ControlIR Model 910
Power Control System

Instruction Manual

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RESEARCH INC.
PROVIDING CONTROLLED ENERGY
DRYING ▲ CURING ▲ HEATING

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RESEARCH INC.
PROVIDING CONTROLLED ENERGY
DRYING ▲ CURING ▲ HEATING

Dear Customer:

Thank you for purchasing a Model 910 ControlIR Power System. We believe it is the finest system of its type and are confident you will think so too.

For technical assistance, training, replacement parts and assemblies, or any other problems or questions, contact our Field Service specialists. They will do everything they can to help you or will put you in touch with someone who can.

This instruction manual has been carefully prepared to make sure you get out of your system all the capabilities we designed and built into it. To tell us how we could make the system, our support of it, or this manual even more useful, we invite you to call our product manager with your suggestions and recommendations.

Additional copies of this manual are available at reasonable cost from our Customer Service Department. Once again, let us welcome you to the growing family of Research, Inc. customers. We look forward to working with you in the future.

Sincerely,

Bill Hoaglund
President/CEO
RESEARCH INC.

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Section 1

Introduction

GENERAL DESCRIPTION

The Model 910 power control system is a complete power control 'solution' featuring a number of elements integrated into a single, ready-to-install package. The Model 910 is a single-phase power control system available in a variety of configurations from 120 to 480 volts and rated at 20-, 40-, or 70-amps. These systems are ideally suited for many industrial power control applications and have been specifically optimized for use with Research Inc. infrared heating systems.

Figure 1-1 Model 910 Single-Phase Power Controller

STANDARD FEATURES

Standard features include:

- Local 10 turn potentiometer with digital dial for precise manual control of load voltage.
- Remote control capability with a 0-5 VDC or 0-20 mA signal.
- Heater power switch with remote interlocks. The load voltage may be enabled or disabled without turning off the main disconnect switch.
- Heater ON/OFF switch controls an AC contactor to remove power from the SCR controller and the load.

OPTIONAL FEATURES

The following standard options are available:

Automatic Temperature Control Option

The automatic temperature control option allows the power level to be adjusted based on an entered temperature setting for the process. The temperature controller uses PID type control and is pre-wired for a 'K' type thermocouple (option code TCT) or a 4/20mA pyrometer signal (option code TCP).

Voltmeter Option

The true RMS load voltage is displayed with a digital meter. A true RMS voltage transmitter is provided for isolation and operator safety.

Section 2

Safety

WARNING!
Hazardous voltages are present at the main disconnect switch and load terminals. Setting the setpoint potentiometer or control signal to minimum does NOT eliminate these hazardous voltages.

Always remove AC line voltage from the system before making contact with internal assemblies, line or load wiring, or fuses. Also remove AC line voltage from the system before making connections, equipment changes, or resistance measurements.

CAUTION!
Up to 480 volts ac is present within the power control solution system.

Do not make any wiring connections when power is applied.

Disconnect power before performing any maintenance or service to the system.

Use extreme caution when adjusting calibration potentiometers on modules when power is applied.

Always use an isolated oscilloscope for checking waveforms.

Section 3

Installation

This section describes how to install and wire the Model 910 power control system. The features and options mentioned here are identified in the model number found inside the enclosure.

⚠ WARNING!
Hazardous voltages are present at the main disconnect switch and load terminals. Setting the setpoint potentiometer or control signal to minimum does NOT eliminate these hazardous voltages.

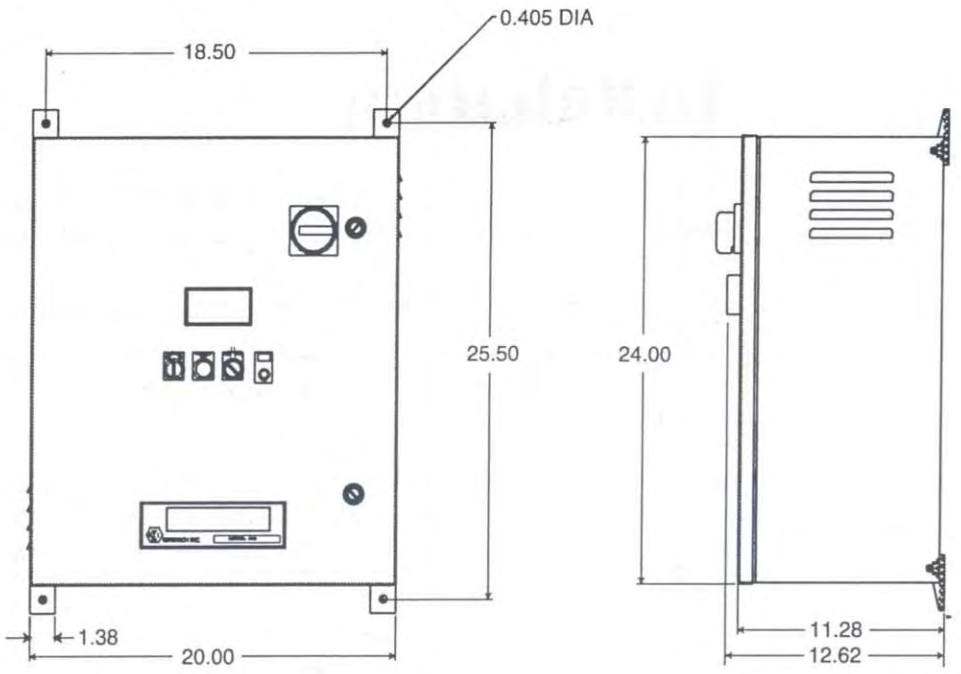
Always remove AC line voltage from the system before making contact with internal assemblies, line or load wiring, or fuses. Also remove AC line voltage from the system before making connections, equipment changes, or resistance measurements.

