Installation & Operating Instructions for Genesys2 LL & PL Series Manifolds

Model LL

Model PL

Features & Benefits

- Fully automatic changeover – no valves or levers to reset after each changeover
- Compatible with Tri-Tech Medical T-Net medical gas monitoring system saving you time and improving safety
- Economizer software – ensures empty portable bulk vessels will not be put back into reserve and the entire liquid contents of portable bulk vessels is used
- Economizer hardware – allows head pressure from secondary portable bulk vessels to be used – instead of vented
- Field upgradeable design – kits allow unit to be changed from - i.e. cylinders to portable bulk or from standard flow to high flow or from lower delivery pressure to higher delivery pressure
- Circuit board triggers all required NFPA 99 alarms – simplifying wiring and reducing cost
- Unit includes hi/low line pressure transducer – eliminating need to purchase hi/low pressure switch improving alarm accuracy and improving safety (manifold will automatically alarm if a transducer goes bad)
- Easy to service layout/design
- Microprocessor based control panel incorporates LED's and illuminated text display readable even in poor lighting conditions
- Electronic monitoring of circuits with up to 19 error, alarm or information messages displayed for ease of maintenance
- Accurate, long life pressure transducers for monitoring of line pressure and bank pressures
- Analog gauges also provided for use in event of power failure
- Pressures may be displayed in psi / kPa / BAR
- Built in DISS gas specific emergency feed ports
- Built in emergency reserve bank ports
- Input power 120 VAC, 50 to 60 Hz (120 – 240 VAC, 50 to 60 Hz on all models without heaters)
- Dual line pressure regulators on NFPA 99 models
- 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
- Available in weatherproof cabinet for outdoor 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 alarms and leakage. 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

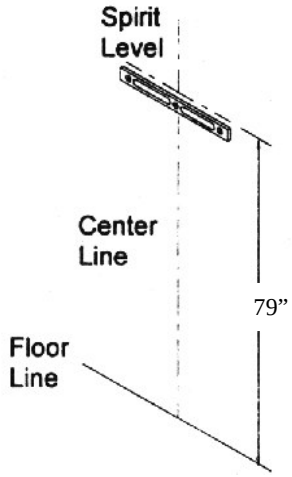
Manifolds should be installed in accordance with guidelines stated by the National Fire Protection Association, the Compressed Gas Association, OSHA, and all applicable local codes. Central supply systems and cylinders should not be placed in a location where the temperature will exceed 125° F (51.6° C) or fall below -20° F (-29° 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. The flow capacity of Nitrous Oxide and Carbon Dioxide manifolds depend upon ambient temperature and the number of cylinders on line. Contact your gas supplier to determine the vaporization rate of Carbon Dioxide and Nitrous Oxide cylinders for the ambient temperature climate at the installation site.

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

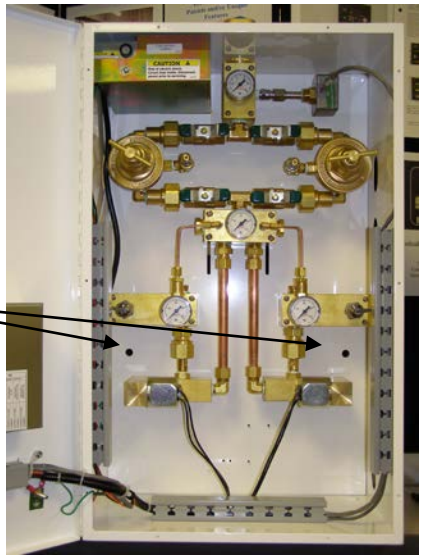


1. Determine and mark the vertical center line for installation of the manifold control cabinet.

2. If you wish to place cylinders under the manifold cabinet, measure from the floor to a point 79” in height above the finished floor of this vertical line. Using a level, mark a horizontal line at this point extending approximately 7” to the left and 7” to the right of center. This line indicates the location for the bottom two mounting bolts of the Z mounting bracket. Mounting the Z bracket @ 79” *aff will result in the bottom of the manifold cabinet being 60” *aff – allowing cylinders to be placed under the manifold cabinet. If you do not wish to place cylinders under the manifold cabinet, measure from the floor to a point 58 1/2” *aff and follow the same steps above.

3. Mount the Z mounting bracket to the wall using fasteners suitable for the type of wall construction.

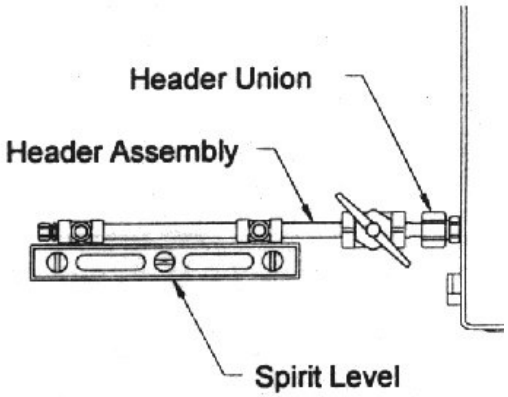
4. Temporarily hang the manifold cabinet on the Z bracket just installed, mating it with the Z bracket on the back of the manifold cabinet. Mark the locations of the two lower cabinet mounting holes on the wall.



5. Remove the manifold cabinet and install female portion of suitable fasteners for lower cabinet mounting holes.

6. Re-hang the manifold cabinet and install suitable fasteners in the lower cabinet mounting holes.

Header Installation



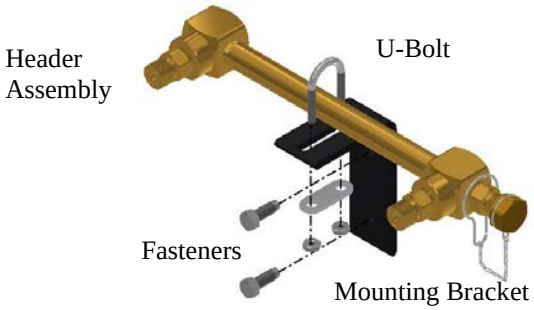
1. Attach the headers to the union on each side of the manifold control cabinet. Using a level, mark the placement of mounting brackets while keeping the header on a horizontal plane.

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.

* aff = above finished floor

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

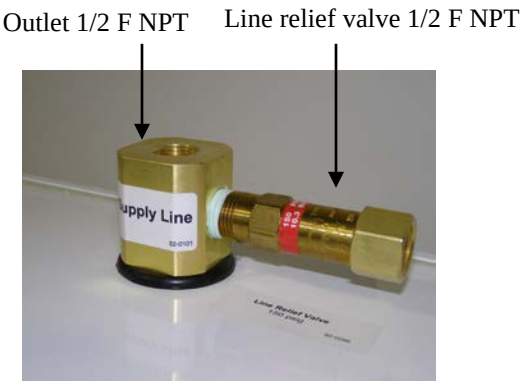
4. Fit the U – bolt over the header piping and tighten the two mounting nuts.



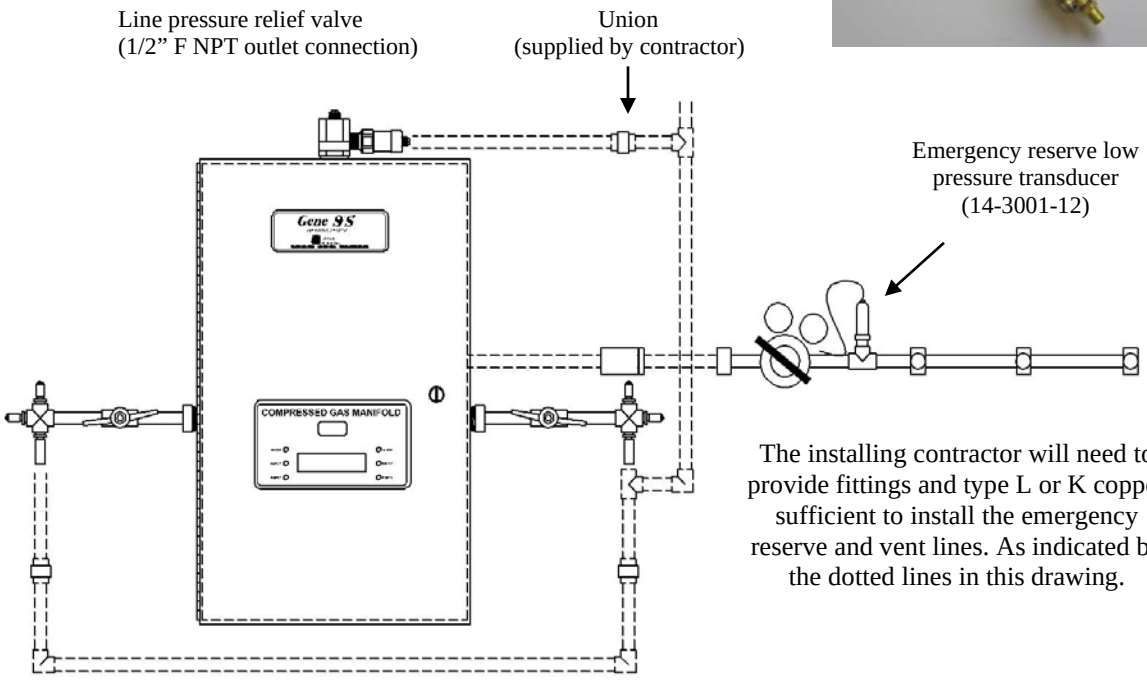
Plumbing – Model LL

1. The outlet of the manifold is located at the top center of the unit as shown here. The outlet connection is 1/2" NPT female. A source valve 1/2" M NPT x 3/4" tube extension has been provided with all NFPA 99 compliant models (part no. 48-0023) and should be installed in the manifold outlet. It may be necessary to install a 1/2" NPT 90° street elbow (part no. 17-0300 sold separately) to meet the confines of the installation site.

2. Source valve part no. 48-0023 (should be installed on the manifold cabinet prior to mounting on the wall)



Recommended Vent Line and Emergency Reserve Plumbing



The installing contractor will need to provide fittings and type L or K copper sufficient to install the emergency reserve and vent lines. As indicated by the dotted lines in this drawing.

Plumbing – Model LL

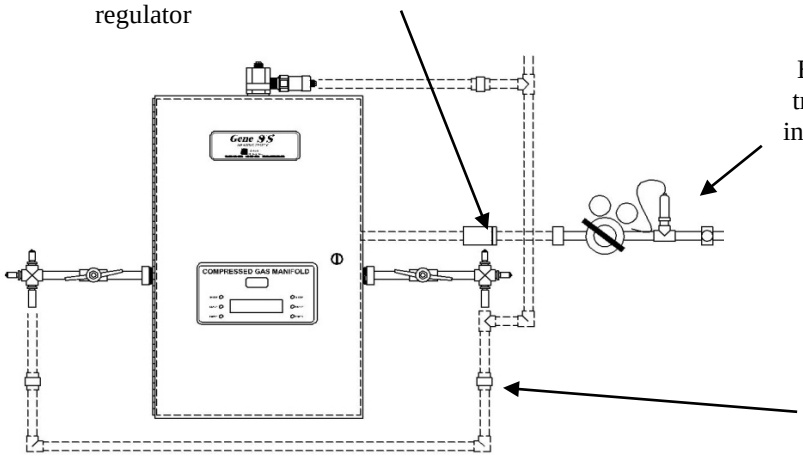
1. In addition to connecting the left & right primary and secondary portable bulk vessel supply banks, the LL models must also have a high pressure reserve bank of cylinders connected to the cabinet to be in compliance with NFPA 99 guidelines.

