SIEMENS

Ferroresonant L-828 Constant Current Regulator with Universal Regulator Controller (URC) Air and Oil Cooled 4-50 kW/6.6 A/20 A

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AC 150/5345-10E

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Preliminary Draft

Record of Changes

Page	Rev	Description	EC No.	Checked	Approved	Date
	A	Released manual.	00260	MR	WT	5/31/00
2-1, 2-3, 2-11, 4-1, 7-5, 7-6, 7-10, 7-12, 7-14,	B	Added part numbers for switch assembly 44A5965/1 (3-Step) and 44A5965/2 (5-Step), and switches 46A0083/5 (3-Step) and 46A0083/7 (5-Step). Also added ammeter 52A0099. Updated Figures 2-1 thru 2-3, and 4-1. Added Figure 7-2 (4 of 4).	00673	MR	WT	4/11/01
Title page	C	Changed to Siemens sans font.	00696	JY	WT	5/16/01
7-5	D	Changed part number for Universal Regulator Controller from 44C5936 to 44A5936.	00749	JY	WT	9/17/01
2-1, 2-5, 2-6, 7-2, 7-3, 8-2, 8-3	E	Added 50 kW CCR to manual.	00802	JY	WT	12/11/01
2-9	F	Updated input current in Table 2-11.	00880	JY	WT	4/26/02
8-2, 8-3	G	Updated wiring schematics (Figure 8-1).	00917	BE	ED	7/10/02
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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.

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.

2. Safety Symbols *(contd.)*

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.

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.
- 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.

6. Operation *(contd.)*

- 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.

8. Maintenance and Repair *(contd.)*

- 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 ferroresonant air-cooled and oil-cooled L-828 constant current regulators (CCRs) (4-50 kW/6.6 A/20 A). These CCRs are manufactured according FAA specification AC 150/5345-10E.

The L-828 CCRs are designed to

- supply three or five precision output current levels (6.6 A maximum) to power airport series lighting circuits on runways and taxiways.
- accurately regulate the output current to within ±1% of the adjustable nominal levels from no load to full load and with input voltage variations of -5% to +10% of nominal.
- maintain the nominal output current levels even when 30 percent of the isolation transformers in the series lighting circuit supplied by the regulator have open secondaries

NOTE: Figure 2-1 shows a ferroresonant L-828 CCR (10 kW/6.6 A) CCR. The other L-828 CCRs (4, 7.5, 15-50 kW/6.6 A/20 A) may differ in size and appearance.

Figure 2-1. Ferroresonant L-828 CCR (10 kW/6.6 A)

2. Universal Regulator Controller

The Universal Regulator Controller (URC) is designed to provide all regulator and control functions for ferroresonant L-828 CCRs manufactured by Siemens Airfield Solutions. This is accomplished with an 8-bit embedded microcontroller and interface circuitry contained on a single 8 x 8 inch through-hole type printed circuit board. The universal regulator controller PCB performs the functions listed below.

- Produces SCR drive signals in accordance with the signals from the input module PCB
- Detects an overcurrent, open circuit, and switches the constant current regulator off
- When in Remote mode, enables CCI to provide 120 Vac at 50 W

3. Theory of Operation

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

Power Circuit

See Figure 2-2. A resonant network T1-C1 to CX feeds the output circuit independent of the impedance of the load with a current proportional to the value of the input voltage. Control and regulation of the output current is accomplished by the SCRs shunting progressively a part of the resonant circuit, decreasing the output current. The components of the resonant network are designed to deliver an output current slightly higher than 6.6 A/20 A for the minimum input voltage, while the SCRs are in the OFF state.

Power Circuit *(contd.)*

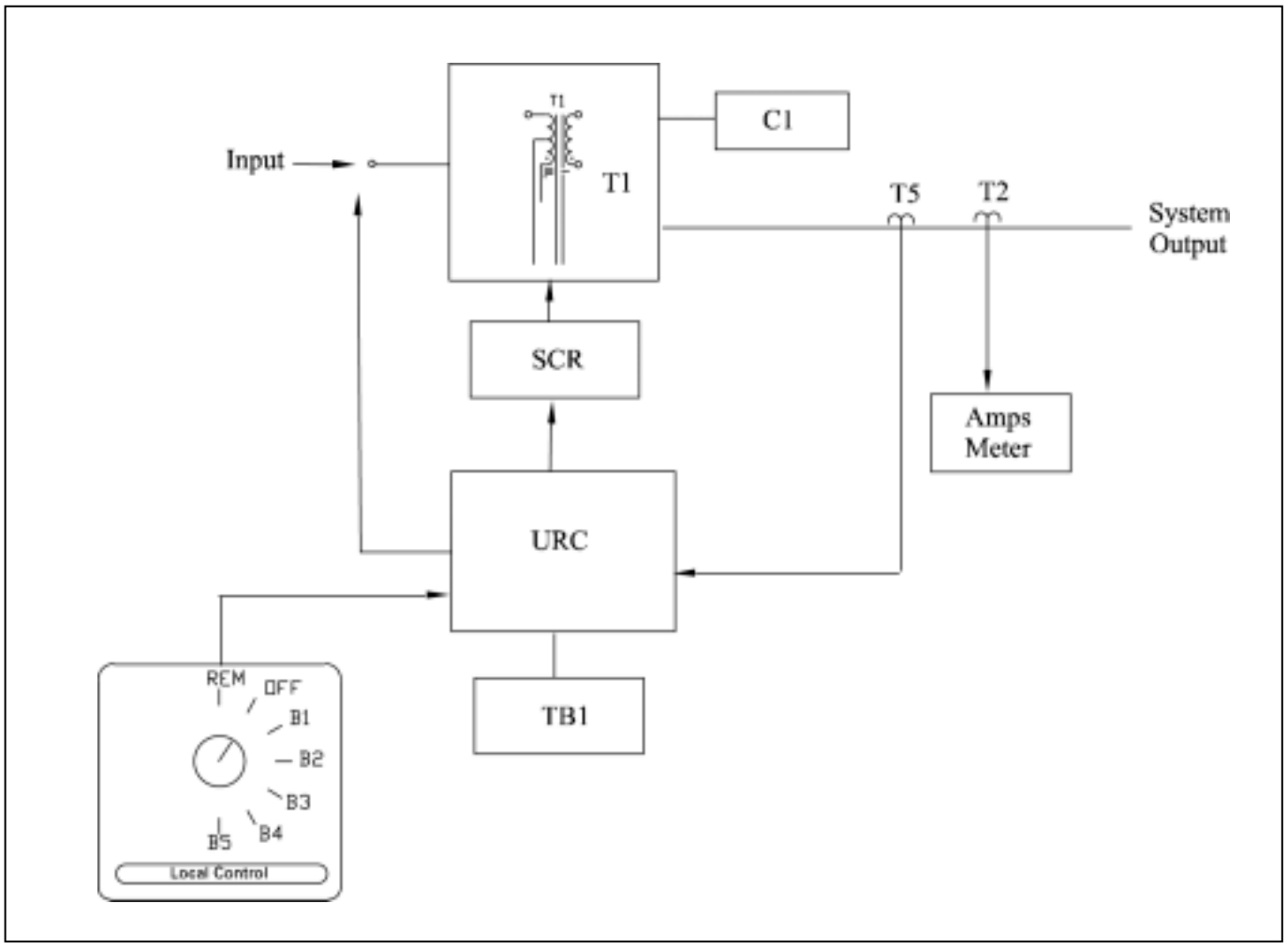


Figure 2-2. L-828 CCR Power Circuit Block Diagram

Output Measurement

The output current flows through the high voltage current transformer T5. The secondary of this transformer delivers a nominal current of .066 A to the current regulator control circuitry.

A second current transformer, T2, provides current to a true rms-reading ammeter mounted onto the front panel to indicate output current.

Universal Regulator Controller

See Figure 2-2. This subsection describes the board level circuitry found on the universal regulator controller.

URC PCB Inputs/Outputs

The URC receives the inputs listed below. See Figure 7-3 in the *Parts* section and Figure 8-1 in the *Wiring Schematics* section.

- Local control signals from the front panel rotary switch
- Remote control signals from a remote control terminal block located in the L-828 chassis (120 Vac) (TB1)
- A current proportional to the output current from a current transformer (T5)
- Phase angle reference voltage
- 24 Vac center tapped supply voltage

The URC provides the outputs listed below.

- A contact to complete the input contactor coil circuit
- A contact to enable the Remote CCI voltage at TB1
- Gate drive signals to the SCR block used to regulate the output current

Output Current Monitor Circuitry

The system output current is sensed by a current transformer (T5) whose secondary is connected to J6.4-J6.3. This current signal is passed through a 15-ohm shunt resistor (R38), located on the URC board. For the 6.6 amp regulator a /100 scale factor is used. Output current steps 1-5 would correspond to voltage levels of 420, 510, 615, 780, and 990 millivolts respectively.

Local Control Position Detection

Local control position detection is accomplished by using a rotary switch (external to the control board) to connect the cathode of an opto-isolator to ground causing the output transistor of the same isolator to turn on and pull the corresponding step signal to ground. This signal is monitored by the micro-controller to determine the local step. There are signal diodes connected from each step back to step one. This allows step one system on to be provided to the micro-controller whenever the step switch is in any position other than remote or off.

Universal Regulator Controller *(contd.)*

Contactor Drive

The contactor drive circuit is provided to complete the circuit that powers the input contactor for the regulator.

Remote Control Position Detection

When the local control signal to the micro-controller indicates "remote" the remote position detection circuitry is active. Relay K1 closes providing 120VAC to the CCI connection on TB2. The remote position detection section is composed of input surge suppression, attenuation, a bridge rectifier and an opto-isolator for each step that together provide remote step signals to the micro-controller.

Failure Protection

This subsection describes URC failure protection.

Overcurrent Protection

The micro-controller detects an over current condition by comparing the output current to a preset value. If the output current exceeds this value the controller will shut the current regulator down by removing drive to the input contactor. This contactor will remain de-energized until the controller is reset either by selecting the OFF position (remotely or locally) or cycling the input power off for a minimum of 2 seconds and then back on. The control board will not recognize momentary over currents caused by load switching or other transient conditions.

Open Circuit Protection

The micro-controller detects an open circuit by the absence of current in the regulator output (this will also detect an open or shorted current transformer). If the output current is less than 1.5 amps, the controller will shut the current regulator down within one second by removing drive to the input contactor. This contactor will remain de-energized until the controller is reset either by selecting the OFF position (remotely or locally) or cycling the input power off for a minimum of 2 seconds and then back on.

4. Ferroresonant L-828 CCRs (4-50 kW/6.6 A/20 A):Required Equipment

Refer to Table 2-1 for required equipment that is supplied. Refer to Table 2-2 for required equipment that is not supplied. Refer to the Parts section for ordering information.

Table 2-1. Required Equipment Supplied

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

4. Ferroresonant L-828 CCRs (4-50 kW/6.6 A/20 A):Required Equipment *(contd.)*

Table 2-2. Required Equipment Not Supplied

Description	Quantity
Input power wire. Refer to Table 2-3.	As required
Remote control wire, AWG 19 minimum, AWG 14 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 arrestor. Refer to Table 2-4 for optional lightning arrestors. **NOTE:** Standard 2400 Vac customer-supplied lightning arrestors should be used external to CCR.	As required
Voltmeter, 60 Vdc full scale	1
Voltmeter for 208-480 Vac CCRs (minimum 600 V scale); for 2400 Vac CCR (minimum 3000 Vac scale)	1
Ammeter, true rms-reading, 9 A maximum scale	1
Inductive-type current probe	1
Ohmmeter	1
2400 V step down transformer for 2400 Vac CCRs such as OLSUN #9219S-25995, 2400/240 Vac, 0.5 kVA	1
Mounting bolts, ½-16 x 1-1/2 in. long, ½ STD washers, and lockwashers	4

NOTE: Table 2-3 refers to recommended input power supply wire, 90 °C, 600 or 5000 V minimum

Table 2-3. Recommended Input Wire Rating

KW Rating	208 Vac	220 Vac	240 Vac	480 Vac	2400 Vac
4 kW	AWG 12, 600 V	AWG 12, 600 V	AWG 12, 600 V	AWG 12, 600 V	Not applicable
7.5 kW	AWG 8, 600 V	AWG 8, 600 V	AWG 10, 600 V	AWG 12, 600 V	Not applicable
10 kW	AWG 6, 600 V	AWG 6, 600 V	AWG 6, 600 V	AWG 12, 600 V	AWG 8, 600 V
15 kW	AWG 4, 600 V	AWG 4, 600 V	AWG 4, 600 V	AWG 10, 600 V	AWG 8, 600 V
20 kW	AWG 2, 600 V	AWG 2, 600 V	AWG 2, 600 V	AWG 6, 600 V	AWG 8, 600 V
30 kW	AWG 1/0, 600 V	AWG 1/0, 600 V	AWG 1/0, 600 V	AWG 4, 600 V	AWG 8, 600 V

Table 2-4. Optional Equipment

Description	Part Number	Note
Input lightning protection	94B0011	A
Digital output volt meter kit 4-30 kW	94B0118	A
Digital current meter kit 4-30 kW	94B0119	A
L-828 Ferro, 208-480 V, with URC On and Remote Auxiliary Contact Modification Kit	94A0258-U	B
L-828 Ferro, 2400 V, with URC On and Remote Auxiliary Contact Modification Kit	94A0258-U2400	B
NOTE A: See Figure 8-1. NOTE B: See Figure 8-2.		

