Installation & Operating Instructions for Genesys™ Analog Series Manifolds

Model TMCU

Model TMLU

Features & Benefits

- Fully automatic changeover – no valves or levers to reset after each changeover
- Field upgradeable design – kits allow unit to be changed from i.e. cylinders to portable bulk or from lower delivery pressure to higher delivery pressure
- 400 psig pressure differential rated solenoid valve
- Exclusive single solenoid pressure differential rated changeover
- Circuit board triggers secondary in use alarm
- Easy to service layout/design
- Circuit board incorporates LED's easily visible even in poor lighting conditions
- Analog gauges also provided
- Built in DISS gas specific emergency feed ports
- Built in emergency reserve bank ports
- Input power 110 VAC, 50 to 60 Hz. Single point connection, even for units with heaters.
- Dual line pressure regulators available making unit NFPA 99 compliant
- Gas specific header bar with integral check valves and cylinder pigtail assemblies
- Variety of header configurations available to meet the available space requirements of your installation

Contents

Technical Assistance----
Phone **800-253-8692**
or 440-937-6244
Fax **440-937-5060**
E-mail **sales@tri-techmedical.com**

Introduction

Tri-Tech Medical manifolds are cleaned for use with oxygen. Each system is tested for changeover, triggering of secondary in use alarm, leakage and flow. Each unit is designed and prepared for the indicated gas service. Tri-Tech Medical manifolds are built in accordance with the National Fire Protection Association and Compressed Gas Association guidelines.

Warranty

All Tri-Tech Medical manifolds are warranted against defects in material and workmanship for the period of one year from date of purchase. All circuit boards are warranted against defects in material and workmanship for the period of three years from date of purchase.

General Instructions/Location & Shelter

Manifolds should be installed in accordance with guidelines stated by the National Fire Protection Association, the Compressed Gas Association, OSHA, and all applicable local codes. Carbon Dioxide and Nitrous Oxide manifolds and cylinders should not be placed in a location where the temperature will exceed 120° F (49° C) or fall below 20° F (-7° C). The manifolds for all other gas services should not be placed in a location where the temperature will exceed 120° F (49° C) or fall below 0° F (-18° C). A manifold placed in an open location should be protected against weather conditions. During winter, protect the manifold from ice and snow. In summer, shade the manifold and cylinders from continuous exposure to direct sunlight.

Leave all protective covers in place until their removal is required for installation. This precaution will keep moisture and debris from the piping interior.

Caution

Failure to follow the following instructions can result in personal injury or property damage:

- Never permit oil, grease, or other combustible materials to come in contact with cylinders, manifold, and connections. Oil and grease may react with explosive force when ignited while in contact with some gases – particularly oxygen and nitrous oxide.
- Cylinder and master valves should always be opened very slowly. Heat of recompression may ignite combustible materials creating an explosive force.
- Pigtails should never be kinked, twisted, or bent into a radius smaller than 3 inches. Mistreatment may cause the pigtail to burst.
- Do not apply heat. Oil and grease may react with explosive force when ignited while in contact with some gases – particularly oxygen and nitrous oxide.
- Cylinders should always be secured with racks, chains, or straps. Unrestrained cylinders may fall over and damage or break off the cylinder valve which may propel the cylinder from its current position.
- Oxygen manifolds and cylinders should be grounded. Static discharges and lightning may ignite materials in an oxygen atmosphere, creating a fire or explosive force.
- Welding should not be performed near nitrous oxide piping. Excessive heat may cause the gas to dissociate, creating an explosive force.
- Remove all protective caps prior to assembly. The protective cap may ignite due to heat of recompression in an oxygen system.

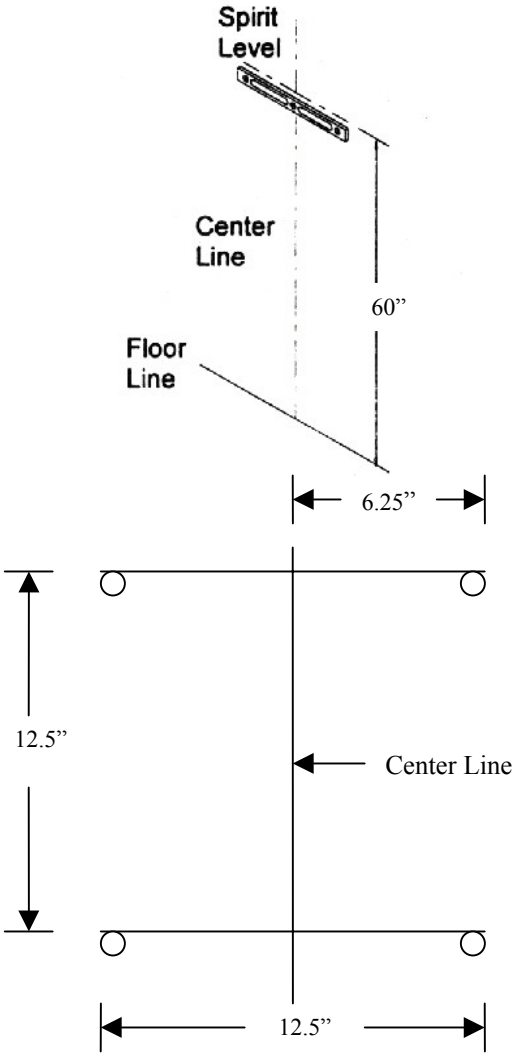
Control Cabinet Installation

1. Determine and mark the vertical center line for installation of the manifold control cabinet.

2. Measure from the floor to a point 60” in height* above the finished floor of this vertical line. Using a level, mark a horizontal line at this point extending approximately 10” to the left and 10” to the right of center. This line indicates the location for the bottom two mounting bolts of the manifold control cabinet. (* - suggested manifold height. Wall mounting heights may vary depending on available space, cylinder height, etc.)

3. Draw another horizontal line 12.5” above and parallel to the lower horizontal line. This line should also extend 7” to the left and 7” to the right of center. This line indicates the location for the upper two mounting bolts of the manifold control cabinet.

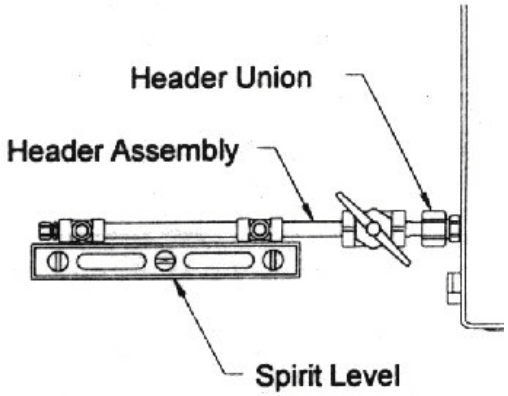
4. Measuring from the vertical center line, along the two horizontal lines, make a mark at 6 ¼” to the left and another at 6 ¼” to the right of the vertical center line. These four locations are the mounting hole locations for the manifold control cabinet. Install the manifold control cabinet using fasteners suitable for the type of wall construction.



Header Installation

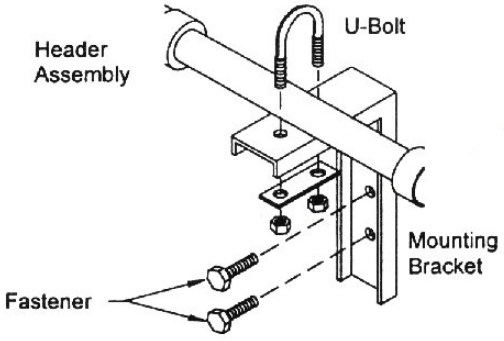
1. Attach the headers to the union on each side of the manifold control cabinet. Using a level, mark the placement of mounting brackets while keeping the header on a horizontal plane.

2. Remove the U – bolt assemblies from the header mounting brackets. Position the brackets so that the top of the bracket is aligned with the bottom of the headers and is centered between the cylinder connections. The end bracket should be placed as close to the last cylinder as possible to provide the most support and stability.



1. Mark the mounting hole and install fasteners suitable for type of wall construction.

2. Fit the U – bolt over the header piping and tighten the two mounting nuts.



Plumbing

1. The outlet of the manifold is located at the top center of the unit as shown here. The outlet connection is ½ NPT female. A ½ NPT male union should be installed between the outlet of the manifold cabinet and the pipeline system. This union is available as an accessory from Tri-Tech Medical (part # 17-0169).

