CRUCIAL POWER PRODUCTS

Technical Publications

Max Series

Mini Series

Document #: 6002–838
Revision A

Operating Documentation

Crucial Power Products

Congratulations on selecting one of the fine products from Crucial Power Products, the Leader in Power Protection Technology. Our wide product offering includes Uninterruptible Power Systems (UPS), Power Conditioners, Automatic Voltage Regulators and Specialty Transformers (e.g. computer–grade, medical–grade). Since our beginnings in 1975, Crucial Power Products has shipped thousands of these fine products around the world, to discerning customers, for use on sensitive equipment and critical applications. Our customers, both new and long–time, continue to enjoy security and peace of mind as they realize what it means to "Stay On Line with Crucial Power Products".

One of our goals is to make these manuals both comprehensive and easy to use. This **new–format** Manual is the result of ideas and inputs from customers who have taken an active interest in our continued success. We invite constructive feedback on our products and documentation via fax, mail or telephone.

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SAFETY

Safety precautions are important when operating or servicing electrical equipment. The following symbols are used extensively throughout this manual. Always heed these precautions since they are essential to the safe operation and servicing of this product.

THIS DANGER SYMBOL IDENTIFIES A CONDITION OR ACTION WHICH WILL RESULT IN SEVER INJURY OR DEATH TO AN INDIVIDUAL OR SEVERE DAMAGE TO EQUIPMENT OR OTHER PROPERTY.

This Caution symbol identifies a condition or action which may result in minor injury to an individual or minor damage to the equipment or other property.

This unit was designed for specific applications. It should **not** be modified and/or used for any application other than for that which it was designed. Optional equipment not described in the sales literature or this manual should not be installed without first checking with the Service department. If you have any questions about this unit's application call the Service department at the number shown on the previous page.

REVISION HISTORY

REV	DATE	PRIMARY REASON FOR CHANGE
A	Aug 2, 1995	Preliminary Release.

LIST OF EFFECTIVE PAGES

PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV
Title Page	A								
a to c	A								
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2–1 to 2–2	A								
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G1	A								

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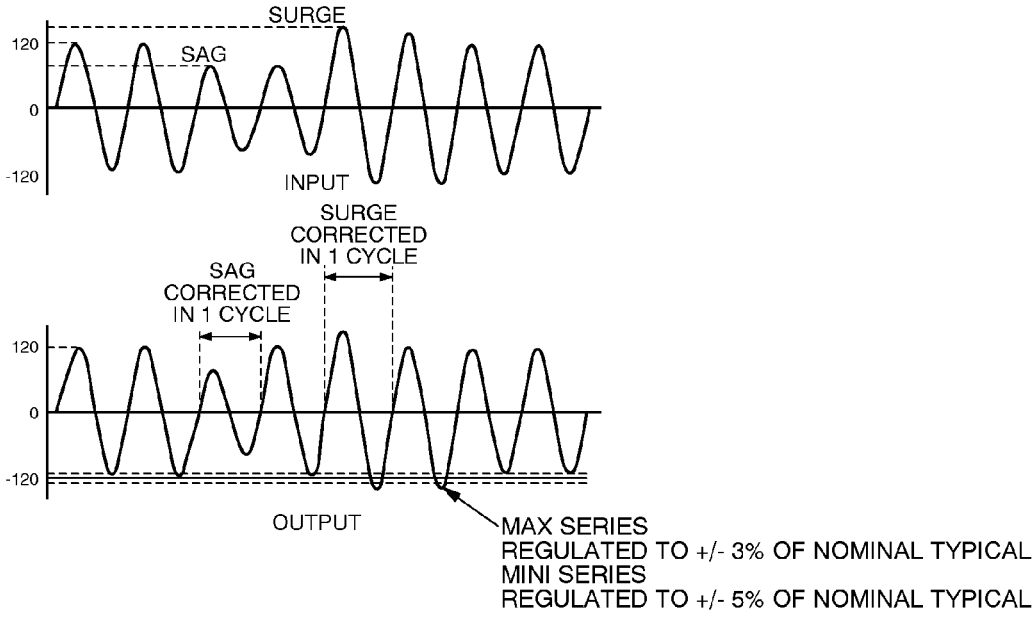
SECTION 1 – OPERATION

1–1 INTRODUCTION

This manual provides installation, operating and maintenance information for the Max Series and the Mini Series voltage regulator units. A detailed description of each product is provided in the following subsections.

All components used are of the highest quality and specifically selected to achieve the highest level of performance. These units are UL listed and conform to the National Electric Code (NEC) and Occupational Safety and Health Act (OSHA) standards.

The Max Series and Mini Series are tapped electronic voltage regulators. The Max Series has six taps on the primary winding of the transformer. The Mini Series havs three taps on the primary winding of the transformer. Each tap is controlled by a silicon controlled rectifier (SCR) switch can become active at any time. Input line–to–line voltage and line current are monitored. Peak voltage is compared with a desired reference. Depending on this comparison, the regulation logic activates the proper SCR switch when the phase current becomes zero. This changes the primary–to–secondary turns ratio which corrects the output voltage to the desired nominal. The correction process starts in less than one cycle. See Illustration 1–1.



REGULATED SYSTEM RESPONSE
ILLUSTRATION 1–1

1–1–1 Max Series

The Max Series is designed to provide the reliable, high–quality power necessary to suit the needs of today's sensitive electronics.

The single–phase, 60 hertz, self contained modular unit provides isolation and regulation of AC power. The zero current tap switching voltage regulation circuitry automatically adjusts for an input voltage range between +10% surge and –26% sag about the nominal rated voltage with an output voltage range of +/–3% typical to +/–4% maximum.

The Max Series is available with input voltages of 120, or 208/220/240, or 480 VAC and output voltages of 120 or 120/240 VAC. These units are available in sizes ranging from 3 kVA to 15 kVA. The specific rating information for your unit is provided on the label plate located on the rear panel at the bottom center.

The Max Series is shown in Illustration 1–2.

MAX SERIES
ILLUSTRATION 1–2

1–1–2 Mini Series

The computer–grade Mini Series power conditioner is designed to provide the reliable, high–quality power necessary to suit the needs of today's sensitive computer systems.

The single phase, 60 hertz, self–contained modular unit provides isolation and regulation of AC power. The zero–current tap switching voltage regulation circuitry automatically adjusts for an input voltage range between +7% surge and –23% sag about the nominal rated voltage with an output voltage range of +/–5% typical to +/–6% maximum.

The Mini Series is available in input voltages of 120, 208, or 240 VAC and output voltages of 120 or 120/240 VAC. The Mini Series is available in sizes ranging 1 to 3 kVA. The specific rating for the unit is provided on the label plate located on the rear panel of the regulator.

The Mini Series is shown in Illustration 1–3.

MINI SERIES
ILLUSTRATION 1–3

1–2 BENEFITS

The Max Series and Mini Series voltage regulators protect electronic equipment from over voltage conditions during line power surges and undervoltage conditions during sags. In addition, the units protect equipment loads by attenuating transients present on utility power lines. Over voltage, overcurrent, and transient conditions stress electronic components and decrease system reliability.

1–3 TRANSFORMER

The transformer contained in the unit is designed for convection cooling by means of free circulation of air through the bottom, and sides of the unit. Maximum ambient temperatures should not exceed 104°F (40°C).