MOUNTING THE SYSTEM

The Model 910 Power Control System may be mounted to a wall with the supplied brackets, on a stand, or bench. The Model 910 must be mounted in a vertical position. When mounting to a wall, the top of the enclosure should not be over 74 inches (1880 mm) above the floor.

Figure 3-1 shows the mounting dimensions using the supplied brackets. Attach the brackets to the enclosure with the hardware provided. Allow a minimum of 4 inches (100mm) clearance on the right and left sides of the system. Allow a minimum of 30 inches (762mm) in front of the system.

Figure 3-1 Wall Mounting Dimensions



The weight of the Model 910 varies slightly with the options installed. The maximum weight of the system is 78 pounds (35.5 kg).

WIRING CONNECTIONS

Conduit entry into the system should be made near the right side of the cabinet for power wiring, near the center of the cabinet for load wiring, and near the left side for 120 VAC control wiring. Assure no metal fragments are allowed to fall into the equipment while holes are made for conduit fittings.

We suggest a separate conduit entry should be made for low level DC control wiring if used. This includes the remote setpoint input or thermocouple wire (temperature control option).

Table 3-1 Wiring Specifications

Wire Ratings:

Wire Temperature Rating:	75° C or Higher
Line/Load Wiring Voltage Rating (120/240 VAC)	300 VAC Minimum
Line/Load Wiring Voltage Rating (480 VAC systems)	600 VAC Minimum
Control Wiring	300 VAC Minimum

Allowable Wire Sizes:

Current Rating of System	Line Connections	Load Connections	Ground Connection	Control Circuit Connections
20 Amp	14-8 AWG	14-2 AWG	14-4 AWG	22-10 AWG
40 Amp	12-4 AWG	14-2 AWG	14-4 AWG	22-10 AWG
70 Amp	10-1 AWG	14-4 AWG	14-4 AWG	22-10 AWG

Recommended Minimum Wire Sizes:

NOTE:
Wire temperature and connector ampacity ratings are based on NEC 310-16 using 75°C copper wire derated for 50°C ambient environment.

Current Rating of System	Line Connections	Load Connections	Ground Connection	Control Circuit Connections
20 Amp	12 AWG	12 AWG	12 AWG	16 AWG
40 Amp	8 AWG	8 AWG	10 AWG	16 AWG
70 Amp	4 AWG	4 AWG	10 AWG	16 AWG

Electrical Inputs:

Remote Power Interlock/Water Flow Input	Contacts Rated for 120 VAC at 0.25 A

Power Wiring Connections

Line Connections

Referring to the wiring specification in table 3-1, connect the external power lines to the top of the disconnect switch.

Load Connections

Connect the load to PWB 100 terminal..

CONTROL CONNECTIONS

Refer to Figure 3-2 for connection of the following items.

Remote Power Interlock, Airflow, or Water Flow Interlock Switch

This feature allows shutdown of the system to protect personnel in case of emergency, and/or the heater in case of low water flow, air flow, conveyor speed, etc. This is accomplished by tripping the power controller contactor off. If this feature is desired, use open during fault condition interlock switches. Connect using the following procedure:

1. Remove the factory installed jumper at TB 100 pins 2 and 3.
2. Connect the switch to TB 100 pins 2 and 3.
3. Repeat steps 1 and 2 using TB 100 pins 4 and 5 if a second switch is desired.
4. If more than 2 switches are desired, wire the switches in *series* and then connect to the system.