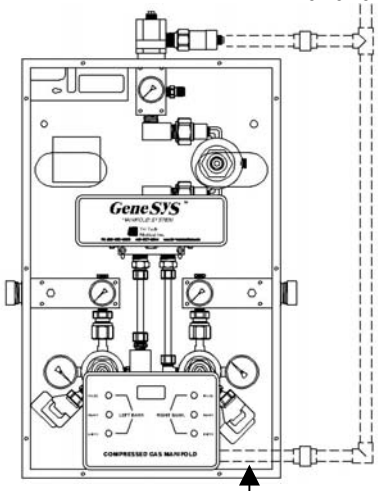
2. A unions (part # 17-0169) should also be installed between the intermediate relief valves and the relief (vent) pipeline system(s). There are two 1/4 NPT female relief valve connections on the model TMCU manifold intermediate relief valves.

3. The intermediate relief valve extension pipe nipple must be installed. It is bagged and taped to the inside of the cabinet for protection during shipment.

4. Plumbing for TMCU models shown at right. Vent lines, (provided by plumber), shown in dotted lines.

5. Plumbing for TMLU models shown below. Vent lines, (provided by plumber), shown in dotted lines.

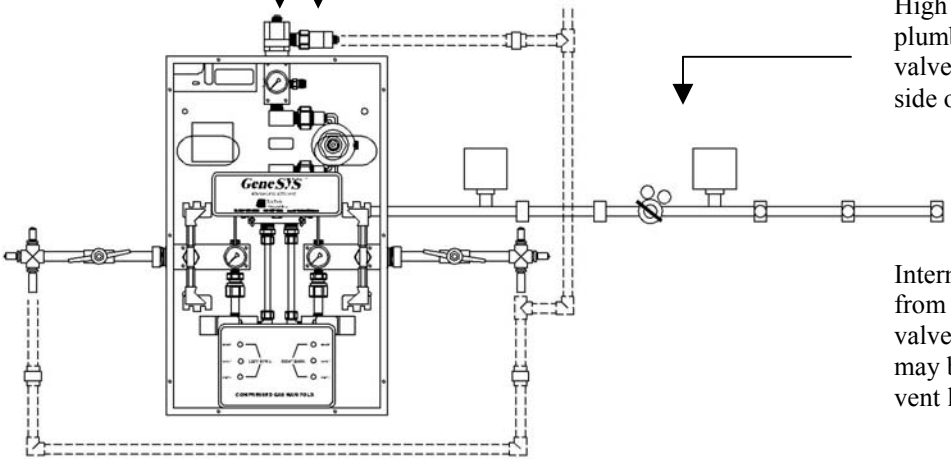
Line relief valve ½ F npt



Intermediate relief connections from both primary regulators connected to a common vent line with the line relief valve

Outlet ½ F npt

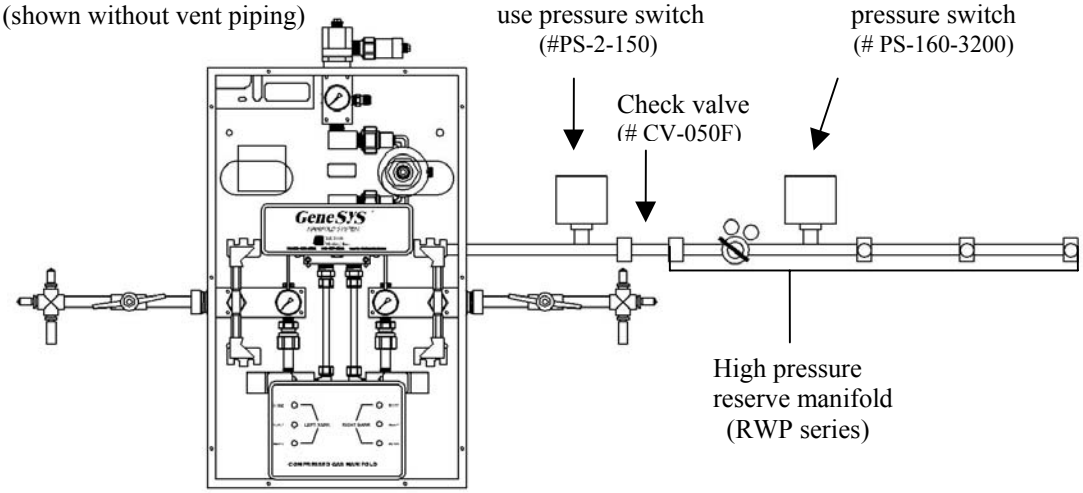
Line relief valve ½ F npt



High pressure reserve may be plumbed into the intermediate relief valve from either the right or left side of the cabinet.

Intermediate relief connections from both intermediate relief valves (located on the headers) may be connected to a common vent line with the line relief valve.

NFPA 99 compliant TMLU
(shown without vent piping)



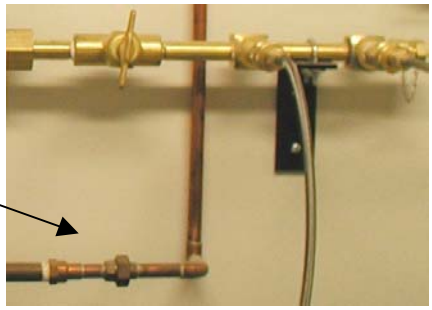
Plumbing

1. In addition to connecting the left & right primary and secondary portable bulk vessel supply banks, the TMLU models must also have a high pressure reserve bank of cylinders connected to the cabinet, a check valve, an "Emergency Reserve in Use" and an "Emergency Reserve Low" pressure switch to be in compliance with NFPA 99 guidelines.

2. Slots have been provided on both the left and right sides of the control cabinet to allow for the high pressure reserve piping.

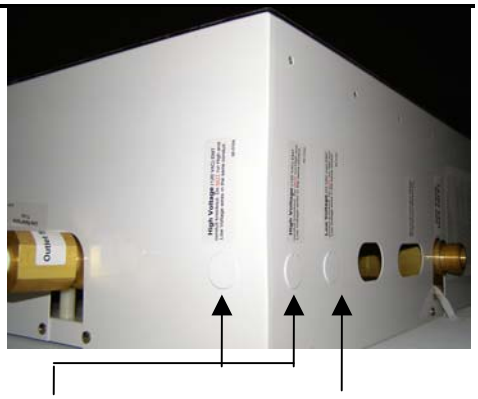
3. A check valve (part number CV-050F shown here) must be installed between the emergency reserve in use pressure transducer and the high pressure reserve regulator.

4. Part # 17-0169 union (sold separately) shown here.



Electrical

1. Use one of the two ½" conduit knock-outs provided located nearest to the top left corner of the cabinet to route conduit to supply either 110 VAC to the power supply. **Note: Separate conduit should be used for low voltage wires (use knock outs provided on the left side of the box)**.



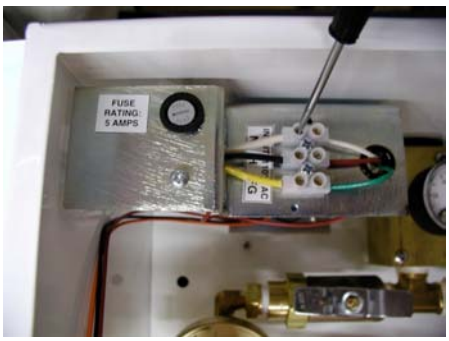
Conduit knockouts for 110 VAC

Conduit knockout for low voltage alarm signals

2. Remove the power supply cover by loosening the two screws located at the top and bottom of the cover and then sliding the power supply cover to the right until the screws are in the center of the tear-drop shaped cut out. Next, lift the cover until it clears the screw heads and the fuse.

3. Route wires of proper gauge (per local building code requirement) through the power supply conduit, thru the grommet on the power supply bracket and into the terminal strip.

4. Connect the 110 VAC facility **emergency power source** electrical wiring to the terminal strip provided on the front of the power supply mounting bracket (per photos right). (N = neutral, L = load, FG = field ground)



Note: The ground must be a solid earth ground with little or no resistance. A "noisy" earth ground will affect the digital display of the manifold.