5. Specifications

This subsection provides specifications for L-828 CCR (4-30 kW/6.6 A/ 20 A) air cooled CCRs with URC board.

Ratings

4, 7.5, 10, 15, 20, and 30 kW

Class

Class 1 (6.6 A maximum output current)
Class 2 (20 A maximum output current)

Construction

A painted steel-frame cabinet houses the power components (transformer and capacitors) and the control logic necessary to regulate the output current level.

Style

Refer to Table 2-5.

Table 2-5. Style

Class	Style	Brightness Steps	Current 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
2	2	5	8.5 A, 10.3 A, 12.4 A, 15.8 A, 20 A

Power Factor

Refer to Table 2-6.

Table 2-6. Power Factors

CCR	Power Factor
4, 7.5, 10 kW	Not less than 90%
15, 20, 30 kW	No less than 95%

Efficiency

Refer to Table 2-7.

Table 2-7. Efficiency

CCR	Power Factor
4-20 kW	Not less than 90%
30 kW	92%

Reactive Loading

The CCRs maintain the current within the limits of Tables 2-8 through 2-10 for all brightness steps when the load is connected via isolating transformers, and the secondaries of 30% of these 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% brightness step.

Reactive Loading *(contd.)*

Table 2-8. Current Range for 3-Step 6.6 A CCR

3-Step	Nominal Output Current	Allowable Current Range
10	4.8 A	4.66-4.94 A
30	5.5 A	5.33–5.67 A
100	6.6 A	6.40–6.70 A

Table 2-9. Current Range for 5-Step 6.6 A CCR

5-Step	Nominal Output Current	Allowable Current Range
1	2.8 A	2.72-2.88 A
2	3.4 A	3.30-3.50 A
3	4.1 A	3.98-4.22 A
4	5.2 A	5.04-5.36 A
5	6.6 A	6.40-6.70 A

Table 2-10. Current Range for 5-Step 20 A CCR

Step	Nominal Output Current	Allowable Current Range
1	8.5 A	8.24-8.76 A
2	10.3 A	9.99-10.61 A
3	12.4 A	12.03-12.77 A
4	15.8 A	15.33-16.27 A
5	20 A	19.40-20.30 A

Resistive Loading

The CCRs maintain the output current within the limits of Tables 2-8 through 2-10 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 above. For regulators less than 10 kW, the regulation is provided at nominal input voltage for all brightness steps.

Environmental Operating Conditions

The L-828 CCRs (4-30 kW/6.6 A/20 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

-40 to +55 °C (-40 to +131 °F)

Relative Humidity

10 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.

  NOTE: Input lightning protection can be ordered as an option for 480 and less input voltages.

- Fuse protection of AC supply voltage of the URC PCB and brightness control voltage for Remote control

Open-Circuit Protection

The primary switch is opened in less than 1 second after an open circuit occurs in the secondary. The open-circuit protective device is reset within 2 seconds after the rotary selector switch on the CCR is turned to OFF (or the CCR is turned OFF while it is in remote control) and re-energized, and is not tripped by switching of load circuits or other transients.

Overcurrent Protection

Regulators include an overcurrent protective device that opens the primary switch when the output current exceed 6.6 A/20 A by 5%. The device operates within 5 seconds after an overcurrent of 5% and within 1 second after an overcurrent of 25%. The device is reset within 2 seconds after the rotary selector switch on the CCR is turned to OFF (or the CCR is turned OFF while it is in remote control). The overcurrent protection is not activated by a momentary (0.25s) overcurrent caused by switching of load circuits or other transients.

Input Current

Refer to Table 2-11.

NOTE: 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 shown on Table 2-11, unless local codes require a different rating technique. Refer to the CCR's nameplate for the kW rating and input voltage to determine the input current on Table 2-11. If no standard-size circuit breaker exists at the 125% value, use the next larger standard-size circuit breaker.

Table 2-11. Recommended L-828 CCR Input Current

KW Rating	208 Vac	220 Vac	240 Vac	480 Vac	2400 Vac
4 kW	27 A	26 A	24 A	12 A	2 A
7.5 kW	51 A	48 A	44 A	22 A	4 A
10 kW	68 A	65 A	59 A	30 A	6 A
15 kW	97 A	92 A	84 A	42 A	8 A
20 kW	129 A	122 A	112 A	56 A	11 A
30 kW	190 A	179 A	164 A	82 A	16 A

Input Voltage

The power transformer for the L-828 regulators is designed for an input voltage of either 208, 220, 240, 480, or 2400 Vac. The input voltage must be accurately determined prior to ordering the regulator because no alternate input voltage tapes are available.

Built-In True RMS-Reading Ammeter

A true rms-reading ammeter mounted on the front of the input module PCB indicates the output current. The screw on the face of the ammeter is for zeroing the indicator needle.

Input Wire Size

Refer to Table 2-3.

Regulation

Refer to Tables 2-8 through 2-10 for output current limits. Current regulation is obtained under the conditions listed below.

- Load variations of zero (short-circuit) to full load with input voltage variations of –5% to +10%, at –40 °C up to +55 °C (-40 °F to +131 °F) ambient temperature
- With up to 30 % of the series load isolating transformers open-circuited

Rating and Input Voltage

Refer to Table 2-12.

Table 2-12. Rating and Input Voltage

Rating	Input Voltage
4, 7.5, 15, 20 kW	208-480 Vac
10, 30 kW	208-2400 Vac

Weight

Refer to Table 2-13 for weight of all L-828 CCRs with URC.

Table 2-13. Weight

Rating and Input Voltage	Weight lb (kg) (Approximate)
4 kW (208-480 Vac)	440 (187.584)
7.5 kW (208-480 Vac)	490 (222.264)
10 kW (208-2400 Vac)	590 (267.624)
15 kW (208-480 Vac)	890 (403.594)
15 kW (2400 Vac)	1140 (517.04)
20 kW (208-480 Vac)	990 (449.064)
20 kW (2400 Vac)	1190 (539.784)
30 kW (208-2400 Vac)	1290 (585.144)

Dimensions

Refer to Table 2-14 for dimensions.

Table 2-14. Dimensions

Rating	A	B	C	D	E
4, 7.5, 15, 20 kW (208-480 Vac)	26.77 in. (679.958 mm)	31.5 in. (800.1 mm)	22.75 in. (577.85 mm)	23.5 in. (597.9 mm)	47.5 in. (1106.5 mm)
15 kW (2400 Vac) 20 kW (2400 Vac) 30 kW (208-2400 V ac)	35.375 in. (898.525 mm)	40.0 in. (1010 mm)	34.75 in. (882.65 mm)	35.5 in. (899.7 mm)	47.5 in. (1106.5 mm)

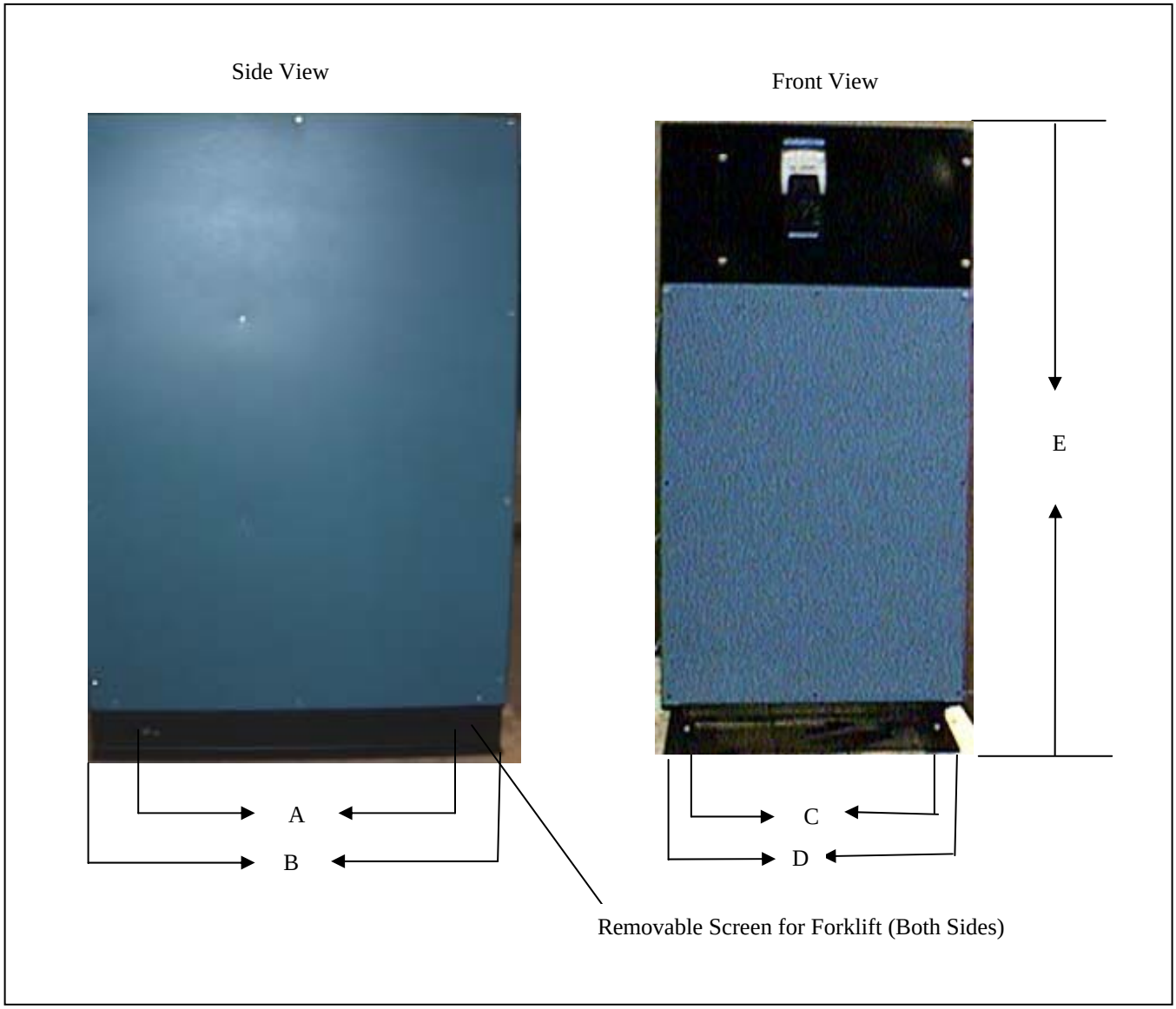


Figure 2-3. Ferroresonant L-828 CCR Dimensions

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

1. Introduction

This section provides instructions for installing L-828 constant current regulators (CCRs) (4-30 kW/6.6 A/20 A). Refer to the airport project plans and specifications for the specific installation instructions and FAA AC 150/5345-10E.

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.

Remove the two lower vent screens on the bottom of the regulator before lifting the regulator. 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.

NOTE: Remove internal shipping strap from the power transformer prior to installation.

Shipping Strap Removal

A metal shipping strap has been installed inside the regulator cabinet to the top of the power transformer to restrain the transformer from movement during shipment. The strap is clearly marked with a label Shipping Strap and must be removed prior to the connection of the input power supply lines. Since the upper panel of the regulator cabinet must be opened to gain access to the shipping strap, it is best removed prior to the placement of the regulator in its final operating location. If the shipping strap is not removed, the regulator will not operate properly since the transformer must be free to vibrate. After removal of the strap, visually inspect the interior of the cabinet to make sure no parts are loose or damaged.

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.

To install wiring, perform the following procedure:

1. Verify the input supply voltage corresponds to the voltage rating on the nameplate of the regulator.

2. Make sure the front panel rotary selector switch S2 is set to the OFF position.

3. Ground the regulator by making an adequate ground wire (AWG 6 or larger) connection to the external earth ground lug on the regulator.