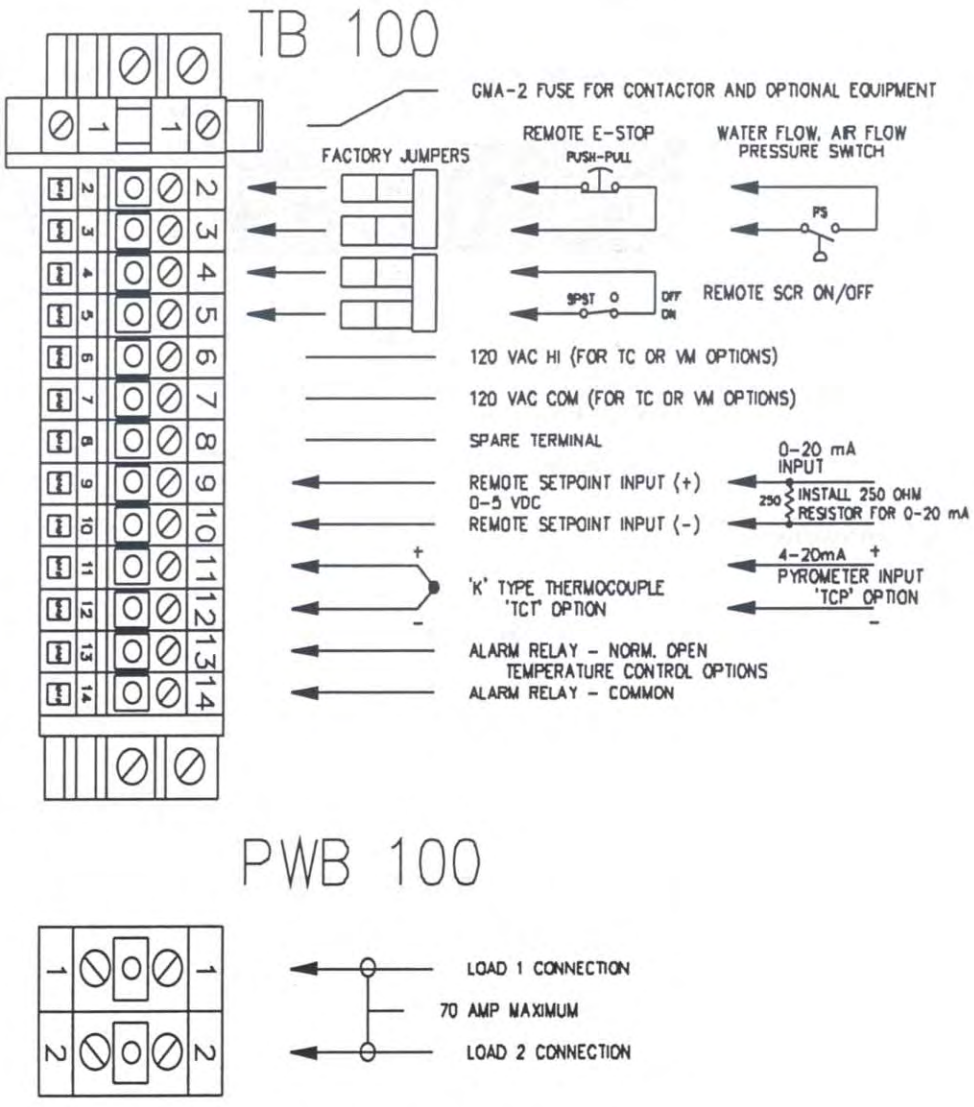
Remote Setpoint Input

This feature allows the power level of the system to be controlled from a remote location

or device. This is accomplished by applying a 0-5 VDC or 0-20 mA signal input from a remote source. This feature is not available when the 'Temperature Controller' option is installed. If this feature is desired use the following procedure:

1. For a 0-5 VDC input, connect the source to TB 100 pins 9+ and 10-.
2. For a 0-20 mA input, connect the source to TB 100 pins 9+ and 10-. Also install a 250 ohm resistor in parallel with your wiring across these terminals.

Figure 3-2 Control Connections



Temperature Control Option Connections (Option Codes TCT & TCP)

Temperature control option 'TCT' is setup to use a 'K' type thermocouple for the temperature input. Temperature control option 'TCP' is setup to use a pyrometer for the temperature input. Alarm connections are provided if required for your process. The alarm contacts are 'dry' type rated for a maximum of 3 Amps resistive at 240 VAC. Make connections as follows:

1. 'TCT' option: Use 'K' type extension wire from the thermocouple to the system connections. Connect the 'K' thermocouple extension wire to TB 100 pins 11+ and 12-.
2. 'TCP' option: The pyrometer should source the 4-20 mA current through it's circuitry. If a '2 wire' pyrometer is used, an external power supply must be used. The model 910 does *not* source current for pyrometer operation. Connect the 4-20mA signal to TB 100 pins 11+ and 12-.
3. 'TCT' and 'TCP' options: Connect the device for the alarm output to TB 100 pins 13 and 14.

Section 4

Operating Instructions

CONTROLS AND INDICATORS

Figure 4-1 shows the location of the controls and indicators.

Main Disconnect Switch

The main disconnect switch turns on and off the power control system. Note the following:

Before turning on the disconnect switch, check the following:

1. The load is wired and ready for power to be applied to it.
2. All safety precautions are observed.
3. The heater ON/OFF switch is set to OFF

Heater ON/OFF Switch

The Heater ON/OFF switch allows the operator to enable or disable the power going to the load. This is accomplished by removing power from the AC contactor. This in turn removes power fom the SCR controller.

Remote/Local Setpoint Switch

The remote/local setpoint switch allows the operator to select the source for the power level setting to the load, lamps, or heaters. The selections include:

1. LOCAL: The power level is adjusted using the digital 10-Turn 'LOCAL SETPOINT' potentiometer.
2. REMOTE: The power level is controlled from a remote location or device.
3. AUTO: The power level is controlled by the temperature controller. The operator will enter a desired temperature setpoint for the process. The power level is adjusted based on the feedback from the temperature sensor connected to the process. This selection is applicable to systems with the 'Temperature Controller' option.

