GENTEC®

AUTOMATIC MEDICAL MANIFOLD

Instruction Manual

(Installation, Operation and Service)

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GR-MAN-MEDGM20723 V1

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Introduction:

Definition of Statements

Statements in this manual preceded by the following words have 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 a 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 right corner of the manifold and converts 100-250 VAC to 24 VDC to power the manifold. The GENTEC GM2-A Series 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.

Installation:

Precautions

WARNING:

- Tempering with gas specific connections is 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 the cylinders to the manifold, momentarily open and close cylinder valve to blow out dirt and debris.
- After connecting the cylinders to the manifold, slowly open cylinder valve to allow compression heat dissipates.
- 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 76mm (3”).
- To avoid accidents, after the manifold wall bracket has been mounted, do not attempt to lift and hang the manifold cabinet alone.
- 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 shall 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:

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

Main Components of Manifold System

The GENTEC® GM2-A and GM2-D series 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 the wall, but may also 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 it upwards on the cardboard packaging.
2. Remove four M12 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 by making a horizontal line and taking into account the clearance of cylinders, a minimum height of 60” (1.5 m) is recommended.
4. Use the mounting bracket as a template, place bracket on the flat wall where manifold will be mounted as shown in Figure 2. Align the top of the bracket with the horizontal line and mark the location of the mounting holes.
5. Remove the bracket and drill holes at the marks. Use anchors to secure the bracket mounted to the wall.
6. Install two M12 hex head bolts and nuts on the upper side of the control module and fasten until the gap between the head of the bolts and the control module is greater than 10mm, as shown in Figure 3.

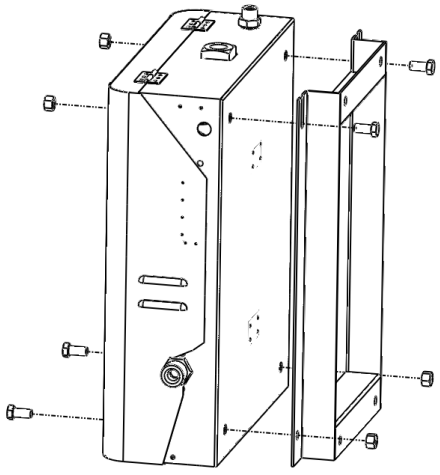


Figure 1

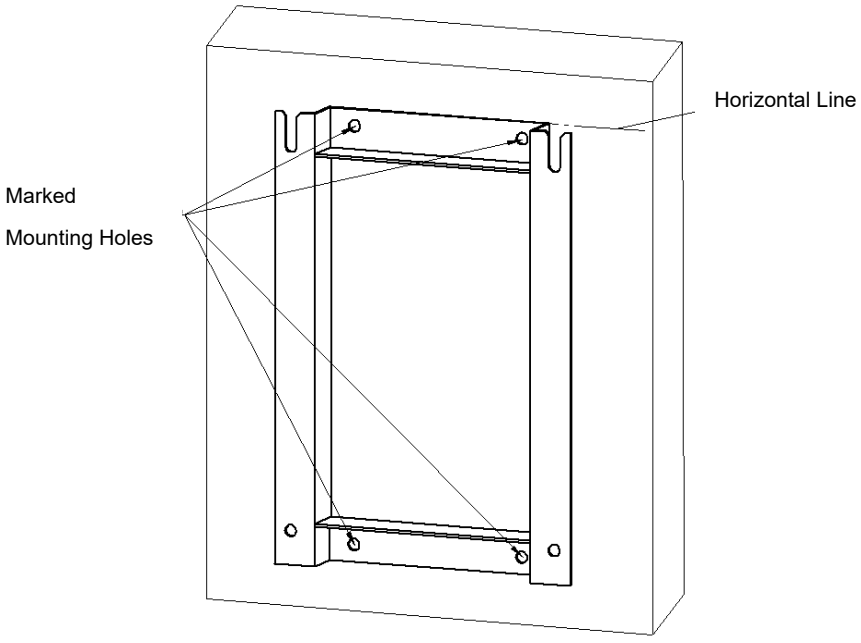


Figure 2

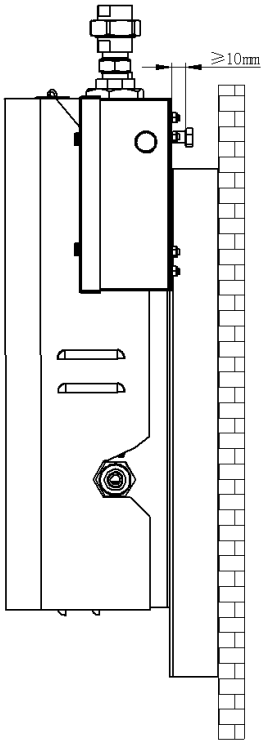


Figure 3

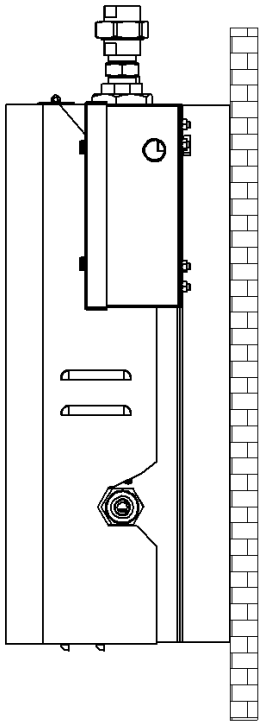


Figure 4

7. Slide the two mounting bolts on the upper side of the control module into the bracket slots and tighten all four screws as shown in Figure 4.
8. Each header extension is shipped with pipe holder and pipe support. Mount pipe support against the wall and on the bottom side of the holder as shown in Figure 5. Attach pipe support to wall using appropriate anchors, 6mm (3/8”) diameter anchors are recommended.

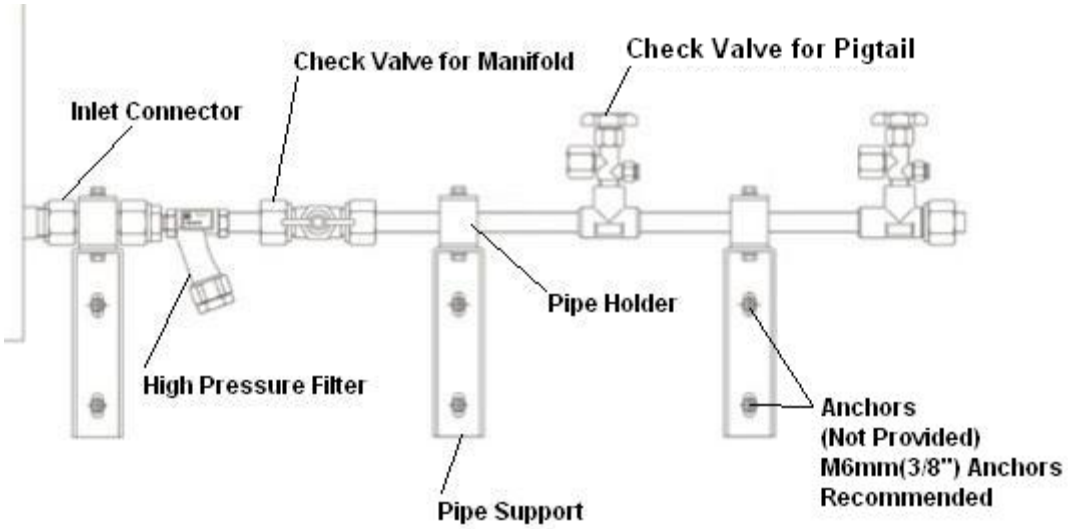


Figure 5

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.

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 6 illustrates a typical 2 x 2 GENTEC GM2-A Series automatic manifold system utilizing 36” length flexible pigtails.

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 7 illustrates a typical 2 x 2 GENTEC GM2-D Series automatic manifold system utilizing 36” length with pre-

formed rigid copper pigtails.

