Control Systems

Xe-90M/145M
R & RS Series
Fixed Speed

Technician's Pocket Guide

About this Pocket Guide

This pocket guide was created to assist Field Service Technicians when troubleshooting *warnings, alarms* within the R-Series/RS-Series machines.

For detailed information of the controller, such as: navigation keys, controller display layout, installation info, and basic operation download in Passport the following PDF files:

Product information manuals:

R37-160kW: CCN 80446164

RS30-37IE: CCN 80448830

RS200-355I/IE: CCN 80449028

*For Engineering Data, P&ID, and Electrical Schematics visit **Sales Library** (website not available on tablets)

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CONTROLLER INTRODUCTION

The Xe-90M/145M control system provides efficient and reliable compressor operation. The controller supports thirty languages, independently configurable units of measure as well as enhanced network and communication capabilities.

This microprocessor-based controller uses a finger touch membrane for operation of the compressor and setting control parameters.

Information about the programming and operating status is available on a Liquid Crystal Display (LCD) from a system of Folders and Pages.

The controller monitors compressor health and should any pre-programmed limit be exceeded the controller automatically displays a warning or issues a trip to shut the compressor down.

The major components of the control system include the controller, voltage transformer, and solenoid valves to control compressor operation.

A series of pressure sensors, temperature sensors, relays, and switches make up the instrumentation that provides feedback to the controller.

Operating and navigating the controller is easy and intuitive through a series of folders and pages within the graphical user interface (GUI). The following explanation introduces and describes the major components that make up the Xe control system. Always refer to the drawings and schematics for your specific compressor or application.

Customer's Main Power Supply

The customer is responsible for correctly sizing and installing the Main Fuse Protection. This is intended to protect the machine during an overcurrent condition. These fuses should be time-delay in order to accommodate the inrush current at machine startup. For an instant, the inrush current drawn by the machine can be several times greater than the full-load rating.

*See the **Engineering Data** sheets in Sales Library for fuse and cable size recommendations.

*Main Fuse Protection not shown in Electrical Schematic.

Important note: Ingersoll Rand (IR) recommends fuses and cable size in the Engineering Data Sheet to facilitate the electrical installation of the machine.
IR is not responsible of customer's power supply, electrical installation outside the air compressor, nor size fuses/cable gage for the customer.

Fuse Designation for R & RS-Series

Always use local electrical code or National Electrical Code manual (NEC) to size fuses.

FU 1, 2, 3 RS-Series Fan Drive Fuses

Fuses are required when the Low ambient option is installed in the machine. FU1, 2, & 3 Fast Acting Class-J fuses protect the Fan Drive (FD) in single stage units. For 2-Stage units, the machine is designed with two Fan Drives FD1 & FD2. The second Fan Drive (FD2) is mentioned below.

FU1, 2, 3 R-Series Fan Drive

Fuses are required when the Low ambient option is installed. The Fan Drive is called FD.

FU4, 5, 6 Fuses for New RS-Series Single & 2-Stage

RS30-37ie FU 4, 5, 6: A three-phase auto-transformer is required for water cooled units (W/C) at

575VAC/60Hz. Dryer option at 208VAC/60HZ and 575VAC/60Hz.

RS200-250kW FU 4, 5, 6: This machine uses two Fan Drives FD1 and FD2 when the Low Ambient Option is installed. The Fast Acting Class-J fuses protecting FD2 are FU4, 5, 6.

FU7, 8, 9 R-Series Dryer Fuses (S-S)

Fuses are required when the Dryer option is installed.

FU7, 8, 9 RS-Series Fuses Low Ambient (2-S)

A three-phase auto-transformer is required with the Low Ambient option at 575VAC/60HZ.

FU10, 11 Fuses

Fuses 10 and 11 are an acceptable alternative to MCB1 and required when line power is 575VAC/60HZ

T1 Transformer & Control Voltage 115 VAC

T1 - Control Transformer

T1 is the schematic designation of the control transformer. A step-down transformer (T1) reduces the incoming line voltage to levels suitable for use with the Xe control system. The reduced voltage sources are called secondary circuits.
The secondary circuit is rated at 115Vac, 1 phase, 60Hz and is used to energize solenoid valves and starter coils. The “hot” connection is X1 and the neutral connection, X3, is grounded to the starter chassis.

Ensure transformer is grounded according to the electrical schematic of the machine.

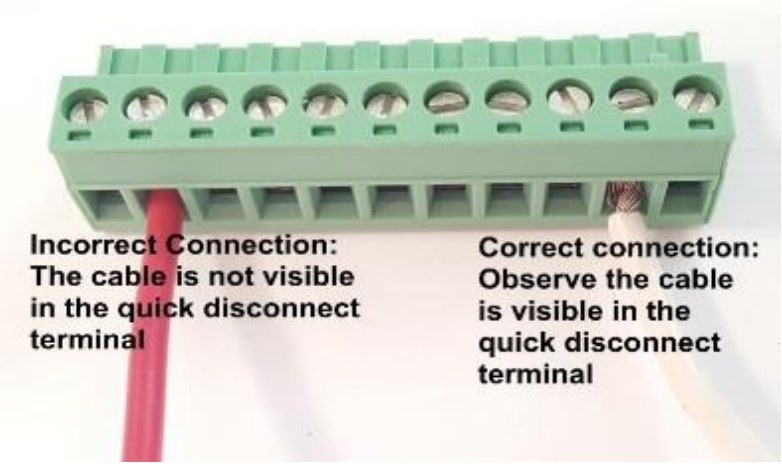
Quick Disconnect Plugs/Connectors

*Also known as Phoenix connector

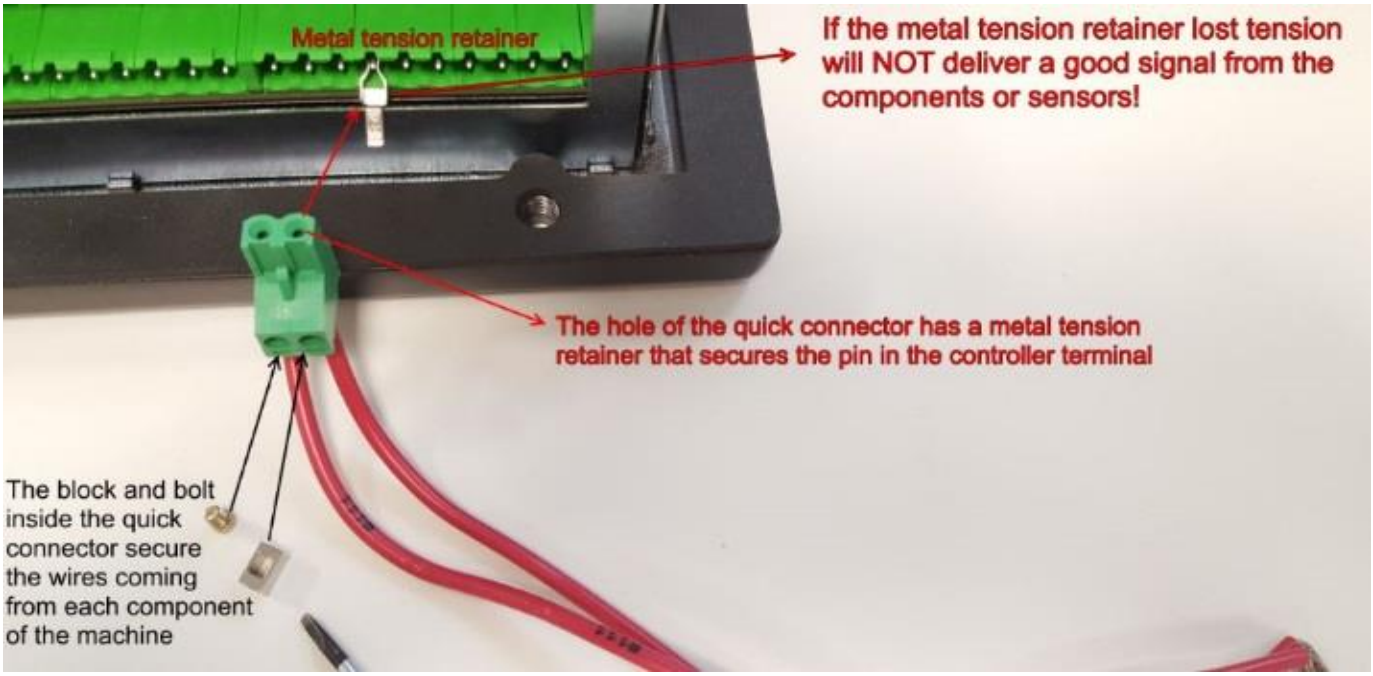
A group of differently sized terminal plugs is used to connect control and instrument wires to the controller. These connectors are female Phoenix type (5.08mm spacing) and plug into matching male receptacles on the controller. Devices and instrumentation connected through each plug are dependent on machine configuration as defined in the electrical schematic and label on the back of the controller cover. Caution should be used to ensure each plug is properly inserted into the correct receptacle.
Always refer to the compressor electrical schematic. These plugs are designed to be inserted in one direction only. The wiring schematic identifies the proper terminal plug for each connected device or instrument.

For example, the 115VAC circuit passes through a circuit breaker and Emergency Stop switch with the “hot” connected to P1-1 and neutral P1-10.

How can I check the quick disconnect plugs?



*Ensure cables are properly installed in the terminals before replacing components



Perform a quick test with a paper clip if faulty signals are suspected.

Replace quick disconnect plug if the tension retainer is defective when tested.

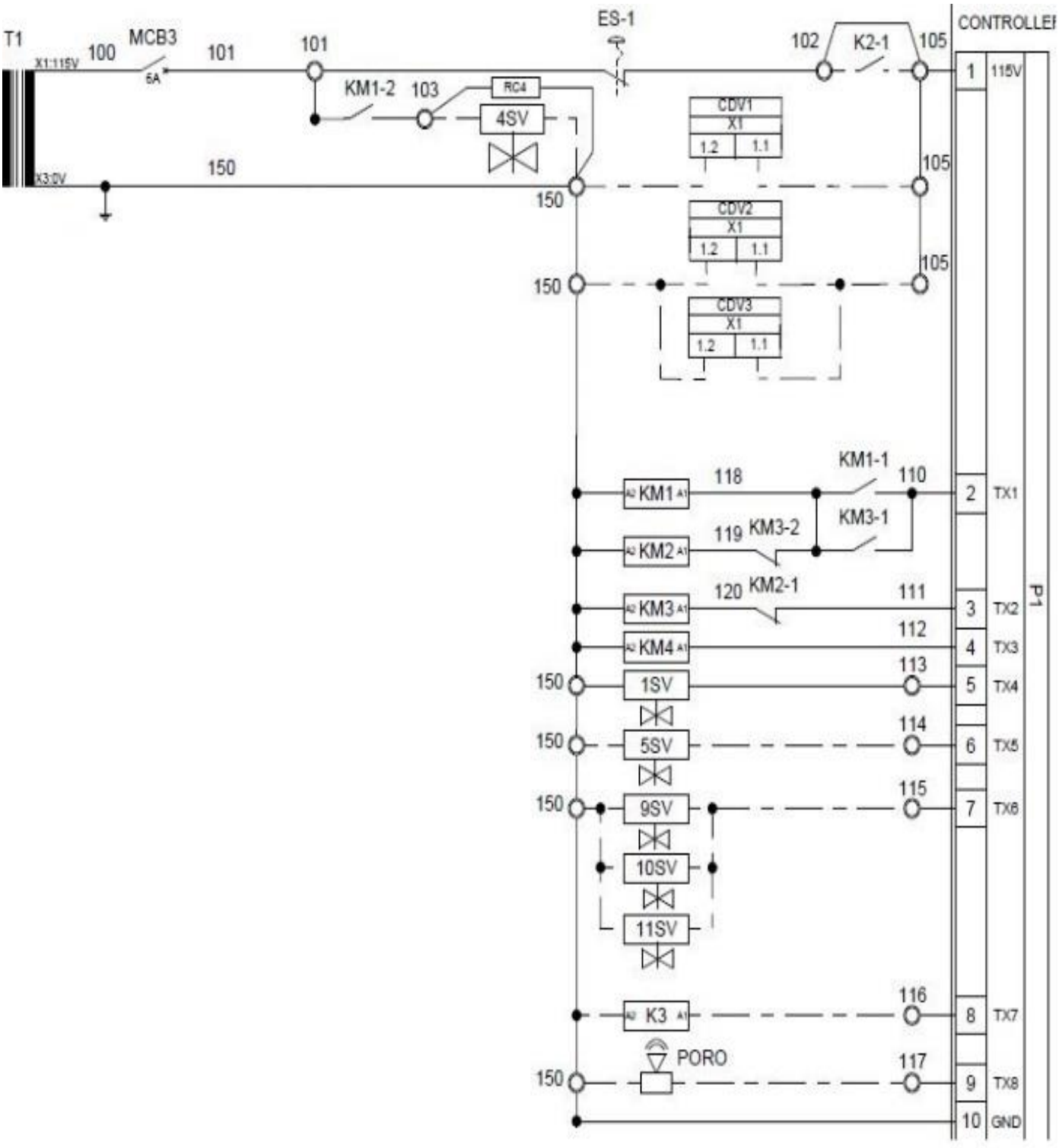
P1 –Triac Outputs

Terminal plug strip P1 is dedicated to outputs that provide control of solenoid valves and starter contactors. These outputs are powered by 115VAC located at P1-1.The 115VAC circuit passes through MCB3 circuit breaker and ES-1 contact with “hot” wire 102 connecting to P1-1 and the Neutral wire connecting to P1-10. Triac output information can be found on the back of the controller.

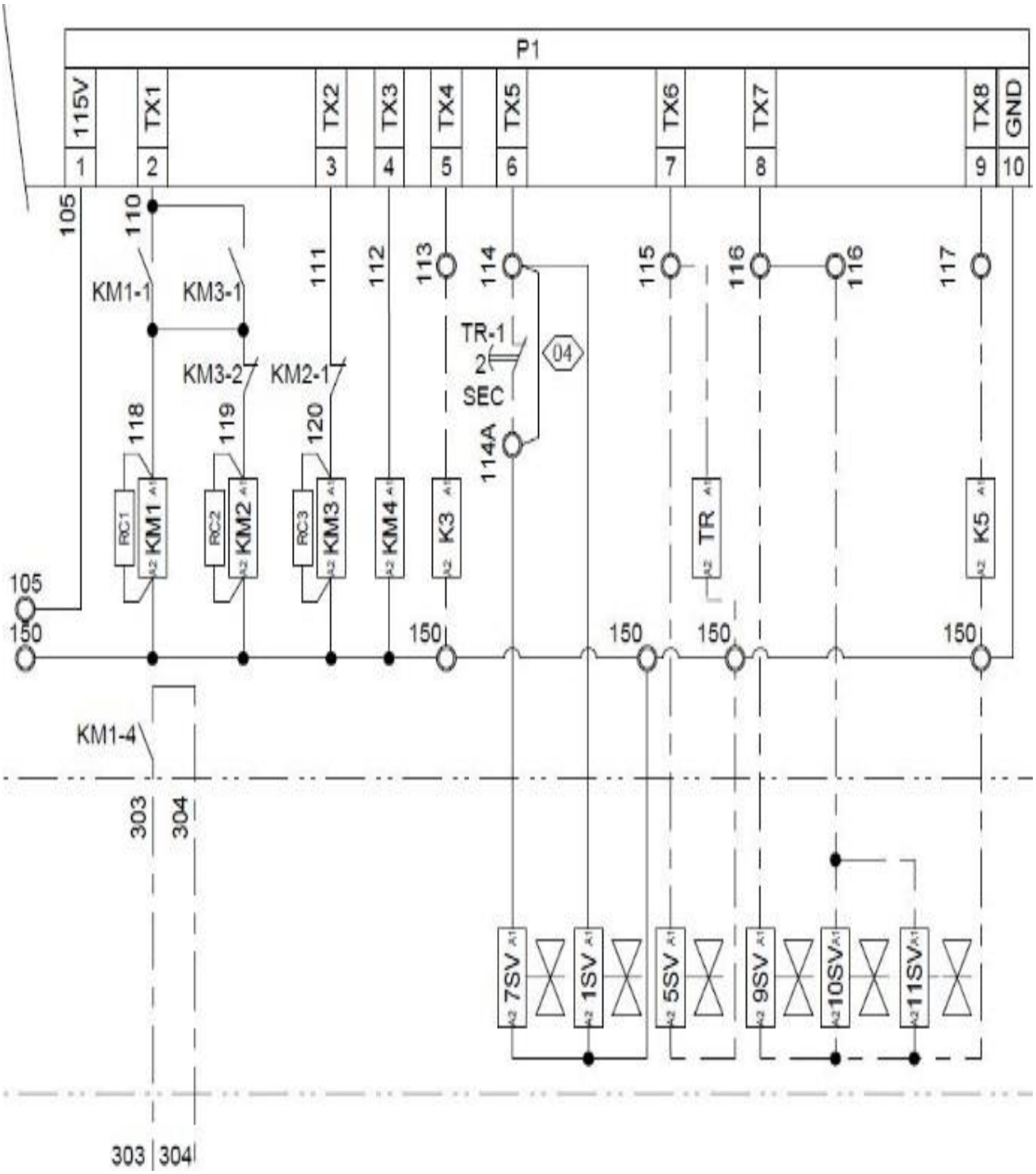
What is a Triac?
It is a three terminal electronic device that conduct current in either direction when triggered by the Xe controller using a small amount of voltage. The Triac delivers the control voltage 110-120 VAC from the transformer to the components in P1 terminal offering fast switching and power control.

*Tips to test the Triac see pages 107-113.

R-Series P1 Triac



RS-Series P1 Triac 115VAC



Terminal Description & Terminal Connection

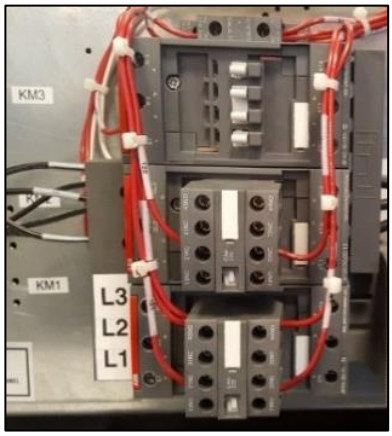
Terminal Description	R-Series	RS-Series
Control Voltage 110-120 VAC	P1-1	P1-1
Contactor KM1 & KM2	P1-2	P1-2
Contactor KM3	P1-3	P1-3
Fan Motor Contact KM4	P1-4	P1-4
Load Solenoid 1SV	P1-5	P1-6
Modulation Solenoid 5SV	P1-6	P1-7
Isolation Solenoid Valve 7SV	N/A	P1-6
Moisture Separator Drain Valve 9SV	P1-7	P1-8
Dryer Filter Drain Valve (Option) 9SV	P1-7	P1-8
Dryer Drain Valve(Option) 9SV	P1-7	P1-8
Blower Drive Control Relay (Option) K3	P1-8	P1-5
PORO	P1-9	101-150 cables(K6)
Common/Ground	P1-10	P1-10

The following section explains the components of the Starter System:

Contactors KM1 & KM2

The controller provides power to KM1 and KM2 main motor starter coils to load and unload the unit under normal operation.
The controller applies 115VAC to the coil of the contactors at A1-A2 terminals, causing the contactor to "pull in" creating the path of electricity to the main motor. Auxiliary contacts KM1-1, KM3-1 and KM3-2 provide full control of the Star/Delta starting circuit.

