

Installation, Operation and Maintenance Instructions



Reciprocating Piston Medical Air Compressor System

Part number 4107 9013 37

Revision 04

June 30, 2020



Installation, Operation and Maintenance Manual

2.4-6.4 Hp “Oil-Less” Reciprocating Piston Medical Air Systems

This unit is purchased from: _____

Date purchased: _____

Model number: _____

Serial number: _____

Option(s) included: _____

Any information, service or spare parts requests should include the machine serial number and be directed to:

BeaconMedæ
1059 Paragon Way
Rock Hill, SC 29730

Telephone: (888) 463-3427
Fax: (803) 817-5750

BeaconMedæ reserves the right to make changes and improvements to update products sold previously without notice or obligation.

Part number 4107 9013 37
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Safety Precautions

Pressurized air from the system may cause personnel injury or property damage if the unit is improperly operated or maintained.

Operator should have carefully read and become familiar with the contents of this manual before installing, wiring, starting, operating, adjusting and maintaining the system.

Operator is expected to use common sense safety precautions, good workmanship practices and follow any related local safety precautions.

In addition:

- **Before starting any installation or maintenance procedures, disconnect all power to the package.**
- All electrical procedures must be in compliance with all national, state, and local codes and requirements.
- A certified electrician should connect all wiring.
- Refer to the electrical wiring diagram provided with the unit before starting any installation or maintenance work.
- Release all pressure from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.
- Notify appropriate hospital personnel if repairs or maintenance will affect available compressed air levels.
- Air inlet must be placed in an area free of toxic or hazardous contaminants. It must be kept away from ETO exhaust vents, vacuum exhaust vents, areas close to automotive exhausts, etc., in accordance with NFPA 99.
- Prior to using the LifeLine® Piston Medical Air System, the medical facility must have a Certifier perform all installation tests as specified in NFPA 99. The medical facility is also

responsible for ensuring that the Medical Air meets the minimum requirements as specified in NFPA 99.

- This is a high speed, rotating piece of machinery. Do not attempt to service any part while machine is in operation.
- To prevent automatic starting, disconnect all electrical power before performing any maintenance.
- Do not operate unit without belt guards, shields or screens in place.
- Make sure that all loose articles, packing material, and tools are clear of the package.
- Check all safety devices periodically for proper operation.
- Never operate a compressor with its isolation (shutoff) valve closed or without its relief valve in place. Damage to the compressor may occur.
- **Do not add lubricating oil of any kind to the compressor.** Absolutely no oil is required for proper operation.
- The “Manual” mode of operation should only be used for emergencies such as a master printed circuit board malfunction and should not be used for normal operation.
- Electrical service must be the same as specified on the control panel nameplate or damage to the equipment may occur.
- Vibration during shipment can loosen electrical terminals, fuse inserts, and mechanical connections. Tighten as necessary.

1.0 General Information

1.1 Component Description

NOTE: The features listed in this section are standard for NFPA 99 medical air systems. In the case of special system configurations, these features may or may not be included with the system.

System Design

The **Lifeline®** Reciprocating Medical Air SPC (Single Point Connection) system consists of a single point connection, tank mounted design, which includes the following:

- At least two oil-less reciprocating compressors and at least two motors
- Duplexed desiccant drying system with purge control
- Duplexed line filters and regulators
- Dew Point and CO transmitters
- Integral, pre-wired, U.L. labeled control panel
- Corrosion resistant air receiver

Each system is fully compliant with the latest edition of NFPA 99. The complete package is pre-wired, pre-piped, and assembled on one common base with single point connections for electrical, intake air, discharge air, and condensation drain. Each system includes valving to allow complete air receiver bypass, as well as air sampling port.

Compressor Module

The compressor design is air-cooled, single stage, two cylinder piston compressor with permanently lubricated, sealed bearings. The cylinders are nickel plated aluminum and the piston is anodized aluminum with teflon hardcoat and teflon carbon composite piston rings. The heavy duty, sealed ball bearings are greased for life. The die cast aluminum crankcase and finned cylinder heads feature high cooling characteristics.

The high capacity cooling fan is contained in a protective fan cowl, providing optimal direct cooling of the cylinders and aftercooler/intercooler. There is a finned, die cast aluminum outlet cooler. A dynamically balanced crankshaft and heavyweight cast iron cooling fan reduce vibration.

Compressor Drive and Motor

The compressor is direct driven by a flange mounted motor. The motor is IP55 that operates at 1700 RPM with 1.15 service factor suitable for 208 or 230/460V 60 Hz, and for 400V 50 Hz electrical service the motor operates at 1500 RPM.

Compressor Assembly

Each compressor has a piped intake manifold with one “hospital type” inlet air filter with isolation valve. The inlet filter removes dust from the incoming air through cyclonic action and through an element. The isolation valves are piped to one common inlet connection. Each cylinder head is equipped with a high discharge air temperature shutdown switch wired to the compressor control system.

The compressor discharge assembly includes a safety relief valve, a check valve, and an isolation valve. The discharge of each compressor is piped into one common discharge line manifold by way of a flex connector. Discharge flex connectors are braided, 304 stainless steel.

Isolation System

The compressor and motor are fully isolated from the receiver by means of a three-point, heavy duty, anti vibration pad system for a minimum of 77% isolation efficiency. Seismic restraint option is available.

1.0 General Information

Dryer

Each desiccant dryer is individually sized for peak calculated demand and capable of producing a 10°F (-12°C) pressure dew point. Dryer purge flow is minimized through a demand-based purge saving control system that includes a 441™ transfer valve utilizing two ceramic slide plates. The inlet to each dryer includes a mounted prefilter with automatic drain and element change indicator.

Control System

The mounted and wired TotalAlert Embedded control system is U.L. labeled. This control system provides automatic lead/lag sequencing and automatic alternation of all compressors based on first-on/first-off principle with a provision for simultaneous operation if required, and automatic activation of reserve unit if required. There are circuit breaker disconnects for each motor with external operators. The control panel also includes full voltage motor starters with overload protection, redundant 24V DC control circuit power supplies, visual and audible reserve unit alarm with isolated contacts for remote alarm, and touch screen display.

The control system includes visual and audible alarms indications with isolated contacts for all standard remote alarms.

Final Line Filters and Regulators

Fully duplexed final line filters rated for 1 micron with element change indicators, along with duplexed final line regulators, are factory mounted and piped.

Dew Point Hygrometer/CO Transmitters

The factory mounted, piped and wired, dew point hygrometer and CO transmitter include remote alarm contacts. The dew point sensor is a ceramic type with system accuracy of $\pm 2^\circ$ F. The CO sensor is a chemical type with system accuracy of ± 2 PPM (at 10 PPM) for carbon monoxide. The dew point alarm is factory set at 36° F (2° C) per NFPA 99, and the CO alarm is factory set at 10 PPM. High CO and

high dew point conditions are indicated with visual and audible alarms. Transmitters disconnected from control system will activate an alarm. See Appendix A & B for detailed information.

Air Receiver

The horizontal air receiver is corrosion resistant, ASME Coded, National Board Certified, and rated for a maximum 150 PSIG design pressure. The tank piping includes a liquid level gauge glass, safety relief valve, manual drain valve, and a zero loss automatic solenoid drain valve.

1.2 Electromagnetic Immunity

EN 61000-6-2

Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in this manual.

Portable and mobile RF communications equipment can affect Medical Electrical Equipment.

The use of accessories, transducers, and cables other than those specified by the manufacturer, may result in decreased immunity of the TotalAlert Embedded control system.

The TotalAlert Embedded control system should not be used adjacent to other equipment. If adjacent use is necessary, the TotalAlert Embedded control system should be observed to verify normal operation in the configuration in which it will be used.


1.0 General Information

EN 61000-6-2 (Cont.)

Guidance and manufacturer's declaration - electromagnetic immunity			
The TotalAlert Embedded control system is intended for use in the electromagnetic environment specified below. The customer or the user of the TotalAlert Embedded control system should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic Discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete, metal or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment
Voltage dips, short Interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0,5 cycle <40 % U_T (>60 % dip in U_T) for 5 cycles <70 % U_T (>30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 0,5 cycle <40 % U_T (>60 % dip in U_T) for 5 cycles <70 % U_T (>30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the TotalAlert Embedded control system requires continued operation during power mains interruptions, it is recommended that the system be installed on an emergency power service.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the a.c. mains voltage prior to application of the test level.			

1.0 General Information

EN 61000-6-2 (Cont.)

Guidance and manufacturer's declaration - electromagnetic immunity			
The TotalAlert Embedded control system is intended for use in the electromagnetic environment specified below. The customer or the user of the TotalAlert Embedded control system should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	<p>Portable and mobile RF communications equipment should be used no closer to any part of the TotalAlert Embedded control system, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p>Recommended separation distance</p> $d = 1,2\sqrt{P}$ $d = 1,2\sqrt{P} \quad 80 \text{ MHz to } 800 \text{ MHz}$ $d = 2,3\sqrt{P} \quad 800 \text{ MHz to } 2,5 \text{ GHz}$ <p>where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m).</p>
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2,5 GHz	3 V/m	<p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,^a should be less than the compliance level in each frequency range.^b</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
<p>^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the TotalAlert Embedded control system is used exceeds the applicable RF compliance level above, the TotalAlert Embedded control system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the TotalAlert Embedded control system.</p> <p>^b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.</p>			

2.0 Installation

2.1 Inspection Upon Receiving

The condition of the **LifeLine®** Reciprocating Medical Air system should be carefully inspected upon delivery. Any indication of damage by the carrier should be noted on the delivery receipt, especially if the system will not be immediately uncrated and installed. The systems may remain in their shipping containers until ready for installation. If the systems are to be stored prior to installation, they must be protected from the elements to prevent rust and deterioration.

DO NOT REMOVE the protective covers from the inlet and discharge connection ports of the unit until they are ready for connecting to the hospital's pipeline distribution system.

2.2 Handling

WARNING:

USE APPROPRIATE LOAD RATED LIFTING EQUIPMENT AND OBSERVE SAFE LIFTING PROCEDURES DURING ALL MOVES.

The compressor package can be moved with either a forklift or dollies. Be sure that the orange spacers used to prevent the compressor and motor assemblies from floating are in place. These spacers will prevent unnecessary movement while moving and mounting the unit. Keep all packing in place during installation to minimize damage. Walk along the route the unit must travel and note dimensions of doorways and low ceilings. **LifeLine®** Reciprocating tankmount systems are designed to go through 36" doorways.

Place units to ensure high visibility of indicators and gauges and for performing maintenance on the system.

2.3 Location

The medical air system should be installed indoors in a clean, well-ventilated environment. Areas of excessive dust, dirt or other air-borne particulate should be avoided.

Secure the package to a flat, level surface capable of supporting the weight and forces of the unit. Make sure that the main base is not bowed, twisted, or uneven. Because of the internal flexible hose connections and spring isolators, no special foundation is required. However, the unit base must be securely bolted using all mounting holes provided in the base. If a raised concrete pad is used, the base must not overhang the concrete pad. A method to drain away moisture is necessary. If a gravity drain is not available, a connection to a drain is necessary. After securing the unit to the floor, remove the orange spacers from under the compressor/motor structure.

The area should have an average ambient temperature of 70°F (21°C) with a minimum ambient temperature of 40°F (4.4°C) and a maximum ambient temperature of 105°F (37.8°C). (Note: At temperatures below 32°F the bare compressor will not be adversely affected, but freezing of the condensate can occur which could affect operation.)

Sound levels of 84 to 85 dbA are to be anticipated depending on the size of the package. Though the sound levels are not excessive, they should be considered when locating the system.

2.4 Space Requirements

The systems should be placed to ensure easy access to perform maintenance and high visibility of indicators and gauges. A minimum space of 24" is recommended on all sides of the compressor system for ventilation and maintenance. A minimum space of 36" in front of the control panel is required by NEC code. A vertical distance of 36" is required above the unit for ventilation and maintenance.

2.0 Installation

2.5 Piping

2.5.1 Intake Piping

WARNING:

The air intake must be placed in an area free of toxic or hazardous contaminants; it must be kept away from ETO gas exhaust vents, vacuum exhaust vents, areas close to automotive exhausts, etc., in accordance with NFPA 99.

The air intake line must be piped to the outside in accordance with NFPA 99. To ensure that no restriction of airflow will occur, size the piping according to the following chart. All piping must be precleaned for medical gas in accordance with NFPA 99. The outside pipe must be turned down and screened to prevent contamination. The source of air is typically from outside the building. In hot and humid areas, using the building's air-conditioned supply (per NFPA 99) may improve operating conditions of the system.

All SPC systems have the necessary flex connectors for the air intake and discharge factory piped, and no further flex connectors are needed.

Table 2.1 System Pipe Length

Lifeline Units	System Pipe Length (ft) - See Notes											
	25	50	75	100	150	200	250	300	350	400	450	500
Duplex 2.4 Hp	1.50	1.50	1.50	1.50	1.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Duplex 3.5 Hp	1.50	1.50	1.50	1.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.50
Duplex 6.4 Hp	2.00	2.00	2.00	2.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	3.00

Notes:

1. All pipe sizes are based on the following: copper pipe (Type L), 14.7 psia, 70° F.
2. The minimum pipe size must be maintained for the total length of the inlet pipe. Use next larger size pipe in the event the minimum is not available.
3. When determining the total pipe length, add all the straight lengths of pipe together in addition to the number of elbows times the effective pipe length for that pipe size. (See Table 2.2 and example on page 2-3.)

Table 2.2 Pipe Length for Elbows

Effective Pipe Length Equivalent to each 90 deg Elbow									
Pipe Size (in.)	1.25	1.50	2.00	2.50	3.00	3.50	4.00	5.00	6.00
Eff. Pipe Length (ft)	3.4	4.0	4.9	6.4	7.9	9.4	10.0	11.9	13.2

Example:

Select the pipe size for a Duplex 3 Hp with 90 feet of straight pipe and 4 elbows:

1. Select the pipe size of 1.5" diameter for 90 feet of straight pipe.
2. Determine the eff. pipe length for an elbow of 1.5" diameter (EPL = 4.0 ft/elbow).
3. Calculate the SYSTEM PIPE LENGTH
 $SPL(1.5"D) = 90 + (4 \times 4.0) = 106 \text{ ft}$
4. Check this SYSTEM PIPE LENGTH to see if it exceeds the minimum pipe size. In this case, it does, select the next larger pipe size from the table (D = 2.0").
5. To double-check the pipe size, recalculate the SPL with the new diameter.
6. $SPL(D = 2.0") = 90 + (4 \times 4.9) = 109.6 \text{ ft}$, which is okay.

2.0 Installation

2.5.2 Discharge Piping

Table 2.3 Minimum Discharge Pipe Size¹

LifeLine Units	Pipe Size
Duplex 2.4 Hp	3/4"
Duplex 3.5 Hp	3/4"
Duplex 6.4 Hp	3/4"

¹ A larger discharge pipe size may be required depending on the length of distribution piping in the facility. However, the distribution pipe size should not be less than the minimum pipe size shown above.

For discharge pipe sizing, refer to standard pressure drop tables. Total pressure drop in piping should not exceed 5 psi.

2.6 Wiring

WARNING:

BE SURE TO DISCONNECT ALL ELECTRICAL POWER FROM THE COMPRESSOR BEFORE PERFORMING ANY ELECTRICAL PROCEDURES.

Refer to the electrical diagram provided with the unit before starting any installation or maintenance work.

Do not operate compressor on a voltage other than the voltage specified on the compressor nameplate.

All customer wiring should be in compliance with the National Electrical Code and any other applicable state or local codes.

CAUTION: In the Duplex configuration, all voltages will be disconnected from the compressor modules using the circuit breaker. The fused knife-switch disconnects control power only.

Refer to the wiring diagram(s) that came with the compressor system for pertinent wiring connections.

Electrical power for the Medical Air system must be supplied from the emergency life support circuit.

Check the control voltage, phase, and amp ratings before starting the electrical installation, and make sure the voltage supplied by the hospital is the same. The wire size should be able to handle peak motor amp load of all operating units, refer to the full load and compressor system amperes on the wiring diagram.

Check all electrical connections within the air system that may have loosened during shipment.

Qualified electricians only should make power connections to the control panel and any interconnecting wiring. The control panel has openings for electrical and alarm/data connections. **Do not drill additional holes in the control panel as this may void the system warranty.** See Figure 2.1 for opening locations.

Ensure that the emergency generation system electrical supply is consistent with the air system's requirements.

Three-phase power supplied from emergency generator(s) must match that of the normal supply to allow for correct direction of the motor rotation at all times.

2.0 Installation

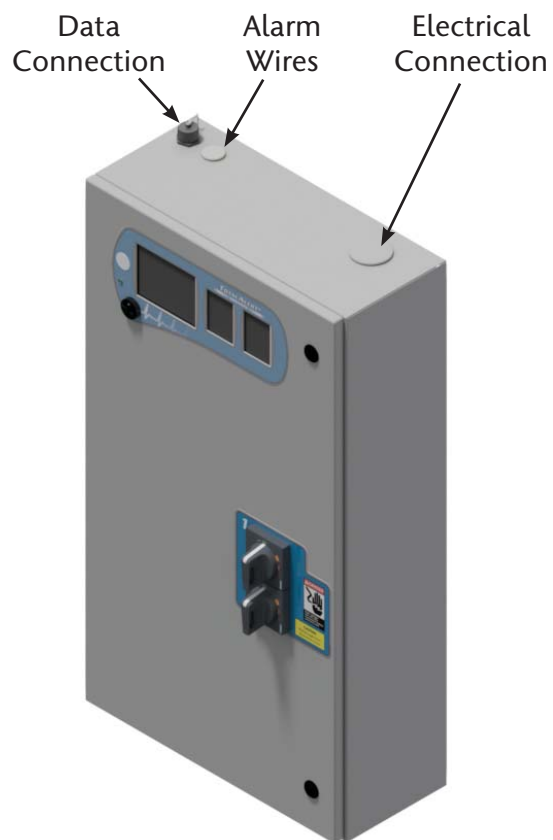


Figure 2.1 Electrical/Alarm/Data Openings

3.0 System Operation

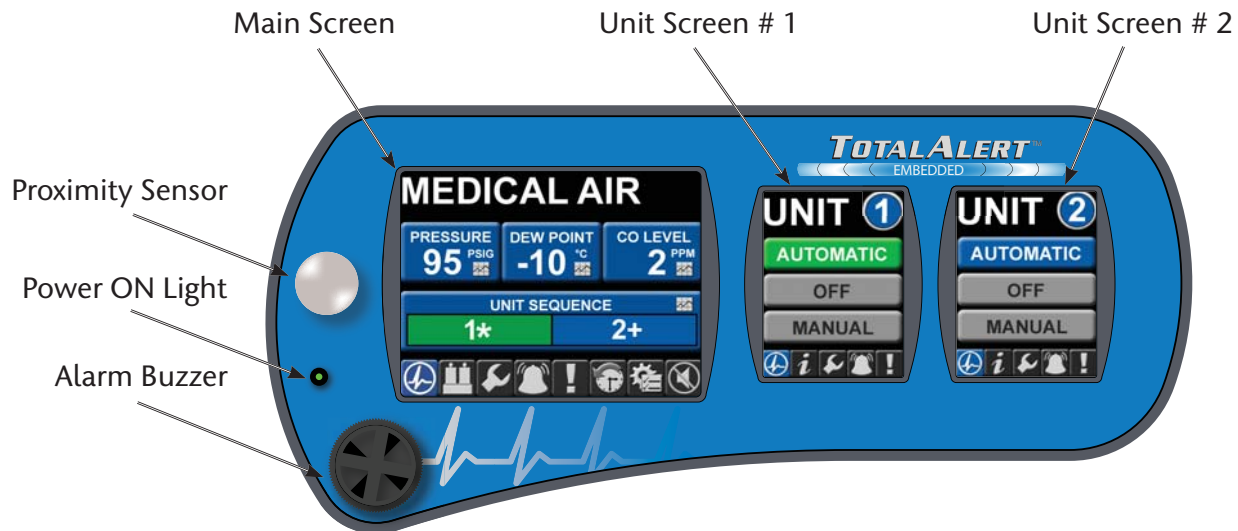


Figure 3.1 Touchscreen Controls

3.1 Prestart-up

The contractor should notify BeaconMedæx two weeks prior to start-up date to schedule an appointment for an authorized technician to review the installation prior to start-up.

CAUTION: Failure to install the unit properly and have an authorized technician from BeaconMedæx start-up the system can void the manufacturer's warranties.

