



L-828 Constant Current Regulators LC-Type (4, 7.5, and 10 kW/6.6 A/60 Hz)

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Siemens Airfield Solutions

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Section 1

Safety

1. Introduction

This section contains general safety instructions for using your Siemens Airfield Solutions equipment. Some safety instructions may not apply to the equipment in this manual. Task- and equipment-specific warnings are included in other sections of this manual where appropriate. Note all warnings and follow all instructions carefully. Failure to do so may result in personal injury, death, or property damage.

To use this equipment safely,

- refer to the FAA Advisory Circular AC 150/5340-26, *Maintenance of Airport Visual Aids Facilities*, for instructions on safety precautions.
- observe all safety regulations. To avoid injuries, always remove power prior to making any wire connections and touching any parts. Refer to FAA Advisory Circular AC 150/5340-26.
- read and become familiar with the general safety instructions provided in this section of the manual before installing, operating, maintaining, or repairing this equipment.
- read and carefully follow the instructions given throughout this manual for performing specific tasks and working with specific equipment.
- store this manual within easy reach of personnel installing, operating, maintaining, or repairing this equipment.
- follow all applicable safety procedures required by your company, industry standards, and government or other regulatory agencies.
- obtain and read Material Safety Data Sheets (MSDS) for all materials used.

2. Safety Symbols

Become familiar with the safety symbols presented in this section. These symbols will alert you to safety hazards and conditions that may result in personal injury, death, or property and equipment damage.

Safety Symbols *(contd.)*



WARNING: Failure to observe this warning may result in personal injury, death, or equipment damage.



WARNING: Risk of electrical shock. Failure to observe this warning may result in personal injury, death, or equipment damage.



WARNING: Disconnect equipment from line voltage. Failure to observe this warning may result in personal injury, death, or equipment damage.



WARNING: Wear safety goggles. Failure to observe may result in serious injury.



CAUTION: Failure to observe may result in equipment damage.



CONTENTS
STATIC-SENSITIVE
MUST BE GROUNDED
WHEN HANDLING PCB

CAUTION: Contents are static-sensitive. Must be grounded when handling PCBs.

3. Qualified Personnel

The term *qualified personnel* is defined here as individuals who thoroughly understand the equipment and its safe operation, maintenance, and repair. Qualified personnel are physically capable of performing the required tasks, familiar with all relevant safety rules and regulations and have been trained to safely install, operate, maintain, and repair the equipment. It is the responsibility of the company operating this equipment to see that its personnel meet these requirements.

4. Intended Use



WARNING: Use of this equipment in ways other than described in this manual may result in personal injury, death, or property and equipment damage. Use this equipment only as described in this manual.

Siemens Airfield Solutions cannot be responsible for injuries or damages resulting from nonstandard, unintended applications of its equipment. This equipment is designed and intended only for the purpose described in this manual. Uses not described in this manual are considered unintended uses and may result in serious personal injury, death, or property damage. Unintended uses may result from taking the following actions:

- making changes to equipment that have not been recommended or described in this manual or using parts that are not genuine Siemens Airfield Solutions replacement parts
- failing to make sure that auxiliary equipment complies with approval agency requirements, local codes, and all applicable safety standards
- using materials or auxiliary equipment that are inappropriate or incompatible with your Siemens Airfield Solutions equipment
- allowing unqualified personnel to perform any task

5. Installation

Read the installation section of all system component manuals before installing your equipment. A thorough understanding of system components and their requirements will help you install the system safely and efficiently.



WARNING: Failure to follow these safety procedures can result in personal injury or death.

- Allow only qualified personnel to install Siemens Airfield Solutions and auxiliary equipment. Use only approved equipment. Using unapproved equipment in an approved system may void agency approvals.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Follow all instructions for installing components and accessories.
- Install all electrical connections to local code.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current demand. All wiring must meet local codes.

Installation *(contd.)*

- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment.
- Protect components from damage, wear, and harsh environment conditions.
- Allow ample room for maintenance, panel accessibility, and cover removal.
- Protect equipment with safety devices as specified by applicable safety regulations.
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning.

6. Operation

Only qualified personnel, physically capable of operating the equipment and with no impairments in their judgment or reaction times, should operate this equipment.

Read all system component manuals before operating this equipment. A thorough understanding of system components and their operation will help you operate the system safely and efficiently.

- Before starting this equipment, check all safety interlocks, fire-detection systems, and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects or pneumatic valves.
- Never operate equipment with a known malfunction.
- Do not attempt to operate or service electrical equipment if standing water is present.
- Use this equipment only in the environments for which it is rated. Do not operate this equipment in humid, flammable, or explosive environments unless it has been rated for safe operation in these environments.
- Never touch exposed electrical connections on equipment while the power is ON.

7. Action in the Event of a System or Component Malfunction

Do not operate a system that contains malfunctioning components. If a component malfunctions, turn the system OFF immediately.

- Disconnect and lock out electrical power.
- Allow only qualified personnel to make repairs. Repair or replace the malfunctioning component according to instructions provided in its manual.

8. Maintenance and Repair

Allow only qualified personnel to perform maintenance, troubleshooting, and repair tasks. Only persons who are properly trained and familiar with Siemens Airfield Solutions equipment are permitted to service this equipment.

- Always use safety devices when working on this equipment.
- Follow the recommended maintenance procedures in your equipment manuals.
- Do not service or adjust any equipment unless another person trained in first aid and CPR is present.
- Connect all disconnected equipment ground cables and wires after servicing equipment. Ground all conductive equipment.
- Use only approved Siemens Airfield Solutions replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals and create safety hazards.
- Check interlock systems periodically to ensure their effectiveness.
- Do not attempt to service electrical equipment if standing water is present. Use caution when servicing electrical equipment in a high-humidity environment.
- Use tools with insulated handles when working with electrical equipment.

Section 2 Description

1. Introduction

See Figure 2-1. This section describes the Siemens Airfield Solutions L-828 constant current regulators (CCRs) LC-Type (4, 7.5, and 10 kW/6.6 A/60 Hz). These CCRs are manufactured according FAA specification AC 150/5345-10E.

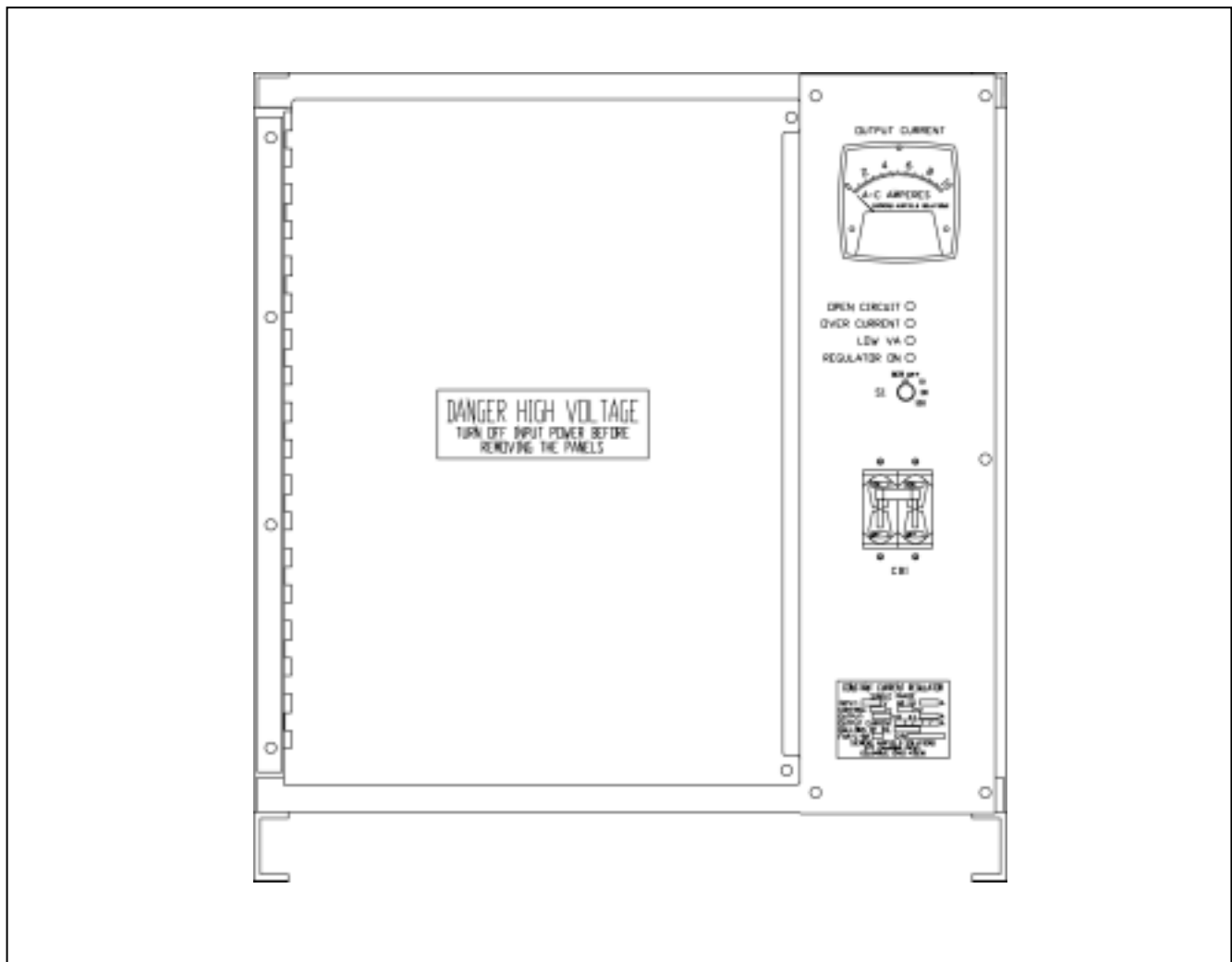


Figure 2-1 L-828 CCR

1. Introduction *(contd.)*

The 4, 7.5, and 10 kW CCRs are designed to

- supply either three or five precision output current levels (6.6 A maximum) for series lighting circuits on airport runways and taxiways.
- accurately regulate the output current to within $\pm 3\%$ of the adjustable nominal level from no load to full load and with input voltage variations of -5% to $+10\%$ of nominal ($-40\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$).

Optional input voltages available are 208, 220, 240, and 480 Vac.

The regulators may be operated manually or by 120 Vac or +48 Vdc remote control signals from a distant location (10,000 feet round trip using AWG #19 control cable). The universal remote control used in the LC-Type CCR requires no circuitry changes between 120 Vac and +48 Vdc remote control signals. Both 120 Vac and +48 Vdc remote control source signals (CCI) are provided.

Protective circuits automatically shut down the regulators if an overcurrent or open-circuit occurs in the series lighting circuit. After an input power loss, operation automatically resumes at the same brightness level within 5 seconds after input power is restored. Output lightning and current-surge protection is provided on all units.

2. L-828 CCR Monitoring Options

The L-828 CCR monitoring options include Scanning Monitor Interface (SMI) and Scanning Monitor Ready (SMR).

Optional Scanning Monitor Interface

The optional scanning monitor interface is a relay assembly that can be mounted internally to the front panel of the CCR. The relay assembly consists of four relays and sockets. The relay assembly is used to generate feedback signals concerning the CCRs operation to the Remote Multiplexer. The relay assembly generates feed back for the following signals: Remote/local status, commanded ON status, regulator running status, and primary power status.

Optional Scanning Monitor Ready

The optional scanning monitor ready includes the scanning monitor interface plus one current transformer (CT) and one potential transformer (PT). It also has resistor loads, and a fuse in the potential transformer secondary. Differential signals presenting the actual series circuit voltage and current are transmitted to the scanning monitor system two-conductor shielded cables.

3. Indicators

See Figure 2-2. Refer to Table 2-1 for the L-828 LC-type CCR indicators.

Table 2-1 L-828 LC-Type CCR Indicators

Indicator	Purpose	NOTE
True rms-reading ammeter (1)	Indicates output current, voltage, and VA readings	A
Open-circuit (red) LED (2)	Indicates circuit open	
Overcurrent (red) LED (3)	Indicates overcurrent	
Overload output LED (4)	Indicates low volt-amp output	
Regulator ON (green) LED (5)	Indicates system in normal operation	
NOTE A: Optional digital ammeter is available.		

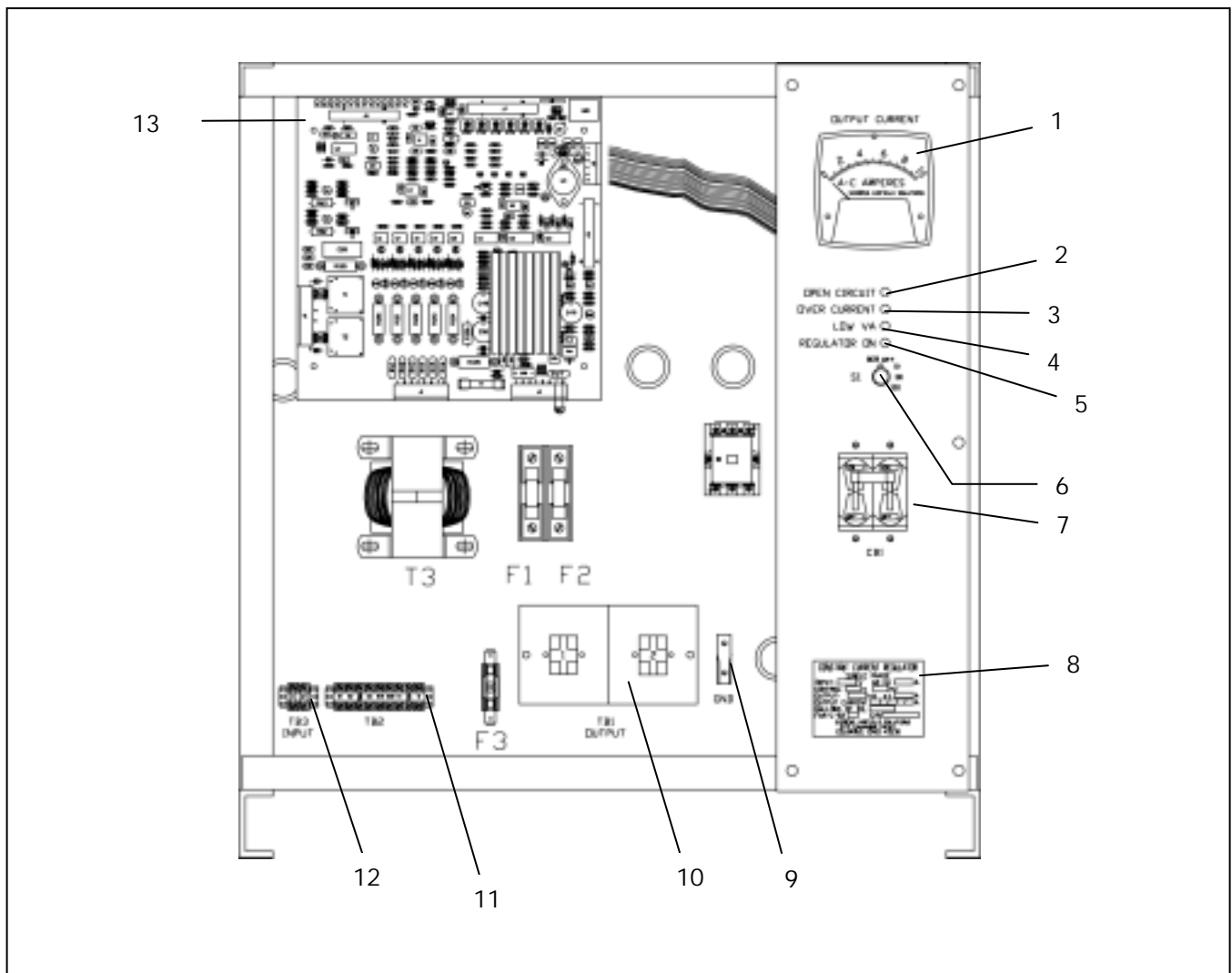


Figure 2-2 4-10 kW LC-Type CCRs (with Door Open)

- | | | | |
|---------------------|------------------------|------------------------|-----------------|
| 1. Ammeter | 5. REGULATOR ON LED | 9. Earth Ground Lug | 13. Control PCB |
| 2. OPEN CIRCUIT LED | 6. Switch S1 | 10. TB1 Output | |
| 3. OVER CURRENT LED | 7. Circuit Breaker CB1 | 11. Terminal Block TB2 | |
| 4. LOW VA LED | 8. Name Plate | 12. Terminal Block TB3 | |

4. Theory of Operation

This subsection describes the L-828 CCR theory of operation.