Contactor KM3



Connected to P1-3, the controller provides power to the KM3 main motor starter coil. Auxiliary contact KM2-1 along with P1-2 provides full control of the Star/Delta starting circuit.

*Star/Delta explained in Tech Direct Tech Tube 10238.
**Picture shows KM1, KM2, KM3 and auxiliary contacts*.

Fan Motor Contactor KM4

Connected to P1-4, the controller provides 115VAC to KM4 fan motor starter coil at start up. KM4 provides control of the cooling fan motor starting circuit. The Fan Motor Protection (FMP) is explained next.

FMP – Fan Motor Protection

The Fan Motor Protection overload is a normally open contact that closes when the Fan Motor Protection is on (Trip 1) and opens when it sees an overcurrent condition. The contact is connected to P3 controller terminal to report alarms. When tripped, FMP must be manually reset.

1SV Load Solenoid Valve (N.C)

Connected to P1, the controller provides power to the 1SV load solenoid valve. When energized, 1SV opens and applies pressure to the load cylinder, allowing the inlet valve to open and the compressor to load. 1SV remains closed/de-energize when the machine is unloaded, auto restart, or OFF.

5SV Modulation Solenoid Valve

Connected to P1, the controller provides power to the 5SV modulation solenoid valve when the controller is set to Mod ACS (machine cycles 3 times and then activates modulation) or Modulation mode only. When energized, 5SV opens allowing the modulation valve to adjust the inlet valve position to meet customer's air demand. Adjustment procedure FSB 5868.

7SV Isolation Solenoid Valve for RS-series

7SV assists the load solenoid 1SV to overcome the modulation pressure regulator output and allow the inlet valve load cylinder to actuate.

TR Timing Relay for RS-Series

TR creates a 2-second delay when powering the 5SV modulation solenoid. This allows the inlet valve load cylinder to begin opening the butterfly valve of the inlet valve assembly.

4SV Water Shut Off Solenoid (W/C only)

4SV is connected to the main contactor KM1 (aux contact KM1-2) in the P1 terminal 115 VAC providing water from customer's water supply (open or close loop) to cool down the machine coolant cooler and aftercooler. The solenoid is connected to the discharge side of the coolers to ensure water remains in the piping when the machine is off.

CDE1 Condensate No Loss Drain

Connected to P1 Triac 115 VAC to release the condensate water from the moisture separator.

The No-Loss Drain valve is also capable to send a warning status to the controller P3 terminal under abnormal conditions.

Note: CDE2 & CDE3 No loss condensate drains are also connected in the Triac and P3 digital inputs for Dryer option only.

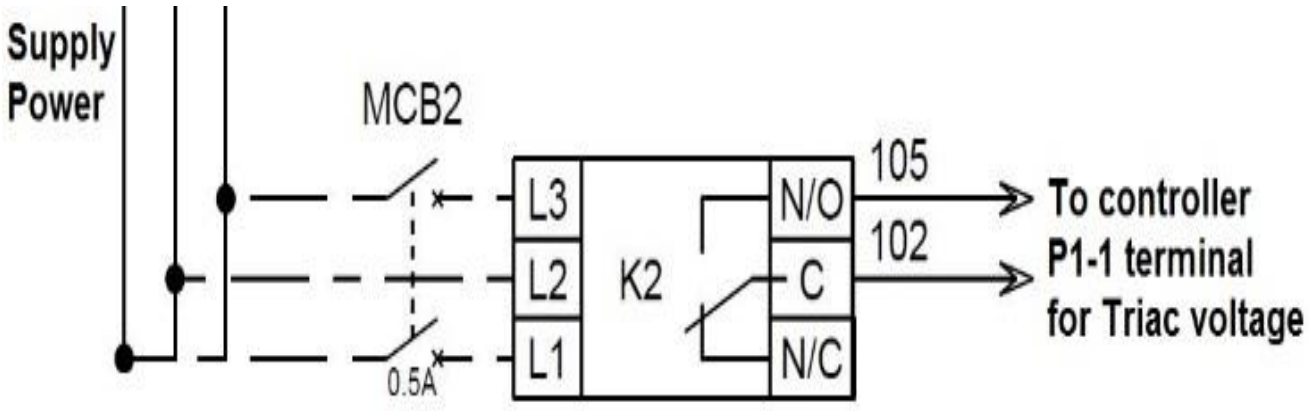
Condensate Drain Valves (9SV, 10SV, 11SV)

Connected to P1, the controller provides power to 9SV (Moisture Separator), 10SV (Dryer Filter Drain) and 11SV (Dryer Drain) valves. When energized, one or more of these drain valves open to allow condensate to release.

Note: 10SV and 11SV are used on units with integrated dryers.

K2 Phase Monitor Relay (Optional)

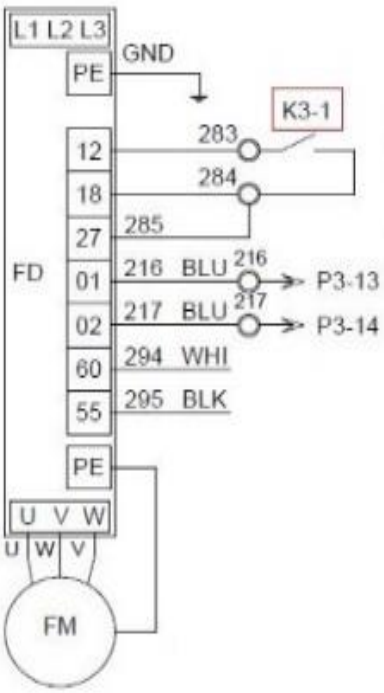
An optional phase monitor can be installed to protect the motor and control system against phase imbalance. The phase monitor is connected to the Incoming Power feed through circuit breaker MCB2 (designated as K2-1 in the Electrical Schematic). The phase monitor will open cables 102 and 105 (K2-1) removing power from P1-1 Triac voltage.

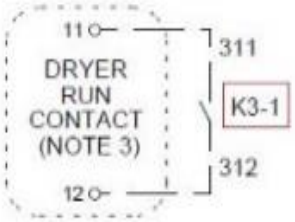


Note: Some Xe-90/145M software revisions will NOT set any event of trip it K2-1 opens only “low sump.”

K3 Blower Drive Control Relay

At startup, the machine energizes K3 relay through P1 terminal closing the run signal for the Blower Drive (FD) terminals 12, 18 and 27 (K3-1).





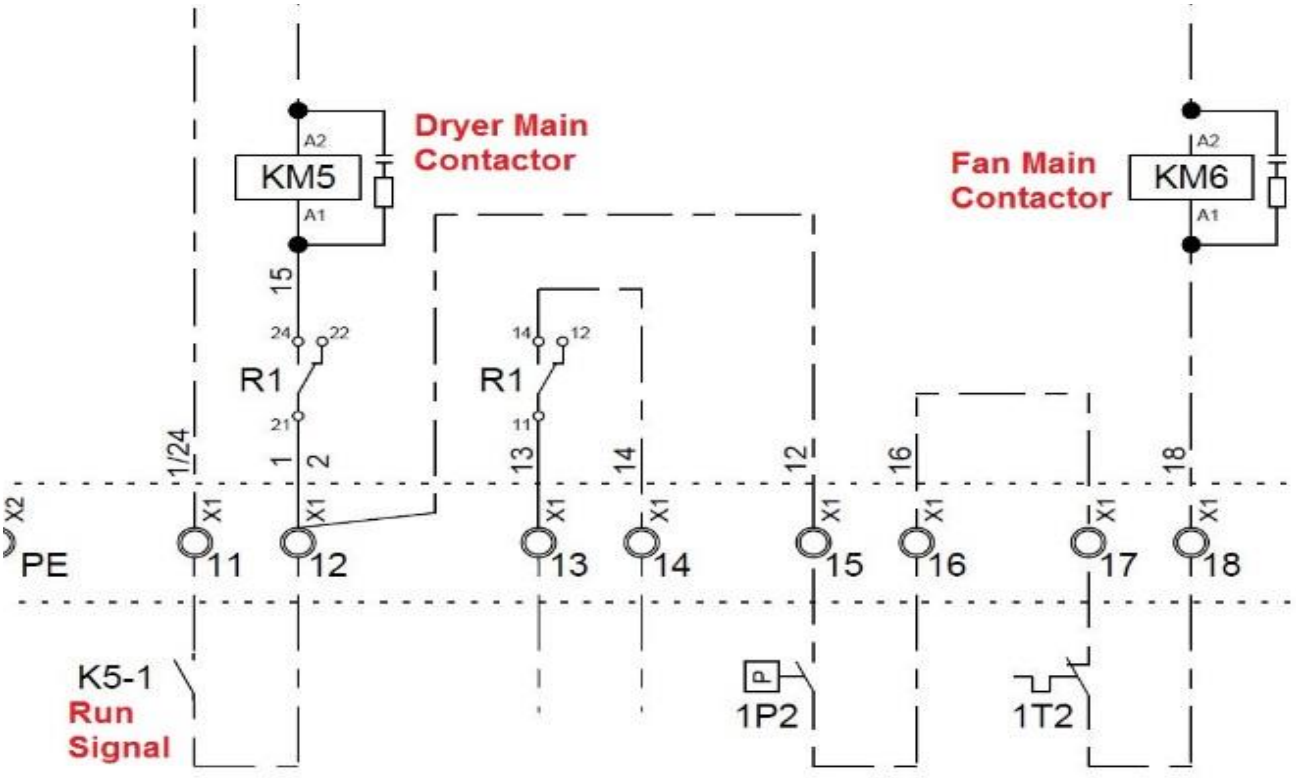
*K3-1 run signal for the Blower Drive or Dryer option.

K3 Dryer Run Relay R-Series

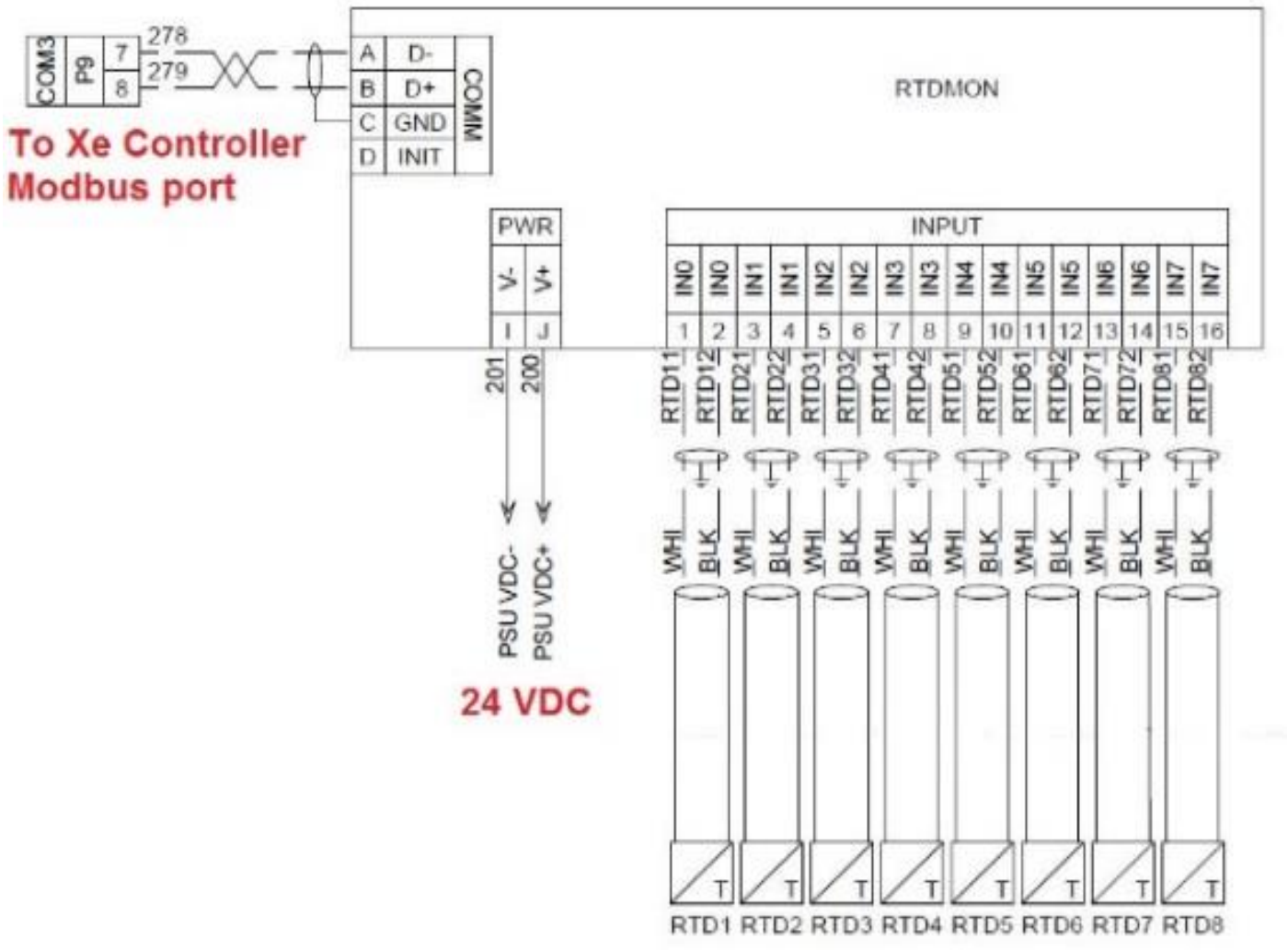
The run signal is also used as the dryer run contact for R-series machines with the Dryer option installed (for RS-Series, the run signal of the Dryer energizes through K5 relay).

K5 Dryer Run relay for RS-Series

At start-up, the controller energize K5 relay closing the run signal K5-1 allowing the Dryer Main Contactor KM5 & Dryer Fan Contactor KM6 to close.

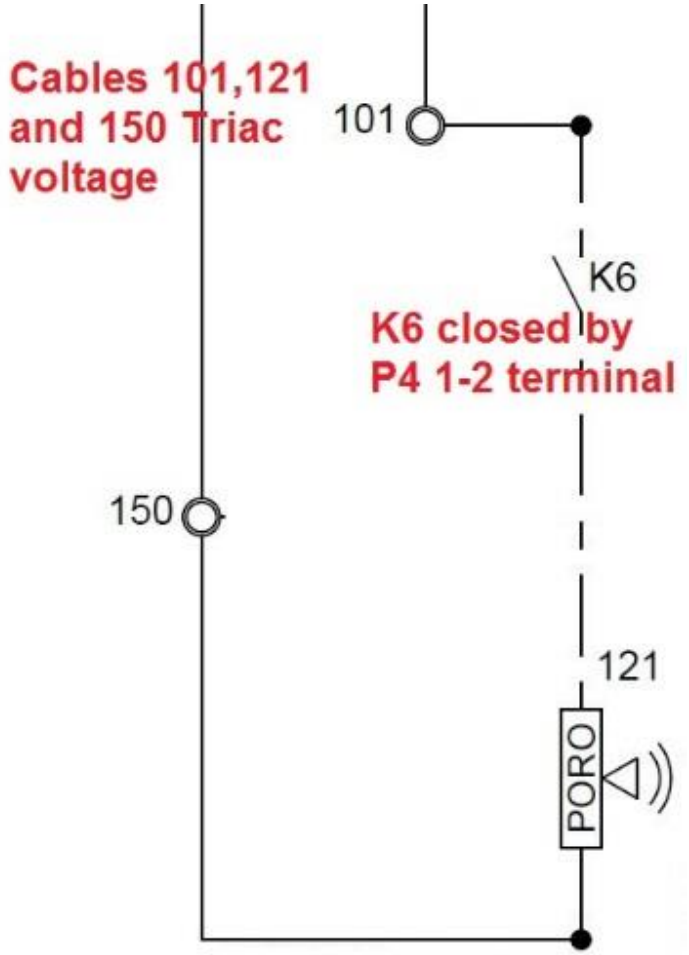


RTD Main Motor Monitor for RS-Series (option)



RTD main motor monitoring is an optional feature connected to the PSU Power supply 24VDC. The main purpose is to monitor the temperatures of the motor bearings and the stator windings via the Modbus port in P9 7-8. The faults associated with this feature are explained in the troubleshooting manual.

K6 PORO relay for RS-Series



A relay connected to P4 1-2 terminals controls the PORO horn in the Triac 115 VAC cables 121 hot/150 common-ground.

Note: the function of the PORO horn for R & RS-Series are explain in "PORO Power Outage Restart Option" section.

PORO - Power Outage Restart Option (Option Only) Connected to P1 Triac 115 VAC powers the PORO horn. The PORO horn provides audible notice of a pending (loss of Incoming Power Supply) automatic machine start. This feature is only used on units with the PORO option. The use of the scheduled start/stop requires the PORO option to be enabled and a PORO horn to be installed for safety reasons.

R-Series PORO: energized by P1-9 Triac voltage. Option needs to be install in the controller Tech Note 207.

RS-Series PORO: close by K6 relay in P4 terminal allowing P1 Triac voltage to energize the PORO horn. (K6 explain in this section)

*PORO Field Installation Kit found in Passport.

MCB1 Main Circuit Breaker

MCB1 is the schematic designation for the Main Circuit Breaker to the primary side of the T1 transformer. MCB1 protects the control power for shorts or grounds in the circuit.

MCB2 Phase Monitor Main Circuit Breaker

MCB2 protects K2 Phase Monitor and, in case of a low voltage condition, opens the control voltage to the controller terminal P1-1. Cables used to open the connections are 102-105.

MCB3 Control Voltage Circuit Breaker

MCB3 is a circuit breaker in the 110/120 VAC secondary side of the control transformer circuit to provide a degree of protection to the controller terminal P1-1.

MCB4 Low Ambient option Main Circuit Breaker

MCB4 protects the circuit for the thermostat and the temperature switch contacts if the Low Ambient option is installed. The heater circuit of MCB4 power supply must be provided by the customer 120VAC/1 Phase/60HZ.

MCB5 Power Supply Main Circuit Breaker

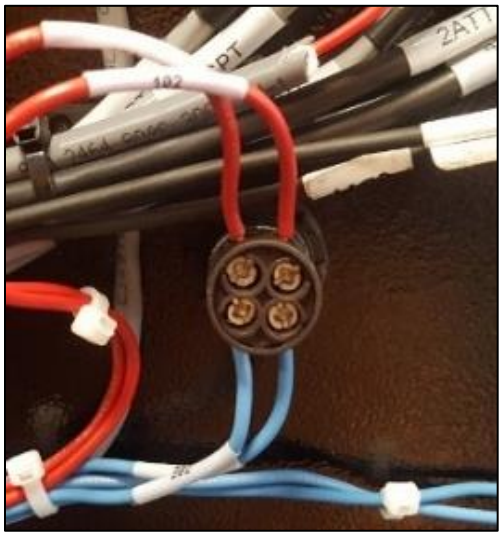
MCB5 is connected to the control voltage 115VAC and provides protection to the Power Supply Unit (PSU). The PSU rectifies 24VDC to power the controller

display and logic at terminal P10 1(N)-2(L). The PSU must be grounded to the starter box chassis.
*Green LED light indicates Power available to PSU

Arc Suppressors (RC)

Suppress the arc created when the contactor coils are energized. If not installed, the arc created by the coils can create nuisance faults in the 5 VDC circuits. Refer to typical electrical schematics for location.