2. The model LL has one 1/2" NPT female line pressure relief valve connection and two 3/8” NPT female intermediate pressure relief valve connections. (This installation is typical – with the two intermediate relief vent lines and the line pressure relief vent line brought together as a common vent line that exits the facility either thru an exterior wall or the roof). See bottom of page 6.

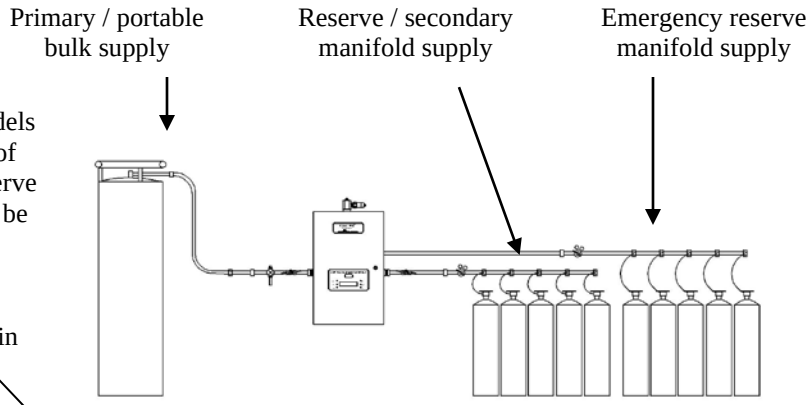
3. The intermediate block has a 1/2" NPT plug which may be removed to allow the emergency reserve to be piped in thru either the left or the right side of the cabinet. Slots have been provided on both the left and right sides of the control cabinet to allow for the high pressure reserve piping.

4. Emergency reserve in use pressure transducer (part no. 14-3002) - installed in factory when ordered with LL manifold.

5. CV-050F check valve (must be installed between the manifold cabinet and downstream of the high pressure reserve regulator



Plumbing – Model PL



1. In addition to connecting the left primary portable bulk vessel supply bank, the PL models must also have a high pressure reserve bank of cylinders and a high pressure emergency reserve bank of cylinders connected to the cabinet to be in compliance with NFPA 99 guidelines.

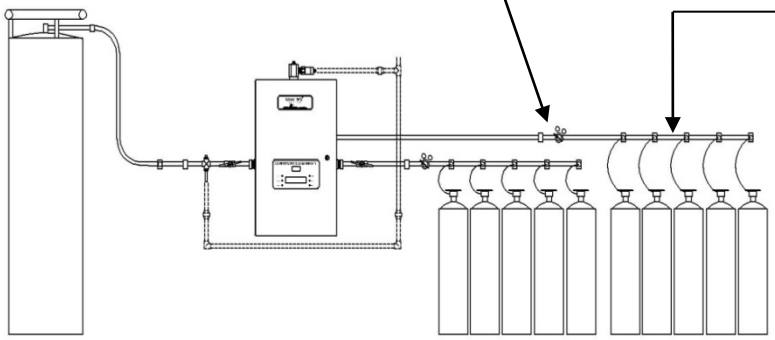
2. A transducer (part no. 14-3001-5) must be installed (by installer) into the port provided in the right / secondary manifold header.

3. The model PL has one 1/2" NPT female line pressure relief valve connection and one 3/8 NPT female intermediate pressure relief valve connections. (This installation is typical – with the intermediate relief vent line and the line pressure relief vent line brought together as a common vent line that exits the facility either thru an exterior wall or the roof). (See drawing at bottom of page).

4. The intermediate block has a 1/2" NPT plug which may be removed to allow the emergency reserve to be piped in through either the left or the right side of the cabinet. Slots have been provided on both the left and right sides of the control cabinet to allow for the high pressure reserve piping.

5. Emergency reserve in use pressure transducer (part no.14-3002) - installed in factory when ordered with PL manifold.

6. CV-050F check valve (must be installed between the manifold cabinet and downstream of the high pressure reserve regulator



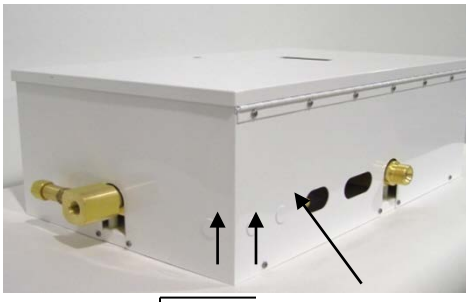
Emergency reserve low pressure transducer (14-3001-12) installed into port on RWP reserve manifold by plumber.

The installing contractor will need to provide fittings and type L or K copper sufficient to install the emergency reserve and vent lines. As indicated by the dotted lines in this drawing.

Electrical

1. Use one of the two 1/2" conduit knock-outs provided located nearest to the top left corner of the cabinet to route conduit to supply 120 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)**.

   120-240 / 1 / 50 – 60 Hz may be used with all units. If the unit has heaters, the heaters only may be wired to 120/1/50-60. An additional transformer (sold separately part no. 35-3004) is required to connect heaters to 240 VAC



Conduit knockouts for 120 VAC

Conduit knockout for low voltage alarm signals

2. Remove the power supply cover by loosening the screw located at the top of the cover and then sliding the power supply cover to the right until the screw is in the center of the tear-drop shaped cut out. Next, pull the cover forward until it clears the screw head and the fuse. Note: the bottom of the cover inserts into a slot in the back plate. Allow the cover to rest on the dual line regulator assembly plumbing just below the power supply.

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.

Neutral

Load

Field Ground

4. Connect the 120 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 may affect the digital display of the manifold.

Wiring – remote alarms – Model LL

Caution: Never connect or disconnect any electrical components with the power on. This may result in damage to components and is not covered under warranty

1. Wires for remote alarms should be brought into the cabinet thru conduit or shielded cables (check local code requirements) thru the knockouts 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.**

Knock out for low voltage remote alarm wiring

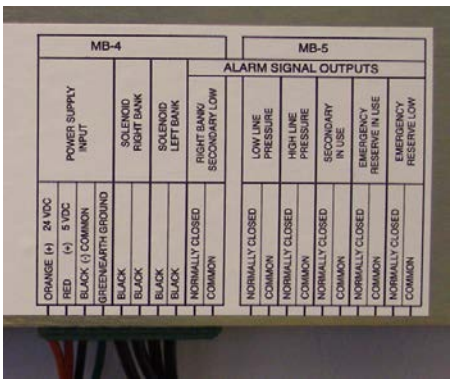
2. If you are installing a model LL with emergency reserve there are five alarm signals required per NFPA 99:
   • High Line Pressure,
   •Low Line Pressure
   •Secondary in Use
   •Emergency Reserve in Use
   •Emergency Reserve Low
   The circuit board will trigger all five of these alarms (no pressure switches are required). The line pressure transducer must be installed outside of the cabinet – downstream of the source or main line valve with the cable being wired to the manifold circuit board to comply with NFPA 99. In this photo the line pressure transducer has been assembled into our PSM-XX assembly and connected to the gauge port on the downstream (patient side) of the source valve and wired to the manifold circuit board.

Line pressure transducer

3. The line pressure transducer may also be mounted inside the cabinet (as shown here). In this arrangement, a hi/low pressure switch (sold separately) will be required to meet the NFPA 99 recommendations. Note: the hi/low pressure switch (supplied separately) would be wired directly to the master alarm panels – **not to the manifold circuit board**.

4. Remote alarm wires are connected to the circuit board at the terminal gate labeled MB5. Signal wires and Common wires for; Low Line Pressure, High Line Pressure, Secondary in Use, Emergency Reserve in Use and Emergency Reserve Low should be connected to the terminals as indicated.

5. Note: all remote alarm terminals are normally closed when the gas pressure is in the normal range. The hi/low set points pre-programmed into the manifold circuit board logic chip are as per the charts on page 33. If desired, the high and low line pressure alarm set points may be adjusted by following the instructions on page 22.



Wiring – remote alarms – Model PL

Caution: Never connect or disconnect any electrical components with the power on. This may result in damage to components and is not covered under warranty

1. Wires for remote alarms should be brought into the cabinet thru conduit or shielded cables (check local code requirements) thru the knockouts 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.**

Knock out for low voltage remote alarm wiring

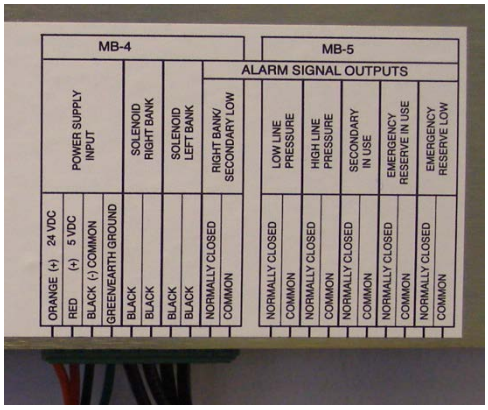
2. If you are installing a model PL with secondary and emergency reserve there are six alarm signals required per NFPA 99:
   • High Line Pressure,
   •Low Line Pressure
   •Secondary in Use
   •Secondary (right bank) Low
   •Emergency Reserve in Use
   •Emergency Reserve Low
   The circuit board will trigger all six of these alarms (no pressure switches are required). The line pressure transducer must be installed outside of the cabinet – downstream of the source or main line valve with the cable being wired to the manifold circuit board to comply with NFPA 99. In this photo the line pressure transducer has been assembled into our PSM-XX assembly and connected to the gauge port on the downstream (patient side) of the source valve and wired to the manifold circuit board.

Line pressure transducer

3. The line pressure transducer may also be mounted inside the cabinet (as shown here). In this arrangement, a hi/low pressure switch (sold separately) will be required to meet the NFPA 99 recommendations. Note: the hi/low pressure switch would be wired directly to the master alarm panels – not to the manifold circuit board.

4. Remote alarm wires are connected to the circuit board at the terminal gate labeled MB5 and MB4. Signal wires and Common wires for; Low Line Pressure, High Line Pressure, Secondary in Use, Emergency Reserve in Use and Emergency Reserve Low should be connected to the terminals as indicated on MB5. The Signal & Common wires for Secondary (right bank) Low should be connected to the terminals as indicated on MB4.

5. Note: all remote alarm terminals are normally closed when the gas pressure is in the normal range. The hi/low set points pre-programmed into the manifold circuit board logic chip are as per the charts on page 33. If desired, the high and low line pressure alarm set points may be adjusted by following the instructions on page 22.



