AMETEK ProLine Mass Spectrometer

User Manual

REGISTERED ISO 9001 MANAGEMENT SYSTEM

90516VE, REV ZB

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Safety Notes

wARnings, cAuTions, and noTEs contained in this manual emphasize critical instructions as follows:

An operating procedure which, if not strictly observed, may result in personal injury or environmental contamination.

An operating procedure which, if not strictly observed, may result in damage to the equipment.

Important information that should not be overlooked.

Dymaxion Electronics and Sensor

Before connecting the 24 VDC power to the electronics, ensure that the electronics are connected to the sensor. Otherwise, damage to the electronics is possible.

Always remove 24 VDC power from the Dymaxion electronics before removing the electronics from the sensor.

Electrical Safety

Up to **2 kV** may be present in the analyzer housings. Always shut down power source(s) before performing maintenance or troubleshooting. Only a qualified electrician should make electrical connections and ground checks.

Any use of the equipment in a manner not specified by the manufacturer may impair the safety protection originally provided by the equipment.

Do not operate this instrument outside of the temperature and humidity specifications stated in Chapter 2.

Fuse must be replaced only with the same type and ratings as described on the power label. Fuse must be certified/listed.

BURN HAZARD. The spectrometer heater jacket normally operates at 60°C (140°F) on the surface and 110°C (230°F) inside. The inlet heater can reach 180°C (356°F). AVOID CONTACT.

Grounding

Instrument grounding is mandatory. Performance specifications and safety protection are void if instrument is operated from an improperly grounded power source.

Verify ground continuity of all equipment before applying power.

Chemical Safety

This instrument may be used to measure process gases and vapors that may be hazardous. The user must check the Material Safety Data Sheet (MSDS) as well as local and national regulations before dispensing and disposing any hazardous material. Route exhaust lines appropriately.

All process tubing and connectors are required to be suitable for the maximum pressure involved.

On oil vane pumps, maintain proper oil level. DO NOT OVERFILL.

Warning Labels

These symbols may appear on the instrument in order to alert you of existing conditions.

PRo TEc TiVE c onduc To R TERMin Al
(Bo Rni ER d E l 'Ec RAn d E PRo TEc Tion)
s chutzerde

cA u Tion - Risk of electric shock
(ATTEn Tion -Ris Qu E d E d Éc HARg E Él Ec TRiQu E)
Achtung - Hochspannung l ebensgefahr

cA u Tion - (Refer to accompanying documents)
(ATTEn Tion -s E RÉFERER Au X docu MEn Ts Join Ts)
Achtung (Beachten s ie beiliegende d okumente)

c Au Tion - Hot s urface

(ATTEn Tion -su RFAc E c HAud E)
Achtung - Heiße Oberfläche

Environmental Information (WEEE)

This AMETEK product contains materials that can be reclaimed and recycled. In some cases the product may contain materials known to be hazardous to the environment or human health. In order to prevent the release of harmful substances into the environment and to conserve our natural resources, AMETEK recommends that you arrange to recycle this product when it reaches its "end of life."

Waste Electrical and Electronic Equipment (WEEE) should never be disposed of in a municipal waste system (residential trash). The **Wheelie Bin** marking on this product is a reminder to dispose of the product properly after it has completed its useful life and been removed from service. Metals, plastics and other components are recyclable and you can do your part by one of the following these steps:

- When the equipment is ready to be disposed of, take it to your local or regional waste collection administration for recycling.
- In some cases, your "end-of-life" product may be traded in for credit towards the purchase of new AMETEK instruments. Contact your dealer to see if this program is available in your area.
- If you need further assistance in recycling your AMETEK product, contact our office listed in the front of the instruction manual.

EC Declaration of Conformity

***Manufacturer's Name*:** AMETEK, Inc., Process Instruments (ISO 9001 Registered 1995)

***Manufacturer's Address*:** Process & Analytical Instruments Division
150 Freeport Road
Pittsburgh, PA, 15238 USA
Phone: 412-828-9040 Fax: 412-826-0686

declares that the product:

***Product Name*:** AMETEK ProLine Mass Spectrometer

Model Number(s):

Faraday Cup	Faraday Cup/Electron Multiplier
DP100	DP100M
DP200	DP200M
DP300	DP300M

complies with the requirements of EMC Directive 2004/108/EC:

EN 61326-1 Radio Frequency Emissions

EN50011 (CISPR 11)	Radiated and Conducted, Class A, Group 2, ISM Device
EN61000-3-2	Harmonic Current
EN61000-3-3	Voltage Fluctuation / Flicker

EN61326-1, / EN50082-1 Immunity

EN61000-4-2	Electrostatic Discharge, 4kV/8kV, contact/air
EN61000-4-3, ENV50204	Radiated Radio Frequencies, 3V/m
EN61000-4-4	Electrical Fast Transient/Burst, .5kV/1kV
EN61000-4-5	Surge, 1kV to Shields, 1kV/2kV AC Differential/Common
EN61000-4-6	Conducted Radio Frequencies, 3 V/m
EN61000-4-11	Voltage Dips and Variations, 100%, 95%, 60% and 30%
EN61000-4-8	Magnetic Immunity

and with the low voltage directive 2006/95/EC:

EN 61010-1, Safety Requirement for Electrical Equipment

Manufacturer's Address in Europe:
AMETEK Precision Instruments Europe GmbH
Rudolf-Diesel-Strasse 16
D-40670 Meerbusch Germany
Contact: Dr. Jurgen Gassen

Mark Coppler
Sr. Compliance Engineer
AMETEK Process Instruments

WARRANTY AND CLAIMS

We warrant that any equipment of our own manufacture or manufactured for us pursuant to our specifications which shall not be, at the time of shipment thereof by or for us, free from defects in material or workmanship under normal use and service will be repaired or replaced (at our option) by us free of charge, provided that written notice of such defect is received by us within twelve (12) months from date of shipment of portable analyzers or within eighteen (18) months from date of shipment or twelve (12) months from date of installation of permanent equipment, whichever period is shorter. All equipment requiring repair or replacement under the warranty shall be returned to us at our factory, or at such other location as we may designate, transportation prepaid. Such returned equipment shall be examined by us and if it is found to be defective as a result of defective materials or workmanship, it shall be repaired or replaced as aforesaid. Our obligation does not include the cost of furnishing any labor in connection with the installation of such repaired or replaced equipment or parts thereof, nor does it include the responsibility or cost of transportation. In addition, instead of repairing or replacing the equipment returned to us as aforesaid, we may, at our option, take back the defective equipment, and refund in full settlement the purchase price thereof paid by Buyer.

Process photometric analyzers, process moisture analyzers, and sampling systems are warranted to perform the intended measurement, only in the event that the customer has supplied, and AMETEK has accepted, valid sample stream composition data, process conditions, and electrical area classification prior to order acknowledgment. The photometric light sources are warranted for ninety (90) days from date of shipment. Resale items warranty is limited to the transferable portion of the original equipment manufacturer's warranty to AMETEK. If you are returning equipment from outside the United States, a statement should appear on the documentation accompanying the equipment being returned declaring that the goods being returned for repair are American goods, the name of the firm who purchased the goods, and the shipment date.

The warranty shall not apply to any equipment (or part thereof) which has been tampered with or altered after leaving our control or which has been replaced by anyone except us, or which has been subject to misuse, neglect, abuse or improper use. Misuse or abuse of the equipment, or any part thereof, shall be construed to include, but shall not be limited to, damage by negligence, accident, fire or force of the elements. Improper use or misapplications shall be construed to include improper or inadequate protection against shock, vibration, high or low temperature, overpressure, excess voltage and the like, or operating the equipment with or in a corrosive, explosive or combustible medium, unless the equipment is specifically designed for such service, or exposure to any other service or environment of greater severity than that for which the equipment was designed.

The warranty does not apply to used or secondhand equipment nor extend to anyone other than the original purchaser from us.

THIS WARRANTY IS GIVEN AND ACCEPTED IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION AND WARRANTIES OF FITNESS OR OF MERCHANTABILITY OTHER THAN AS EXPRESSLY SET FORTH HEREIN, AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON OUR PART. IN NO EVENT SHALL WE BE LIABLE UNDER THIS WARRANTY OR ANY OTHER PROVISION OF THIS AGREEMENT FOR ANY ANTICIPATED OR LOST PROFITS, INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, TIME CHANGES OR ANY OTHER LOSSES INCURRED BY THE ORIGINAL PURCHASER OR ANY THIRD PARTY IN CONNECTION WITH THE PURCHASE, INSTALLATION, REPAIR OR OPERATION OF EQUIPMENT, OR ANY PART THEREOF COVERED BY THIS WARRANTY OR OTHERWISE. WE MAKE NO WARRANTY, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF FITNESS OR OF MERCHANTABILITY, AS TO ANY OTHER MANUFACTURER'S EQUIPMENT, WHETHER SOLD SEPARATELY OR IN CONJUNCTION WITH EQUIPMENT OF OUR MANUFACTURE. WE DO NOT AUTHORIZE ANY REPRESENTATIVE OR OTHER PERSON TO ASSUME FOR US ANY LIABILITY IN CONNECTION WITH EQUIPMENT, OR ANY PART THEREOF, COVERED BY THIS WARRANTY.

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OVERVIEW

The AMETEK ProLine is a process quadrupole mass spectrometer that provides continuous multi-point monitoring.

This overview of the ProLine provides information on the following:

- Theory of Mass Spectrometry
- ProLine Subsystems
- Technical Support

Mass Spectrometer Theory

The mass spectrometer allows you to identify the masses of individual atoms and molecules that have been converted to ions from a given sample. This technique is unique in that it provides a fingerprint identification for the structural and chemical properties of these molecules.

A mass spectrometer consists of the following components:

- Sampling System
- Mass Spectrometer Hardware
- Data System

Sampling System

The Sampling System serves as a connection between the outside sample environment and the vacuum environment that the mass spectrometer requires. The AMETEK ProLine can be equipped with a variety of inlet systems. All of these systems are configured to bring the required number of sample streams into the ProLine at the specified pressure, while maintaining the high vacuum necessary for proper mass spectrometry operation.

Mass Spectrometer Hardware

Once the sample reaches the mass spectrometer hardware, three processes take place:

- Ionization
- Separation
- Detection

Ionization

The AMETEK ProLine incorporates a closed-ion source. During ionization, sample molecules are turned into ions which are then focused towards the quadrupole to be detected. The process occurs in the ionizer which consists of a filament, filament electron repeller, ionizer body, ion volume and two focusing lenses. See Figure 1-1.

The filament produces electrons. As current flows through the filament, it is electrically heated to incandescence and emits free electrons. Once the electrons are free, they are accelerated towards the ionizer body by the potential difference between the filament and the ionizer body. As a cloud of electrons accelerates

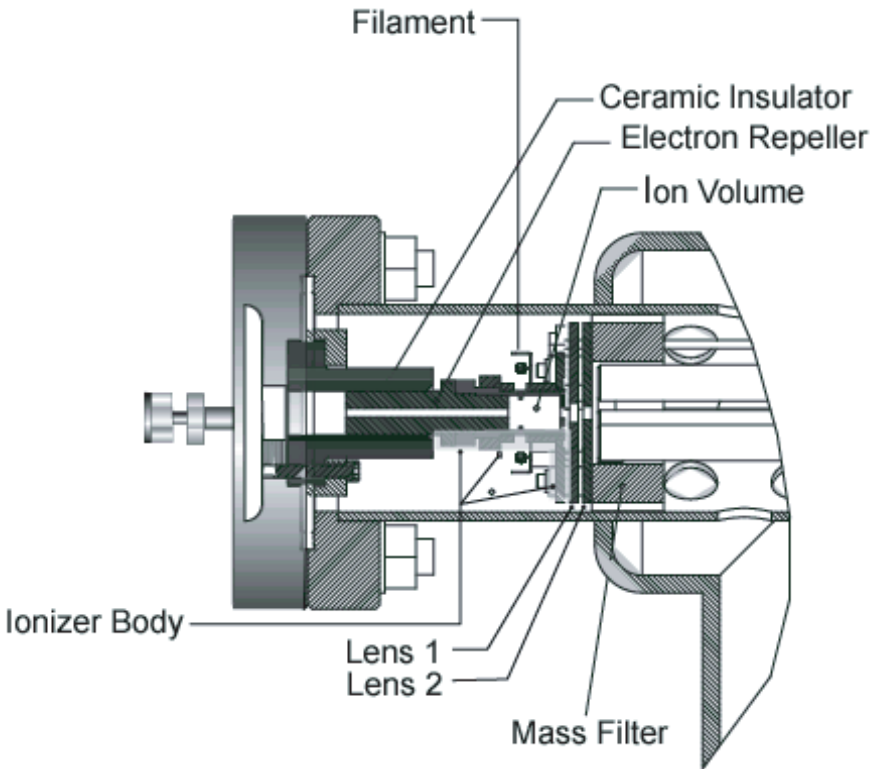


Figure 1-1.
Ionizer components.

towards the ionizer body, the electrons collide with the sample in the center of the ion volume and create ions.

Once the positive ions are formed, they are extracted from the ion region and focused towards the quadrupole mass filter by a difference in potential. Lens 1 has an applied negative voltage that, due to a difference in electrostatic potential, attracts the newly formed positive ions, passing them through Lens 2. Lens 2, in turn, focuses the electrons into the quadrupole.

EI Ionization

When a single electron is removed during ionization, a positive ion is created - this is referred to as a molecular ion. When the bombarding electrons cause the molecular bonds to break, fragment ions form. This ionization process is known as electron impact ionization (EI).

Operation of the mass spectrometer depends on maintaining low vacuum pressures. These pressures take into account not only the operational pressures of the mass spectrometer, but also the pressures of the sampling system environments.

Separation

Once the ions reach the quadrupole mass filter, they are filtered according to their mass-to-charge (m/z) ratio. Each ion has an identifiable mass. The quadrupole mass filter is constructed of four electrically-conducting, parallel cylindrical rods. A constant direct current (DC) voltage and an alternating radio-frequency (RF) voltage is applied along the length of the rods. Through proper electronic tuning, these voltages set the criteria for the ions that pass through the quadrupole.

As an ion enters the quadrupole mass filter, the RF and DC fields cause it to undergo oscillations. Depending upon the criteria set for motion through the quadrupole, an ion either strikes a rod or passes through the quadrupole. Ions meeting the m/z criteria have stable trajectories and emerge from the mass filter assembly (Figure 1-2). Ions with other m/z values have unstable trajectories and are neutralized as they strike one of the rods.

Ions that successfully pass through the quadrupole are again focused towards the detector using an exit aperture which has an applied negative voltage that attracts the positively charged ions.

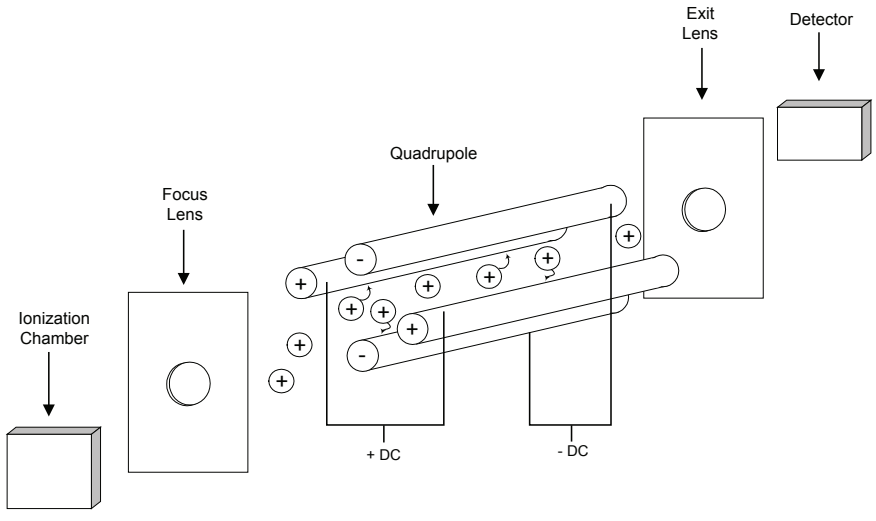


Figure 1-2.
Mass Filter.

Detection

The simplest detection setup consists of a Faraday cup detector. An electron multiplier is used for amplified sensitivity.

A Faraday cup detector is a closed structure except for an opening that allows the ions to enter. As the positive ions exit the quadrupole mass filter, they strike the detector, creating a current. This current is then sent to the preamplifier for amplification and then to the data system for display.

When an electron multiplier is used, the ions are attracted to the multiplier because of its negative charge. As the ions strike the multiplier, secondary electrons are emitted. This creates a cascading effect as each secondary electron generates more secondary electrons as they move down the multiplier wall, amplifying the signal by approximately one thousand.

The system uses a microchannel plate (MCP) electron multiplier. It consists of an array of millions of small glass capillaries fused together in the shape of a disk. The inside wall of each channel has a resistive, electrically semi-conductive layer, forming independent electron multipliers. As the ions are approaching the MCP, a positive electrical gradient pulls the electrons into the MCP. As they cascade down and strike the channel walls, they generate secondary electrons.

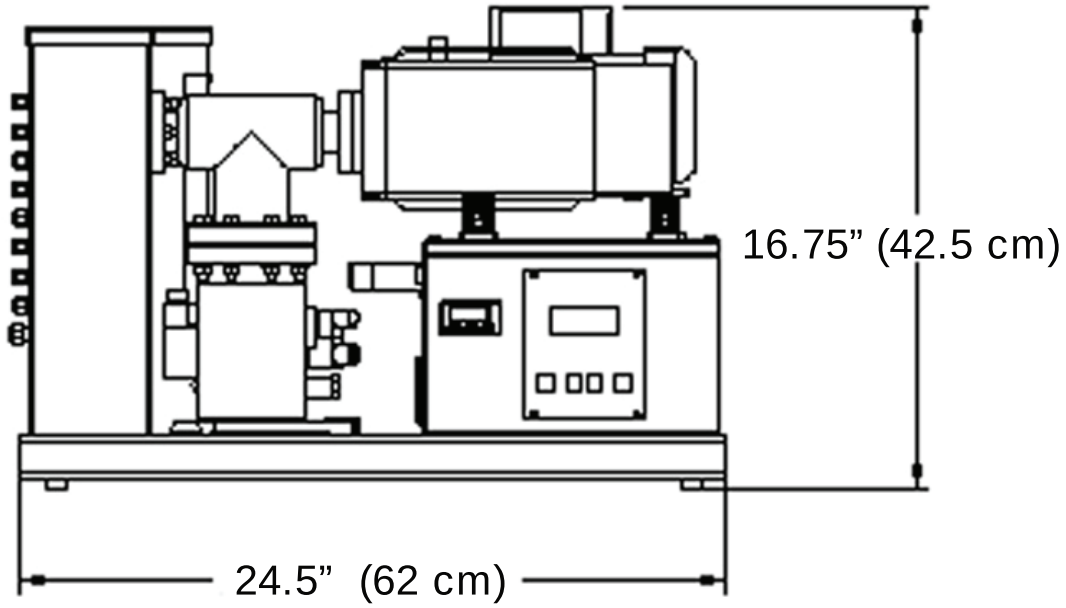
Data System

Overall control of the system, acquisition of data, and access to collected data is accomplished through the AMETEK Process 2000 software. Adjustment of all instrument parameters that affect sampling, ionization, separation and detection are software controlled. All data acquisition parameters are also set using the software.

ProLine Overview

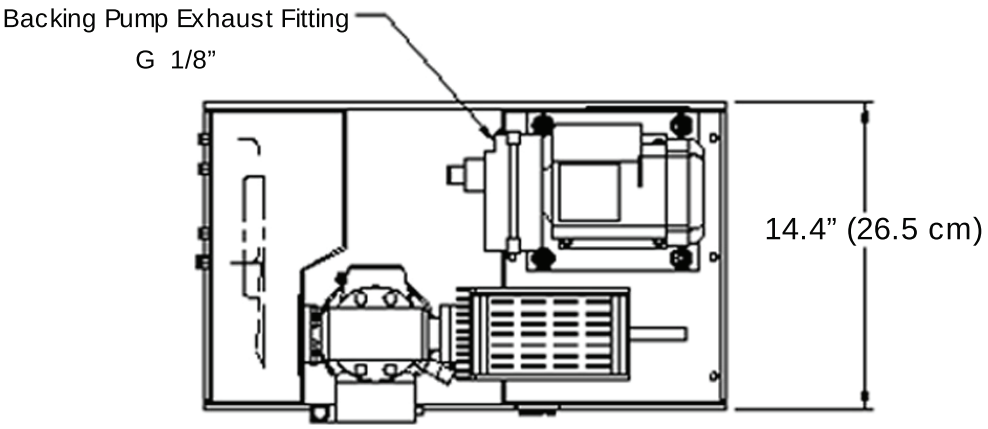
The ProLine consists of the following subsystems (Figure 1-3a and b):

- Closed Source Mass Spectrometer Package
- Multiple Valve Inlet System
- Electrical and Controls System
- Vacuum Pumping System
- Options

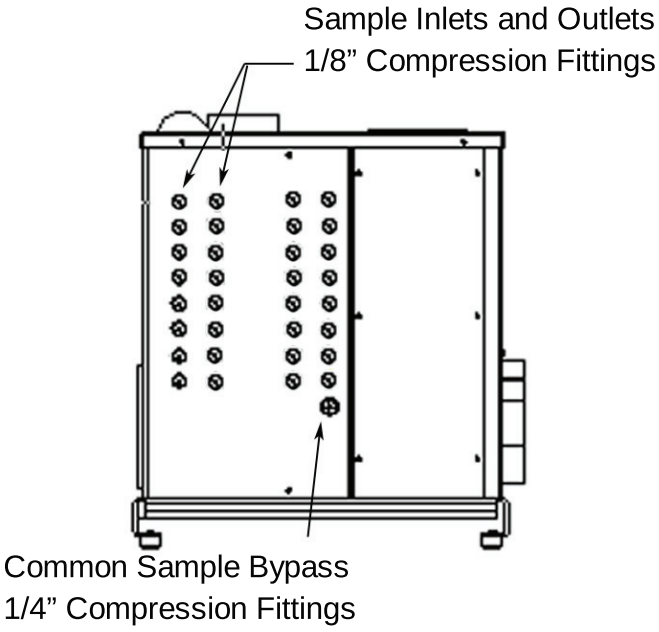


Front View

Figure 1-3a.
ProLine dimensions.
Front, top, height.



Top View



Sampling System

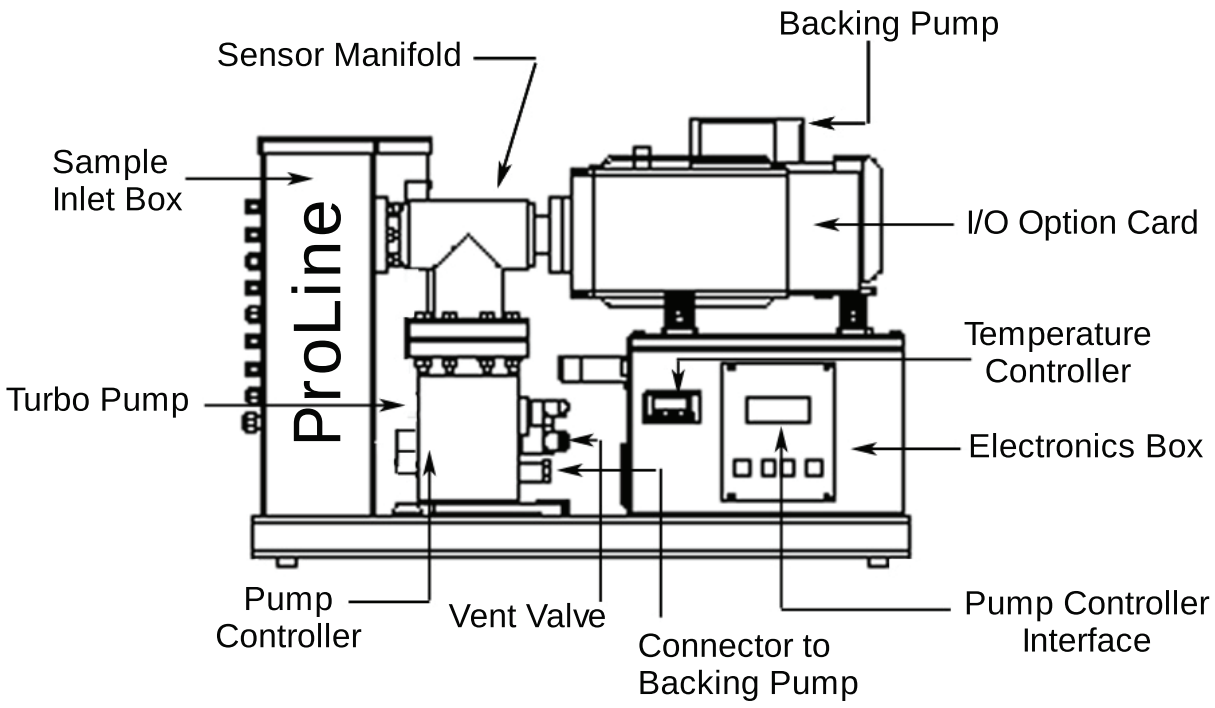


Figure 1-3b.
ProLine, systems labeled.

AMETEK Closed Source

The AMETEK smart sensor offers the latest quadrupole technology using a closed/enclosed source. The electronics package operates at 100 AMU range using a Faraday cup / electron multiplier detector.

ProLine Multi-Port Sampling System

The ProLine multi-port sampling system (Figure 1-4) comprises:

- an inlet system consisting of one or two sets of eight, three-way electric solenoid valves (configurations of 8 or 16) and a valve control board (Figure 1-5);
- a heater to reduce the risk of condensation or other interference in the sample lines and a heating jacket for the sensor/manifold;
- a vacuum system consisting of a turbopump and controller, backing pump and associated tubing.

A constant pressure is maintained at the analyzer inlet using a fixed capillary in the sampling system. Sample and calibration gas streams can range from 0 to 20 PSIG.

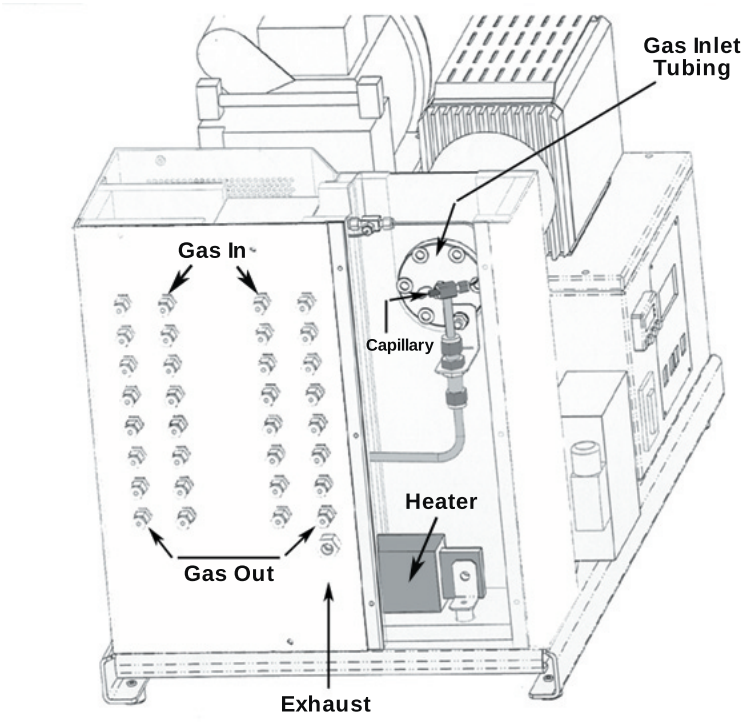


Figure 1-4. Sampling system.

Valve control board

The valve control board monitors valve activity. If your analyzer uses the 8-valve system, you will only be using one valve control connector (J4) on the top of the board and the two connectors (I/O Option and power) on the side of the board closest to the front of the unit. If you have a 16-valve unit, you will be using both valve control connectors (J4 and J3).

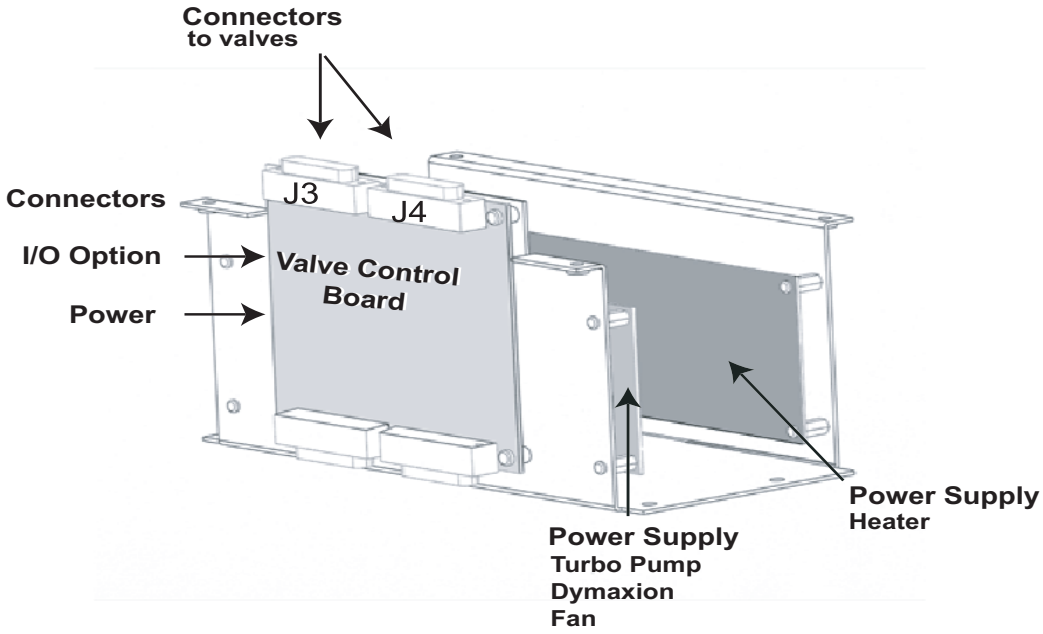


Figure 1-5. Location of ProLine power supplies and valve control board.

Electrical and Controls

Electrical power is delivered to the unit through an AC power line. All power and electrical signals must be delivered to the unit per the National Electric Code and local requirements.

Temperature Control for Heater

The ProLine unit uses an electronic controller to regulate the sample inlet heater. This controller is user-adjustable for optimum performance and should require no subsequent maintenance. See Chapter 6 for more information on factory-set parameters and adjusting the temperature.

I/O Option Board

The I/O Option board monitors the following parameters:

- Heater inlet temperature
- Turbo pump status

Power Supplies

There are two power supplies located in the U-shaped bracket in the electroncs box. When viewed from the back of the analyzer, the left-hand power supply is used to power the turbo pump, electronics package and the fan. The right-hand power supply is used to power the heaters (Figure 1-5).

Pumps

The turbopump and backing pump start automatically upon application of power using the power button. Both pumps will turn off if they are overheated because of leaks, system failure or mechanical failure.

With the capillary inlet arrangement, pressure inside the chamber is approximately 5 x 10^{-6} Torr.

The ProLine uses a turbomolecular pump with drag stages that is connected directly to the inlet manifold. The turbomolecular pump is assisted by a backing pump.

Communication

The ProLine uses a cable from the electronics package to the host PC for communication. The cable is attached to the RS-232 communications port on the electronics package and is plugged into the RS-232 port of the host PC.

Options

The Proline offers two options to the standard system: an auxiliary pump for extended pressure range sampling, and an I/O data system (Opto 22). Both of these options are housed in a base enclosure that is located underneath, and attached to, the base plate of the standard ProLine. A Flow Switch can be added as an option to either system.

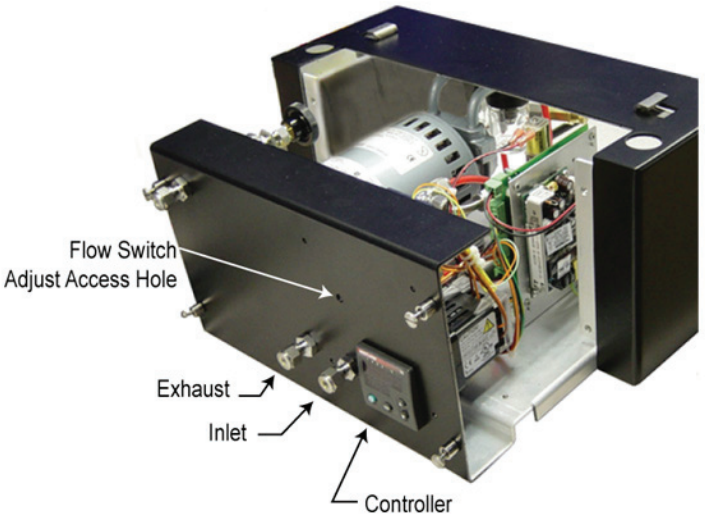


Figure 1-6. Extended pressure range option.

Extended Pressure Range Option

This option is used when your application requires an auxiliary pump to draw the sample into the inlet system. The pump and associated electronics are easily accessed by sliding the optional extended pressure range unit out from the valve end of the ProLine after removing the inlet tubing and the four panel screws.