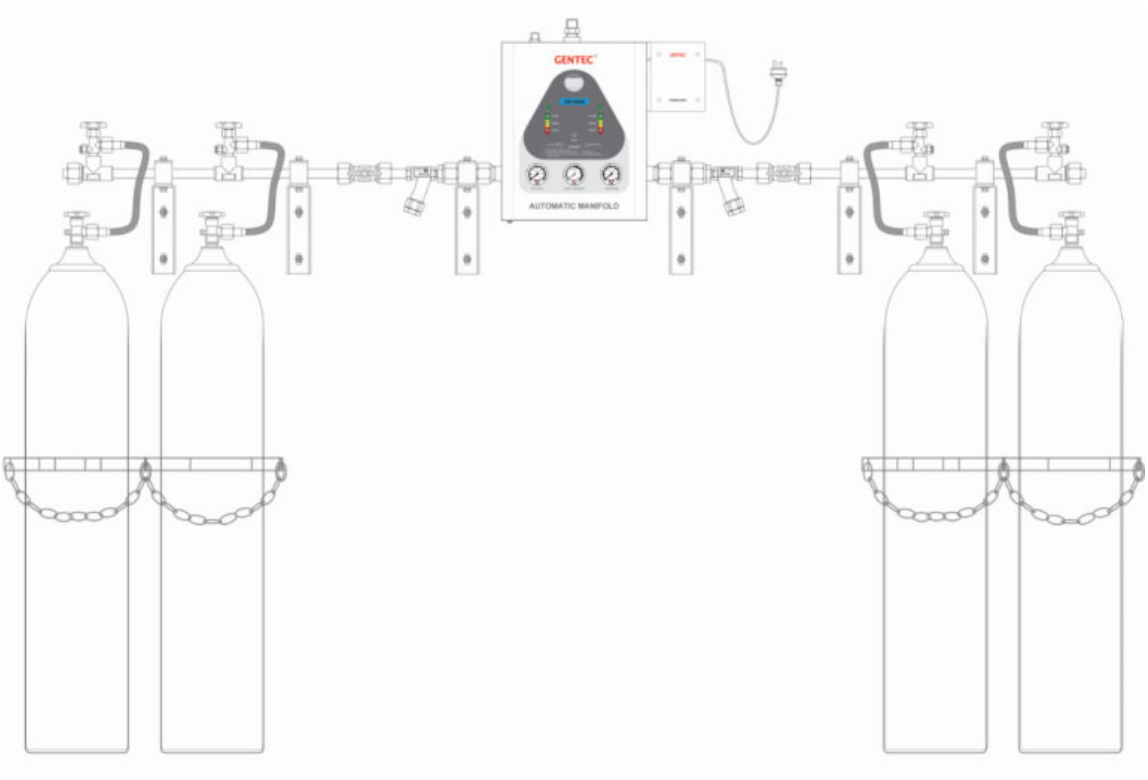


Figure 6

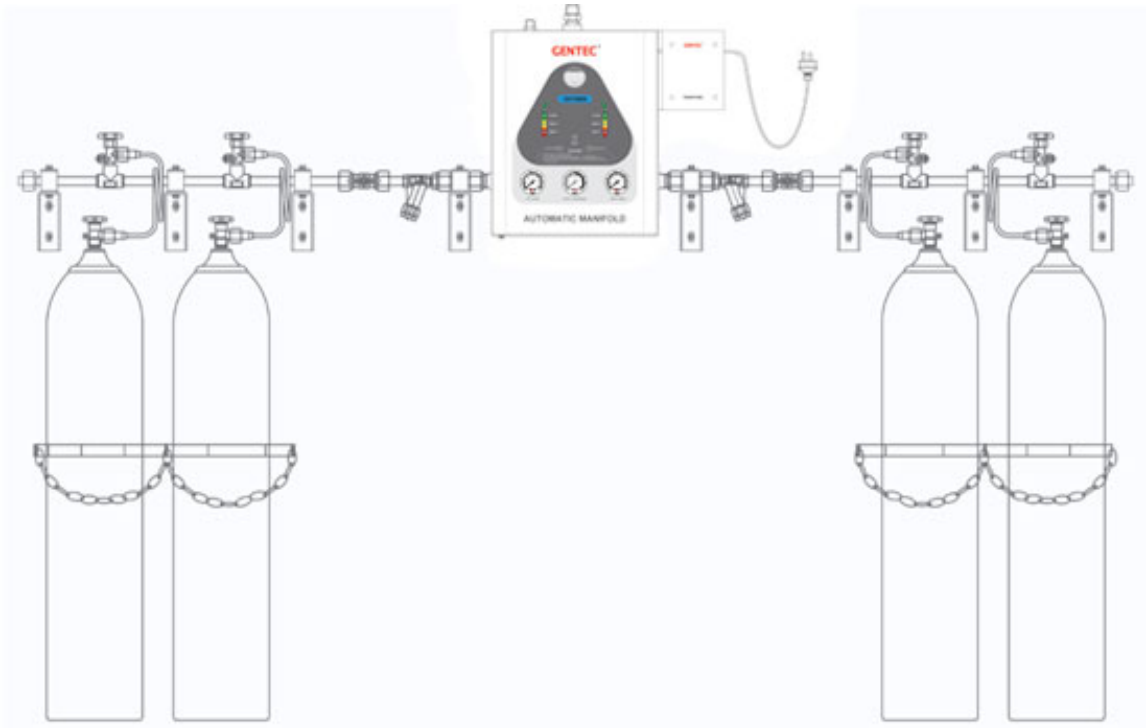


Figure 7

Connection: 1. Remove the protective caps from manifold header pigtail connections.

2. Attach one end of the pigtails to the cylinder valve.

3. Position the cylinders as shown in Figure 6 and Figure 7. Make sure that every cylinder that stand against the wall or stand freely on the floor is secured using chain or strapped belt. Rigid copper pigtails used in oxygen and helium manifolds may be bent according to the needs before connected to the cylinder outlets.

4. Tighten all pigtail connections, but do not over-tighten, as it may cause the connector to deform.

WARNING:

- All pigtail assemblies are shipped in sealed bags and are cleaned as if for oxygen use. Manifold header connections are cleaned and capped. Do not unpack or remove any cap until ready to install. During installation, please 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, damage or break cylinder valve.

CAUTION:

1. Prior to connecting pigtail to cylinder, slightly open and close each cylinder valve to blow out dirt and debris.
2. Do not use thread sealant on header or pigtail connections.

Electrical Wiring

1. Wire Power Supply Input to 120-240VAC 60Hz Life Circuit.
2. Wire Medical Master Alarm Reserve-In-Use Signal to Main Control Board Terminal C6 Common, NO6 Signal

CAUTION:

All wiring shall be protected in accordance with NFPA 70; UL and CE, National Electric Code to prevent physical damage from cable ducts and gas pipeline.

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. Check the following:
   a) Both master shut-off valves on the header bar are fully open (turned counter clockwise)
   b) Both red “Empty” indicators on front of the manifold are illuminated.
   c) If connected to a master alarm panel, check whether “Changeover” alarm is activated.
3. Close the manifold’s shut-off valve.
4. Slowly open the cylinder on the right side of the manifold and verify the following:
   a) Right bank red “EMPTY” light goes out;
   b) Right bank green “IN USE” light illuminates;
   c) Right bank cylinder pressure gauge reads cylinder pressure
5. Slowly open the cylinder on left side of manifold and verify the following:
   a) Left bank red “EMPTY” light goes out;
   b) Left bank yellow “READY” light illuminates;
   c) Left bank cylinder pressure gauge reads cylinder pressure.
   d) If connected to a master alarm panel, check whether “Changeover” alarm is activated.
6. Close the right bank cylinder, slightly press the vent valve on the regulator and verify the following:
   - Right bank cylinder pressure gauge drops slowly.
   - As the right cylinder pressure is nearly depleted, the manifold switches to the left bank.
   - After changeover, the right bank green “IN USE” light goes out, the red “EMPTY” light illuminates and alarm is activated.
   - After changeover, the 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 the right side of the manifold and verify the following:
   - Right bank red “EMPTY” light goes out;
   - Right bank yellow “READY” light illuminates;
   - Right bank cylinder pressure gauge reads cylinder pressure
9. Close the left bank cylinder, slightly press the vent valve on the regulator and verify the following:
   - Left bank cylinder pressure gauge drops slowly.
   - As left cylinder pressure is nearly depleted, the manifold switches to the right bank.
   - After changeover, the left bank green “IN USE” light goes out, the red “EMPTY” light illuminates and the alarm is activated.
   - After changeover, the right bank yellow “READY” light goes out and the green “IN USE” light illuminates.

10. Slowly open one cylinder on the left side of the manifold and verify the following:
    - Left bank red “EMPTY” light goes out;
    - Left bank yellow “READY” light illuminates;
    - Left bank cylinder pressure gauge reads cylinder pressure.
11. Close both the left and right side cylinders.
12. Record the pressure readings of the left and right bank cylinder pressure gauges.
13. Wait for 15 minutes.
14. Compare the current readings of the left and right bank cylinder pressure 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 the manifold control module panel cover.
16. Slowly open all cylinders on both banks of manifold.
17. Open the manifold’s shut-off valve.

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 shut-off valve on the outlet of the 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 8.

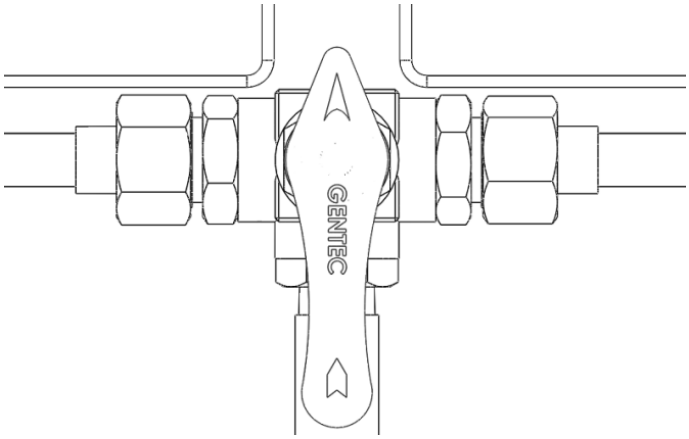


Figure 8

6. All outlets from the pipeline and downstream of the manifold control console should be closed and no flow should come out from the manifold unit.
7. Close both the right and left cylinders.
    - Record pressure readings of the right and left bank cylinder pressure gauges.
    - Wait for 15 minutes.
8. Compare the readings of the right and left bank cylinder pressure gauges.
9. If the outlet pressure gauge indicates a loss of pressure, the leak may be downstream of the Tee Ball Valve. If the right or left cylinder pressure gauge indicates a loss of pressure, the leak may be upstream of line regulator inlet isolation valves.
10. Locate the leak by applying a small amount of an oxygen compatible leak detector solution while manifold is under pressure. The formation of bubbles indicates a leak.
11. Since the manifold has been thoroughly factory tested, it is recommended to check the additional connections first.
12. Eliminate the 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 shut-off valve on the outlet of manifold.

CAUTION:

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

Operation:

Precautions

WARNING:

- Tampering with gas-specific connections is prohibited. Do not alter, remove or modify gas-specific connections.
- Before connecting the cylinders to the manifold, momentarily open and close cylinder valve to blow out dirt and debris
- After connecting the cylinders to the manifold, slowly open cylinder valve to allow compression heat dissipates.
- 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 only 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 GM2-A and GM2-D series manifold specifications:

	Delivery (Line) pressure		
Parameter	55	100	185
Intermediate pressure - Ready Bank	70	150	180
Dome bias pressure	55**	70	70
Intermediate pressure - In Use bank	125±10PSI*	220±10PSI	250±10PSI
Intermediate relief valve	350PSI	350PSI	350PSI
Line regulator relief valve	80PSI	150PSI	275PSI
Pressure changeover setting	120PSI	200PSI	250PSI
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-O2	Analog	3000	Lower	55	3500	1"-11$\frac{1}{2}$	3/4 NPT	100 ~ 240

GMS-AM-O2			Middle	100		NPSM		VAC
GMS-AH-O2			Higher	185				
GMS-AL-AIR			Lower	55				
GMS-AM-AIR			Middle	100				
GMS-AL-N2O			Lower	55				
GMS-AM- N2O			Middle	100				
GMS-AL-CO2			Lower	55	1000			
GMS-AM-CO2			Middle	100				
GMS-AH-CO2			Higher	185				
GMS-AM-IAIR			Middle	100				
GMS-AH-IAIR			Higher	185				
GMS-AL-NIT			Lower	55				
GMS-AM-NIT			Middle	100	3500			
GMS-AH-NIT			Higher	185				
GMS-AL-IN			Lower	55				
GMS-AM-IN			Middle	100				
GMS-AH-IN			Higher	185				
GMS-DL-O2	Digital	3000	Lower	55	3500	1"-11$\frac{1}{2}$ NPSM	3/4 NPT	100 ~ 240 VAC
GMS-DM-O2			Middle	100				
GMS-DH-O2			Higher	185				

GMS-DL-AIR			Lower	55				
GMS-DM-AIR			Middle	100				
GMS-DL-N2O			Lower	55				
GMS-DM- N2O			Middle	100				
GMS-DL-CO2			Lower	55	1000			
GMS-DM-CO2			Middle	100				
GMS-DH-CO2			Higher	185				
GMS-DM-IAIR			Middle	100				
GMS-DH-IAIR			Higher	185				
GMS-DL-NIT			Lower	55				
GMS-DM-NIT			Middle	100	3500			
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 in Figure 9.

1. Bank Regulator: These regulators are used to reduce incoming cylinder high pressure into 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 100psi will become 150psi if a 50psi “bias” pressure is added to the dome (100 + 50).

