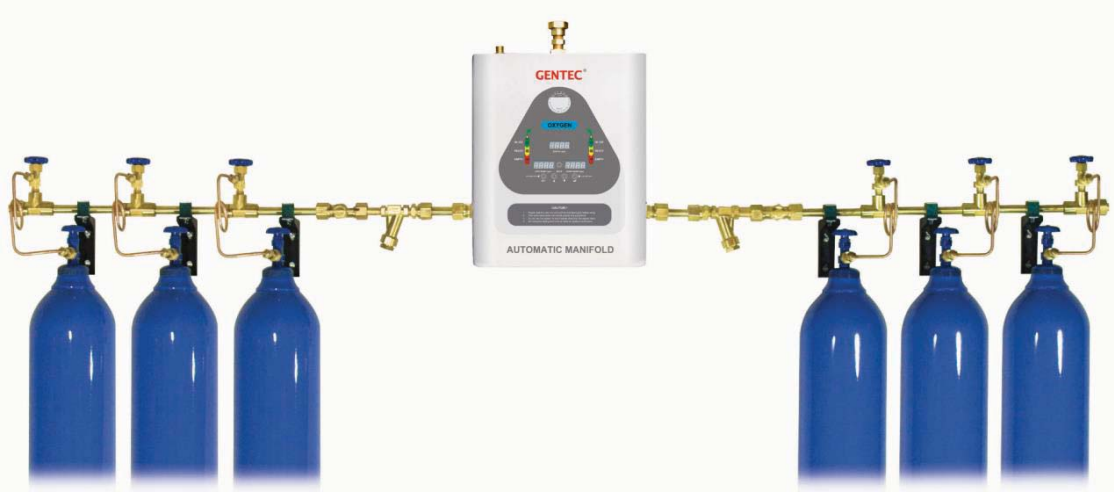
# AUTOMATIC MEDICAL MANIFOLD

# Manual

## (Installation; Operation and Service)




**GENTEC (SHANGHAI) CORPORATION**

www.gentec.com.cn

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## Definition of Statements

Statements in this manual preceded by following words are of special significance.

 **WARNING:** Means there is a possibility of injury or death to yourself or others.

 **CAUTION:** Means there is a possibility of damage to unit or other property.

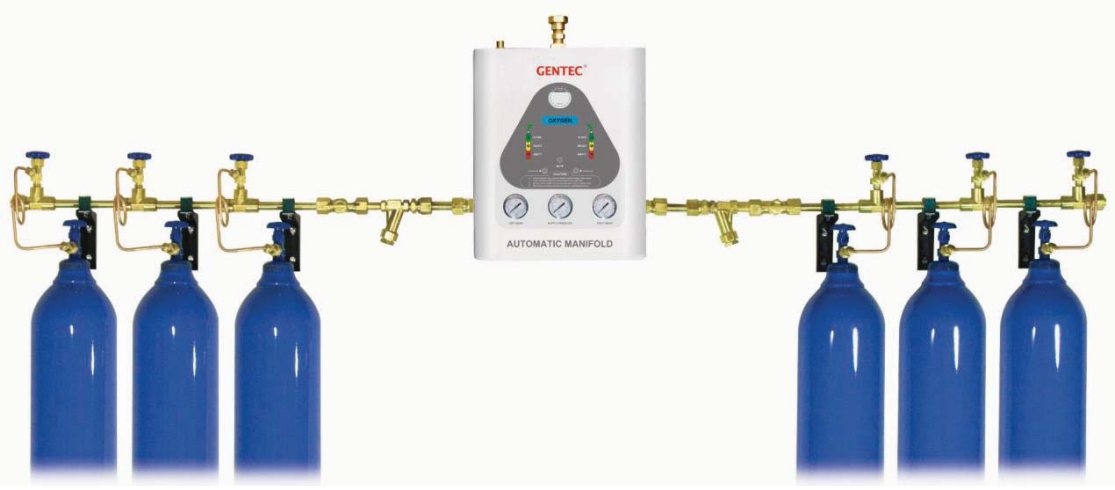
**NOTE:** Indicates points of particular interest for more efficient and convenient operation.

# Product Description

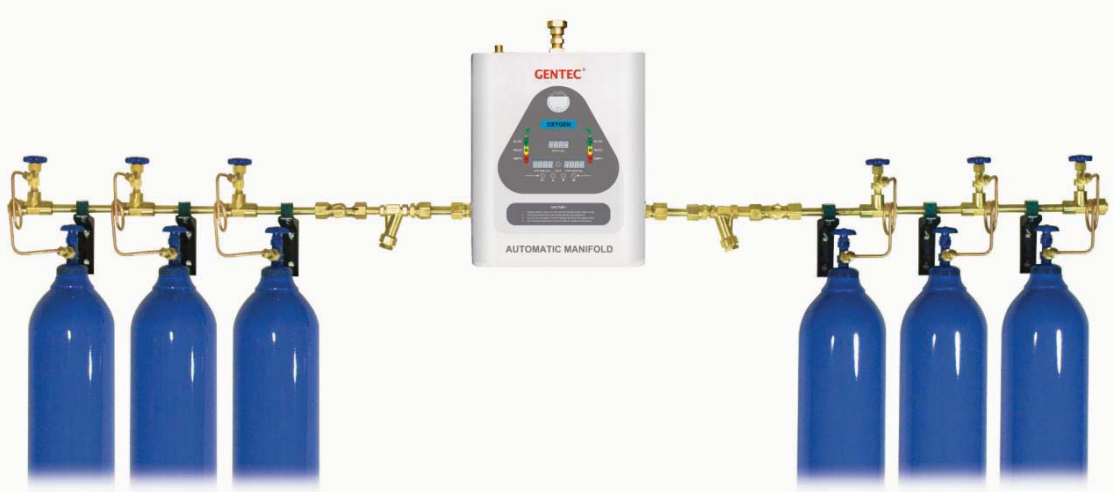
GM2 series automatic changeover manifold provides uninterrupted supply of gas to a hospital or other medical facilities. Two high-pressure cylinder banks are used for the auto-changeover with one bank designated as “Primary” source of gas and the other bank serves as a reserve “Secondary” source of gas. LED displays on the front of the manifold indicates the status of the gas supply. When the primary bank of cylinders is depleted, an automatic switchover to the reserve bank occurs without an interruption of gas flow to the facility. A red LED will illuminate when a bank is depleted of gas and two normally closed dry contacts for the reserve In-use alarm will open. The contacts may be wired to an external alarm, remote buzzer or a building management system.

When replacement cylinders are attached to depleted bank, the red lamp goes out and green lamp illuminates indicating bank has been automatically designated as secondary supply. No other user interaction is required. Both sets of dry contacts close to cancel any external alarm condition.
The power supply is mounted to the top left corner of the manifold and converts 100-250 VAC to 24 VDC to power the manifold.
The GENTEC GM2-ASeries manifold is designed to comply with National Fire Protection Association (NFPA 99)

The GENTEC® GM2-A series automatic manifold system is shown below.



The GENTEC® GM2-D series automatic manifold system is digital display model.




## Precautions

### WARNING:

- Tempering with gas specific connections shall be prohibited. Do not alter, remove or modify gas specific connection.
- Keep all manifold parts, tools and work surfaces free of oil, grease and dirt.
- Do not use chemicals, lubricants or sealants unless specified in these instructions.
- Before connecting cylinder to manifold, momentarily open and close cylinder valve to blow out dirt and debris.
- After connecting cylinder valve slowly to allow heat of compression to dissipate.
- Do not apply heat to any part of the manifold system.
- Do not use flame or “sniff” test for leaks.
- Always secure high-pressure cylinders with racks, straps, or chains. Unrestrained cylinders may fall over and damage or break off cylinder valve.
- Do not repeatedly bend, sharply bend, or twist copper pigtails as damage to tubing may occur.
- Do not bend flexible pigtails into a radius smaller than 80mm (3”).
- After manifold wall bracket has been mounted, one person alone should not attempt to lift and hang the manifold cabinet.
- Do not put manifold into operation until verified by a qualified person per NFPA

99 or other local standard.

- For installing $CO_2$ and $N_2O$ manifolds, please refer to NFPA99C" Central supply systems for nitrous oxide and carbon dioxide shell be prevented from reaching temperatures lower than the recommendations of the central supply system's manufacturer, but shall never be lower than -7°C(20F) or greater than 54°C(130°F)

**CAUTION:**

- These and other flammable materials may ignite when exposed to high pressure oxygen or nitrous oxide.
- When the manifold is used combustible gas, the manifold must be installed in a ventilated environment and want to stay away from open flame.

## Main Components of Manifold System

The GENTEC® GM2-A and GM2-Dseries automatic manifold system may be shipped in more than one carton, depending on number of cylinder connections. Main carton contains following items:

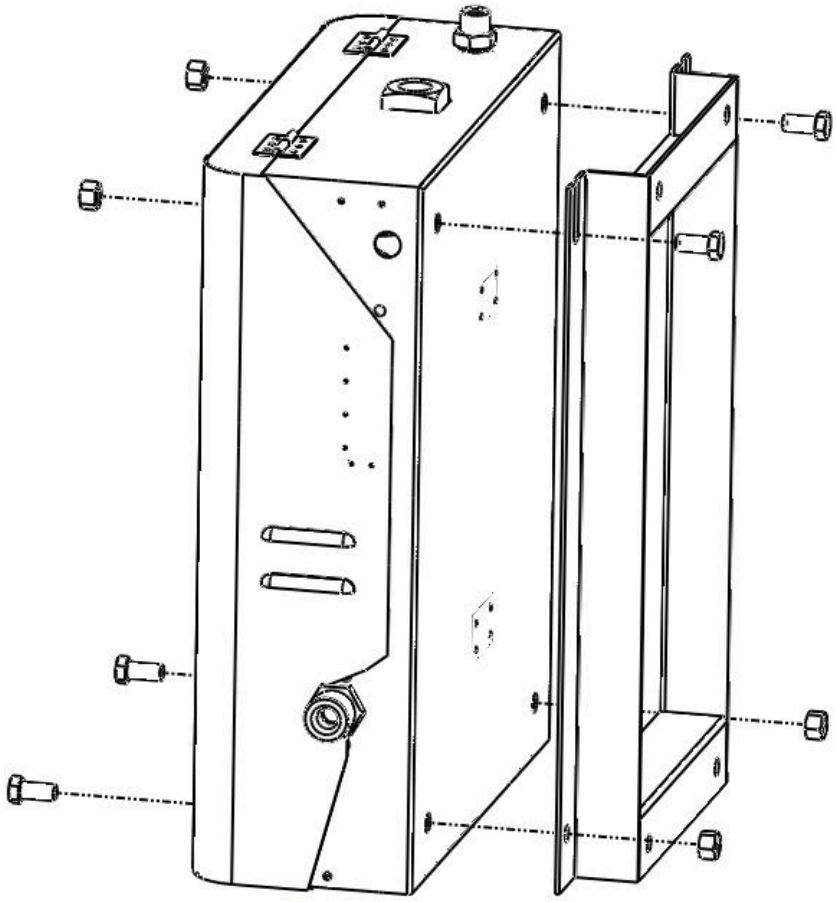
- Manifold Control Box
- Power Supply Assembly Box with 2m (79") connection cable
- Two Sets (3/4" source shut-off valve and filter)
- Automatic Manifold Manual

Additional cartons contain appropriate number of Manifold Cylinder header (Right and Left), high pressure pigtails, wall mounts and accessories. The Manifold is designed to be mounted directly to a wall, but may be freestanding floor mounted with addition of a manifold control panel floor mount kit and an appropriate number of header floor mount kits.

## Manifold Mounting

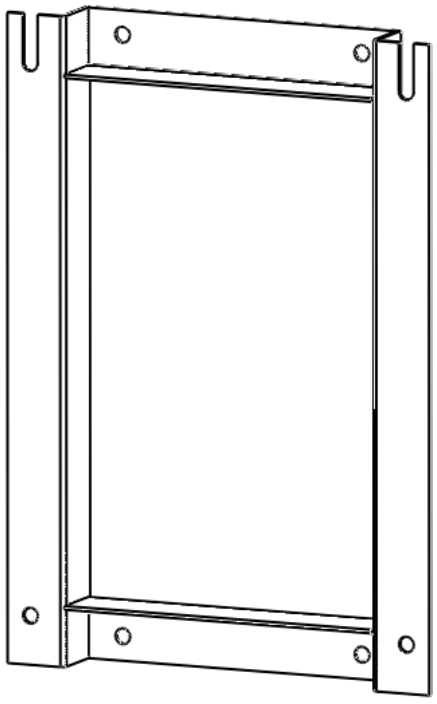
**Wall Mounting Instructions:**

1. Remove manifold control module from shipping carton and place face up on cardboard packaging insert.
2. Remove the four M8 hex head bolts from the mounting bracket on the back of the manifold control module as shown below (Figure 1). Lift the manifold away from the mounting bracket and set aside.



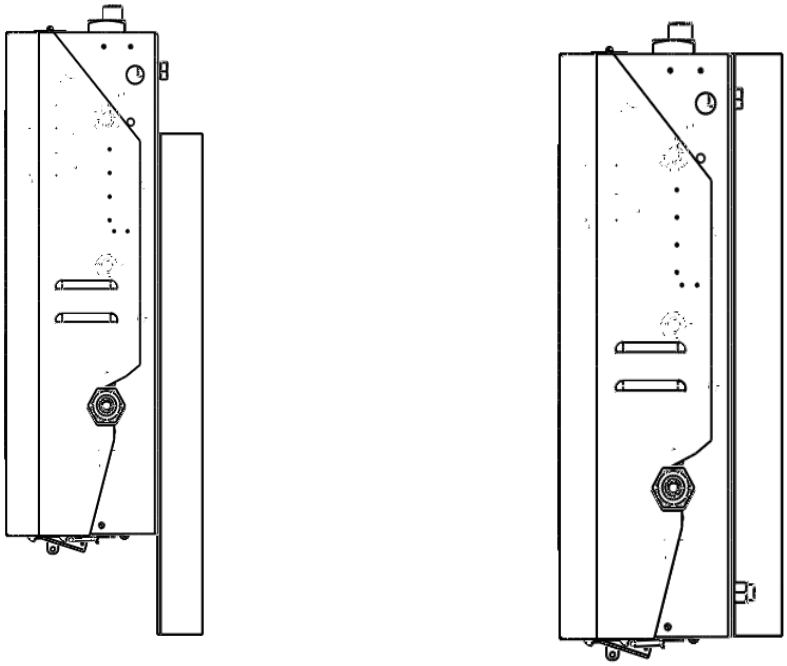
3. Mark wall appropriately taking in account for clearance of cylinders. A minimum height of at least 60”is recommended. Convert mark to level horizontal line

4. Use the mounting bracket as a template, place bracket flat against wall as shown in Figure 2 on the flat wall where manifold will be mounted, align top of the bracket with the level horizontal line.



5. Mark locations of mounting holes. Remove bracket and drill mounting holes. Attach bracket to wall with appropriate anchors (by others).

6. Hang manifold control module onto the mounting bracket. The top two control module bolts will slide into the slots of the bracket. Secure the all 4 bolts



Each header extension is shipped with a pipe holder and pipe support. Mount pipe support against wall and on bottom side of header as shown in Figure 4. Attach pipe support to wall using appropriate anchors (by others). 6mm (3/8”) diameter anchors are recommended.

**CAUTION:**

Each header segment must be supported by a pipe support before additional header segments are added.

Do not use thread sealant on header or pigtail connections.

