Integra Med Touch Series LCD Area Alarm & Zone Valve Box Systems

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Description

The Powerex Med Touch area alarm zone valve panel digitally displays gas pressure (1 psi increments) and provides alarm conditions as required by the latest edition of NFPA 99 for up to 7 medical gases. The alarm is ETL listed to UL 1069 and CSA C22.2 # 205 Signal equipment. Transducers are included.

Features & Benefits

- Five year parts and one year labor warranty
- Up to 7 valves and area/gas boards in one box
- Dual gauge/purge ports on all valves
- Accommodates valve sizes from 1/2" to 2"
- Eliminates extra costs associated with typical area alarm with remotely installed transducers; brazing in tee's and risers, installing low voltage wiring
- Drastically reduces long term costs of annual testing and maintenance vs typical area alarm with transducers installed remotely above the ceiling
- Individual 2.85" LCD touch screen display for each gas service
- The LCD touch screen allows all alarm programming and set up to be done without the use of tools
- A green normal or red alarm condition for each gas service confirms the condition for each individual gas service
- Emergency preparedness instructions - Med Touch alarm panels allow users to set up customized instructions for each alarm signal which appear when the signal is in alarm
- Last event history (per gas board /signal point).
- Made in the U.S.A.
- NFPA and ISO pre-loaded gas 'labels'
- English, and English/French pre-loaded languages
- Editable text and alarm 'labels'
- Self-contained unit designed for ease of installation & service
- Self-diagnostic error message display for ease of maintenance
- Audio and visual alarm indicators
- Bright, easy to read LCD displays – clearly visible in both day and night lighting conditions
- Constant display and monitoring of each gas

Integra Med Touch Area Alarm & Zone Valve Box

- User programmable high/low set points
- Dry contacts for remote monitoring of all alarm conditions on each gas module and on the CPU module for the entire panel
- Easy to read – color coded gas modules
- Hinged frame for easy accessibility
- Color coded displays

In addition, each Area Alarm Module shall incorporate the following features:

- Does not require re-calibration
- Gas specific sensor with DISS nut & nipple. An error message will be displayed if incorrect sensor or no sensor is attached.
- Shall be capable of displaying gas readouts in in PSI, kPa, BAR, inHg, or mmHg.
- Gas alarm repeat feature is factory set at 10 minutes, and is adjustable or may be turned off

The following options shall be able to be added to the panel at the time of order or after installation;

- Optional Text / e mail notification of alarm events sent to up to 5

addresses

- Optional Ethernet module. This module may be added to any alarm panel. It will provide the following features:
- Webserver – allows a remote user access to the alarm's webpage – viewing a graphic image of the alarm with all signal conditions, pressure & event / history log information
- Text notification of alarm conditions (up to 5 addresses)
- Event / history log – maintains a rolling list of the 100 most recent alarm condition events and a file of the 1,000 most recent alarm events and is downloadable through embedded web page
- Event log is viewable and downloadable through embedded web page, including the most recent 1,000 events.
- Optional Ethernet connectivity with embedded web page
- Interface with building automation system via Ethernet

Contents

Introduction

The Powerex gas alarm system monitors the status of the medical gas distribution system and provides audible and visual indicators. The Powerex alarm system monitors the status of the medical gas sources in accordance with NFPA 99 and CSA Z7396.1. An optional Ethernet/rabbit board may be added either at the time of order or retro-fit after installation which will provide; website launch for real-time monitoring of the alarm, text/e mail notifications of alarm condition(s) sent to up to 5 addresses, event log history of up to 1,000 events, and Modbus interface.

Powerex ball valves and zone valve boxes are cleaned for use with oxygen. Each valve is tested for leakage in both the open and closed position. Each unit is designed and built in accordance with the National Fire Protection Association and Compressed Gas Association guidelines.

The installation and maintenance should be conducted in accordance with the following standards: NFPA 99 or CSA Z7396.1

Components

The Powerex Integra Touch gas alarm system is comprised of a rough-in back box, a window frame, a circuit board panel, and transducer(s).

The rough-in back box houses the power supply, fuse, on/off switch, and a terminal strip for electrical wiring. An isolated transformer reduces the 110V or 220V AC input to low voltage DC.

The circuit board panel includes enclosed printed circuit boards with programming circuitry.

The Push Button module includes a power on indicator, Silence button, History button, Alarm Set-Up buttons and an audible alarm.

The Gas (Area) module(s) on the front panel are identified with gas specific, color coded displays (per NFPA 99 or CSA Z7396.1. The gas displays include LCD's which indicate high/normal/low pipeline pressure. The digital LCD display(s) shows the actual gas pressure. The gas pressure may be displayed in in PSI, kPa, BAR, inHg, or mmHg. The unit is pre-programmed to display PSI / inHg from the factory, but may be re-programmed in the field to display BAR, kPa or mmHg. In addition there are features which illuminate to indicate System and Program failures. Each module is supplied with dry contacts for remote signaling of high and low pipeline pressure.

Transducers

The transducer converts pressure to an electrical signal and supplies the electrical signal to the alarm circuit board Gas module panels. After the initial 24 hour 150 psi pressure test (required per NFPA 99) has been completed the pressure/vacuum transducers may be connected to the medical gas pipeline. Should a transducer require service or replacement, it is considerably safer and less time consuming to locate and replace transducers which have been installed in the appropriate zone valve box as opposed to remotely above the ceiling. Installation of the transducers in the zone valve box also eliminates contamination issues – such as having to set up a tent in order to remove ceiling tiles.

NOTE: Shown above with EZ Backfeed assemblies assembled and installed. The EZ Backfeed assemblies will be shipped assembled with the exception: plugs will be installed in the gauge ports for compliance with NFPA 99 required pressure tests.

Alarm Installation

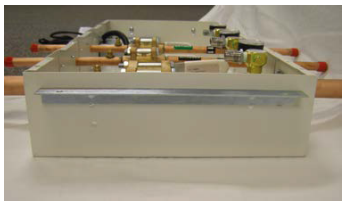
Installation of the Powerex alarm involves installing the rough-in back box, transducers, front panel and making the necessary conduit, plumbing and electrical connections. All installation and testing should be done in accordance with NFPA 99 or CSA Z7396.1. Zone valves must be installed in accordance with NFPA 99 or CSA Z7396.1. Verify the valve is in the fully open position. An internal nitrogen purge must be used during the brazing operation. The purge gas should flow away from the valve body. Brazing alloys per appropriate standards must be used. Before brazing, wet rags must be wrapped around the tube extensions next to the valve flanges to prevent overheating and possible damage to the valve seals. Direct the flame away from the valve body. The valve body temperature must not exceed 300 degrees F to prevent damaging the Teflon seals. Do not braze the opposite side of the valve assembly until after the first side has cooled.

⚠WARNING ***Electrical power intended for the alarm to be installed should be disconnected prior to installation.***

⚠WARNING ***This device should only be installed by qualified personnel. Installation should not be attempted by anyone not having general experience with the installation of devices of this nature.***

Rough-in Box Installation

This example is a rough-in box for a three gas three valve alarm and zone valve box. Your rough-in box should look the same or similar to this unit.



NOTE: The transducers, gauges and circuit board panel are shipped loose, for protection during shipment, and must NOT be installed until after the initial pressure test is completed.

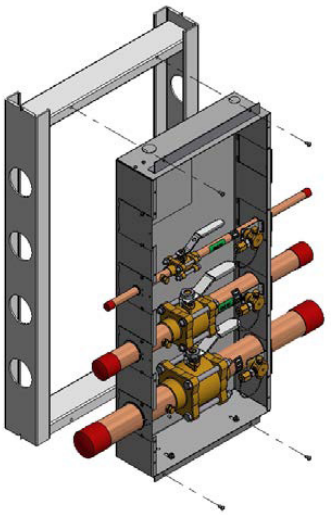
Refer to the building plans to determine the location of the alarm.

The contractor is to provide rigid mounting that will support the alarm box on both ends. The metal flanges provided on both ends of the rough-in box are to rest against the rigid mounting brackets. Screws (contractor provided) are to be driven thru the holes in the metal flanges into the mounting brackets. Flanges are adjustable to allow for a drywall depth of 1/2" to 1 1/8".

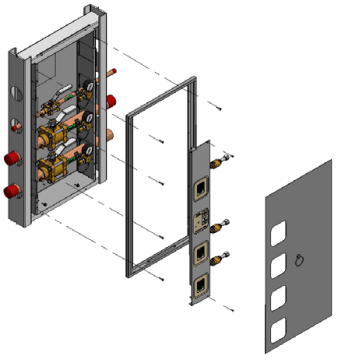
Mount alarm rough-in box so it will be flush or just below the finished wall surface using the adjustment feature on the flanges.

Rough-In Box Installation

1. Powerex Integrated alarm/ zone valve box should be plumbed with inlet gas on the left and the patient (use) side on the right.



2. The rough-in (back box) is shipped with a cardboard dust cover installed. You will need to remove the dust cover to install the rough-in and perform the initial pressure test. The dust cover should be re-installed after the pressure test to protect the valves until the wall covering (drywall, paint etc.) is complete.
3. The rough-in box should be installed in accordance with NFPA 99. The height above the finished floor will vary depending on the back box size. Fasten the valve box to horizontal braces installed between the studs so that the front edge of the rough in box will be flush or slightly recessed with the finished wall covering.



4. Before brazing, remove the plastic tube caps from the valves. Ball valves must be installed in accordance with "Installation of Ball Valves" instructions on page 8.
5. The system must be tested (per appropriate standards) to ensure that no cross-connections have been made. The system must be tested (per appropriate standards) for leaks. Gauges and transducers should not be installed until after the leak testing is completed. Excessive pressure will damage the gauges and transducers. Note: Pressure in the system will increase or decrease with temperature rise or fall.
6. After the system passes the leak test, gauges and transducers may be installed. Gauges and transducers must be installed on the downstream (patient) side of the valve. Pipe sealants used to install the gauges must comply with NFPA 99 or CSA Z7396.1. Use care to exclude pipe sealants from the valve cavity and from interior tube surfaces exposed to medical gas flow or vacuum service. Properly applied Teflon tape is an acceptable alternative to pipe sealants.
7. Mark the areas controlled by each valve on the labels provided on each valve.

8. After the wall covering is complete, the dust cover may be removed from the rough-in box and the window frame and window may be installed. **NOTE:** Remove protective film from both sides of window.

⚠WARNING ***Mis-connection of the gases could lead to serious or fatal injury to patients. Following installation, valves must be tested for cross-connection (per appropriate standards) to ensure that the intended services are correctly connected to the appropriate service lines.***

⚠WARNING ***Make certain the labeling coincides with the gas service, and areas controlled by the valve and that it is easily read.***

Installation of Ball Valves

Ball valves must be installed in accordance with NFPA 99 or CSA Z7396.1. Verify the valve is in the fully open position. An internal nitrogen purge must be used during the brazing operation. The purge gas should flow away from the valve body. Brazing alloys per appropriate standards must be used. Before brazing, wet rags must be wrapped around the tube extensions next to the valve flanges to prevent overheating and possible damage to the valve seals. Direct the flame away from the valve body. The valve body temperature must not exceed 300 degrees F to prevent damaging the Teflon seals. Do not braze the opposite side of the valve assembly until after the first side has cooled.

NOTE: the valve bolts may need to be re-tightened after brazing due to the effects of heating & cooling. Torque the hex nuts in ¼ turn increments, using a cross pattern until the proper torque setting is reached per the chart below:

Valve Size	Torque (in-lbs)
1.2" - 1"	100
1 1/4" - 1 1/2"	150
2"	270

The system must be tested (per appropriate standards) to ensure that no cross-connections have been made.

The system must be tested (per appropriate standards) for leaks.

Gauges and transducers should not be installed until after the leak testing is completed. Excessive pressure will damage the gauges and transducers.

NOTE: Pressure in the system will increase or decrease with temperature rise or fall.

After the system passes the leak test, gauges and transducers may be installed. Pipe sealants used to install the gauges must comply with NFPA 99 or CSA Z7396.1. Use care to exclude pipe sealants from the valve cavity and from interior tube surfaces exposed to medical gas flow or vacuum service. Properly applied Teflon tape is an acceptable alternative to pipe sealants.

Check shutoff valve handle operation for proper clearance from any obstructions.

⚠WARNING ***Mis-connection of the gases could lead to serious or fatal injury to patients. Following installation, valves must be tested for cross-connection (per appropriate standards) to ensure that the intended services are correctly connected to the appropriate service lines.***

Maintenance

1. Ball valves should be operated periodically and tested for closure ability and leakage. If seals stick or leak, they should be replaced.

2. Clean the exterior of the valve boxes routinely with soap and water. Strong solvents will damage the lexan window and the silk screened printing on the window.

3. The ball valves have a removable swing out body design which allows for the changing of internal components. All valve bodies can be accessed by loosening all bolts and nuts and removing only one bolt, at this point the body may be swung out for servicing.

⚠WARNING ***To protect the lives of patients, always notify the appropriate medical facility staff before shutting off the supply of medical gas or vacuum through a ball valve. Do not close ball valves except in cases of emergency. Authorized hospital personnel or staff should close ball valves in the event of fire, explosion or damage to the pipeline or equipment.***

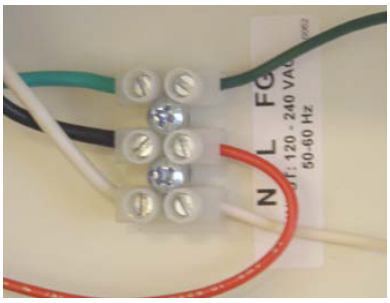
Wiring

The power supply is located in the top (left side) of the rough-in box. Remove the cardboard dust cover and panel covering the power supply. Make conduit connections for wiring from the facility emergency power source per NFPA 99.

To remove the power supply cover, loosen the two screws at the bottom of the cover and slide the cover to the right, then lift the cover over the screw heads. Slide the wiring harness strain relief to the left until it is free from the cover.

Use the 3/4” conduit knock-out provided on the top left side of the rough-in box to route conduit to supply either 120 or 240 VAC to the power supply. Note: Should optional low voltage wires be used, they should be installed in a separate conduit.

Route wires through the power supply conduit installed on the top left side of the rough-in box. Connect the 120 or 240 VAC facility emergency power source electrical wiring to the terminal strip provided on the lower left side of the box. (N = Neutral, L = Line (hot), FG = Field Ground)



Installing the Window Frame and Circuit Board Panel

After the wall covering and finishing have been completed, remove the cardboard dust cover and attach the window frame to the rough-in box using the 12-3115 8-32 x 3/4” screws provided.

