



Product Manual

E-Stop Emergency Stop Control System



Designed and Built by:

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Revision Log

Revision Level	Date	Description
D	04/20/2016	Reformat and update PN



Preface

General

The E-Stop Control System is for use with remote, pneumatically actuated valves and oxygen monitors. This control system was developed to assist in monitoring automated cryogenic systems that use inert gas such as nitrogen to assure an oxygen deficient atmosphere does not occur. With the E-Stop Control System, you can be confident the cryogenic system is operating safely.

Specifications

- Power - 120 VAC
- Air Supply - 20 - 145 psig max., 1/4" fpt connection
- Dimensions - 16"H x 14"W x 6"D
- Designed to work with pneumatic actuated valves which require air pressure to open and will close in the absence of air pressure
- Air to actuator - 1/4" fpt connection (fittings are supplied to accommodate 1/4" copper or 1/4" flexible poly tube)
- Internal pressure regulator to accommodate different actuator requirements

Product Features

The E-Stop Control System interfaces with Chart's Oxygen Monitor/Alarm.

The remote actuated liquid nitrogen supply valve will close if any of the following conditions occur:

- Oxygen monitor goes into a low oxygen alarm state
- Oxygen monitor loses its power or detects an internal fault
- The red mushroom E-Stop button is pushed
- An auxiliary alarm condition occurs
- Power is lost to the E-Stop control system

The E-Stop Control System provides positive indication of the following:

- When the power is on and all conditions are safe, the system has a green indicating light illuminated.

- When any alarm happens, a red indicating light becomes illuminated, identifying which alarm condition exists.
- When the alarm condition exists, an audible horn sounds to alert personnel in the area.
- After an alarm occurs, the liquid nitrogen supply valve will not open immediately when the alarm condition goes away. The latching alarms, requiring acknowledgement by personnel to be sure the system is safe again to resume operation. The need for acknowledging the alarm is indicated by the illuminated RESET button. When the RESET button is pressed, and the alarm condition no longer exists, the system will re-open the liquid nitrogen supply valve and the RESET button will lose its illumination.

Product Manual

This manual is designed to be used in conjunction with the E-Stop Control System. It should be thoroughly read and understood by anyone that operates this equipment. If there are any questions regarding the operation of this product, contact Chart's Technical Service division at 1-800-400-4683.

The safety requirements for operating this system and handling or transporting extremely cold liquid products are shown in the Safety section. It is imperative that all persons having contact with this system become thoroughly familiar with all maintenance, safety precautions, and procedures contained in this product manual.

The Introduction section discusses the principle of operation and gives a brief description of the E-Stop Control System Components.

For instructions on installing this system please refer to the Installation section.

The Operation section includes information on setting up multiple monitors, discussing the auxiliary input alarm and output indication, and a section on service and repair.

Please refer to the Specifications section for a detailed schematic of the E-Stop Control System.

Terms

Throughout this manual safety precautions will be designated as follows:



Warning! *Description of a condition that can result in personal injury or death.*



Caution! *Description of a condition that can result in equipment or component damage.*



Note: *A statement that contains information that is important enough to emphasize or repeat.*

Acronyms / Abbreviations

The following acronyms / abbreviations are used throughout this manual:

CGA	Compressed Gas Association
FPT	Female Pipe Thread
NFPA	National Fire Protection Association
O ₂	Oxygen
OD	Outer Dimension
PSIG	Pounds per Square Inch (Gauge)
VAC	Voltage - Alternating Current



Safety

Strict compliance with proper safety and handling practices is necessary when using a cryogenic system. We recommend that all our customers re-emphasize safety and safe handling practices to all their employees and customers. While every possible safety feature has been designed into the system and safe operations are anticipated, it is essential that the user of the cryogenic system carefully read and fully understand all WARNINGS and CAUTION notes listed in this safety summary and enumerated below. Also read the information provided in the Safety Bulletin for Oxygen and Inert Gases following this Safety Summary. Periodic review of the Safety Summary is recommended.



Warning! *In an oxygen enriched atmosphere flammable items burn vigorously and could explode.*

Excess accumulation of oxygen creates an oxygen-enriched atmosphere (defined by the Compressed Gas Association as an oxygen concentration above 23%). Certain items considered non-combustible in air may burn rapidly in such an environment. Keep all organic materials and other flammable substances away from possible contact with oxygen; particularly oil, grease, kerosene, cloth, wood, paint, tar, coal, dust, and dirt which may contain oil or grease. **DO NOT** permit smoking or open flame in any area where oxygen is stored, handled, or used. Failure to comply with this warning may result in serious personal injury or death.



