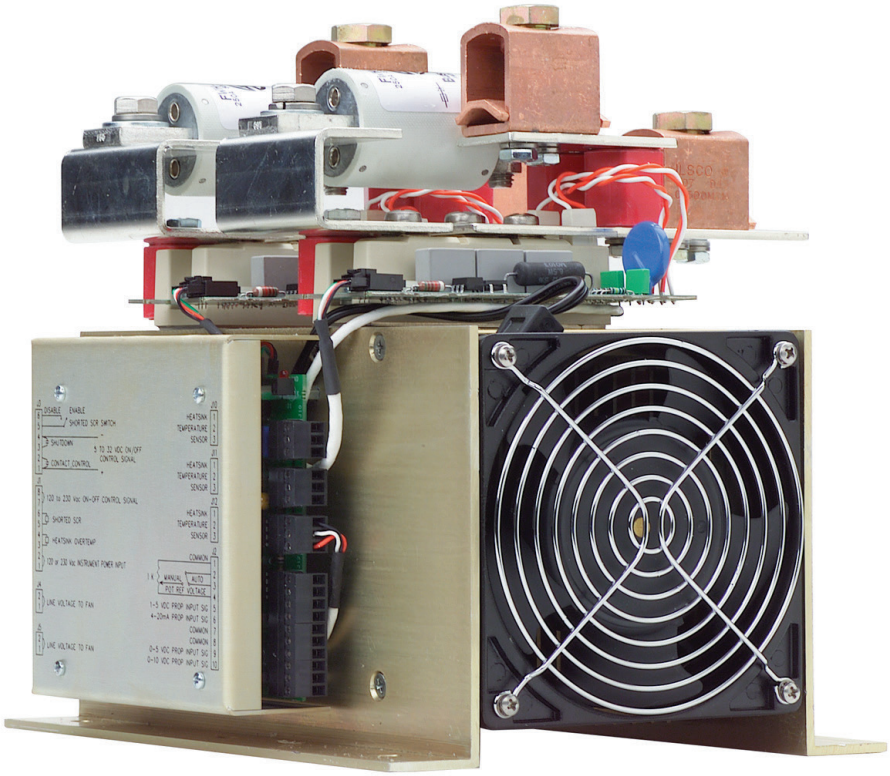
# User's Manual

# MaxPac



CHROMALOX
*Advanced Thermal Technologies*

PK480-5
0037-75428
June 2018

Thank you for choosing the Chromalox® MaxPac™ - a complete power control solution with industry-best price and performance.

For more than 100 years, customers have relied on Chromalox for the utmost in quality and innovative solutions for industrial heating applications. Chromalox manufactures the world's largest and broadest line of electric heat and control products.

The MaxPac Series SCR Controllers provide the best control for applications where consistent heater/process temperature is critical or where fine resolution of power is required.

**Common MaxPac features include:**

- 120 - 575 Vac @ 100 - 1200 Amps
- Isolated Control Circuit
- Flexible I/O Power Wiring
- Easy Customer Interface
- Remote Stop
- Compact Size and Construction
- Touch-Safe Design (option on 100 - 650 Amp models)
- dv/dt Transient Voltage Protection
- MOV Protection
- Built-In Power Distribution
- Soft Start
- 100KA SCCR Rating

**Features for the MaxPac I, II, and III include:**

- Zero Crossover Firing
- Isolated Control Circuit
  - On/Off Control Inputs:
    - 120 thru 240 Vac
    - 5 - 32 Vdc
    - Dry Contact Closure
  - Proportional (DOT Firing) Inputs:
    - 4 - 20 mA, 0 - 20 mA, 0-5 Vdc, 1 - 5 Vdc, 0 - 10 Vdc
    - Remote Manual Adjust (Optional)
    - Remote Auto/Manual Switch (Optional)
- Electronically Protected with Temperature Warning and Stop System
- Cycle Resolution 3, 5, 7, 11, 13, 17, 19
- Shorted SCR Detection (Optional)
- Soft Start
- Time proportional switching mode
- Staged Heating
- Rotary wwitch selection of input, leg configuration, modbus

**Features for the MaxPac IP include:**

- Phase Angle Firing
- Isolated Control Circuit Inputs
  - 0 - 5 mA, 0 - 20 mA
  - 0 - 50 mA, 1 - 5 mA
  - 4 - 20 mA, 10 - 50 mA
  - 0 - 5 Vdc, 0 - 10 Vdc
- Optional Current Limit
- Soft Start
- Line Voltage Compensation
- Zero & Gain Adjustments
- Built-In Manual Adjustment
- Current Limit Adjustment (Optional)

# Table of Contents

# 1 Important Safeguards

## IMPORTANT SAFEGUARDS

***The MaxPac User Manual uses this symbol to alert personnel to potential hazards that may damage the equipment.***

***The MaxPac User Manual uses this symbol to alert personnel to potential hazards that may cause injury or death.***

Please read all instructions before installing and operating your MaxPac™.

**Before working inside the equipment, confirm that all power has been turned off, locked off, and preferably earthed [grounded] at all points of low and high potential, on both the supply line and load side circuits, as required / permitted by all codes and standards.**

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Contact an area supervisor or safety personnel for more information.

Throughout the MaxPac User Manual, the safety alert and the international electric shock/electrocution symbols will alert you to potential hazards. Safety precautions should always be followed to reduce the risk of personal injury to persons from fire and electrical shock hazards.

Each safety message is preceded by a safety alert symbol and one of three words: DANGER, WARNING, or CAUTION. These mean:

**DANGER** You WILL be killed or seriously hurt if you do not follow instructions.

**WARNING** You CAN be killed or seriously hurt if you do not follow instructions

**CAUTION** You CAN be hurt if you do not follow instructions.

Damage Prevention Messages:

You will see other **IMPORTANT** messages that are proceeded by the word **CAUTION** that are intended to help prevent damage to the MaxPac™ or other equipment. Note that Damage Prevention Messages are NOT accompanied by the Safety Alert Symbol.

**Key Safety Practices**
All personnel working on high voltage electrical equipment must adhere to all national and local regulations, codes, and standards.

Only suitably qualified and experienced persons, who are familiar with this equipment, and the work they are to do, should carry out installation, commissioning, operation, or maintenance of this panel and the associated heater.

Such persons shall adhere to proper high voltage safety procedures, including the use of appropriate personal protective equipment (ppe).

Failure to adhere to any of the above may result in equipment damage, operating losses, injury, or death. Chromalox will not be liable for failure to adhere to all governing regulations, codes, standards, site procedures and information given in this manual.

# 2 Description

**MaxPac I, II, and III**

The Chromalox Model MaxPac IP, I, II and III Series are specifically designed for the OEM market. The Chromalox MaxPac I, II and III controllers are highly versatile SCR Power Paks. Firing modes includes On/Off and DOT proportional zero voltage switching. Chromalox's exclusive DOT (Demand Oriented Transfer) firing switches the fewest number of cycles to provide the most precise zero crossover control. At 50% output the units output alternates between one cycle "On" and one cycle "Off". At 51% the output continues with one cycle "On" one cycle "Off" and gradually integrates one extra "On" cycle for the additional one percent. This DOT fired technique also minimizes temperature overshoot, temperature fluctuations and helps extend the loads element life due to reduced thermal shock.

The power SCR assemblies consist of one, two or three SCR's connected back to back with a semiconductor fuse, RC Snubber and MOV protection. The firing circuit is based on common integrated circuit. Diagnostic indicators are included as well as plug-in terminal blocks for easy customer interface.

**MaxPac IP**

The Chromalox MaxPac IP utilizes Single Phase, Phase Angle firing to modulate power to an inductive or resistive load. Phase Angle control has the advantage of proportioning every cycle thereby providing very fine resolution of power. Fast responding loads in which the resistance changes as a function of temperature require Phase Angle control. The MaxPac IP offers a Soft Start feature that assures that the load power is gradually increased from zero to the value set by the command signal in the event of a power interruption. In addition, optional Current Limit is used to protect the load, SCR controller and the total system from large surge currents that could occur at start-up.

† This can be set to three cycles 'On' / three cycles 'Off' (see section on installation options).

# 3 Before You Install

***READ AND UNDERSTAND BEFORE CARRYING OUT THE WORK DETAILED BELOW***

Immediately after receiving your MaxPac I, II, III or IP Series Controller, visually inspect the shipment packaging and record any damage on the shipping documents. Unpack the controller and carefully inspect for obvious damage due to shipment. If any damage has occurred, YOU must file a claim with the carrier company, since the carrier company will not accept a claim from the shipper (Chromalox).

Be sure to check the model number and verify that you have received the correct Model of controller.

If the controller is not installed and placed into operation immediately, it should be stored in a cool, dry environment. Temperature extremes and excessive moisture can damage the controller.

Before choosing a location in which to mount your MaxPac, please consider the following:

**Temperature**
When mounting the SCR unit in a control panel, attention should be paid to the enclosure temperature. The SCR is rated to perform at its nameplate current rating in temperatures up to 50˚C (122˚F). Ensure that adequate ventilation is provided or some other method of maintaining the correct cabinet temperature is used.

**Cleanliness**
Careful attention must be paid in areas subjected to airborne particles. The efficiency of the heat sinks relies on their conducting surfaces being maintained in a clean manner. (See the Maintenance Section.)

**Dampness**
High humidity or hosing down a unit should be avoided.

**Clearance**
Choose a location that will provide adequate spacing around the unit when mounted. This will ensure proper air flow necessary to cool the device.

**WARNING**

***Hazardous Voltage: Disconnect and lockout power before installing or servicing. Failure to comply could result in personal injury or equipment damage.***

# Installation

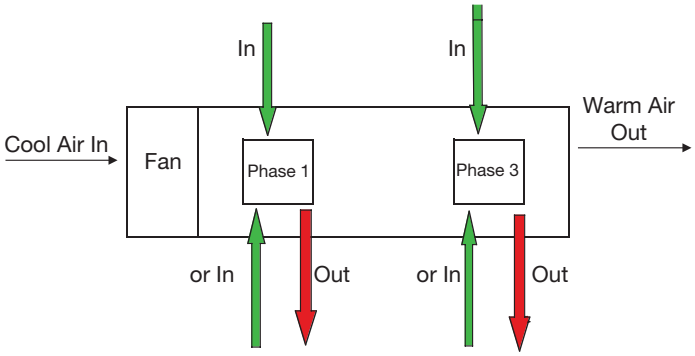
The forced air design of the MaxPac series allows mounting in any direction. It is essential that air flow through the enclosure be planned to insure proper cooling.

The 100 amp through 300 amp open design MaxPac allow the input line power to connect from either of two directions.

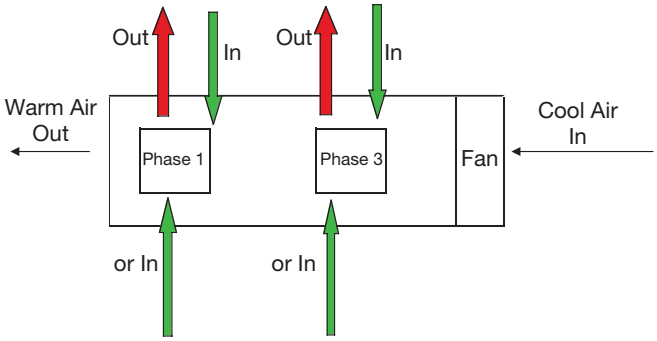
The output power can only be connected from one direction. The three mounting configurations are shown below (MaxPac II Three-Phase Two-Leg Shown).

Open designs above 300 amps and all closed designs allow incoming and outgoing wiring in either direction.

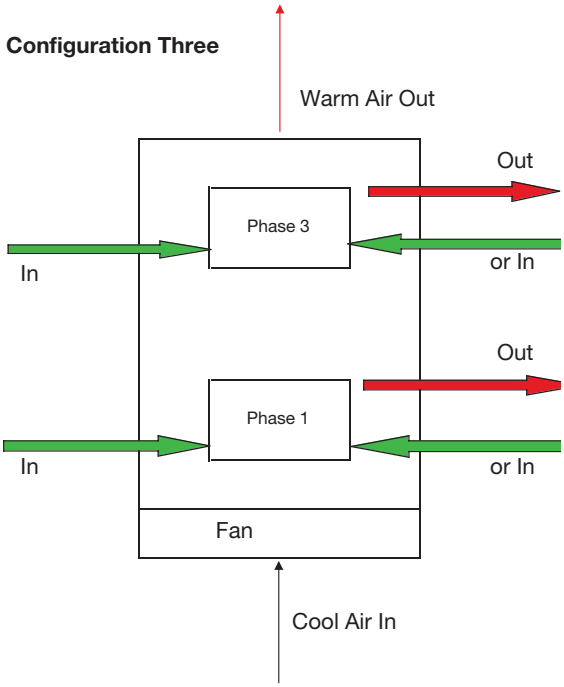
**Configuration One**




**Configuration Two**

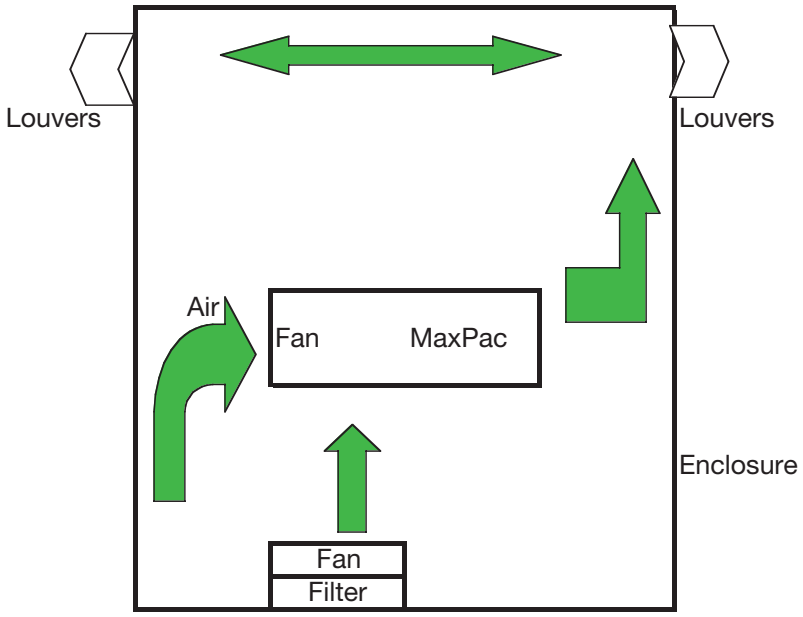



**Configuration Three**

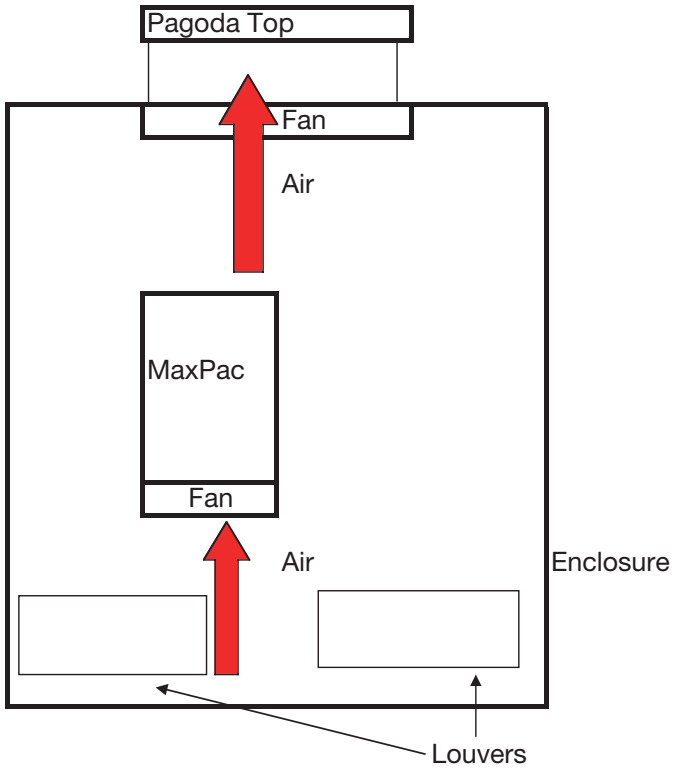


**Examples of Proper Air Flow**

Since hot air rises naturally, it is not recommended that cooling air enter from the top and exhaust at the bottom of the enclosure.