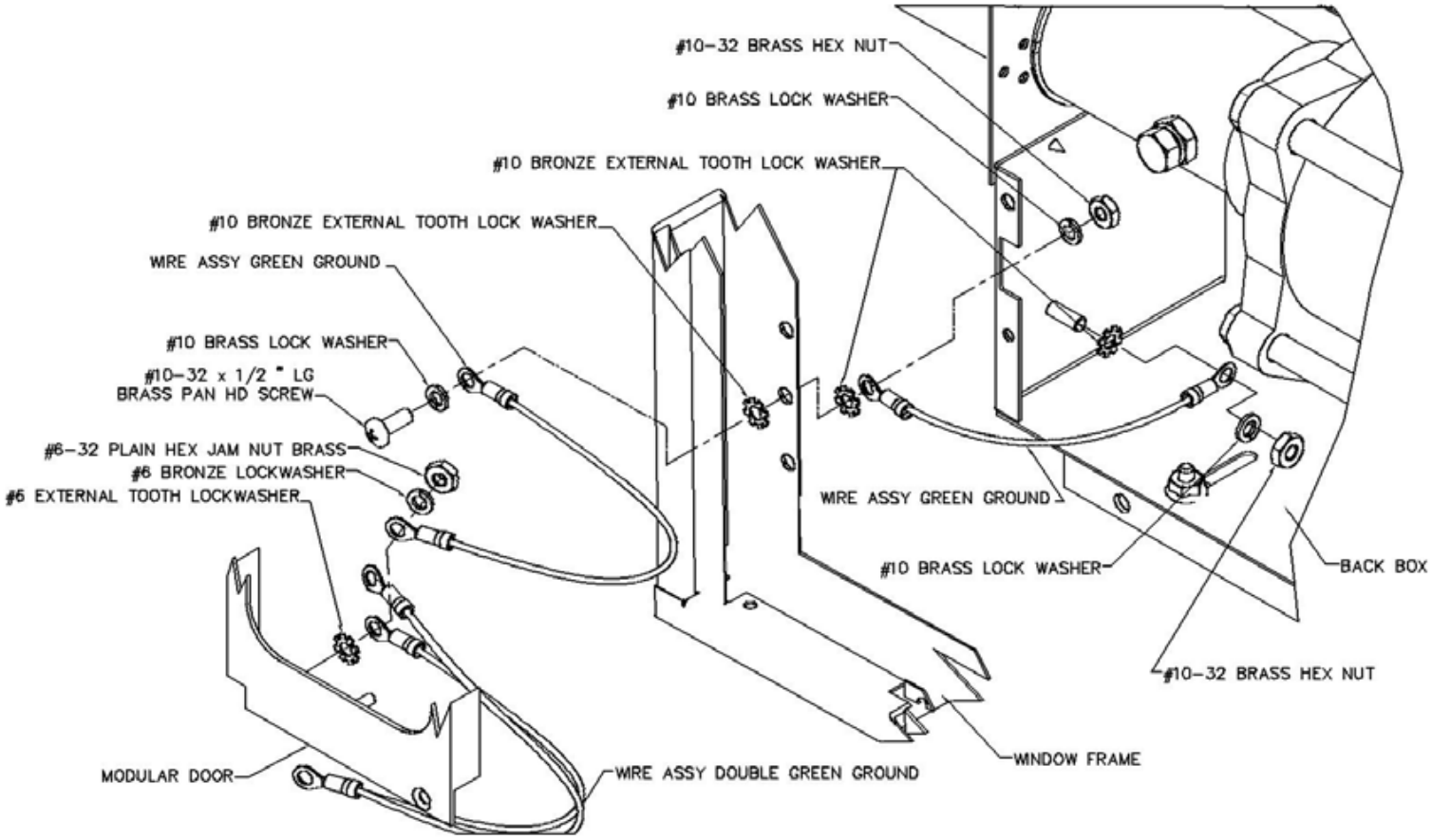
Temporarily hang the circuit board panel from the window frame by the bottom edge using one of the 12-3085 6-32 x 7/16” screws as shown. This will make it easier to assemble the ground wires.

This photo shows the ground wires partially assembled as supplied from the factory.

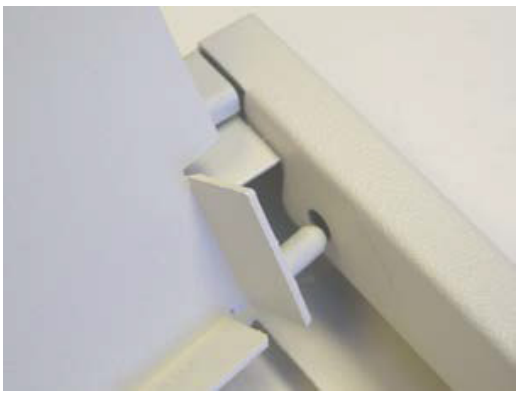
Assembling the Ground Wiring and Attaching the Circuit Board Panel

Assemble the ground wires as shown and attach the brass grounding screw to the bottom left corner hole in the window frame and rough-in box.

The finished ground wiring assembly should look like this. Remove the 12-3066 6-32 x 3/8" screw while supporting the circuit board panel.



Position the circuit board panel into the window frame so that the displays are in the normal reading position with the panel at 90° (open position). The window frame has built-in hinge pin holes on the left side at the top and bottom – as shown here. The circuit board panel has a mating fixed hinge pins. Insert the top hinge pin into the top hole first.

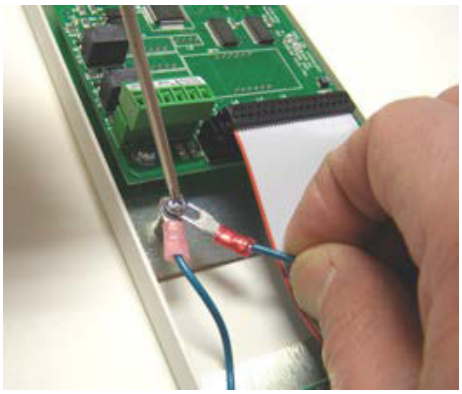


Insert the bottom hinge pin into the bottom frame hole.

Wiring the Circuit Board Panel

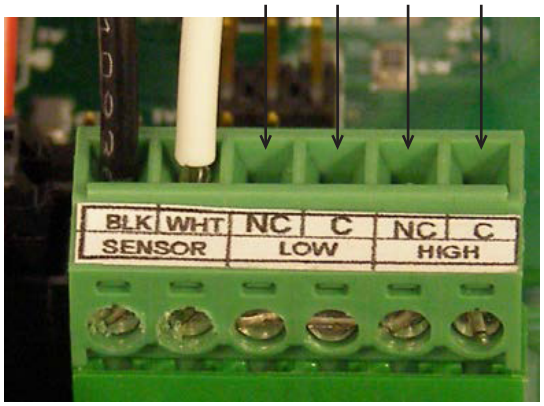
Attach the yellow/orange plug connector at the end of the wiring harness to the appropriate connector located at the bottom right corner of the button module circuit board as shown here. The plug should lock/clip into place. The plug can only be inserted one way.

There is a green ground wire in the wiring harness which must be fastened to the nearest grounding screw terminal on one of the gas board sub-plates.

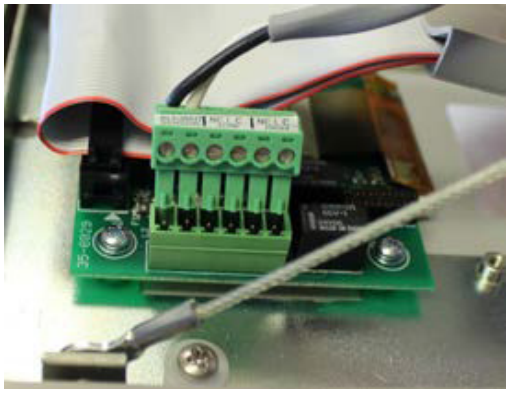


The wire terminal connector on the gas board has six wire connection slots. The two wires from the transducer should be installed in the BLK & WHT SENSOR slots. These are the two slots closest to the center of the gas board (as shown).

The other four connection slots are for optional remote signals of the low and high line pressure alarms.



The transducer plug may be removed from the gas module to make it easier to install the wires.



Gauges have been provided and packaged separately for protection during shipment. There are three different gauges for the different gas pressure applications; 0 – 30 in Hg for medical vacuum and WAGD service, 0 – 300 psig for high pressure (100 psig and above), and 0 – 100 psig for all other applications. Use oxygen safe Teflon tape on the threads and tighten wrench-tight until gauge face is facing forward. Pressurize each line and use oxygen safe leak test to verify each connection is free from leaks.

Installing the transducers and circuit board panel

The transducers have been shipped with gas specific DISS fittings and are labeled for a specific gas service. Match the transducer to the valve labeled with the same gas service and connect it (wrench tight) to the mating DISS gas fitting. Pressurize each line and use oxygen safe leak test to verify each connection is free from leaks.

When finished the gauges and transducers will look like this.

After all of the transducer wires have been attached and the transducers attached to the proper DISS gas connections, the circuit board panel may be closed and fixed in place using two each 12-3066 6-32 x 3/8" screws as shown here.

Visually verify that the appropriate transducer wire pair has been attached to the appropriate gas module by looking at the front of the alarm panel. If there is not an Error Condition or a System alarm, the proper (matching gas service) transducer has been connected to the gas board.

⚠WARNING ***If the transducer leads are shorted together – the display may freeze. To clear this condition, turn power off to the alarm for a few seconds, correct the wiring, and then turn power back on.***

Alarm Start Up

A toggle switch is provided to control the power supplied to the alarm. To restore power to the circuit feeding this alarm panel, the toggle switch on the front of the power supply should be placed in the ON position.

Check the green power LED indicator on the front of the button module. It should be illuminated.

If you haven't already, you are now ready to pressurize the piping system to normal operating pressures. The gas circuit board shown here is a Medical Air module at normal operating pressures.

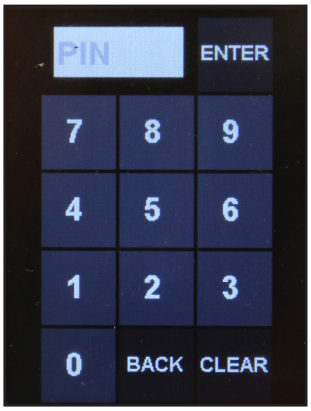
The window has been shipped with a clear plastic protective covering on both sides. This should be removed before installing the window into the window frame.

Programming the Alarm

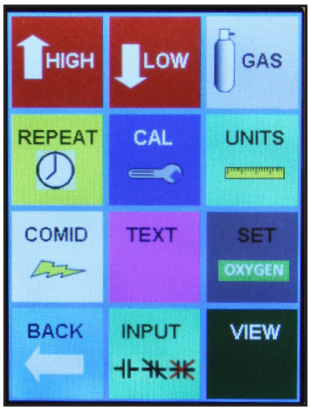
This section covers the procedures to follow in order to configure a module with site specific information such as; room / area coverage information, re-programming the high and low alarm points and emergency preparedness instructions. **NOTE:** Only authorized personnel should program the alarm! It is important to note that while the panel being programmed is in the program mode, it is not monitoring the medical gas system and alarm conditions will not trigger an alarm.

Accessing the Alarm Program Mode

To program the alarm, the circuit boards must be placed individually, one at a time in the program mode. To place a circuit board in the programming mode, simply touch the board to be programmed. The display should change to this security screen.



All alarm panels have been pre-programmed to allow access with the pin # 0711. Type in 0711 and touch Enter. You will have 30 seconds to make selections when programming. After 30 seconds of no key touch, the display will return to its standard view and any information which has not been saved will be lost.



The next screen which will appear is the function options. There are eleven different function options. Simply touch the icon representing the function you wish to program. The following table provides a brief description of each function:

Function	Description
High	Set high alarm set point
Low	Set low alarm set point
Gas	Set gas service
Repeat	Set repeater delay (in minutes)
Cal	Change calibration of pressure reading
Units	Change units of measure
ComID	Change Com ID number
Text	Input room / area and emergency instructions & master alarm signal selection menu
Set	Change labelling and latching
Back	Return to previous screen
View	Synopsis view of programming

Programming Text and E Text

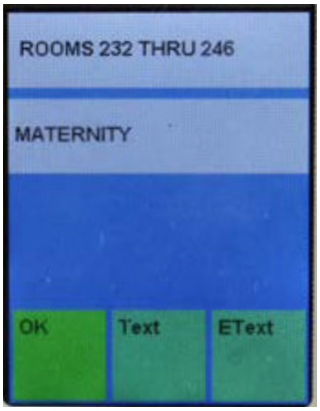
After placing the board in the program mode and touching the Text function icon, the text input screen (shown here) is displayed. To enter text such as the room(s) or area(s) monitored by the alarm panel, touch the Text button. To enter emergency instruction text, touch the EText button. The two white areas represent a top and bottom line of text which will be displayed at the bottom of the gas board display. Touch the top white area to enter the top line of text or the bottom white area to enter the bottom line of text.

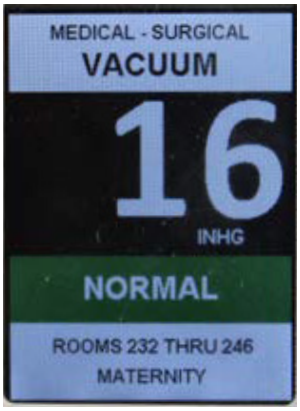
Use the character keypad (shown here) to enter the text message you would like displayed. Note: each text display line is limited to 20 total characters or spaces.

- When finished touch Enter
- On the next screen touch OK
- On the next screen touch Back
- On the next screen touch Save

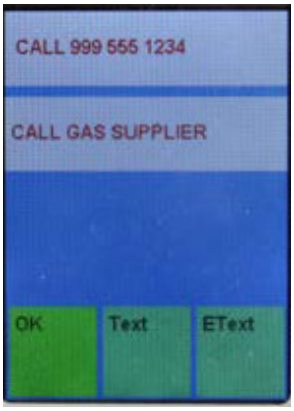
NOTE: To delete a line of text after it has been saved you must press the SP button.

Below are examples of a completed Text display screen and how it appears as displayed as part of gas display. When an alarm occurs the emergency instructions will appear alternately with the normal information label Note: the text will automatically be centered.





E Text instructions are entered in the same method as described above. Note that E Text instructions will appear in red and will be displayed alternately with the normal display screen only when the board is in an alarm condition.