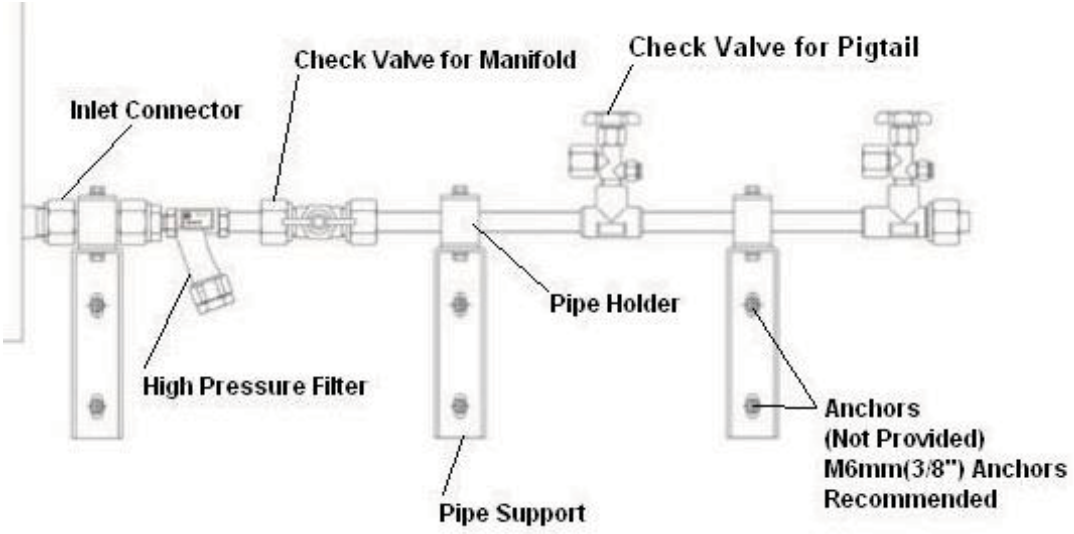


**Figure 4**

## Pigtail Installation and Cylinder Connection

All manifold other than oxygen and helium utilize 36” length flexible stainless-steel braided pigtails. All cylinders on the right bank of the manifold, even those placed directly beneath should be positioned so that the cylinder outlets face right. All cylinders on the left bank of the manifold, even those placed directly beneath should be positioned so that the cylinder outlets face left.

Figure 10 illustrates a typical 2 x 2 GENTEC GM2-Aseries automatic manifold system utilizing 36” length flexible pigtails.

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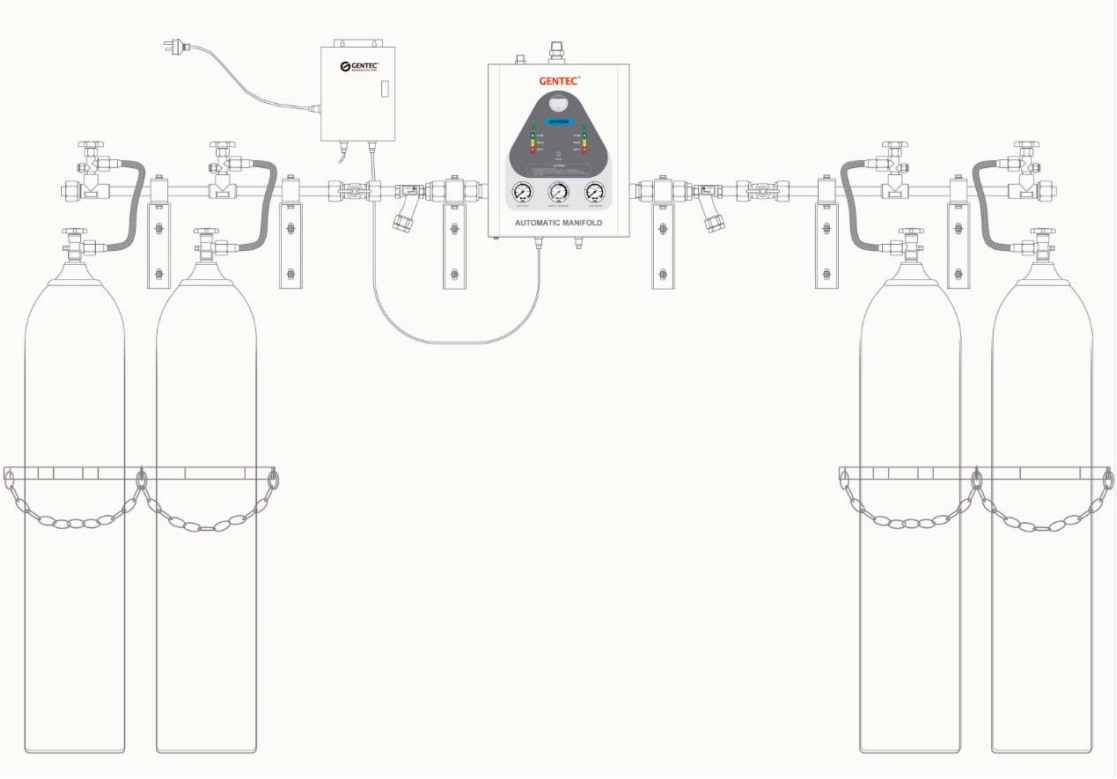



**Figure 10**

Oxygen and helium manifolds are supplied 36” length with pre-formed rigid copper pigtails. All cylinders on the right bank of the manifold, even those placed directly beneath should

be positioned so that the cylinder outlets face right. All cylinders on the left bank of the manifold, even those placed directly beneath should be positioned so that the cylinder outlets face left.

Figure 11 illustrates a typical 3 x 3 GENTEC GM2-Dseries automatic manifold system utilizing 36” length with pre-formed rigid copper pigtails.

**Connection:** 1. Remove plastic shipping caps from manifold header pigtail connections.

2. Connect one end of pigtail assembly to check valve on header connection. Coiled end of rigid copper pigtails attaches to check valve on header connection.

3. Position gas cylinders as shown in Figure 10 and 11. Secure each cylinder to wall or floor stand with chains or straps.

4. Connect pigtails to each cylinder. Rigid copper pigtails used on oxygen and helium manifold systems are pre-formed to approximate required shape. Lower and of rigid copper pigtails must be bent 90° toward cylinder outlets.

5. Tighten all pigtail connections firmly. Do not over-tighten.

**Note:** All wiring shall be protected from physical damage by raceways or conduit in accordance with NFPA 70; UL and CE, National Electric Code.

**WARNING:**

All pigtail assemblies are shipped in sealed bags and are cleaned as if for oxygen use. Manifold header connections are clean and capped. Do not unpackage or remove any cap until ready to install. During installation use care to maintain cleanliness.

Do not repeatedly bend, sharply bend, or twist copper pigtails as damage to tubing may occur.

Do not bend flexible pigtails into a radius smaller than 76 mm (3”).

Always secure cylinders with racks, straps, or chains. Unrestrained cylinders may fall over and damage or break off cylinder valve.

**CAUTION:**

Prior to connecting pigtail to cylinder, slightly open and close each cylinder valve to blow out dirt and debris.

Do not use thread sealant on header or pigtail connections.

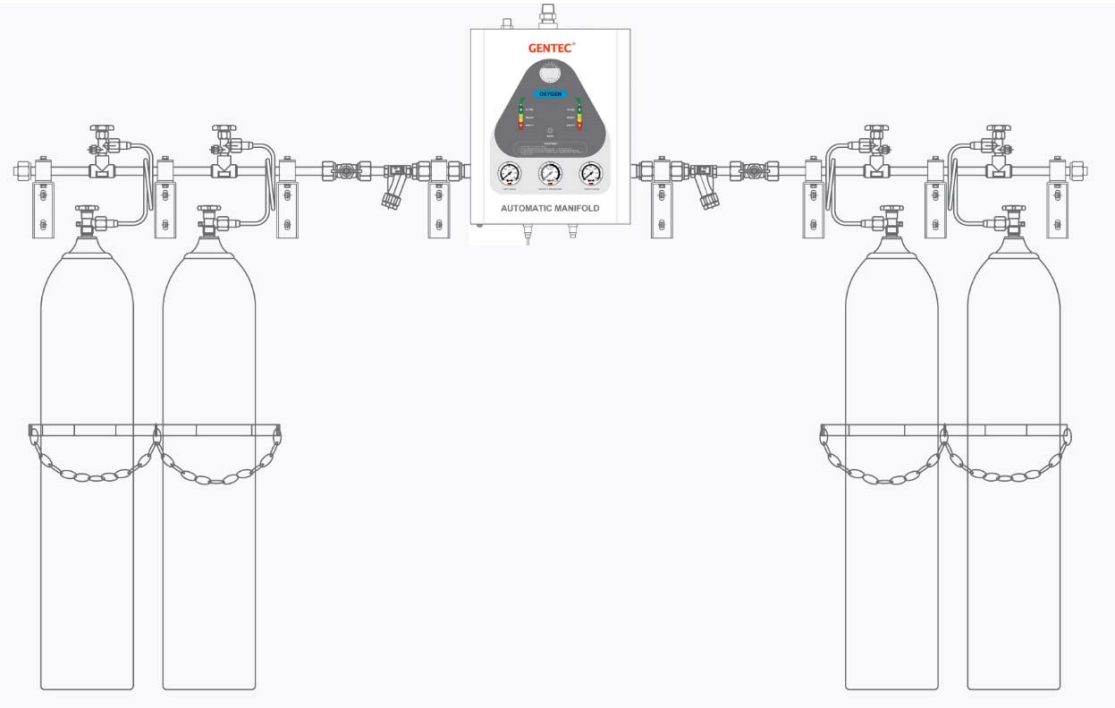



**Figure 11**

## Initial Power-Up and Operational Testing

1. Pull open the front cover of the control module from the bottom. The front cover opens from bottom to top. Two prongs on each side of the control module can be lifted and inserted to the cover to hold the cover open.
2. Verify the following:
   a) Both master isolation valves on the header bars are turned fully counter clockwise (open).
   b) Both red “Empty” indicators on front of the manifold are illuminated.
   c) If connected to a master alarm panel, “CHANGEOVER” alarm is activated.
3. Close source shut-off valve.
4. Slowly open cylinder on the right side of the manifold.
   Verify the following:
   - Right bank red “EMPTY” light goes out;
   - Right bank green “IN USE” light illuminates;
   - Right bank cylinder contents gauge reads cylinder pressure
5. Slowly open one cylinder on left side of manifold. Verify the following:
   - Left bank red “EMPTY” light goes out;
   - Left bank yellow “READY” light illuminates;

- Left bank cylinder contents gauge reads cylinder pressure.
- If connected to a master alarm panel, “CHANGEOVER” alarm is not activated.

6. Close right bank cylinder. Slightly depress the vent valve on the regulator. Verify the following:
    - Right bank cylinder contents gauge drops slowly.
    - As right cylinder pressure is nearly depleted, manifold changes over to left bank.
    - After change-over, right bank green “IN USE” light goes out and red “EMPTY” light illuminates, alarm is activated.
    - After change over, left bank yellow “READY” light goes out and the green “IN USE” light illuminates.
7. Verify the “Line Pressure” gauge reading is acceptable.
8. Slowly open one cylinder on right side of manifold. Verify the following:
    - Right bank red “EMPTY” light goes out;
    - Right bank yellow “READY” light illuminates;
    - Right bank cylinder contents gauge reads cylinder pressure
9. Close left bank cylinder. Slightly depress the vent valve on the regulator. Verify the following:
    - Left bank cylinder contents gauge drops slowly.
    - As left cylinder pressure is nearly depleted, manifold changes over to right bank.
    - Left bank green “IN USE” light goes out and red “EMPTY” light illuminates, alarm is activated.
    - After change over, right bank yellow “READY” light goes out and the green “IN USE” light illuminates.
10. Slowly open one cylinder on left side of manifold. Verify the following:
    - Left bank red “EMPTY” light goes out;
    - Left bank yellow “READY” light illuminates;
    - Left bank cylinder contents gauge reads cylinder pressure.
11. Close left and right side cylinder.
12. Record pressure readings of left and right bank cylinder contents gauges.
13. Wait 15 minutes.
14. Compare current readings of left and right bank cylinder contents gauges to those recorded in step 12. If there is a noticeable pressure change on either gauge, perform leak testing described in the next section.
15. Close manifold control module panel cover.
16. Slowly open all cylinders on both banks of manifold.
17. Open the source shut-off valve.

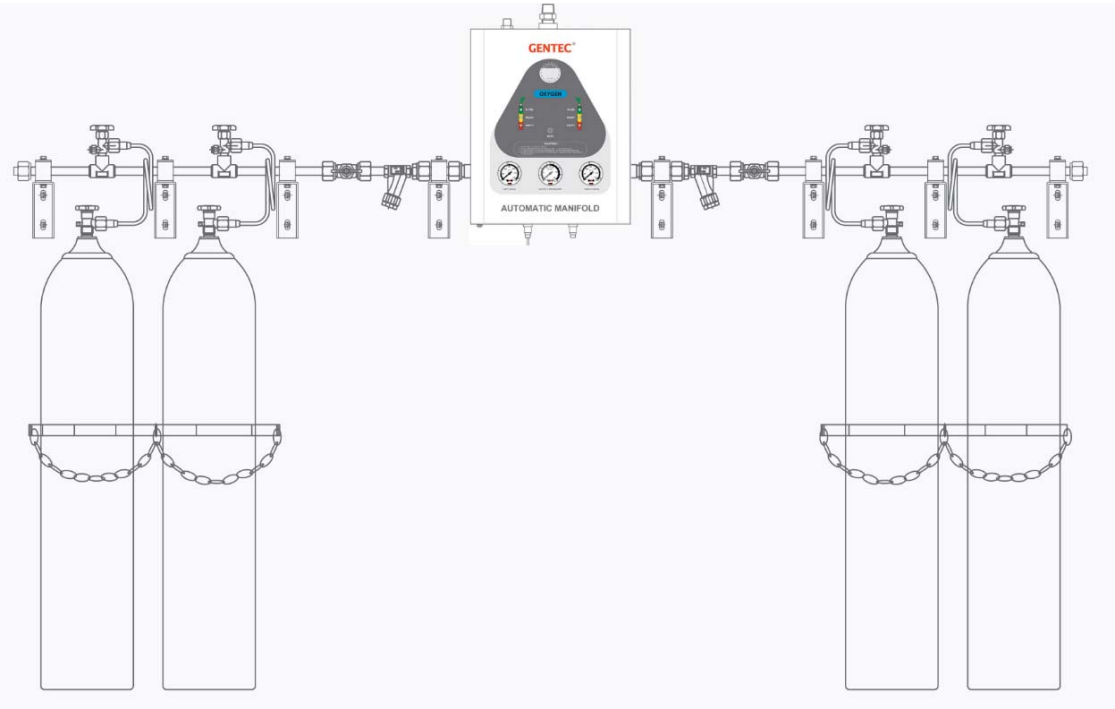



**Figure 14**

## Leak Testing

The following leak testing is recommended if a leak is observed during the previous Initial Power-Up and Operational Testing procedure. If a noticeable drop in either pressure gauge reading or digital was not detected, this leak testing is not required.

1. Close the source shut-off valve on outlet of manifold.
2. If the manifold control module cover is closed, open the cover as described in step 1 of Initial Power-Up and Operational Testing.
3. Slowly open both master isolation valves for both banks if they are closed.
4. Slowly open one cylinder on each side of the cylinder bank to pressurize the header bar and pipeline.
5. Move the 3 way ball valve to the closed position as shown in Figure 22.
6. All outlets from the pipeline, downstream of the manifold control console, should be closed and no flow should come out from the manifold unit.
7. Close right and left cylinders.
    - Record pressure readings of left and right bank cylinder contents gauge and line gauge.
    - Wait 15 minutes.
8. Compare current readings of left and right bank cylinder contents and line gauge.

9. If the line pressure gauge indicates a loss of pressure, the leak may be downstream of the Tee Ball Valve. If the left or right cylinder contents gauge indicates a loss of pressure, the leak may be upstream of line regulator inlet isolation valves.
10. Locate leak by applying a small amount of an oxygen compatible leak detector solution while manifold is under pressure. Formation of bubbles indicates a leak.
11. It is recommended to check connections added during installations first, since manifolds are factory tested.
12. Eliminate leaks by tightening or replacing connections or tubing. Retest and verify all leaks have been eliminated.
13. Slowly open all isolation valves and cylinders on both cylinder banks.
14. Open the source shut-off valve on outlet of manifold.