Introduction

Current regulation is obtained by using SCRs to switch the supply power (by varying the *On* duration of the AC cycle) to the power transformer and by using feedback circuitry to monitor the transformer's output. The brightness level is selected from one of three or five preset values. Load variation is detected as a change in the control voltage by the controller. The controller changes the conduction angle of the AC voltage to the SCRs to adjust the power flow into the power transformer. This sequence of events compensates for the load variation and maintains the output current at the preset level.

Silicon Control Rectifiers (SCRs)

See Figure 8-1 in the *Wiring Schematics* section. When power is applied to the CCR at TB3 terminals 1 and 2 and the contactor K1 and circuit breaker CB1 are closed, no current will flow in the primary of the power transformer T1 until the silicon control rectifiers (SCRs) receive a trigger pulse. When this pulse occurs, the SCRs turn on. This allows the current to flow into the primary of the power transformer T1 until the SCR is switched off by the zero crossing of the input voltage.

The path of the current flow is from TB3-2 through the circuit breaker CB1, contractor K1, SCR1 terminals 1 and 3 to L2, L1, and primary of T1, and back to K1, CB1, and TB3-1. Since alternating current is used for the regulator operation, after zero-crossing the current flows in the opposite direction using the other SCR (see SCR1 terminals 1 and 2).

The power level in the primary of the power transformer is controlled by varying the phase of the conduction angle. If very low output current is desired, the conduction angle would be near zero degrees, that is, the SCR is not triggered until the input voltage is near zero-crossing. Little power is then available to power transformer T1.

For maximum power to occur in the primary of the power transformer T1, the conduction angle will be near 180 degrees. Immediately after zero-crossing of the input power sine wave, the SCR is triggered and operates continuously throughout the 180-degree duration of the input sine wave.

For 67% power from the power transformer, the conduction angle will be nearly 90 degrees. This occurs approximately at the voltage peak of the sine wave when the SCR switches into conduction. Switching the transformer on-line at this time creates a rather abrupt rise time, since the sine wave is at its peak voltage. Choke L1 slows this rapid rise time from the conduction of the SCRs.

Contactor

In the event of an SCR failure, the contactor provides a means to break the current driving the primary of the power transformer T1. Under normal conditions, the contactor K1 (see Figure 8-1 in the *Wiring Schematics* section) has no making or breaking current across it, since the SCR is off when the contactor is opening and closing. This is accomplished by the coil-control circuitry and provides increased life for the contactor.

Transformers

Transformer T6 provides 120 Vac remote control source voltage at TB2 terminal 8 through fuse F3.

Transformer T3 provides AC voltage to the control PCB. T3 provides both 120/60 Vac and 36/18 Vac.

5. 60 Hz LC-Type L-828 CCRs (4-10 kW/6.6 A): Required Equipment

Refer to Table 2-2 for required equipment that is supplied. Refer to Table 2-3 for required equipment that is not supplied. Refer to the Parts section for ordering information.

Table 2-2 Required Equipment Supplied

Description	Quantity
L-828 constant current regulator	1
Instruction manual	1 per order

Table 2-3 Required Equipment Not Supplied

Description	Quantity
Input power wire. Refer to Table 2-4.	As required
Remote control wire, AWG 19 minimum, AWG 12 maximum	As required
Ground wire, AWG 6 minimum	As required
Output load wire, AWG 8 minimum, 5000 Vac, L-824 type	As required
Shorting jumper wire, AWG 8 minimum	As required
Disconnect switch or main circuit breaker	1
Input lightning arrester. Refer to Table 2-5 for optional lightning arrestors. NOTE: Standard 2400 Vac customer-supplied lightning arrestors should be used external to CCR.	As required
Circuit breaker for input power lines. NOTE: The soft-start feature of this CCR eliminates the need for a special slow-trip circuit breaker on input power lines.	1
Screwdriver	1
Voltmeter, 600 Vdc full scale	1
Voltmeter, 60 Vdc full scale	1
Ammeter, true rms-reading, 10 A maximum scale	1
Ohmmeter	1
Mounting bolts, 1/2-16 x 1-1/2 in. long, 1/2 STD washers, and lockwashers	4

6. 60 Hz LC-Type L-828 CCRs (4-10 kW/6.6 A): Required Equipment *(contd.)*

NOTE: Table 2-4 refers to recommended input power supply wire, less than 100 feet, 90°C, 600 or 5000 V minimum. For 100 to 250 feet, use the next larger (even) gage wire.

Table 2-4 Recommended Input Wiring Rating

kW Rating	208 Vac	220 Vac	240 Vac	480 Vac
4 kW	AWG 12, 600 V	AWG 12, 600 V	AWG 12, 600 V	AWG 16, 600 V
7.5 kW	AWG 8, 600 V	AWG 8, 600 V	AWG 10, 600 V	AWG 14, 600 V
10 kW	AWG 6, 600 V	AWG 6, 600 V	AWG 6, 600 V	AWG 12, 600 V

Table 2-5 Optional Lightning Arrestors

Input Voltage	Lightning Arrestor Part Number
208/220/240 Vac	94B0011-2
480 Vac	94B0011-1

6. Input Power Breaker Sizing

It is recommended that the circuit breaker on the input power supply lines have a rating of 125% of the CCR's input current, as given in Table 2-5, unless local codes require a different rating technique. Refer to the CCR's nameplate for the kW rating and input voltage to determine the actual input current from Table 2-5. If no standard-size circuit breaker exists at the 125% value, use the next larger standard-size circuit breaker.

NOTE: The currents listed in Table 2-6 represent actual input currents assuming the worst case limits of AC 150/5345-10E for power factor, efficiency, and number of required lamps out.

Table 2-6 CCR Input Current

Rating	208 Vac	220 Vac	240 Vac	480 Vac
4 kVA	27 A	26 A	24 A	12 A
7.5 kVA	51 A	48 A	44 A	22 A
10 kVA	68 A	65 A	59 A	30 A

7. Specifications

This subsection provides specifications for L-828 CCR (4-10 kW/6.6 A).

Ratings

4, 7.5, 10 kW

Class

Class 1, 6.6 A (maximum output current)

Style

Refer to Table 2-7 for Style.

Table 2-7 Style

Class	Style	Brightness Steps	Nominal Output Power
1	1	3	4.8 A, 5.5 A, 6.6 A
1	2	5	2.8 A, 3.4 A, 4.1 A, 5.2 A, 6.6 A

Power Factor

Minimum power factor: 90%

Efficiency

Minimum efficiency: 90%

Reactive Loading

The CCR maintains the output current within the limits of Table 2-8 for all brightness steps when the load is connected via isolating transformers, and the secondaries of 50 percent of the transformers become open-circuited. The load before opening the isolation transformer secondaries may be any value from half to full load. For regulators less than 10 kW loaded as specified above, the current remains below 6.8 amperes for the 100 percent brightness step.

Table 2-8 Output Current

Class	Style	Step	Nominal Output	Allowable Range
1	1	B100	6.6 A	6.40-6.80 A*
		B30	5.5 A	5.33-5.67 A
		B10	4.8 A	4.66-4.94 A
1	2	B5	6.6 A	6.40-6.70 A
		B4	5.2 A	5.04-5.36 A
		B3	4.1 A	3.98-4.22 A
		B2	3.4 A	3.30-3.50 A
		B1	2.8 A	2.72-2.80 A

*For the 10 kW CCR only, the allowable range is 6.40 to 6.70 A.

Resistive Loading

The regulator maintains the output current within the limits of Table 2-8 while powering any load between no load (or short circuit) and full load. For regulators 10 kW or larger, the regulation is maintained over the full range of environmental conditions specified in this section and for the input voltages specified in Table 2-4. For regulators less than 10 kW, the regulation is provided at nominal input voltage for all brightness steps.

Regulation

Refer to Table 2-8 for output current limits. Current regulation is obtained under the conditions listed *in Environmental Operating Conditions*.

Environmental Operating Conditions

The L-828 CCRs (4-10 kW/6.6 A) are designed for indoor use only in an area with adequate ventilation for cooling the constant current regulator. The environmental operating conditions include temperature range, relative humidity, and altitude.

Temperature Range

Without monitoring circuitry: -40 to +55 °C (-40 to +131 °F)
With monitoring circuitry: 0 to +55 °C (-18 to +131 °F)

Relative Humidity

0 to 100% (noncondensing)

Altitude

Sea level to 6,600 ft (2000 m)

Protection Devices

L-828 CCRs have the following protection devices:

- Output open-circuit protection
- Output overcurrent protection
- Lightning arrestors on output terminals and bushings
- Fuse protection of remote control supply voltage (48 Vdc and 120 Vac), and power supply for printed circuit board
- Input breaker for supply voltage
- W VA (load wattage in excess of maximum available volt-amperes)

Open-Circuit Protection

The regulator includes an open-circuit protective device to open the primary switch within 2 seconds after an open circuit occurs in the secondary. The device resets within 2 seconds after the control switch is turned off and re-energized, and cannot be tripped by switching the load circuits or other transients.

Overcurrent Protection

10kW regulators include an overcurrent protective device that opens the primary switch when the output current exceeds the 100 percent current (6.6 A) by 5 percent. The device operates within 5 seconds after an overcurrent of 5 percent and within 1 second after an overcurrent of 25 percent. The device resets within 2 seconds after the control switch is turned off and re-energized. The overcurrent protection cannot be activated by a momentary (0.25 second) overcurrent caused by switching the load circuits and other transients.

Maximum Safe Overload

Maximum safe overload is 8.5%. Refer to Table 2-9.

Table 2-9 Maximum Safe Overloads

Rating	Safe Overload
4 kW	4340 W
7.5 kW	8137 W
10 kW	10,850 W

Input Voltages

The standard power transformer for the L-828 regulators is designed for an input voltages of 208, 220, 240, or 480 Vac. The 240 Vac has a field-adjustable tap. See the name plate on the regulator for the input voltage rating.

Input voltage is single phase 60 Hz ac. The regulator is designed to withstand momentary voltages up to 120 percent of nominal input voltage without shutting off or being damaged by such overvoltage so long as the duration of overvoltage excursions are not longer than 50 milliseconds and do not occur more than once per minute.

Built-In True RMS-Reading Ammeter

A flush-mounted true rms-reading ammeter mounted on the front of the input module PCB indicates the output current. The meter accuracy is +3.0 percent of the maximum output current.

Input Wire Size

Refer to Table 2-4.

Temperature Rise

The temperature rise of the transforming portion of the regulator is in accordance with ANSI C57.12.91 for air-cooled regulators.

Weight

Refer to Table 2-10.

Table 2-10 Weight

CCR	lb (kg)
4 kW	229 (103.9)
7.5 kW	298 (135.2)
10 kW	341 (154.7)

CCR Dimensions

See Figure 2-3. CCR dimensions are 31 in. (788 mm) (Height) x 28 in. (711 mm) (Width) x 28 in. (711 mm) (Depth)

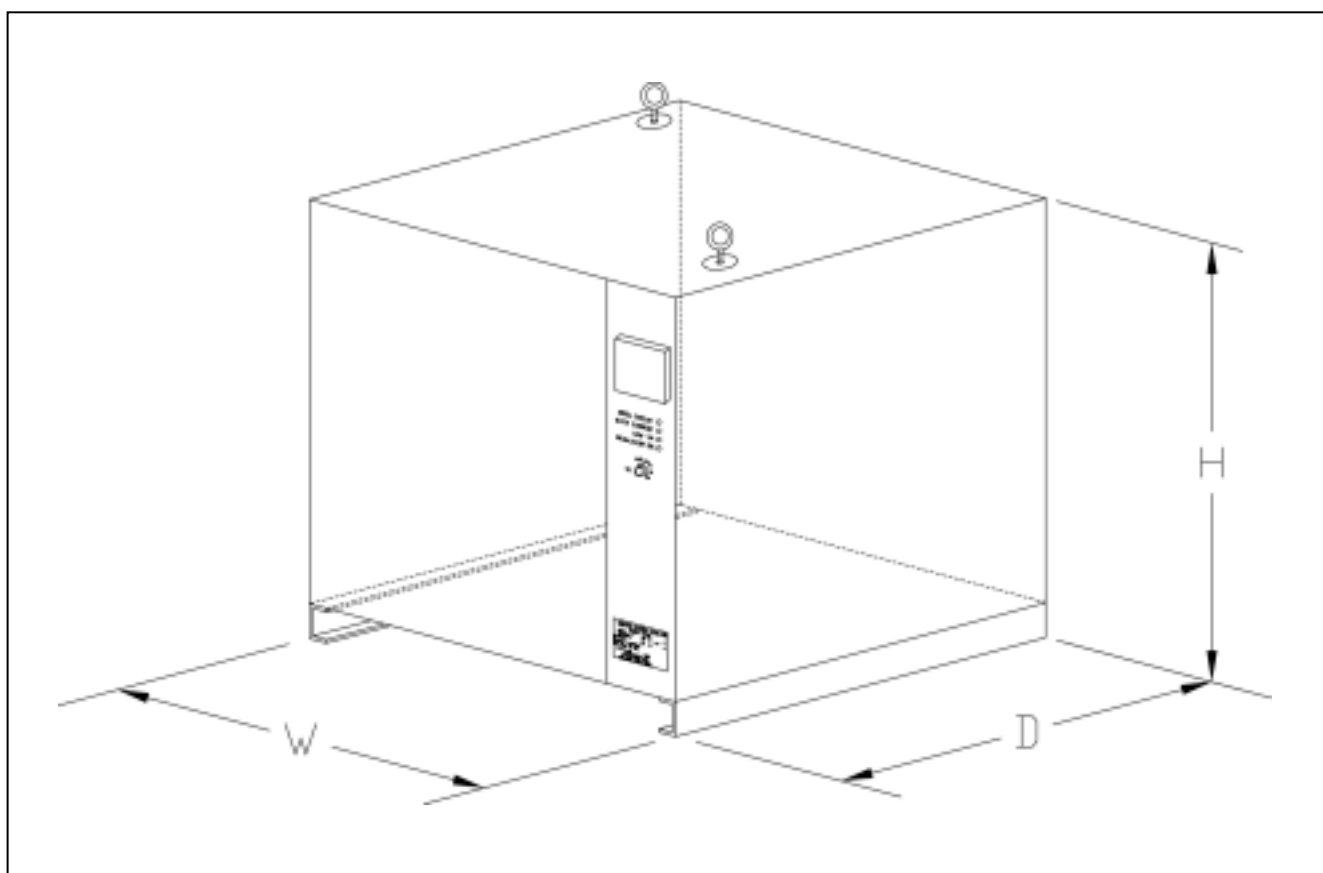


Figure 2-3 LC-Type L-828 CCR Cabinet Dimensions

Section 3

Installation



WARNING: Allow only qualified personnel to perform the following tasks. Observe and follow the safety instructions in this document and all other related documentation.