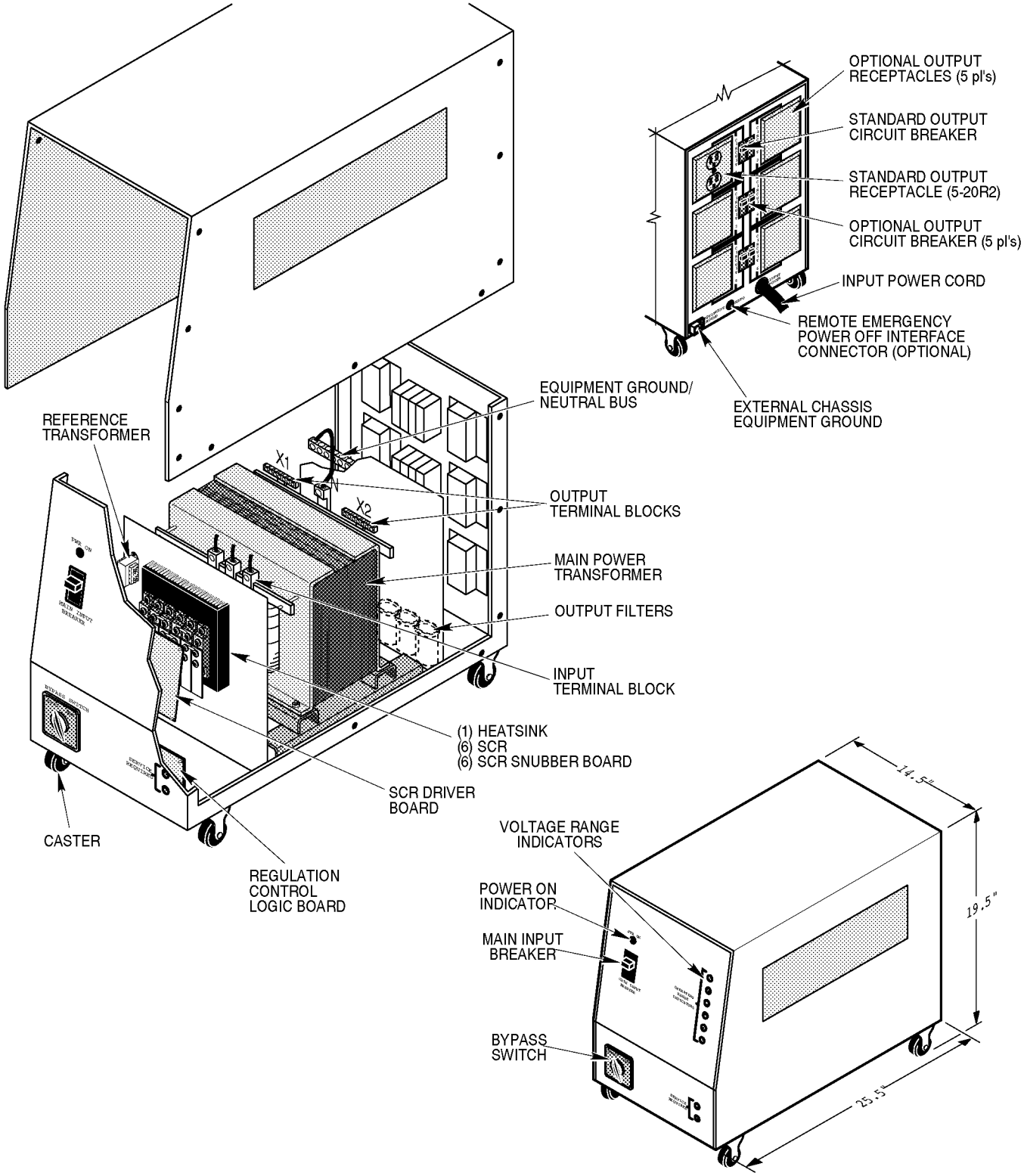
1–4 PRODUCT FEATURES

Sections 1–4 and 1–5 describe the features of the Max Series and Mini Series. Some features described in Section 1–4 are standard on all models while other features are offered as options. Refer to Table 1–1 to determine if the features described in this section are applicable to your unit. Refer to Section 5. Options for information on optional features.

TABLE 1–1
PRODUCT FEATURES

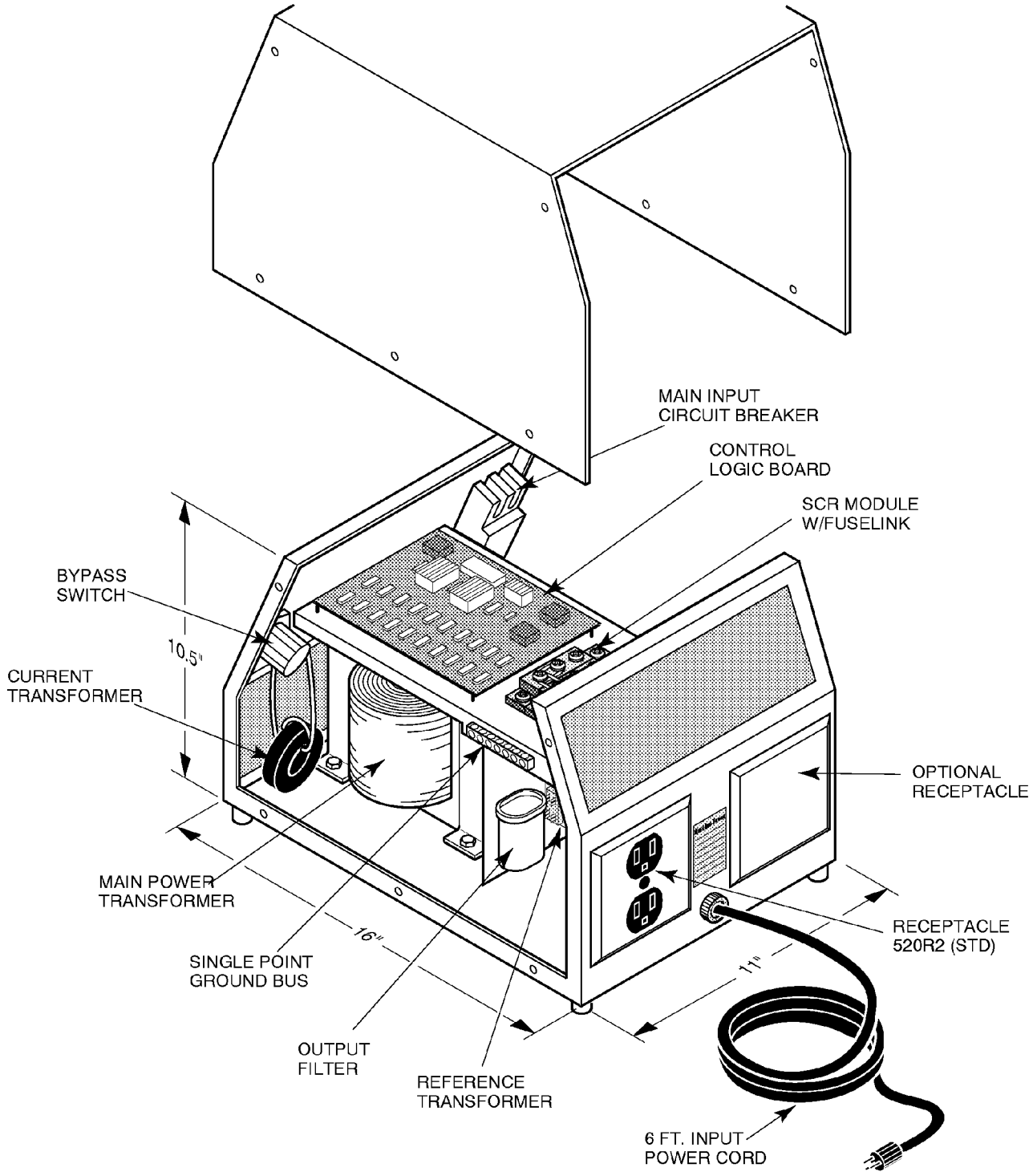
OPTIONS	Max	Mini
BYPASS SWITCH	S	S
MAIN INPUT CIRCUIT BREAKER	S	S
POWER ON INDICATORS	S	S
OUTPUT FILTER	S	S
INPUT POWER CORD (6 FEET)	S	S
CASTERS	S	N/A
K–FACTOR RATING	O	O
LOCKING INPUT PLUG	O	O
MATCHING INPUT RECEPTACLE	O	O
SPECIAL PAINT	O	O
REMOTE EMERGENCY POWER OFF STATION WITH 50 FEET CABLE	O	N/A
THERMO REMOTE EMERGENCY POWER OFF STATION WITH 50 FEET CABLE	O	N/A
MANUAL RESTART SHUNT–TRIP MAIN OUTPUT CIRCUIT BREAKER WITH REPO PLUG	O	N/A
SHUNT–TRIP MAIN INPUT CIRCUIT BREAKER WITH REPO PLUG	O	N/A

TABLE KEY: S = Standard equipment, O = Available as an option, N/A = Not available for this model.