WARNING:

Prior to putting the LifeLine® Reciprocating Medical Air system into use, the medical facility must have a Certifier perform all installation tests as specified in NFPA 99. The medical facility is also responsible for ensuring that the Medical Air meets the minimum requirements for Medical Air as specified in NFPA 99.

Prestart-up and start-up procedures should be performed for a new installation or when major maintenance has been performed.

WARNING:

Have more than one person on hand during prestart-up and start-up procedures to ensure safety and to facilitate certain checks.

The main power source to the control panel should be OFF for the duration of the visual inspection.

Ensure that the equipment is installed on a solid level surface. Walk around the system to ensure that there is enough clearance on all sides to perform operational checks/actions and maintenance. The temperature of the area containing the modules should be approximately 70°F (21.1°C) with a minimum ambient temperature of 40°F (4.4°C) and a maximum ambient temperature of 105°F (40°C).

Check the inlet piping for proper size and connection to the compressor modules. Refer to section 2.5 in this manual.

Check all piping system joints that might have come loose during shipment and installation to ensure they are tight.

3.0 System Operation

Check the air receiver, dryers, controls, and compressors for damage.

Check the drain valves on the air receiver and compressor modules.

Check all valves for full open and full close travel. Ensure that the system's valves are positioned for proper operation. (Refer to labeling on valve handles) **Remove all packing material from the unit including the orange shipping blocks under the compressor module(s) and dryer module (if applicable).**

Check the electrical connections to the control cabinet.

Verify electrical service. Before starting the system, check to see that voltage, amperage, and wire size are appropriate.

CAUTION: Electrical service must be as specified or damage to equipment may occur.

WARNING:

To prevent electrical shock, ensure that ALL electrical power to the system is OFF, including the disconnect switches and Automatic-Manual-Off touch screens on the control panel. The facility's supply circuit breaker should also be locked out.

Open the electrical cabinet by loosening the fasteners on the front.

CAUTION: Vibration during shipment and installation can loosen electrical terminals, fuse inserts, and mechanical connections. Tighten as necessary.

Check the electrical cabinet for any broken components.

Check that all motor starter connections are tight and that there are no loose objects such as terminal lugs, screws, nuts, etc., in the cabinet.

3.2 Initial Start-up

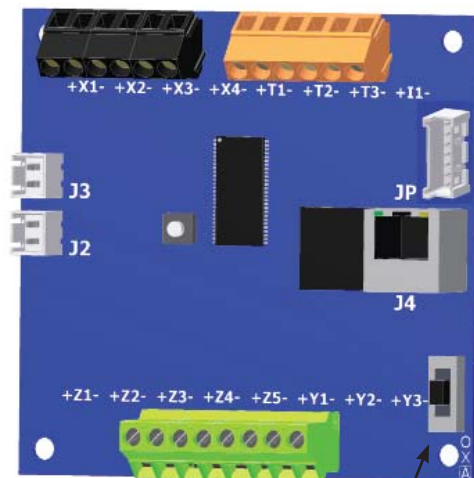
CAUTION: Complete the prestart-up procedure before continuing with the initial start-up procedure

WARNING:

To prevent electrical shock, ensure that ALL electrical power to the system is OFF, including the disconnect switches and Automatic-Manual-Off touch screens on the control panel. The facility's supply circuit breaker should also be locked out.

NOTE: DO NOT ADD OIL TO THE COMPRESSOR. The design of the LifeLine® Reciprocating compressor is totally oil-less. It is not necessary to fill the crankcases with oil.

Inside the control panel, make sure that all unit printed circuit boards are set to the manual override "Off" position. This is indicated by the middle position "X" on the three-position sliding switch as shown in Figure 3.2.



Manual Override
Switch

O - On Manual
X - Off
A - Automatic

Figure 3.2 Unit PCB Override Switch

3.0 System Operation

Check all voltages supplied to the **LifeLine®** system to ensure they are the required value and phases needed by the control panel.

Open the inlet isolation valve on each compressor.

Open the outlet isolation valve on each compressor.

Open the receiver isolation valves.

Close the receiver bypass valve.

Close the DP/CO sensor isolation valve.

Close the inlet and outlet valves on **both** dryer/filter/regulator assemblies.

Close the outlet isolation valve.

Apply power to the system and turn the disconnect switches to “On”.

Inside the control cabinet, switch one of the unit printed circuit boards from the manual override “Off” position to the bottom position, the default “Automatic” mode. Make sure the Pump Mode on the Unit touchscreens are in the Off position, see Figure 3.3.



Figure 3.3 Unit Screen - Off Position

Check for correct direction of rotation of each compressor by pressing the “Rotation” button on touchscreen display (found in the Service section of the Unit touchscreens - See Section D.3.7 for additional information) and observing rotation. See Figure 3.4. The Pump Mode for each compressor must be in the Off Position for the Rotation to function.

WARNING:

DO NOT RUN THE COMPRESSOR BACKWARDS!

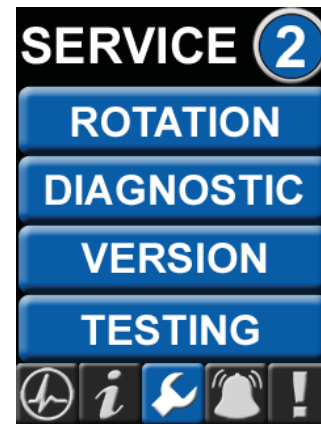


Figure 3.4 Unit Screen - Service: Rotation

Rotation direction arrows are located on the fan guard/belt guard (rotation is counter clockwise, facing the compressor fan). Correct the rotation, if required, by switching the motor leads at the starter.

REMOVE POWER BEFORE WORKING ON ANY ELECTRICAL CONNECTIONS.

Repeat the process of switching the Unit printed circuit boards from the manual override “Off” position to the default “Automatic” position and testing rotation.

3.0 System Operation

Start each compressor by pressing “Automatic” on the touchscreen. See Figure 3.5. Allow each compressor module to operate for a short time (15 to 30 seconds) and check for any unusual noises or vibrations. Switch the compressor back to the “Off” position on the touchscreen.



Figure 3.5 Unit Screen - Automatic Mode

After testing each compressor, if everything appears normal, put each compressor into the “Automatic” mode and allow each compressor to run until pressure builds in the air receiver. The lag compressor should stop first when the pressure reaches its set point on the controller. Pushing the reset button on the control panel can now reset the lag alarm. See Figure 3.6. The lead compressor should stop when the pressure reaches 110 psig. Check for any leaks in the piping up to the inlet isolation valves of the dryers. Repair leaks, if needed.

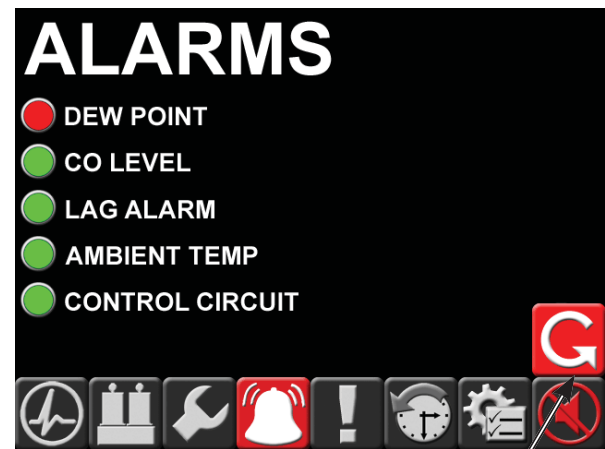


Figure 3.6 Main Screen - Reset Button

Slowly open the inlet isolation valve on one of the dryers. Press “Manual” on the corresponding dryer display screen to begin operation. The dryer will now begin to cycle. See Figure 3.7.



Figure 3.7 Main Screen - Dryer Operation

The pressure reading on one of the gauges should be the same as the panel. The other gauge will normally read 0 psig, and airflow will be coming from the dryer purge exhaust muffler.

3.0 System Operation

It is possible in Automatic mode that the outlet dew point may be low enough to activate the purge saving feature. If the purge saving feature is activated, then both dryer pressure gauges will be at the same pressure as the control panel and there will be no flow from the dryer purge exhaust muffler.

Check for air leaks.

Adjust the pressure regulator to the desired pressure setting.

Open the outlet isolation valve of the dryer/filter/regulator group. Check for air leaks.

Open the Dew Point/CO sensor isolation valve.

Slowly open the outlet isolation valve to allow air to flow out to the hospital.

Adjust the pressure regulator setting if necessary.

If everything appears normal, open the inlet isolation valve of the other dryer/filter/regulator assembly. If the dryer pressures appear as expected, open the dryer/filter/regulator outlet isolation valve. Close the other dryer/filter/regulator inlet and outlet isolation valves.

CAUTION: Only one dryer/filter/regulator group should be on line at a time.

Adjust the pressure regulator to the desired pressure.

Adjust the pressure regulator setting, if necessary.

The dryer should purge until the dew point monitor reading is below minus 10°C. If dew point is below minus 10°C; both pressure gauges of the on-line dryer will read the same.

Observe the system for normal operation.

3.3 Normal Start-up

Hospital shutoff valve - CLOSED.

Compressor isolation valves open (inlet and discharge)

Isolation (receiver) valves - OPEN.

Receiver bypass valve - CLOSED.

One air dryer off line with valves CLOSED; the other air dryer on-line with the valves OPEN.

Main electrical power - ON.

Disconnect switches - ON.

Pump mode to “Automatic” on touchscreen display.

One dryer unit to “Automatic” on touchscreen display. Dryer unit on touchscreen matches dryer unit with valves open.

Pressure increasing to 100 psi.

Check that each compressor shuts down as it reaches its off-limit pressure.

Check that the mainline regulator is set for the desired output pressure and adjust if necessary.

Slowly OPEN the hospital shutoff valve.

NOTE: Opening the hospital valve may cause a pressure demand that brings the lag compressors back on-line. This is a normal sequence.

NOTE: The Medical Air system is now on-line and in the Normal Operating Mode (lead/lag operation).

To verify dryer operation, refer to Appendix A for desiccant dryers.

3.0 System Operation

3.4 Normal Operation

3.4.1 Controls

During normal operation, all pumps should be in "Automatic" mode to effectively control the system. The controls monitor the system pressure condition (see Table 3-1), starts and stops the compressors depending on changing pressure conditions, and automatically alternates the lead position between compressor units.

In a typical **duplex** system, one compressor will be able to handle the system load. The control will signal the lead compressor to start at 90 psig with falling system pressure. If the one compressor can carry the load, then the system pressure will rise to 110 psig. At this point, the control will turn off the lead compressor. When the system pressure drops again to 90 psig, the control will automatically sequence the lead role to the other compressor and will start it. This is known as "first on/first off" instead of the more traditional "last on/first off". With the "first on/first off" sequencing technique, starts and stops on the compressor are minimized.

If the lead compressor runs continuously in lead for more than 17 minutes, the control will automatically sequence the compressor attempting to evenly distribute the run time among all available compressors. If during operation, the second compressor is required to come on in addition to the lead compressor, the control will turn on the "Lag Alarm" (see Section 3.6).

NOTE: For a compressor to be considered available to the system, its pump must be in the "Automatic" position.

Table 3.1 System Pressure Factory Settings

System Pressure Settings	Start (Close)	Stop (Open)
Lead	Varies	110 psig
Lag	85 psig	Varies
Backup Switch	80 psig	105 psig

NOTE: Factory settings may vary depending on system size and configuration.

For maintenance or other reasons, compressors can operate in "Manual" position. The compressor(s) in the "Manual" mode will start and stop depending on backup pressure switch conditions.

NOTE: Any compressor in the "Manual" mode will start and stop depending on backup pressure switch condition.

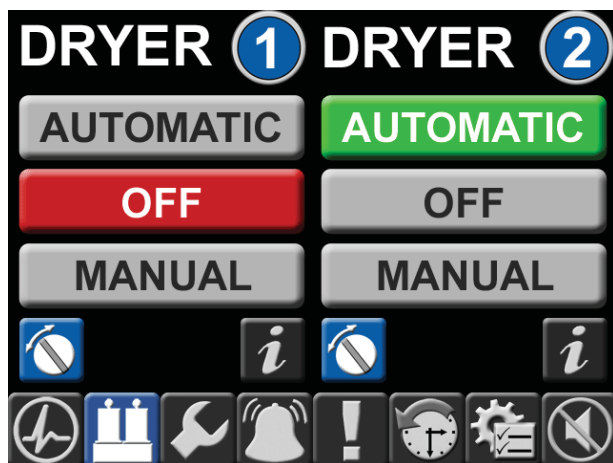
3.4.2 Dryers

This fully automatic, heat-less type dryer alternately cycles the compressed process gas flow through two desiccant charged vessels where the gas' vaporous moisture content is adsorbed. One desiccant vessel is always on-line in a **drying cycle** throughout normal dryer operation. The opposite, off-line vessel is in a **regeneration cycle** for removal of the previously adsorbed moisture content, or in a purge saving cycle at line pressure.

When the dryer is in the "Manual" mode, the dryer will shift towers every 30 seconds. At normal operating conditions, one tower is approximately 100 psig and the other tower is at 0 psig. Any condition other than this is not normal and will cause a high dew point condition. During tower changeover, the online chamber will exhaust, and the chamber that is regenerating (purging) will come to line pressure. There is a 5 second repressurization cycle. If the dryer is in the "Manual" mode, the dryer will use 15% of the system capacity to purge the dryer.

3.0 System Operation

When the dryer is in the “Automatic” mode, the dew point monitor controls the dryer purge, and purging depends on the dew point condition. See Figure 3.8. When the dew point reading is above the setpoint of -10°C (14°F), the dryer will function normally (one tower at system pressure, one tower at 0 psig). When the dew point is below the setpoint of -10°C (14°F), the purge valve will close. In this condition, both towers will be approximately 100 psig (dependent upon tank pressure) and the dryer will not shift towers until the dew point is above -10°C (14°F).



Dryer 2 is in Automatic mode, Dryer 1 is in Off position

Figure 3.8 Main Screen - Dryer Operation

3.5 Normal Shutdown

Dryer in Automatic Mode

Disconnect switches-OFF

Main power source-OFF

Hospital shutoff valve-CLOSED

Air receiver manual tank drain-OPEN

Pressure gauge decreasing to 0 psi (0 kPa)

Close air receiver manual tank drain when pressure decreases to 0 psi (0 kPa)

3.6 Emergency Shutdown / Alarms

The following conditions may arise during operation.

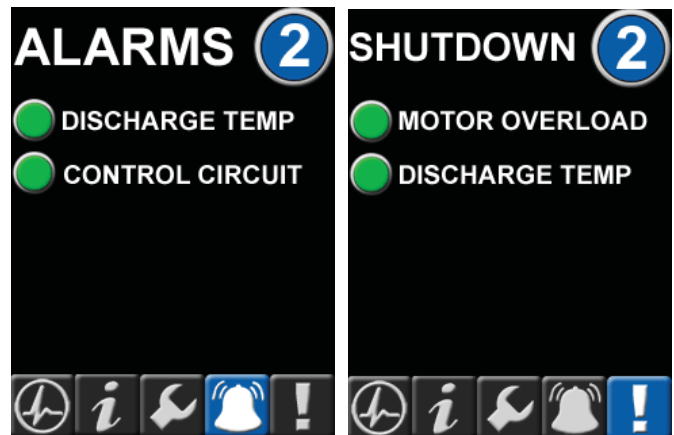


Figure 3.9 Unit Screens - Shutdown and Alarms

Motor Overload Shutdown - This shuts down the compressor in question and will not re-start it until the reset button on the starter inside the main control cabinet is reset and the appropriate reset button is pressed on the control panel display. See “Motor overheating” in the Troubleshooting Section 4.0.

High Air Temperature Shutdown - This shuts down the compressor in question and will not re-start it until the appropriate button is pressed on the control panel. Before allowing the unit to re-start, the condition should be checked (see “Compressor shuts off unexpectedly” in the Troubleshooting Section 4.0). Even after resetting the alarm and putting the compressor in “Automatic” mode, the unit may not re-start, depending on system sequencing and system pressure.

High Air Temperature Alarm - This does not shut down the compressor in question but instead is a warning that a shutdown is likely to occur. The condition should be checked immediately (see “High temperature alarm” in the Troubleshooting Section 4.0) to avoid a compressor shutdown.

3.0 System Operation

Control Circuit Alarm - This does not shut down the compressor in question but instead is a notification that there is a loss of communication between printed circuit boards within the control panel. See Appendix D on Control System for troubleshooting.

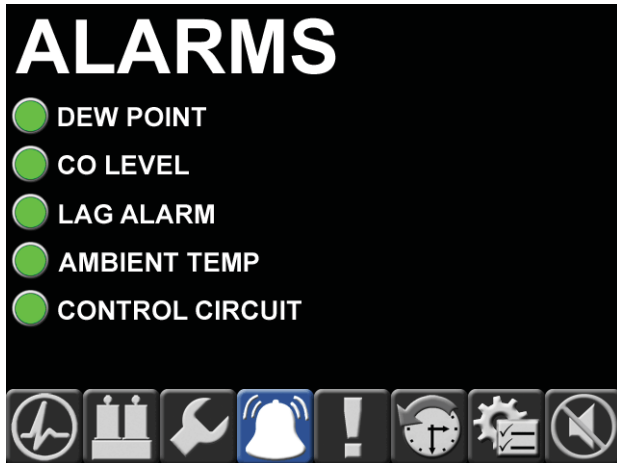


Figure 3.10 Main Screen - Alarms

Dew Point Alarm - This alarm activates if the dew point exceeds the alarm setting. To silence the alarm, press the horn silence button. If the situation does not correct itself through normal dryer use, see Appendix B, section B.7 Troubleshooting for possible causes and solutions. The alarm remains latched until the alarm condition is reset by the operator.

CO Level Alarm - This alarm activates if the CO level exceeds the 10 ppm set point. To silence the alarm, press the horn silence button. See Appendix C, section C.10 Troubleshooting for possible causes and solutions. The alarm remains latched until the alarm condition is reset by the operator.

Lag Unit Running Alarm - This alarm activates if the last available compressor unit comes on. (See Section 3.4 for normal operation) To silence the alarm, press the horn silence button. For persistent lag alarms, check to see if any leaks or valves are open downstream or reduce the system load.

Ambient Temperature Alarm - This alarm activates when the temperature in the room exceeds the set point. The audible alarm does not sound but a touchscreen shows an active alarm and records it in the event log. The alarm remains latched until the alarm condition is reset by the operator.

Dryer Tower Switching Failure Alarm (Optional) For units with this feature, there is one pressure switch that senses pressure inside each dryer tower for a total of two pressure switches for each dryer. If the pressure in both towers of the same dryer fall below 50 psig, the “Dryer # Switch” on the alarm screen changes from Green to Red and the remote dryer fault contacts (one for each dryer) change condition (refer to the wiring diagram that came with the unit for terminal numbers). A short time delay (1.5 seconds) starts when both pressure switches fall below 50 psig to eliminate false alarms during normal tower switching. To eliminate alarms during periods when the dryer is turned “off” for maintenance or other reasons, the dryer tower switching failure alarm is bypassed for that dryer.

Low Dryer Outlet Pressure Alarm (Optional) For units with this feature, there is an adjustable pressure switch located upstream of the dryer check valve that alarms if the pressure in that line drops below the 75 psig factory setpoint. In the event of an alarm, the “Dryer # Pressure” on the alarm screen changes from Green to Red and a remote set of contacts change condition (refer to the wiring diagram that came with the unit for terminal numbers).

4.0 Trouble Shooting

Problem	Possible Causes	Solution
Failure to start	Main power disconnected	Turn on main power
		Change power supply phase on incoming power
	Power failure	Restore power
	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
	Overload tripped on starter	Reset & check for system overload
	High temperature sensor activated	Allow unit to cool; reset alarm & check for over temperature condition
	Pressure sensor open	Check sensor wiring or replace sensor
	Loose or faulty connection	Check & tighten all wire connections
Power failure	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
Compressor shuts off unexpectedly	Overload tripped on starter	Reset & check for system overload
	Pressure sensor failure	Replace
	High temperature sensor activated	Allow unit to cool; reset alarm & check for over temperature condition
High temperature alarm	High temperature sensor activated	Allow unit to cool; reset alarm & check for over temperature condition
Motor overheating	Low voltage	Check for proper supply voltage
	Defective motor	Contact BeaconMedæ s

4.0 Trouble Shooting

Problem	Possible Causes	Solution
Low discharge pressure	System piping leaks Defective pressure sensor Aftercooler drain solenoid stuck open Intake filter clogged Gasket leaks; piston ring wear	Repair leaks Replace sensor Check electrical connections Clean or replace Replace gaskets and rings
Compressor cycles too often	System undersized Faulty pressure sensor System piping leaks Check valve or line to receiver is leaking or plugged Both dryers on line Water in air receiver	Contact BeaconMedæ Replace sensor Repair leaks Replace if necessary Valve off one dryer Drain air receiver
Compressor won't shut off	Pressure sensor faulty	Adjust or replace
Abnormal noise	Mounting bolts loose Worn piston or rider ring; broken valve parts	Tighten bolts Replace

NOTE: For air dryer trouble shooting, see Appendix A.