Wiring – remote alarms

1. Wires for remote alarms should be brought into the cabinet thru conduit or shielded cables (check local code requirements) thru the knockout on the left side of the cabinet shown here. . **Note: Separate conduit should be used for high voltage wires – never run low voltage wires in the same conduit as high voltage wires.**

2. If you are installing a model TMCU (cylinder x cylinder) cabinet to meet NFPA 99 there are three alarm signals recommended per NFPA 99, High Line Pressure, Low Line Pressure and Reserve in Use. The TMCU circuit board will trigger the "Secondary in Use" alarm (an optional hi/low pressure switch is required). Note: the hi/low pressure switch would be wired directly to the master alarm panels – not to the manifold circuit board.

3. Remote alarm wires for the "Secondary in Use" alarm may be connected to a terminal strip located just to the right of the circuit board. The wires (labeled A1 & A2) connecting this terminal strip to the circuit are connected to dry contacts on the circuit board. **No voltage higher than 24 VDC should be connected to these terminals.**

4. Note: the remote alarm terminals are normally closed when the gas pressure is in the normal range. The hi/low set points pre-set in the manifold are as per the following charts:

Knock out for low voltage remote alarm wiring

Secondary in Use "changeover" remote dry contact connections

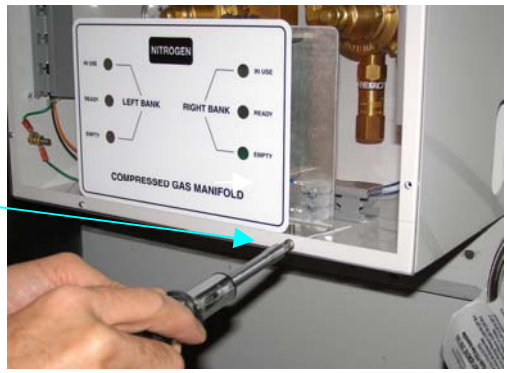
Pressure Settings for TMCU Models (all pressures in psig)

Maximum Inlet Pressure	Normal Delivery Press	Line Relief Setting	Secondary In Use Set Point
3,000	50	75	135 left bank / 110 right bank
3,000	80	150	235 left bank / 220 right bank
3,000	190	250	235 left bank / 220 right bank

Pressure Settings for TMLU Models (all pressures in psig)

Maximum Inlet Pressure	Normal Delivery Press	Line Relief Setting	Secondary In Use Set Point
400	50	75	60 both banks
400	80	150	135 both banks
400	190	250	190 both banks

Installing headers & attaching cylinders – TMCU models

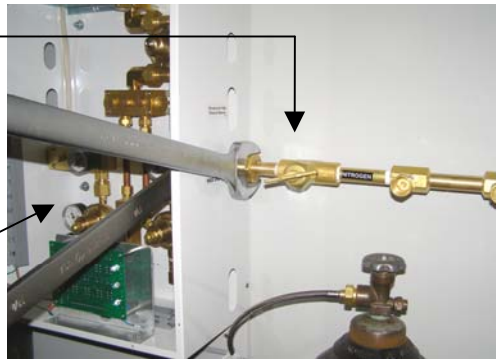


1. Remove the plastic front cover panel by removing the 10 (ten) screws around the perimeter of the front panel.

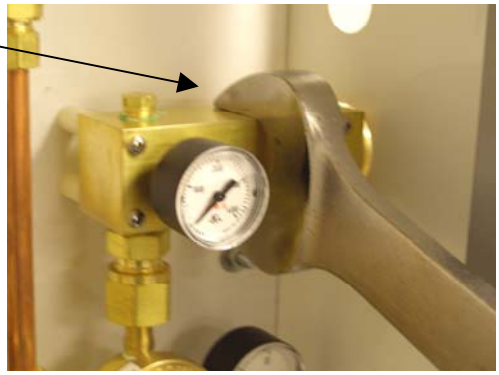
2. Match the gas service indicated by the labels on the control cabinet with the gas service indicated by the label on the headers and the CGA fittings on the header and the pigtails. ***It is critical that the headers, pigtails and contol cabinet gas service/CGA match.***

   CGA 320 = CO2 carbon dioxide
   CGA 326 = N2O nitrous oxide
   CGA 346 = medical air
   CGA 540 = oxygen
   CGA 580 = N2 nitrogen
   or Argon

Master valve



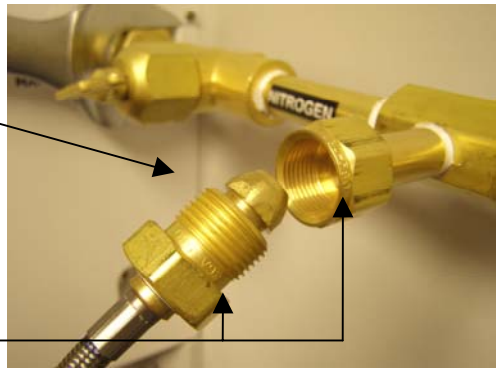
3. Using two 1 ½" wrenches, one on the inlet block inside the control cabinet and the other on the union nut, tighten the headers to the control cabinet.



4. Check the master valves to be certain they are open (turn counter-clockwise to open). (Note: the master valve should always be left open. It is to be used only in the event of an emergency).

5. Attach the pigtails to the header check valve outlets using two 1 1/8" open end wrenches.

6. SLOWLY open all cylinder valves (turn counter-clockwise to open). Check all cylinder and pigtail connections for leaks using an oxygen safe leak test solution (any bubbles forming around connections indicate leakage).



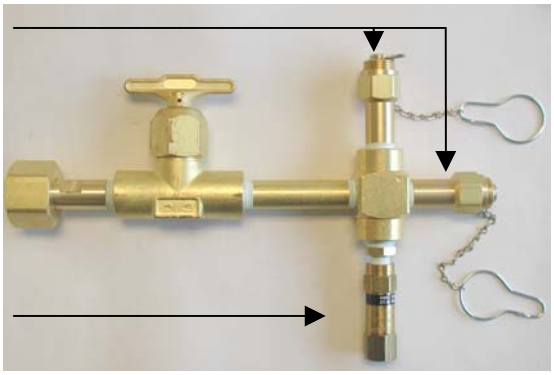
CGA #'s are marked here

7. Check all cylinder and pigtail connections for leaks using an oxygen safe leak test solution (any bubbles or foam forming around connections indicate leakage).

Installing pigtails & attaching cylinders – TMLU models

CGA connections for pigtails with gas tight cap, chain & hook rings.

Intermediate pressure relief valve x ¼ F npt



1. A typical header for a model TMLU portable bulk vessel vapor withdrawl manifold is shown here. CGA connections are stamped on both the header fittings and on the pigtail fittings. **It is critical that these fittings match the gas service of the control cabinet.**

   CGA 320 = CO2 carbon dioxide
   CGA 326 = N2O nitrous oxide
   CGA 346 = medical air
   CGA 540 = oxygen
   CGA 580 = N2 nitrogen
   or argon

2. Connect the end of the pigtail with the CGA fitting to the "Use" valve mating fitting on the portable bulk vessel. Open the use valve. The pressure building valve or regulator should be turned on or opened for all vessels connected to the manifold (both service and reserve banks). Allow approximately 1 hour for the portable bulk vessel(s) to build pressure.

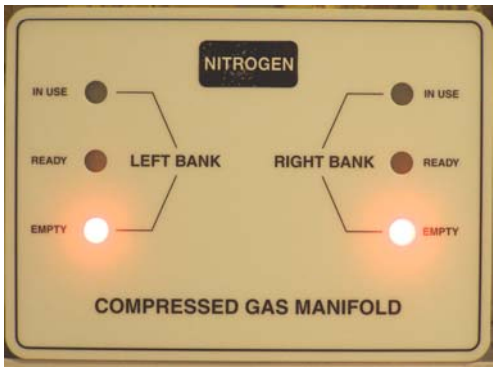
3. Check all cylinder and pigtail connections for leaks using an oxygen safe leak test solution (any bubbles or foam forming around connections indicate leakage).