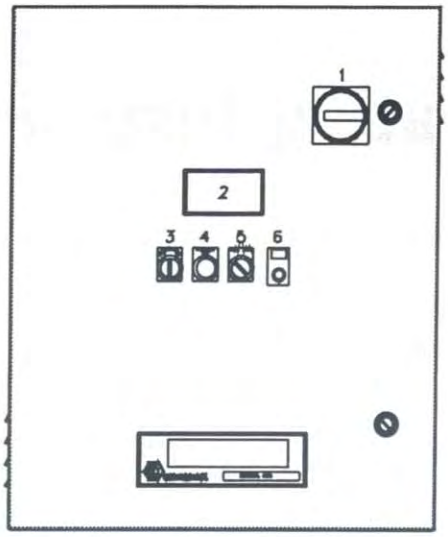
Local Setpoint Potentiometer

The power level is adjusted using the digital 10-Turn 'LOCAL SETPOINT' potentiometer when the 'Setpoint' switch is in the 'Local' position.

Load Volts Indicator (Option Code VM)

This option provides indication of the 'True RMS' load voltage.

Figure 4-1 Controls and Indicators



1. Disconnect Switch
2. Optional Temperature Controller, or Optional Volt Meter
3. Heater ON/OFF Switch
4. Heater Power On Indicator light
5. Remote/Local Setpoint Switch
6. Local Setpoint Potentiometer

TEMPERATURE CONTROL OPTION

This section contains information regarding how the temperature controller is configured for your system. Refer to the Model XT19 installation and instruction manual for using the temperature controller.

Setup Summary

Table 4-1 displays the factory configurations made for your system:

Table 4-1 Temperature Controller Configuration

Sensor input (TCT option)	'K' type thermocouple scaled 0 – 2500 deg. F
Sensor input (TCP option)	4-20mA signal scaled 0-2500 deg. F
Control Type:	PID (proportional, integral, & derivative)
AL 1 (alarm 1):	Full scale high, non-latching, set for 2000 deg. F (This alarm will trip a relay connected to TB100 pins 13 and 14.)
Control output:	0-20 milliamps
The alarm may be re-configured as necessary for your process	

THEORY OF OPERATION

Principles of SCR Power Control

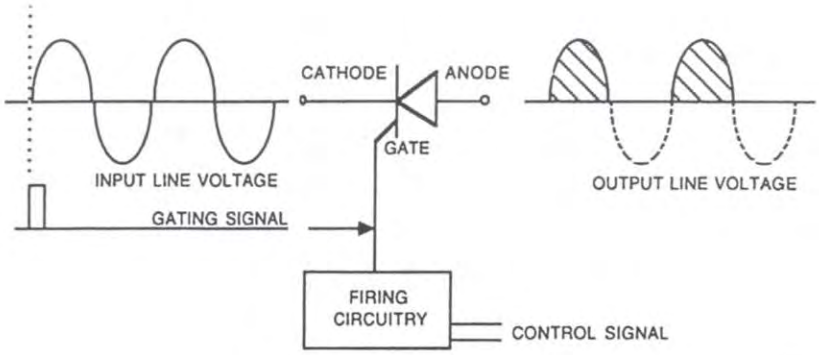
SCR type power controllers control power by regulating when silicon controlled rectifiers (SCRs) conduct AC line current to the load.

A SCR is a solid-state, electronic switching device that turns on (fires) very quickly when a low-level "gating" signal is applied to its gate electrode. The timing of the gating signal, and therefore the length of time the SCR conducts, is determined by the controller's firing circuitry in response to a control signal. The greater the percentage of time the SCR is on, the greater the average power it allows to pass through to the load.

The Model 910 uses a random-fire solid state relay within its SCR poser controller. This relay is a package consisting of 2 SCRs and a gate drive circuit.

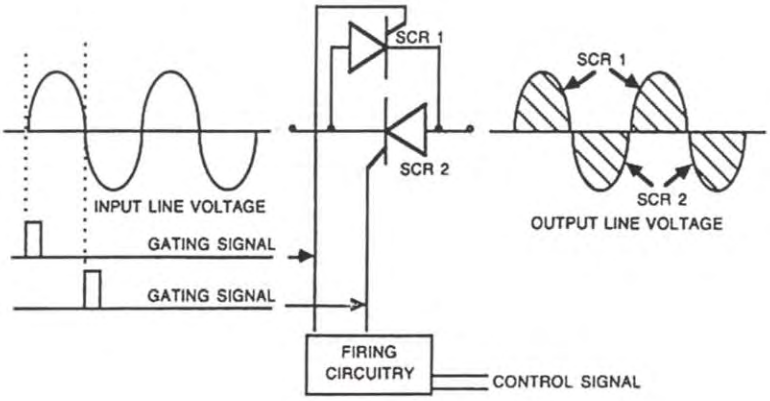
During the positive half-cycle of the AC line voltage the SCR's anode is positive with respect to its cathode, so during that half-cycle the SCR will begin to conduct whenever a gating signal is applied to its gate electrode (see figure 4-2). Once turned on, an SCR will continue to conduct until its anode-to-cathode voltage drops to zero, so the SCR continues to conduct until the end of the half-cycle.

Figure 4-2 Conduction of one SCR when turned on at the beginning of a half-cycle



Because an SCR is a type of diode, it can conduct only during every other half-cycle of the applied voltage. Therefore, SCRs used to control AC power are usually installed in pairs, connected in reverse-parallel, as shown in figure 4-3. One of the SCRs then can be fired during the positive half-cycle and the other can be fired during the negative half-cycle.