5.0 Maintenance

5.1 Maintenance Schedule

WARNING:

BEFORE STARTING ANY MAINTENANCE PROCEDURES, DISCONNECT ALL POWER TO THE PACKAGE.

Release all pressure from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.

Never perform any maintenance functions while the unit is in operation.

Maintenance Schedule

Item	Frequency	Action
Check condensate in tank	Daily	Open manual drain valve, check auto drain
Check operation of safety valve	Weekly	Manually release pressure
Check inlet air filter(s)	Weekly	Inspect and clean or replace
Check nuts, bolts, fittings, etc.	Monthly	Inspect and tighten
Check flow through orifice of dew point sensor	Every 6 months	Check for flow blockage
Calibrate CO transmitter	Monthly	Purchase <i>6-Month Service Kit</i> See Appendix B
Check dew point sensor accuracy	Yearly	Verify dew point sensor accuracy (contact BeaconMedæS)
Replace compressor inlet filters and dryer pre-filters & afterfilters	Yearly	Purchase <i>1-Year System Basic Service Kit</i> Purchase <i>1-Year Unit Basic Service Kit (1 per compressor)</i>
Zero-Loss Drain Valve	Yearly	Rebuild Zero-Loss Drain Valve. Rebuild Kit is included in the System Basic Service Kit
Replace DP and CO transmitters	Every 2 years	Purchase <i>2-Year System Sensor Kits</i> See Appendix B and C
Replace dryer desiccant	Every 3 years	Purchase <i>3-Year Dryer Extended Service Kit</i> See Appendix A
Replace compressor valve plates and valve parts*	Every 7,500 hours	Replace (2-Year Unit Service Kit)

*An authorized BeaconMedæS Service Technician should perform compressor valve plates and valve parts repair and/or replacement. Please contact BeaconMedæS Customer Service department at 1-800-756-2590 to schedule this maintenance.

5.0 Maintenance

5.2 Service Kits

Note: The service kits listed in this section are standard for NFPA 99 medical air systems. In the case of special system configurations, locate service kit part numbers in the Maintenance section of the Main Screen on the panel controls. See Appendix D Controls.

5.2.1 6-Month CO Service Kits

KIT NUMBER	DESCRIPTION	QTY	WHERE USED
4107 4004 63	KIT - CO Calibration	1	All Systems

Contents: 20 PPM CO Gas Bottle, 0 PPM CO Gas Bottle, 0.5 LPM Regulator #ABL-4021, Nylon Tubing Storage Case

5.2.2 1-Year System Basic Service Kits (Control/Dryer/Base)

KIT NUMBER	DESCRIPTION	QTY	WHERE USED
4107 4000 29	KIT - Reciprocating Basic Size A	1	2.4, 3.5, 6.4 Hp Duplex

Contents: (2) Dryer inlet filters, (2) Dryer discharge filters, (2) Inlet filter float drains, (2) Dryer purge mufflers, (1) Zero loss drain valve service kit, (1) Sight glass tube, (1) 3/8" Polypropylene ball, (1) 3/8" in-line check, (1) 1/2" MNPT inline filter 90 micron

5.2.3 1-Year Unit Basic Service Kits

KIT NUMBER	DESCRIPTION	QTY	WHERE USED
4107 4015 22	Unit Recip Basic Kit A	1 per unit	2.4, 3.5, 6.4 Hp (60Hz/50Hz)

Contents: (1) Main air inlet filter

Note: 1-Year Unit Basic Service Kits required in addition to the above 1-Year System Basic Service Kit.

5.2.4 2-Year Unit Service Kits

KIT NUMBER	DESCRIPTION	QTY	WHERE USED
4107 4015 29	Valve Rebuild Kit	2 per unit	2.4, 3.5, 6.4 Hp

Contents: Valve kit components per cylinder head

Note: Valve kit to be installed by BeaconMedaes Service technician.

5.0 Maintenance

5.2.5 2-Year System Sensor Kits

KIT NUMBER	DESCRIPTION	QTY	WHERE USED
4107 4000 59	Dew Point / CO Sensors	1	All Systems

Contents: (1) Dew Point sensor, (1) CO sensor

5.2.6 3-Year Dryer Extended Service Kits

KIT NUMBER	DESCRIPTION	QTY	WHERE USED	CONTENTS
4107 4000 34	Kit - Dryer Extended Service Kit (Size A)	1	2.4, 3.5, 6.4 Hp Duplex	(2) 6 lb. bags desiccant (2) ISO 2 dryer service kit

Contents: (2) 6 lb. bags desiccant, (2) ISO 2 dryer service kit

Note: Each dryer service kit contains: (2) o-rings for canister bases, (2) o-rings for tower mounting flanges, (2) check valves for dryer manifold block, and (2) o-rings for check valves.

5.2.7 3-Year Unit Extended Service Kits

KIT NUMBER	DESCRIPTION	QTY	WHERE USED
4107 4015 27	Kit - 3-Year Unit Extended Service Kit	1 per unit	2.4, 3.5, 6.4 Hp

Contents: (1) 1/8" pressure relief valve, (1) check valve (aftercooler inlet), (1) o-ring

Note: 3-Year Unit Extended Service Kits do not include 1-Year System Basic Service Kit or 1-Year Unit Basic Service Kits. These must be purchased in addition to the 3-Year Dryer Extended Service Kit and the 3-Year Unit Extended Service Kit.

6.0 Inspection/Replacement Procedures

6.1 Air Intake Filter

WARNING:

Before starting any maintenance procedures, disconnect all power to the package.

Release all pressure from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.

Never perform any maintenance functions while the unit is in operation.

The air intake filter element should be changed annually under normal operating conditions. To change the filter:

1. Turn off the compressor being serviced and lock open the appropriate disconnect switches.
2. Close intake isolation valve.
3. Remove the protective cover by loosening the wing nut (if applicable) and latches.
4. Remove the element.
5. Clean inside of housing
6. Insert a new element (note orientation of the element).
7. Replace protective cover and tighten wing nut (if applicable) and latches.
8. Open intake isolation valve.
9. Turn on the compressor.

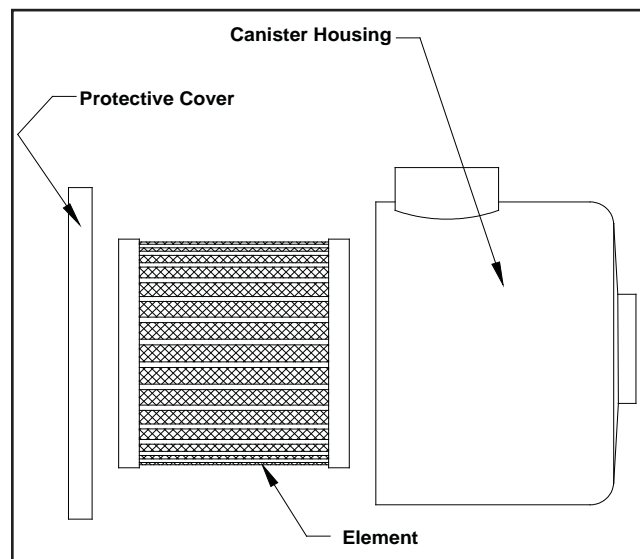


Figure 6.1 Air Intake Filter

6.0 Inspection/Replacement Procedures

6.2 Liquid Level Sight Glass

The sight glass is located lower than the receiver tank and it will show approximately 1/2 full when the receiver is empty. This is a normal condition.

6.3 Zero Loss Electronic Drain

6.3.1 Isolating the Zero Loss Electronic Drain

Before servicing the Zero Loss Electronic Drain, the drain must be isolated in three locations. The following valves must be closed in the following sequence:

1. Isolation valve for equalization line
2. Top knob on manual drain sight glass
3. Valve after the manual drain sight glass

To bring the electronic drain back into operation, open each of the valves in the following sequence:

1. Valve after the manual drain sight glass
2. Top knob on manual drain sight glass
3. Receiver drain valve

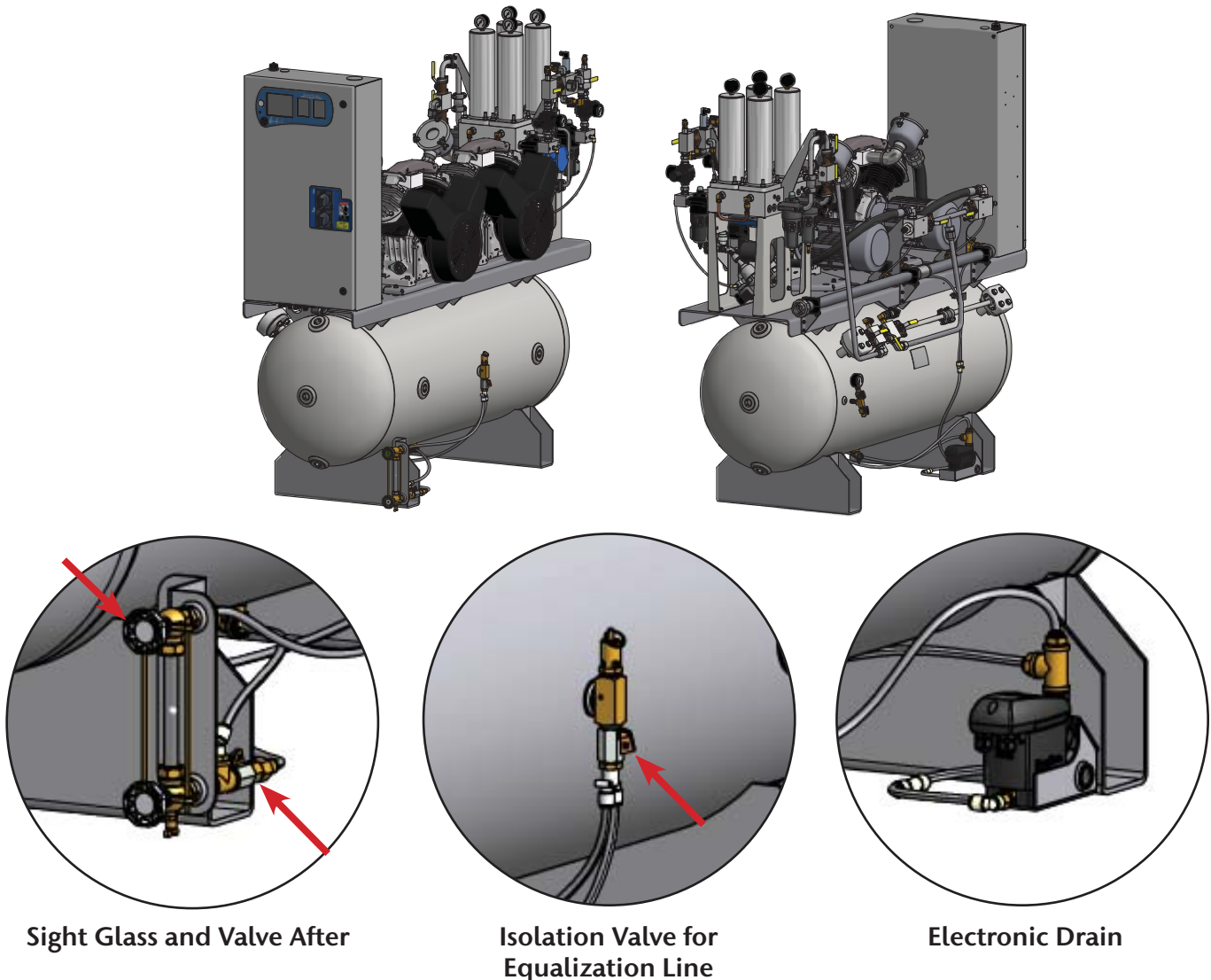


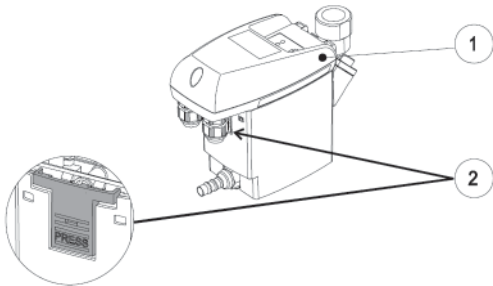
Figure 6.2 Electronic Drain Isolation Valves

6.0 Inspection/Replacement Procedures

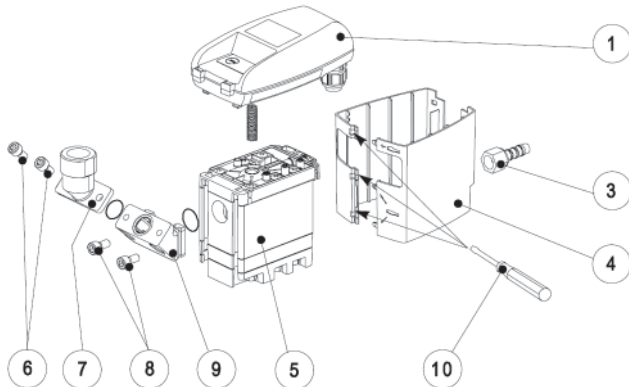
6.3.2 Replacing the Service Module

The following steps describe the replacement procedure for the service module of the Zero-loss Drain Valve, model UFM-D05 (See Section 5.2.9 to identify the Zero-Loss Drain Valve model).

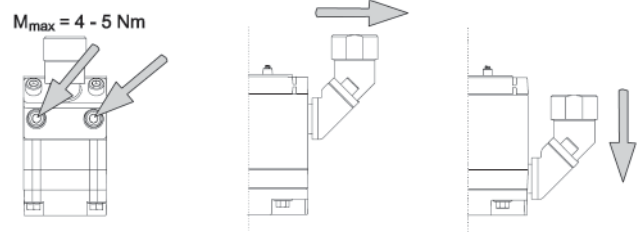
1. Remove the control unit (1) by pressing the release latch (2).



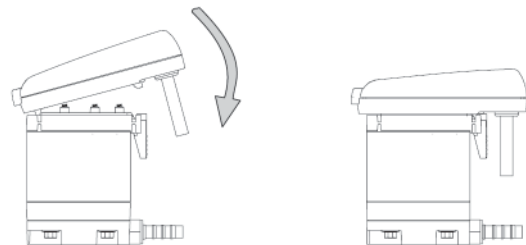
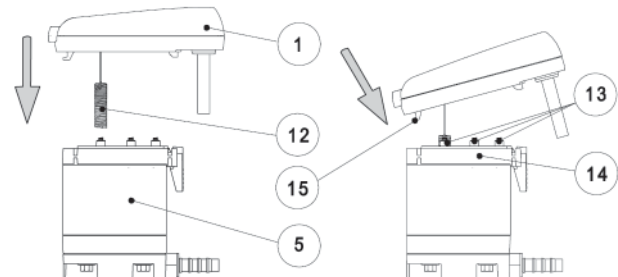
2. Remove the outlet connection (3).



3. Remove the cover (4) using a small, flat blade screwdriver (10) and pressing the release latches.
4. Detach the inlet from the Service Module by removing screws (6) from the elbow connector (7).
5. Remove the screws (8) from the intermediate adapter (9) and remove the adapter by pulling outward, then sliding it down.



6. Ensure that the sensor tube plate (14) and contact springs (13) are clean, dry and free from impurities.



7. Insert the sensor (12) into the sensor tube plate.
8. Place the hooks (15) of the control unit (1) into the sensor tube plate (14).
9. Press the control unit down and snap into place.
10. Reassemble the intermediate adapter (9), the inlet connection (7) and outlet tube (3), tighten screws (8 & 6) to 4-5 Nm (35-45 Inch Lbs).
11. Press and hold the Reset Button for 5 seconds to reset the controls.

6.0 Inspection/Replacement Procedures

6.4 Backup Pressure Switch Set Point Adjustments

The backup switch is set at the factory to the operating point(s) as stated on the wiring diagram supplied with the unit. It is good practice to cycle the switch to determine actual operating points before proceeding with readjustment.

CAUTION:

- ALWAYS change pressure setting gradually.
- ALWAYS check switch setting before making any adjustments.
- DO NOT force slotted adjustment screw when it becomes difficult to turn.
- ALWAYS isolate the pressure transducer before making any adjustments to the backup pressure switch.

Adjusting Instructions

1. To locate the adjuster, slide the adjustment access cover to reveal a slotted adjustment screw.
2. Turn the screw inward (clockwise) to increase the setpoint and outward (counter-clockwise) to decrease the setpoint. The backup pressure switch should always be set with falling pressure level starting at a pressure level higher than the setpoint.
3. Using the pressure gage, determine the actuation point of the switch.
4. If the actuation point is above the desired value, turn the slotted adjustment screw counter-clockwise to decrease the actuation point, and if it is below, turn the slotted adjustment screw clockwise to increase it.
5. For exact pressure setting, cycle pressure switch and make fine adjustments by repeating steps 2 through 4 (trial and error process) until the desired setting is obtained.
6. Slide the adjustment access cover back into place over the slotted adjustment screw.

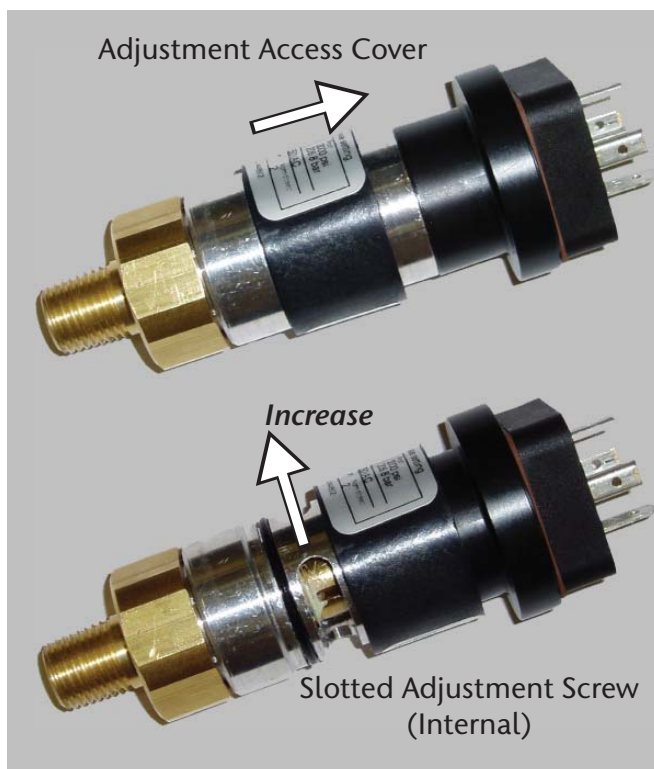


Figure 6.3 Backup Pressure Switch

6.5 General Inspections

A general inspection should be performed on a regular basis (monthly) for safety items. Items to inspect include all wiring, flex hoses, and other items. If a damaged item is viewed, call your local BeaconMedaes service technician for a thorough inspection and report of findings.

A thorough inspection of the compressor cooling-air discharge grating and the aftercooler coils should be performed at least every six months or more frequently if conditions require. If a dust/dirt buildup is visible, clean the grating or coils to remove the buildup. Excess dust/dirt buildup in these areas will prevent air from cooling the compressor unit or the aftercooler, affecting performance of the air system.

7.0 Replacement Parts

Any information, service or spare parts requests should include the machine serial number and be directed to:

BEACONMEDAES

1059 Paragon Way
Rock Hill, SC 29730

Telephone: (888) 4-MEDGAS
(888) 463-3427

Fax: (803) 817-5750

A Parts List is available as a supplement to this Operation and Maintenance Manual. Please contact BeaconMedaes to have the Parts List sent to you or download an electronic version from the website at www.beaconmedaes.com.