WARNING: URC PCB is static-sensitive. Must be grounded when handling PCB.

1. Introduction

This section provides instructions for installing L-828 constant current regulators (CCRs) (4-10 kW/6.6 A). Refer to the airport project plans and specifications for the specific installation instructions.

2. Unpacking

The equipment is shipped ready for installation. Handle equipment very carefully to prevent component damage. Unpack the carton upon receipt and check the contents and their condition. Note any exterior damage to the carton that might lead to detection of equipment damage.

If you note any damage to any equipment, file a claim with the carrier immediately. The carrier may need to inspect the equipment.

NOTE: Take care to maintain the unit in an upright position when handling the regulator.

3. Installation

This section describes installation procedures. It includes information for lifting, mounting, and wiring and starting up the CCR. It also provides procedures for adjusting the output current and overcurrent.

Lifting CCR

Lift the regulator using a forklift or a portable hoist through the four 3/4-inch ID eyebolts on top of the cabinet. Place the regulator inside a well ventilated room with sufficient clearance for personnel to inspect and maintain the unit.

Mounting CCR

The L-828 CCR may be mounted on the floor or on a rack or shelf.

Floor Mounting

The regulator can be placed directly on the floor without the use of bolts. However, if the regulator must be bolted to the floor, the contractor should drill holes in the bottom 2 channels and use bolts and lead molies to secure the regulator to the floor.

Rack Mounting

This subsection provides recommendations for optional racking mounting. Follow the guidelines below when rack mounting the LC-type CCR.

- See Figures 3-1 and 3-2. Refer to Table 3-1 for rack/shelf mounting hardware.
- See Figure 3-1. Keep a minimum of 36 inches (914.4 mm) between shelves.
- Refer to CCR Dimensions in the *Description* section for mounting dimensions.

Table 3-1 Rack/Shelf Mounting Hardware

Item	Description	Quantity	Manufacturer Part Number
1	Channel 1, 1-5/8 x 1-5/8 inches	2/blank	UNISTRUT #P1000
2	Shelf support bracket	2	UNISTRUT #P2543
3	Hex head cap screw, 1/2 x 1-3/16 inches	8	UNISTRUT #HHCS050119EG
4	Nut with spring	8	UNISTRUT #P1010

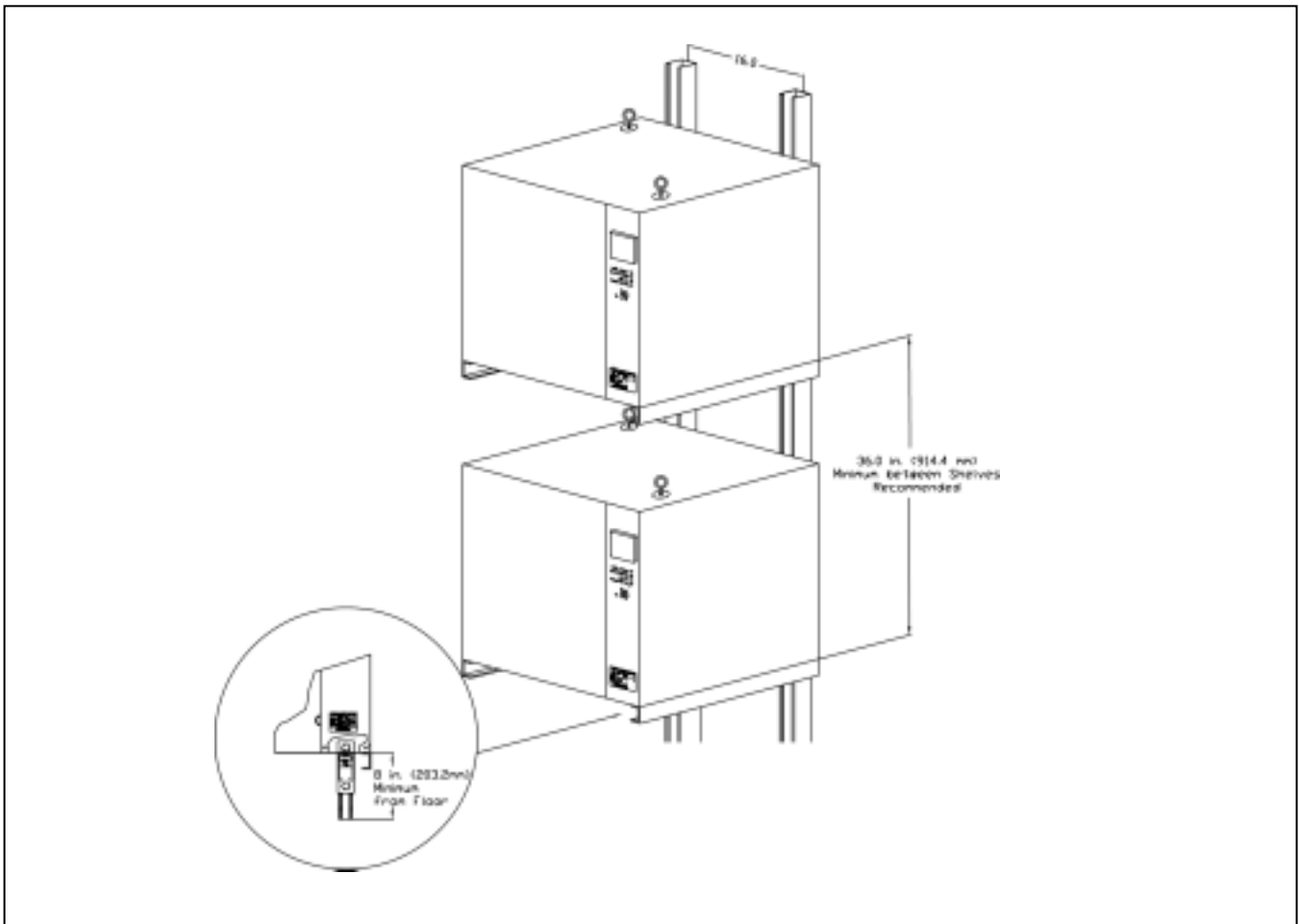


Figure 3-1 Rack Mount Installation

Rack Mounting (contd.)

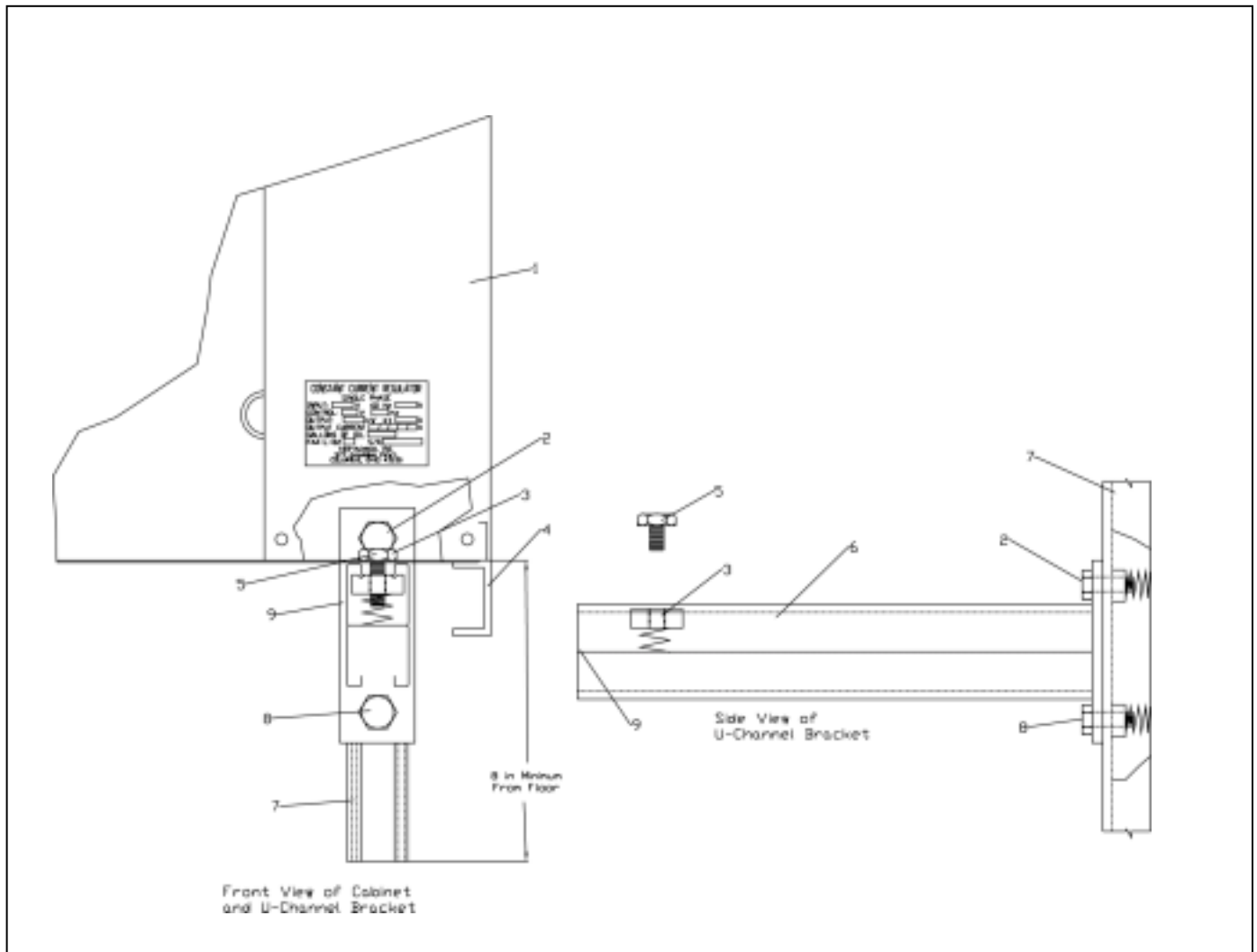


Figure 3-2 Rack Mount Hardware Details

- | | | |
|-----------------------|----------------------|-------------------------------|
| 1. Front of Cabinet | 4. Side Rail | 7. Back Rail |
| 2. Top Back Rail Bolt | 5. U-Channel Bolt | 8. Bottom Back Rail Bolt |
| 3. Nut with Spring | 6. U-Channel Bracket | 9. Front of U-Channel Bracket |

Wiring Connections and Startup



WARNING: Installation and operation of the CCR should be performed by personnel qualified to work on high voltage equipment. The high voltage involved with the unit makes it potentially dangerous and may be lethal if contacted by operating personnel.

The regulator is delivered ready to operate when properly connected and should not require any electrical adjustments. The contractor responsible for installation will be required to supply items such as necessary wire, conduit, connectors, and mounting hardware.

Wiring Connections and Startup *(contd.)*

To install wiring, perform the following procedure:

1. Install all input and output cables. See Figure 3-3 for cable location, Figures 3-4 and 3-5 for Remote control wiring, Figure 3-6 for input/output wiring, and Figure 2-4 in the *Description* section for the internal parts of the CCR.

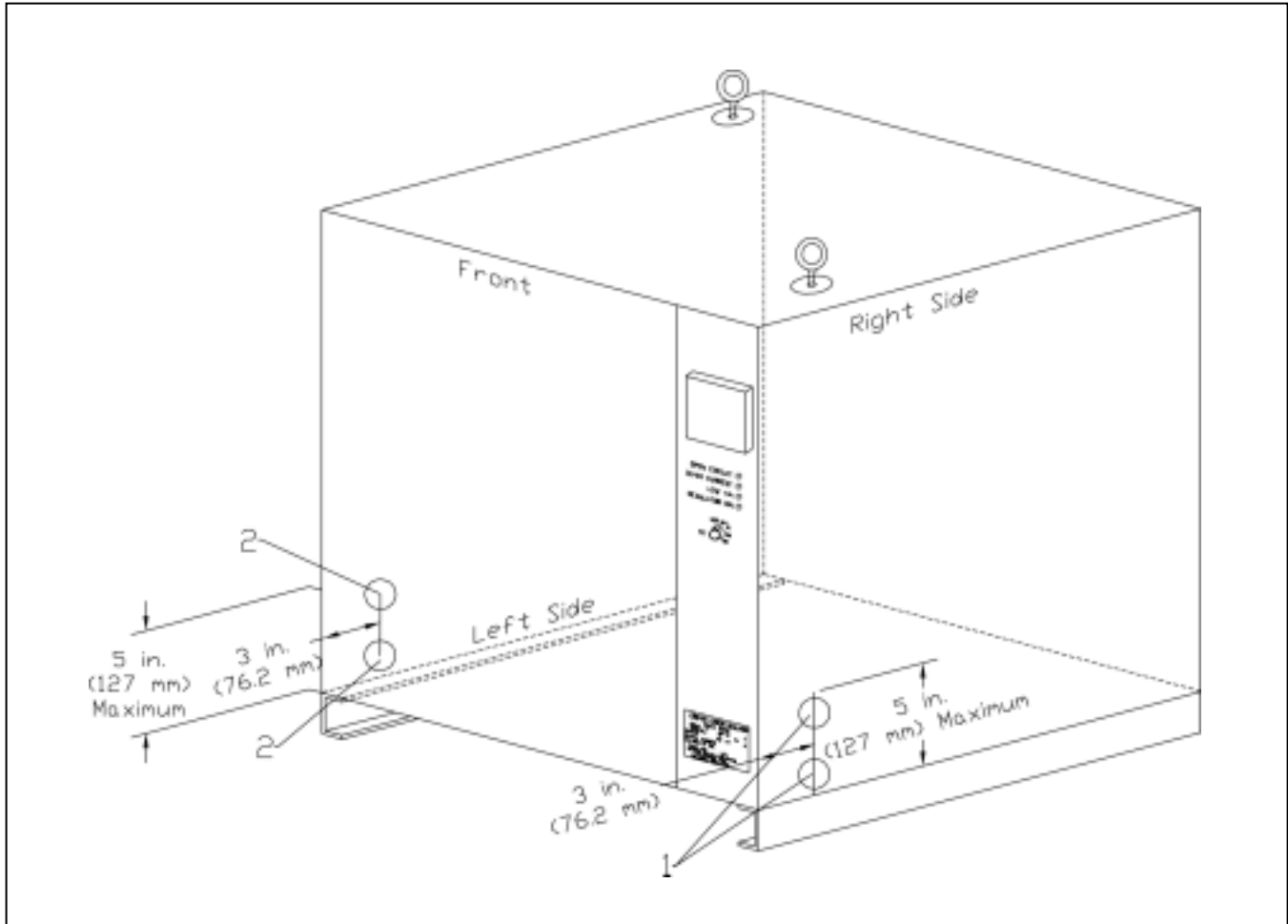


Figure 3-3 Location for Cables

1. Suggested Center for Load Cable (Conduit Cutout Center on 1.5-Inch Radius of Clearance)
2. Suggested Center for Radio Cable (Conduit Cutout Center on 1.5-Inch Radius of Clearance)