4. An appropriate disconnect-type cutout or circuit breaker shall be provided outside the regulator for the input power supply lines.

5. Short-circuit the output terminals TB2-1, TB2-2 and bushings E1, E2 using AWG minimum wire to avoid lamp destruction in case of excessive current output.

6. Install appropriate external lightning arrestors on the input power supply lines as close as possible to the CCR's input fuse block F1/F2, or terminal block TB3, whichever is present.

6. Refer to Table 2-3 for the recommended input wire. Connect the power supply lines from the disconnect switch or main circuit breaker to the CCR input fuse block F1/F2 or terminal block TB3. Tighten all connections.

7. Engage main circuit breaker or disconnect switch to energize the regulator.

8. Turn front panel rotary selector switch S2 to all brightness steps, and verify that current values on the panel ammeter correspond to those in Tables 2-8 through 2-10 for each brightness step.

9. Disengage the main current breaker or disconnect switch to de-energize the regulator.

10. Turn the rotary selector switch S2 to OFF.

Wiring Connections and Startup *(contd.)*

11. Connect remote control lines, if required, to remote control terminal block TB1. Use AWG 19, 300 V wire or larger as indicated in Table 3-3 for 120 Vac signals. See Figure 8-1 in the *Wiring Schematics* section for remote control connections.

    NOTE: If the Siemens Airfield Solutions Advanced Control Equipment is used with the ferroresonant L-828 CCR, refer to the Advanced Control Equipment manual for wiring connections to remote control.

    NOTE: Tables 3-1 through 3-3 provide the necessary connections for remote control. Terminal B1 (B10) does not need to be wired. Brightness step B1 (B10) occurs when the regulator is switched on.

Table 3-1. Remote 120 Vac Control Connections (3-Step/6.6 A)

For this remote intensity step…	Connect CCI to…
LOW (4.8 A)	CC
MEDIUM (5.5 A)	CC, B30
HIGH (6.6 A)	CC, B100
OFF	Not applicable

Table 3-2. Remote 120 Vac Control Connections (5-Step/6.6 A)

For this remote intensity step…	Connect CCI to…
2.8 A	CC
3.4 A	CC, B2
4.1 A	CC, B3
5.2 A	CC, B4
6.6 A	CC, B5
OFF	Not applicable

Table 3-3. Remote 120 Vac Control Connections (5-Step/20 A)

For this remote intensity step…	Connect CCI to…
8.5 A	CC
10.3 A	CC, B2
12.4 A	CC, B3
15.8 A	CC, B4
20 A	CC, B5
OFF	Nothing

12. Make sure wiring connections are tight and no wires are shorting across each other.

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

Wiring Connections and Startup *(contd.)*

13. Energize regulator and set rotary selector switch to REM. Operate the CCR by remote control, and verify correct current levels are obtained on all brightness steps.

14. Turn rotary selector switch S2 to OFF and de-energize regulator (disengage disconnect switch or main circuit breaker). Remove short-circuit link from output terminals TB-2-1 and TB2-2 and bushings E1 and E2.

15. Connect the 6.6 A/20 A series lighting circuit to the output terminals/ bushings and tighten all connections.

Section 4
Operation

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

1. Introduction

This section provides the operational procedures listed below for the L-828 constant current regulator (CCR) (4-30 kW/6.6 A/20 A).

- control procedures
- shutdown procedures
- adjustment procedures

2. Control Procedures

This subsection describes the operations of local and remote controls.

Local Control

See Figure 4-1. Refer to Tables 4-1 through 4-3. The front panel rotary selector switch S2 is used for regulator local control. Rotary switch S2 for the 3-step CCR has three positions; the rotary switch for the 5-step has five positions. The regulator automatically maintains the output current within ±1% of the nominal value for the brightness position selected.

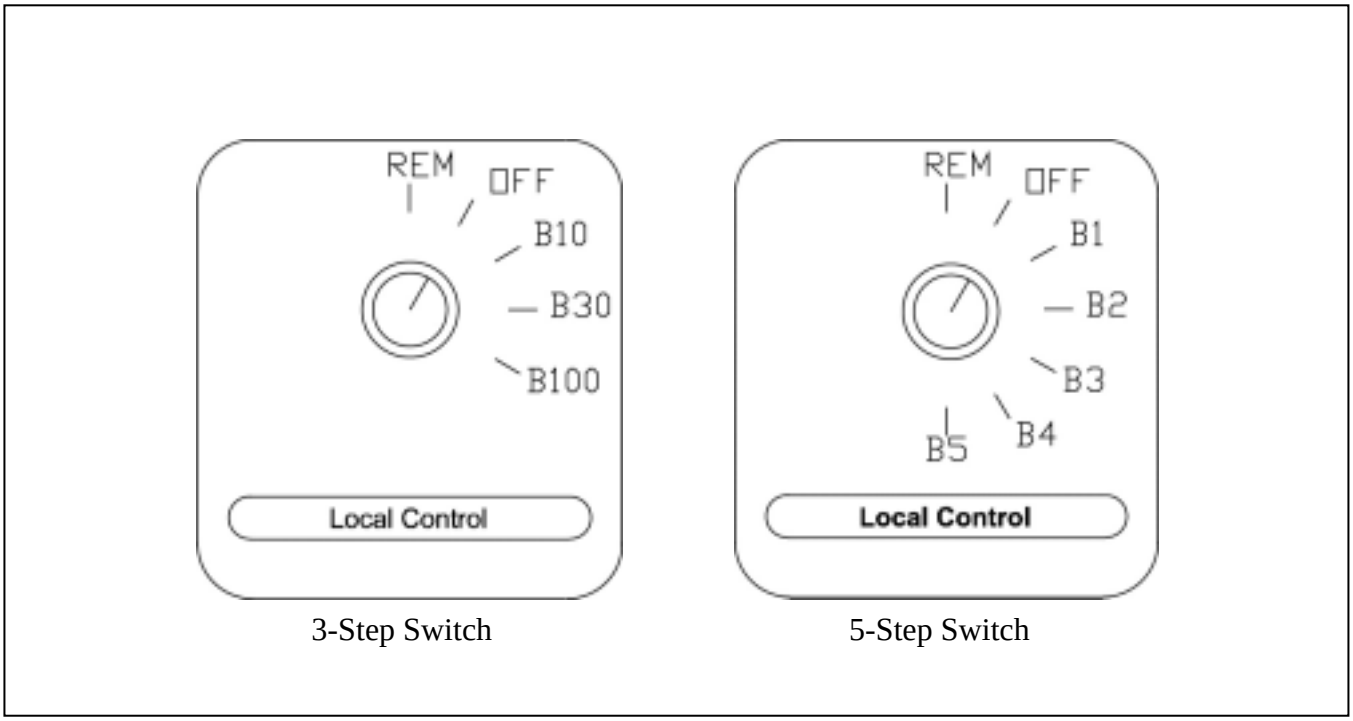


Figure 4-1. Switch S2 (3-Step/5-Step)

Local Control *(contd.)*

Table 4-1. Output Current from Rotary Switch S2 Positions for Local Control (3-Step/6.6 A)

If you set S2 to the following...	The result is...
B10	4.8 A current output
B30	5.5 A current output
B100	6.6 A current output

Table 4-2. Output Current from Rotary Switch S2 Positions for Local Control (5-Step/6.6 A)

If you set S2 to the following...	The result is...
B1	2.8 A current output
B2	3.4 A current output
B3	4.1 A current output
B4	5.2 A current output
B5	6.6 A current output

Table 4-3. Output Current from Rotary Switch S2 Positions for Local Control (5-Step/20 A)

If you set S2 to the following...	The result is...
B1	8.5 A current output
B2	10.3 A current output
B3	12.4 A current output
B4	15.8 A current output
B5	20 A current output

Remote Control

See Figure 4-1. Refer to Table 4-4 for instructions on how to set up and use remote control.

Table 4-4. Remote Control

If...	Then...
The rotary switch S2 is set to position REM and remote control wiring is connected to remote control terminal block TB1 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 S2 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 S2 is set to REM	Remote control of the regulator is possible.
No remote control connections exist on terminal block TB1 (switch S2 is set to REM)	The position REM becomes an additional OFF position; that is, the regulator is de-energized.

3. Shutdown Procedure

See Figure 4-1. To shut down the CCR, set rotary switch S2 to position OFF.

NOTE: Power to the output terminals is now off, and the regulator cannot be energized by remote control signals. Power is still present on the input power terminals and on the internal control circuitry.

To remove input power, disengage disconnect switch or external circuit breaker.

4. Adjustment Procedures

This subsection provides regulator adjustment procedures.

NOTE: The regulator has been adjusted at the factory to provide the nominal output current levels as given in Tables 2-8 through 2-10. If the current level settings need to be adjusted, read the following warning statement before proceeding.

WARNING: Only personnel qualified to work on high voltage systems should attempt to make any adjustments on the constant current regulator.

WARNING: Turn rotary selector switch S2 on the front panel of the regulator to position OFF. Remove input power before servicing control circuitry.

WARNING: Before attempting to service the regulator, remove input power by turning off disconnect switch or main circuit breaker. If the regulator de-energizes suddenly, the output circuit could be interrupted by an overcurrent, open-circuit or undervoltage condition. Turn rotary selector switch S2 to position OFF and disconnect the input power (turn off main circuit breaker or disconnect switch) before inspecting the output circuit. Without this precaution, a dip in the power line may produce an on-cycling and re-energize the regulator, causing an output voltage of several hundreds or thousands of volts to be present. These high voltages can cause serious injury or death.

Output Current Adjustment

To adjust the output current, perform the following procedure:

1. Connect a clamp-on true rms-reading instrument (such as a Fluke 87 multimeter with Y8101A current clamp or equivalent) around one of the output current leads.

   NOTE: Make sure the meter is set on the AC current scale.

   NOTE: Because the output current waveform is not a true sine wave, the ammeter must be of the true-rms type. Field instruments such as clamp-on ammeters and Simpson voltmeters will give erroneously low readings.

Output Current Adjustment
(contd.)

2. Energize the regulator locally, and set the rotary selector switch S2 to the maximum brightness position 5 (100).

3. See Figure 4-2. Carefully adjust R40 (1) on the universal regulator controller board until the desired current is measured on the meter.

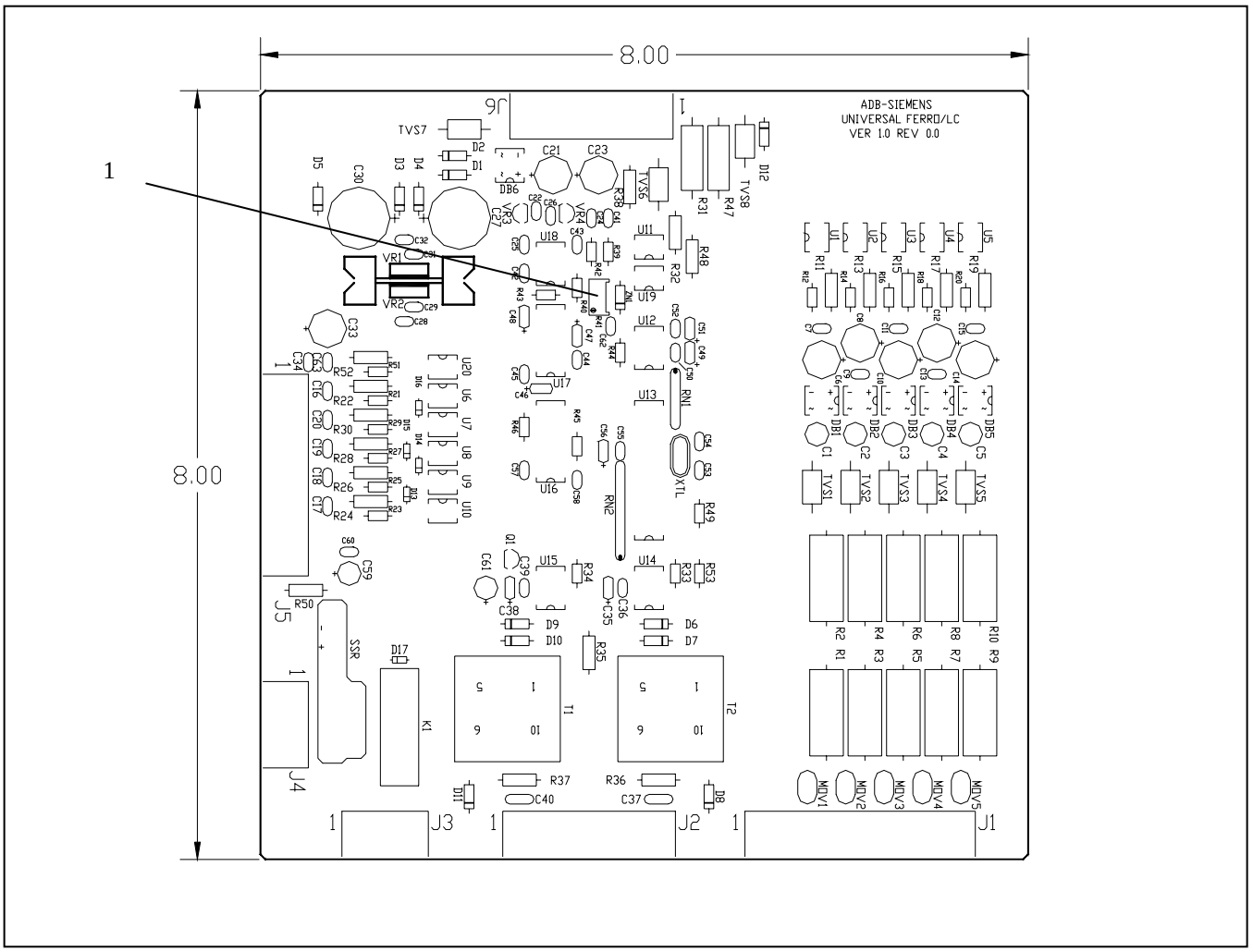


Figure 4-2. R40 (URC Board) (1)

Overcurrent Adjustment

No adjustment is provided.