**CAUTION:**

Avoid getting leak detector solution onto electrical components. Wipe off excess leak detector solution after testing.

## Precautions

**WARNING:**

- Tampering with gas-specific connections shall not be permitted. Do not alter, remove or modify gas-specific connections.
- Before connecting cylinder to manifold, momentarily open and close cylinder valve to blow out dirt and debris.
- After connecting cylinder to manifold, open cylinder valve s-l-o-w-l-y to allow heat of compression to dissipate.
- Always secure cylinders with tacks, straps, or chains. Unrestrained cylinders may fall over and damage or break off cylinder valve.
- Do not repeatedly bend, sharply bend, or twist copper pigtails as damage to tubing may occur.
- Do not bend flexible pigtails into a radius smaller than 76 mm (3”).
- Service to be performed by qualified medical equipment technician.

**Note:** In order to ensure proper manifold switchover operation, do not change the delivery (line) pressure preset by factory.

# Manifold System Specifications

The GENTEC® GM2-A and GM2-D series automatic manifold systems are designed in accordance to the current edition of NFPA 99 and ISO 7396-1 (optional). The following gas types and outlet pressures are available.

Table 1 for the GM2-A and GM2-D series manifold specifications:

| | Delivery(Line) pressure | | |
|---|---|---|---|
| Parameter | 55 | 100 | 185 |
| Intermediate pressure - Ready Bank | 100 | 150 | 300 |
| Dome bias pressure | 55** | 70 | 70 |
| Intermediate pressure - In Use bank | 155±10PSI* | 220±10PSI | 370±10PSI |
| Intermediate relief valve | 450PSI | 450PSI | 450PSI |
| Line regulator relief valve | 75PSI | 125PSI | 225PSI |
| Pressure changeover setting | 120PSI | 180PSI | 320PSI |
| Maximum inlet pressure | 3000PSI | 3000PSI | 3000PSI |

*The intermediate pressure value of the "In Use" bank is dependent upon the dome bias pressure. Variations from the 55 PSI delivery pressure will affect the intermediate pressure reading.

**Same as delivery pressure.

Table 2 for the GM2-A and GM2-D series manifold's specifications:

| Model Number | Pressure monitor | Inlet max Pressure psi | Delivery Pressure | | Delivery Flow SCFH | Inlet port | Outlet port | Power |
|---|---|---|---|---|---|---|---|---|
| | | | Level | psi | | | | |
| GMS-AL-OXY | Analogue | 3000 | Lower | 55 | 3500 | 1"-11$\frac{1}{2}$ NPSM | 3/4 NPT | 24V DC 150VA |
| GMS-AM-OXY | | | Middle | 100 | | | | |
| GMS-AH-OXY | | | Higher | 185 | | | | |
| GMS-AL-AIR | | | Lower | 55 | | | | |
| GMS-AM-AIR | | | Middle | 100 | | | | |
| GMS-AL-N2O | | | Lower | 55 | 1000 | | | |
| GMS-AM- N2O | | | Middle | 100 | | | | |
| GMS-AL-CO2 | | | Lower | 55 | | | | |
| GMS-AM-CO2 | | | Middle | 100 | | | | |
| GMS-AH-CO2 | | | Higher | 185 | | | | |
| GMS-AM-IAIR | | | Middle | 100 | 3500 | | | |
| GMS-AH-IAIR | | | Higher | 185 | | | | |
| GMS-AL-NIT | | | Lower | 55 | | | | |
| GMS-AM-NIT | | | Middle | 100 | | | | |
| GMS-AH-NIT | | | Higher | 185 | | | | |
| GMS-AL-IN | | | Lower | 55 | | | | |
| GMS-AM-IN | | | Middle | 100 | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| GMS-AH-IN | | | Higher | 185 | | | | |
| GMS-DL-OXY | Digital | 3000 | Lower | 55 | 3500 | 1"-11$\frac{1}{2}$ NPSM | 3/4 NPT | 24V DC 150VA |
| GMS-DM-OXY | | | Middle | 100 | | | | |
| GMS-DH-OXY | | | Higher | 185 | | | | |
| GMS-DL-AIR | | | Lower | 55 | | | | |
| GMS-DM-AIR | | | Middle | 100 | | | | |
| GMS-DL-N2O | | | Lower | 55 | 1000 | | | |
| GMS-DM- N2O | | | Middle | 100 | | | | |
| GMS-DL-CO2 | | | Lower | 55 | | | | |
| GMS-DM-CO2 | | | Middle | 100 | | | | |
| GMS-DH-CO2 | | | Higher | 185 | | | | |
| GMS-DM-IAIR | | | Middle | 100 | 3500 | | | |
| GMS-DH-IAIR | | | Higher | 185 | | | | |
| GMS-DL-NIT | | | Lower | 55 | | | | |
| GMS-DM-NIT | | | Middle | 100 | | | | |
| GMS-DH-NIT | | | Higher | 185 | | | | |
| GMS-DL-IN | | | Lower | 55 | | | | |
| GMS-DM-IN | | | Middle | 100 | | | | |
| GMS-DH-IN | | | Higher | 185 | | | | |

## Main Components Specification of Manifold System

Please see The GENTEC® GM2-A and GM2-D series automatic manifold system schematics as shown. Figure 15.

- Bank Regulator: These regulators are used to reduce incoming cylinder contents pressure to a lower intermediate pressure. A dome loaded, single-stage, piston style diaphragm type regulator (one for each bank of cylinders) has an internal adjusting spring used to set a “base” pressure. A “bias” pressure may be applied to the dome of the regulator in order to boost the pressure above the spring set “base” pressure. The “Dome” or bonnet of the regulator is a pressure tight chamber and when pressure is applied a “bias” pressure is added as a result of added force to the adjusting spring. For example, a spring set “base” pressure of 100 psi will become 150 psi if a 50 psi “bias” pressure is added to the dome (100 + 50).

- Pressure Transducer (only on GMS-D model): Pressure Transducers are connected to the high pressure port of each bank regulator to monitor pressure within each back of cylinders. A 4-20mA pressure transducer with a range of 0-3600 psi is used.

- Pressure switch: An adjustable, dual pole open pressure switch. Pressure switches are connected to the high pressure port of each bank regulator in order to monitor pressure in each bank of cylinders.

- Tee Check Valve: A three way tee with built in check valves. Check valves prevents backflow of gas. Installed downstream of bank regulators.

- High Pressure Relief Valve: Serves as an intermediate relief valve to protect components between bank regulators and the line regulators in event of an overpressure condition during bank regulator failure.

- Low Pressure Relief Valve: A relief valve to relief pressures downstream of line regulators in order to prevent over pressurization.
- Tee Ball Valve: Tee Ball Valve is a three way ball valve and reduces the number of valves used downstream of bank regulators for less leak points. Serves as a maintenance and gas flow directional valve. Allows servicing of line regulators and

components while manifold is in use.

- Line Regulator: A single-stage, diaphragm type regulator used to reduce manifold's intermediate pressure to normal hospital line pressure. Two line regulators are provided per NFPA 99 requirements to allow for isolation and service of one while other is in use.
- Bias Pressure Regulator: A single-stage, piston type regulator used to regulate amount of pressure provided to domes of bank regulator.
- Solenoid Valve: A 24 VDC, solenoid assembly used to direct dome bias pressure to one of the bank regulators. As dome bias pressure is directed to one of bank regulator, dome of other bank regulator is vented through solenoid valve.
- Circuit Board (Digital Display): An electronic circuit board controls the manifold changeover. The Circuit Board monitors pressure transducers and controls the solenoid valve in order to initiate manifold switchover. The Circuit Board illuminates the appropriate front panel indicators and also provides dry contracts for activation of the external master alarms. Connection port to external power source.
- Circuit Board (Analog Display): An electronic circuit board controls the manifold changeover. Receives pressure switch signals to control the solenoid valve in order to initiate manifold switchover. The Circuit Board illuminates the appropriate front panel indicators and also provides dry contracts for activation of the external master alarms. Connection port to external power source.

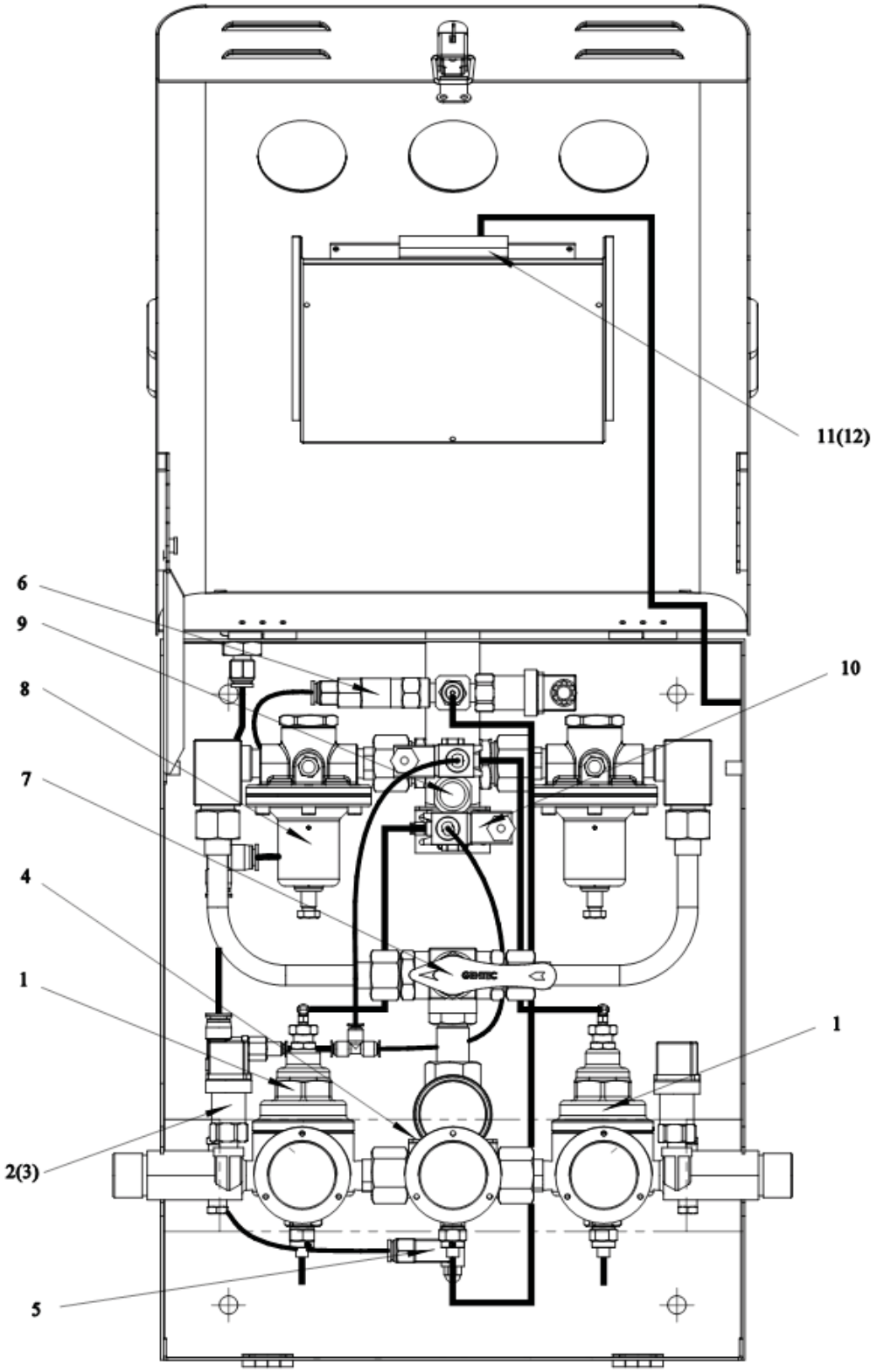



**Figure 15**

# Manifold System Gas Flow

High pressure gas is provided to the left and right manifold bank inlets via cylinders, pigtails, and header assemblies. Flow of high pressure gas through the left and right side of manifold is exactly the same, each passing through a master valve located on the header and then directly to a bank regulator.

Bank regulators reduce incoming cylinder pressures to an intermediate pressure. Bank regulators are referred to as a “dome loaded” type of regulator. These regulators have an internal adjusting spring manually set at a specific pressure similar to other diaphragm type pressure regulators. In addition to internal adjusting spring, bias pressure may be applied to the dome of the regulator (adjusting spring side of diaphragm) thus boosting pressure above what is manually set by the adjusting spring. This output pressure boost will be approximately equal to the amount of bias pressure.

For example, if a bank regulator is manually adjusted to 100psi via internal adjusting spring, and a dome bias pressure of 55psi is applied, the output pressure will increase to approximately 155psi (100 + 55). When the bias pressure is removed, the output pressure setting will return to 100psi.

Outlet of both the left and right bank regulators pass through a Tee Ball Valve and dual line regulator assembly. An intermediate high pressure relief valve protects components between the bank and line regulators in the event of a bank regulator seat failure.

The dual line regulator assembly consists of two line regulators connected in parallel. Inlet of the regulator is determined by the Tee ball valve. Output of both the line regulators tee together and exit at the manifold’s main outlet. A line relief valve along with a line pressure gauge is connected to the manifold’s main outlet.

Outlet pressure is then routed to a bank regulator reducing pressure to 55 PSI at the solenoid switch. Solenoid switches 55psi (dome bias pressure) to one of the bank regulators. When one bank regulator is supplied bias pressure, the other bank’s dome bias pressure is vented. An electronic circuit board controls the solenoid valve based upon the input received from the right and left pressure transducer. The solenoid valve directs bias pressure to the bank

designated as primary.

Manifold designed for 55 psi nominal outlet pressure do not use a bias pressure regulator. Full line pressure (55 psi) is routed directly to the solenoid valve and serves as dome bias pressure.

## Manifold System Switchover - Control and Display

After electrical power has been applied to the manifold, the side pressurized first is designated primary or “In Use” bank. In order to simplify the following explanation, we will arbitrarily select right side of manifold as primary bank. The green“In Use” light on the right side will be illuminated and the yellow “Ready” light on the left (secondary) bank will be illuminated.

The Solenoid valve directs dome bias pressure to the bank regulator on the right side. If we use a 55psi oxygen manifold as an example, the output of the right bank pressure regulator is approximately 170psi (100psi base pressure + 70psi bias pressure).The output of the left bank regulator is approximately 100psi (base pressure only, no bias pressure). Since the bank regulator on right side has the highest pressure, all flow is supplied by right bank of cylinders.
As the cylinder pressure on the right side depletes, the pressure falls to pressure switch setting (120 psi). Right side pressure signals the circuit board to switch the solenoid valve. The solenoid valve then vents the dome bias pressure from the right bank regulator and directs the bias pressure to the left bank regulator. The Green “In-use” light on the right side goes out and the Red “EMPTY” light illuminates. The circuit board will send a signal to master alarm panel indicating a change-over alarm. The Yellow light on left goes out and the Green light illuminates.

When cylinders on the right side are replaced and pressure is restored, right side pressure switch signals the circuit board to cancel switch-over alarm and turns off right side red “EMPTY” light and illuminates and the Yellow“READY” light gets illuminated.

Since the left bank regulator has the dome bias pressure applied, its output pressure is boosted to approximately 170psi. The right bank regulator has no dome bias pressure and its output pressure is controlled only by base pressure (100 psi). All flow is supplied by the left bank of cylinders until the pressure drops to approximately 120 psi, the left pressure switch then signals the circuit board, causing a switch over to the right side in same fashion as previously described.

In the event of a power failure, unpowered solenoid valve will direct dome bias pressure to left bank regulator. A changeover alarm will be activated on master alarm panels. All flow will be supplied by left bank of cylinders until depleted. Right bank of cylinders will then automatically begin to supply flow.