Emergency Stop Button (ES)



ES is located next to the controller in the starter panel and is intended to stop the compressor in an emergency condition **only**.
The switch has two sets of normally closed contacts (ES-1 &

ES-2) that open when the red E-Stop button is pressed. Refer to the electrical schematics for the correct terminal location. ES-1 contact (red wires) is located just after MCB3 in the 115 VAC circuit and connects to terminal P1-1

ES-2 contact (blue wires) is located in the 24 VDC logic circuit at P3 7-8 for R-Series or P3 1-2 for RS-Series.

These contacts act in parallel to ensure power is removed from the starter coils, solenoids, and controller logic to cause the compressor to stop immediately. The E-Stop will remain in the open position until manually reset by pulling the red E-Stop button forward.

Main Motor Overload Relay (FR1)

Connected to the bottom of KM1, the main motor overload relay provides protection in the event of an overcurrent condition in the motor windings. It is adjustable per the nominal current and service factor values found on the motor data tag. For Settings see Tech Note

FR1 is normally closed and sends a trip signal to the controller P3 terminal, opening the digital signal at cables 95-96.

1ATS – High Air Temperature Switch for RS

A normally closed switch installed in the discharge port of the Air End, and opens when the discharge temperature rises above 245°F (118°C). The mechanical switch serves as a back-up for the usual controller temperature shutdown at 228°F (109°C). 1ATS is connected in the 110/120 VAC circuit to P1-1 and should it open, the Xe shuts

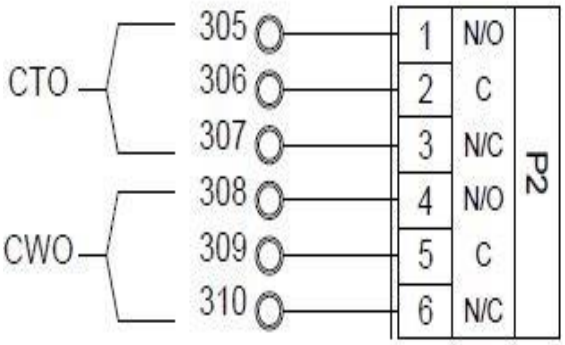
the compressor down alarming in “Control Power Loss”, if Control Power Loss set point is enabled in Factory Settings.

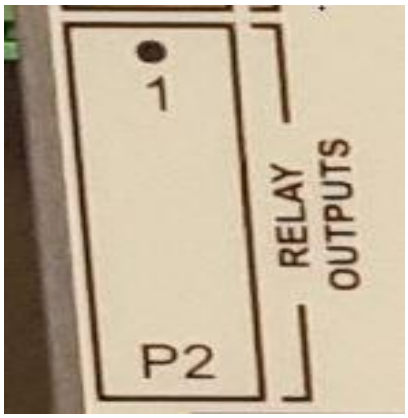
Note: A shorted 1ATS switch can cause the MCB3 breaker to open when power is applied to the machine or start button is pressed.

***Switch available for 2-stage units**

P2 Relay Outputs

Terminal plug strip P2 is dedicated to outputs that provide dry contacts for remote warning and trip notification. P2 contains 2 outputs rated at 250VAC, 48-62Hz, 3 Amps. Relay outputs (P2) information found on the back of the controller.





*Electrical Schematic for R & RS series P2 terminal

CTO-Common Trip Outputs:

- N.O connected at P2-1.
- Common P2-2
- N.C connected at P2-3.

CWO-Common Warning Outputs

- N.O connected at P2-4
- Common P2-2
- N.C connected at P2-6.

What is a dry contact?

Also called voltage free contact. The purpose is to close or open P2 terminals, without changing the primary voltage applied to the controller, allowing the customer to monitor the running status of the machine.

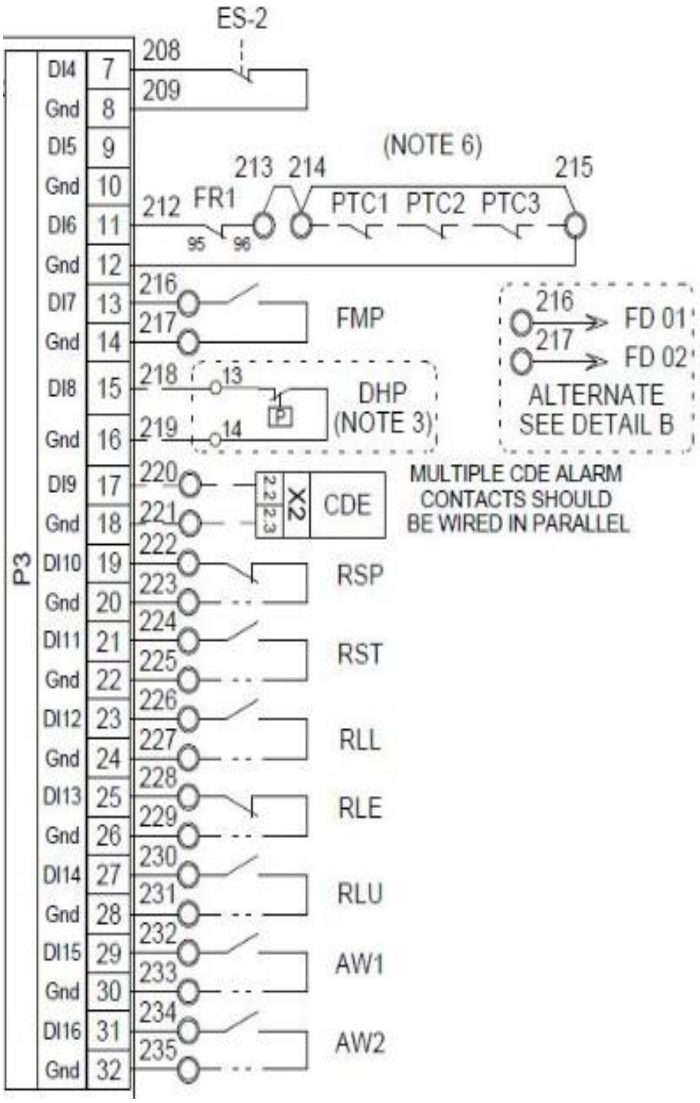
Why customers use the P2 output relay terminal?

Some customers connect light bulbs in P2 to monitor the running, warning, or trip status of the machine.

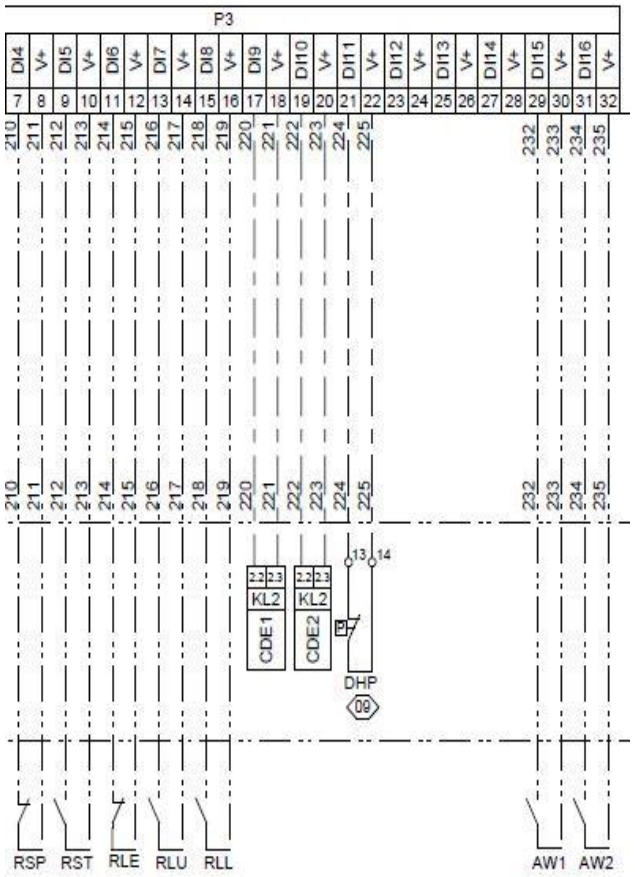
P3 Digital Inputs

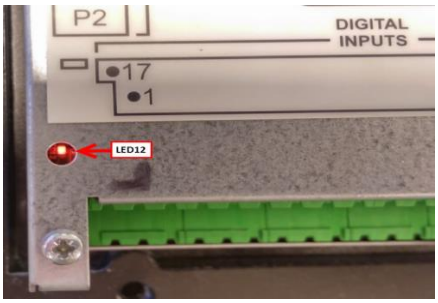
Terminal plug strip P3 is dedicated to digital inputs that provide remote control and feedback from various switches installed on the package, like motor overload/fan motor overload.

R-Series

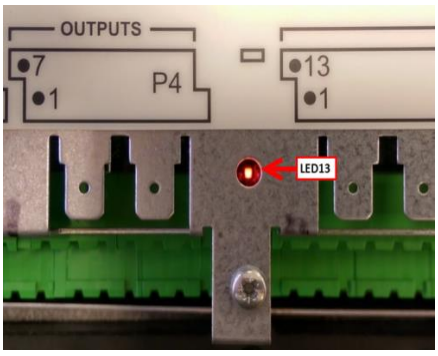


RS-Series

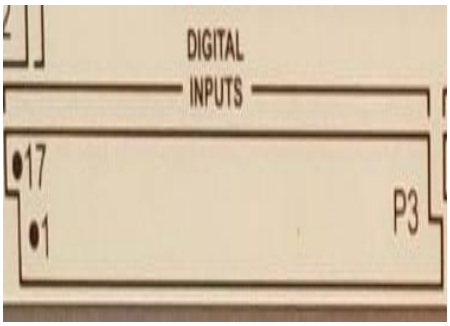




LED 12 serves as a digital input short notification. See Tech Note 8089 for more information. P3 also has Red LED (LED12) that comes on if any of the digital input connections from P3 are shorted to earth ground. The LED is at lower left corner just to left of "1" of P3.



LED13 comes on if 5VDC is shorted out on any of the analog inputs. It is visible through the hole between text "P4" and text "1" of P4.
Remove pressure transducer connections one at a time until the LED goes off. Note: There is a 5 second time delay before LED goes off after shorted input is removed. Also note that LED lights lite up when power is applied to the controller and the turn off after 5 seconds if no short is detected.



Actual P3 terminal (32 connections total)

P3 Inputs Terminal Description ***Inputs to controller and normal state of components.**	**R-Series**	**RS-Series**
Emergency Stop	Close P3 7-8	Close P3 1-2
Main Motor Overload	Close P3 11-12	Close P3 3-4
Fan Motor Protector	Close P3 13-14	Close P3 5-6
Dryer High Pressure Switch (DHP) Option TAS	Close P3 15-16	Close P3 21-22
Condensate Drain Error Signal	Close P3 17-18	Close P3 17-18
Remote Stop	Close P3 19-20	Close P3 7-8
Remote Start	Open P3 21-22	Open P3 9-10
Remote Lead/Lag	Open P3 23-24	Open P3 15-16
Remote Load Enable	Close P3 25-26	Close P3 11-12
Remote Load/Unload	Open P3 27-28	Open P3 13-14
Auxiliary 1 Warning	Open P3 29-30	Open P3 29-30
Auxiliary 2 Warning	Open P3 31-32	Open P3 31-32

*Emergency Stop, Main Motor Overload, and Fan Motor Protection devices are explained in section **P1 Triac Outputs**.

Dryer High Pressure Switch (DHP)

On units with an integrated dryer, if the dryer high pressure switch opens while the dryer is running, a fault is sent to the controller P3 terminal.
If this happens, the compressor will continue to run, but the dryer will stop. The contact must be open for at least 3 seconds before the warning will occur. However, this switch is a locking switch. The dryer high-pressure switch must be reset (contact closed) before this warning can be reset. If this warning is reset while the conditions for running the dryer exist, the dryer can restart.

Condensate Drain Error

This will occur if the compressor is running, the package discharge pressure is over 50 psi (3.45 bar), and the condensate drain error contact closes for at least 240 seconds. This warning will be ignored for 4.5 minutes after starting. If the drain valve has an error, the 24 VDC signal is removed from the controller P3 terminal, creating the alarm.

Remote Stop (RSP)

The remote stop button is intended to stop the compressor remotely. The normally closed contact is connected to P3 terminal. The switch must be closed when the unit is attempted to start remotely. This is an option that can be installed by the customer.

Remote Start (RST)

The remote start button is intended to start the compressor remotely. The normally open momentary switch is connected to P3 terminal. This is an option that can be installed by the customer.

Remote Lead/Lag (RLL)

The remote Lead/Lag is a normally open switch used to rotate Lead/Lag compressors from a remote location. The normally open contact is connected to P3 terminal. This is an option that can be installed by the customer.

Remote Load Enable (RLE)

The remote Load Enable is a normally closed switch to control the Load Enable function for the compressors

from a remote location. The normally closed contact is connected to the controller P3 terminal. This is an option that can be installed by the customer.

Remote Load/Unload (RLU)

The remote Load/Unload is a normally open switch used control the Load/Unload function for the compressors from a remote location. The normally closed contact is connected to the controller P3 terminal. This is an option that can be installed by the customer.

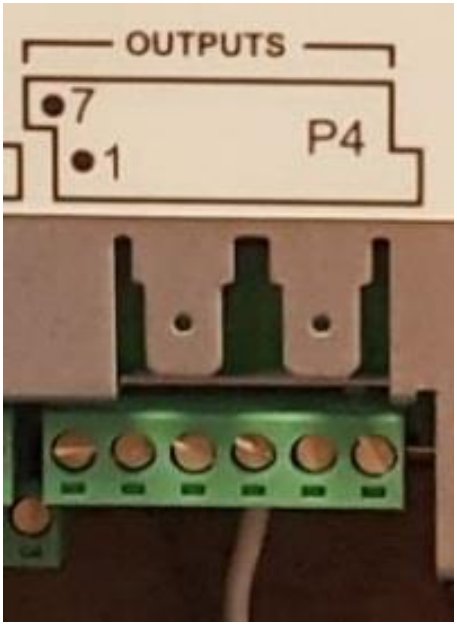
Auxiliary Warning Inputs (AW1/AW2)

Inputs for normally open contacts to indicate warning conditions in P3 terminal. In case of a warning/alarm the AW1 & AW2 inputs will close letting know the operator the compressor is in a fault condition.

P4 – Digital and Analog Outputs

Digital and Analog outputs are used for a variety of Reasons. Two example are the stepper motor and variable speed drive control.
Depending on the machine type, one or more outputs can be connected to the controller.
The controller has four digital and two analog outputs located at terminal plug strip P4.

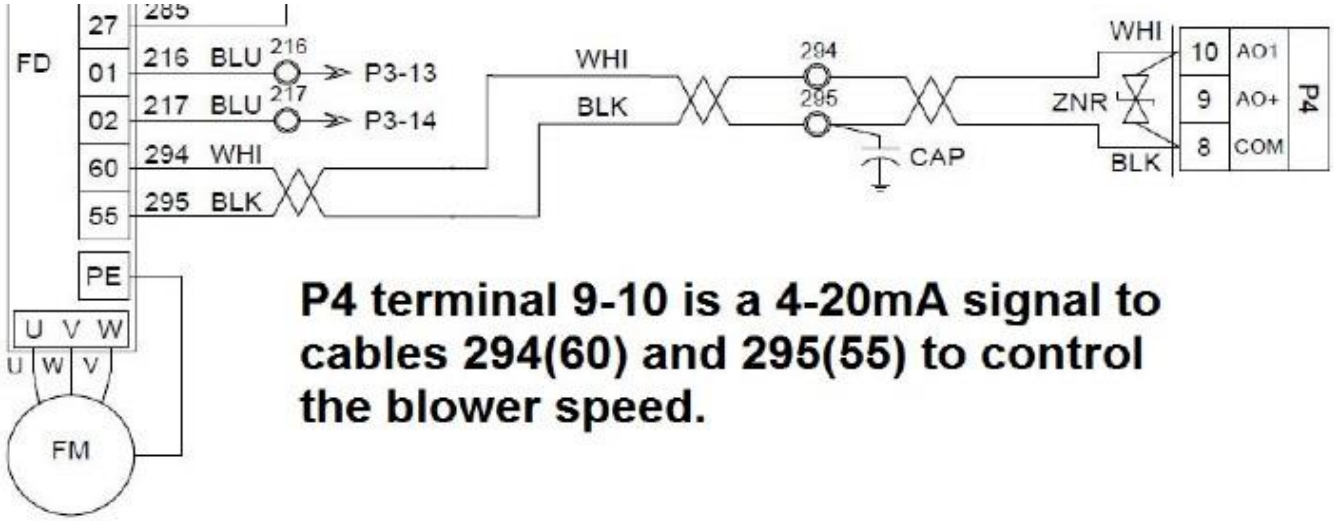
Digital Outputs



Digital AO1 connected to P4-1, 2
Digital AO2 connected to P4-3, 4
Digital AO3 connected to P4-5, 6
Digital AO4 connected to P4-7, 8

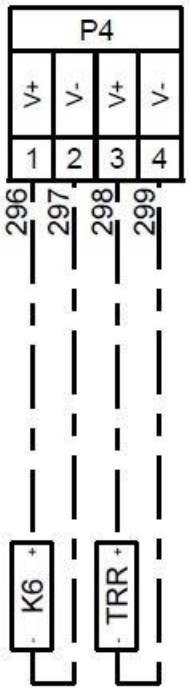
Analog AO5 connected to P4-9, 10
Analog AO6 connected to P4-11, 12

R & RS-Series P4 Analog output for Blower Drive



Test on blower speed signal Tech Tube 10968.

*Machines with Low Ambient option installed.

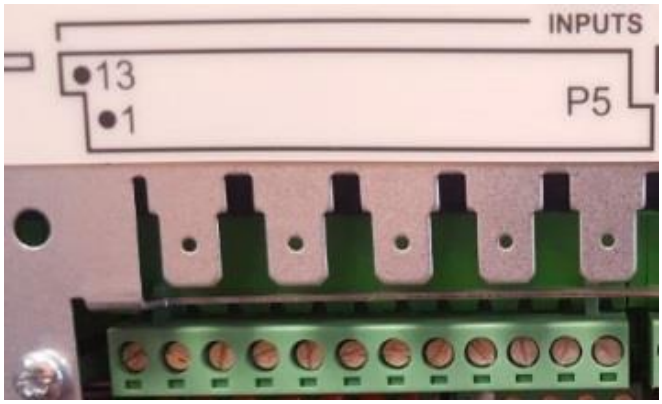


RS-Series only

P4 1-2 Digital output is the PORO relay that closes to activate the horn

P4 3-4 TRR unloaded, loaded, or in auto restart condition. No warnings/alarms active.

P5 Analog Pressure Sensor Inputs



Pressure transducers are used to convert air pressure signals to voltage signals between 0.5 and 4.5 Volts DC.

How a pressure transducer work?

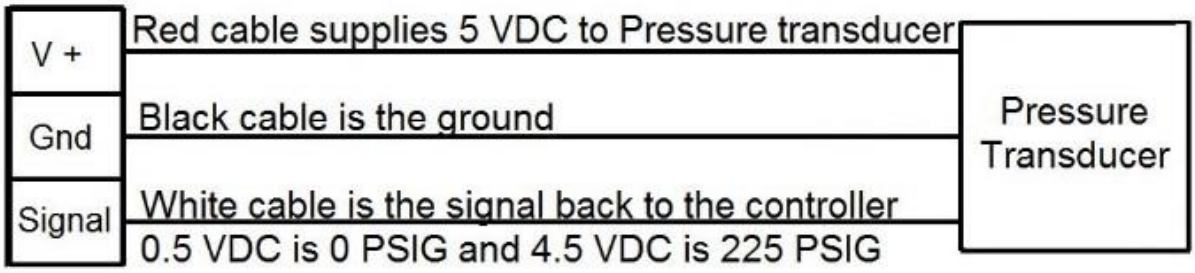
The transducer contains a metal diaphragm connected to a small piece of steel called the beam. The beam is attached to a strain gauge. As pressure pushes the diaphragm, the beam flexes and bends the strain gauge. A continuous voltage is applied to the strain gauge assembly. As the strain gauge bends due to the changing pressure on the diaphragm, the resistance value through the strain gauge changes a corresponding amount. The result is a variable output signal that ranges from 0.5 VDC (0 PSIG (0 Bar)) to 4.5 VDC (225 PSIG (15.51 Bar)). This output signal is

directly proportional to pressure and follows a linear path throughout its range.