MAX SERIES COMPONENT LAYOUT

ILLUSTRATION 1 – 4



MINI SERIES COMPONENT LAYOUT

ILLUSTRATION 1 – 5

1–4–1 BYPASS SWITCH

The bypass switch is located on the front panel. See Illustrations 1–4 and 1–5. The switch bypasses the voltage regulation electronics but maintains the functioning of the voltage change/isolation transformer between the input and the output. In the AUTO position, the output voltage is regulated. In the MAN (manual) position, regulation logic is bypassed and input power is applied to load via the transformer without regulation. Select the MAN position if there is a problem with the regulation logic circuitry. Refer to section 1–7–2, Non–regulating Condition for the procedure to operate the unit in the bypass mode.

1–4–2 Main Input Circuit Breaker (IMCB)

The Input Main Circuit Breaker (IMCB) located on the front panel of the unit, is used to switch power to the unit On and OFF. See Illustrations 1–4, 1–5. An optional IMCB is shunt tripped on the Max Series by activation of a solenoid within the breaker when an optional remote Emergency Power OFF (EPO) switch is activated. Also the optional Two Stage Thermo Repo station can be used to trip the IMCB. The Manual Restart option will trip the IMCB if input power to the Max Series turns off. If the IMCB is shunt–tripped, refer to Section 4.2 – Miscellaneous Problems for the Reset Procedure. Be sure to observe ALL Warnings and cautions when setting the IMCB to ON or OFF.

1–4–3 Power ON Indicator

The Power On Indicator is located on the front of the unit. See Illustrations 1–4 and 1–5. This neon indicating lamp is on when input power is applied and the IMCB is turned on. If the lamp is not ON, there is no input power to the unit or the IMCB is not in the ON position.

1–4–4 Input Power Cord

The input power cord is supplied on all Max Series and Mini Series. See Table 1–2 for the connector and ampere rating.

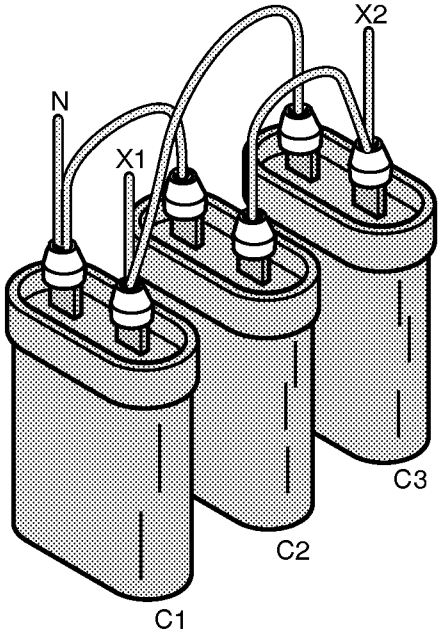
All Max Series regulators have available input power of 480 VAC and the input power cord has no connector.

TABLE 1–2
Input Configurations

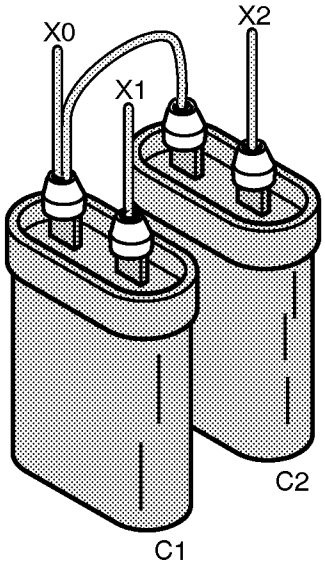
UNIT SIZE	INPUT VOLTAGE	AMPERAGE RATING	CONNECTOR DESCRIPTION
1 kVA	120	10A	NEMA #5–15P1
2 kVA	120	20A	NEMA #5–20P1
3 kVA	120	30A	NEMA #5–30P1
3 kVA	208–220–240	20A	NEMA #6–20P1
5 kVA	120	60A	NEMA #5–50P1
5 kVA	208–220–240	40A	NEMA #6–30P1
8 kVA	120	90A	Field Wire
8 kVA	208–220–240	50A	NEMA #6–50P1
10 kVA	208–220–240	60A	Field Wire
15 kVA	208–220–240	90A	Field Wire

1–4–5 Output Filter

An output filter is installed on all Max Series and Mini Series regulators. See Illustrations 1–6 and 1–7.



MAX SERIES OUTPUT FILTER
ILLUSTRATION 1–6



MINI SERIES OUTPUT FILTER
ILLUSTRATION 1–7

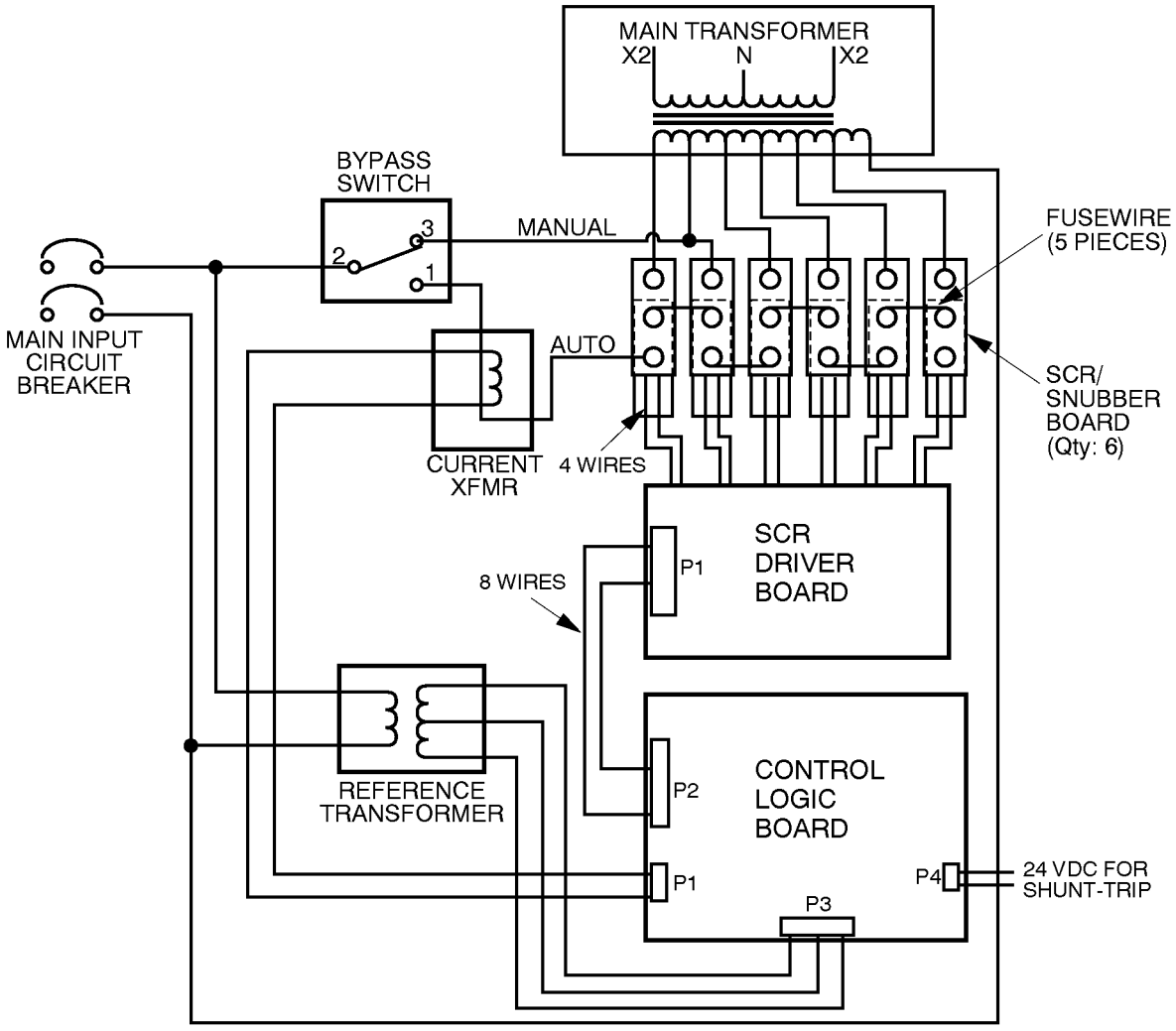
1–5 REGULATOR COMPONENTS

Regulation is accomplished by solid–state electronics which control the tap switching function at the zero–current–crossing. Refer to Section 1–1 Theory of Operation for more detail.