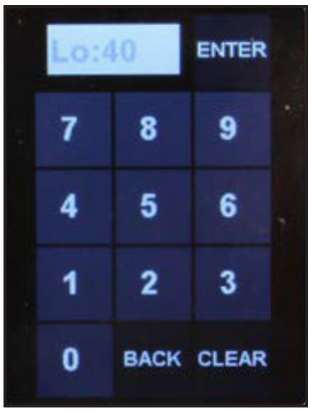


Programming the High & Low Alarm Pressure Set Points

After placing the board in the program mode and touching the High function icon, the high line pressure set point and programming keypad is displayed. The currently programmed high pressure alarm set point is displayed in the white box in the top left corner. If the gas module being programmed is a typical 50 psig delivery pressure gas, the board has been pre-programmed at the factory with the high line pressure set point at 60 psig, so the display should show the number 60. If you wish to change this setting:

- type in the new pressure
- touch Enter,
- on the next screen touch Back
- on the next screen touch Save to adjust the pressure setting.

After placing the board in the program mode and touching the Low function icon, the low line pressure set point and programming keypad is displayed. The currently programmed low pressure alarm set point is displayed in the white box in the top left corner. If the gas module being programmed is a typical 50 psig delivery pressure gas, the board has been pre-programmed at the factory with the low line pressure set point at 40 psig, so the display should show the number 40. If you wish to change this setting:



- type in the new pressure
- touch Enter
- on the next screen touch Back
- on the next screen touch Save to adjust the pressure setting.

NOTE: The alarm is designed with a safety feature so that the high and low set points must be at least 1 (psig / in Hg), 1 (bar) or 1 (kPa) increments apart. The high set point will not be able to be set below the low set point and vice versa.

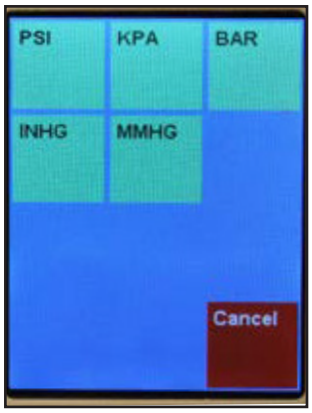
Programming the Repeater Delay

After placing the board in the program mode and touching the Repeat function icon, the remote signal input screen (shown here) is displayed. The current repeater delay programmed is displayed in the white box at the top. In the example shown here, Rp 10 means the repeater delay is programmed for 10 minutes. Entering zero will disable the repeater. Use the keypad to type in the number of minutes you would like (maximum is 240),

- then touch Enter
- on the next screen touch Back
- on the next screen touch Save

Programming the Units of Measure

After placing the board in the program mode and touching the Units function icon, the units input screen (shown here) is displayed. The alarm panel has been pre-programmed with the units desired based on the part number which was ordered. The positive gas service options are; PSI, kPa and BAR. The negative gas service options are; inHg and mmHg. Simply



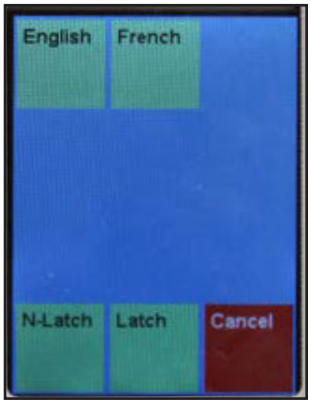
- touch the button you would like to re-program the units
- then touch Enter
- on the next screen touch Back
- on the next screen touch Save

Programming the Gas Service (Area Alarm)

After placing the board in the program mode and touching the GAS function icon, the gas input screen (shown here) is displayed. The alarm panel has been pre-programmed with the gas service desired based on the part number which was ordered. To select a different gas service use the double arrow left or right buttons to scroll thru the database of gas services until you find the one you need

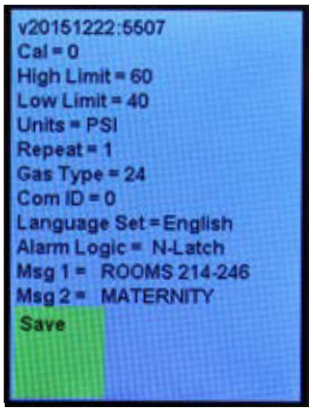
- then touch Enter
- on the next screen touch Back
- on the next screen touch Save

Programming Language and Latching or Non-latching Alarm Relays



After placing the board in the program mode and touching the Set function icon, the sets input screen (shown here) is displayed. The alarm panel has been pre-programmed with the language desired based on the part number which was ordered. Choose a different language set by simply touching the button you would like. Your selection will take you immediately to the next screen on which you should touch Back and on the next screen touch Save. You will need to re-enter the program mode and again select the Set function icon to choose Latching (LATCH) or Non-Latching (NLATCH) software. Your selection will take you immediately to the next screen on which you should touch Back and on the next screen touch Save.

View Screen



After placing the board in the program mode and touching the VIEW function icon, the view screen (shown here) is displayed. The view screen provides a summary view of all of the programming for the circuit board. It does not provide any programming options. It is simply a view only screen. The first line provides the software version. The Cal value represents any re-programmed change from the factory calibration. The High and Low Limit values are the high and low pressure alarm set points. The Units value is the units of measure. The Repeat value is the number of minutes in which an alarm will be repeated after it has been silenced but remaining in an alarm condition. The Gas Type number is a code (see table below) which corresponds to the gas service which has been programmed for the board. The Com ID number is the communication ID number which has been programmed for the board. The Language Set is an abbreviation for the label set which has been programmed for the board. The Alarm Logic is the latching or non-latching software which has been programmed for the board. MSG 1 are the rooms or area(s) covered by the alarm. MSG 2 are the emergency instructions programmed for the board.

The gas boards are pre-programmed for a specific gas service from the factory. After placing a gas board in the program mode, it is possible to change the gas service of the board. It is an NFPA 99 requirement that the transducer gas service match the gas service of the gas board to which it is connected. The following list cross references the number that is actually displayed on the gas board numeric display with the full names of the gases:

Gas # Displayed	Gas Service	Transducer Type
12	Nitrogen	250
24	Oxygen	100
04	Nitrous Oxide	100
08	CO_2 or CO_2-O_2 Mix	100
22	Medical Vacuum	30
32	WAGD/AGSS	30
16	Medical Air	100
06	Helium or Heliox	100
H16	Instrument Air	250
H24	Hyperbaric Oxygen	100
H08	Medium Pressue CO_2	100
SP	Gas Mixture	100
HSP	High Pressure Gas Mix	250
3SP	Tri-Gas	100

Adjusting the Digital Pressure Calibration

The digital line pressure may be adjusted slightly (per the chart below) by following the simple procedure below. *This can be done by one person at the alarm panel – no need to open/ adjust the transducers!*

Range of adjustment:

VAC or EVAC /WAGD ± 1 inHg

100 psig transducers ± 3 PSI

250 psig transducers ± 5 PSI

After placing the board in the program mode and touching the CAL function icon, the calibration input screen (shown here) is displayed. The alarm panel has been calibrated and programmed and does not ever require recalibration. If you wish to slightly change the calibration (usually to match another alarm panel in immediate area) you may. The number displayed in the white box at the top of the display is the current pressure reading. Simply

- touch the Down or the Up button until you achieve the pressure reading desired
- touch OK
- on the next screen touch Back
- on the next screen touch Save

Programming the Board Com ID

Note: This feature is used when the alarm is used in conjunction with the optional Ethernet module or as a component in a wireless master panel.

Note: When used in conjunction with the Ethernet module, each circuit board must have a sequential Identification Number from 1 to 16 based on its position in the alarm panel. 1 thru 4 would be from the top of the second slot to the bottom of the second slot. 5 – 8 would be from the top of the third slot to the bottom of the third slot, etc.

Note: When used as a component in a wireless master. Each 8 remote signal dry contact circuit board must have a UNIQUE sequential Identification Number from 1 to 8 based on its position in the alarm panel. For additional information see the Powerex Wireless Master Alarm literature.

After placing the board in the program mode and touching the COMID function icon, the remote signal input screen (shown here) is displayed. The current Com ID # programmed is displayed in the white box at the top. Entering zero will disable the Com ID for this board. Use the keypad to;

- type in the Com ID number you would like
- then touch Enter
- on the next screen touch Back
- on the next screen touch Save.

Programming Ethernet/Rabbit Boards

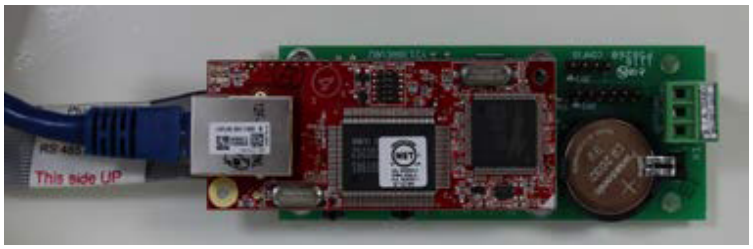
(e-mail/text messages, accessing alarm website, interface Modbus with building automation system & access event log).

NOTE: Networking options only work when used with manufacturer supported software systems (currently Windows 7 or newer). System router ports must be configured for 'half duplex'.

The Ethernet/rabbit board module (photo at right) may be ordered initially as part of the alarm or added later as a simple retro-fit assembly. To install the Ethernet kit, follow the installation instructions per Appendix F. To program the rabbit board, you will need to download Real Term: Serial Capture Program. This is a free software download available on the internet. You will want to install the Real Term software on a laptop so that you have the mobility to bring the laptop close to the alarm panel. You will also need a 35-3033 rabbit board programming kit. NOTE: If your operating system doesn't pull in the driver for the 35-5069 cable, you must download the driver from the website.

http://www.ftdichip.com/Drivers/VCP.htm

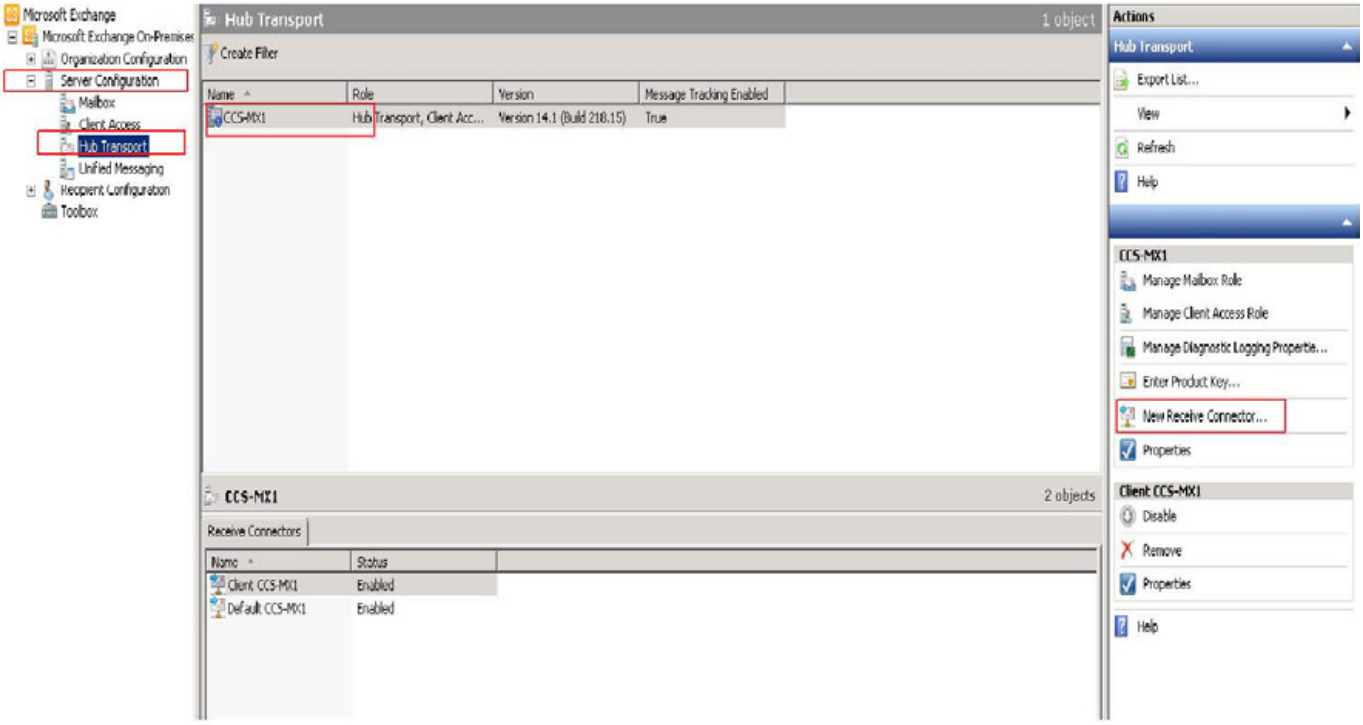
Always turn the power off to the alarm panel before making any electrical connections or disconnections. Warning: Uncoupling the rabbit board from the Ethernet board (red and green boards in above photo) will result in loss of all of the programming. After the Ethernet kit is installed in the alarm panel and the Real Term: Serial Capture Program software is installed on a laptop and the 35-3033 rabbit board programming kit is connected properly, you are ready to begin. **NOTE:** All commands are issued from the command prompt over the serial port. Set the laptop's serial port to 9600 8n1. Restore power to the Ethernet/rabbit board.



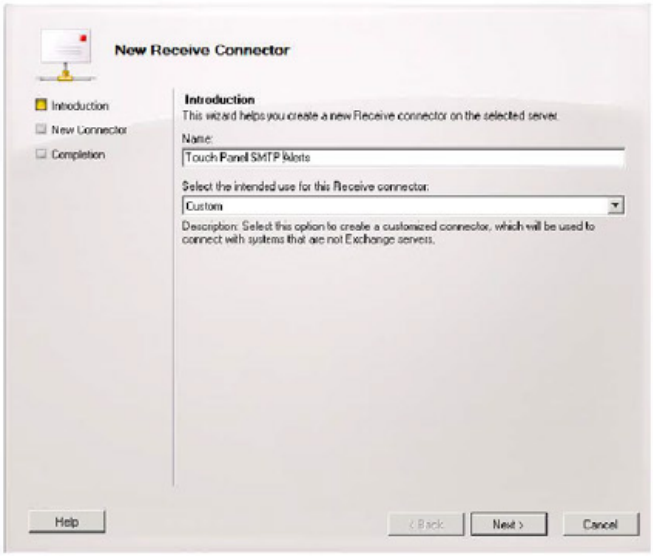
Create Receive Connector – Exchange 2007/2010

"SMTP" (Simple Mail Transfer Protocol) is one of the most common ways of sending e-mail. SMTP is a simple text conversation across a TCP/IP connection. The Email Server resides on port 587, and so, that is what the rabbit board SMTP _ PORT is currently defined.