Removing the Transducer and Demand Valve from inside the Manifold

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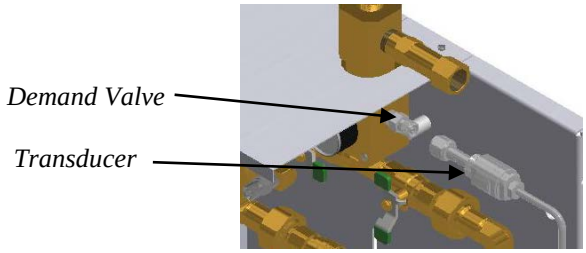
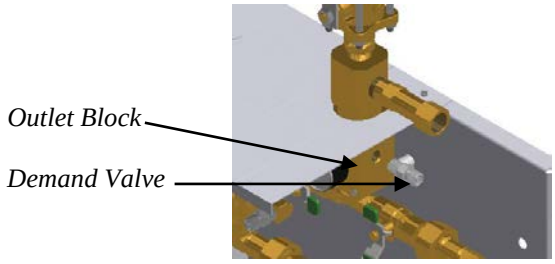
Close the area zone valve. Warning: Do not close zone valve until all personnel have been advised of the intended service and all systems requiring medical gas are being supplied from portable or alternate supplies. Bleed the residual gas pressure from the manifold.

1 Carefully remove the Transducer from the Demand Valve. *(But **do not** discard the Transducer & Demand Valve.)* Clean off any debris from the threads of the transducer nut and nipple.



2 Carefully remove the Demand Valve from the Outlet Block and remove any loose debris from the valve. Also carefully remove any loose debris from the threads of the Outlet Block.



3 Once the debris is removed from Outlet Block, replace the Demand Valve with a 1/4" NPT Hex Plug that comes with the kit. Thread on and tighten the plug onto the Outlet Block.

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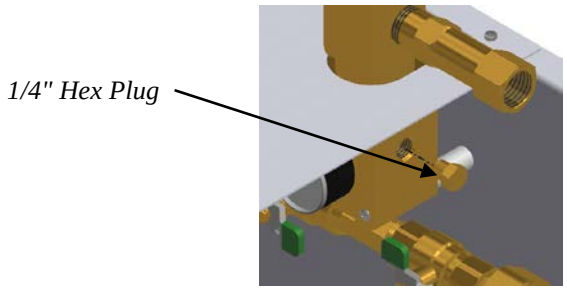

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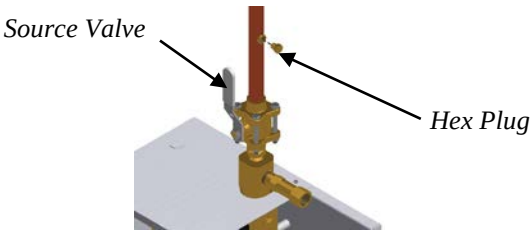
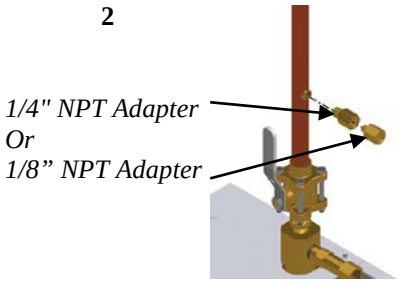
Installing the PSM-T Valve Kit outside the Manifold

1



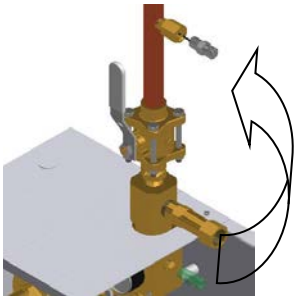
Remove the hex plug from the Source Valve side port. Carefully remove any debris from the threads of the Source Valve.

2



Select one of the two adapters that come with the PSM-T Valve Kit. After selecting the proper adapter, thread on and tighten the adapter onto the Source Valve side port.

3

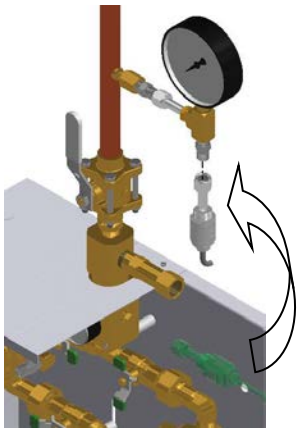


With the proper adapter selected. Re-wrap the threads of the Demand Valve with oxygen clean wrapping tape. Thread on and tighten onto the Source Valve. *(This is same Demand Valve from inside the manifold cabinet).*

4

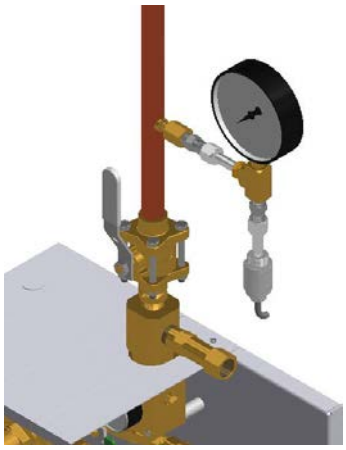
With the Demand Valve tighten, thread on and tighten the PSM-T on the Demand Valve.

5



With the PSM-T is tighten down, re-insert the Transducer through the manifold. *(This is the same Transducer from inside the manifold cabinet*). Thread on and tighten the Transducer to the bottom of the PSM-T valve Kit.

6

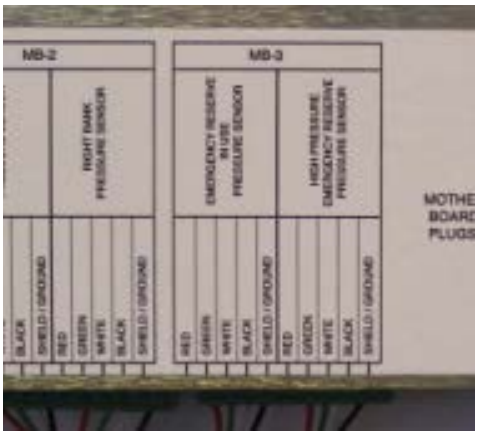


The PSM-T Valve kit is completed

Wiring – remote alarms – Model LL & PL

Caution: Never connect or disconnect any electrical components with the power on. This may result in damage to components and is not covered under warranty

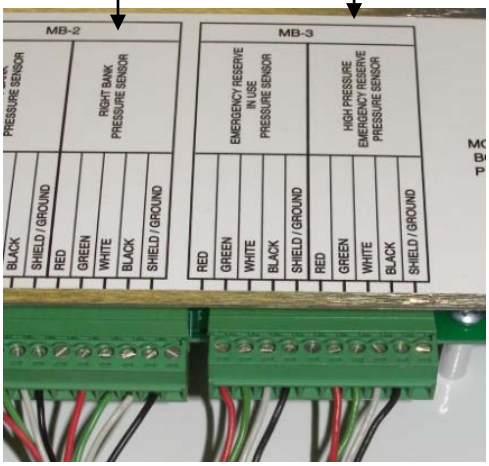
1. **BOTH MODELS LL & PL -** The 14-3001-12 emergency reserve low transducer must be wired to the manifold circuit board at the MB-3 connection points labeled "High Pressure Emergency Reserve Pressure Sensor".

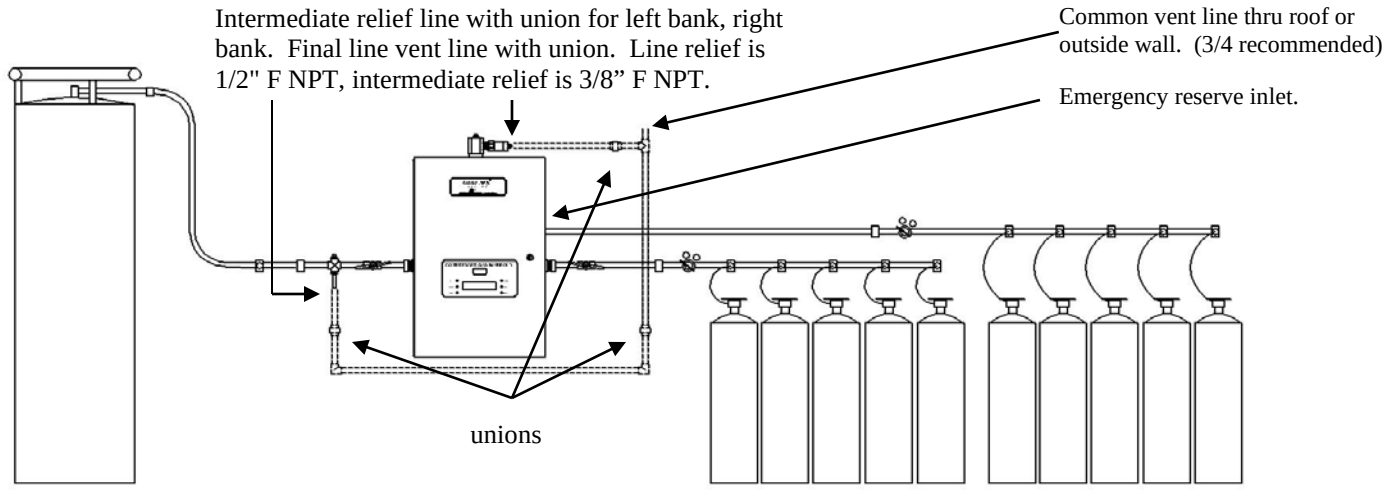


14-3001-12 wiring location

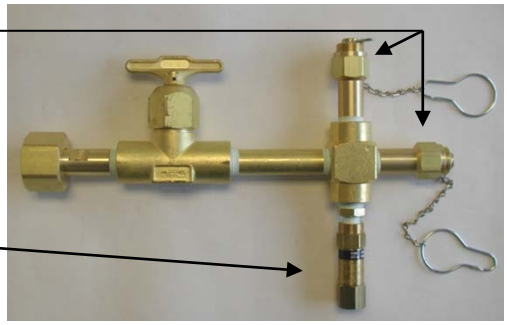
14-3001-5 wiring location

2. **MODEL PL ONLY –** The 14-3001-5 Secondary (right bank) Low transducer must be wired to the manifold circuit board at the MB-2 connection points labeled Right Bank Pressure Sensor.





Installing pigtails & attaching cylinders



1. This drawing above shows a completed installation. Note the copper vent tubing and tubing between the emergence reserve manifold and control cabinet are installed and furnished by the installer. The unions part no's are 17-0169 for the line relief and 17-0271 for the intermediate vent relief (two required for model LL if installed indoors).

2. The check valve outlet fittings on the manifold header bars are CGA (Compressed Gas Association) gas specific threads. Each of these fittings has an integral check valve. Make sure the 3 digit CGA number stamped on the outer perimeter of these fittings matches the CGA number stamped on the mating CGA fittings on the pigtails. Attach the pigtails to the check valve outlet fittings on the manifold header bars.