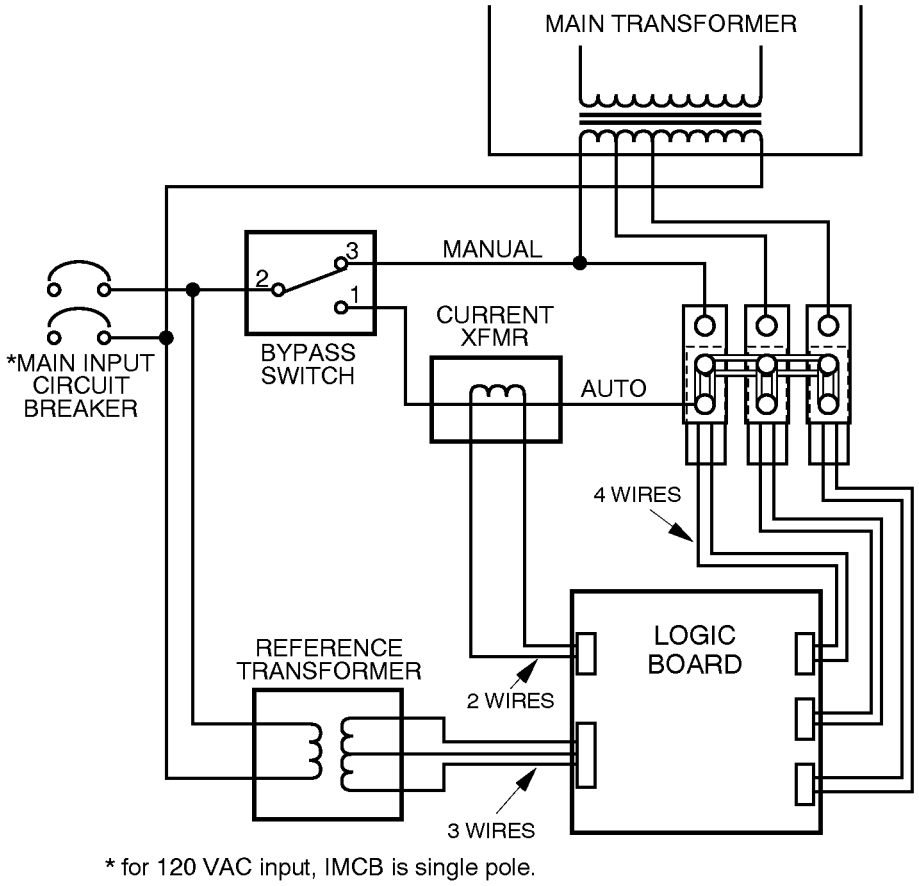
See Illustrations 1–4 and 1–5 for the mounting of the regulation components.

In a Max Series, the regulation components include 1 control logic board, 1 driver board, 6 SCR/SCR snubber board assemblies, 1 current transformer, 1 reference transformer, and 1 heatsink. See Illustration 1–8 for a functional block diagram of the regulation panel components.

In the Mini Series regulator, the regulation components include 1 logic board, 3 SCRs, 1 current transformer, and 1 reference transformer. See Illustration 1–9 for a functional block diagram of the regulation panel components.



MAX SERIES FUNCTIONAL BLOCK DIAGRAM
ILLUSTRATION 1–8



* for 120 VAC input, IMCB is single pole.

MINI SERIES FUNCTIONAL BLOCK DIAGRAM
ILLUSTRATION 1–9

1–6 STARTING THE UNIT

This procedure is to be used only for starting the unit during the normal course of operation. Follow this operating procedure any time the unit has been turned off in a non–emergency situation.

CAUTION

If this is the initial startup or if the unit has been moved, perform the startup procedure in Section 3–4–9 before applying power to the unit.

1. **Verify that the bypass switch is set to AUTO.**
2. **Verify that the connected load is OFF.**
3. **Exercise facility branch circuit breaker.**
4. **Turn on main input circuit breaker.**
   There is a 6 second delay before output power is turned on.
5. **Turn on connected load.**

1–7 OPERATION

These units are designed for unattended continuous operation. All Max and Mini Series have an IMCB that can be switched ON or OFF on a regular basis.

1–7–1 Normal Condition

When the unit is powered up and regulating, the power on indicating lamp and also on the Max Series, one of the green voltage range indicators will be on.

The normal operating condition of the units is as follows:

1. Facility branch circuit breaker set to ON.
2. Bypass switch in AUTO position.
3. Input Main Circuit breaker ON.
4. Connected load set to ON.

1–7–2 Non–Regulating Condition

In case the regulating circuits fail to regulate, the unit can continue to operate in bypass mode (without regulation) until regulation can be restored. Follow the procedure listed below to operate the unit in bypass mode.

Note

The following procedure is only for temporary operation. Voltage surge and sag protection is not available for any load while the bypass switch is in manual mode (bypass switch is set to MAN).

1. Turn connected load OFF.
2. Set IMCB to OFF.
3. Turn bypass switch from AUTO to MAN.
4. Set IMCB to ON.
5. Turn connected load ON.
6. Contact Crucial Power Products Customer Support at (800) 244–4069 for service.

SECTION 2 – PREINSTALLATION

2–1 LOCATION CONSIDERATIONS

Provide an operating environment which meets the following conditions:

- Ambient Temperature 0˚ to 40˚ C (32˚ to 104˚ F)
- Relative Humidity 10 to 95% Non–condensation

POSITIONING. Position the unit so there is easy access to the front of the regulator. Allow at least 3 inches to each side and rear of the units. All units can be serviced from the front as long as the 3 inches are maintained on each side to remove the top cover. This unit is air cooled by convection. Do not block the air flow from the bottom, sides, or front of the unit.

TABLE 2–1
MAX SERIES SITE PLANNING SPECIFICATIONS

NOMINAL INPUT VOLTAGE	**120**	**208–220–240**	**480**
INPUT VOLTAGE RANGE	**88.8–132**	**153.9–229, 163–242, 177.6–264**	**355–528**
MAXIMUM INPUT VOLTAGE	**132**	**229, 242, 264**	**528**
FREQUENCY	**60 HZ +/–5%**	**60 HZ +/–5%**	**60 HZ +/–5%**
AMBIENT TEMPERATURE ˚F (˚C)	**80 (26.7)**	**80 (26.7)**	**80 (26.7)**

kVA SIZE	INPUT VOLTAGE	NOMINAL INPUT RATED CURRENT	HEAT REJECTION BTU/hr	WEIGHT lbs (kg)	SIZE H x W x D in. (cm)
				WITHOUT PACKAGING	
3	120	25	408	115 (52)	19.5 X 14.5 X 25.5 (50 X 37 X 65)
	208–220–240	14.4–13.6–12.5			
	480	6.25			
5	120	41.67	680	140 (64)	
	208–220–240	24 –27.7–20.8			
	480	10.42			
8	120	66.67	1080	210 (95)	
	208–220–240	38.5–36.4–33.3			
	480	16.7			
10	208–220–240	48–45.5–41.7	1360	230 (105)	
	480	20.83			
15	208–220–240	72.1–68.2–62.5	2040	280 (127)	
	480	31.25			

TABLE 2–2
MINI SERIES SITE PLANNING SPECIFICATIONS

NOMINAL INPUT VOLTAGE	**120**	**208**	**240**
INPUT VOLTAGE RANGE	**92.4–128.4**	**160–222.6**	**184.8–256.8**
MAXIMUM INPUT VOLTAGE	**128.4**	**222.6**	**256.8**
FREQUENCY	**50 OR 60 HZ +/–5%**	**50 OR 60 HZ +/–5%**	**50 OR 60 HZ +/–5%**
AMBIENT TEMPERATURE ˚F (˚C)	**80 (26.7)**	**80 (26.7)**	**80 (26.7)**

kVA SIZE	INPUT VOLTAGE	NOMINAL INPUT RATED CURRENT	HEAT REJECTION BTU/hr	WEIGHT lbs (kg)	SIZE H x W x D in. (cm)
				WITHOUT PACKAGING	
1	120	8.33	136	56 (25.5)	10.5 X 11 X 16 (10.5 X 28 X 41)
	208	4.8			
	240	4.167			
1.5	120	12.5	204	59 (27)	
	208	7.21			
	240	6.25			
2	120	16.67	272	70 (32)	
	208	9.62			
	240	8.33			
2.5	120	20.84	340	73 (33)	
	208	12.02			
	240	10.42			
3	120	25	408	80 (36)	
	208	14.42			
	240	12.5			

SECTION 3 – INSTALLATION

3–1 INSTALLATION

Install the unit using the procedures in this section. Final installation must be in accordance with NEMA standards and conform to local electrical codes as appropriate.