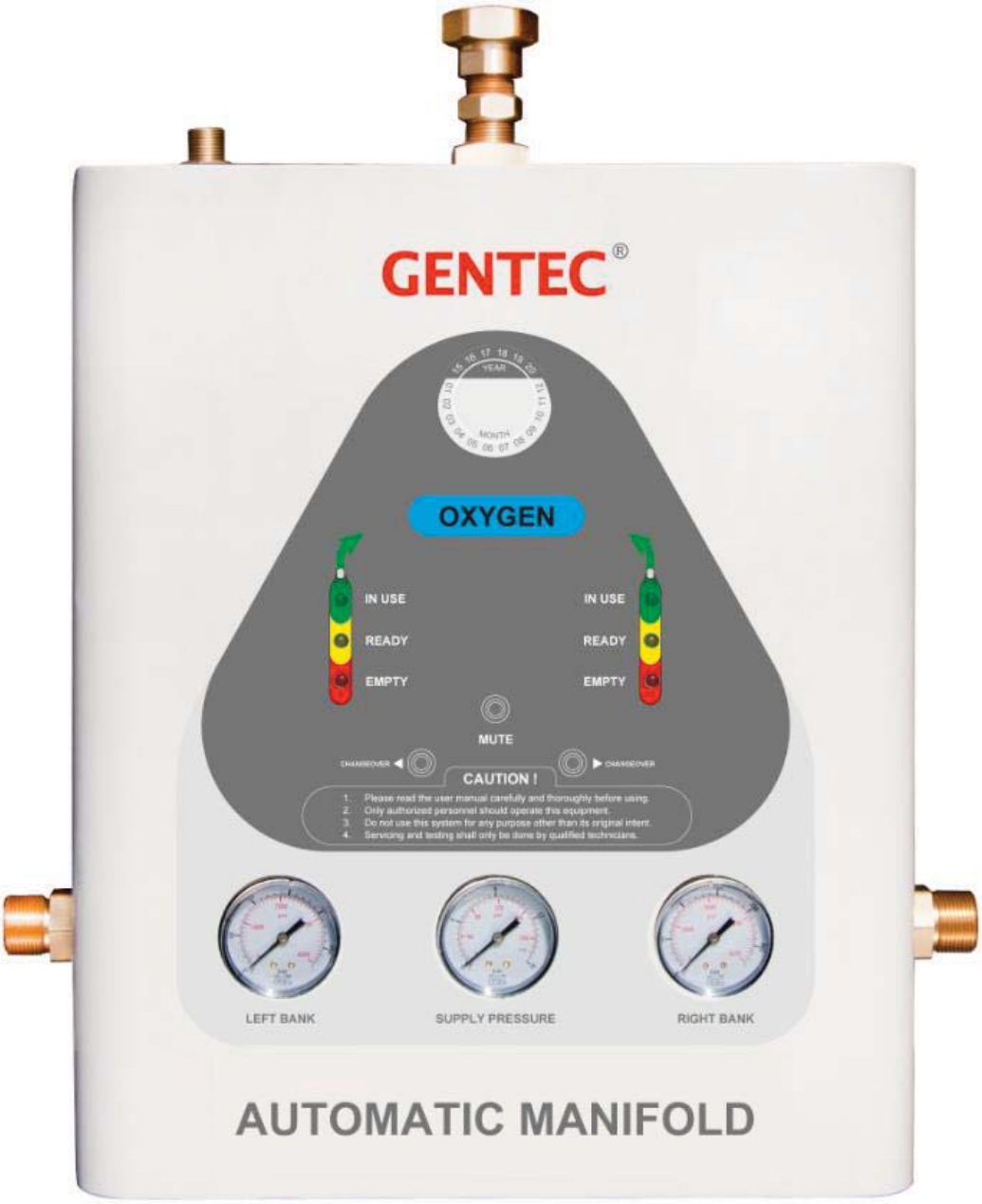



**Figure 18**

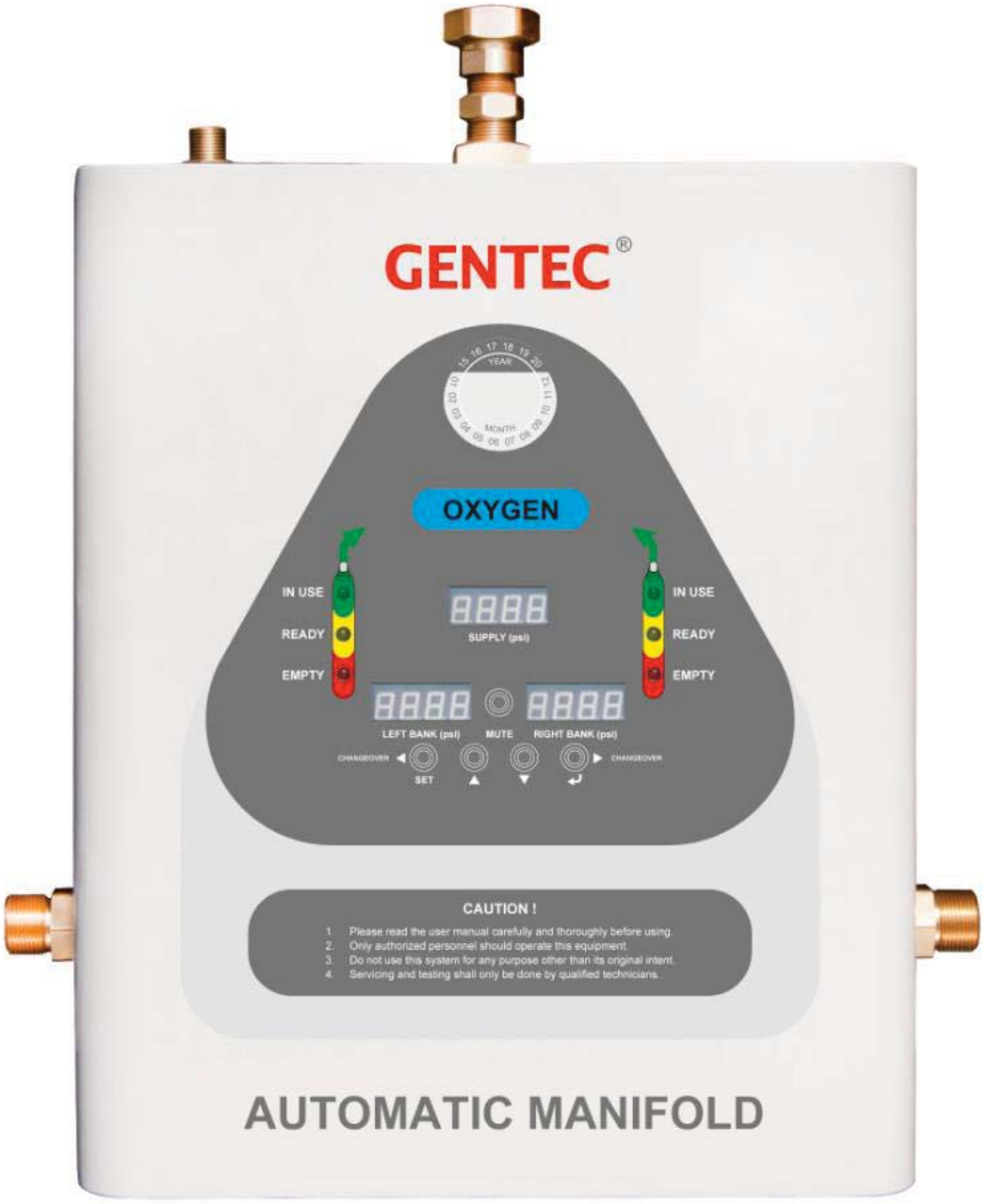

GENTEC®
YEAR
MONTH
OXYGEN
IN USE
READY
EMPTY
SUPPLY (psi)
IN USE
READY
EMPTY
LEFT BANK (psi)
MUTE
RIGHT BANK (psi)
CHANGEOVER
SET
CHANGEOVER
CAUTION !
1. Please read the user manual carefully and thoroughly before using.
2. Only authorized personnel should operate this equipment.
3. Do not use this system for any purpose other than its original intent.
4. Servicing and testing shall only be done by qualified technicians.
AUTOMATIC MANIFOLD

**Figure 19**

# Performance Verification

**WARNING:**

- If necessary, most service, adjustment, and testing can be performed while manifold is in service. However, this should only be done by GENTEC's engineers or qualified technicians experienced in servicing medical equipment.
- Servicing and testing manifold while not in use, with ¾" source shutoff valve closed, is preferred.
- All regulators in the manifold are pre-set and locked to prevent accidental changes. If adjustments are required, the adjustment nut must be loosened before adjustment. After adjustments are made, it is recommended to tighten the nut to lock the setting for the regulator.

**Note:** All pressure values listed in table 1 are nominal factory settings, Actual customer settings may vary.

Use following test step to verify manifold's functional performance.

1. Pull open the front cover of the control module from the bottom. The front cover opens from bottom to top. Two prongs on each side of the control module can be lifted and inserted to the cover to hold the cover open.
2. Verify the following
    - Master Isolation Valves on left and right bank are fully open
    - There is sufficient pressure in right and left banks. Left and right bank pressure gauges indicate at least 1800 psi (at least 600 psi for Nitrous Oxide or CO2)
    - Power is applied to manifold.
3. If manifold is not in use, close source shutoff valve.
4. Turn Tee Ball Valve handle indicator to point towards the right as shown in Figure 21
5. As a starting point for this procedure, set the manifold, so right bank is in use. If the right bank green light is illuminated, proceed to the next step. If the left bank green light is illuminated, manually switch the manifold to the right side by pressing the right manual switch button on the overlay of manifold cover.
6. Verify that the right bank green light "IN USE" and the left bank yellow "READY" lights are illuminated.
7. If the manifold is connected to a master alarm panel, verify the manifold change-over

alarm is not activated

8. The Bias regulator is set for 70 psi. For systems with outlet pressure of 55 psi, the bias regulator is a straight thru and does not regulate pressure.
9. Verify pressure gauge reading (intermediate pressure – in use bank) on left side bank regulator is as indicated in Table 1. If pressure in not correct, refer to Bank Regulator Pressure Adjustment procedure. If Bank Regulator is operating correctly but intermediate pressure is still incorrect, replace the Bias regulator with preset of 70 psi.
10. Verify front panel Supply Pressure Gauge or Digital reading is as indicated in Table 1 (Outlet Pressure). If the pressure is not correct, refer to Line Regulator Pressure Adjustment procedure. Note reading for later use.
11. Watch pressure gauge or digital readings of right side bank regulator and front panel supply pressure gauge and digital for at least five minutes. Readings may be slightly higher without vent flow. Verify readings do not continue to increase.
12. Close all cylinders on right side of manifold. Slightly press the vent valve on the regulator so the bank high pressure gauge drops slowly. Verify manifold switches to left bank when right bank high pressure gauge and digital drops to below the specified setting of the bank regulator.
13. Verify only left bank green “IN USE” and right bank red “EMPTY” lights illuminate.
14. If the manifold is connected to a master alarm panel, make sure the Change-over alarm is activated.
15. Turn 3-way ball valve indicator to point towards the left as shown in Figure 20. The gas flow should be directed towards the left side line regulator.
16. Slightly push vent valve on top of Left Line Regulator to create a small flow of gas through manifold.
17. Verify pressure gauge reading (intermediate pressure –in use bank) on left side bank regulator is as indicated in Table 1. If pressure is not correct, refer to Bank Regulator Pressure Adjustment procedure.
18. Verify front panel supply pressure gauge and digital reading is same as in step 10. If pressure is not correct, refer to Line Regulator Pressure Adjustment procedure.
19. Watch pressure gauge on the left bank regulator and supply pressure gauge for at least five minutes. Readings may be slightly higher without vent flow. Verify readings do not continue to increase.
20. Close all cylinders on left side of manifold. Slightly push vent valve on top of left bank regulator and watch high pressure gauge drop slowly. Verify manifold switches to right bank when left bank high pressure gauge drops to value indicated in Table 1.
21. Verify only right bank green “IN USE” and left bank red “EMPTY” lights illuminate. The alarm is activated.
22. Slowly open one cylinder on left side. Verify left bank red “EMPTY” light goes out and

left bank yellow “READY” light illuminates.

23. Turn Tee Ball valve indicator to point towards the right as shown in Figure 21
24. Close left and right side cylinders.
25. Record pressure readings of right and left bank cylinder contents gauges.
26. Verify after 15 minutes, pressure gauge readings have not changed.
27. Slowly open all cylinders on both banks of manifold.
28. Using switches located on the Circuit Board, switch the manifold to the bank of cylinders with least pressure.
29. Reinstall manifold control panel cover.
30. Open the source shut-off valve on top of manifold.