8.0 Specifications

8.1 Duplex Tankmount Piston NFPA Medical Air System

	Duplex Tankmount					
Model Hp	2.4		3.5		6.4	
Package Hp	4.8		7.0		12.8	
Max. Pressure (PSI)	145		145		145	
Delivery (CFM) 100 psi at compressor, per compressor	7.6		9.7		19.3	
RPM	1720		1720		1750	
Intake Pipe Size (in)	1-1/4		1-1/4		1-1/4	
Discharge Pipe Size (in)	3/4		3/4		3/4	
Safety Valve Setting (psi) pump	135		135		135	
Max. Ambient Temperature	105°F		105°F		105°F	
Tank Size	80	120	80	120	80	120
Dimensions (inches)						
Length	74.75	74.75	74.75	74.75	74.75	74.75
Width	31.48	33.14	31.48	33.14	31.48	33.14
Height	66.20	70.20	66.20	70.20	66.20	70.20
Weight (lbs)	982	1047	1001	1065	1085	1147

9.0 Maintenance Record

Model Number _____

Serial Number _____

Installation Date _____

Date of Service								
Hours								
Load								
Ambient Temp.								
Inlet Filter								
Misc.								
Serviced By								

Notes:

9.0 Maintenance Record

Model Number _____

Serial Number _____

Installation Date _____

Date of Service								
Hours								
Load								
Ambient Temp.								
Inlet Filter								
Misc.								
Serviced By								

Notes:

Appendix A: Desiccant Dryer

A.1 General Information

CAUTION: This manual is designed to serve as the operation and maintenance guide for your dryer, if equipped. The contents of this manual should be carefully read BEFORE attempting any phase of operation or maintenance. Failure to follow the operating and maintenance procedures of the instruction manual could result in personal injury or property damage.

All information, specifications and illustrations within this manual are those in effect at the time of printing. The manufacturer reserves the right to change or make improvements without notice and without incurring any obligation to make changes or add improvements to products previously sold.

When requesting information, service, ordering of spare parts, etc., please reference all information supplied on the serial number plate located on the side of the control panel.

To facilitate maintenance, recommended spare parts for your specific dryer model are available. Failure to maintain recommended spare parts and filter cartridges might result in expensive and unnecessary downtime for which the manufacturer cannot be responsible. To request a quotation of, or place an order for, recommended or emergency spare parts, please contact **BeaconMedaes Service** at 1-888-4MEDGAS.

A.1.1 Drying Cycles

This fully automatic, heatless type dryer alternately cycles the compressed, process gas flow through two desiccant charged towers where the entrained, vaporous moisture content of the gas is adsorbed. One desiccant tower is always on-line in a drying cycle throughout normal dryer operation. The opposite, off-line tower is in a regeneration cycle for removal of the previously adsorbed moisture content or in a purge saving cycle at line pressure.

Manual Mode

When the dryer is in the “Manual” mode, the dryer will shift towers every 30 seconds. At normal operating conditions, one tower is at system pressure and the other tower is at 0 p.s.i. Any condition other than this is not normal and will cause a high dew point condition. During tower changeover, the online chamber will exhaust, and the chamber that is regenerating (purging) will come to line pressure. There is a five second re-pressurization cycle. If the dryer is in the continuous purge cycle (Manual Mode), the dryer will use 15% of the NFPA system capacity to purge the dryer.

Automatic Mode

When the dryer is in the “Automatic” mode, the dew point monitor controls the dryer purge, and purging depends on the dew point condition. When the dew point reading is above the setpoint of -10°C (14°F), the dryer will function normally (one tower at system pressure, one tower at 0 p.s.i.). When the dew point is below the setpoint of -10°C (14°F), the purge valve will close. In this condition both towers will be approximately 100 p.s.i. and the dryer will not shift towers until the dew point is above -10°C (14°F).

A.1.2 Pre-filter

As the first line of defense against water contaminants, a coalescing pre-filter with an automatic drain is installed. The coalescing pre-filter removes water aerosols from the gas stream before the gas enters the dryer. Liquids collected by the assembly’s filter cartridge(s) fall to the housing sump and are drained by a float drain. Installer should pipe these drain connections to a common drain point.

Appendix A: Desiccant Dryer

A.2 Operation

A.2.1 Initial Start-Up



Figure A.1 Main Screen - Dryer Operation

1. CLOSE the dryer isolation valves.
2. Check that the compressed air supply is on. Let the system come up to pressure. Slowly OPEN the dryer inlet isolation valve.
3. Press “Manual” on the dryer display screen to begin operation. The dryer will now begin to cycle.
4. Check that purge air is flowing from the purge muffler.
5. Slowly OPEN the dryer outlet isolation valve.
6. Open the dew point and CO sensor (if supplied) isolation valves.
7. Check for airflow at the dew point sensor orifice.
8. Operate the dryer for five to ten minutes with the source isolation valve closed.
9. During the conditioning run test all joints to locate any leaks using leak detector spray or a suitable alternative. Tighten or repair any leaks and retest.

NOTE: Any small leaks on the dryer outlet side will cause a deterioration of the dew point.

12. Press “Automatic” on the dryer display screen to begin operation in Automatic mode.

13. On the completion of the conditioning run, **slowly open** the source isolation valve. The dryer will now be fully operational.

A.2.2 Procedure to Switch Off Dryer

1. Put second dryer on line by repeating steps 4 thru 7 above.
2. CLOSE the dryer outlet isolation valve.
3. Press “OFF” on the dryer display screen.
4. CLOSE the dryer inlet isolation valve. Dryer should de-pressurize.

WARNING:

Wait at least 2 minutes for pressure in the dryer to decay before performing any service to the dryer.

A.2.3 Normal Start-up

This procedure is to be followed when the dryer has been shut down for a short period during which time the desiccant has not been exposed to wet gas.

1. Start up the compressor if shut down.
2. Set the appropriate dryer to Automatic mode.
3. Slowly OPEN the dryer inlet isolation valve.
4. Slowly OPEN the dryer outlet isolation valve.
5. Check operation of the dryer.

Appendix A: Desiccant Dryer

A.2.4 Maintenance Shut Down

1. CLOSE the dryer outlet isolation valve.
2. CLOSE the dryer inlet isolation valve.
3. Allow the dryer to continue to cycle until the purge exhaust fully depressurizes both chambers.
4. Switch off electrical power to the dryer by removing the fuse.

WARNING:

Display prominent notices indicating that maintenance is being carried out.

A.3 Trouble Shooting

WARNING:

To protect the lives of patients, always notify the appropriate medical facility staff before performing any maintenance or service procedures on the air system. Compressed air levels may be affected during maintenance or service procedures.

WARNING:

Some of the following trouble-shooting checks are conducted while the dryer's electrical power supply is energized. THEREFORE, A POTENTIAL ELECTRICAL SHOCK HAZARD EXISTS. A qualified electrical technician should conduct these checks. The dryer's electrical power supply must be de-energized before any electrical maintenance or repair work is conducted.

WARNING:

Ensure that the dryer and associated pre-filter(s) and afterfilter(s) are valve isolated and fully depressurized before attempting to remove or disassemble any subassemblies or components. Failure to do so may result in serious personal injury and/or equipment damage.

CAUTION: Each component has been selected to compliment the performance of the other components of the system. Therefore, use of unauthorized parts or improper operation will degrade system performance.

IMPORTANT: Water molecules can diffuse through a pinhole size leak even though pressure inside the piping is several hundred PSIG. It is not at all uncommon to have a minute pinhole leak in a gas line cause an increase in dew point from -40°F to -10°F at a distance of forty or more feet downstream of the leak.

WARNING:

Compressed air can be dangerous unless safety precautions are observed in the use of compressed air and compressed air equipment. Completely vent the internal air pressure to the atmosphere before disassembling any subassemblies or components and before doing any work on compressed air equipment. To vent internal air pressure, follow the maintenance shutdown instructions.

Appendix A: Desiccant Dryer

A.3 Troubleshooting

Problem	Possible Causes	Solution
Dryer not cycling	Main power disconnected	Turn on main power
	Power failure	Restore power
	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
	Dryer circuit board failure	Check and replace if defective
	Dryer operation in Off position	Select Automatic or Manual mode
	Loose or faulty connection	Check & tighten all wire connections
	Switching valve failure	Replace switching valve
Dew point degradation	Incorrect purge air flow	Check purge orifice for blockage. Clean and replace as required
	Excessive system flow rate	Reduce inlet flow rate and/or increase operating pressure
	Inlet air temperature is above the dryer's design inlet working temperature	Check the compressor aftercooler and cooling system. Adjust as necessary to bring the dryer inlet temperature to less than the maximum design working temperature of 43°C (110°F)
	Liquids entering the dryer inlet	Isolate and depressurize the pre-filter assembly. Inspect pre-filter cartridges and end seals for loosening and/or damage. Tighten or replace as necessary.
		Inspect the pre-filter automatic drain valve. Ensure that it is not clogged and is draining properly. Repair or replace as necessary, if a problem is noted.
	Purge muffler restricted	Replace muffler.

Appendix A: Desiccant Dryer

A.3 Troubleshooting

Problem	Possible Causes	Solution
Dew point degradation (continued)	Desiccant is contaminated. The “white” desiccant beads may appear discolored and dirty if contamination has occurred. Union or other piping/ component leaks at dryer outlet manifold or downstream of dryer outlet.	Shutdown and depressurize the dryer. Inspect the desiccant and replace if fouled. Inspect any existing pre-filter if fouling is noted. Soap test the dryer outlet manifold and piping downstream of dryer. Repair all leaks noted.
Back pressure on a desiccant chamber during the regeneration cycle.	Dirty or fouled purge muffler Outlet check valve leaking	Switch off power and remove purge muffler and clean using an air nozzle, or replace. Repair check valve

NOTE: The presence of backpressure will result in insufficient regeneration followed by dew point degradation. An off-line chamber’s pressure **MUST be less than 3 psig** throughout all regeneration cycles.

Appendix A: Desiccant Dryer

A.4 Maintenance

WARNING:

To protect the lives of patients, always notify the appropriate medical facility staff before performing any maintenance or service procedures on the air system. Compressed air levels may be affected during maintenance or service procedures.

WARNING:

Compressed air can be dangerous unless safety precautions are observed in the use of compressed air and compressed air equipment. Completely vent the internal air pressure to the atmosphere before disassembling any subassemblies or components and before doing any work on compressed air equipment. To vent internal air pressure, follow the maintenance shutdown instructions.

A compressed air dryer should give long and trouble free operation if the recommended preventative maintenance program is carried out.

The following is a recommended schedule:

1. **Quarterly procedure** - Clean the auto drain in the coalescing filter. Monitor the backpressure on the purging tower. If the gauge reads more than 0 psig (when purging), check the purge muffler for blockage and replace if necessary.
2. **Annual procedure** - Replace all filter cartridges and purge muffler(s). Check the automatic drain function in the coalescing filter. Refer to chart located in Section A.4.1 for correct system size and part numbers. Contact BeaconMedaes Service at 1-888-4MEDGAS for parts.
3. **Three-year procedure** - Change all annual parts. Change desiccant, check valves, and purge valve(s). See chart in Section A.4.1 for correct system size and part numbers.

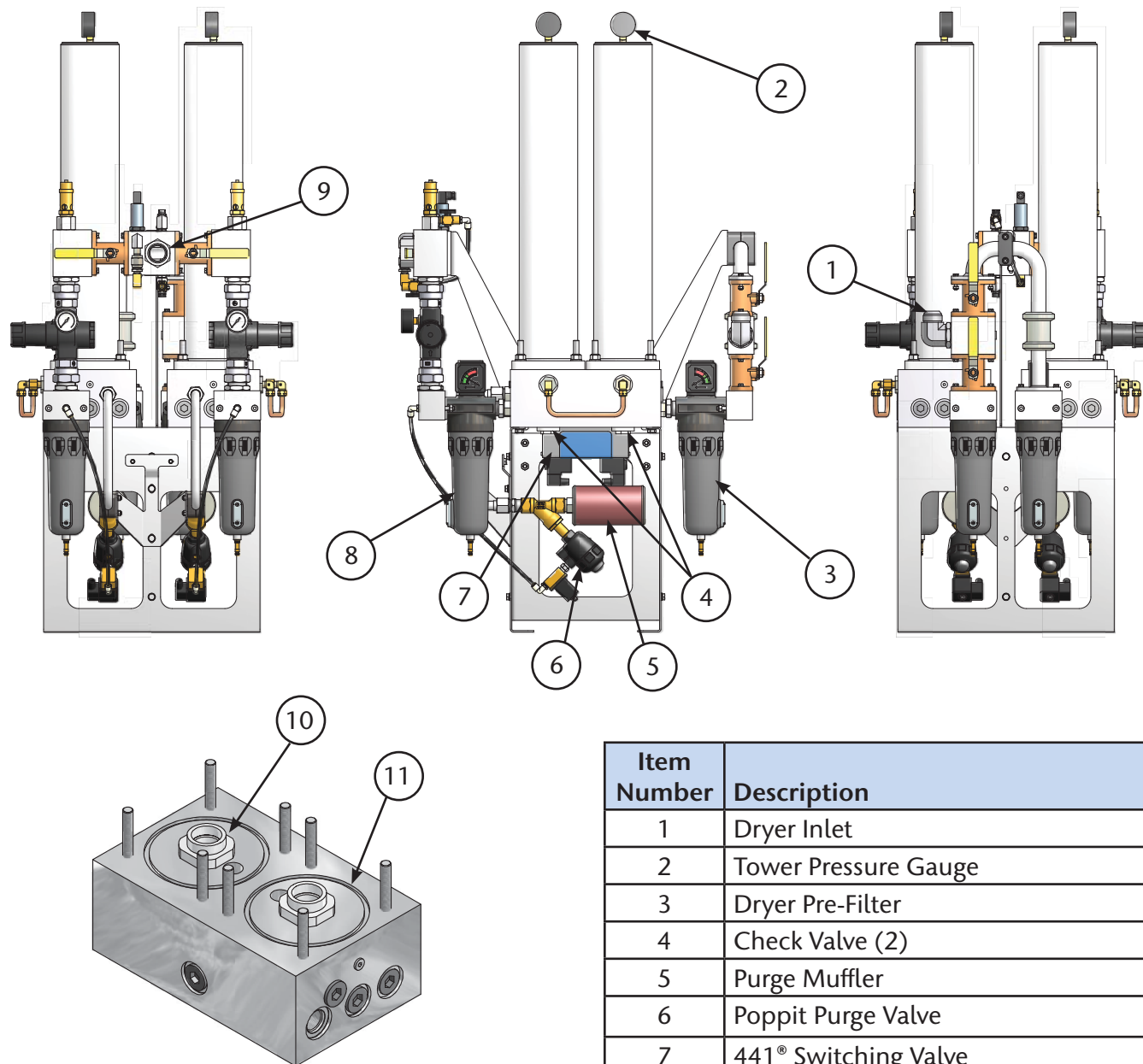
A.4.1 Maintenance Interval

Service Interval	Description
Every year	Pre-filter
Every year	After-filter
Every year	Purge muffler
Every 3 years	Desiccant
Every 3 years	Check valve
Every 3 years	Tower o-ring
Every 3 years	Canister o-ring
As needed	Switching valve
As needed	Tower pressure gauge
As needed	Purge Poppit Valve

Note: All service components are listed as parts within the service repair kits in Section 5.2

Appendix A: Desiccant Dryer

Figure A.2 Desiccant Dryer Components



Item Number	Description
1	Dryer Inlet
2	Tower Pressure Gauge
3	Dryer Pre-Filter
4	Check Valve (2)
5	Purge Muffer
6	Poppit Purge Valve
7	441® Switching Valve
8	Dryer After-Filter
9	Air System Outlet
10	Canister O-Ring
11	Tower O-Ring

Appendix A: Desiccant Dryer

A.5 Replace/Repair

WARNING:

Ensure that the dryer and associated pre-filter(s) and afterfilter(s) are valve isolated and fully depressurized before attempting to remove or disassemble any subassemblies or components. Failure to do so may result in serious personal injury and/or equipment damage.

A.5.1 Desiccant Replacement Procedure

WARNING:

Used desiccant material must be handled with special care. Desiccant is an adsorbent material. Used desiccant may contain chemicals and/or gases that are hazardous, toxic and/or flammable. It is recommended that all used desiccants be analyzed to determine content before disposal. Exercise proper care and procedures during handling and storage of used materials. All containers must be properly labeled and disposed of in accordance with local, state and federal regulations.

1. Shut down dryer – close the inlet and outlet isolation valves and turn off electrical power to the dryer.

WARNING:

Desiccant towers contain springs which may release potential energy upon dismantle.

2. Remove hex nuts, washers and towers from manifold assembly.
3. Remove spring and perforated screen from top of canister.

4. Remove canister from manifold assembly, being careful not to spill any desiccant.
5. Dispose of used desiccant into suitable containers.
6. Remove any blockage that may have lodged in the perforated screens.
7. Replace canister O-rings. Set canister onto manifold assembly.
8. Install the perforated screen into the bottom of the canister.
9. Fill canisters with desiccant to one inch (1") from the top of canister. Install perforated screen.

CAUTION: DO NOT OVERFILL

10. Set spring retainer on top of perforated screen. Install tower over the canister. Install plain washers and hex nuts. Tighten nuts in an X-pattern until chambers are snug against the manifold. Torque to 35 ft-lbs.

A.5.2 Check Valve Replacement Procedure

1. Remove the caps/plugs from the underside of the dryer block. See Figure A.3.
2. Using a 1 1/8 deep well socket, remove the check valves.
3. Replace check valve and cap/plug in dryer block.

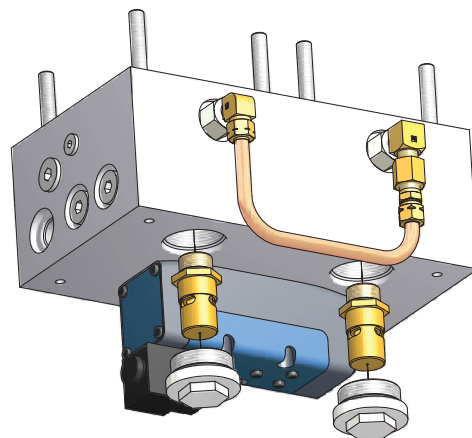


Figure A.3 Dryer Block Check Valves

Appendix A: Desiccant Dryer

A.6 Dryer Specifications

Type:	Desiccant Heatless
Design Pressure:	105 psig
Operating Pressure:	60 psig minimum, 125 psig maximum
Maximum Inlet Air Temperature:	43°C (110°F)
Ambient Temperature:	4.4°C (40°F) minimum, 40.5°C (105°F) maximum
Pressure Dew Point Capability @ 100 psig:	-12°C (10°F)
Normal DP Operating Range:	-8°C (17.6°F) to -12°C (10°F)
Differential Pressure @ 100 psig and 37.8°C (100°F):	2 to 8 psig
Desiccant:	Activated Alumina
Control:	Fully automatic solid-state electric
Power:	24VDC Power

Appendix B: Dew Point Transmitter

B.1 General Information

CAUTION: This manual is designed to serve as the operation and maintenance guide for your Dew Point Transmitter, if equipped. The contents of this manual should be carefully read BEFORE attempting any phase of operation or maintenance. Failure to follow the operating and maintenance procedures of the instruction manual could result in personal injury or property damage.

WARNING:

Before starting any installation, maintenance or service procedure, disconnect ALL power to the system to prevent electrical shock.

Before making or breaking any medical gas line connections, make sure the system is depressurized in order to avoid personal injury.

Before removing the dew point transmitter, verify that the source of line pressure has been closed and the line pressure reduced to atmospheric pressure.

An alarm condition on dew point indicates a dew point level exceeding the maximum set point, or a faulty dew point transmitter. Immediate action should be taken to reduce the possibility of high dew point in the Medical Air line.

If the dew point transmitter flowmeter becomes clogged, dew point readings may be inaccurate, allowing moisture to accumulate undetected.

B.2 Introduction

The dew point transmitter is a continuous, on-line instrument that measures the absolute moisture content in the final air line. The transmitter measures dew point with excellent long term stability. The Advanced Ceramic Moisture sensor is durable and has been designed for ruggedness and simplicity. The transmitter is fully calibrated at the factory prior to shipment.

B.3 Specifications

1. Dew point Temperature: -100° to 20°C (-148° to 68°F)
2. Operating Temperature: 0° to 60°C (32° to 140°F)
3. Dew point accuracy: $\pm 2^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$)
4. Air Consumption: 0.75 LPM (1.6 SCFH)

B.3.1 Output

Analog output: 4 - 20 mA

B.3.2 General

1. Operation Voltage: 12 - 28 VDC
2. Probe material: Stainless Steel (316)
3. Sensor protection: Ceramic

B.4 Operation

Although the correct operation of the transmitter is not sample flow dependent, it is important that flow velocity through the sample source to the sample block is high enough to avoid long lead time lags in response to changes in moisture at the sample source.