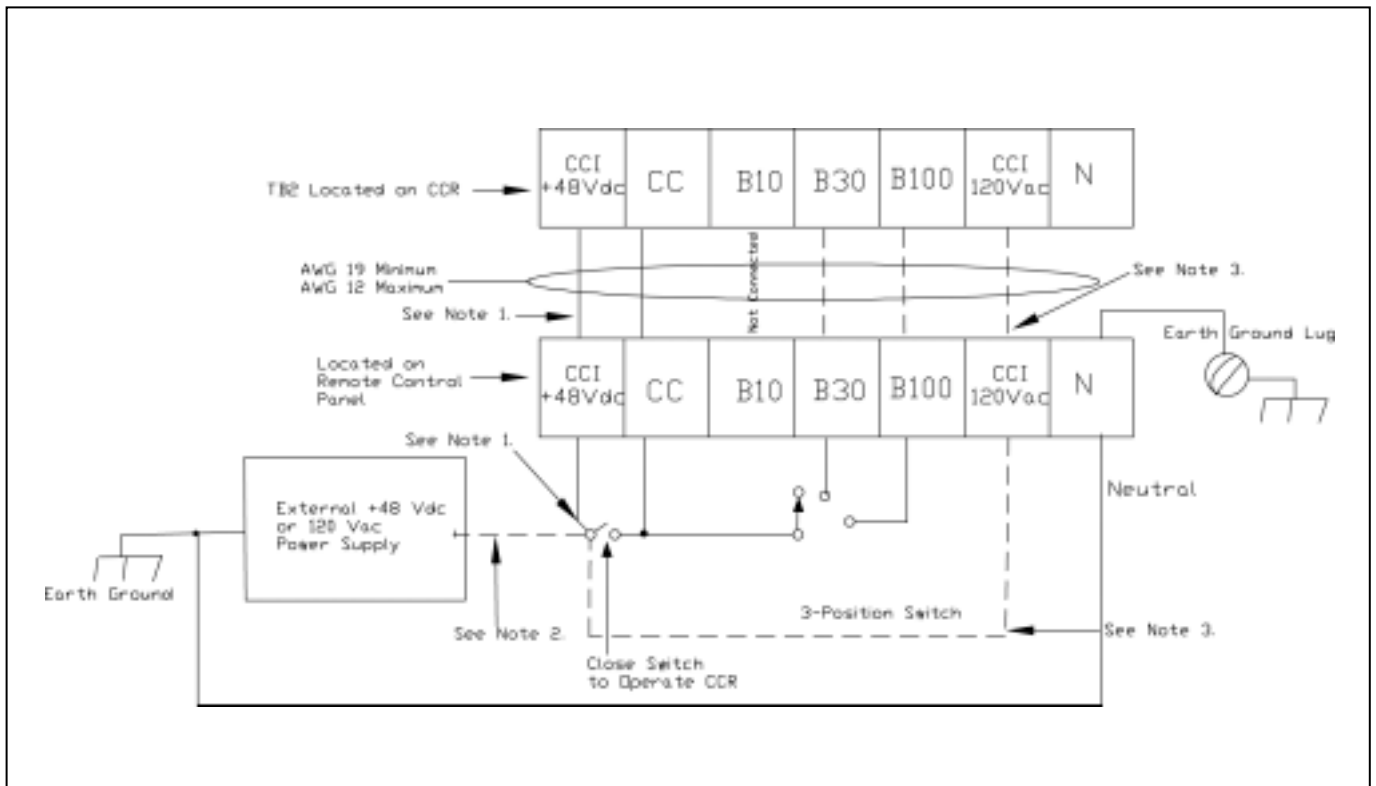


Figure 3-4 Remote Control Wiring (3-Step)

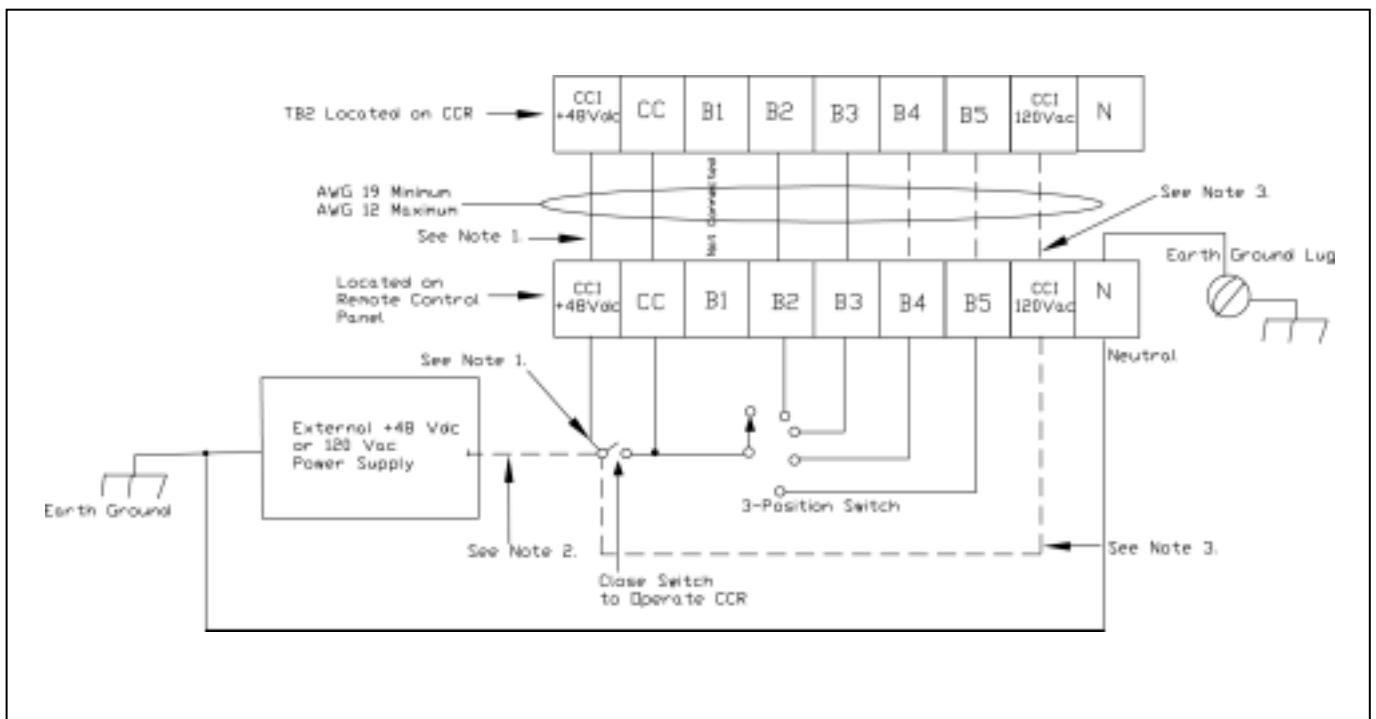


Figure 3-5 Remote Control Wiring (5-Step)

Wiring Connections and Startup *(contd.)*

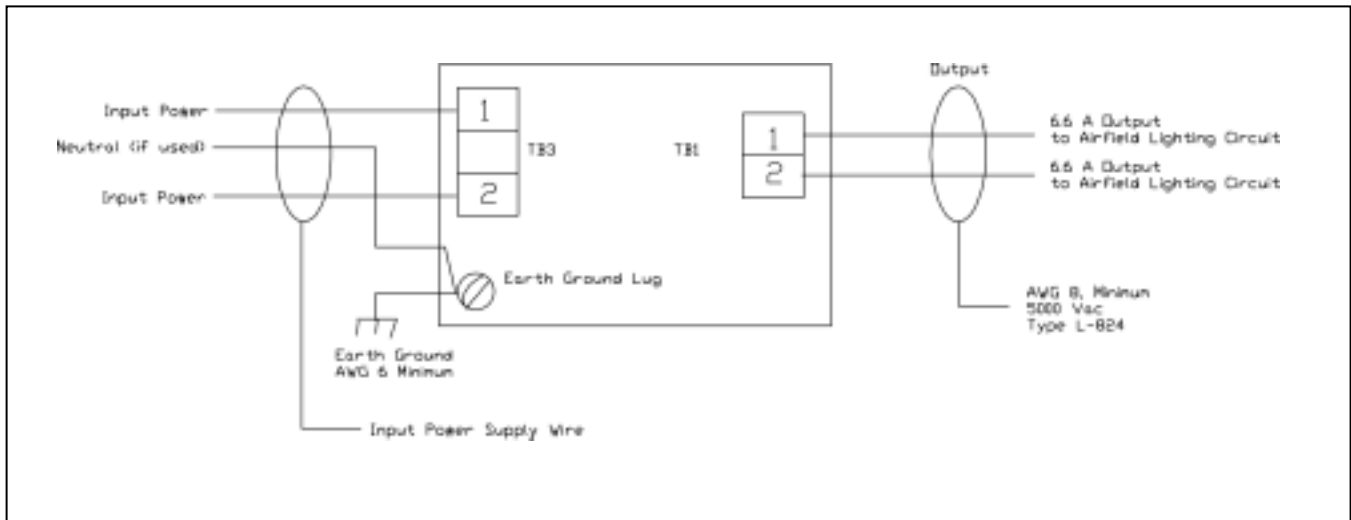


Figure 3-6 Input/Output Wiring

2. See Figure 2-4. Verify that the input supply voltage corresponds to the voltage rating on the name plate (8) of the regulator.
3. Make sure the rotary switch S1 (6) on the front panel is set to the OFF position.
4. Ground the regulator by making an adequate ground wire (AWG 6 or larger) connection to the earth ground lug (9) on the regulator.

NOTE: An appropriate disconnect-type fuse cutout or circuit breaker shall be provided for the input power supply lines. For installations requiring load switching during regulator operation, the regulator may be connected to an L-847 circuit selector switch.

NOTE: Do not use the LC-Type CCR to power an L-849 REIL system unless the CCR is at least half loaded with steady burning lights.

Wiring Connections and Startup *(contd.)*

- Refer to Table 2-5. Install appropriate external lightning arrestors on the input power supply lines as close as possible to the CCR's input terminal block TB3 (12).

NOTE: If optional lightning arrestors are ordered with the regulator, they are factory-installed.

NOTE: Since lightning is a phenomenon that varies in intensity and frequency with geographical locations, it is recommended that each installation evaluate the need for additional lightning protection.

- Short-circuit the output terminals on TB1 (10) using AWG 10 (minimum) wire.
- Refer to Table 2-4. Connect the voltage supply lines from the disconnect switch or main circuit breaker to the CCR input terminal block TB3 (11). Tighten all connections.

NOTE: Do not route the output cable in the vicinity of other wiring sensitive to EMI or RFI.

- Energize the regulator by engaging the main circuit breaker or disconnect switch. Turn the regulator's circuit breaker CB1 (7) to the on position, and turn rotary selector switch S1 (6) to all brightness steps. Verify current values on the panel ammeter (1) correspond to those in Table 2-8.
- De-energize regulator by disengaging the main circuit breaker or disconnect switch. Turn the rotary switch S1 to the OFF position.
- Connect the remote control lines, if required, to remote control terminal block TB2 (11). All CCRs use AWG 19, 300 V or larger control wire size. See Figures 3-4 and 3-5 for remote control connections.

NOTE: Tables 3-2 through 3-4 give the necessary connections for remote control. Terminal B1 (or B10) does not need to be wired. Brightness step B1 (or B10) occurs when the regulator is switched on.

Table 3-2 Remote Control Connections

Terminal Block TB2 Label	Function
N	Remote control common
CCI	Remote control power
CC	Remote on-command voltage
B10, B30, B100	Brightness control (3-step CCR)
B1, B2, B3, B4, B5	Brightness control (5-step CCR)

Wiring Connections and Startup *(contd.)*

Table 3-3 Remote 120 Vac Control Connections (3-Step)

If you use 3-Step CCR Remote Intensity Step...	Connect CCI to...
High (6.6 A)	CC, B100
Medium (5.5 A)	CC, B30
Low (4.8 A)	CC, B10
Off	Not applicable

Table 3-4 Remote 120 Vac Control Connections (5-Step)

If you use 5-Step CCR Remote Intensity Step...	Connect CCI to...
6.6 A	CC, B5
5.2 A	CC, B4
4.1 A	CC, B3
3.4 A	CC, B2
2.8 A	CC, B1
Off	No connection

11. Make sure efficiency-adjustment wire #200 on TB6 is set to terminal 1 for full output load or terminal 2 when the load on the output is up to ½ the rated load.
12. Make sure all wiring connections are tight and no wires are shorting across each other.



CAUTION: Incorrect wiring can damage the regulator. Double check all connections.

13. See Figure 2-4. Energize the regulator and set circuit breaker CB1 (7) to the ON position. Set rotary switch S1 (6) to the REM position and operate the CCR by remote control. Verify correct current levels are obtained on all brightness steps.
14. Turn rotary switch S1 to OFF and de-energize regulator by disengaging disconnect switch or main circuit breaker.

Wiring Connections and Startup *(contd.)*

16. Connect the 6.6 A series lighting circuit to the output terminals and tighten all connections.

NOTE: Do not route output cable in the vicinity of other wiring sensitive to EMI or RFI.