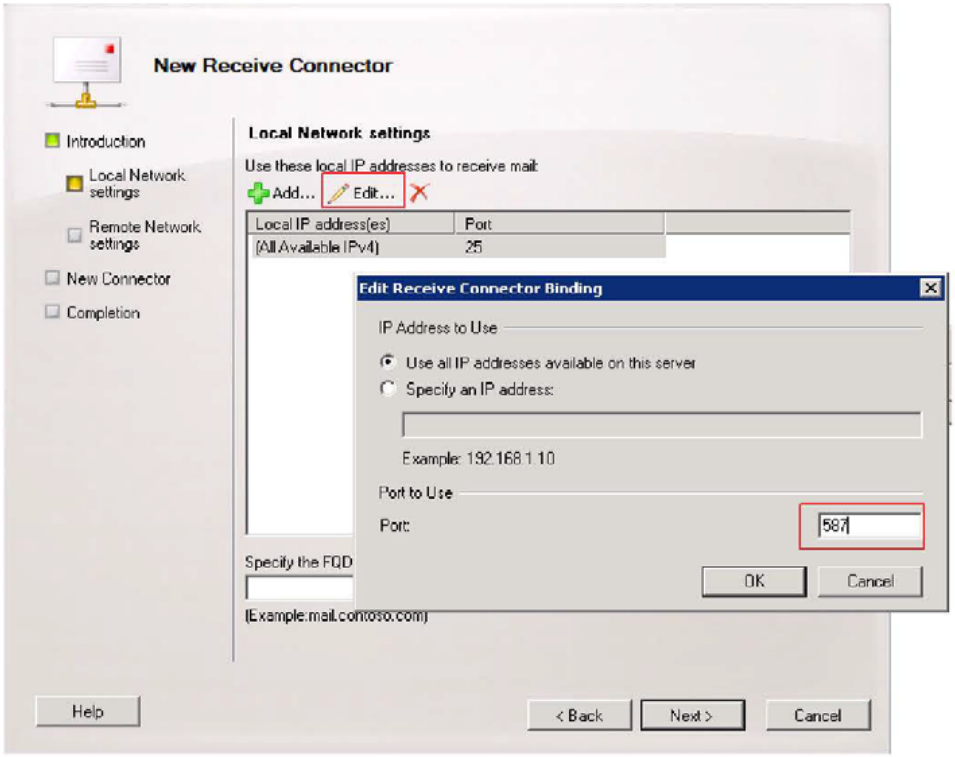
1. Open the Exchange Management Console.
2. Expand Server Configuration.
3. Click on Hub Transport.
4. Select the server name on the right hand side.
5. In the Toolbox Actions. Click on **New Receive Connector**.



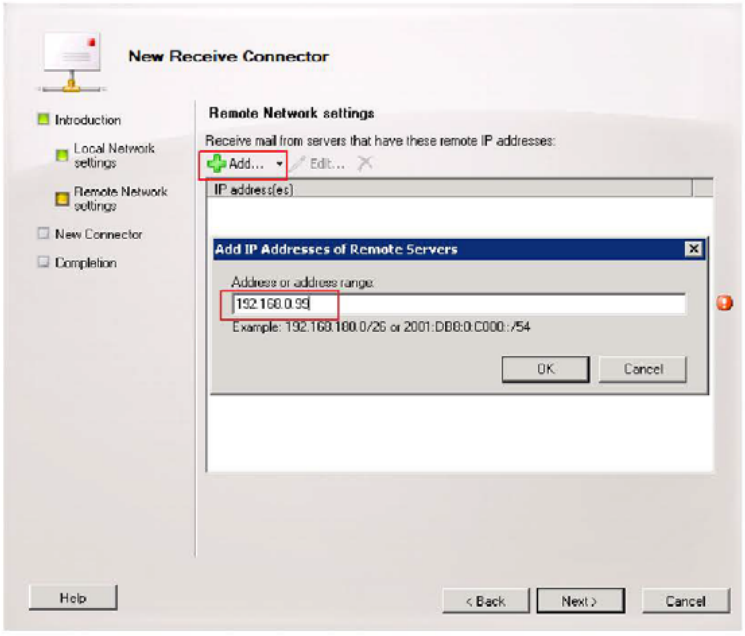
6. In the **New Receive Connector** wizard enter a Name for the connector and leave the Intended use set to Custom then click [Next>].



7. In the **Local Network Settings** Click Edit and change the Port to Use from 25 to 587 and click [OK] then Click [Next>].

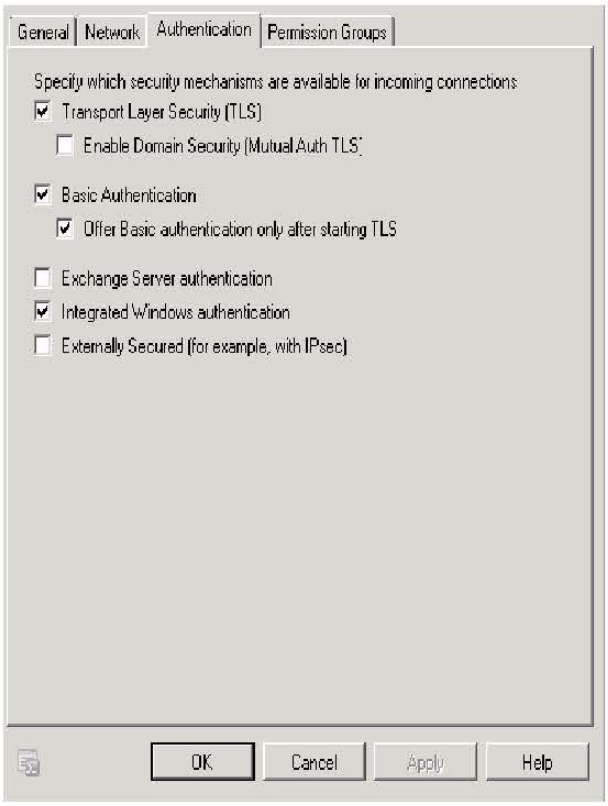


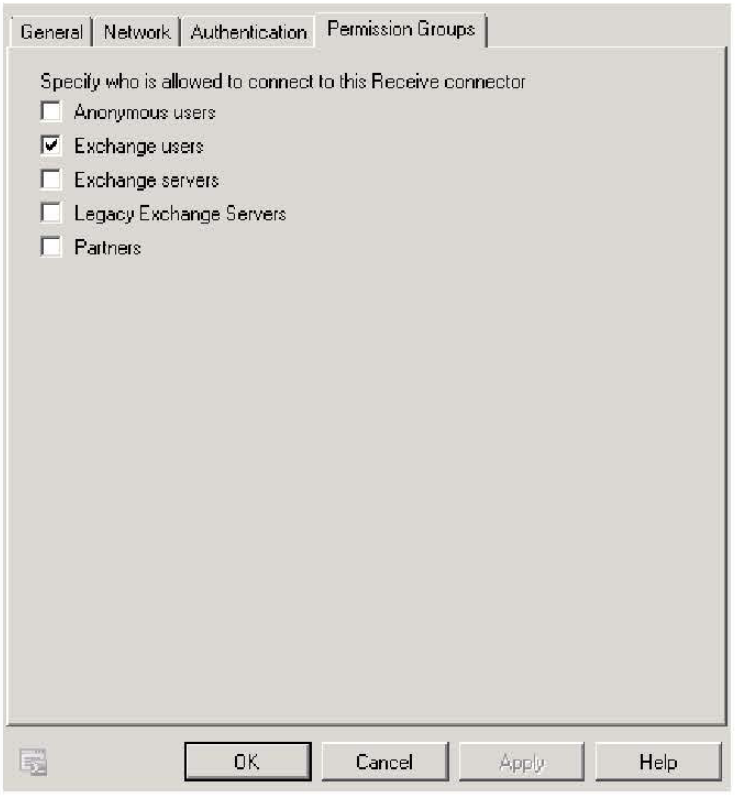
8. In the **Remote Network Settings** click on the red **X** to delete the default IP range of 0.0.0.0-255.255.255.255 then click Add
9. In the **Add IP Address of Remote Servers** enter the IP address of your Rabbit Board and click [OK] then [Next>].



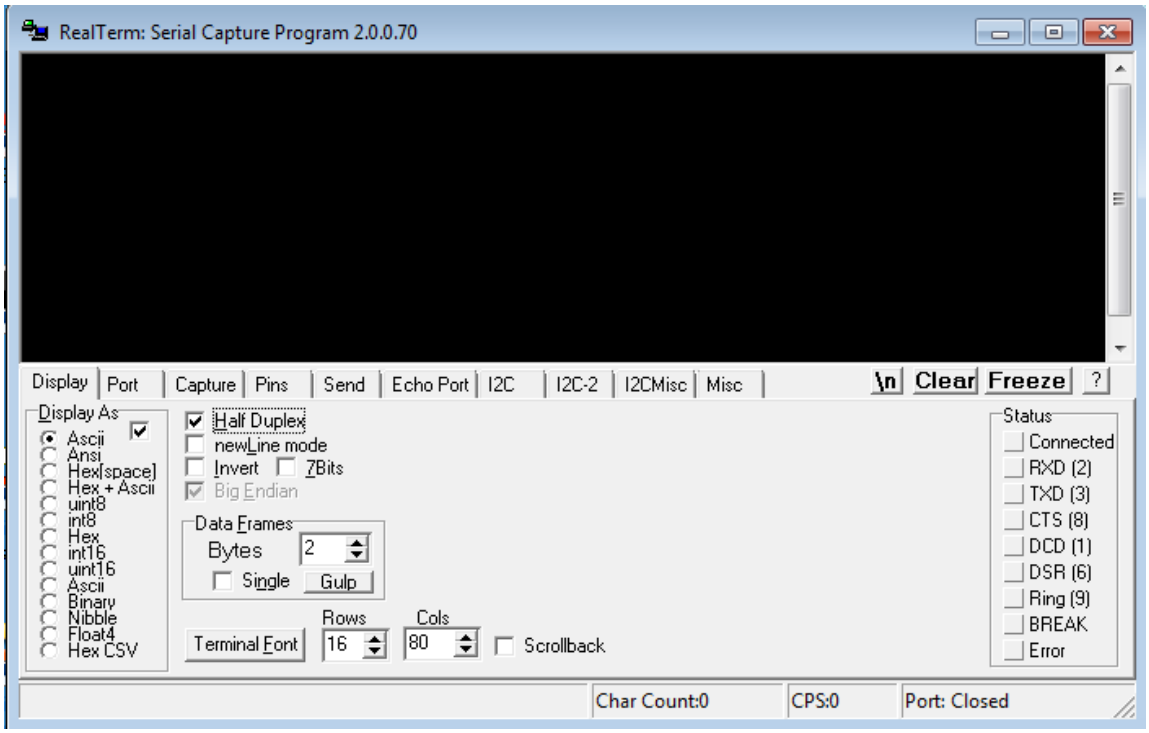
10. on the **New Connector** configuration summary screen click [New].

11. Once the new receive connector is successfully created right click on it in the list of Receive Connectors and select Properties.
12. Configure the Authentication and Permission Groups tabs as illustrated below and click [OK].



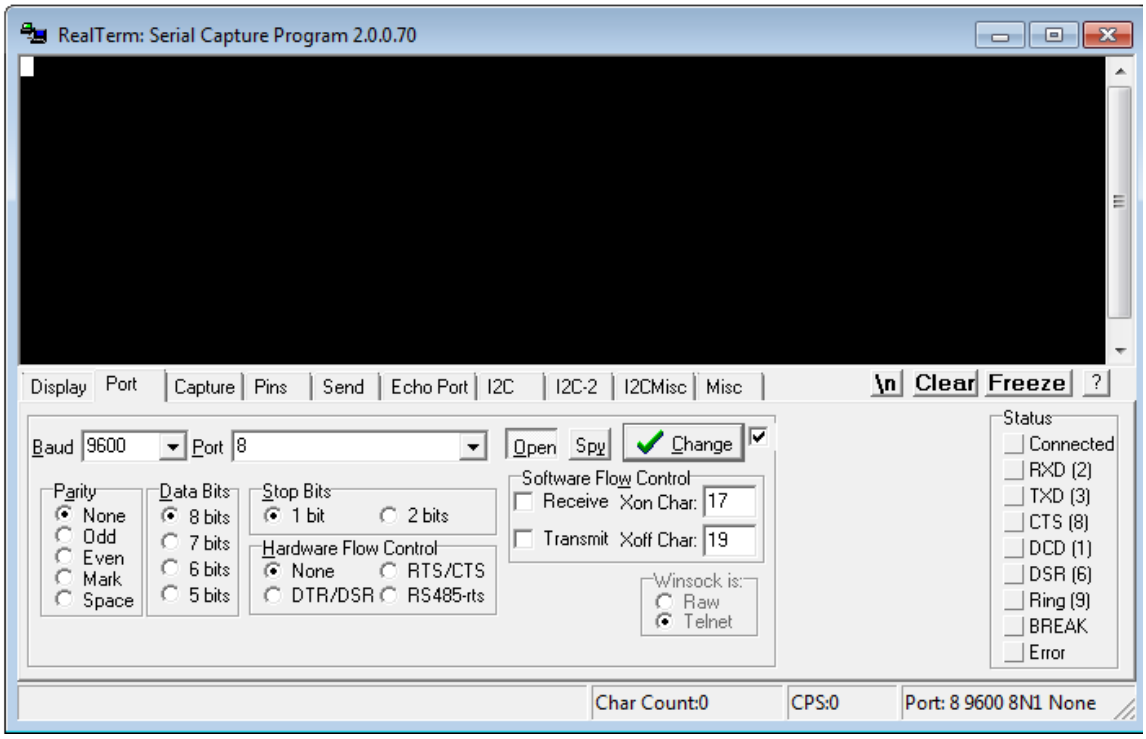


Launch the Real Term: Serial Capture Program. The set-up screen should look like this. Under the Display Tab check the Half Duplex Box.