2. High 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 0-3600psi is used.

   Low Pressure Transducer (only on GMS-D model): Pressure Transducers are connected to the manifold’s outlet port to monitor the outlet pressure. A 4-20 mA pressure transducer with a range of 0-300 psi is used.
3. Pressure switch (only on GMS-A model): An adjustable, dual pole open pressure switch. Pressure switches are connected to the high pressure port of each bank regulator in order to monitor the pressure of each bank cylinders.
4. Tee Check Valve: A three way tee with built-in check valves to prevent backflow of the gas. It is installed downstream of the bank regulators.
5. High Pressure Relief Valve: It serves as an intermediate relief valve to protect components between bank regulators and line regulators, in the event of an overpressure condition during bank regulator failure.
6. Low Pressure Relief Valve: A relief valve to relief pressures downstream of line regulators in order to prevent over pressurization.
7. Tee Ball Valve: Tee Ball Valve is a three way ball valve and reduces the number of valves used downstream of bank regulators, i.e. has fewer leak points. It serves as a maintenance and gas flow directional valve, it allows service of line regulators and a component while manifold is in use.
8. 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 that allow for isolation and service of one regulator while the other one is in use.
9. Bias Pressure Regulator: A single-stage, piston type regulator used to regulate amount of pressure provided to domes of bank regulator.
10. Solenoid Valve: A 24 VDC, solenoid assembly used to direct dome bias pressure to one of the bank regulators. As the dome bias pressure is directed to one of the bank regulators, the dome of other bank regulator is vented through solenoid valve.
11. Circuit Board (Digital Display): An electronic circuit board controls the manifold changeover. The Circuit Board monitors pressure transducers, controls the solenoid valve in order to initiate manifold switchover. The Circuit Board displays the appropriate front panel on digital indicators and it also provides dry contacts that can be used to connect external master alarm and power source.
12. 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 it also provides dry contacts that can be used to connect external master alarm and power source.
13. Power Box: The input power is 100-240 VAC, through the internal medical power supply, the output power is

converted to 24 VDC and it is connected to the PCB board. The power box has protection rating of IP6.

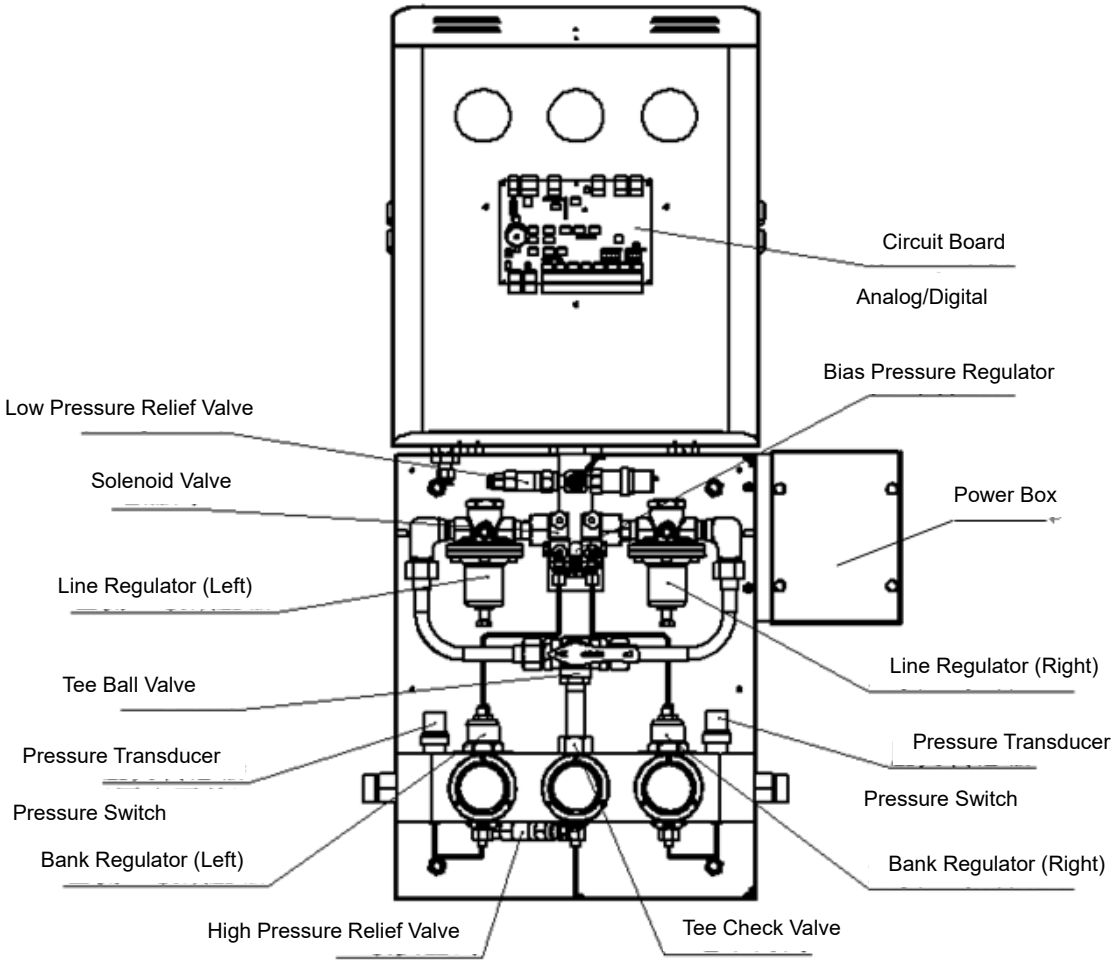


Figure 9

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 the manifold is exactly the same, each passing through a master valve located on the header and then directly to the bank regulators.

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 155 psi (100psi + 55psi). When the bias pressure is removed, the output pressure setting will return to 100 psi.

Outlets 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 55psi 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 55psi nominal outlet pressure do not use a bias pressure regulator. Full-line pressure (55psi) 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 as primary or "In Use" bank. In order to simplify the following explanation, we will arbitrarily select the right side of the manifold as the 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 100 psi (base pressure only, no bias pressure). Since the bank regulator on the right side has the highest pressure, all flows are supplied by the cylinders on the right bank.

As the cylinder pressure on the right side depletes, the pressure falls to pressure switch setting (120psi). 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 the master alarm panel indicating a change-over alarm. The Yellow light on the left goes out and the Green light illuminates.

When cylinders on the right side are replaced and the pressure is restored, the 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 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 (100psi). All flows are 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 the 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 flows will be supplied by the cylinders on the left bank until depleted. The cylinders on the right bank will then automatically begin to supply flow.

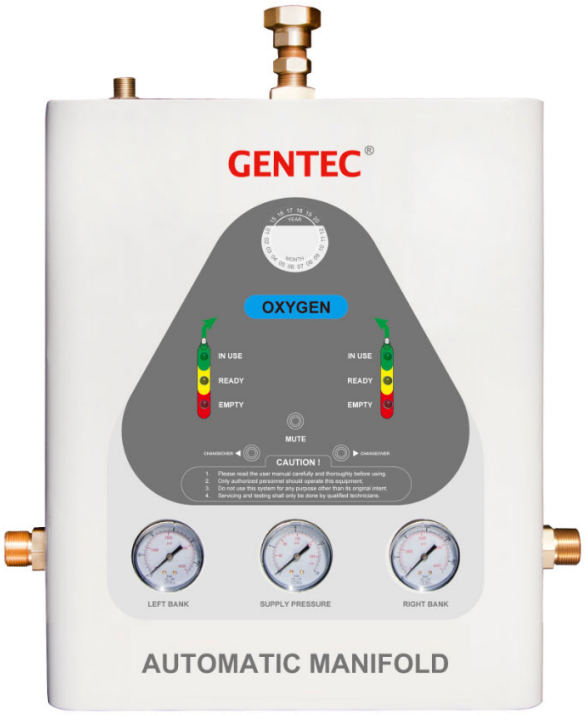


Figure 10

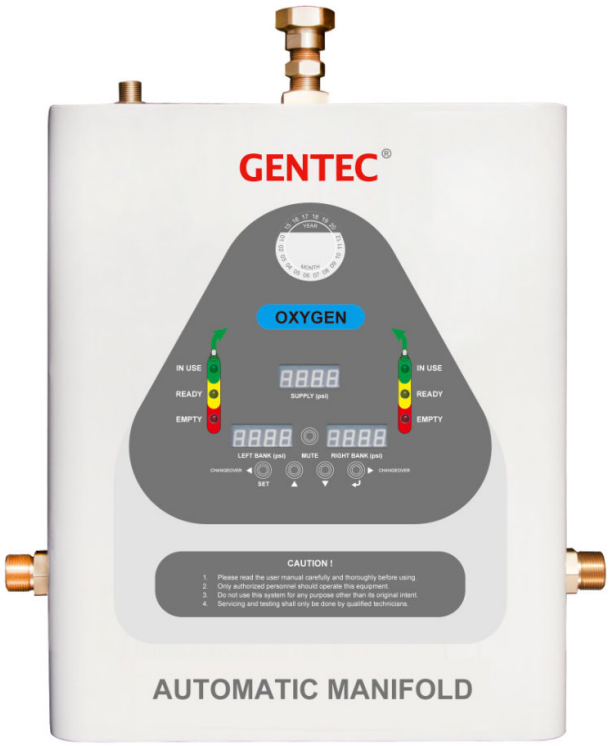

GENTEC®
OXYGEN
IN USE
READY
EMPTY
SUPPLY (psi)
LEFT BANK (psi)
MUTE
RIGHT BANK (psi)
SET
CAUTION !
1. Please read the user manual carefully and thoroughly before using.
2. Only authorized personnel should operate this equipment.
3. Do not use this system for any purpose other than its original intent.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

Figure 11

Setting or Adjustments:

Performance Verification

WARNING:

- Most service, adjustment, and testing can be performed while manifold is in service, when necessary. 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 and shut-off 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 the following test steps 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, as shown in Figure 12 and Figure 13.