The output signal is processed by an analog to digital converter within the controller. Depending on the voltage level, the controller may change the pressure reading displayed, load/unload the compressor, or possibly shut the compressor down.

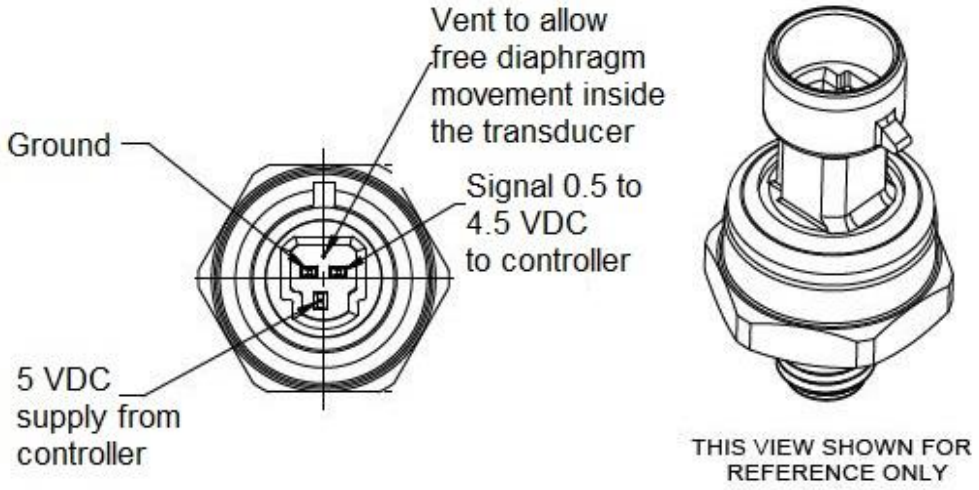
If a pressure sensor is replaced, it is important to calibrate the new sensor. Calibration allows the controller to read the sensor's output signal with the diaphragm in a totally relaxed state and then correct for any minor deviations from 0.5 VDC. Calibration directions are included in the Operator's Manual. There are no adjustments to the pressure sensors themselves.

Pressure Transducer Voltage Signals



For 1AVPT Inlet Vacuum Transducer 0.5 VDC is 0 PSIG and 4.5 VDC is 15 PSIG

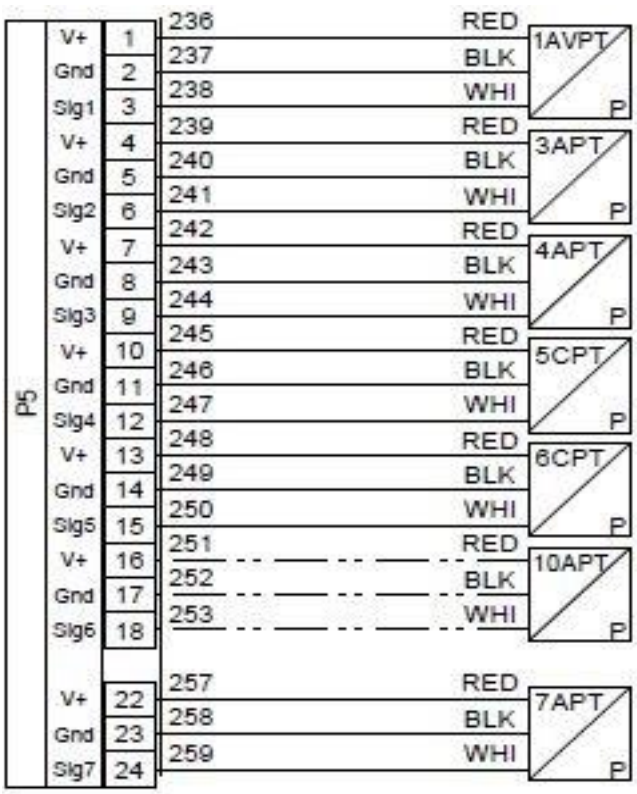
*Ensure the ground cable is connected properly to have a correct feedback signal to the controller



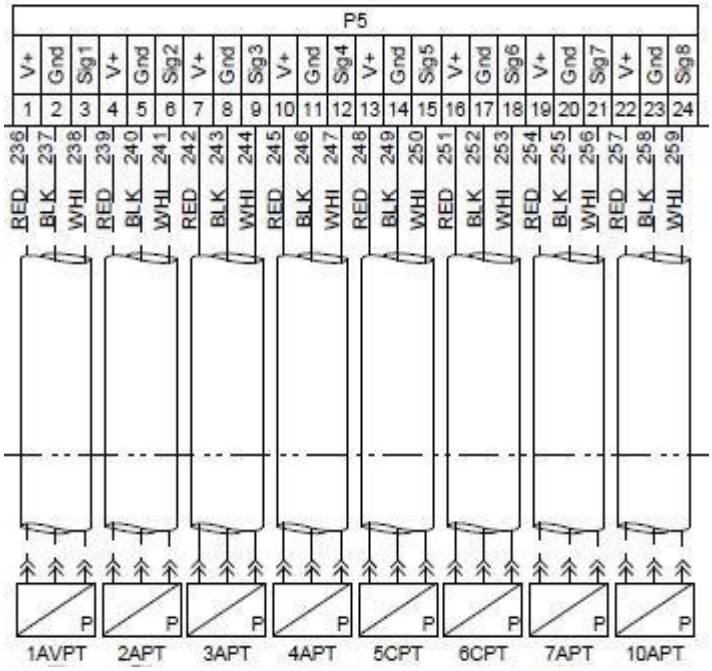
Note: The signal terminal takes the DC feedback from the pressure transducer and calculates the corresponding psi/bar value to be shown on the controller display.

P5 Pressure Inputs Terminal Description	R-Series	New RS-Series
1AVPT (0-15 PSIG/1.03 Bar) Inlet Vacuum	P5- 1, 2, 3	P5- 1, 2, 3
2APT (0-225 PSIG/15.51 Bar) Inter stage Air Pressure (2-Stage)	P5- 19,20,21	P5 4,5,6
3APT (0-225 PSIG/15.51 Bar) Sump Pressure	P5 4,5,6	P5 7,8,9
4APT (0-225 PSIG/15.51 Bar) Package Discharge Pressure	P5 7,8,9	P5 10,11,12
5CPT (0-225 PSIG/15.51 Bar) Coolant Filter In Pressure	P5 10,11,12	P5 13,14,15
6CPT (0-225 PSIG/15.51 Bar) Coolant Filter Out Pressure	P5 13,14,15	P5 16,17,18
7APT (0-225 PSIG/15.51 Bar) Package A/C Pressure (Dryer Option)	P5 22,23,24	P5 19,20,21
10 APT (0-225 PSIG/15.51 Bar) Remote Sensor (Optional)	P5 16,17,18	P5 22,23,24

P5 Electrical Schematic Connection



R-Series



RS-Series

1AVPT Inlet Vacuum

Connected to P5, 1AVPT has a range of 0 to 15 psi (0 - 1.03 Bar). The output signal to the controller is 0.5 VDC at 0 psi (0 Bar) and 4.5 VDC at 15 psi (1.03 Bar). Inlet vacuum differential pressure is monitored to ensure the inlet air filter health and the butterfly valve in the inlet valve assembly is open when the machine loads (if the inlet valve is not open when the machine

loads it will create a higher differential pressure at 1AVPT sensor causing the alarm High Inlet Vacuum).

2APT – Inter stage Air Pressure (Two-stage Only)

Mounted between the first and second stage of the compressor Air End, 2APT ensures the male rotor of the second stage Air End is rotating when the machine is running loaded/unloaded. The trip occurs when the pressure exceeds 75 psi (5.17 Bar).
2APT has an output signal range of 0 psi (0 Bar) at 0.5 VDC to 225 psi (15.51 Bar) at 4.5 VDC.

3APT - Sump Pressure

Sump pressure is monitored for several reasons, including a comparison to package discharge pressure to calculate separator element differential. 3APT also provides logic for the controller to position the inlet valve during unloaded operation.
The normal unloaded sump pressure is maintained within a range of 18-24 PSIG (1.24-1.65 Bar) to ensure adequate coolant flow and allow the unloaded compressor to operate at a low horsepower condition.

3APT has an output signal range of 0 psi (0 Bar) at 0.5 VDC to 225 psi (15.51 Bar) at 4.5 VDC.

4APT - Package Discharge Pressure

The controller monitors package discharge pressure in order to load or unload the compressor. 4APT is compared with the sump pressure to calculate separator element differential.
4APT has an output signal range of 0 psi (0 Bar) at 0.5 VDC to 225 psi (15.51 Bar) at 4.5 VDC.

5CPT – Injected Coolant Pressure

Mounted before the coolant filter to measure the inlet pressure coming from the sump.
5CPT has an output signal range of 0 psi (0 Bar) at 0.5 VDC to 225 psi 15.51 Bar) at 4.5 VDC.

6CPT – Coolant Filter Out Pressure

Mounted at the discharge of the coolant filter manifold assembly to monitor the differential pressure of the coolant filter element. The 2 readings at 5CPT and 6CPT are used to calculate differential pressure.

6CPT has an output signal range of 0 psi (0 Bar) at 0.5 VDC to 225 psi (15.51 Bar) at 4.5 VDC.

7APT – Package A/C Pressure (Dryer option)

Mounted in the air system, just downstream of the aftercooler.
Package A/C pressure is used with integrated dryers and monitors air pressure entering the dryer.
7APT has an output signal range of 0 psi (0 Bar) at 0.5 VDC to 225 psi (15.51 Bar) at 4.5 VDC.

10APT – Remote System Pressure (Option)

Mounted in the air system, downstream of the compressor package and any preparatory equipment.
Remote system pressure is used for several purposes including enabling the compressor to react faster to system events.
10APT has an output signal range of 0 psi (0 Bar) at 0.5 VDC to 225 psi (15.51 Bar) at 4.5 VDC.

P6 Analog Temp Sensor Inputs

Temperature sensitive resistors called, thermistors, are used to monitor temperature changes at various points within the compressor package. They operate on a 5 volt DC circuit.

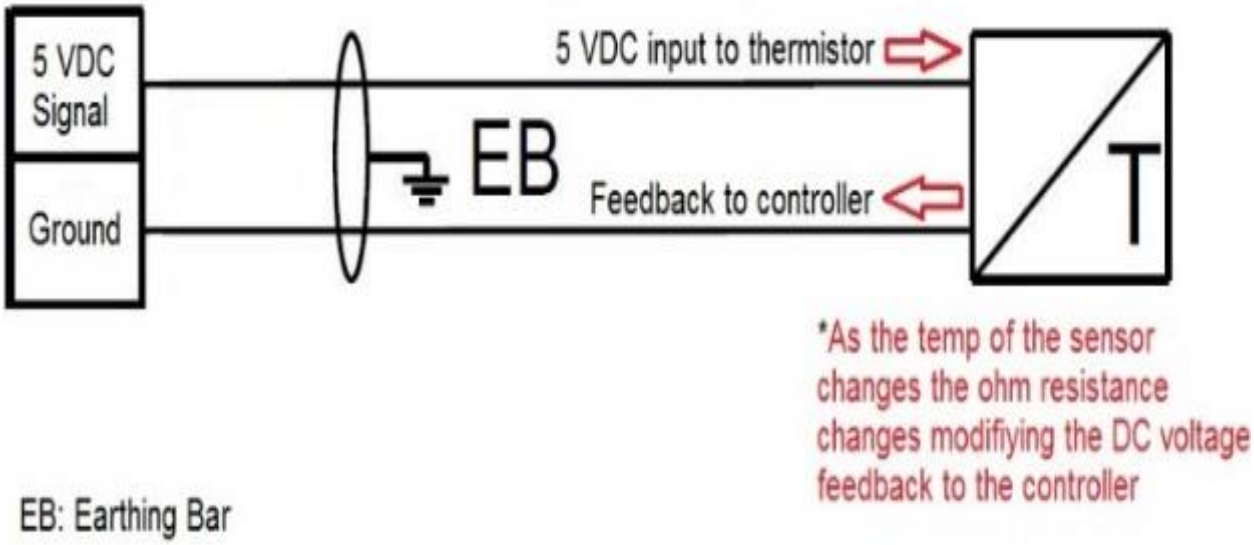
How a thermistor work?

As the temperature of the sensor changes the resistance through the sensor changes by a corresponding amount. As the output voltage varies due to the temperature changes, the voltage signal is processed by an analog to digital converter within the controller. The Xe controller uses Negative Temperature Coefficient (NTC) thermistors, meaning that temperature and resistance are inversely proportional. In other words, as temperature increases, resistance decreases and vice-versa. The controller may provide a warning of rising temperature or could shut the compressor down if operating conditions dictate.

How can I check a thermistor?

Place the thermistor in cold water (of known temperature) and take an Ohm reading across the 2 wires. Do the same with hot water and compare the 2 values with the Thermistor Resistance Chart.

*If the thermistor Ohm value does not match the expected value, it is defective.



P6 Thermistor Description & Connection

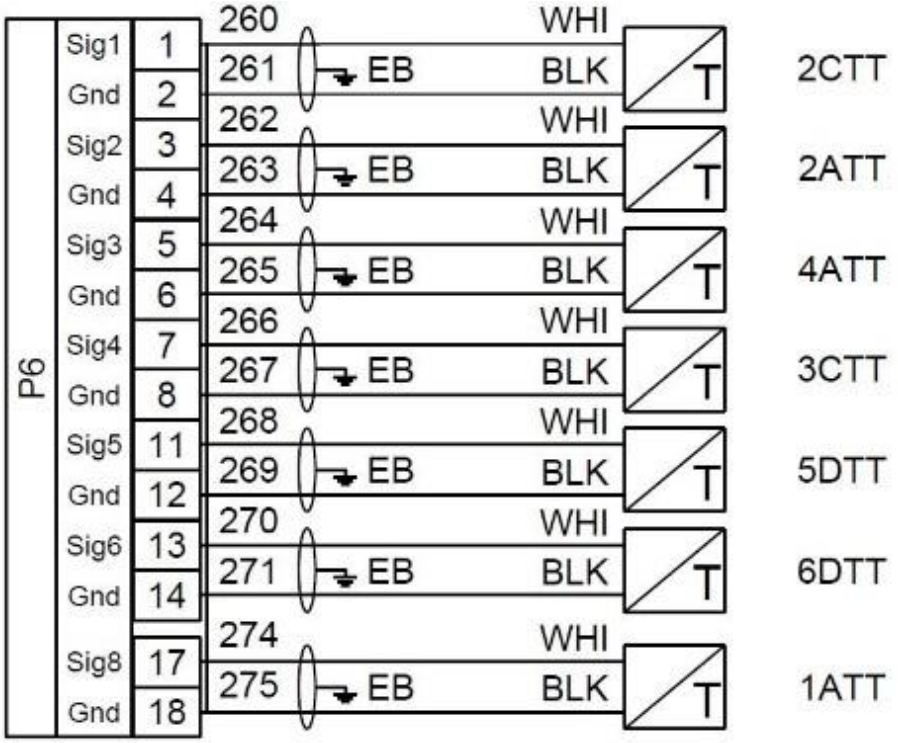
Thermistor Description	R-series	RS-series
1ATT Package Inlet Temperature	P6 17-18	P6 1-2
2ATT Air End Discharge Temperature	P6 3-4	P6 3-4
2CTT Injected Coolant Temperature	P6 1-2	P6 5-6
3CTT Oil Cooler Out Temp (Option)	P6 7-8	N/A
4 ATT Package Discharge Temperature	P6 5-6	P6 11-12
5DTT Dryer Dew Point (Option)	P6 11-12	P6 13-14
6DTT Refrigerant temp (Option)	P6 13-14	P6 15-16

Thermistor Resistance Chart

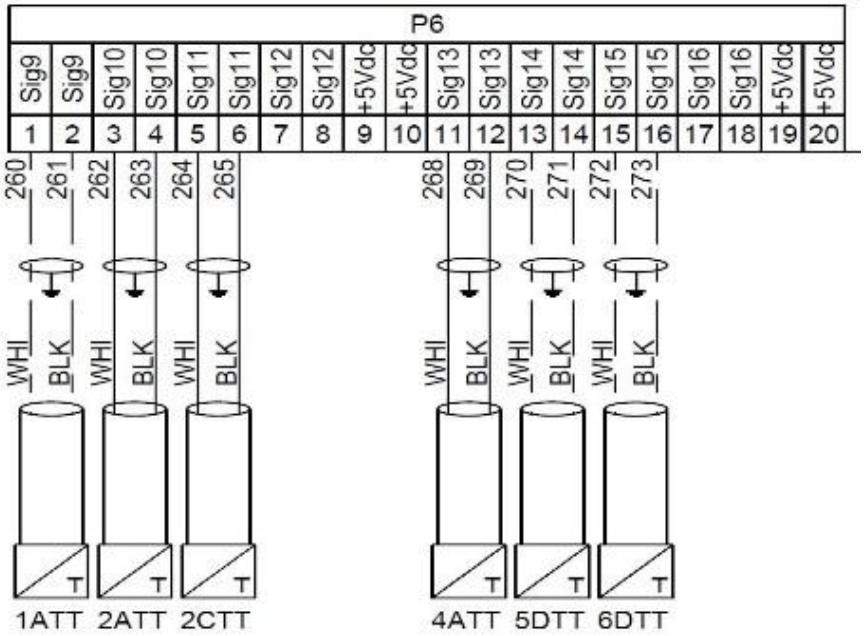
Temp ^{0}F	Ohms	Temp ^{0}F	Ohms	Temp ^{0}F	Ohms
32	33631	104	5241	176	1194
41	25988	113	4276	185	1014
50	20244	122	3507	194	865.2
59	15889	131	2894	203	741
68	12562	140	2400	212	636.9
77	10000	149	2001	221	549.7
86	8013	158	1677	230	476.1
95	6461	167	1412	239	413.9

*Chart not applicable for Oil Free RTD sensors (see Nirvana Oil Free/Sierra Manual).

*3CTT, 5DTT and 6DTT (option)



R-Series



RS-Series

*5DTT and 6DTT (option)

1ATT – Package Inlet Temperature Sensor

Mounted at the inlet air ducting of the package, 1ATT monitors the temperature of the incoming air to the package. 1ATT has a range between -10°F (-23.33°C) and 250°F (121.1°C).
The output voltage is 0.5 volts DC at 0°F to
4.5V DC at 246°F (118.9°C).

2ATT – Air End Discharge Temperature Sensor

The controller uses 2ATT to monitor the temperature of the air/coolant mixture as it leaves the Air End discharge port. 2ATT has a range between -10°F (-23.3°C) and 250°F (121.1°C).
The output voltage is 0.5 volts DC at 0°F to
4.5V DC at 246°F (118.9°C). The controller shows a High Air End Discharge warning at 221°F (105°C). The High Air End Discharge shutdown occurs at 228°F (108.9°C). The alarm can be reset when 2ATT reads below 217°F (102.8°C).