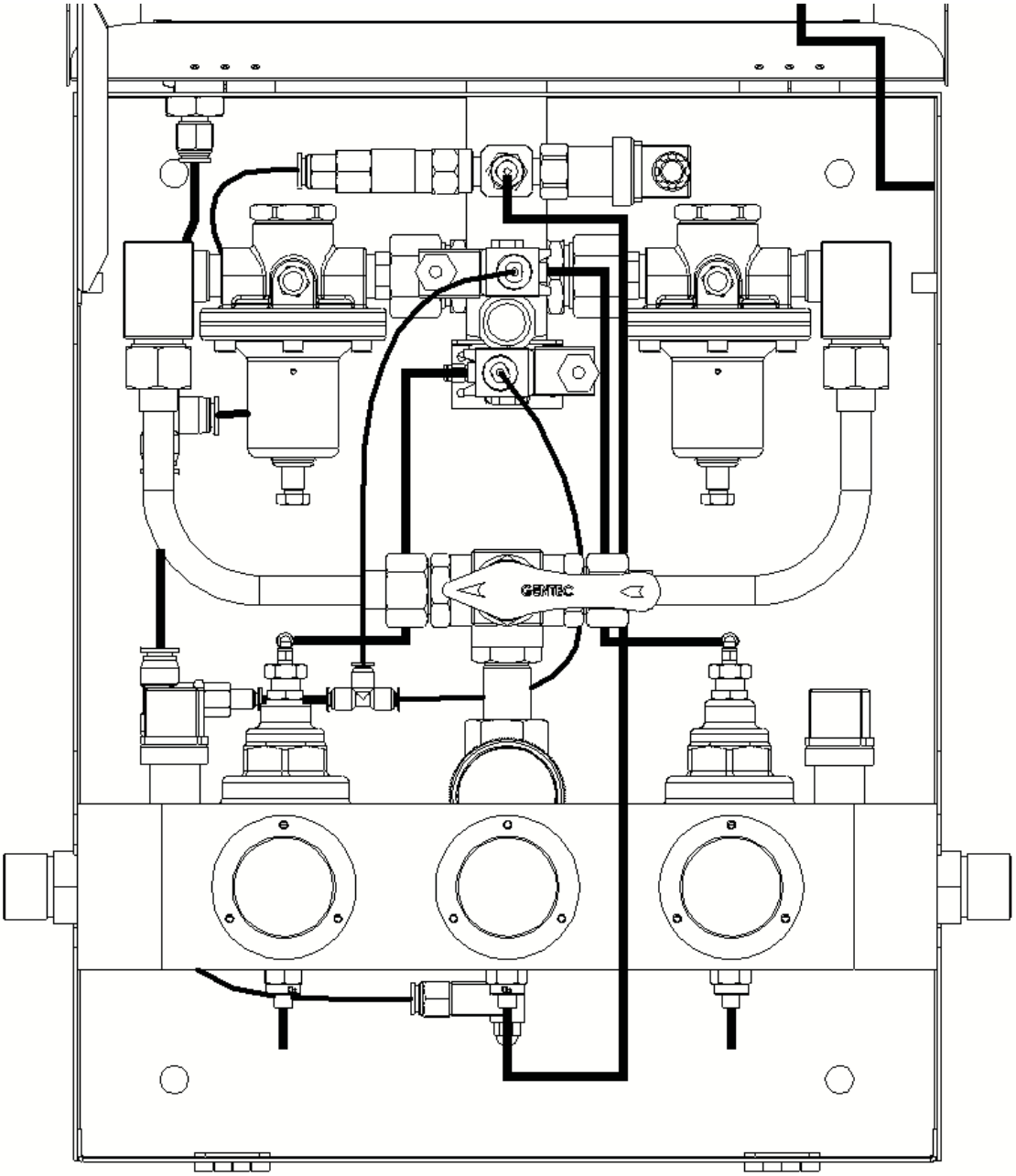



**Figure 20**

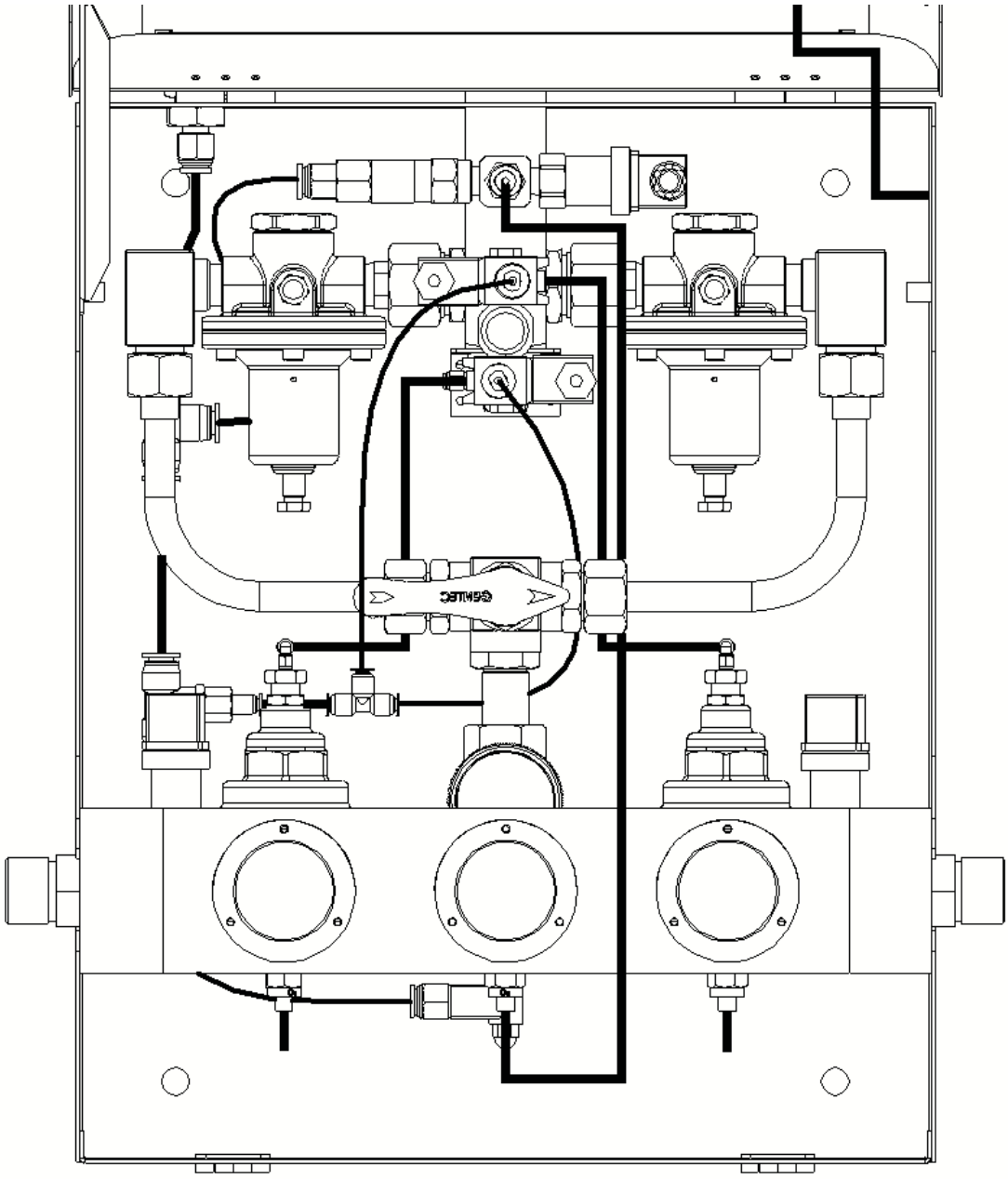


**Figure 21**

# Bank Regulator Pressure Setting and Adjustment

**WARNING:**

- If necessary, most service, adjustment, and testing can be performed while bank regulator is in service. However, this should only be done by GENTEC's engineers or qualified technicians experienced in servicing equipment to be approved.
- All regulators in the manifold are pre-set and locked to prevent accidental changes. If adjustments are required, the adjustment nut must be loosened before adjustment. After adjustments are made, it is recommended to tighten the nut to lock the setting for the regulator.

Following procedure describes process of setting bank regulator's "Base" pressure. This procedure should only be performed if bank regulator pressure are not within acceptable limits during performance verification procedure or after installation of a new bank pressure regulator.

Base pressure setting is a mechanical adjustment controlled by regulator's internal adjusting spring and is regulator's output pressure without any control pressure. Recommended settings are listed in Table 1 under heading of "Intermediate Pressure – Ready Bank". After base pressure has been set, pressure will be increased by amount of control pressure applied. Refer to Figure 22 and 23 for location of components called out in this procedure.

1. Shut off all cylinders on both banks of the manifold.
2. Close the main supply source valve.
3. Close the shut off valve on the upper Tee Check Valve (See figure XX)
4. Using the Circuit Board switches, cycle the manifold from bank to bank to vent residual dome bias pressure.
5. Depress bleed valves on both line regulators to relieve all pressure from the manifold.
6. Slowly open one cylinder on the side of manifold that needs adjustment. For example, if the right bank regulator needs adjustment, open one cylinder on the right side of manifold.
7. Slightly vent off the pressure from the bleed valve to create a small flow of gas through the manifold. Make sure the lock nut is loosened. Hold the copper pipe in place and use a wrench to adjust the adjustment screw on the bonnet of the

regulator. Set the bank regulator to the specific setting and tighten the nut to lock the setting.

(Intermediate Pressure - Ready Bank).

8. Close cylinder valves.
9. If the other bank regulator also needs to be adjusted, repeat steps 4 through 8.
10. Apply Teflon tape to the threads.
11. Open the shut off valve on the upper Tee Check Valve (See figure XX)
12. Slowly open all cylinders on both manifold banks.
13. Open main supply source valve.

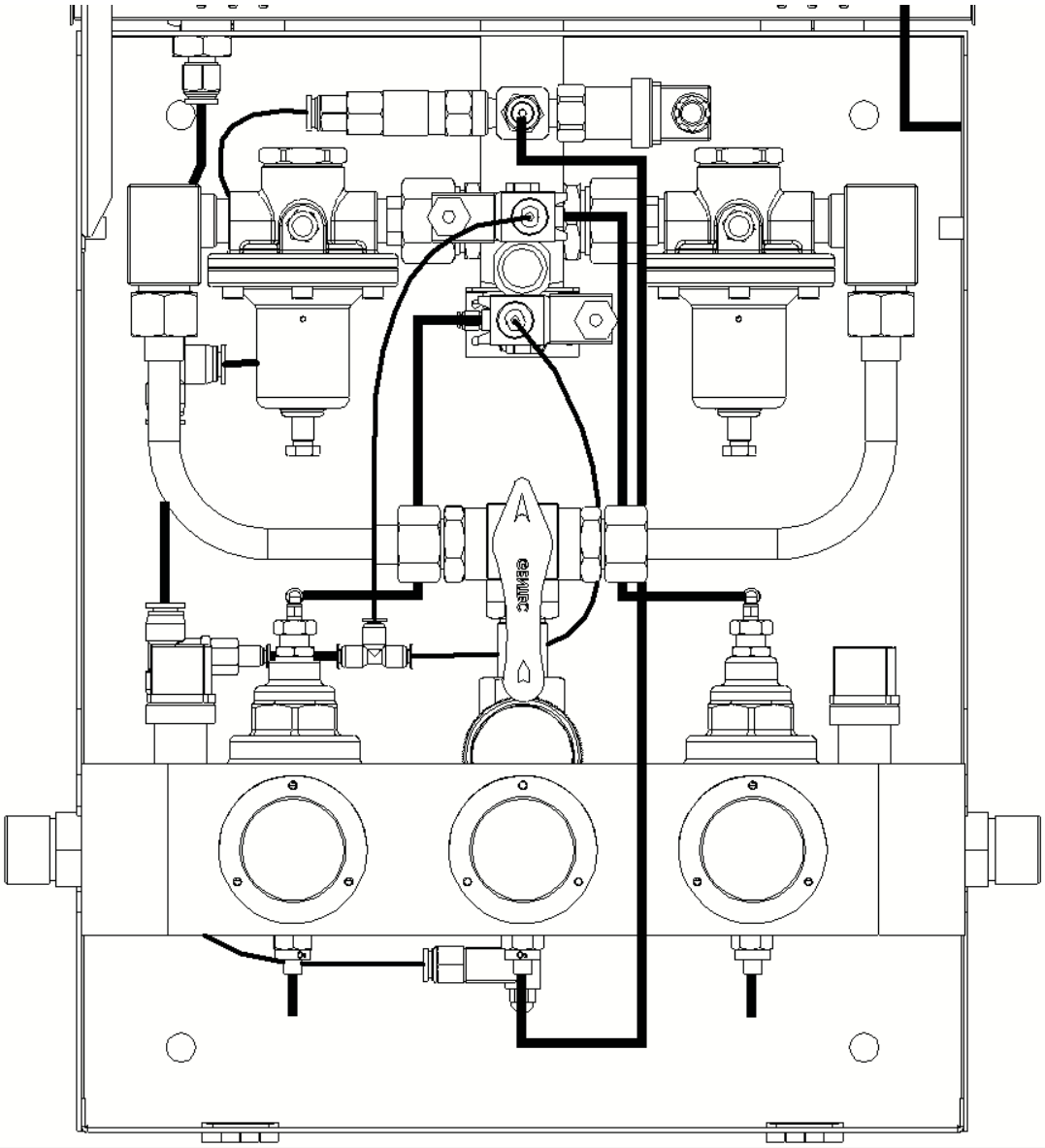


**Figure 22**

**Figure 23**

## Line Regulator Pressure Setting and Adjustment

**WARNING:**

- If necessary, most service, adjustment, and testing can be performed while line regulator is in service. However, this should only be done by GENTEC's engineers or qualified technicians experienced in servicing medical equipment to be approved.
- All regulators in the manifold are pre-set and locked to prevent accidental changes. If adjustments are required, the adjustment nut must be loosened before adjustment. After adjustments are made, it is recommended to tighten the nut to lock the setting for the regulator.

The following procedure describes the process of setting line regulator pressure. This procedure should only be performed if line regulator pressure are not within acceptable limits during performance verification procedure or after installation of a new line pressure regulator.

When shipped from factory, line regulators pressure has is pre-set and the 3-Way Ball Valve pointing to the right side. Refer to Figure 20.

1. Remove manifold cover (see Figure 2).
   Pull open the front cover of the control module from the bottom. The front cover opens from bottom to top. Two prongs on each side of the control module can be lifted and inserted to the cover to hold the cover open.
2. Ensure both bank regulators are supplying pressure
3. Close the main supply source valve.
4. Turn Tee Ball Valve handle indicator to point towards the side of line regulator that requires adjustment.
5. Use a wrench to loosen the locking nut on the line regulator.
6. Use a wrench to adjust the outlet pressure to the appropriate setting. Note reading on gauge for later use. Refer to table 1 (delivery pressure) setting.
7. Move the Tee Ball Valve to the off position as shown in Figure 23.
8. Depress the line pressure in the line regulator by depressing the bleed valve.
9. Repeat steps 4-8 to make adjustments for the other line regulator.
10. Open main source supply valve.
11. Close manifold cover.

## Pressure Control and Display Setting and Adjustment

The GENTEC® GM2 series manifold is controlled by a Micro-Processor Based circuit board. The Circuit Board is preconfigured before shipment. Any adjustments shall be done by GENTEC's engineer or an approved technician. Recommended settings are listed in Table 1

## Precautions

**WARNING:**

- Tempering with gas specific connections shall be prohibited. Do not alter, remove or modify gas specific connection.
- Keep all manifold parts, tools and work surfaces free of oil, grease and dirt. These and other flammable materials may ignite when exposed to high pressure oxygen or nitrous oxide.
- Use only proper repair tools and parts. Use only approved repair parts provided by GENTEC.
- Do not use chemicals, lubricants or sealants unless specified in these instructions.
- Before connecting cylinder to manifold, momentarily open and close cylinder valve to blow out dirt and debris.
- After connecting cylinder valve slowly to allow heat of compression to dissipate.
- Do not apply heat to any part of the manifold system.
- Do not use flame or "sniff" test for leaks.
- Always secure high-pressure cylinders with racks, straps, or chains. Unrestrained cylinders may fall over and damage or break off cylinder valve.
- Do not repeatedly bend, sharply bend, or twist copper pigtails as damage to tubing may occur.
- Do not bend flexible pigtails into a radius smaller than 80mm (3").

## Routine Maintenance

The GENTEC® GM2 series automatic manifold system routine maintenance following:

**Daily:**

- Visually inspect manifold for normal operation. Record front panel indicator status (e.g. left bank “IN USE”, right bank “READY”).
- Record left and right bank pressure gauge or digital readings.
- Record outlet pressure gauge or digital reading.

**At Cylinder Replacement:**

- Visually inspect each pigtail for cleanliness, and damage. Do not use and immediately replace dirty or damaged pigtails.
- Check for leaks at cylinder to pigtail connection using oxygen compatible leak detector solution.

**Quarterly:**

- Change filters connected to header bars every three months.

**Annually:**

- Verify manifold operation using performance Verification procedure.

**Every 3-5 Years:**

- Replace pigtails. Be sure to test and replace according to local laws.

## Pressure Switch Replacement

Following procedure describes process of setting pressure switches. This procedure should only need to be performed if manifold changeover pressures were not within acceptable limits during Performance Verification procedure. Recommended settings are listed in Table 1. When cylinder pressure of “IN USE” bank drops to switch setting, manifold will switch to opposite cylinder bank. Switches should always be adjusted as pressure decreases, see Figure 25. If pressure switch can not be set, switch must be replaced. Pressure switches are not repairable.

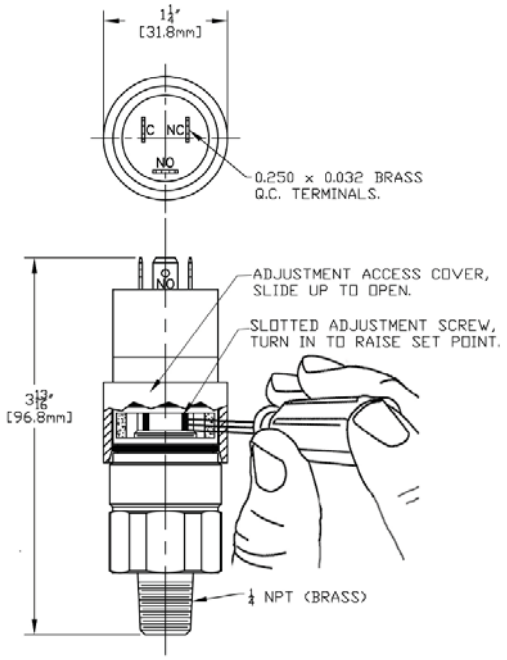



**Figure 25**

## Bank Regulator Replacement

Bank Regulators can be replaced while the manifold is in service. However, this should only be done by a qualified technician experienced in gas related equipment.

The following exploded diagram shows all the internal parts for replacement if necessary. Replacing damaged parts with genuine GENTEC spares can be an option when replacement regulators are not available.