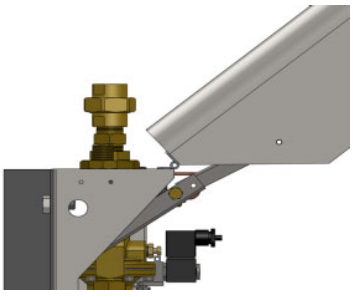


Figure 12

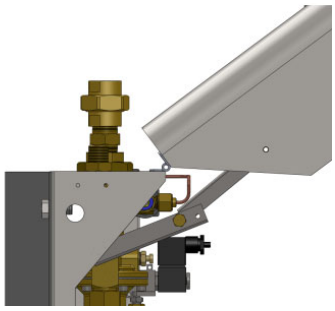


Figure 13

2. Verify the following:
   - Master Isolation Valves on left and right bank are fully open
   - There is sufficient pressure in right and left banks, with pressure gauges indicate of at least 1800 psi (at least 600 psi for Nitrous Oxide or Carbon Dioxide)
   - Power is applied to manifold.
3. If manifold is not in use, close the shutoff valve.
4. Turn Tee Ball Valve handle indicator towards the right as shown in Figure 15.
5. As a starting point for this procedure, set the manifold so that the right bank is in use. If the green light on the right

bank is illuminated, proceed to the next step. If the green light on left bank 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**" light are illuminated.
7. If the manifold is connected to a master alarm panel, verify that the manifold change-over alarm is not activated
8. The bias regulator is set for 70psi. For systems with outlet pressure of 55psi, the bias regulator is a straight thru and does not regulate pressure.
9. Verify the pressure gauge reading (intermediate pressure – in use bank) on the left side bank regulator as indicated in Table 1. If the pressure is not correct, refer to Bank Regulator Pressure Adjustment procedure. If the bank regulator is operating correctly but intermediate pressure is still incorrect, replace the bias regulator with preset of 70psi.
10. Verify the front panel supply pressure gauge or digital reading as indicated in Table 1 (Outlet Pressure). If the pressure is not correct, refer to Line Regulator Pressure Adjustment procedure. Please read thoroughly before use.
11. Watch the pressure gauge or digital reading of the right side bank regulator and front panel supply pressure gauge and digital reading for at least five minutes. Readings may be slightly higher without vent flow. Verify that the readings do not continue to increase.
12. Close all cylinders on the right side of the manifold. Slightly press the vent valve on the regulator so that the bank high pressure gauge drops slowly. Verify that the manifold switches to the left bank when the high pressure gauge and digital reading on the right bank drop to below the specified setting of the bank regulator.
13. Verify that only the 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 towards the left as shown in Figure 14. 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 that the pressure gauge reading (intermediate pressure –in use bank) on the left side bank regulator is as indicated in Table 1. If the pressure is not correct, refer to Bank Regulator Pressure Adjustment procedure.
18. Verify that the front panel supply pressure gauge and digital reading are the same as in step 10. If the pressure is not correct, refer to Line Regulator Pressure Adjustment procedure.
19. Watch the pressure gauge on the left bank regulator and front panel supply pressure gauge for at least five minutes. Readings may be slightly higher without vent flow. Verify that the readings do not continue to increase.
20. Close all cylinders on the left side of manifold. Slightly push vent valve on top of left bank regulator and watch high pressure gauge drops slowly. Verify that the manifold switches to right bank when the left bank high pressure gauge drops to the value indicated in Table 1.
21. Verify that only the right bank green "IN USE" and left bank red "EMPTY" lights illuminate and the alarm is activated.
22. Slowly open one cylinder on the left side and verify that the left bank red "EMPTY" light goes out and left bank yellow "READY" light illuminates.
23. Turn Tee ball valve indicator towards the right as shown in Figure 21

24. Close both the left and right side cylinders.
25. Record the pressure gauge readings of the left and right bank cylinders.
26. After 15 minutes, verify that the pressure gauge readings have not changed.
27. Slowly open all cylinders on both banks of the manifold.
28. Using switches located on the Circuit Board, switch the manifold to the bank which cylinders have least pressure.
29. Reinstall manifold control panel cover.
30. Open the shut-off valve on top of the manifold.

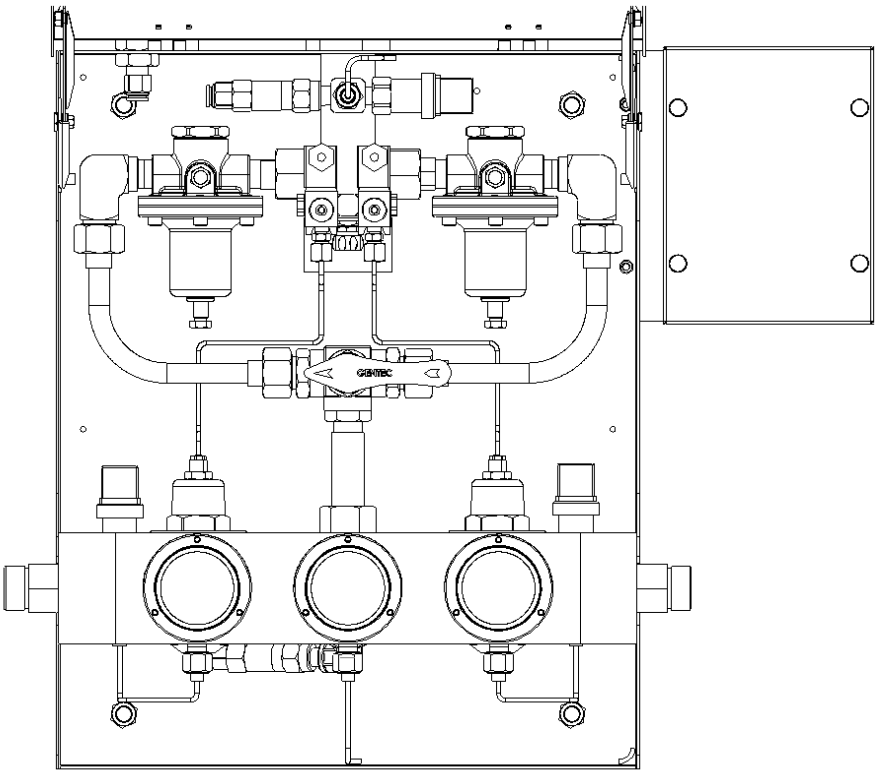


Figure 14

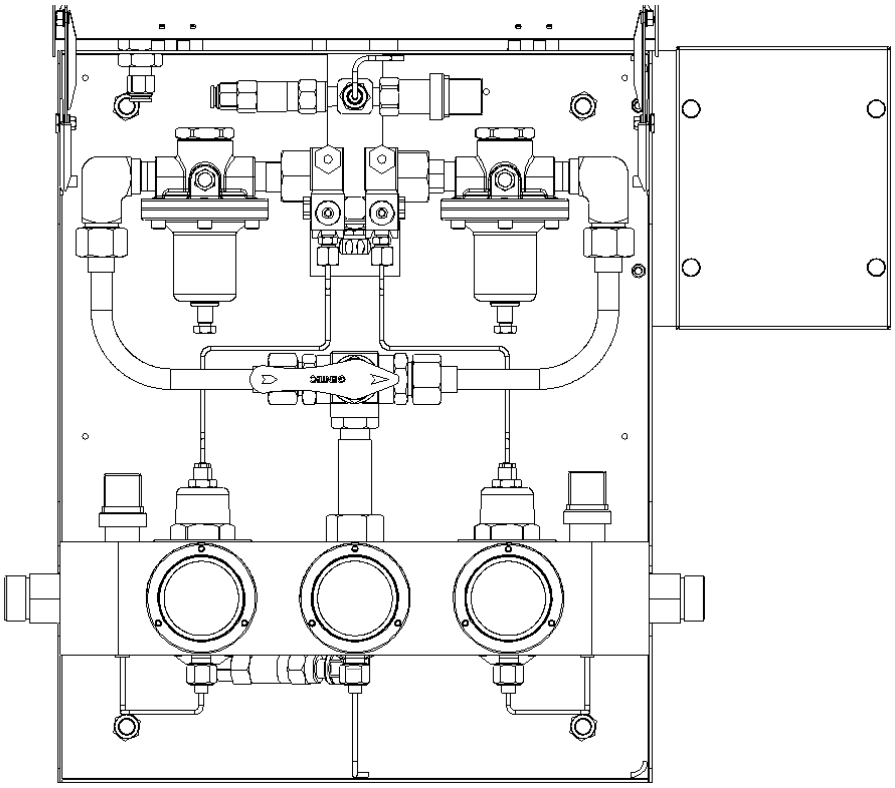


Figure 15

Bank Regulator Pressure Setting and Adjustment

WARNING:

- Most service, adjustment, and testing can be performed while bank regulator is in service, when necessary. However, this should only be done by GENTEC's engineers or qualified technicians experienced in servicing equipment.
- 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 the 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 regulator's output pressure without any control pressure. Recommended settings are listed in Table 1 under heading of "Intermediate

Pressure – Ready Bank". After the base pressure has been set, pressure will be increased by the amount of control pressure applied. Refer to Figure 16 for the location of the components stated in this procedure.

1. Shut off all cylinders on both banks of the manifold.
2. Turn off the power supplies.
3. Close the shut off valve on the upper Tee Check Valve
4. Using the Circuit Board switches, cycle the manifold from bank to bank to vent residual dome bias pressure.
5. Press the bleed valves on both line regulators to relieve all pressures 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 the 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 the 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.
12. Slowly open all cylinders on both manifold banks.
13. Turn on the power supplies.

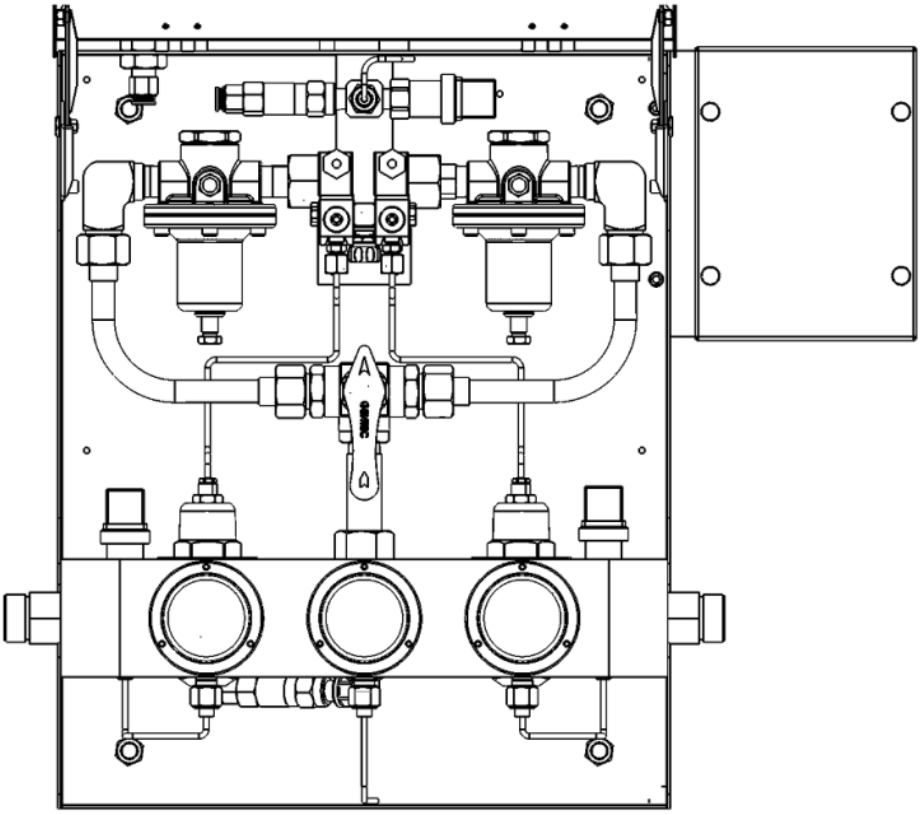


Figure 16

Line Regulator Pressure Setting and Adjustment

WARNING:

- Most service, adjustment, and testing can be performed while line regulator is in service, when necessary. However, this should only be done by GENTEC's engineers or qualified technicians experienced in servicing medical equipment.
- 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 been pre-set and the 3-Way Ball Valve is pointing to the right side, as shown in Figure 17.