Appendix B: Dew Point Transmitter

B.5 Alarms

Dew points that exceed set points shall cause an alarm condition at the control panel. When the dew point exceeds the alarm set point, the alarm contacts are de-energized. The alarm remains de-energized until the alarm condition is cleared by the operator. A high dewpoint alarm will activate if the transmitter loses power or is disconnected from the control system.

WARNING:

Respond to alarm conditions immediately. An alarm condition on the dew point indicates a dew point level exceeding the maximum set point. Immediate action to correct the problem should be taken. Prolonged exposure to condensing moisture can damage the Medical Air equipment.

WARNING:

Electrical shock hazard

No repair should ever be attempted by anyone not having experience in the repair of devices of this nature. Failure to follow proper repair procedures can result in serious injury.

CAUTION: No maintenance and testing should ever be undertaken or attempted by anyone not having general experience in the repair of devices of this nature. Also, to avoid damaging the unit or any of its components, no maintenance and testing should be undertaken by qualified individuals who are not familiar with the procedures in this manual.

Replace damaged parts with components from **BeaconMedaes**. Test the unit after installation of replacement parts to make certain that it complies with the published specifications.

B.6 Maintenance

B.6.1 Repair Policy

Do not use a unit that is not functioning properly until all necessary repairs have been made and the unit has been tested to determine that it is functioning in accordance with the manufacturer’s published specifications. Contact **BeaconMedaes Technical Services** department at 1-888-4MEDGAS (888-463-3427) for assistance.

NOTE: To ensure full reliability, have all maintenance and testing done by a qualified technician. If this cannot be done, maintenance and testing of those parts discussed in this manual may be undertaken by a competent, trained individual having experience in the repair of devices of this nature.

B.6.2 Maintenance Schedule

Maintenance	Frequency	Action
Check flow through orifice	Weekly	Check for proper flow
Check transmitter accuracy	Yearly	Verify dew point sensor accuracy (contact BeaconMedaes)
Replace Sensor	Every 2 years	See Section B.9

Appendix B: Dew Point Transmitter

B.7 Troubleshooting

WARNING:

Before removing the dew point transmitter, verify that line pressure has been valved off or reduced to atmospheric pressure.

Before servicing the dew point transmitter, do the following:

1. Close dew point transmitter isolation valve
2. Allow transmitter piping to depressurize through the flowmeter until it reduces to atmospheric pressure.
3. Disconnect sensor cable and remove transmitter from piping.

NOTE: Remote alarms will be activated

Problem	Possible Cause	Solution
Slow system response	Insufficient flow through dew point sensor	Check flow
No power	No incoming power	Verify line power is being supplied
Erratic display	Unit defect	Contact BeaconMedaes
High dew point	Air is not being dried	Verify that the online dryer (valve open) is in the “Automatic” position on the control panel and that the off-line dryer (valve closed) is in the “Off” position on the control panel. Check flow
	Faulty sensor	Replace sensor

Appendix B: Dew Point Transmitter

B.8 Dew Point Sensor Calibration

The dew point sensor is shipped to you pre-calibrated, no user calibration is required. Contact **BeaconMedæ**s to check accuracy if required.

B.9 Dew Point Sensor Replacement

Check the response time of the sensor by removing it from the sensor chamber and covering the probe with your hand. The dew point reading should rise rapidly. If the dew point does not rise or is slow to respond, it is time to replace the sensor. To replace, disconnect the power to the instrument, unplug and remove the sensor from the dew point sensor chamber, replace sensor and reassemble.

Description	Part No.	Qty Required
Sensor	1089 9481 53	1
Cable	4107 6510 89	1

NOTE: The Dew Point Sensor is included in the 2-Year System Sensor Kits as shown in section 5.2.5. If ordering the 2-Year System Sensor Kits, there is no need to order the above Sensor as well.

Appendix C: CO Transmitter

C.1 General Information

CAUTION: This manual is designed to serve as the operation and maintenance guide for your CO Transmitter, if equipped. The contents of this manual should be carefully read BEFORE attempting any phase of operation or maintenance. Failure to follow the operating and maintenance procedures of the instruction manual could result in personal injury or property damage.

WARNING:

Before starting any installation, maintenance or service procedure, disconnect ALL power to the system to prevent electrical shock.

Before making or breaking any medical gas line connections, make sure the system is depressurized in order to avoid personal injury.

An alarm condition on CO indicates a CO level exceeding the maximum set point, or a faulty CO sensor. Immediate action should be taken to reduce the possibility of CO in the Medical Air line.

C.2 Introduction

The CO transmitter is a continuous, on-line instrument that measures the carbon monoxide level in the final product line. The instrument's electronics are enclosed in a NEMA-4 corrosion resistant case. The unit operates on 24 VDC power supplied from the control panel and sends a 4-20mA signal to the control panel. The transmitter uses a state-of-the-art electrochemical cell for detecting carbon monoxide. The sensor has a life expectancy of approximately two years. It is easily replaced and should be periodically calibrated as its output diminishes during its life especially during the final months. Contact BeaconMedæ's Technical Services department at 1-888-4MEDGAS (1-888-463-3427) for technical support or to order spare parts.

C.3 Specifications

1. Analog output: 4-20mA
2. Operation Voltage: 24 VDC
3. Sensor body material: Aluminum
4. Air Consumption: Minimum 0.5 to 0.9 CFH (14 to 25 lph)

C.4 Power Connection

This is a two wire transmitter. Connect to 24VDC power supply only (See Fig C.1).

C.5 Alarms

CO levels that exceed 10 ppm set point shall cause an alarm condition at the control panel. When the CO level exceeds the set point, the alarm contacts are de-energized. The alarm remains de-energized until the alarm condition is cleared by the operator. A high CO alarm will activate if the transmitter loses power or is disconnected from the control system.

Appendix C: CO Transmitter

C.6 Operation

CAUTION: At initial startup, if the unit is reading a gas level, do not make any adjustments for a few hours until the unit has a chance to settle in and stabilize.

If gas readings remain high or below zero (-0), re-calibration may be needed. We also recommend checking the compressor's air intake for contamination first.

C.7 Maintenance

WARNING:

Electrical Shock Hazard. No repair should ever be attempted by anyone not having experience in the repair of devices of this nature. Failure to follow proper repair procedures can result in serious injury.

Replace damaged parts with components from **BeaconMedæ**s. Test the unit after installation of replacement parts to make certain that it complies with the published specifications. Contact **BeaconMedæ**s Technical Services department at 1-888-4MEDGAS (1-888-463-3427) for technical support or to order spare parts.

C.7.1 Maintenance Schedule

Maintenance	Frequency	Action
Recalibration	Every month	See Section C.9
Replace Sensor	Every 2 years	See Section C.8

C.8 Sensor Checkout & Replacement

To check a sensor's response, test gas has to be placed on the sensor. When it fails to show a gas response during calibration, a new sensor is required.

To replace the sensor (see Fig C.1), disconnect the power to the unit, disconnect the inlet air connection and unscrew the cover to access the inside of the transmitter. Next, unplug the CO sensor from the bottom of the internal PC board. Then remove the cap on the bottom of the transmitter and remove the CO sensor and wiring. Unplug the wiring from the sensor and replace it with a new one. Reinstall the sensor in the reverse order. Once the sensor is installed go through steps C.9.1 and C.9.2 to calibrate and verify the proper operation of the CO sensor.

C.9 Calibration

C.9.1 Zeroing Transmitter

The following procedure should be used for zeroing the transmitter. (See C.11 Accessories and Replacement Parts for zero gas part numbers)

- Turn on the power and allow the transmitter to warm up for several hours to stabilize.
- Disconnect the inlet air line to the transmitter and connect the air line from the zero gas cylinder.
- Allow the calibration gas from the cylinder to flow through the sensor for approximately 3 minutes to stabilize the sensor.
- Remove the cover from the transmitter housing.
- For this step a multimeter on mV setting will need to be used. Insert positive lead of multimeter (Red) into + test point socket. Insert negative lead of multimeter (Black) into - test point socket. Locate the blue pot (marked "Z") and adjust the pot until the mV display reads 40.0 +/-0.3 mV. Turning the adjusting screw ClockWise will increase and CounterClockWise will decrease the output. Refer back to main screen to confirm CO setting is on "0" or "1".
- Proceed to C.9.2 for calibrating the transmitter.

Appendix C: CO Transmitter

C.9.2 Transmitter Calibration

The following procedure should be used to calibrate the transmitter. (See C.11 Accessories and Replacement Parts for calibration kit part numbers)

- Zero the transmitter prior to calibration, see C.9.1 for zeroing procedure.
- Disconnect the zero gas cylinder from the transmitter and connect the air line from the 20 ppm CO gas cylinder.
- Allow the calibration gas from the cylinder to flow through the sensor for approximately 3 minutes to stabilize the sensor.
- Locate the dark blue potentiometer (marked “C”) and adjust the pot until the mV display reads 50.7 \pm 0.3 mV. Turning the adjusting screw ClockWise will increase and CounterClockWise will decrease the output. Refer back to main screen to confirm CO setting is on “19-21”.
- As this adjustment may affect the previously completed Zero Adjustment, it is necessary to repeat both the zeroing procedure and calibration procedure once more to ensure the transmitter is set properly.
- After verifying that both Zero and Calibration adjustments are done correctly, reinstall the cover on the transmitter.

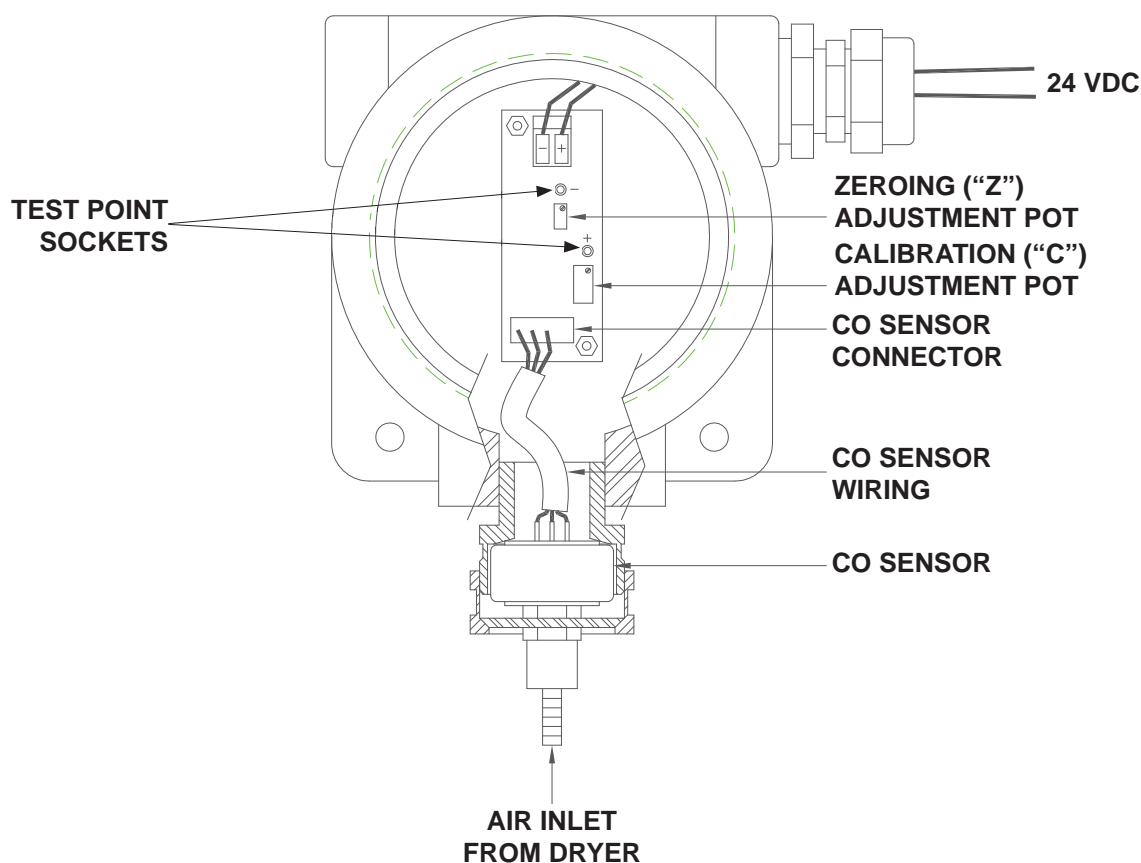


Figure C.1 CO Transmitter Assembly

Appendix C: CO Transmitter

- Reconnect the inlet air line from the dryer.

C.10 Troubleshooting

WARNING:

Before removing the CO sensor, verify that line pressure has been valved off or reduced to atmospheric pressure.

Before servicing the CO sensor, do the following:

Problem	Possible Causes	Solution
CO Alarm - 10 ppm or above	Inlet air to the medical air system is contaminated	Move air inlet location or remove source of CO contamination
Monitor will not calibrate	Sensor depleted	Replace sensor
CO Alarm - CO reading erratic	Incoming power feed to control panel adjacent to CO signal wires	Separate incoming power feed from CO signal wires

- Unplug sensor(s) or turn off monitor.
- Depressurize the CO sensor.

NOTE: Remote alarms will be activated.

C.11 Accessories & Replacement Parts

Description	Part No.	Qty Required
Calibration Kit*	4107 6532 36	1
CO Sensor Element	4107 6530 69	1
20 ppm Carbon Monoxide	4107 6525 14	1
Impurity Free Air (Zero Gas)	4107 6525 13	1

* Kit includes calibration connector, 20 ppm test gas and 0 ppm test gas in carrying case.

NOTE: CO Sensor is a component of the 2-Year System Sensor Kit as listed in Section 5.2.5. If purchasing the 2-Year System Sensor Kit, there is no need to purchase the CO Sensor listed above in addition.

Appendix D: TotalAlert Embedded Control System

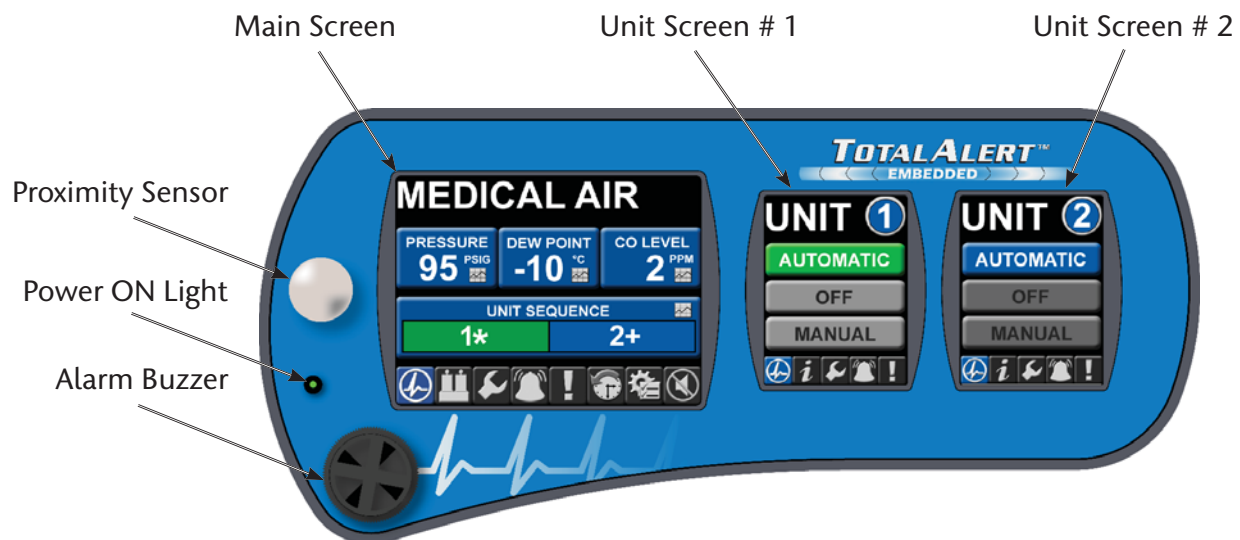


Figure D.1 Touchscreen Controls

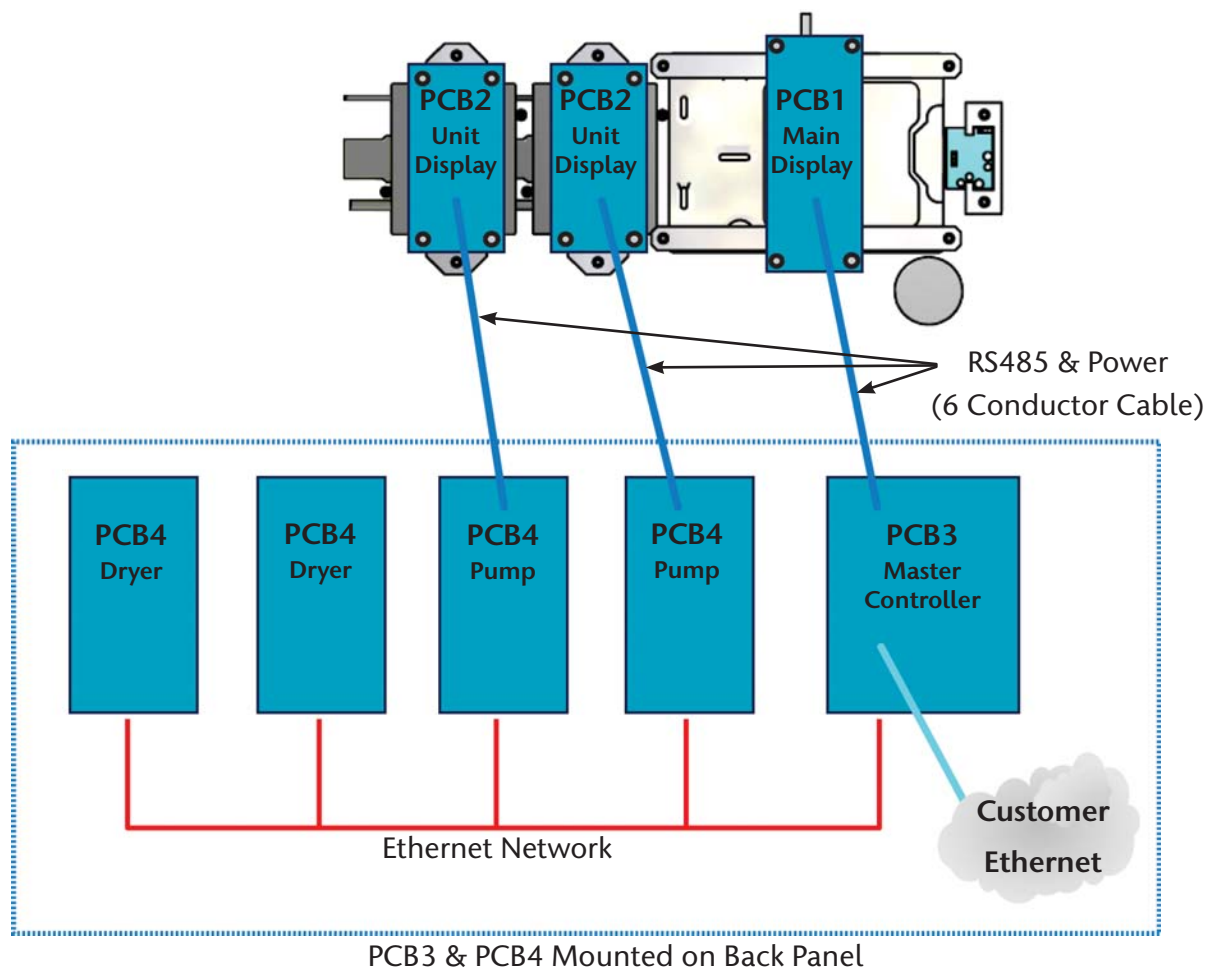


Figure D.2 Duplex Medical Air Configuration - Printed Circuit Boards

Appendix D: TotalAlert Embedded Control System

D.1 Board Configurations

The source control system is comprised of four (4) different printed circuit boards (PCBs) with interconnecting wiring (RS485 or Ethernet) for internal communications between the boards. See Figure D.2.