**Forced Air In**
**(Recommended)**




**Forced Air Out**
**(Not Recommended)**

# 4 Installation

***READ AND UNDERSTAND BEFORE CARRYING OUT THE WORK DETAILED BELOW***

Please read all information in this section before beginning the installation of your MaxPac.

Installation of the MaxPac requires three steps:

1. Mounting
2. Power wiring
3. 120 **or** 230 VAC 50/60hz for instrument power. See 4.2.4, pg. 16.

## 4.1 - Step 1: Mounting

Before mounting your MaxPac, please read the section titled “Before You Install’ on page 5 for a description of an ideal environment for the unit’s operation.

The space required for mounting the MaxPac Power Pak depends upon the model. The table below refers to the figures on the following pages. These figures illustrate the dimensions and mounting holes for the various MaxPac Power Pak models. Please refer to these figures before mounting your unit.

**Figure Model**

1.....100A, 150A, & 200A 2-Leg Open Type
1.....100A, 150A, 200A, & 300A 1-Leg Open Type
2.....100A, 150A, & 200A 3-Leg Open Type
3.....300A 2-Leg Open Type
4.....100A, 150A, 200A, 300A & 400A 1-Leg Touch-Safe
4.....400A 1-Leg Open Type
5.....100A, 150A, 200A, 300A & 400A 2-Leg Touch-Safe
5.....400A 2-Leg Open Type
6.....100A, 150A, 200A, 300A & 400A 3-Leg Touch-Safe
6.....300A & 400A 3-Leg Open Type
7.....550A & 650A 1-Leg Touch-Safe
7.....550A & 650A 1-Leg Open Type
8.....550A & 650A 2-Leg Touch-Safe
8.....550A & 650A 2-Leg Open Type
9.....550A & 650A 3-Leg Touch-Safe
9.....550A & 650A 3-Leg Open Type
800-1200 Amp units, consult factory

**IMPORTANT:** Please note that the figures on the following pages are **not drawn to the same scale.**

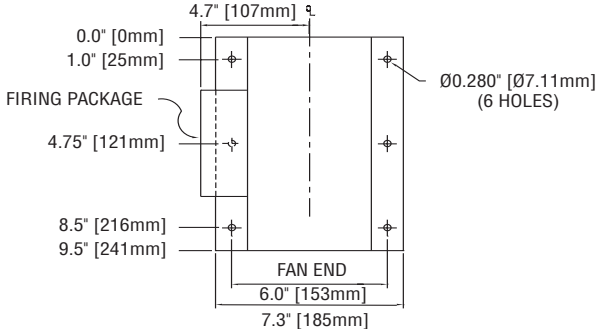



**Figure 1**

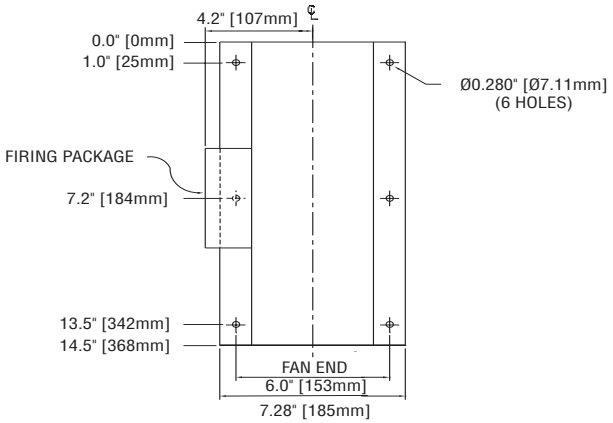



**Figure 2**

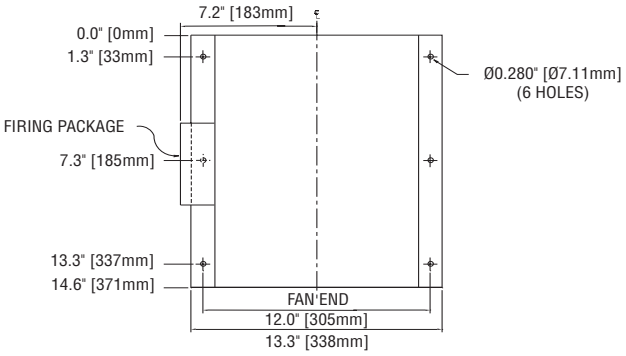



**Figure 3**

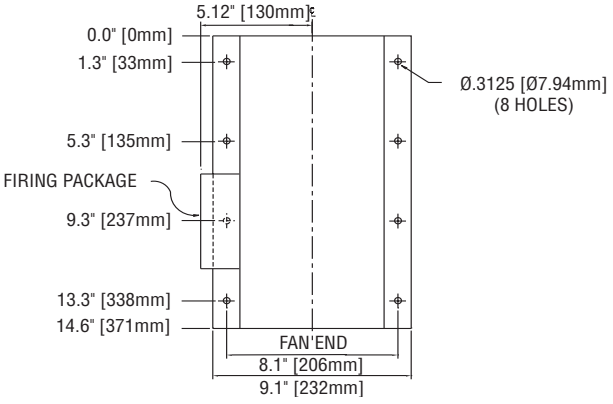



**Figure 4**

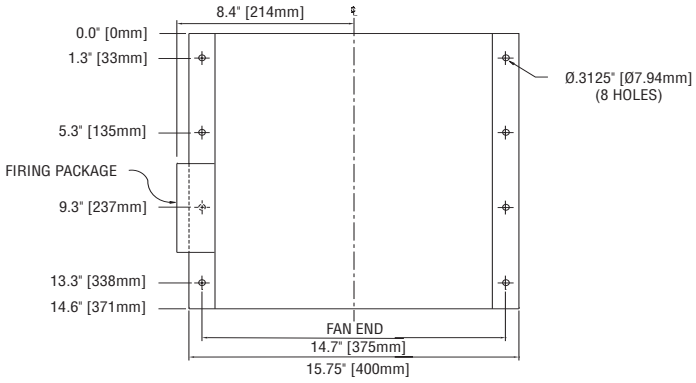



**Figure 5**

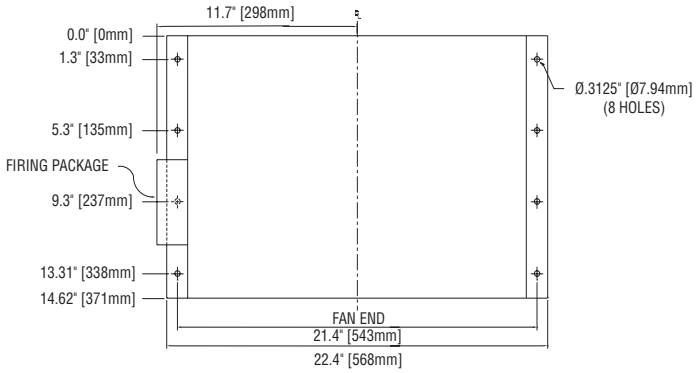



**Figure 6**

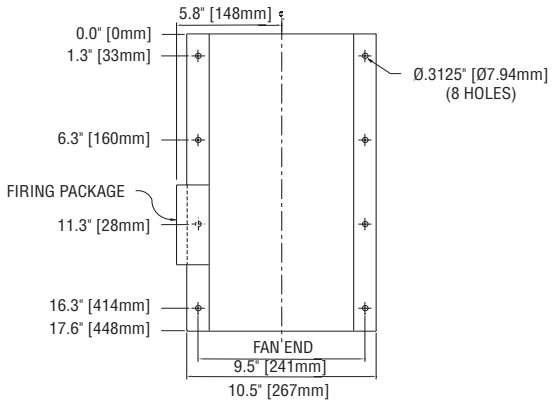



**Figure 7**

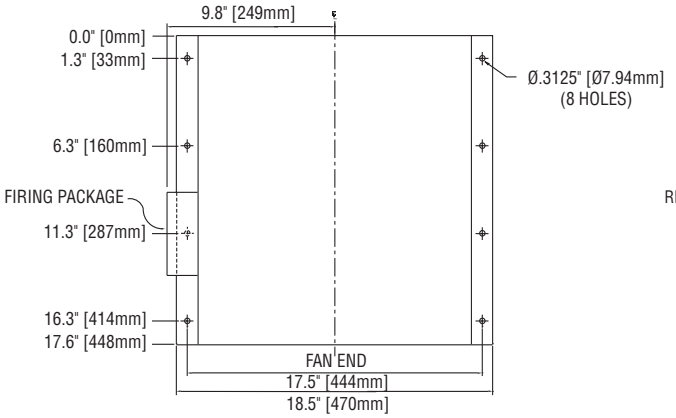



**Figure 8**

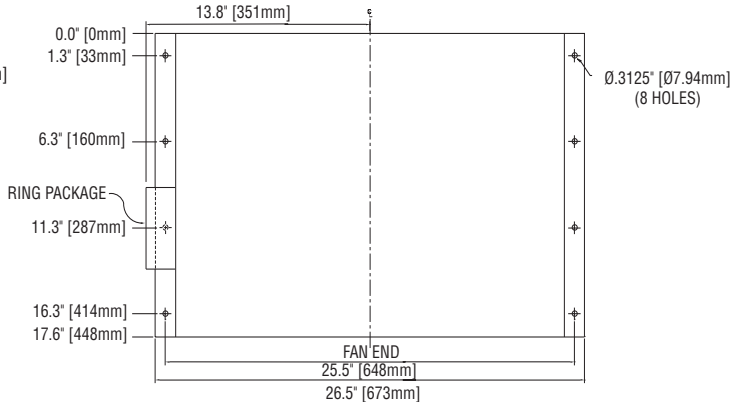



**Figure 9**

## 4.2 - Step 2: Wiring

Careful attention must be paid when attaching the wiring to the MaxPac to ensure proper and safe operation. This section contains detailed information on how to connect the power, resistive load, ground, and command signal wiring.

**WARNING**

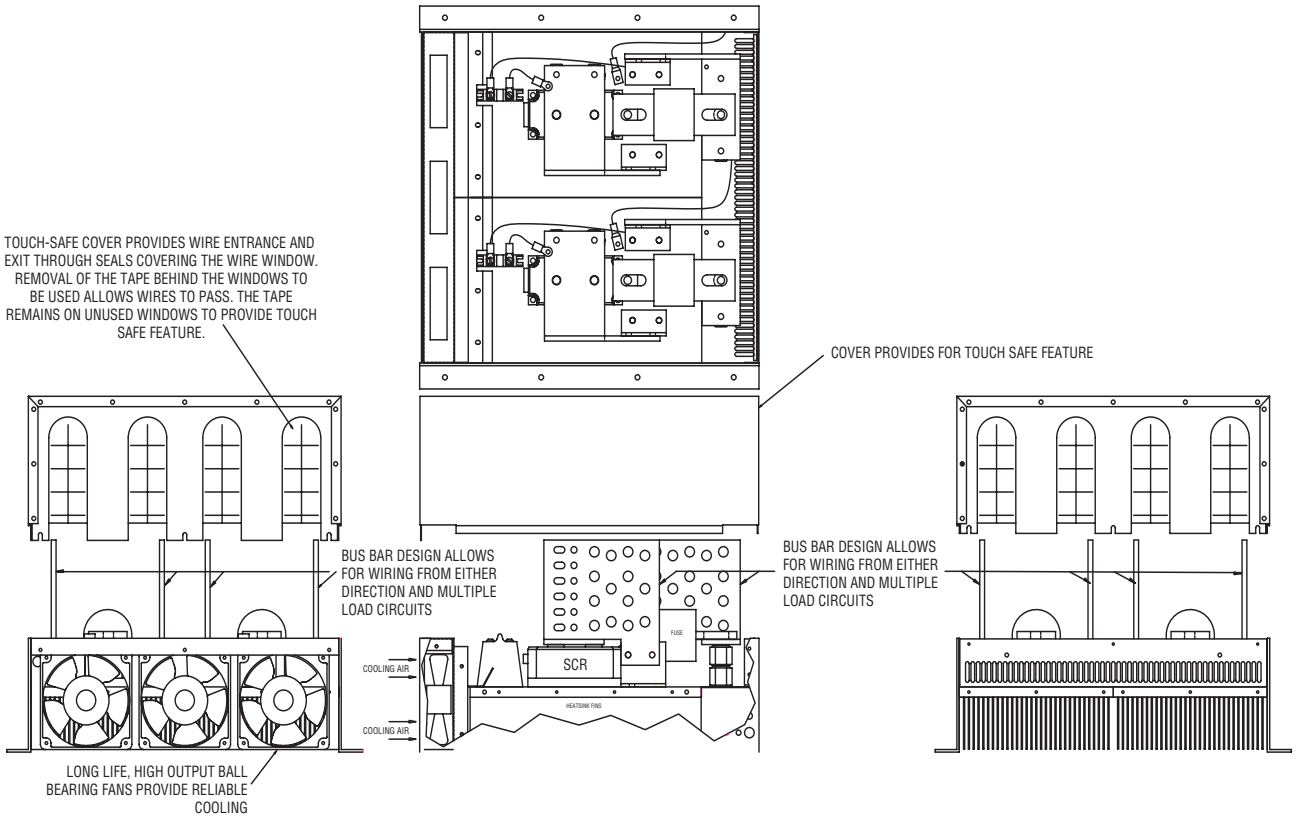
***Hazardous Voltage: Only qualified personnel should perform electrical wiring for the MaxPac Power Paks. LETHALLY HIGH VOLTAGES are associated with this equipment and are dangerous if improperly installed.***

**IMPORTANT:** Select installation wiring that is in accordance with the National Electrical Code and any local standards that may be applicable.