Warning! *Nitrogen and argon vapors in air may dilute the concentration of oxygen necessary to support or sustain life.*

Exposure to such an oxygen deficient atmosphere can lead to unconsciousness and serious injury, including death.



Warning! *Accidental contact of liquid gases with skin or eyes may cause a freezing injury similar to a burn.*



Caution! *Before locating oxygen equipment, become familiar with the relevant EU Directives or NFPA Standard No. 55 (www.nfpa.org), “Compressed Gases and Cryogenic Fluids Code” and with all local safety codes.*

The NFPA standard covers general principles recommended for the installation, storage, use and handling of compressed gases and cryogenic fluids in portable and stationary containers, cylinders, equipment and tanks in all occupancies.

Safety Bulletin

Portions of the following information are extracted from Safety Bulletin SB-2 from the Compressed Gas Association, Inc. (CGA). For the full text of Safety Bulletin SB-2 and for more information about oxygen atmospheres, refer to Safety Bulletin SB-2 from the CGA. Additional information on nitrogen and argon and liquid cylinders is available in CGA Pamphlet P-9. Write to the Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Arlington, VA 22202 or visit their website at www.cganet.com.

Oxygen Deficient Atmospheres

The normal oxygen content of air is approximately 21%. Depletion of oxygen content in air, either by combustion or by displacement with inert gas, is a potential hazard and users should exercise suitable precautions.

One aspect of this possible hazard is the response of humans when exposed to an atmosphere containing only 8 to 12% oxygen. In this environment, unconsciousness can be immediate with virtually no warning.

When the oxygen content of air is reduced to about 15 to 16%, the flame of ordinary combustible materials, including those commonly used as fuel for heat or light, may be extinguished. Somewhat below this concentration, an individual breathing the air is mentally incapable of diagnosing the situation because the onset of symptoms such as sleepiness, fatigue, lassitude, loss of coordination, errors in judgment and confusion can be masked by a state of “euphoria” leaving the victim with a false sense of security and well being.

Human exposure to atmosphere containing 12% or less oxygen leads to rapid unconsciousness. Unconsciousness can occur so rapidly that the user is rendered essentially helpless. This can occur if the condition is reached by an immediate change of environment, or through the gradual depletion of oxygen.

Most individuals working in or around oxygen deficient atmospheres rely on the “buddy system” for protection - obviously the “buddy” is equally susceptible to asphyxiation if he or she enters the area to assist the unconscious partner unless equipped with a portable air supply. Best protection is obtainable by equipping all individuals with a portable supply of respirable air. Life lines are acceptable only if the area is essentially free of obstructions and individuals can assist one another without constraint.

If an oxygen deficient atmosphere is suspected or known to exist:

1. Use the “buddy system.” Use more than one “buddy” if necessary to move a fellow worker in an emergency.
2. Both the worker and “buddy” should be equipped with self-contained or airline breathing equipment.

Oxygen Enriched Atmospheres

An oxygen-enriched atmosphere occurs whenever the normal oxygen content of air is allowed to rise above 23%. While oxygen is nonflammable, ignition of combustible materials can occur more readily in an oxygen-rich atmosphere than in air; and combustion proceeds at a faster rate although no more heat is released.

It is important to locate an oxygen system in a well ventilated location since oxygen-rich atmospheres may collect temporarily in confined areas during the functioning of a safety relief device or leakage from the system.

Oxygen system components, including but not limited to, containers, valves, valve seats, lubricants, fittings, gaskets and interconnecting equipment including hoses, shall have adequate compatibility with oxygen under the conditions of temperature and pressure to which the components may be exposed in the containment and use of oxygen. Easily ignitable materials shall be avoided unless they are parts of equipment or systems that are approved, listed, or proven suitable by tests or by past experience.

Compatibility involves both combustibility and ease of ignition. Materials that burn in air may burn violently in pure oxygen at normal pressure, and explosively in pressurized oxygen. In addition, many materials that do not burn in air may do so in pure oxygen, particularly when under pressure. Metals for containers and piping must be carefully selected, depending on service conditions. The various steels are acceptable for many applications, but some service conditions may call for other materials (usually copper or its alloy) because of their greater resistance to ignition and lower rate of combustion.