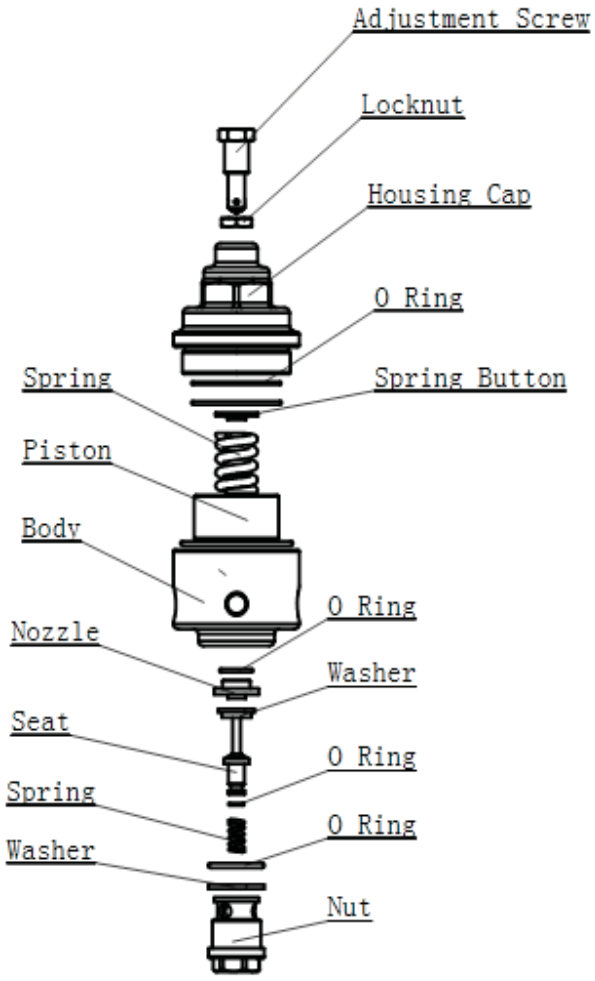



**Figure 26**

## Line Regulator Replacement

Line Regulators can be replaced while the manifold is in service. However, this should only be done by a qualified technician experienced in gas related equipment.

The following exploded diagram shows all the internal parts for replacement if necessary. Replacing damaged parts with genuine GENTEC spares can be an option when replacement regulators are not available.

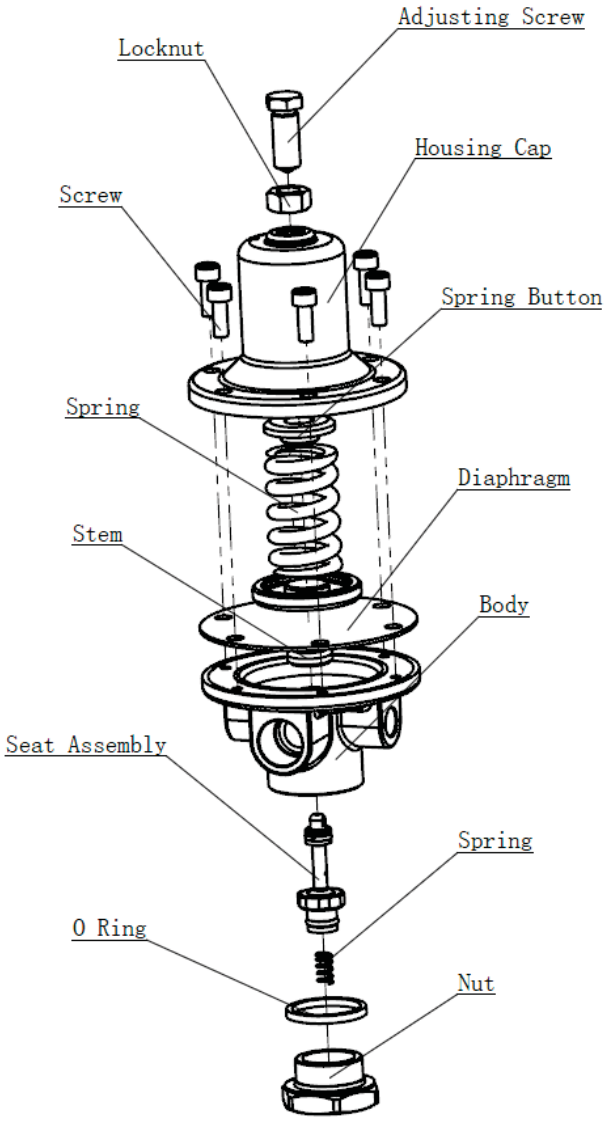



**Figure 28**

# Circuit Board Specifications

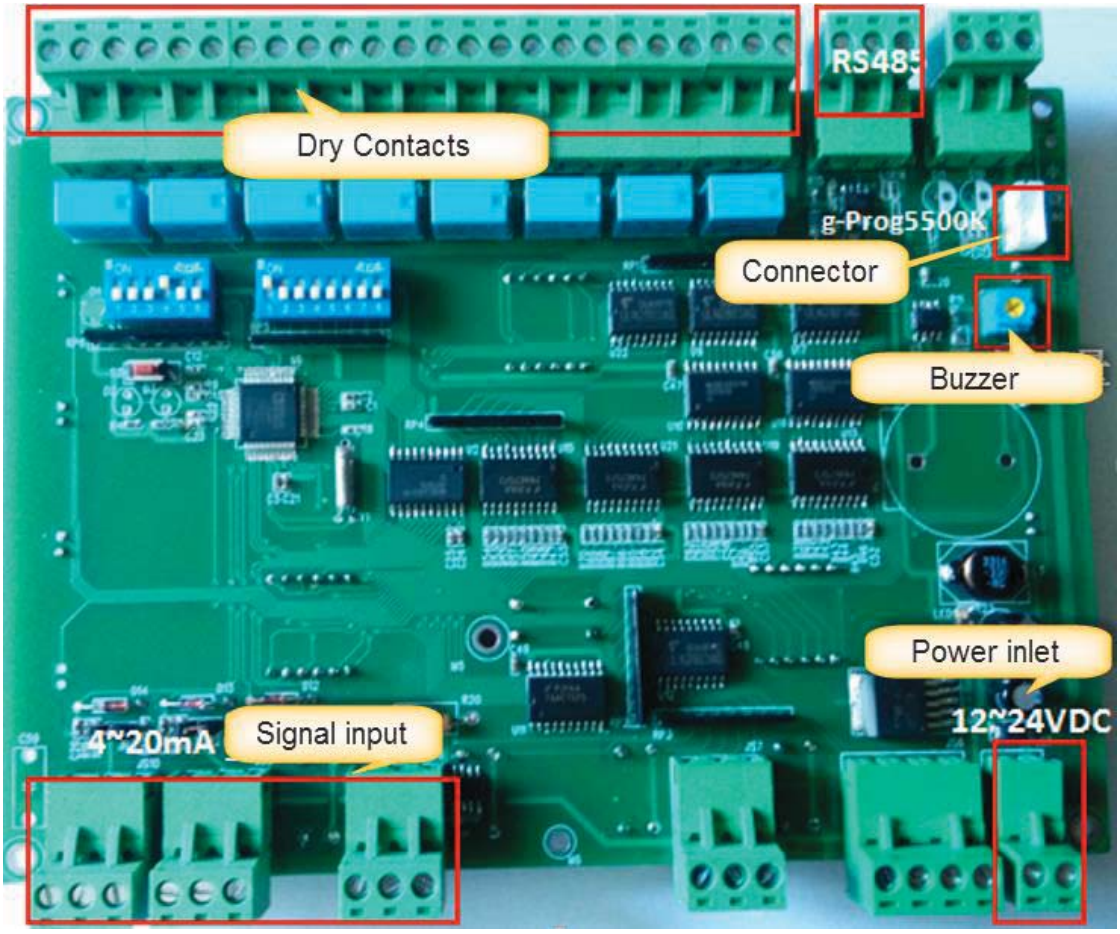
## Display Panel

| | |
|---|---|
| **MECHANICAL** | |
| Physical Dimension | 180mmX130mmX30mm (Length X Width X Depth ) |
| **ENVIRONMENT** | |
| Ambient Temperature | 0℃ ~50℃ (32℉ ~122℉)* |
| Ambient Humidity | 10% ~85% RH, Non-condensing* |
| **ELECTRICAL** | |

| | |
|---|---|
| Power Requirements | +12~24VDC |
| Optional Analog Input | Input Type: 4-to-20 mA current,<br>Working Range: 4~20 mA<br>Channels: 3 Maximum<br>Safety Range: 0~12V DC/0~28 mA Maximum |
| Analog Data Display | 3 Channels |
| Display Resolution | Four digit |
| **COMMUNICATION** | |
| Optional RS-485 Port | @ 9600,19200,38400,115200 baud, standard |
| **HUMAN INTERFACE** | |
| LED Display | LED lights and Seven-segment LEDs |
| Optional Buzzer | (OPTION) |

1, Front View


2, Back View




## 3. Transducer Connection

### 3.1.1 4~20mA

**JS8**

| | | | |
|---|---|---|---|
| | Vdc | A1+ | COM |

**JS9**

| Vdc | A2+ | COM |
|---|---|---|

**JS10**

| Vdc | A3+ | COM |
|---|---|---|


**Table 3 : Analog Input Connection**

| INPUT AND OUTPUT CONNECTIONS | |
|---|---|
| **SCREW TERMINAL** | **CONNECTION** |
| **VDC** | DC Power Output |
| **A1+ (Left Bank)** | Analog Channel 1Signal + |
| **COM** | Analog Input Common (Ground) |
| **VDC** | DC Power Output |
| **A2+ (Main Line)** | Analog Channel 2 Signal + |
| **COM** | Analog Input Common (Ground) |
| **VDC** | DC Power Output |
| **A3+ (Right Bank)** | Analog Channel 2 Signal + |
| **COM** | Analog Input Common (Ground) |

## 3.3 Buttons Operation

### 3.3.1 Mute/Test (S4) Button

Provides three functions as follows:

(1). Test Mode: In normal operation, push and release the button to enter test mode. An alarm will sound
The digital gauge readings will show the following sequence:
- Fully dimmed to fully lit
- Display of set high limit alarm
- Display of set low limit alarm
- Fully dimmed to normal operation

(2). Mute/Silencing of Alarm: When an alarm alerts, pushing this button will mute the alarm for a factory default of 240 minutes

### 3.3.2 Buttons Parameters and Settings

Button parameters and settings allows users to modify basic parameters through the use of onboard buttons. The modifiable parameters include: Upper and lower alarm setting for left and right bank content as well as the supply pressure alarm conditions. Advanced parameters and settings can be

modified through g-Prog5500 software via connection to PC.

Buttons and Setup:

1. Set Button (S7)
   a. Press “Set” button and “Increase” button simultaneously for 3 seconds to enter parameter settings mode. When pushing “Set” + “increase” to enter setup mode, make sure you have not manually switched the change over to the left side.

   b. LED lights will cycle through showing different parameter mode(s) to enter. See chart below for indication of mode. To enter desired mode, press the enter button (right key)

LED Light Indicates Following Parameter Setup Modes

| | Left | Middle (outlet) | Right |
|---|---|---|---|
| Upper Limit | | Both sides Green LED on | |
| Lower Limit | Left red LED on | Both side Red LED on | Right Red LED on |

Once within a mode, use the arrow keys to increase or decrease the setting. Press the save button to save the adjustment. Push set to move onto next parameter. Press and hold select button for 3 seconds to exit setup mode. When idle for more than one minute, the system also automatically exists setup mode.

   c. To restore back to factory settings press “Set” button and “Decrease” button simultaneously for 3 seconds
   d. Pushing Select Button by itself when not in setup mode will enable a manual switchover to the left bank.
2. Increase button (S8)
   Used to modify settings in increasing increments.
3. Decrease button (S9)
   Used to modify settings in decreasing increments.
4. Save/Return button(S10)
   a. Saves modified parameters.
   b. When not in setup mode, the return button enables a manual switchover to the right bank

### 3.4、Dry Contact Output (JS5)

| NC 1 | C 1 | NO 1 | NC 2 | C 2 | NO 2 | NC 3 | C 3 | NO 3 | NC 4 | C 4 | NO 4 | NC 5 | C 5 | NO 5 | NC 6 | C 6 | NO 6 | NC 7 | C 7 | NO 7 | NC 8 | C 8 | NO 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Table 4: Input/output Signal Connections (JS5)**

| INPUT AND OUTPUT CONNECTIONS | | | |
|---|---|---|---|
| **Relay No.** | **Terminals** | **CONNECTION** | **Function Description** |
| 1 | NC1 | Relay 1 Normally Close | Outlet Pressure too high-------- NC1 , C1 short circuit<br>Otherwise ------ NO1 , C1 short |
| | C1 | Relay 1 Common | |
| | NO1 | Relay 1 Normally Open | |
| 2 | NC2 | Relay 2 Normally Close | Outlet Pressure too high -------- NC2 , C2 short circuit<br>Otherwise------ NO2 , C2 short circuit |
| | C2 | Relay 2 Common | |
| | NO2 | Relay 2 Normally Open | |
| 3 | NC3 | Relay 3 Normally Close | During Alarm Buzzer------- NC3 , C3 short circuit<br>Muting---------- NO3 , C3 short circuit |
| | C3 | Relay 3 Common | |
| | NO3 | Relay 3 Normally Open | |
| 4 | NC4 | Relay 4 Normally Close | Left pressure is too low -------- NC4 , C4 short circuit<br>Otherwise----- NO4 , C4 short circuit |
| | C4 | Relay 4 Common | |
| | NO4 | Relay 4 Normally Open | |
| 5 | NC5 | Relay 5 Normally Close | Right pressure is too low-------- NC5 , C5short circuit<br>otherwise------ NO5 , C5short circuit |
| | C5 | Relay 5 Common | |
| | NO5 | Relay 5 Normally Open | |
| 6 | NC6 | Relay 6 Normally Close | Any Pressure Warning-------- NC6 ,C6short circuit<br>No Pressure Warning-------- NO6 , C6short circuit |
| | C6 | Relay 6 Common | |
| | NO6 | Relay 6 Normally Open | |
| 7 | NC7 | Relay 7 Normally Close | When switching to left bank-------NC7 and C7 becomes short circuit ◦<br>Left bank standby----------NO7and C7 becomes short circuit ◦ |
| | C7 | Relay 7 Common | |
| | NO7 | Relay 7 Normally Open | |
| 8 | NC8 | Relay 8 Normally Close | When switching to right bank-------NC8 and C8 becomes short circuit ◦<br>Right Bank Standyby----------NO8 and C8 becomes short circuit ◦ |
| | C8 | Relay 8 Common | |
| | NO8 | Relay 8 Normally Open | |

* Typically, connect NC and C to the master alarm.

## 3.5 RS-485 Device ID Selection Switch(S1)

When connected to a RS-485 network, the switch is used to select a unique network device ID. The number must not be used by other modules, devices, or computers on the same network for correct device identification.