### 4.2.1 - Touch-Safe Design

If the MaxPac model you purchased is of a Touch-Safe design, follow the steps on the following page to install the electrical wiring. This will ensure the wiring is done properly while maintaining the Touch-Safe feature. If your MaxPac is of an Open design below 400 Amps, disregard this subsection.

The following is a detailed drawing of a Touch-Safe unit:



### 4.2.2 - Steps for Touch-Safe Design Cover Removal and Installation

Remove Cover:

1. Loosen the thumb screws on both ends of the cover.
2. Lift the cover from the base.

Install Wiring:

3. Attach the wires to the bus bars in accordance with the instructions in the next section.
4. Choose the entrance and exit directions for the wiring as desired.
5. After the wiring is complete, remove the tape from the inside of the wire gaskets of the windows that the power wiring will enter or exit.

**WARNING**

***Hazardous Voltage: DO NOT remove the tape from the back of the windows that are not used, as this maintains the Touch-Safe feature.***

Replace Cover:

6. Angle the end of the cover without screws towards the “fan-end” of the unit.
7. Slip that end into place first while allowing the wiring to pass through the desired windows.
8. Slip the opposite end of the cover into place.
9. Tighten all thumb screws.

### 4.2.3 - Line/Load Power Wiring

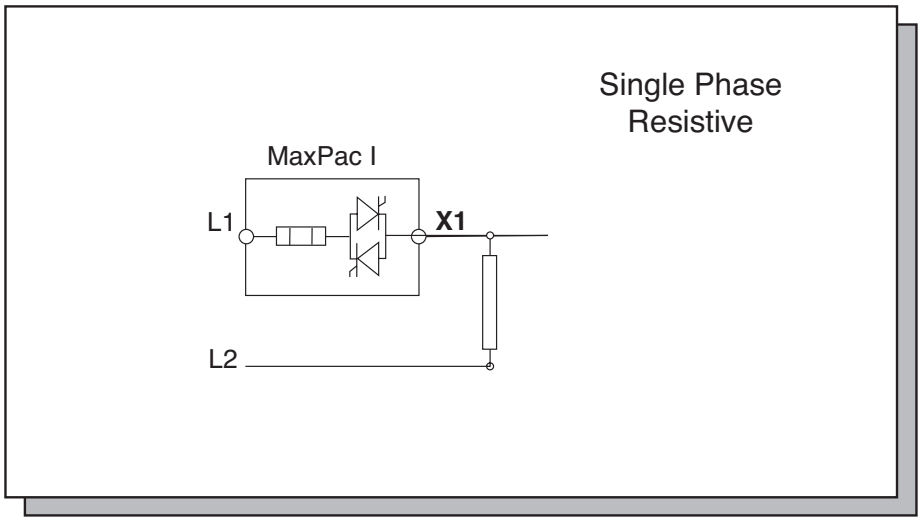
The following illustrations depict how to connect the MaxPac to a resistive load. Make sure you refer to the correct illustration for the MaxPac series you have purchased.

For the power/load drawings:

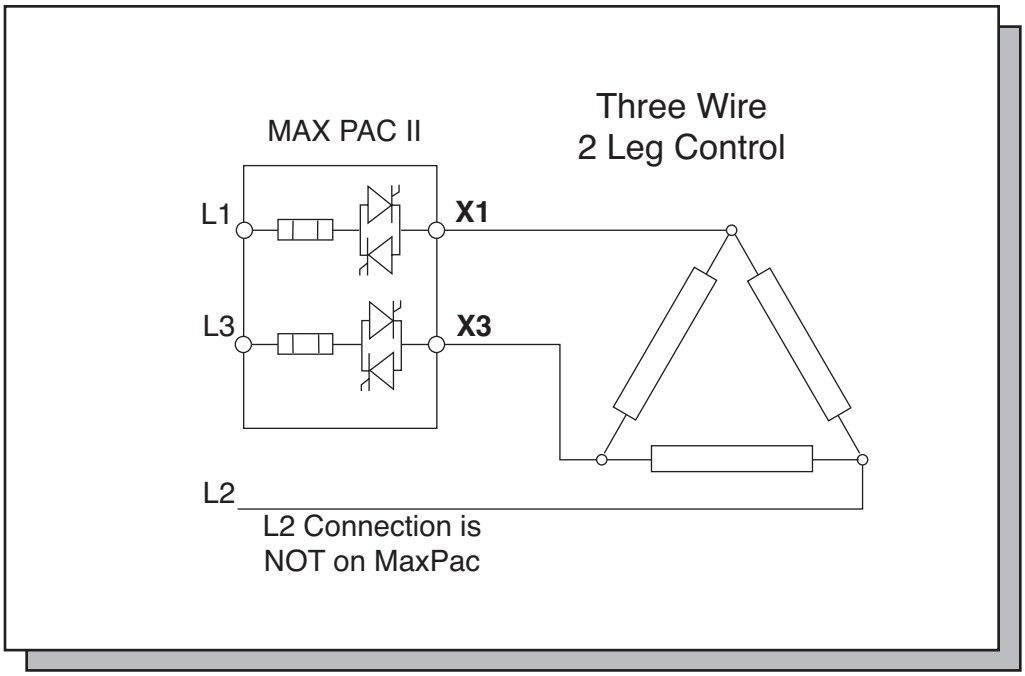
On open design units up to 300 Amps, X1, X2, X3, L1, L2, and L3 refer to copper lugs.

On open design units 400 Amps and greater and all Touch-Safe designs, X1, and X2, and X3, L1, L2, and L3 refer to bus bar connections.

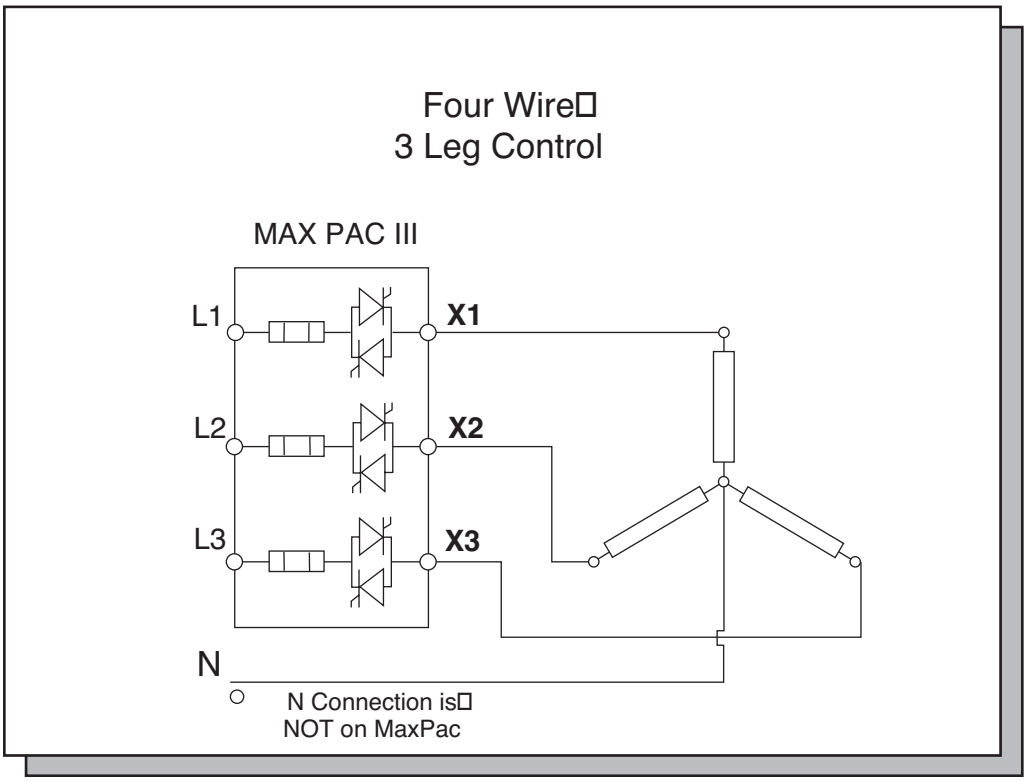
**MaxPac I**



**MaxPac II**

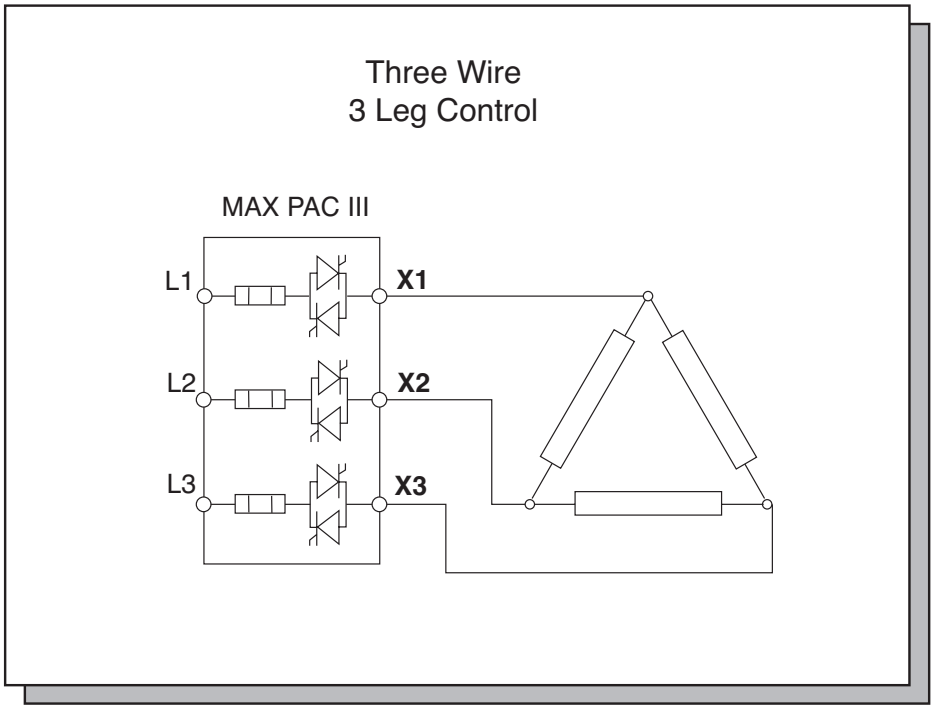



**MaxPac III**

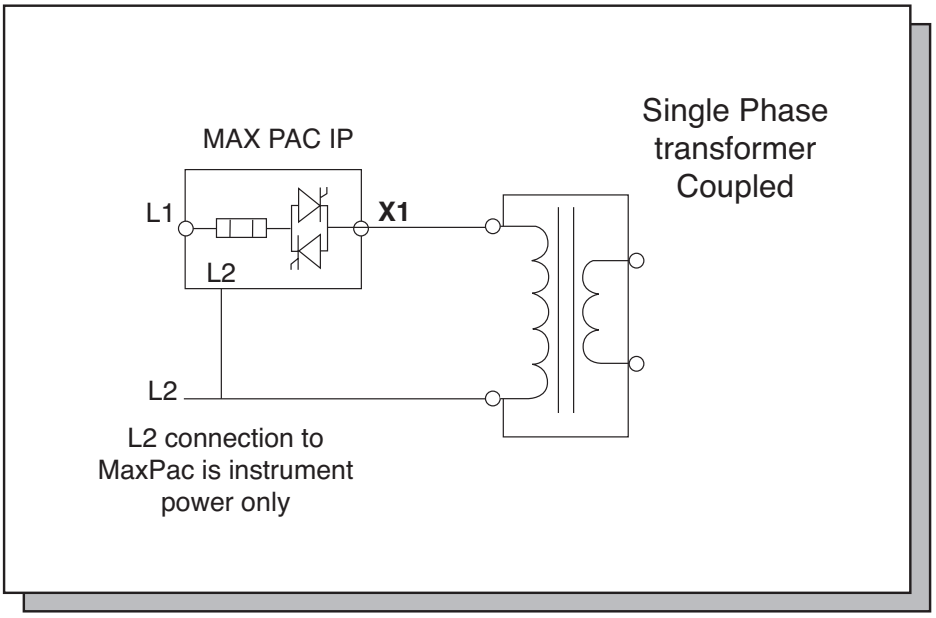



| CAUTION |
| --- |
| **IMPORTANT:** The $I^2t$ fuses installed on the SCR are designed to protect the SCR from faults on the load connection side. They are **NOT** intended to provide wire protection. |

**MaxPac III**




**MaxPac IP**




| CAUTION |
| --- |
| **IMPORTANT:** The $I^2t$ fuses installed on the SCR are designed to protect the SCR from faults on the load connection side. They are **NOT** intended to provide wire protection. |

The bus bars are designed to accept NEMA standard two-hole crimp lugs in accordance with the charts below.