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 S2) when performing maintenance tasks on the regulator. This will prevent the regulator from accidentally being turned on and causing serious injury or death. Always switch S8 on card rack off before removing or inserting PCBs. De-energize regulator by turning rotary switch S2 to OFF, and remove input power to regulator by turning off disconnect switch or main circuit breaker before opening access door to service regulator.

1. Introduction

This section provides preventive maintenance for L-828 constant current regulators (CCRs) (4-30 kW/6.6 A/ 20 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 (4-30 kW/6.6 A/20 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.	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.
	Check and record output current on each brightness step.	Use a true rms-reading instrument. Adjust current levels if out of tolerance. Refer to *Adjustment Procedures* in the *Operation* section. Refer to Tables 2-8 through 2-10 for the current range for the 3-Step and 5-Step CCRs.

Continued on next page

2. Maintenance Schedule
(contd.)

Table 5-1. L-828 CCR (4-30 kW/6.6 A/20 A) Maintenance

Interval	Maintenance Task	Action
Annually	Check relays, wiring and insulation.	Clean dirty or slightly pitted contractor contacts. Use a fine file for surface cleaning. Replace contacts that are excessively burned or pitted. Operate the local control switch S2 to check for proper operation of relays and contactors. Make sure input and output connections are tight and that no damaged wires and frayed or burned insulation exists.
	Inspect housing for rust spots.	Clean and touch-up rust spots with paint.
	Inspect lightning arrestor connections.	Tighten any loose connections. Replace charred or burnt wiring or broken arrestors.
	Perform a short-circuit test.	Refer to *Short-Circuit Test* in this section.
	Perform an open-circuit test.	Refer to *Open-Circuit Test* 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 nameplate of the regulator.

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 regulator (turn off disconnect switch or main circuit breaker) and turn rotary switch S2 to OFF.

2. Remove leads from output terminals and bushings. Use AWG 8 or larger wire to short output bushings.

3. Make sure the panel ammeter on the regulator is zeroed. If not, adjust the screw on the face cover so the needle is set to 0 amps.

Short-Circuit Test *(contd.)*

4. Energize the regulator and turn the rotary selector switch S2 to the lowest brightness step (1) and then to the remaining brightness steps. Check the output current on the ammeter at each step. The output current should be within the tolerance given in Tables 2-8 through 2-10.

5. If the output current is not within the limits specified in Tables 2-8 through 2-10, 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.

6. Turn off disconnect switch or main circuit breaker to remove input power to regulator.

7. Disconnect the shorting jumper and reconnect output cables.

8. 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 rotary switch S2 to OFF.

2. Disconnect cables from the output terminals and bushings.

3. Turn on input power to the regulator.

4. Turn rotary switch S2 to the lowest brightness position (1). The open-circuit protective device should automatically de-energize the regulator in less than 2 seconds.

5. Turn rotary switch S2 to OFF. The open-circuit protective device should reset.

6. Turn rotary switch S1 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 regulator de-energizes suddenly, 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 produce an on-cycling and re-energize the regulator, resulting in an output voltage of several hundreds or thousands of volts which can cause serious injury or death.

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

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

1. Introduction

This section provides the following troubleshooting information for the ferroresonant L-828 CCR (4-30 kW/6.6 A/20 A): preliminary troubleshooting check list and troubleshooting procedures.

2. Preliminary Troubleshooting

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

- 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 S2 from OFF to Step B1 (B10)?
- Short the output of the CCR with an AWG 10 wire, and turn on the CCR. If the regulator operates normally, the problem is 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 and SCR protection network.

3. Troubleshooting Fuses

This subsection provides information for troubleshooting fuses.

Input Power Fuses F1 and F2

Refer to Table 6-1 for amp rating as a function of input voltage and CCR kW rating for input power fuses F1 and F2.

NOTE: Fuse F1 and F2 rating in amps is equal to 250 V.

Table 6-1. CCR Input Voltage and CCR kW Rating for Input Power Fuses F1 and F2

CCR Input Voltage	CCR kW Rating					
	4 kW	**7.5 kW**	**10 kW**	**15 kW**	**20 kW**	**30 kW**
208 Vac	30 A	50 A	70 A	100 A	125A	200 A
220 Vac	25 A	50 A	60 A	90 A	125 A	175 A
240 Vac	25 A	45 A	60 A	80 A	110 A	175 A
480 Vac	12 A*	25 A*	30 A*	40 A*	60 A*	90 A*
*600 Vac						

Step-Up/Down Transformer T3 Fuses F3 and F4

Refer to Table 6-2. Fuses F3 and F4 protect transformer T3, which supplies 240 Vac to contractor coil and universal regulator power supply transformer T4.

NOTE: On 2400 Vac CCRs, fuses F3 and F4 are replaced by fuses F1 and F2 with a rating of 0.63 A, 4800 V.

Table 6-2. Transformer T3 Fuses F3 and F4 Ratings

CCR Input Voltage	Fuse F3 and F4 Rating
208 Vac	12 A, 250 V
220 Vac	12 A, 250 V
240 Vac	4 A, 250 V
480 Vac	3 A, 600 V

Universal Regulator Power Supply Transformer Fuses F5 and F6

Universal regulator power supply transformer fuses F5 and F6 protect T4 and are ½ amp, 250 V.

120 V Source to CCI Power

This ½ amp, 250 V fuse protects transformer T6. This 120 V source to CCR power is used only on the 208/220 and 2400 Vac regulators.

4. General Troubleshooting Procedures

This subsection provides general troubleshooting procedures.

Problem	Possible Cause	Corrective Action
1. Regulator not turning on	Main power supply off	Verify presence of input voltage.
	Switched off due to overcurrent	Switch regulator off in local. Wait for 2 seconds and check to see if the regulator now operates correctly.
	Incorrect external wiring	If the regulator works correctly in local but not in Remote, check the Remote control signals.
	Blown fuse	Replace any blown fuse. Check the input supply voltage and make sure that it is between –5% and +10% of the nominal value listed on the CCR nameplate.
	Defective PCB	Replace PCB.

Continued on next page

4. General Troubleshooting Procedures *(contd.)*

Problem	Possible Cause	Corrective Action
2. Regulator turns on but de-energizes suddenly	Output circuit interrupted	Apply a short to the regulator output. Turn the regulator on. If the regulator works correctly, repair the lighting circuit. Follow all safety precautions in this manual.
	Defective printed circuit board	Replace regulator controller.
	Overcurrent condition	Verify SCR ignition by replacing the PCB or SCR protection network. Check SCRs and wiring. Replace SCR.
3. Output Current always 6.6 A/20 A or more	Universal regulator controller not calibrated	With regulator set on Step B100 (B5), adjust R40 until a current reading of 6.6 A or 20 A is measured. Check remaining steps to verify the values from Tables 2-8 through 2-10.
	Overcurrent condition	Refer to problem #2 in this table, *Regulator turns on but de-energizes suddenly*.
4. Output Current always 4.8 A or less for 3-Step CCR or 2.8 A or less for 5-Step CCR or 8.5 or less on 20 A	Defective control board	If problem exists in Remote and local control, replace universal regulator controller.
	SCRs always conducting	Verify SCR ignition by replacing PCB. Check SCRs and wiring for shorts in SCR circuitry. Replace SCR protective network PCB. Replace SCR.
	Defective resonant circuit (transformer or capacitor)	Visually inspect capacitors for damaged housing or wire connections. Visually inspect transformer for damaged coils, connections, and/or wiring. Faulty capacitors will exhibit a bulging case.
	CCR overload	Remove section of load.

Continued on next page

4. General Troubleshooting Procedures *(contd.)*

Problem	Possible Cause	Corrective Action
5. More than 2 seconds required for CCR to de-energize on open-circuit load	Faulty overcurrent protection	Replace URC PCB.
6. Short lamp life and/or high output current reading on panel ammeter	Incorrect output current adjustment	Refer to *Output Current Adjustment* in the *Operation* section.
	Faulty overcurrent protection	Replace URC PCB.
7. Regulator not indicating proper current	Incorrect output current adjustment	Refer to *Output Current Adjustment* in the *Operation* section.
	Defective controller	Replace universal regulator controller.
8. Regulator operates by local control switch S2, but not by Remote control	Rotary switch S2 on input module not set to REM	Set switch S2 to REM.
	Blown fuse	On 208, 220, 2400 Vac regulators, check fuse F7.
	Loose or broken Remote control wires	Check connections on Remote terminal block TB1. If 120 Vac Remote control signals are used, use an AC voltmeter (300 Vac scale) to verify correct signals are received at the CCR.
	Incorrect wire connections	Refer to Tables 3-1 through 3-3.
9. Ammeter on CCR oscillates and loud growling noise occurs	SCR drive not working properly	Check connections at SCR module. Replace URC PCB.
10. Output current not able to be adjusted up to 6.6 A/20 A	Regulator load too large	Either reduce the load or replace the regulator with a larger kW CCR. **NOTE:** This problem can also be verified by shorting the output of the CCR and verifying output current can be adjusted correctly in each step.

Section 7
Parts

1. Introduction

To order parts, call Siemens Airfield Solutions Customer Service or your local representative. Use this five-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 Item column numbers correspond to the numbers that identify parts in illustrations following each parts list. NS (not shown) indicates that a listed part is not illustrated.

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.

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

Item	Description	Part Number	Quantity	Note
S1	Assembly	xxxxxxxx	1	A
NS	Part	xxxxxxxx	1	
H1	Part or Assembly			
	Part/Assembly for option 1	xxxxxxxx	2	
	Part/Assembly for option 2	xxxxxxxx	2	
T1	Assembly	xxxxxxxx	1	
	• Part	xxxxxxxx	1	
	• Part	xxxxxxxx	2	
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 (4-50 kW/6.6 A/20 A) Part Numbering System

See Figure 7-1. Refer to Table 7-1 for the ferroresonant L-828 CCR (4-30 kW/ 6.6 A) part numbers. Refer to Table 7-2 for the ferroresonant L-828 CCR (15/20/30 kW/20 A) part numbers.

The part number for the L-828 50 kW/20 A/2400 V CCR is 44D1365-3U.