Minimum inlet pressure requirements for LLU Manifold

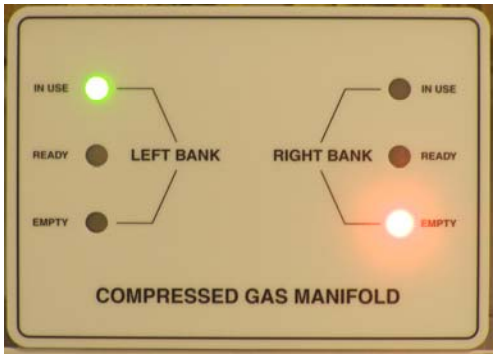
Manifold delivery pressure	Minimum inlet pressure	Relief valve setting on vessel
50 psig	150 psig	235 psig
80 psig	150 psig	235 psig
190 psig	250 psig	350 psig

Start up & testing procedures

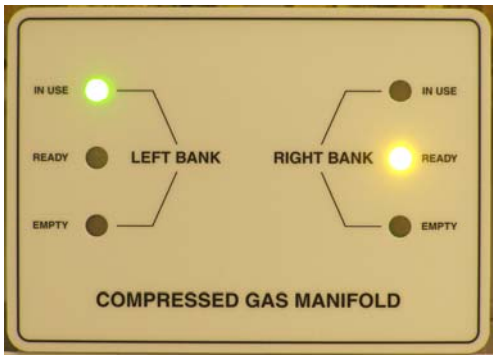
1. Turn on the 110 VAC to the unit. Both the left & right bank Red (Depleted) LED's should be illuminated and the left and right bank Green (In Use) and Yellow LED's (Ready) should be extinguished. If the manifold is wired to a remote alarm (master alarm) – the Secondary in Use alarm will be activated.



2. SLOWLY open one cylinder valve on the left bank. The left bank pressure gauge (inside the cabinet) should display the full pressure of the cylinder. The Red (Empty) LED for the left bank should have extinguished and the Green (In Use) LED should be illuminated. The right bank Red (Empty) LED should remain illuminated and if the manifold is wired to a remote alarm (master alarm) – the Secondary in Use alarm will be activated.

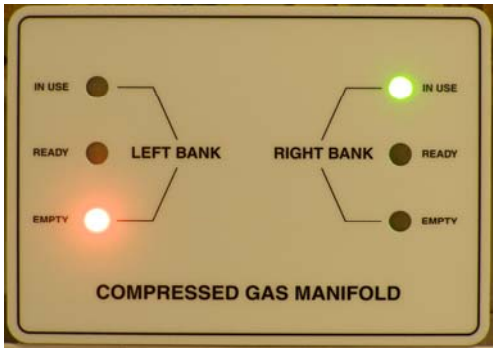


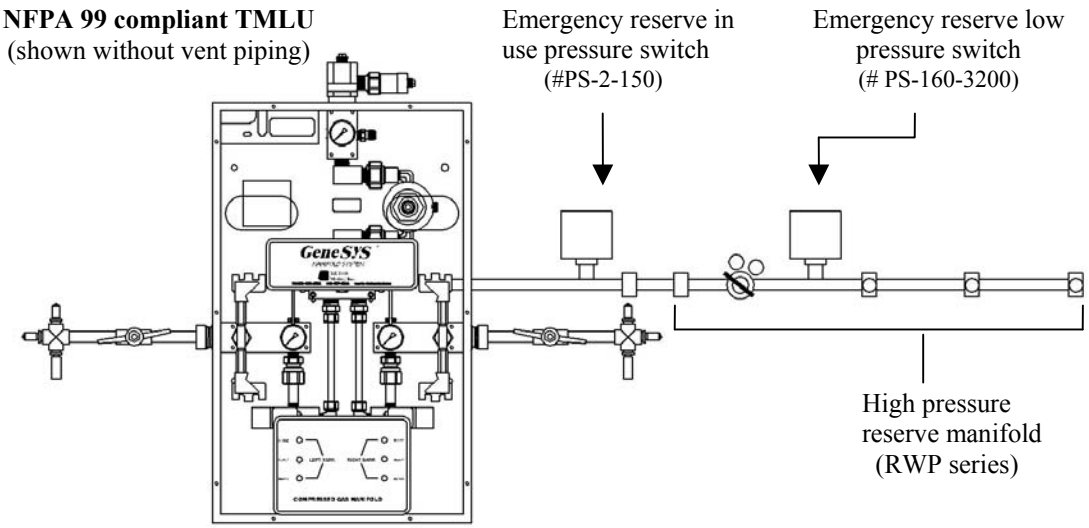
3. SLOWLY open one cylinder valve on the right bank. The right bank pressure gauge (inside the cabinet) should display the full pressure of the cylinder. The Red (Empty) LED for the right bank should have extinguished and the Yellow (Ready) LED should have illuminated. If the manifold is wired to a remote alarm (master alarm) – the Secondary in Use alarm will not be activated.



4. Turn off all open left bank cylinder valves. Create a slight flow of gas in the delivery pipeline system. A DISS demand valve has been provided on the outlet block. Mating DISS fittings may be used to create a flow of gas within the manifold cabinet. The left bank pressure gauge should fall and the control automatically switches over to the right bank. Delivery pressure remains constant. The left bank Red (Empty) LED will illuminate. The Secondary in Use alarm should activate on the remote or master alarm(s).

5. SLOWLY reopen the cylinders on the left bank. The left bank pressure gauge should return to full pressure. The left bank yellow (Ready) LED will illuminate. Simultaneously the left bank red (Empty) will extinguish. All remote Secondary in Use alarms will be canceled. Repeat steps 2 – 4 substituting right for left to simulate a changeover from the right bank to the left bank.





Model LLU – Emergency Reserve Pressure Settings & Alarm Set Points

1. NFPA 99 requires five alarms for portable bulk manifold systems with high pressure reserve; high line pressure, low line pressure, secondary in use, emergency reserve in use and emergency reserve low.
2. The high and low line pressure alarms are generated by a pressure switch which is mounted on the downstream side of the source valve. NFPA 99 also requires a gauge and a DISS union assembly on the downstream side of the source valve. This assembly (high/low switch, gauge and DISS union is available as an assembly. The part #'s are as follows:

Gas Service	Part #
Oxygen (O2)	PST-24
Medical Air	PST-16
Nitrous Oxide (N2)	PST-04
Carbon Dioxide (CO2)	PST-08
Nitrogen (N2)	PSX-12

3. The emergency reserve low bank pressure switch (part # PS-160-3200) should be installed on the extra port on the RWP series manifold. This port is located prior (upstream) to the master valve and the regulator.

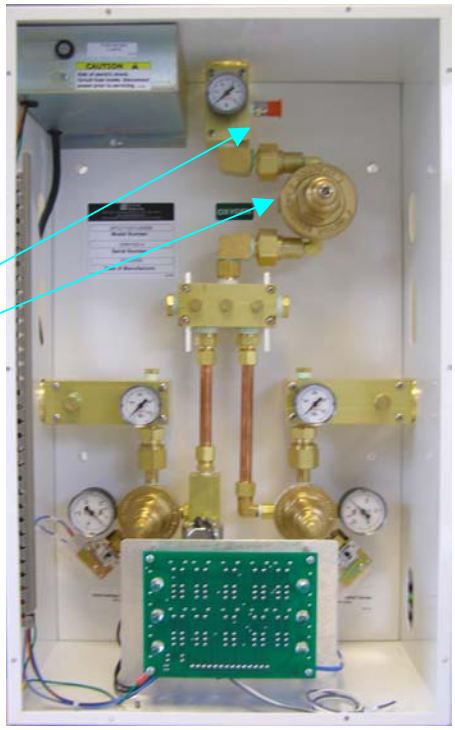
4. The emergency reserve in use pressure switch (part # PS-2-150) should be installed on copper tubing (provided by plumbing contractor) after (downstream) the check valve (part # CV-050F).

5. Refer to the chart below for information on setting the delivery (outlet) pressure of the emergency reserve regulator and emergency reserve in use and emergency reserve low pressure switches.