The following drawings show proper installation of the crimp lugs on the bus bars:

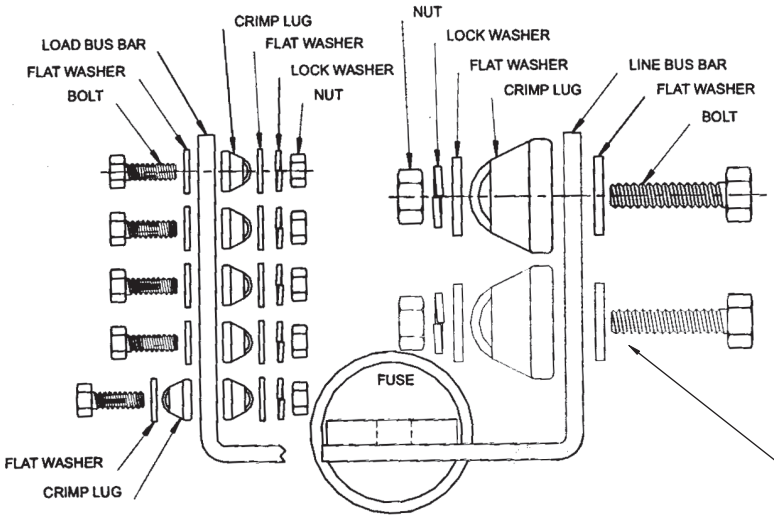



**Illustration 1:** View From Rear Ventilated Panel

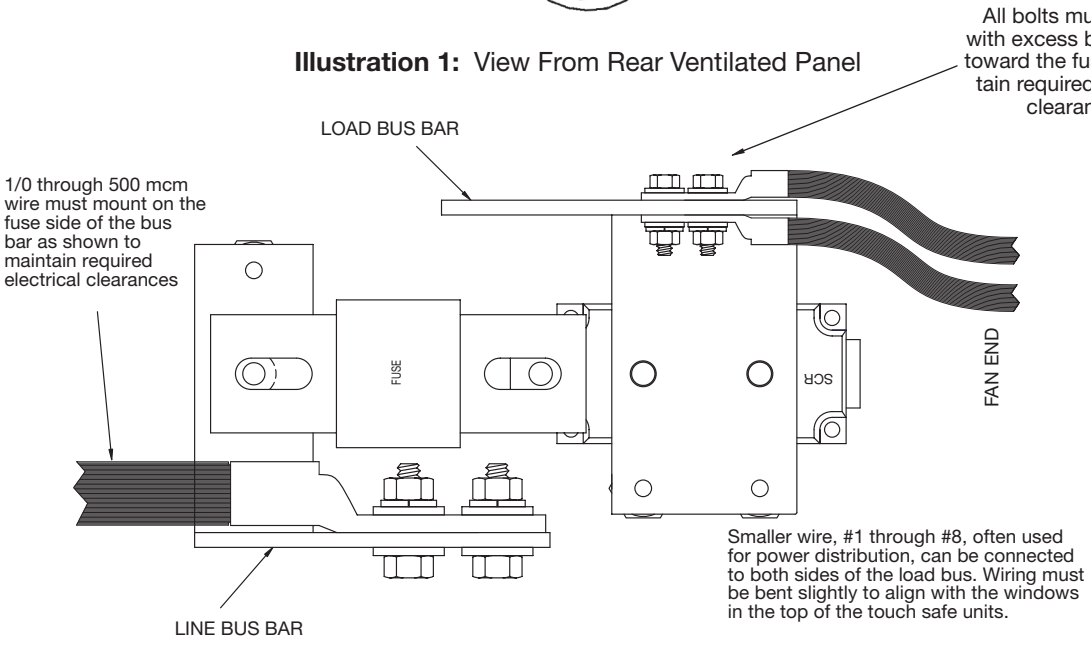



**Illustration 2:** View From Top

**Touch-Safe Units**

100 - 400 Amps

| Input Bus | Output Bus |
|---|---|
| Up to (3) 1/0 - 300 mcm (70 $mm^2$ — 150 $mm^2$) | Up to (10) #8 - #1 (10 $mm^2$ — 50 $mm^2$) |
| Up to (2) 350 - 500 mcm (185 $mm^2$ — 240 $mm^2$) | Up to (3) #1/0 - 300 mcm (70 $mm^2$ — 150 $mm^2$) |
| | Up to (2) 350 - 500 mcm (185 $mm^2$ — 240 $mm^2$) |

550 - 650 Amps

| Input Bus | Output Bus |
|---|---|
| Up to (4) 1/0 - 300 mcm (70 $mm^2$ — 150 $mm^2$) | Up to (12) #8 - #1 (10 $mm^2$ — 50 $mm^2$) |
| Up to (3) 350 - 500 mcm (185 $mm^2$ — 240 $mm^2$) | Up to (4) #1/0 - 300 mcm (70 $mm^2$ — 150 $mm^2$) |
| | Up to (3) 350 - 500 mcm (185 $mm^2$ — 240 $mm^2$) |

800 - 1200 Amps Open Design

Input and output bus drilled to accomodate qty (4) 1/0 - 500 mcm NEMA standard two-hole crimp lugs per phase.

The power wires must always mount on the fuse side of the bus bar. This is essential for maintaining the required spacing between phases and the sides and to align with the openings in the top. The only exception to this is when using power distribution using connectors of size #8 to #1. There is adequate spacing for these connectors to mount on both sides of the bus bar if necessary. The bolt head should always be on the outside of the bus (side away from the fuse) with the bolt extending toward the fuse. Flat washers should be used on both the bolt head and the nut and a lockwasher should be under the nut. The Touch Safe MaxPac is designed to allow both input and output wiring to enter/exit in either direction. On the 550 amp and 650 amp models it is necessary to mount the wire in the holes that maximize the distance for the wire to exit the enclosure. This maximizes the distance from the cover to the un-insulated connector. When using the power distribution feature and mounting terminals on both sides of the bus bar, the wires mounted on the outside of the bus bar must be bent inward slightly to align with the opening in the top. All wiring, especially the larger wires should be bent prior to mounting to the bus bars. Do not use the bus bars as an anchor to bend the power cables.

### 4.2.4 - Instrument Power

**MaxPac requires 120 or 230 VAC 50/60Hz for instrument power. This voltage supplies power for the control circuits, fans, high temperature warning indicator, and shorted SCR Indicators (see Fig. 1 on page 21).**

**This supply is fused on the main circuit board.**

### 4.2.5 - Grounding

The MaxPac uses electrically isolated SCR's. The enclosure will therefore be at the potential of the panel to which it is mounted. Holes are provided on the back of both sides of the MaxPac for NEMA standard two hole crimp lugs (the same as used on the bus bars) for additional grounding as may be required.

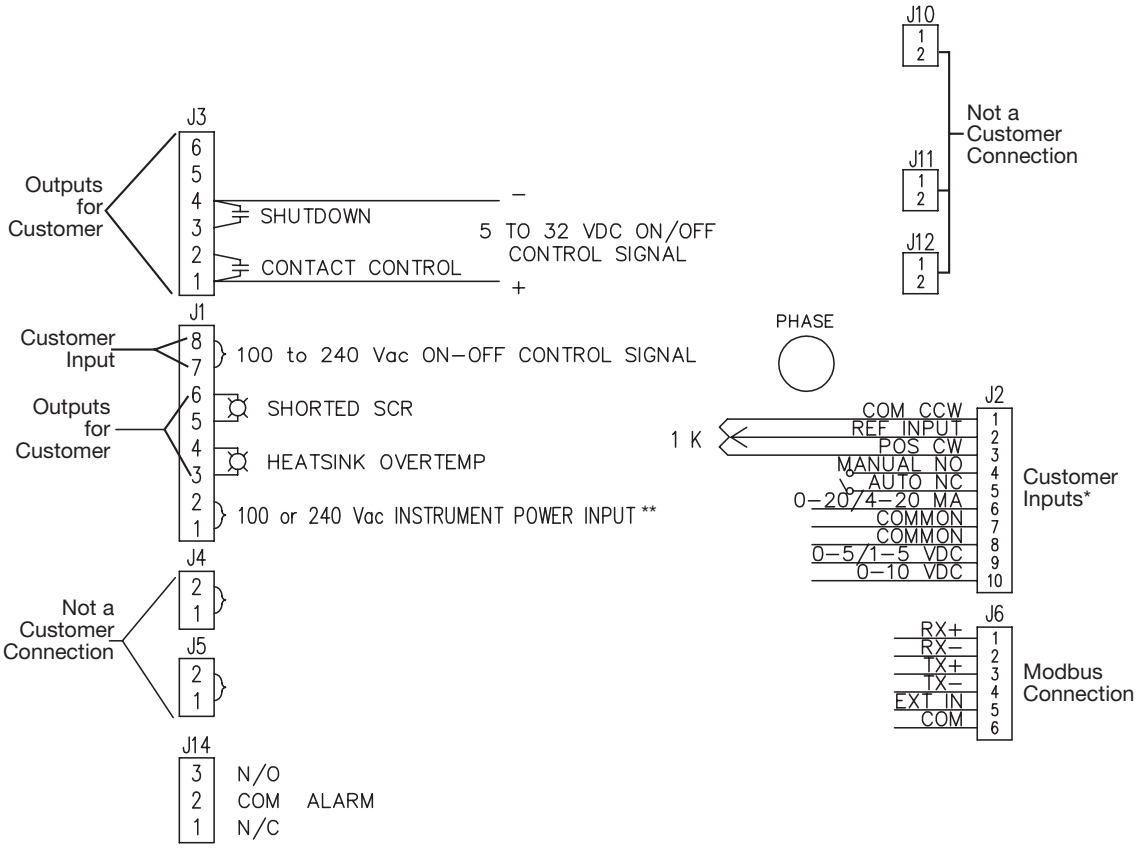
| **IMPORTANT** |
| --- |
| Chasis is provided with hole pattern for standard NEMA two-hole crimp lugs. |

**WARNING**

***Hazardous Voltage: This Electrical Equipment must be installed by a qualified person and effectively grounded in accordance to the National Electric Code and local codes.***

## 4.2.6 - Command Signal Wiring

Please refer to the following figure for illustrations of the 6-, 8-, and 10-pin input terminals.




*Only one customer input is allowed, eg. J3 pins 1 & 2 contact control may not be used at the same time as J2 pins 6 & 7 (4-20 mA)
**Instrument power 4 VA maximum

**MaxPac I, II, and III**

**On/Off Control Signals**

**AC Input** – The 120 – 230 VAC signal lines are connected to terminal J1-7 & 8. An input voltage of 120 to 230 VAC turns the power On. The turn OFF voltage for the power control is 0 VAC.

**DC Input** – The 5 – 32 VDC signal lines are connected to terminal J3-1&4. An input voltage of 5 to 32 VDC turns the power On. The turn OFF voltage for the power control is 0 VDC.

**NOTE:** For AC or DC input to be used for ON/OFF control, SWI rotary switch must be set to position 0 and unit must be jumpered for AUTO

**Contact Closure Input** – The dry contact signal lines are connected to terminal J3-1&2. A closed contact turns the power On. The turn OFF is an open contact.

**Process Analog Control Signals**

The MaxPac II accepts 0 –5/1 – 5/0 – 10 VDC and 4 – 20 mA input signals, they are factory calibrated. The following signals are connected to:

0 - 5 VDC: Terminal J2 - 9(+) & 7(-)
1 - 5 VDC, 11 - 5 VDC: Terminal J2 - 5(+) & 7(-)
0 - 10 VDC: Terminal J2 - 10(+) & 7(-)
4 - 20 mA, 10 - 20 mA: Terminal J2 - 6(+) & 7(-)

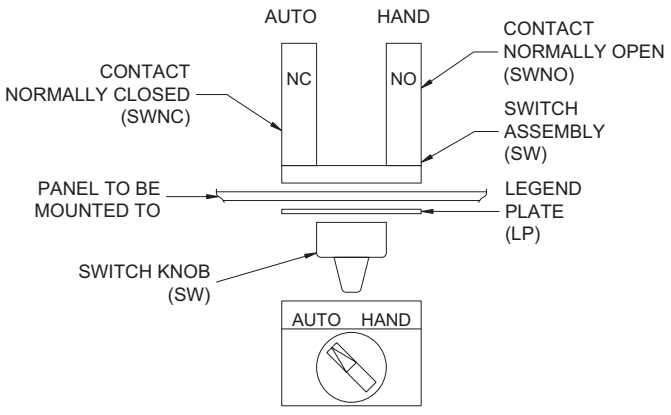



**Illustration 3**

**Auto/Manual Input**

The MaxPac I, II and II can be wired to make it possible to select an input from either a temperature/process controller or a manual input potentiometer. A switch is used to select between the input from a 1K potentiometer or a linear control input (see input connections).

The unit is shipped with a jumper from terminals 4 and 5 of terminal block J2. This jumper must be removed when connecting the auto/manual switch and potentiometer.

**Demand Indicator**

The LED demand indicator is located on the main PC board and is viewable through the cover. With the On/Off control option, the indicator will display steady “on” and steady “off”. With the DOT Firing or Time-Proportional options, the indicator will display the firing sequence.

**SCR Control Board**

The control board provides the following functions:

The low voltage dc to operate the circuitry:
A switching regulator circuit converts the instrument power to +8 VDC.

The power distribution for the cooling fans:
The incoming instrument power is routed to the fan power terminals.
Add fusing as required for fan power requirement.

The signal condition for the on/off input and analog inputs:
The 120 to 240 on/off input is isolated by an opto-coupler. The DC and contact closure inputs are buffered by the circuitry.

The drive signal to the SCR trigger boards:

The temperature alarm:

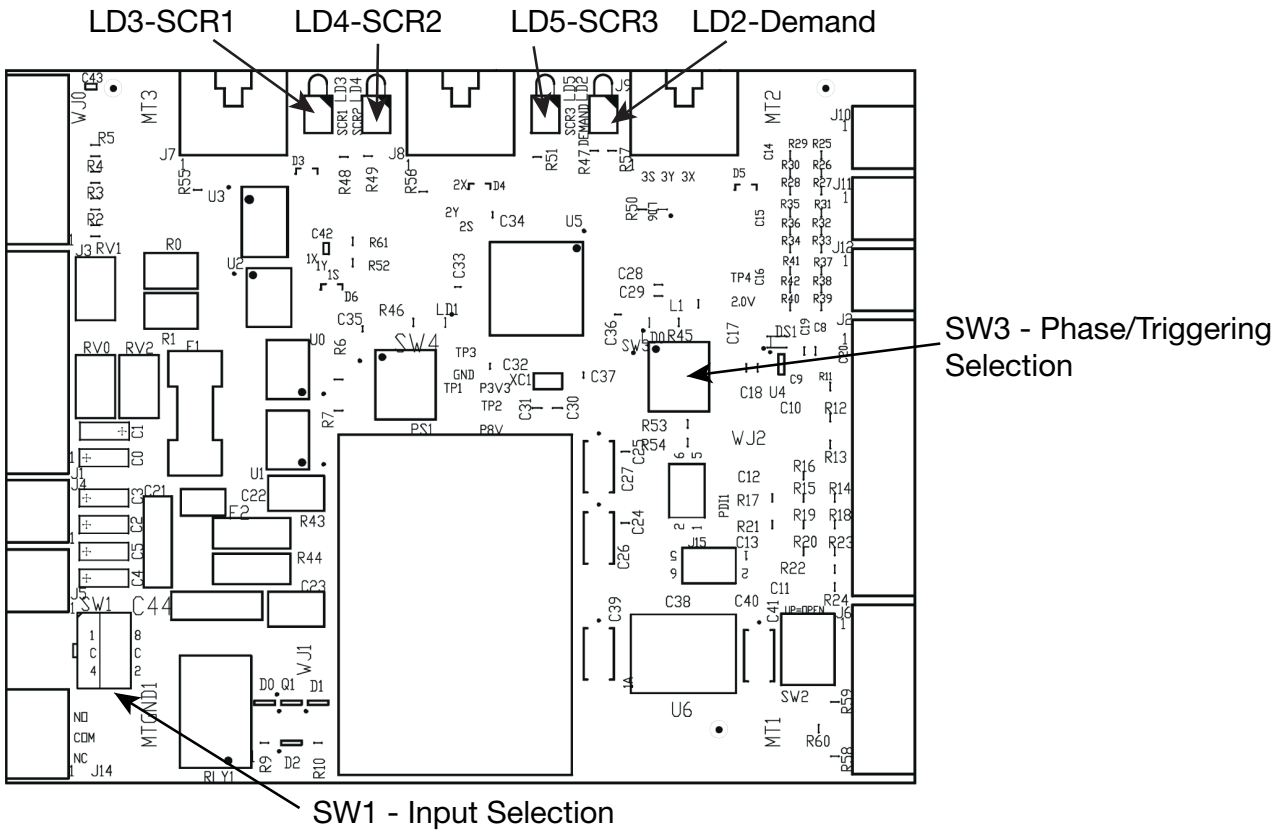
The heat sink temperature is derived from a resistive temperature detection (RTD) sensor mounted on the heat sink. This is then compared to two set points.