17. Check if the input current x input voltage x CCR efficiency (CCR efficiency = .90) is larger than the kilowatt rating on the CCR nameplate. If it is, either reduce the load or replace the CCR with one having a larger kilowatt rating.

18. Check current output on the regulator in all steps in both remote and local control.

NOTE: The regulator has been preset at the factory to the calibrated values given in ? If the regulator is not providing the correct current, it will have to be calibrated as given in *Calibrating Regulator* in this section.

Calibrating Regulator

This subsection describes how to calibrate the L-828 LC-type CCRs.

Introduction

A separate true-rms-reading ammeter (minimum accuracy of 1%, such as a Fluke Meter and Ammeter Probe multimeter with model Fluke Y8101A Current Probe current clamp or equivalent true RMS reading meter) is required to carry out the calibration of the regulator. Do not use the ammeter on the front panel of the regulator.



CAUTION: If the meter does not say "True RMS," it must not be used. Failure to observe may result in equipment damage.

Calibrating the regulator consists of performing the procedures below in the order given.

1. Setting up the regulator
2. Adjusting output current
3. Adjusting overcurrent
4. Changing input voltage
5. Adjusting current sensing relay

Setting Up Regulator for Calibration

To set up the regulator for calibration, perform the following procedure:

1. See Figure 2-4. Check to make sure the proper input voltage is supplied to the CCR at terminal block TB3 (12).
2. Make sure the transformer output connections are at the 100% tap (terminals 1 and 6).
3. See Figure 3-1. On the output terminals, connect a true rms-reading ammeter, such as a Bechman *Tech 360* multimeter, and a lamp load equal to one-half of the CCR's rated load. If the load is greater than one-half of the CCR's rated load, short output varistors RV2 (10) to RV3 (9).
4. See Figure 2-4. Set CCR's local control switch S1 (6) to the highest intensity step (S1 position fully clockwise), 5 for 5-step CCR or 100 for a 3-step CCR.
5. See Figure 3-1. Turn the overcurrent-adjustment potentiometer R48 (8) on the control PCB fully counterclockwise.
6. See Figure 2-4. Turn on the CCR. Observe normal operation for a minimum of 2 minutes during which time the output should not vary and only the green LED marked REGULATOR ON (5) should be lit. No red alarm LEDs should be lit.

Adjusting Output Current

To adjust the output current, perform the following procedure:

1. See Figure 2-4. Turn on the CCR and set local control switch S1 (6) to the highest intensity step, 5 for 5-step CCR or 100 for a 3-step CCR.

NOTE: See Figure 3-1. The external true-rms ammeter (1) should read 6.60 ± 0.1 amps. If the reading is outside of this range, adjust potentiometer R47 (7) on the Control PCB to obtain 6.60 amps.

NOTE: Potentiometer R47 is the master reference adjustment. Changing this potentiometer changes the adjustment of potentiometers R48 (8), R46 (6), R45 (5), R44 (4), and R43 (3).

Adjusting Output Current *(contd.)*

- See Figure 2-4. Set switch S1 to next to the lowest brightness step, and verify that the true-rms ammeter reading corresponds to Tables 3-5 and 3-6. If the reading is not in the current value range given in Tables 3-5 and 3-6, adjust the appropriate potentiometer listed in the table until the correct current value is obtained.

Table 3-5 Setting 3-Step Output Current Levels

CCR S1 Position	Ammeter Reading	Potentiometer
30	5.50	R46
10	4.80	R45

Table 3-6 Setting 5-Step Output Current Levels

CCR S1 Position	Ammeter Reading	Potentiometer
4	5.20	R46
3	4.10	R45
2	3.40	R44
1	2.80	R43

- Repeat Step 2 for the remaining lower brightness step(s).

NOTE: See Figure 3-1. Potentiometers R43 (3), R44 (4), R45 (5), R46 (6) have independent circuits, so any adjustments made on these potentiometers will not effect the adjustment of the other three potentiometers.

- When the output current adjustment has been completed, turn off the CCR. Remove shorting cable on output varistors, if used.

NOTE: Potentiometers R44 (4) and R43 (3) are used only on 5-step CCRs. R44 and 43 have no function on a 3-step CCR.

Adjusting Overcurrent

Before adjusting the overcurrent, set up the regulator and adjust the output current.

To adjust the overcurrent, perform the following procedure:

- See Figure 3-7. With power off, connect a test lead across TP7 (1) and TP9 (2) on the Control PCB. This will move the trip level for the overcurrent detection threshold from the normal operating point of 6.93 amps to 6.6 amps.

Adjusting Overcurrent *(contd.)*

2. See Figure 2-4. Turn switch S1 (6) to the highest brightness step, 5 for 5-step CCR or 100 for a 3-step CCR. Ammeter should read 6.6 amps.

NOTE: See Figure 3-7. Do not change the adjustment of R47 (7), since this not only will affect the output current of the CCR but the potentiometer adjustment levels for all other current levels.

3. Physically center the overcurrent potentiometer R48 (Figure 3-7, Item 8). While viewing the red overcurrent LED (Figure 2-4, Item 3) on the control panel, slowly turn R48 clockwise until the LED begins to glow. Then quickly turn control switch S1 (Figure 2-4, Item 6) to the next lower intensity step. This will turn the LED off because the current level is less.

NOTE: If the potentiometer R48 is turned too far, the CCR will shut down. If this should occur, return potentiometer R48 to the centered position and reset the CCR by momentarily turning off the CCR off and then back on.

4. While watching the overcurrent LED, return S1 to the highest intensity step, and time how long it takes for the overcurrent LED indicator to start to glow. It should take 3 ± 1 seconds.

NOTE: If the LED comes on in less than 2 seconds, turn potentiometer R48 a slightly counterclockwise. If more than 4 seconds are required for the LED to light, turn R48 slightly clockwise. Repeat Step 4 until the correct time period (3 ± 1 seconds) is obtained.

5. See Figure 3-7. Turn off the CCR and remove test leads from TP7 (1) and TP9 (2). The trip level for the overcurrent threshold is now calibrated for 6.93 amps.

Section 4

Operation



WARNING: Contents are static-sensitive. Must be grounded when handling PCB.

1. Introduction

This section provides the operational procedures for the L-828 style constant current regulators (CCRs) listed below.

- Local control procedures
- Remote control procedures
- Shutdown procedures



WARNING: When installing and servicing the L-828 CCR, do not rely on circuit breaker CB1 for safety. When CB1 is turned off, the line voltage is still present on the input terminals and on the CB1 terminals. Always remove power to the regulator using the external circuit breaker or disconnect the switch before installing or servicing the regulator.

2. Local Control

This subsection describes local control operations.

See Figure 2-4 in the *Description* section. Refer to Tables 4-1 and 4-2. The rotary switch for the 3-step CCR has five positions; the rotary switch for the 5-step has seven positions. The rotary switch S1 (6) on the front panel is used for local control of the regulator.

Table 4-1 Rotary Switch S1 Position for 3-Step CCRs

If you set switch S1 to the following...	The result is...
REM	Operation of CCR by remote control signals.
OFF	CCR off. Cannot turn on by remote control.
10	4.8 A current output.
30	5.5 A current output.
100	6.6 A current output.

2. Local Control Procedures (contd.)

Table 4-2 Rotary Switch S1 Position for 5-Step CCRs

If you set switch S1 to the following...	The result is...
REM	Operation of CCR by remote control signals.
OFF	CCR off. Cannot turn on by remote control.
1	2.8 A current output.
2	3.4 A current output.
3	4.1 A current output.
4	5.2 A current output
5	6.6 A current output

For regulator operation by +48 Vdc or 120 Vac remote control signals, rotary switch S1 must be set to REM. Remote control is disengaged when switch S1 is set to any position other than REM.

3. Remote Control

See Figure 2-4. Refer to Table 4-3 for setting up remote control.

Table 4-3 Setting Up Remote Control

If...	Then...
The rotary switch S1 is set to position REM and remote control wiring is connected to remote control terminal block TB2 on the regulator	The output current of the regulator will correspond to the brightness setting energized by remote 120 Vac or +48 Vdc control signals.
Switch S1 is set to OFF	Remote control signals will not operate the regulator, that is, turn the regulator on to a particular brightness setting or turn the regulator off.
Switch S1 is set to REM	Remote control of the regulator is possible.
No remote control connections exist on terminal block TB2, that is, switch S1 is set to REM	The position REM becomes an additional OFF position, that is, the regulator is de-energized.
More than one remote intensity is accidentally selected	The highest intensity will be selected.

4. Shutdown Procedure

To shut down the CCR, perform the following procedure:

1. See Figure 2-4. Set rotary switch S1 (6) to position OFF.

NOTE: Power to the output terminals (10) is now off, and the regulator cannot be energized by remote control signals. Power is still present on the input power terminal TB3 (12).

2. Disengage disconnect switch or external circuit breaker to remove input power.

Section 5

Maintenance



WARNING: Only personnel authorized to work on high-voltage equipment should perform maintenance on the regulator.



WARNING: Operate regulator under local control (using rotary switch) when performing maintenance tasks on the regulator. This will prevent the regulator from accidentally being turned on and causing serious injury or death. De-energize regulator by turning rotary switch to OFF, and remove input power to regulator by turning off disconnect switch or main circuit breaker before opening access door to service regulator.



WARNING: Always de-energize the regulator by turning rotary switch S1 to OFF, and remove input power to the regulator by turning off the disconnect switch or main circuit breaker before opening the access door to the service regulator.

1. Introduction

This section provides preventive maintenance for L-828 constant current regulators (CCRs) (4-10 kW/6.6 A).

2. Maintenance Schedule

To keep the L-828 CCRs operating efficiently, follow a preventive maintenance schedule. Refer to Table 5-1.

Table 5-1 L-828 CCR (4-10 kW/6.6 A) Maintenance

Interval	Maintenance Task	Action
Daily	Check all control equipment for proper operation.	Check local and remote control (if used) on each brightness step.
Monthly	Check input voltage. Check and record output current on each brightness step.	If input voltage is not within -5% to +10% of the nominal value specified on the nameplate of the regulator, notify power company to correct voltage. Use a true rms-reading instrument. Adjust current levels if out of tolerance. Refer to <i>Adjustment Procedures</i> in the <i>Operation</i> section. Refer to Table 2-10 for the current range for the 3-Step and 5-Step CCRs.
Annually	Check relays, wiring and insulation. Inspect housing for rust spots. Inspect lightning arrestor connections. Perform a short-circuit test. Perform an open-circuit test.	Clean dirty or slightly pitted contactor contacts. Use a fine file for surface cleaning. Replace contacts that are excessively burned or pitted. Operate the local control switch to check for proper operation of relays and contactors. Make sure input and output connections are tight and that no damaged wires or damaged insulation exists. Clean and touch-up rust spots with paint. Tighten any loose connections. Replace charred or burnt wiring or broken arrestors. Refer to <i>Short-Circuit Test</i> in this section. Refer to <i>Open-Circuit Test</i> in this section.
Unscheduled	Check load on regulator.	At installation and subsequent load changes make sure that the output rms voltage times the output true rms current does not exceed the rated load on the name plate of the regulator.

2. Maintenance Schedule

(contd.)

Short-Circuit Test



WARNING: Since high open-circuit voltages may result by opening the primary of a series lighting circuit, only personnel authorized to work on high-voltage equipment should be allowed to perform the short-circuit test.

To perform the short-circuit test, perform the following procedure:

1. Remove input power to the regulator (turn off disconnect switch or main circuit breaker) and turn the rotary switch to OFF.
2. Remove leads from output terminals and bushings. Use AWG 8 or larger wire to short output bushings.
3. Energize the regulator and turn the rotary selector switch to the lowest brightness step (B1 for 5-Step, B10 for 3-Step) and then to the remaining brightness steps. Check the output current on the ammeter at each step.

NOTE: The output current should be within the tolerance given in Table 2-8. The panel meter is intended to indicate function. Any calibrations should be performed with a calibrated true RMS current meter.

4. If the output current is not within the limits specified in Table 2-7, check the input voltage to the regulator. The supply voltage should be within -5% to $+10\%$ of the nominal input voltage given on the regulator nameplate. Refer to *Adjustment Procedures* in the *Operation* section.
5. Turn off disconnect switch or main circuit breaker to remove input power to regulator.
6. Disconnect the shorting jumper and reconnect output cables.
7. Close input-power disconnect switch or main circuit breaker.

Open-Circuit Test



WARNING: Since high open-circuit voltages may result by opening the primary of a series lighting circuit, only personnel authorized to work on high-voltage equipment should be allowed to perform the open-circuit test.

To perform the open-circuit test, perform the following procedure:

1. Remove input power to regulator (turn off disconnect switch or main circuit breaker) and turn the rotary switch to OFF.
2. Disconnect cables from the output terminals and bushings.

Open-Circuit Test *(contd.)*

3. Turn on input power to the regulator.
4. Turn the rotary switch to the lowest brightness position (B1 for 5-Step, B10 for 3-Step). The open-circuit protective device should automatically de-energize the regulator in less than 2 seconds.
5. Turn the rotary switch to OFF. The open-circuit protective device should reset.
6. Turn the rotary switch to position 1. The regulator should turn on and then de-energize in less than 2 seconds.
7. If regulator operation is satisfactory, turn rotary switch to OFF, and turn off disconnect switch or main circuit breaker before reconnecting the load.
8. After the load has been reconnected, turn on input power to the regulator.

Section 6

Troubleshooting



WARNING: Allow only qualified personnel to perform the following tasks. Observe and follow the safety instructions in this document and all other related documentation.



WARNING: De-energize regulator by turning rotary switch S1 to OFF, and remove input power to regulator by turning off disconnect switch or main circuit breaker. Discharge capacitors and ground output terminals bushings by using a grounding rod prior to touching any parts.



WARNING: If the regulator de-energizes, the output circuit could be interrupted by an overcurrent, open-circuit, or undervoltage condition. Before inspecting the output circuit, place rotary selector switch S1 in the OFF position and turn off disconnect switch or main circuit breaker. Without this precaution, a dip in the power line may reset the regulator and turn it on, resulting in an output voltage of thousands of volts which can cause serious injury or death.



CONTENTS
STATIC-SENSITIVE
MUST BE GROUNDED
WHEN HANDLING PCB

WARNING: Contents are static-sensitive. Must be grounded when handling PCB.



CAUTION: Short the output terminals before switching the regulator on. The wire should be AWG 8 or larger.

1. Introduction

This section provides a preliminary troubleshooting check list and troubleshooting procedures for the LC-Type L-828 CCR (4-10 kW/ 6.6 A).

2. Preliminary Troubleshooting

The following is a check list of initial steps to perform.