Under the Port Tab;

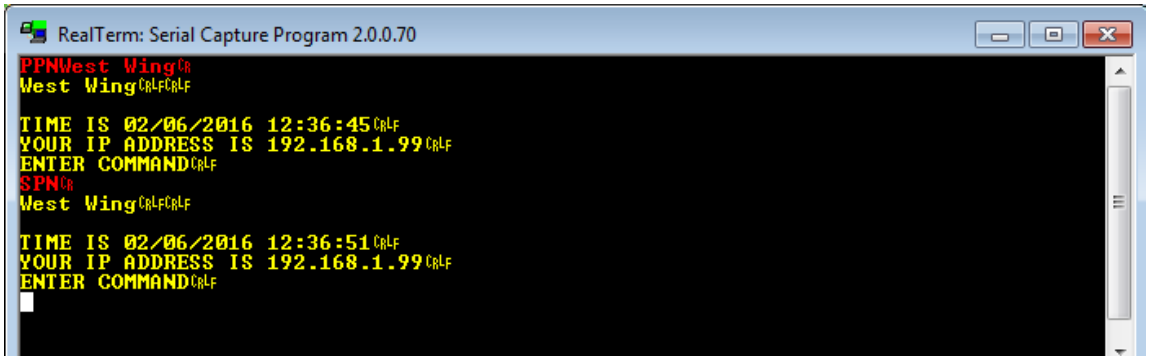
1. Select a baud rate of 9600
2. Leave the defaults of Parity= None, Data Bits = 8, and Stop Bits = 1
3. Select the port in use on the laptop
4. Click the Open button



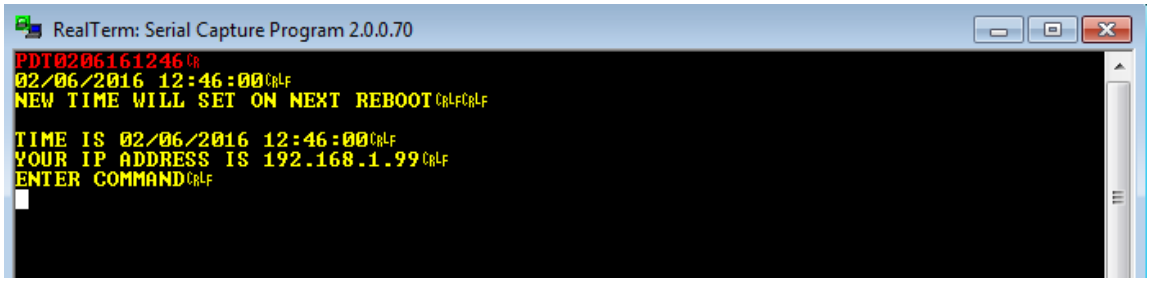
To set up a new Ethernet/Rabbit board, the following 4 commands must be completed:

INIT (Initialize) – this command MUST be run first after installing a new rabbit board or after if a battery was replaced on the rabbit board when the alarm panel was not under 120 VAC power.

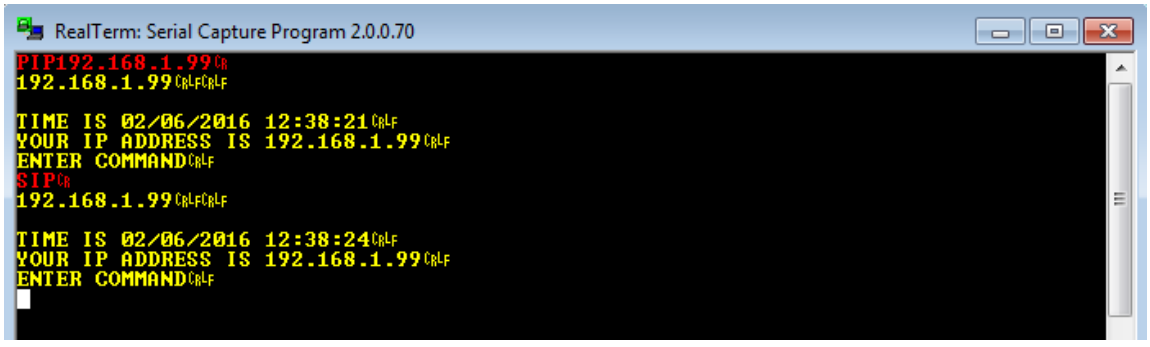
PPN (program panel name) – this command programs the name of the alarm panel as it will be displayed on the website and recorded in the event log. In the example below, we have named the alarm panel West Wing.



PDT (program date/time) – this command programs the date and time as it will be displayed on the website and recorded in the event log.

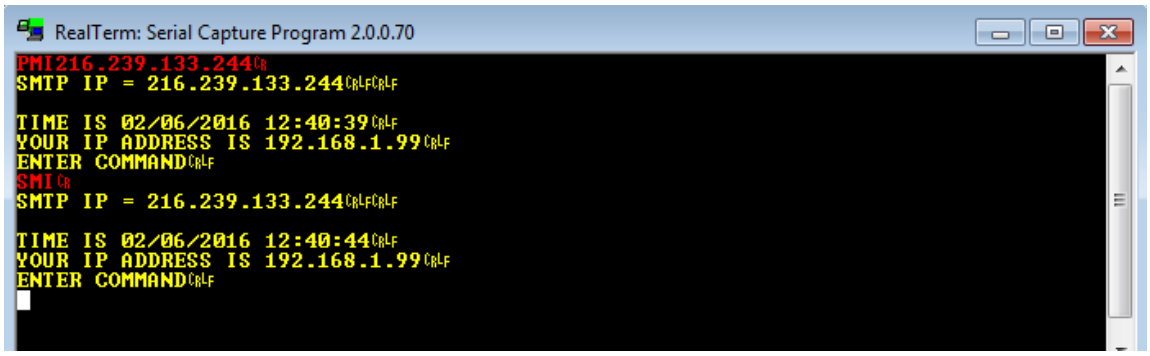


PIP (program panel IP) – this command programs the rabbit board's IP address.

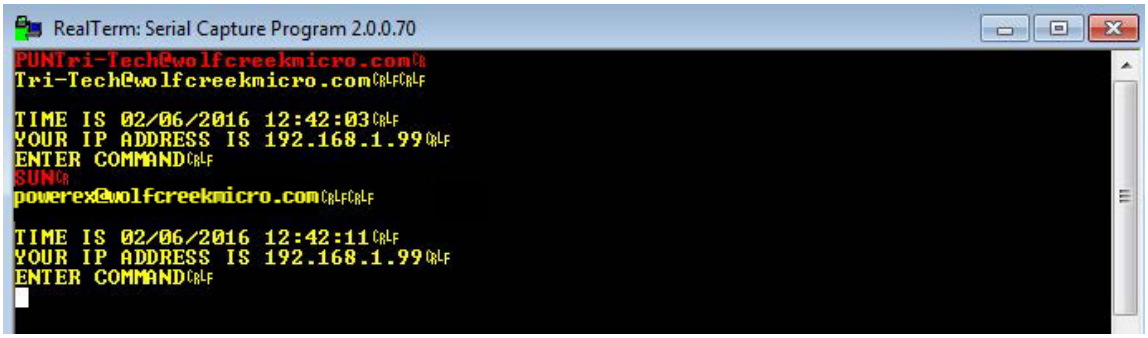


To set up users to receive e-mail or text notifications when alarm conditions occur, the following 4 commands must be completed:

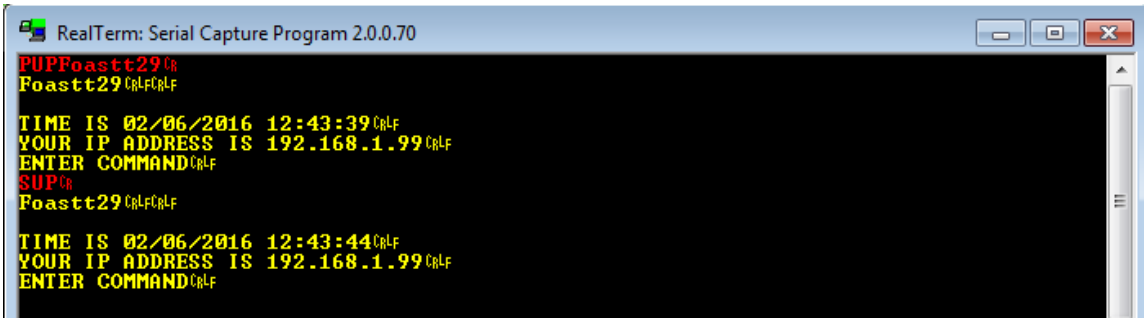
PMI (program SMTP mail server IP) – this command establishes the mail server IP address.



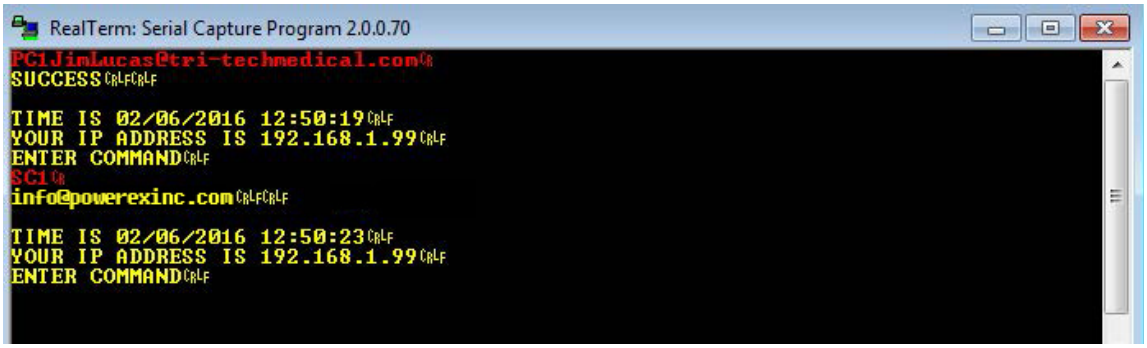
PUN (program user name) – this command establishes the SMTP user name.
In the example below, we have used powerex@wolfcreekmicro.com.



PUP (program user password) – this command programs the SMTP password. In the example below, we have used Foastt29. (Case Sensitive).

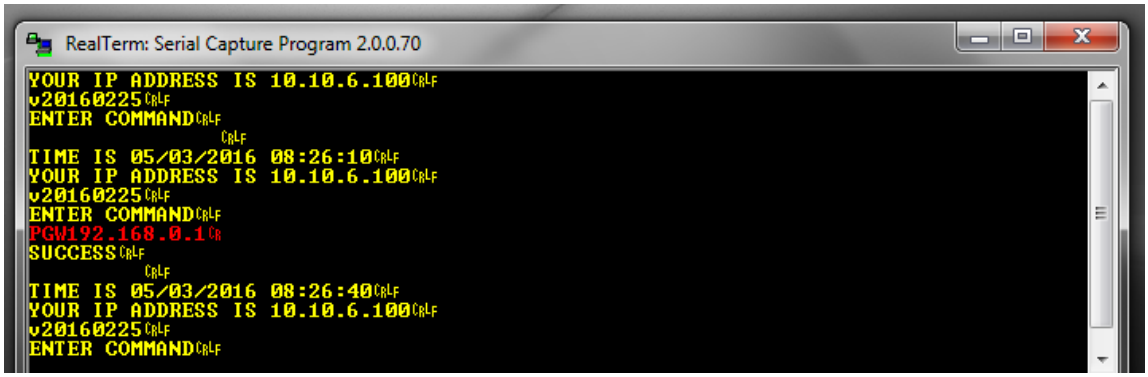


PCx (program contact) – this command is used to program a contact to be notified where x is the contact number. The contact number(s) will be displayed on the event log. Up to five contacts may be programmed. See Appendix H for Text Message carriers access information.

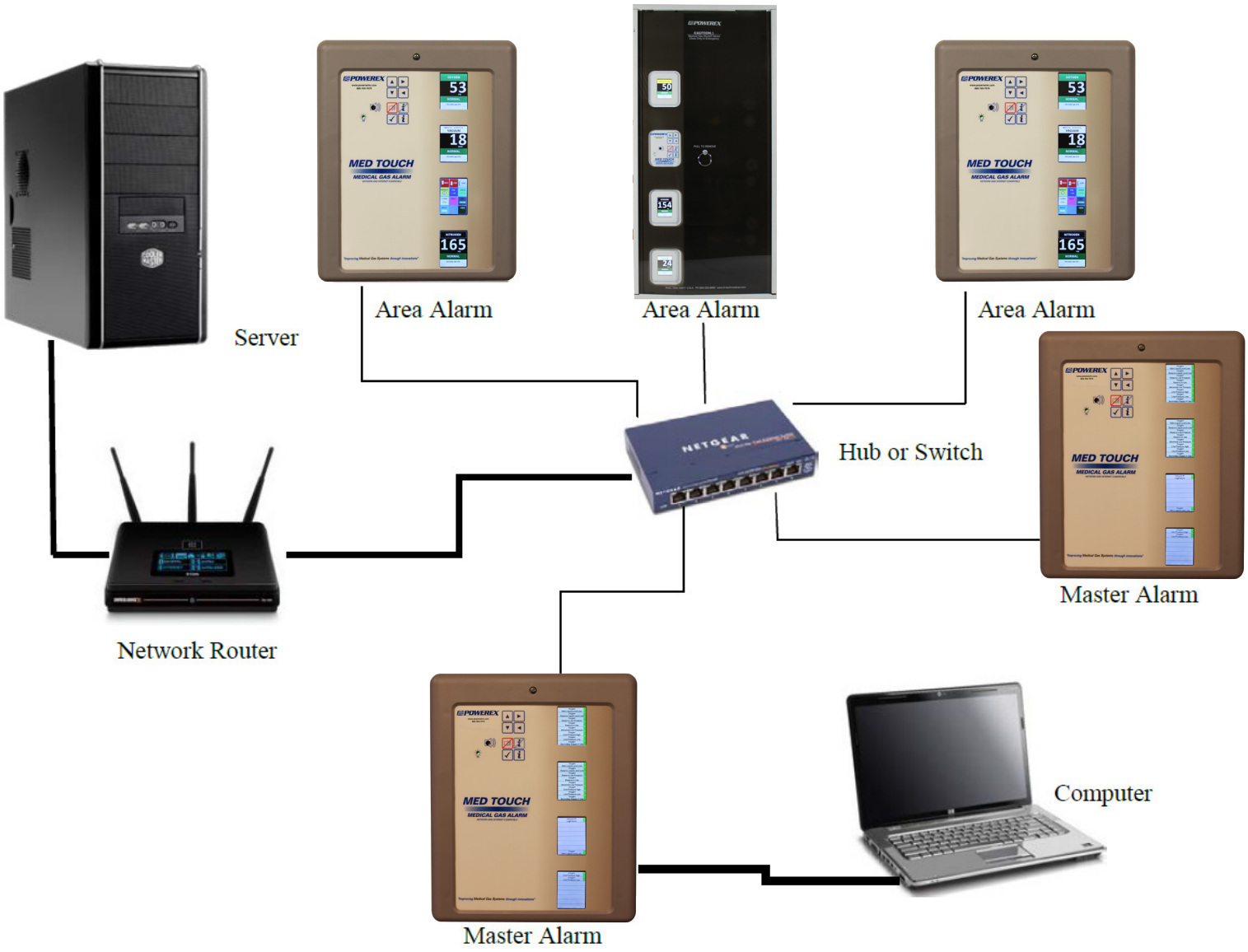


To set up communication through the facilities network server with the internet, the Program Gateway must be used.

PGW (program gateway) – this command establishes communication from the alarm rabbit board through the facilities network server to the internet.



Below is an illustration of a simplified typical managed network at a facility. Both the Server's IP address and Gateway address must be programmed into the Ethernet/rabbit board of any alarm panel desired to be connected to the internet.