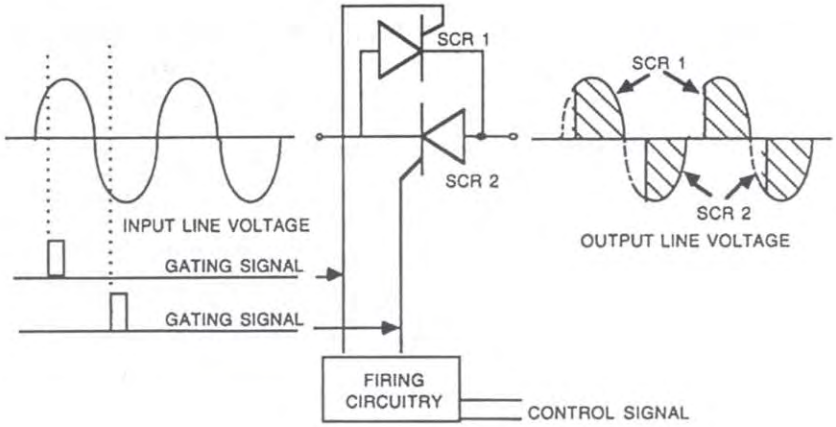
Figure 4-3 Conduction of two SCRs connected in reverse parallel when turned on at the beginning of half-cycles



Principles of Phase Angle Control

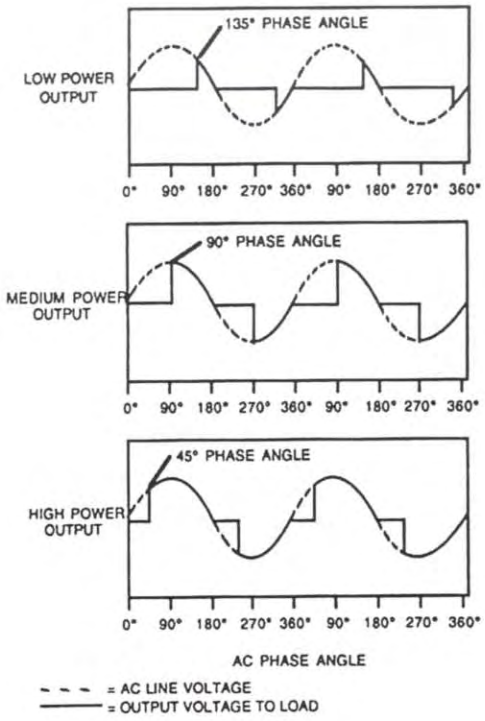
In phase angle controllers, the SCRs conduct during all or part of every half-cycle. When delivering full power, the SCRs start conducting at the beginnings of the AC half-cycles. When delivering less than maximum power, the gating signal is de-layed so the SCRs start conducting some time later than the beginnings of the half-cycles. Operation of a phase angle controller at partial output is depicted in figure 4-4.

Figure 4-4 Conduction of two SCRs connected in reverse parallel when turned on after the beginning of the half-cycles



The average power a phase angle controller delivers to its load is determined by the number of electrical degrees by which the gating signal that turns on the SCRs is delayed past the beginnings of the half-cycles. The later in each half-cycle the SCRs fire, the less the time the SCRs conduct during each half-cycle and, therefore, the less power is delivered to the load (see figure 4-5). The 0–5 VDC control signal received by the phase angle firing-circuit determines the amount by which the gating signal is delayed.

Figure 4-5 Phase angle power control



The output voltage of a phase angle controller does not change linearly with respect to the number of degrees the SCR conduction phase angle changes. Therefore, the SCR controllers have a built-in load feedback circuit to linearize the relationship between the control signal and the voltage output. The feedback circuit also adjusts the power controller output to compensate for changes in line voltage and load impedance (this is called "line and load regulation").

Phase angle power control offers a number of attractive features. Because the power controller output level is adjusted by varying the SCR on time within each AC half-cycle, the controller's output is quite constant, rather than being divided into multiple-cycle periods of on time and off time. In addition, a variety of feedback and output indication (metering) circuits can easily be incorporated into the controller.

Section 5

Maintenance and Trouble Shooting

ROUTINE MAINTENANCE

The following bimonthly routine maintenance is suggested:

1. Remove power connection to the system. Lock out power if possible. Carefully vacuum any dust or dirt collecting within the enclosure. Use caution to not disturb the wiring. Service more often in dusty locations.
2. Clean the outside of the enclosure with glass cleaner and a soft cotton cloth as necessary.

TROUBLESHOOTING

Symptom	Action
Heater Contactor will not energize.	1. Verify line voltage is applied to the main disconnect switch. 2. Verify remote heater enable interlocks or water flow switches (if used) are closed. 3. If not using remote heater enable interlocks or water flow switches, verify the 2 pin jumpers are installed between TB 100 pins 2 to 3, and 4 to 5. 4. Check fuses FU 1060, FU 1061, FU 109, FU 110 and TB 100 pin 1.
No output to load, heaters, or lamps. Setpoint switch is in LOCAL mode.	1. Verify a 0-10 VDC signal is present on pins 2 and 3 of the 4-pin power controller connector. This voltage is proportional to the setting of the local setpoint potentiometer. 2. Verify that 24 VAC is present on the 2-pin connector of the power controller. 3. If the COMMAND led on the power controller is not lit and the local setpoint potentiometer is set greater than 100, refer to the power controller manual regarding repairs.
No output to load, heaters, or lamps. Setpoint switch is in REMOTE or AUTO. Operation O.K. with set-point switch in LOCAL.	1. Verify the polarity of the remote input. TB 100 pin 9 is positive, and 10 is negative. 2. Units with Temperature control option: Place temperature controller in manual mode with 50 percent output. Verify 2.5VDC at TB 100 pins 9 and 10. Refer to the temperature controller manual regarding repairs.