3–1–1 Unpacking the Max Series

Unit is shipped on a pallet secured with metal bands and can be handled using a forklift or pallet jack.

CUT METAL BANDS CAREFULLY. THEY ARE UNDER TENSION AND MAY CAUSE INJURY.

1. Position the container away from walls or other obstructions.
2. Cut metal shipping bands.
3. Remove cardboard cover. Avoid puncturing the cardboard cover with sharp objects which may damage the surface of the unit.
4. Remove the unit from the pallet. Remember the Max Series can weigh as much as 300 pounds. Check the weight of the unit on Table 2–1 before lifting.
5. Remove the plastic film.
6. inspect the unit for damage per Section 3–1–3 Inspection.
7. Move unit to installation site.
8. Before final positioning of the unit(s) verify all the routing of all input and output cabling.

3–1–2 Unpacking Mini Series

The Mini Series is shipped in a cardboard box with special foam barriers and supports inside.

1. Open cardboard box with a knife using care not to damage the regulator inside.
2. Remove the foam barriers on top of the unit.
3. Remove the regulator from the cardboard box. Review Table 2–2 for the weight of the unit before lifting. The Mini Series can weigh as much as 80 pounds.
4. Inspect the unit for damage per Section 3–1–3 Inspection.
5. Move the regulator to the installation site.
6. Before final positioning of the unit(s), verify all the routing of the input and output cabling.

3–1–3 Inspection

Perform the following Inspection procedure of the unit to check for obvious damage or safety hazards that may have occurred during shipping or handling of the unit. All units must be inspected when received and again prior to use. Any damage must be reported immediately to Crucial Power Products or an authorized representative. Freight damage claims should be initiated with the carrier.

Do not connect unit to building power until the following procedure has been completed.

1. Inspect all external surfaces (panels, covers, etc) for abrasions, indentations, or other obvious damage.
2. File a claim with shipping agency for any damage caused by shipping.
3. Forward a copy of damage claim to Crucial Power Products at the following address:

   CrucialPowerProducts
   Attn: Customer Service
   5900 triumph Street
   Commerce, CA 90040

3–1–4 Input Power Connection for Max Series Regulator

Procedure

1. All Max Series regulators are equipped with an input power cord. See Table 2–1 for amperage rating and input connector. A customer furnished mating connector or J–Box is required for input power. The circuit which feeds this connector should be dedicated to providing power only to this unit. This circuit must include two power conductors and an insulated ground conductor. Size the conductor to suit the unit kVA rating, the input voltages, and the overall length of the cable.

   The input power cable size and installation must be in accordance with the National Electrical Code (NEC) and applicable local requirements.

   A parity sized ground, with respect to the primary input conductors is recommended. The grounding conductor is to be grounded to the earth at the service equipment or other acceptable true building ground. All Max Series regulators are equipped with a grounding terminal lug which allows for a single zero signal reference ground interface. It provides a method for collecting the system grounds into one central point for routing back to the building service entry panel. The grounding terminal may, in addition, be bonded to the raised floor pedestal stringer system to complete an EDP reference network and help dampen high frequency noise.

Input power connections should be installed by a licensed electrical contractor in accordance with local codes.

2. Verify the input voltage to the Max Series. Locate the Max Series label at the bottom center of the rear panel. Make sure the voltages are correct for the Max Series. If the voltages are in the 200 VAC range but are not correct to the system label, refer to Section 3–1–8 to change the internal connections of the Max Series.

VERIFY THAT THE INCOMING HIGH VOLTAGE CIRCUIT IS DE–ENERGIZED BEFORE CONTINUING WITH THIS PROCEDURE.

3. Turn facility circuit breaker to OFF, lock and log out in accordance with OSHA Lockout/Tag–out requirements.

4. Install mating connector assembly or junction box for input of Max Series.

5. Check input voltages for correct pinouts as required by the Max Series.

6. Plug input power connector to input socket or hardwire input power cord to the junction box.

3–1–5 Input Power Connections for Mini Series Regulators

PROCEDURES

1. All Mini Series regulators are equipped with an input power cord and plug. See Table 2–2 for amperage rating and input connectors. A customer furnished mating connector is required for input power. The circuit which feeds this connector should be dedicated to providing power only to this unit. The circuit must include two power conductors and an insulated ground conductor. Size the conductors to suit the unit kVA rating, the input voltage and the overall length of the cable. The input power cable size and installation must be in accordance with the National Electrical Code (NEC) and applicable local requirements. A parity sized ground, with respect to the primary input conductors is recommended. The grounding conductor is to be grounded to the earth at the service equipment or other acceptable true building ground.

Input power connections should be installed by a licensed electrical contractor in accordance with local codes.

2. Verify the input voltage to the Mini Series. Locate the Mini Series label on the rear panel of the units and make sure the input voltage agrees with the unit.

VERIFY THAT THE INCOMING HIGH–VOLTAGE CIRCUIT IS DE–ENERGIZED BEFORE CONTINUING WITH THIS PROCEDURE.

3. Turn facility circuit breaker to OFF, lock and tagout in accordance with OSHA Lockout/Tag–out requirements.
4. Install mating connector assembly for input of Mini Series.
5. Check input voltages for correct pinouts as required by the Mini Series.
6. Plug input power connector to input socket.

3–1–6 Output power connection for Max Series

The Max Series rear panel can be a complete distribution panel for the loads for the Systems. See Illustration 1–4 Rear Panel View. The Max Series is equipped with one 5–20R2 receptacle and output circuit breaker. Up to five optional receptacle and circuit breaker subsystems can be supplied. The circuit breaker can be either a one pole or two pole breaker to match the requirements of the output receptacles. Contact Crucial Power Products Sales and Marketing for pricing and availability at (800) 244–4069.

3–1–7 Ouptut Power Connections for Mini Series

The Mini Series is equipped with one NEMA 5–20R2 receptacle. The Mini Series is equipped with space for up to two power output receptacle plates. See Illustration 1–5. The output receptacles are protected by fuses or the input circuit breaker. Contact Crucial Power Product's Sales and Marketing at (800) 244–4069 for any options the loads might require.

3–1–8 Max Series with 208–220–240 Volt Input

This Max Series has internal changes required for the regulator to operate properly in the 200 VAC input range. The following steps must be done to assure proper operation.

1. With a true RMS volt meter, read the input voltage to power the Max Series and determine which input voltage is available.

DANGER!!

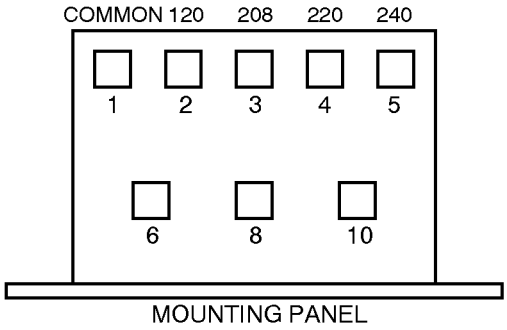
VERIFY THAT THE INCOMING VOLTAGE CIRCUIT IS DE–ENERGIZED BEFORE CONTINUING WITH THIS PROCEDURE.

2. Remove the top cover of the Max Series. There are seven screws on each side that must be removed and the top cover can be lifted off.

3. On the front side of the main transformer are 3 taps that are labeled 208, 220, and 240. Select the tap for the measured input voltage and fasten the input power wire to this terminal. Torque the lug to 25 lb. in (29NM).

4. Locate the reference transformer on the front side of the front divider panel, just behind the front panel of the Max Series. See Illustration 1–4. The reference transformer, Crucial Power Products Part #1400–001A, has 5 lugs in a row away from the mounting panel. See Illustration 3–1.

3–1–8 Max Series with 208–220–240 Volt Input (continued)



200 VAC INPUT REFERENCE TRANSFORMER
ILLUSTRATION 3–1

There will be 2 wires, 1 lug, on the common terminal. There will be 1 wire, 120VAC, on terminal 2. This powers the Power On lamp. Terminals 3, 4 and 5 select the 208, 220 and 240 VAC input. Select the terminal that matches the lug selected on the main transformer input. Remember the Max Series reference transformer tap selection must match the main transformer tap selected. If this is not done, incorrect output voltages can result from the Max Series and cause damage to the load being powered by Max Series.