Table 7-1. L-828 CCR (4-30 kW/6.6 A) Part Numbers

kW Rating	208 V	220 V	240 V	480 V	2400V
4 kW	44D1301-XU	44D1302-XU	44D1093-XU	44D1327-XU	—
7.5 kW	44D1303-XU	44D1304-XU	44D1094-XU	44D1328-XU	—
10 kW	44D1305-XU	44D1306-XU	44D1095-XU	44D1307-XU	44D1329-XU
15 kW	44D1308-XU	44D1309-XU	44D1310-XU	44D1097-XU	44D1195-XU
20 kW	44D1312-XU	44D1313-XU	44D1096-XU	44D1314-XU	44D1315-XU
30 kW	44D1323-XU	44D1324-XU	44D1325-XU	44D1196-XU	44D1181-XU

Table 7-2. L-828 CCR (15/20/30 kW/20 A) Part Numbers

kW Rating	208 V	220 V	240 V	480 V	2400V
15 kW	44D1337-3U	44D1338-3U	44D1339-3U	44D1340-3U	44D1341-3U
20 kW	44D1343-3U	44D1344-3U	44D1345-3U	44D1346-3U	44D1347-3U
30 kW	44D1355-3U	44D1356-3U	44D1357-3U	44D1358-3U	44D1359-3U

3. L-828 CCR (4-50 kW/6.6 A/20 A) Part Numbering System *(contd.)*

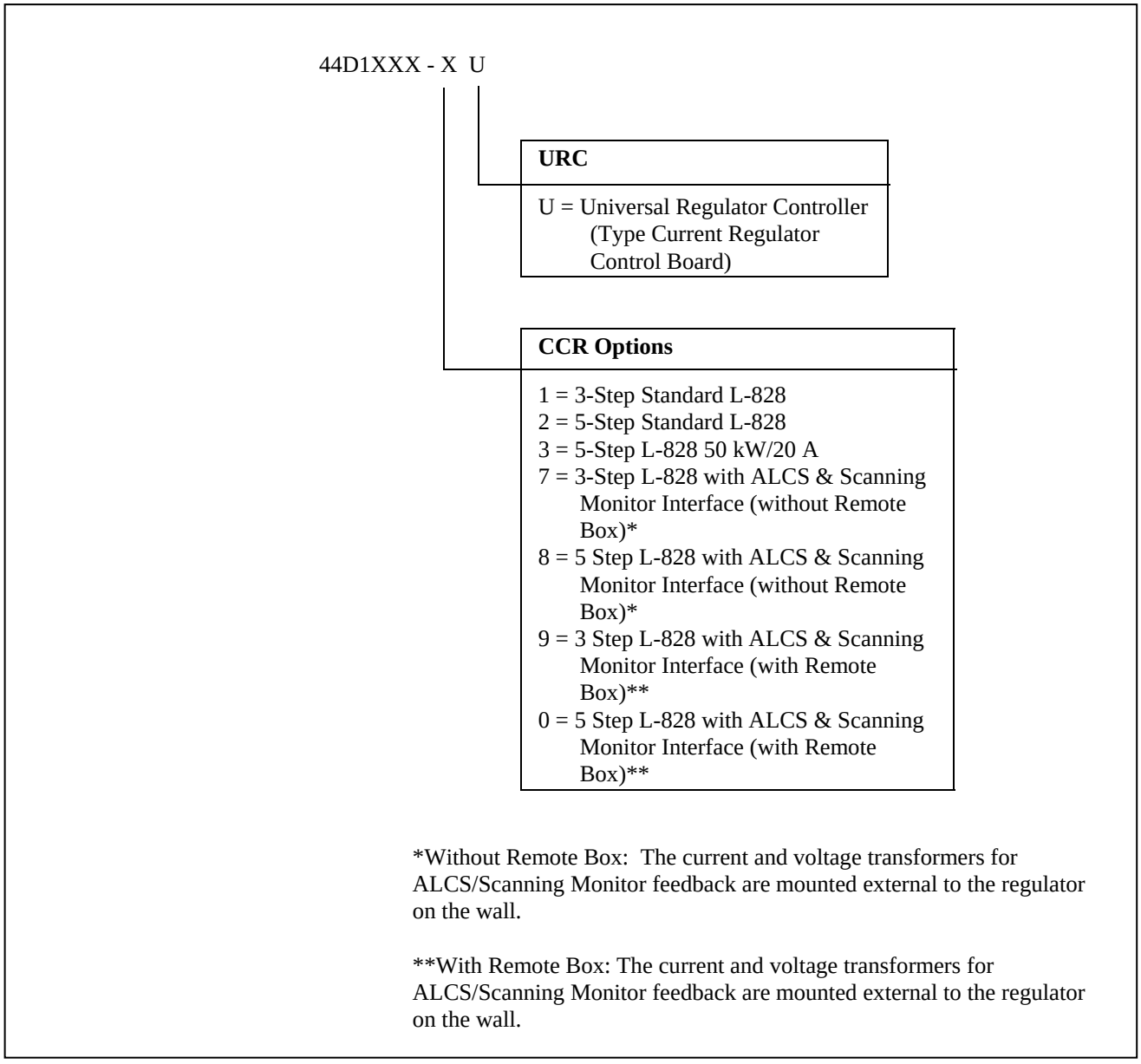


Figure 7-1. L-828 CCR Part Numbers

4. L-828 CCR General Assembly (4, 7.5, and 10 kW/208-480 and 2400 Vac/6.6 A) Parts List

This subsection provides part numbers for the L-828 ferroresonant CCR (4, 7.5, and 10 kW/208-480 and 2400 Vac/6.6 A). See Figure 7-2.

NOTE: Figure 7-2 shows only a 15 & 20 kW CCR. Ferroresonant L-828 CCR (4. 7.5, 10, and 30 kW) parts may have different part locations.

Item	Description	Part Number	Quantity	Note
NS	Power transformer		1	
	4 kW (208, 220, and 240 Vac)	35C0134		
	4 kW (408 Vac)	35C0155		
	7.5 kW (208, 220, and 240 Vac)	35C0135		
	7.5 kW (480 Vac)	35C0156		
	10 kW (208, 220, and 240 Vac)	35C0136		
	10 kW (480 Vac)	35C0151		
	10 kW (2400 Vac)	35C0157		
1	Fuse		2	
	Fuse, 25 A, 250 V (4 kW, 220/240 Vac CCRs)	47A0069		
	Fuse, 30 A, 250 V (4 kW, 208 Vac CCRs)	47A0092		
	Fuse, 45 A, 250 V (7.5 kW, 240 Vac CCRs)	47A0070		
	Fuse, 50 A, 250 V (7.5 kW, 208/220 Vac CCRs)	47A0093		
	Fuse, 60 A, 250 V (10 kW, 220/240 Vac CCRs)	47A0071		
	Fuse, 12 A, 600 V (4 kW, 480 Vac CCRs)	47A0090		
	Fuse, 25 A, 600 V (7.5 kW, 480 Vac CCRs)	47A0091		
	Fuse, 30 A, 600 V (10 kW, 480 Vac CCRs)	47A0085		
	Fuse, 70 A, 250 V (10 kW, 208 Vac CCRs)	47A0094		
2	Fuse holder		1	
	Fuse holder, 30 A for 4 kW, 208, 220, and 240 Vac	72A0091		
	Fuse holder, 60 A for 7.5 kW (208, 220, and 240 Vac), and 10 kW (208, 220, and 240 Vac)	72A0098		
	Fuse holder, 30 A, 600 V for 4, 7.5, and 10 kW (480 Vac)	49A0081		
	Fuse holder, 100 A, 250 V for 10 kW (208 Vac)	49A0091		
3	Contactor		1	
	Contactor for 4 kW (208, 220, 240, 480 Vac); 7.5 and 10 kW (480 Vac)	53A0178		
	Contactor for 7.5 and 10 kW (208, 220, 240 Vac)	53A0179		
4	Transformer		1	
	Transformer (208, 220, 240 Vac)	35C0207		
	Transformer (480/240 Vac)	35C0150		

Continued on next page

4. L-828 CCR General Assembly (4, 7.5, and 10 kW/208-480 and 2400 Vac/6.6 A) Parts List
(contd.)

Item	Description	Part Number	Quantity	Note
5	Fuse		2	
	Fuse, 12 A, 250 V (208, 220 Vac only)	47A0128		
	Fuse, 4 A, 250 V (240 Vac only)	47A0073		
	Fuse, 3 A, 600 V (480 only)	47A0084		
	Fuse, 1 A, 2400 V	47A0088		
6	Fuse holder		See note.	A
	Fuseblock	47A0061		
	Fuse holder, 30 A	49A0084		
	Fuse holder assembly	44C1217		
7	Heatsink		1	
	Heatsink (for 4 and 7.5 kW CCR)	50B0028		
	Heatsink (for10 kW CCR)	50B0032		
8	SCR block	28A0011	1	
9	SCR protective network	44B1171	1	
10	Fuse, ½ A, 250 V, Slo-Blo	47A0119	1	
11	Transformer, 240/240	35A0496	1	
12	Univeral Regulator Controller	44A5936	1	
13	Capacitor, 26 µF, 525 Vac	20A0019	See note.	A
14	Current transformer (6.6 A/6.6 A)	35C0493	1	
15	URC Step switch assembly		1	
	URC Step Switch assembly (for 3-Step)	44A5965-1		
	URC Step Switch assembly (for 5-Step)	44A5965-2		
16	Rotary switch		1	
	Rotary switch, 30 degree, SP, 5 Position (for 3-Step)	46A0083-5		
	Rotary switch, 30 degree, SP, 7Position (for 5-Step)	46A0083-7		

NOTE A: Quantity for part varies.

4. L-828 CCR General Assembly (4, 7.5, and 10 kW/208-480 and 2400 Vac/6.6 A) Parts List *(contd.)*

Item	Description	Part Number	Quantity	Note
NS	Analog ammeter	52A0099	1	
NS	Lightning protector (varistor)	32A0025	See note.	A
NS	Transformer, 2400/240 Vac	35C0146	1	
NS	Contactor assembly for 10 kW, 2400 Vac	44C1410-1	1	
NS	Contactor	53A0250	1	
NS	Thermostat	54A0007	1	
NS	Strip heater for 240 Vac, 150 W	85A0054	1	
NS	Varistor, 275 Vac, 360 joules	32A0032	See note.	A
NS	High voltage terminal (2400 Vac only)	49A0086	2	

NOTE A: Quantity for part varies.
NS: Not Shown

4. L-828 CCR General Assembly (4, 7.5, and 10 kW/208-480 and 2400 Vac/6.6 A) Parts List *(contd.)*

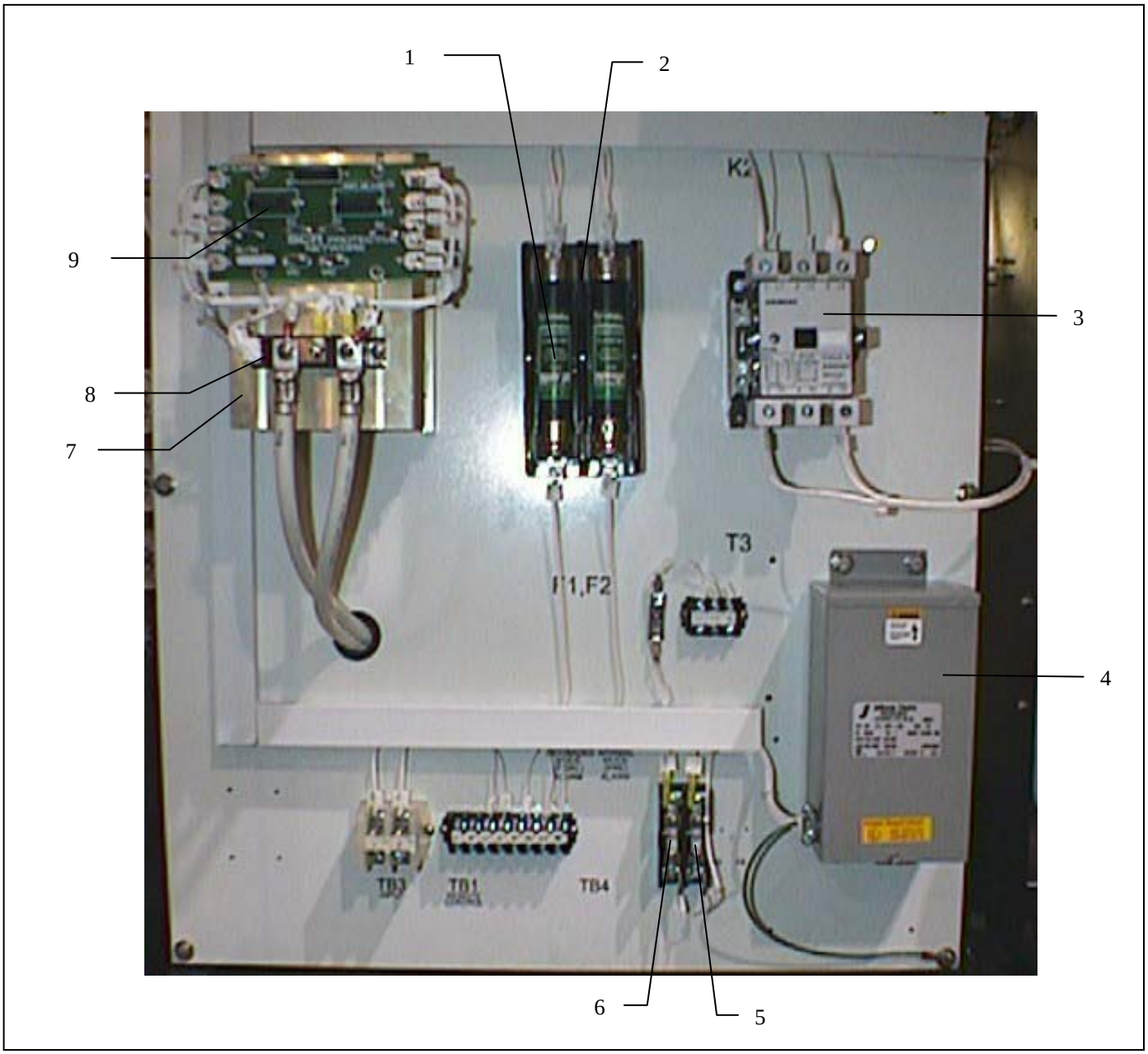


Figure 7-2. Ferroresonant L-828 CCR (15 & 20 kW) (Part 1 of 4)