The first alarm is a warning and activates the externally connected device.

This allows time to correct the problem before the second alarm inhibits the firing circuit.

The Shorted SCR Alarm:

When a short is detected the externally connected device output is activated.



The method of setting the MaxPac for desired mode of operation is as follows:

Input Command Selection

The unit can be set to drive its output in response to the following command inputs:

- Analog potentiometer
- Analog inputs: 4-20mA (or 0-20mA), 0-5Vdc (or 1-5Vdc), 0-10V
- Digital ON/OFF inputs: AC ON/OFF, DC ON/OFF

To select between any of these inputs, set the MaxPac as indicated in the table below:

| Input Command Select | Method of Selection |
|---|---|
| Potentiometer | Select MANUAL mode by leaving no connection between J2.4 & J2.5. The rotary switch selection at SW1 is ignored when in MANUAL mode<br><br>OR<br><br>Select AUTO mode by jumpering J2.4 & J2.5, and then set rotary switch at SW1 to position 1 |
| ON / OFF (will turn output in if either AC or DC ON/ OFF inputs are energized) | Select AUTO mode by jumpering J2.4 & J2.5, and then set rotary switch at SW1 to position 0 |
| 0-10Vdc | Select AUTO mode by jumpering J2.4 & J2.5, and then set rotary switch at SW1 to position 2 |
| 0-5Vdc | Select AUTO mode by jumpering J2.4 & J2.5, and then set rotary switch at SW1 to position 3 |
| 1-5Vdc | Select AUTO mode by jumpering J2.4 & J2.5, and then set rotary switch at SW1 to position 4 |
| 0-20mA | Select AUTO mode by jumpering J2.4 & J2.5, and then set rotary switch at SW1 to position 5 |
| 4-20mA | Select AUTO mode by jumpering J2.4 & J2.5, and then set rotary switch at SW1 to position 6 |
| **Note:** SW1 position 7 is reserved for factory use, and should not be used | |

## Phase Selection and Firing Mode

SW3 selects the phase selection and firing method of the MaxPac.

Normally, this switch should be left in its factory-installed position. If it should become necessary to change it, set only accordance to the table below. Choosing a setting that does not match your unit's number of phases and legs will result in the unit entering alarm mode and turning the output off after an initial attempt to turn outputs on.

| SW3 Position | Selection | Note |
|---|---|---|
| 0 | Reserved for factory use | Do Not Use this Selection |
| 1 | DOT for MXPCI | Caution: Do not choose this setting if your unit is a MXPCII or MXPCII type |
| 2 | DOT for MXPCII | Caution: Do not choose this setting if your unit is a MXPCI or MXPCII type |
| 3 | DOT for MXPCIII | Caution: Do not choose this setting if your unit is a MXPCI or MXPCII type |
| 4 | Time Proportional for MXPCI | Caution: Do not choose this setting if your unit is a MXPCII or MXPCII type |
| 5 | Time Proportional for MXPCII | Caution: Do not choose this setting if your unit is a MXPCI or MXPCII type |
| 6 | Time Proportional for MXPCIII | Caution: Do not choose this setting if your unit is a MXPCI or MXPCII type |
| 7 | Reserved for factory use | Do Not Use this Selection |

## LED Indicators

LEDs and their function are as follows:

| Designator | Name | Description |
|---|---|---|
| LD2 | Output Demand Indication | This LED blinks on according to the switching of output |
| LD3 | Switch SCR1 | OFF in normal operation. Turns ON if shorted SCR is detected in one direction. Blinks rapidly if phase voltage is not present or if SCR is shorted in both directions. |
| LD4 | Switch SCR2 | OFF in normal operation. Turns ON if shorted SCR is detected in one direction. Blinks rapidly if phase voltage is not present or if SCR is shorted in both directions. |
| LD5 | Switch SCR3 | OFF in normal operation. Turns ON if shorted SCR is detected in one direction. Blinks rapidly if phase voltage is not present or if SCR is shorted in both directions. |

## Alarm Output

The form C contact at J14 will be in the alarmed state in any of the following conditions:

- If any shorted SCR is detected. One or more of the shorted SCR LEDs LD3-LD5 will be lit in this case
- If missing Zero Cross transitions are detected at the SCRs. Typically, this is caused by missing power on one or more phases, or from incorrect detection of phase sequence. One or more of the shorted SCR LEDs LD3-LD5 will be blinking in this case
- If sensed temperature of the heat sink at an SCR junction exceeds 200 degrees Fahrenheit or 93 degrees Celsius. The Overtemp output will also be engaged in this case.
- If sensed phase sequence does not match the setting of selector SW3. (Normally, SW3 should be left in its factory-set state. See caution in section titled, “Phase Selection and Firing Mode“).

### Remote Stop

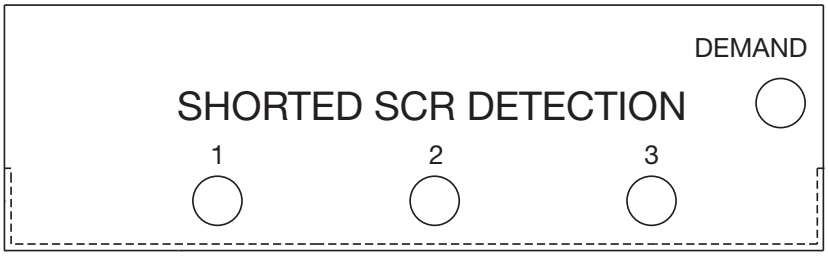
When it is necessary to disable or enable the output, connect a dry contact between J3 – 3 & 4. When it is closed, the power control will disable the output.

| CAUTION |
| --- |
| **IMPORTANT:** This stop overrides the control input only. It will NOT protect against faulted or damaged SCRs. |

### Shorted SCR Detection (optional)

This features provides a means of alerting an operator to a problem with the system. An external indicated lamp or relay can be connected to J1 – 5 & 6 (See Fig. 2). This indicator must be rated for the instrument power applied to J1 -1 & 2. Three diagnostic LEDs show which SCR pair is faulted. These lights are synchronized with the demand indicator and can only indicate while the demand is active.

The latching alarm means that if the alarm activates and the system subsequently returns to normal, the alarm will remain latched until a reset button (external – customer provided) is pressed. A non-latching alarm resets automatically.

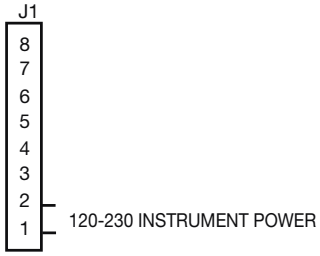



### Heat Sink Over-Temperature

An external lamp or relay may be connected to J1 – 3 & 4 (see Figure 2) (this must be rated for the instrument power applied to J1 – 1 & 2). This will provide an indication to the operator that the heat sink has approached an unsafe temperature level of 200˚F (93˚C) The unit will enter a stop mode if the temperature rises to 212˚F (100˚C).

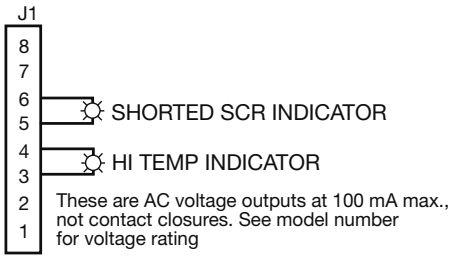
**Input Terminals (MaxPac I, II, and III):**

FIG 1



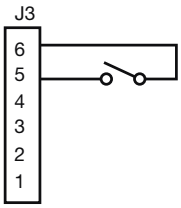

**120-230 INSTRUMENT POWER REQUIRED ON ALL CONFIGURATIONS**

FIG 2



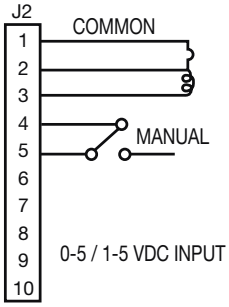

**SHORTED SCR AND HI TEMP INDICATORS.**

FIG 3



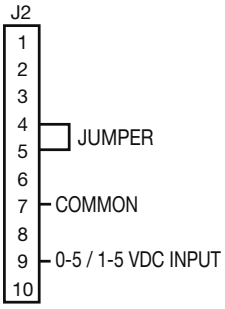

**SHORTED SCR INDICATOR RESET**

FIG 4



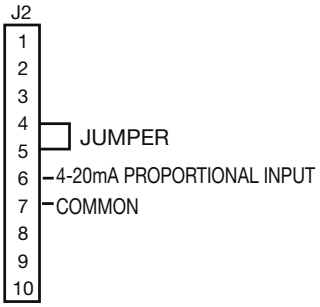

**MANUAL CONTROL INPUT SIG**

FIG 5



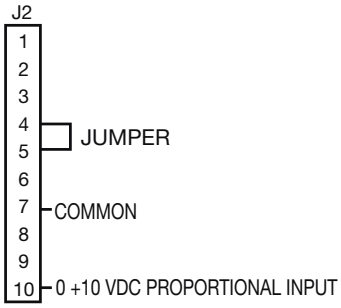

**0-5 / 1-5 VDC PROPORTIONAL INPUT SIG**

FIG 6



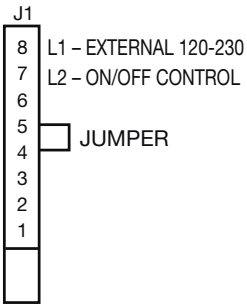

**4-20mA PROPORTIONAL INPUT SIG**

FIG 7



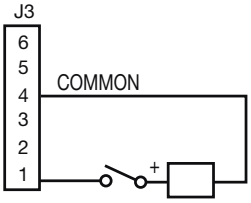

**0 +10 VDC PROPORTIONAL INPUT SIG**

FIG 8



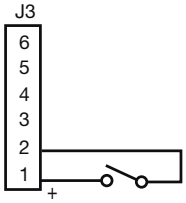

**120-240 ON/OFF CONTROL**

FIG 9



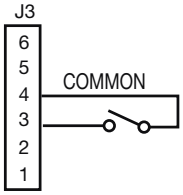

**EXTERNAL +5-32 VDC ON/OFF**

FIG 10




**DRY CONTACT ON/OFF**

FIG 11




**REMOTE SHUTDOWN**

## MaxPac IP

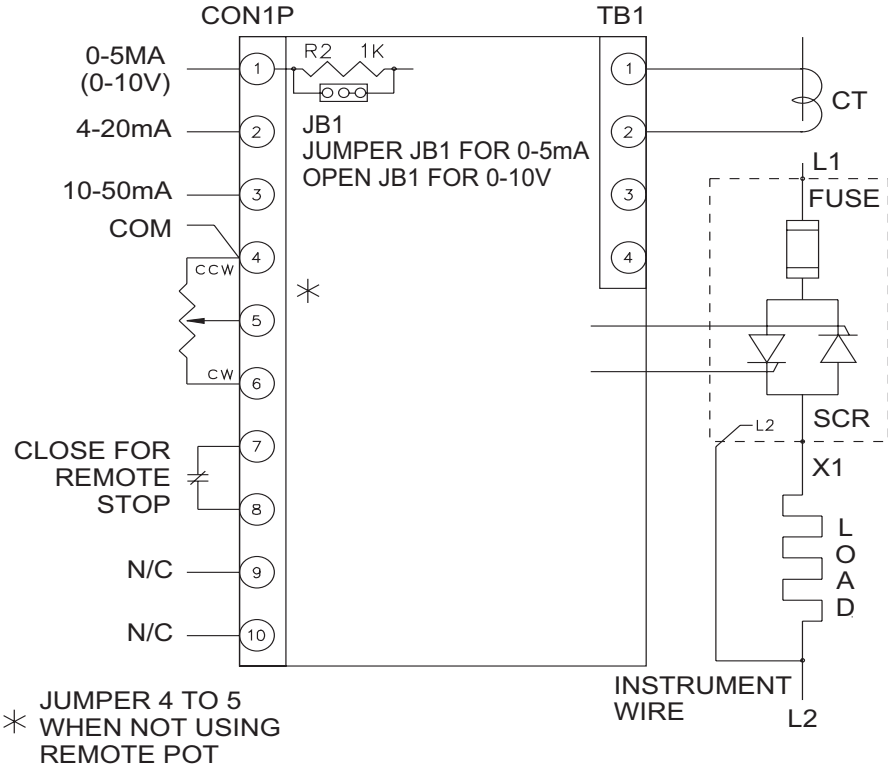
The Chromalox MaxPac IP is a solid-state proportional power controller that utilizes a Phase Angle firing technique to modulate power to an inductive or resistive load. Separate adjustable Zero, Gain, Manual Bias, and Current Limit potentiometers are provided along with screw type plug-in connectors for input signals, Emergency Stop, and optional Remote Manual Bias with 0 - 100% dial. All units have thermostat protection with N.C. contacts.

### Start-up

The MaxPac IP has been factory calibrated for 4 - 20mA input. Be sure the operating voltage and signal input are correctly applied. Also, make sure the Emergency Stop, if used, has N.O. contacts and jumper pins 4 & 5 on the 10-pin connector if remote manual bias are not used. Please read the information on calibration at the end of this section for current limit settings for loads with extreme hot to cold ratios or those that are overrated. Other ranges may be field calibrated by use of zero and gain potentiometers.

**⚠ CAUTION**

**IMPORTANT:** With the Current Limit option, the current transformer must be terminated properly to prevent it from being damaged.




**Customer Connection**

### 4.2.6 - Calibration (MaxPac IP):

Many high-temperature heating elements exhibit extreme hot to cold resistance ratios. Heating elements composed of Platinum, Molybdenum, Tungsten, and Tantalum, to name a few, draw excessive current on start-up. Depending on the mass of the elements, these “high starting currents” may exist for extended periods of time. Generally, once the elements have achieved their normal operating temperatures, the current drawn through the MaxPac Power Pak will fall within the rating of the unit. For these types of loads, we recommend adjusting the I LIM (Current Limit) to 50% or less. This will decrease voltage as well as current.

1. Set Current Limit (I LIM) pot to 0% for full current output (CCW).

   Current Limit is for limiting current for loads that have extreme hot to cold resistance ratios or are overrated. We recommend for these types of loads to adjust I LIM (Current Limit) to 50% or less. This will also decrease voltage as well as current. 0% Current Limit gives 100% current output (CCW). 100% Current Limit gives 10% current output (CW).