3–1–9 Start–up for the Max Series, Mini Series

1. Max Series Start–Up. Verify the input voltage to the Max Series is matches the nameplate located on the bottom center of the rear panel. Remember the input voltage can be nominal to plus 10% or minus 26%. Connect the input power cable and make sure the output circuit breakers are OFF on original start–up. Place the bypass switch in the AUTO position. Turn on the Input Power circuit breaker and note the Power On lamp turns on at the same time. After 6 seconds, one lamp only will turn on of the 6 operating range indicators. Turn on one of the output circuit breakers and check the corresponding socket for the correct output voltage. Remember the output voltage is identified on the label plate located on the bottom center of the rear panel. The output voltage must be rated voltage $\pm$4%.

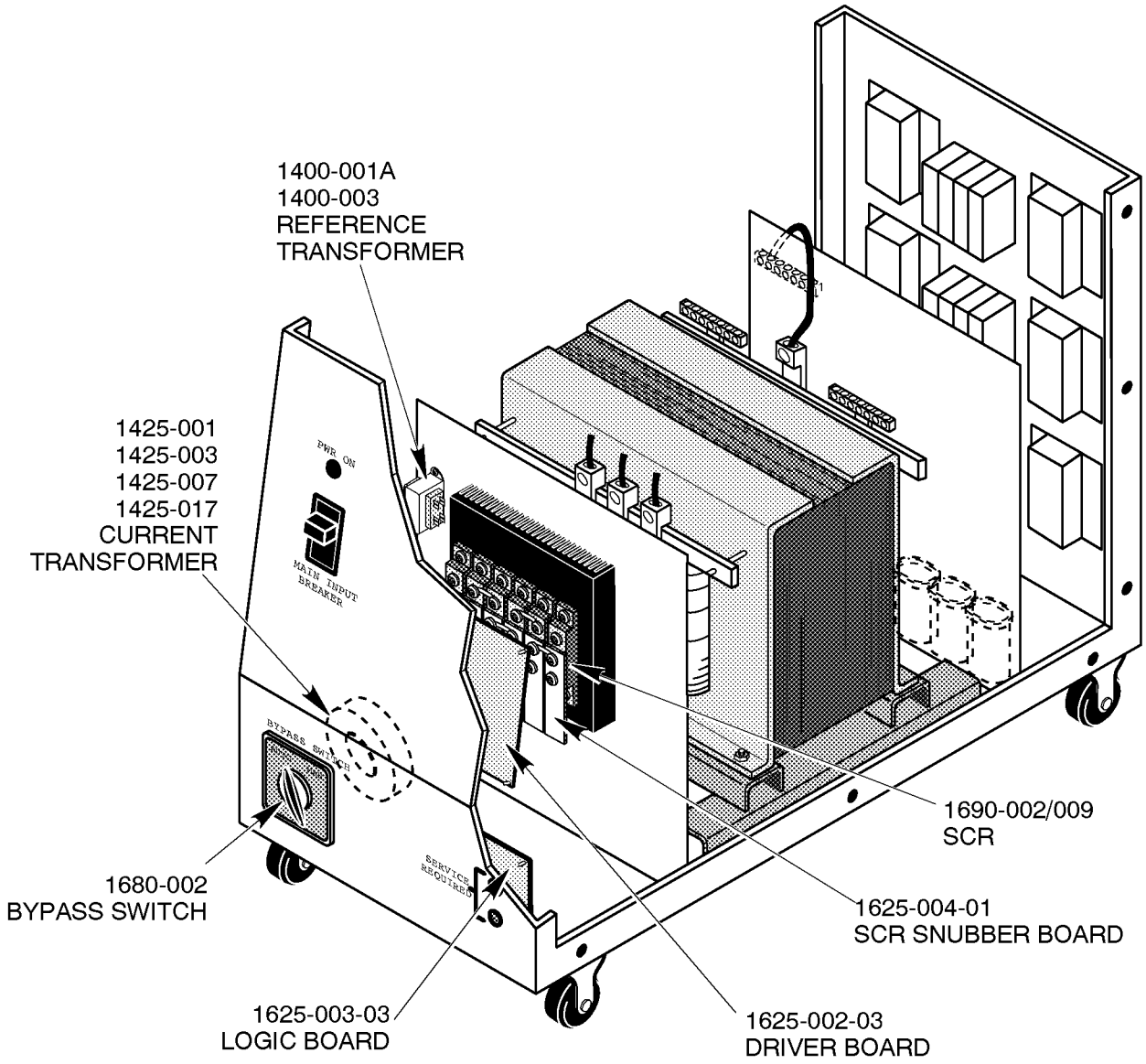
2. Mini Series Start–Up. Check the input power at the source and be sure this matches the nameplate on the rear panel of the Mini Series. Remember the input range is nominal plus 7% to minus 23%. Plug the input cable to the socket with the input power circuit breaker in the OFF position. Place the bypass switch in the AUTO position. Disconnect output loads from the output sockets. Turn on the Input Power breaker and the Power On lamp will turn on. After 6 seconds, the output power will turn on. Measure the output power. It must match the nameplate $\pm$5%.

3–2 CONFIGURATION

The unit is shipped factory configured. No configuration is necessary. Do not change tap connections.

3–3 RENEWAL PARTS

3–3–1 Renewal Parts (Max Series)