The extended pressure range option consists of the following (Figure 1-7):

- Auxiliary Pump
- Pressure Controller
- VSO Valve
- Flow Switch (Optional)
- Power Supply
- PCB Board

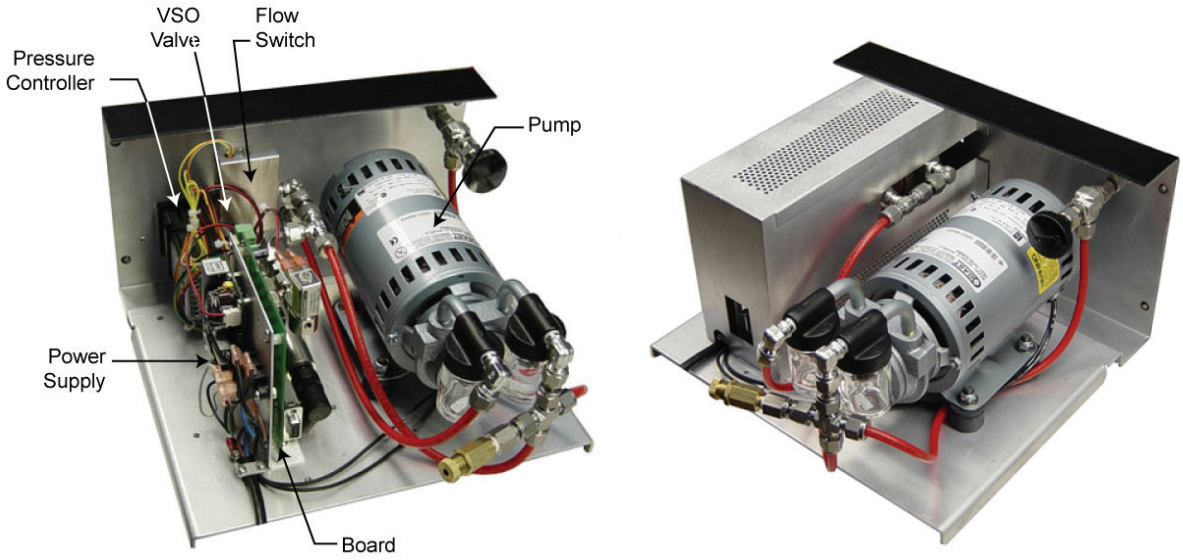


Figure 1-7. Extended pressure range option for the ProLine.

Before operating the ProLine, you will have to loosen the springs on the sub-atmospheric pump to free it for use. The springs were tightened down at the factory to prevent damage during shipping and help reduce vibration when the analyzer is operating.

To release the springs on the sub-stmospheric pump, follow these steps:

1. Loosen the four captured screws on the face of the tray that holds the sub-atmospheric pump.

2. Detach the inlet tubing from the inlet ports using a 9/16” wrench.

3. Gently slide the tray towards you to allow access to the nuts that hold the springs down under the pump.

4. Loosen the nuts on the springs with a 7/16” wrench until the nuts no longer touch the washers and the pump “floats” on the springs.

5. Gently slide the tray back into the base, replace the inlet tubing and secure the door with the four screws.

NOTE

For more information on replacing the sub-atmospheric pump, refer to the manufacturer’s instruction manual included with your unit.

NOTE

Detailed information on the extended pressure range option can be found in the Appendix 2 of this manual.

I/O Data Acquisition Option

This option is used when your application requires additional information that can only be obtained through analog/digital input or output. The Opto I/O system consists of a series of I/O modules, a “brain” module and a power supply. It is housed in the opposite end of the unit from the extended pressure range option system and slides out for easy access. The unit provides four (4) I/O connectors and one RS-485 connector (Figure 1-8). More information on configuring your I/O system can be found in the Appendix of this manual.

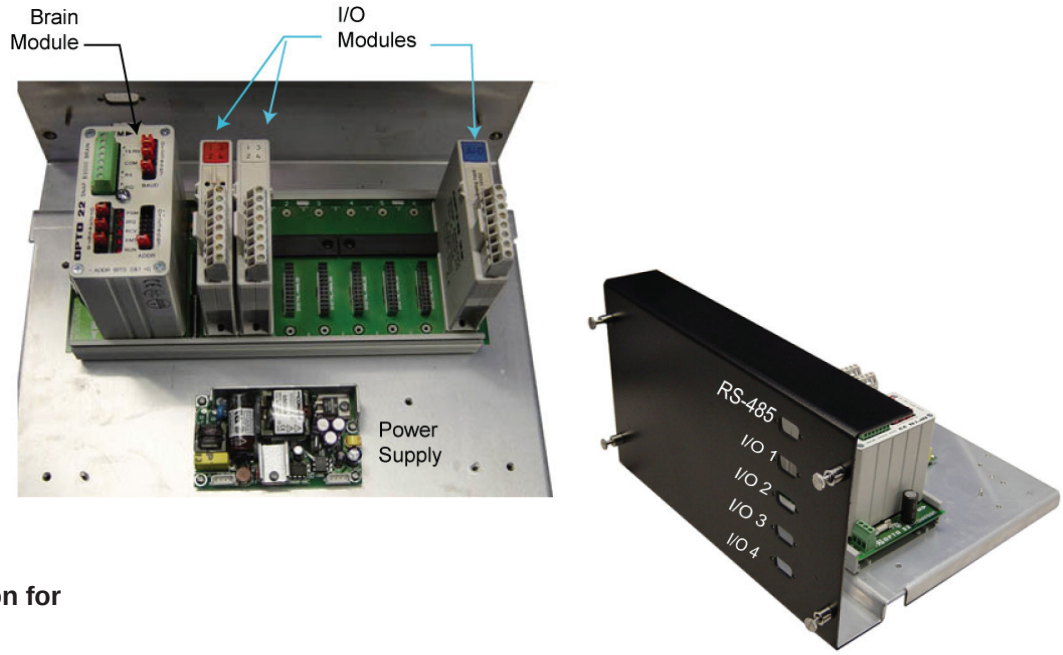


Figure 1-8.
Opto I/O option for the ProLine.

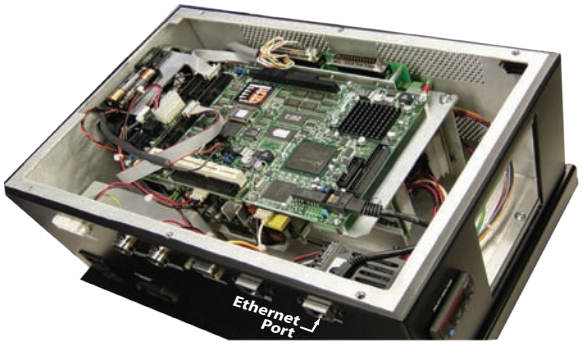


Figure 1-9.
On-Board PC located in electronics box.

On-Board PC (CE Pending)

This option includes an on-board PC located in the electronics box (Figure 1-9). The on-board PC communicates with a remote PC using an Ethernet crossover CAT-5 cable plugged into an Ethernet port. The on-board PC can also communicate through a network (LAN) using a standard Ethernet cable. The remote computer computer uses Microsoft’s Remote Desktop Communication software over the 10/100 Base-T interface to establish communications. Instructions for connection and operation are included in the Process 2000 software manual.

Technical Support

AMETEK is committed to providing you with the best technical support in the industry. If you need service or application assistance, please call AMETEK at (412) 828-9040, or call your local AMETEK representative.

If you need to return equipment, you will be asked to provide the following information before obtaining a Return Material Authorization (RMA) number.

- Billing and shipping address
- Model number
- Serial number
- Purchase order number
- Telephone number

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SPECIFICATIONS

ProLine

Sensor:

Enclosed source. Options: electron multiplier, 100 AMU

Performance:

Mass Position: 0.1 AMU
Peak Height: ± 2% per 12 hours.
Sensitivity: 1 PPM

Specifications are valid after a 60-minute warm-up.

Mass Range:

1-100 AMU

Resolution:

Adjustable to constant peak width (0.5 AMU at 10% height)

Emission Current:

0.1 to 10 mA

Electron Energy:

30 to 150 volts to operate

Ion Energy:

1-10 volts

Source Sensitivity:

(Faraday Cup): 2 x 10^{-4} amps per Torr at detector (measured with nitrogen at mass 28) with peak width = 0.5 at 10% height and 1 x 10^{-3} amps emission current.

Pumping System:

Turbomolecular pump.
Backing pump

Multi-Stream, Variable Pressure Inlet System:

Inlet with electronically-controlled sample and calibration valves. Valve position is controlled by the host PC.

Sample Pressure Range:	All Ports	0-20 PSIG
Fittings:	1/8” stainless steel compression fittings	

Utilities:

Electrical:

100 to 230 VAC, 50/60 Hz, 500 VA

Environment:

Ambient Temperature: 53 °F to 104 °F (12°C TO 40 °C)
IEC Installation Category II
IEC Pollution Degree 2
Max. Altitude: 2000 meters
Relative Humidity: 10% to 90%, non-condensing

RS-232 Serial Communications Interface:

Isolated, baud rate selection of 1200 to 38400; 9-pin, female D-connectors.

RS-485 Addressable Communications Interface:

Isolated; baud rate selection of 1200 to 38400; programmable addresses; 2-pin, female D-connectors

Ethernet Connectivity:

10/100BASE-T Ethernet - Auto-Sensing; RJ-45 connector


NOTE

Always use a shielded Category 5 cable for Ethernet connections. This is required to minimize electromagnetic interference.

Dymaxion Physical Dimensions

Weight: 4.6 lb (2.1 kg) without quad head, 7.4 lb (3.4 kg) with quad head
Width: 4.5” (11.4 cm)
Length: 9” (22.9 cm)
Height: 5.25” (13.3 cm)

ProLine Physical Dimensions

Width: 14 3/8” (36.5 cm)
Length: 24” (60.96 cm)
Height: 15 1/2” (39.37 cm)

Software:

The Process 2000 software.

Minimum PC Requirements:

Pentium, 233 MHz microprocessor, 64 MB RAM, with Windows 95/98 or NT/XP.

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INSTALLATION / OPERATION

This chapter contains information of the installation and initial setup and operation of the ProLine including the following:

- ProLine System Overview
- Pumping System Connections
- Electronics Package Installation and Connections
- Sampling Setup
- Software Installation
- Turning the Filament On
- Shutdown Procedure

Electronics and Sensor

Before connecting the 24 VDC power to the electronics, ensure that the electronics are connected to the sensor. Otherwise, damage to the electronics is possible.

Always remove 24 VDC power from the Dymaxion electronics before removing the electronics from the sensor.

ProLine System Overview

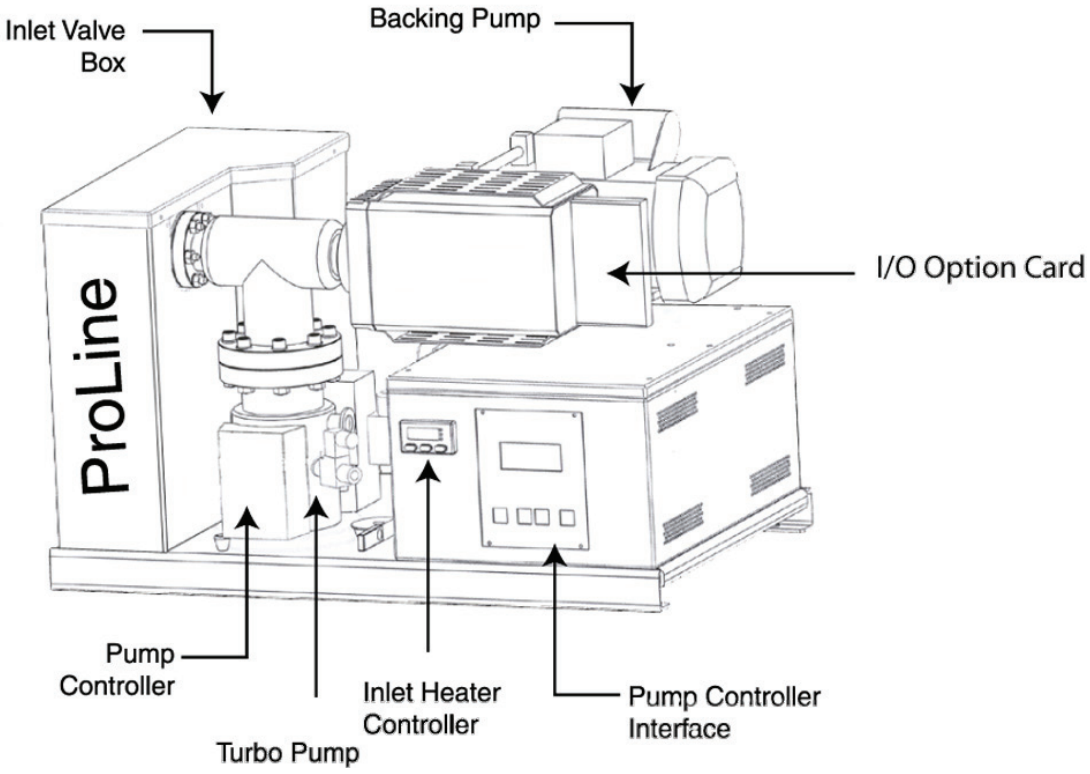


Figure 3-1.
ProLine front view.

Pumping System Installation

The ProLine pumping system consists of the following:

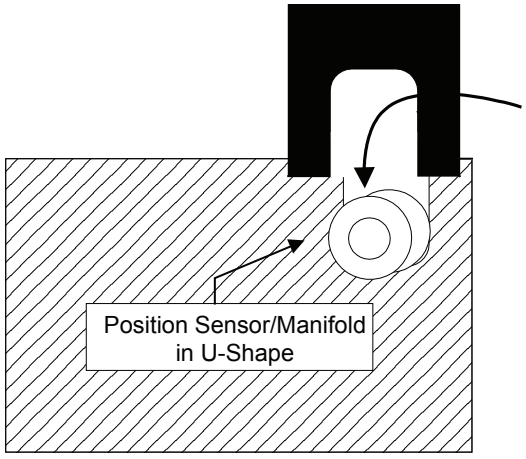
- Turbo Pump
  - turbo pump power cable
  - RS-485 to pump controller cable
  - flexible hose that connects the backing pump to the turbo pump
- Backing Pump
  - backing pump power cable

Installing the Turbo Pump

The sensor head and manifold are already attached to the turbo pump at the factory. Remove any packing from the turbo pump. The turbo pump will be mounted using the guides on the ProLine between the sample inlet box and the electronics box.

1. Remove the top cover from the sample inlet box by removing the four screws holding the cover to the box.

2. There is a U-shaped cutout on the back wall of the sample box through which the sensor head and manifold will be positioned to provide access to the inlets. There is also a piece of black metal with a U-shaped cutout that is used to secure the sensor/manifold in place.



Sample Inlet Box Back Wall

3. Set the turbo pump between the guides and rotate until you have positioned the sensor/manifold correctly in the U-shaped slot on the sample inlet wall. Once it is in the correct position, slide the clip onto the pump to lock it into position.

4. Slide the U-shaped piece of metal over the top of the sensor/manifold on the inside of the sample box wall. Use the screws provided to attach it to the wall from the outside of the box. The sensor/manifold should now be secure, locking the head/sensor in position.

5. Attach the flexible roughing hose from the turbo pump to the backing pump by connecting each end of the hose.

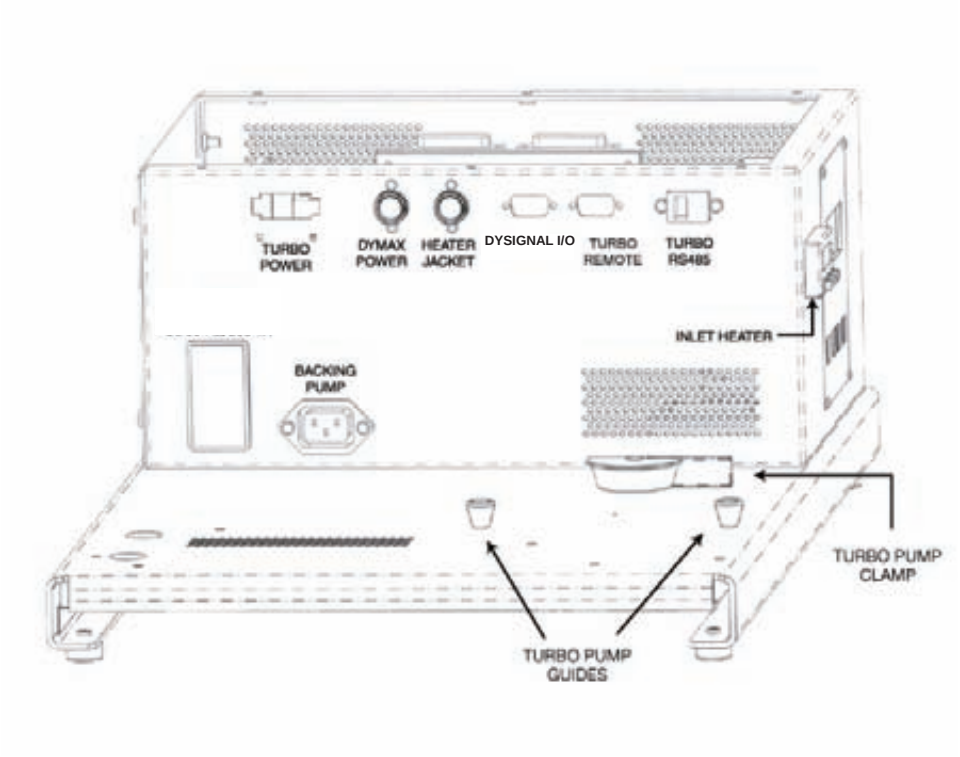


Figure 3-2a.
Electronics box connections.

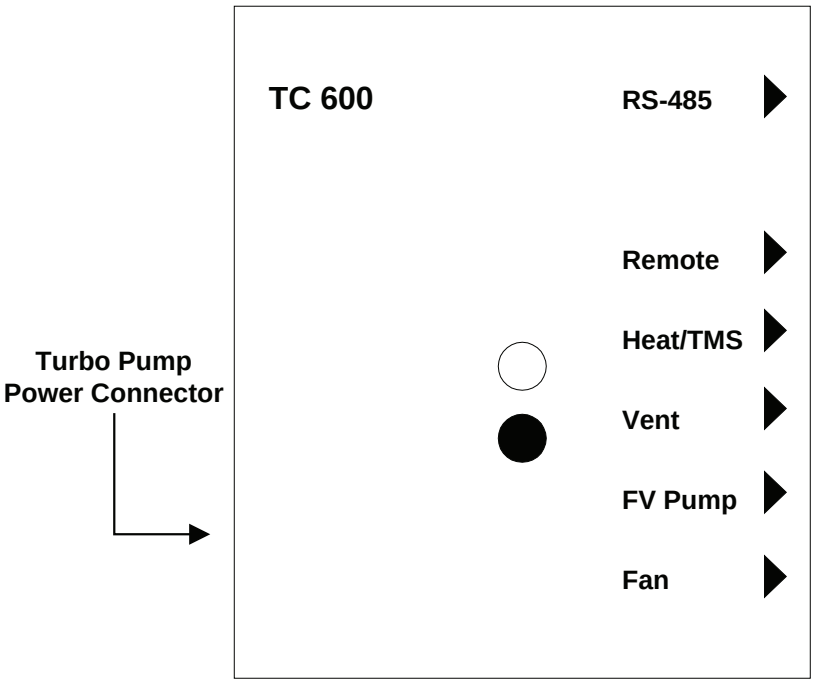


Figure 3-2b.
ProLine connections and turbo pump controller box.

Turbo Pump Cable Connections

1. Attach one end of the turbo pump power cable to the connector labeled "Turbo Power" in Figure 3-2b. Attach the other end to the power connector on the side of the pump controller. This supplies power to the turbo pump.

2. Attach the RS-485 turbo cable from the connector labeled "Turbo RS485" in Figure 3-2b to the connector labeled "RS-485" on the turbo pump controller.

Backing Pump Connection

The backing pump was mounted on the ProLine at the factory. There is only one connection that must be made to the backing pump. Connect the power cable from the backing pump to the outlet labeled "Backing Pump" in Figure 3-2b.

There is a switch on the backing pump which is set to "ON" at the factory. Once you apply power to the pumps, the switch will turn green to indicate that the pump is on. Do not turn the switch off.

Electronics Package Installation

The electronics package is shipped in a separate package along with the ProLine. The electronics will be factory-configured with the I/O Option card installed and the appropriate cables ready to be installed in the ProLine.

Before installing the Electronics package on the sensor head do the following:

- Attach the communications cable to the RS-232 port on the back of the electronics package. The other end of the cable is plugged into the RS-232 port on the back of the computer.
- Set the RS-232 / RS-485 switch on the back of the electronics to RS-232 (Figure 3-6).

Connecting the Electronics to Quadrupole Head

Power must be off.

Before connecting the 24 VDC power to the electronics, ensure that the electronics are connected to the sensor. Otherwise, damage to the electronics is possible.

1. Align the key on the electronics unit to the notch on the collar end of the quadrupole head assembly.
2. Insert the electronics onto the quadrupole head until firmly seated (do not twist).
3. Lock the electronics unit to the quadrupole head using the tightening knobs

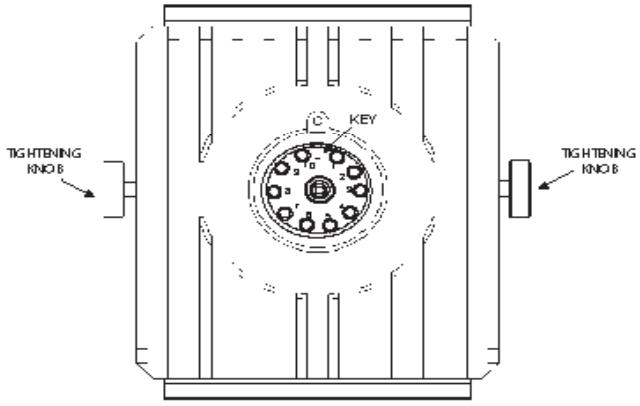


Figure 3-3.
Electronics Pinouts.

(Figure 3-3) on the side of the electronics until it is **SECURELY** hand-tightened. NEVER TWIST THE ELECTRONICS . Always insert it straight in and pull it straight back.

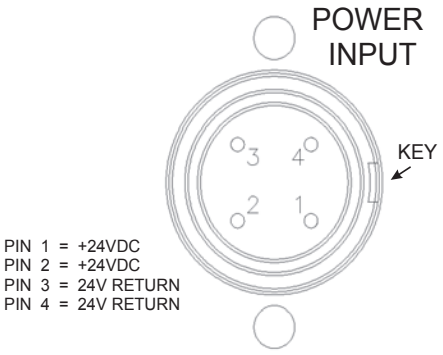


Figure 3-4.
Power Input Pinouts.

Connecting Electronics to DC Line Power

The electronics package requires 24 volts DC (± 1 volt) and 3.3 amps.

1. If not already connected, connect the DIN connector from the DC power panel inside the enclosure to the power-input connection on the back of the electronics.
2. Align the key and push in the connector.
3. Push the outer ring over the connector and rotate clockwise until the ring locks in place (Figure 3-4).

Electronics Package Connections

1. Connect the communications cable from the back of the electronics to the RS-232 port on the back of your PC.
2. Plug the power cable on the back of the electronics into the outlet labeled "Dymax Power" in Figure 3-5.
3. Make the connection between the I/O Option card cable on the back of the

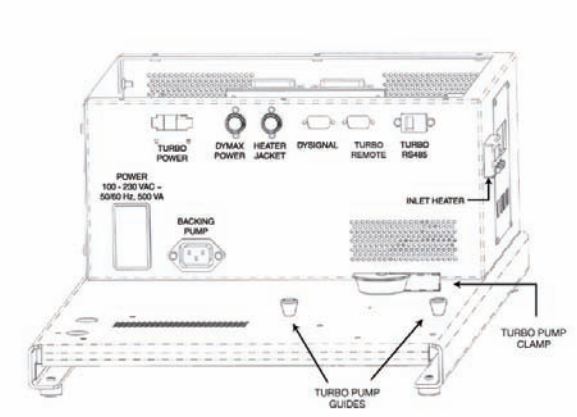


Figure 3-5.
Electronics Connections.

electronics and the connector labeled "Dymax I/O " in Figure 3-5.

RS-485 Switch Termination Settings

When using RS-485 communications, you must terminate using the dipswitch settings on the back of the electronics unit as shown in the diagram on the right.

LEDs

The electronics LEDs are located on the back of the electronics as shown in Figure 3-6. When first started, the electronics package cycles through the LEDs, turning them green, red and yellow. This allows you to check that each LED is working properly. When the unit is through cycling, the top LED turns green and then the third LED (RF) turns green as well.

The LEDs are listed below in the order in which they appear (top to bottom) on the back of the electronics unit.

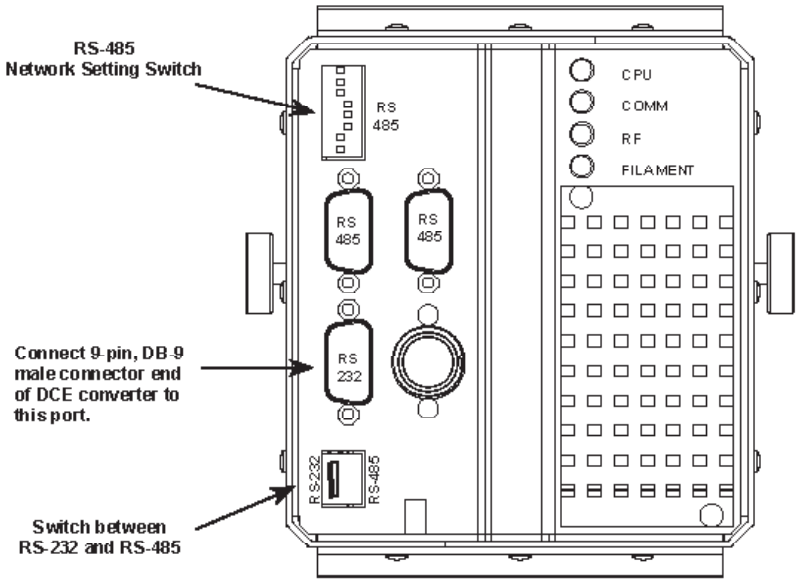


Figure 3-6. Communication ports and LEDs.

CPU

Indicates CPU and system status.

- OFF: Electronics power is off.
- RED: CPU has stopped.
- FLASHING RED: Battery-backed RAM has been cleared. Check battery.
- GREEN: Normal operation.

Comm

Shows the status of communications between the electronics and the PC. It flashes green when receiving data from the PC. It remains off when the electronics package is inactive. A red light indicates a communications error.

RF

Shows the status of the RF circuit. The LED is green if the RF amplifier is operating properly, and turns red if you have an RF failure. The LED is yellow during automatic RF tune.

Filament

This LED indicates the status of the filament. The LED is green if the filament is on and is working properly. The LED appears red if the filament is off due to an overpressure, open or short condition. The LED appears yellow if half of the filament has failed.

Heating Jacket

The installation of the heating jacket requires no tools.

1. There are three grounding strips on the heater jacket (Figure 3-7). Before fitting the jacket to the manifold, you must bend these strips around the edge of the jacket to the inside, so the ground strip contacts the metal manifold surface, to ground it.

2. Once you have grounded the jacket, position the jacket on the vacuum chamber so that the snaps are on the back side of the manifold. Once in position, attach the snaps so the jacket fits snugly around the chamber. Make sure the heater doesn't make contact with any other equipment or wiring that can be damaged from high temperatures.

3. Plug the power cord on the jacket into the heater controller connection labeled "Heater Jacket" in Figure 3-2.

When operating the heating jacket with the electronics package, the mounting flange temperature must not exceed 80 °C.

Heating jacket operation produces high temperatures. Avoid touching the jacket surfaces or equipment that is being heated.

Heating Jacket Maintenance

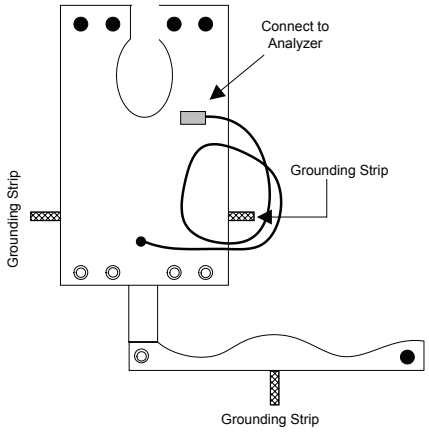


Figure 3-7. Heating jacket ground strip locations.

The heating jacket doesn't require regularly scheduled maintenance. However, regular inspection is recommended, and damaged units should be removed from service immediately. Jackets should be protected from chemical spillage, mechanical damage and corrosive atmospheres.

Sample Gas Flow

Sample gas flows from the inlet ports (Figure 3-8) through the three-way electric solenoid valves and manifold. The selected sample gas then flows to the analyzer. The vacuum pumps work together to maintain a constant pressure in the ionizer. The vacuum system consists of a turbo drag pump, a backing pump and associated plumbing. The inlet system is configured so that all ports operate at a sample pressure of between 0 to 20 PSIG.

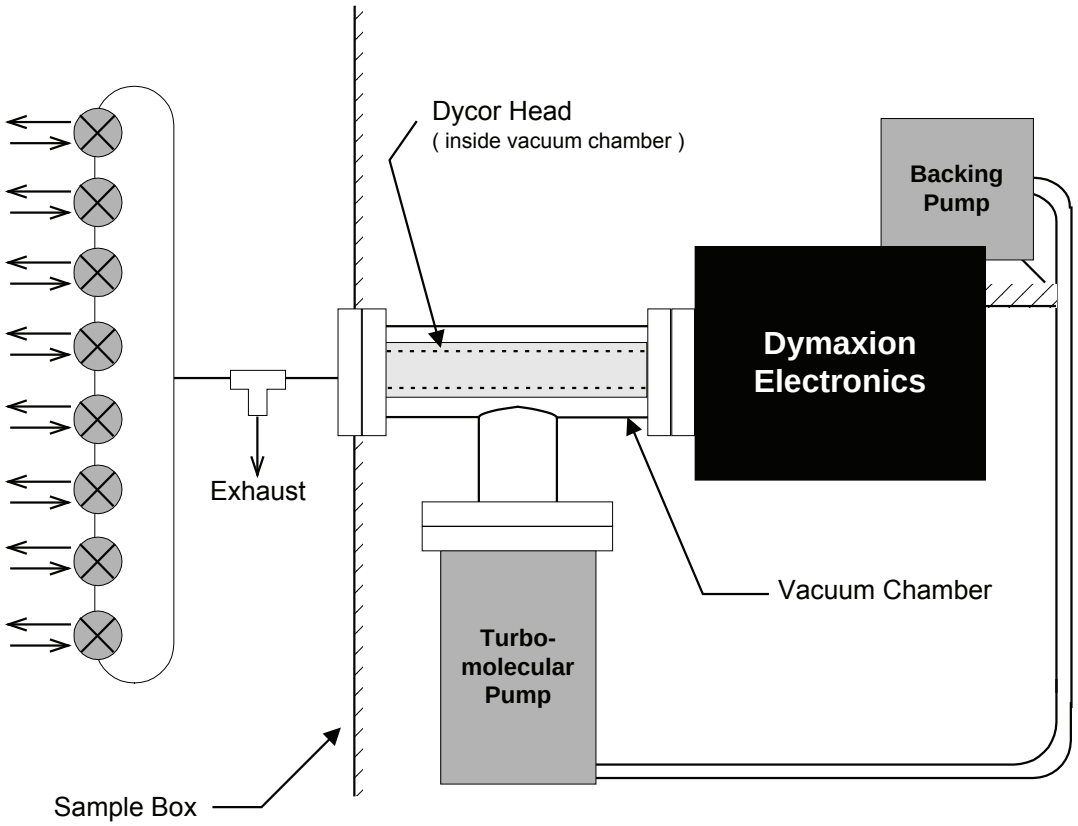


Figure 3-8.
ProLine sample flow.

Attaching the Sample / Calibration Lines

1. Attach the sample / calibration lines to the “Sample Gas In” port bulkhead fittings using 1/8” stainless steel tubing and 1/8” Swagelok® nuts and ferrules. Make sure that the tubing is installed as far into the fitting as possible.

2. If necessary, vent the “Sample Gas Out” lines from the process streams to a safe area (e.g. a fume hood). To conserve calibration gas, cap the calibration gas line with a 1/8” Swagelok cap to ensure that calibration gas will not flow when another valve is selected.

3. The sample gas exhaust is the last of the Gas Out fittings on the right front of the sample inlet box (Figure 3-9). Use appropriate caution when venting the gas and vent at atmospheric pressure.

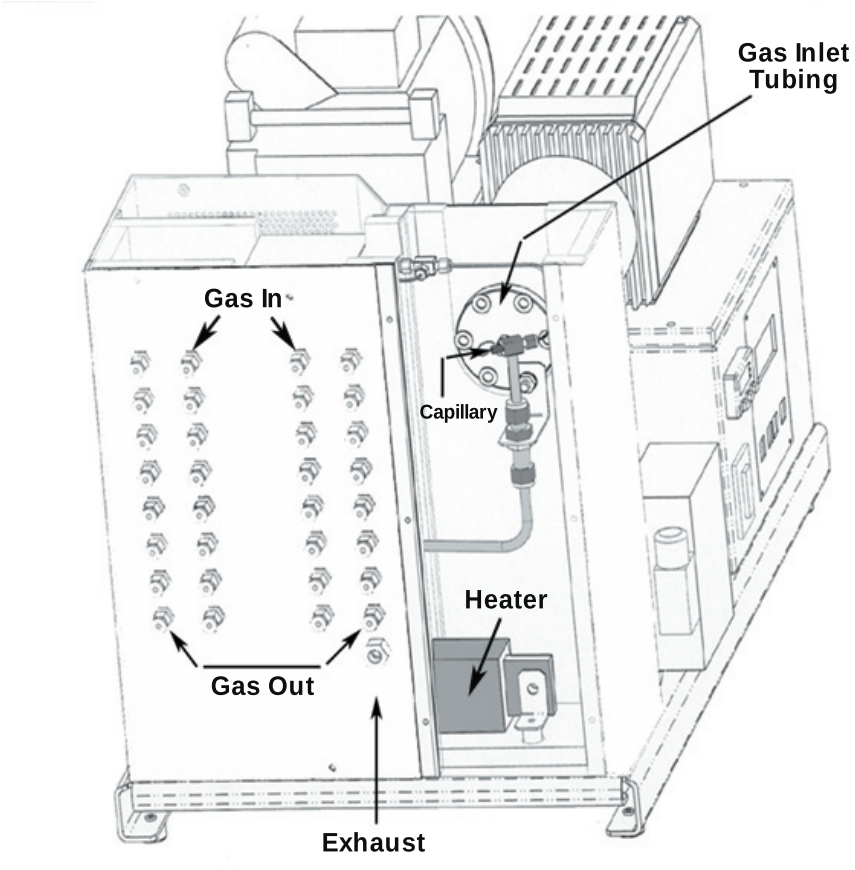


Figure 3-9.
Sample Gas In and Sample Gas Out ports.