3. Connect the other end of the pigtail to the "Use" valve mating fitting on the portable bulk vessel. Open the use valve (turn counter-clockwise to open). 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.

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

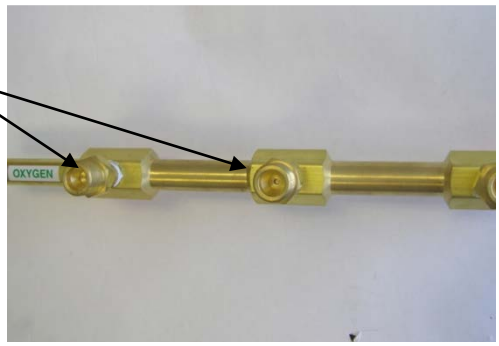
5. Verify that the pressure being supplied to the manifold cabinet exceeds the minimum inlet pressure requirements per the table on page 31.

Installing pigtails & attaching cylinders

1. The check valve outlet fittings on the manifold header bars are CGA (Compressed Gas Association) gas specific threads. Each of these fittings has an integral check valve. Make sure the 3 digit CGA number stamped on the outer perimeter of these fittings matches the CGA number stamped on the mating CGA fittings on the pigtails.

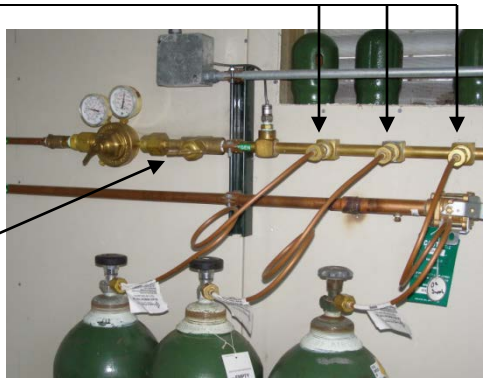
2. Connect the pigtails to the check valve outlets on the manifold headers.

Check valve outlet fittings



Attach pigtails to header check valve outlets using 1-1 /8" open end wrench

Master valve



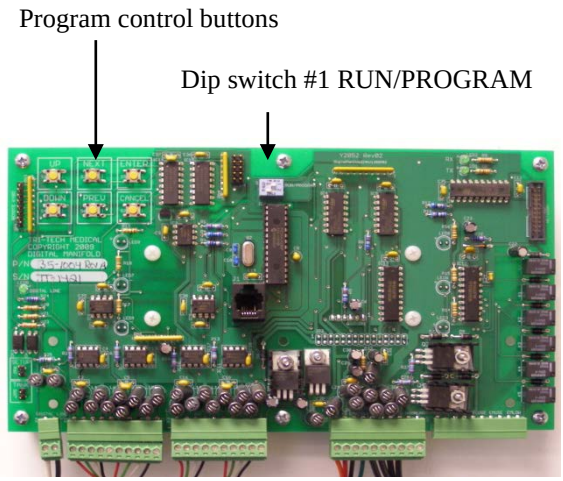
3. Check the master valves to be certain they are open (turn counter-clockwise to open). (Note: the master valve should always be left open. It is to be used only in the event of an emergency).

4. **SLOWLY** open all cylinder valves until fully open (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).

5. Note: The manifold has been tested for leaks at the factory, but the installer MUST check for leaks at all connections made during installation.

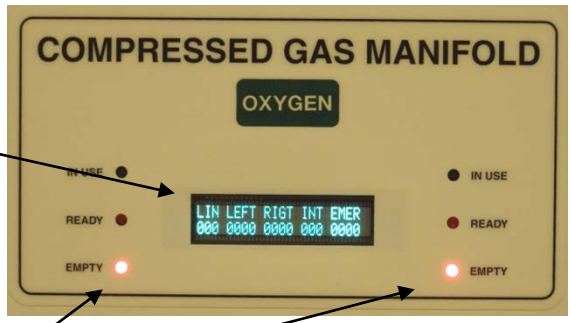
Start up & checking procedures – Model LL

The manifold is pre-programmed (per page 31) and tested before it is shipped. You may, however, wish to modify some of the programming (see page 20). The unit has been designed to allow some programming to be simply and safely altered in the field.

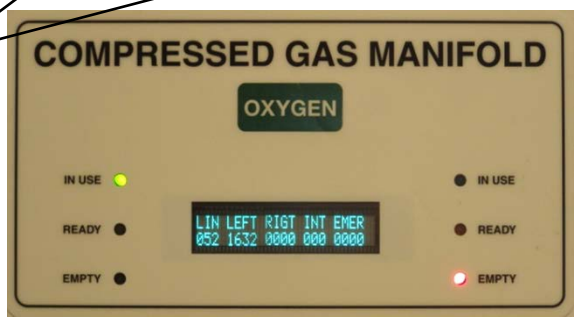


1. Start with all cylinders turned off and with zero pressure supplied to the manifold cabinet. To conduct the initial start-up testing of the manifold, it is simpler and faster if the circuit board is switched from the standard 'cycling view' (this is the mode in which it is shipped) to the 'global view'. To do this, the cover must be removed from the circuit board and the top #1 dip switch must be switched from the RUN mode to the PROGRAM mode. (Note: local alarms are **not** displayed when in the global view mode).

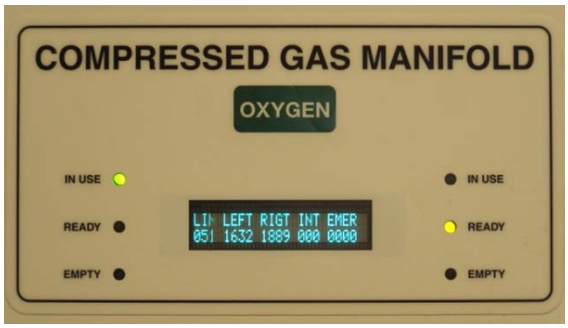
2. Turn on the 120 VAC to the unit. For both models LL & PL with Emergency Reserve headers utilizing the 14-3001-12, 14-3002 and 14-3001-5 (PL only) transducers, the display should illuminate showing all zeros for the Line Pressure (LIN), Left Bank Pressure (LEFT) and Right Bank Pressure (RIGHT). The intermediate (INT) and emergency reserve (EMER). (Note: If the LL or PL has been installed without an Emergency Reserve or with an Emergency Reserve utilizing pressure switches in place of transducers, the INT (intermediate and EMER (emergency reserve) can both be made to read zeros if a 35-3013 emergency reserve jumper kit is installed. Both the left and right bank Green (In Use) and Yellow LED's (Ready) should be extinguished and the Red (Empty) LED's should be illuminated.



3. Verify that the left vessel has 130 psi or higher by observing the pressure gauge on the vessel. SLOWLY open one cylinder valve on the left bank. The left bank pressure gauge (inside the cabinet) and the text display (on the outside of the cabinet) should show the full pressure of the cylinder. The Red (Depleted) LED for the left bank should have extinguished leaving only the Green (In Use) LED illuminated.



4. Verify that the right vessel has 130 psi or higher by observing the pressure gauge on the vessel. SLOWLY open one cylinder valve on the right bank. The right bank pressure gauge (inside the cabinet) and the digital display (on the outside of the cabinet) should show the full pressure of the cylinder. The Red (Depleted) LED for the right bank should have been extinguished and the Yellow (Ready) LED should have illuminated.



Start up & checking procedures (cont'd) –Model LL

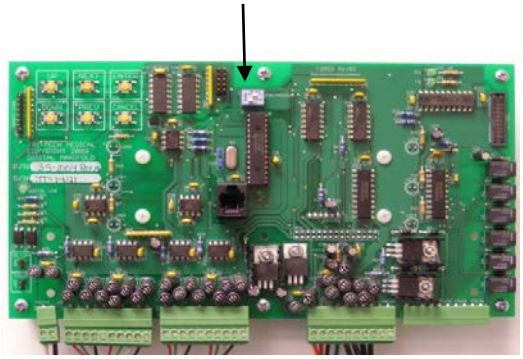
5. Turn off all open left bank cylinder valves. Create a slight flow of gas in the delivery pipeline system. DISS demand valves have been provided on the line regulators. Mating DISS fittings may be used to create a flow of gas within the manifold cabinet. The left bank pressure text display and pressure 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 supply in use alarm should activate on the master alarm(s).

6. SLOWLY reopen the cylinders on the left bank. The left bank pressure gauge and digital display should return to full pressure. The left bank yellow (Ready) LED will illuminate simultaneously the left bank red (Empty) will extinguish. All remote secondary supply in use alarms will be canceled.

7. Repeat steps 5 & 6 to simulate an empty right bank.

8. The model LL, will also display pressures for the intermediate area (INT) and the emergency reserve (EMER) and trigger the master alarm signal for "Emergency Reserve in Use" and "Emergency Reserve Low". To properly adjust the emergency reserve regulator the primary and secondary banks must both be shut off and the cabinet pressure drained. SLOWLY open one cylinder on the emergency reserve bank and observe the EMER pressure display and check to make sure it agrees with the gauge on the emergency reserve regulator. Adjust the delivery pressure from the emergency reserve regulator following the table on page 31 (if this is a 50 psi line pressure application this regulator should be set to 65 psi). **When testing the Emergency Reserve in Use and Emergency Reserve Low master alarms please note – there is a 15 second delay designed into the manifold logic**. The Emergency Reserve in Use alarm will be triggered when the INT pressure falls below 75 psi (50 psi line pressure application) for more than 15 seconds. The Emergency Reserve Low alarm will be triggered when the EMER pressure falls below 1200 psi for more than 15 seconds. Test the Emergency Reserve in Use alarm by first pressurizing both the primary & secondary and the emergency reserve banks, set Dip switch no.1 to the RUN/PROGRAM position and close the valves on both the primary & secondary bank vessels, establish a gas flow thru the manifold. After the primary then secondary banks deplete to empty, and the intermediate pressure falls below75 psi (50 psi line pressure application models) the Emergency Reserve in Use alarm should be triggered after a 15 second delay.

Dip switch # 1 set to Run/Program

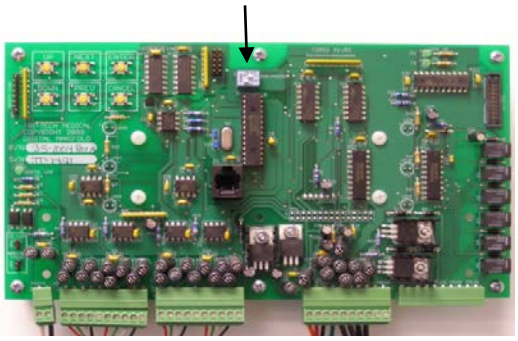


9. After you are satisfied that the manifold is functioning properly and that all master alarm signals are being triggered properly. The manifold circuit board should be returned to the 'cycling view' mode. This is achieved by moving the dip switch from the PROGRAM to the RUN position.