2. Set Manual (MAN) pot to zero so unit will not be biased above input (CCW).

   Manual control adjustment provides a means of setting the output level of the MaxPac Power Pak in the absence of controlling instrumentation. The manual control signal value “adds” to the controlling instrument to set minimum output. The desired output power level may be set by adjusting the manual control. This value of output will then be present even in the absence of a control signal.

3. Set Remote Manual pot to zero output so unit will not be biased above input (CCW). (Jumper pins 4 & 5 if not used.)

   Remote Manual control adjustment provides a means of setting the output level of the MaxPac Power Pak in the absence of controlling instrumentation. The Remote Manual control is also effective when a control signal is connected. The Remote Manual control signal value “adds” to the controlling instrument to set minimum output. The desired output power level may be set by adjusting the Remote Manual control. This value of output will then be present even in the absence of a control signal. Connect Remote Manual pot wire to Pin 4 (CCW), Pin 5 (W), and Pin 6 (CW) of plug-in connector.

4. Check for open contact for Emergency Stop.

   Emergency Stop inhibits all SCR trigger pulses regardless of the level of the input signal or manual potentiometer. For Emergency Stop, close contact Pin 7 to Pin 8 of plug-in connector. Leave contacts open for operation.

5. Check for polarity of input signal.

6. Adjust input signal to low end of scale.

   Zero Adjust control sets the power output starting point or reference. Thus, it effectively cancels positive inputs to the MaxPac Power Pak.

   EXAMPLE: 0 - 5 mA input à set to 0 mA input
   4 - 20 mA input à set to 4 mA input

7. With power off, connect line voltage and load as shown.

8. Connect meter to input and output.
   ***WARNING: Set meter to correct scale to read proper input or output.***

9. Apply power to unit.

10. Adjust input signal to low end of scale.

11. Using the Zero pot, adjust the output voltage just to zero volts.

12. Adjust input signal to top end of scale.

    Gain Adjust Control sets the maximum power output for maximum input signal.
    EXAMPLE: 0 - 5 mA input: set to 5 mA input
    4 - 20 mA input: set to 20 mA input

13. Using the Gain pot, adjust output voltage just to maximum volts.

14. Repeat steps 11, 12, 13, and 14 until no adjustment is necessary of Zero and Gain pots for proper output voltage indication. Voltage output should increase proportionally to the signal input applied.

15. Adjust input signal to low end of scale (zero voltage output).

16. With Manual pot at zero for zero voltage output, adjust (CW) to 100% for full voltage output. Voltage output should increase proportionally. Return to CCW position and output will decrease to zero output.

17. With Remote Manual at zero for zero voltage output, adjust (CW) to 100% for full voltage output. Voltage output should increase proportionally. Return to CCW position and output will decrease to zero output.

18. With Manual pot (CW) at 100% and I LIM (Current Limit) at 0%, adjust I LIM towards 100% noting that voltage output decreases with the adjustment of the Current Limit pot. Adjust Current Limit pot for your application, if needed.

19. Turn POWER OFF and remove meters. TEST COMPLETE.

# 5 Controller Configuration

# 6 Specifications

**MaxPac I, II, and III**

**Control Inputs**
Accepts all of the following as standards:

**On/Off Control**
Signal Input
120 thru 230 VAC ± 10% (4 VA Maximum)
5-32 VDC
Contact Closures

**Proportional Control**

| Signal Input | Input Impedance |
|---|---|
| 4 - 20 mA | 50 Ohms |
| 1 - 5 VDC | 10k Ohms or greater |
| 0 - 5 VDC | 9k Ohms or greater |

Remote Manual Adjust
Auto/Manual Switch

**Instrument Power** ..... 120 or 230 VAC 50/60 Hz

**Output Voltage** ..... 0 - 99% RMS line voltage (Eo-Vsupply - 1.5V SCR forward drop)

**Resolution (proportional)** Better than 0.1%

**Line Voltage** .....120 - 575 VAC, 60 Hz
CE 400 VAC 50 Hz

**Load Current Rating** .....100, 150, 200, 300, 400, 550, 650, 800, 1000, 1200A

**Ambient Temperature** ....0 - 50°C (32 - 122°F)

**SCR Capability**
Dielectric .....Withstand capability
Surge Rating 1500V RMS min.
Typically fifteen (15) times nominal RMS rating for 8.3 milliseconds

Isolation .....SCRs isolation 2500V
Input-output isolation 1500V

**Heat Sink** .....Ground potential up to 650 Amps

**High Temperature** .....AC Voltage Output
**Indicator Output** 100 mA @ Instrument Power

**Shorted SCR** .....AC Voltage Output
**Indicator Output** 100 mA @ Instrument Power

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**MaxPac IP**

**Control Inputs**

Accepts all of the following as standards:

**Phase Angle Control**

| Signal Input | Input Impedance |
|---|---|
| 1 - 5, 0 - 5mA | 1K Ohms |
| 4 - 20, 0 - 20mA | 250 Ohms |
| 10 - 50, 0 - 50mA | 100 Ohms |

Optional Remote Manual Adjust

**Fan Power** ..... 120 or 230 VAC 50/60 Hz

**Output Voltage** ..... 0 - 99% RMS line voltage (Eo=Vsupply - 1.5V SCR forward drop)

**Resolution (proportional)** Better than 0.1%

**Line Voltage** ..... 120, 208, 240, 277, 380, 480 and 575 VAC ± 10% 50/60 Hz

**Load Current Rating** .. 100, 150, 200, 300, 400, 550, 650, 800, 1000, 1200A

**Ambient Temperature** ....0 - 50°C (32 - 122°F)

**SCR Capability** .....Withstand capability
1500V RMS min.
Typically fifteen (15) times nominal RMS rating for 8.3 milliseconds

**Surge Rating** .....Typically fifteen (15) times nominal RMS rating for 8.3 milliseconds

**Isolation** .....SCRs isolation 2500V
Input-output isolation 1500V

**Heat Sink** .....Ground potential up to 650 Amps

**Thermostat** .....4 Amps @ 120V resistive
2 Amps @ 240V resistive
N.C. Contact Standard

**Current Limit** .....10 - 100% of rated output current

**Soft Start** .....25% demand per second typical reset speed
8.3 milliseconds

# 7 Maintenance

***READ AND UNDERSTAND BEFORE CARRYING OUT THE WORK DETAILED BELOW***

**WARNING**

***Hazardous Voltage: Disconnect all power before performing any maintenance or examining the power module. Exposed terminals may carry LETHALLY HIGH VOLTAGES when power is applied.***

## Environmental Issues:

Temperature:
When mounting the SCR unit in a control panel attention should be paid to the enclosure temperature. The SCR is rated to perform at it's nameplate current rating in temperatures up to 50˚C (122˚F). Ensure that adequate ventilation is provided or some other method of maintaining the correct cabinet temperature is used.

**Cleanliness:**
Careful attention must be paid in areas subjected to airborne particles The efficiency of the heatsinks rely on there conducting surfaces being maintained in clean manner. (See Maintenance Section)

**Dampness:**
High humidity or hosing down should be avoided.

**Connections:**
Ensure that all electrical connections are secure and tight. (See Maintenance Section)

**Fusing:**
The $I^2t$ fuses installed on the SCR are designed to protect the SCR's from faults on the load connection side. They are NOT intended to provide wire protection.

## Maintenance

**Connections**:
Loose connections in the power wiring will generate hot spots, which will cause degradation of electronic equipment. Periodically inspections should be made to to ensure that connections are secure and that there are no signs of excessive heating such as discoloration etc.

**Filters:**
Many high power control enclosures rely on blowers or fans to maintain a safe operating temperature. The filters used with these devices should be changed on a periodic basis to insure adequate enclosure cooling is maintained.

# 8 Troubleshooting

***READ AND UNDERSTAND BEFORE CARRYING OUT THE WORK DETAILED BELOW***

The following guidelines cover most of the common problems that could occur with the MaxPac. They are not intended to be, nor can they be, absolutes to cover every possible failure.

## Problem

**Note: Heater load must be conntected to Test.**

**No Power or unbalanced power to the load.**

If Demand Light is "**Off**"

1. Check incoming line power. Verify that fans are running
2. Check the instrument power.
3. Check the fuse on the main board.
4. Verify the input signal.
5. Check that remote stop J3 - 3 to 4 is open.
6. Check that the J2 - 4 to 5 is Jumpered.
7. Verify that heat sink is not in over temperature mode.

If Demand Light is "**On**"

1. Check the connections to SCR trigger board.
2. Check the power fuses ($I^2t$).
3. Look for damage on the trigger board.

| Observation | Possible Root Cause |
|---|---|
| LD3 – SCR1 light is ON and Alarm relay engaged | Shorted SCR1 |
| LD4 – SCR2 light is ON and Alarm relay engaged | Shorted SCR2 |
| LD5 – SCR3 light is ON and Alarm relay engaged | Shorted SCR3 |
| LD3 – SCR1 light is blinking and Alarm relay engaged | Missing phase or phase error, SCR1 |
| LD4 – SCR2 light is blinking and Alarm relay engaged | Missing phase or phase error, SCR2 |
| LD5 – SCR3 light is blinking and Alarm relay engaged | Missing phase or phase error, SCR3 |
| Over temp output conducts, Alarm relay engaged, and heater output still functions | Heat Sink Temperature greater than 200˚F (93˚C) detected but all outputs less than 212˚F (100˚C) |
| Over temp output conducts, Excessive temperature of heat sink and Alarm relay engaged, heater output still functions | Heat Sink Temperature greater than 200 ˚F (93˚C) detected but all outputs less than 212˚F (100˚C) |

**Diagnostics with Safety Cover Removed**

| Observation | Possible Root Cause |
|---|---|
| Heartbeat LED not blinking | Loss of electronics AC power. Check fuse. |

# 9 Parts and Accessories

**Instrument Power Fuse**

| Chromalox Part Number | Description |
|---|---|
| 0024-01312 | Fuse, 0.125A, 2 AG |

**500 VAC $I^2T$ Fuse**

| | |
|---|---|
| 0024-07634 | 200 Amp $I^2t$ Fuse |
| 0024-07630 | 250 Amp $I^2t$ Fuse |
| 0024-07632 | 400 Amp $I^2t$ Fuse |
| 0024-03116 | 500 Amp $I^2t$ Fuse |
| 0024-07633 | 700 Amp $I^2t$ Fuse |
| 0024-03118 | 800 Amp $I^2t$ Fuse |
| 0024-03200 | 1000 Amp $I^2t$ Fuse |

**600 VAC $I^2T$ Fuse**

| | |
|---|---|
| 0024-07644 | 125 Amp $I^2t$ Fuse |
| 0024-07645 | 175 Amp $I^2t$ Fuse |
| 0024-07636 | 250 Amp $I^2t$ Fuse |
| 0024-07637 | 400 Amp $I^2t$ Fuse |
| 0024-07638 | 500 Amp $I^2t$ Fuse |
| 0024-07639 | 700 Amp $I^2t$ Fuse |
| 0024-07640 | 800 Amp $I^2t$ Fuse |
| 0024-07646 | 1000 Amp $I^2t$ Fuse |
| 0024-01191 | 1200 Amp $I^2t$ Fuse |

**Fans**

| Chromalox Part Number | Description |
|---|---|
| 0045-00231 | 120 VAC rated Fan |
| 0045-00235 | 230 VAC rated Fan |

**Crimp Lug Chart**

For Open Design 400 - 1200 Amp and all Touch-Safe Models:

| Conductor Size | Chromalox Part # | Panduit Part # |
|---|---|---|
| #8 AWG (10mm$^2$) | 0135 - 10002 | LCD8 - 14A - L |
| #6 AWG or #6 Weld (16mm$^2$) | 0135 - 10003 | LCD6 - 14A - L |
| #4 AWG or #4 Weld (25mm$^2$) | 0135 - 10004 | LCD4 - 14A - L |
| #2 AWG (35mm$^2$) | 0135 - 10005 | LCD2 - 56B - Q |
| #1 AWG or #2 Weld (50mm$^2$) | 0135 - 10006 | LCD1 - 56C - E |
| #1/0 AWG or #1 Weld (70mm$^2$) | 0135 - 10007 | LCD1/0 - 12 - X |
| #2/0 AWG or #1/0 Weld (70mm$^2$) | 0135 - 10008 | LCD2/0 - 12 - X |
| #3/0 AWG or #2/0 Weld (95mm$^2$) | 0135 - 10009 | LCD3/0 - 12 - X |
| #4/0 AWG or #3/0 Weld (120mm$^2$) | 0135 - 10010 | LCD4/0 - 12 - X |
| 250 MCM or #4/0 Weld (150mm$^2$) | 0135 - 10011 | LCD250 - 12 - X |
| 300 MCM (150mm$^2$) | 0135 - 10012 | LCD300 - 12 - X |
| 350 MCM (185mm$^2$) | 0135 - 10013 | LCD350 - 12 - 6 |
| 400 MCM (240mm$^2$) | 0135 - 10014 | LCD400 - 12 - 6 |
| 500 MCM (240mm$^2$) | 0135 - 10015 | LCD500 - 12 - 6 |

**SCR Replacement**

Be sure to replace thermstrate interface material and torque as follows:

| MFG Part # | SCR Part # | Thermstrate Part # | Torque inch/lb to Heat Sink | Torque inch/lb to Terminals |
|---|---|---|---|---|
| SKKT92 | 0002 - 47560 | 0029 - 00700 | 44 inch/lb (5 Nm) | 26 inch/lb (3Nm) |
| SKKT162 | 0002 - 47559 | 0029 - 00822 | 44 inch/lb (5 Nm) | 44 inch/lb (5 Nm) |
| SKKT250 | 0002 - 47537 | 0029 - 00719 | 44 inch/lb (5 Nm) | 80 inch/lb (9 Nm) |
| SKKT500 | 0002 - 47557 | 0029 - 00814 | 44 inch/lb (5 Nm) | 106 inch/lb (12 Nm) |

**MaxPac I, II, and III Accessories:**

| Part Number | Description |
|---|---|
| 0135 - 28193 | SCR Trigger Board |
| 0135 - 28194 | On/Off Main Firing Board |
| 0135 - 20117 | Potentiometer & Remote/Manual Switch |

**MaxPac IP Accessories:**

| Part Number | Description |
|---|---|
| 0135 - 28002 | Firing Circuit 120, 240 VAC |
| 0135 - 28006 | Firing Circuit 208, 277, 480 VAC |
| 0135 - 28037 | Firing Circuit 380 VAC |

# 10 Warranty and Return Information

**Warranty Notice**

The Warranty below complies with the federal law applicable to products manufactured after December 31, 1976. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

**Chromalox Warranty**

Chromalox instruments and controls are warranted against defects in workmanship and materials. No other express warranty, written or oral, applies with the exception of a written statement from an officer of Chromalox®, Inc.

**Warranty Period**

This warranty extends for one year from date of shipment from the factory or authorized distributor.