Purging the pressure regulator and calibration gas line

Since the calibration gas line outlet is capped to ensure that the calibration gas will not flow when another valve is selected, there is the possibility that gas may be residing in the dead space between the cap and the cal gas flow. To ensure that the gas available for calibration is pure, you will need to purge the calibration gas line as well as the pressure regulator on the calibration gas cylinder.

If the calibration gas is hazardous, before proceeding make sure that you are able to vent the calibration gas to a safe location and with appropriate caution.

1. Attach the pressure regulator to your calibration gas cylinder.
2. Attach one end of the 1/8" stainless steel tubing to the pressure regulator at the calibration gas cylinder. Attach the other end to the calibration "Gas In" port bulkhead fitting making sure it is installed as far into the fitting as possible.
3. Ensure that the "Gas Out" port for the calibration gas is open and not capped.
4. Open the calibration gas cylinder to allow the gas to flow through the pressure regulator.
5. Open the pressure regulator to allow the calibration gas to flow through the calibration gas line, making sure the pressure is between 2 and 10 PSIG.

The pressure must not exceed 20 PSIG.

6. Allow the calibration gas to flow through the gas inlet/outlet for about 60 seconds to purge any stale air/gas that may be in the line. A longer purge time may be required depending on the length of your plumbing lines.
7. Once the line is purged, with gas still flowing, place a 1/8" Swagelok cap on the "Gas Out" port for the calibration gas.

The calibration gas line does not need to be purged again unless you change the calibration gas for that port.

Software Installation

1. Insert System 2000 software CD into CD ROM drive.

2. The installation program should begin to run immediately. If it does not start automatically, click **RUN**... from the Windows **Start** menu. Type the drive letter, followed by a colon (:) and a backslash (\) and the word “setup.exe” (d:\setup.exe) and click **OK** to start the installation program.

3. The Dycor Process 2000 setup begins and the **Welcome** screen opens. Click **Next** to continue the installation or **Cancel** to abort the installation.

4. Follow the instructions on the subsequent screens to complete the installation. When you get to the **Setup Complete** screen, click **Finish** to complete the installation. The default location for the System 2000 software is in the **Dycor System 2000** folder.

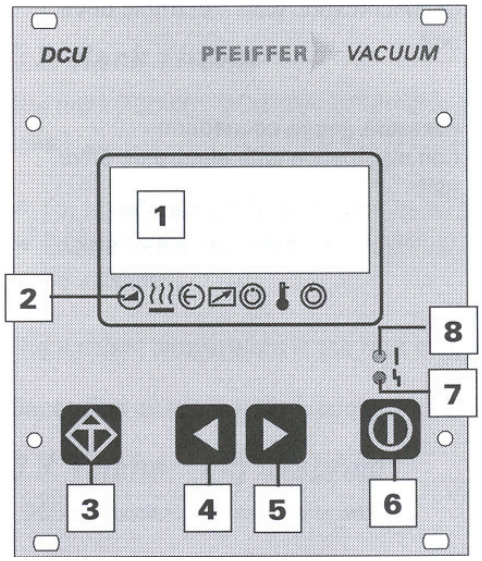
ProLine Operation

Powering Up the ProLine

When you are ready to power up the ProLine, plug the AC power cord into the connector labeled “Power” (Figure 3-2) on the side of the electronics box. Next, press the switch above the cord to the on position to apply power to the unit. The backing pump and turbo pump will be powered up upon application of power to the unit.

Pump Controller Interface

After switching on, the pump control unit performs a self-test and also a test on the connected turbo electronics which can be seen on the pump controller interface (Figure 3-10). Providing there are no errors, the control unit is now ready to operate.



1	LCD Display
2	Status Display
3	“Error Acknowledgment” Key
4	Key “Left”
5	Key “Right”
6	“Pumping Station ON/OFF” Key
7	Red Diode for Error Status
8	Green Diode for Operating Status

Figure 3-10. Pump controller display.

ON / OFF

ERROR

Electronics Package Warm-Up Time

As with all complex electronic systems, the electronics package reaches thermal equilibrium only after a certain amount of time has passed once power has been applied and the unit is running. We recommend that the electronics run for a minimum of one hour prior to its use in situations where the most stable readings are required.

Turning on the filament

- On the Process 2000 software desktop, click the yellow light bulb icon on the toolbar (Figure 3-11a).
- Or, on the **Control** menu, click **Filament**. The yellow light bulb icon on the toolbar will become indented (Figure 3-11b).

Once the filament has been on for an hour, you can begin to set parameters for your application.

NOTE

Refer to the AMETEK Process 2000 Software manual for information on how to add a device, set device settings and select display modes and preferences.

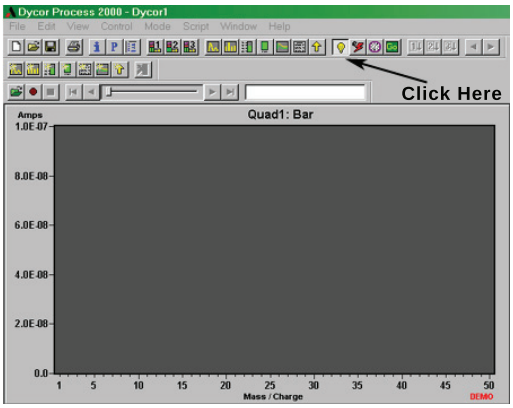


Figure 3-11a.
Click filament on.

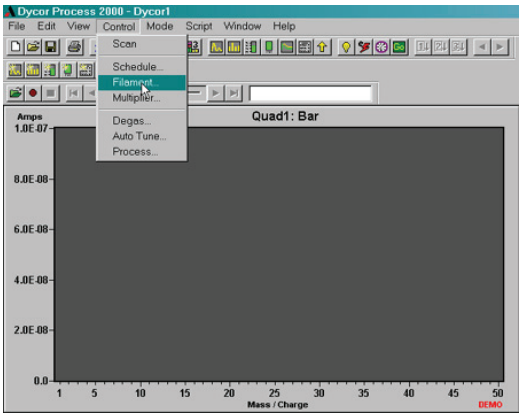


Figure 3-11b.
Use Control menu to turn filament on.

Shutting Down the ProLine

To perform an orderly shutdown of the ProLine, follow the procedure below.

- Turn off the filaments and scanning using the Process 2000 software.
- Turn off the AC power by pressing the ON/OFF switch.

After the power has been removed from the system, the electronics package and the filaments will still be hot.

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MAINTENANCE AND TROUBLESHOOTING

ProLine Maintenance

Inlet Heater Controller

The ProLine uses a Watlow™ electronic controller to regulate the inlet temperature. This controller (Figure 4-1) is mounted on the front panel.

The controller is user-adjustable from room temperature to 80 °C (176 °F).

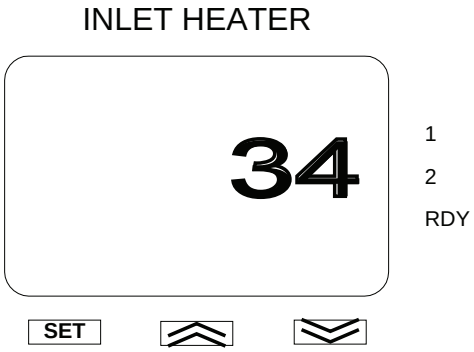


Figure 4-1.
Inlet Heater controller display.

Adjusting the inlet heater temperature

To adjust the temperature on the inlet heater, do the following:

1. Hold down the blue **Set** button. The display changes to “0”.
2. Use the **arrow up** and **arrow down** keys to select the temperature you want to maintain.
3. Release the **Set** button once you have reached the desired temperature.

The factory-set parameters for the controller are listed in Figures 4-2a and 4-2b.

Inlet Heater	
Setpoint	SP = 0 - 80
Input Type	In = H
Celsius/Fahrenheit	C_F = C
Range Low	rL = 0
Range High	rH = 80
Output 1 Function	Ot1 = heat
Output 2 Function	Ot2 = ALM
Display Default	DISP = Ac
Input Failure Mode	FAIL = bPLS
Setpoint Lockout	SLOC = no
Lockout Tag	TAg = none
Proportional Band	Pb = 6
Integral Function	It = 99.99
Cycle Time	CT = 5.0
Derivative Function	dE = 5.11
Alarm Type	ALty = dEnc
Alarm Hysteresis	AhyS = Z
Alarm Latch	LAt = no
Alarm Silence	SIL = no
Alarm Lo	ALO = -5
Alarm Hi	AhI = 5

Figure 4-2a.
Series 935A Watlow Controller. Inlet heater factory-set parameters.

SETUP

SEn	tc
Lin	H
C-F	C
S.dEC	0
IS>En	no
SP.Lo	0
SP.hi	80
Ftr.E	OFF
Ot 1	hEAt
Ctr1	Ftb
Ftb1	5.0
PL 1	100.0
PSL1	0.0
PSh1	100.0
nLF1	OFF
Ot 2	dE.AL
hyS2	2
Lgc2	AL O
Lat2	nLAt
SiL2	OFF
dSP2	On
Unit	SI
I.Err	nLAt
FAIL	bPLS
dSP	Pro
rP	OFF
LOC	0

OPERATIONS

A-M	Auto
Aut	OFF
CAL	0
ht.M	Pid
Pb.ht	6
It.ht	99.99
dE.ht	5.11
A2.hi	5
A2.Lo	-5

Figure 4-2b.
Series SD31 Watlow Controller. Inlet heater factory-set parameters.

SETUP		
Ai		
SEt		
	SEn	tC
	Lin	H
	FiL	0.5
	i.Er	oFF
	dEC	0
LooP		
SEt		
	h.Ag	Pid
	C.Ag	oFF
	t.tUn	no
	t.Agr	Crit
	UFA	bPLS
	FAiL	bPLS
	L.dE	no
	rP	oFF
	L.SP	0
	h.SP	80
	SP.Lo	-100
	SP.hi	100
otPt		
SEt		
1		
otPt		
	o.Fn	hEAt
	o.Ct	Ftb
	o.tb	5.0
	o.Lo	0
	o.hi	100
otPt		
SEt		
2		
otPt		
	o.Fn	ALM
	0.Fi	1
ALM		
SEt		
1		
ALM		
	A.ty	dE.AL
	A.hy	2
	A.Lg	AL o
	A.Sd	both
	A.LA	nLAt
	A.bL	oFF
	A.Si	oFF
	A.dSP	on
	A.dL	0

ALM		
SEt		
2		
ALM		
	A.ty	oFF
	A.Sr	
	A.hy	
	A.Lg	
	A.Sd	
	A.LA	
	A.bL	
	A.Si	
	A.dSP	
	A.dL	
ALM		
SEt		
3		
ALM		
	A.ty	oFF
	A.Sr	
	A.hy	
	A.Lg	
	A.Sd	
	A.LA	
	A.bL	
	A.Si	
	A.dSP	
	A.dL	
ALM		
SEt		
4		
ALM		
	A.ty	oFF
	A.Sr	
	A.hy	
	A.Lg	
	A.Sd	
	A.LA	
	A.bL	
	A.Si	
	A.dSP	
	A.dL	
gLbL		
SEt		
	C_F	C
	AC.LF	60
	C.LEd	both
	2cnE	on
	chan	on
	dprS	1

Figure 4-3.
Watlow EZ Zone PM Controller. Inlet heater factory-set parameters.

	dprS	1
	d.ti	0
	USr.5	none
	USr.r	none
CoM		
SEt		
	Ad.S	1
	MAP	1
	nuS	YES

OPERATIONS

Ai		
oPEr		
	Pu	READ ONLY
	i.Er	READ ONLY
	i.CA	0
Mon		
OPEr		
	C.MA	READ ONLY
	h.Pr	READ ONLY
	C.SP	READ ONLY
	Pu.A	READ ONLY
Loop		
OPEr		
	C.M	AUto
	A.tSP	90
	AUt	no
	C.SP	70
	id.S	70
	h.Pb	6
	ti	2
	td	307
	o.SP	0
ALM		
OPEr		
1		
ALM		
	A.Lo	-5
	A.hi	5
ALM		
OPEr		
2		
ALM		
	A.Lo	
	A.hi	
ALM		
OPEr		
3		
ALM		
	A.Lo	
	A.hi	
ALM		
OPEr		
4		
ALM		
	A.Lo	
	A.hi	

Pumping System Maintenance

Turbopump

Change the oil cartridge in the turbopump annually following the turbopump manufacturer's instructions.

Remove power to the ProLine before performing this maintenance.

Diaphragm roughing / backing pump

When the ProLine is in continuous use, you must change the diaphragms in the diaphragm pump every six to nine months. In some cases, diaphragm life may be considerably longer depending on the composition of the gases being pumped. Diaphragm identification and replacement instructions can be found in the pump manufacturer's documentation supplied with your analyzer.

Rotary vane roughing / backing pump

When the ProLine is in continuous use, the oil in the rotary vane pump should be changed at least once a year. In some cases, depending on the compounds being pumped, oil must be changed more frequently. If, when viewing the oil through the sight glass, it looks dark or discolored, it needs to be changed. Oil change instructions can be found in the pump manufacturer's documentation supplied with your analyzer.

Extended Range Pumping Option Maintanance

The extended range pumpin option requires no regular maintenance.

Electronics Package Maintenance and Troubleshooting

This section includes information on:

- maintaining the quadrupole head,
- changing the filament,
- disassembling the source,
- cleaning the source
- reassembling the source
- replacing the electron detector.
- troubleshooting the electronics

The rest of the electronics system should require no routine maintenance during normal use.

Disconnect all power from the analyzer before starting these procedures.

Touching any part of the quadrupole head source or mass filter with your fingers will leave dirt and oil on the parts resulting in contamination of the quadrupole head. Use clean plastic/latex gloves when handling components.

Dymaxion Electronics and Sensor

Before connecting the 24 VDC power to the electronics, ensure that the electronics are connected to the sensor. Otherwise, damage to the electronics is possible.

Always remove 24 VDC power from the Dymaxion electronics before removing the electronics from the sensor.

Quadrupole Head Maintenance

- The quadrupole head requires periodic maintenance. When handling the quadrupole head, follow standard vacuum practices, including:
  - Do not touch any parts that resides within the vacuum system with bare hands. Wear lint- and powder-free gloves.
  - Make sure that the area in which you are performing the maintenance is clean.
  - Do not blow off or dry any parts using compressed air unless you know that it is moisture- and oil-free.
  - After cleaning, dry the parts in an oven or use a heat gun.
- The entire head can be disassembled with the exception of the mass filter subassembly. Most parts can be replaced if necessary.
- As the analyzer head is used, deposits will form on the source parts and on the mass filter. The lifetime of the source parts varies with application, exposure time, and vacuum pressure.

Do not place the mass filter in an ultrasonic cleaner. The filter parts can become loose during ultrasonic cleaning. This will significantly degrade analyzer performance. A loosened mass filter must be replaced.

Closed Source

The AMETEK conductance limited/enclosed source contains a dual-wire filament so the analyzer can continue to function if one side of the filament burns out. The replacement filament comes in a protective container and can easily be replaced in the field.

- The filament should be replaced soon after its resistance exceeds 1.3 ohms (thoriated iridium filament) or 2.5 ohms (tungsten filament), or when it is determined to be half-open (filament LED is yellow).

Equipment required to replace a filament

- needle nose pliers,
- 5/64” hex wrench (supplied by AMETEK),
- filament assembly kit (supplied by AMETEK),
- latex gloves - powder-free (optional).

NOTE

Handling the filament by the shorting tabs (Figure 4-5) on the filament plate will ensure against contamination through handling since these tabs will eventually be discarded.

CAUTION

Before changing the filament, you must remove the electronics from the quadrupole head and remove the quadrupole head from the vacuum system. The electronics power must be turned off before servicing.

Removing the electronics from the quadrupole head

- After powering down the electronics, carefully use the tightening knobs on the sides of the electronics to unlock the electronics from the quadrupole head.
- Once loosened, gently pull straight back on the electronics, without twisting, until it is free of the head. Do not remove the cabling from the electronics.

Replacing the filament

1. Remove the six (6) ¼-28 bolts that fasten the quadrupole head 10-pin feedthrough to the vacuum system and remove the quadrupole head.
2. Remove and discard the copper gasket. **DO NOT TRY TO REUSE THE GASKET.**
3. Position the quadrupole head so that it is pointing up and is secure.

Removing the ion volume

The ion volume on the enclosed source must be removed to replace the filament. Using a hex wrench, remove the lock screw holding the ion volume and lock ring to the source (Figure 4-3). Carefully remove the screw, lock ring and ion volume and set them aside.

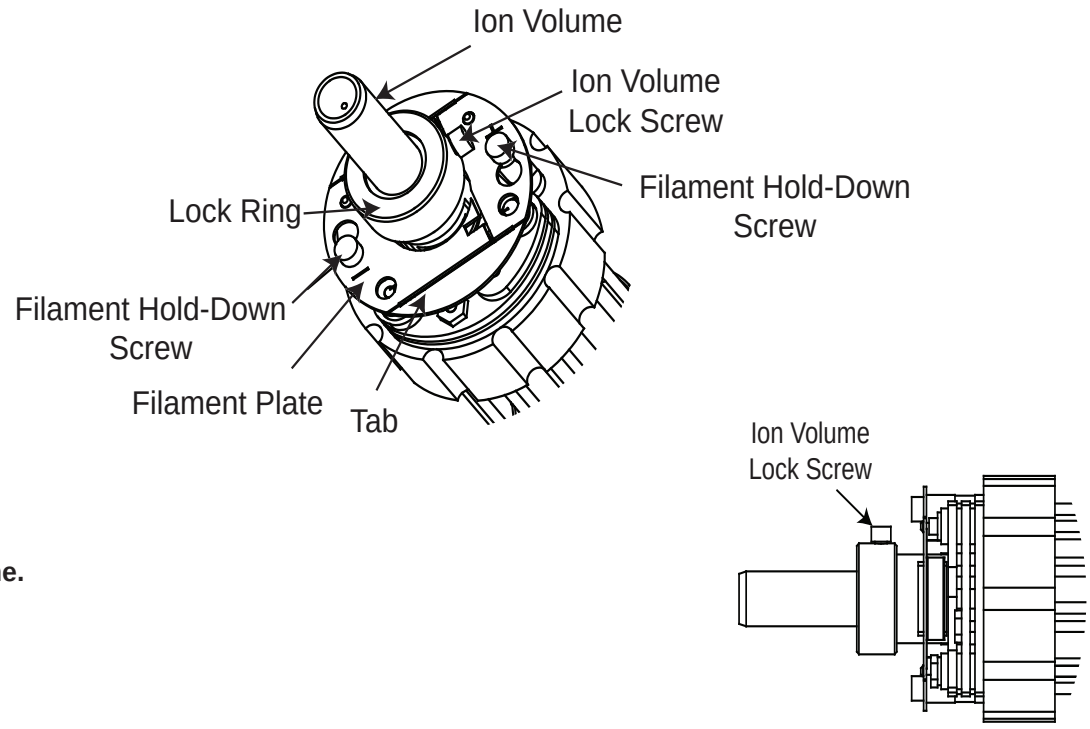


Figure 4-3.
Ison volume.

Removing the old filament

The filament plate is held in place by two (2) socket-head cap screws threaded into a filament base on each side. Using the hex wrench provided, loosen these two screws enough to rotate the filament plate counterclockwise and remove it by sliding the plate over the screw heads (see Figure 4-3). Be sure to remove all residual pieces of the old filament.

1. Install the new filament being careful not to bend or break the delicate filament wires. Handle only the shorting tabs on the filament plate.

2. Tighten the set screws that hold the new filament in place.

3. Replace the ion volume by setting it back on the head and secure it with the set screw.

4. Remove the shorting tabs on the filament by gently bending them back and forth with needle nose pliers until the tabs break at the notches at their bases.

Be sure the filament coils are aligned with the slots in the ion volume and ionizer. Make sure the filament coils do not touch the base plate, ionizer or ion volume in any manner other than at welds.

5. Install a new copper gasket on the quadrupole feedthrough flange. Be sure it remains centered on the flange as the head assembly is installed into the vacuum system using the six bolts.

6. Tighten the bolts using a cross pattern to ensure proper tightening and a leak-tight connection. The maximum torque required is 110 in.-lb. (9 ft-lb.).

7. Check for electrical isolation between the feedthrough pins.

   - The check should be performed on the pins on the atmosphere side of the unit (Figure 4-4).
   - The pins should be electrically isolated from each other and from ground.
   - There should be approximately one ohm continuous circuit between the filament Pins 3 and 8. They should be isolated from ground.

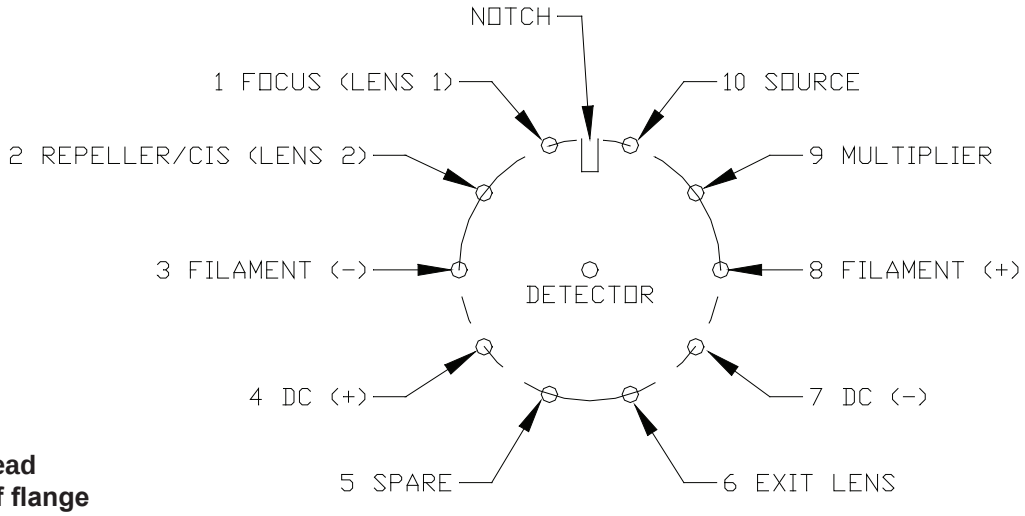


Figure 4-4. Quadrupole head pinout, view of flange (atmosphere side).

Disassembling the Source

Closed Source

Disassembly of conductance limited/enclosed source

- Remove the filament (see instructions in this chapter).
- Loosen the set screws on the barrel connectors that hold the three leads coming down from the source elements. The filament bases can be left intact. Remove the source assembly from the mass filter.

1. Loosen and remove the three (3) locknuts that hold the source connection rods in place on the lenses. Refer to Figure 4-5 and Figure 4-7.
2. Loosen and remove the three (3) screws that hold the lens together in sandwich form. Be careful not to lose the small ceramic or metal washers from the source; each serves to hold the source in precise alignment. See Figure 4-7.

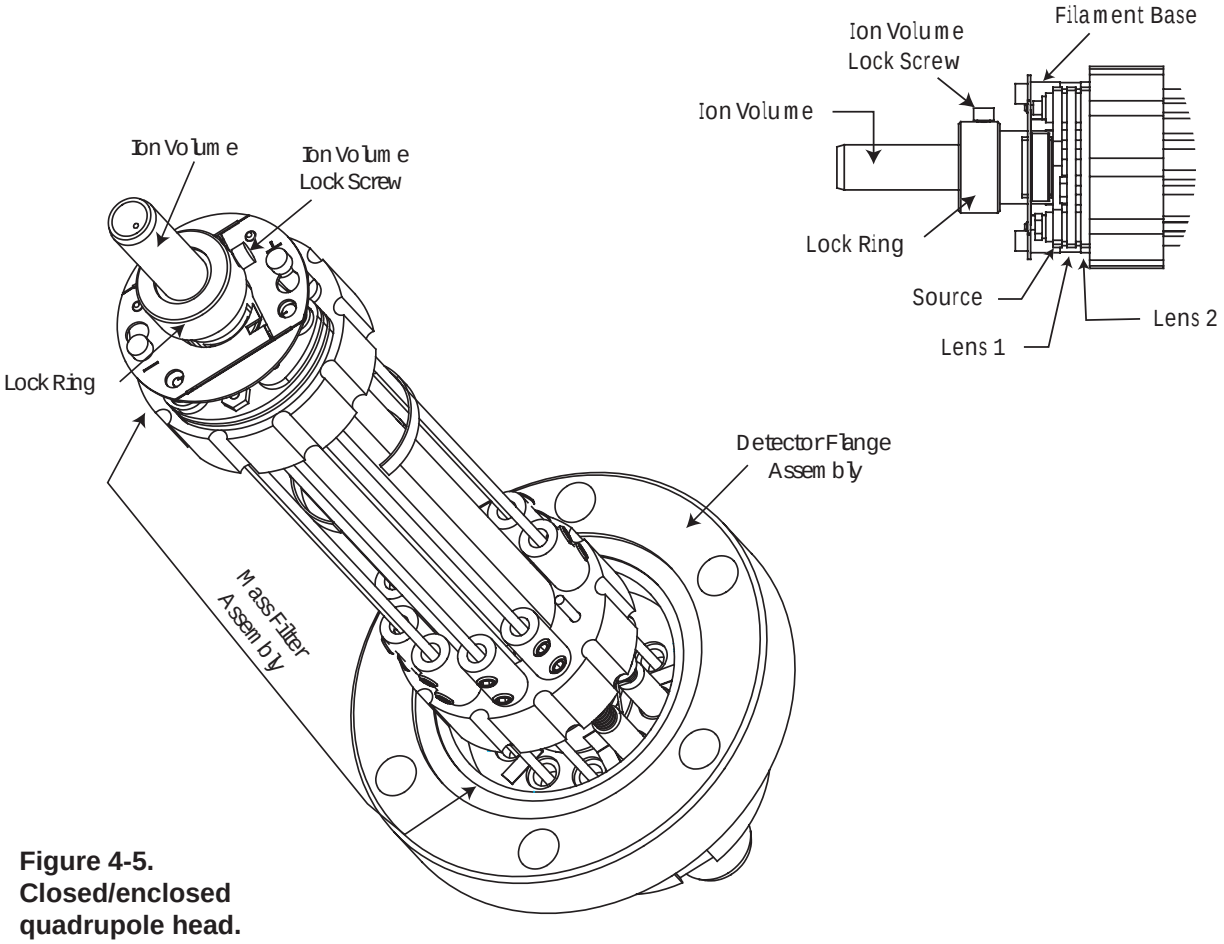


Figure 4-5. Closed/enclosed quadrupole head.

Cleaning the conductance limited/enclosed source

The conductance limited/enclosed source can be fully disassembled and cleansed of deposits. However, only the removable ion volume will usually need cleaning since this is where most sample ionization occurs. If the entire source assembly is covered with deposits, it must be disassembled and thoroughly cleaned. Instructions for cleaning the source follow in this chapter. However, it is often more advantageous to replace the source with a new one. Contact AMETEK to order a new source.


NOTE

The source cannot be disassembled without damaging the filament. Be prepared to install a new filament if you disassemble the source for cleaning or any other purpose.

Mass filter

Deposits can form at the entrance to the mass filter rods when they are operated at high pressures or over a long period of time.

- Deposits can sometimes be seen as discolorations on the metal. In some atmospheres, the rods might be coated with an invisible layer that will keep the mass filter from operating properly. This will result in a loss of sensitivity over the full range of the spectrum. If the peaks disappear at high scan speeds, an insulating layer may have developed on the surface of the rods.
- Unless the nature of these discolorations can be identified exactly, the only sure way of removing them is with a fine abrasive.
- The entire quadrupole head assembly must be disassembled to clean the rods.


NOTE

We recommend that the assembly be returned to the factory where the rods can be cleaned properly.

Cleaning the Source

The ion volume and the source can be cleaned gently using a soft brush, such as a toothbrush, and a small round brush to access the interior of the ion volume.

1. Make a paste by mixing aluminum oxide powder (Lapmaster 1300 or equivalent) with tap water.

2. Using a small nylon bristle brush, wet the parts and apply the paste. A small round brush is required to clean the interior of the ion volume and the holes in the lenses. Scrub only enough to remove any deposits or discolorations. Scrubbing too long can damage the finish on the source parts. Rinse parts thoroughly in tap water.

3. Sonicate the parts in a mixture of de-ionized water and cleaner (Alconox Powdered Precision Cleaner or equivalent) for approximately one hour. Remove from the sonicator.

4. Rinse the parts thoroughly in de-ionized water. Replace in the sonicator.

5. Sonicate the parts in de-ionized water for approximately one hour.

6. Remove parts from the water and dry the parts by baking in an oven at 100 °C for 30 minutes. Alternatively, dry the parts with a heat gun until the water has evaporated.

7. Reassemble the source (Figure 4-7).

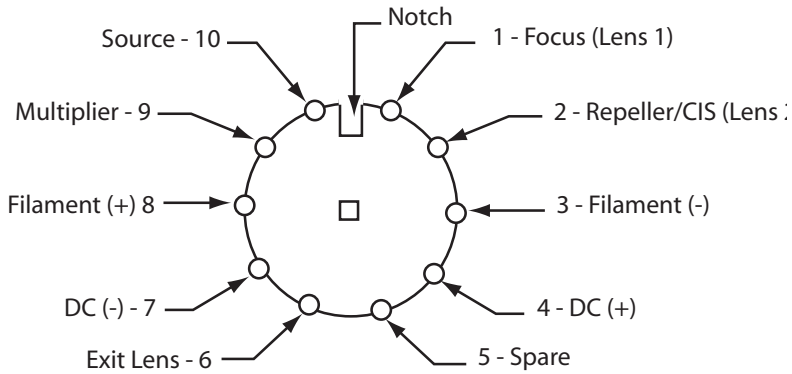


Figure 4-6. Quadrupole head pinout, view of flange (source side).

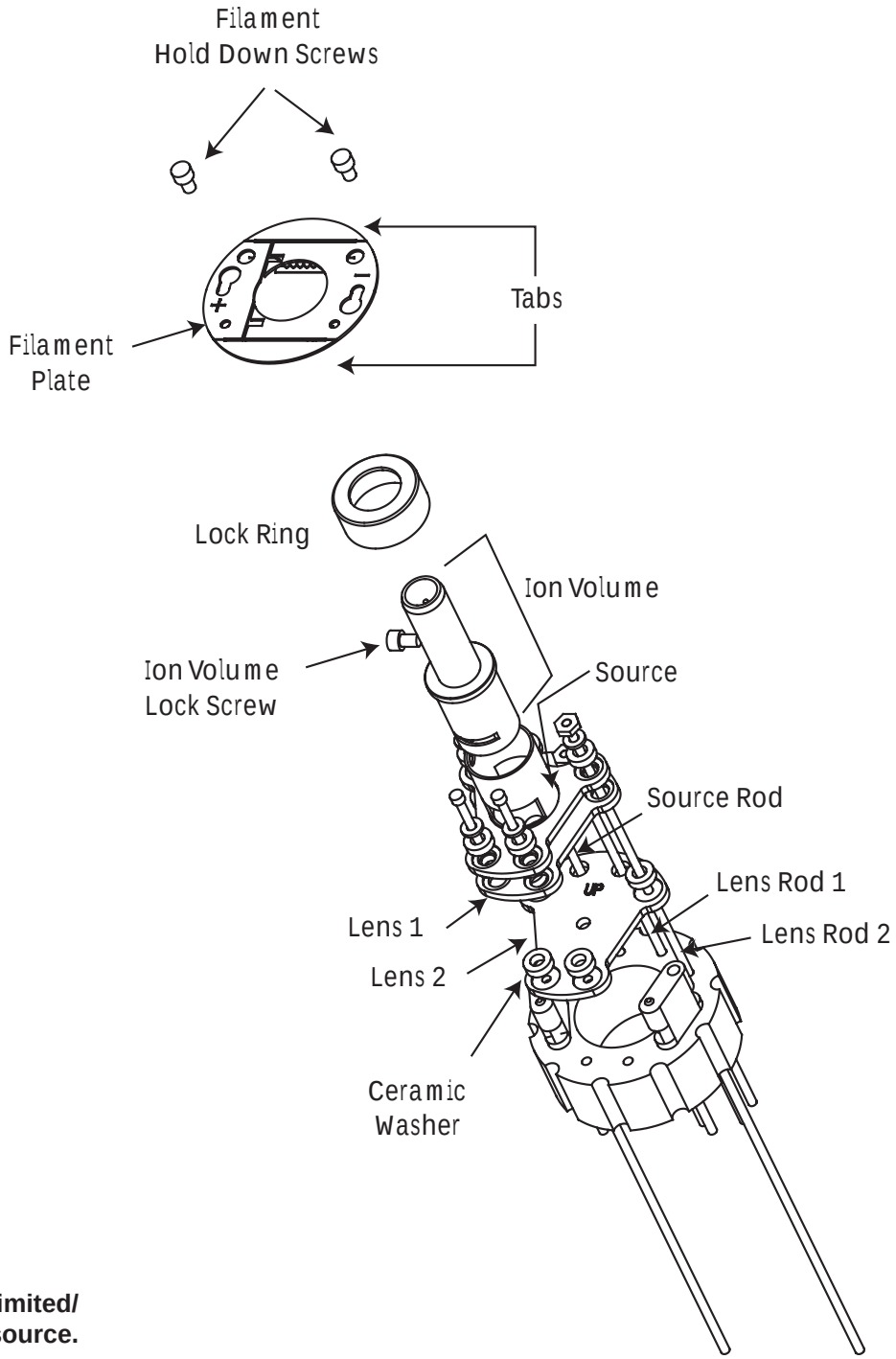


Figure 4-7.
Breakdown of conductance limited/ enclosed ion source.