The following additional commands are available for reviewing and testing:
SCx (show contact) – this command is used to verify the contact entry. For example - SC2 would display the contact entry for user #2.
MCx (test command) – this command is used to verify that a contact and e mail server is set up correctly. It sends a test e mail to that contact.

Following is a complete list of the available commands:
All commands are issued from the command prompt over the serial port. Set the PC's serial port to 9600 8N1.
Boot the rabbit board.

INIT // INIT SETUPS.
!!! IMPORTANT !!! This MUST be run first on a new board or after battery replacement. Usage: INIT

SIP // SHOW IP. SPN // SHOW PANEL NAME.
SMB // SHOW MODBUS ID. SMI // SHOW SMTP MAIL SERVER IP.
SUN // SHOW USER NAME. SUP // SHOW USER PASSWORD.
SDT // SHOW DATE/TIME. SAL // SHOW ALARM LOG.
SGW // SHOW GATEWAY. SCx // SHOW CONTACT.
Usage: Enter the command as shown.

SCx // SHOW CONTACT where x is contact number 1-5. Usage: SC1 will show email contact 1 of 5.

PPN // PROGRAM PANEL NAME. Usage: PPNMyPanel will set the Panel Name to MyPanel.

PMB // PROGRAM MODBUS ID. Usage: PMB01 will set the Modbus ID to 1.

PDT // PROGRAM DATE/TIME. Usage: PDT0129160842 will set RTC to Jan 29th, 2016 at 8:42am. PDT0203162042 will set rtc to Feb 3rd, 2016 at 8:42pm.

PIP // PROGRAM IP. Usage: PIP192.168.0.50 will set the rabbit board IP address to 192.168.0.50

PGW // PROGRAM GATEWAY. Usage: PGW192.168.0.1 will set the gateway IP address to 192.168.0.1

PMI // PROGRAM SMTP MAIL SERVER IP. Usage: PMI192.168.0.50 will set the SMTP mail server to 192.168.0.50; PMI will clear the SMTP mail server.

PUN // PROGRAM USER NAME. Usage:PUNMyUserName will set the SMTP user name to MyUserName; PUN will clear the user name.

PUP // PROGRAM USER PASSWORD. Usage:PUPMyPassword will set the SMTP password to MyPassword, (Case Sensitive); PUN will clear the password.

PCx // PRGRAM CONTACT where x is contact number 1-5. Usage: PC1Name@mymail.com will set contact 1 to Name@mymail.com; PC1 will delete the contact.

MCx // MAIL CONTACT where x is contact number 1-5. Usage: MC1 will send contact 1 a test email.

To setup a new Rabbit board

1. INIT
2. PPNPanelName
3. PDT0129160842 replace with current date and time.
4. PIPx.x.x.x replace x's with board's IP address.
5. PGWx.x.x.x replace x's with gateway's IP address.

If SMTP mail server is to be used

1. PMIx.x.x.x replace x's with Server's IP address.
2. PUNMyUserName
3. PUPMyPassword (Case Sensitive)
4. PCxname@email.com and/or PCx14567890123@vtext.com up to 5 contacts total.
5. Use the show and test mail commands as necessary to check setups.

Website Access

Web access to the overview and alarm log pages is designed to be fully functional without any setup. As long as the user can 'ping' the rabbit board all they have to do is point a browser at it. In the case of the default IP address (192.168.1.99) not being appropriate for their network they would then need to issue a PIP command with the IP address desired, ex. PIP192.168.0.55.

Alarm Displays & Functions

Button Module

Power on Indicator

The power on indicator (green LED) is illuminated whenever electrical power (120 or 240 VAC) is connected to the alarm and the on/off switch is turned on.

Test Button

When the Test button on the front panel is pressed, the alarm illuminates all segments of all lights and LED's and sounds the buzzer.

Alarm Silence

In the event of an alarm condition an audible alarm sounds. The audible alarm can be silenced by pressing the alarm silence button. The alarm will alternate displaying the rooms/area monitored with the emergency instructions until the alarm condition is rectified. Depressing the silence button will silence the alarm for approximately 10 minutes (factory setting). After approximately 10 minutes, the audible alarm will sound again. (See alarm operation section on page 20 for more detail).

View Last Event Alarm History Button

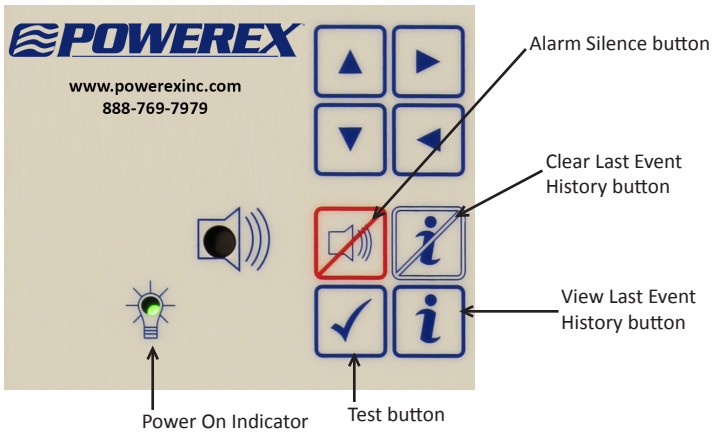
The Last Event History button may be pressed and held at any time to view last event alarm history. Viewing alarm history is only active while the Last Event History button is pressed, releasing the button returns the alarm to normal operation. Pressing the Last Event History Button will display the following:

Gas (Area) and Remote Signal Transducer Modules – The High and/or Low Pressure indication will be displayed along with the actual highest or lowest pressure which occurred.

Remote Signal (Master) Module – If there was an alarm condition for any Remote Signal the Red LCD will be illuminated. All other LCD's will be off.

4-20 mA Module – The High and/or Low value indication will be displayed along with the actual highest or lowest value which occurred.

Clear Last Event Alarm History Button – To clear Last Event Alarm History you simply press the Clear History button.



▲ (up arrow)

The up arrow may be pressed & held at any time to display the high line pressure alarm set points of the gas module (area) boards, the remote signal transducer boards and the 4 – 20mA boards.

▼ (down arrow)

The down arrow may be pressed & held at any time to display the low line pressure alarm set points of the gas module (area) boards, the remote signal transducer boards and the 4 – 20mA boards.

► (right arrow)

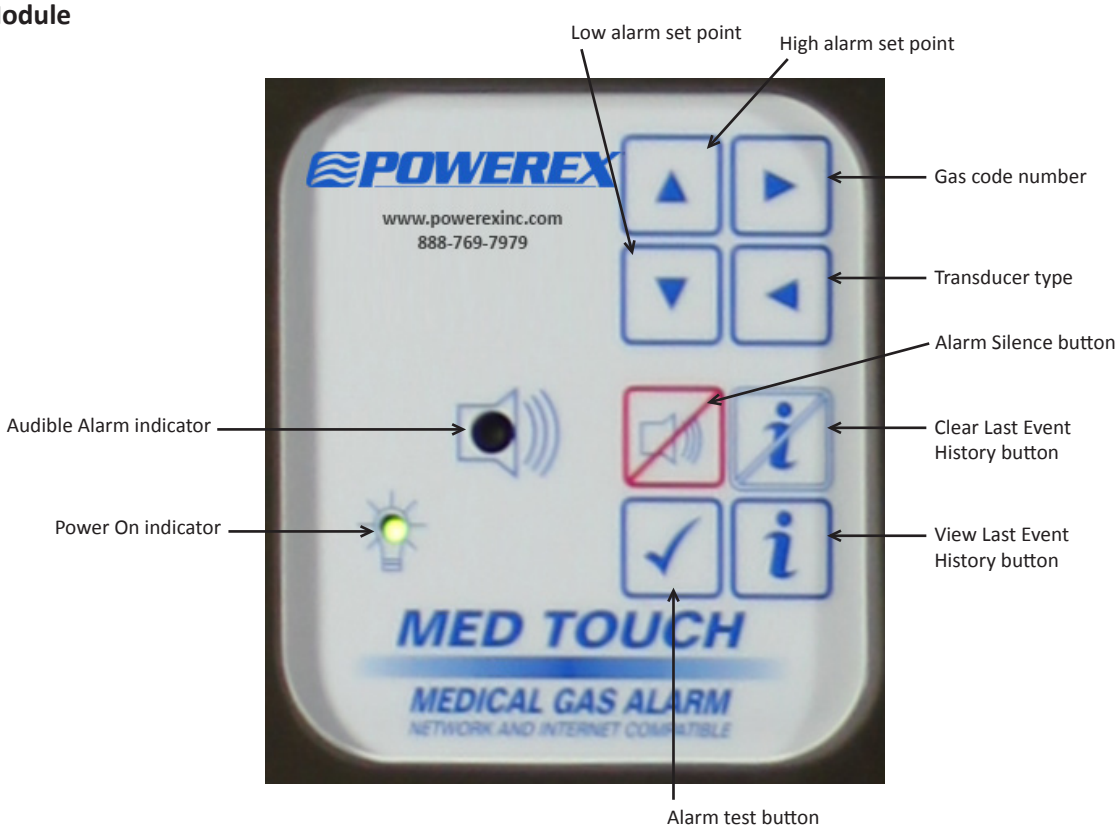
The right arrow may be pressed & held at any time to display the gas service for which the gas modules (area) boards are currently programmed. (See list on page 26).

◄ (left arrow)

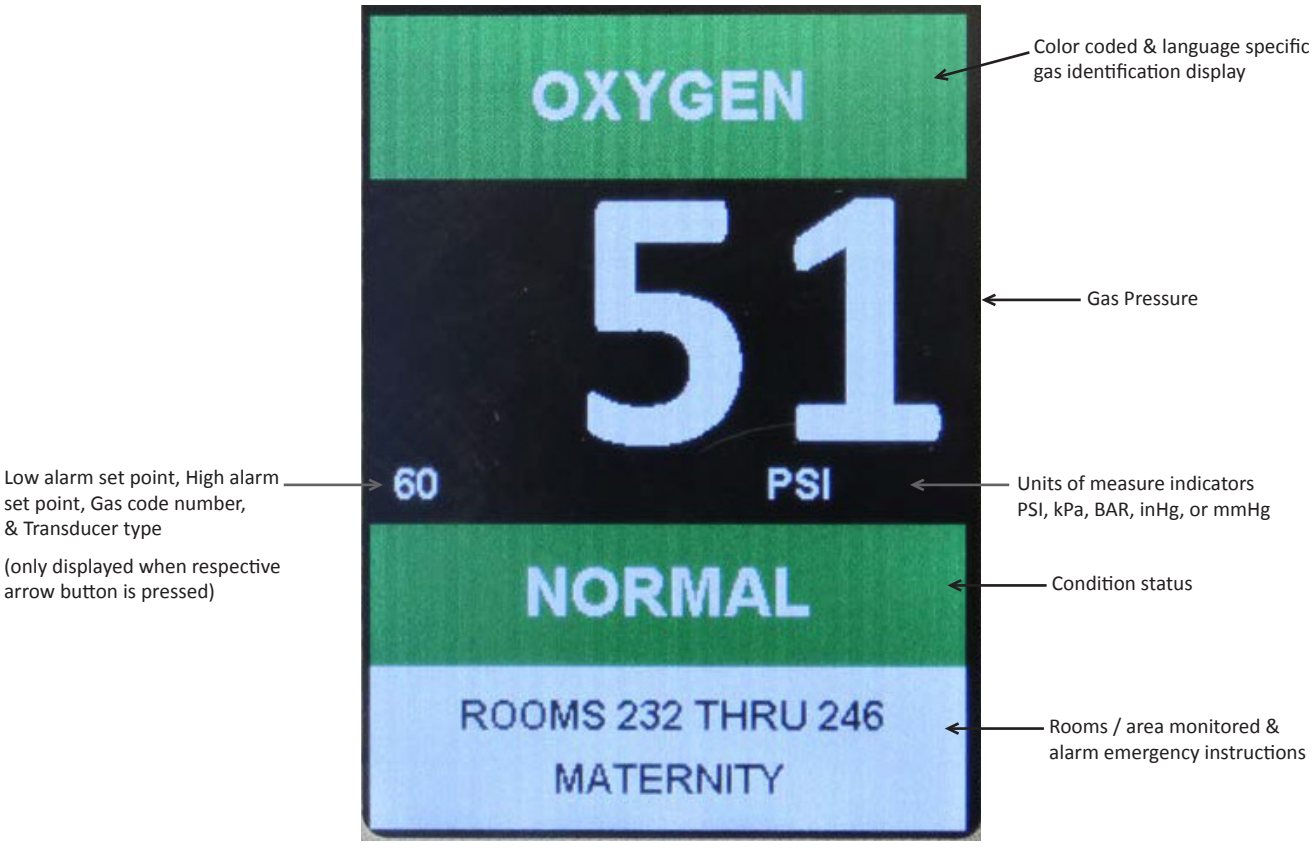
The left arrow may be pressed & held at any time to display the type of transducer that is connected to each gas module (area) board. The 3 types are 0 – 30 In Hg, 0 – 100 psig and 0 – 250 psig. When the left arrow is pressed:

- "30" will be displayed for a 0 – 30 In Hg transducer
- "100" will be displayed for a 0 – 100 psig transducer
- "250" will be displayed for a 0 – 250 psig transducer.

Button Board Module



Gas Module (Area Alarms)



Alarm Operation

This section deals with the daily operational aspects of the alarm panel. After installation has been completed and the final user programming of the panel has been properly configured, it is ready for operation.

Silencing the Alarm

Press the Silence button when the alarm is sounding and the alarm will be silenced.

Repeater Delay

Area alarm modules are programmed with a Repeater Delay feature which monitors only the Gas Module (Area) alarms. The Repeater Delay has been factory programmed to make the alarm re-sound every 10 (ten) minutes as long as the alarm condition exists. Note: the repeater delay may be re-programmed to a different duration or turned-off (see programming page 12).

Testing the Alarm

Pressing and holding the Test button initiates a self-test of the alarm. All LCD's will illuminate for as long as the Test button is depressed. In addition the buzzer will sound. If any LCD is faulty the circuit board should be replaced. If the buzzer does not sound, it is faulty and the circuit board should be replaced.

NOTE: The alarms have a filter programmed to ignore transient signals that are less than 0.7 seconds in duration.

Area Alarm Gas Modules

Monitor the status of the medical gas 'areas' of the facility. Gas modules communicate with transducers and provide: 1) the pressure readings of the gas on each gas display 2) the Normal LCD (green) or Alarm Conditions LCD (red) on each gas display and 3) the emergency instructions (programmed by the user).