Symptom	Action
Full voltage cannot be obtained.	1. Verify the line voltage. Load voltage maximum is approximately 98 percent of the line voltage. 2. Test in LOCAL setpoint mode. Set the 'Local Setpoint' potentiometer to 900. The voltage should be 108 (120 volt line), 216 (240 volt line), or 432 (480 volt line). Adjust the SPAN potentiometer of the power controller as necessary. 3. Refer to the power controller manual regarding repairs.
Load voltage will not go to zero.	1. Test in LOCAL setpoint mode. Set the 'Local Setpoint' potentiometer to 000 dial divisions. Adjust the zero potentiometer until the voltage is 0 Volts.

CALIBRATION

Generally components of the power control system hold their calibration very well over a long period of time. Usually verification of calibration is all that is necessary. We suggest verification or calibration be performed on a yearly basis. Calibration should be performed by qualified personnel as dangerous voltages are present.

Power Controller

Refer to the power controller manual for specific calibration instructions. Calibrate using step 1, 2 or 3 below (use whichever is used most often):

1. When LOCAL setpoint mode is selected, the local setpoint potentiometer is used as the source for the input. Adjust the zero and span potentiometers on the power controller. The SPAN potentiometer is adjusted for 90 percent or rated line voltage for 900 dial divisions of the local setpoint pot. The ZERO potentiometer is adjusted for 0 Volts output when the local setpoint is set to 000 dial divisions.

2. Voltmeter Option or No Options: When REMOTE setpoint mode is selected, use a 0-5 VDC source for an input. Adjust the zero and span potentiometers on the power controller. The SPAN potentiometer is adjusted for 90 percent of rated line voltage for 4.5 VDC input. The ZERO potentiometer is adjusted for 0 Volts output when the local setpoint is set to 000 dial divisions.

3. Temperature Controller option only: When AUTO setpoint mode is selected, the temperature controller is used as the source for the input. Adjust the zero and span potentiometers on the power controller. The SPAN potentiometer is adjusted for 90 percent of rated line voltage for 90 percent output of the temperature controller. The ZERO potentiometer is adjusted for 0 volts output when the temperature controller is set to 0 percent.

Panel Voltmeter Calibration

The front panel load voltmeter is calibrated to match as closely as possible the true RMS voltage measured at the load terminals.

1. Connect a true RMS DVM to load 1 and load 2 (TB101 pins 1 and 2).

2. Connect another DVM across pins 1(+) and 2(-) of the EXT 200 RMS voltage transmitter.

3. Turn the HEATER switch to OFF. Measure the voltage of EXT 200 pins 1(+) and 2(-) to be 0.0 VDC +/- 10 millivolts. Adjust the EXT 200 zero potentiometer if necessary.

4. Verify the panel voltmeter reads 0 volts. If necessary, carefully remove the front cover of the meter and adjust the zero potentiometer for 000 +/- 1 reading.

5. Turn the Heater switch to ON. Adjust the LOCAL SETPOINT potentiometer for the following load voltage based on the voltage your system is configured for:
   480 VAC units: 450 VAC
   240 VAC units: 225 VAC
   120 VAC units: 110 VAC

6. Measure the voltage of EXT 200 pins 1(+) and 2(-) to be the following voltage +/- 10 millivolts:
   480 VAC units: 3.750 VDC
   240 VAC units: 1.875 VDC
   120 VAC units: 0.917 VDC
   Adjust the EXT 200 span potentiometer if necessary

7. Verify that the panel voltmeter reads the voltage as set in Step 5 above. If necessary, carefully remove the front cover of the meter and adjust the span potentiometer for a +/- 1 reading.

Temperature Controller Option

Refer to the temperature controller manual for calibration instructions.

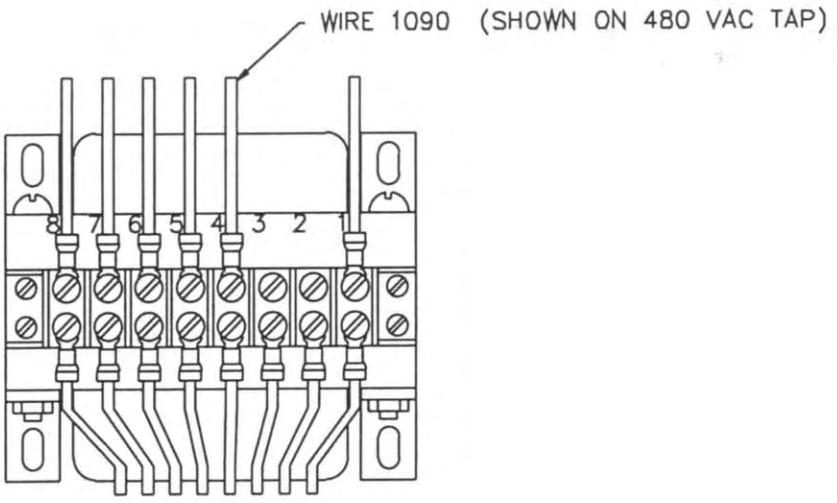
LINE VOLTAGE RE-CONFIGURATION

The AC line voltage for the Model 910 Power Control System may be re-configured. A wire with wire number 1090 is connected to pins 2, 3, or 4. Move this wire to the pin corresponding to the desired line voltage.