4. L-828 CCR General Assembly (4, 7.5, and 10 kW/208-480 and 2400 Vac/6.6 A) Parts List *(contd.)*

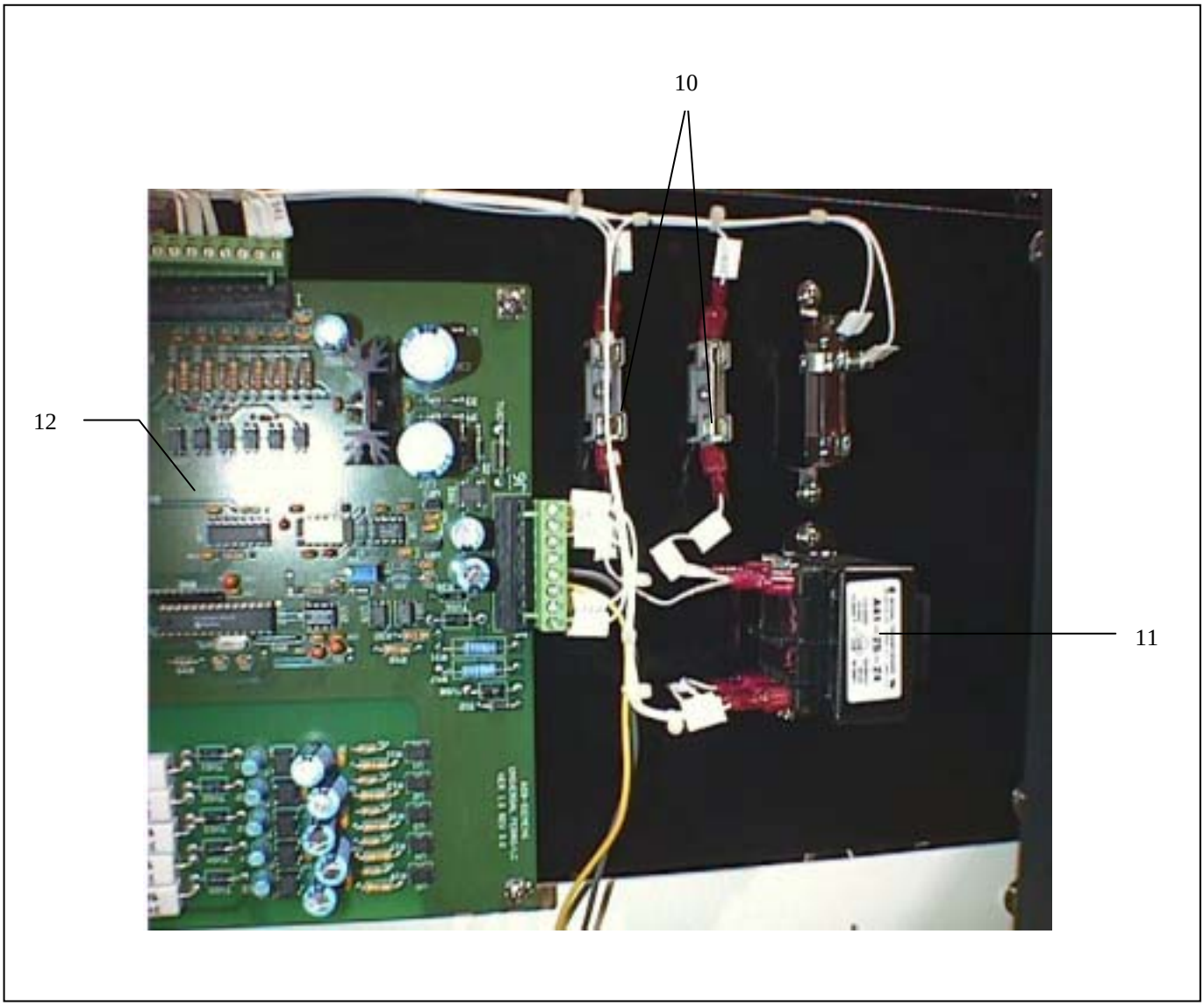


Figure 7-2. Ferroresonant L-828 CCR (15 & 20 kW) (Part 2 of 4)

4. L-828 CCR General Assembly (4, 7.5, and 10 kW/208-480 and 2400 Vac/6.6 A) Parts List *(contd.)*

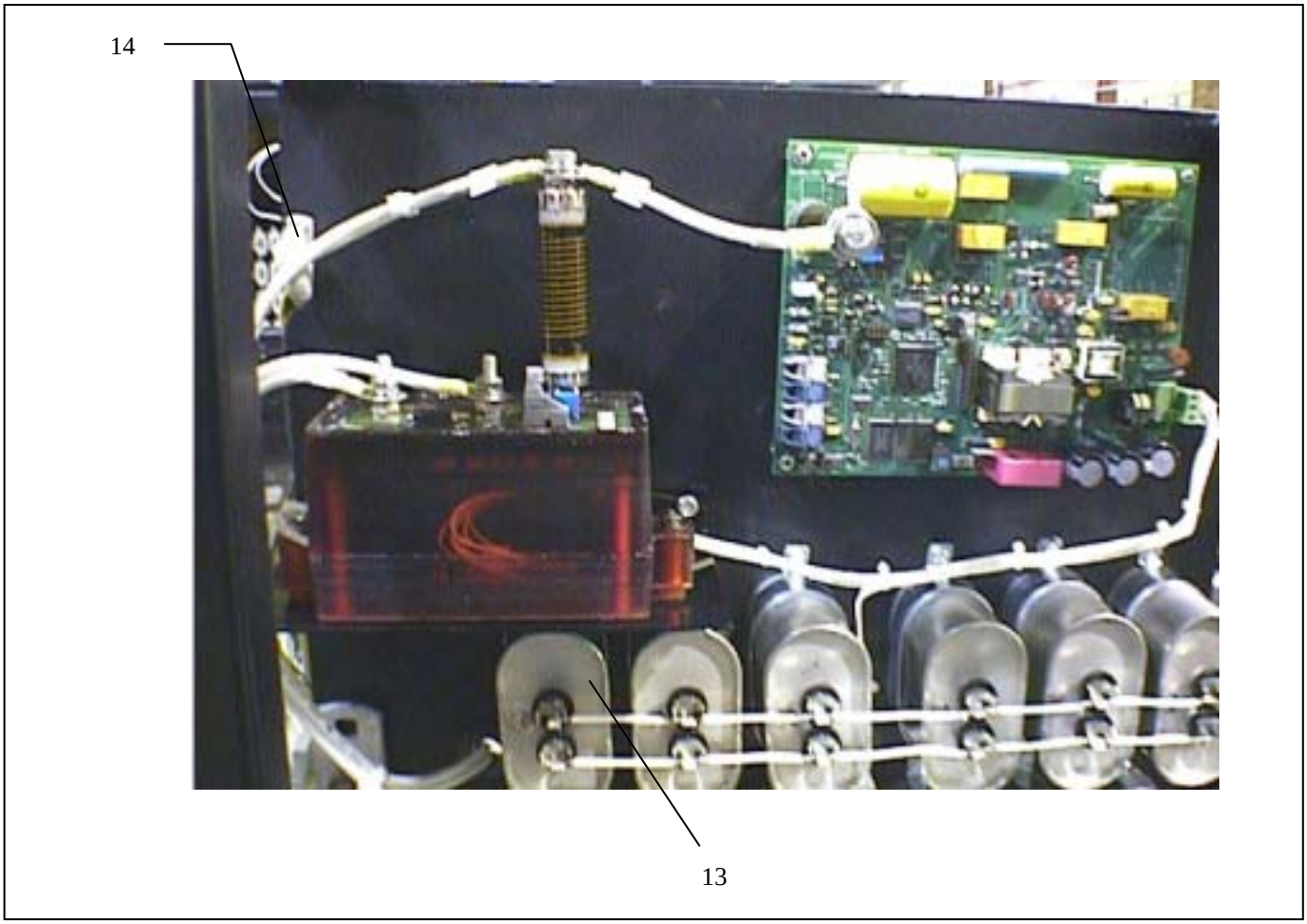


Figure 7-2. Ferroresonant L-828 CCR (15 & 20 kW) (Part 3 of 4)

4. L-828 CCR General Assembly (4, 7.5, and 10 kW/208-480 and 2400 Vac/6.6 A) Parts List
(contd.)

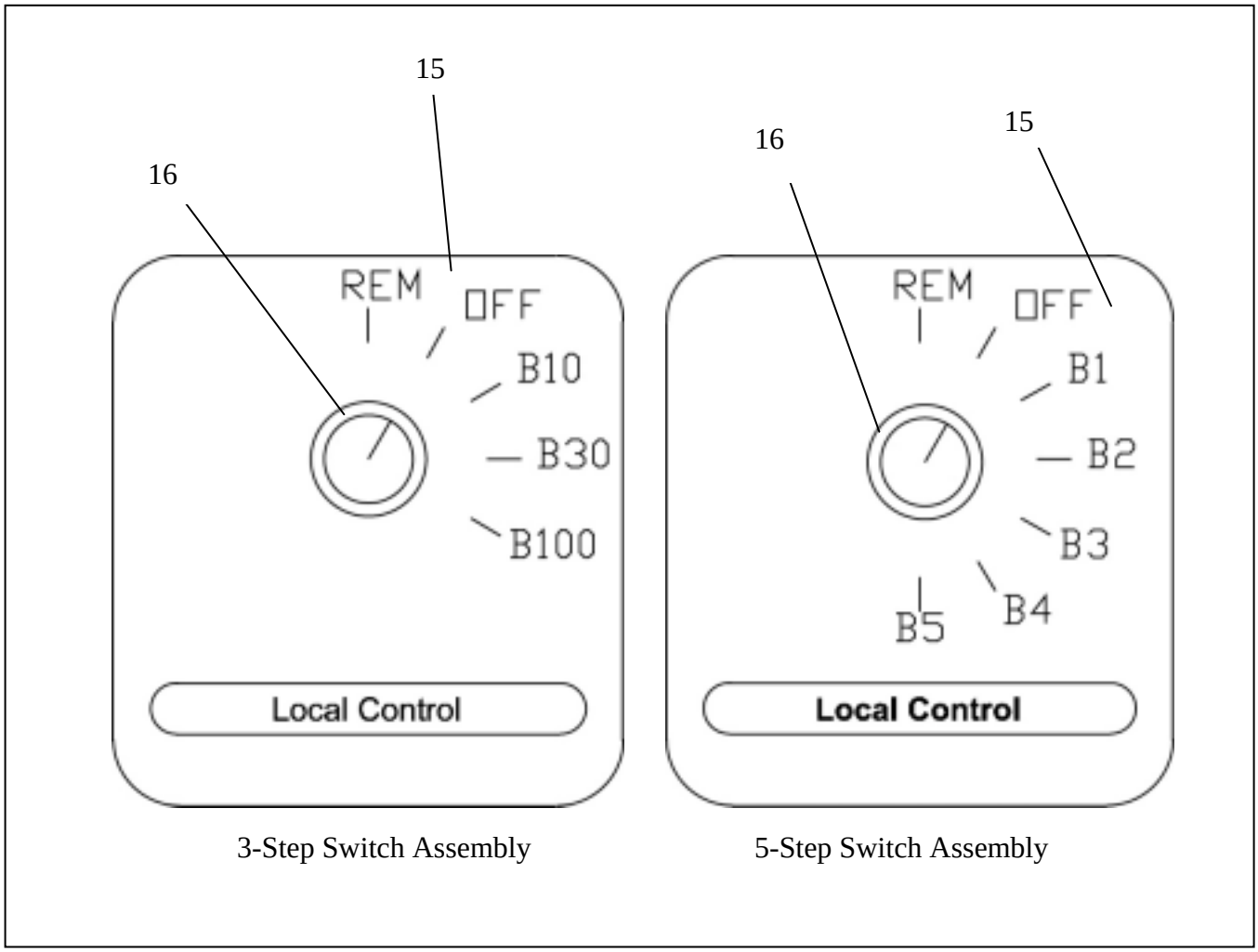


Figure 7-2. Ferroresonant L-828 CCR (15 & 20 kW) (Part 4 of 4)

5. L-828 CCR General Assembly (15 & 20 kW/208-480 & 2400 Vac 6.6 A/20 A) Parts List

This subsection provides part numbers for the L-828 ferroresonant CCR (15 & 20 kW/208-408 & 2400 Vac 6.6 A/20 A). See Figure 7-2.