Similarly, materials that can be ignited in air have lower ignition energies in oxygen. Many such materials may be ignited by friction at a valve seat or stem packing, or by adiabatic compression produced when oxygen at high pressure is rapidly introduced into a system initially at low pressure.



Introduction

Principle of Operation

The E-Stop (Emergency Stop) Control System is designed to work with an area oxygen monitor/alarm system. This control system provides added safety by closing a remote, pneumatically actuated liquid nitrogen supply valve when any of the following occur:

- Power to this control system is lost
- The area's oxygen monitor has alarmed
- The red mushroom E-Stop button has been pushed
- An alarm has occurred on the "Auxiliary Input Alarm" terminals.

If any of these system faults occur, the system will de-energize the solenoid valve and consequently close the pneumatic actuated valve in the field. When any of the faults occur, a red indicating light will appear and a horn will sound to notify personnel which fault has happened.



Note: This system is designed to work with a pneumatic actuated valve, which requires 10-20 psig pressure to open the valve, and closes when the pressure is removed from the actuator.



Note: Consideration should be given to using nitrogen gas rather than air in cold environments. If the dew point of the compressed air source is higher than the expected temperatures outside, it is possible to get water condensation/ice in the air lines which may damage this system or the actuator on the liquid nitrogen valve. If nitrogen gas is used instead, caution must be taken to ensure that the pressure of the nitrogen supply gets no higher than 145 psig, and no less than the pressure required to operate the actuator being used on the liquid nitrogen valve.

E-Stop Control System Components

RESET Button

When any of the system faults occur (or when turning the power on) the RESET button will become illuminated. Any time the button is illuminated, the solenoid valve is de-energized, and the remote pneumatically actuated valve is

now closed. The RESET button will remain illuminated until someone acknowledges the fault and presses the RESET button. When the RESET button is pressed, the light will go out (if the fault condition no longer exists) and the solenoid valve will energize, which will open the actuated valve. If the fault condition still exists, the RESET button will remain illuminated even after pressing it, and the remote pneumatically actuated valve will remain closed.

Pressure Regulator/Filter

The system has an integral pressure regulator/filter included so that it can be adjusted to work with many different operating pressure/actuators. The filter on the regulator will help keep the air supply (see note on this page regarding usage of nitrogen gas rather than air), clean for longest life on the pneumatic components including the solenoid valve and pneumatic actuator. It is very important to make sure the pressure regulator is adjusted properly. Proper adjustment will assure the pneumatic actuated valve will open properly as well as prevent too much pressure from being applied, which would damage/destroy the actuator.

The pressure setting on the regulator is adjusted by turning the adjustment knob on top (clock-wise to increase pressure, counter clock-wise to decrease pressure) until the desired pressure is read on the gauge. When the correct pressure is set, push down on the adjustment knob and it will snap into a locked position. Once the regulator has been set for the actuator that is being used, it should not need to be adjusted again, unless a new actuator, which requires a different pressure to open, is installed at a later date.

The filter on the regulator has a clear bowl around it so that it can easily be visually inspected for cleanliness. When the filter gets too dirty, it should be changed with a new one to protect the pneumatic components downstream.

Solenoid Valve

A 3-way solenoid valve is used to control pressure being supplied to the pneumatic actuated valve. When the valve is energized (power on and no faults), it will supply pressure (as set by the regulator) to the pneumatic actuator in the field. When the valve becomes de-energized, it will vent any pressure that was being supplied to the actuator out the EXHAUST port, which will allow the pneumatically actuated valve to close.

The solenoid valve has a small orange button that can be pushed to manually energize the valve (if power is turned on). The valve will remain energized (supplying air to the "ACTUATOR" port) as long as the button is held down.

Releasing the button will return the valve to the de-energized state. This can be useful if any troubleshooting of the system needs to be done.

Indicating Lights

The front of the control unit has some red and green indicating lights to help give visual indication of the status of the system. The lights and their actions are defined as follows:

- POWER - a green light that will be on any time the system is powered up.
- E-STOP ALARM - a red light that will be on if any of the following occur:
 - The red mushroom E-Stop button which is mounted in this control assembly has been pushed in.
 - Any remote E-Stop button, wired into this control system, has been pushed in.