1. Remove the manifold cover; 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 that both bank regulators are supplying pressure
3. Turn off the power supplies.
4. Turn Tee Ball Valve handle indicator towards the side of the 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 the reading on gauge for later use; refer the setting to Table 1 (delivery pressure).
7. Move the Tee Ball Valve to the off position as shown in Figure 16.
8. Press the bleed valve to relieve pressure on the line regulator.
9. Repeat steps 4-8 to make adjustments for the other line regulator.
10. Turn on the power supplies.
11. Close the manifold cover.

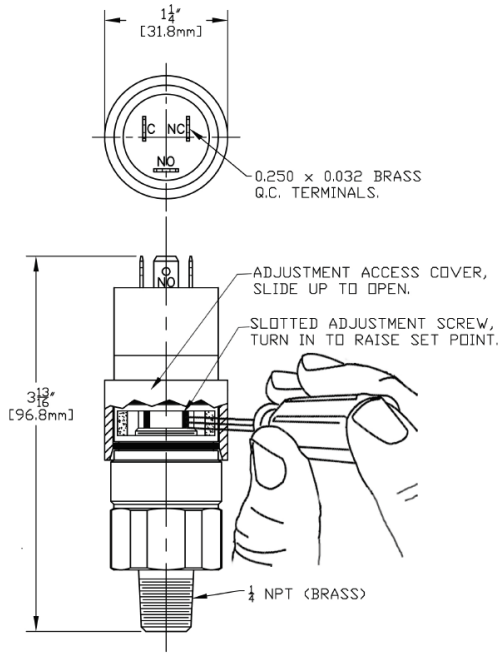


Figure 17

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

Maintenance:

Precautions

WARNING:

- Tempering with gas specific connections is 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 the cylinders to the manifold, slowly open cylinder valve to allow compression heat dissipates.
- 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 76 mm (3”).

Routine Maintenance

The routine maintenance procedures for GENTEC® GM2 series automatic manifold system are as follows:

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 reading.
- 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 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, shown in Figure 17. If pressure switch cannot be set, switch must be replaced. Pressure switches are not repairable.

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 exploded diagram of Figure 18 shows all the internal parts for replacement, if necessary. Replacing damaged parts with genuine GENTEC spare parts can be an option when replacement regulators are not available.

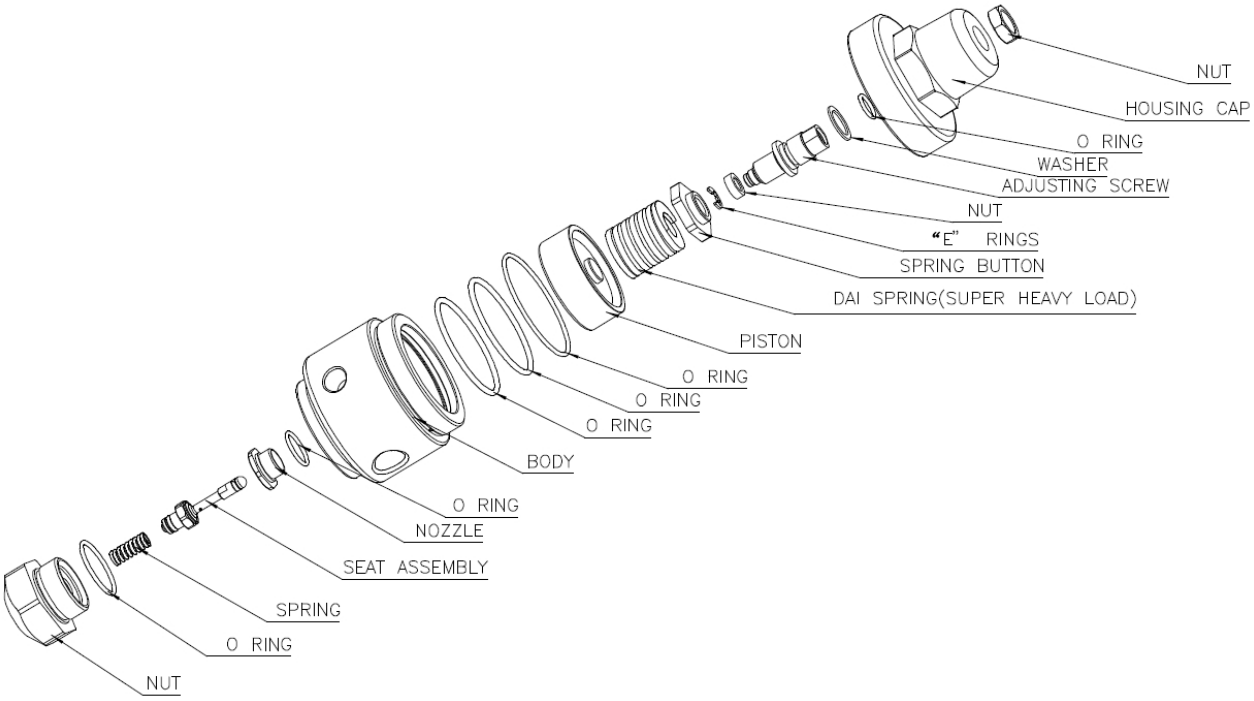


Figure 18

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. Figure 19 is the exploded diagram that 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.

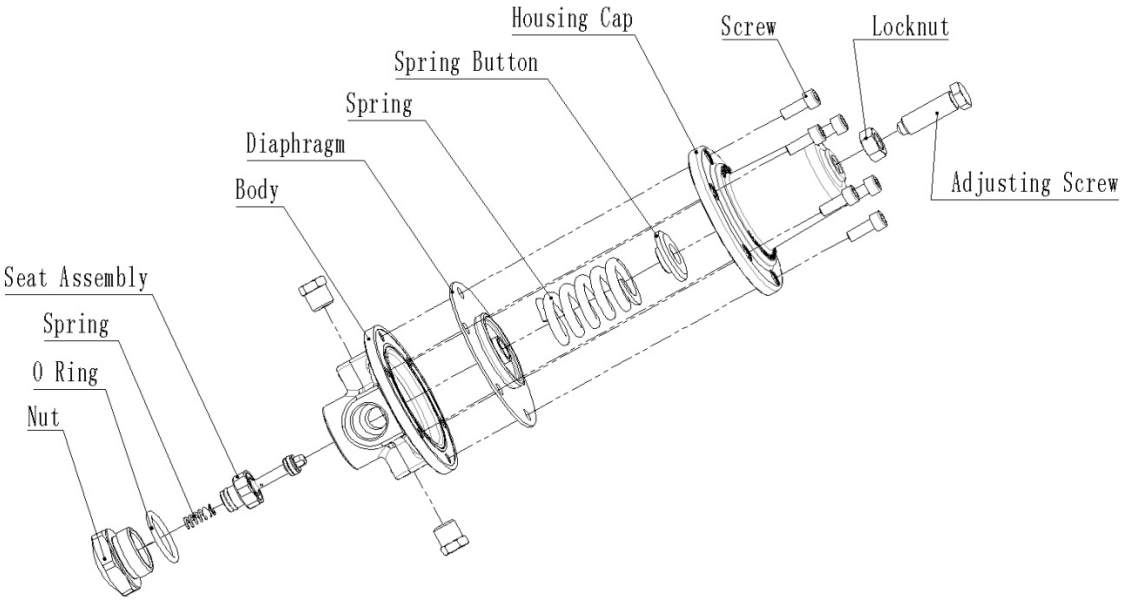


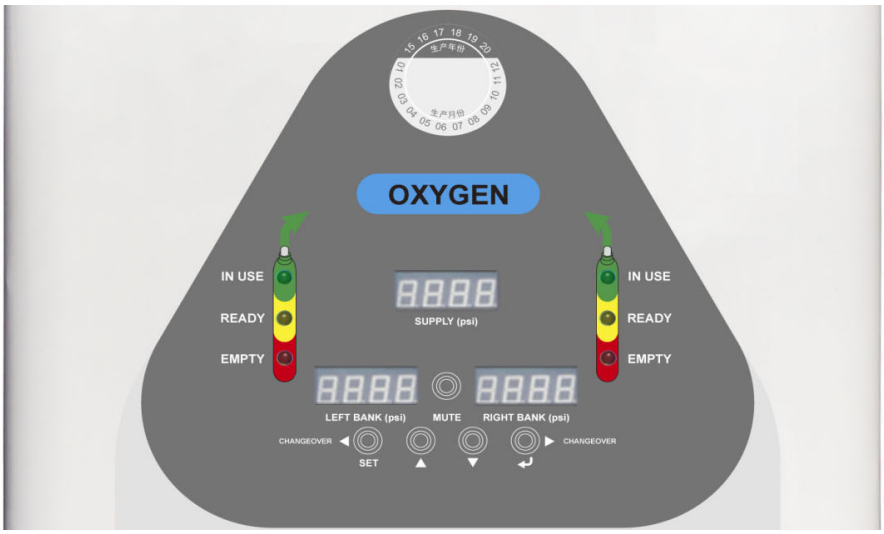
Figure 19

Circuit Board Specification and Setup

Display Panel

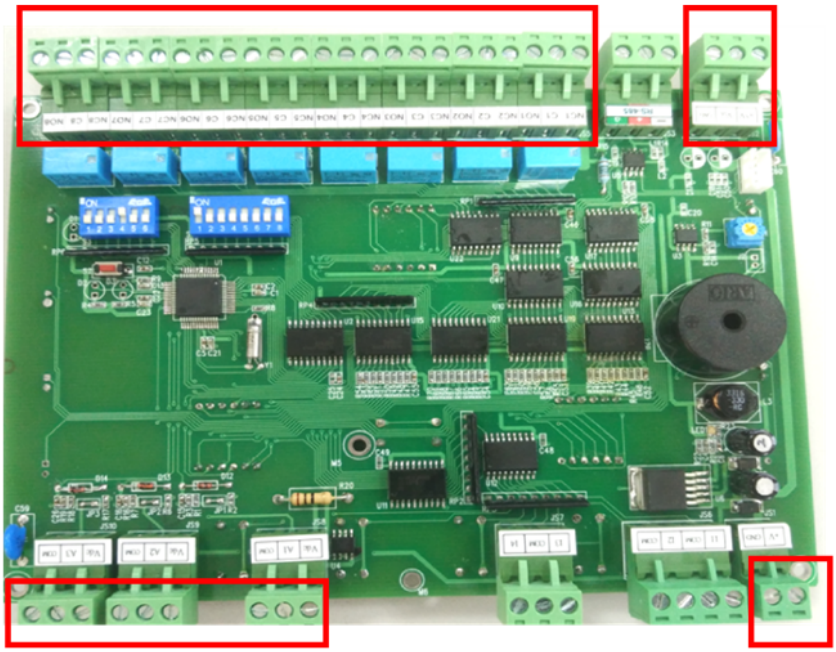
MECHANICAL	
Physical Dimension	180mm X 130mm X 30mm (Length X Width X Depth)
ENVIRONMENT	
Ambient Temperature	0℃ ~50℃ (32℉ ~122℉)*
Ambient Humidity	10% ~85% RH, Non-condensing*
ELECTRICAL	
Power Requirements	+12~24VDC
Optional Analog Input	Input Type: 4-to-20 mA current, Working Range: 4~20 mA Channels: 3 Maximum 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