Item	Description	Part Number	Quantity	Note
NS	Power transformer		1	
	15 kW (208, 220, and 240 Vac) (6.6 A)	35C0159		
	15 kW (408 Vac) (6.6 A)	35C0152		
	20 kW (208, 220, and 240 Vac) (6.6 A)	35C0137		
	20 kW (480 Vac) (6.6 A)	35C0153		
	15 kW (208, 220, and 240 Vac) (20 A)	35C0173		
	15 kW (408 Vac) (20 A)	35C0174		
	20 kW (208, 220, and 240 Vac) (20 A)	35C0177		
	20 kW (480 Vac) (20 A)	35C0178		
1	Fuse		2	
	Fuse, 80 A, 250 V (15 kW, 240 Vac CCRs)	47A0096		
	Fuse, 90 A, 250 V (15 kW, 220 Vac CCRs)	47A0083		
	Fuse, 100 A, 250 V (15 kW, 208 Vac CCRs)	47A0098		
	Fuse, 110 A, 250 V (20 kW, 240 Vac CCRs)	47A0099		
	Fuse, 125 A, 250 V (20 kW, 208/220 Vac CCRs)	47A0072		
	Fuse, 40 A, 600 V (15 kW, 480 Vac CCRs)	47A0086		
	Fuse, 60 A, 600 V (20 kW, 480 Vac CCRs)	47A0087		
2	Fuse block		1	
	Fuse block, 100 A, 250 V for 15 kW, 208, 220, 240 Vac	49A0091		
	Fuse block, 200 A, 250 V for 20 kW, 208, 220, 240 Vac	72A0099		
	Fuse block, 60 A, 250 V for 15 and 20 kW, 480 Vac	49A0082		
3	Contactor		1	
	Contactor, 15 kW (480 V)	53A0179		
	Contactor, 15 kW/20 kW (208/240 V)	53A0332		
	Contactor, 20 kW (208/240 V)	53A0192		
	Contactor, (20 A)	53A0180		

Continued on next page

5. L-828 CCR General Assembly (15 & 20 kW/208-480 & 2400 Vac 6.6 A/20 A) Parts List *(contd.)*

Item	Description	Part Number	Quantity	Note
4	Transformer		1	
	Transformer (208, 220, 240 Vac)	35C0207		
	Transformer (480/240 Vac)	35C0150		
5	Fuse		2	
	Fuse, 4 A, 250 V (240 Vac only)	47A0073		
	Fuse, 3 A, 600 V	47A0084		
6	Fuse holder		See note.	A
	Fuse holder 30 A, 600 V	49A0084		
	Fuse holder	47A0061		
7	Heatsink (180 mm)	50B0030	1	
8	SCR block	28A0011	1	
9	SCR protective network	44B1171	1	
10	Fuse, ½ A, 250 V, Slo-Blo	47A0119	1	
11	Transformer, 240/12/24 V	35A0496	1	
12	Universal Regulator Controller	44A5936	1	
13	Capacitor, 26 µF, 525 Vac	20A0019	See note.	A
14	Current transformer		1	
	Current transformer (6.6 A/6.6 A)	35C0493		
	Current transformer (20 A/6.6 A)	35A0528		
15	URC Step switch assembly		1	
	URC Step Switch assembly (for 3-Step)	44A5965-1		
	URC Step Switch assembly (for 5-Step)	44A5965-2		
16	Rotary switch		1	
	Rotary switch, 30 degree, SP, 5 Position (for 3-Step)	46A0083-5		
	Rotary switch, 30 degree, SP, 7Position (for 5-Step)	46A0083-7		
NS	Analog ammeter	52A0099	1	
NS	Lightning protection (varistor)	32A0024	2	
NS	Transformer, 240/120 V (6.6 A)	35A0277	1	

NOTE A: Quantity for part varies.
NS: Not Shown

6. L-828 CCR General Assembly (15 & 20 kW/ 2400 Vac, 30 kW/ 208-2400 Vac 6.6 A/20 A) Parts List

See Figure 7-2. This subsection provides part numbers for the L-828 ferroresonant CCR (15 & 20 kW/2400 Vac and 30 kW/208-2400 Vac 6.6 A/20 A).

Item	Description	Part Number	Quantity	Note
NS	Power transformer		1	
	15 kW (2400 Vac) (6.6 A)	35C0148		
	20 kW (2400 Vac) (6.6 A)	35C0161		
	30 kW (208, 220, 240 Vac) (6.6 A)	35C0167		
	30 kW (480 Vac) (6.6 A)	35C0149		
	30 kW (2400 Vac) (6.6 A)	35C0145		
	15 kW (2400 Vac) (20 A)	35C0175		
	20 kW (2400 Vac) (20 A)	35C0179		
	30 kW (208, 220, 240 Vac) (20 A)	35C0185		
	30 kW (480 Vac) (20 A)	35C0186		
	30 kW (2400 Vac) (20 A)	35C0187		
1	Fuse		2	
	Fuse, 90 A, 600 V (for 30 kW, 480 Vac CCRs)	47A0097		
	Fuse, 175 A, 250 V, 30 kW, 220, 240 Vac CCRs)	47A0101		
	Fuse, 200 A, 250 V (30 kW, 208 Vac CCRs)	47A0102		
2	Fuseblock, 100 A, 600 V for 480 Vac CCRs	49A0085	1	
3	Contactor		1	
	Contactor, 30 kW, 208-240 Vac	53A0192		
	Contactor, 30 kW, 480 Vac	53A0180		
4	Transformer		1	
	Transformer (208, 220, 240 Vac)	35C0207		
	Transformer (480/240 Vac)	35C0150		
5	Fuse		2	
	Fuse, 4 A, 250 V, 30 kW (208-240 Vac)	47A0073		
	Fuse, 30 A, 600 V, 30 kW (480 Vac)	47A0084		
	Fuse, 1 A, 2400 V, 30 kW (2400 Vac)	47A0088		
6	Fuse holder		See note.	A
	Fuseblock (6.6 A/20 A)	47A0061		
	Fuse holder, 30 A, 30 kW (480 Vac)	49A0084		
	Fuse holder assembly, 2400 Vac CCRs	44D1217		

NOTE A: Quantity for part varies.
NS: Not Shown

Continued on next page

6. L-828 CCR General Assembly (15 & 20 kW/ 2400 Vac, 30 kW/ 208-2400 Vac 6.6 A/20 A) Parts List *(contd.)*

Item	Description	Part Number	Quantity	Note
7	Heatsink		1	
	Heatsink (180 mm) for 15 and 20 kW (2400 Vac CCRs)	50B0030		
	Heatsink (300 mm) for 25 and 30 kW (280-2400 Vac CCRs)	50B0027		
8	SCR block		1	
	SCR block for 15 and 20 kW (2400 Vac CCRs)	28A0011		
	SCR block for 30 kW (208-2400 Vac CCRs)	28A0012		
9	SCR protective network PCB	44B1171	1	
10	Fuse, ½ A, 250 V, Slo-Blo	47A0119	1	
12	Universal Regulator Controller	44A5936	1	
13	Capacitor, 26 µF, 525 Vac	20A0019	See note.	A
14	Current transformer	35C0493	1	
15	URC Step switch assembly		1	
	URC Step Switch assembly (for 3-Step)	44A5965-1		
	URC Step Switch assembly (for 5-Step)	44A5965-2		
16	Rotary switch		1	
	Rotary switch, 30 degree, SP, 5 Position (for 3-Step)	46A0083-5		
	Rotary switch, 30 degree, SP, 7Position (for 5-Step)	46A0083-7		
NS	Analog ammeter	52A0099	1	
NS	Transformer (2400/240 Vac)	35C0146	1	
NS	Contactor assembly, 15, 20, 30 kW (2400 Vac CCRs)	44C1410-1	1	
NS	Contactor	53A0250	1	
NS	Thermostat	54A0007	1	
NS	Strip heater, 240 Vac, 150 W	85A0054	1	
NS	Varistor, 275 Vac, 360 joules	32A0032	See note.	A

Continued on next page

Item	Description	Part Number	Quantity	Note
NS	Terminal, H.V. for 15, 20, 30 kW (2400 Vac CCRs)	48A0086	2	
NS	Lightning protection (varistor)	32A0024	2	
NS	Transformer, 240/24 Vac	35A0496	1	
NS	Transformer 240/120 (6.6 A)	35A0277	1	
NOTE A: Quantity for part varies. NS: Not Shown				

7. Universal Regulator Controller Parts List

See Figure 7-3.

Item	Description	Part Number	Quantity	Note
J3,4	Header, PCB, 90-degree, 3X1, 7.62 mm	70A0543-03	2	
J2	Header, PCB, 90-degree, 6X1, 7.62 mm	70A0543-06	1	
J1	Header, PCB, 90-degree, 8X1, 7.62 mm	70A0543-08	1	
J6	Header, PCB, 90-degree, 8X1, 5.08 mm	70A0545-08	1	
J5	Header, PCB, 90-degree, 10X1, 5.08 mm	70A0545-10	1	
R40	Resistor, ¼ W,9.53k, 1%, MF, COM	R2509531M12	1	

7. Universal Regulator Controller Parts List
(contd.)

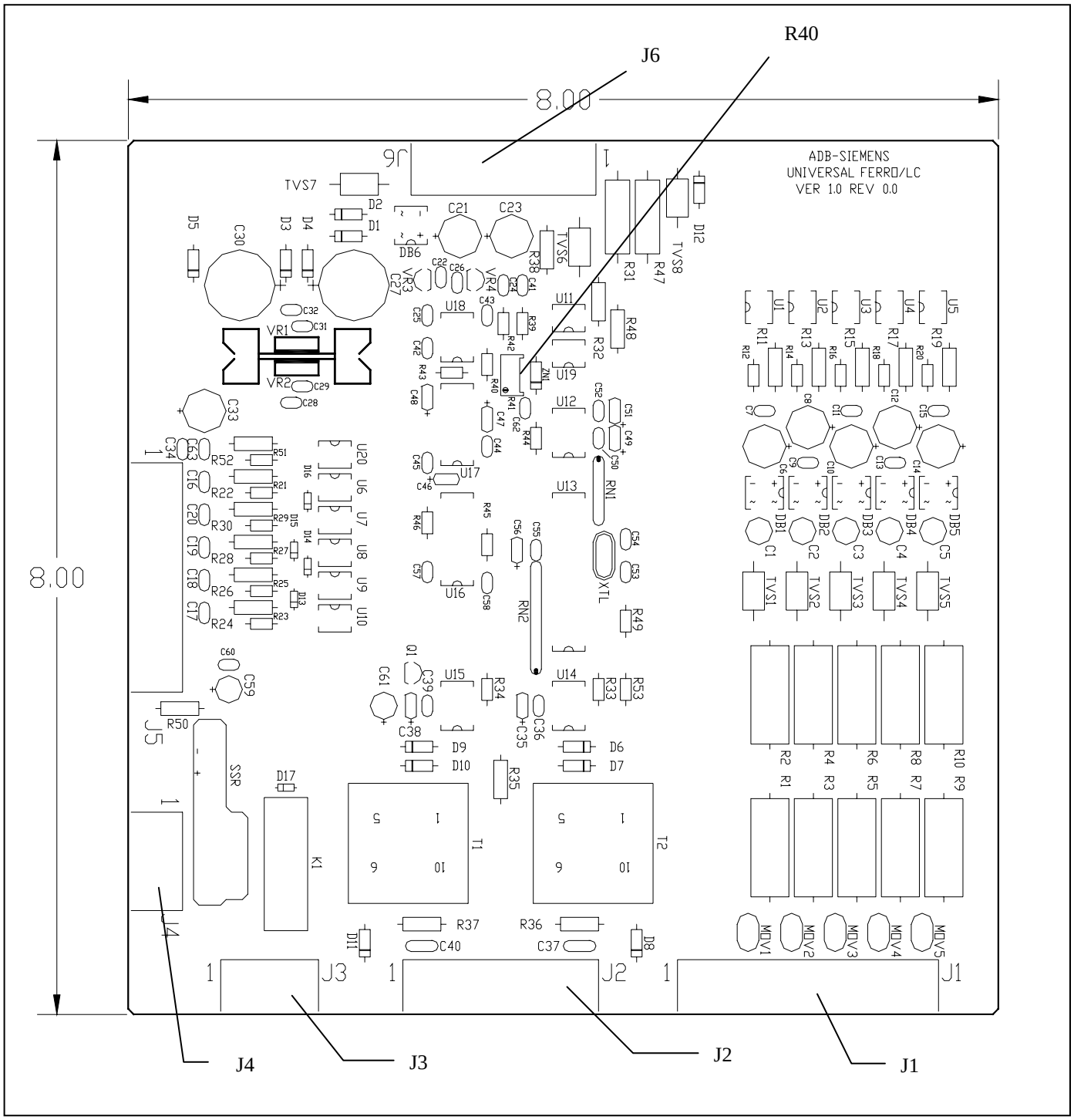


Figure 7-3. Universal Regulator Controller PCB

8. Recommended Spare Parts

This subsection provides recommended spare parts.