- Check all LED indicators, fuses and circuit breakers. Refer to Table 6-1.
- Visually examine all areas of the CCR. Do burnt or loose connections/parts exist?
- Is the input voltage present and within +10 to -5% of nominal?
- Check all the fuses.
- Are the wire harness connectors to the control board fully seated?
- Have the PCBs been adjusted in accordance with the instruction manual?
- If the CCR works in local but not Remote, check the voltage on the Remote control lines.
- Can the CCR be re-energized by turning the rotary switch from OFF to Step B1 (B10)?
- Short the output of the CCR with an AWG 8 wire, and turn on the CCR. If the regulator operates normally, the problem is probably load related.
- If the CCR turns on and then shuts off after a few seconds and the ammeter has a high current reading, the problem is overcurrent. Adjust the output current accordingly. If the output current is not adjustable, replace the control board restart the regulator.
- If the CCR still fails in overcurrent, replace the SCR and restart.

Table 6-1 Fuses and Circuit Breaker

Circuit Breaker/Fuses	Description	Function
Circuit Breaker CB1		Protects K1 (contacts), SCR1, L1, L2, and main transformer T1
Fuse F1, F2	1 A, Slo-Blo for 480 V CCRs 2 A, Slo-Blo for 208, 220, & 240 V CCRs	Protects transformers T3 and T4, contactor K1 (coil), triac Q21 and DC power supplies on Control PCB
Fuse F3	¼ A, 250 V, Slo-Blo	Protects internal 120 Vac CCI source and transformer T6
Fuse F4	¼ A, 250 V, Slo-Blo	Protects the internal +48 Vdc (on Control PCB) CCI source circuitry on the Control PCB

4. General Troubleshooting Procedures *(contd.)*

Problem	Possible Cause	Corrective Action
3. Regulator repeatedly trips circuit breaker CB1 on Start-up.	Feedback transformer T2 or main transformer T1 failed	Turn control switch S1 to the OFF position. Reset circuit breaker CB1. While observing the CCR's output ammeter, turn on the CCR. If the meter moves, go to the corrective action below. If the meter does not move, replace feedback transformer T2 or main transformer T1.
	SCR1 shorted	With CB1 and control switch S1 off, remove connector J4 by pulling it from the PC board. Then turn on the circuit breaker CB1 and control switch S1. If circuit breaker CB1 still trips, replace SCR1.
	Control PCB failed	Replace Control PCB.
4. Regulator shuts down from overcurrent protection (red LED lit)	Faulty overcurrent protection	Test the operation of the overcurrent protection (red LED on). With the CCR off, connect a jumper across TP7 to TP9 (see Figure 8-1). Turn on the CCR to an output of 6.6 A, and time how long it takes for the overcurrent protection to shut off the CCR. Green REGULATOR ON LED will turn off when the overcurrent circuitry operates. The time period will be 20 ± 10 seconds from proper operation. If the time period is less than 10 seconds or more than 30 seconds, the CCR may be improperly calibrated.
	CCR not properly calibrated	With CB1 and control switch S1 off, remove connector J4 by pulling it from the Control PC board. Then turn on circuit breaker CB1 and then control switch S1.
	SCR1 fails	Replace SCR1. NOTE: SCR1 may have failed if overcurrent indicator (red LED) does not light.
	Control PCB or SCR1 fails.	Replace SCR1 or Control PCB. NOTE: SCR1 or Control PCB may have failed if overcurrent indicator (red LED) lights.

Continued on next page

4. General Troubleshooting Procedures *(contd.)*

Problem	Possible Cause	Corrective Action
5. Regulator shuts down from open-circuit protection (red LED lit)	Open-circuit protection fails	Test the load for open-circuit condition. Then short the CCR's output TB1 and check for normal operation. Refer to calibration instructions in <i>Calibrating Regulators</i> in the <i>Installation</i> section. Repair lighting loop.
	Contactor K1 defective	Inspect contacts of contactor K1. Replace contactor K1, if necessary.
	Transformer T5 or R5 (on panel) defective	Inspect T5 or R5. Replace, if necessary.
	Contactor K1 coil fails	Turn the CCR on and off repeatedly. If green LED indicator for REGULATOR ON lights but contactor K1 does not click on, replace contactor K1.
	Control PCB failed	If turning CCR on and off does not light REGULATOR ON LED, then replace Control PCB.
6. Incorrect CCR output current	CCR not properly calibrated	Refer to <i>calibration instructions in Calibrating Regulators in the Installation</i> section.
	Control PCB failed	Replace Control PCB if CCR does not calibrate properly.
7. W VA-Indicator red LED light lit	Too many burned out lamps in lighting loop	Replace burned out lamps.
	Load demand greater than 4% over – 5% input voltage on a 4 kW or 7.5 or 10 kW CCR	Reduce load or obtain a CCR with a higher kW rating.
	Half-power tap was selected on TB6 terminal 2, and load demand requires more than ½ of the CCR's rated output power	Move wire #200 from TB6 terminal 2 to TB6 terminal 1.
	Input voltage low for the required voltage, as selected on CCR's TB5	Provide required voltage to CCR.
	NOTE: Measure voltage at the input of CCR TB3 with the CCR in operation.	
Continued on next page		

4. General Troubleshooting Procedures *(contd.)*

Problem	Possible Cause	Corrective Action
7. W VA-Indicator red LED light lit <i>(contd.)</i>	CCR's output current not properly calibrated TB5 wired to wrong voltage	Refer to calibration instruction in <i>Calibrating Regulators</i> in the <i>Installation</i> section. See wiring diagram in Figure 8-1 in the <i>Wiring Schematics</i> section. If 480 V connection has been made for 208-240 V CCR input, or vice versa, contract the Siemens Airfield Solutions Sales Department. Refer to warning below.



WARNING: A CCR wired for 480 Vac must not be changed to 240, 220, or 208 Vac. A CCR wired for 240, 220, or 208 must not be changed to 480 Vac. Failure to observe this warning may result in equipment damage.

Section 7

Parts

1. Introduction

To order parts, call Siemens Airfield Solutions Customer Service or your local representative. Use this four-column parts list, and the accompanying illustration, to describe and locate parts correctly.

2. Using the Illustrated Parts List

This subsection describes how to use the illustrated parts list covered later in this section. It does not provide the actual parts list.

The Part Number column gives the Siemens Airfield Solutions part number.

The Description column gives the part name, as well as its dimensions and other characteristics when appropriate. Indentions show the relationships between assemblies, subassemblies, and parts.

Part Number	Description	Quantity	Note
XXXXXXXX	Assembly	1	A
XXXXXXXX	Part	1	
XXXXXXXX	Part or Assembly		
XXXXXXXX	Assembly	1	
NOTE A			

The Quantity column contains the quantity required per unit, assembly, or subassembly. The code AR (As Required) is used if the part number is a bulk item ordered in quantities or if the quantity per assembly depends on the product version or model.

The Note column contains letters that refer to notes at the end of each parts list. Notes contain special ordering or product/part version information.

**3. L-828 CCR (4-10 kW/6.6 A)
A) Part Ordering Code**

See Figure 7-1. Refer to Table 7-1 for the LC-type L-828 CCR (4-10 kW) part numbers.

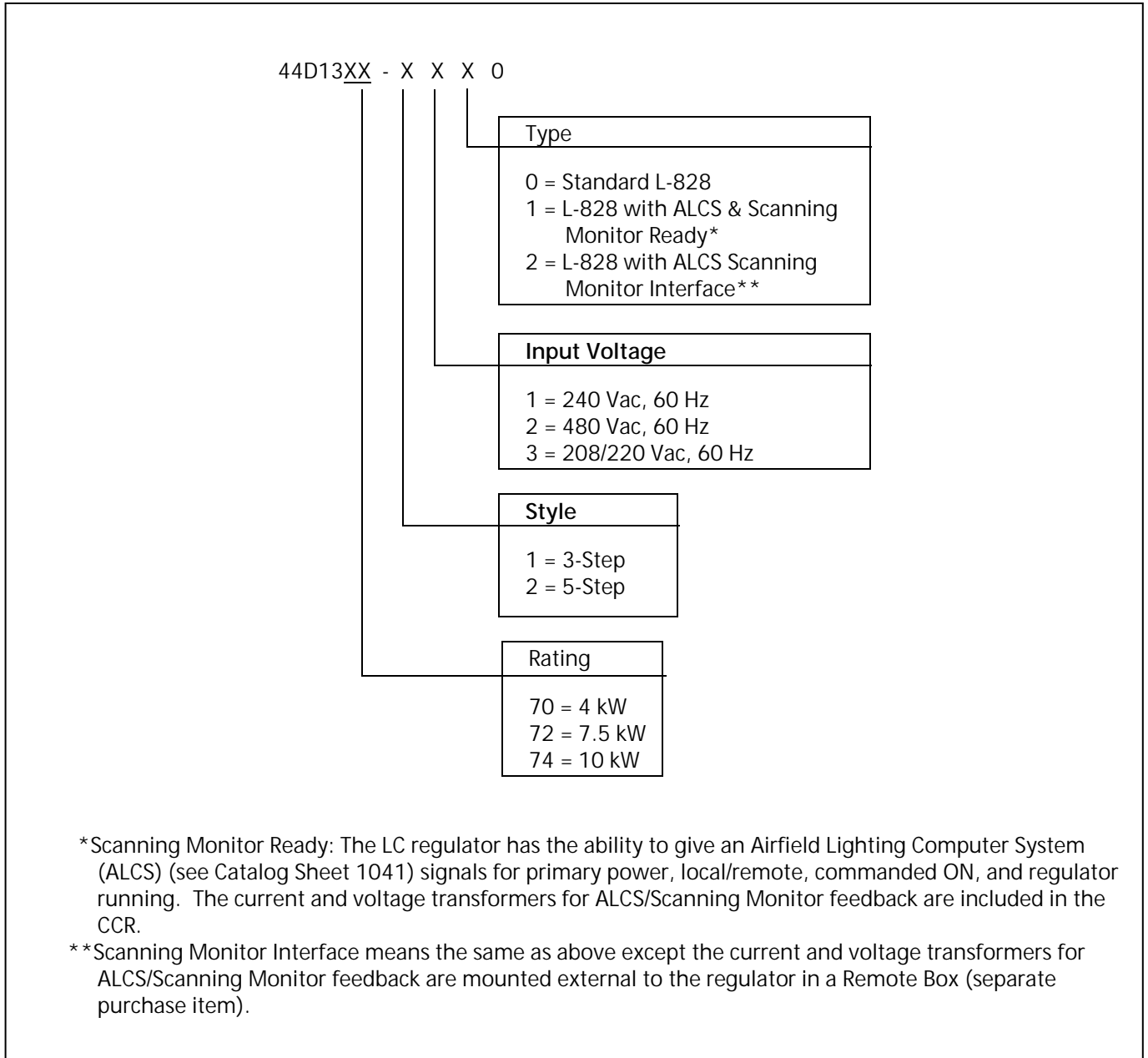


Figure 7-1 60 Hz L-828 CCR (4-10 kW/6.6 A)

4. L-828 CCR General Assembly (4-10 kW/6.6 A) Parts List

This subsection provides part numbers for the L-828 LC-Type CCR (4-10 kW/6.6 A/60 Hz).

NOTE: Substitution of electronic components may be done only if the substitution is the exact physical equivalent (body or case size) and equal, or better electrical characteristics with respect to tolerance, failure rate, and/or reliability.

See Figure 7-2. Refer below for the part numbers for the 4 kW/6.6 A/208-240 CCR.

NOTE: Figure 7-2 shows a 4 kW LC-Type CCR. The appearance and location of parts for the 7.5 and 10 kW CCRs may differ.

Part Number	Description	Quantity	Note
35B0462	Power transformer, 4 kW/6.6 A, 208/240 V coil	1	
57A0035	Circuit breaker, 30 A, 2 P, 480 Vac	1	
47A0113	Fuse, 2A, 250 V, SLO-BLO (for 208-240 V CCR)	2	
47A0108	Fuse, 1A, 500 V (for 480 V CCR)	2	
49A0084	Fuseholder	1	
53A0198	Contact, 3P, 25 A, 16 A, 120 Vac, coil	1	
33A0013	Choke, 4 kW, LC	1	
44D1475	LC control PCB assembly	1	
44D1476-1	LC PCB control switch, 3-Step	1	
44D1476-2	LC PCB control switch, 5-Step	1	
52A0107	Ammeter, 3PB-AMC-100X 0-10A	1	
47A0117	Fuse, ¼ A, 250 V, SLO-BLO	1	
35A0438	Transformer, 240/480 Vac, multisecondary	1	
35A0290	Current transformer, 6.6/66 mA	1	

Continued on next page

4. L-828 CCR General Assembly (4-10 kW/6.6 A)
Parts List (contd.)

Part Number	Description	Quantity	Note
35A0343	Ratio transformer, 6:1	1	
32A0025	Varistor, 750 V	2	
28A0011	SCR block, 95 amp, 1200VRRM	1	
44B1712P	Air choke, 4 kW	1	
44A4824-1	LC snubber network, 240 V	1	



Figure 7-2 LC-Type L-828 CCR Component Parts (1 of 4)

4. L-828 CCR General Assembly (4-10 kW/6.6 A)
Parts List (contd.)

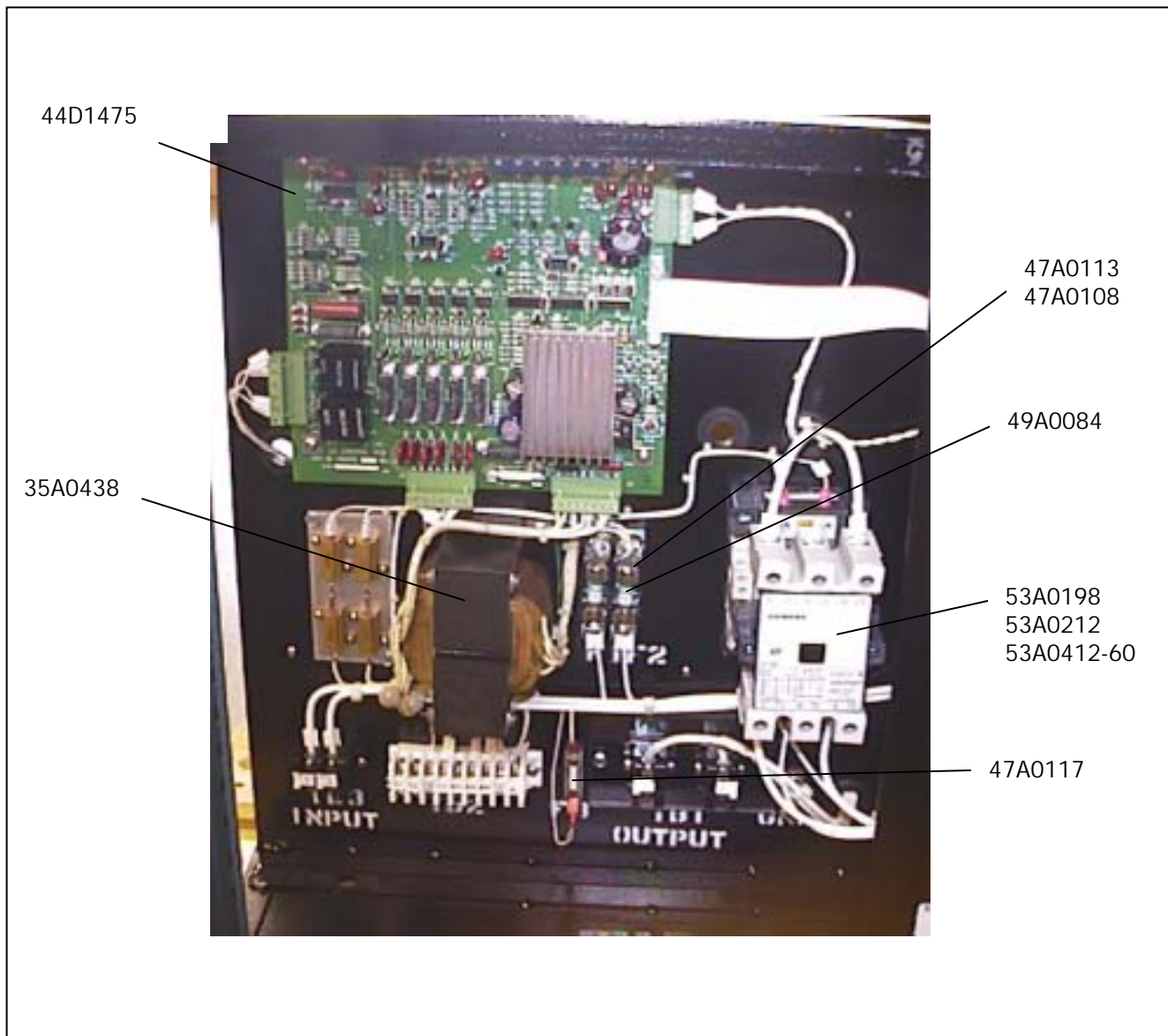


Figure 7-2 LC-Type L-828 CCR Component Parts (2 of 4)