2CTT - Injected Coolant Temperature

Mounted at the coolant filter discharge, 2CTT monitors the temperature of the coolant being injected into the

Air End. 2ATT has a range between -10°F (-23.3°C) and 250°F (121.1°C).
The output voltage is 0.5 volts DC at 0°F (-17.8°C) to 4.5V DC at 246°F (118.9°C).

3CTT Coolant Cooler-Out Temperature Sensor (Option)

Mounted to the discharge of the coolant cooler (cold side), 3CTT monitors the temperature of the coolant at the cooler output.
3CTT has a range between -10°F (-23.3°C) and 250°F (121.1°C). The output voltage is 0.5 volts DC at 0°F (-17.8°C) to 4.5V DC at 246°F (118.9°C).

4ATT Package Discharge Temperature Sensor

Mounted at the package discharge, near the moisture separator, 4ATT monitors the temperature of compressed air downstream of the compressor's aftercooler.
This sensor is for information only and has no Warning or Alarm feature. If the sensor is removed, the controller shows the message "sensor failure" without shutting down the compressor. This is informational only.

4ATT has a range between -10°F (23.3°C) and 250°F (121.1°C). The output voltage is 0.5 volts DC at 0°F (-17.8°C) to 4.5V DC at 246°F (118.9°C).
*If another sensor fails, 4ATT can be swapped with that sensor for troubleshooting purposes.

5DTT Dryer Dew Point Sensor (TAS only)

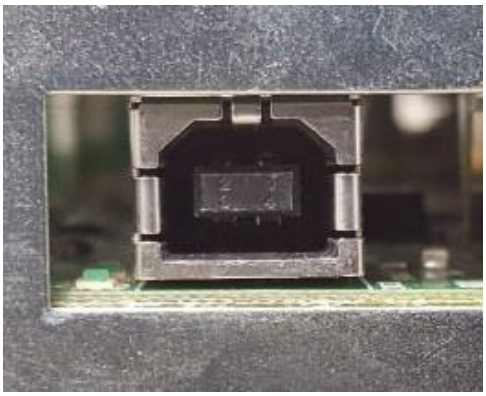
Mounted at the moisture separator of the dryer, 5DTT monitors the dew point of the dryer.
5DTT has a range between -10°F (23.3°C) and 250°F (121.1°C). The output voltage is 0.5 volts DC at 0°F (-17.8°C) to 4.5V DC at 246°F (118.9°C).

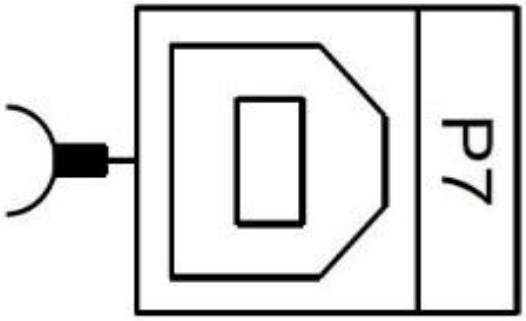
6DTT Refrigerant Temperature Sensor (TAS only)

Mounted at the refrigerant discharge tubing, 6DTT monitors the refrigerant discharge temperature.
6DTT has a range between -10°F (23.3°C) and 250°F (121.1°C). The output voltage is 0.5 volts DC at 0°F (-17.8°C) to 4.5V DC at 246°F (118.9°C).

P7 USB Service Tool Port

The Xe controller has one USB B service port that provides access to the file system and allows programming through the Field Service Tool.





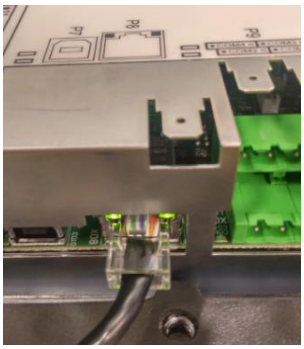
Controller Connection Electrical Schematic Terminal

*A standard USB Type-A to B cable (commonly a USB printer cable) is required for access through this port.

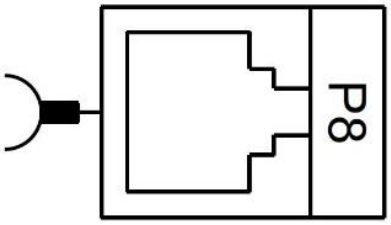
USB printer cable

P8 RJ45 Ethernet Port

The Xe-M controller has one RJ45 Ethernet port that provides access to the controller's web pages through a TCP/IP network and web browser. This port also provides remote service tool capabilities as well as remote monitoring and compressor control through a Modbus TCP type system controller.
Settings are available through the controller UI to configure the Ethernet port as needed.
Note 1: Additional settings are required to allow remote control of the compressor.
Note 2: For detailed Web Access information, see Xe Controller Manual.



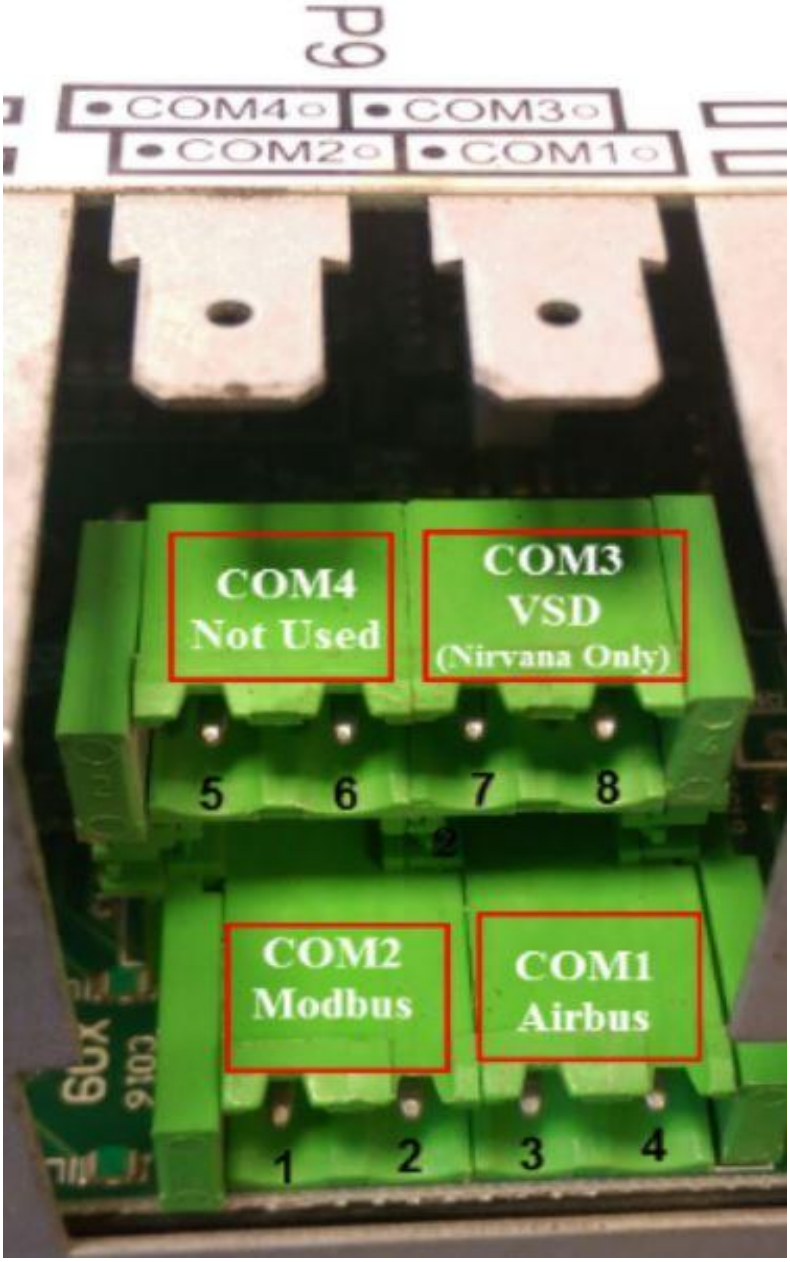
For Ethernet Configuration
Controller connection RJ-45 Cable RJ-45(Ethernet cable)*Web access light is on *Must have a valid IP address on the customer's network



Electrical Schematic Terminal

P9 RS485 Communication (COM1-4)

In addition to USB and Ethernet communication, the Xe has four RS-485 serial ports located at terminal plug strip P9.



COM1 Airbus (RS485-1 Network)
P9-3 = L1 (+)
P9-4 = L2 (-)

COM2 Modbus
P9-1 = L1 (+)
P9-2 = L2 (-)

COM3 VSD (Nirvana Only)
P9-7 = L1 (+)
P9-8 = L2 (-)

COM4 - Not used

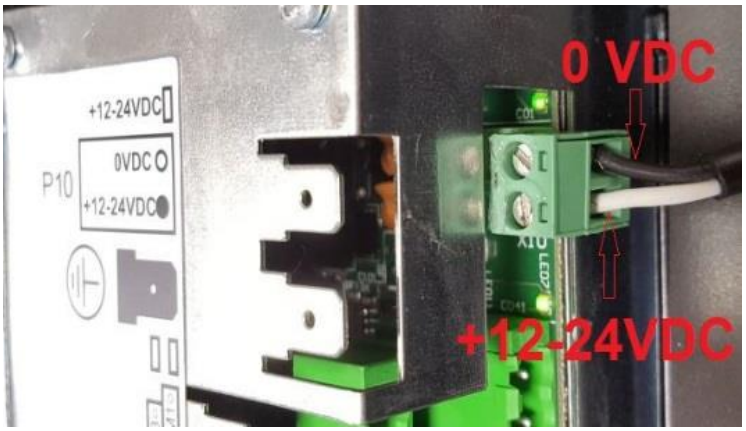
For Serial Communication to work, all components wired into the system must be using the same serial protocol at the same speed, or be "*speaking the same language*". If any one component wired in does not use the same protocol, it can cause communication difficulties.

*RS-485 data communications and other low voltage signals can be subject to electrical interference

Note: Search in Tech Direct for detail information about serial communication.

P10 – 24VDC Power Supply

12-24VDC power required for controller logic, display, analog and digital signals.

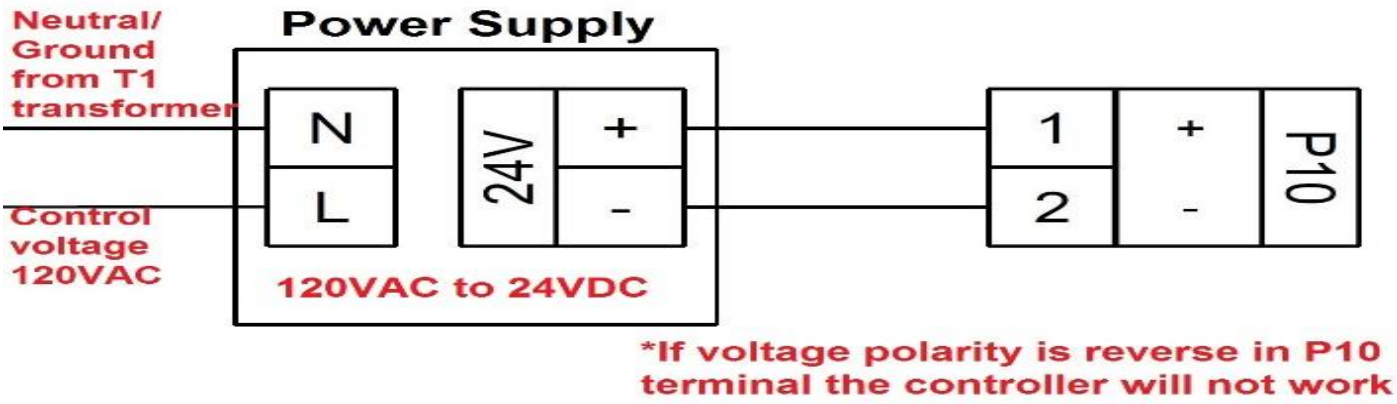


P10-2= Negative

P10-1= Positive

*Supply Input P10 = 10.9-26.4 VDC at 0.45 Amps

Electrical Schematic R & RS-Series



Both machines require an external DC voltage source to power the controller. Ensure MCB5 circuit breaker is closed/operational.

Warnings & Alarms Troubleshooting Tips

Important note: Every warning, alarm, or compressor model have a letter close to the fault. Example:

- R = R-Series models
- RS = New RS-Series models
- W = Warning
- A = Alarm

Change Inlet Filter

Xe Software Logic for R & RS machines:

W: Will occur if 1AVPT sensor is greater than 0.7 psi (.05 Bar) vacuum (or 1.3 psi (.09 Bar) vacuum if the high dust filter option is enabled) and the compressor has been loaded for at least 8 seconds. This condition must exist for 3 seconds before the warning is issued.

Recommended Checks

- Check if the inlet valve opens all the way when the machine loads.
- Is the filter clogged? Check for oil mist.

- Is 1AVPT reading 0 psi (0 Bar) when the machine is not running (calibration is required).
- Is the 1AVPT sensor range 0-15 psi (0-1.03 Bar)?
- Ensure sensor and tubing are clean.
- Is the high dust filter option in the controller disabled for a High Dust Filter element?

Change Separator Element

Xe Software Logic for R & RS machines:

W: Will occur if the compressor is loaded, the compressor is warmed up (the injected coolant temperature is at least 120 °F), the package discharge pressure is at least 90 psi (6.21 Bar), and the separator pressure drop is greater than 12 psi (.83 Bar). This condition must exist for 3 seconds before the warning is issued.

Recommended Checks

- Take a coolant sample. Scavenge line might be plugged.
- When was the last time the separator element was replaced? See machine PM Table for reference.

- Is the inlet filter housing sealing tight on top of the inlet valve preventing access of dirt and debris?
- Is the machine using Ingersoll Rand OEM parts and coolant?
- Ensure 3APT sump pressure and 4APT package discharge sensors are reading 0 when the machine is not running.
- Are the remote sensor and dryer set to “ON”. If one is turned on the other one needs to be set to off.
- Is the dryer “ON” for a TAS unit?
- If the machine has a dryer, check the inline filter for obstructions.

Change Coolant Filter

Xe Software Logic for R & RS machines:

This will occur if the compressor has been running loaded for at least 8 seconds, coolant temperature is greater than 120°F (48.9°C), and the coolant filter pressure drop (5CPT - 6CPT) is greater than 25 psi (1.72 Bar). This condition must exist for 150 seconds before the warning is issued.

Recommended Checks

- Ensure the sensors 5CPT and 6CPT are reading 0 psi (0 Bar) when the machine is not running.
- How many hours are on the coolant filter? Compare to with the machine PM table for reference.
- Check inside the coolant filter for metal debris, or foreign material.
- Check piping and coolant filter housing for obstruction.
- If the sensors are fluctuating when the machine is stopped, the wiring is not connected properly or the wiring is touching an AC source. This causes electrical noise in the DC signals.

Sensor Failure

Xe Software Logic for R & RS machines:

W & A: This will occur whenever a temperature or pressure sensor is missing, broken, or not connected properly.

Recommended Checks

- Check for the correct connection of the sensor according to the Electrical Schematic.
- If multiples sensor failure alarms are present, it is possible a sensor is shorting the DC voltage of the controller. Troubleshoot to isolate the sensor.
- To check a thermistor, perform a quick check according to section P6 Analog Temp Sensor Inputs.
- *Remember 4ATT can be used to troubleshoot other thermistors
- Check connectors per Quick Disconnect Plugs/Connector section of this manual.
- If a Dryer/TAS sensor failure is active, ensure the machine has the option installed.
- If the remote pressure set point is set to ON and a sensor failure is reported for the remote pressure signal, the controller shall revert to using the package discharge pressure sensor for load and unload sequence control and revert to displaying the package discharge pressure on the home page gauge (troubleshoot the remote pressure sensor).
- To ensure pressure sensor reading is accurate connect a manual gauge to compare actual pressure.

- A sensor failure 4APT will be issued if the sump pressure is over 100 psi (6.89 Bar) and the Package Discharge Pressure (4APT) is 50 psi (3.44 Bar) less than the sump pressure. Check for clogged separator, or broken sensor.
- If the reading of the pressure sensor fluctuates, it is faulty, the wire connection is incorrect, or the sensor wire is close to an A/C cable creating electrical noise.

Notes for Sensor Failure

RS-Series: 1AVPT Inlet Vacuum: This sensor failure is only checked if the compressor is running and loaded. Otherwise, the sensor failure for inlet vacuum is ignored. This is due to the design of the inlet valve on the ARES air compressors.

*See FSB 1950 in Tech Direct for R-Series Pressure Transducer Failure Testing and Remote Mounting.

High Sump Pressure

Xe Software Logic for R & RS machines:

W: If the compressor is running loaded, has been loaded for at least 8 seconds and the sump pressure is more than 25 psi (1.72 Bar) above the rated pressure for the compressor. If this warning occurs, the online and offline pressures will be reduced (PAC logic ID 11439). This condition must exist for 3 seconds before the warning is issued.

A: This will occur if the compressor is running loaded for at least 8 seconds, and any one of the 3 following conditions exist: (1) the sump pressure is above the rated pressure by 35 psi (2.41 Bar). (2) The separator pressure drop is measured to be more than 25 psi (1.72 Bar) and the package discharge pressure at least equal to the minimum online set point value. (3) The sump pressure is above 165 psi (11.38 Bar) if the rated pressure is less than 190 psi (13.1 Bar) or the sump pressure is above 220 psi (15.17 Bar) if the rated pressure is 190 psi (13.1 Bar).

Recommended Checks

- Check the hours on the separator. Replace if exceeds PM schedule time.
- Is the sump pressure 3APT and package discharge pressure 4APT reading zero psi (0 Bar) when the machine is not running? Calibrate. Replace faulty sensor. Check wiring. Test quick connector.
- For machines under 34°F (1.1°C), install a Low Ambient kit to prevent excessive coolant thickness at start-up. Some cases the separator element will implode due to excessive thickness of the coolant when machine starts cold.
- Check for use of OEM Ingersoll Rand Parts.

High Air End Discharge Temp

Xe Software Logic for R & RS machines:

W: Will occur if the compressor is running and 2ATT is greater than 221°F (105°C) (97% of 228°F (108.9°C)) and the compressor is running. This condition must exist for 3 seconds before the warning is issued.

A: This will occur if 2ATT is greater than 228°F (108.9°C) and the compressor is running.

Recommended Checks

- Is the cooler clean front and back?
- Ensure blower drives are running at max speed.
- If the injected coolant temperature is above 180°F ensure thermal control valve is operating.
- When the machine is up to temperature, the airend discharge temperature should be only a few degrees higher than the cooler in temperature.
- Ensure the cooler temperature out is at least 30°F (-1.11°C) **LESS** than the cooler in when the machine is up to temperature. Check TCV.
- Check for piping obstruction.
- Ensure check valve is working Tech Note ID 9930.
- Is the sump sight glass at least ½ full when the machine is running loaded?

Auxiliary 1 (R, RS)

Xe Software Logic

W: This will occur if auxiliary input 1 closes. The contact must be closed for at least 3 seconds before the warning will occur.

Recommended Checks

- Check device or component connected to P3 terminal “AW1” in the Electrical Schematic of the machine. The connection is normally open, so whatever is connected issuing the warning must be closed. Ask customer what is connected to the terminal AW1 to troubleshoot the warning.