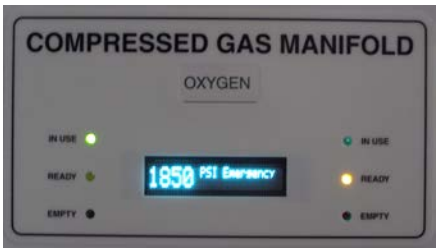
Start up & checking procedures (cont'd) – Model PL

5. Turn off all open left bank vessel valves. Create a slight flow of gas in the delivery pipeline system. DISS demand valves have been provided on the line regulators. Mating DISS fittings may be used to create a flow of gas within the manifold cabinet. The left bank pressure text display and 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 supply in use alarm should activate on the master alarm(s).
6. With the left bank in a red (Empty) condition and the right bank in a green (In Use) condition, create a slight gas flow and close all of the right bank cylinder valves. When the right bank pressure drops below 1,200 PSI stop the gas flow. After approximately 15 seconds, the right bank low alarm will be triggered.
7. SLOWLY reopen the vessel(s) on the left bank. The left bank pressure gauge and digital display should return to full pressure. The left bank green (In Use) LED will illuminate simultaneously the left bank red (Empty) will extinguish. All remote secondary supply in use alarms will be canceled.
8. The unit will also display pressures for the intermediate area (INT) and the emergency reserve (EMER) and trigger the master alarm signal for "Emergency Reserve in Use" and "Emergency Reserve Low". To properly adjust the emergency reserve regulator the primary and secondary banks must both be shut off and the cabinet pressure drained. SLOWLY open one cylinder on the emergency reserve bank and observe the EMER pressure display and check to make sure it agrees with the gauge on the emergency reserve regulator. With a slight flow of gas, adjust the delivery pressure from the emergency reserve regulator following the table on page 31 (if this is a 50 psi line pressure application this regulator should be set to 65 psi). **When testing the Emergency Reserve in Use and Emergency Reserve Low master alarms please note – there is a 15 second delay designed into the manifold logic**. The Emergency Reserve in Use alarm will be triggered when the INT pressure falls below 75 psi (50 psi line pressure applications) for more than 15 seconds. The Emergency Reserve Low alarm will be triggered when the EMER pressure falls below 1200 psi for more than 15 seconds. Test the Emergency Reserve in Use alarm by first pressurizing both the primary & secondary and the emergency reserve banks, set Dip switch no.1 RUN/PROGRAM position and close the valves on both the primary & secondary bank vessels, establish a gas flow thru the manifold. After the primary then secondary banks deplete to empty, and the intermediate pressure falls below75 psi (50 psi line pressure application models) the Emergency Reserve in Use alarm should be triggered after a 15 second delay.
9. After you are satisfied that the manifold is functioning properly and that all master alarm signals are being triggered properly. The manifold circuit board should be returned to the 'cycling view' mode. This is achieved by moving the dip switch from the PROGRAM to the RUN position.

Dip switch # 1 set to Run/Program



Models LL & PL – Emergency Reserve Plumbing & Wiring

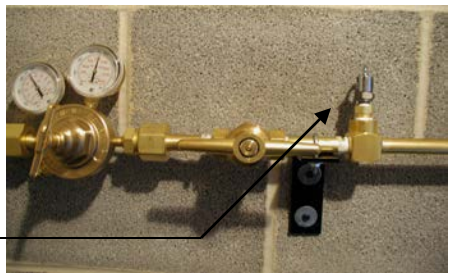


The manifold includes digital displays for the emergency reserve bank pressure and the intermediate area pressure. (Refer to appendix E – page 31)

Remote master alarms will be triggered by the manifold for the required NFPA 99 alarms;

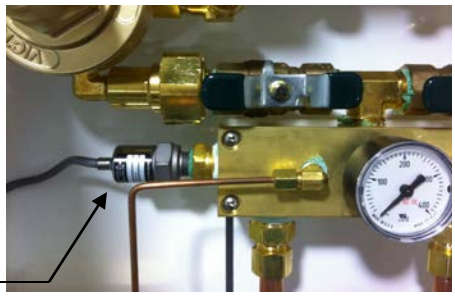
- high line pressure,
- low line pressure,
- secondary in use,
- emergency reserve in use and
- emergency reserve low and
- right bank (secondary) low (on PL units only)

Refer to the appendix E on page 31 for information on setting the delivery (outlet) pressure of the emergency reserve regulator and pre-programmed emergency reserve in use and emergency reserve low alarm set points.



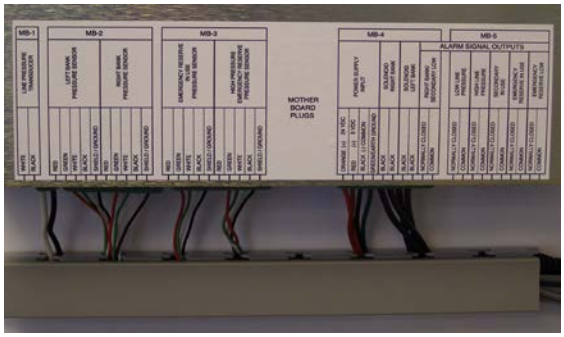
The emergency reserve low bank pressure transducer (part no. 14-3001-12) should be installed on the extra port on the RWP series manifold. This port is located prior (upstream) to the master valve and the regulator.

Note: if the 14-3001-12 and 14-3002 transducers are not used (and pressure switches are used instead or not used at all because a reserve manifold is not being used) the "Reserve Alarms" programming option (see page 20) must be disabled and the 35-3013 high pressure reserve jumper kit must be installed or else error codes will be displayed by the circuit board.



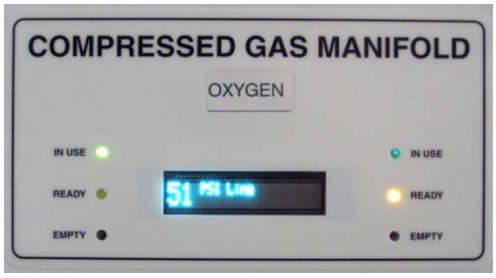
The emergency reserve in use pressure transducer (part no. 14-3002) will be pre-installed on the intermediate block at the factory (when ordered as a set).

Both the emergency reserve low bank pressure transducer and the emergency reserve in use transducer must be wired to the manifold circuit board as indicated by the labeling instruction (see page 33). Remote master alarm signal and common wires must also be connected to the manifold circuit board as indicated by the labeling instructions on the back of the circuit board cover.



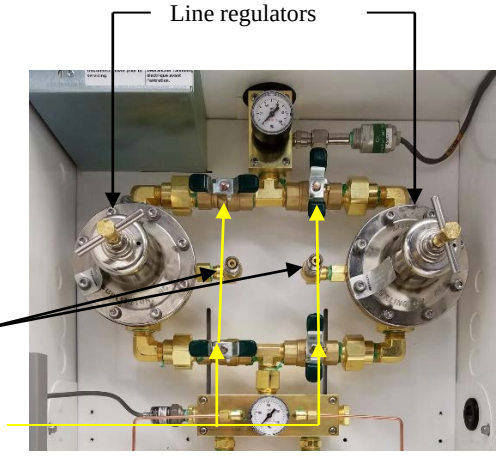
Cylinder replacement & handling

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 for a split second to blow out any dirt or contaminants that may have become lodged into 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. Leak test the connections using an oxygen approved leak test solution.
9. Observe the following conditions: The red (Empty) LED is extinguished and the yellow (Ready) LED is illuminated and the secondary in use alarm is cancelled.
10. 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. DISS demand valves have been provided on the line regulators for this purpose. Mating DISS fittings may be used to create a flow of gas within the manifold cabinet.
3. Open the manifold cabinet door and locate the line pressure regulators. Ball valves 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. One line regulator should be valve closed and the other valve open. The line regulators on-line and off-line should be alternated every other month to ensure each is exercised.
4. Turn the T – bar handle clockwise to increase pressure or counter-clockwise to decrease pressure. It may be necessary to use a 3/4” open-end wrench, loosen the locknut on the adjusting screw ***(on High Flow Models Only).***
5. After adjustment, retighten the locknut on the adjusting screw and close the cabinet door.



Programming Adjustments

The manifold is pre-programmed and tested before it is shipped. You may, however, wish to modify some of the programming. The unit has been designed to allow some programming to be simply and safely altered in the field. The aspects of the program which may be altered include:

- ✓ Low line pressure
- ✓ High line pressure
- ✓ Right bank pressure low (PL models only)
- ✓ Emergency reserve low
- ✓ Disable emergency reserve in use and emergency reserve low alarms
- ✓ Units of measure (psi, bar or kPa)
- ✓ Calibrate line sensor
- ✓ Display scroll time (seconds)
- ✓ Application logic (this should only be changed if the unit is being converted to a new application – in conference with a factory technician)

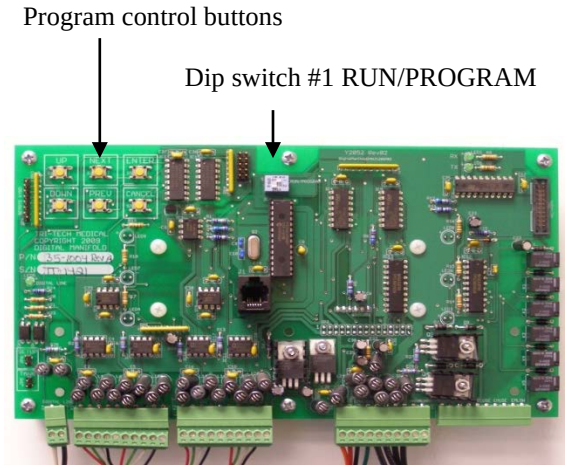
1. To make any programming change, the cover must be removed from the circuit board and the top #1 dip switch must be switched from the RUN mode to the PROGRAM mode.

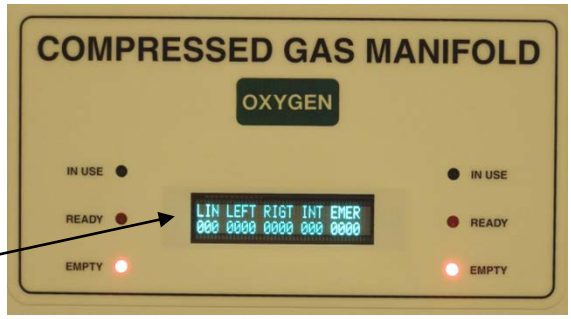
2. Once the #1 dip switch has been changed from the RUN mode to the PROGRAM mode, the display should look like this

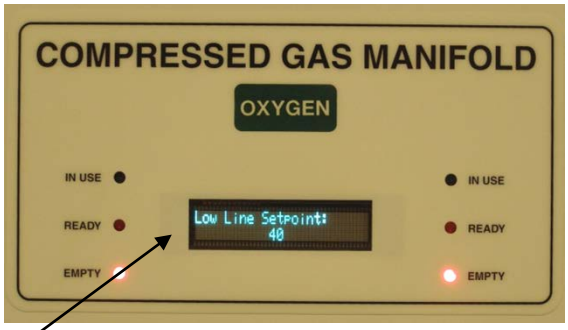
3. While viewing the display on the front of the cabinet door, use the NEXT or PREVIOUS buttons to toggle thru the menu choices. When you find the item you wish to reprogram, use the UP or DOWN buttons to display the new setting desired and then use the ENTER button to save changes to the programming. **Note – if the ENTER button is not pressed for each and every change, that programming change will not be saved**. The display will display the word SAVED when you have successfully saved a programming change.