1. PCB1: Display Board for 5.7” Touch Screen Display
2. PCB2: Display Board for 3.5” Touch Screen Display
3. PCB3: Master Source Controller Board
4. PCB4: Pump Controller Board or Dryer Controller Board

In a standard medical air duplex system, the PCB configuration consists of the following quantities and types of boards:

- PCB1 – (1) One for the Main 5.7” display
- PCB2 – (2) One for each of the Unit 3.5” displays
- PCB3 – (1) Master Controller
- PCB4 – (4) One for each compressor (2) and one for each dryer (2)

D.2 PCB1 (5.7” Display Controller)

D.2.1 Basic Software Architecture

The primary purpose of PCB1 is to drive the LCD display for the 5.7” Master screen. Its other functions include the following:

1. Communicate to the Master Controller Board (PCB3) via a RS-485 bus to relay commands from the touch screen interface and display messages from the master controller.
2. Interface to the 5.7” Display touch screen to interpret the user interaction.

3. Drive the 24VDC local alarm horn when signaled by the master controller via the RS485 bus.
4. Read the input from the motion detector at the front panel and relay the status to the master controller so it can distribute the information to the other pump controllers and then to their corresponding 3.5” display boards (PCB2).
5. Accept new firmware via the Ethernet jack when connected to a PC configured with genuine BeaconMedaes software for reprogramming.

D.2.2 5.7” User Interface for Source Systems

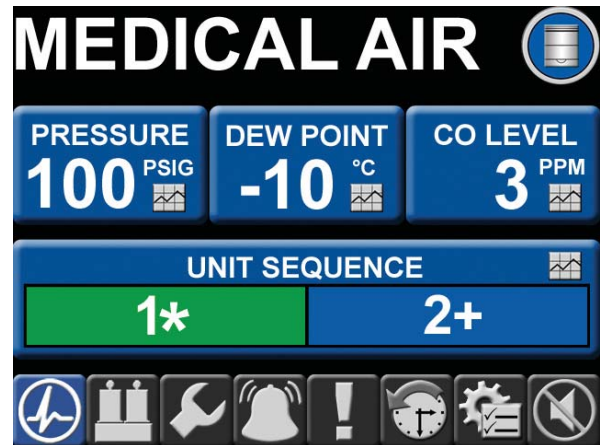


Figure D.3 Main Screen

The primary master screen user interface is displayed on a 5.7” 640 x 480 pixel display as shown in Figure D.3. The interface is designed such that any information can be accessed with a minimal amount of touches by the user.

The 5.7” screen is divided into two main areas – the top portion above the toolbar which changes depending on the icon selected on the toolbar and bottom portion which contains the toolbar (Figure D.4) and is available on most screens.

Appendix D: TotalAlert Embedded Control System



Figure D.4 5.7” Screen Toolbar

From left to right, the toolbar icons represent the following:

	Main Screen (default) ** If No Dryers (Image is 2x wide and Dryer Image is not shown).
	** Dryer Information (Medical Air with Dryers Only)
	Service
	Alarms (no Shutdown)
	Shutdown
	Event History Log
	System Configuration Settings
	Horn Silence

D.2.3 5.7” Boot/Communication Screen

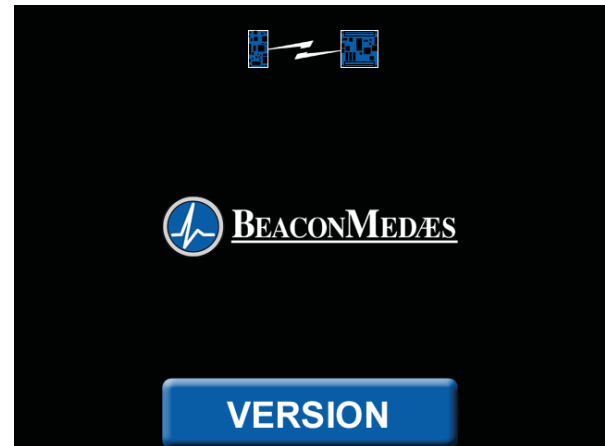


Figure D.5 Boot/Communication Screen

The boot/communication screen (Figure D.5) shows at boot time and will change to the default main screen once communication and compatibility are confirmed:

- If a RS485 link failure is detected the link icon at the top of the screen will appear and the bottom version button will appear to allow the user to check display board (PCB1) version information.
- If the connecting board is incompatible with the display board (for example, board not properly connected), only the bottom version button will appear with a red button background.

Appendix D: TotalAlert Embedded Control System

D.2.4 5.7” Main Screen

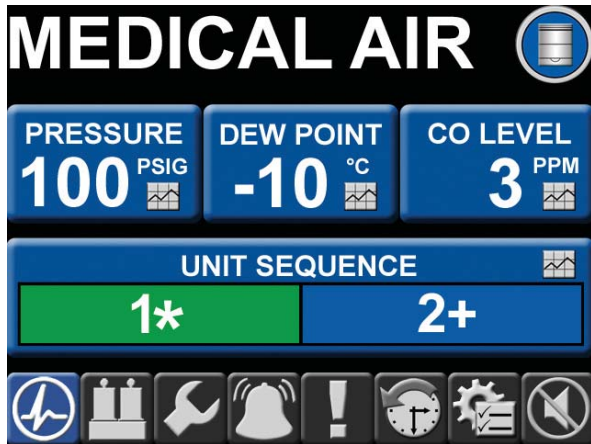


Figure D.6 Main Screen

The main (default) screen (Figure D.6) shows the pertinent system measurements as well as unit sequence information.

The pertinent system measurements include: Pressure, Dew Point, and CO Level. Pressing pertinent system data buttons shows Trend information for that value.

Unit Sequence information shows all system units.

- If the unit is running, that color bar shows green and the adjoining symbol shows “*” for across the line (full speed).
- If a unit is available and not running, that color bar shows blue and the adjoining symbol shows “+” if that unit is next to start.
- If a unit is stopped, that color bar shows red and the adjoining symbol shows “!” if stopped for a shutdown.
- If the unit is unavailable and not running, that color bar shows dark grey and the adjoining symbol shows “X”.
- If a unit is unavailable because it is in Manual mode and it is running, that color bar shows green and the adjoining symbol shows “X”.

- If the unit is unavailable because the unit is an expandable unit, that color bar shows dark grey and the adjoining symbol shows “E”.
- If the unit is unavailable because the unit cannot be reached via ethernet, that color bar shows dark grey and the adjoining symbol shows “?”.

D.2.5 5.7” Trend Screen

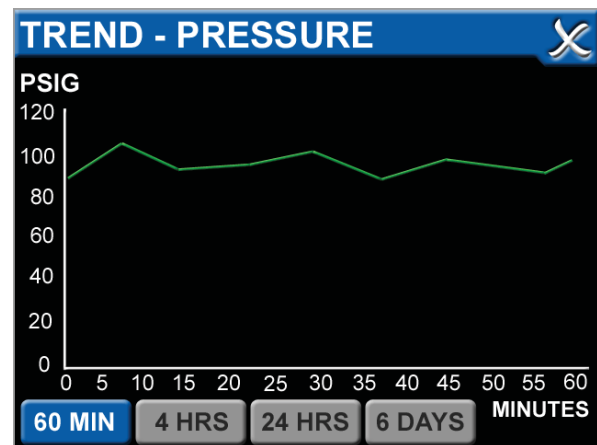


Figure D.7 Trend Screen

The trend screen (Figure D.7) shows the measured value over a specific time period:

- The default time period when opening the window is the last 60 minutes. For a given period, the maximum amount of data stored will only be for the most recent time period and the older data will be removed from view and memory.
- Another time period is selected by pressing the buttons at the bottom of the window. These periods are 60 minutes (240 data points – 0.25 min resolution), 4 hours (240 data points – 1 min resolution), 24 hours (240 data points – 6 min resolution) and 6 days (240 data points – 0.6 hour resolution).

Appendix D: TotalAlert Embedded Control System

D.2.6 5.7” Dryer Screen (If Equipped)



Figure D.8 Dryer Screen

The dryer screen (Figure D.8) shows the operation mode of the dryer(s) and which tower is online if the “Status” mode is selected:

- The default view when the dryer screen is selected shows both dryer operation modes. If only one dryer is installed on the system, only the left “Dryer 1” is visible.
- The operation modes for the dryer: Automatic (Green and dew point purge controlled), Off (Red and not running), Manual (Green and timer controlled).
- If there are no dryers on the system, this screen is not available.
- When the Status button “i” is selected, the view on the dryer section changes to an image depicting the dryer. The arrows on the tower and the purge muffler indicate which tower is online (green arrow pointing down) and which tower is offline (no arrow or blue arrow pointing up). The blue arrow pointing up on the tower indicates that tower is purging. The two blue arrows on the purge muffler also indicate the dryer is purging. Once the purge cycle is complete and the dryer is ready to switch (based on dewpoint in automatic mode), the blue arrows are not visible.

D.2.7 5.7” Service Screen

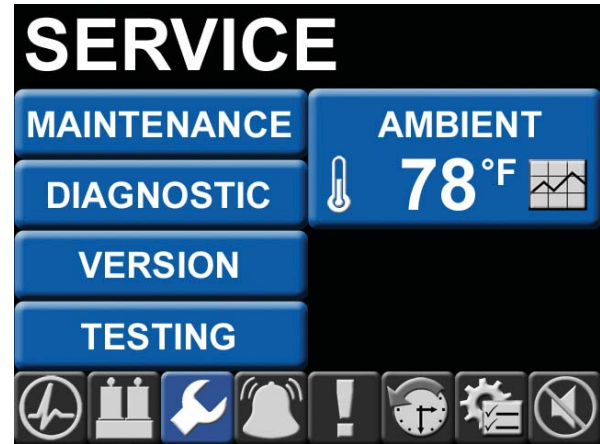


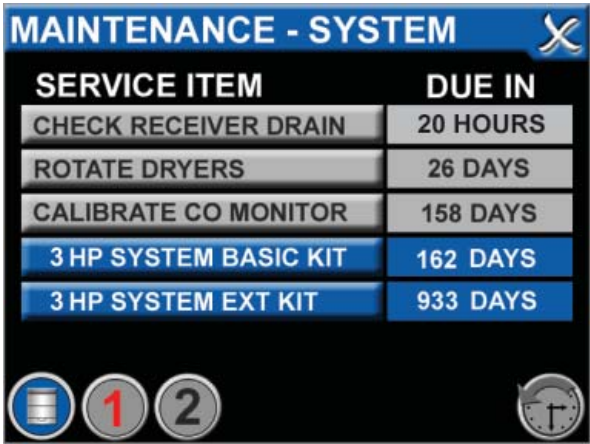
Figure D.9 Service Screen

The service screen (Figure D.9) allows the selection of various sub screens along with the current ambient temperature at the system:

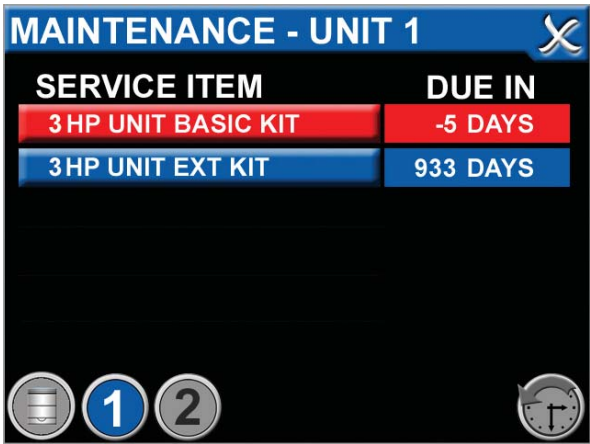
- Maintenance – Additional multiple screens depicting suggested and required maintenance items with resettable timers. When maintenance is due, both the maintenance button and the service icon on the tool bar turn red instead of blue.
- Diagnostic - Depicts the I/O status of the connecting unit controller board. For example, the digital inputs (X1-X7 as 0 or 1), the analog readings (T1-T2, I1-I4, P1-P2 and V1-V2 with A/D values), the 24VDC powered digital outputs (Z1-Z2 as 0 or 1) and the dry contacts (Y1-Y12 as 0 or 1).
- Version – Displays the RS485 communication version, firmware versions for the 5.7 display board and the connecting controller board.
- Testing – Allows for test mode of all alarm events. See Section D.5 for more information.
- Temperatures – Display the current ambient temperature and the current cabinet temperature (optional). When the button is pressed, the trend information is available for these temperatures.

Appendix D: TotalAlert Embedded Control System

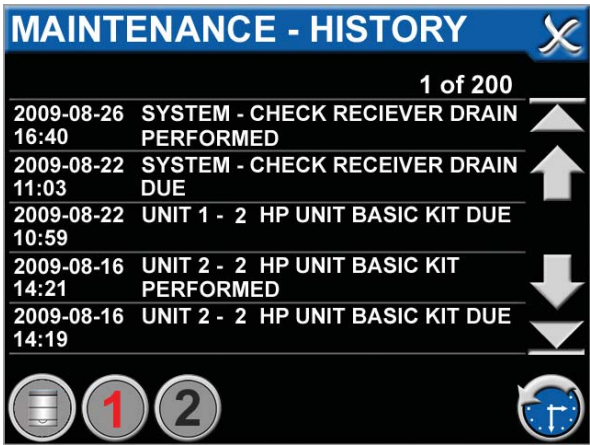
D.2.8 5.7” Maintenance Screen



System Maintenance Screen



Unit Maintenance Screen



Maintenance History Screen

Figure D.10 Maintenance Screens

The maintenance screens (Figure D.10) are accessed via the service screen:

- Additional multiple screens depicting suggested and required maintenance items with resettable timers. If an item is past due the button color changes from blue to red if the item is a required maintenance versus a suggested maintenance.
- The first (default) screen shows as the System maintenance. Items that are suggested are shown as a grey button and indicators are not visible or flagged for these items. When the user resets the timer, the action is logged in the service history.
- Other screens (Unit and History) are accessed by pressing the bottom round icons. Note that only unit icons are shown if the unit is physically installed and not an expansion unit.

D.2.9 5.7” Alarms Screen



Figure D.11 Alarms Screen

The alarms screen (Figure D.11) shows all of the system alarm information. An alarm is classified as an event of significance that does not shut the system down. These alarms are latched and are not cleared until a user presses the reset button on the alarms screen. This reset button will reset all alarms for that given system.

Appendix D: TotalAlert Embedded Control System

- Green alarm condition indicates a normal status for that condition.
- Red alarm condition indicates an abnormal status for that condition.
- The horn silence button at the bottom right will show Red if the horn is on and not reset yet. Once the horn is silenced, the button will return back to the gray condition.

D.2.10 5.7” Shutdown Screen



Figure D.12 Shutdown Screen

The shutdown screen (Figure D.12) shows all of the system shutdown event information. A shutdown is classified as an event of significance that does shut the unit or system down. Only certain system shutdown events are latched and are not cleared until a user presses the reset button on the shutdown screen. Unit “X” shutdown events are not latched on this screen. They are instead latched at the individual unit screen and reset at that screen. The system reset button will reset all system shutdown events for that given system (not Unit “X”).

- Green shutdown condition indicates a normal status for that condition.
- Red alarm shutdown indicates an abnormal status for that condition.

D.2.11 5.7” History Screen

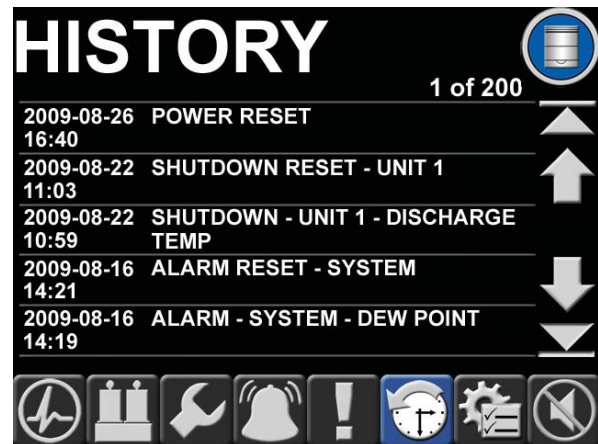


Figure D.13 History Screen

The history screen (Figure D.13) shows all of the system event history excluding service maintenance history.

- Most recent events are shown on the first (default) page and are shown in descending date/time order. Located at the top right are the page number and the total number of pages. The maximum number of pages is 200 (1000 events divided by 5 events per page).
- Page up and Page down arrows change the view 5 events up or down at a time and are only visible if subsequent event information is available. The Home button changes the view to the top or most recent events and the End button changes to the bottom or the oldest events.
- A maximum of 1000 most recent events are stored for the system.

Appendix D: TotalAlert Embedded Control System

D.2.12 5.7” Settings Screen

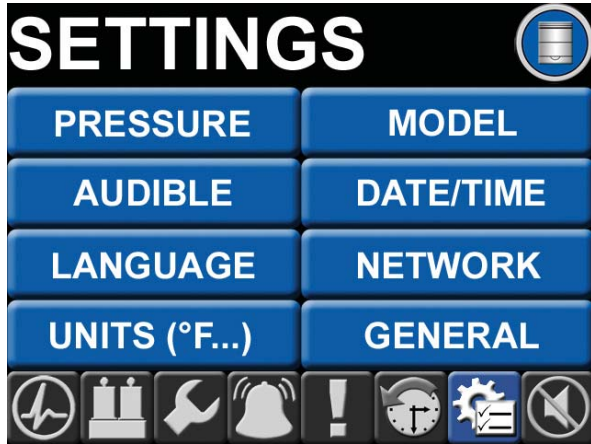


Figure D.14 Settings Screen

The settings screen (Figure D.14) allows the selection of various sub screens that pertain to system configuration data. All value/adjustment changes are password protected.

- Pressure/Vacuum – Allows the adjustment of system pressure or vacuum operating range.
- Audible – Allows the horn to re-initiate if an alarm or shutdown event has not cleared, but the horn was silenced. The allowable values for re-initiate time are never, 15 min, 30 min, 1 hour, 8 hours, and 24 hours.
- Language – Allows the choice of pre-defined display language.
- Units – Allows the display units to be displayed and changed.
- Model – Displays the pertinent system model information.
- Date/Time – Allows the date/time to be displayed and changed.
- Network – Allows the network (IP address, etc) to be displayed and changed.
- General – Allows the miscellaneous general information to be displayed and changed.

D.3 PCB2 (3.5” Display Controller)

D.3.1 Basic Software Architecture

The primary purpose of PCB2 is to drive the LCD display for the 3.5” Unit screen. Its other functions include the following.

1. Communicate to the Pump Controller Board (PCB4) via a RS-485 bus to relay commands from the touch screen interface and display messages from the pump controller.
2. Interface to the 3.5” Display touch screen to interpret the user interaction.
3. Accept new firmware via the Ethernet jack when connected to a PC configured with genuine BeaconMedaes software for reprogramming.

D.3.2 3.5” User Interface for Source Systems



Figure D.15 Unit Screen

The primary unit screen user interface (Figure D.15) is displayed on a 3.5” 240 x 320 pixel display. The interface is designed such that any information can be accessed with a minimal amount of touches by the user.

Appendix D: TotalAlert Embedded Control System

The 3.5” screen is divided into two main areas – the top portion above the toolbar which changes depending on the icon selected on the toolbar and bottom portion which contains the toolbar (Figure D.16) and is visible on most screens.



Figure D.16 3.5” Screen Toolbar

From left to right, the toolbar icons represent the following:



Main Screen (default)



Status/Information (Hourmeter)



Service



Alarms (no Shutdown)



Shutdown

D.3.3 3.5” Boot/Communication Screen

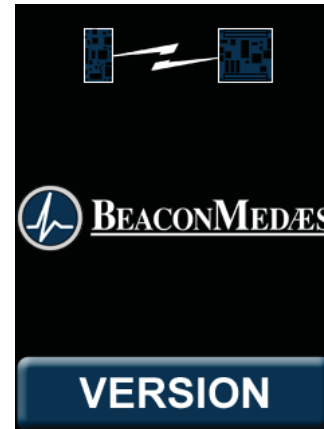


Figure D.17 Boot/Communication Screen

The boot/communication screen (Figure D.17) shows at boot time and changes to the default main screen once communication and compatibility are confirmed:

- If a RS485 link failure is detected the link icon at the top of the screen appears and the version button appears to allow the user to check display board (PCB2) version information.
- If the connecting board is incompatible with the display board (for example, the boards are not properly connected), only the bottom version button appears with a red button background.