Auxiliary 2

Xe Software Logic for R & RS machines:

W: This will occur if auxiliary input 2 closes. The contact must be closed for at least 3 seconds before the warning will occur.
This will occur if Control Power Loss is disabled and auxiliary input 2 closes.

Recommended Checks

- Check device or component connected to P3 terminal “AW2” in the Electrical Schematic of the machine. The connection is normally open, so whatever is connected issuing the warning must be

closed. Ask customer what is connected to the terminal AW2 to troubleshoot the warning.
- Ensure control voltage is available to the main contactors and solenoids if Control Power Loss setting is disabled in Factory Settings.

Service

Xe Software Logic for R & RS machines:

Service warnings occur when the compressor has operated a certain number of hours, based on the total hours. Service warnings can have multiple levels, depending on the service level selection. A service level selection of 0 disables service warnings.

Recommended Checks

- Add factory pass code to reset the alarm in factory settings.
- Select Service warnings according to customer needs/option installed. (High dust filter or EL Coolant)

Service Level-1

Xe Software Logic for R & RS machines:

If service level-1 has been selected for the compressor, a “SERVICE REQUIRED” warning will be issued on hour intervals equal to the service time period set point. This warning can be reset the same as any other warning.

Recommended Checks

- Add factory pass code to reset the alarm in factory settings.
- Select service warnings according to customer needs/options installed. (High dust filter or EL Coolant)

Service Level-2

Xe Software Logic

If service level-2 has been selected for the compressor, the service complete factory set point will be used to clear a level-2 service warning and reset the service

time or date. The service complete can be reset before a service warning occurs.
The initial “SERVICE REQUIRED” warning will occur at total hour intervals equal to the service time period set point. However, 100 hours before this a “100 HOURS TO SERVICE” warning will occur. This warning can be reset the same as any other warning. One hundred hours later the “SERVICE REQUIRED” warning will occur. This warning can be reset the same as any other warning, however this warning will return in 24 hours if the service complete factory set point has not be set. If the service complete has not been set, 100 hours later, the “ALARM – SERVICE REQUIRED” warning will be issued. This warning can only be cleared by the service complete factory set point. Once the service complete factory set point is set, indicating the service is completed, the time for the next “SERVICE REQUIRED” warning will be calculated by adding the service time period to the total hours value, with the “100 HOURS TO SERVICE” warning occurring 100 hours before and the “ALARM – SERVICE REQUIRED” warning occurring 100 hours after that time.

Recommended Checks

- Add factory pass code to reset the alarm in factory settings.
- Select service warnings according to customer needs/options installed. (High dust filter or EL Coolant)

Communication Failure

Xe Software Logic for R & RS machines:

W: This will occur if the compressor is the lead compressor in integral sequencing and is unable to communicate with another compressor.

Recommended Checks

- Be sure ISC is only enabled on the Master.
- Master should have Airbus Address of 1.
- Be sure the comm cable is only grounded at the Master.
- Be sure all controllers have the latest software.
- Be sure COMM Control is enabled on all controllers.

- Be sure comm cable is the minimum required (Belden 9841) or equivalent RS485 cable
- ISC can have up to 4 compressors daisy-chained together
- Be sure all comm cable have good end-to-end continuity

Sensor Failure 10APT – Remote Sensor

Xe Software Logic for R & RS machines

This will occur if the remote sensor option is on and the remote sensor is recognized as missing or broken. If this occurs, the compressor will automatically start using 4APT for loading and unloading the compressor. Units equipped with an integrated dryer cannot have a remote pressure sensor. This condition must exist for 3 seconds before the warning is issued.

Recommended Checks

- Check remote sensor feedback voltage to controller. If pressure is zero the feedback signal to the controller terminal should be 0.5 VDC.

- Broken/loose connection. Is the sensor connected to the right terminal according to Electrical Schematic?
- Strip the wire of the sensor and re-connect. Ensure the ground cable of the sensor measure 0.2Ω to 0.4Ω to the ground of the starter box. If not, correct issue.
- Check quick connector.

High Discharge Pressure

Xe Software Logic for R & RS machines:

Will occur if the compressor is using a remote sensor or is under the control of an external device, such as an 8XI, is loaded, and the discharge pressure (4APT) is greater than the maximum offline pressure. This condition must exist for 3 seconds before the warning is issued. If this condition occurs, the compressor will automatically unload. The compressor will be available to reload once the discharge pressure falls to the rated pressure value.

Recommended Checks

- For Dryer/TAS units, ensure the inline filters are clean.
- If piping is installed, bypass the dryer and re-test
- Check the sequencer such as X8i is programmed correctly. See Tech Note ID 11293.
- Install a manual pressure gauge. Is the pressure sensor reading accurately?
- If the sensor is installed before or after a dryer, could it be freezing?
- Is the sensor able to calibrate to 0 PSIG (0 Bar) when the system pressure is bled down?

Condensate Drain Error

Xe Software Logic for R & RS machines:

This will occur if the compressor is running, the package discharge pressure is over 50 psi (0 Bar), and the condensate drain error contact closes for at least 240 seconds. This warning will be ignored for 4.5 minutes after starting.

Recommended Checks

- The condensate drain has a normally open switch that receives 24 VDC from the controller. If the condensate drain tries to release the condensate water and the piping is clogged/dirty, the normally open switch closes to allow the controller to see the fault.
- The 120 VAC power of the condensate drain only energizes the drain to release the condensate water.
- Is the drain or piping dirty? A clogged pipe won't allow the drain to discharge, causing an error in the condensate drain.
- The drain is 120 VAC, so it can be bench tested.

Freeze Warning

Xe Software Logic for R & RS machines:

This will occur if the evaporator sensor has a value of 687 (about 0.5 C) or below (low temp) while the dryer is running, on compressors with the integrated dryer. This is a dryer fault. If this happens, the compressor will continue to run, but the dryer will stop. The

condition must exist for at least 180 seconds before the warning will occur. NOTE: If this warning is reset while the conditions for running the dryer exist, the dryer can restart. Also, the dryer can restart if the evaporator value rises to 709 (about 5 C). However, the warning will still be displayed.

Recommended Checks

- Check temperature probe with a cup of ice.
- Ensure metering device is not damaged.
- Check refrigerant charge.
- Calculate superheat and subcooling.

Dryer High Pressure

Xe Software Logic for R & RS machines:

On compressors with the integrated dryer, this will occur if the dryer high-pressure switch opens while the dryer is running. This is a dryer fault. If this happens, the compressor will continue to run, but the dryer will stop. The contact must be open for at least 3 seconds before the warning will occur.

If this warning is reset while the conditions for running the dryer exist, the dryer can restart. However, this switch is a locking switch. The switch must be reset before the dryer can run. Resetting the warning on the display does not reset the switch.

Recommended Checks

- High ambient temperature (if air cooled).
- Dirty condenser (if water cooled).
- High inlet air temperature.
- High airflow rate.
- Condenser fan operation.
- Refrigerant charge.
- Defective pressure sensor.

Condenser Temperature High

Xe Software Logic for R & RS machines:

This will occur if the condenser sensor has a value above high temperature threshold while the dryer is running, on compressors with the integrated dryer. This is not a dryer fault. If this happens, the compressor and

dryer will continue to run. The condition must exist for at least 180 seconds before the warning will occur.

Recommended Checks

- High ambient temperature (if air cooled).
- Dirty condenser (if water cooled).
- High inlet air temperature.
- High airflow rate.
- Condenser fan operation.
- Refrigerant charge.
- Defective pressure sensor.

Condenser Temperature Low

Xe Software Logic for R & RS machines:

This will occur if the condenser sensor has a value below the low temperature threshold while the dryer is running, on compressors with the integrated dryer. This is not a dryer fault. If this happens, the compressor and dryer will continue to run. The condition must exist for at least 180 seconds before the warning will occur.

Recommended Checks

- Check temperature probe with a cup of ice.
- Ensure metering device is not damaged.
- Check refrigerant charge.
- Calculate superheat and subcooling.

Change HE Filter

Xe Software Logic for R & RS machines:

The HE filter is located between the aftercooler discharge and the inlet to the dryer and is only on compressors with an integrated dryer. The drop across the HE filter is measured by subtracting the package discharge pressure from the aftercooler discharge pressure. If the compressor is running, the measured drop across the HE filter is at or above 10 psi (0.7 bar), the compressor is hot (injected coolant temp above 120 °F), and the package discharge pressure (4APT) is above 90 psi (6.21 Bar), this warning can occur. The condition must exist for at least 3 seconds before the warning will occur. This is not a dryer fault. If this happens, the warning will be displayed, but the dryer will continue to run.

Recommended Checks

- Change HE filter
- Verify wiring and instrumentation

Low Sump Pressure

Xe Software Logic for R & RS machines:

Will occur if the compressor is running unloaded or loaded and 3APT is less than 13 psi (.9 Bar) for 15 seconds.

Recommended Checks

- Is the unloaded sump pressure 18-24 psi (1.24-1.65 Bar)? If not, adjust inlet valve per Tech Note 1497
- If the main motor has rotation, check 3APT sensor for proper reading.
- Calibrate 3APT sensor. Compare reading to a manual gauge.
- Ensure 115 VAC supply to P1-1 terminal is connected properly

- Verify the main contactors are not opening when the machine is loaded/unloaded
- Overridden when Control Power Loss is unchecked
- Check to make sure K2 relay is working

Check Motor Rotation

Xe Software Logic for R & RS machines:

This will occur if 3APT is less than 1 psi (.07 Bar) on a compressor, 3 seconds after starting (6 seconds if the compressor is equipped with a soft starter or airend discharge temperature is less than 50 °F). This condition can be caused by the motor running in reverse. Once correct motor rotation is established, this trip will not be checked again unless power is removed from the controller.

Recommended Checks

- Ensure the main contactors are pulling in. First set is KM3 + KM1 (WYE connection). Then KM3 drops to energize KM1 + KM2 (Delta Run).
- If the main contacts are pulling in ensure the sensor 3APT is reading correctly.

- Possible shorted coil in contact. Measure Ohms of the contactor coil and compare to the other 2 contactors. If shorted coil or open coil replace contactor or coil.
- Check auxiliaries of the contact. A N.C auxiliary will open and a N.O will close if pressed when testing (ensure to LOTO/disconnect power to test the auxiliaries/contact coils).
- Ensure correct rotation of the motor/Air End.
- Is 2ATT reading more than 50°F (10°C) when the Air End rotates?

Main Motor Overload

Xe Software Logic for R & RS machines:

This will occur if the motor overload relay contact opens. The contact must be open for at least 3 seconds before the trip will occur.

Recommended Checks

- Check Tech Note 361 to adjust overload (same principle for RS models).
- Ensure the incoming voltage is balance to ground.

- Check Tech Flash ID 11103 to help you troubleshoot incoming power problems.
- The overload opens/breaks the circuit to P3 terminal. Ensure wires are connected.
- Is the motor pulling more current than the motor data tag calculation? Measure with an amp meter for accuracy. If amps are close to the overload setting, increase overload 5 amps and re-test.
- The Air End is the load: Are SPM readings high or oil samples flagged? A damaged bearing in the Air End can increase the amps in the induction motor opening the motor overload.
- The motor overload is normally closed. If the overload cannot be reset it is defective.

Fan Motor Overload

Xe Software Logic for R & RS machines:

Will occur if a fan motor overload relay contact opens. The contact must be open for at least 3 seconds before the trip will occur.

Recommended Checks

- Is the overload set properly according to the motor amperage found in the motor data tag? See Tech Note 8557.
- Are the running amps balanced according to Tech Note 2297?
- The wires of the fan overload are connected to P3 terminal. Check wiring and P3 terminal connector.
- Is ductwork installed causing an air restriction?
- If the machine has a blower drive installed, install an LCP or HIM to read the fault log of the drive.
- Megger the motor

Remote Stop Failure

Xe Software Logic for R & RS machines:

Will occur if the remote start/stop option is enabled, the remote stop button remains open and either start button is pressed. The remote stop switch is normally closed.

Recommended Checks

- Ensure the connection in P3 terminal of the remote stop circuit is closed: 0 volts DC across the 2

cables of the remote stop means a good closed circuit. A 24 VDC across the remote stop in P3 terminal shows an open circuit. Fix wiring + E-stop switch.

- Check quick connect plug
- If the remote stop box in the status menu of the controller is not selected, the controller is not receiving the signal from the remote stop switch. Check wiring + switch

Remote Start Failure

Xe Software Logic for R & RS machines:

Will occur if the remote start/stop option is enabled, the compressor is started by the remote start button, and the button stays closed for 7 seconds after the compressor starts. The remote start switch is a momentary switch (Only holds the connection closed when it is manually pressed by the user)

Recommended Checks

- Ensure the momentary remote start switch is not stuck closed. To start a machine press the remote start switch for no more than 2 to 5 seconds.

Emergency Stop

Xe Software Logic for R & RS machines:

This will occur when the emergency stop button is engaged.

Recommended Checks

- The remote stop switch is a 24 VDC signal on P3 terminal in the controller. An open switch will show this alarm. Check for loose/broken wiring. Broken switch.
- Ensure switch is reset. Check for loose wires.

High Coolant Filter Pressure Drop

Xe Software Logic for R & RS machines:

This will occur if the compressor has been running loaded for at least 8 seconds, is warmed up, already

has a change coolant filter warning, and the coolant filter pressure drop (5CPT - 6CPT) is greater than 35 psi (2.41 Bar).

Recommended Checks

- Replace oil filter according to PM schedule.
- Are the sensors reading 0 psi (0 Bar) when the machine is not running? Correct/calibrate sensors.
- If the sensors readings are fluctuating rapidly, there is a short, ground or electrical noise from a power cable (blower motor, drain valve)
- Take oil sample for contaminated environments.
- Check wiring of the sensors in P5 terminal.

High Inlet Vacuum

Xe Software Logic for R & RS machines:

This will occur if the compressor is running loaded and the inlet vacuum is greater than 1.8 psi (.12 Bar). If the compressor has a high dust filter, the trip threshold for inlet vacuum is 2.4 psi (1.7 Bar). This logic only checks 1AVPT sensor when the machine is loaded or running in modulation.

Recommended Checks

- Ensure the inlet valve opens when the machine is loaded. Check control air signal to cylinder. Perform PM in the inlet valve/blowdown block.
- Ensure software revision is greater than 3.1.0.4 for machine changing from On/Offline to Modulation.
- Is the air filter clogged? Check inlet filter condition.
- Is the High Dust filter option selected in Factory settings?

Unit Too Cold To Start

Xe Software Logic for R & RS machines:

This will occur if the compressor does not have the low ambient option, the Air End discharge temperature (2ATT) is less than 35°F (1.7°C), and the operator attempts to start the compressor. This fault can only occur once a day. Once this fault occurs, the operator can reset it and start the compressor. This fault will be logged in the trip history to indicate that the compressor is being started in low ambient conditions.

Recommended Checks

- For machines in low ambient conditions, offer the customer the Low Ambient Kit. Search in Passport for low ambient kits or contact Parts ID.
- Ensure 2ATT is reading more than 35°F. Check for loose/broken sensor.
- For machines with low ambient kits ensure the heat trace option is connected and the thermostat is set no less than 50°F.
- For more info, see Tech Note 7998.

High Inter Stage Pressure

Xe Software Logic for R & RS 2 stage units:

This will occur if the compressor is running and the inter stage pressure (2APT) is greater than 75 psi (5.17 Bar). This trip will only occur in 2-stage compressors.

Recommended Checks

- Is 2APT reading 0 psi when the machine is not running? Calibrate sensor/check connection.

- If 2APT is reading more than 75 psi (5.17 Bar) and the sump pressure is very low, check for blockage. The 2nd stage gear is loose spinning on the 2nd stage male rotor shaft. Split motor/ Air End.

Invalid Calibration

Xe Software Logic for R & RS machines:

Will occur if the sensor zero value is +/- 10% of its scale. This will only occur when a sensor is calibrated.

Recommended Checks

- Ensure sensor part number matches with the machine. Look in Passport or call Parts ID.
- For pressure sensors ensure the pressure sensor line reads 0 psi (0 Bar).

Load Cycles High

Xe Software Logic for RS machines:

Will occur if the average load cycles calculated over the last 30 days is a value greater than 15. Also occurs

once in a 30-day period and can be immediately reset. Please contact Ingersoll Rand for guidance to remedy excessive cycles.

Recommended Checks

- Install modulation. Protect the inlet valve piston/blowdown block from cycling constantly.
- Check for blockage at the discharge/customer air piping causing the compressor to cycle all the time.
- Increase the air receiver capacity.
- Verify that pressure sensors are reading correctly.
- Install muffler.

Load Cycles Severe

Xe Software Logic for RS machines:

Will occur if the average load cycles calculated over the last 30 days is a value greater than 24. Also occurs once in a 30-day period and can be immediately reset. Please contact Ingersoll Rand for guidance to remedy excessive cycles.

Recommended Checks

- Check for blockage at the discharge/customer air piping causing the compressor to cycle all the time.
- Install modulation. Protect the inlet valve piston/blowdown block from cycling constantly.
- Increase the air receiver capacity.
- Verify that pressure sensors are reading correctly.
- Install muffler.

Elevated Air End Discharge Temperature

Xe Software Logic for R & RS machines:

Will occur if the main motor is running and airend discharge temperature > = 215°F (101.7°C) for 30 minutes.

Recommended Checks

- If the coolant injection temperature is close to 180°F (82.2°C) check the thermal valve cage and element.
- Is the coolant injection temperature to the cooler lower than the cooler discharge temperature? If not, check thermal valve/thermal element movement through the thermal block. Check cage movement.

- If the differential temperature between the coolant injection and the Air End discharge greater than 40°F (4.44°C) check for clogged oil filter/clogged piping (Air End needs more oil in the rotors to cool down compression).
- For units with a blower drive ensure the blower is running at 100% (50 HZ or 60 HZ depending on the drive parameter/motor data plate).
- Is the coolant at least ½ way full in the sump sight glass when the machine is running loaded?
- Inspect free movement of the check valve at the cooler return. Tech Note 9930.
- Test 4ATT thermistor for accuracy.

Clean Cooler

Xe Software Logic for RS machines:

Will occur if Enable Ambient Monitoring set point is ON, the main motor is running and the CTD is greater than 40°F (4.4°C) for a period of 30 minutes.

Recommended Checks

- Clean cooler. Check for ductwork restriction. Ensure blower is running.
- Check 1ATT and 4ATT sensor readings. Check connections/calibrate sensors.

Low Ambient

Xe Software Logic for R & RS machines:

Will occur if the Enable Ambient Monitoring set point is ON, low ambient enable set point is OFF, and the package inlet temperature is less than 40°F (4.44°C) for a period of 30 minutes.

Will also occur if the Enable ambient Monitoring set point is ON, low ambient enable set point is ON, and the package inlet temperature is less than -10°F (-23.3°C) for a period of 30 minutes.

Recommended Checks

- For machine installed in low ambient conditions, correct ductwork. Check 1ATT sensor for proper reading/calibrate sensor.

- For machine with Low Ambient option check if louvers stuck open/louver motor stuck open or not working.

High Motor Winding Temperature

Xe Software Logic for RS machines:

Will occur if any enabled Motor Winding RTD temperature reading exceeds 302°F (150°C).

Recommended Checks

- Check motor for dirt, debris, oil, etc. Clean accordingly.
- Check for blockage of the cooling air path into and through the machine.
- Is ductwork installed? Improve airflow to the motor.
- Ensure all wires are connected properly to the module RTD Monitor option installed in the machine.
- Check for excessive amps from the main motor. Megger and Milliohm to check for shorts/ground within the motor winding. Compare running amps

with the overload setting. Is the motor pulling more amps than normal?
- Check incoming power for low voltage condition affecting high amps in the line.
- Cool down motor and monitor with an infrared temperature gun.