Manifold Delivery Pressure	Recommended Emergency Reserve Regulator Delivery Pressure Setting	Recommended Emergency Reserve in Use alarm set point	Pre-set Emergency Reserve Low alarm set point
50 psig	65 psig	75 psig	1200 psig
80 psig	70 psig	80 psig	1200 psig
200 psig	170 psig	180 psig	1200 psig

Cylinder replacement & handling

1. Close all cylinder valves on the depleted bank.
2. SLOWLY loosen and remove the pigtail connection from the depleted cylinders.
3. Remove depleted cylinders and replace protective caps.
4. Place and secure full cylinders into position using chains, belts or cylinder stands.
5. Remove protective cylinder caps from full replacement cylinders. With the valve outlet pointed away from all people in the area, slowly open each cylinder valve slightly to blow out any dirt or contaminants that may have become lodged in the cylinder valve.
6. Connect pigtails to cylinder valves and tighten with wrench.
7. SLOWLY turn each cylinder valve until each cylinder is fully on.
8. Observe the following conditions: The red (Empty) LED is extinguished and the yellow (Ready) LED is illuminated and the remote reserve in use alarm is cancelled.
9. The manifold supply bank is now replenished and automatically placed in “reserve”.



Line delivery pressure adjustment

1. Leave the manifold in full operational status.
2. Create a flow condition in the delivery piping system. A DISS demand valve has been provided on the outlet block . Mating DISS fittings may be used to create a flow of gas within the manifold cabinet.
3. The line pressure regulator(s) is located at the top of the manifold cabinet. Ball valves are provided only on models with dual line regulators on the inlet and outlet sides of each regulator determine which regulator is “on line” and which is “off line”. Note: when the ball valve handle is perpendicular to the pipeline, the ball valve is closed.
4. Using a ¼” hex wrench, a hole(s) has been provided in the front cover to access the line regulator feed screw (shown here). Clockwise increases the line pressure and counter-clockwise decreases the line pressure.

Item	Part Number	Description
Primary Regulator & Repair Kits	68-0003	0 – 300 psig delivery, 3,000 psig inlet, 6 port
	68-0003RK	Rebuild kit for primary regulator 68-0003
Line Regulators & Repair Kits	68-0004	5 – 125 psig standard flow line regulator
	68-0004RK	Rebuild kit for 5 - 125 standard flow line regulator 68-0004
	68-0002	5 – 125 psig high flow line regulator
	68-0002RK	Rebuild kit for 5 - 125 high flow line regulator 68-0002
	68-0001	10 – 200 psig high flow line regulator
	68-0001RK	Rebuild kit for 0 – 200 high flow line regulator 68-0001
Circuit Board	35-1005	Universal TMCU/TMLU Manifold Circuit Board
Pressure Switch (in control cabinet)	14-2013	Universal TMCU/TMLU Pressure Switch
Pressure Switches (outside cabinet)	PS-1-80	High/Low line pressure switch range 1 – 80 psig preset @ 40/60
	PS-2-150	Emergency reserve in use switch range 2 – 150 psig
	PS-10-250L	N2 Low line pressure switch range 10-250 psig preset @ 160 on fall
	PS-10-250H	N2 High line pressure switch range 10-250 psig preset @ 200 on rise
	PS-160-3200	Emergency reserve low switch range 160 – 3200 psig preset @ 1200
Pressure Switch, Gauge, DISS Assemblies (includes above appropriate pressure switch (switches 2 for N2) pre-assembled in a Tee or Cross with a 4" gauge & DISS union check valve	PST-04	N2O
	PST-08	CO2
	PSX-12	N2
	PST-16	Medical Air
	PST-24	Oxygen
DISS Demand Check Union Assemblies	PS-04	Nitrous Oxide ¼ M npt demand valve x 1/8 M npt nipple
	PS-08	CO2 ¼ M npt demand valve x 1/8 M npt nipple
	PS-12	N2 ¼ M npt demand valve x 1/8 M npt nipple
	PS-16	Medical Air ¼ M npt demand valve x 1/8 M npt nipple
	PS-24	Oxygen ¼ M npt demand valve x 1/8 M npt nipple
Solenoid Valves	48-1007	Used on TMCU models for all gas services
	48-1008	Used on TMLU models for all gas services - left side
	48-1009	Used on TMLU models for all gas services - right side
Power Supply	AA400-C	110 VAC / 24 & 5 VDC
Gauges (inside cabinet)	14-1018	0 – 4,000 psig 1 ½" x 1/8 M npt center back
	14-1016	0 – 400 psig 2" x ¼ M npt bottom port
	14-1017	0 – 400 psig 1 ½" x 1/8 M npt center back
	14-1009	0 – 300 psig 1 ½" x 1/8 M npt center back
	14-1008	0 – 100 psig 1 ½" x 1/8 M npt center back
Gauges (outside cabinet)	ZV300-5	0 – 100 psig 4" x ¼ M npt bottom port
	ZV300-6	0 – 300 psig 4" x ¼ M npt bottom port
Relief Valves	RV-22-075	75 psig x ½ M npt inlet
	RV-22-150	150 psig x ½ M npt inlet
	RV-22-250	250 psig x ½ M npt inlet
	RV-11-400	400 psig x ¼ M npt inlet
Intermediate Check Valve	17-4003	½ M npt x ½ OD tube compression
Pigtails for cylinders	20-1001	24" single loop rigid copper O2 – CGA 540
	20-0001	24" Flexible stainless braided O2 - CGA 540
	20-1002	24" single loop rigid copper N2O – CGA 326
	20-0002	24" Flexible stainless braided N2O - CGA 326
	20-0003	24" Flexible stainless braided CO2 – CGA 320
	20-0004	24" Flexible stainless braided AIR – CGA 346
	20-0005	24" Flexible stainless braided N2 or Ar – CGA 580
Pigtails for portable bulk vessels	20-2001	72" Flexible with check valve – O2 – CGA 540
	20-2002	72" Flexible with check valve – N2 or Ar – CGA 580
	20-2003	72" Flexible with check valve – CO2 – CGA 320
	20-2004	72" Flexible with check valve – N2O – CGA 326
Union	17-0169	½" M npt x ½" M npt 3 piece union
Wall Brackets	WB-1	Single cylinder wall bracket with chain
	WB-2	Dual cylinder wall bracket with chain

Note: trouble-shooting and repairs should be done by qualified personnel only.

Symptom	Probable Cause	Remedy or Check
Cabinet Indicator Lights		
No indicator lights on front panel illuminate when power is connected.	Power input	Check electrical power supply
	Blown fuse	Check fuses on power supply
	Internal wiring disconnected	Check all wiring connections
Red indicator lights are on but both banks are full	Master valve or cylinder valves on bank are closed	Open valves SLOWLY
	Pigtails are installed with check valves in wrong direction	Close cylinders and re-install pigtails in proper flow direction
	Bank pressure is not sufficient for logic board to place it in "In Use" or "Ready" status	Replace cylinders with full cylinders. Or, if using portable bulk vessels, open pressure building valve on vessel or replace portable bulk vessel with higher delivery pressure portable bulk vessel
	Primary regulators are out of adjustment	Adjust primary regulators – per manual
	Circuit board defective	Replace circuit board
Loss of Cylinder Contents		
Audible or inaudible gas leakage (origin unknown)	Leakage at manifold piping connections	Tighten, reseal or replace
	Leakage thru manifold solenoid vent / relief	Replace solenoid valve
	Regulator with bad seat	Rebuild or replace regulator
Venting at relief valve	Leaking gauge	Replace gauge
	Regulator set too high	Set delivery pressure per specifications
	Overpressure due to failed regulator seat	Rebuild or replace regulator
	Regulator freeze-up (N2O or CO2) / heater failure	Repair heater or add heater and consider adding additional cylinders
Left bank will not be placed into ready (Red/Empty status stays illuminated) when bank pressure is full	Left primary regulator is out of adjustment – set too low	Adjust left primary regulator – per manual
Right bank (ditto above)	Right primary regulator is out of adjustment – set too low	Adjust right primary regulator – per manual

Note: trouble-shooting and repairs should be done by qualified personnel only.