Appendix D: TotalAlert Embedded Control System

D.3.4 3.5” Main Screen



Figure D.18 3.5” Main Screen

The main (default) screen (Figure D.18) shows the operation mode of the unit along with its automatic versus manual mode setting:

- Automatic (Blue = Standby, Grey = Unselected, Green = Unit Running)
- Off (Red = Selected, Grey = Unselected)
- Manual (Blue = Standby – Backup Pressure Switch is not closed, Grey = Unselected, Green = Unit Running)

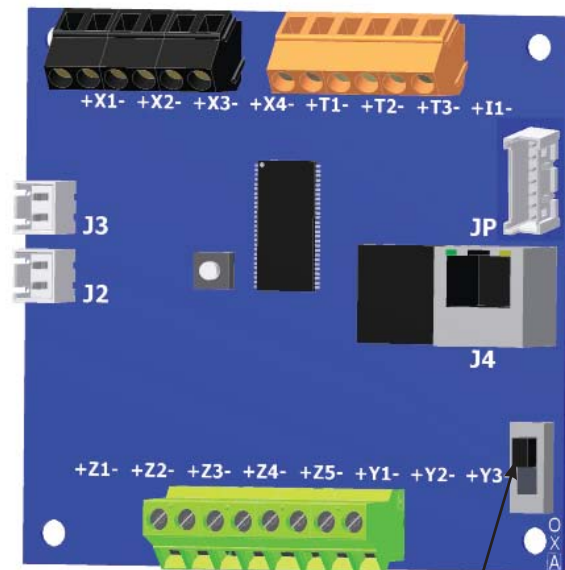
D.3.5 3.5” Main Screen: Manual Override

During the system startup, the manual override, located on the printed circuit board (PCB4), switch is utilized to ensure the compressor is in the Off position. The manual override switch on PCB4 is a safety measure as well, for emergency situations to ensure the compressor unit produces medical air.

In the event of an emergency and the control system is not operating effectively, the manual override switch can be moved from the Automatic position to the Manual position. See Figure D.19. Moving to this position forces the compressor to operate against the backup pressure switch, starting and stopping according to the switch settings.



3.5” Unit screen with Manual Override selected



Manual Override Switch

O - On Manual

X - Off

A - Automatic

PCB4 with Manual Override switch On

Figure D.19 Manual Override

Appendix D: TotalAlert Embedded Control System

If the switch is in Manual or Off position on PCB4, the touchscreen controls no longer control the compressor. Moving the switch back to the Automatic position puts the unit under the control of the TotalAlert Embedded control system.

CAUTION: The “Manual Override” mode of operation should only be used for emergencies such as a loss of unit display board or loss of display touchscreen and should not be used for normal operation.

D.3.6 3.5” Status Screen



Figure D.20 3.5” Status Screen

The status screen (Figure D.20) shows the running hour meter values.

D.3.7 3.5” Service Screen



Figure D.21 3.5” Service Screen

The service screen (Figure D.21) allows access to the unit “jog” feature, diagnostic screen and version screen:

- **Rotation** – Allows the unit to run for a short period to check rotation. When pressed, the unit will either begin the “jog” sequence or show a screen instructing you to place the unit in “OFF” mode first (the unit must be in “OFF” mode before it can check rotation). When “jog” mode is started, the unit will first delay for 5 seconds to allow the user to get in position to check the rotation, then run the unit for a brief period.
- **Diagnostic** – Depicts the I/O status of the connecting unit controller board. For example, the digital inputs (X1-X4 as 0 or 1), the analog readings (T1-T3 and I1 with A/D values), the 24VDC powered digital outputs (Z1-Z5 as 0 or 1) and the dry contacts (Y1-Y3 as 0 or 1).
- **Version** – Displays the RS485 communication version, the firmware versions for the 3.5 display board and the connecting controller board.
- **Testing** – Allows for test mode of all shutdown events. See Section D.5 for more information.

Appendix D: TotalAlert Embedded Control System

D.3.8 3.5” Alarms Screen



Figure D.22 3.5” Alarms Screen

The alarms screen (Figure D.22) shows all of the unit alarm information. An alarm is classified as an event of significance that does not shut the unit down. These alarms are latched and are not cleared until a user presses the reset button on the alarms screen. This reset button will reset all alarms for that given unit.

- Green alarm condition indicates a normal status for that condition.
- Red alarm condition indicates an abnormal status for that condition.

D.3.9 3.5” Shutdown Screen

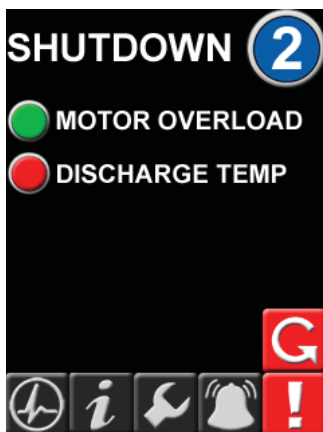


Figure D.23 3.5” Shutdown Screen

The shutdown screen (Figure D.23) shows all of the unit shutdown event information. A shutdown is classified as an event of significance that does shut the unit down. These shutdown events are latched and are not cleared until a user presses the reset button on the shutdown screen. This reset button will reset all shutdown events for that given unit.

- Green shutdown condition indicates a normal status for that condition.
- Red alarm shutdown indicates an abnormal status for that condition.

D.4 Password Access

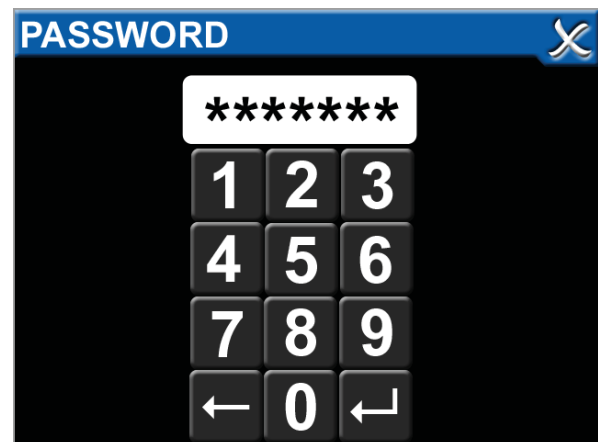


Figure D.24 Password Screen

The TotalAlert Embedded control system contains items that can be changed or adjusted. Before making any changes on the system or unit screens, a password prompt appears. A proper password must be entered before adjusting the control system. See Figure D.24.

The password for the Scroll Medical Air System is “121212”. After entering the password, the password remains valid for approximately ten minutes or until the unit resets itself to the default display screens. Reentering the password after “timing out” allows the user to continue making system adjustments.

Appendix D: TotalAlert Embedded Control System

D.4.1 Main Screen Password Items

On the 5.7” main screen, several screens allow adjustments with the proper password.

- Maintenance - Resetting a Service Activity: A service notification activates when a service item is past due. Upon completion of the past due service activity, reset the service due counter by pressing the item on the service screen, selecting update, and entering the password when prompted.
- Maintenance - Testing the System Alarms: The Testing button allows the operator to create an Alarm or Shutdown condition to test the complete alarm network. See section D.5 for additional information.
- Settings - Pressure: Adjust system “Max” and “Min” operating pressure settings within a factory-set range of pressures.
- Settings - Horn: An option is available to reinitiate the horn during an alarm/shutdown event. The operator can elect to have the horn reinitiate after a set period of time after the silencing of the horn.
- Settings - Language: The operator can select from the language options available on the system.
- Settings - Display Units: The operator can select preferences for the display of pressure, dew point, and other temperatures.
- Settings - Date and Time: Ensure the correct date and time for the system, as this impacts history log reporting.
- Settings - Network Configuration: Configure how the system operates remotely within the existing facility network.

- Settings - General Options: Select method for displaying alarms/shutdowns. Operator can change the timer setting for sleep mode on the screens.

D.4.2 Unit Screen Password Items

In the Service section of the Unit screens, the operator can create alarm or shutdown conditions to test the complete alarm network. See section D.5 for additional information.

D.5 Testing Alarms

In the Service section of the Main screen and Unit screens, the operator is enabled to test each alarm and shutdown event. When an alarm/shutdown event is selected to test, the actual alarm/shutdown is latched. At this point, the system responds as if an actual alarm/shutdown has occurred.

CAUTION: If testing a shutdown event, the compressor being tested will shut down.

For an alarm/shutdown event, the following will occur (in addition to the compressor shutting down for a shutdown event):

- The horn will initiate.
- All appropriate control screens will show the alarm/shutdown condition.
- An alarm/shutdown signal will be sent to the Master alarms.
- The operator must respond and relatch the alarm/shutdown signal by pressing the “reset” button on the appropriate main screen or unit screen.
- A History item will be created that shows the “Test” alarm/shutdown event and a subsequent event for the correction of the “Test” item.

Appendix D: TotalAlert Embedded Control System

D.6 Maintenance

D.6.1 Maintenance Screens

The TotalAlert Embedded touchscreen displays all of the necessary information to plan service activities and order the correct service kits to perform the maintenance.

To view the service schedule, press the Service icon on the 5.7” main screen (Figure D.9), then select Maintenance from the list of headings.

When the Scroll icon located in the bottom left is blue, this indicates that the service items and service due times pertain to the general medical air system (Figure D.10). By selecting the numbers next to the Scroll icon in the bottom left, the service activities for the individual units (compressors) are displayed.

To see details on an individual service activity, press that service on the touchscreen and details of the activity appear, with a description of the service kit required to perform the service.

D.6.2 Maintenance Alerts

When a maintenance activity is due, a notification appears on the main 5.7” screen (Figure D.25). The Service icon appears in Red. There is not an audible horn activated to alert to the service activity, just the colored icon.

To view the alert, press the Service icon on the toolbar, then select the Maintenance choice from the menu. This is highlighted in Red.

Within the Maintenance screen, if one of the Service Items on the list appears in red, the overdue Service Activity is a System maintenance item. If one of the Unit numbers in the bottom right corner appears in red, the overdue service activity is related to the particular unit. Press the Unit number to move to the service screen for that unit to find the overdue activity.

By selecting the activity that is overdue (in red), the detail screen appears for that service item and provides the necessary information for the service activity: part number, description.

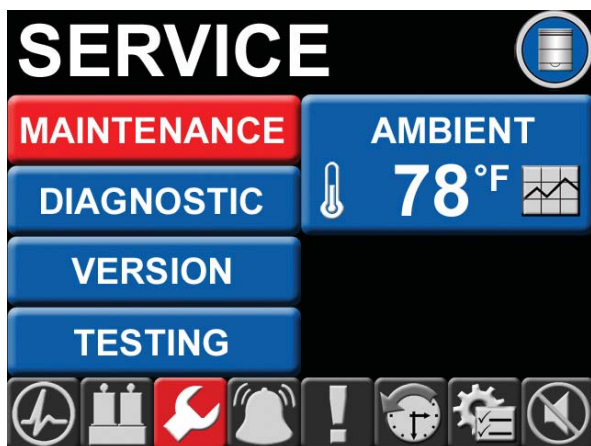


Figure D.25 Maintenance Alert

Appendix D: TotalAlert Embedded Control System

D.6.3 Resetting a Service Activity



Figure D.26 Resetting a Service Activity

After a service activity is performed, to reset the schedule, do the following:

- Select the service activity on the touchscreen (Figure D.26).
- Press the Reset button.
- Enter the password (as explained in Section D.4).

D.7 Remote Monitoring

CAUTION: The information systems personnel should be notified before changing any of the network settings. Changing the settings could keep the equipment from working properly.

D.7.1 Set Up: Equipment Required

- PC with an Ethernet connection
- PC with a web browser, such as Microsoft Internet Explorer
- Cat5 or better Ethernet cable

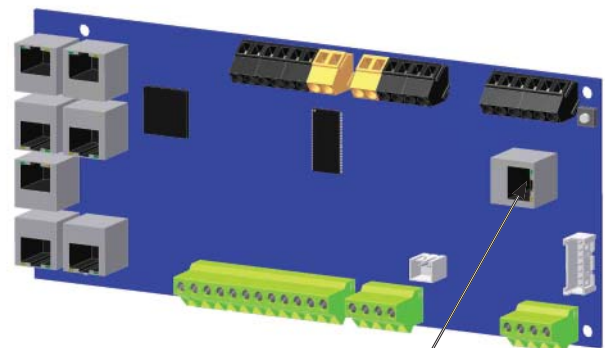
D.7.2 Set Up: Physical Connection

WARNING:

ONLY CONNECT THE CUSTOMER NETWORK TO THE CUSTOMER ETHERNET CONNECTION AS SHOWN IN FIGURE D.27.

DO NOT UNPLUG EXISTING ETHERNET CABLES USED FOR THE INTERNAL CONNECTIONS. DO NOT ATTEMPT TO REMOVE ETHERNET SECURITY PROTECTORS TO USE FOR CUSTOMER ETHERNET CONNECTION.

IF THE CUSTOMER ETHERNET IS PLACED IN AN INTERNAL ETHERNET CONNECTION, THE INTERNAL ETHERNET FUNCTIONALITY WILL NOT PERFORM AS DESIGNED.



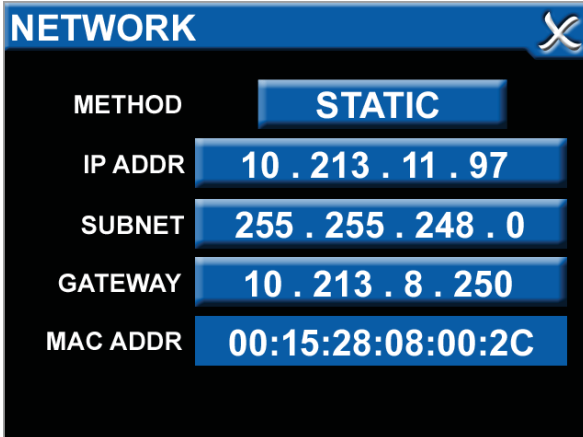
Customer Ethernet Connection
on PCB3 Master

Figure D.27 Connecting the cable

1. Using a Cat5 Ethernet cable, connect the medical air system to an Ethernet switch or hub. Connect the cable to the Customer Ethernet Connection (Figure D.27) on PCB3 Master board.
2. Verify the green LINK LED on the printed circuit board illuminates.

Appendix D: TotalAlert Embedded Control System

D.7.3 Set Up: Network Configuration



The screenshot shows a 'NETWORK' configuration screen with a blue header and a close button (X) in the top right corner. Below the header, there are five rows of configuration options, each with a label on the left and a value in a blue button-like field on the right:

METHOD	STATIC
IP ADDR	10 . 213 . 11 . 97
SUBNET	255 . 255 . 248 . 0
GATEWAY	10 . 213 . 8 . 250
MAC ADDR	00:15:28:08:00:2C

(Network screen is found in Settings section from Main toolbar)

Note: To learn the IP address of the air system, go to the 5.7" main touchscreen, press the Settings icon, press Network from the listing and the IP address will appear in the second line underneath the method. See Figure D.28.

Figure D.28 System IP Address

1. **IP Address using DHCP method:** Upon power-up of the system, the device will search for a DHCP server. If a DHCP server is found, IP Address, subnet mask and gateway are automatically obtained. If not found, the device will check for a DHCP server every 30 seconds. When found, the IP Address, subnet mask and gateway are automatically obtained.
2. **IP Address using Static method:** Upon power-up of the system, the device will immediately begin using the fixed IP configuration.

D.7.4 Set Up: Connecting to the Embedded Website of the Air System

1. Start a web browser such as Microsoft Internet Explorer.
2. Enter the system's IP address in the browser's address bar.

Example: <http://10.213.11.97>

Appendix D: TotalAlert Embedded Control System

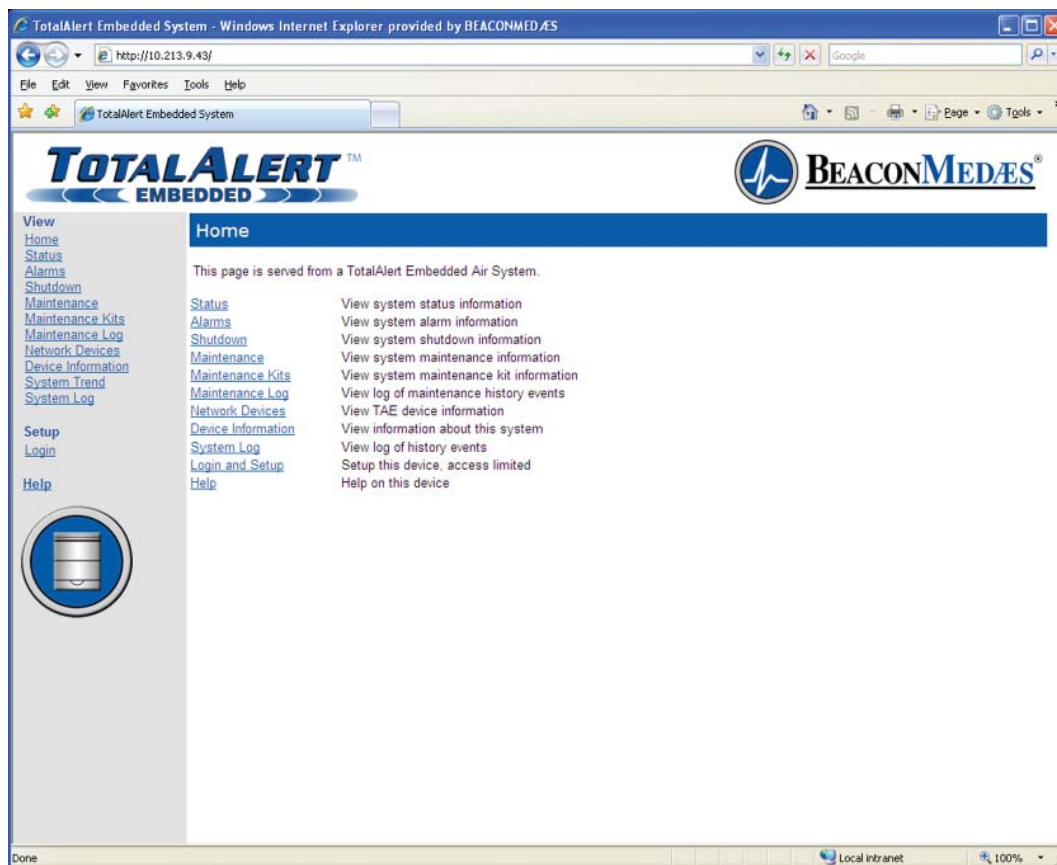


Figure D.29 Typical Medical Air System home page

D.7.5 Login to Setup Pages

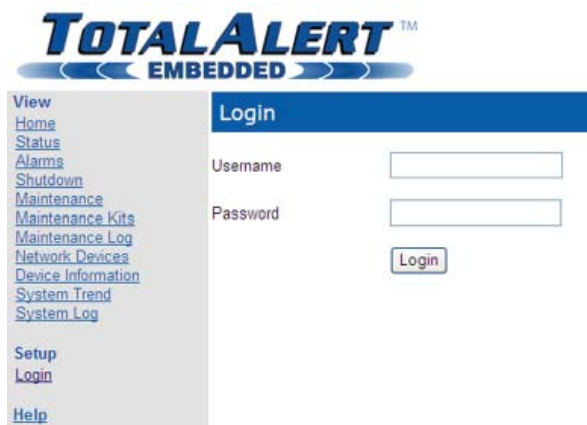


Figure D.30 Login for Setup Pages

1. Once connected to the TotalAlert Embedded control system, your browser will display the typical home page (Figure D.29).
2. Click “Login” on the menu bar in the left pane. The web browser will request a username and password (Figure D.30).
3. The factory defaults are:
Username: new
Password: new
4. The left sidebar will now contain the setup links (Figure D.31).

Appendix D: TotalAlert Embedded Control System

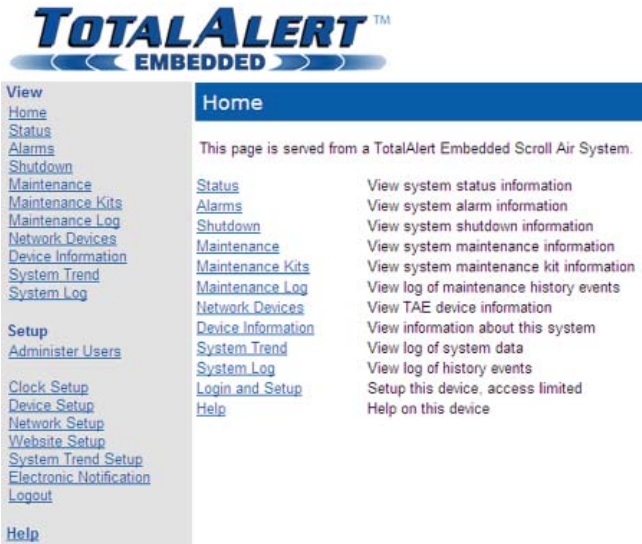


Figure D.31 Setup Menu

D.7.6 Device Setup

This Device Setup page (Figure D.32) is used to configure the medical air system name, location, facility name, and contact information.