Assembling the conductance limited/enclosed source


NOTE

Assemble the source in reverse order of the disassembly taking care to center each ceramic washer in its seat to prevent cracking it. Do not crush the ceramic washer or strip the threaded parts by over-tightening the source hardware - tighten to snug only!

1. Install the source so that Lens 2 is seated against the ceramic quadrupole collar. The hardware binding the source together may need to be loosened temporarily so that all the rods can fit through the ceramic quadrupole collar holes, and so that Lens 2 can sit against the collar. Carefully insert the rods through the holes in the ceramic collar and into the barrel connectors and the detector flange assembly according the pinout in Figure 4-6. Be sure that the screws are tightened snugly to the hardware once the source is in place.

2. Install the filament as described in "Replacing the Filament" in this chapter.

3. Once the quadrupole head has been checked, replace the ion volume by setting it back on the head (Figure 4-5) and secure it with the lock screw. Insert the head into the vacuum chamber and secure using the six bolts originally removed.

Capillary Replacement

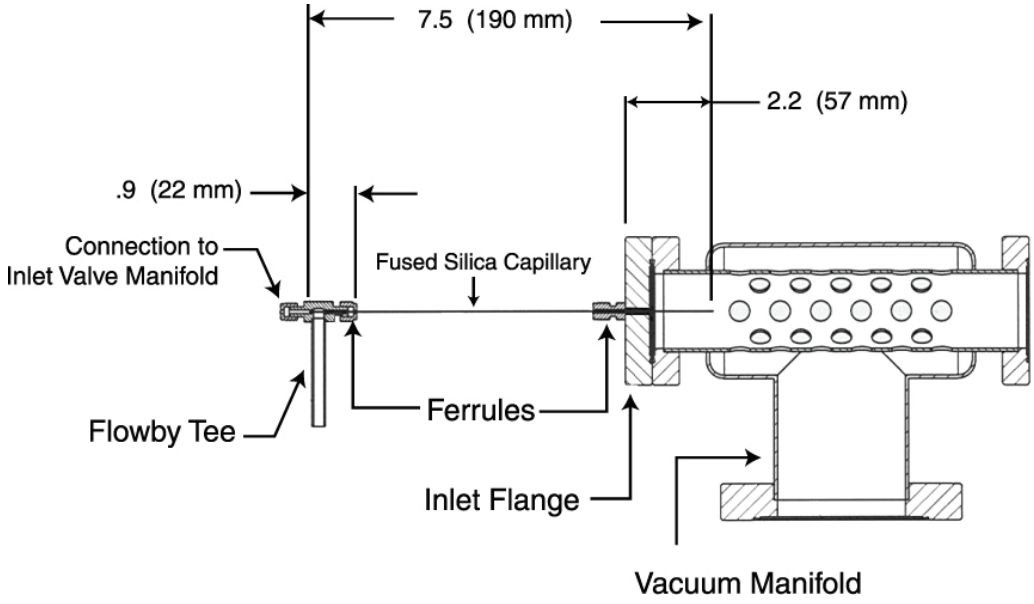


Figure 4-8.
Capillary replacement dimensions.

NOTE

The drawing in Figure 4-8 is a representation of the capillary configuration and does not depict the capillary when in use.

NOTE

Tolerance on the capillary dimensions is ± .06" (1.5mm).

CAUTION

Use safety glasses when uncoiling and cutting the capillary.

1. Uncoil the capillary carefully and cut to a length of 7.5 inches (190mm) using a capillary precision cutting tool (SGE #0625010) or comparable tool.

2. Mark insertion dimensions on each end using tape or permanent marker. Mark the end that you insert into the ferrule on the inlet flange 2.2 inches (57mm) from the end. Mark the end you insert into the ferrule on the flowby tee 0 .9 inches (22mm) from that end.

3. Loosen the nut holding the ferrule on the inlet flange to release the ferrule (Figure 4-8). Thread the capillary through the ferrule.

4. Insert the ferrule and capillary onto the inlet flange and secure with the nut just to keep in place.

5. Adjust the capillary to the insertion point you marked by loosening the nut to allow the capillary to move in and out easily.

6. Once the capillary is in the correct position (at the insertion point you marked), tighten the nut until the capillary is grasped and then tighten 1/4 turn more. Do not overtighten.

7. Repeat the insertion process for the ferrule on the flowby tee.

8. Once the capillary is secure in both ferrules and at the correct insertion points, remove any temporary markers or tape.

Electron Multiplier

The multiplier is immune to up-to-air cycling and routine low-level ion bombardment. However, over time the system will begin to lose gain. When this becomes unacceptable, a new multiplier will restore the original gain of the system.


NOTE

Call AMETEK Process Instruments or your local representative to arrange for factory service to replace the multiplier. Because of the complexity of the detector flange assembly, we recommend that the multiplier be replaced at the factory.

Troubleshooting the Electronics

Things to Check First

In many cases, a system failure is not due to a problem with an electronic component, but rather to one of the following:

- Operation at too high pressure (greater than 1 x 10^{-4} Torr).
- Improper setting of parameters on a source or calibrate button.
- Incorrect or improper cable connection.
- Burned out filament.
- Shorted-out ion source parts usually resulting from an incorrect filament or source replacement.
- Failure to establish proper communications.

Quick and Easy Solutions

The first step in providing a solution to the problem is performing the following checks.

1. Make sure the quadrupole rod assembly is properly supported within the vacuum housing.
2. Make sure all cables are connected properly to the electronics unit.
3. Make sure that the electronics is fully pushed onto the feedthrough contacts. Reset the electronics by unplugging the power cable from the unit and plugging it back in.
4. Check the continuity between the filament feedthroughs.
   Although protected, the thoriated iridium filament will eventually wear out. The best way to determine if this is the case is to check the filament continuity.
   - The check should be performed on the pins on the atmosphere side of the unit (Figure 4-9).
   - The pins should be electrically isolated from each other and from ground.
   - There should be approximately one ohm continuous circuit between the filament Pins 3 and 8. They should be isolated from ground.

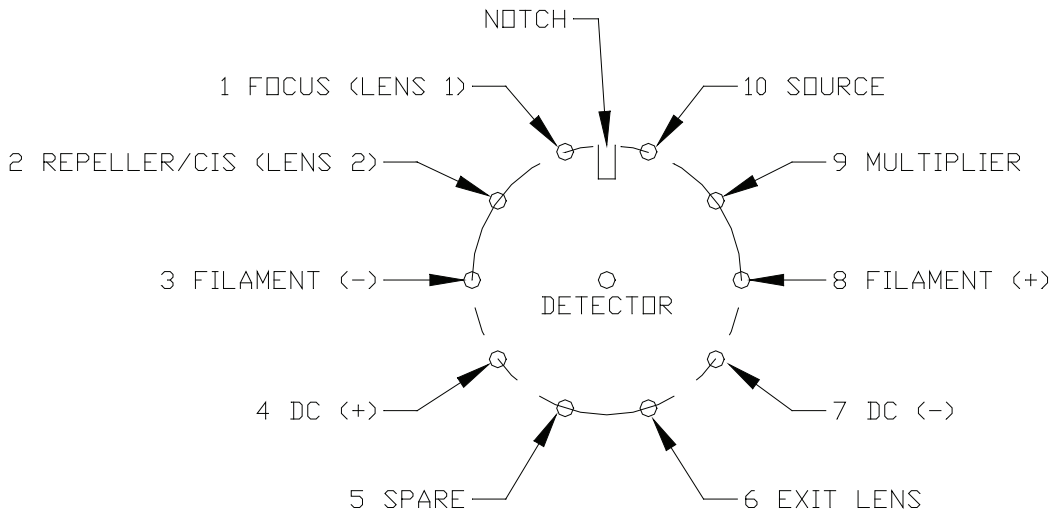


Figure 4-9.
Quadrupole head pinout, view of flange (atmosphere side).

– If no continuity exists between Pins 3 and 8, remove the quadrupole head from the vacuum system and replace the filament assembly with a replacement filament assembly.

If the problem persists after going through these steps, you will have to localize the problem area. These potential problem areas are:

- Electronics Communications and LEDs
- Filament LED

Electronics Communications and LEDs

1. Make sure the power supply cable between the electronics and the power supply is plugged in at both ends.

2. Make sure the electronics RS-232/RS-485 switch is in the correct position for the communications port that you are using.

3. Check the LEDs on the back of the electronics to make sure that all lights are green. The second light should be blinking green. Refer to “LED” section below for LED details.

4. In the software, make sure that **Device Enabled** and **Live Data** boxes are both checked on the **General** tab.

The LEDs are listed below in the order in which they appear (top to bottom) on the back of the electronics unit.

CPU

Indicates CPU and system status.

- OFF: Electronics power is off.
- RED: CPU has stopped.
- FLASHING RED: Battery-backed RAM has been cleared. Check battery.
- GREEN: Normal operation.

Comm

Shows the status of communications between the electronics and the PC. It flashes green when receiving data from the PC. It remains off when the electronics package is inactive. A red light indicates a communications error.

RF

Shows the status of the RF circuit. The LED is green if the RF amplifier is operating properly, and turns red if you have an RF failure. The LED is yellow during automatic RF tune.


NOTE

If you are having a problem in this area please contact your service engineer.

Filament

This LED indicates the status of the filament. The LED is green if the filament is on and is working properly. The LED appears red if the filament is off due to an open or short condition. The LED appears yellow if half of the filament has failed.

Filament Trip and LEDs

1. Check the LEDs on the back of the electronics package. You can determine filament status by the color of the lights. Refer to the previous section for LED details.

2. Make sure the filament is turned on by clicking the “Light Bulb” icon on the toolbar in the AMETEK System 2000 software to make sure it is yellow (ON). Check the filament status and emission current by accessing the **Edit** menu on the toolbar and clicking **Add Display**. Click **Head Status**.

3. Restart the entire system and recheck the filament status and emission current.

4. If there is no filament current, turn off the instrument, pull the electronics from the analyzer head and check the continuity between Pins 3 and 8.

5. If the filament is burned out (LED is red), open the vacuum system and replace the filament assembly.

If the filament checks out OK, do the following:

- Check the LEDs on the back of the electronics .

- If the LEDs are green and the filament has not tripped, call the factory for assistance.

BOARD REPLACEMENT

The electronics unit contains six boards (Figure 5-1) that can be replaced in the field if damaged or found to be not working properly. These boards can be replaced using only a #1 Phillips screwdriver and a 1/4” nut driver. The boards are:

- **I/O Option Board**
  Located between the Front Panel and the LED / Heat Sink.

- **Master Board**
  Located behind the left front panel on the front of the unit.

- **Control Board**
  Located behind the front heat sink and LED panel on the left side.

- **Scan Board**
  Located behind the front heat sink and LED panel on the right side.

- **Amp Card**
  Located behind the rear heat sink and under the Amp cover.

- **RF Board**
  Located behind the rear heat sink and separated from it by the conductor guide.

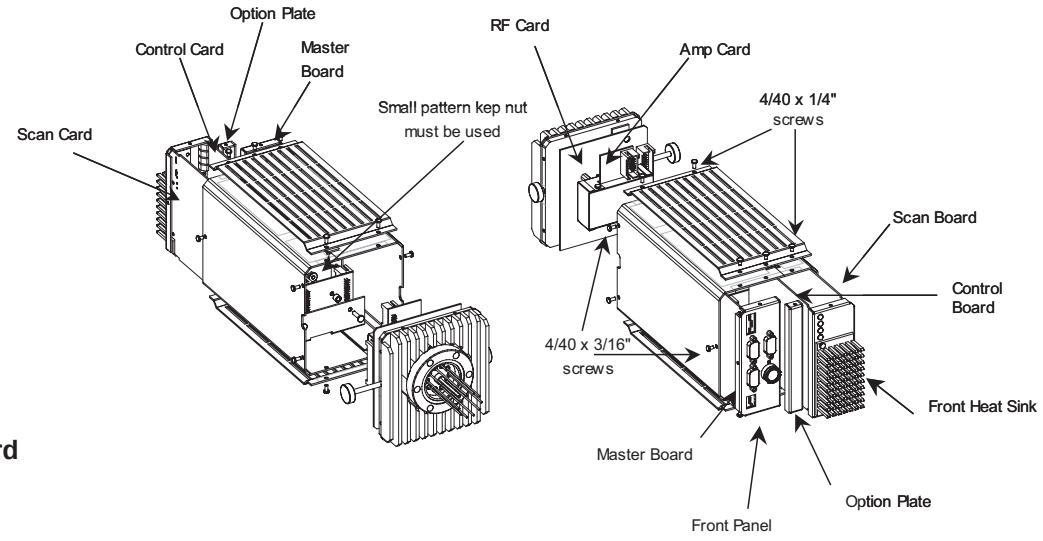


Figure 5-1. Dymaxion board locations.

I/O Option Board

NOTE

The I/O Option board must be removed to facilitate replacement of the Master, Control and Scan boards.

The I/O Option Board slot is located between the Front Panel and the LED / Heat Sink (see Figure 5-2a).

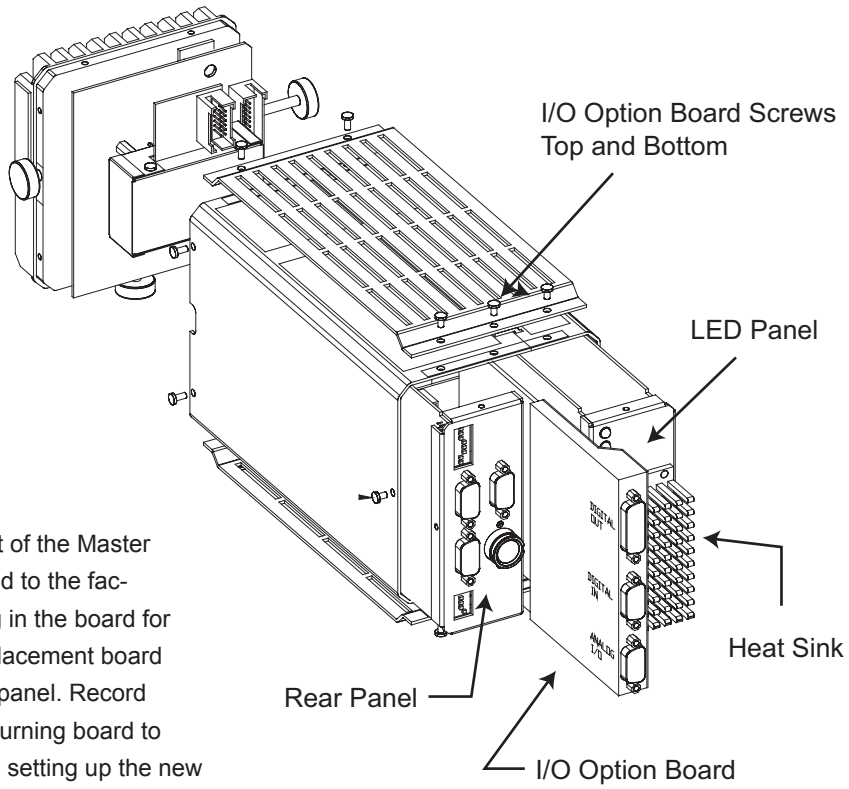


Figure 5-2a.
I/O Option board replacement slot.

Front Panel is part of the Master Board and returned to the factory when sending in the board for replacement. Replacement board includes the front panel. Record settings before returning board to factory to facilitate setting up the new board.

Removing the I/O Option Board

1. Disconnect the cables from the three connectors (15-pin and two 9-pin) at the back of the I/O Option board (Figure 5-2b).

2. Remove the screws from the top and bottom of the I/O Option board that hold the case to the electronics unit. See Figure 5-2a.

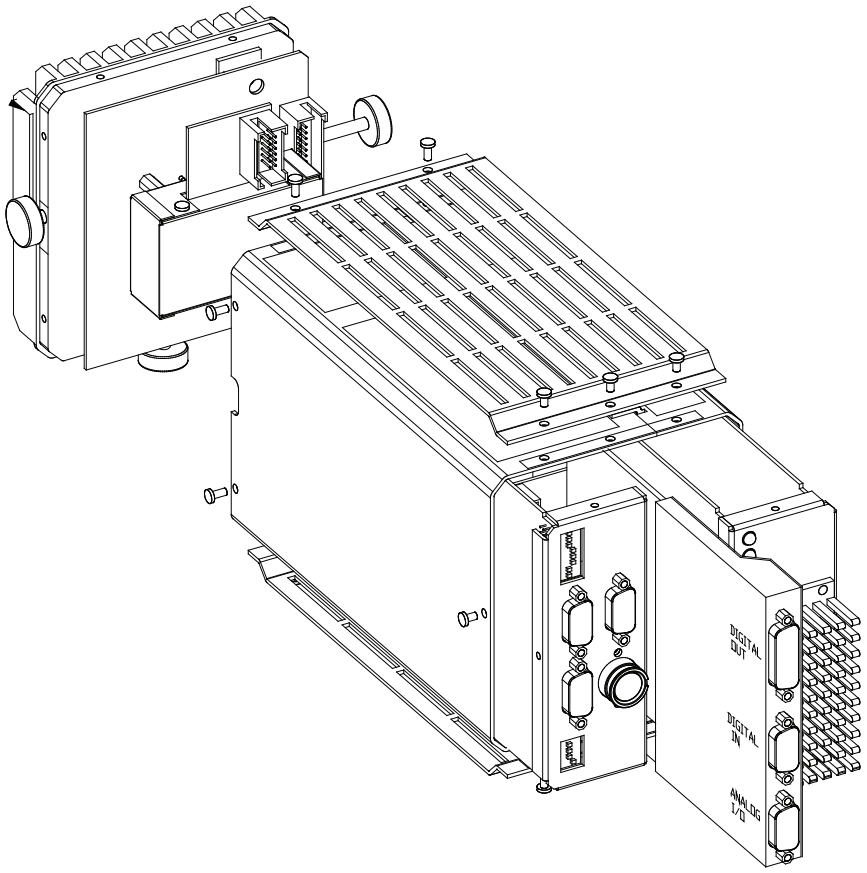
3. Gently slide out the board disengaging the inside connectors. It may be necessary to slightly wiggle the board so that it comes loose. You do not need to remove the cover from the board.

Replacing the I/O Option Board

1. Gently slide the I/O Option board into the slot in the back of the electronics unit making sure that you engage the connector on the board with the electronics unit itself.

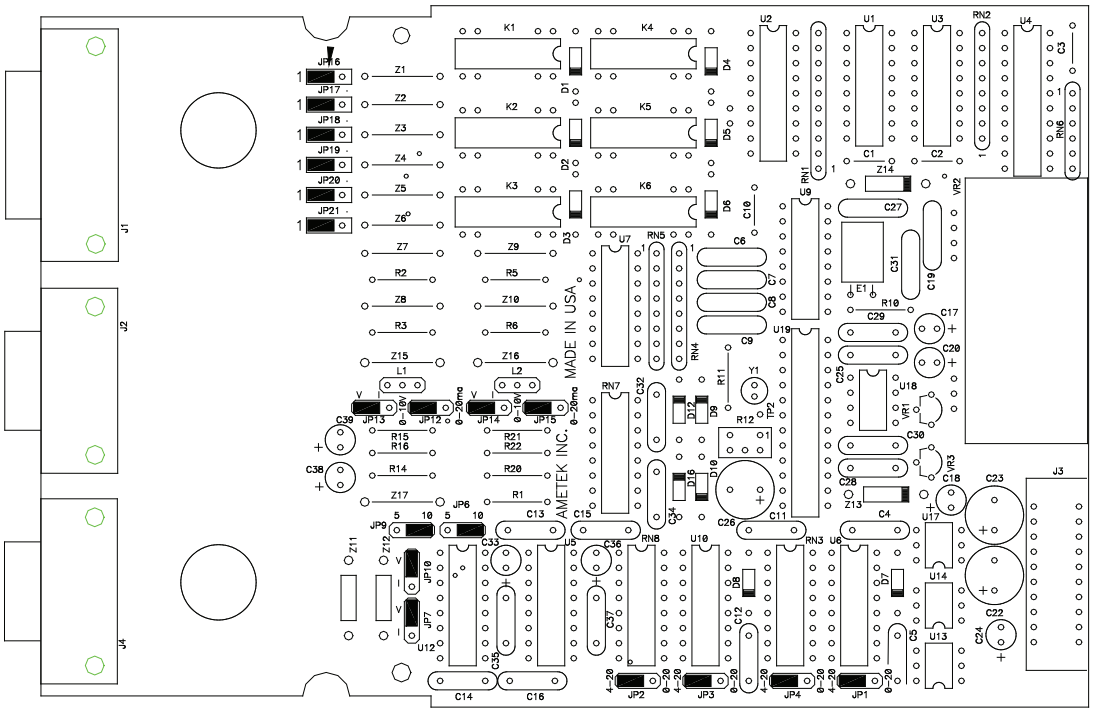
2. Insert the screws at the top and bottom of the I/O Option board cover, securing it to the electronics unit.

3. Attach the cables to the appropriate connectors on the I/O Option card. See Figure 5-2b.



Digital Out	Top Connector (15 pin)
Digital In	Middle Connector (9 pin)
Analog I/O	Bottom Connector (9 pin)

Figure 5-2b.
I/O Option board showing connectors.



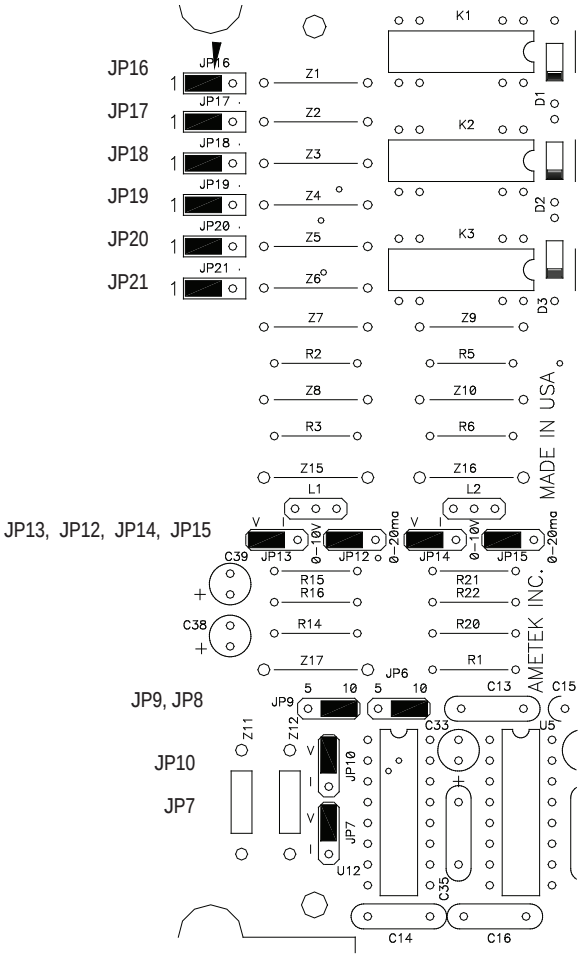


Figure 5-2c.
I/O Option board showing jumpers.

Master Board

The Master board is found behind the front panel of the electronics unit to the left of the heat sink (see Figure 5-1). The entire front panel is part of the Master board and is returned to the factory when a replacement board is ordered.

Make sure that the RS-485 and RS-232/RS-485 dipswitch settings are recorded before shipping the board to the factory to facilitate setting up the new replacement board. Also note the outlets to which your cables are connected on the panel. See Figure 5-2.

Removing the Master Board

To remove the Master board, follow these steps:

1. Remove the I/O Option board for easier access.
2. Remove the 1/4” screws from the top and bottom of the unit and the 3/16” screw from the left side of the unit (see Figure 5-1). These three screws hold the board in place.
3. Loosen or remove the screws at the top and bottom of the option plate to allow easier access to the removal of the Master board.
4. Pull out the front panel and Master board.

Replacing the Master Board

1. Place the new board with attached front panel into the slot from which you removed the old board. There is one connector into which to plug the replacement board.
2. Replace or retighten the screws for the option plate to put it back in place.
3. Secure the board and front panel in place using the 1/4” screws for the top and bottom of the unit and the 3/16” screw for the left side.
4. Using the information that you recorded from your old board, set the RS-485 and RS-232/RS-485 dipswitch settings. Plug in the cables as required.
5. Replace the I/O Option board.

Removing the Control Board

The Control Board is located behind the front heat sink and the LED panel on the left-hand side (see Figure 5-1). It is the shorter of the two boards attached to the LED panel.

To remove the Control board, follow these steps:

1. Remove the I/O Option board.
2. Remove the 1/4” screws from the front top and bottom casing of the unit and the 3/16” screw from the right side See Figure 5-1.
3. Loosen or remove the screws at the top and bottom of the option plate to allow easier access to the removal of the Control board.
4. Grab the heat sink and pull on it to remove the assembly with the Control and Scan boards. It is connected to the unit by four connectors.
5. Once the assembly has been removed from the unit casing, remove the upper left and bottom right 3/8” screws with internal tooth lock washer from the heat sink. See Figure 5-4.
6. Gently pull on the front heat sink to remove it. The LED panel is now visible.

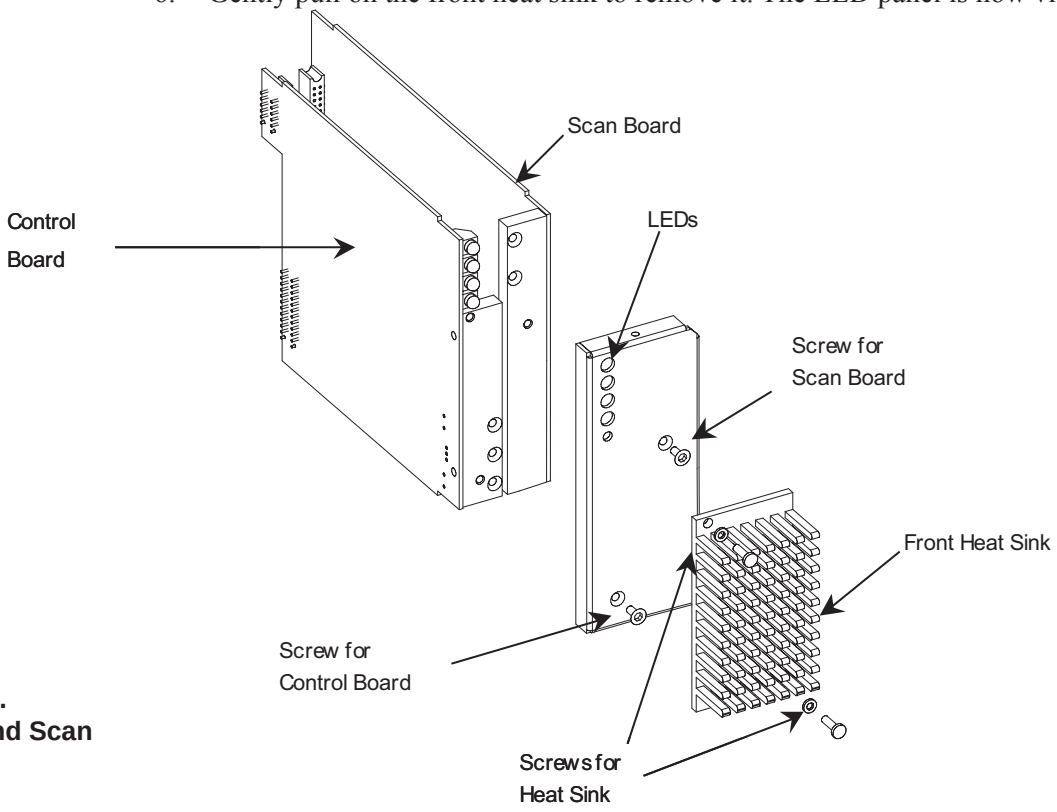


Figure 5-4. Control and Scan boards.

7. Remove the 1/4” screw from the bottom left of the LED panel.

8. Gently pull the Control board away from the adhesive gap pad on the back of the LED panel.

Replacing the Control Board

1. Attach the LED panel at the bottom left using the 1/4” screw.

2. Replace the front heat sink using the 3/8” screws and lock washers on upper left and bottom right.

3. Insert the board into the unit making sure the four connectors (2 on each side) are plugged in.

4. Replace or retighten the screws for the option plate to put it back in place.

5. Replace the 1/4” screws on the top and bottom and the 3/16” screw on the right side of the unit casing.

6. Replace the I/O Option board.


NOTE

There are adhesive gap pads on the back side of the front heat sink and the LED panel to ensure that all fixtures are secure and in place.

Scan Board

Removing the Scan Board

The Scan board is located across from the Control board and to its right, behind the LED panel and the front heat sink. It is the longer of the two boards attached to the LED panel. See Figure 5-1.

Follow these steps to remove the Scan board.

1. Remove the I/O Option board.
2. Remove the 1/4” screws from the front top and bottom casing of the unit and the 3/16” screw from the right side. See Figure 5-1.
3. Loosen or remove the screws at the top and bottom of the option plate to allow easier access to the removal of the Control board.
4. Grab the heat sink and pull on it to remove the assembly with the Control and Scan boards. It is connected to the unit by four connectors.
5. Once the assembly has been removed from the unit casing, remove the upper left and bottom right 3/8” screws with internal tooth lock washer from the front heat sink.
6. Gently pull on the heat sink to remove it. The LED panel is now visible.
7. Remove the 1/4”screw from the top right of the LED panel.
8. Gently pull the Scan board away from the adhesive gap pad on the back of the LED panel.

Replacing the Scan Board

1. Attach the LED panel at the upper right using the 1/4” screw.
2. Replace the front heat sink using the 3/8” screws and lock washers on upper left and bottom right.
2. Insert the board into the unit making sure the four connectors (2 on each board) are engaged.
4. Replace or retighten the screws for the option plate to put it back in place.
5. Replace the 1/4” screws on the top and bottom and the 3/16” screw on the right side of the unit casing.

6. Replace the I/O Option board.


NOTE

There are adhesive gap pads on the back side of the front heat sink and the LED panel to ensure that all fixtures are secure and in place.

Amp Card

Removing the Amp Card

The Amp Card is part of the RF assembly at the rear of the unit. It is located under the Amp cover. See Figure 5-5.

To remove the Amp card, follow these steps:

1. There are eight screws holding the RF assembly in the unit casing. Remove the (2) top 1/4” and (2) bottom 1/4” screws.
2. Remove the (2) 3/16” screws from each side.
3. Grab hold of the rear heat sink and pull hard to remove the assembly from the casing.
4. You now have the complete RF assembly in your hand. Refer to Figure 5-5.
5. Remove the Amp cover by removing the two 1/4” self-tapping sheet metal screws. The Amp card is underneath.
6. Remove the Amp card by removing the (4) 1/4” screws holding it to the Amp card shield.

Replacing the Amp Card

1. Secure the Amp card onto the Amp card shield using the (4) 1/4” screws.
2. Attach the Amp card cover to the Amp card using the two 1/4” self-tapping sheet metal screws.
3. Insert the RF assembly into the unit casing and secure using the (4) 1/4” screws for the top and bottom of the unit and the (4) 3/16” screws for the sides.

Removing the RF Card

The RF card is located directly behind the rear heat sink and separated from it by the conductor guide. See Figure 5-5.

Follow these steps to remove the RF card for replacement:

1. There are eight screws holding the RF assembly in the unit casing. Remove the (2) top 1/4” and (2) bottom 1/4” screws.
2. Remove the (2) 3/16” screws from each side.
3. Grab hold of the rear heat sink and pull hard to remove the assembly from the casing.
4. You now have the complete RF assembly in your hand. Refer to Figure 5-5.
5. Remove the Amp cover by removing the two 1/4” self-tapping sheet metal screws. The Amp card is underneath.
6. Remove the (4) 1/4” screws holding the Amp Card to the Amp card shield.
7. Using the 1/4” nut driver remove the (4) 3/8” standoffs from the Amp card shield. You can now see the RF card.

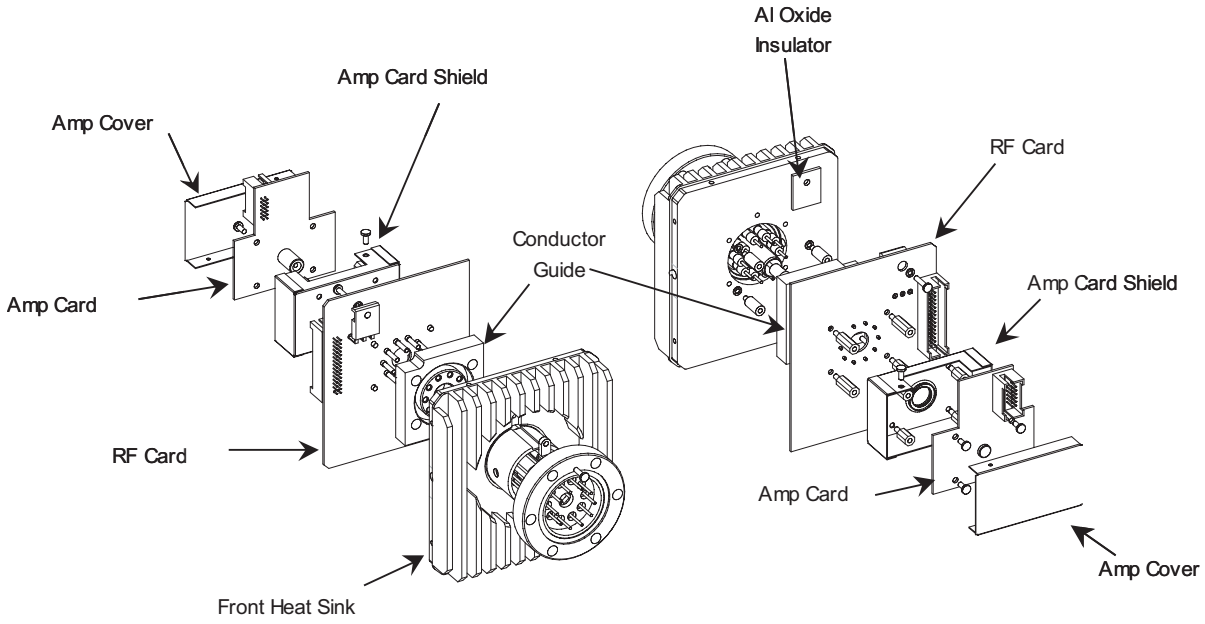


Figure 5-5.
Amp card and RF board replacement.

