Systems are designed to operate with very little user maintenance. Follow the suggested routine maintenance schedule (Sec. 6.1, p. 34) to keep your system in top operating condition for many years.

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 a cloth or paper towel wetted with ispopropanol.

For assistance with service parts, please visit the idealvac.com website, or call to speak with one of our customer service representatives.

6.1 SERVICE SCHEDULE

Item	Service Interval											
	Months							Hr	Cycles			
	1	3	12	24	48	60	120	20k	100k	300k	1.5M	2M
Edwards nXR60i Roughing Pump			X									
Clean inlet strainer & external fan cover			X									
Replace exhaust filter			X									
Replace pump- bearings						X						
Replace pump controller							X					
Pfeiffer HiPace 300 Turbo												
Replace operating fluid reservoir					X							
Replace rotor bearing					X							
ViAir Air Compressor												
Replace filter element			X									
IVP Super-Seal Pneumatic Valves												
Rebuild or replace											X	
IVP Delta-P Valve												
Rebuild or replace												X
IVP ULTRALock Gate Valve												
Rebuild or replace ISO 100										X		
MKS 902B Piezo Transducer												
Replace												X

Table 12 - Recommended preventive maintenance schedule

For service or replacement procedures, see the product owner's manual on the USB drive supplied with the system or by part number at idealvac.com.

7. CERTIFICATIONS

Ideal Vacuum Products is a Certified UL508a Panel Shop. The Exploravac electrical enclosure is built with UL standards/certification in mind. All in house wiring uses UL certified wire spools and assembly is completed using UL required calibrated tooling and vendor recommended tools. UL listed components are used throughout. Fuse selections and ratings follow proper UL guidelines. The Exploravac system chassis, vacuum chamber and all welded fittings conform to RoHS. System components used in the Exploravac model P1013547 hold the following certifications:

Equipment	Certifications
Pfeiffer HiPace 300 turbo pump	CE
Edwards nXR60i multi roots roughing pump:	CE, EMC, RoHS, REACH
Evactron E50 plasma cleaning system:	RoHS, CE, NRTL, TUV
Inficon MPG400 Pirani and cold cathode gauge	CE
MKS 902B Piezo Transducer	CE
ProSense SPT25 pressure transmitter	CE
ViAir onboard compressor system	CE, RoHS, REACH

Table 13 - Equipment certifications

8. APPENDIX

The datasheet on the next page has the specifications of your built-to-order ExploraVAC system.

Following the datasheet page are actual test performance graphs of your ExploraVAC system.

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