**Limitations**

Products must be installed and maintained in accordance with Chromalox instructions. Users are responsible for the suitability of the products to their application. There is no warranty against damage resulting from corrosion, misapplication, improper specification or other operating conditions beyond our control. Claims against the carrier company for damage in transit must be filed by the buyer.

**Returns**

Items returned to Chromalox must be accompanied by a Return Authorization Number. This number may be obtained from Chromalox' Customer Service Department at the phone number listed below.

The Return Authorization Number must appear on the exterior of the shipping carton and on the shipping documents.

Defective items will be repaired or replaced at our option and at no charge.

Return the defective part or product, freight prepaid, to the following address:
Chromalox, Inc.
1347 Heil Quaker Blvd.
LaVergne, TN 37086-3536

Phone: (615) 793-3900
Fax: (615) 793-3563

# Ordering Information for MaxPac I

## Model SCR Power Pack

**MXPC I Single Phase SCR Power Pack**

| Code | Control Configuration |
|---|---|
| **5** | Proportional Control, DOT Zero-Crossover Firing, Command Input Signals: 4-20mA, 0-5 VDC, 1-5 VDC (via Modbus RTU/485 only), 0-10 VDC, Remote 0-1000 OHM Potentiometer w/Manual Override, Modbus RTU/RS485 Communications. RTD Heat Sink Temperature Sensor with Two Set-Points, Automatic Line Sensing 50/60HZ, Remote Permissive Stop Input, Form "C" Dry Contact Alarm Output, Staged Heating w/Digital Calibration Zero / Span Adjustments(4-8 mA, 8-12 mA,12-16 mA,16-20 mA (via Modbus RTU/RS485 only), LED Diagnostics: Command Input, Main/Trigger Boards Running, SCR Status per Phase, Diagnostic Kit via Modbus RTU/RS485: Highest Heat Sink Temperature, Last Heat Sink Temperature, Highest and Lowest Ambient Temperature, Line Frequency Monitoring, Third Party Certifications: UL, cUL, CE, DEMKO (650 A and below). |

| Code | Current at 50°C (122°F) | |
|---|---|---|
| **01** | 100 Amp | Open Design |
| **02** | 100 Amp | Touch Safe Design |
| **03** | 150 Amp | Open Design |
| **04** | 150 Amp | Touch Safe Design |
| **05** | 200 Amp | Open Design |
| **06** | 200 Amp | Touch Safe Design |
| **07** | 300 Amp | Open Design |
| **08** | 300 Amp | Touch Safe Design |
| **09** | 400 Amp | Open Design |
| **10** | 400 Amp | Touch Safe Design |
| **11** | 550 Amp | Open Design |
| **12** | 550 Amp | Touch Safe Design |
| **13** | 650 Amp | Open Design |
| **14** | 650 Amp | Touch Safe Design |
| **15** | 800 Amp | Open Design |
| **16** | 1000 Amp | Open Design |
| **17** | 1200 Amp | Open Design |

| Code | Line Voltage |
|---|---|
| **1** | 120 VAC - 480 VAC |
| **2** | 575/600 VAC |

| Code | Instrument Power |
|---|---|
| **1** | 120 VAC 50/60 Hz |
| **2** | 230 VAC 50/60 Hz |

| Code | Compression Lug Kits (Open Design up to 300 Amps) For Other Ranges See Crimp Lug Chart |
|---|---|
| **L0** | None |
| **L1** | 100 - 150 Amp PAK 1(#2 - 4/0)/connection |
| **L2** | 200 - 300 Amp PAK 1(1/0 - 500mcm)/connection |

**MXPC I - 5 03 1 1 L1** **(Continued on next page)**

# Ordering Information for MaxPac I (continued)

| Code | Fusing Option (1) | |
|---|---|---|
| | For < 500VAC Applications, Select One | |
| **F00** | None | |
| **F01** | 100 -150 Amp PAK | (200 Amp Fuse) |
| **F02** | 200 Amp PAK | (250 Amp Fuse) |
| **F03** | 300 Amp PAK | (400 Amp Fuse) |
| **F04** | 400 Amp PAK | (500 Amp Fuse) |
| **F05** | 550 Amp PAK | (700 Amp Fuse) |
| **F06** | 650 Amp PAK | (800 Amp Fuse) |
| **F07** | 800 Amp PAK | (1000 Amp Fuse) |
| **F08** | 1000 Amp PAK | (1200 Amp Fuses) |
| **F09** | 1200 Amp PAK | (Two 1000 Amp Fuses) |
| | 700 V Fuses for 575/600 V Applications, Select One | |
| **F10** | 100 Amp PAK | (125 Amp Fuse) |
| **F11** | 150 Amp PAK | (175 Amp Fuse) |
| **F12** | 200 Amp PAK | (250 Amp Fuse) |
| **F13** | 300 Amp PAK | (400 Amp Fuse) |
| **F14** | 400 Amp PAK | (500 Amp Fuse) |
| **F15** | 550 Amp PAK | (700 Amp Fuse) Ω |
| **F16** | 650 Amp PAK | (800 Amp Fuse) |
| **F17** | 800 Amp PAK | (1000 Amp Fuse) |
| **F18** | 1000 Amp PAK | (1200 Amp Fuse) |
| **F19** | 1200 Amp PAK | (Two 1000 Amp Fuses) |

| Code | Remote Man. Adjust/Auto Man. Switch |
|---|---|
| **0** | None |
| **1** | Pot with 0 - 100% dial and Local/Remote Single Turn 1K Potentiometer (Proportional Control Only) (Supplied loose for customer mounting) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **MXPC I -** | **5** | **03** | **1** | **1** | **L1** | **F01** | **1** | **Typical Model Number** |

1) SCR Fusing is for semiconductor protection only, not wire protection.
2) Supplied Loose for Customer Mounting.

**Note:**
Storage Temperature 14ºF to 158ºF (-10ºC to 70ºC).
CE application requires filters.

**Crimp Lug Chart**

| Chromalox # | Panduit # | Conductor Size | Torque In-Lb. | Torque Nm |
|---|---|---|---|---|
| 0135-10002 | LCD8-14A-L | #8 AWG | 180 | 20 |
| 0135-10003 | LCD6-14A-L | #6 AWG or #6 Weld | 180 | 20 |
| 0135-10004 | LCD4-14A-L | #4 AWG or #4 Weld | 180 | 20 |
| 0135-10005 | LCD2-56B-Q | #2 AWG | 180 | 20 |
| 0135-10006 | LCD1-56C-E | #1 AWG or #2 Weld | 180 | 20 |
| 0135-10007 | LCD1/0-12-X | #1/0 AWG or #1 Weld | 480 | 54 |
| 0135-10008 | LCD2/0-12-X | #2/0 AWG or #1/0 Weld | 480 | 54 |
| 0135-10009 | LCD3/0-12-X | #3/0 AWG or #2/0 Weld | 480 | 54 |
| 0135-10010 | LCD4/0-12-X | #4/0 AWG or #3/0 Weld | 480 | 54 |
| 0135-10011 | LCD250-12-X | 250 MCM or #4/0 Weld | 480 | 54 |
| 0135-10012 | LCD300-12-X | 300 MCM | 480 | 54 |
| 0135-10013 | LCD350-12-6 | 350 MCM | 480 | 54 |
| 0135-10014 | LCD400-12-6 | 400 MCM | 480 | 54 |
| 0135-10015 | LCD500-12-6 | 500 MCM | 480 | 54 |

**Note:** NEMA standard two hole copper crimp lugs only.

# Ordering Information for MaxPac IP

## Model SCR Power Pack

**MXPC IP — Single Phase SCR Power Pack**

| Code | Control Configuration |
|---|---|
| 1 | Phase Angle Control (Accepts: 0-5 mA, 0-20 mA, 0-50 mA, 1-5mA, 4-20 mA, 10-50 mA, 0-5Vdc, 0-10 VDC) |
| 2 | Phase Angle Control with Current Limit |

| Code | Current at 50°C (122°F) | |
|---|---|---|
| 01 | 100 | Amp Open Design |
| 02 | 100 | Amp Touch Safe Design |
| 03 | 150 | Amp Open Design |
| 04 | 150 | Amp Touch Safe Design |
| 05 | 200 | Amp Open Design |
| 06 | 200 | Amp Touch Safe Design |
| 07 | 300 | Amp Open Design |
| 08 | 300 | Amp Touch Safe Design |
| 09 | 400 | Amp Open Design |
| 10 | 400 | Amp Touch Safe Design |
| 11 | 550 | Amp Open Design |
| 12 | 550 | Amp Touch Safe Design |
| 13 | 650 | Amp Open Design |
| 14 | 650 | Amp Touch Safe Design |
| 15 | 800 | Amp Open Design |
| 16 | 1000 | Amp Open Design |
| 17 | 1200 | Amp Open Design |

| Code | Voltage |
|---|---|
| 1 | 120 VAC |
| 2 | 208 VAC |
| 3 | 240 VAC |
| 4 | 277 VAC |
| 5 | 480 VAC |
| 6 | 575 VAC |

| Code | Fan Power |
|---|---|
| 1 | 120 VAC 50/60 Hz |
| 2 | 230 VAC 50/60 Hz |

| Code | **Compression Lug Kits** (Open Design up to 300 Amps) |
|---|---|
| | For Other Ranges See Crimp Lug Chart |
| L0 | None (Select for all Touch Safe Designs and for over 30 Amp Open Design) |
| L1 | 100 - 150 Amp PAK 1(#2 - 4/0)/connection |
| L2 | 200 - 300 Amp PAK 1(1/0 - 500mcm)/connection |

**MXPC IP - 2 03 1 1 L1** **(Continued on next page)**

# Ordering Information for MaxPac IP (continued)

| Code | Fusing Option (1) | |
|---|---|---|
| | For < 500VAC Applications, Select One | |
| **F00** | None | |
| **F01** | 100 -150 Amp PAK | (200 Amp Fuse) |
| **F02** | 200 Amp PAK | (250 Amp Fuse) |
| **F03** | 300 Amp PAK | (400 Amp Fuse) |
| **F04** | 400 Amp PAK | (500 Amp Fuse) |
| **F05** | 550 Amp PAK | (700 Amp Fuse) |
| **F06** | 650 Amp PAK | (800 Amp Fuse) |
| **F07** | 800 Amp PAK | (1000 Amp Fuse) |
| **F08** | 1000 Amp PAK | (1200 Amp Fuses) |
| **F09** | 1200 Amp PAK | (Two 1000 Amp Fuses) |
| | 700 V Fuses for 575 V Applications, Select One | |
| **F10** | 100 Amp PAK | (125 Amp Fuse) |
| **F11** | 150 Amp PAK | (175 Amp Fuse) |
| **F12** | 200 Amp PAK | (250 Amp Fuse) |
| **F13** | 300 Amp PAK | (400 Amp Fuse) |
| **F14** | 400 Amp PAK | (500 Amp Fuse) |
| **F15** | 550 Amp PAK | (700 Amp Fuse) |
| **F16** | 650 Amp PAK | (800 Amp Fuse) |
| **F17** | 800 Amp PAK | (1000 Amp Fuse) |
| **F18** | 1000 Amp PAK | (1200 Amp Fuse) |
| **F19** | 1200 Amp PAK | (Two 1000 Amp Fuses) |

| Code | Remote Man. Adjust/Auto Man. Switch |
|---|---|
| **0** | None |
| **1** | Pot with 0 - 100% dial and Local/Remote Switch(2) Single Turn 1KΩ Potentiomete |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MXPC IP -2** | **03** | **1** | **1** | **L1** | **F01** | **1** | **Typical Model Number** |

1) SCR Fusing is for semiconductor protection only, not wire protection.
2) Supplied Loose for Customer Mounting.

**Note:**
Storage Temperature 14ºF to 158ºF (-10ºC to 70ºC).
CE application requires filters.

**Crimp Lug Chart**

| Chromalox # | Panduit # | Conductor Size | Torque In-Lb. | Torque Nm |
|---|---|---|---|---|
| 0135-10002 | LCD8-14A-L | #8 AWG | 180 | 20 |
| 0135-10003 | LCD6-14A-L | #6 AWG or #6 Weld | 180 | 20 |
| 0135-10004 | LCD4-14A-L | #4 AWG or #4 Weld | 180 | 20 |
| 0135-10005 | LCD2-56B-Q | #2 AWG | 180 | 20 |
| 0135-10006 | LCD1-56C-E | #1 AWG or #2 Weld | 180 | 20 |
| 0135-10007 | LCD1/0-12-X | #1/0 AWG or #1 Weld | 480 | 54 |
| 0135-10008 | LCD2/0-12-X | #2/0 AWG or #1/0 Weld | 480 | 54 |
| 0135-10009 | LCD3/0-12-X | #3/0 AWG or #2/0 Weld | 480 | 54 |
| 0135-10010 | LCD4/0-12-X | #4/0 AWG or #3/0 Weld | 480 | 54 |
| 0135-10011 | LCD250-12-X | 250 MCM or #4/0 Weld | 480 | 54 |
| 0135-10012 | LCD300-12-X | 300 MCM | 480 | 54 |
| 0135-10013 | LCD350-12-6 | 350 MCM | 480 | 54 |
| 0135-10014 | LCD400-12-6 | 400 MCM | 480 | 54 |
| 0135-10015 | LCD500-12-6 | 500 MCM | 480 | 54 |

**Note:** NEMA standard two hole copper crimp lugs only.

# Ordering Information for MaxPac II

## Model SCR Power Pack

**MXPC II Three Phase SCR Power Pack**

| Code | Control Configuration |
|---|---|
| **5** | Proportional Control, DOT Zero-Crossover Firing, Command Input Signals: 4-20 mA, 0-5 VDC, 1-5 VDC (via Modbus RTU/485 only), 0-10 VDC, Remote 0-1000 OHM Potentiometer w/Manual Override, Modbus RTU/RS485 Communications. RTD Heat Sink Temperature Sensor with Two Set-Points, Automatic Line Sensing 50/60HZ, Remote Permissive Stop Input, Form “C” Dry Contact Alarm Output, Staged Heating w/Digital Calibration Zero / Span Adjustments(4-8 mA, 8-12 mA,12-16 mA,16-20 mA(via Modbus RTU/RS485 only), LED Diagnostics: Command Input, Main/Trigger Boards Running, SCR Status per Phase, Diagnostic Kit via Modbus RTU/RS485: Highest Heat Sink Temperature, Last Heat Sink Temperature, Highest and Lowest Ambient Temperature, Line Frequency Monitoring, Third Party Certifications: UL, cUL, CE, DEMKO (650A and below). |

| Code | Current at 50°C (122°F) | |
|---|---|---|
| **01** | 100 Amp | Open Design |
| **02** | 100 Amp | Touch Safe Design |
| **03** | 150 Amp | Open Design |
| **04** | 150 Amp | Touch Safe Design |
| **05** | 200 Amp | Open Design |
| **06** | 200 Amp | Touch Safe Design |
| **07** | 300 Amp | Open Design |
| **08** | 300 Amp | Touch Safe Design |
| **09** | 400 Amp | Open Design |
| **10** | 400 Amp | Touch Safe Design |
| **11** | 550 Amp | Open Design |
| **12** | 550 Amp | Touch Safe Design |
| **13** | 650 Amp | Open Design |
| **14** | 650 Amp | Touch Safe Design |
| **15** | 800 Amp | Open Design |
| **16** | 1000 Amp | Open Design |
| **17** | 1200 Amp | Open Design |

| Code | Line Voltage |
|---|---|
| **1** | 120 VAC - 480VAC |
| **2** | 575/600 VAC |

| Code | Instrument Power |
|---|---|
| **1** | 120 VAC 50/60 Hz |
| **2** | 230 VAC 50/60 Hz |

| Code | Compression Lug Kits (Open Design up to 300 Amps) For Other Ranges See Crimp Lug Chart |
|---|---|
| **L0** | None |
| **L1** | 100 - 150 Amp PAK 1(#2 - 4/0)/connection |
| **L2** | 200 - 300 Amp PAK 1(1/0 - 500mcm)/connection |