8. Using the 1/4” nut driver, remove the (4) 5/8” standoffs holding the RF card to the connector guide.

9. Remove the 1/2” screw on the top right of the RF card. This holds the card to the aluminum oxide insulator on the rear of the heat sink.

It is very important to remember to replace this screw and insulator when reassembling the unit after replacing the board. The insulator is coated with thermally conductive joint compound. If it is not replaced, the unit will not work.

10. Separate the RF card from the conductor guide.

It is very important to remember to retain the conductor guide as it is not part of the replacement board.

Replacing the RF Card

1. Using the 1/4” nut driver, loosely attach the conductor guide to the RF card using the 5/8” standoffs.

2. Plug the analyzer head onto the loosely assembled guide conductor and RF card. Tighten the standoffs using the 1/4” nut driver.

Failure to secure the assembly to the analyzer head at this point can result in failure of the unit through cracking of the feedthrough. If the feedthrough is cracked, a leak will develop.

3. Screw in the 1/2” screw in the upper right corner of the RF card to connect to the aluminum oxide insulator.

Failure to install this screw and aluminum oxide insulator will cause the unit not to operate.

4. Using the 1/4” nut driver, attach the Amp card shield to the RF card using the 3/8” standoffs.

5. Attach the Amp Card to the amp card shield using the (4) 1/4” screws.

6. Attach the amp card cover to the Amp card using the (2) 1/4” self-tapping sheet metal screws.

7. Insert the RF assembly into the unit casing and secure using the (4) 1/4” screws for the top and bottom of the unit and the (4) 3/16”screws for the sides.

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SERVICE AND PARTS REPLACEMENT

Components in the Electronics Box

The electronics box houses the following components that can be replaced by the user:

- Power supplies
- Valve control board
- Power switch fuses
- Heater inlet controller
- Pump controller interface
- Quadrupole head maintenance, filament replacement

Use caution when accessing any of the components in the electronics box.

Accessing the Electronics Box Contents

Follow the instructions below to access components in the electronics box for service or replacement.

1. After powering down the electronics , carefully use the tightening knobs on the sides of the Dymaxion to unlock the electronics from the quadrupole head.

2. Once loosened, gently pull straight back on the Dymaxion, without twisting, until it is free of the head. Do not remove the cabling from the electronics.

3. Detach the tubing from the backing pump that is connected to the turbo pump. You will not detach the backing pump from the top of the electronics box.

4. Remove the six screws that hold the top cover on the electronics box.


NOTE

If you have the computer option on your analyzer, the top board that you will view is the computer board. It will have a plug-in flash card and four connectors: a power connection, communication connection, connection to the computer's hard drive and a LAN connection.

5. If you do not have the computer option, you will see two power supplies attached to either side of the U-bracket.

6. Remove the four screws on the back cover of the electronics box to remove the cover and access the valve control board. This also makes it easier to replace other components in the box.


NOTE

The fan is attached to the back cover of the electronics box. Make sure to detach the connector from the fan or power supply if you are removing the back cover.

Electronics Box Parts Replacement

Computer Board Replacement

If you have this option, refer to the appropriate appendix in this manual.

Power Supply Boards

If you have the computer option on your analyzer, first remove the computer board as described in the appendix. You can now easily see both power supply boards attached to either side of the U-bracket in the box.

Removing the power supply boards

Looking at the analyzer from the back, there are two power supply boards attached to the U-bracket (Figure 6-1).

- Left side: Power supply for the turbo pump, electronics package and fan.
- Right side: Power supply for the heater.

1. Using a Philips screwdriver, remove the five screws on the standoffs that hold the power supply board to the U-bracket.

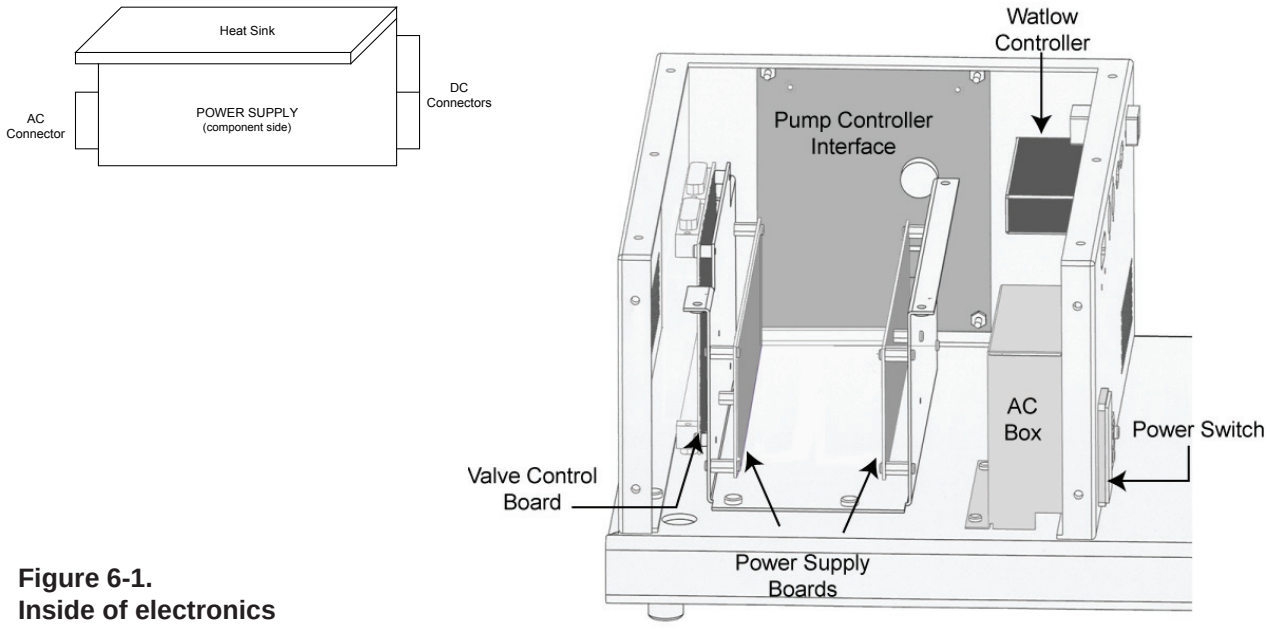

Figure 6-1. Inside of electronics box (back view).

2. Each power supply has three connectors attached to the board: a single AC connector and two DC connectors. Remove these connectors from the board.

Replacing the power supply boards

1. The power supplies have three connectors that must be attached before mounting the board to the bracket.

2. Replace the one AC connector and the two DC connectors on the board.

3. Using a Philips screwdriver, attach the board using the five screws to the standoffs that hold the power supply board to the U-bracket.

6. Replace the covers of the electronics box.

Valve Control Board

In order to access the valve control board, you must remove the U-bracket from the electronics box.

Removing the valve control board

1. Remove the top and rear covers of the electronics box.

2. If your analyzer has the computer option, remove the computer assembly as described in the appendix of this manual.

3. There are three (optionally four) connectors on the valve control board that must be removed. If your analyzer uses the 8-valve system, there is one valve control connector (J4) on the top of the board and two connectors (I/O Option and power) on the side of the board closest to the front of the unit. If you have a 16-valve unit, there will be two valve control connectors (J4 and J3) on the top. See Figure 6-2.

4. Once the connectors have been removed, you will be able to tilt the entire U-bracket and lay it on its right side so that the valve control board is facing up and you can access the screws to remove it.

5. Remove the valve control board by loosening the four screws holding the board to the standoffs.

Replacing the valve control board

To replace the valve control board, follow these instructions.

1. Attach the board to the four standoffs on the U-bracket using the screws you removed.

2. Attach either one (8-valve unit) at position J4 or two (16-valve unit) valve control connectors (positions J4 and J3) to the top of the board.

3. Attach the I/O Option and power connectors to the side of the valve control board.

4. Tilt the U-bracket back to its original position so that it is seated on the floor of the electronics box.

5. Reattach the U-bracket to the floor of the box using the four screws.

6. Replace the covers of the electronics box.

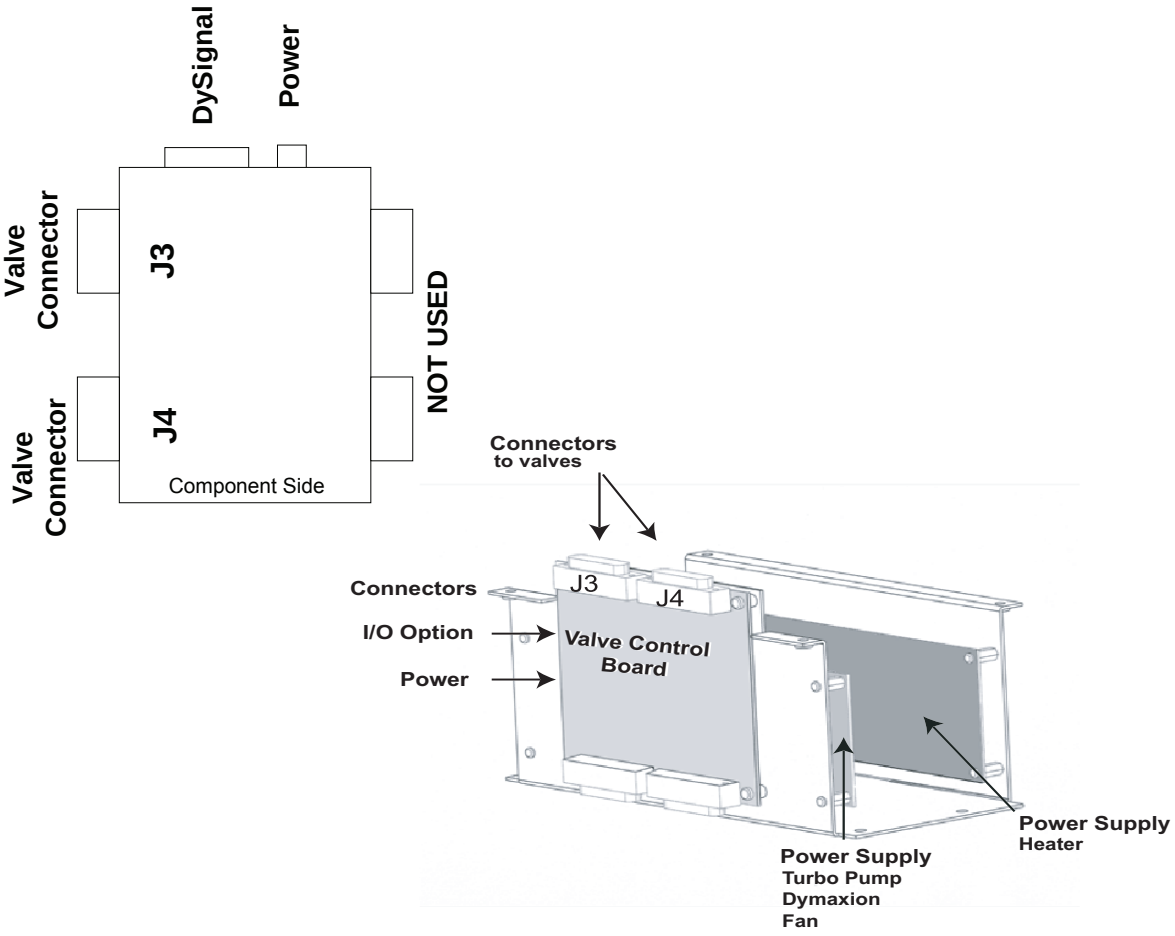

Figure 6-2.
Valve Control board.

Power Switch

The power switch is located on the rear side on the outside of the electronics box. The only replaceable parts on the switch are the fuses.

If you need to replace the power switch,, you must call the factory for assistance. Do not attempt to replace the switch or any items in the AC power box yourself.

Replacing the power switch fuses

Make sure that you have removed power to the analyzer by switching off the power.

1. There is a small tab at the top of the outside of the power switch. Using your fingernail or a small screwdriver, pull down the tab to open the door exposing the fuse holders.

2. There are two fuses that power the switch which are located in fuse holders that slide out from the switch box. There are directional arrows at the bottom of the switch door and on each of the fuse holders to indicate correct orientation upon replacement.

3. Slide out the fuse holders and remove the fuses. Replace the burned-out fuses with new fuses. If you have a 120V system, use an 8 Amp fuse; if you have a 230V system, use a 3.15 Amp fuse. Units with the sub-atmospheric pump option will have an 10 Amp slow blow fuse (110V) or a 5 Amp slow blow fuse(230V). Check the fuse you are replacing to determine the correct one to use.

If your system includes the Extended Pressure Range option, replace the standard fuses with an 10 Amp slow blow fuse for 120V system (AMETEK 25779JE) or a 5 Amp slow blow fuse for 230V system (AMETEK 25702JE).

4. Replace the fuse holders in the switch box making sure to align them in the correct orientation as described by the arrows on the sliders and on the bottom of the switch box door. Close the switch box door and make sure it snaps shut.

Inlet Heater Controller

The heater inlet controller is located on the front of the electronics box.

Removing the inlet heater controller

1. Remove the top and the back covers of the electronics box.

2. Remove the back terminal block from the inlet heater controller by holding the terminal block on either side, placing your fingers on the ridges and squeezing the sides of the terminal block to release it from the controller.

3. The controller has hard plastic “fingers” both above and below where it enters the electronics box that hold the controller in place. It is easier to remove the controller if you release the plastic fingers on the underside of the controller first.

   Using a stiff piece of card stock or some other thin, firm material, slide it between the fingers of the holder and the controller on the underside of the controller. This releases the grip of the fingers on the underside.

   Using your fingers (or another piece of card stock), lift up the fingers on the top side of the controller to release their grip on the controller. Gently pull the controller out through the front of the electronics box.

Replacing the inlet heater controller

1. Slide the new controller through the front of the electronics box to the rear. It will pass through the grip fingers to hold it in place on the top and bottom.

2. Replace the terminal block on the end of the controller by snapping it into place.

3. Replace the covers of the electronic box.

Turbo Pump Controller Interface

If the turbo pump controller interface needs to be replaced, follow these instructions.

Removing the pump controller interface

1. Remove the top cover of the electronics box.
2. Remove the four black screws holding the pump controller interface on the front of the electronics box.
3. Gently push the controller interface from the rear through the front of the box to remove it.
4. Remove the flat wire, phone-like connector from the controller interface.

Replacing the pump controller interface

1. Attach the flat wire connector to the controller interface.
2. Position the new controller interface in the slot and secure to the front of the electronics box using the four black screws.
3. Replace the top cover of the electronics box.

Spare Parts

Board, valve control	80545SE
Capillary, 30µ ID, 360µ OD	09073JE
Controller, temperature, inlet heater	25654JE
Display unit, turbo pump (controller interface)	12087JE
Electronics,all models *Specify AMU range and whether the unit is Faraday or Multiplier*	90519VE
Fan, electronics cooling	75013SE
Fan, turbo pump	25584JE
Ferrule, 0.4mm ID, 1/16 fitting	33477JE
Filament, iridium	95499VE
Filament, tungsten	74654SE
Fuse, 120V, 6.3Amp slow blow	25692JE
Fuse, 120V, 8 Amp	25699JE
Fuse, 230V, 3.15 Amp slow blow	25693JE
Fuse, 120V Extended Range ProLine, 10 Amp slow blow	25779JE
Fuse, 230V Extended Range ProLine	Consult Factory
Gasket, 2 3/4” copper	GAS0001
Gasket, 4 1/2”, copper	GAS0002
Heater, finned strip, 24V, 100W	25656JE
Heater jacket	75018SE
Inlet assembly, 8-valve	74936SE
Inlet manifold	74931SE
Ion volume	74844KE
Power supply, 24 VDC out, 150W	25648JE

Pump, dry diaphragm, voltage slectable	38032JE
Pump, rotary vane, 110V	38033JE
Pump, rotary vane, 230V	38035JE
Pump, turbo,	38031JE
Relay, solid state	25650JE
Sensor, 100 AMU	75028SE
Shield, turbo pump protection	42343JE
Valve, solenoid, 3-way, manifold mount, 24 VDC	36075JE
Valve, vent, turbo pump	36066JE

WIRING DIAGRAMS

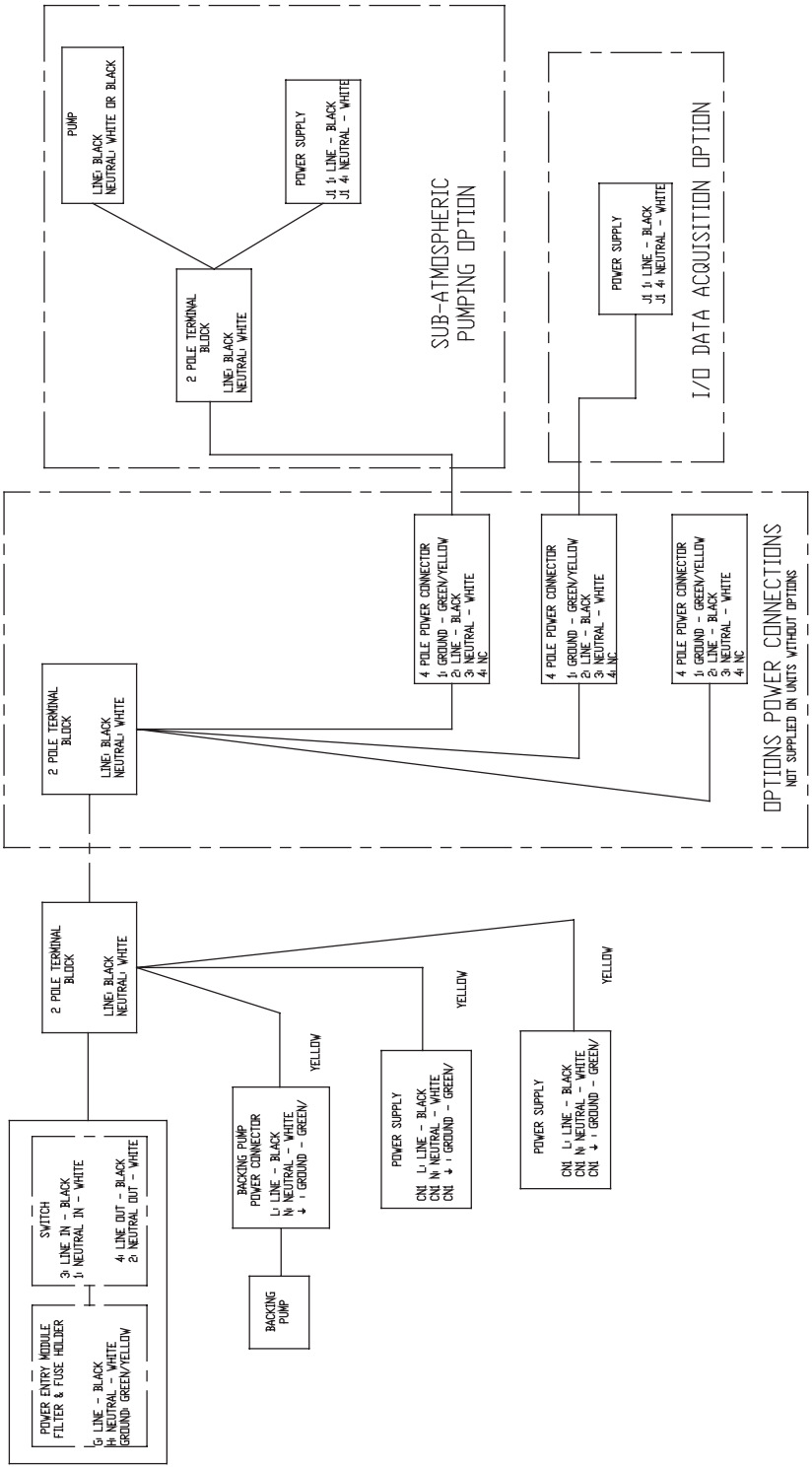

Figure 7-1. ProLine AC wiring diagram.

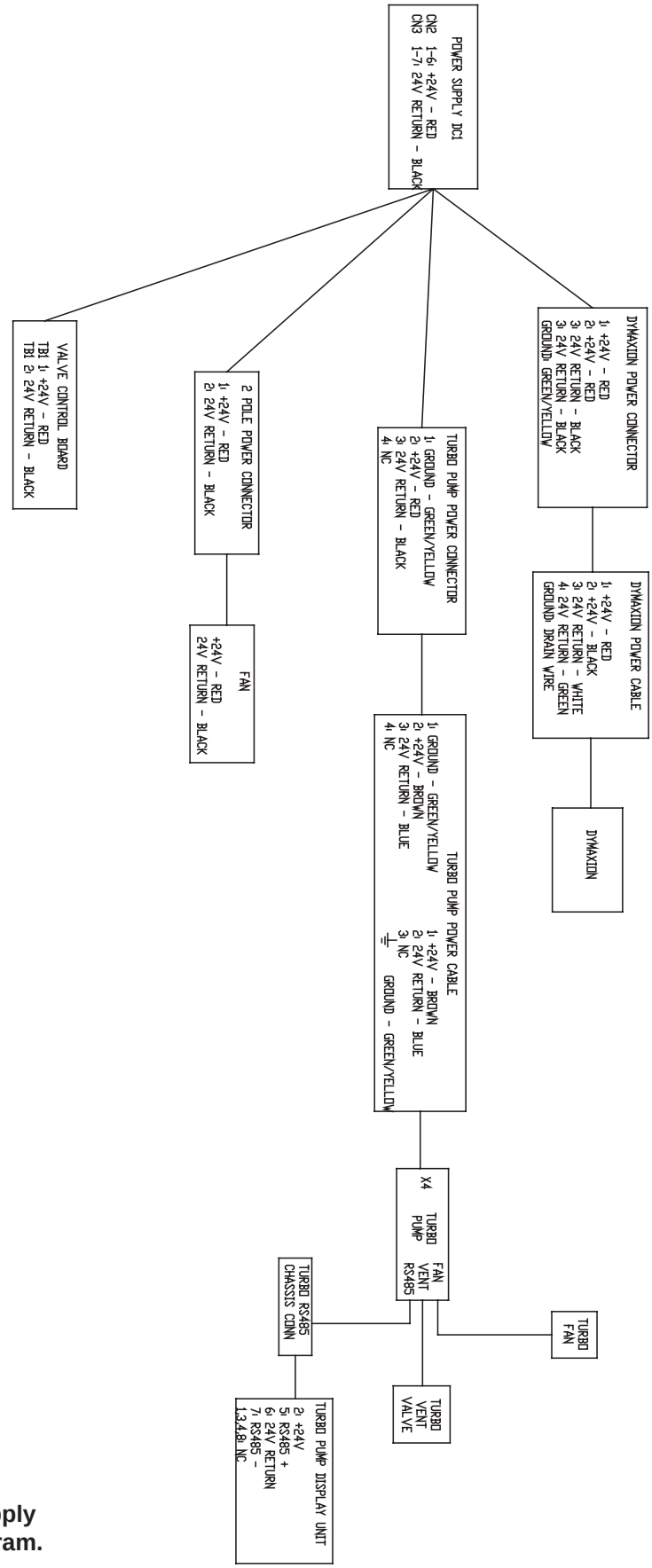

Figure 7-2a.
ProLine power supply #1, DC wiring diagram.

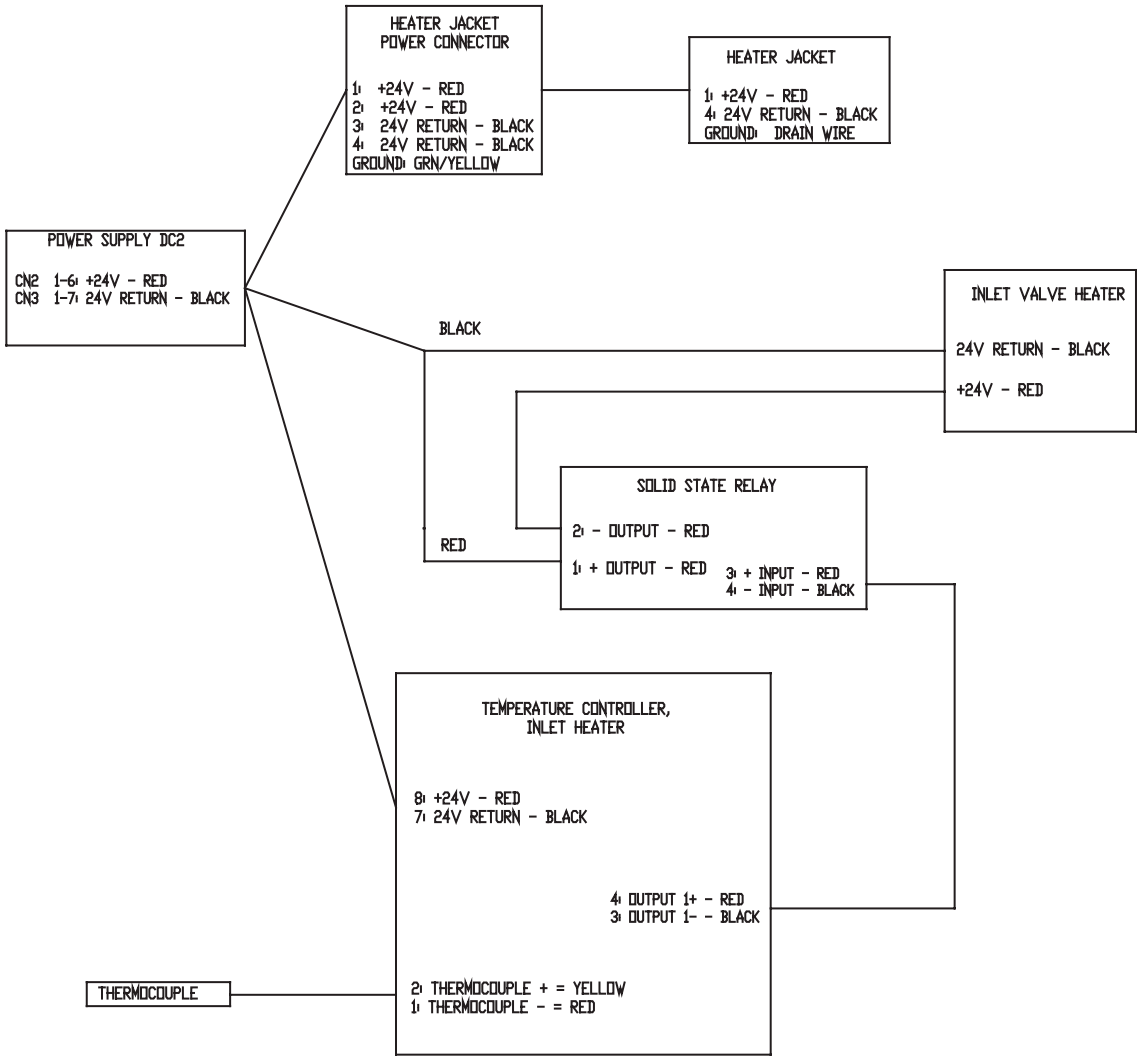

Figure 7-2a.
ProLine power supply
#2, DC wiring diagram.

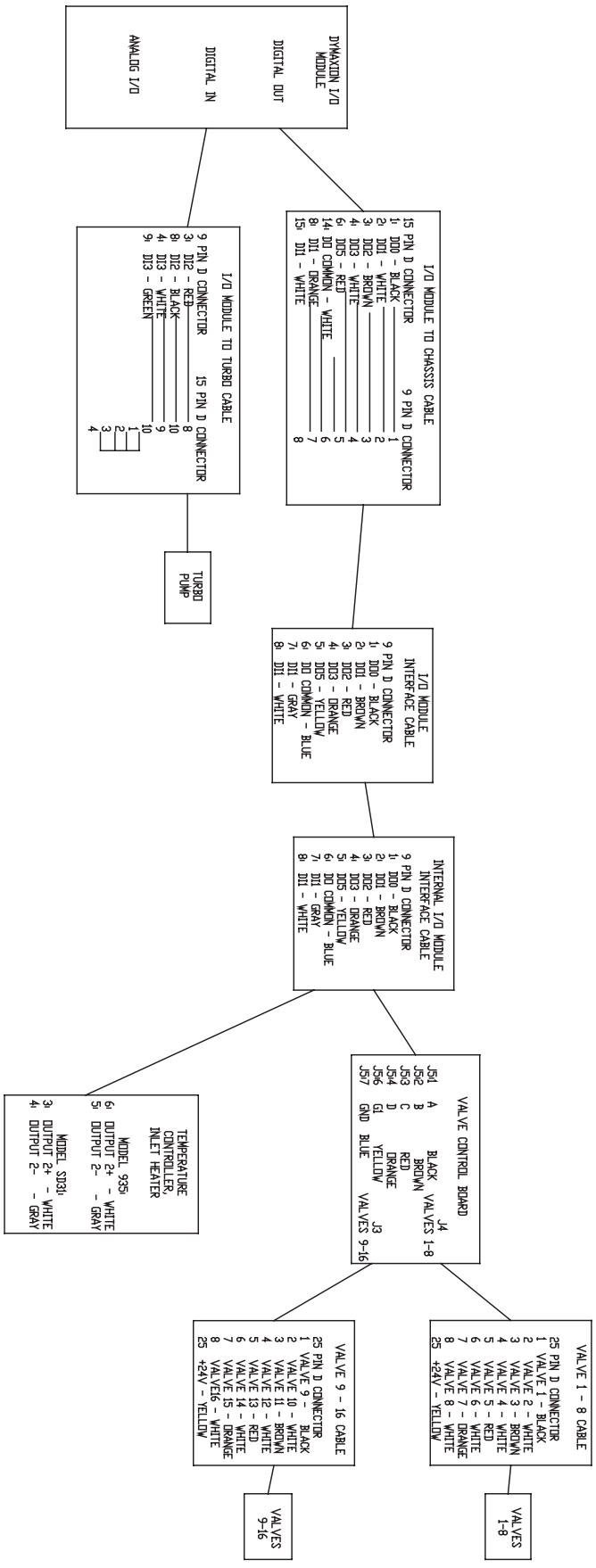

Figure 7-3.
ProLine signal wiring diagram.

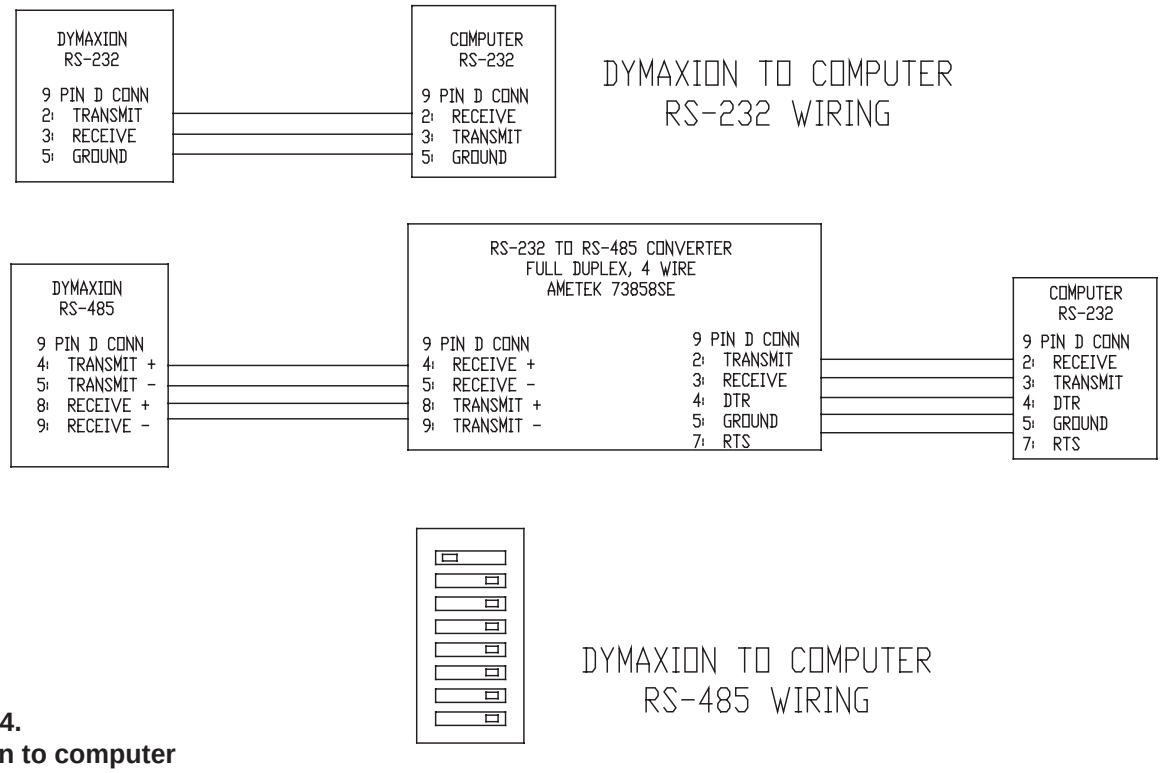

Figure 7-4.
Dymaxion to computer wiring, RS-232 and RS-485.