Dry Contact　　Relay输出　　RS485　　RS485输出



Signal Input 4-20 mA　　传感器输入4~20mA　　Power Inlet　　电源输入24V

3. Transducer Connection

3.1.1 4~20mA

JS8: receive left bank pressure

VDC	A1+	COM

JS9: receive outlet pressure

VDC	A2+	COM

JS10: receive right bank pressure

VDC	A3+	COM

Table 2 Analog Input Connection

INPUT AND OUTPUT CONNECTIONS	
TERMINALS	**CONNECTION DESCRIPTIONS**
VDC	DC Power Output
A1+ (Left Bank)	Analog Channel 1 Signal +
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 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 sequences:

- 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 30 minutes.

3.3.2 Buttons Parameters and Settings

Button parameters and settings allow 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 as well as the alarm supply pressure 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” 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)

Table 3 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 automatically exits 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)

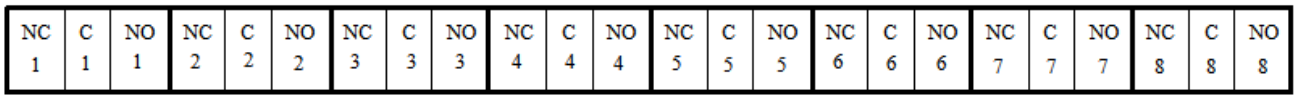


Table 4 Input/output Signal Connections (JS5)

INPUT AND OUTPUT CONNECTIONS			
Relay No.	**Terminals**	**CONNECTION**	**Function Description**
1	NC1	Relay 1 Normally Close	Outlet Pressure too high-------- NC1 and C1 short circuit Otherwise ------ NO1 and C1 short circuit
	C1	Relay 1 Common	
	NO1	Relay 1 Normally Open	
2	NC2	Relay 2 Normally Close	Outlet Pressure too low ------- NC2 and C2 short circuit Otherwise------ NO2 and C2 short circuit
	C2	Relay 2 Common	
	NO2	Relay 2 Normally Open	
3	NC3	Relay 3 Normally Close	During Alarm Buzzer Activated------- NC3 and C3 short circuit Muting---------- NO3 and C3 short circuit
	C3	Relay 3 Common	
	NO3	Relay 3 Normally Open	
4	NC4	Relay 4 Normally Close	Left pressure is too low -------- NC4 and C4 short circuit Otherwise----- NO4 and C4 short circuit
	C4	Relay 4 Common	
	NO4	Relay 4 Normally Open	
5	NC5	Relay 5 Normally Close	Right pressure is too low-------- NC5 and C5short circuit otherwise------ NO5 and C5short circuit
	C5	Relay 5 Common	
	NO5	Relay 5 Normally Open	
6	NC6	Relay 6 Normally Close	Any Pressure Warning / Reserve Bank in Use -------- NC6 and C6 short circuit No Pressure Warning-------- NO6 and C6short circuit (For NFPA99 Normally Closed Master Alarm, Connect to C6 & NO6)
	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 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 Right Bank Standby-------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 (Enable manual switchover)
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

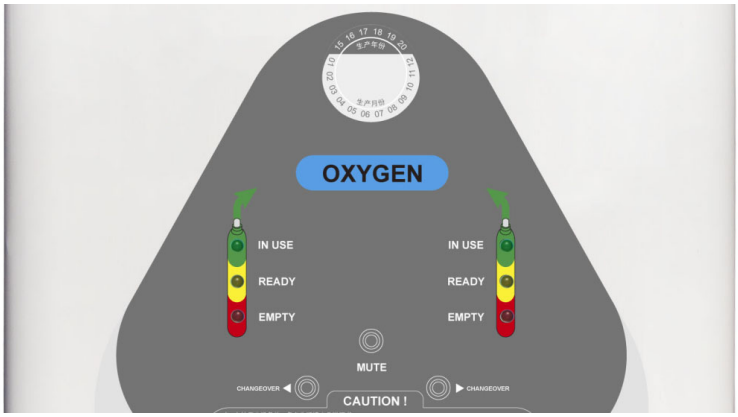
3.9 DC Power Input Connector

Voltage: +12~24V

Table 9: DC Power Connector (JS1)

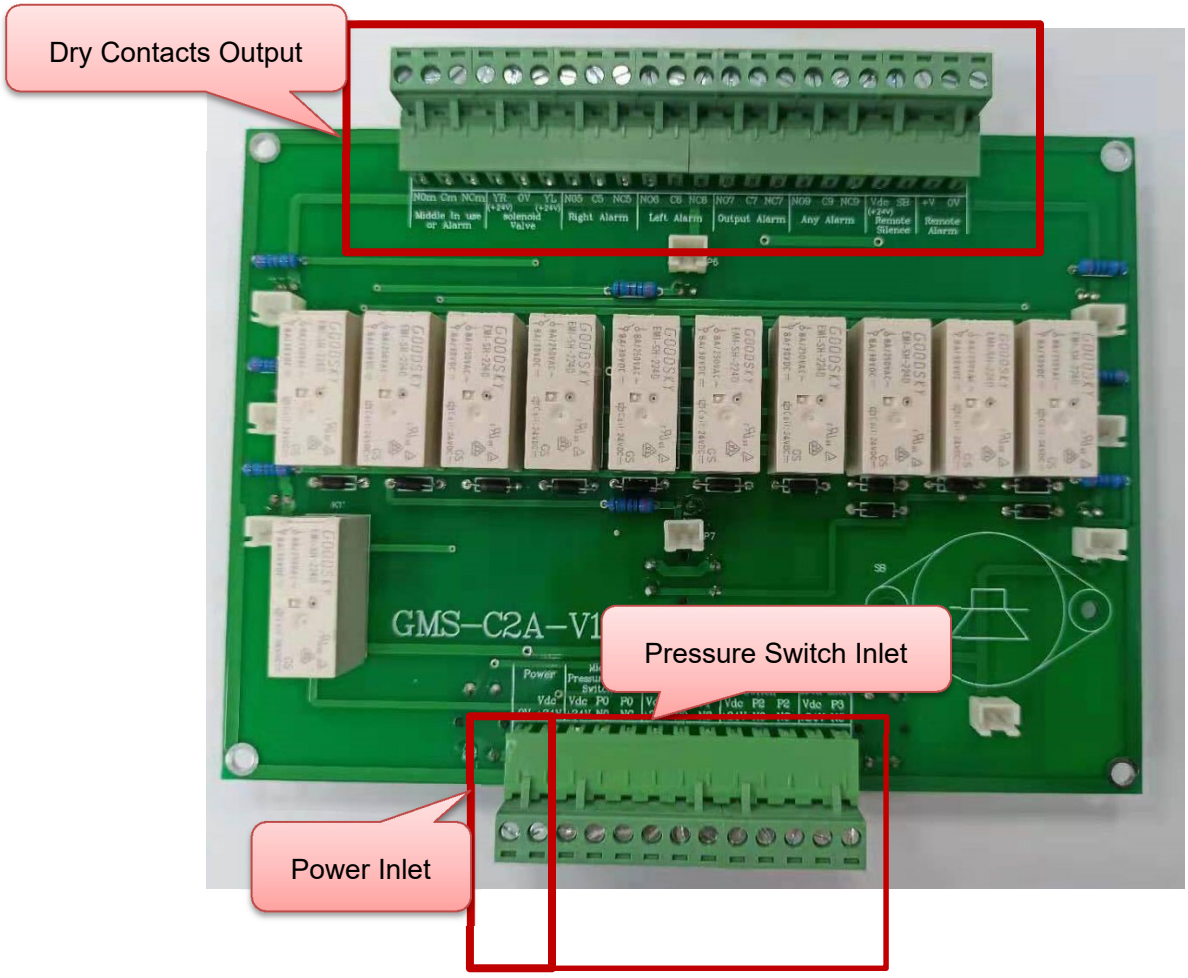
J1 DC POWER CONNECTOR		
PIN	1	2
CONNECTION	+VCC	GND