Symptom	Probable Cause	Remedy or Check
Both banks feeding	Leaking header/pigtail connection	Tighten fitting or re-tape with Oxygen safe Teflon tape (if npt fitting) and tighten.
	Leaking intermediate check valve	Replace check valve
	Leaking solenoid valve	Replace solenoid valve
	Model TMCU – primary regulator(s) out of adjustment	Set delivery pressure to specifications per chart on page 20
	Model TMLU – inlet pressure to control cabinet is too low	Verify that minimum inlet pressure requirements are met
	Model TMLU – portable bulk venting	Gas usage not high enough to justify portable bulk reserve
	Model TMLU – gas flowing thru economizer circuit	This is normal when reserve bank pressure is 50 psig greater than service bank pressure – no correction needed to manifold control cabinet. May consider reducing size of banks if reserve bank is more than 35% depleted at time it is placed in service "In Use" If gas is flowing thru economizer when the reserve bank pressure is not 50 psig greater than service bank pressure – the economizer check valve needs to be replaced.
Changeover occurs, reserve in use alarm is triggered and then clears	Manifold is unable to support required flow	Increase manifold flow capacity (call factory for assistance)
	Model TMLU – portable bulk vessel(s) are unable to support required flow	Increase bank size. If using two or more portable bulk vessels per bank currently, connect pigtail(s) (no check valve) from vent to vent of all vessels on the same bank and open the vent valves. This will equalize the head pressure of the vessels and utilize the combined vaporization capacity – not just the capacity of the vessel with the highest delivery pressure set point.

General Maintenance

Control Cabinet

Daily – Record line and bank pressures
Monthly – Check regulators, compression fittings and valves for external leakage. Check valves for closure ability.
Annually – Check relief valve pressures. Check regulator seats.

Manifold Headers & Pigtails

Daily – Observe nitrous oxide and carbon dioxide systems for cylinder frosting or surface condensation. Should excessive condensation or frosting occur it may be necessary to increase manifold capacity.
Monthly – Inspect valves for proper closure. Check pigtails for cleanliness, flexibility, wear, leakage, and thread damage. Replace damaged pigtails immediately. Inspect header check valves for closure ability.
Every 4 years – Replace all pigtails

Appendix A – Manifold Specifications

Maximum Inlet Pressure: Model TMCU: 2,500 psig
Model TMLU: 400 psig

Operating Ambient Temperature range:

Model TMCU: 0 F (-18 C) to 130 F (54.4 C) all gases except N20 & CO2
20 F (-7 C) to 130 F (54.4 C) N2O & CO2
Model TMLU -20 F (-29 C) to 130 F (54.4 C)

Storage Temperature: -20C(-4F) to +85C(185F)
AC Input: 120 volts AC - 50-60 Hz
Input Fuse: 5 amp input AC line fuse protects the input wiring to power supply
Power Consumption: 45W (0.4 amps using 120 VAC) maximum without heaters
245W (2.1 amps using 120 VAC) maximum with heaters
Pressure Measurement Accuracy:
All gauges are 3/2/3 design. They are ± 3% of full scale in the first and last 1/3 rd of their range. They are ± 2% of full scale in the middle 1/3rd of their range.
Solenoid Valve: 24VDC – Normally Open (Valve opens when de-energized)
Control Cabinet Dimensions: Dimensions excluding inlet & outlet fittings
15 ¾" W x 24 ¾" H x 9 ¼" D
Dimensions including inlet & outlet fittings
17 ¼" W x 27" H x 9 ¼" D

Primary Regulator Settings (TMCU Models)
Note: All settings done with 2,200 psig cylinder pressure and with slight gas flow thru the manifold. Primary regulator outlet pressure will vary with varying inlet pressures. (The outlet pressure will rise as the cylinder pressure decreases as much as 40 – 50 psig). All pressures shown in psig.

Normal Delivery Pressure (factory delivery pressure)	**Left Primary Regulator Set Point**	**Right Primary Regulator Set Point**
50	160	120
80	260	220
190	260	220

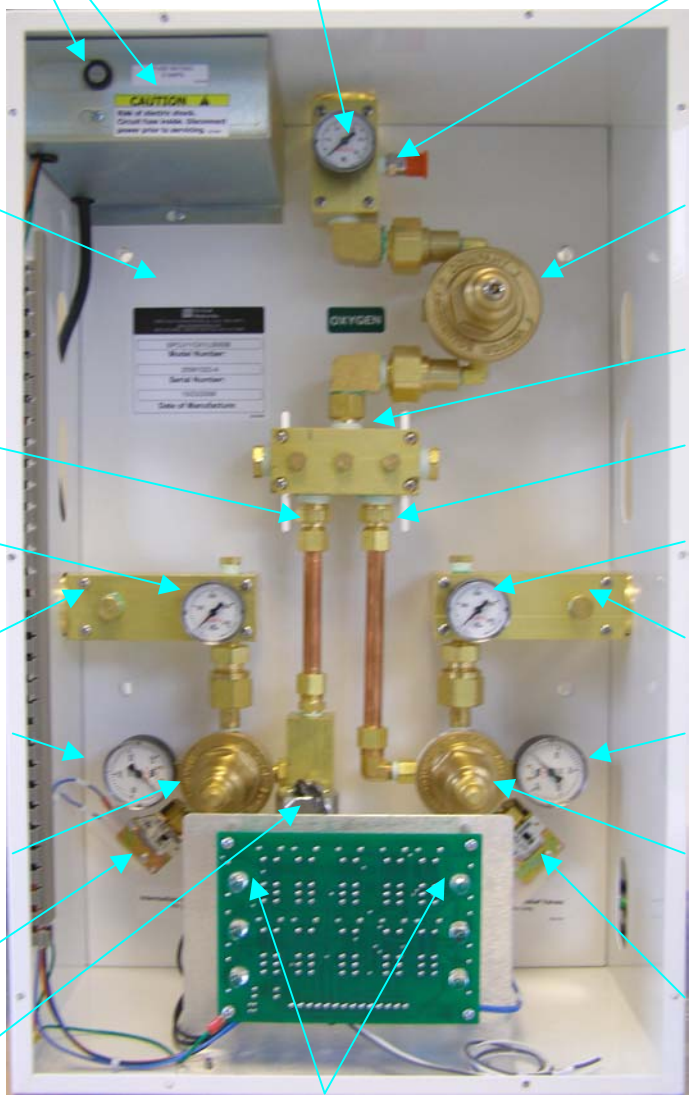
110 VAC connection terminals, fuses and power supply (transformer)

Line pressure gauge

Outlet – ½ F npt (not visible in this photo – outside cabinet)

Line pressure relief valve ½ F npt (not visible in this photo - outside cabinet)

DISS demand valve – may be used to bleed line pressure during service and as an emergency feed port for the facility



Possible line pressure regulator (if ordered with dual line regulators)