Figure D.32 Device Setup

1. Click Device Setup to access the Device Setup page.
2. Enter the new device name.
3. Enter the location
4. Enter the facility description.
5. Enter the contact information.
6. Click the Submit button.

D.7.7 Network Setup

This Network Setup page (Figure D.33) is used to configure the facility network information and e-mail server configuration.

NOTE: Obtain the IP Address and DNS Name from the facility's Information Systems department.



Figure D.33 Network Setup

1. Click Network Setup to access the Network Setup page.
2. Select Enable or Disable for the DHCP Mode.
3. Enter the IP Address for the DNS server configuration.
4. Enter the IP Address and DNS name for the e-mail SMTP server configuration.
5. Click the Submit button.

D.7.8 Website Setup

This Website Setup page (Figure D.34) is used to configure the automatic refresh interval for the website. By selecting an auto-refresh interval, the web page will be refreshed automatically, keeping all information current during a viewing period.

Appendix D: TotalAlert Embedded Control System



Figure D.34 Website Setup

1. Click Website Setup to access the Website Setup page.
2. Select a time interval from the pull-down list of options.
3. Click the Submit button.

D.7.9 System Trend Setup

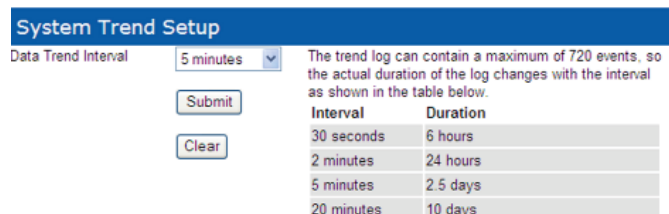


Figure D.35 System Trend Setup

This System Trend Setup page (Figure D.35) is used to configure the trend log for the website and to allow the data to be cleared. The System Trend screen contains a maximum of 720 events for each of the items recorded, so the actual duration of the trend log changes with the time interval selected. The durations available to select are 6 hours, 24 hours, 2.5 days, and 10 days.

1. Click System Trend Setup to access the System Trend Setup page.
2. Select a time interval from the pull-down list of options.
3. Click the Submit button.

D.7.10 Electronic Notification Setup

This Electronic Notification Setup page (Figure D.36) is used to configure the Electronic Notification feature of the TotalAlert Embedded control system. By setting up the Electronic Notification, key personnel can receive notifications of all alarm/shutdown alerts and/or all maintenance alerts (e-mail, pager, phone text message). The device acts as an SMTP client. An SMTP server is required for electronic notification to function.

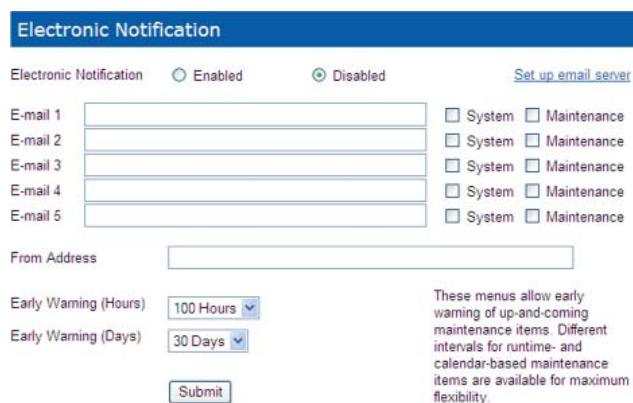


Figure D.36 Electronic Notification Setup

1. Click Electronic Notification Setup to access the Electronic Notification Setup page.
2. Select Enable to enable the e-mail notification tool.
3. Enter up to five email addresses.

Appendix D: TotalAlert Embedded Control System

4. For each address, select “System” for that person to receive all alarm/shutdown alerts. Select “Maintenance” for that person to receive all maintenance alerts. An individual may receive both types of alerts.
5. Enter an email address in the “From” box as this will be the sender of the notifications.
6. If desired, early warning notifications can be set up for maintenance items. By selecting these time intervals, a notification will be sent before the maintenance item is due, providing time for planning the service activity.
7. Click the Submit button.

D.7.11 Navigating the Website

The TotalAlert Embedded website allows the user to easily view the status of all activity pertaining to the medical air system. By clicking the menu items to the left of the screen, a user can view pages displaying accurate and timely information about the system. These pages include:

Status

Data at 2010-05-27 11:24:46 [Refresh Now](#) (Auto refresh every 5 seconds)

System

Hours	Pressure	Dewpoint	CO Level	Ambient	Alarms	Shutdown	Service
311.9 hrs	120 psig	-98 degC	4 ppm	24 degF	OK	OK	Not Due

Units

Number	Hours	Operation Mode	Run Mode	Seq	Alarms	Shutdown	Service
1	77.9 hrs	Automatic	Stopped	Lag 1	OK	OK	Not Due
2	72.7 hrs	Automatic	Stopped	Lead	OK	OK	Not Due
3	Expansion Unit (Not Installed)						

Dryers

Number	Hours	Operation Mode	Cycles	Tower A Mode	Tower B Mode
1	247.5 hrs	Off	32519	Off	Off
2	3.7 hrs	Off	196	Off	Off

Figure D.37 Status Page

Status: The Status page (Figure D.37) displays current information for both the overall system (run hours, pressure, ambient temperature, alarms, shutdown, and service) and the units (run hours, operation mode, run mode, sequence, alarms, shutdown, and service).

Alarms

Data at 2010-05-27 11:41:42 [Refresh Now](#) (Auto refresh every 5 seconds)

System	
Alarm	Status
Dew Point	OK
CO Level	OK
Lag Alarm	OK
Ambient Temp.	OK
Control Circuit	OK

Units

Alarm	Unit 1	Unit 2	Unit 3
Discharge Temp	OK	OK	Expansion

Figure D.38 Alarms Page

Alarms: The Alarms page (Figure D.38) displays the current status of all system alarms and alarm status for each unit.

Shutdown

Data at 2010-05-27 11:42:07 [Refresh Now](#) (Auto refresh every 5 seconds)

System

Shutdown	Status
Unit 1	OK
Unit 2	OK
Unit 3	OK

Units

Shutdown	Unit 1	Unit 2	Unit 3
Motor Overload	OK	OK	Expansion
Discharge Temp.	OK	OK	Expansion

Figure D.39 Shutdown Page

Shutdown: The Shutdown page (Figure D.39) displays the current status of all system shutdowns and shutdown status for each unit.

Appendix D: TotalAlert Embedded Control System

Maintenance		
Data at 2010-05-27 11:42:31 Refresh Now (Auto refresh every 5 seconds)		
System		
Service Item	Due In	Interval
Check Receiver Drain	4976 Hours	24 Hours
Rotate Dryers	29 Days	30 Days
Calibrate CO Monitor	179 Days	180 Days
System Basic Kit	351 Days	365 Days
System Sensor Kit	729 Days	730 Days
System Extended Kit	1081 Days	1095 Days
Unit 1		
Service Item	Due In	Interval
Unit Basic Kit	351 Days	365 Days
Unit Extended Kit	1081 Days	1095 Days

Figure D.40 Maintenance Page

Maintenance: The Maintenance page (Figure D.40) displays a listing of all service items for both the system and each unit. The display includes the time frame for which the service activity is due and the time interval for each service activity.

Maintenance Kits		
System (1 per system)		
Service Item	Interval	Service Kit
Calibrate CO Monitor	180 Days	4107 6525 12 - CO Calibration Kit (Regulator, Gas, Case)
System Basic Kit	365 Days	4107 4000 29 - System Basic Kit [Size A] (Dryer Filters, Sight Glass Kit, Valve Kits etc.)
System Sensor Kit	730 Days	4107 4000 59 - System Dew Point / CO Sensor Kit (Dew Point and CO Sensors)
System Extended Kit	1095 Days	4107 4000 36 - System Extended Kit [Size C] (Desiccant, O-rings, Valve Kits etc.)
Unit (1 per unit)		
Service Item	Interval	Service Kit
Unit Basic Kit	365 Days	4107 4000 45 - Unit Basic Kit (Inlet Filter - 1 Kit per Unit)
Unit Extended Kit	1095 Days	4107 4000 53 - Unit Extended Kit (O-rings, Valve kits etc. - 1 Kit per Unit)

Figure D.41 Maintenance Kits Page

Maintenance Kits: The Maintenance Kits page (Figure D.41) displays all service kits required to perform the maintenance activities on the Maintenance page. Included on the page are the service item, the time interval for each time, and the part number and description of the service kit required to perform the maintenance function, specific to the medical air system installed.

Maintenance Log	
Data at 2010-05-27 11:43:46 Refresh Now Click here to create a downloadable text file	
Page 1 of 2 (17 events total) ← ← → →	
Date / Time	Event
2010/05/26 14:12:29	System - Calibrate CO Monitor - Maintenance Performed (291.7 hrs)
2010/05/26 14:12:18	System - Rotate Dryers - Maintenance Performed (291.7 hrs)
2010/05/26 13:33:01	System - System Sensor Kit - Maintenance Performed (291.2 hrs)
2010/05/26 13:31:50	System - System Sensor Kit - Maintenance Due (291.2 hrs)
2010/05/26 13:31:50	System - System Sensor Kit - Maintenance Interval Reset (291.2 hrs)
2010/05/26 09:55:49	System - Check Receiver Drain - Maintenance Interval Reset (288.0 hrs)
2010/05/26 09:55:13	System - Check Receiver Drain - Maintenance Due (288.0 hrs)
2010/05/25 09:20:10	System - Check Receiver Drain - Maintenance Performed (264.7 hrs)
2010/05/25 07:23:00	System - Check Receiver Drain - Maintenance Due (263.0 hrs)
2010/05/24 08:11:04	System - Check Receiver Drain - Maintenance Performed (239.8 hrs)

Figure D.42 Maintenance Log Page

Maintenance Log: The Maintenance Log page (Figure D.42) displays a listing of all maintenance activity for both the system and the units. The log displays the date/time of the event and a description of the event (maintenance due alert, maintenance performed, interval reset). The Maintenance Log page includes the option to create a downloadable text file of the log.

Network Devices				
Data at 2010-05-27 11:44:45 Refresh Now (Auto refresh every 5 seconds)				
Device Name	Browse	Device Type	Device S/N	Device Location
TAE_12100	http://10.213.9.43	This_TAE	12100	West Wing, Level 6 Plant Room
TAE_12102	http://10.213.11.79	TAE_Scroll	12102	Ray Wilson's Office

Figure D.43 Network Devices

Network Devices: The Network Devices page (Figure D.43) displays all TotalAlert and TotalAlert Embedded devices on the facility's network. The page displays the device name, IP address, device type, device serial number, and device location. By clicking the IP address of a device, the user moves to the website of that device.

Appendix D: TotalAlert Embedded Control System

Device Information	
Data at 2010-05-27 11:45:01 Refresh Now	
System Information	
Item	Value
System Model Number	PAT03-120H-DCD
System Serial Number	HOP159621
System Warranty Level	Standard
Service Contact	Gordon Yeomans
Device Name	TAE_12100
Device Type	TAE_RECIP
Device Serial Number	12100
Device Location	West Wing, Level 6 Plant Room
Facility Name	Doncaster Royal Infirmary
Facility Contact	Mike Myers
System Ship Date	2010/04/01
System Startup Date	2010/04/26
System Startup Person	Matt Clark
System Wiring Diagram PN	4107950010

Figure D.44 Device Information

Device Information: The Device Information page (Figure D.44) displays information specific to the TotalAlert Embedded device. The information displayed includes an array of details pertaining to the system, including model number, serial number, contact information for service, and much more. The Device Information page includes specific information about the printed circuit boards found in the control cabinet (hardware and software descriptions).

System Trend					
Data at 2010-05-27 11:46:06 Refresh Now Click here to create a downloadable CSV file					
Date / Time	Tank Pressure (psig)	Dew Point (Degrees C)	CO Level (ppm)	Ambient Temp. (Degrees F)	Cabinet Temp. (Degrees F)
2010/05/27 11:45:51	120.85	-98	4	24	24
2010/05/27 11:43:51	120.85	-98	4	24	24
2010/05/27 11:41:51	120.85	-98	4	24	24
2010/05/27 11:39:51	120.85	-98	4	24	24
2010/05/27 11:37:51	120.85	-98	4	24	24
2010/05/27 11:35:51	120.85	-98	4	24	24
2010/05/27 11:33:51	120.85	-98	4	24	24
2010/05/27 11:31:51	120.85	-98	4	24	24
2010/05/27 11:29:51	120.85	-98	4	24	24
2010/05/27 11:27:50	120.85	-98	4	24	24
2010/05/27 11:25:51	120.85	-98	4	24	24
2010/05/27 11:23:51	120.85	-98	4	24	24

Figure D.45 System Trend

System Trend: The System Trend page (Figure D.45) displays multiple items on the system measured at specified time intervals. These items may include tank pressure, dew point, CO level, and ambient temperature. The time intervals may be every 30 seconds, 2 minutes, 5 minutes, or 20 minutes (see section D.7.6 System Trend Setup). The System Trend page includes the option to create a downloadable spreadsheet file of the events. To clear the system trend data, go to the System Trend Setup page on the website (see Section D.7.6).

System Log	
Data at 2010-05-27 11:48:08 Refresh Now Click here to create a downloadable text file	
Page 1 of 36 (355 events total) ← →	
Date / Time	Event Message
2010/05/27 11:43:30	Alarm - System - Control Circuit Unit 1 (120# 24F)
2010/05/27 11:43:29	Alarm - System - Control Circuit Dryer 2 (120# 24F)
2010/05/27 11:43:29	Alarm - System - Control Circuit Dryer 1 (120# 24F)
2010/05/27 11:43:29	Alarm - System - Control Circuit Unit 2 (120# 24F)
2010/05/27 11:43:29	Alarm Reset - System (120# 24F)
2010/05/27 11:43:29	Alarm - System - Control Circuit Dryer 2 (120# 24F)
2010/05/27 11:43:29	Alarm - System - Control Circuit Dryer 1 (120# 24F)
2010/05/27 10:45:35	Alarm Reset - System (120# 24F)
2010/05/27 10:44:32	Alarm - System - Lag Alarm (83# 24F)
2010/05/27 10:43:29	Alarm Reset - System (121# 24F)

Figure D.46 System Log

System Log: The System Log page (Figure D.46) displays a listing of all alarm and shutdown activity for both the system and the units. The log displays the date/time of the event and a description of the event (alarm/shutdown, reset, test). The System Log page includes the option to create a downloadable text file of the log.

Appendix D: TotalAlert Embedded Control System

D.7.12 Available for Download

In three of the viewing pages on the website, the user can download information for analysis or record keeping. The Maintenance Log, System Trend, and System Log pages all contain a link for the user to click to create the downloadable file.

1. Click on one of the pages to display the information available for download (Maintenance Log, System Trend, or System Log).
2. Click on the link to create a downloadable file, located in the upper right above the displayed information.
3. Select to view the information on the web page or to save the file to the computer.

The Maintenance Log and the System Log create text files that list all of the events in descending order from most recent to oldest. See Figure D.47.

The System Trend creates a CSV file (spreadsheet) that contains all of the trend information, descending from most recent to oldest. See Figure D.48.

Appendix D: TotalAlert Embedded Control System

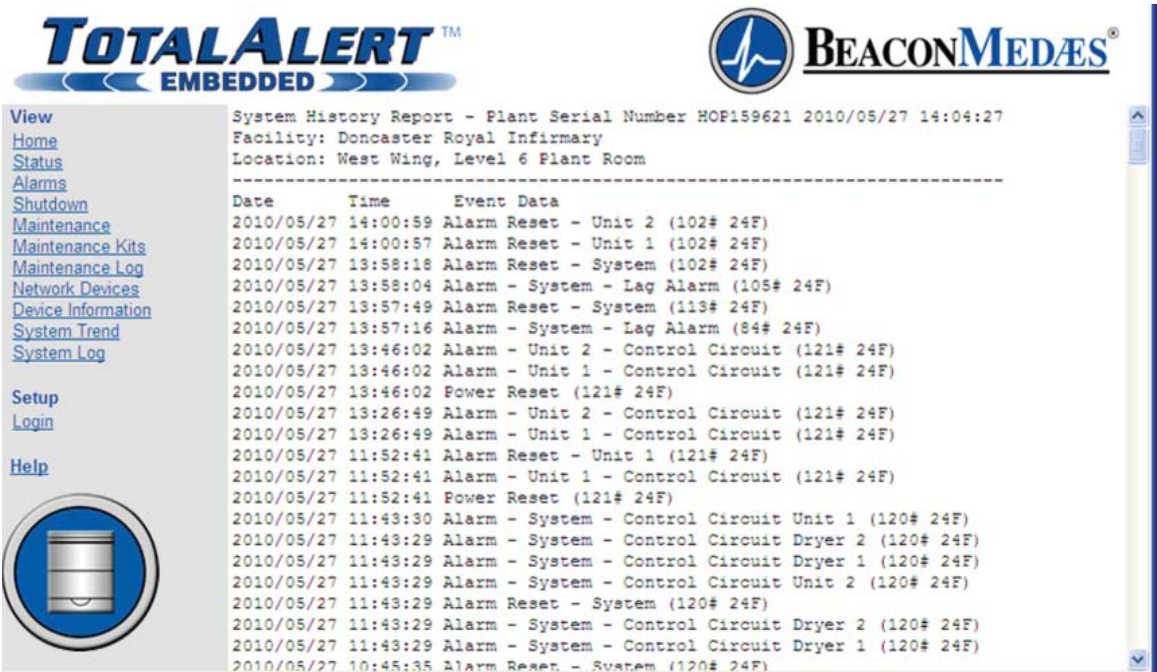


Figure D.47 System Log Download

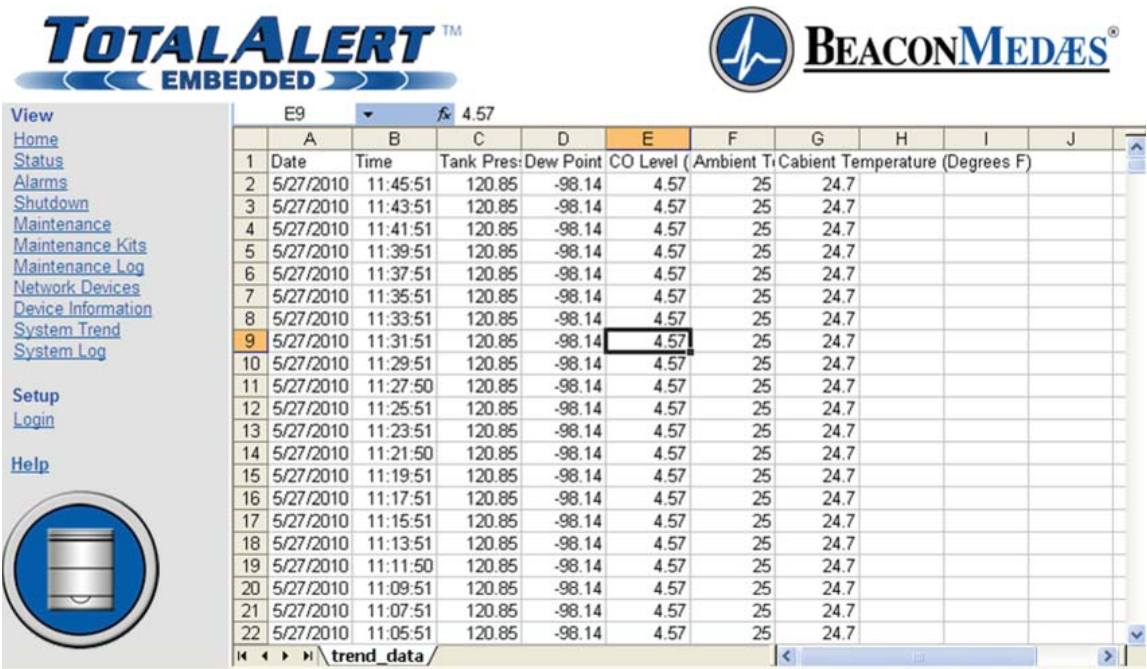


Figure D.48 System Trend Download



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