4. Return the dip switch to the RUN position and replace the circuit board cover when you are finished making changes to the programming.

Displays showing common pre-programmed alarm set points







General Maintenance

	Control Cabinet	Headers & Pigtail
Daily	Record line and bank pressures	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	Check regulators, compression fittings and valves for external leakage. Check valves for closure ability. Alternate line regulator in use (if dual).	Inspect valves for proper closure. Check pigtails for cleanliness, flexibility, wear, leakage, kinked, pinched or twisted and thread damage. Replace damaged pigtails immediately. Inspect header check valve outlets for closure ability.
Annually	Check relief valve pressures. Check regulator seats. Tighten regulator bonnets 1 to 2 degrees (out of 360).	
Every 4 years		Replace all pigtails
Every 10 years	Rebuild or replace: all regulators, 17-4003 intermediate check valves, 48-1008 & 48-1009 solenoid valves, and DISS demand check valves.	Rebuild or replace master valves. Replace all check valve outlets.

Error Codes, Alarm Codes & Information Codes

Code Displayed	Message Displayed	Explanation
Error 01	Left bank sensor out of range	This condition is activated when the left sensor's raw readings are at either extreme. Can be caused by a disconnected, wired incorrectly, bad, or over-pressurized sensor.
Error 02	Right bank sensor out of range	This condition is activated when the right sensor's raw readings are at either extreme. Can be caused by a disconnected, wired incorrectly, bad, or over-pressurized sensor.
Error 03	Intermediate pressure out of range	This condition is activated when the intermediate sensor's raw readings are at either extreme. Can be caused by a disconnected, wired incorrectly, bad, or over-pressurized sensor.
Error 04	Emergency reserve out of range	This condition is activated when the emergency sensor's raw readings are at either extreme. Can be caused by a disconnected, wired incorrectly, bad, or over-pressurized sensor.
Error 07	Intermediate pressure high	Message is displayed whenever the intermediate pressure exceeds 500 psi.
Error 08	Emergency reserve pressure high	Message is displayed whenever the high pressure emergency reserve bank pressure exceeds 3,000 psi.
Error 09	Line sensor noise detected	Message is displayed if a gas board detects noise in the signal from its digital sensor.
Error 10	Line sensor failed to respond	Message is displayed if a line sensor is not responding.
Error 11	Line sensor is disconnected	Message is displayed whenever a line sensor is disconnected.
Error 12	Secondary supply leak detected	Message is displayed when a leak is detected in the secondary bank.
Error 13	Emergency reserve leak detected	Message is displayed when a leak is detected in the emergency reserve bank.
Error 14	Gas type mismatch	This error code is triggered by a mismatch in gas type between the line sensor and user selected gas type in setup of the manifold circuit board.

Error Codes, Alarm Codes & Information Codes (continued)

Code Displayed	Message Displayed	Explanation
Alarm 01	Line pressure low	Message is displayed and low line pressure relay activated whenever the line pressure is below the programmed low line pressure alarm set point.
Alarm 02	Line pressure high	Message is displayed and high line relay activated whenever the line pressure is above the programmed high line pressure alarm set point (high line pressure alarm is triggered).
Alarm 03	Secondary supply in use	Message is displayed and secondary in use relay activated when the manifold has switched over to the secondary bank. Clears when tank is replaced. (LL models only).
Alarm 03	Right bank empty	Message is displayed and secondary in use relay activated and right bank status LED's switch from yellow (illuminated to extinguished) to red (from extinguished to illuminated). (PL models only).
Alarm 04	Emergency reserve in use	Message is displayed and emergency in use relay activated whenever the intermediate pressure is below the programmed emergency in use pressure alarm set point. (LL models only).
Alarm 05	Emergency reserve pressure low	Message is displayed and emergency low relay activated whenever the emergency pressure is below the programmed emergency reserve low pressure alarm set point. (LL models only).
Alarm 06	Right bank / Secondary Low	Message is displayed and low line pressure relay activated whenever the right bank pressure is below 1,200 psi factory pre-set or pressure set point as re-programmed in the field. (PL models only)
Info 01	Economizer in use – see manual	Message is displayed whenever the ready bank pressure exceeds the service bank pressure by 50 psi or more. The logic compares the service and ready bank pressures once a second. (LL models only).
	XX% Remains	(emergency reserve only - except for N2O & CO2 services). It calculates and displays the percent of gas remaining in the emergency reserve bank.

Definitions and clarifications

Alarm Code – Alarm conditions per NFPA 99C and Z7396.1 guidelines.

Error Code – Messages that provide diagnostic information to assist in resolving system problems.

Information Codes – Messages that provide information regarding the operation of the system.

Item	Part Number	Description
Line Regulators & Repair Kits	68-0004R	Line regulator standard flow 5 - 125 psi
	68-0004RK	Standard flow line regulator repair/rebuild kit
	68-0002R	Line regulator high flow 5 - 125 psi
	68-0002RK	High flow line regulator repair/rebuild kit 5 - 125 psi
	68-0001R	Line regulator high flow 10-200 psi
	68-0001RK	High flow line regulator repair/rebuild kit 10 - 250 psi
Circuit Board	35-1004R	LL / PL series PLC board with single text display
Power Supply	35-2013R	Power supply
Transducers/Sensors	14-3001-12R	0 - 2,500 psi transducer with 12' cable for emergency reserve low (both LL and PL models)
	14-3001-5R	0 - 2,500 psi transducer with 15' cable for right bank low (PL models only)
	14-3002	0 – 500 psi transducer with 3' cable for left or right banks and emergency reserve in use
	14-3024	0 - 250 psi transducer with 1.5' cable N2
	14-3025	0 - 100 psi transducer with 1.5' cable Oxygen
	14-3026	0 - 100 psi transducer with 1.5' cable Med Air
	14-3027	0 - 100 psi transducer with 1.5' cable Nitrous Oxide
	14-3028	0 - 100 psi transducer with 1.5' cable Carbon Dioxide
Solenoid Valves	48-1008R	Left Solenoid valve for LL / PL series
	48-1009R	Right Solenoid valve for LL / PL series
Check Valve	17-4003R	Intermediate check valve 1/2" M NPT x 1/2 OD tube
Tubes & Compression Fittings	17-4012	Compression Sleeve 1/2 OD tube - glass filled Teflon
	17-4005	Compression Nut for 17-4012
	Q1100-1	1/2 OD copper tube x 7"
	17-4013	Compression Sleeve 3/8 OD tube - glass filled Teflon
	17-4024	Compression Nut for 17-4013
Gauges	14-1018	0 - 4,000 psi 1 1/2" x 1/8 M NPT center back gauge
	14-1016	0 - 400 psi 2" x 1/4 M NPT bottom port gauge
	14-1017	0 - 400 psi 1 1/2" x 1/8 M NPT center back gauge
	14-1009	0 - 300 psi 1 1/2" x 1/8 M NPT center back gauge
	14-1008	0 - 100 psi 1 1/2" x 1/8 M NPT center back gauge
Relief Valves	RV-22-075	75 psi x 1/2" M NPT inlet with pipe away adaptor
	RV-22-150	150 psi x 1/2" M NPT inlet with pipe away adaptor
	RV-22-250	250 psi x 1/2" M NPT inlet with pipe away adaptor
	RV-11-400	400 psi x 1/4" M NPT inlet with pipe away adaptor
Pigtails	20-1001	36" (pre-bend) single loop rigid copper Oxygen (w/o check) – CGA 540
	20-1002	36" single loop rigid copper Nitrous Oxide – CGA 326
	20-0002	24" Flexible stainless braided N2O - CGA 326 with captured fittings
	20-0003	24" Flexible stainless braided CO2 – CGA 320 with captured fittings
	20-0004	24" Flexible stainless braided AIR – CGA 346 with captured fittings
	20-0005	24" Flexible stainless braided N2 – CGA 580 with captured fittings
Union	17-0169	Union 3 pieces 1/2" F NPT x 1/2" F NPT & (1) 5"lg x 1/2" M NPT Nipple
Master Valve	17-0256	Master Valve 1/2" F NPT x 1/2 F NPT
Master Valve Repair Kit	GMV-1001RK	Master valve rebuild kit
Heater element	35-2001	Ceramic Heater
Accessory	TAV-1	Manifold Remote Audio/Visual Alarm kit

Item	Part Number	Description
Pigtails for RWP & RSP Models	20-1001	24” single loop rigid copper Oxygen – CGA 540
	20-0001	24” Flexible stainless braided Oxygen - CGA 540
	20-1002	24” single loop rigid copper Nitrous Oxide – CGA 326
	20-0002	24” Flexible stainless braided Nitrous Oxide - CGA 326
	20-0003	24” Flexible stainless braided Carbon Dioxide – CGA 320
	20-0004	24” Flexible stainless braided Medical Air – CGA 346
	20-0005	24” Flexible stainless braided Inert – CGA 580
Pigtails for LL, TML & PL Models	20-2001	72” Flexible – Oxygen – CGA 540
	20-2002	72” Flexible – Nitrogen, Argon, Helium– CGA 580
	20-2003	72” Flexible – Carbon Dioxide – CGA 320
	20-2004	72” Flexible – Nitrous Oxide – CGA 326
Union for Line Vent	17-0169	Union 3 pieces 1/2” M NPT x 1/2” M NPT 1 1/4" - 14 UNS
Union for Intermediate Vents	17-0271 (2 required)	Union 3 pieces 3/8” M NPT x 1/2” M NPT 1 1/4" - 14 UNS
Master Valve	17-0256	Master Valve 1/2" F NPT x 1/2" F NPT
Master Valve Repair Kit	GMV-1001RK	Master valve rebuild kit
	35-3013	High Pressure Reserve Jumper Kit
Heater element	35-2001	Ceramic Heater
Accessory	TAV-1	Manifold Remote Audio/Visual Alarm kit