Note: *The light does not indicate whether it was the E-STOP button which was supplied with this control system, or if it was a remote E-Stop button which caused the condition.*

- O₂ MONITOR ALARM - a red light that will be on in either of the following conditions:
 - The oxygen monitor has detected an oxygen level that is below the desired level. If using the Toxgard II oxygen monitor, this could be the CAUTION, or WARNING level, depending on which relay has been wired into the system.



Caution! *Be sure to read the "Oxygen Monitor" section of this manual for details about the different alarm relays.*

- The Fault relay on the Toxgard II oxygen monitor (if being used) has tripped, indicating a loss of power to the oxygen monitor, or an internal fault in the oxygen monitor.
- AUXILIARY ALARM - a red light that will be on if the auxiliary alarm has tripped (if used).

- RESET - a red illuminated push-button which will not be illuminated if the power is on and there are no alarm conditions present. The push button will become illuminated any time an alarm has occurred and either:
 - The alarm condition has not gone away, or
 - The alarm has not been acknowledged by pressing the RESET button

Indicating Horn

The front of the control unit has a small indicating horn that will sound when any alarm condition is present (oxygen monitor, E-Stop button, etc.). The only alarm condition that the horn will not sound on is loss of power to this E-Stop system itself. The horn will also sound upon power being applied to the panel. The horn will continue to sound until the alarm condition is cleared and the RESET button has been pressed.

Oxygen Monitor

This system was designed with the MSA Toxgard II oxygen monitor in mind. However, it could be used with many different types of oxygen monitors as long as they have a relay contact for the alarm conditions, which operates such that the relay is CLOSED when no alarm conditions are present, and OPENS when the alarm condition occurs. If the oxygen monitor has adjustable set points for the alarms, this will enable the user to adjust the oxygen level at which the actuated liquid nitrogen supply valve will close.



Note: *If the MSA Toxgard II unit is used, it has three relays (CAUTION, WARNING and ALARM) that can be used. The CAUTION and WARNING alarms are negative acting (meaning the alarm will activate when the current oxygen level goes BELOW the set point) and the ALARM alarm is positive acting (meaning the alarm will activate when the current oxygen level goes ABOVE the set point). Because the intent of this safety system is to close the supply of liquid nitrogen in the event of a lack of oxygen in the room, this system should be used with either the CAUTION or the WARNING alarms, but not the ALARM alarm. Take special note of this when wiring the system.*

This system will cause the remote pneumatically actuated valve to close when the oxygen level drops below the set point of the alarm, which is wired in the installation (either the CAUTION or the WARNING). Therefore, it is possible to wire the system such that it will close the remote pneumatically actuated valve when the MSA Toxgard II unit goes into a CAUTION state, rather than the WARNING state.

The set points for both the CAUTION and WARNING alarms can be set by the user. For details on this procedure, refer to the "Changing Parameter Settings" section in the MSA Toxgard II manual.

Fault Relay

If the Toxgard II unit is used, it has a Fault relay that should be used. Using the Fault relay makes the system more fail-safe. The Fault relay can be used to signal events such as losing its power or detecting an internal fault. The Fault relay of the Toxgard II monitor is designed to be energized under normal operating conditions. The NO and NC contacts reflect the de-energized, power-off, or Fault condition. If the Fault relay is wired into this control system properly, the remote pneumatically actuated valve will close whenever the Fault relay trips. Since the CAUTION, WARNING and ALARM relays of the Toxgard II oxygen monitor are NOT energized, this control system has no way of knowing if the oxygen monitor is turned on or not, unless the Fault relay is used. As a result, it is strongly recommended to wire the Fault relays of the Toxgard II oxygen monitor into this control system.



Installation

Mounting

Mount the control unit on the wall. The unit can be mounted anywhere indoors. It is not designed to be used outdoors. It may be more convenient if the unit is mounted near the oxygen monitor, however this is not necessary.

Wiring



Note: Refer to the supplied electrical schematics for all questions and connections. The following steps are guidelines. The electrical schematics should always be regarded as the most current and accurate at all times.