High Motor Bearing Temperature

Xe Software Logic for RS machines:

Will occur if any enabled Motor Bearing RTD temperature reading exceeds
203°F (95°C).

Recommended Checks

- Check motor for dirt, debris, oil, etc. Clean accordingly.
- Ensure to grease bearings. Perform PM. Check old motor grease for metal debris.
- Check for blockage of the cooling air path into and through the machine
- Is ductwork installed? Improve airflow to motor.

- Ensure all wires are connected properly to the RTD Monitor option installed in the machine.
- Cool down motor and monitor with an infrared temperature gun.

Motor Winding Temperature Failure

Xe Software Logic for RS machines:

Will occur for each motor winding temperature if the corresponding Motor Temperature Enable set point is set to ON and the RTD monitor shows an open circuit condition for a given channel for 10 consecutive reads.

Recommended Checks

- Ensure the RTD monitor is connected to the 24 VDC power supply and to the controller P9 COM3.
- Ensure all the 6 winding temperature sensors are connected properly to the RTD monitor. Check loose/broken wire.

Motor Bearing Temperature Failure

Xe Software Logic for RS machines:

Will occur for each motor bearing temperature if the corresponding Motor Temperature Enable set point is set to ON and the RTD monitor shows an open circuit reading for a given channel for 10 consecutive reads.

Recommended Checks

- Ensure the RTD monitor is connected to the 24 VDC power supply and to the controller P9 COM3.
- Ensure all the 2 bearing temperature sensors are connected properly to the RTD monitor. Check loose/broken wire.

Motor Monitor Communications Failure

Xe Software Logic for RS machines:

Will occur if any of the motor temperature enable settings are ON and the controller is unable to establish communications with the Motor RTD Monitor within 10 seconds of reaching the home screen after boot.

Recommended Checks

- Ensure the RTD monitor is connected to the 24 VDC power supply and to the controller P9 COM3.
- Disconnect the 6 winding and 2 bearing temperature sensors to clear the alarm in case one sensor is shorting/grounding the RTD monitor. If alarm persists, the RTD monitor module is bad.

High Separator Delta P

Xe Software Logic for R & RS machines:

A: Will occur if the controller has been in a Run-Loaded state for 8 seconds, Package Discharge Pressure > 65 psi (4.48 Bar), and separator pressure drop > 25 psi (1.72 Bar).

Note: the separator pressure drop is calculated with Sump Pressure – Package Discharge Pressure if enable dryer is OFF and as Sump Pressure – After-cooler
Discharge Pressure if enable dryer is ON.

Recommended Checks

- Ensure sump and package discharge sensors are reading correctly with machine off. Check sensor/reconnect sensors. Check ground.
- Check for inlet filter assembly properly seating on the inlet valve. Check for dirt and debris. Take oil sample.

Blower Fault

Xe Software Logic for R & RS machines:

A: Will occur if the Blower Control Type set point is set to Variable Speed and the Fan Motor Overload digital input opens for a period of 3 seconds.
The number of Blower Fault event occurrences may be recorded in controller memory. This counter shall only be available via Modbus and Field Service Tool and shall be resettable via the FST.

The Xe controller ONLY shows the general alarm from the blower drive.

To check a Blower Drive alarm a HIM or LCP device needs to be connected to the Blower Drive to read the specific alarm code/number.

Recommended Checks

- Read the alarm from the blower drive (not the general alarm in the Xe controller) and troubleshoot according to the fault code/number found in Tech Direct.
- Is the blower drive incoming voltage balanced to ground? If not, correct.
- Disconnect motor leads from the blower drive output. If the blower drive shows running, perform Megger/Milliohm on the blower motor.
- P3 Terminal connection is the one receiving the drive status alarm. Check for good connections.
- Ensure the ductwork of the machine is properly sized not creating airflow restriction = high amps.

High Ambient Temperature

Xe Software Logic for R & RS machines:

A: Will occur if the Enable Ambient Monitoring set point is ON, the compressor has been in the Run-Starting state for greater than 5 seconds, or is in the Run-Unload Normal, Run-Unload Forced, Run-Load, or Stopping state and the package inlet temperature

sensor reads a value greater than 125°F (51.7°C) (High Ambient OFF) or 135°F (57.2°C) (High Ambient ON).

Recommended Checks

- Compare 1ATT thermistor sensor to resistance chart.
- Is the ambient temp higher than 125°F?
- Is the package exhaust air recirculating back to the compressor inlet? Improve airflow to package.
- Check connection of the sensor according to Electrical Schematic. Is it in the right P6 terminal?

Control Power Loss

Xe Software Logic for R & RS machines:

Will occur if Control Power Loss is enabled, Emergency Stop input is closed and the auxiliary 2 digital input closes for a time period of 0.5 seconds. This will occur if the compressor should be running and the AC input voltage, as read from the VSD, falls below 100 VAC. There is a delay of 2 seconds on this trip in

case the power quickly returns. A phase monitor is something that can cause this trip.

Recommended Checks

- Check/reset MCB3 circuit breaker. If trips again there is a shorted/grounded component. Remove all the components from P1 terminal with the exception of the hot 120 VAC and ground cable. Re connect the components to see which one is causing the trip (troubleshoot by elimination technic)
- E-stop wiring needs to be close to allow control voltage to P1-1 terminal.
- Possible condensate drain short/ground.
- 1ATS HAT switch circuit open.
- K2 circuit breaker open.
- LVM low voltage monitor tripped.
- Solenoid shorted/grounded tripping MCB3 circuit breaker.
- Broken wire or defective quick connector plug.

Start Inhibit Trip Guide

High Air End Discharge Temperature

This will occur if 2ATT is greater than 95% of 228°F (108.9°C). Alarm clears when 2ATT falls below 217°F (102.8°C).

High Sump Pressure

This will occur if the sump pressure (3APT) is 25 psi (1.72 Bar) or higher than the rated pressure of the compressor.

Wait For Blowdown

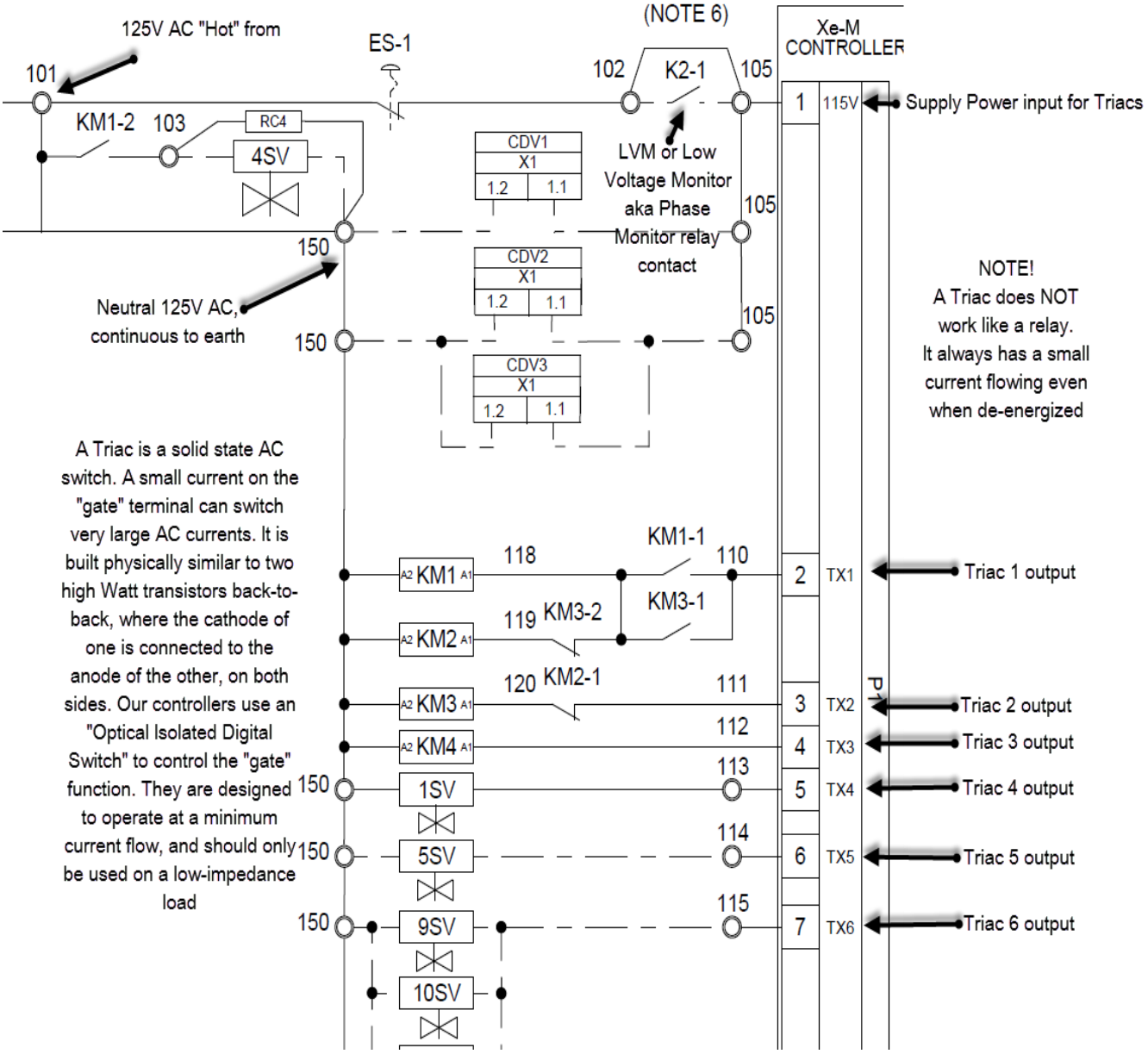
Will occur if the sump pressure is greater than 20 psi (1.38 Bar) before the machine is started.

Isolation Contact Open

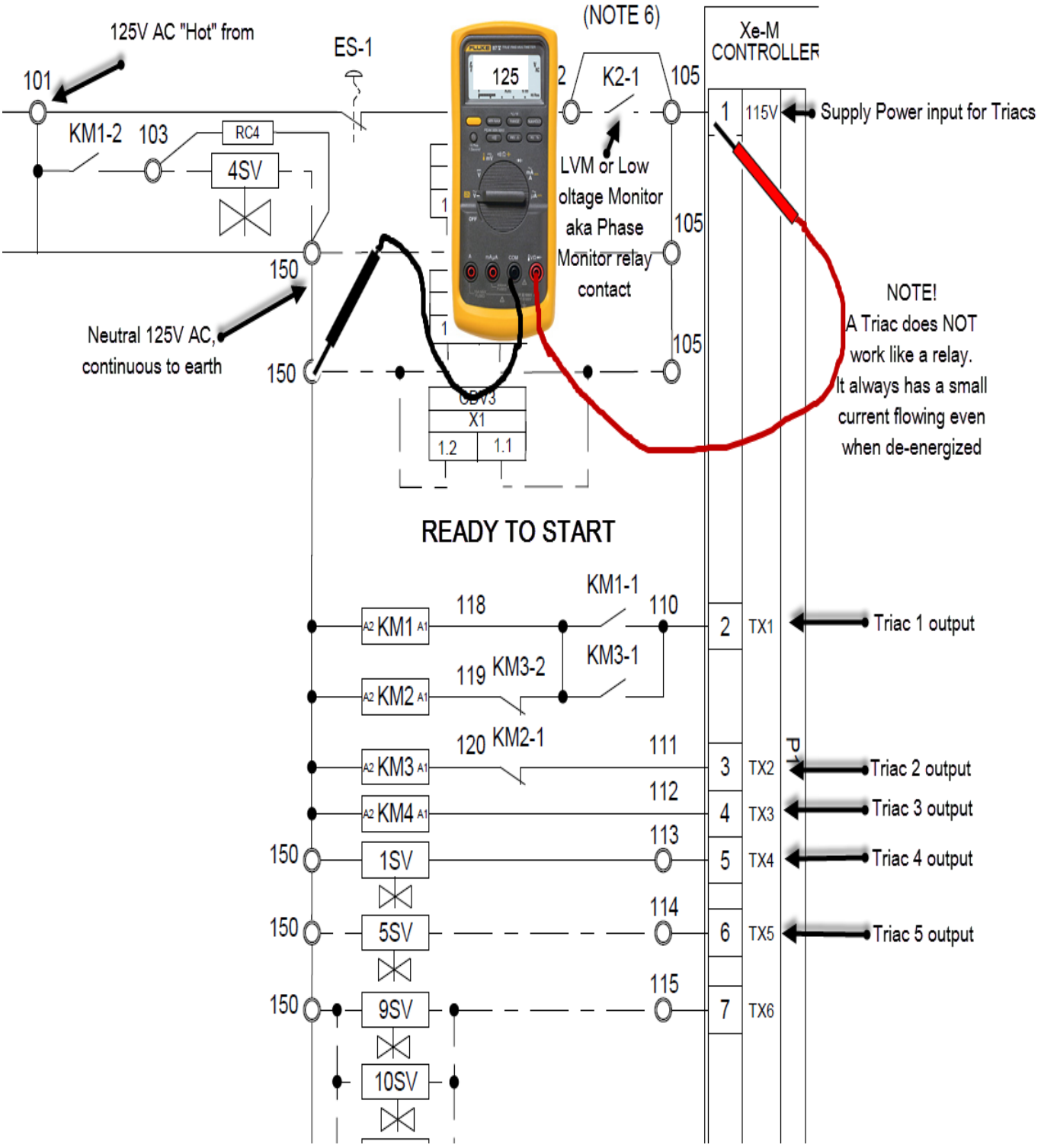
Will occur if the controller is in a Ready to Start or Run-Auto Restart state, the Blower Control Type set point is set to Variable Speed, and Fan Starter Contact 1 is de-energized.

Tips to Test the Triac P1 Terminal

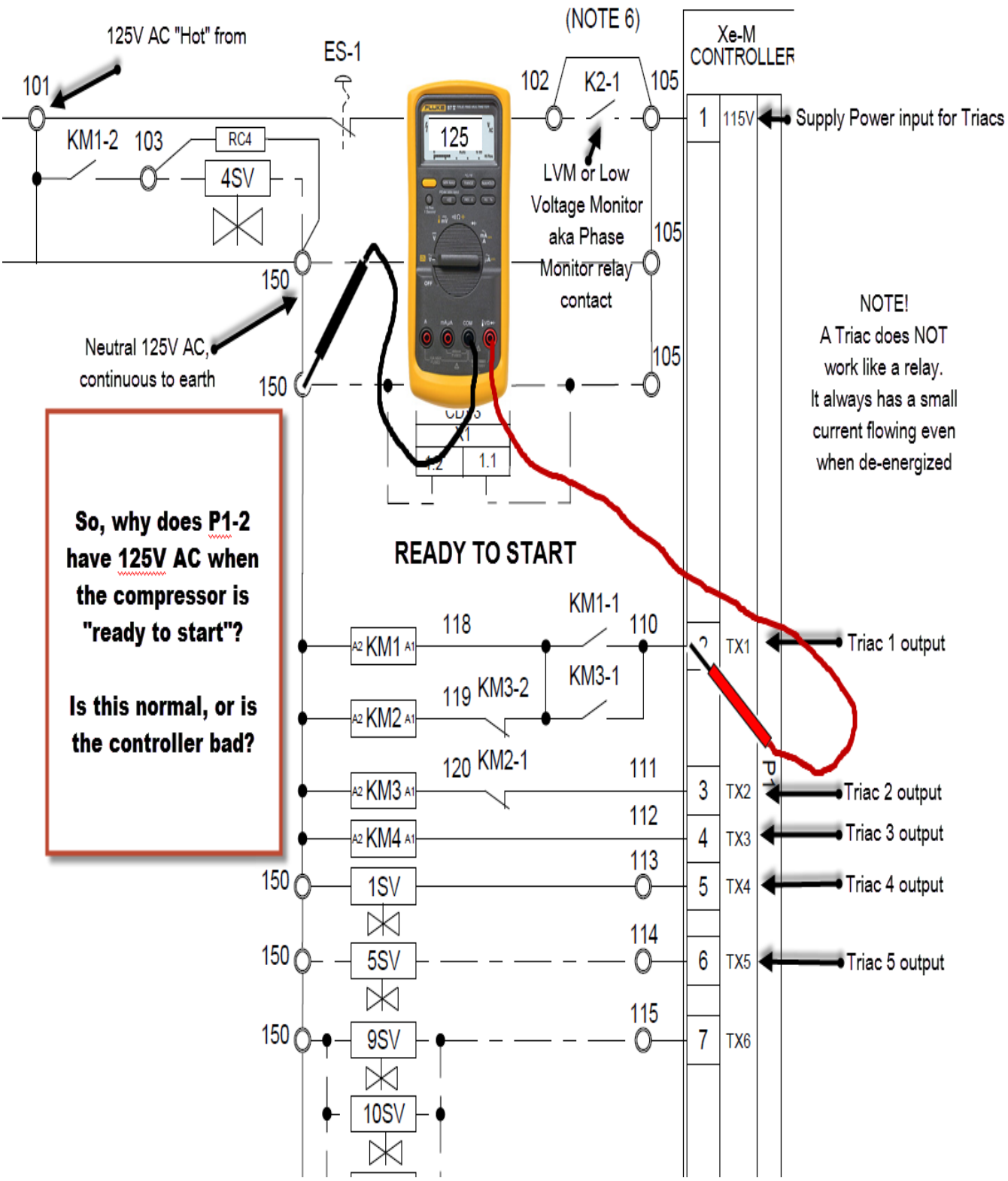
*Ensure to isolate a shorted/grounded solenoid, sensor, or component before testing the Triac.