1. Front View



5500PCB (Analog) Circuit Board

2. Board View

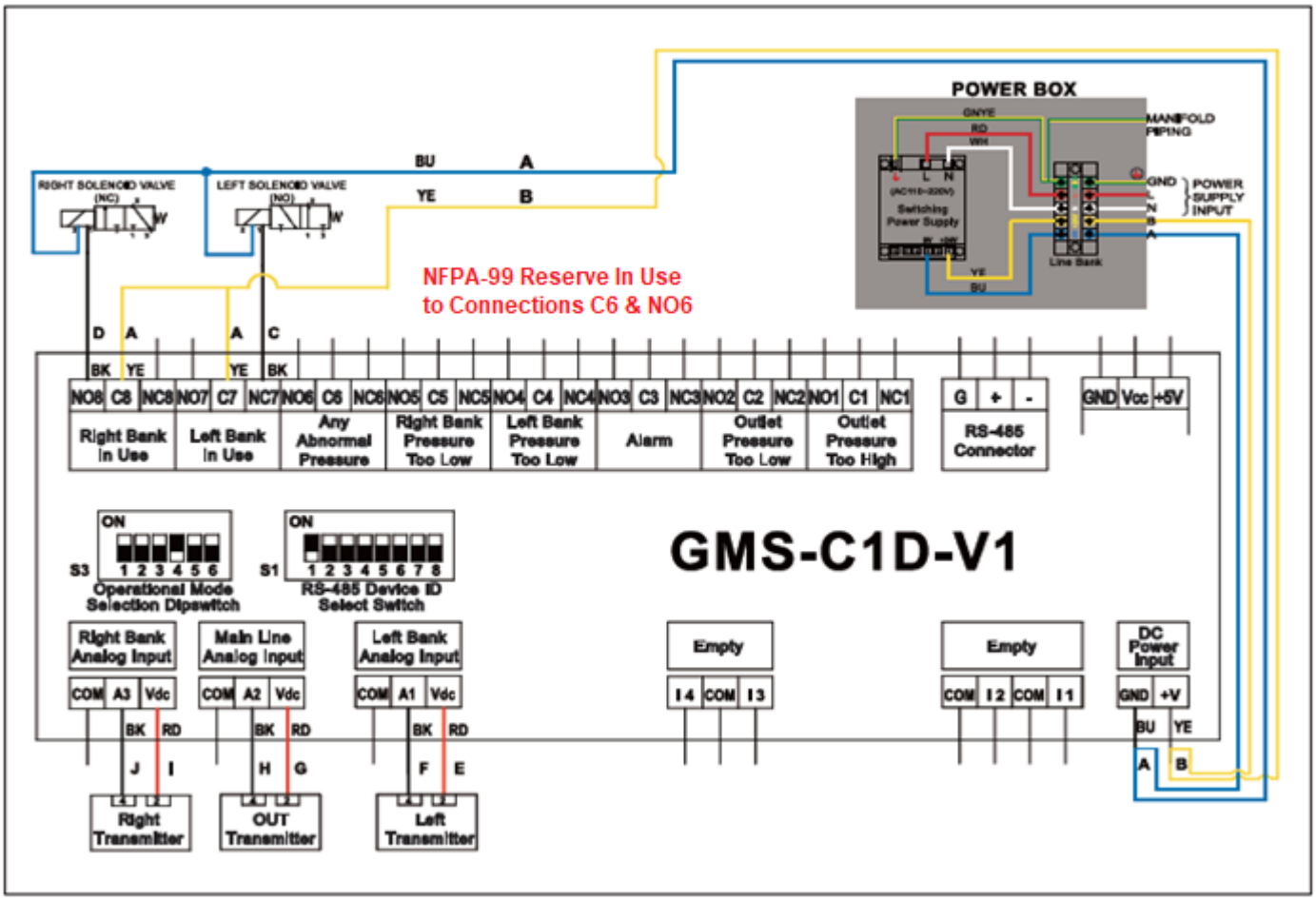


1. Voltage Input：+24VDC
2. Pressure switch input: left and right pressure switch normally open, normally closed and common leads are connected to the corresponding PCB board corresponding to P1 / P2 position
3. Changeover buttons
    a. Left Changeover button manually enables changeover to the left bank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

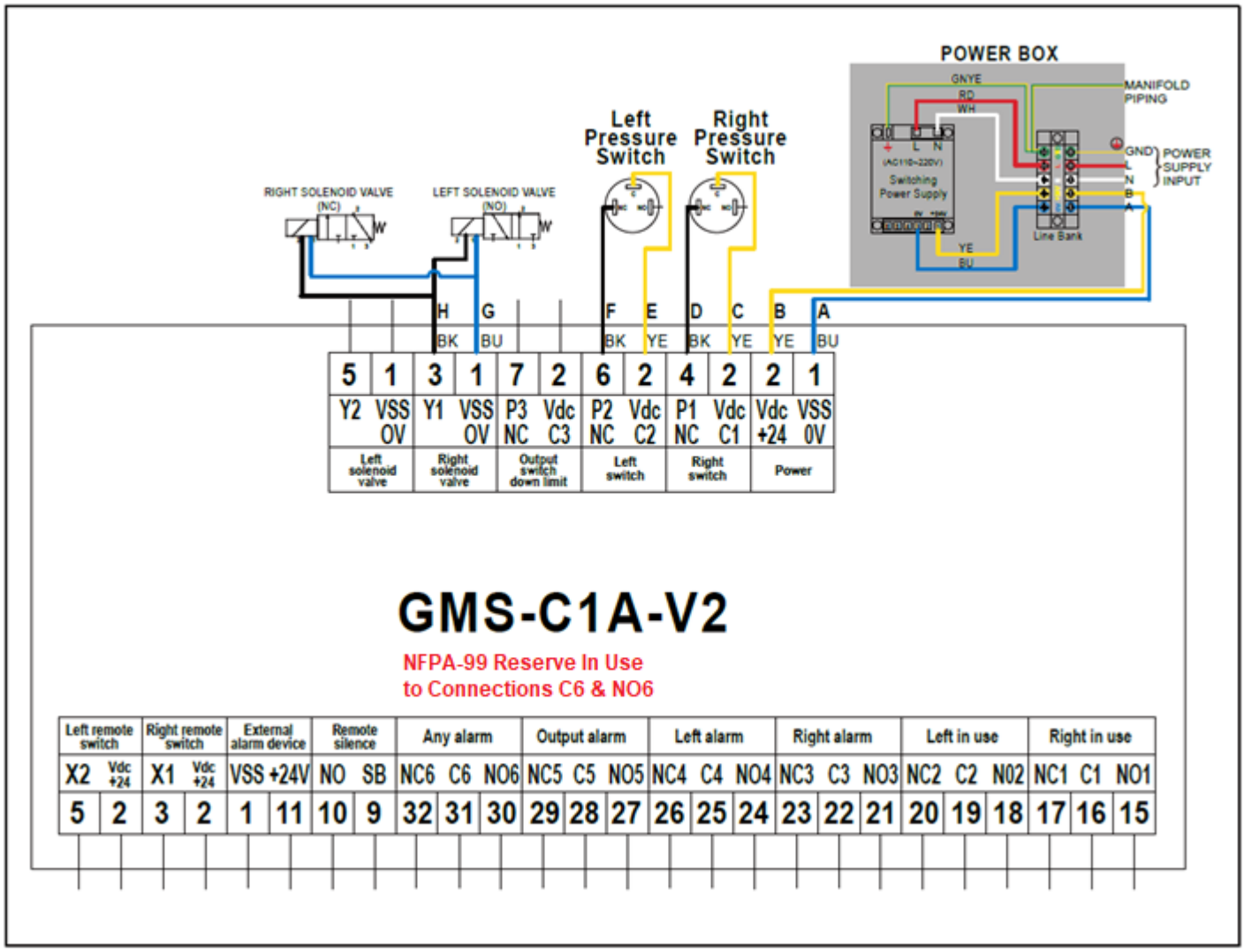
S1 DIP Switch Functions:

Dry Contacts	Function Description	DIP number	Switch ON
NC1 C1 NO1	Right Bank in Use--------NO1 and C1 short circuit Otherwise-------NC1 and C1 short circuit	1	C1 connect +24V
NC2 C2 NO2	Left Bank in Use-------- NO2 and C2 short circuit Otherwise-------NC2 and C2 short circuit	2	C1 connect +24V
NC3 C3 NO3	Pressure too low on right side------- NO3 and C3 short circuit Otherwise-----NC3 and C3 short circuit	3	C3、C4 Connected +24V
NC4 C4 NO4	Pressure too low on left side------- NO4 and C4 short circuit Otherwise-----NC4 and C4 short circuit		
NC5 C5 NO5	Abnormal outlet pressure-------- NO5 and C5 short circuit otherwise------ NC5 and C5 short circuit	4	C1 connect +24V
NC6 C6 NO6	Any abnormal pressure / Reserve In Use -------NO6 and C6 short circuit. (For NFPA99 Normally Closed Master Alarm, Connect to C6 & NO6) otherwise----NC6 and C6 short 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 - Digital



Wiring Diagram - Analog



Maintenance and Repair

a. Routinre Maintenance

Daily:

(1). Visually inspect manifold for normal operation.

(2). Record left and right bank pressure gauge.

(3). Record outlet pressure gauge or digital reading.

At Cylinder Replacement:

(1). Visually inspect piping system, if there is dirt or damage, Do not use and immediately clean or replace the components.

(2). Check for leaks at cylinder to pigtail connection using oxygen compatible leak detector solution

(3). For leaking test, use oxygen compatible leaking detect solution.

Quarterly:

(1). Replace the filter element quarterly.

Annually:

(1) Verify manifold operation using performance Verification procedure.

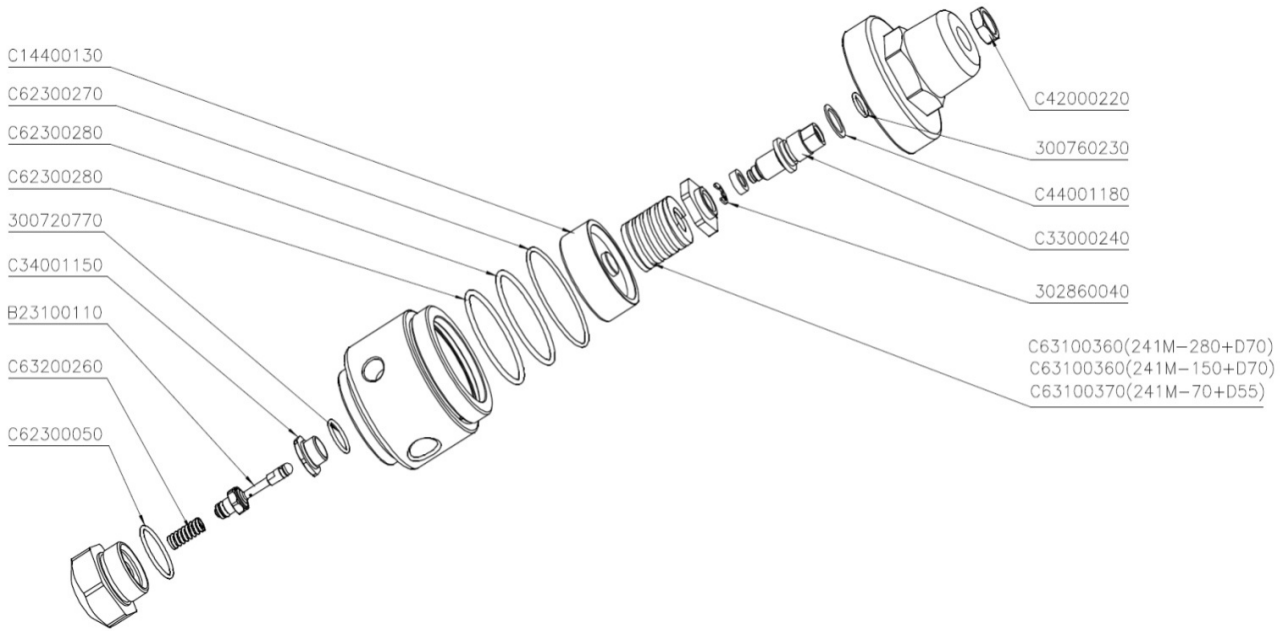
Every 3-5 Years:

(1). Replace the pigtail and copper pipe every 3 to 5 years to ensure that the testing and replacement comply with local laws.

b. Master Regulator Maintenance

The first-stage pressure regulator of the manifold can be replaced within the service period, but the replacement of the manifold must be performed by a qualified technician.