**MXPC II - 5 03 1 1 L1** **(Continued on next page)**

# Ordering Information for MaxPac II (continued)

| Code | Fusing Option (1) | |
|---|---|---|
| | For < 500VAC Applications, Select One | |
| **F00** | None | |
| **F01** | 100 -150 Amp PAK | (200 Amp Fuse) |
| **F02** | 200 Amp PAK | (250 Amp Fuse) |
| **F03** | 300 Amp PAK | (400 Amp Fuse) |
| **F04** | 400 Amp PAK | (500 Amp Fuse) |
| **F05** | 550 Amp PAK | (700 Amp Fuse) |
| **F06** | 650 Amp PAK | (800 Amp Fuse) |
| **F07** | 800 Amp PAK | (1000 Amp Fuse) |
| **F08** | 1000 Amp PAK | (1200 Amp Fuses) |
| **F09** | 1200 Amp PAK | (Two 1000 Amp Fuses) |
| | 700 V Fuses for 575 V Applications, Select One | |
| **F10** | 100 Amp PAK | (125 Amp Fuse) |
| **F11** | 150 Amp PAK | (175 Amp Fuse) |
| **F12** | 200 Amp PAK | (250 Amp Fuse) |
| **F13** | 300 Amp PAK | (400 Amp Fuse) |
| **F14** | 400 Amp PAK | (500 Amp Fuse) |
| **F15** | 550 Amp PAK | (700 Amp Fuse) |
| **F16** | 650 Amp PAK | (800 Amp Fuse) |
| **F17** | 800 Amp PAK | (1000 Amp Fuse) |
| **F18** | 1000 Amp PAK | (1200 Amp Fuse) |
| **F19** | 1200 Amp PAK | (Two 1000 Amp Fuses) |

| Code | Remote Man. Adjust/Auto Man. Switch |
|---|---|
| **0** | None |
| **1** | Pot with 0 - 100% dial and Local/Remote Single Turn 1KΩ Potentiometer (Proportional Control Only) (Supplied loose for customer mounting) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MXPC II -** | **5** | **03** | **1** | **1** | **L1** | **F01** | **1** |

**Typical Model Number**

1) SCR Fusing is for semiconductor protection only, not wire protection.
2) Supplied Loose for Customer Mounting.

**Note:**
Storage Temperature 14ºF to 158ºF (-10ºC to 70ºC).

**Crimp Lug Chart**

| Chromalox # | Panduit # | Conductor Size | Torque In-Lb. | Torque Nm |
|---|---|---|---|---|
| 0135-10002 | LCD8-14A-L | #8 AWG | 180 | 20 |
| 0135-10003 | LCD6-14A-L | #6 AWG or #6 Weld | 180 | 20 |
| 0135-10004 | LCD4-14A-L | #4 AWG or #4 Weld | 180 | 20 |
| 0135-10005 | LCD2-56B-Q | #2 AWG | 180 | 20 |
| 0135-10006 | LCD1-56C-E | #1 AWG or #2 Weld | 180 | 20 |
| 0135-10007 | LCD1/0-12-X | #1/0 AWG or #1 Weld | 480 | 54 |
| 0135-10008 | LCD2/0-12-X | #2/0 AWG or #1/0 Weld | 480 | 54 |
| 0135-10009 | LCD3/0-12-X | #3/0 AWG or #2/0 Weld | 480 | 54 |
| 0135-10010 | LCD4/0-12-X | #4/0 AWG or #3/0 Weld | 480 | 54 |
| 0135-10011 | LCD250-12-X | 250 MCM or #4/0 Weld | 480 | 54 |
| 0135-10012 | LCD300-12-X | 300 MCM | 480 | 54 |
| 0135-10013 | LCD350-12-6 | 350 MCM | 480 | 54 |
| 0135-10014 | LCD400-12-6 | 400 MCM | 480 | 54 |
| 0135-10015 | LCD500-12-6 | 500 MCM | 480 | 54 |

**Note:** NEMA standard two hole copper crimp lugs only.

# Ordering Information for MaxPac III

## Model SCR Power Pack

**MXPC III Three Phase Six SCR Power Pack**

| Code | Control Configuration |
|---|---|
| **5** | Proportional Control, DOT Zero-Crossover Firing, Command Input Signals: 4-20 mA, 0-5 VDC, 1-5 VDC (via Modbus RTU/485 only), 0-10 VDC, Remote 0-1000 OHM Potentiometer w/Manual Override, Modbus RTU/RS485 Communications. RTD Heat Sink Temperature Sensor with Two Set-Points, Automatic Line Sensing 50/60HZ, Remote Permissive Stop Input, Form "C" Dry Contact Alarm Output, Staged Heating w/Digital Calibration Zero / Span Adjustments(4-8 mA, 8-12 mA,12-16 mA,16-20 mA(via Modbus RTU/RS485 only), LED Diagnostics: Command Input, Main/Trigger Boards Running, SCR Status per Phase, Diagnostic Kit via Modbus RTU/RS485: Highest Heat Sink Temperature, Last Heat Sink Temperature, Highest and Lowest Ambient Temperature, Line Frequency Monitoring, Third Party Certifications: UL, cUL, CE, DEMKO (650A and below). |

| Code | Current at 50°C (122°F) | |
|---|---|---|
| **01** | 100 Amp | Open Design |
| **02** | 100 Amp | Touch Safe Design |
| **03** | 150 Amp | Open Design |
| **04** | 150 Amp | Touch Safe Design |
| **05** | 200 Amp | Open Design |
| **06** | 200 Amp | Touch Safe Design |
| **07** | 300 Amp | Open Design |
| **08** | 300 Amp | Touch Safe Design |
| **09** | 400 Amp | Open Design |
| **10** | 400 Amp | Touch Safe Design |
| **11** | 550 Amp | Open Design |
| **12** | 550 Amp | Touch Safe Design |
| **13** | 650 Amp | Open Design |
| **14** | 650 Amp | Touch Safe Design |
| **15** | 800 Amp | Open Design |
| **16** | 1000 Amp | Open Design |
| **17** | 1200 Amp | Open Design |

| Code | Line Voltage |
|---|---|
| **1** | 120 VAC - 480VAC |
| **2** | 575/600 VAC |

| Code | Instrument Power |
|---|---|
| **1** | 120 VAC 50/60 Hz |
| **2** | 230 VAC 50/60 Hz |

| Code | Compression Lug Kits (Open Design up to 300 Amps)<br>For Other Ranges See Crimp Lug Chart |
|---|---|
| **L0** | None |
| **L1** | 100 - 150 Amp PAK 1(#2 - 4/0)/connection |
| **L2** | 200 - 300 Amp PAK 1(1/0 - 500mcm)/connection |

Note: 550-1200 Amp and all Touch-Safe Designs: Buss

**MXPC III - 5 04 1 1 L1** **(Continued on next page)**

# Ordering Information for MaxPac III (continued)

| Code | Fusing Option (1) | |
|---|---|---|
| | For < 500VAC Applications, Select One | |
| **F00** | None | |
| **F01** | 100 -150 Amp PAK | (200 Amp Fuse) |
| **F02** | 200 Amp PAK | (250 Amp Fuse) |
| **F03** | 300 Amp PAK | (400 Amp Fuse) |
| **F04** | 400 Amp PAK | (500 Amp Fuse) |
| **F05** | 550 Amp PAK | (700 Amp Fuse) |
| **F06** | 650 Amp PAK | (800 Amp Fuse) |
| **F07** | 800 Amp PAK | (1000 Amp Fuse) |
| **F08** | 1000 Amp PAK | (1200 Amp Fuses) |
| **F09** | 1200 Amp PAK | (Two 1000 Amp Fuses) |
| | 700 V Fuses for 575 V Applications, Select One | |
| **F10** | 100 Amp PAK | (125 Amp Fuse) |
| **F11** | 150 Amp PAK | (175 Amp Fuse) |
| **F12** | 200 Amp PAK | (250 Amp Fuse) |
| **F13** | 300 Amp PAK | (400 Amp Fuse) |
| **F14** | 400 Amp PAK | (500 Amp Fuse) |
| **F15** | 550 Amp PAK | (700 Amp Fuse) |
| **F16** | 650 Amp PAK | (800 Amp Fuse) |
| **F17** | 800 Amp PAK | (1000 Amp Fuse) |
| **F18** | 1000 Amp PAK | (1200 Amp Fuse) |
| **F19** | 1200 Amp PAK | (Two 1000 Amp Fuses) |

| Code | Remote Manual Adjust |
|---|---|
| **0** | None |
| **1** | Pot with 0 - 100% dial and Local/Remote Single Turn 1KΩ Potentiometer (Proportional Control Only) (Supplied loose for customer mounting) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MXPC III - 5** | **04** | **1** | **1** | **L1** | **F02** | **1** | **Typical Model Number** |

1) SCR Fusing is for semiconductor protection only, not wire protection.
2) Supplied Loose for Customer Mounting.

**Note:**
Storage Temperature 14ºF to 158ºF (-10ºC to 70ºC).

**Crimp Lug Chart**

| Chromalox # | Panduit # | Conductor Size | Torque In-Lb. | Torque Nm |
|---|---|---|---|---|
| 0135-10002 | LCD8-14A-L | #8 AWG | 180 | 20 |
| 0135-10003 | LCD6-14A-L | #6 AWG or #6 Weld | 180 | 20 |
| 0135-10004 | LCD4-14A-L | #4 AWG or #4 Weld | 180 | 20 |
| 0135-10005 | LCD2-56B-Q | #2 AWG | 180 | 20 |
| 0135-10006 | LCD1-56C-E | #1 AWG or #2 Weld | 180 | 20 |
| 0135-10007 | LCD1/0-12-X | #1/0 AWG or #1 Weld | 480 | 54 |
| 0135-10008 | LCD2/0-12-X | #2/0 AWG or #1/0 Weld | 480 | 54 |
| 0135-10009 | LCD3/0-12-X | #3/0 AWG or #2/0 Weld | 480 | 54 |
| 0135-10010 | LCD4/0-12-X | #4/0 AWG or #3/0 Weld | 480 | 54 |
| 0135-10011 | LCD250-12-X | 250 MCM or #4/0 Weld | 480 | 54 |
| 0135-10012 | LCD300-12-X | 300 MCM | 480 | 54 |
| 0135-10013 | LCD350-12-6 | 350 MCM | 480 | 54 |
| 0135-10014 | LCD400-12-6 | 400 MCM | 480 | 54 |
| 0135-10015 | LCD500-12-6 | 500 MCM | 480 | 54 |

**Note:** NEMA standard two hole copper crimp lugs only.

CHROMALOX
*Advanced Thermal Technologies*

# EC Declaration of Conformity

We, Chromalox Precision Heat and Control
1347 Heil Quaker Boulevard
LaVergne, Tennessee 37086-3536
Phone: +1 (615) 793-7561
Fax: +1 (615) 213-8091

declare under sole responsibility that the following described product in our delivered version complies with the appropriate basic safety and health requirements of the EC Low Voltage Directive (2006/95/EC) and EC Electromagnetic Compatibility Directive (2004/108/EC) based on its design and type, as brought into circulation by us. In case of alteration of the machine, not agreed upon by us, this declaration will lose its validity.

Description of the Electrical Equipment: MaxPac SCR controllers

Model Number: MaxPac Series; MaxPac I, II, III

**Applicable Harmonized Standards:**

| | **Low Voltage Directive** |
|---|---|
| Specification: | EN60947-4-3:2000<br>Low-voltage switch gear and control gear<br><br>Part 4-3: Contactors and motor-starters<br>AC semiconductor controllers and contactors for non-motor loads |
| Utilization Category: | AC-51 Non-inductive or slightly inductive loads, resistive furnaces |
| Pollution Degree 2 | Normally only non-conductive pollution occurs. Occasionally, a temporary conductivity caused by condensation may be expected. |
| Voltage Rating: | 400 VAC 50 Hz Line<br>230 VAC 50 Hz Instrument max 75 watts |
| Impulse Rating: | 2.5 KV for 5 seconds |
| Overload Current Profile: | 140% for 1 second |
| Fuses: | 500 Volt, 200KA RMS symmetrical interrupting rating, $I^2t$ fusing provided with all CE units. |

**EMC Directive**

1. Radiated Disturbance Emissions – 30 to 1000 MHz Electric Field
   EN 61000-6-4:2001 / EN 55011:2007
2. Conducted Disturbance Emissions – Voltage
   EN 61000-6-4:2001 / EN 55011:2007
3. Conducted Disturbance Immunity
   EN 61000-6-2:2005 / EN 61000-4-6:1996
4. Radiated Disturbance Immunity
   EN 61000-6-2:2005 / EN 61000-4-3:1995
5. Electrical Fast Transients/Bursts Immunity
   EN 61000-6-2:2005 / EN 61000-4-2:1995
6. Voltage Dips and Interrupts Immunity
   EN 61000-6-2:2005 / EN 61000-4-11:1994
7. Electrostatic Discharge Immunity
   EN 61000-6-2:2005 / EN 61000-4-2:1995
8. Voltage Fluctuations/Flicker
   EN 61000-3-3 / A2:2005
9. Harmonic Current Emissions
   EN 61000-3-2:2006

Filters Required: Instrument power filter:
Chromalox P/N 0005-60057
Line Filter, single phase:
Chromalox P/N 0005-60055
Line Filter, three phase:
Chromalox P/N 0005-60056

10. Surge Immunity
EN 61000-6-2:2005 / EN 61000-4-5:1995

The Technical documentation required by Annex IV (3) of the Low Voltage Directive is maintained by (Name) of (company and location in the European Union)

Year in which CE Marking was affixed: 2002

Authorized Signature/Date: 
Jim Birnie

Date

Title of Signatory: Engineering Manager

Chromalox, International
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U.K.