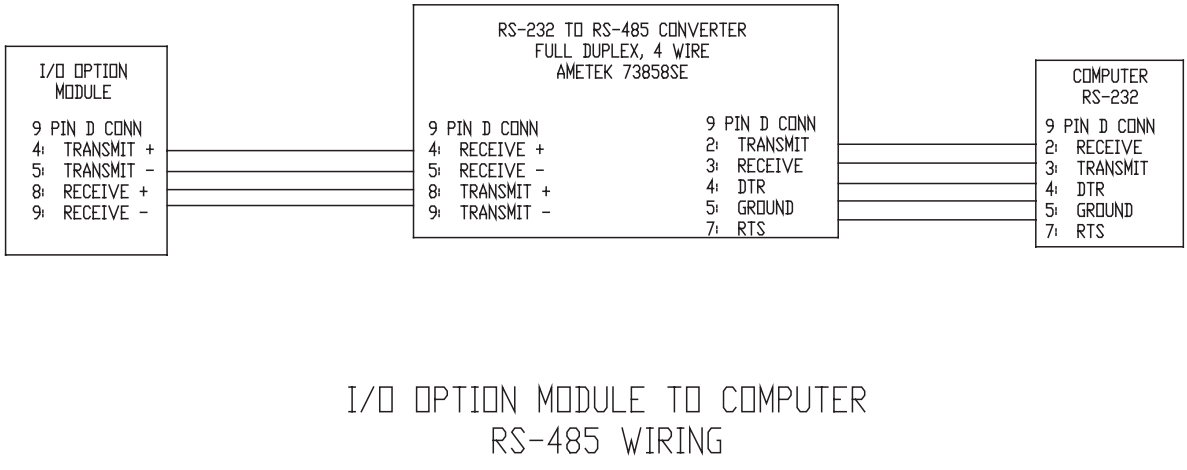

Figure 7-5.
Opto 22, I/O option module to computer RS-485 wiring.

I/O 1 (DB9 MALE)		SNAP ODC5SRC
1	←	1 Positive Common
2	←	2 Channel 0
4	←	4 Channel 1
6	←	6 Channel 2
8	←	8 Channel 3

Figure 7-6.
I/O 1, DB9 connector pinout for SNAP-ODC5SRC digital output module, 4 channel, 5-60 Volt DC.

PROLINE ON-BOARD COMPUTER

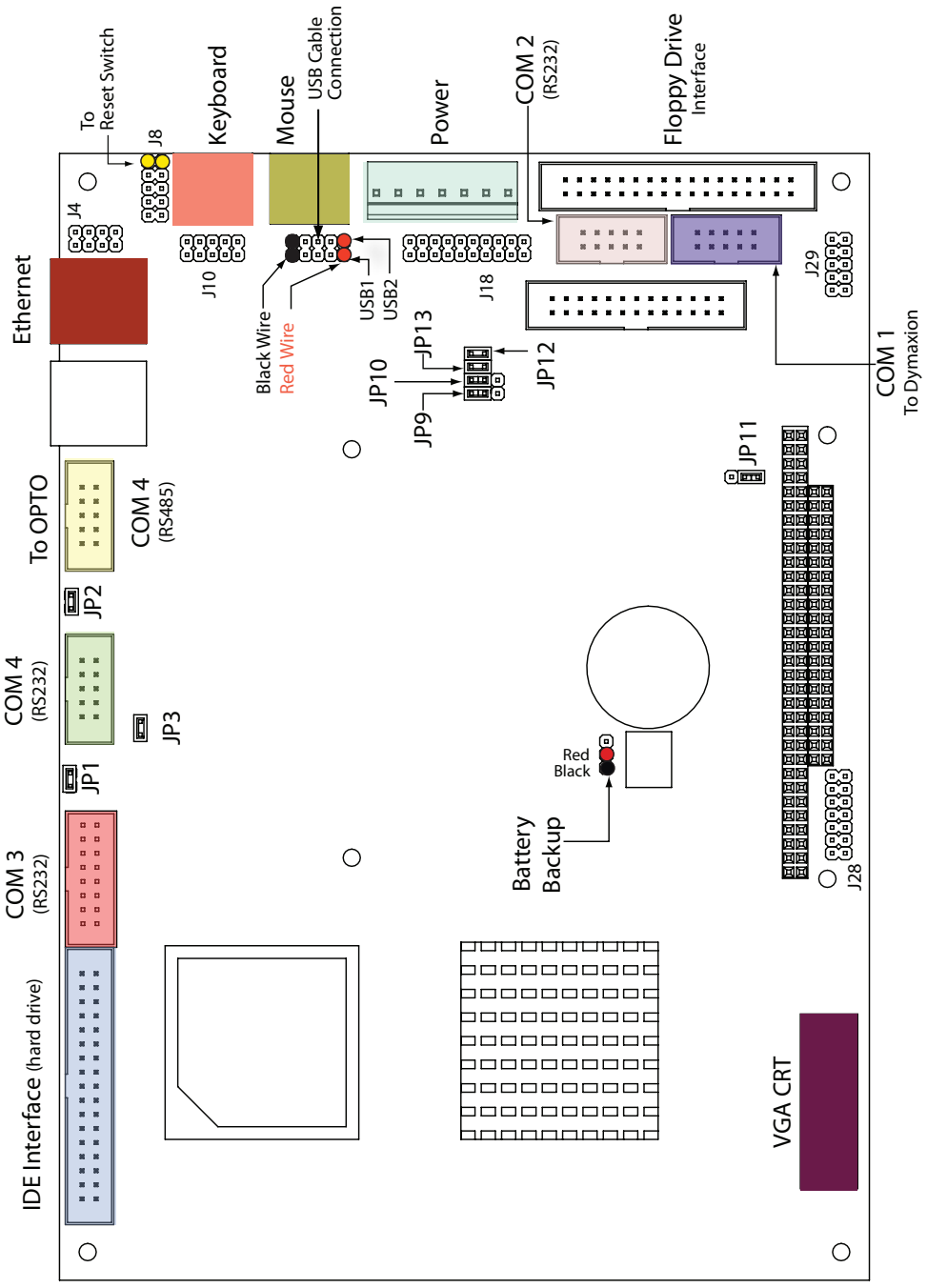

Figure 7-7. On-board PC connections.

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OPTO 22 SNAP DATA ACQUISITION SYSTEM

These instructions describe the steps necessary to set-up the SNAP I/O Data Acquisition System to work with your analyzer. Complete information on how to use the modules is provided in the Opto 22 SNAP user manual that you received with the product.

These instructions are divided into the following sections:

- Analyzer and SNAP I/O System connections
- Required settings for SNAP modules
- Setting module parameters using System 2000 software

Opto I/O Rack 8-Position Module Configuration

Device Address: 128		
Position 0	Alarm 1	DO0
	Alarm 2	DO1
	Alarm 3	DO2
	Alarm 4	DO3
Device Address: 128		
Position 1	Flow Switch (Optional)	DI0
	SPARE	DI1
	SPARE	DI2
	SPARE	DI3
Position 2 through 6		Available
Device Address: 130 (Factory Configured)		
Position 7	Inlet Pressure	AI14
	Inlet Proportional Valve	AI15

I/O 1 DB-9 Connector Pinouts

for SNAP-ODC5SRC Digital Output Module, 4 ch, 5-60 VDC

I/O 1 (DB9) SNAP ODC5SRC

1 ——— 1 Positive Common
2 ——— 2 Channel 0
4 ——— 4 Channel 1
6 ——— 6 Channel 2
8 ——— 8 Channel 3

NOTE

See included module specification sheets for more information.

Baud Rate

Baud Rate is 38.4

Jumper Position

3 2 1 0

SNAP-IDC5-SW and SNAP-IDC5-SW-NC Modules

Description

The SNAP-IDC5-SW and SNAP-IDC5-SW-NC modules provide four channels of contact status input. Each module supplies 15 volts of power to an external dry contact switch. The SNAP-IDC5-SW senses switch closure; the SNAP-IDC5-SW-NC senses switch opening. Each user-supplied switch is connected with two wires. Because these modules include power for the switch, they are particularly cost-effective when labor costs for wiring external power are high.

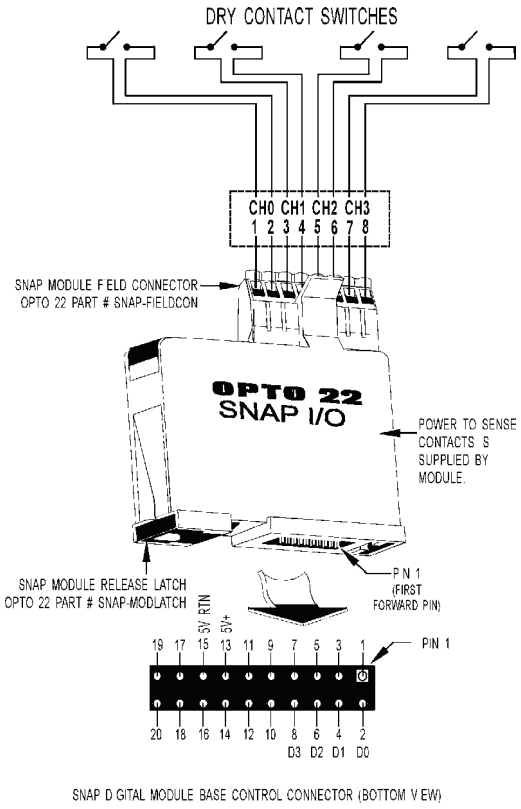
Typical switches for use with these modules are switched status sensors (level sensors, pressure indicators, etc.), magnetic reed switches (used on doors or windows for burglar alarms), snap-action micro switches, the auxilliary switches on motor starters, and most relay contacts.

CAUTION: The SNAP-IDC5-SW and SNAP-IDC5-SW-NC inputs are not intended to be used with contacts that are connected to any external user-supplied voltage or currents.

Specifications

Field Side Ratings (each channel)	
Open Circuit Voltage (Switch Open)	15 VDC typical
Short Circuit Current (Switch Closed)	7 milliamps nominal
Minimum Off Resistance	≥20 K ohms
Maximum Allowable On Resistance (Wire + Contact Resistance)	500 ohms
Logic Side Ratings	
Logic Output Voltage for SNAP-IDC5-SW (normally open)	<0.5 V max. (switch closed; LED on) @ 2 mA sinking 2.7 V min. (switch open; LED off) @ 0.4 mA sourcing
Logic Output Voltage for SNAP-IDC5-SW-NC (normally closed)	<0.5 V max. (switch open; LED on) @ 2 mA sinking 2.7 V min. (switch closed; LED off) @ 0.4 mA sourcing
Maximum Operating Common Mode Voltage (Field Term to Logic Connector)	250 V
Power Requirements	5 VDC (±0.25) @ 200 mA
Module Ratings	
Number of Channels Per Module	4
Turn-on Time	5 msec
Turn-off Time	25 msec
Channel-to-channel Isolation	None
Input-to-output Isolation	1500 V AC/DC
Temperature	0°C to 70°C, operating -30°C to 85°C, storage

SNAP-IDC5-SW and SNAP-IDC5-SW-NC Wiring Diagram



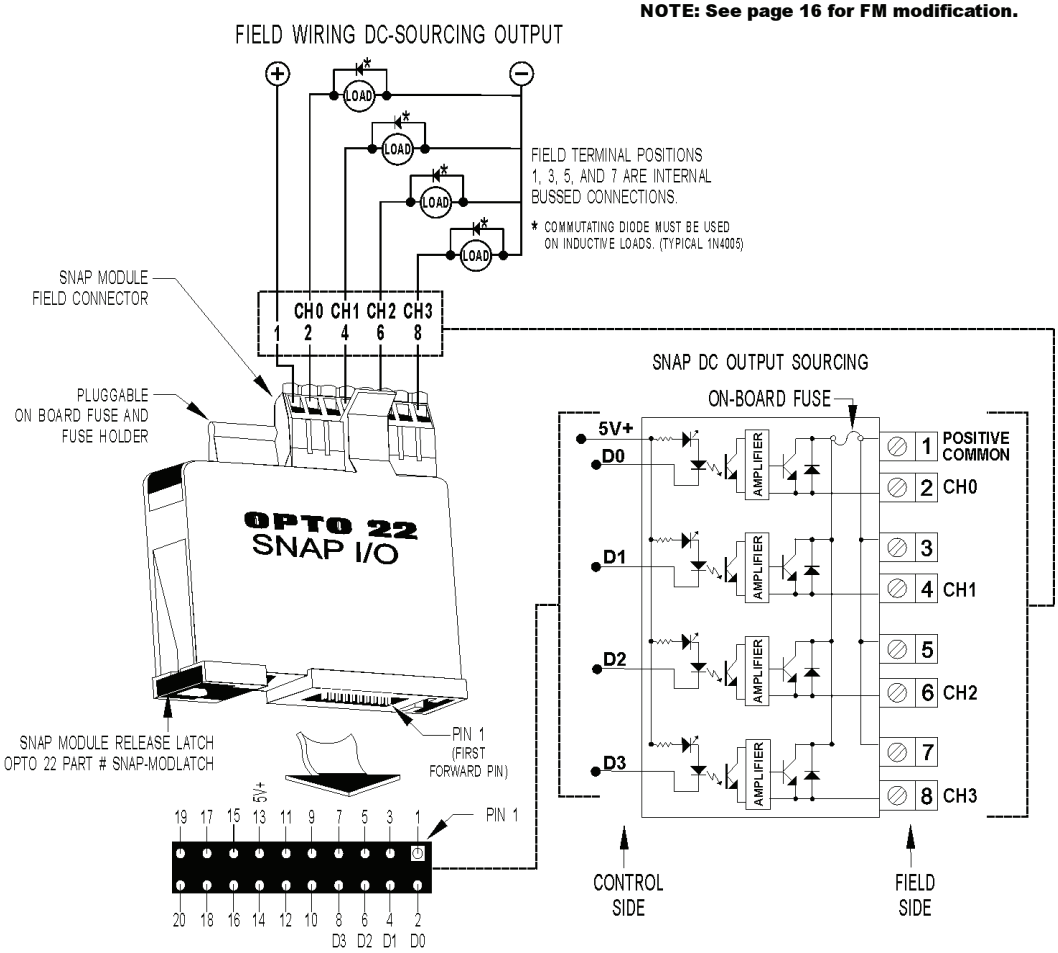
SNAP DIGITAL MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Part Number	Description
SNAP-ODC5SRC	4-channel DC output 5–60 VDC logic source
SNAP-ODC5SRCFM	4-channel DC output 5–60 VDC logic source, Factory Mutual approved

Schematics

SNAP-ODC5SRC
Output Module - Sourcing

NOTE: See page 16 for FM modification.



SNAP DIGITAL MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Installation

The Opto 22 SNAP I/O system interfaces with devices connected to SNAP input and output I/O modules. A device connected to an input module is read by the SNAP I/O Brain. The SNAP Brain processes the information and sends it to the host PC running the System 2000 software. In the reverse direction, the System 2000 PC sends an instruction to the SNAP Brain and the Brain processes the request and sends it to the appropriate output module to turn a device on or off, or to set it to a value.

Communications with a host computer is via an RS-485 serial link that connects to the SNAP I/O Brain.

Disconnect all power from the SNAP I/O system before starting these procedures.

Components of the SNAP I/O System

The components used in the Opto 22 SNAP I/O System consist of:

- SNAP Brain
- SNAP input/output modules
- SNAP rack
- power supply

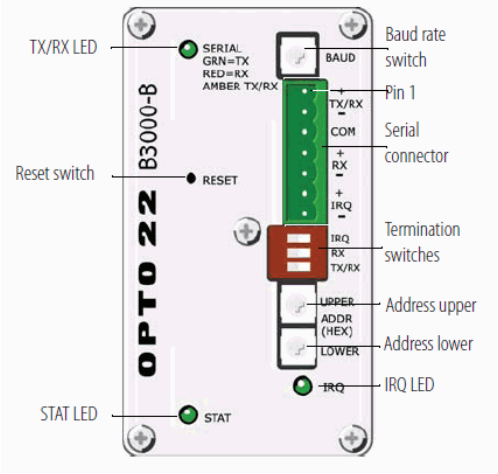
The SNAP Brain is the core of the I/O system. Using the SNAP I/O modules, it monitors and controls all connected I/O points and provides communication functions.

OPTO Brain B3000-B

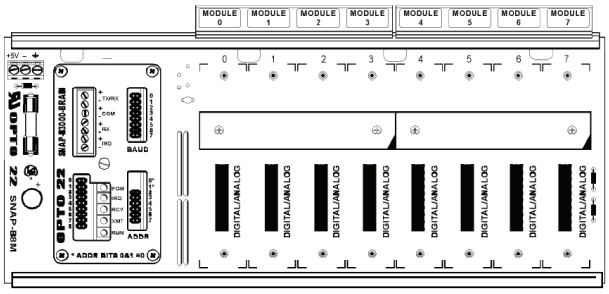
The B3000-B is a mistic serial brain designed as a modern drop-in replacement for the serial B3000 brain, which is obsolete as of October 2009.

The B3000-B has the same functionality as the B3000, except that it does not support the Optomux protocol. Customers replacing the B3000 with the B3000-B are required to update to the Process 2000 software AMETEK part number 88175P Process 2000.

Like the older B3000, the B3000-B is a high-performance processor used to remotely control a mix of SNAP analog and digital I/O modules on a B-series rack. The brain connects to an Opto 22 controller or a host computer over an RS-485 serial link.

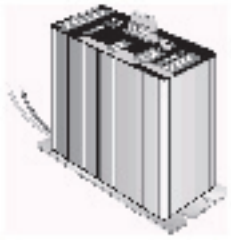


Opto Brain B3000-B



Opto Rack with I/O Modules

Opto I/O Modules



Opto Power Supply

Input / Output Modules

Configuring the B3000-B OPTO Brain

Using the B3000-B

The B3000-B *mistic* serial brain is a drop-in replacement for the obsolete B3000 serial brain. The B3000-B can be used with:

- FactoryFloor controllers running OptoControl strategies
- SNAP PAC S-series controllers, along with other *mistic* I/O units migrated to PAC Project
- A PC equipped with an Opto 22 PCI-AC48 adapter card (which provides an RS-485 port)

NOTE: The B3000-B has the same functionality as the B3000, except that it *does not support the Optomux protocol*. For Optomux, use an E1 or E2 brain. If you are not migrating to the SNAP PAC System but building a new system, use SNAP PAC SB serial brains instead.

For Help

This technical note covers basic configuration only. See form #1781, the *B3000-B User's Guide*, for complete details. If you cannot find the answer you need in the user's guide, please contact Product Support.

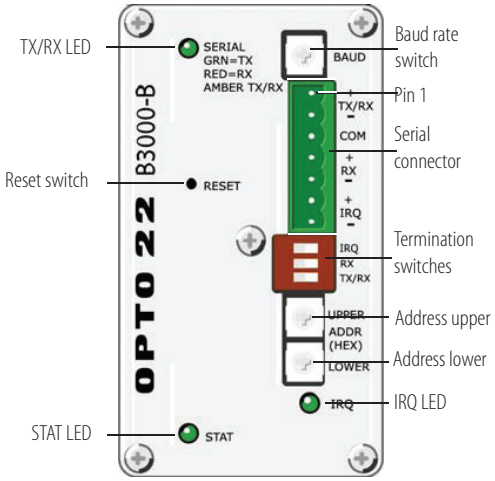
Phone: 800-TEK-OPTO (835-6786)
951-695-3080
Monday through Friday, 7 a.m. to 5 p.m. Pacific Time

Fax: 951-695-3017

E-mail: support@opto22.com

Website: www.opto22.com

B3000-B Top View



Setting Up Serial Networking

1. Attach an RS-485 serial cable to the serial port. If you are using *mistic* interrupts, wire IRQ+ and IRQ– (pins 6 and 7). See the *B3000-B User's Guide* for details on network wiring.
2. Rotate the baud rate switch to set the desired baud rate, as shown in the table below.

   NOTE: Due to timing tolerances, some baud rates may not work with some compatible devices.

Baud Rate Switch

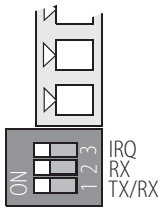
Baud rate	Switch position
(Reserved)	F
230400 bps	E
115200 bps	D
76800 bps	C
57600 bps	B
38400 bps	A
19200 bps	9
9600 bps	8

Baud rate	Switch position
4800 bps	7
2400 bps	6
1200 bps	5
600 bps	4
300 bps	3
(Reserved)	2
(Reserved)	1
(Reserved)	0

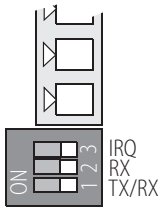
3. Use the three termination switches to set termination as follows:
   - For the B3000-B at the physical end of the cable, set all three of the termination switches to the ON position.
   - For all B3000-B units that are not at the physical end of the cable, set all three of the termination switches to the OFF position.

   NOTE: Since biasing is normally done at the controller or computer, the B3000-B does not include biasing switches.

End of cable



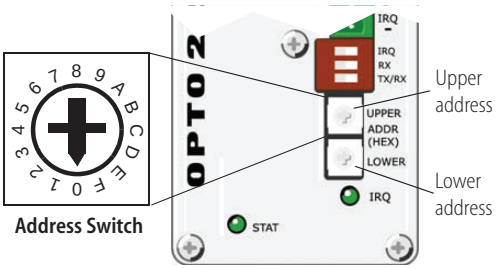
All other positions



4. Use the two rotary address switches to set the unit's address, as shown on the following page.

NOTE

Baud rate switch set to A for 38400 bps baud rate. Termination switches set to "ON" position for 4 wire end of link termination. Upper address set to 8 and lower address set to 3 for a base address of 128.



Each B3000-B contains four addresses: the base address, base +1, base +2, and base +3. The base address is an even multiple of 4.

Normal communications are Binary with CRC16.

Both Binary and ASCII with CRC16 are supported by OptoControl and PAC Control. Switch settings for each address are shown in the tables below.

For Binary or ASCII with Checksum, see tables on the following page.

Binary Mode with CRC16 (supported by Opto Control and PAC Control)

Upper address switch

Lower address switch

Base Address	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
Upper Address	0	0	0	0	1	1	1	1	2	2	2	2	3	3	3	3
Lower Address	0	4	8	C	0	4	8	C	0	4	8	C	0	4	8	C

Base Address	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124
Upper Address	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7
Lower Address	0	4	8	C	0	4	8	C	0	4	8	C	0	4	8	C

Base Address	128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188
Upper Address	8	8	8	8	9	9	9	9	A	A	A	A	B	B	B	B
Lower Address	0	4	8	C	0	4	8	C	0	4	8	C	0	4	8	C

Base Address	192	196	200	204	208	212	216	220	224	228	232	236	240	244	248	252
Upper Address	C	C	C	C	D	D	D	D	E	E	E	E	F	F	F	F
Lower Address	0	4	8	C	0	4	8	C	0	4	8	C	0	4	8	C

ASCII Mode with CRC16 (supported by Opto Control and PAC Control)

Upper address switch

Lower address switch

Base Address	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
Upper Address	0	0	0	0	1	1	1	1	2	2	2	2	3	3	3	3
Lower Address	1	5	9	D	1	5	9	D	1	5	9	D	1	5	9	D

Base Address	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124
Upper Address	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7
Lower Address	1	5	9	D	1	5	9	D	1	5	9	D	1	5	9	D

Base Address	128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188
Upper Address	8	8	8	8	9	9	9	9	A	A	A	A	B	B	B	B
Lower Address	1	5	9	D	1	5	9	D	1	5	9	D	1	5	9	D

Base Address	192	196	200	204	208	212	216	220	224	228	232	236	240	244	248	252
Upper Address	C	C	C	C	D	D	D	D	E	E	E	E	F	F	F	F
Lower Address	1	5	9	D	1	5	9	D	1	5	9	D	1	5	9	D

Binary Mode with Checksum (*not* supported by Opto Control and PAC Control)

Upper address switch

Lower address switch

Base Address	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
Upper Address	0	0	0	0	1	1	1	1	2	2	2	2	3	3	3	3
Lower Address	2	6	A	E	2	6	A	E	2	6	A	E	2	6	A	E

Base Address	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124
Upper Address	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7
Lower Address	2	6	A	E	2	6	A	E	2	6	A	E	2	6	A	E

Base Address	128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188
Upper Address	8	8	8	8	9	9	9	9	A	A	A	A	B	B	B	B
Lower Address	2	6	A	E	2	6	A	E	2	6	A	E	2	6	A	E

Base Address	192	196	200	204	208	212	216	220	224	228	232	236	240	244	248	252
Upper Address	C	C	C	C	D	D	D	D	E	E	E	E	F	F	F	F
Lower Address	2	6	A	E	2	6	A	E	2	6	A	E	2	6	A	E

ASCII Mode with Checksum (*not* supported by Opto Control and PAC Control)

Upper address switch

Lower address switch

Base Address	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
Upper Address	0	0	0	0	1	1	1	1	2	2	2	2	3	3	3	3
Lower Address	3	7	B	F	3	7	B	F	3	7	B	F	3	7	B	F

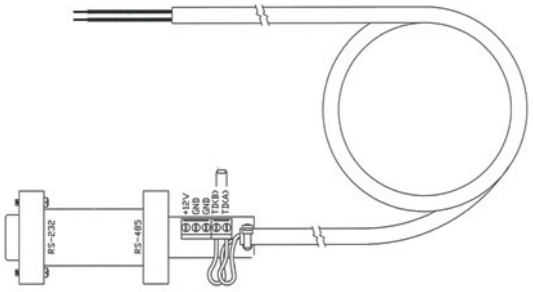
Base Address	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124
Upper Address	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7
Lower Address	3	7	B	F	3	7	B	F	3	7	B	F	3	7	B	F

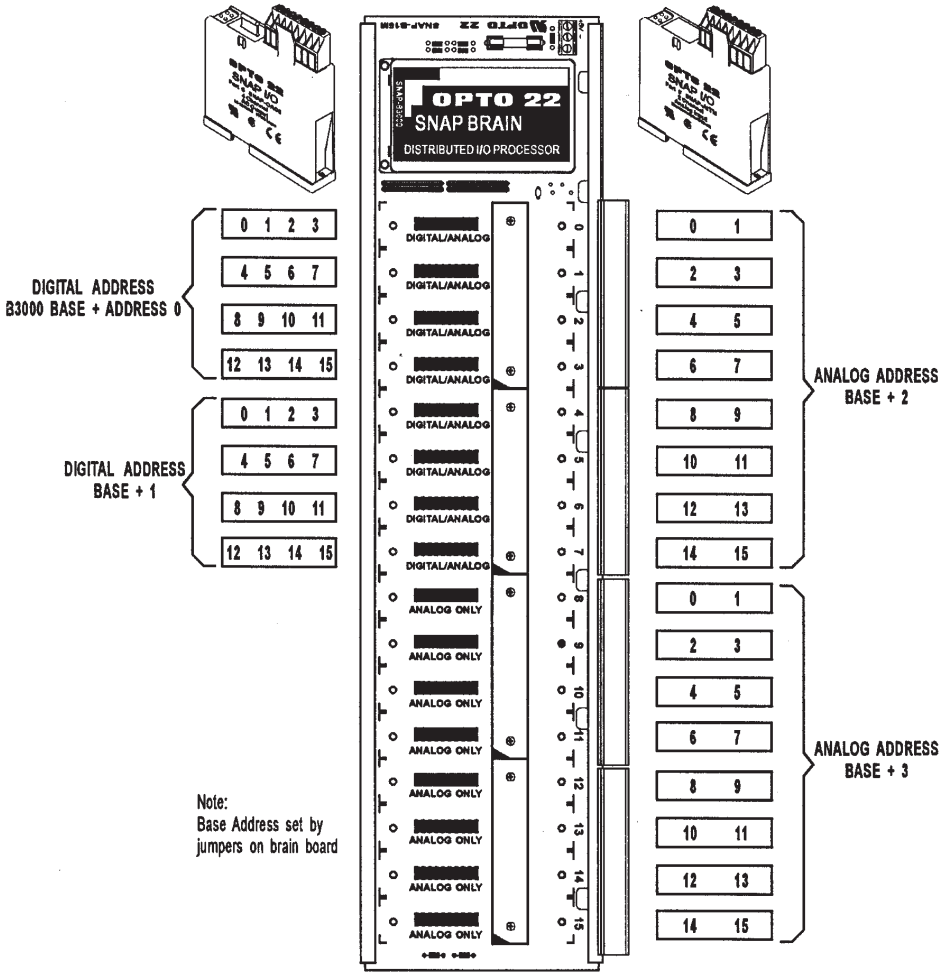
Base Address	128	132	136	140	144	148	152	156	160	164	168	172	176	180	184	188
Upper Address	8	8	8	8	9	9	9	9	A	A	A	A	B	B	B	B
Lower Address	3	7	B	F	3	7	B	F	3	7	B	F	3	7	B	F

Base Address	192	196	200	204	208	212	216	220	224	228	232	236	240	244	248	252
Upper Address	C	C	C	C	D	D	D	D	E	E	E	E	F	F	F	F
Lower Address	3	7	B	F	3	7	B	F	3	7	B	F	3	7	B	F

RS-232 to RS-485 Converter Cable

Figure 1.
RS-232 to RS-485 converter cable.





NOTE

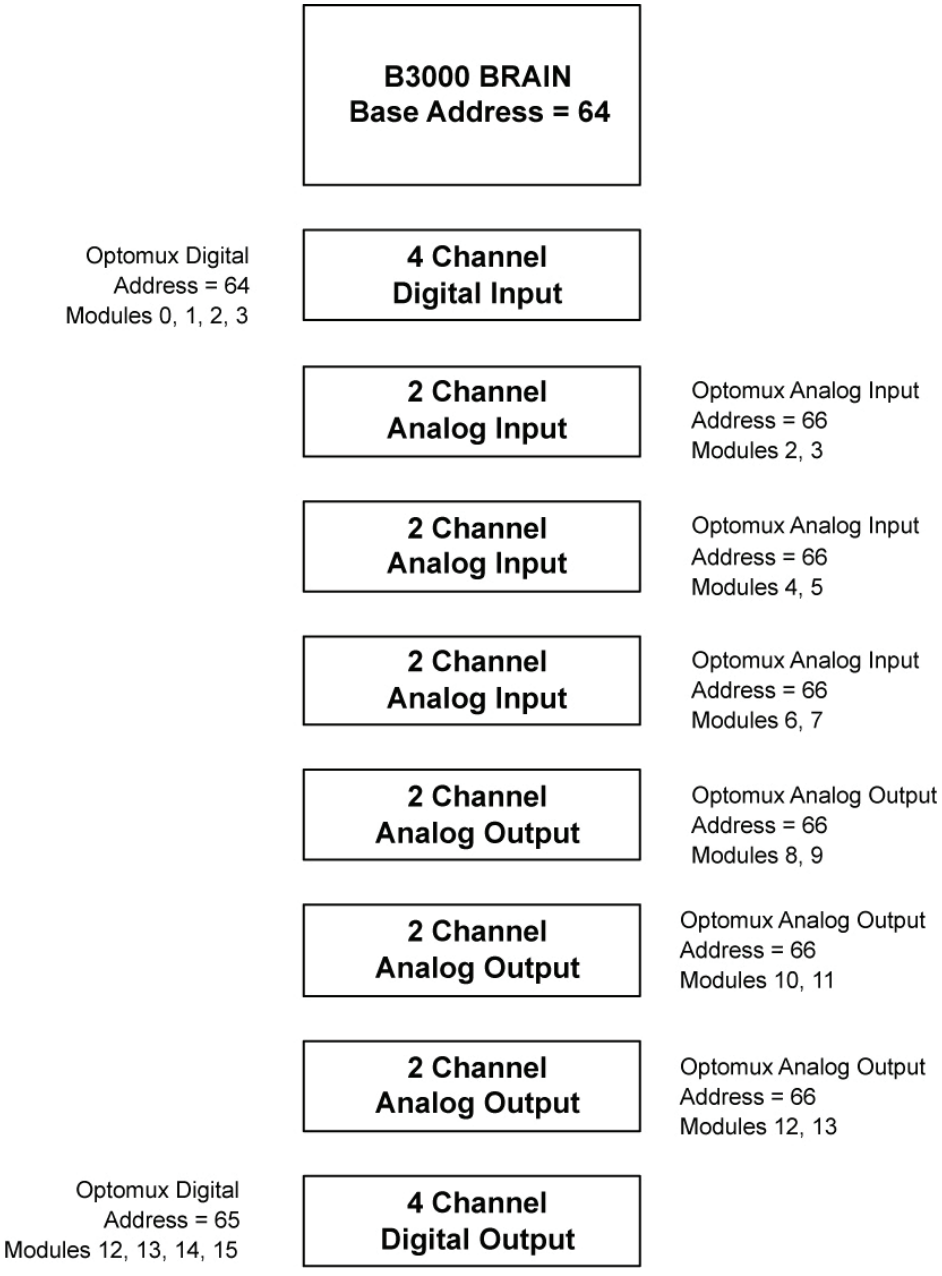
Power can be applied once the I/O system is connected properly.