MAX SERIES PARTS LIST
ILLUSTRATION 3–2

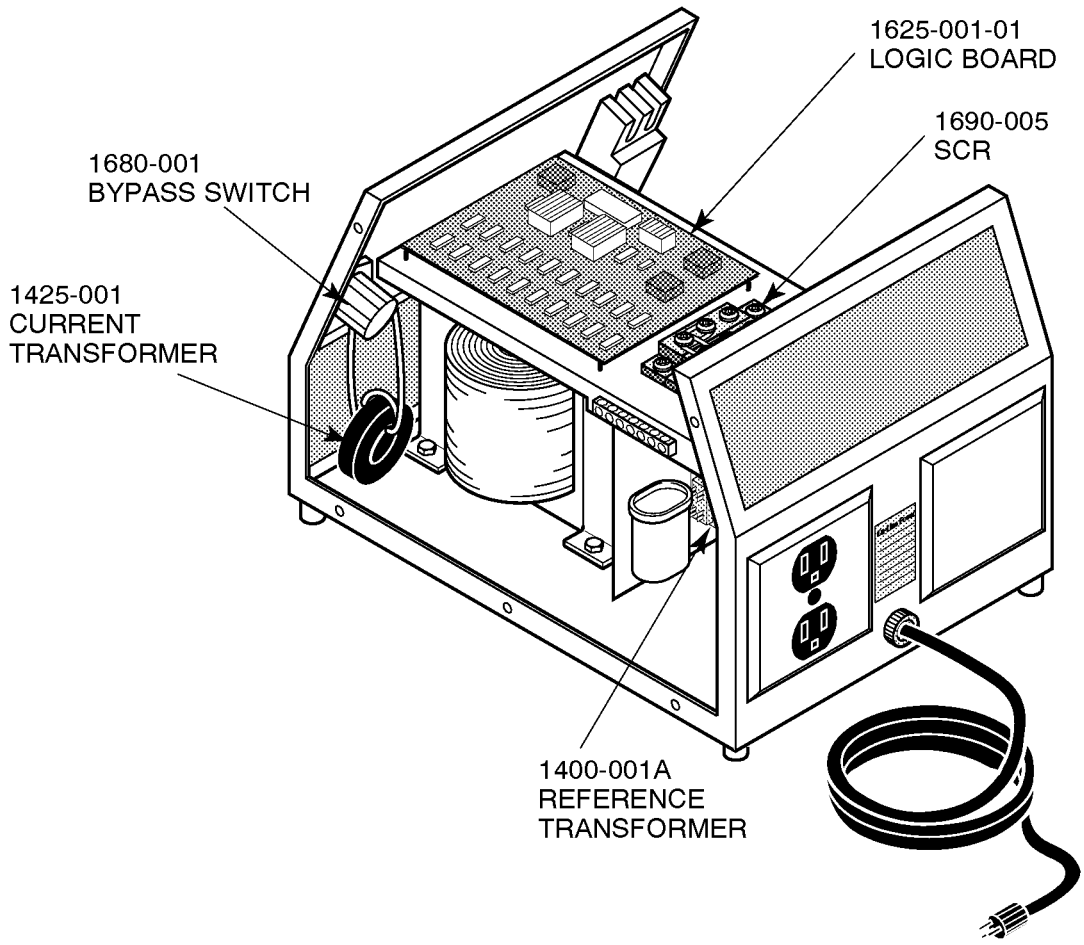
3–3–2 Vendor Parts List, Max Series

Vendor No.	Vendor	Description (Remarks)
1690–002/009	Crucial Power Products	SCR, ALL MODELS
1625–004–01	Crucial Power Products	PCB, SCR SNUBBER BOARD, ALL MODELS
1625–003–03	Crucial Power Products	PCB, LOGIC BOARD, ALL MODELS
1625–002–03	Crucial Power Products	PCB, DRIVER BOARD, ALL MODELS
1400–001A	Crucial Power Products	TRANSFORMER, REFERENCE 120, 208, 220, AND 240 VAC INPUT
1400–003	Crucial Power Products	TRANSFORMER, REFERENCE 480 VAC INPUT
1680–002	Crucial Power Products	BYPASS SWITCH
1425–001	Crucial Power Products	TRANSFORMER, CURRENT, 50:5
1425–003	Crucial Power Products	TRANSFORMER, CURRENT, 100:5
1425–007	Crucial Power Products	TRANSFORMER, CURRENT, 200:5
1425–017	Crucial Power Products	TRANSFORMER, CURRENT, 25:5

TABLE 3–1
BYPASS SWITCH AND CURRENT TRANSFORMER PARTS LIST

kVA SIZE	MODEL NUMBERS		INPUT VOLTAGE	BYPASS SWITCH	CURRENT TRANSFORMER
	120 OUTPUT	120/240 OUTPUT			
3	C6003A0100T1	C6003A0200T1	120	1680–002	1425–001
	C6003B0100T1	C6003B0200T1	208		1425–001
	C6003C0100T1	C6003C0200T1	220		1425–001
	C6003D0100T1	C6003D0200T1	240		1425–001
	C6003H0100T1	C6003H0200T1	480		1425–017
5	C6005A0100T1	C6005A0200T1	120		1425–001
	C6005B0100T1	C6005B0200T1	208		1425–001
	C6005C0100T1	C6005C0200T1	220		1425–001
	C6005D0100T1	C6005D0200T1	240		1425–001
	C6005H0100T1	C6005H0200T1	480		1425–017
8	C6008A0100T1	C6008A0200T1	120		1425–003
	C6008B0100T1	C6008B0200T1	208		1425–001
	C6008C0100T1	C6008C0200T1	220		1425–001
	C6008D0100T1	C6008D0200T1	240		1425–001
	C6008H0100T1	C6008H0200T1	480		1425–017
10	C6010B0100T1	C6010B0200T1	208		1425–007
	C6010C0100T1	C6010C0200T1	220		1425–007
	C6010D0100T1	C6010D0200T1	240		1425–007
	C6010H0100T1	C6010H0200T1	480		1425–003
15	C6015B0100T1	C6015B0200T1	208		1425–007
	C6015C0100T1	C6015C0200T1	220		1425–007
	C6015D0100T1	C6015D0200T1	240		1425–007
	C6015H0100T1	C6015H0200T1	480		1425–003

3–3–3 Renewal Parts (Mini Series)



MINI SERIES PARTS LIST
ILLUSTRATION 3–3

3–3–4 Vendor Parts List, Mini Series

Vendor No.	Vendor	Description (Remarks)
1690–005	Crucial Power Products	SCR, ALL MODELS
1625–001–01	Crucial Power Products	PCB, LOGIC BOARD, ALL MODELS
1400–001A	Crucial Power Products	TRANSFORMER, REFERENCE, ALL MODELS
1680–001	Crucial Power Products	BYPASS SWITCH
1850–007	Crucial Power Products	NEON INDICATOR
1425–001	Crucial Power Products	TRANSFORMER, CURRENT, 50:5

3–4 SERVICE

3–4–1 Calibrate Control Logic Board (Max Series)

The SCR driver board has seven green LEDs. Two LEDs should be lighted at all times. LED 7 indicates power is applied to the board and is always on. LEDs 1 through 6 represent tap settings and only one should be on at any time. See Illustration 3–4.

If no LED is lit or if more than two LEDs are lit, immediately turn IMCB to OFF. Call Crucial Power Product's Customer Support at (800) PWR–SRVC for service.

If only one LED (1 through 6) is lit, perform the following calibration:

Procedure

1. Remove top cover of the Max Series by unbolting 6 screws located on corners and right and left sides of panel.
2. Set IMCB to ON.
3. Turn on load subsystems to create a 1 kVA load.

DANGER!!

FATAL SHOCK HAZARD!! LETHAL VOLTAGES EXIST WITHIN THE MAX SERIES DURING THE FOLLOWING CHECK. FOLLOW THE STEPS BELOW EXACTLY. FAILURE TO DO SO COULD RESULT IN SEVERE INJURY OR DEATH.

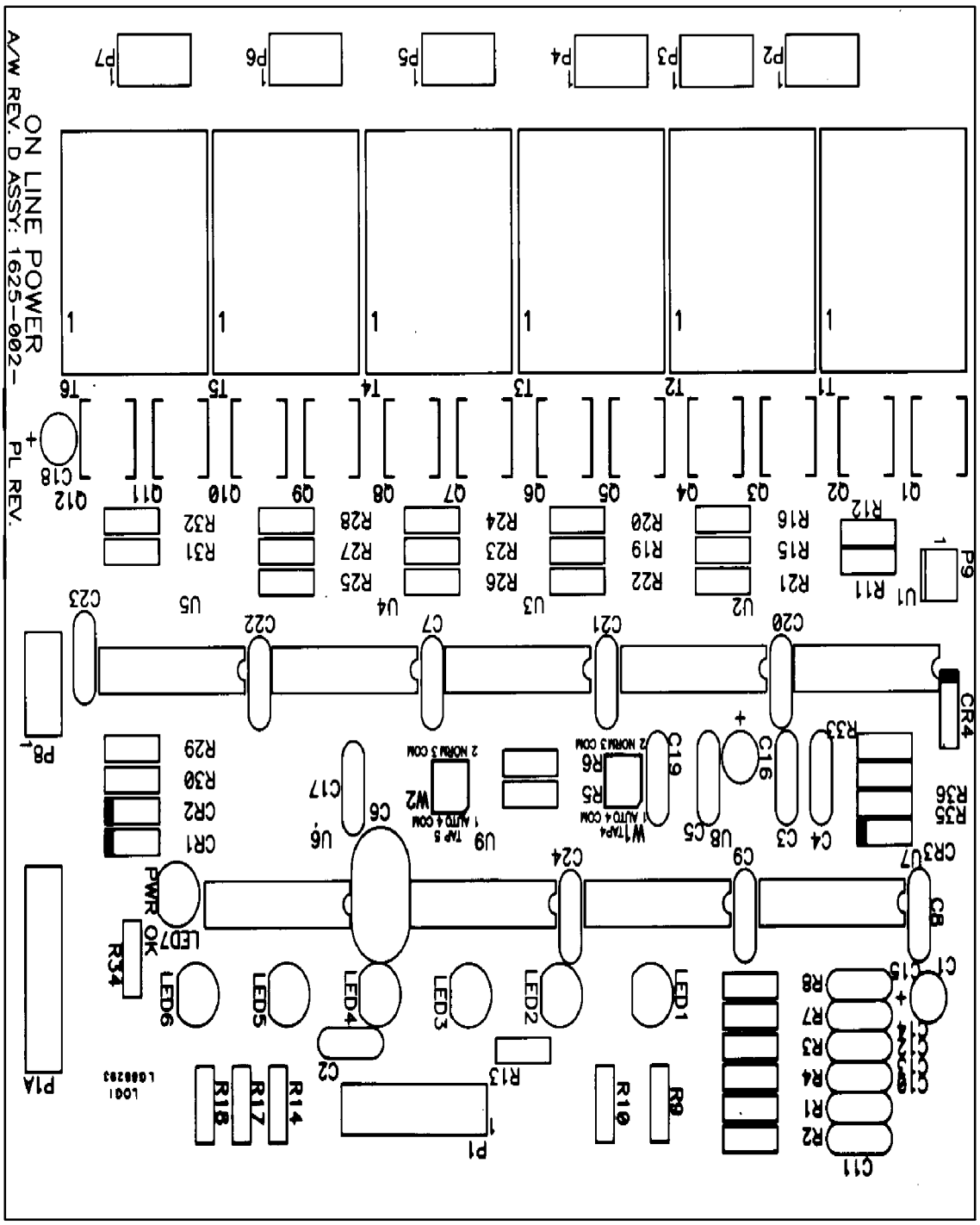
4. Make the following adjustments on the Control Logic board. See Illustration 3–5.
   a. Measure AC voltage across R1 or R2. Voltage should be between 10 and 100mv AC.
   b. Measure DC voltage across C42. Reading must be 8.5 VDC.
   c. Adjust R62 until voltage reads 8.5 VDC.