1. Have a properly trained electrical run 120vac power wires in conduits to the control box. Terminate the wires as follows:
 - a. Hot power (typically black) wire to terminal #101.
 - b. Neutral (typically white) wire to terminal #N.
 - c. Ground (typically green) wire to grounding lug on the sub-panel.
2. Connect wires from the oxygen monitor alarm to the E-Stop panel as follows:
 - a. Connect a wire from terminal #103 in the E-Stop panel to the NC terminal of the appropriate oxygen monitor alarm.
 - b. Connect a wire from terminal #104 in the E-Stop panel to the COM terminal of the appropriate oxygen monitor alarm.



Note: The Toxgard II monitor has 3 alarms available labeled “CAUTION”, “WARNING” and “ALARM”.

- The “CAUTION” and “WARNING” alarm are negative acting, meaning the alarm will trip as the oxygen level drops below the set-point. Each of these alarms has its own set-point, which can be adjusted by the user.
- The “ALARM” alarm is positive acting, meaning the alarm will trip as the oxygen level rises above the set-point.

- In most cases, this system is intended to be used as a safe-guard against LOW oxygen levels. Consequently, the system should be used with either the “CAUTION” or the “WARNING” alarms, and NOT the “ALARM” alarm.
- If the MSA Toxgard II monitor is not used, the installer should take care to wire to the terminals of an alarm whose contacts will OPEN upon the alarm condition and CLOSE during the safe condition.

- c. Connect a wire from terminal #104 in the E-Stop panel to the COM terminal of the “FAULT” relay in the MSA Toxgard II monitor.



Note: If using only one of the MSA Toxgard II monitors, it is possible to make a short jumper wire to go from the COM terminal of the alarm relay used in the previous step to the COM terminal of the FAULT relay. However, if any other oxygen monitor is used, or more than one MSA Toxgard II monitor is used, do not connect the COM terminals.

- d. Connect a wire from terminal #105 in the E-Stop panel to the NO terminal of the “FAULT” relay in the MSA Toxgard II monitor.
3. Connect the wires for the Auxiliary Input Alarm as follows:
 - If only one auxiliary input alarm is used:
 - a. Remove the jumper wire between terminals #103 and #111.
 - b. Connect a wire from terminal #103 in the E-Stop panel to the COM terminal of the Auxiliary input alarm.
 - c. Connect a wire from terminal #111 in the E-Stop panel to the NC terminal of the Auxiliary input alarm.



Note: The Auxiliary input alarm should work such that the contacts are CLOSED during normal, safe operation and OPEN in the event of an alarm.

- If two auxiliary input alarms are being used:
 - a. Remove the jumper wire between terminals #103 and #111.
 - b. Remove the jumper wire between terminals #111 and #112.
 - c. Connect a wire from terminal #103 in the E-Stop panel to the COM terminal of the first Auxiliary alarm.
 - d. Connect a wire from terminal #111 in the E-Stop panel to the NC terminal of the first Auxiliary alarm.
 - e. Connect a wire from terminal #111 in the E-Stop panel to the COM terminal of the second Auxiliary alarm.
 - f. Connect a wire from terminal #112 in the E-Stop panel to the NC terminal of the second Auxiliary alarm.



Note: Both Auxiliary input alarms should work such that the contacts are **CLOSED** during normal, safe operation and **OPEN** in the event of an alarm.

- If the Auxiliary input alarm(s) feature is NOT being used:
 - a. Install a jumper wire from terminal #103 to terminal #111.
 - b. Install a jumper wire from terminal #111 to terminal #112.
 - c. Both of these jumper wires are installed at the factory before it ships.
4. Connect the wires for any remote E-Stop (Emergency Stop) buttons as follows:
 - a. Remove the jumper wire from terminals #106 and #107.
 - b. Connect a wire from terminal #106 to the COM terminal of the remote E-Stop button.
 - c. Connect a wire from terminal #107 to the NC terminal of the remote E-Stop button.
 - d. If additional E-Stop buttons are used, continue removing jumper wires and wiring to the remote E-Stop button's COM and NC terminals in this fashion. Refer to the supplied electrical prints for details.



Note: This relay is energized under normal, safe operation. In normal safe operation, the normally closed terminal is open, and the normally open terminal is closed. When an alarm condition is present, the relay de-energizes and the normally open contact becomes open and the normally closed contact becomes closed.

Plumbing Air Lines

1. Have a properly trained technician supply shop air to the "AIR SUPPLY" port on top of the unit.



Note: Maximum supply pressure is 145 psig.