Line pressure regulator

Intermediate block

Check valve

Check valve

Inlet pressure gauge

Inlet pressure gauge

Inlet pressure block

Inlet block

Left bank primary regulator outlet pressure gauge

Right bank primary regulator outlet pressure gauge

Left bank primary regulator

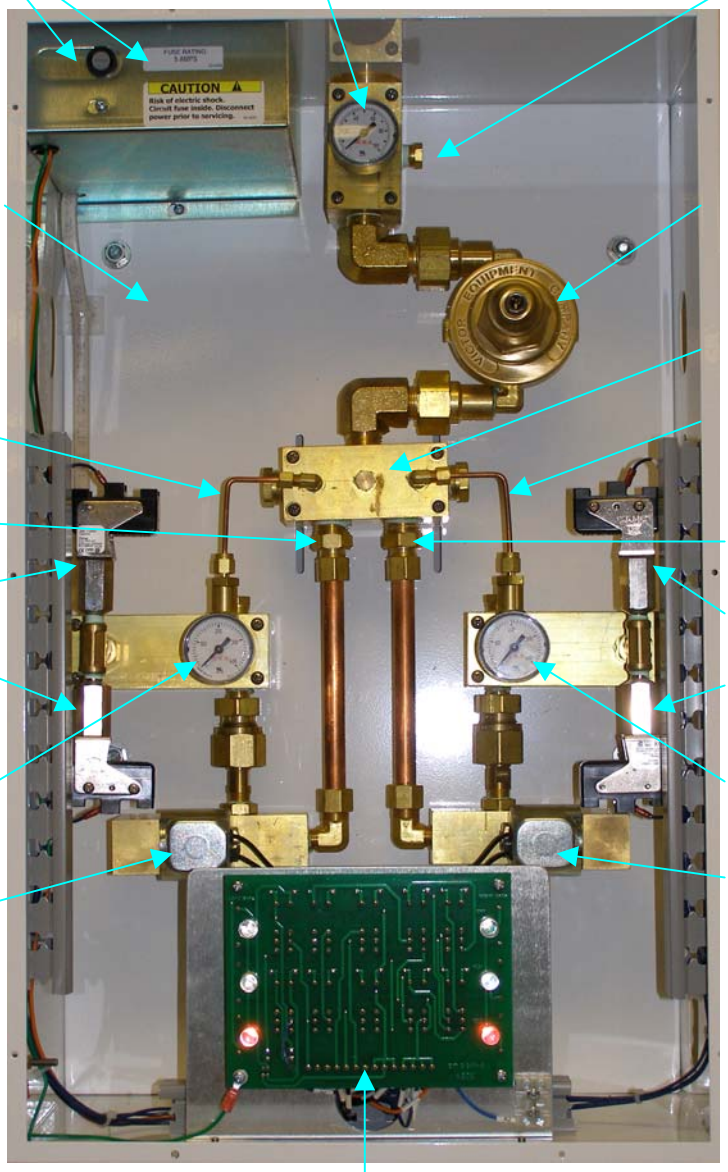
Right bank primary regulator

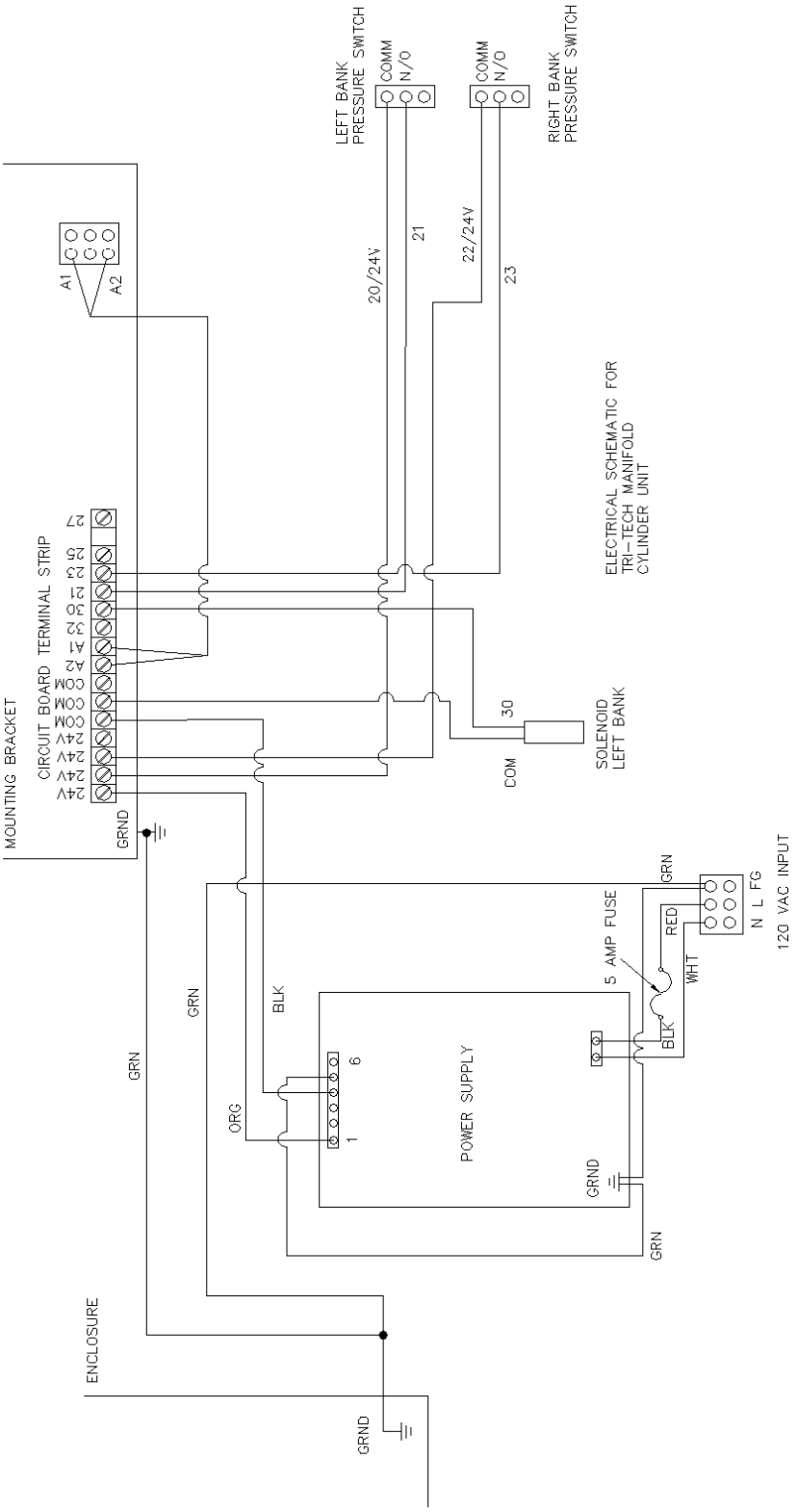
Pressure switch

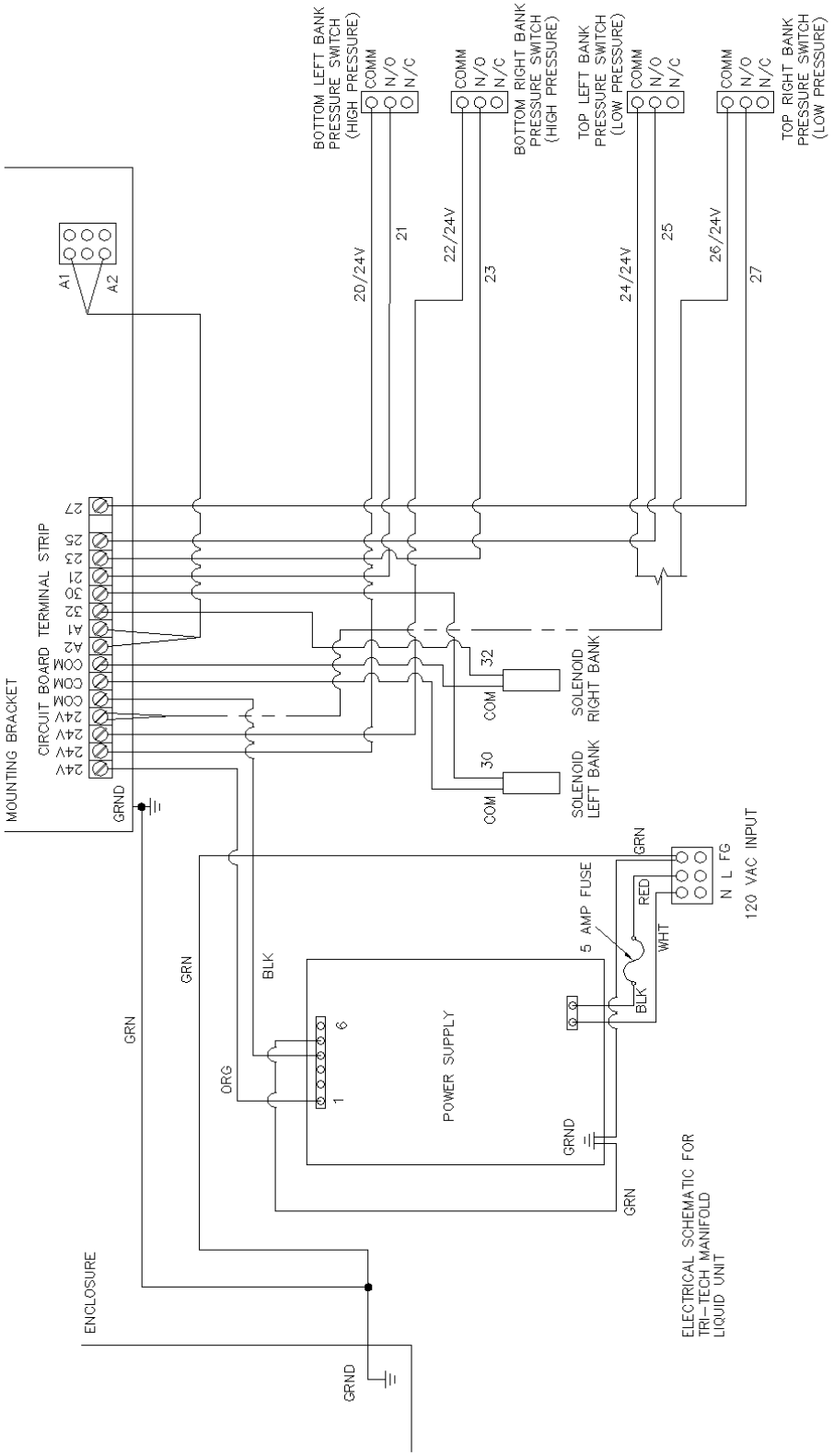
Pressure switch

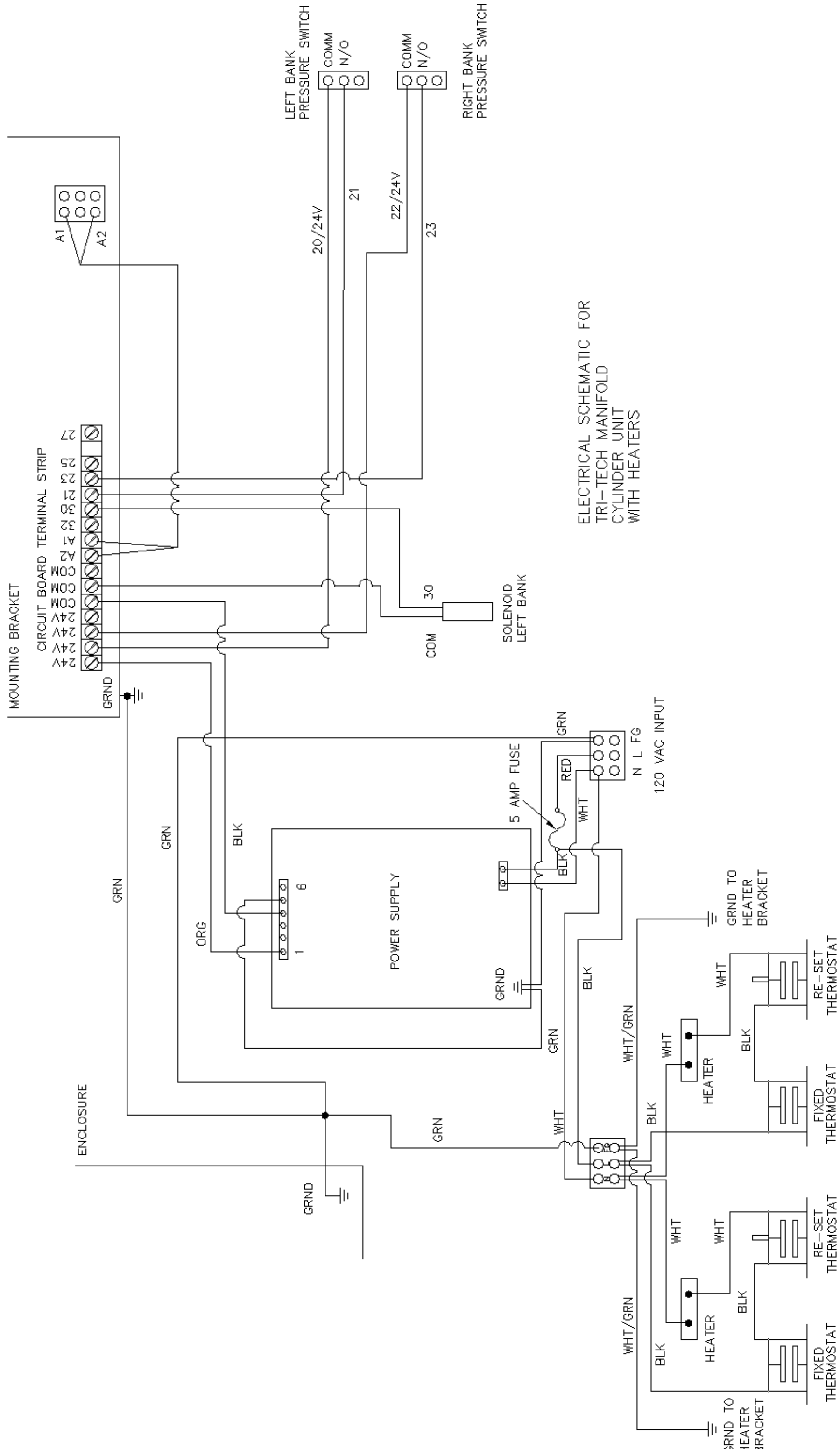
Solenoid valve

Intermediate pressure relief valves (behind circuit board on bottom port of primary regulators


Line pressure gauge
Outlet – ½ F npt (not visible in this photo – outside cabinet
Line pressure relief valve ½ F npt (not visible in this photo – outside cabinet)
110 VAC connection terminals, fuses and power supply (transformer)
DISS demand valve – may be used to bleed line pressure during service and as an emergency feed port for the facility
Possible line pressure regulator (if ordered with dual line regulators)
Line pressure regulator
Intermediate block
Economizer circuit
Economizer circuit
Check valve
Check valve
Low pressure switch
Low pressure switch
High pressure switch
High pressure switch
Inlet pressure gauge
Inlet pressure gauge
Solenoid valve
Solenoid valve
Circuit board


ELECTRICAL SCHEMATIC FOR
TRI-TECH MANIFOLD
CYLINDER UNIT
LEFT BANK
PRESSURE SWITCH
RIGHT BANK
PRESSURE SWITCH
COMM
N/O
20/24V
21
22/24V
23
A1
A2
MOUNTING BRACKET
CIRCUIT BOARD TERMINAL STRIP
27
25
23
21
30
32
A1
A2
COM
COM
COM
24V
24V
24V
24V
GRND
30
COM
SOLENOID
LEFT BANK
GRN
N L FG
120 VAC INPUT
5 AMP FUSE
RED
WHT
BLK
GRN
BLK
GRN
ORG
6
1
POWER SUPPLY
GRND
GRN
ENCLOSURE
GRND


BOTTOM LEFT BANK PRESSURE SWITCH (HIGH PRESSURE)
COMM
N/O
N/C
BOTTOM RIGHT BANK PRESSURE SWITCH (HIGH PRESSURE)
TOP LEFT BANK PRESSURE SWITCH (LOW PRESSURE)