The following exploded diagram shows all internal parts that can be replaced when necessary. It is recommended to use repair parts provided by GENTEC to replace damaged parts.



Bank Regulator

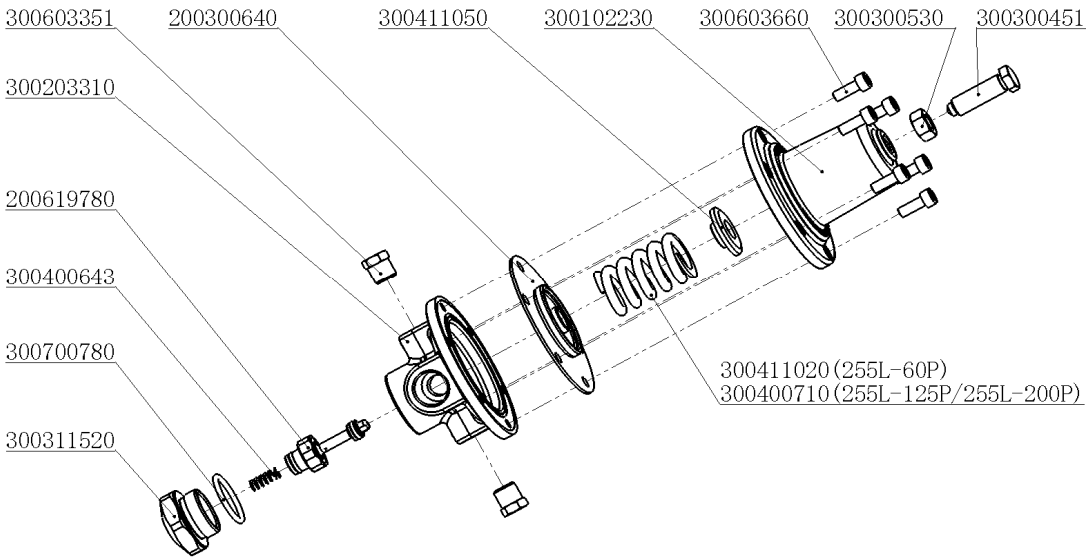
9-Digit	Part Description	Quantity	Material
C42000220	Nut	1	Brass
300760230	O-Ring	1	Rubber
C44001180	Washer	1	Nylon
C33000240	Adjusting Screw	1	Brass
302860040	“E” Ring	1	Stainless Steel
C63100370 (241M-70+D55) C63100360 (241M-150+D70) C63100360 (241M-280+D70)	Spring	1	Steel
C14100130	Piston	1	Brass
C62300270	O-Ring	1	Rubber
C62300280	O-Ring	2	Rubber
300720770	O-Ring	1	Rubber
C34001150	Nozzle	1	Brass
B23100110	Seat Assembly	1	Component
C63200260	Spring	1	Stainless Steel
C62300050	O-Ring	1	Rubber

Seat Assembly Repair Kit: 200620510 (KIT-GMS-241M) includes Seat Assembly (B23100110) and O-Ring (C62300050)

c. Line Regulator Maintenance

The manifold can be replaced within the service period of the secondary pressure regulator, but the replacement of the manifold must be performed by a qualified technician.

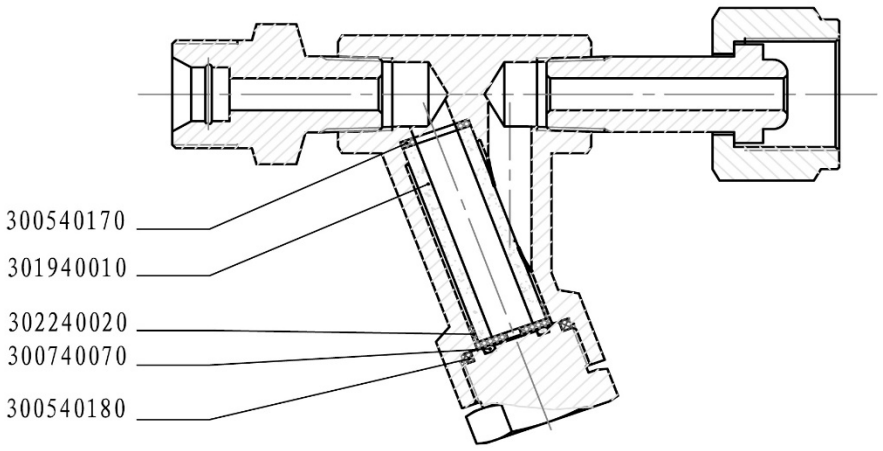
The following exploded diagram shows all the internal parts that can be replaced when necessary. It is recommended to use the spare parts provided by Gentec to replace the damaged parts。



Line Regulator			
9-Digit	Part Description	Quantity	Material
300300451	Adjusting Screw	1	Brass
300600530	Screw nut fastener	1	Brass
300603660	M6 Screws	6	Stainless Steel
300102230	Housing Cap	1	Brass
300411050	Spring Button	1	Brass
300411020(255L-60P) 300400710(255L-125P/255L-200P)	Spring	1	Stainless Steel
200300640	Diaphragm	1	Component
300203310	Body	1	Brass
200619780	Seat Assembly	1	Component
300400643	Spring	1	Stainless Steel
300700780	O-Ring	1	Rubber
300311520	Nut	1	Brass

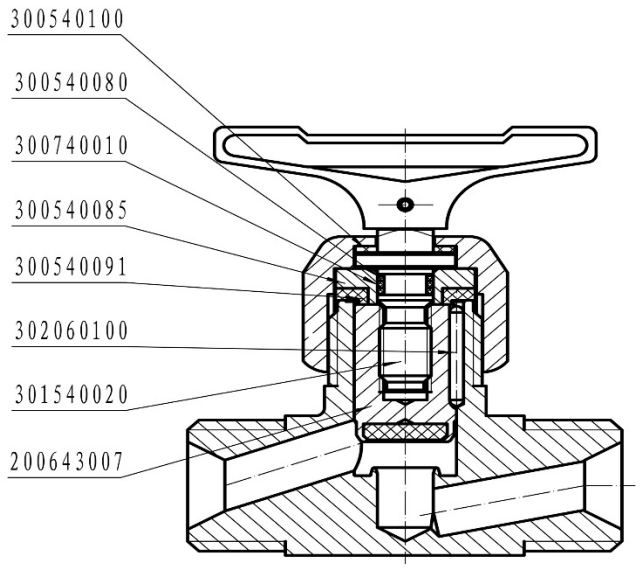
Seat Assembly Repair Kit: 200620610 (KIT-255L-E) include Seat Assembly (200619730) and O-Ring (300700780) .

d. Filter Maintenance



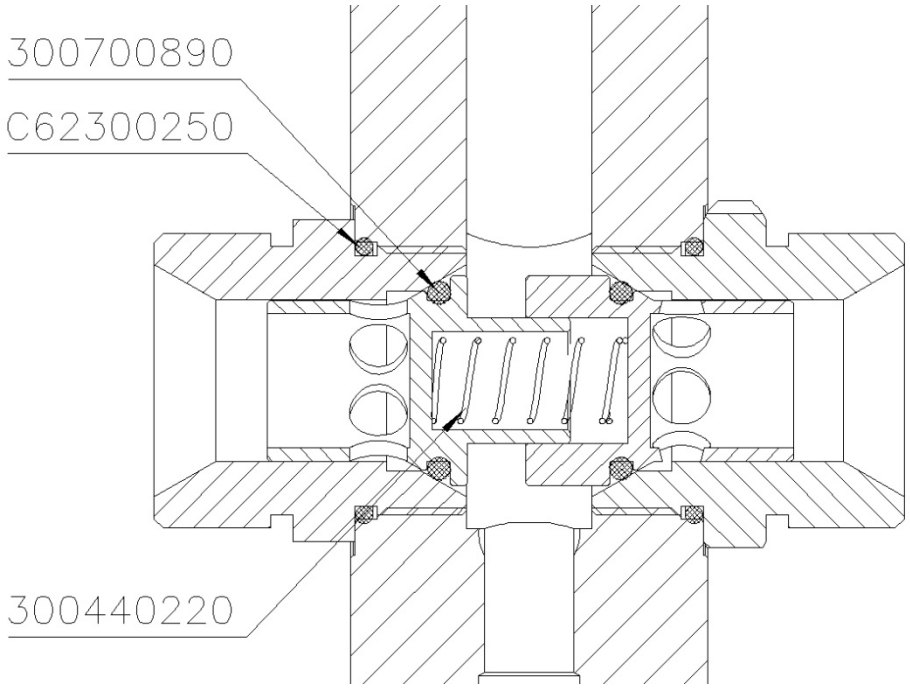
Filter			
9-Digit	Part Description	Quantity	Material
300540170	Washer	1	TEFL
301940010	Sintered Element	1	Brass Alloy
302240020	Sealing Button	1	TEFL
300740070	O-Ring	1	Neoprene
300540180	Sealing Ring	1	TEFL

e. Shut-off Valve Maintenance



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

f.Three-way Check Valve Maintenance



Three-way check valve maintenance diagram

9-Digit	Part Description	Quantity	Material
300440220	Spring	1	Stainless Steel
C62300250	O-Ring	2	Rubber
300700890	O-Ring	2	Rubber

Troubleshooting Guidelines

Potential Problems, Causes, and Solutions:

Ref. No.	Problem(s)	Cause(s)	Solution(s)
1	No outlet pressure	Inlet filter is plugged, blocking the gas. All isolation valves on one or both sides of manifold are not opened.	Check filter on both sides of the manifold, change the filter, if necessary. Open the master isolation valve for each bank.
2	No outlet pressure from regulator	1. Regulating spring inside the regulator is broken. 2. Pressure adjusting screw or threading is broken.	1. Change the spring. 2. Change the bonnet or pressure adjusting screw.
3	The safety relief port on top of the regulator bonnet is releasing gas.	Broken diaphragm	Change with a new diaphragm
4	Regulator is leaking from outside	Bonnet is loose Inlet/outlet connection is loose	1. After dissipating the remaining gas inside the regulator, tighten the bonnet. 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	Handle bar is loose Handle bar seal is broken	Tighten the handle bar Change the seal
6	The ball valve is leaking from the body	The connections are loose The valve stem is broken or cracked	Tighten the connections Change the stem seals
7	Regulator is sending out abstract signals.	1. The flow is too high after the changeover occurred 2. The changeover process caused too much pressure on the system	1. Check the flow, and adjust to low flow 2. Close the outlet pressure and re-run the system. 3. Change the washer inside the regulator.
8	Not show or incorrect display	The pressure transducer is broken. Circuit Board is broken.	Change pressure transducer Change the Circuit Board

Warranty

GENTEC warrants that GENTEC® GM2-A and GM2-D series automatic manifold system to be free of defect in materials or workmanship when installed and operated in accordance with instructions for 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 expense of the equipment owner.