EXAMPLE:

This example shows a setup with three devices:

- 2 digital (Address 64 and 65)
- 1 analog (Address 66)

Digital Input	Address 64	Modules 0, 1, 2, 3
Digital Output	Address 65	Modules 12, 13, 14, 15
Analog Input	Address 66	Modules 2, 3, 4, 5, 6, 7
Analog Output	Address 66	Modules 8, 9, 10, 11, 12, 13

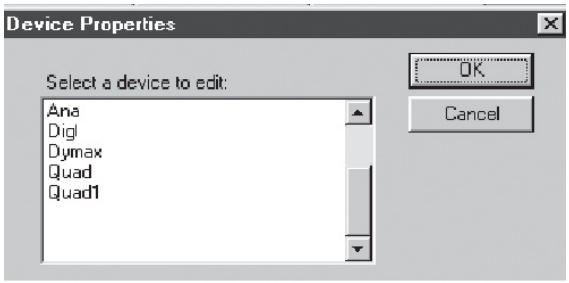


Setting the Device Properties for Digital Input Modules

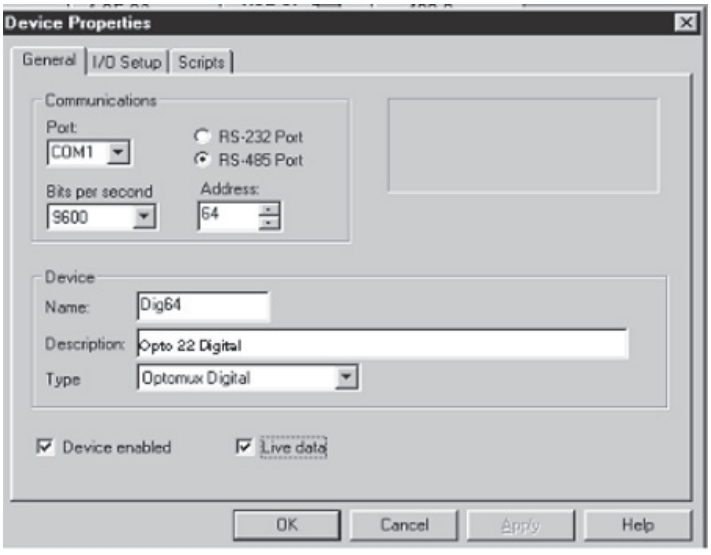
- On 2000 software, click the **Edit** menu and select **Device Properties**. Select your Opto 22 SNAP device from **Select a device to edit**. Click **OK**. The **Device Properties** dialog box appears.

If a digital device is not listed, click **Cancel**. On the main screen click the **Edit** menu and **Add Device**. Click Optomux Digital. Once the Opto 22 SNAP System has been added, you can proceed with setting the parameters.

- Configure the **General** tab as follows:



- **Bits per Second:** 9600
- **Address**: 64
- **Type**: Optomux Digital
- Make sure **Device Enabled** and **Live Data** boxes are checked.

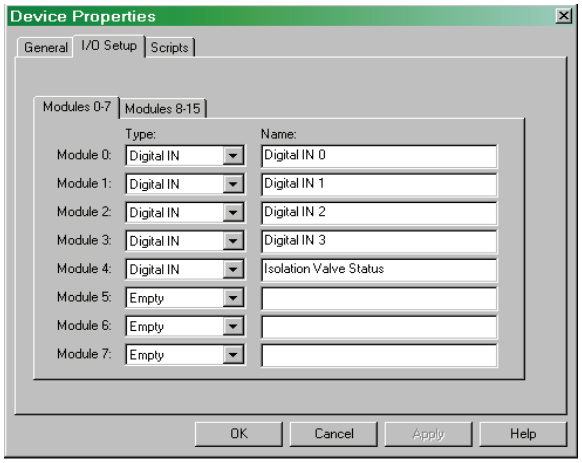


- Click the **I/O Setup** tab for each module position, enter the **Type** and **Name** (see example below).

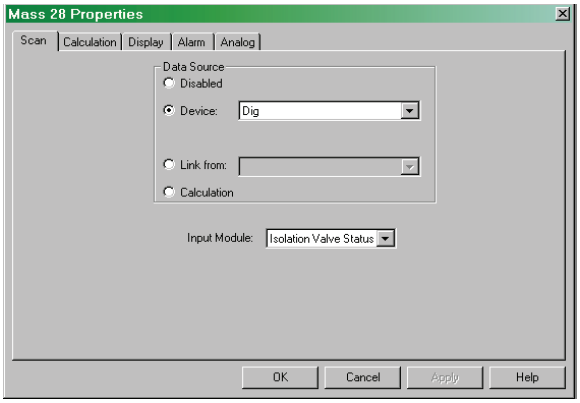
NOTE

Older I/O systems had a single digital input or output per module. The SNAP I/O system combines four inputs or outputs into one module. For the SNAP I/O system, the System 2000 module number refers to a particular digital I/O channel, not the physical module. For example, if a single digital output module is installed in the first SNAP rack position, the System 2000 will refer to it as Modules 0, 1, 2 and 3. See Figure 2 – B3000 I/O Mapping and Example.

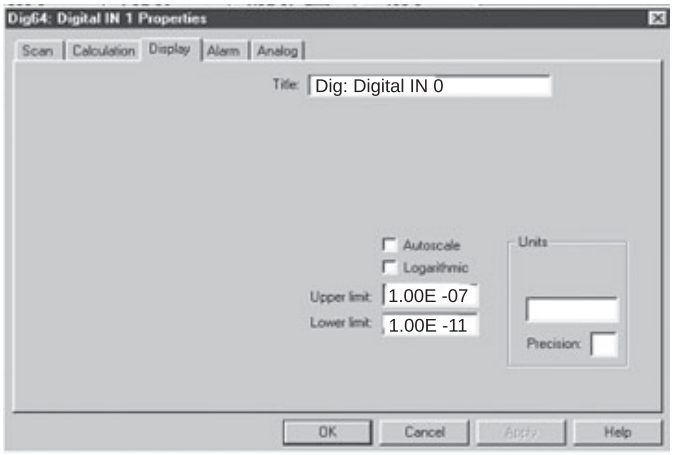
Add Display for Digital Module



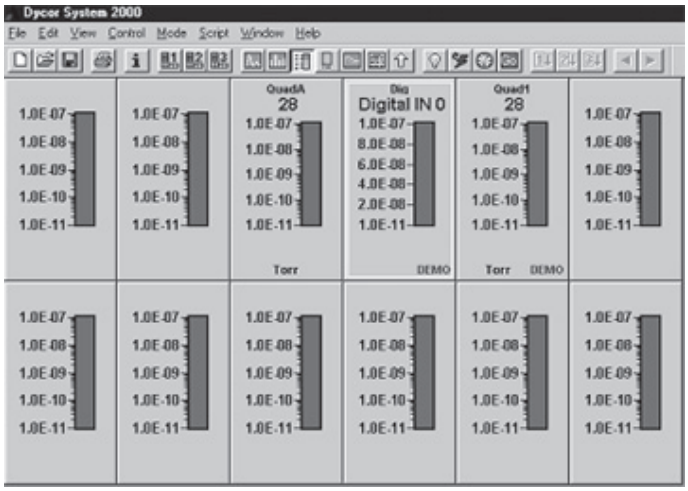
- To create displays so that you can view the data being monitored, go to the mode display where you want your information viewed. Right-click on one of the screens.
- Click **Scan**.
- Click **Device** and select your digital device.



- Click the **Display** tab to configure the parameters for the display.



- Click **OK** for it to become part of the mode display you have chosen.



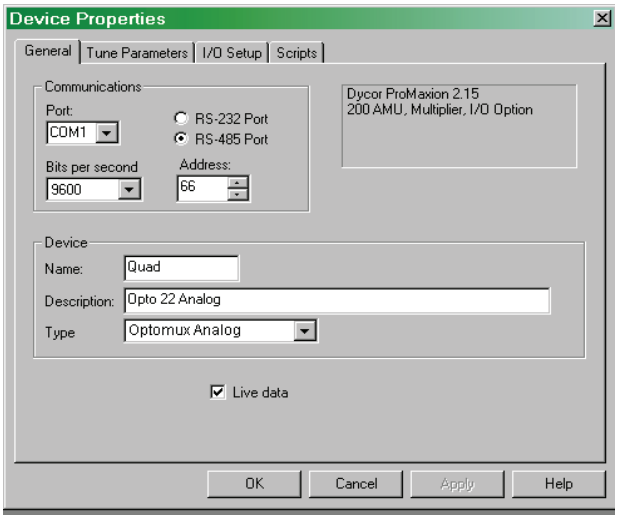
Setting Device Properties for Analog Input Modules

- On the 2000 software click on the **Edit** menu and select **Device Properties**. Select your SNAP I/O System device under **Select a device to edit**. Click **OK**. The **Device Properties** dialog box appears.

If an analog device is not listed, go back to the main screen and click on the **Edit** menu and click **Add Device**. Click Optomux Analog. Once the analog module has been added, you can proceed with setting the parameters.

- Configure the **General** tab as follows:

  - **Bits per Second**: 9600



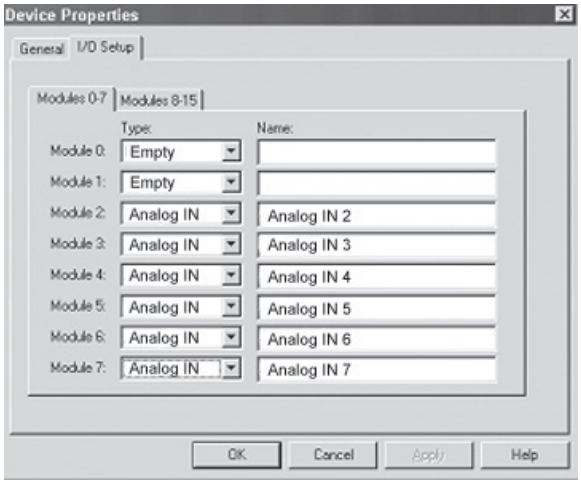
  - **Address**: 66
  - **Type**: Optomux Analog

  - Make sure that the **Live Data** box is checked.

- Click on the **I/O Setup** tab and enter the **Type** and **Name** for the input and output channels (see the example on next page).

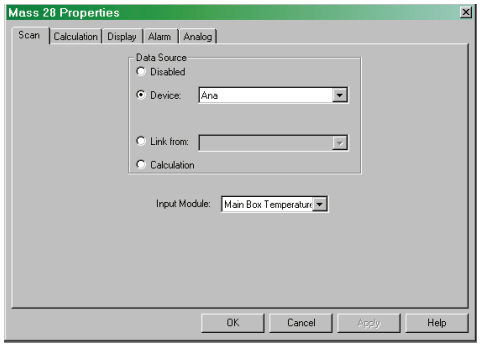
NOTE

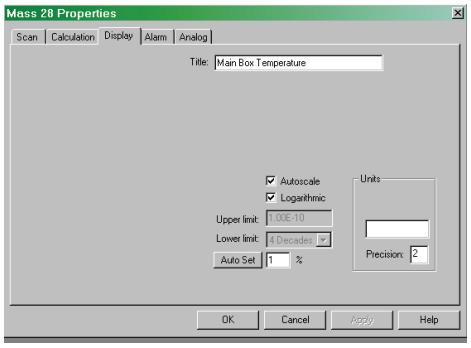
Older I/O systems had a single analog input or output per module. The SNAP I/O system combines two inputs or outputs into one module. For the SNAP I/O system, the System 2000 module number refers to a particular analog I/O channel, not the physical module. For example, if a single analog output module is installed in the first SNAP rack position, the System 2000 will refer to it as Modules 0 and 1. See Figure 2 – B3000 I/O Mapping and Example.

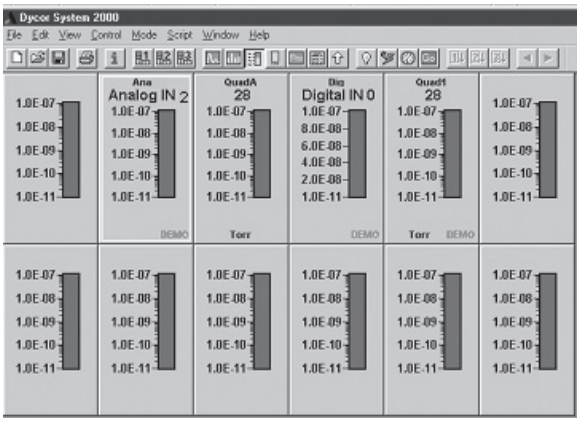


Add Display for Analog Module

- To create displays so that you can view the data being monitored, go to the mode display where you want your information viewed. Right-click on one of the screens.
- Click **Scan**.
- Click **Device** and select your analog input device.
- Click on the **Display** tab to configure the parameters for the display.







Digital and Analog Outputs

1. Refer to Chapter 8 in the 2000 software manual for setting up the Digital Outputs.

2. Refer to Chapter 9 in the 2000 software manual for setting up the Analog Outputs.

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OPTO 22 USER SETUP

The following OPTO 22 I/O user modules are available with your ProLine mass spectrometer system. Specifications for the modules are included in this chapter.

Analog Output	2 channel	4 relays	AOA-23

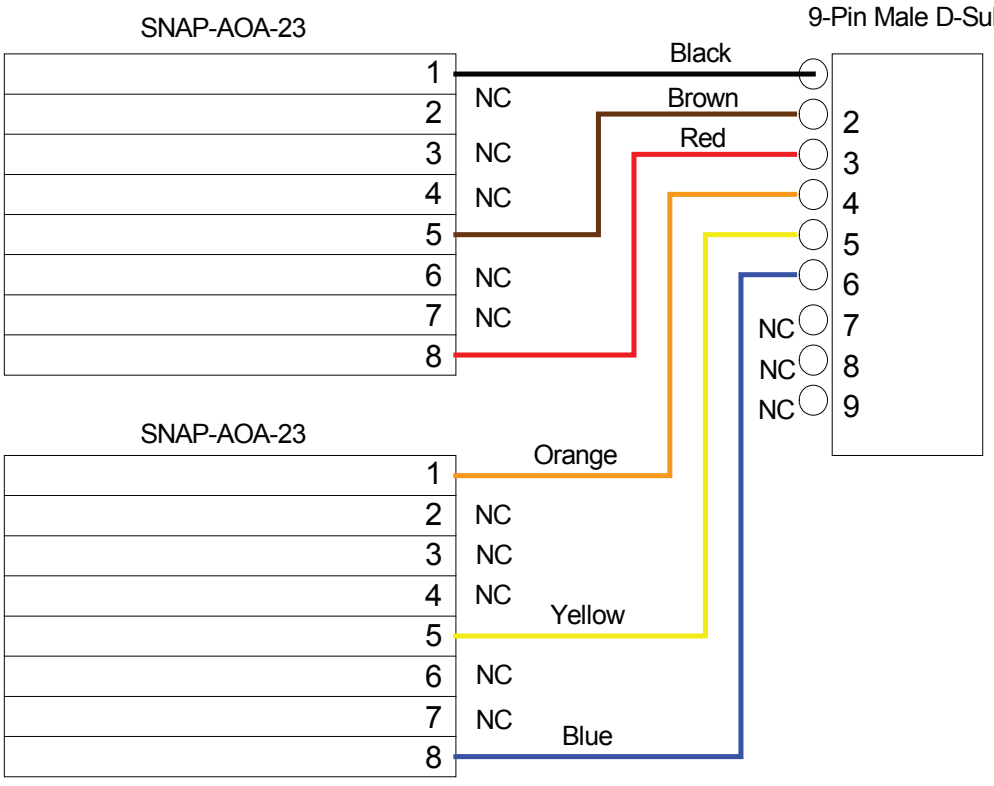
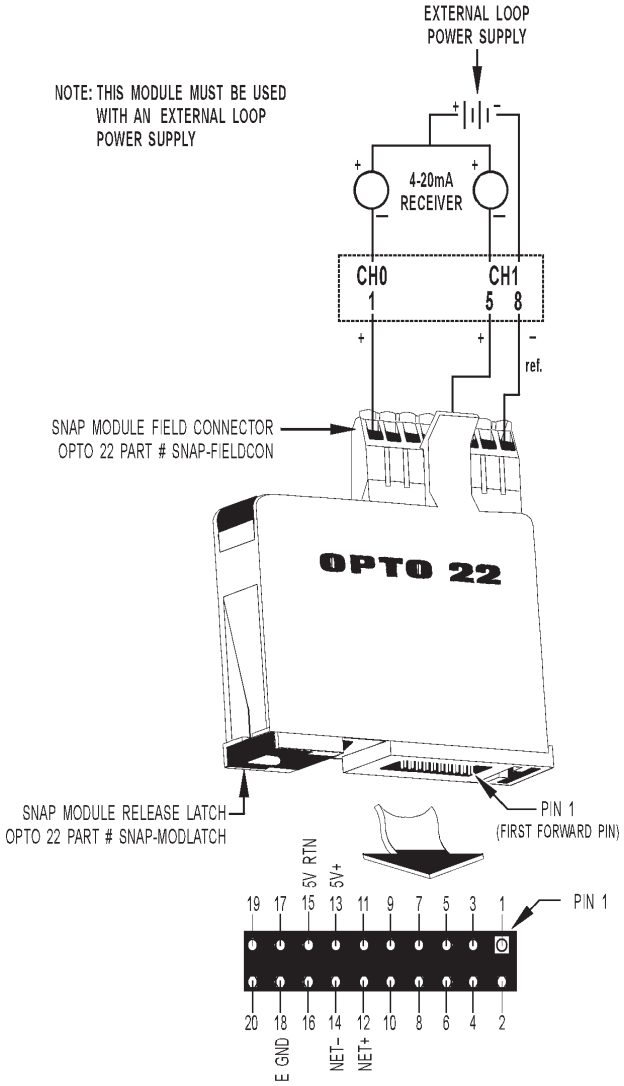


Figure A2-1.
Pin out for AOA-23 modules.

Form 1066-011022

Part Number	Description
SNAP-AOA-23	Dual-channel analog output 4–20 mA current loop

Dual-Channel Current Output 4–20 mA



SNAP ANALOG MODULE BASE CONTROL CONNECTOR (BOTTOM VIEW)

Description

The SNAP-AOA-23 module provides a nominal output range of 4 mA to 20 mA. An external loop power source is required for the current loops.

NOTE: Both channels share a common reference terminal.

Specifications

Input	12-bit serial data (each channel)
Outputs	4 to 20 mA (each channel)
Span	16 mA
Resolution	3.9 µA
Response Time (% of span/delta I/ delta time)	99.9%/15.98 mA/3 mS
DC Common Mode Rejection	>-120 dB
AC Common Mode Rejection	>-120 dB @ 60 Hz
Maximum Operating Common Mode Voltage	250 V
Common Mode Resistance	>1000 M Ω
Accuracy	0.1% of Span
Gain Temperature Coefficient	50 PPM/°C
Offset Temperature Coefficient	20 PPM/°C
Module Power Requirements	5 Volts DC (±0.15) @ 150 mA
Loop Power Requirements	8 Volts DC (min) to 32 Volts DC (max)
Max. Loop Resistance (Ohms) @ Loop Supply	250 450 650 1050 1450 8V 12V 15V 24V 32V
Max. Loop Resistance formula	Loop Resistance = (Loop Voltage - 3) / 0.02
Ambient Temperature:	

EXTENDED PRESSURE RANGE OPTION

Description

The extended pressure range option is used when the application requires sampling of gases with pressures below atmospheric pressure, down to approximately 650 Torr absolute. This optional module draws sample into the inlet system while actively controlling the sample gas pressure at the entrance of the mass spectrometer. The pump, associated hardware, and electronics, are mounted in an enclosure beneath the inlet valve end of the ProLine (Figure A2-1).

The extended pressure range option consists of the following:

- Auxiliary dry rotary vane sample pump
- Pressure controller
- VSO valve
- Flow switch (Optional)
- Pressure control circuit board
- Pressure transducer
- Manual regulating valve
- Power supply

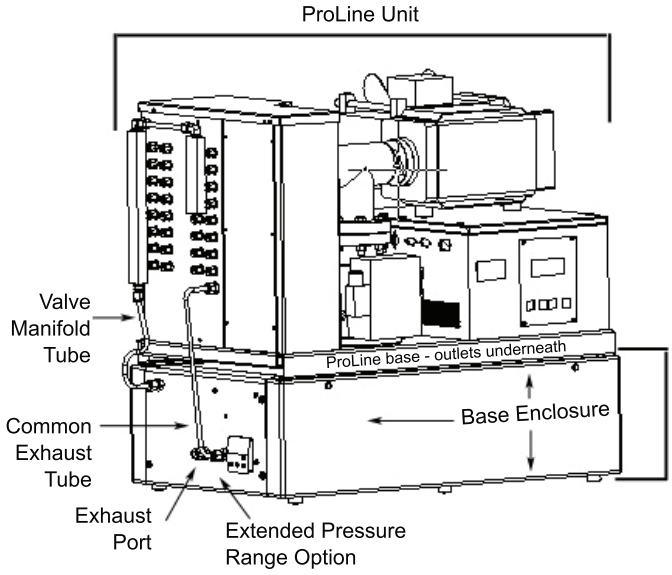


Figure A 2-1
ProLine with extended pressure range option.

Sample Flow

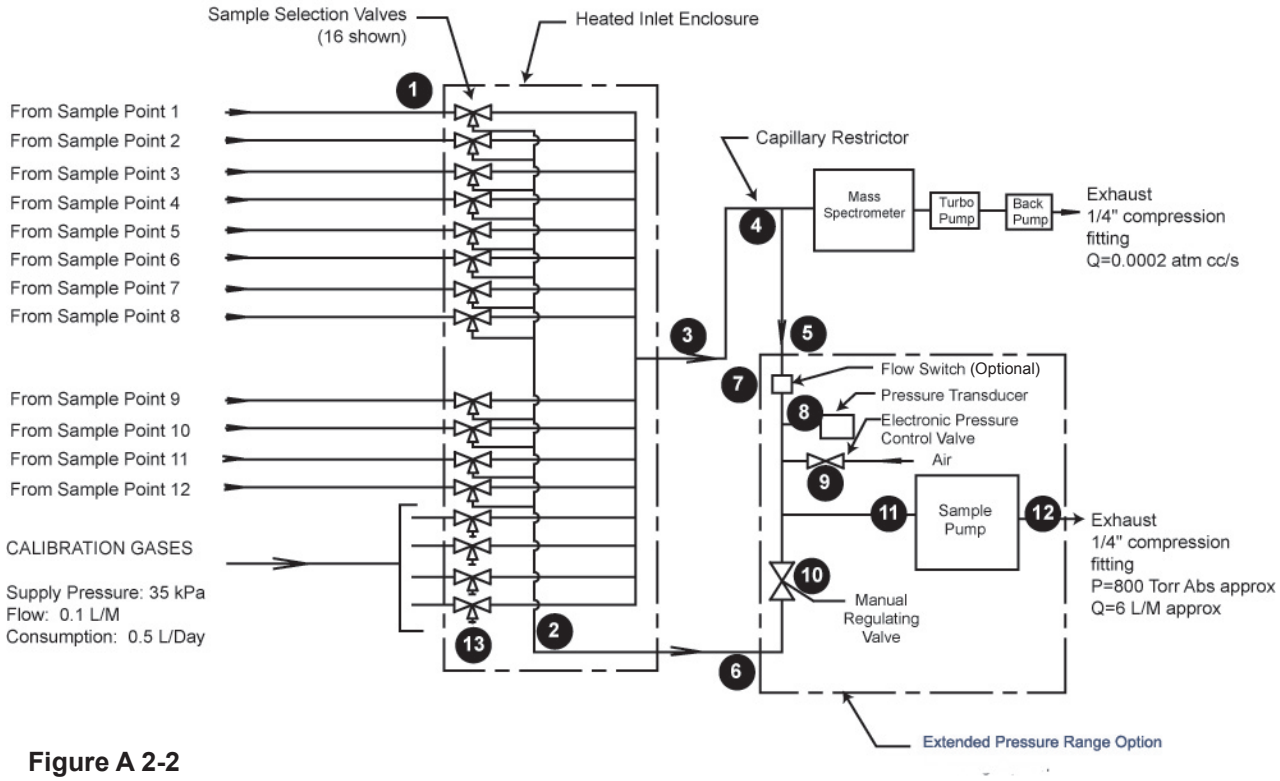


Figure A 2-2 Extended pressure range option sample flow.

The extended pressure range option allows sampling of gases at, or slightly below, atmospheric pressure and creates a stable sampling pressure for the mass spectrometer inlet. Refer to Figure A2-2 to follow the sample flow. The numbers in the circles on the diagram refer to the number sequence in the steps below.

1 Sample Entry

The sample gas enters the sample selection valves. These valves are 3-way manifold-mount, electric solenoid valves. They are housed in the heated inlet enclosure. The user's sample gas connections are 1/8" compression fittings.

2 Common Exhaust

When valves are not selected (not energized), the sample path is connected to a common exhaust that allows the sample gas to flow through all the sample lines continuously. This ensures that fresh sample is available to the mass spectrometer.

3 Sample Loop

When a valve is selected, sample gas flow is diverted from the exhaust (2) to plumbing leading to the vacuum chamber inlet flange.

4 **Capillary Restrictor**
The sample gas then flows past the end of a capillary restrictor. A small amount of the gas passes through the restrictor and into the mass spectrometer head. The remainder of the gas flows on to the extended pressure range option.

5 **From Common Exhaust Port**
This is the port through which the gas that does not pass through the capillary restrictor but exits the ProLine through the common exhaust enters the extended pressure range module.

6 **From Exhaust Manifold Port**
This is the port where all the gases exhausting from streams that are not being sampled leave the exhaust manifold and enter the extended pressure range module.

7 **Flow Switch (Optional)**
The sample gas flows through the flow switch which is monitored by the Process software (Chapter 19 Process Software Manual). The software monitors whether or not the flow is adequate. A “no flow” reading usually indicates that the selected sample line is clogged.

8 **Pressure Transducer**
The pressure transducer measures the pressure in the sample line and sends a signal to the pressure control circuitry and to the software.

9 **Electronic Pressure Control Valve**
The electronic pressure control valve, controlled by the pressure control circuitry, admits air into the sample plumbing. The air flow is automatically adjusted to maintain a constant sample line pressure.

10 **Manual Regulating Valve**
All the gas exhausting from streams that are not being sampled passes through the regulating valve. This valve is set at the factory and generally needs no adjustment.

11 **Sample Pump Inlet**
Gas from both selected and unselected gas streams enters the sample pump at the inlet.

12 **Sample Pump Exhaust**
Sample gases are exhausted from the sample pump at this point.

13 **Calibration Gases**
The exhaust (out) ports for calibration gases are plugged to prevent calibration gas from flowing continuously. The calibration gas “IN” connection is a 1/8” compression fitting.

Installation

NOTE

Remove the packaging materials that protect the unit during shipment.

NOTE

If the ProLine is not mounted on the base enclosure, follow all of the steps below to mount the Proline. If the ProLine has already been mounted to the base unit, skip to Step 3.

CAUTION

If the ProLine was attached to your extended pressure range option at the factory, the fuses were replaced to accommodate this option. If you are attaching the extended range option to the Proline yourself, you must replace the power switch fuses. A 100/120V system requires an 10 Amp slow blow fuse (AMETEK 25779JE) and a 200/230V system requires a 5 Amp slow blow fuse (AMETEK 25702JE). See Chapter 6 in this manual for instructions on replacing the fuses.

1. Ensure that the mounting clamps on the top side of the base enclosure are fully retracted by turning the clamp screws counterclockwise and pushing the clamps towards the center of the module as far as they will go. See Figure A2-3.

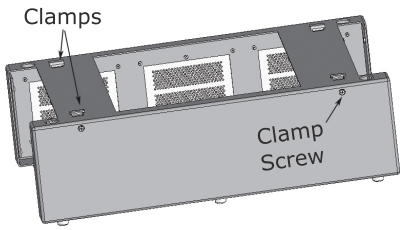


Figure A 2-3. Clamps and clamp screws on base module (shown without options inserted).

2. Attach the ProLine unit to the top of the base enclosure by positioning the rubber feet on the bottom of the ProLine unit over the four holes near the corners on the top of the enclosure. Once you have inserted the rubber feet within the holes on the enclosure (they fit loosely and are not tightened in any way), the clamps will be positioned to grasp the railings on the bottom of the ProLine. Fasten the ProLine to the enclosure by tightening the clamps using the clamp screws. Do not overtighten clamp screws.

To remove packing materials from the option modules:

3. Loosen the four screws used to attach the option module to the base enclosure.

4. Detach any tubing connected to the exterior of the module.

5. Slide the tray out until it is clear of the base enclosure.

6. Once the tray is clear of the base enclosure, you will see packaging material beneath the sample pump. To remove the packing material, use a 7/16” nut driver to loosen the four pump mounting nuts. Remove the packing material and discard it. Next, adjust the mounting nuts so that they are close to, but do not touch, the washers beneath them. This allows the pump to “float” on the spring mounts, reducing vibration to the unit. See Figure A2-4.

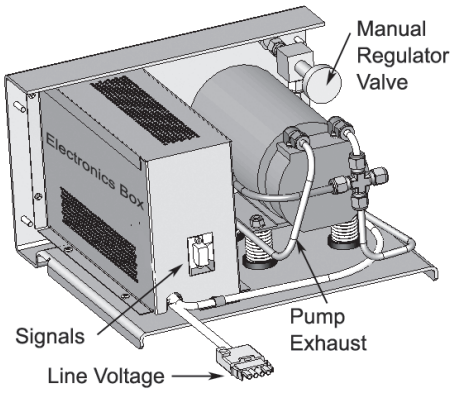


Figure A 2-4. Extended pressure range option module, line voltage and signal connectors on electronics box.

7. Attach the power cable (white connector) on the extended pressure range module to one of the three line voltage outlets on power distribution box on the underside of the ProLine (Figure A2-5).

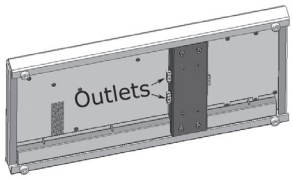


Figure A 2-5. Three voltage outlets on underside of ProLine accessed through base enclosure.

8. The signal cable is hardwired to either the opposite end of the inside of the base enclosure or, if you also have the OPTO 22 option, to the back of that option. Reach into the base enclosure and find the signal cable. Attach it to the signal plug on the electronics box of the extended pressure range option. See Figure A2-4.

9. Once the pump mounting springs have been adjusted, the power cable connected and the signal cable connected, you can slide the tray holding the extended pressure range option back into the base enclosure and secure it using the four mounting screws.

10. Reattach all tubing - Figure A2-6.

    - Valve manifold tube
    - Common exhaust tube

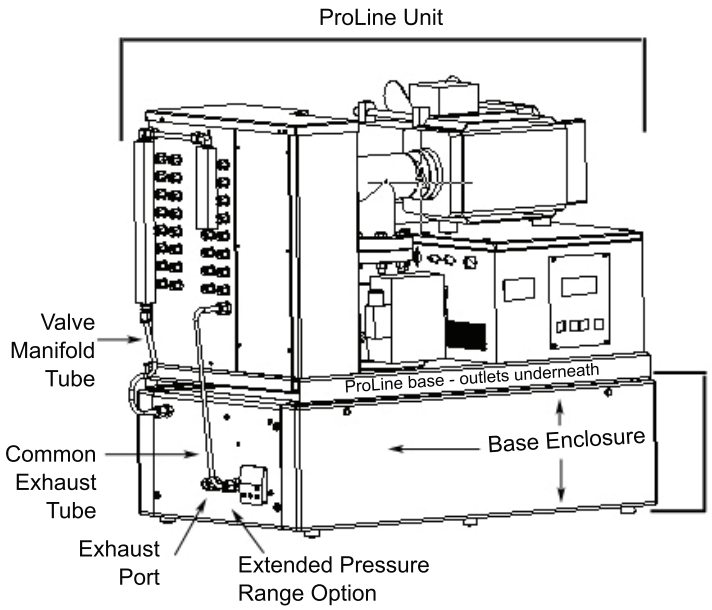


Figure A 2-6. Location of valve manifold and exhaust tubing and exhaust port.

CAUTION

Exhaust port must be plumbed to a safe area and exhausted at atmospheric pressure ± 1 PSIA. This 1/4" O.D. tube exhausts all of the gas that enters the inlet.

11. Attach the sample and calibration tubing to the ProLine. Sample tubes can connect to any port that is connected to the exhaust manifolds. On a 16-valve ProLine, the sample gas tubes can connect to ports 1 through 4 and ports 9 through 16. On an 8-valve ProLine, the sample gas tubes can connect to ports 1 through 4.

    Calibration gas tubes connect to the "in" port numbers 5 through 8 on both the 16-valve and 8-valve ProLine. The "out" ports that correspond to the "in" ports chosen for calibration gas must be plugged with a 1/8" cap to prevent the continuous flow of gas.

Once you have completed the plumbing, you can turn on the power.

Turning On the Extended Pressure Range Module

The extended pressure range module receives power as soon as the main power switch on the ProLine is turned on. Allow the vacuum pumps time to reach operating pressure, and then start the Process 2000 software and turn on the filaments as described in the Installation section of Chapter 3 in this manual. Allow the unit to warm up.

Initial Adjustments

NOTE

Make sure that all sample and calibration tubes are connected and operating at normal pressure and temperature before performing these adjustments. Flow and transit times from each sample line will vary with sample pressure, tube diameter, and line length. Consult the factory if you have specific flow requirements.

1. Open the Process 2000 software. The **Process Status** screen (Figure A2-7) will open. Click on **Status Inputs**. Find the "Inlet Pressure" and "Inlet Prop Valve" locations in the left-hand column.

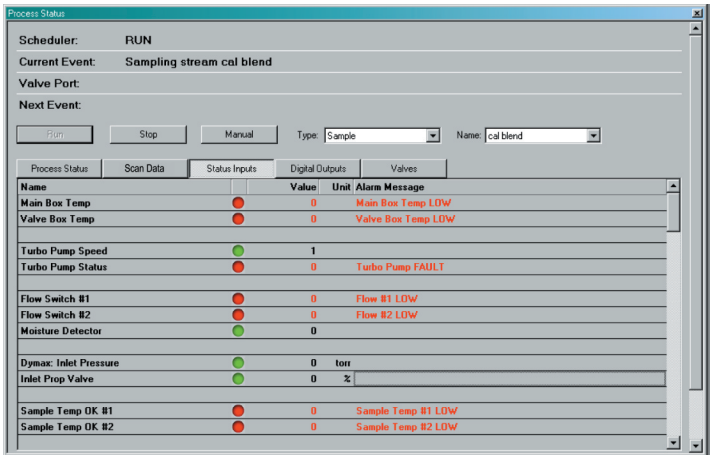


Figure A 2-7. Process Status screen with Status Inputs displayed.