**4. L-828 CCR General
Assembly (4-10 kW/6.6 A)
Parts List (contd.)**

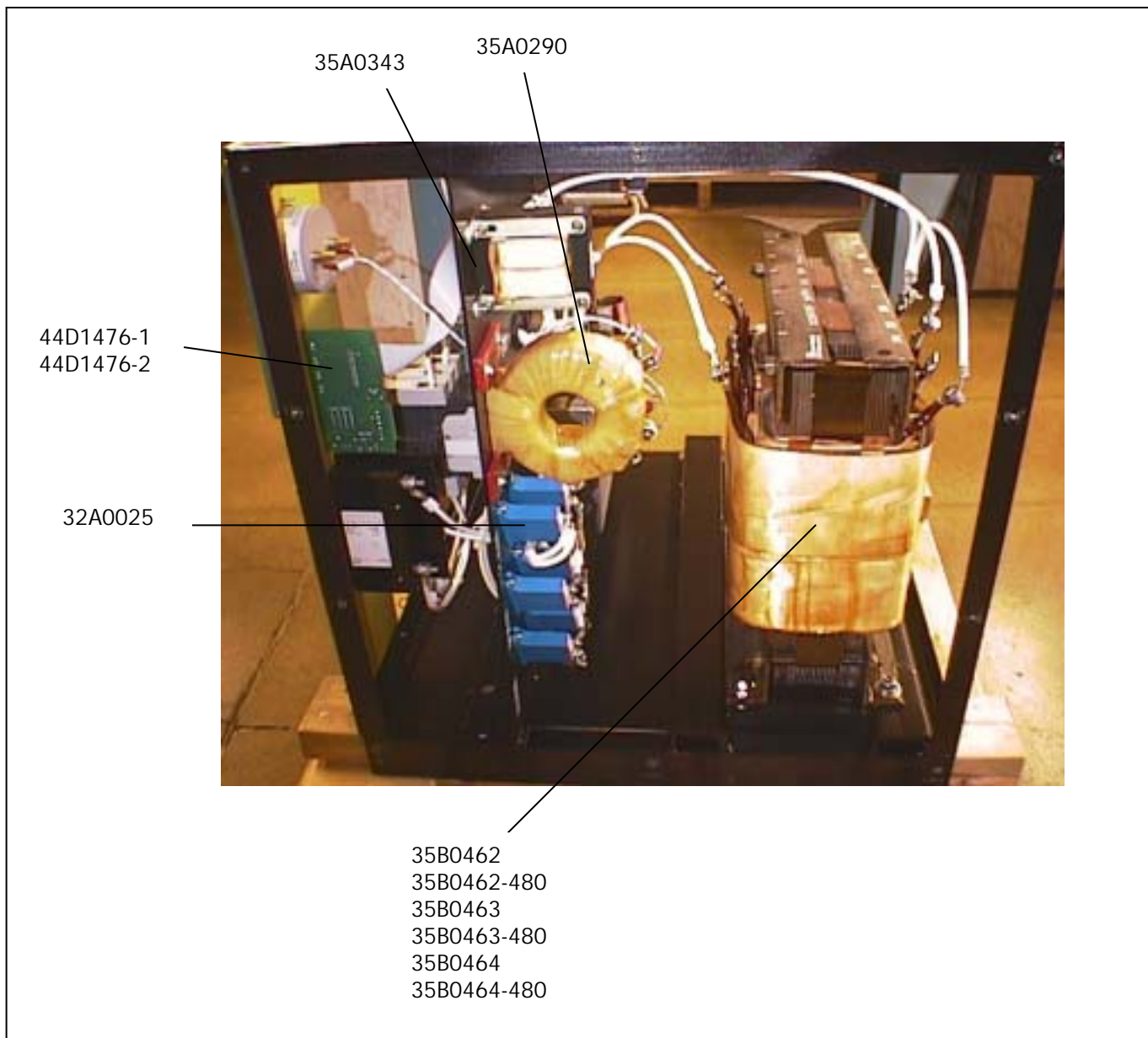


Figure 7-2 LC-Type L-828 CCR Component Parts (3 of 4)

**4. L-828 CCR General
Assembly (4-10 kW/6.6 A)
Parts List (contd.)**

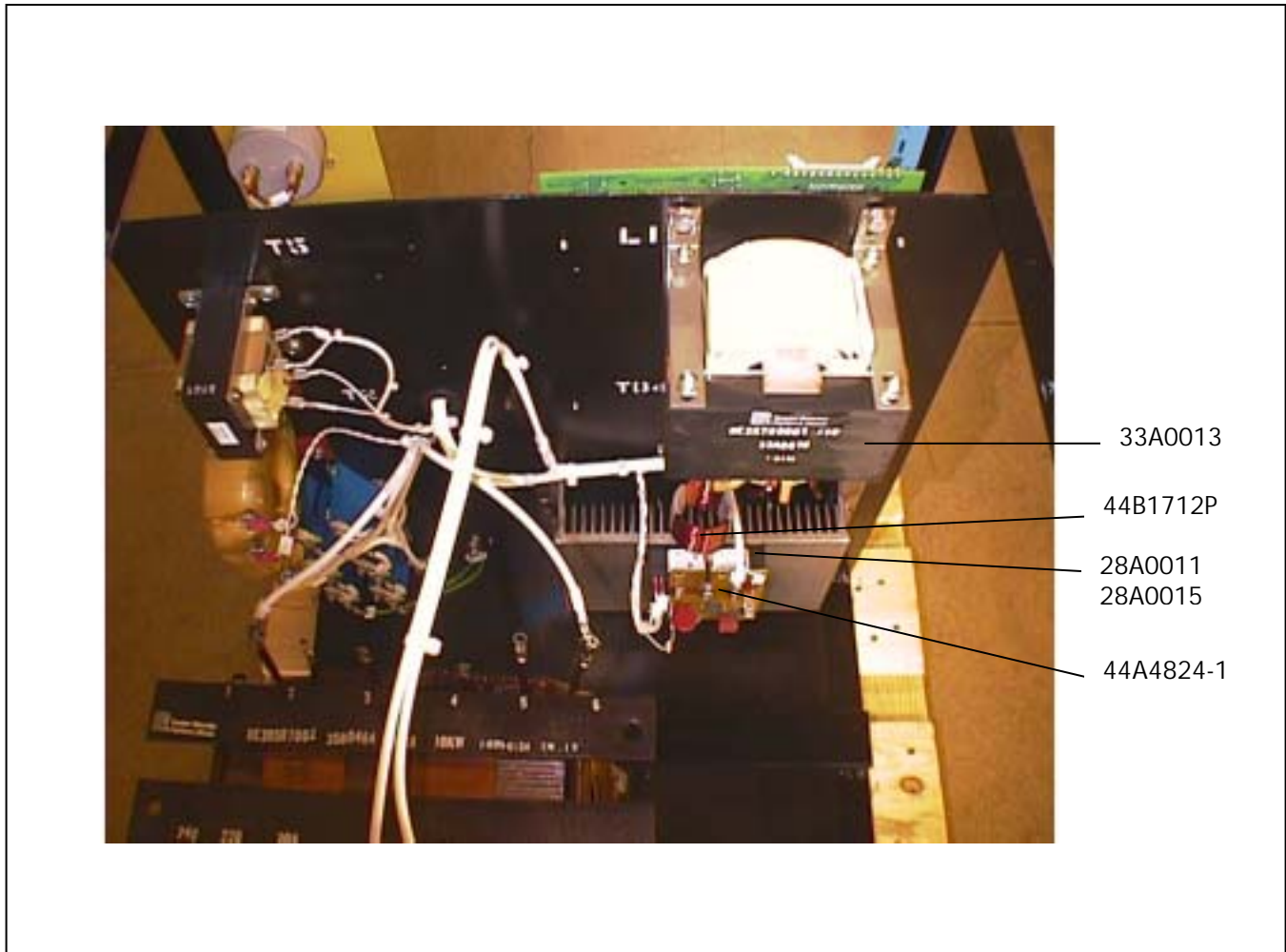


Figure 7-2 LC-Type L-828 CCR Component Parts (4of 4)

**4. L-828 CCR General
Assembly (4-10 kW/6.6 A)
Parts List (contd.)**

See Figure 7-2. Refer below for the part numbers for the 4 kW (480 Vac) L-828 CCR.

Part Number	Description	Quantity	Note
35B0462-480	Power transformer, 4 kW/6.6 A, 480 V coil	1	
57A0037	Circuit breaker, 15 A, 2 P, 480 Vac	1	
47A0108	Fuse, 1A, 500 V (for 480 V CCR)	2	
49A0084	Fuseholder	1	
53A0198	Contact, 3P, 25 A, 16 A, 120 Vac, coil	1	
33A0013	Choke, 4 kW, LC	1	
44D1475	LC control PCB assembly	1	
44D1476-1	LC PCB control switch, 3-Step	1	
44D1476-2	LC PCB control switch, 5-Step	1	
52A0107	Ammeter, 3PB-AMC-100X 0-10A	1	
47A0117	Fuse, ¼ A, 250 V, SLO-BLO	1	
35A0438	Transformer, 240/480 Vac, multisecondary	1	
35A0290	Current transformer, 6.6/66 mA	1	
35A0343	Ratio transformer, 6:1	1	
32A0025	Varistor, 750 V, 970 Vdc	2	
28A0011	SCR block, 95 amp, 1200VRRM	1	
44B1712P	Air choke, 4 kW	1	
44A4824-1	LC snubber network, 240 V	1	

**4. L-828 CCR General
Assembly (4-10 kW/6.6 A)
Parts List (contd.)**

Refer below for the part numbers for the 7.5 kW (208-240 Vac)
L-828 CCR.

Part Number	Description	Quantity	Note
35B0463	Power transformer, 7.5 kW/6.6 A, 208/240 V coil	1	
57A0036	Circuit breaker, 50 A, 2 P, 480 Vac	1	
47A0113	Fuse, 2A, 250 V, SLO-BLO (for 208-240 V CCR)	2	
49A0084	Fuseholder	1	
53A0212	Contact, 3P, 42 A, 32 A, 120 Vac, coil	1	
33A0015	Choke, 7.5 kW, LC	1	
44D1475	LC control PCB assembly	1	
44D1476-1	LC PCB control switch, 3-Step	1	
44D1476-2	LC PCB control switch, 5-Step	1	
52A0107	Ammeter, 3PB-AMC-100X 0-10A	1	
47A0117	Fuse, ¼ A, 250 V, SLO-BLO	1	
35A0438	Transformer, 240/480 Vac, multisecondary	1	
35A0290	Current transformer, 6.6/66 mA	1	
35A0343	Ratio transformer, 6:1	1	
32A0025	Varistor, 750 V, 970 Vdc	4	
28A0015	SCR, dual module, 150 amp, 1200 V	1	
44B1712P	Air choke, 4 kW	1	
44A4824-1	LC snubber network, 240 V	1	

**4. L-828 CCR General
Assembly (4-10 kW/6.6 A)
Parts List (contd.)**

See Figure 7-2. Refer below for the part numbers for the 7.5 kW (480 Vac) L-828 CCR.

Part Number	Description	Quantity	Note
35B0463-480	Power transformer, 7.5 kW/6.6 A, 480 V coil	1	
57A0035	Circuit breaker, 30 A, 2 P, 480 Vac	1	
47A0113	Fuse, 2A, 250 V, SLO-BLO (for 208-240 V, 480/5-Step) CCR)	2	
47A0108	Fuse, 1A, 500 V (for 480 V, 3-Step CCR)	2	
49A0084	Fuseholder	1	
53A0198	Contact, 3P, 25 A, 16 A, 120 Vac, coil	1	
33A0015	Choke, 7.5 kW, LC	1	
44D1475	LC control PCB assembly	1	
44D1476-1	LC PCB control switch, 3-Step	1	
44D1476-2	LC PCB control switch, 5-Step	1	
52A0107	Ammeter, 3PB-AMC-100X 0-10A	1	
47A0117	Fuse, ¼ A, 250 V, SLO-BLO	1	
35A0438	Transformer, 240/480 Vac, multisecondary	1	
35A0290	Current transformer, 6.6/66 mA	1	
35A0343	Ratio transformer, 6:1	1	
32A0025	Varistor, 750 V, 970 Vdc	4	
28A0015	SCR, dual module, 150 amp, 1200 V	1	
44B1712P	Air choke, 4 kW	1	
44A4824-1	LC snubber network, 240 V	1	

**4. L-828 CCR General
Assembly (4-10 kW/6.6 A)
Parts List (contd.)**

See Figure 7-2. Refer below for the part numbers for the 10 kW (208-240 Vac) L-828 CCR.