TOP RIGHT BANK PRESSURE SWITCH (LOW PRESSURE)
20/24V
21
22/24V
23
24/24V
25
26/24V
27
A1
A2
MOUNTING BRACKET
CIRCUIT BOARD TERMINAL STRIP
GRND
32
30
COM
SOLENOID RIGHT BANK
SOLENOID LEFT BANK
GRN
RED
WHT
BLK
5 AMP FUSE
N L FG
120 VAC INPUT
POWER SUPPLY
ORG
ENCLOSURE
ELECTRICAL SCHEMATIC FOR
TRI-TECH MANIFOLD
LIQUID UNIT


ELECTRICAL SCHEMATIC FOR
TRI-TECH MANIFOLD
CYLINDER UNIT
WITH HEATERS
LEFT BANK PRESSURE SWITCH
RIGHT BANK PRESSURE SWITCH
COMM
N/O
20/24V
21
22/24V
23
A1
A2
MOUNTING BRACKET
CIRCUIT BOARD TERMINAL STRIP
27
25
23
21
3G
32
A1
A2
COM
COM
COM
24V
24V
24V
24V
GRND
30
COM
SOLENOID LEFT BANK
POWER SUPPLY
1
6
5 AMP FUSE
N L FG
120 VAC INPUT
GRN
BLK
ORG
RED
WHT
WHT/GRN
ENCLOSURE
GRND TO HEATER BRACKET
HEATER
RE-SET THERMOSTAT
FIXED THERMOSTAT

Buyer's purchase order is subject to the following conditions of sale:

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Seller's published prices, terms of payment, including discounts, and transportation terms in effect at date of shipment of goods, shall apply. Prices are subject to change without notice. All pricing is in U.S. dollars.

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Delivery will be made F.O.B. Seller's shipping point or Vendor's plant, all risk of loss shall pass to Buyer upon delivery to carrier, and Buyer shall be responsible for obtaining insurance if desired. Seller will ship by carrier selected by Seller unless specified by Buyer in its order.

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Unless otherwise specified, invoices shall be due and payable with thirty (30) days of the invoice date. Payments shall be in U.S. dollars. A 1.5 % per month finance charge will be added to any invoice not paid within terms. A $20.00 bank charge will be added to any returned checks.

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