- The Inlet Pressure value should be between 400 and 760 initially.
- The Inlet Prop Valve percentage reading should be in the range of 20% to 50%.

- If the Inlet Prop Valve percentage reading is not between 20% and 50%, change the setpoint on the pump controller to a number several digits lower or higher. The controller is located on the extended pressure range module front panel near the lower right-hand corner (Figure A2-8).

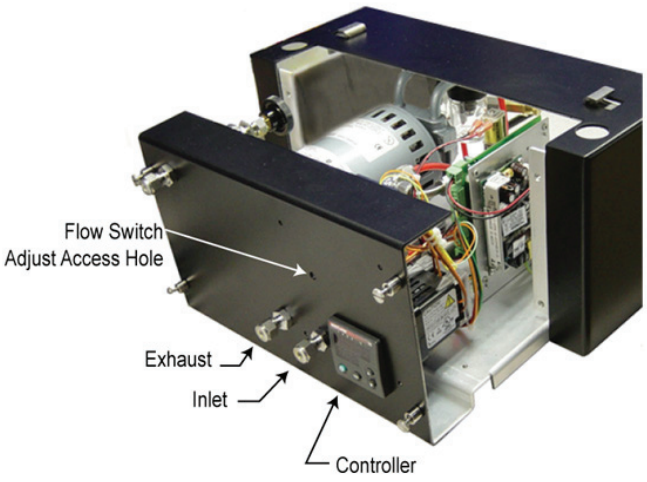


Figure A 2-8. Location of valve manifold and exhaust tubing and exhaust port.

- The setpoint is shown at the bottom of the display. It is changed using the up and down arrow keys on the right side of the face panel. Pressure reading is shown at the top of the display.

- Allow 10 to 15 seconds for stabilization after changing the setpoint and then read the Inlet Prop Valve percentage again.

- If the percentage reading is above 50%, raise the controller setting. If the percentage reading is below 20%, lower the controller setting.

- Repeat the setpoint adjustment until the percentage is within the 20% to 50% range.

2. Open each of the sample and calibration valves manually using the Process 2000 software.

NOTE

Note the Inlet Pressure on the Status Input screen before continuing.

- On the **Process Status** screen, click **Valves**. A listing of all of the valves appears with an indication as to whether the valve is open (green) or closed (red) (Figure A2-9).

- Open each valve by clicking on the red indicator under the **State** column

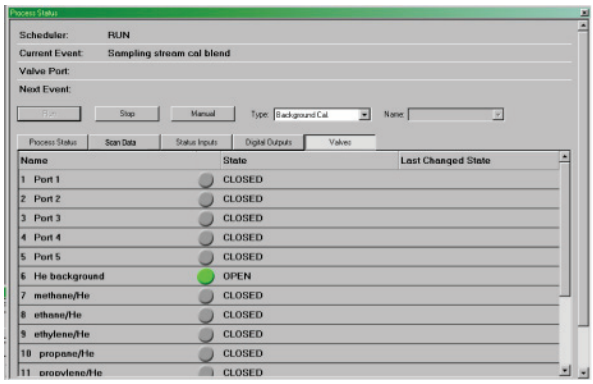


Figure A 2-9.
Valve status screen.

to change the valve from closed to open (green). All valves should have a green indicator showing they are all open.

- The pressure should stabilize at the setpoint in less than 15 seconds.
- You may need to adjust the regulators on the calibration gas tanks to keep the inlet pressure in range.

Adjusting the Flow Switch

NOTE

Flow Switch is an option.

There is a flow switch inside the extended pressure range module that senses flow through the sample inlet valve currently selected (Figure A2-2, point 7). The flow switch is set and tested at the factory but may need to be adjusted once all the sample lines are connected.

- Make sure that the power is on and all sample lines are at operating pressure and temperature.
- Open the Process 2000 software to the **Process Status** screen and open a sample valve by clicking on the red (OFF) indicator under the **State** column changing it to green (ON) (Figure A2-9).

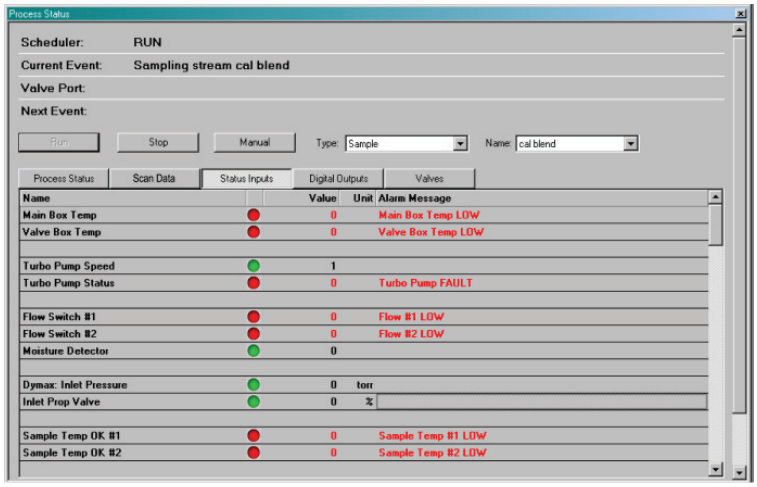


Figure A 2-10.
Status input screen.

- To check the flow on the valve that you just opened, on the **Process Status** screen, click **Status Inputs**. The **Status Inputs** screen displays (Figure A2-10).
- Locate **Flow Switch #1** in the left-hand column. If the sample flow is adjusted correctly, the indicator beside the flow switch will be green. If it is not flowing properly, the indicator will be red.

Green Indicator on Flow Switch

If the **Flow Switch** indicator is green, you can continue checking all of the other valves by turning them on one at a time and checking the flow following the same procedure as for the first valve.

If all of the valves show proper flow, test the operation of the switch itself by blocking one of the lines and then turning that valve on. When you check the

Status Input screen for the status of the **Flow Switc**h, the indicator should turn red (flow blocked) after 5 or 10 seconds to show that the flow switch is working properly.

Red Indicator on Flow Switch (Adjust Flow)

If the **Flow Switch** indicator remains red once the valve is opened and proper flow is expected, you will need to adjust the flow switch.

- Locate the flow switch adjust access hole on the front of the extended pressure range module (Figure A2-11). Using a flat-blade screwdriver, insert it into the access hole and turn the adjusting screw inside clockwise until the indicator on the **Status Input** screen just turns green. Turn 1/4-turn more.

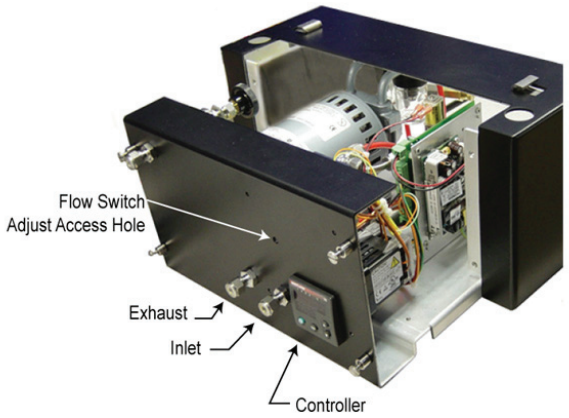


Figure A 2-11. Location of flow switch adjust access hole.

- Test the flow by blocking the sample line. The **Flow Switch** indicator should turn red to show that the sample gas is not flowing through the switch.

- If the **Flow Switch** indicator remains green after the sample line has been blocked, turn the adjusting screw counterclockwise until the **Flow Switch** indicator just turns red. Turn 1/4 turn more. Unblock the sample line. The **Flow Switch** indicator should turn green to indicate that gas is flowing through the switch.

- After making these adjustments, cycle through all of the valves to ensure correct operation of all the sample line.

Once all of the valves have been opened and the pressure response is verified, sample analysis can begin.

Inlet Pressure Controller Settings

These parameters are set at the factory and should not require any adjustment. For a complete description of each parameter, refer to the controller manufacturer's documentation which is included with your unit.

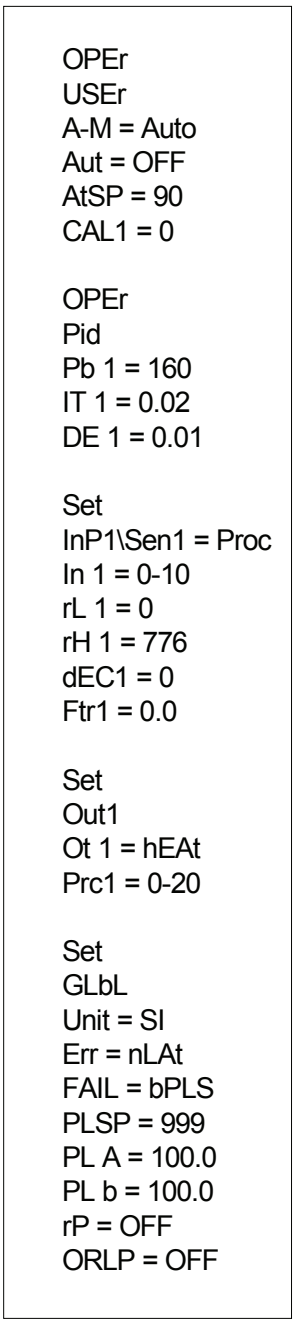


Figure A 2-10.
For Watlow Series 96.
Inlet Pressure controller settings.

SETUP		
Ai		
SEt		
	SEn	voLt
	UniT	Pro
	S.Lo	0.00
	S.hi	10.00
	r.Lo	0
	r.hi	776
	P.EE	oFF
	FiL	0.5
	i.Er	oFF
	dEC	0
LooP		
SEt		
	h.Ag	Pid
	C.Ag	oFF
	t.tUn	no
	t.Agr	Crit
	UFA	bPLS
	FAiL	bPLS
	L.dE	no
	rP	oFF
	L.SP	0
	h.SP	776
	SP.Lo	-100
	SP.hi	100
otPt		
SEt		
	o.ty	MA
	Fn	hEAt
	Fi	1
	S.Lo	0.00
	S.hi	20.00
	o.Lo	0
	o.hi	100
	o.CA	0
ALM		
SEt		
1		
ALM		
	A.ty	OFF
	Sr.A	
	A.hy	
	A.Lg	
	A.Sd	
	A.LA	
	A.bL	
	A.Si	
	A.dSP	
	A.dL	
ALM		
SEt		
2		
ALM		
	A.ty	oFF
	A.Sr	
	A.hy	
	A.Lg	
	A.Sd	
	A.LA	
	A.bL	
	A.Si	
	A.dSP	
	A.dL	
ALM		
SEt		
3		
ALM		
	A.ty	oFF
	A.Sr	
	A.hy	
	A.Lg	
	A.Sd	
	A.LA	
	A.bL	
	A.Si	
	A.dSP	
	A.dL	
ALM		
SEt		
4		
ALM		
	A.ty	oFF
	A.Sr	
	A.hy	
	A.Lg	
	A.Sd	
	A.LA	
	A.bL	
	A.Si	
	A.dSP	
	A.dL	
FUn		
SEt		
	LEu	high
	Fn	nonE
	Fi	0

Figure A 2-10b.
For Watlow EZ Zone PM controller.
Inlet Pressure controller settings.

```
gLbL
SEt
        C_F     C
        AC.LF   60
        C.LED   both
        2one    on
        chan    on
        d.Prs   1
        d.ti    0
        USr.S   none
CoM
SEt
        Ad.S    1
        MAP     1
        nUs     YES

OPERATIONS

Ai
oPEr
        Ain     READ ONLY
        i.Er    READ ONLY
        i.CA    0
Mon
OPEr
        C.MA    READ ONLY
        h.Pr    READ ONLY
        C.SP    READ ONLY
        Pu.A    READ ONLY
Loop
OPEr
        C.M     AUto
        A.tSP   90
        AUt     no
        C.SP    450
        id.S    450
        h.Pb    300
        ti      1
        td      1
        db      0
        o.SP    0
ALM
OPEr
1
ALM
        A.Lo
        A.hi
ALM
OPEr
```

```
2
ALM
        A.Lo
        A.hi
ALM
OPEr
3
ALM
        A.Lo
        A.hi
ALM
OPEr
4
ALM
        A.Lo
        A.hi
```

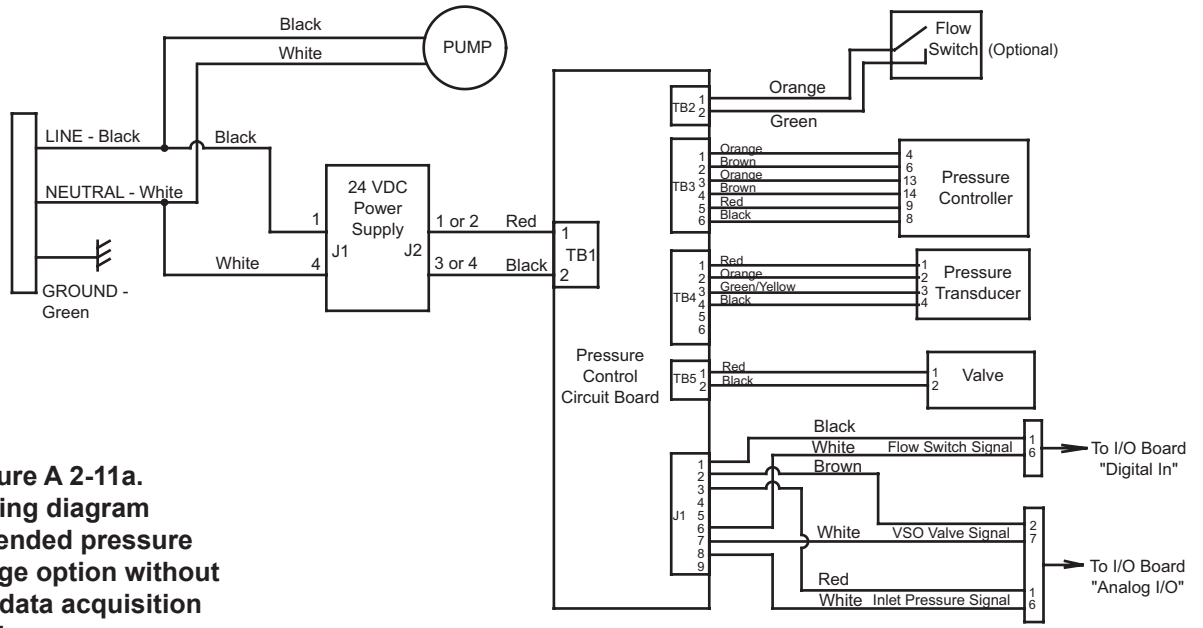


Figure A 2-11a. Wiring diagram extended pressure range option without I/O data acquisition option.

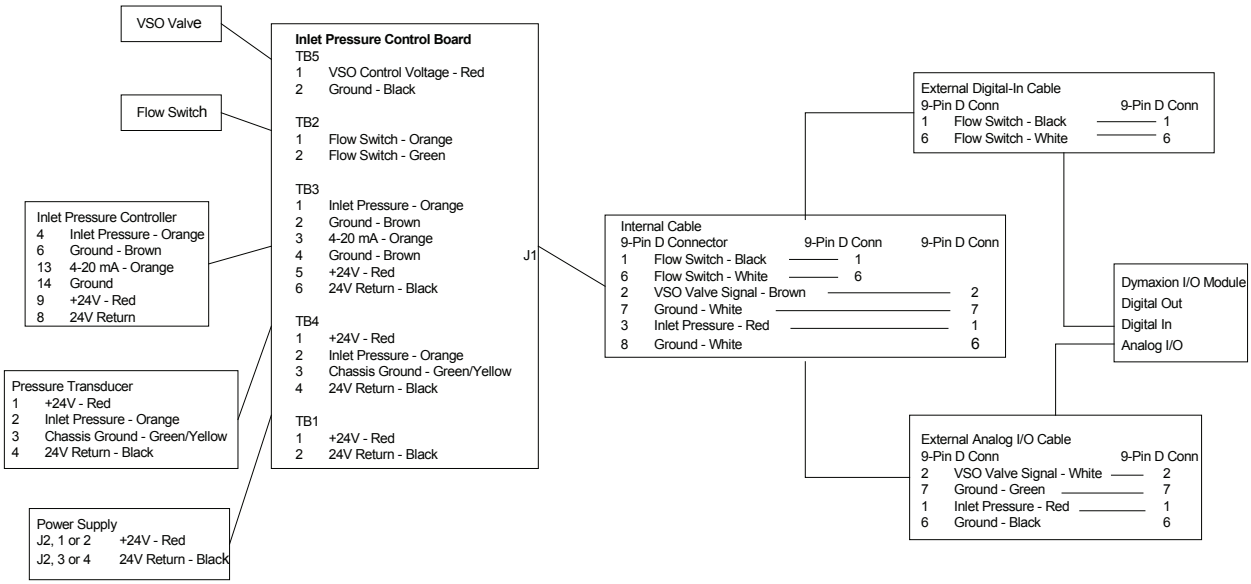


Figure A 2-11b. Signal wiring diagram extended pressure range option without I/O data acquisition option.

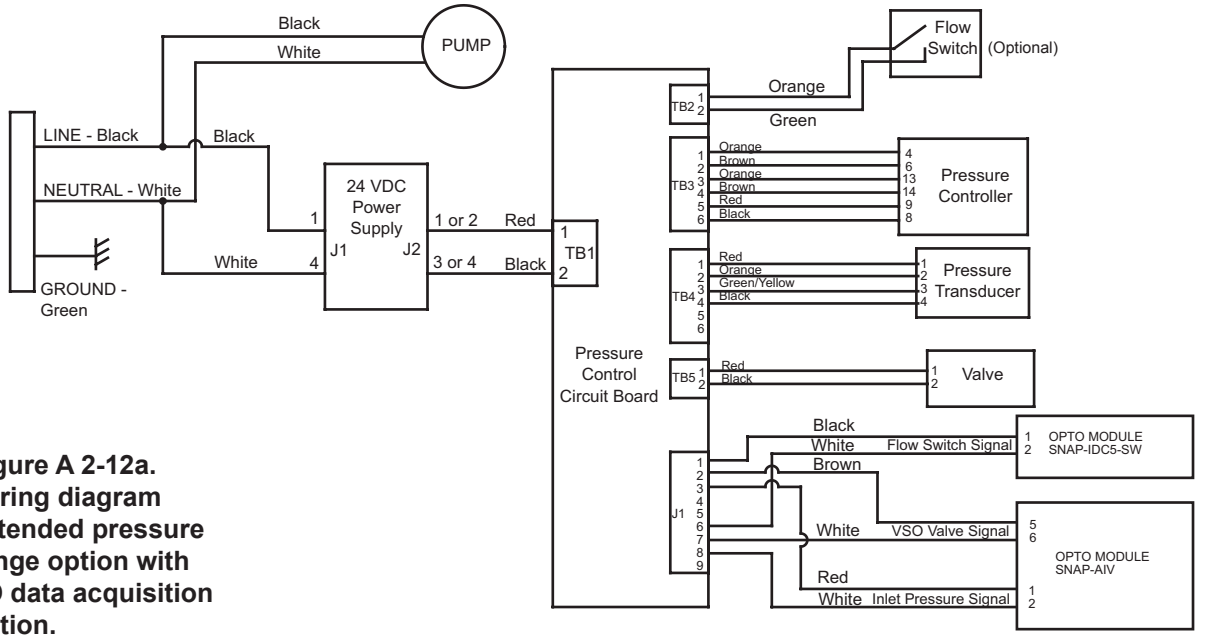


Figure A 2-12a. Wiring diagram extended pressure range option with I/O data acquisition option.

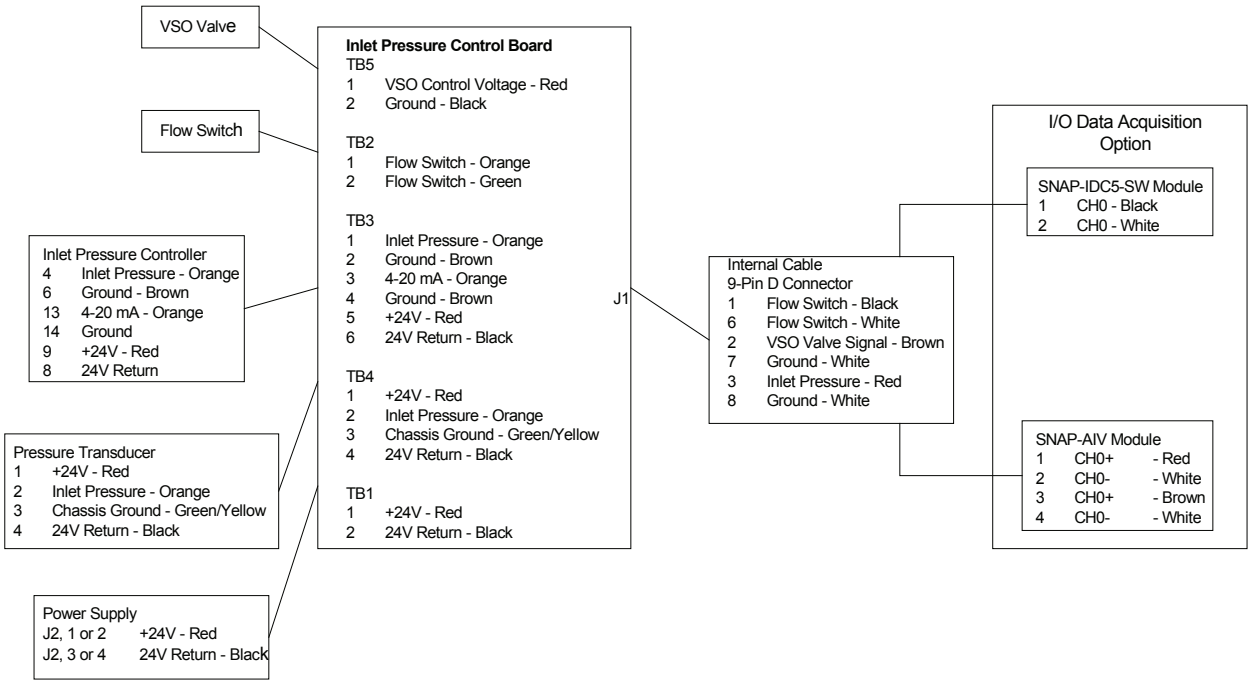
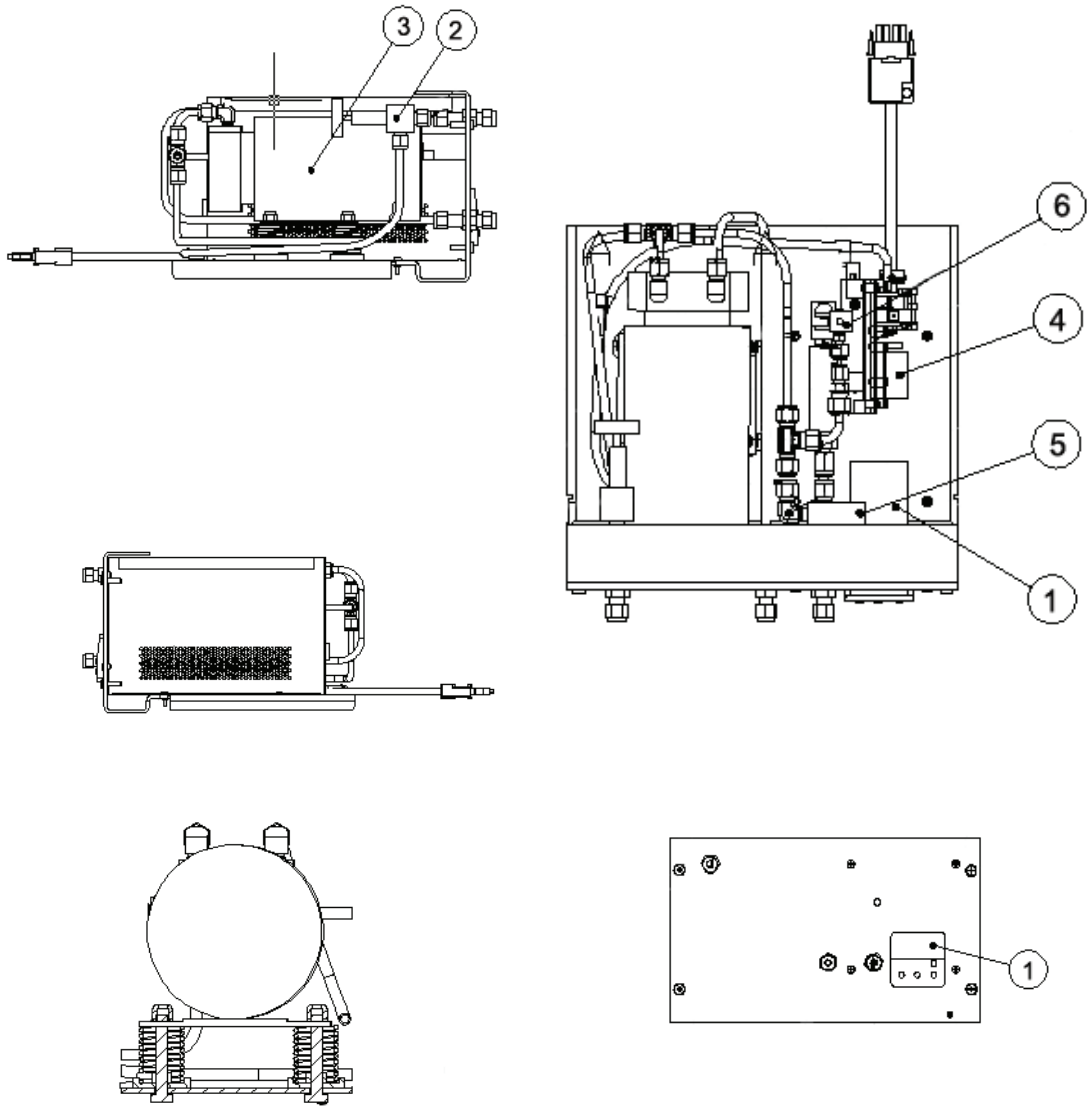
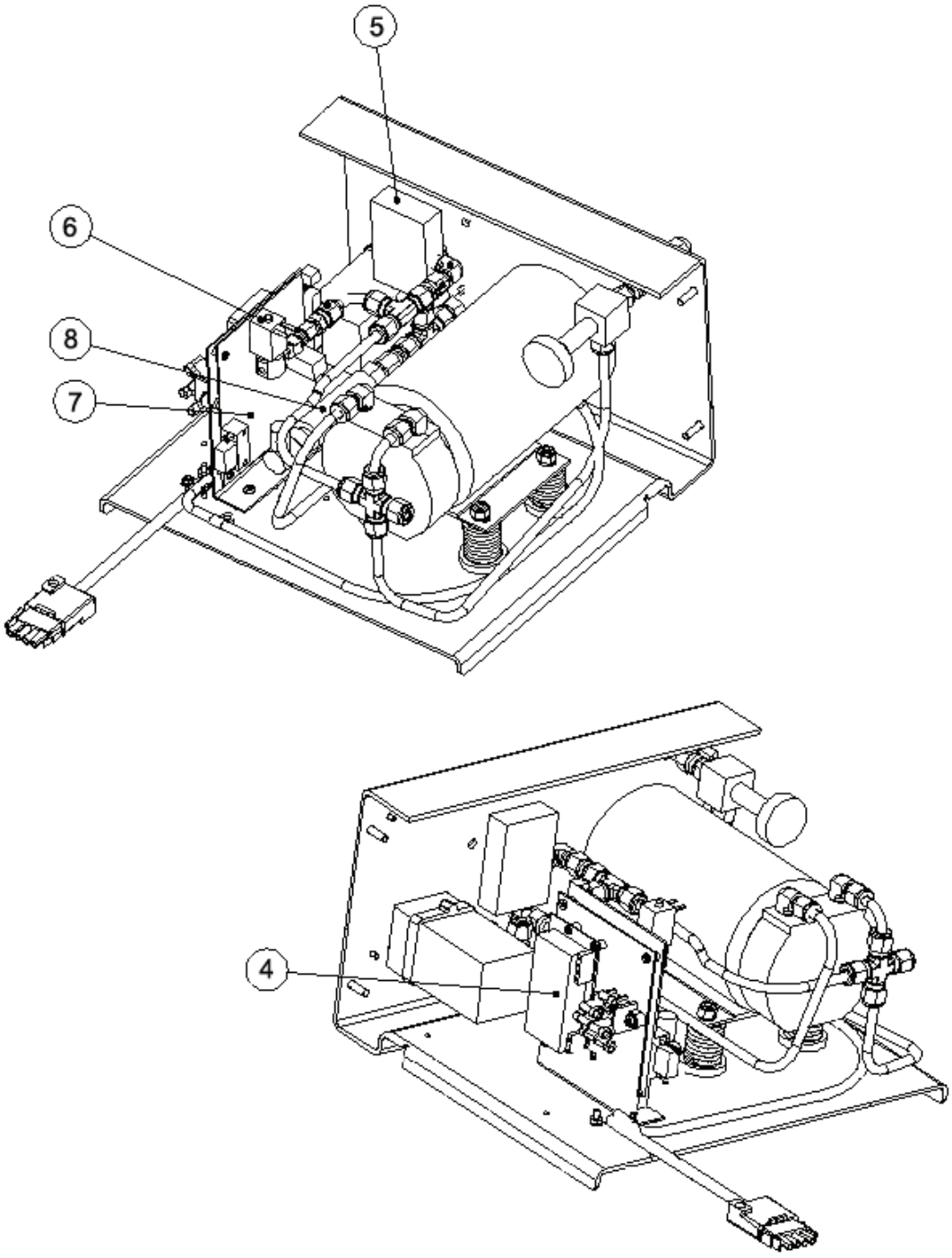


Figure A 2-12b. Signal wiring diagram extended pressure range option with I/O data acquisition option.

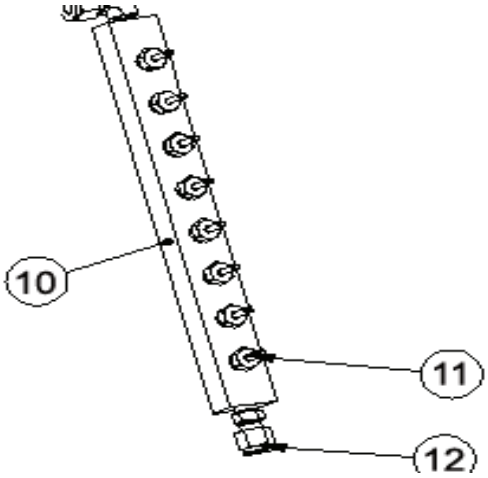
Extended Pressure Range Option Parts



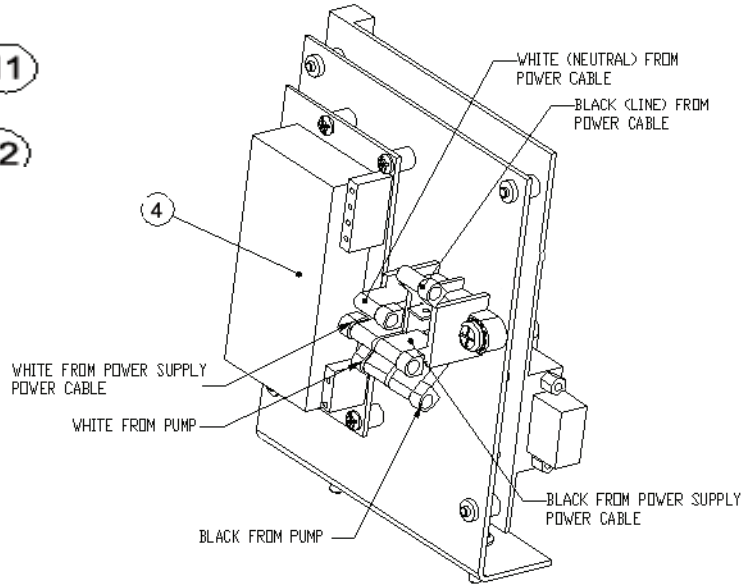
1	25621JE	Controller
2	36083JE	Regulating Valve
3	38000JE	Sample Pump, 120V
	38002JE	Sample Pump, 230V
4	25679JE	Power Supply
5	37055JE	Flow Switch (Optional)
6	36073JE	Solenoid Valve



1	25621JE	Controller
4	25679JE	Power Supply
5	37055JE	Flow Switch (Optional)
6	36073JE	Solenoid Valve
7	80553SE	Inlet Pressure Control Bd
8	25681JE	Pressure Transducer

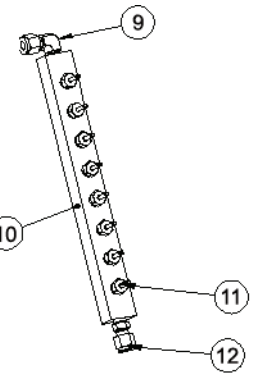


5	37055JE	Flow Switch
8	25681JE	Pressure Transducer



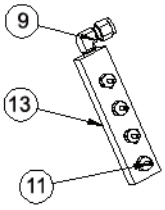
TERMINAL BLOCK DETAIL

4	25679JE	Power Supply



8-POSITION MANIFOLD

9	33022JE	Elbow
10	75153KE	8-Position Manifold
11	33541JE	Male Adapter
12	33540JE	Male Connector



4-POSITION MANIFOLD

9	33022JE	Elbow
11	33541JE	Male Adapter
13	75152KE	4-Position Manifold

NOTE

The ProLine equipped with the extended pressure range option requires a different fuse than the ProLine operating without this option. See Chapter 6 in this manual for information on replacing the power switch fuses.

100/120V System	*25779JE*	*10 Amp, slow blow, 5x20mm*
200/230V System	*25702JE*	*5 Amp, slow blow, 5x20mm*

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