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

Component	Symptom	Probable Causes	Remedy or Check
Circuit board	No indicator lights on front panel illuminate when power is connected.	Wiring connection. Power input out of range Bad circuit board, or power supply	Check wiring connections. Check electrical power supply output voltages. Replace power supply or circuit board.
Circuit board	Red indicator lights are on but both banks are full	Master valve or cylinder valves on bank are closed. Pigtails are installed with check valves in wrong direction Bank pressure is not sufficient for logic board to place it in “In Use” or “Ready” status (see appendix E minimum inlet pressures page 31)	Open valves SLOWLY Close cylinders and re-install pigtails in proper flow direction 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
Circuit board	Error code(s) being displayed	Loose or disconnected or broken wire, mis-connected wire, a bad transducer, a calibration problem or an over-pressure situation.	Check wires for good and correct location connection to circuit board (See ERROR CODES page 22) If all wires are connected properly and located properly – it may be necessary to replace a transducer or recalibrate board.
Entire manifold	Loss of cylinder contents	Leakage in manifold cabinet, headers or pigtails. Leakage thru manifold solenoid vent / relief Leakage around regulator bonnet Regulator with bad seat Leaking gauge Regulator set too high Overpressure due to failed regulator seat Regulator freeze-up (N2O or CO2) / heater failure	Locate leak using oxygen compatible leak test solution, tighten, reseal or replace leaking fitting(s) or pigtails. Replace solenoid valve Tighten regulator bonnet Rebuild or replace regulator Replace gauge Set delivery pressure per specifications (see page 31) Rebuild or replace regulator Flow rate exceeds manifold design capacity or cylinder withdrawal capacity – add cylinders. Repair heater or add heater and consider adding additional cylinders

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

Component	Symptom	Probable Causes	Remedy or Check
Loss of cylinder contents	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
		Inlet pressure to control cabinet is too low	Verify that minimum inlet pressure requirements are met per chart on page 31
		Portable bulk vessel is venting	Gas usage is not sufficient to justify portable bulk reserve
		Gas flowing thru the economizer circuit	This is normal when the reserve bank pressure is 50 psi greater than the service bank pressure – no correction needed to manifold control cabinet. May consider reducing the number of liquid vessels on each bank if the reserve bank is more than 35% depleted at the time it is placed in service. If gas is flowing thru the economizer when the reserve bank pressure is not 50 PSI greater than the service bank pressure – the economizer check valve needs to be replaced.
		Manifold is unable to support the required flow.	Increase manifold flow capacity (call factory for assistance.
System	Changeover occurs, secondary in use alarm is triggered and then clears placing empty or near empty bank into reserve	Manifold is unable to support required flow	Increase manifold flow capacity (call factory for assistance) 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 pressures and utilize the combined vaporization capacity – not just the vaporization capacity of the vessel with the highest delivery set point.

Appendix A

Glossary of Terms

AC ***Alternating Current***
An electric current that reverses direction or polarity at regular intervals.

Alarm Code
Alarm conditions per NFPA 99C guidelines.

BAR ***Bar***
A measurement of the force in a compressed gas system.
1 BAR = 14.7 psi (1 atmosphere)

Check Valve
A valve which operates mechanically and automatically to stop a reverse flow of gas

DC ***Direct Current***
An electric current that flows in one direction. The current can be steady or pulse.

Economizer Circuit
A mechanical piping circuit which allows built up reserve gas to be used in low volume rather than allowing the gas to vent to atmosphere.

Error Code
Messages that provide diagnostic information to assist in resolving system problems.

Information Code
Messages that provide information regarding the operation of the system.

kPa ***Kilopascals***
A measurement of the force in a compressed gas system.
1 kPa = .14 psi

LED ***Light Emitting Diode***
A semiconductor diode that converts applied voltage to light.

NFPA ***National Fire Protection Association***
The National Fire Protection Association is an association engaged in standards development.

NO ***Normally Open***
An electrical circuit in which the switch is normally open. No current flows through the circuit in normal operation. Only when the switch is closed is the flow of current started.

A normally open solenoid valve is one designed so that it is open when there is no power to the solenoid and closed when it is energized.

NC ***Normally Closed***
An electrical circuit in which the switch is normally closed. Current flows through the circuit in normal operation. Only when the switch is opened is the flow of current stopped.

psi ***Pounds per Square Inch***
A measurement of the force in a compressed gas system.
1 psi = 6.9 kPa

Solenoid Valve
A valve that is opened or closed electromagnetically.

Transducer
A device that converts pressure into an electrical signal.

Transient Signal
An intermittent and brief signal that quickly corrects and returns the alarm to a normal operating mode before monitoring personnel can silence the alarm

V ***Voltage***
Voltage is electrical pressure or force. One volt is equal to the difference of electrical potential between two points on a conducting wire carrying a constant current of one ampere when the power dissipated between the points is one watt.

Appendix B – Technical Specifications

Maximum Inlet Pressure:

Emergency Reserve (both LL & PL models)	3,000 psi
Right bank (secondary) model PL only	3,000 psi
Cabinet models LL & PL:	400 psi

Operating Ambient Temperature range:

Models LL & PL -20 F (-29 C) to 125 F (54.4 C)

Storage Temperature: -20 F (-29C) to + 185F (85 C)

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

Full Load Amps: .375 without heaters
2.10 with heaters

Pressure Measurement Accuracy:

0-100 psi transducer +/-1% of full scale - Line Pressure
Oxygen, Nitrous Oxide, Medical Air, Carbon Dioxide

0-250 psi transducer +/-1% of full scale - Line Pressure - Nitrogen

0 500 psi transducer +/-2% of full scale – Bank & Intermediate Pressures model LL only

0 – 2,500 psi transducer +/-2% of full scale –
Bank Pressures model CC, Emergency Reserve Bank Pressure model LL

Solenoid Valve: 24VDC – Normally Open (Valve opens when de-energized)

Dimensions

Control Cabinet: Dimensions excluding inlet & outlet fittings
15 3/8” W x 25” H x 9 1/4” D

Dimensions including inlet & outlet fittings
17 1/4” W x 27” H x 9 1/4” D

Line Pressure Transducers: Housing dimensions: 1.25” Diameter x 3.75” Length including inlet fittings

Weatherproof Control Cabinet

Dimensions excluding inlet & outlet fittings
17 ¼” W (cabinet) 19 1/4” W (door) x 26 3/4” H x 11” D

Dimensions including inlet & outlet fittings
20 1/4” W x 29” H x 11” D

Ball valves

Line pressure gauge

Outlet – 1/2" F NPT (not visible in this photo)

Line pressure relief valve 1/2" F NPT (not visible in this photo)

DISS demand valves – may be used to bleed line pressure during service and as emergency feed ports for the facility

Line pressure transducer – may be installed downstream of manifold source valve in PSM-xx assembly to eliminate separate hi/low pressure switch. Manifold PCB board will trigger master alarm hi/low line pressure alarms

Line pressure regulator

Line pressure regulator

Intermediate pressure gauge

Economizer circuit

Economizer circuit

Intermediate check valve

Intermediate check valve

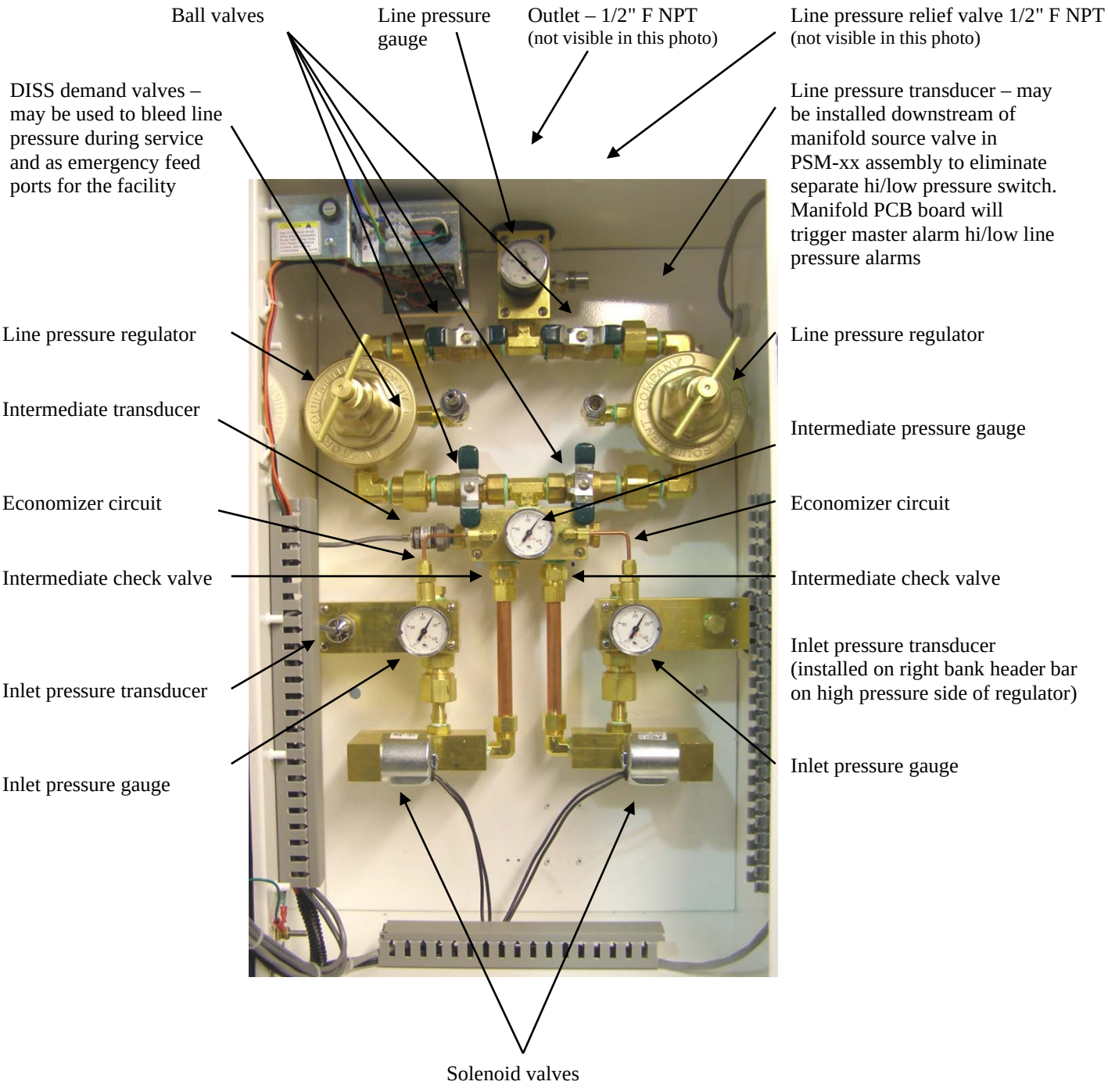
Inlet pressure transducer

Inlet pressure transducer

Inlet pressure gauge

Inlet pressure gauge

Solenoid valves


Ball valves
Line pressure gauge
Outlet – 1/2" F NPT (not visible in this photo)
Line pressure relief valve 1/2" F NPT (not visible in this photo)
DISS demand valves – may be used to bleed line pressure during service and as emergency feed ports for the facility
Line pressure transducer – may be installed downstream of manifold source valve in PSM-xx assembly to eliminate separate hi/low pressure switch. Manifold PCB board will trigger master alarm hi/low line pressure alarms
Line pressure regulator
Line pressure regulator
Intermediate transducer
Intermediate pressure gauge
Economizer circuit
Economizer circuit
Intermediate check valve
Intermediate check valve
Inlet pressure transducer (installed on right bank header bar on high pressure side of regulator)
Inlet pressure transducer
Inlet pressure gauge
Inlet pressure gauge
Solenoid valves