Pin 2	120 VAC
Pin 3	240 VAC
Pin 4	480 VAC

See figure 5-1 below.

Figure 5-1 AC Voltage Tap



Dimensions and Specifications

SPECIFICATONS

Environmental Limits:

Operating Temperature	0-50 deg. C (32-122 deg. F)
Storage Temperature	-40-70 deg. C (-10-158 deg. F)
Humidity	0-90 %, non-condensing
Clearance	4" (100mm) on right and left sides.

Weight:

The ststem weight varies slightly with the options installed. The maximum weight of the system is 78 pounds (35.5 kg).

Operating Voltage:

120, 240, or 480 VAC +10%, -15% at 50 or 60 Hertz. Voltage set at factory per order.

Operating Current and kW:

Current Rating of System	Continuous Current Rating at 50 °C	Maximum Power kW at 120 VAC	240 VAC	480 VAC
20 Amp	20 Amps	2.4	4.8	9.6
40 Amp	40 Amps	4.8	9.6	19.2
70 Amp	70 Amps	8.4	16.8	33.6

Line Fusing:

Current Rating of System	Fuse Type	Fuse Rating
20 Amp	JJS-25	Class T 25 Amp 600 Volt
40 Amp	JJS 50	Class T 50 Amp 600 Volt
70 Amp	JJS-90	Class T 90 Amp 600 Volt

Power Control:

Control Mode:

SCR phase-angle control of the voltage applied to a single phase load. True RMS voltage feedback for load voltage regulation.

Control Range:

0 to 97 % of supply voltage.

Output Linearity:

RMS load voltage varies linearly with control signal, within +/- 2 percent.

Voltage Compensation:

The RMS load voltage remains constant, independent of supply voltage changes within +10%, -15% 50/60 HZ.

Electrical Isolation:

Heatsink to supply and load voltage: 4000V (RMS).

Command signal to supply and load voltage: 4000V (RMS).

Command Indicator:

A LED indicates when the SCRs are turned on. The intensity of the command indicator is proportional to the local setpoint or command signal applied.

Wiring Specifications

Wire Ratings:

Wire Temperature Rating:	75° C or Higher
Line/Load Wiring Voltage Rating (120/240 VAC)	300 VAC Minimum
Line/Load Wiring Voltage Rating (480 VAC systems)	600 VAC Minimum
Control Wiring	300 VAC Minimum

Allowable Wire Sizes:

Current Rating of System	Line Connections	Load Connections	Ground Connection	Control Circuit Connections
20 Amp	14-8 AWG	14-2 AWG	14-4 AWG	22-10 AWG
40 Amp	12-4-AWG	14-2 AWG	14-4 AWG	22-10 AWG
70 Amp	10-1 AWG	14-4 AWG	14-4 AWG	22-10 AWG

Recommended Minimum Wire Sizes:

NOTE:
Wire temperature and connector ampacity ratings are based on NEC 310-16 using 75°C copper wire derated for 50°C ambient environment.

Current Rating of System	Line Connections	Load Connections	Ground Connection	Control Circuit Connections
20 Amp	10 AWG	10 AWG	12 AWG	16 AWG
40 Amp	8 AWG	8 AWG	10 AWG	16 AWG
70 Amp	4 AWG	4 AWG	10 AWG	16 AWG

Electrical Inputs:

Remote Power Interlock/Water Flow Input	Contacts Rated for 120 VAC at 0.25 A

Specifications for Options

Option Code	Temperature Controller Option	
TCT & TCP	Thermocouple type (TCT):	Type 'K'
	Sensor Input (TCP):	4-20mA scaled 0-2500 deg. F
	Alarm relay rating:	5A @ 120VAC resistive, 3A @ 240VAC
	Sample rate:	10 HZ
	Calibration accuracy:	+/- 0.2% of full scale +/- 1 digit
	Control modes:	PID or PI, PD, P only, or On/Off.
	Temperature stability:	5uV/°C max, 3 uV/°C typical
	Noise Rejection:	Common Mode > 100 dB, Series Mode > 70 dB
	Autotune:	Operator initiated
Option Code	**Voltmeter Option**	
VM	RMS Voltage transducer:	0-600 VAC to 0-5 VDC
	Overall accuracy:	+/- 2 VAC

DIMENSIONS

Figure 6-1 displays the overall dimensions of the Model 910 power control system. The dimensions include the side vents and door handle.