If the pressure of one of the gases drops below the programmed low limit setting, the following events take place simultaneously: 1) the Normal LCD will be extinguished 2) the Pressure Low LCD (red) will illuminate 3) an audible alarm will sound 4) the emergency instructions will be displayed alternately with the pressure low (red) alarm display if they have been programmed by the user.

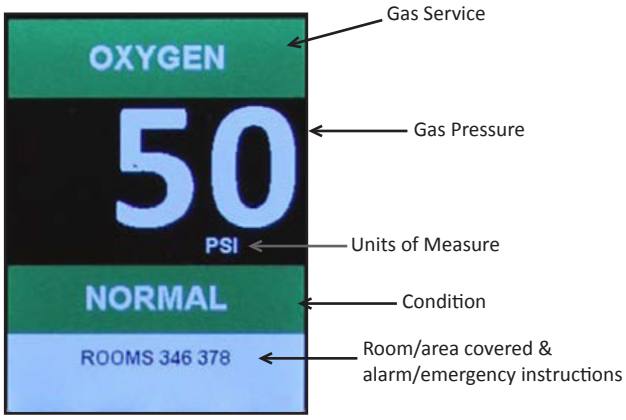
If the pressure of one of the gases rises above the programmed high limit setting, the following events take place simultaneously: 1) the Normal LCD will be extinguished 2) the Pressure High LCD (red) will illuminate 3) an audible alarm will sound 4) the emergency instructions will be displayed alternately with the pressure high (red) alarm display if they have been programmed by the user.

Gas display in normal condition displaying rooms/area text which has been programmed by user.

Gas display in low pressure alarm condition displaying rooms/area being monitored which have been programmed by user. The rooms/area text will alternate with the emergency instructions when in an alarm condition.

Gas display in low pressure alarm condition displaying emergency instructions which have been programmed by user.

Gas Module (Area Alarms)



Gas Service

(see programming – page 13)

Gas Pressure

The LCD Digital Pressure Display displays the pressure as indicated by the transducer. The gas pressure may be displayed in PSI, kPa, BAR, inHg, or mmHg. PSI and inHg is the factory setting.

NOTE: Vacuum & EVAC/WAGD may be displayed as inHg or mmHg. Only the applicable unit selection buttons will be active based on the gas service selected. For example - the PSI, kPa and BAR selection buttons will be displayed but are not active when a negative pressure gas has been selected. In kPa mode the Nitrogen gas display indicates one tenth of the actual pressure when the pressure exceeds 999 kPa (i.e. 1100 kPa is displayed as 110 and the kPa and (x 10) appears in the pressure text box.

NOTE: Alarm settings are maintained even if power is interrupted.

Units of Measure

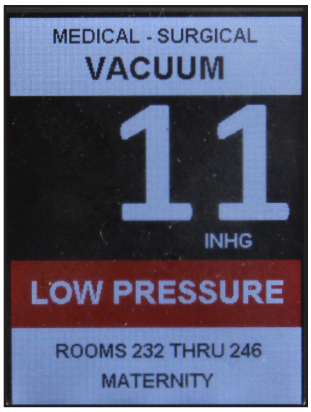
The Units of Measure is displayed as PSI/inHg, BAR or kPa (whichever is selected during programming – PSI and inHg is factory setting) providing the unit of measure displayed on the LCD pressure reading. In the kPa mode the Nitrogen gas display indicates one tenth of the actual pressure when the pressure exceeds 999 kPa (i.e. 1100 kPa is displayed as 110 and the kPa and (x 10) appears in the pressure text box.

High/Normal/Low Condition Status

Should the line pressure of a gas exceed the programmed alarm set points for low or high line pressure, the corresponding low or high line pressure LCD will be illuminated simultaneously with the buzzer sounding to announce an alarm condition has occurred. When the line pressure is neither high nor low it is considered within the normal range and the green Normal LCD is illuminated. These indications are relative to the high and low pressure set points which have been programmed into the alarm. These high and low set points should be set in accordance with NFPA 99 at ± 20% of the normal operating pressure.

Other Possible Conditions

Other possible system conditions may occur in the event of a wiring problem, sensor problem or board malfunction. The following codes will be displayed when a System Error or Failure is detected, or when the View Recent History button is pressed:



Alarm	Reason
No Sensor	Sensor wire(s) not connected
No Sensor Data	No data sent within allotted time
Bad Sensor Data	Corrupt data, sensor noise
Wrong Gas Type	Mismatched sensor and gas board
Wrong Pressure Range	Sensor does not match gas board sensor selection
Low Pressure	Pressure is below low alarm set point
High Pressure	Pressure is above high alarm set point

NOTE: This table covers all alarm modules used in both area & master alarm panels.

Rooms/Area Covered & Alarm/Emergency Instructions

When in the Normal Condition, the rooms/area covered information which has been entered by the user is displayed. When in an alarm condition, the emergency instructions which have been entered by the user are displayed alternately with the rooms/area monitored information. In addition the display will flash on and off. (see programming – page 12).

Appendix A

Glossary of Terms

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

BAR A measurement of force in a compressed gas system.
1 BAR = 14.5 PSI or 1 BAR = 100 kPa

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

IN Hg **Inches of Mercury**
A measurement of the force in a gas vacuum system.
1 IN Hg = 3.38 kPa.

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

Latching Alarm Relay
Requires manual intervention (pressing the Silence button) to silence the alarm buzzer if the alarm condition has corrected itself.

LCD **Liquid Crystal Display**
A semiconductor liquid crystal film sealed between glass plates that changes its optical properties when voltage is applied.

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

mmHG A measurement of force in a gas vacuum system.
1 mmHg = .019 PSI or 1 mmHg = .039 inHg.

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

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

Non-Latching Alarm Relay
The alarm buzzer will silence itself when the alarm condition is corrected.

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

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

Transducer
A device that converts pressure into an electrical signal.

V **Voltage**

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

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

Appendix B

Medical Gas Alarm Specifications & Maintenance

Operating Ambient Temperature range: +10°C (50°F) to +50°C (122°F)

Storage Temperature: -20°C (-4°F) to +85°C (185°F)

AC Input: 120 - 240 volts AC - 50-60 Hz

DC output (to remote signal devices): 5 VDC

Input Fuse: 5 amp input AC line fuse protects the input wiring to power supply

Power Consumption: 45W maximum @ 120 V
50 W maximum @ 240 V

Pressure Measurement Accuracy:
0-30 inHg transducer +/-1%
Vacuum, Gas Evacuation

0-100 PSIG transducer +/-1%
Oxygen, Nitrous Oxide, Medical Air, Carbon Dioxide

0-250PSIG transducer +/-1%
Nitrogen

Dimensions

Transducers Housing dimensions
1.990W x 1.990H x 3.625
(Length including inlet fittings)

Maintenance

1. Ball valves should be operated periodically and tested for closure ability and leakage. If seals stick or leak, they should be replaced.
2. Clean the exterior of the valve boxes routinely with soap and water. Strong solvents will damage the lexan window and the silk screened printing on the window.
3. The ball valves have a removable swing out body design which allows for the changing of internal components. All valve bodies can be accessed by loosening all bolts and nuts and removing only one bolt, at this point the body may be swung out for servicing.

⚠WARNING ***To protect the lives of patients, always notify the appropriate medical facility staff before shutting off the supply of medical gas or vacuum through a ball valve. Do not close ball valves except in cases of emergency. Authorized hospital personnel should close ball valves in the event of fire, explosion or damage to the pipeline or equipment.***

Please note there is no required maintenance for area alarm components.

Appendix C

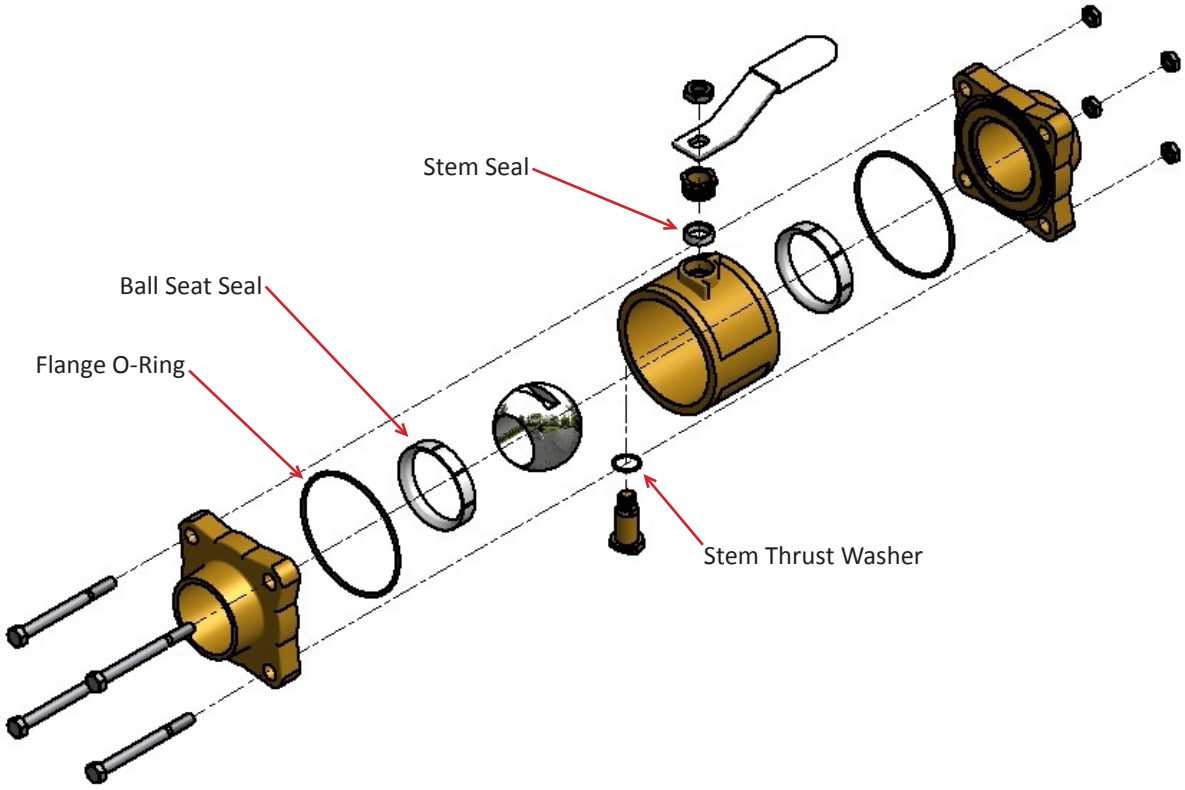
Servicing Ball Valve Seals

Model Numbers

½”	¾”	1”	1 ¼”	1 ½”	2”
PX-52-02	PX-52-03	PX-52-04	PX-52-05	PX-52-06	PX-52-07

Removal of Seals & O-Rings

Remove and discard the warn-out seals and o-rings from Ball Valve.

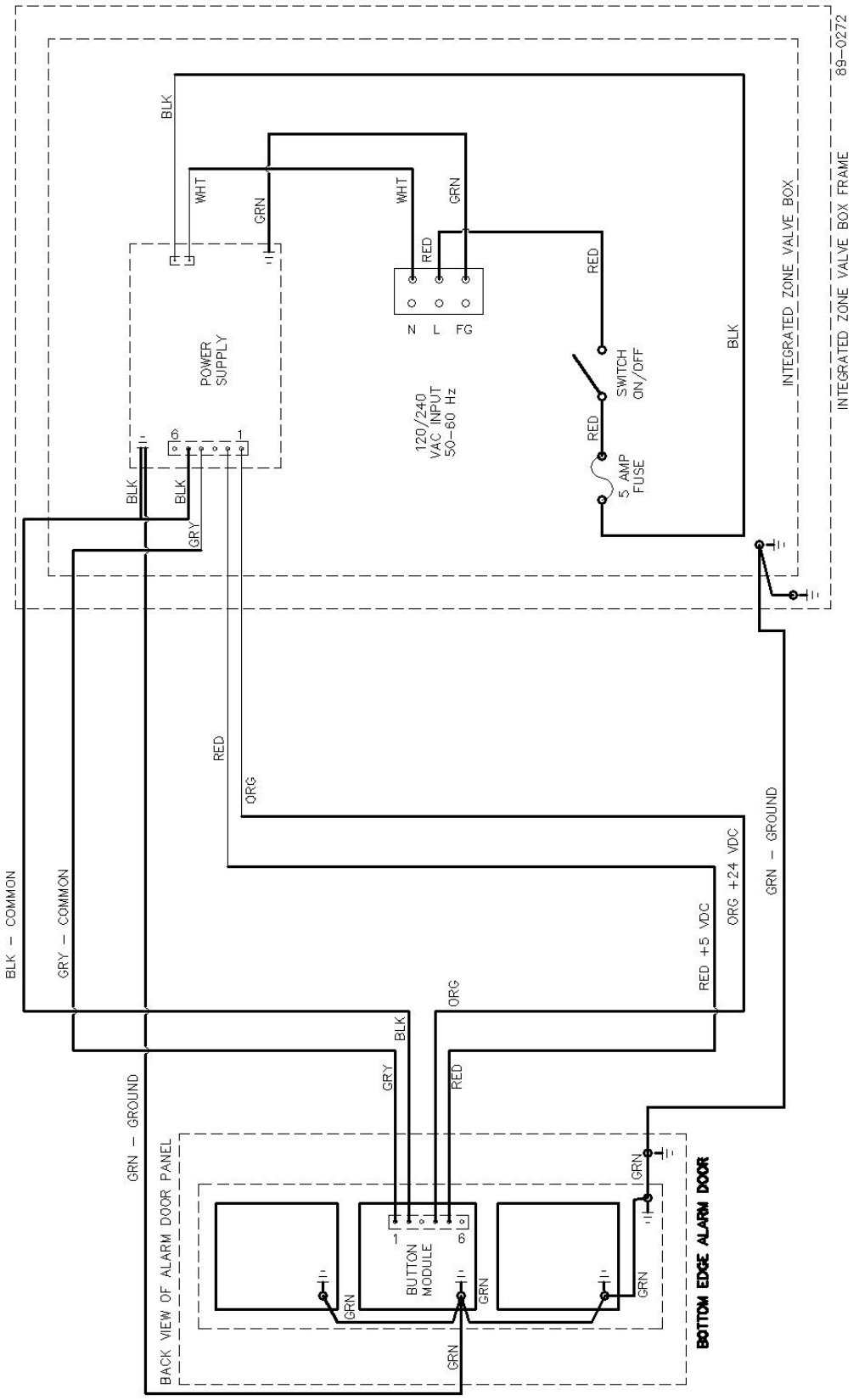


Seal Kit Part Number	Valve Size	Seal Kits Include the Following:
PX-52-0002S	½”	2 Ball Seat Seals 2 Flange O-Rings 1 Stem Seal 1 Stem Thrust Washer
PX-52-0003S	¾”	
PX-52-0004S	1”	
PX-52-0005S	1 ¼”	
PX-52-0006S	1 ½”	
PX-52-0007S	2”	