**Table 5: RS-485 Device ID Selection Switch (S6)**

| DEVICE ID | S6 DIP SWITCH SETTING | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 001 | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF |
| 002 | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **003** | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF |
| **004** | OFF | OFF | ON | OFF | OFF | OFF | OFF | OFF |
| **005** | ON | OFF | ON | OFF | OFF | OFF | OFF | OFF |
| **006** | OFF | ON | ON | OFF | OFF | OFF | OFF | OFF |
| **007** | ON | ON | ON | OFF | OFF | OFF | OFF | OFF |
| **008** | OFF | OFF | OFF | ON | OFF | OFF | OFF | OFF |
| | | | | … … … | | | | |
| **254** | OFF | ON | ON | ON | ON | ON | ON | ON |
| **255** | ON | ON | ON | ON | ON | ON | ON | ON |

## 3.6 Operational Mode Selection Dipswitch(S3)

**Table 6: Operational Mode Selection (S2)**

| S2 SWITCH SETTING | | | | | | OPERATIONAL MODE SELECTION |
|---|---|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** | **6** | |
| X | X | X | OFF | OFF | OFF | RS232/485, Baud Rate is set 9600 |
| X | X | X | ON | OFF | OFF | RS232/485, Baud Rate is set 19200 |
| X | X | X | OFF | ON | OFF | RS232/485, Baud Rate is set 38400 |
| X | X | X | ON | ON | OFF | RS232/485, Baud Rate is set 115200 |
| OFF | OFF | OFF | X | X | OFF | Execution mode 0 (no alarm condition priority use) |
| ON | OFF | OFF | X | X | OFF | Execution mode 1 (Right Bank Priority Use) |
| OFF | ON | OFF | X | X | OFF | Execution mode 2(Left Bank Priority Use) |
| ON | ON | OFF | X | X | OFF | Reserved |
| OFF | OFF | ON | X | X | OFF | System and Relay Test |
| ON | OFF | ON | X | X | OFF | Display Communication Parameters |
| OFF | ON | ON | X | X | OFF | Display ADC Measured Voltage(in mV) |
| ON | ON | ON | X | X | OFF | ADC Calibration (Can be done inside factory with equipment) |
| X | X | X | X | X | ON | Firmware Uploading |

## 3.7 RS-232 (TTL) Connector

The miniature connector is used to upgrade the firmware and operating parameters of the module

**Table 7: RS-232 Connector**

| PIN NUMBER | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **ASSIGNMENT** | +5V | TXD | RXD | GND |

## 3.8 RS-485 Screw Terminal Connector

**Table 8: RS-485 Connector (JS5)**

| JP2 CONNECTOR | | | |
|---|---|---|---|
| **Pin No.** | **1** | **2** | **3** |
| **Assignment** | Inverting Input/Output | Non-inverting Input/Output | SH |

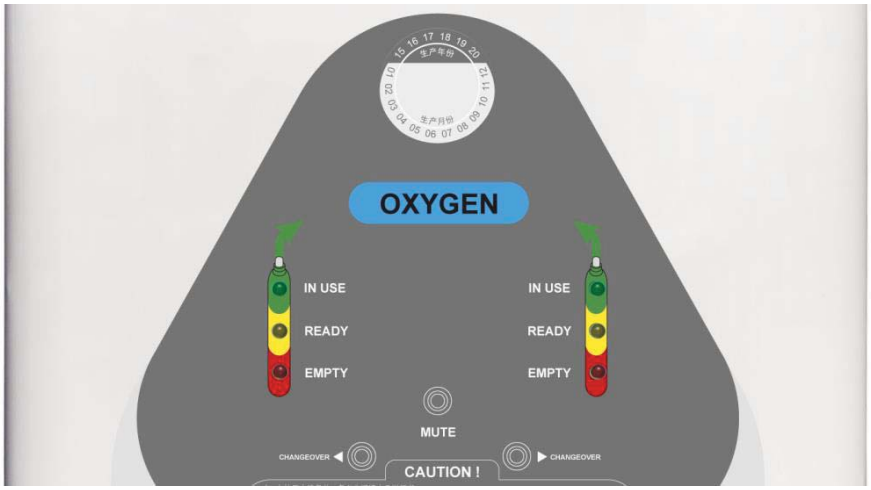
## 3.9 DC Power Input Connector

Voltage: +12~24V

**Table 9: DC Power Connector (JS1)**

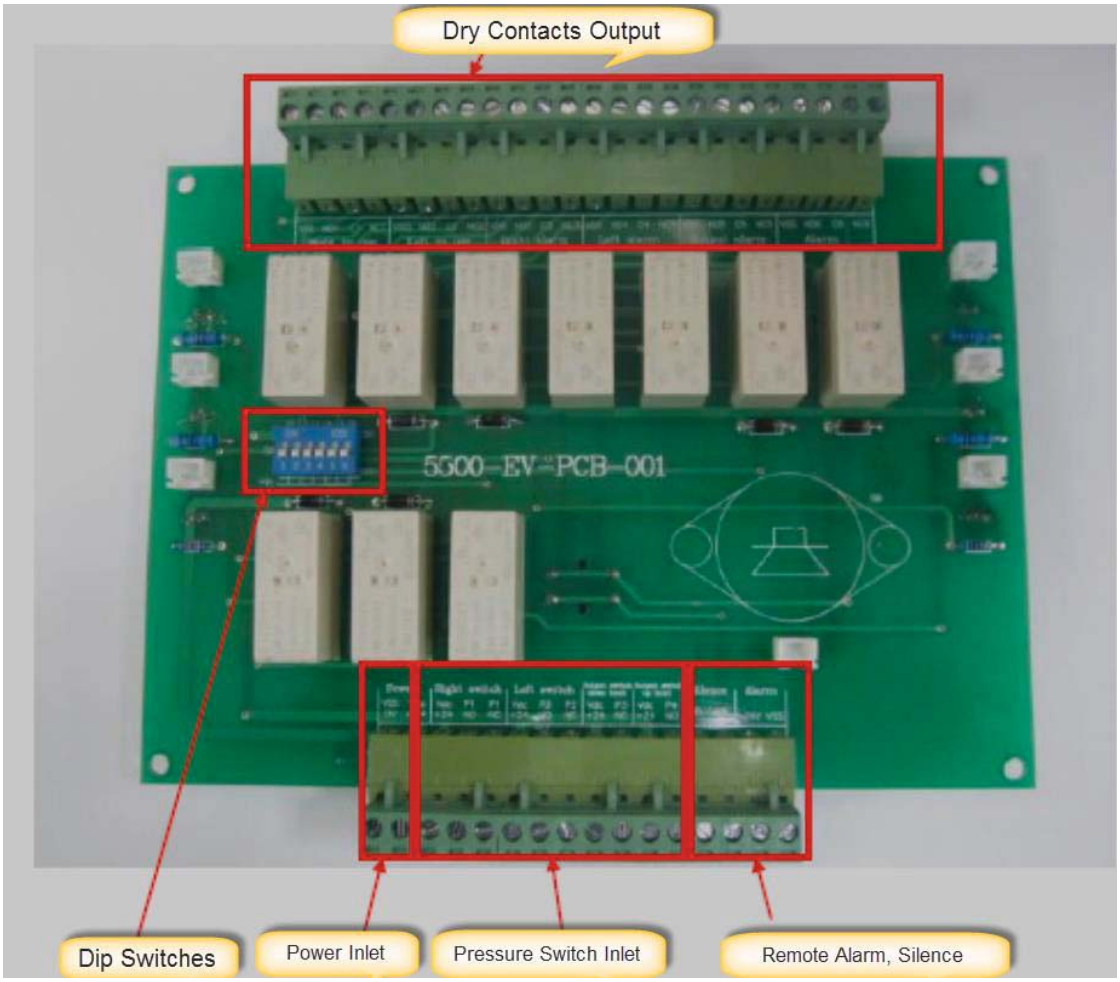
| J1 DC POWER CONNECTOR | | |
|---|---|---|
| **PIN** | 1 | 2 |
| **CONNECTION** | +VCC | GND |

## 1. Front View




5500PCB (Analog) Circuit Board

## 2. Board View



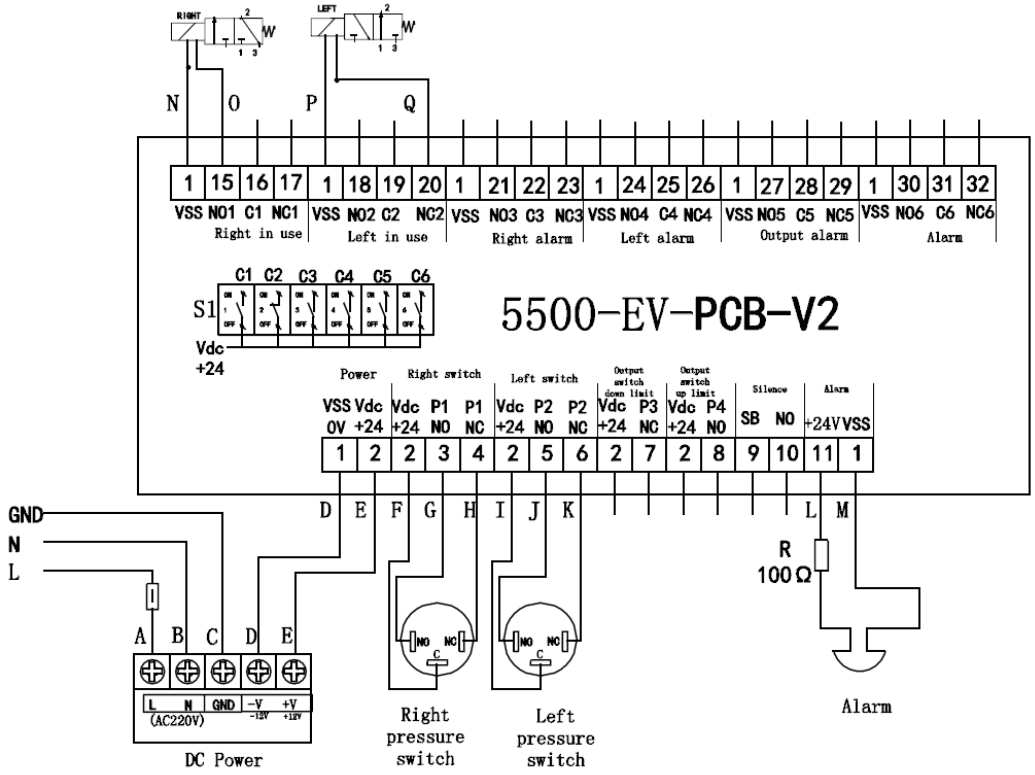

1. Voltage Input：+24VDC
2. Pressure switch input: left and right pressure switch normally open, normally closed and common leads are connected to the corresponding PCB board corresponding P1 \ P2 position
3. Changeover buttons
    a. Left Changeover button manually enables changeover to the left bank
    b. Right Changeover button manually enables changeover to the right bank

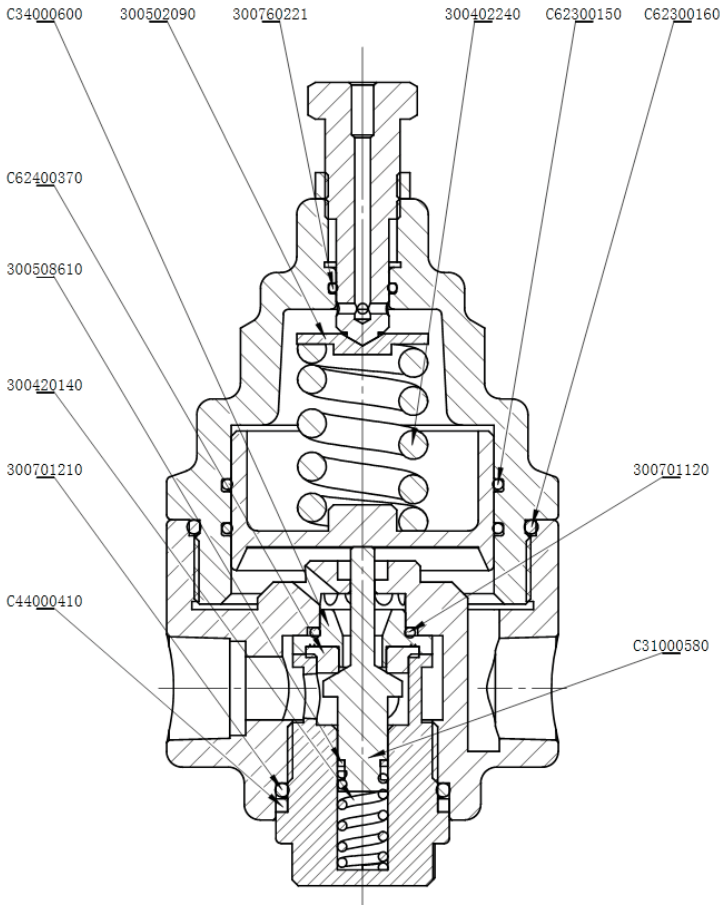
S1 DIP Switch Functions:

| Dry Contacts | Function Description | DIP number | Switch ON |
|---|---|---|---|
| NC1<br>C1<br>NO1 | Right Bank in Use--------NO1，C1short circuit<br>Otherwise-------NC1，C1short circuit | 1 | C1 connect +24V |
| NC2<br>C2<br>NO2 | Left Bank in Use-------- NO1，C1short circuit<br>Otherwise-------NC1，C1short circuit | 2 | C1 connect +24V |
| NC3<br>C3<br>NO3 | Pressure too low on right side------- NO3 , C3short circuit<br>Otherwise-----NC3，C3short circuit | 3 | C3、C4 Connected +24V |
| NC4<br>C4 | Pressure too low on left side------- NO4 , C4short circuit | | |

| | | | |
|---|---|---|---|
| NO4 | Otherwise-----NC4，C4short circuit | | |
| NC5<br>C5<br>NO5 | Abnormal outlet pressure-------- NO5 , C5short circuit<br>otherwise------ NC5 , C5short circuit | 4 | C1 connect +24V |
| NC6<br>C6<br>NO6 | Any abnormal pressure-------NO6，C6short circuit<br>otherwise----NC6，C6short circuit | 5 | C1 connect +24V |
| | Alarm self-locking function, during any abnormal pressure, system locks alarm condition regardless of whether the condition is resolved or MUTE button pressed. | 6 | K9 normally open contact connected +24V |

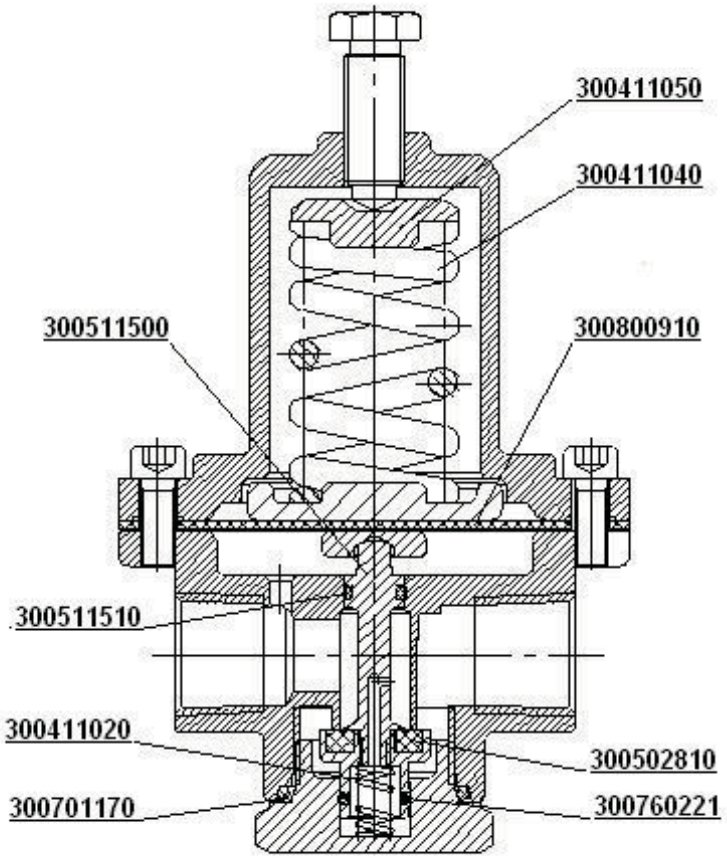
## Wiring Diagram





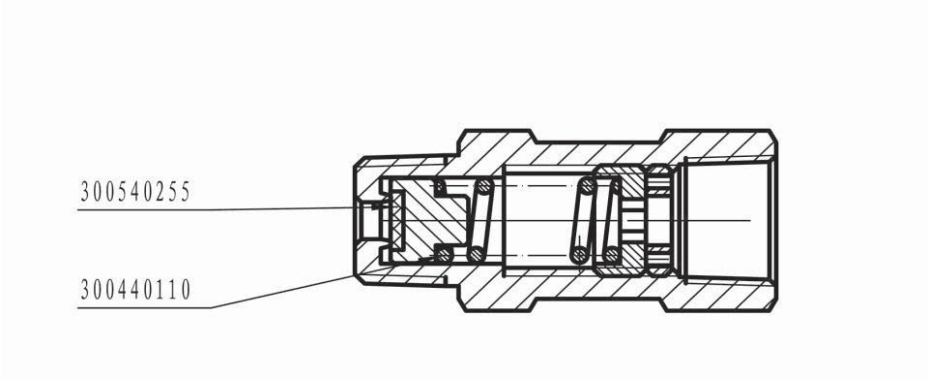

## Bank Regulator

| 9-Digit | Part Description | Quantity | Material |
|---|---|---|---|
| C44000410 | Washer | 1 | PTFE |
| 300701210 | O RING | 1 | FKM |
| 300420140 | Spring | 1 | Stainless Steel |
| 300508610 | Washer | 1 | PTFE |
| C62400370 | Washer | 1 | PTFE |
| C34000600 | Nozzle | 1 | Brass |
| 300502090 | Washer | 1 | Brass |
| 300760221 | O-Ring | 1 | EPDM |
| 300402240 | Spring | 1 | Stainless Steel |
| C62300150 | O-Ring | 1 | CR |
| C62300160 | O-Ring | 1 | CR |
| 300701120 | O-Ring | 1 | FKM |
| C31000580 | Valve | 1 | Brass |