- A fitting for 1/4" OD copper tubing is supplied to connect into the 1/4" FPT fitting in the "AIR SUPPLY" port.
 - A fitting for 1/4" OD flexible poly tubing is supplied to connect into the 1/4" FPT fitting in the "AIR SUPPLY" port.
2. Run an air line from the "ACTUATOR" port to the pneumatic actuated valve.
 - Fittings for 1/4" OD copper tubing are supplied to connect into the 1/4" FPT fitting in the "AIR SUPPLY" port and a 1/4" FPT connection on the actuator.
 - Fittings for 1/4" OD poly tubing are supplied to connect into the 1/4" FPT fitting in the "AIR SUPPLY" port and a 1/4" FPT connection on the actuator.
 3. Before turning the power switch on, measure the voltage between terminals #101 and #N to be sure the proper voltage is present. If the proper voltage is not present, remedy the situation before continuing.

4. Obtain the specifications for the pneumatic actuator being used on the actuated liquid nitrogen valve and determine the correct pressure required for opening the valve.
5. Push the red E-Stop button.
6. Turn the system power switch to ON.
7. Adjust the air pressure regulator by turning the adjustment knob on top until the pressure is set to the value required to open the valve (determined in step 8).
8. Push the adjustment knob on the regulator down to “lock” the setting in place.
9. Turn on and set-up the oxygen monitor.
 - Refer to the Oxygen monitor manual for details on setting the unit up and setting alarm set points.
 - Verify no alarms are present on the oxygen monitor.
10. Pull the E-Stop button out.
11. Push the RESET button.
12. Verify the actuated valve opens.
13. Test to be sure the actuated liquid nitrogen valve closes when:
 - The red E-Stop button is pushed in.
 - The power to the control unit is turned off.
 - An oxygen monitor alarm has been activated.
 - The auxiliary alarm trips (if being used).



Operation

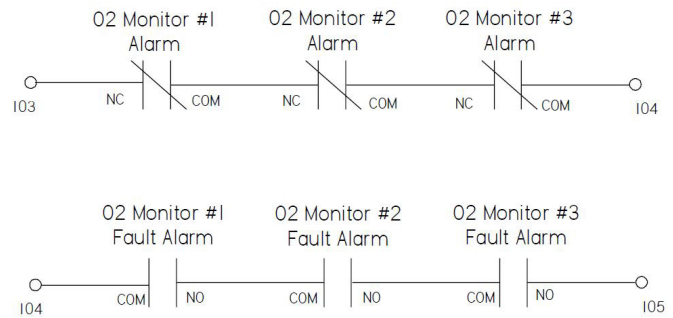
Multiple Oxygen Monitors

This system was designed such that multiple oxygen monitors can be used all at the same time for added system safety. The design allows the customer to use only one, or as many oxygen monitors as they would like. If wired as described, the system will close the remote actuated valve if any of the oxygen monitors experiences a low oxygen level, or has a fault alarm, or loses power.

To include multiple oxygen monitors, make the following wiring changes:

1. Connect a wire from terminal #103 in the control panel to the NC terminal of the first oxygen monitor alarm (see step 2a of the Wiring Installation instructions).
2. Connect a wire from the COM terminal of the first oxygen monitor to the NC terminal of the second oxygen monitor.
3. Connect a wire from the COM terminal of the second oxygen monitor to the NC terminal of the third oxygen monitor.
4. Continue in this fashion until you get to the last oxygen monitor.
5. Connect a wire from the COM terminal of the last oxygen monitor to terminal #104 in the control panel.
6. Connect a wire from terminal #104 in the control panel to the COM terminal of the Fault relay of the first oxygen monitor (see step 2c of the Wiring Installation instructions).
7. Connect a wire from the NO terminal of the first oxygen monitor to the COM terminal of the Fault relay of the second oxygen monitor.
8. Connect a wire from the NO terminal of the second oxygen monitor to the COM terminal of the Fault relay of the third oxygen monitor.
9. Continue in this fashion until you get to the last oxygen monitor.
10. Connect a wire from the NO terminal of the Fault relay of the last oxygen monitor to terminal #105 in the control panel.

The following diagram illustrates how three oxygen monitors could be wired into this system. The same process could be followed for any other number of oxygen monitors.