Appendix E – Operational Pressure Specifications

(all pressures shown in psig)

Minimum inlet pressure requirements for LL Manifold

Manifold delivery pressure	Minimum inlet pressure	Relief valve setting on vessel
50	135	235
75	135	235
170	250	350

Minimum inlet pressure requirements for PL Manifold

Manifold delivery pressure	Minimum inlet pressure Left bank	Regulator setting Right bank	Factory pre-set right bank low pressure alarm (may be re-programmed – see page 20)
50	135	150	1,200 (all gas services except N2O & CO2) 400 (N2O and CO2)
75	300	250	1,200 (all gas services except N2O & CO2) 400 (N2O and CO2)
170	300	250	1,200 (all gas services except N2O & CO2) 400 (N2O and CO2)

Line Pressure Settings for LL Models

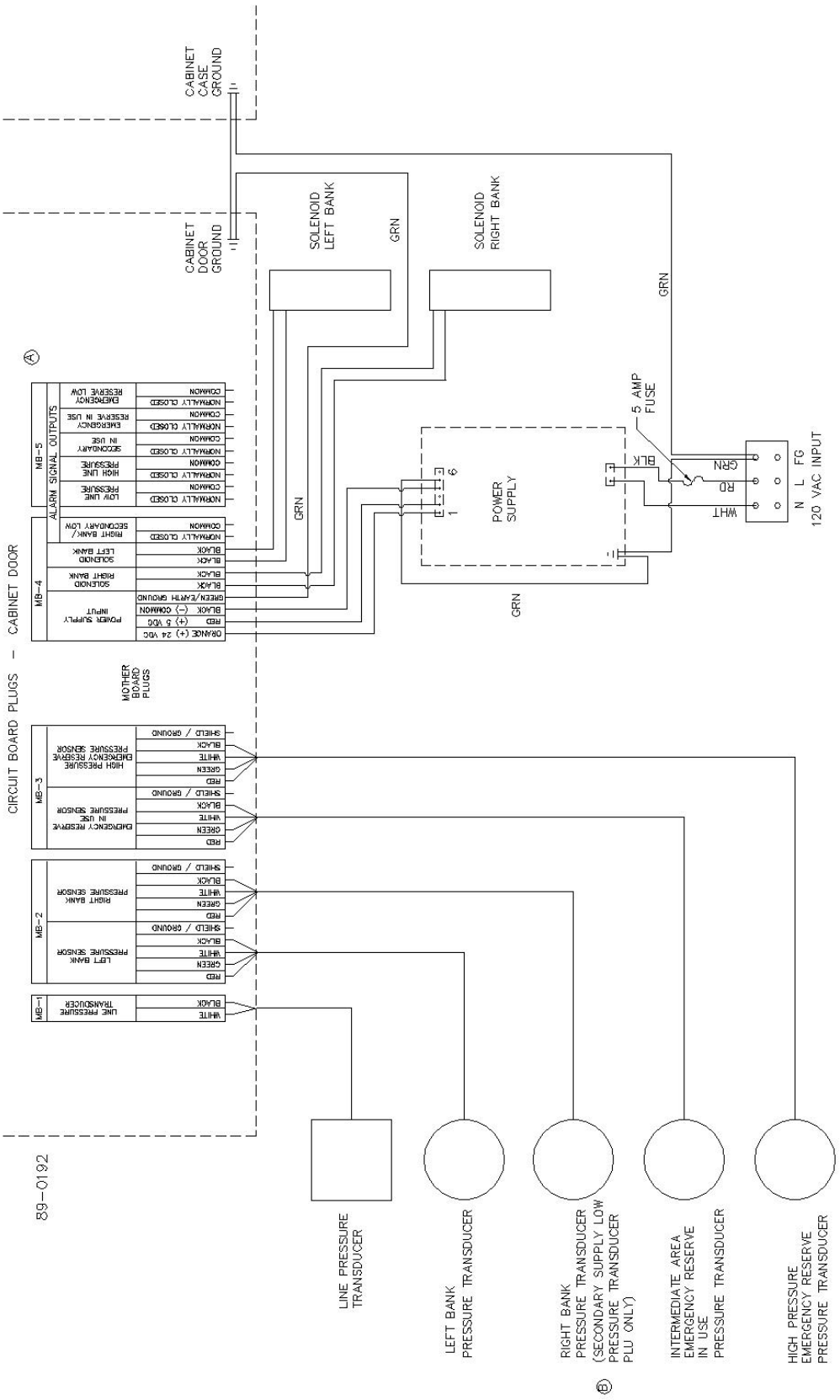
Normal Delivery Press	Line Relief Setting	High Line Press Set Point (may be re-programmed – see page 20)	Low Line Press Set Point (may be re-programmed – see page 20)	Secondary In Use Set Point
50	75	60	40	95 both banks
75	150	96	64	100 both banks
170	250	200	140	220 both banks

Line Pressure Alarm Settings for PL Models

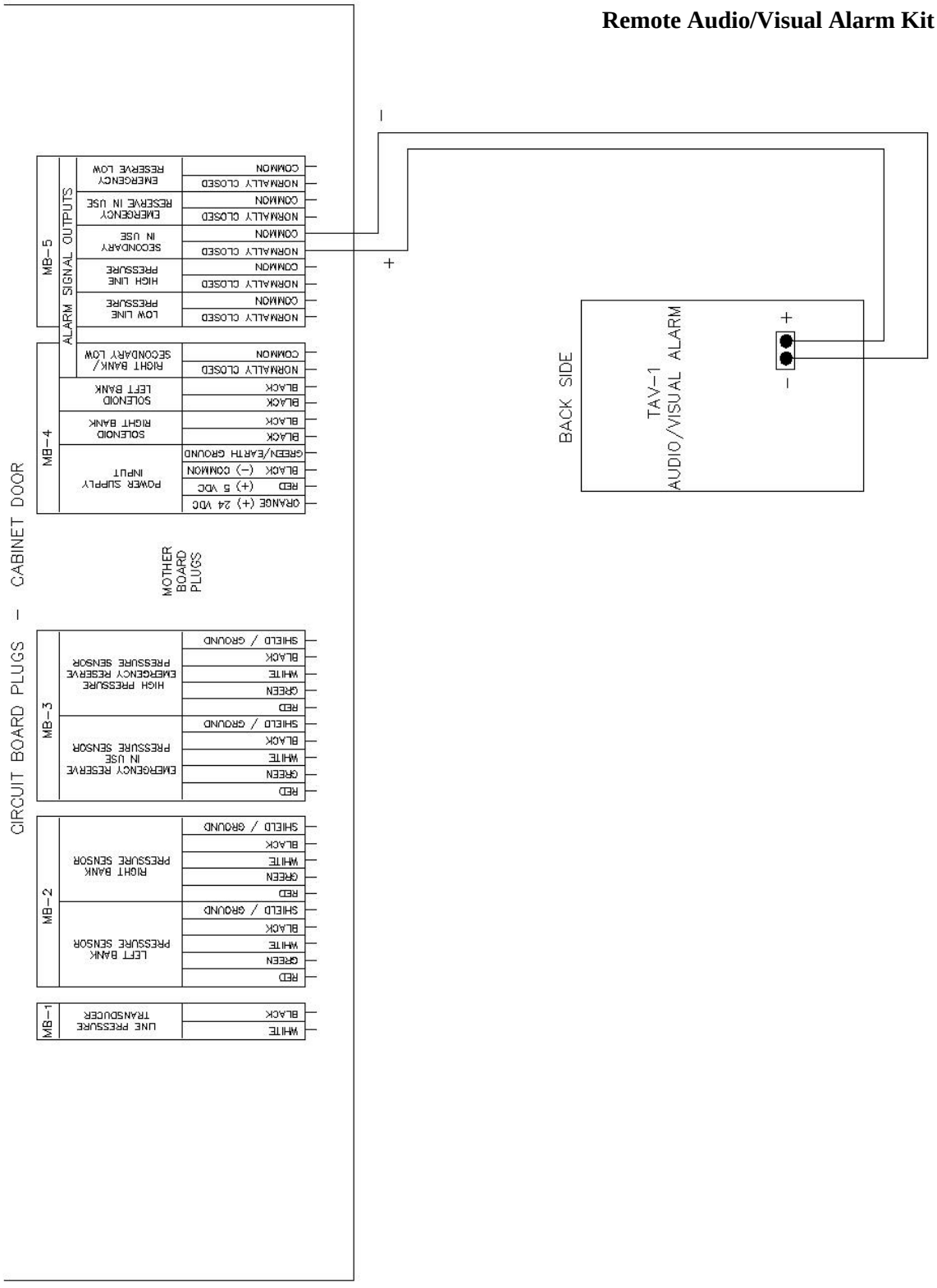
Normal Delivery Press	Line Relief Setting	High Line Press Set Point (may be re-programmed – see page 20)	Low Line Press Set Point (may be re-programmed – see page 20)	Secondary In Use Set Point
50	75	60	40	95 both banks
75	150	96	64	100 both banks
170	250	200	140	220 both banks

Pressure Settings for LL & PL Models Emergency Reserve In Use & Emergency Reserve Low

Manifold Delivery Pressure	Recommended Emergency Reserve Regulator Delivery Pressure Setting	Pre-programmed Emergency Reserve in Use alarm set point	Pre-programmed Emergency Reserve Low alarm set point (may be re-programmed – see page 20)
50	65	75	1,200 (all gas services except N2O & CO2) 400 (N2O and CO2)
75	80	90	1,200 (all gas services except N2O & CO2) 400 (N2O and CO2)
170	200	210	1,200 (all gas services except N2O & CO2) 400 (N2O and CO2)


CABINET CASE GROUND
CABINET DOOR GROUND
SOLENOID LEFT BANK
SOLENOID RIGHT BANK
GRN
5 AMP FUSE
POWER SUPPLY
BLK
GRN
RD
WHT
N L FG
120 VAC INPUT
CIRCUIT BOARD PLUGS – CABINET DOOR
MOTHER BOARD PLUGS
MB-5 ALARM SIGNAL OUTPUTS
MB-4
MB-3
MB-2
MB-1
89-0192
LINE PRESSURE TRANSDUCER
LEFT BANK PRESSURE TRANSDUCER
RIGHT BANK PRESSURE TRANSDUCER (SECONDARY SUPPLY LOW PRESSURE TRANSDUCER PLU ONLY)
INTERMEDIATE AREA EMERGENCY RESERVE IN USE PRESSURE TRANSDUCER
HIGH PRESSURE EMERGENCY RESERVE PRESSURE TRANSDUCER

Remote Audio/Visual Alarm Kit TAV-1



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