   Note
   Potentiometer R62 is a 30–turn pot. It may require several turns before output level changes.

   d. Measure output voltage between transformer terminals X1 and X2.
   Refer to Illustration 1–4 for transformer terminal configuration.
   e. Adjust R39 until output voltage reads 120V or 240V, ± 3%, depending on rated output voltage.

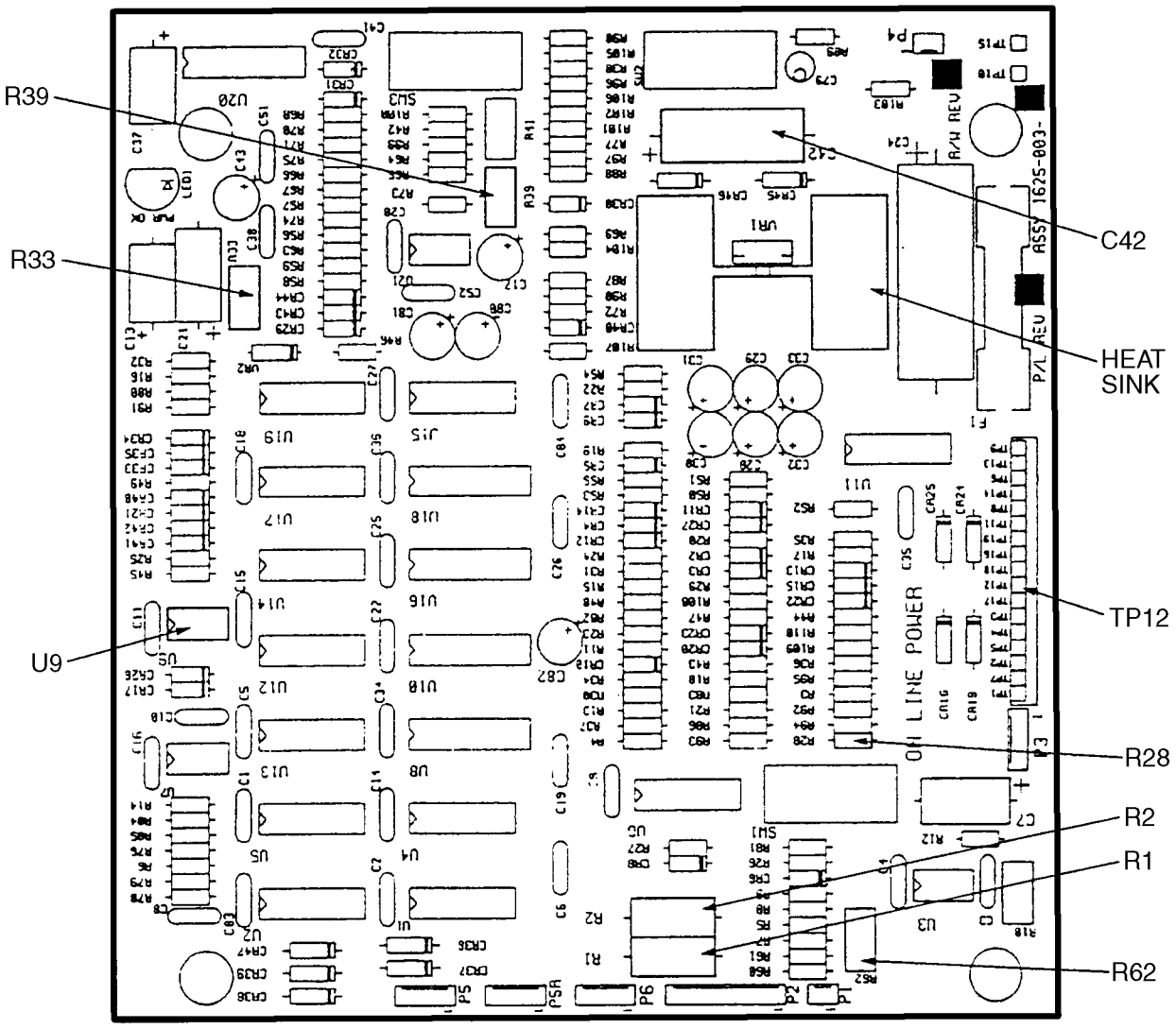
   Note
   Output voltage does not change linearly as potentiometer R39 is rotated. Output voltage does a step change. Pot R39 is a 30–turn pot. It may require several turns before output level changes.

3–4–1 Calibrate Control Logic Board (continued)



SCR DRIVER BOARD
ILLUSTRATION 3–4

3–4–1 Calibrate Control Logic Board (continued)



CONTROL LOGIC BOARD
ILLUSTRATION 3–5

APPENDIX A – SPECIFICATIONS

	MAX SERIES	MINI SERIES
Sizes	3, 5, 8, 10, 15 kVA	1, 1.5, 2, 2.5, and 3 kVA
Input Voltage	120 or 208/220/240 or 480 VAC	120, or 208, or 240 VAC
Output Voltage	120 or 120/240 VAC	
Frequency	60 Hz ±5%	
Transformer Type	Single Phase Computer-Grade, Dual-Shielded, Isolation Transformer	
Transformer Impedance	3 to 5% maximum	
Efficiency	96% minimum	
Load Power Factor	0.3 Leading or Lagging to Unity	
Harmonic Distortion	3% Individual, 5% Total at Switching	
Audible Noise	<35 dB. Measured on Response Curve "A"	
Typical Noise Rejection	Common Mode: -120 dB Normal Mode: -60 dB/decade	
Input Voltage Regulation Range	+10% to -26% of nominal	+7% to -23% of nominal
Output Voltage Regulation Range	±3% Typical ±4% All Line-Load Cond.	±5%
Cooling	Convection	
Response Time	1 Cycle Typical	
Loading Rating	Continuous, Regardless of Load/Line Conditions	
Overall Inrush Rating	200% for 10 seconds; 1000% for 1 Cycle	
Environmental		
Operating Temperature	32°F (0°C) to 104°F (40°C)	
Storage Temperature	-4°F (-20°C) to 140°F (60°C)	
Operating Humidity	10 to 95% Non-Condensing	
Dimensions		
Height	19.5" (49.5 cm)	10.5" (26.8 cm)
Width	14.5" (36.8 cm)	11" (28.2 cm)
Depth	25.5" (64.8 cm)	15.5" (39.7 cm)

GLOSSARY

AC	Alternating Current
Current transformer	The transformer used to feed a current signal to the logic board.
IMCB	Input Main Circuit Breaker — The circuit breaker on the front panel used to switch power ON and OFF.
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
OSHA	Occupational Safety and Health Administration
PCB	Printed Circuit Board — A surface for the mounting and interconnection of electronic components.
REPO	Remote Emergency Power Off — A switch, separate from but wired to the regulation unit, when pressed, shunt trips the Main Input Circuit Breaker.
Thermal REPO	Thermal Remote Emergency Power Off — A thermal activated switch, separate from but wired to the regulation unit, which reacts to a predetermined temperature range by shunt tripping the Main Input Circuit Breaker.
Reset (a circuit breaker)	Move the breaker first to OFF position, then to ON. This step required after the breaker has ”tripped”
SCR	Silicon–Controlled Rectifier
Shunt Trip	A device for tripping a circuit breaker indirectly, using a signal to activate a solenoid, instead of directly, because of an overcurrent condition.
Trip	A circuit breaker in an open position as a result of an overcurrent condition to the load, or as the result of a remote trip command (shunt trip). In a tripped condition, power to the load is off. The tripped circuit breaker position differs from the off position in that the breaker must first be turned to the OFF position before restoring power to the load.
TB	Terminal Block