Auxiliary Input Alarm

The system has an auxiliary input alarm that can be used to signal the remote pneumatic actuated valve to close. This feature is optional and need not be used, but is included as an added feature for versatility. Possible uses for this feature might include, but are not limited to:

- A remote ON/OFF switch in another room
- A second oxygen monitor alarm in the room
- A second oxygen monitor alarm in another room
- Pressure switch installed in liquid supply line

If the auxiliary input alarm function is not going to be used, a jumper must be installed at the appropriate terminals in the panel at installation. Refer to the supplied drawings as well as the notes in the Installation section of this manual for details of jumper wire placement.

Auxiliary Output Indication

The system has an auxiliary output feature that can be used to signal other monitoring equipment when the E-Stop system goes into an alarm condition. The auxiliary output is a Form C relay, which provides contacts for both normally open and normally closed action. The relay is energized in normal, safe operation. When the relay is energized, the normally open contact will be closed, and the normally closed contact will be open. The relay de-energizes upon any alarm condition (Oxygen monitor, E-Stop, Auxiliary, loss of power, etc.) and the normally open contact will become open, and the normally closed contact will become closed. The contacts for this relay are rated at 10 amps.

Recommended Spare Parts

This system is very simple and uses few moving parts to ensure long-term reliability and stable operation. However, since it is a safety related device, it is highly recommended to have a few spare parts on hand for immediate replacement, should it be necessary. The following table identifies the parts suggested to have on hand. Some of the parts can be ordered from Chart at www.chartparts.com (the Chart part number is provided below). The relays and fuses are easiest to obtain locally and the manufacturer's part number is indicated.

Description	Recommended Spare Qty
3-way solenoid valve - 120vac (Chart PN 10904353)	1
Pressure regulator/filter (Chart PN 11668410)	1
2-pole Relay (Mfg. PN IDEC#RH2B-UAC120V)	1
3-pole Relay (Mfg. PN IDEC#RH3B-UAC120V)	1
Fuse, 1A (Mfg. PN BUSS MDL 1A, 250V)	2

Service and Repair

Should any service or repair be required on this system, use the following procedures:

Replace the Solenoid Valve

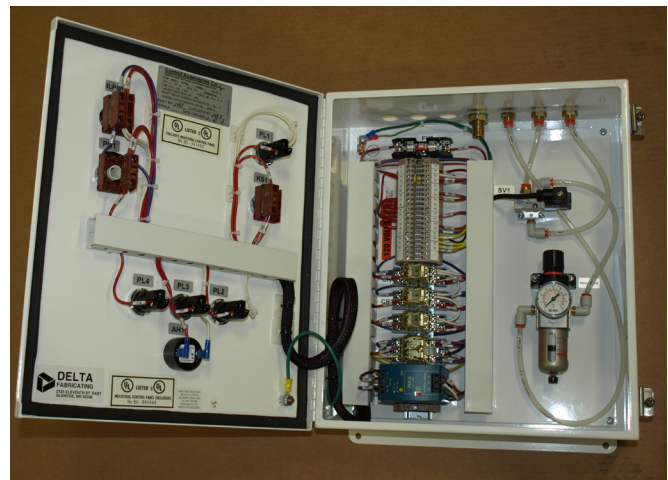
1. Turn system power switch to the OFF position.
2. Loosen the two clamps on the side and open the control unit door.
3. Remove the solenoid valve wiring connector.
4. Remove the two small screws, which hold the valve body in place.
5. Remove the valve body.
6. Install the new valve by reversing the above steps.
 - Take special care to ensure the tubing returns to the correct valve ports.

Replace the Fuse

1. Turn system power switch to the OFF position.
2. Loosen the two clamps on the side and open the control unit door.
3. Pull the fuse out of the fuse holder.
4. Insert a new fuse into the fuse holder.
5. Close the control unit door and tighten the clamps.
6. Turn power switch to the ON position.

Replace the Relay

1. Turn system power switch to the OFF position.
2. Loosen the two clamps on the side and open the control unit door.
3. Pull the relay body out of the relay base.
4. Align the metal tabs on the bottom of the new relay body with the slots in the relay base.
5. Push the new relay body into the relay base so that it is firmly seated.
6. Close the control unit door and tighten the clamps.
7. Turn power switch to the ON position.



Specifications

Schematic