Tools Needed: Adjustable wrench; 7/16,” ½,” 9/16,” 5/8,” and 11/16” hex wrench

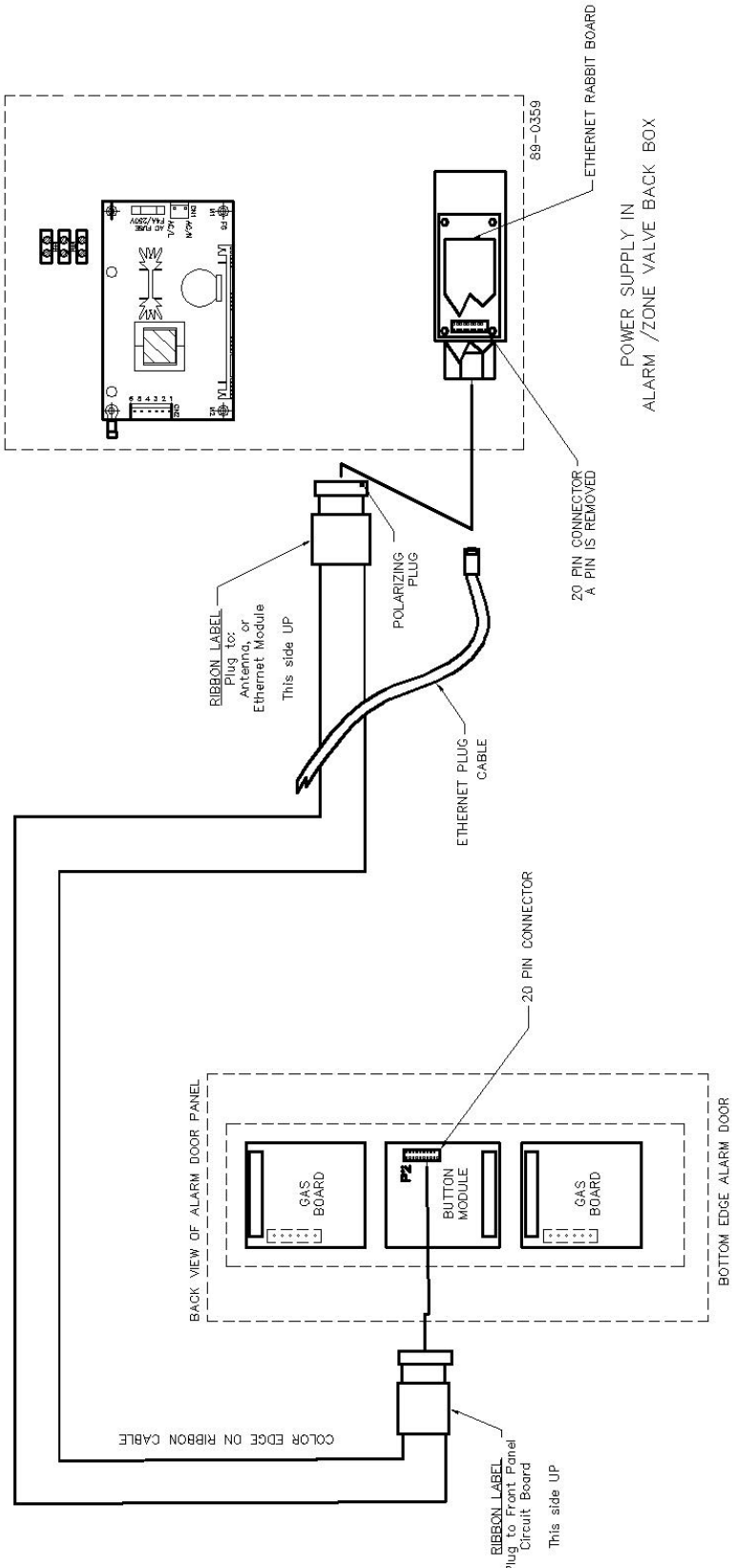
Appendix D

Wiring Diagram



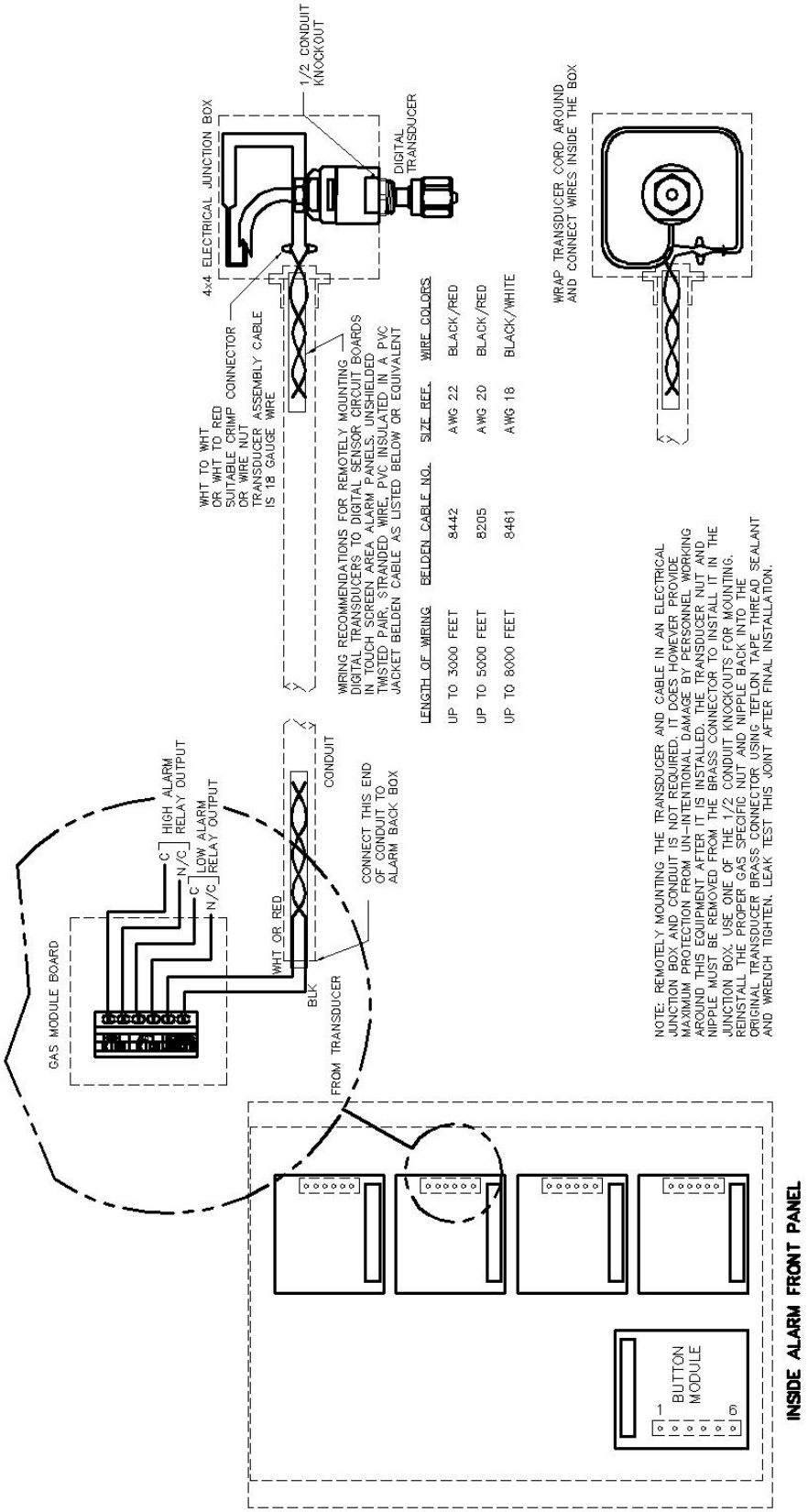
Appendix E

Wiring Diagram



Appendix F

Wiring Diagram



Appendix J

Text Message Carriers

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"@airtouchpaging.com",	"Airtouch Pagers1",
"@alphapage.airtouch.com",	"Airtouch Pagers2",
"@myairmail.com",	"Airtouch Pagers3",
"@alltelmessage.com",	"Alltel",
"@message.alltel.com",	"Alltel PCS",
"@alphanow.net",	"AlphNow",
"@page.americanmessaging.net",	"American Messaging (SBC/Ameritech)",
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"@paging.acswireless.com",	"Ameritech Paging",
"@pageapi.com",	"Ameritech Paging1",
"@airtelap.com",	"Andhra Pradesh Airtel",
"@archwireless.net",	"Arch Pagers (PageNet)",
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"@txt.att.net",	"AT&T SMS",
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"@cmcpaging.com",	"Carolina Mobile Communications",
"@cwwsms.com",	"Carolina West Wireless",
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"@cellularonewest.com",	"Western Wireless",
"@sms.wildmist.net",	"Wildmist Wireless",
"@wyndtell.com",	"Wyndtell"

Notes

Notes

Powerex Limited Warranty

Warranty and Remedies. (a) Standard Period of Warranty – Parts and Labor. Powerex warrants and represents all Products shall be free from Defects for the first twelve (12) months from the date of shipment by Powerex. During such warranty period, Powerex shall be fully liable for all Defects in the Products (the "Product Defects"), i.e., all costs of repair or replacement, which may include "in and out" charges, so long as the Products are located in the United States or Canada, and the Products are reasonably located and accessible by service personnel for removal. "In and out" charges include the costs of removing a Product from buyer's equipment for repair or replacement.

(b) Additional Period of Warranty – Parts Only (No Labor). In addition to the above, Powerex warrants the products described herein to be free from defects in material and workmanship for forty-eight (48) months from end of Standard Period of Warranty with the exception of any components which are recommended to be replaced in less than sixty months in our Installation/Operation manuals. Within said period Powerex will repair or replace any part or component which is proven to be defective in either material or workmanship. This warranty covers parts only. Labor is not included. This warranty is valid only when the product has been properly installed according to Powerex specifications, used in a normal manner and serviced according to factory recommendations. This warranty does not cover failures due to damage which occurs in shipment or failures which result from accidents, misuse, abuse, neglect, mishandling, alteration, misapplication or damage due to acts of nature.

(c) General. Powerex warrants each Powerex branded Pipeline Accessory (collectively "Products", individually each a "Product") to be free from defects in material and workmanship ("Defects") at the date of shipment. EXCEPT AS SET FORTH BELOW, NO OTHER WARRANTY, WHETHER EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SHALL EXIST IN CONNECTION WITH THE SALE OR USE OF SUCH PRODUCTS. TO THE EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. All warranty claims must be made in writing and delivered to Powerex in accordance with the procedures set forth on its website (www.powerexinc.com), or such claim shall be barred. Upon timely receipt of a warranty claim, Powerex shall inspect the Product claimed to have a Defect, and Powerex shall replace any Product which it determines to have had a Defect; provided, however, that Powerex may elect, upon return of the Product, to refund to buyer any part of the purchase price of such Products paid to Powerex. Freight for returning Products to Powerex for inspection or for shipping warranty parts shall be paid by buyer where permitted by applicable law. Powerex is not responsible for any import fees, taxes, duties, licenses or other fees imposed by any governmental authority upon the production, sale, shipment and/or use of Products covered hereunder. The warranties and remedies herein are the sole and exclusive remedy for any breach of warranty or for any other claim based on any Defect, or non-performance of the Products, whether based upon contract, warranty or negligence.

(d) Coverage. The warranty provided herein applies to Powerex pipeline products only.

(e) Exceptions. Notwithstanding anything to the contrary herein, Powerex shall have no warranty obligations with respect to Products:

(i) That have not been installed in accordance with Powerex's written specifications and instructions;

(ii) That have not been maintained in accordance with Powerex's written instructions;

(iii) That have been materially modified without the prior written approval of Powerex; or

(iv) That experience failures resulting from operation, either intentional or otherwise, in excess of rated capacities or in an otherwise improper manner.

The warranty provided herein shall not apply to: **(i)** any defects arising from corrosion, abrasion, use of insoluble lubricants, or negligent attendance to or faulty operation of the Products; **(ii)** ordinary wear and tear of the Products; or **(iii)** defects arising from abnormal conditions of temperature, dirt or corrosive matter; **(iv)** any OEM component which is shipped by Powerex with the original manufacturer's warranty, which shall be the sole applicable warranty for such component.

Limitation of Liability. NOTWITHSTANDING ANYTHING TO THE CONTRARY HEREIN, TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, UNDER NO CIRCUMSTANCES SHALL POWEREX BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTAL, PUNITIVE, SPECULATIVE OR INDIRECT LOSSES OR DAMAGES WHATSOEVER ARISING OUT OF OR IN ANY WAY RELATED TO ANY OF THE PRODUCTS OR GOODS SOLD OR AGREED TO BE SOLD BY POWEREX TO BUYER. TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, POWEREX'S LIABILITY IN ALL EVENTS IS LIMITED TO, AND SHALL NOT EXCEED, THE PURCHASE PRICE PAID. In the event of breach of any warranty hereunder, Powerex's sole and exclusive liability shall be at its option either to repair or to replace any defective product, or to accept return, transportation prepaid, of such product and refund the purchase price; in either case provided that written notice of such defect is given to Powerex within twelve (12) months from date of shipment to Buyer, that the product is found by Powerex to have been defective at the time of such shipment, that the product has been installed and/or operated in accordance with Powerex's instructions, that no repairs, alterations or replacements have been made by others without Powerex's written approval, and that Buyer notifies Powerex in writing within fifteen (15) days after the defect becomes apparent and promptly furnishes full particulars in connection therewith; and provided further that in no event shall the aggregate liability of Powerex in connection with breach of any warranty or warranties exceed the purchase price paid for the product purchased hereunder. Powerex may, at its option, require the return of any product, transportation and duties prepaid, to establish any claim of defect made by Buyer. Unless otherwise agreed in writing

(a) Powerex will not accept and shall have no responsibility for products returned without its prior written consent, and **(b)** Powerex will not assume any expense or liability for repairs to products made outside of its plant by third parties. In the event Powerex elects to replace a defective product, costs of installation, labor, service, and all other costs to replace the product shall be the responsibility of Buyer.

Powerex shall not, except as set forth above, be otherwise liable to Buyer or to any person who shall purchase from Buyer, or use, any products supplied hereunder for damages of any kind, including, but not limited to, indirect, special or consequential damages or loss of production of loss of profits resulting from any cause whatsoever, including, but not limited to, any delay, act, error or omission of Powerex. Supplier's repair or replacement of any Product shall not extend the period of any warranty of any Product.

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