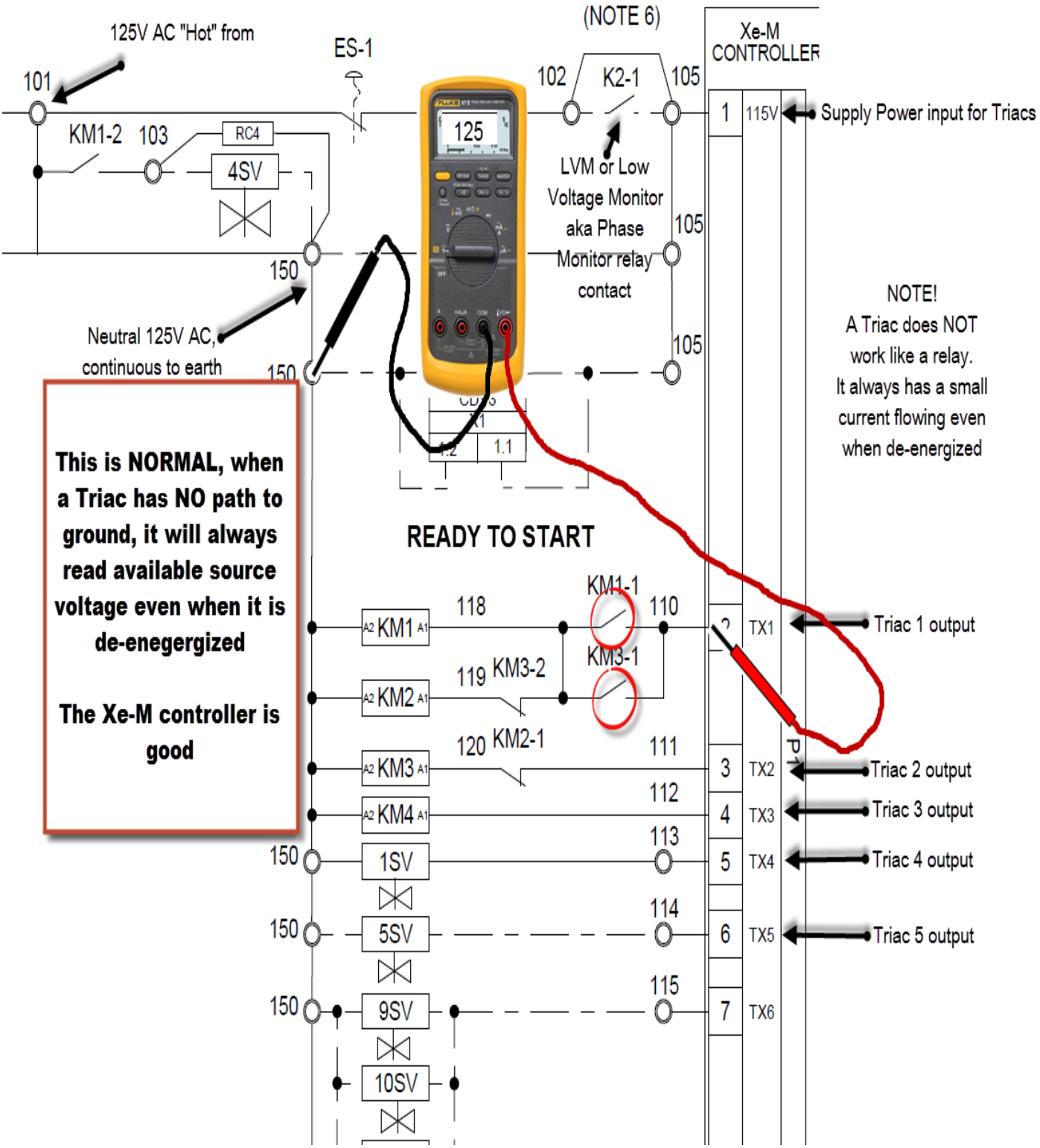
Triac Test 1


125V AC "Hot" from
101
ES-1
(NOTE 6)
Xe-M
CONTROLLER
125
2
K2-1
105
1
115V
Supply Power input for Triacs
KM1-2
103
RC4
4SV
LVM or Low
oltage Monitor
aka Phase
Monitor relay
contact
105
150
Neutral 125V AC,
continuous to earth
150
105
NOTE!
A Triac does NOT
work like a relay.
It always has a small
current flowing even
when de-energized
X1
1.2
1.1
READY TO START
KM1-1
118
110
KM1
KM3-1
119
KM3-2
KM2
120
KM2-1
111
KM3
2
TX1
Triac 1 output
112
KM4
3
TX2
Triac 2 output
4
TX3
Triac 3 output
113
150
1SV
5
TX4
Triac 4 output
114
150
5SV
6
TX5
Triac 5 output
115
150
9SV
7
TX6
10SV

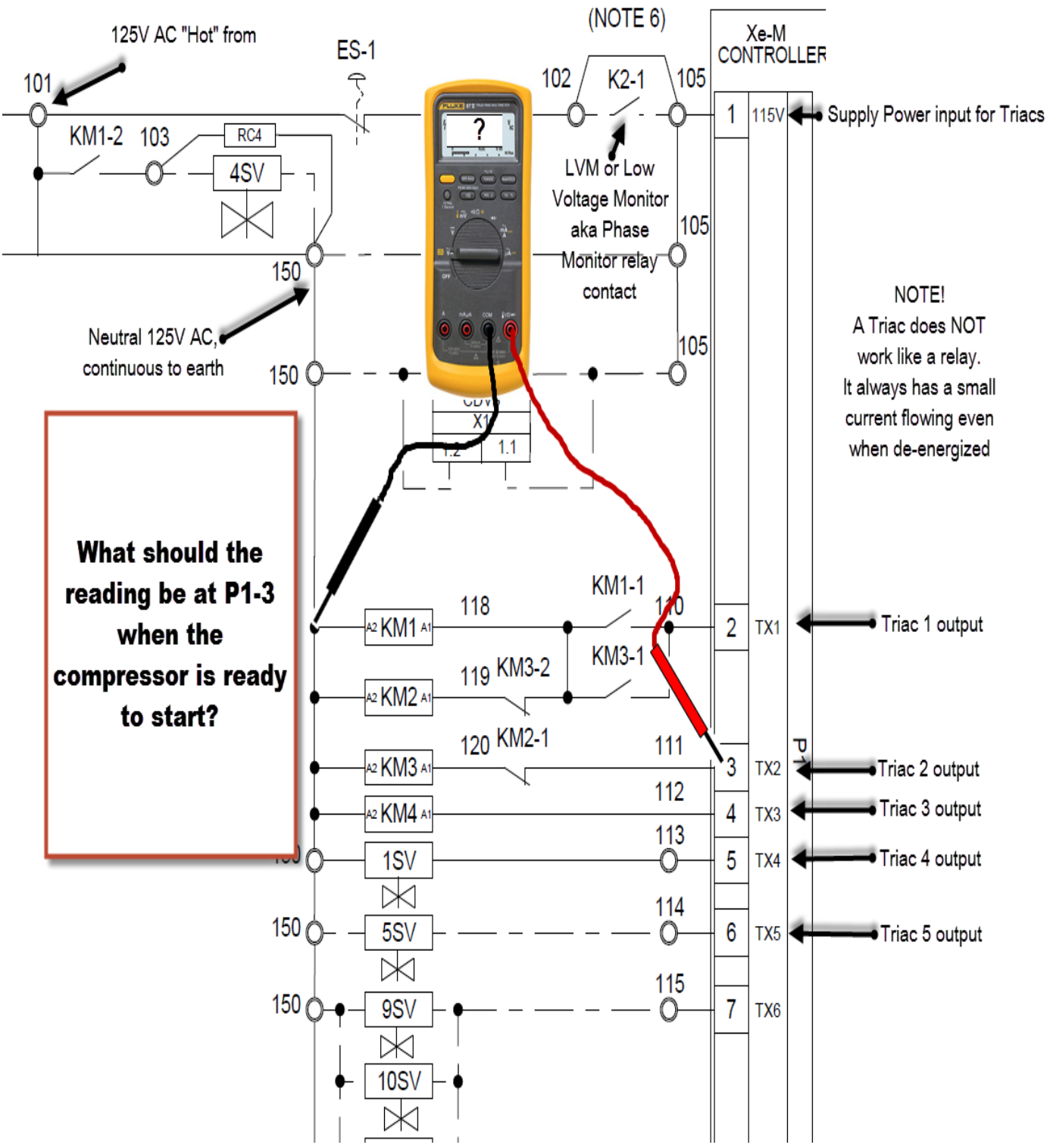
Triac Test 2


125V AC "Hot" from
101
ES-1
(NOTE 6)
Xe-M
CONTROLLER
102
K2-1
105
1
115V
Supply Power input for Triacs
KM1-2
103
RC4
4SV
125
LVM or Low
Voltage Monitor
aka Phase
Monitor relay
contact
105
150
Neutral 125V AC,
continuous to earth
105
NOTE!
A Triac does NOT
work like a relay.
It always has a small
current flowing even
when de-energized
150
1.2
1.1
So, why does P1-2
have 125V AC when
the compressor is
"ready to start"?
Is this normal, or is
the controller bad?
READY TO START
KM1-1
118
110
A2 KM1 A1
TX1
Triac 1 output
KM3-1
119 KM3-2
A2 KM2 A1
120 KM2-1
111
A2 KM3 A1
3
TX2
Triac 2 output
112
A2 KM4 A1
4
TX3
Triac 3 output
150
1SV
113
5
TX4
Triac 4 output
150
5SV
114
6
TX5
Triac 5 output
150
9SV
115
7
TX6
10SV

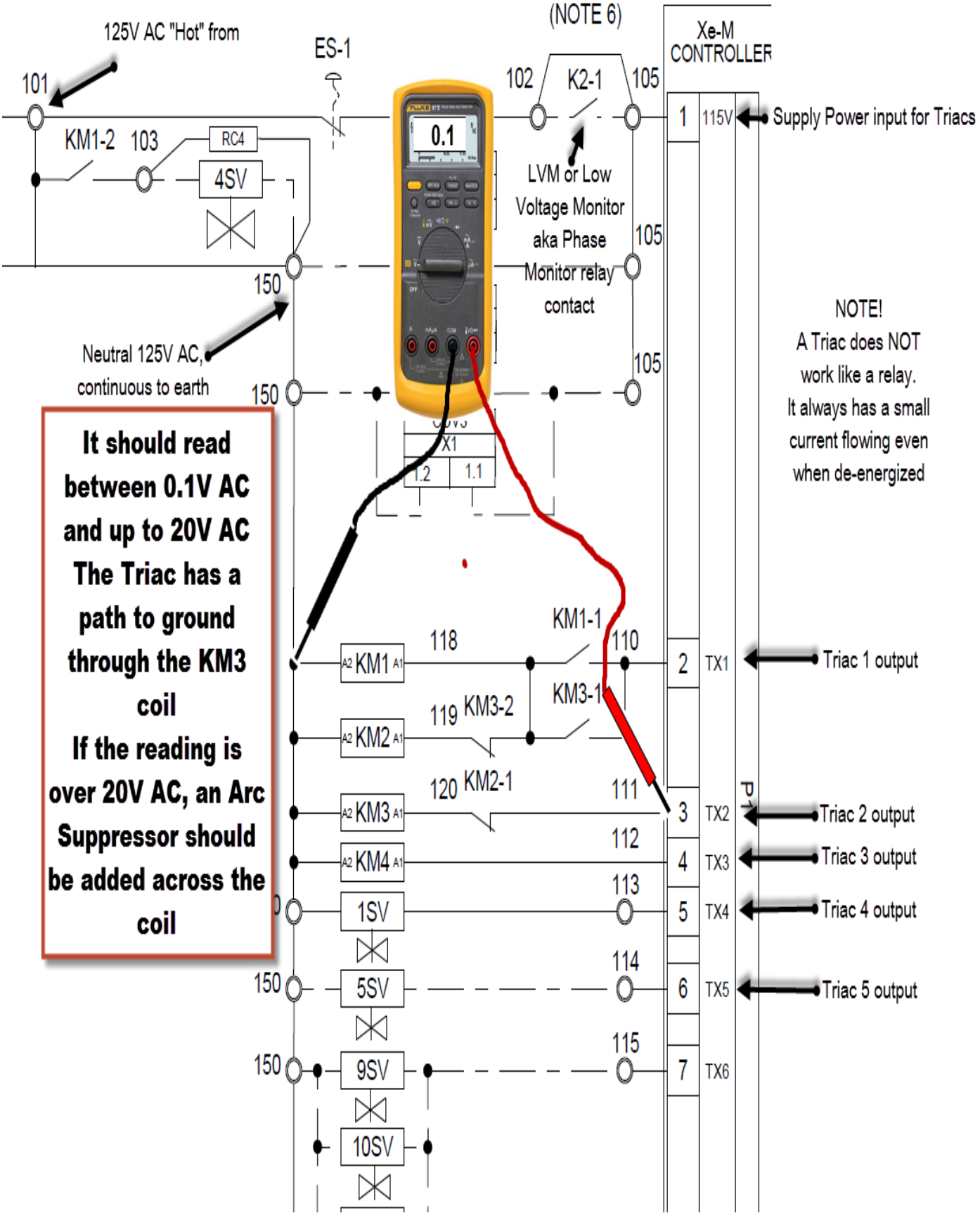
Triac Test 3


125V AC "Hot" from
101
ES-1
(NOTE 6)
102
K2-1
105
Xe-M
CONTROLLER
1
115V
Supply Power input for Triacs
KM1-2
103
RC4
4SV
125
LVM or Low
Voltage Monitor
aka Phase
Monitor relay
contact
105
150
Neutral 125V AC,
continuous to earth
105
NOTE!
A Triac does NOT
work like a relay.
It always has a small
current flowing even
when de-energized
This is NORMAL, when a Triac has NO path to ground, it will always read available source voltage even when it is de-enegergized
The Xe-M controller is good
READY TO START
KM1-1
118
110
A2 KM1 A1
TX1
Triac 1 output
KM3-1
119
KM3-2
A2 KM2 A1
120
KM2-1
111
A2 KM3 A1
3
TX2
Triac 2 output
112
A2 KM4 A1
4
TX3
Triac 3 output
113
150
1SV
5
TX4
Triac 4 output
114
150
5SV
6
TX5
Triac 5 output
115
150
9SV
7
TX6
10SV

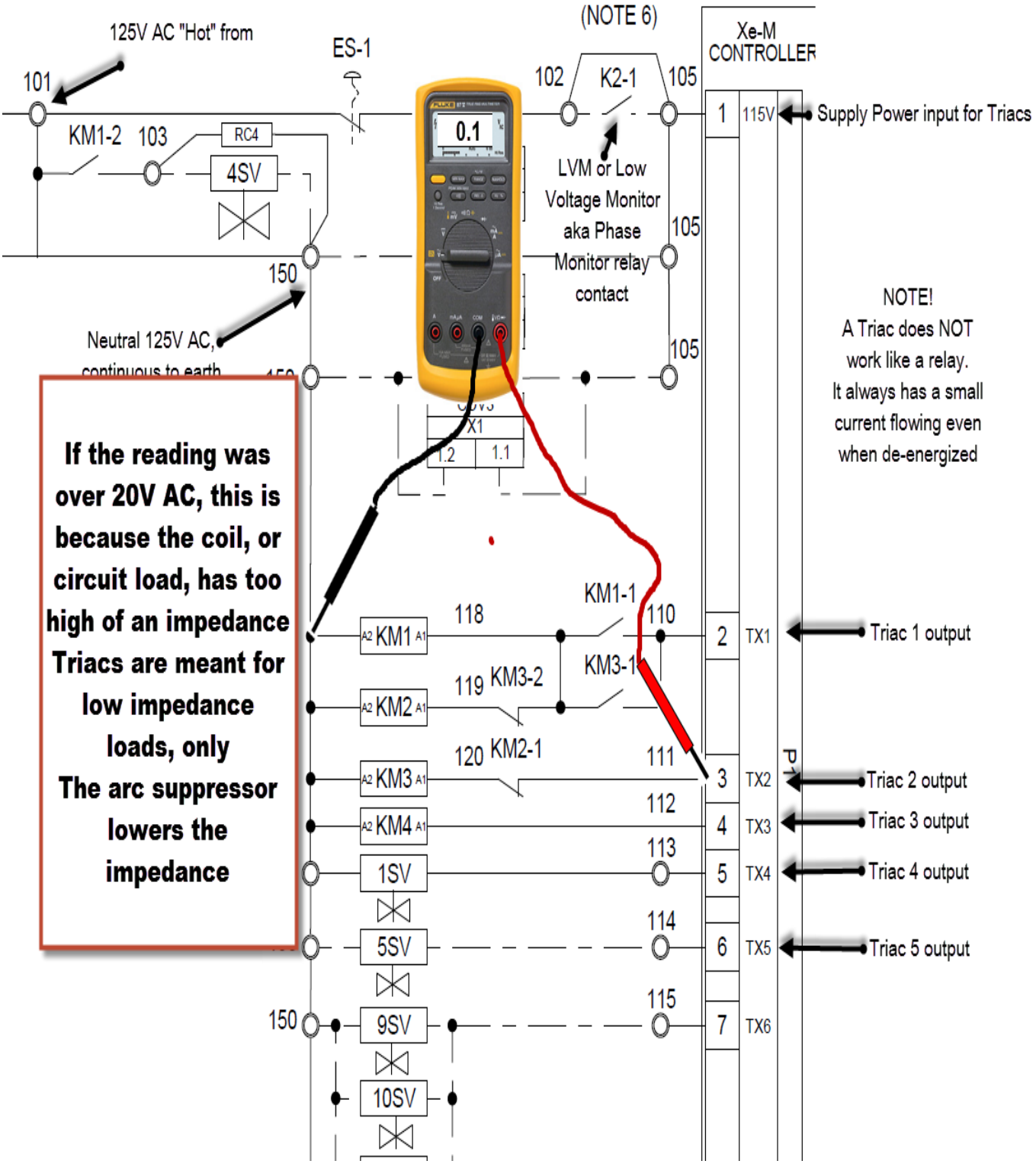
Triac Test 4


125V AC "Hot" from
101
ES-1
(NOTE 6)
102
K2-1
105
Xe-M
CONTROLLER
1
115V
Supply Power input for Triacs
KM1-2
103
RC4
4SV
LVM or Low
Voltage Monitor
aka Phase
Monitor relay
contact
105
150
Neutral 125V AC,
continuous to earth
105
150
NOTE!
A Triac does NOT
work like a relay.
It always has a small
current flowing even
when de-energized
What should the reading be at P1-3 when the compressor is ready to start?
KM1-1
118
110
KM1
2
TX1
Triac 1 output
KM3-1
119
KM3-2
KM2
120
KM2-1
111
KM3
3
TX2
P1
Triac 2 output
112
KM4
4
TX3
Triac 3 output
113
1SV
5
TX4
Triac 4 output
114
150
5SV
6
TX5
Triac 5 output
115
150
9SV
7
TX6
10SV

Triac Test 5


125V AC "Hot" from
101
ES-1
(NOTE 6)
Xe-M
CONTROLLER
102
K2-1
105
1
115V
Supply Power input for Triacs
KM1-2
103
RC4
4SV
0.1
LVM or Low
Voltage Monitor
aka Phase
Monitor relay
contact
105
150
NOTE!
A Triac does NOT
work like a relay.
It always has a small
current flowing even
when de-energized
Neutral 125V AC,
continuous to earth
150
105
X1
.2
1.1
It should read
between 0.1V AC
and up to 20V AC
The Triac has a
path to ground
through the KM3
coil
If the reading is
over 20V AC, an Arc
Suppressor should
be added across the
coil
KM1-1
118
110
A2 KM1 A1
2
TX1
Triac 1 output
KM3-1
119
KM3-2
A2 KM2 A1
120
KM2-1
111
A2 KM3 A1
3
TX2
Triac 2 output
112
A2 KM4 A1
4
TX3
Triac 3 output
113
1SV
5
TX4
Triac 4 output
114
150
5SV
6
TX5
Triac 5 output
115
150
9SV
7
TX6
10SV

Triac Test 6


125V AC "Hot" from
101
ES-1
(NOTE 6)
Xe-M CONTROLLER
102
K2-1
105
1
115V
Supply Power input for Triacs
KM1-2
103
RC4
4SV
0.1
LVM or Low Voltage Monitor aka Phase Monitor relay contact
105
150
Neutral 125V AC, continuous to earth
105
NOTE!
A Triac does NOT work like a relay.
It always has a small current flowing even when de-energized
If the reading was over 20V AC, this is because the coil, or circuit load, has too high of an impedance Triacs are meant for low impedance loads, only
The arc suppressor lowers the impedance
X1
2
1.1
KM1-1
118
110
2
TX1
Triac 1 output
A2 KM1 A1
KM3-1
119
KM3-2
A2 KM2 A1
120
KM2-1
111
3
TX2
Triac 2 output
A2 KM3 A1
112
4
TX3
Triac 3 output
A2 KM4 A1
113
1SV
5
TX4
Triac 4 output
114
5SV
6
TX5
Triac 5 output
150
115
9SV
7
TX6
10SV