Figure 6-1 Model 910 Dimensions

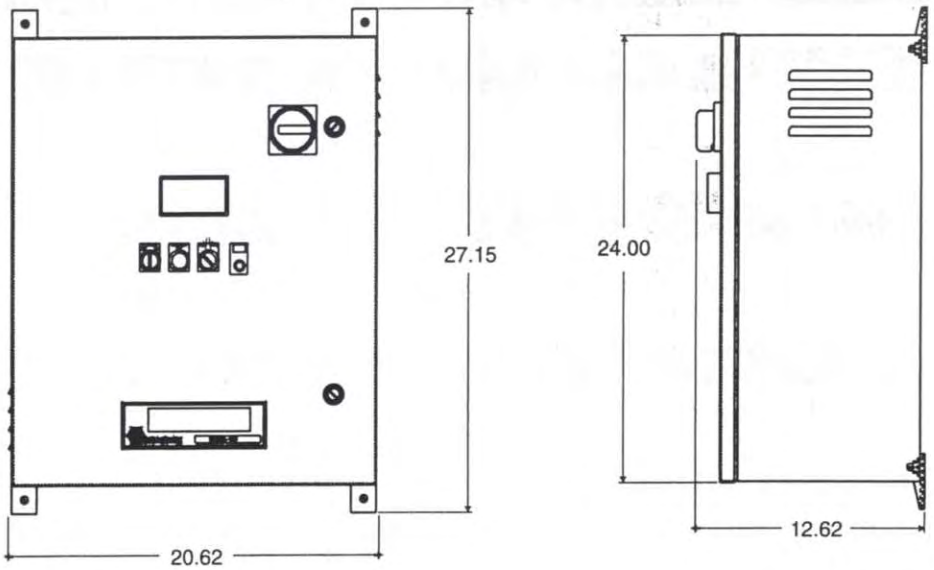
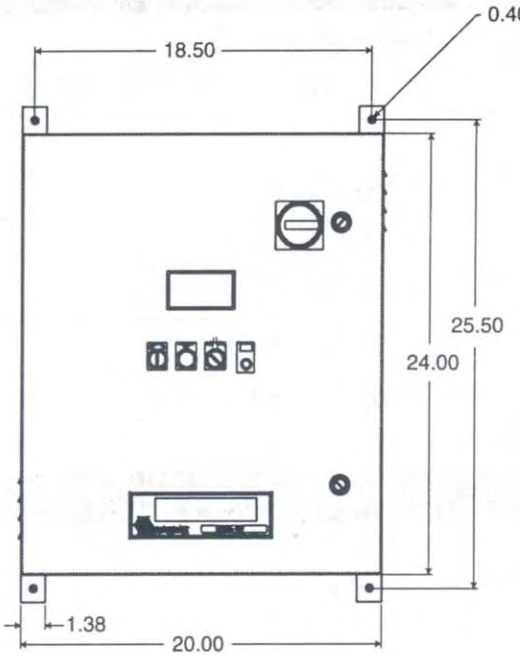


Figure 6-2 shows the mounting dimensions using the supplied brackets.

Figure 6-2 Wall Mounting Dimensions



Ordering Information

Model	Product Description
910	Single Phase SCR Power Control System
Code	**Enclosure**
A	Wall Mount(1)
Code	**Line Voltage**
120	120 Volts AC
240	240 Volts AC
480	480 Volts AC
Code	**Current Capacity**
20	20 Amperes
40	40 Amperes
70	70 Amperes
Code	**Options(2)**
TCT	Temperature Controller - Thermocouple Input
TCP	Temperature Controller - 4/20mA, Pyrometer Input
VM	Digital Voltmeter
00	None
(1)	*Overall Dimensions (including side vents and door handle): 27.15 Inches High (689.6mm) X 20.62 Inches Wide (524 mm) X 12.62 Inches Deep (321 mm).*
(2)	*Select one only.*

Ordering Example

	Model	Enclosure	Line Voltage	Current Capacity	Option
Typical Model Number	**910**	**A**	**240**	**70**	**TCT**

Spare and Replacement Parts

Description	Part Number
Fuse – 90 Amp 600 VAC	086797-002
Fuse – 50 Amp 600 VAC	089718-004
Fuse – 25 Amp 600 VAC	086160-004
Fuse – 1 Amp Time Delay "CC"	086445-015
Fuse – 2 Amp 5x20 mm Fast Act.	087146-002
True RMS AC Voltage Transmitter	097832-002
Digital Meter – 0-600 VAC	097831-005
Control Transformer – 70 VA	099366-001
Potentiometer – 1K, 10 Turn	055769-004
Digital Dial	042952-000
Switch – 3 Position Spring Return-to-Center Selector (contact blocks seperate, see below)	087543-004
Switch – contact block 1 CON NO	087545-001
Switch – contact block 2 CON NO NC	087545-001
Model XT19 Temperature Controller (Thermocouple Input)	097399-002
Model XT19 Temperature Controller (4-20mA, Pyrometer Input)	097399-003
Main Disconnect Switch 3P (70A)	099395-001
Main Disconnect Switch 3P (40A)	099395-002
Main Disconnect Switch 3P (20A)	099395-003
Actuator for Disconnect Switch	099396-001
Contactor 3 Pole 70 A	091964-012
Contactor 3 Pole 40 A	091964-021
Contactor 3 Pole 20 A	091964-022
Model 1022 Power Controller 70A	099311-002
Model 1022 Power Controller 40A	099923-059
Model 1022 Power Controller 20A	099923-051