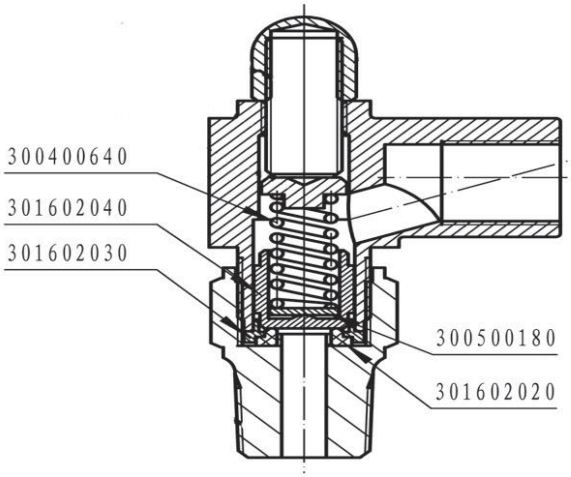

## Line Regulator

| 9-Digit | Part Description | Quantity | Material |
|---|---|---|---|
| 300411050 | Washer | 1 | Steel |
| 300411040 | Spring | 1 | Stainless Steel |
| 300800910 | Diaphragm | 1 | Rubber |
| 300701170 | O-Ring | 1 | Neoprene |
| 300511500 | Valve Assembly | 1 | Brass + Neoprene |
| 300411020 | Spring | 1 | Stainless Steel |
| 300760221 | O-Ring | 1 | Neoprene |
| 300502810 | Sealing Washer | 1 | TEFL |
| 300511510 | Damping Washer | 1 | TEFL |



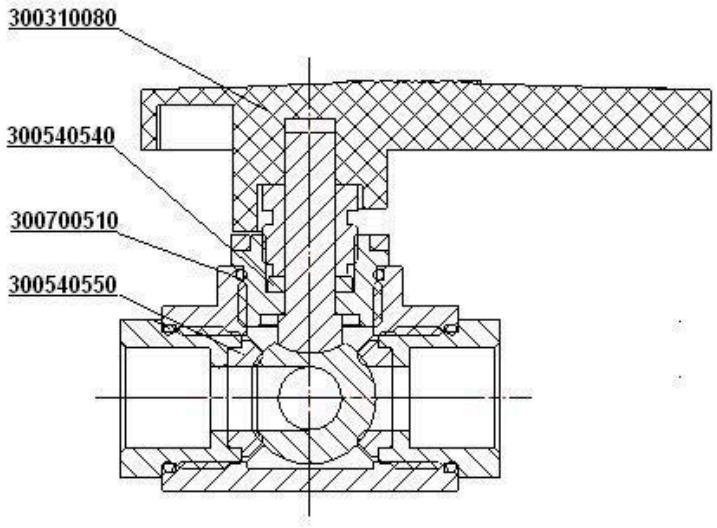

## Outlet Pressure Relief Valve

| 9-Digit | Part Description | Quantity | Material |
|---|---|---|---|
| 300540255 | Washer | 1 | Neoprene |
| 300440110 | Spring | 1 | Stainless Steel |



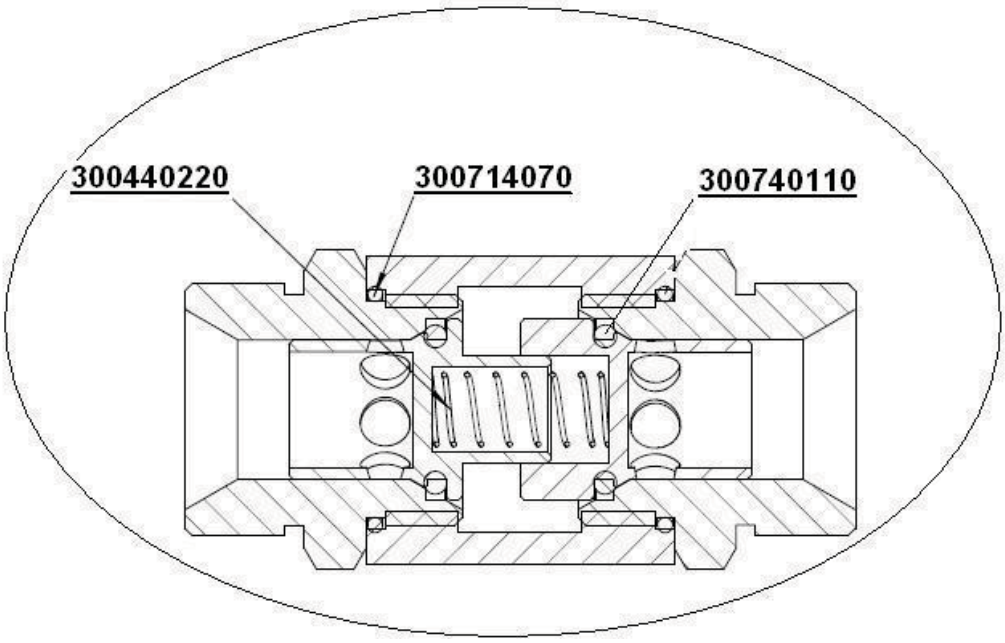

## Bank Pressure Relief Valve

| 9-Digit | Part Description | Quantity | Material |
|---|---|---|---|
| 301602020 | Valve Assembly | 1 | Neoprene |
| 300500180 | Washer | 1 | Brass |
| 301602030 | Valve Assembly | 1 | Brass |
| 301602040 | Valve Assembly | 1 | Brass |
| 300400640 | Spring | 1 | Stainless Steel |



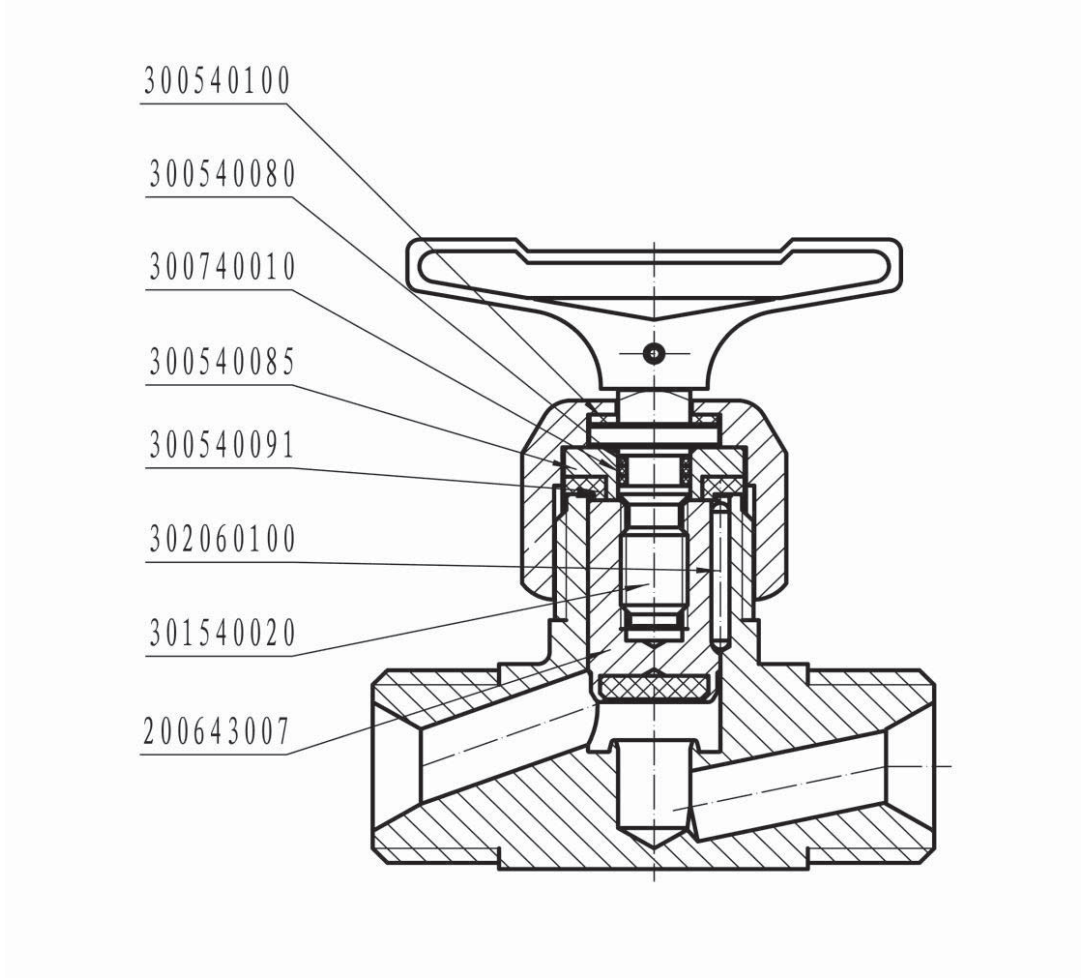

## 3-Way Ball Valve

| 9-Digit | Part Description | Quantity | Material |
|---|---|---|---|
| 300310080 | Bar-Handle | 1 | Polymer + Copper |
| 300700510 | O-Ring | 3 | Neoprene |
| 300540540 | Sealing Ring | 1 | TEFL |
| 300540550 | Sealing Ring | 4 | TEFL |



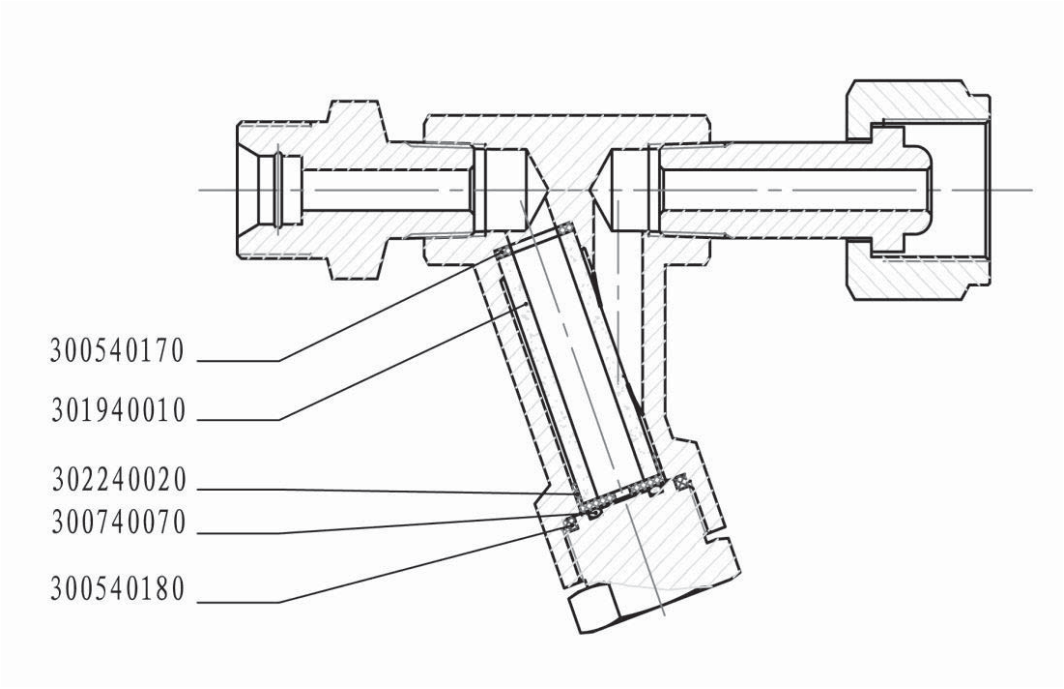

## Tee Check Valve

| 9-Digit | Part Description | Quantity | Material |
|---|---|---|---|
| 300440220 | Spring | 1 | Stainless Steel |
| 300740110 | O-Ring | 2 | Neoprene |
| 300714070 | O-Ring | 2 | Neoprene |




## Master Isolation Valve

| 9-Digit | Part Description | Quantity | Material |
|---|---|---|---|
| 300540100 | Washer | 1 | Nylon |
| 300540080 | Washer | 2 | TEFL |
| 300740010 | O-Ring | 1 | Neoprene |
| 300540085 | Washer | 1 | Brass |
| 300540091 | Sealing Washer | 1 | DERLIN |
| 302060100 | Pin | 1 | Stainless Steel |
| 301540020 | Valve Stem | 1 | Brass |
| 200643007 | Valve Assembly | 1 | Brass + PCTEF |




## Filter

| 9-Digit | Part Description | Quantity | Material |
|---|---|---|---|
| 300540170 | Washer | 1 | TEFL |
| 301940010 | Sintered Element | 1 | Brass Alloy |
| 302240020 | Sealing Button | 1 | TEFL |
| 300740070 | O-Ring | 1 | Neoprene |
| 300540180 | Sealing Ring | 1 | TEFL |

# Troubleshooting Guidelines

## Potential Problems, Causes, and Solutions:

| Ref. No. | Problem(s) | Cause(s) | Solution(s) |
|---|---|---|---|
| 1 | No outlet pressure | 1. Inlet filter is plugged, blocking the gas<br>2. The all isolation valve on one or both sides of manifold is not open all the way. | 1. Check filter on both sides of manifold, if necessary, change it.<br>2. Open the master isolation valve for each bank. |
| 2 | No outlet pressure from regulator | 1. Regulating spring is broken inside the regulator.<br>2. Pressure adjusting screw is broken or threading is broken. | 1. Change a spring.<br>2. Change the bonnet or pressure adjusting screw. |
| 3 | The safety relief port on top of the regulator bonnet is releasing gas. | 1. Broken diaphragm | 1. Change new diaphragm |
| 4 | Regulator is leaking from outside | 1. Bonnet is loose<br>2. Inlet/outlet connection is loose | 1. After dissipating the remaining gas inside the regulator, tighten the bonnet.<br>2. Make sure the inlet/outlet connections do not have cracks, and then tighten the connections. |
| 5 | 3-Way ball valve is leaking from the handle bar | 1. Handle bar is loose<br>2. Handle bar seal is broken | 1. Tighten the handle bar<br>2. Change a seal |
| 6 | The ball valve is leaking from the body | 1. The connections are loose<br>2. The valve stem is broken or cracked | 1. Tighten the connections<br>2. Change the stem seals |
| 7 | Regulator is sending out abstract signals. | 1. The flow is too high after the change over occurred<br>2. The change over process caused too much pressure on the system | 1. Check the flow, and adjust to low flow<br>2. Close the outlet pressure and re-run the system.<br>3. Change the washer inside the regulator. |
| 8 | Display shown not correct or not shown | 1. The pressure transducer is broken.<br>2. Circuit Board is broken. | 1. Change pressure transducer<br>2. Change the Circuit Board |

# Warranty

GENTEC warrants The GENTEC® GM2-Aand GM2-Dseries automatic manifold system to be free of defect in materials or workmanship when installed and operated in accordance with instructions for the twelve (12) months from the date of shipment. This warranty covers all necessary parts required for correction on defective materials or workmanship at GENTEC's cost.

The warranty requires the owner to ensure that the equipment has been properly installed according to GENTEC specifications, used in a normal manner and serviced according to factory recommendations. Damage due to misuse, abuse, negligence, accident, mishandling, abnormal wear and tear, shipment, or acts attributable to acts of God, is not covered by this warranty and must be replaced or repaired at the sole expensive of the equipment owner.