Part Number	Description	Quantity	Note
35B0464	Power transformer, 10 kW/6.6 A, 208/240 V coil	1	
57A0052	Circuit breaker, 70 A, 2 P, 480 Vac	1	
47A0113	Fuse, 2A, 250 V, SLO-BLO	2	
49A0084	Fuseholder	1	
53A0412-60	Contact, 3P, 80 A, 45 A, 120 Vac, coil	1	
33A0016	Choke inductor	1	
44D1475	LC control PCB assembly	1	
44D1476-1	LC PCB control switch, 3-Step	1	
44D1476-2	LC PCB control switch, 5-Step	1	
52A0107	Ammeter, 3PB-AMC-100X 0-10A	1	
47A0117	Fuse, ¼ A, 250 V, SLO-BLO	1	
35A0438	Transformer, 240/480 Vac, multisecondary	1	
35A0290	Current transformer, 6.6/66 mA	1	
35A0343	Ratio transformer, 6:1	1	
32A0025	Varistor, 750 V, 970 Vdc	6	
28A0015	SCR, dual module, 150 amp, 1200 V	1	
44B1712P	Air choke, 4 kW	1	
44A4824-1	LC snubber network, 240 V	1	

**4. L-828 CCR General
Assembly (4-10 kW/6.6 A)
Parts List (contd.)**

See Figure 7-2. Refer below for the part numbers for the 10 kW (480 Vac) L-828 CCR.

Part Number	Description	Quantity	Note
35B0464-480	Power transformer, 10 kW/6.6 A, 480 V coil	1	
57A0051	Circuit breaker, 35 A, 2 P, 480 Vac	1	
47A0108	Fuse, 1A, 500 V, SLO-BLO	2	
49A0084	Fuseholder	1	
53A0198	Contact, 3P, 25 A, 16 A, 120 Vac, coil	1	
33A0016	Choke inductor	1	
44D1475	LC control PCB assembly	1	
44D1476-1	LC PCB control switch, 3-Step	1	
44D1476-2	LC PCB control switch, 5-Step	1	
52A0107	Ammeter, 3PB-AMC-100X 0-10A	1	
47A0117	Fuse, ¼ A, 250 V, SLO-BLO	1	
35A0438	Transformer, 240/480 Vac, multisecondary	1	
35A0290	Current transformer, 6.6/66 mA	1	
35A0343	Ratio transformer, 6:1	1	
32A0025	Varistor, 750 V, 970 Vdc	6	
28A0015	SCR, dual module, 150 amp, 1200 V	1	
44B1712P	Air choke, 4 kW	1	
44A4824-1	LC snubber network, 240 V	1	

5. Recommended Spare Parts

This subsection provides recommended spare parts for the LC-Type CCR.

Recommended Spare Parts (4 kW/208-240 Vac)

See Figure 7-2. This subsection provides spare part for the 4 kW (208-240 Vac) L-828 CCR.

Part Number	Description
47A0113	Fuse, 2 A, 250 V, SLO-BLO, 5-Step
44D1475	Control PCB assembly
44D1476-1	LC PCB switch assembly, 3-Step
44D1476-2	LC PCB switch assembly, 5-Step
47A0117	Fuse, ¼ A, 250 A, SLO-BLO
32A0025	Varistor
28A0011	SCR, dual

Recommended Spare Parts (4 kW/480 Vac)

See Figure 7-2. This subsection provides part numbers for the 4 kW (480 Vac) L-828 CCR.

Part Number	Description
47A0108	Fuse, 1 A, 500 V, SLO-BLO, 3-Step
44D1475	Control PCB assembly
44D1476-1	LC PCB switch assembly, 3-Step
44D1476-2	LC PCB switch assembly, 5-Step
47A0117	Fuse, ¼ A, 250 A, SLO-BLO
32A0025	Varistor
28A0011	SCR, dual

Recommended Spare Parts (7.5 kW/208-240 Vac)

See Figure 7-2. This subsection provides part numbers for the 7.5 kW (208-240 Vac) L-828 CCR.

Part Number	Description
47A0113	Fuse, 2 A, 250 V, SLO-BLO, 5-Step
44D1475	Control PCB assembly
44D1476-1	LC PCB switch assembly, 3-Step
44D1476-2	LC PCB switch assembly, 5-Step
47A0117	Fuse, ¼ A, 250 A, SLO-BLO
32A0025	Varistor
28A0015	SCR, dual

**Recommended Spare Parts
(7.5 kW/480 Vac)**

See Figure 7-2. This subsection provides part numbers for the 7.5 kW (480 Vac) L-828 CCR.

Part Number	Description
47A0108	Fuse, 2 A, 250 V, SLO-BLO, 3-Step
44D1475	Control PCB assembly
44D1476-1	LC PCB switch assembly, 3-Step
44D1476-2	LC PCB switch assembly, 5-Step
47A0117	Fuse, ¼ A, 250 A, SLO-BLO
32A0025	Varistor
28A0015	SCR, dual

**Recommended Spare Parts
(10 kW/208-240 Vac)**

See Figure 7-2. This subsection provides part numbers for the 10 kW (208-240 Vac) L-828 CCR.

Part Number	Description
47A0113	Fuse, 2 A, 250 V, SLO-BLO, 5-Step
44D1475	Control PCB assembly
44D1476-1	LC PCB switch assembly, 3-Step
44D1476-2	LC PCB switch assembly, 5-Step
47A0117	Fuse, ¼ A, 250 A, SLO-BLO
32A0025	Varistor
28A0015	SCR, dual

**Recommended Spare Parts
(10 kW/480 Vac)**

See Figure 7-2. This subsection provides part numbers for the 10 kW (480 Vac) L-828 CCR.

Part Number	Description
47A0113	Fuse, 2 A, 250 V, SLO-BLO, 5-Step
44D1475	Control PCB assembly
44D1476-1	LC PCB switch assembly, 3-Step
44D1476-2	LC PCB switch assembly, 5-Step
47A0117	Fuse, ¼ A, 250 A, SLO-BLO
32A0025	Varistor
28A0015	SCR, dual

Section 8

Wiring Schematics

1. Introduction

This section provides wiring schematics for LC-Type L-828 constant current regulators (CCRs) (4-10 kW/6.6 A).

2. Wiring Schematics

See Figure 8-1 for internal wiring schematics.

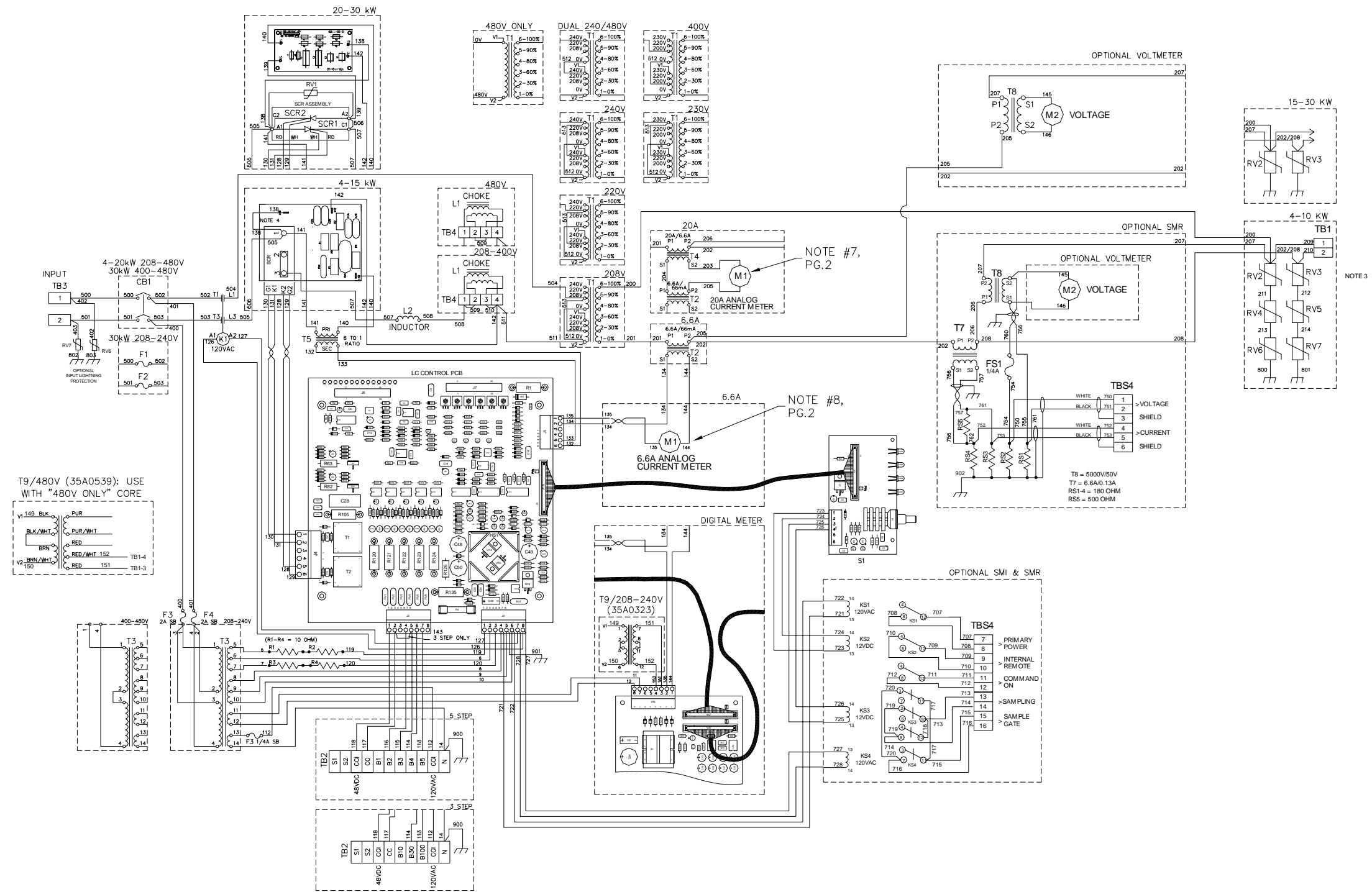


Figure 8-1 LC-Type L-828 CCR Internal Wiring Schematic (Part 1 of 2)

CCR PART NUMBERS

POWER	PART NUMBER
4 kW	44D1370/XXXX
7.5 kW	44D1372/XXXX
10 kW	44D1374/XXXX
15 kW	44D1376/XXX
20 kW	44D1378/XXXX
30 kW	44D1380/XXXX

CCR PART NUMBERS /OPTIONS

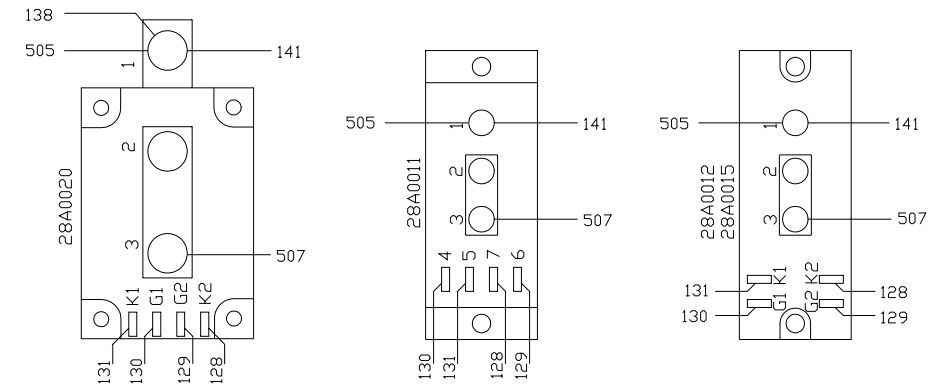
XXXX	FUNCTION
1XXX	3 STEP, 6.6A
2XXX	5 STEP, 6.6A
3XXX	5 STEP, 20A
X1XX	240 VAC, 60 Hz
X2XX	480 VAC, 60 Hz
X3XX	208 VAC, 60 Hz
X4XX	230 VAC, 50 Hz
X5XX	400 VAC, 50 Hz
XX0X	STANDARD INTERFACE
XX1X	SCANNING MONITOR READY
XX2X	SCANNING MONITOR INTERFACE

CCR MODIFICATION KITS

PART NUMBER	DESCRIPTION
	INPUT PROTECTION:
94B0011	INPUT VARISTOR KIT, 208-480 VAC
	DIGITAL METER KITS
94A0116/1	LC DIGITAL METER KIT, 4-10 KW
94A0116/2	LC DIGITAL METER KIT, 15-30 KW, 480VAC
94A0116/3	LC DIGITAL METER KIT, 20 KW, 240 VAC
94A0116/4	LC DIGITAL METER KIT, 30 KW, 240 VAC

500 SERIES WIRES - PRIMARY POWER

POWER	208-240 V	400-480V
4 kW	10AWG/600V 89A0068/1	10AWG/600V 89A0068/1
7.5 kW	8AWG/600V 89A0068/1	8AWG/600V 89A0068/1
10 kW	10AWG/600V 89A0078/1	10AWG/600V 89A0078/1
15 kW	6AWG/600V 89A0081/1	6AWG/600V 89A0081/1
20 kW	2AWG/600V 89A0083/1	6AWG/600V 89A0081/1
30 kW	2AWG/600V 89A0083/1	6AWG/600V 89A0081/1



NOTES:

1. WIRE NUMBERS REASSIGNED AT THE CREATION OF THIS DOCUMENT.
2. WIRE SIZES:
 112-120, 126-135, 138-146, 149-152: CONTROL 18AWG, 89A0073/1
 200-214: HIGH VOLTAGE, 12AWG, 25KV, 89A0086/1
 400-403: MEDIUM POWER, 12AWG, 600V, 89A0012/9
 500-513: PRIMARY POWER, SEE TABLE.
 707-728: SCANNING MONITOR INTERFACE, 22AWG, 600V, 89A0002/9
 750-758: SCANNING MONITOR READY, 22AWG 2 COND SHLD, 89A0126
 760-762: SCANNING MONITOR READY, 22AWG, 600V, 89A0002/9
 800-803: GROUND, 12AWG, 600V, GN/YL, 89A163/5.
 900-902: GROUND, 18AWG, 600V, GN/YL, 89A0163/7.
3. SEE BILL OF MATERIALS FOR NUMBER OF MOV'S OR SURGE SUPPRESSORS IN EACH LEG.
4. USE DIAGRAMS ABOVE FOR WIRING SCR MODULES.
5. CHANGES FROM EARLIER WIRING:
 100 SERIES FROM 18AWG TO 22AWG AND REV. H; BACK TO 18AWG.
 111 TO 900
 125 TO 901
 136 TO 400
 137 TO 401
 200 SERIES RENUMBERED
 400 SERIES ADDED
 500 SERIES RENUMBERED, 600 SERIES OMITTED
 900 SERIES TO 750-762 AND RENUMBERED
 800 AND 900 SERIES ADDED
6. TERMINATE ENDS OF WIRES #400 & 401 AT CBI WITH 70A0523 RING TERMINALS.
7. IF 20A REGULATOR IS WIRED W/O METER, LAND 205 ON T4-S2 IN PLACE OF 203.
8. IF 6.6A REGULATOR IS WIRED W/O METER, LAND 144 ON J5-1 IN PLACE OF 135.

Figure 8-1 LC-Type L-828 CCR Internal Wiring Schematic (Part 2 of 2)