Spare Parts for 4, 7.5, and 10 kW (208-480 Vac) and 10 kW (2400 Vac) 6.6 A/20 A CCRs

See Figure 7-2. This subsection provides spare parts for 4, 7.5, and 10 kW (208-480 Vac) and 10 kW (2400 Vac) 6.6 A/20 A CCRs.

Item	Description	Part Number	Quantity	Note
5	Fuse		2	
	Fuse, ½ A, 250 V, Slow Blow	47A0119		
	Fuse, 3 A, 600 V, 480 Vac CCRs	47A0084		
	Fuse, 4 A, 250 V, 240 Vac CCRs	47A0073		
	Fuse, 12 A, 600 V (4 kW, 480 Vac CCRs)	47A0090		
	Fuse, 25 A, 600 V (7.5 kW, 480 Vac CCRs)	47A0091		
	Fuse, 25 A, 250 V (4 kW, 220/240 Vac CCRs)	47A0069		
	Fuse, 30 A, 600 V (10 kW, 480 Vac CCRs)	47A0085		
	Fuse, 30 A, 250 V (4 kW, 208 Vac CCRs)	47A0092		
	Fuse, 45 A, 250 V (7.5 kW, 240 Vac CCRs)	47A0070		
	Fuse, 50 A, 250 V (7.5 kW, 208/220 Vac CCRs)	47A0093		
	Fuse, 60 A, 250 V (10 kW, 220/240 Vac CCRs)	47A0071		
	Fuse, 70 A, 250 V (10 kW, 208 Vac CCRs)	47A0094		
8	SCR block	28A0011	1	
9	SCR protective network	44B1171	1	
12	Universal Regulator Controller	44A5936	1	

Spare Parts for 15 and 20 kW (208-480 Vac) 6.6 A/20A CCRs

See Figure 7-2. This subsection provides spare parts for 15 and 20 kW (208-480 Vac) 6.6 A/20A CCRs.

Item	Description	Part Number	Quantity	Note
5	Fuse		2	
	Fuse, 1/2 A, 250 V, Slo-Blo	47A0119		
	Fuse, 3 A, 600 V, 480 Vac CCRs	47A0084		
	Fuse, 4 A, 250 V, 240 Vac CCRs	47A0073		
	Fuse, 40 A, 600 V (15 kW, 480 Vac CCRs)	47A0086		
	Fuse, 60 A, 600 V (20 kW, 480 Vac CCRs)	47A0087		
	Fuse, 80 A, 250 V (15 kW, 240 Vac CCRs)	47A0096		
	Fuse, 90 A, 250 V (15 kW, 220 Vac CCRs)	47A0083		
	Fuse, 100 A, 250 V (15 kW, 208 Vac CCRs)	47A0098		
	Fuse, 110 A, 250 V (20 kW, 240 Vac CCRs)	47A0099		
	Fuse, 125 A, 250 V (20 kW, 208/220 Vac CCRs)	47A0072		
8	SCR block	28A0011	1	
9	SCR protective network	44B1171	1	
12	Universal Regulator Controller	44A5936	1	

Spare Parts for 15 and 20 kW (2400 Vac) and 30 kW (208-2400 Vac) 6.6 A/20 A CCRs

See Figure 7-2. This subsection provides spare parts for 15 and 20 kW (2400 Vac), and 30 kW (208-2400 Vac) 6.6 A/20 A CCRs.

Item	Description	Part Number	Quantity	Note
5	Fuse		2	
	Fuse, 1 A, 2400 V, 25 &30 kW (2400 Vac CCRs)	47A0088		
	Fuse, 1/2 A, 250 V, Slo-Blo	47A0119		
	Fuse, 3 A, 600 V, 25 & 30 kW (480 Vac CCRs)	47A0084		
	Fuse, 4 A, 250 V, 25 & 30 kW (208-240 Vac CCRs)	47A0073		
	Fuse, 75 A, 600 V, 25 kW (480 Vac CCRs)	47A0095		
	Fuse, 90 A, 600 V, 30 kW (480 Vac CCRs)	47A0097		
	Fuse, 150 A, 250 V, 25 kW (220/240 Vac CCRs)	47A0100		
	Fuse, 175 A, 250 V, 25 kW (208 Vac CCRs), and 30 kW (220/240 Vac CCRs)	47A0101		
	Fuse, 200 A, 250 V (30 kW, 208 Vac) CCRs	47A0102		
8	SCR block			
	SCR block for 15 & 20 kW (2400 Vac CCRs)	28A0011	2	
	SCR block for 25 & 30 kW (208-2400 Vac CCRs)	28A0012	1	
9	SCR protective network	44B1171	1	
12	Universal Regulator Controller	44A5936	1	

Section 8
Wiring Schematics

1. Introduction

This section provides ferroresonant L-828 constant current regulator (CCR) (4-30 kW/6.6 A/20 A) with universal regulator controller (URC) wiring schematics.

2. Wiring Schematics

See Figure 8-1 for the L-828 CCR (4-30 kW/6.6/20 A) internal wiring schematic. See Figure 8-2 for the 208-480 V and 2400 V wiring modification kits.

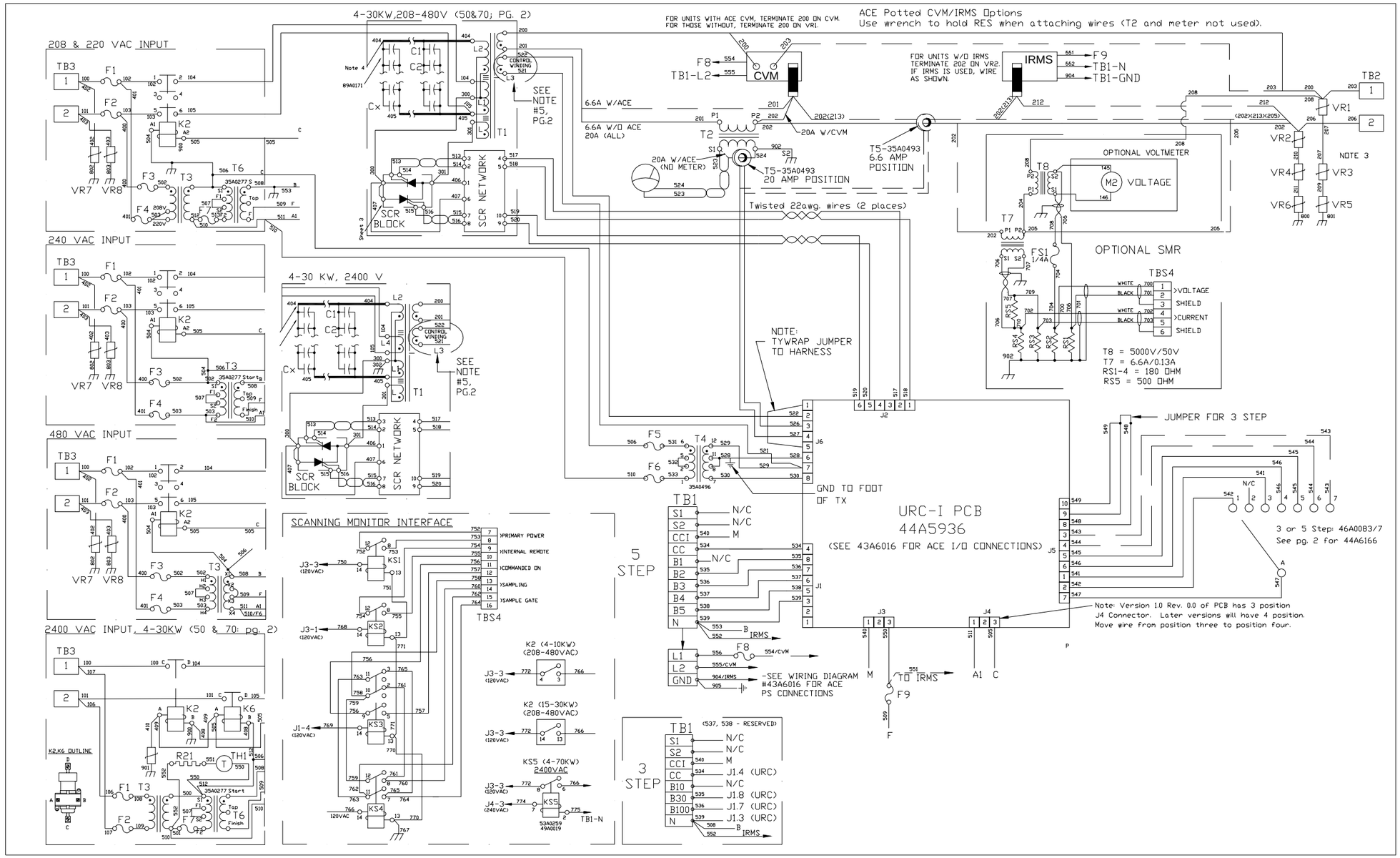


Figure 8-1. L-828 CCR with URC Internal Wiring Schematic (Part 1 of 2)

CCR PART NUMBERS Note: A U suffix signifies a URC type control board

POWER	CURRENT	208 V	220 V	240 V	480 V	2400 V
4 kW	6.6 A	44D1301/X	44D1302/X	44D1093/X	44D1327/X	
7.5 kW	6.6 A	44D1303/X	44D1304/X	44D1094/X	44D1328/X	
10 kW	6.6 A	44D1305/X	44D1306/X	44D1095/X	44D1307/X	44D1329/X
15 kW	6.6 A	44D1308/X	44D1309/X	44D1310/X	44D1097/X	44D1195/X
15 kW	20 A	44D1337/X	44D1338/X	44D1339/X	44D1340/X	44D1341/X
20 kW	6.6 A	44D1312/X	44D1313/X	44D1096/X	44D1314/X	44D1315/X
20 kW	20 A	44D1343/X	44D1344/X	44D1345X	44D1346/X	44D1347/X
25 kW	6.6 A	44D1317/X	44D1318/X	44D1319/X	44D1320/X	44D1321/X
25 kW	20 A	44D1349/X	44D1350/X	44D1351/X	44D1352/X	44D1353/X
30 kW	6.6 A	44D1323/X	44D1324/X	44D1025/X	44D1196/X	44D1181/X
30 kW	20 A	44D1355/X	44D1356/X	44D1357/X	44D1358/X	44D1359/X
50 kW	20 A				44D1364/X	44D1365/X
70 kW	20 A				44D1367/X	44D1368/X

CCR PART NUMBERS /OPTIONS

X	FCC CODE	STEPS	INTERNAL MONITOR	SCN MTR INTERFACE	SCN MTR READY	DUAL RELAY ALARM	COMPUTER ALARM
1	L-828	3					
2	L-829	3	Y			Y	
3	L-828	5					
4	L-829	5	Y			Y	
5	L-829	3	Y				Y
6	L-829	5	Y				Y
7	L-828	3		Y			
8	L-828	5		Y			
9	L-828	3			Y		
0	L-828	5			Y		

CCR MODIFICATION KITS

PART NUMBER	DESCRIPTION
	INPUT PROTECTION:
94B0011	INPUT VARISTOR KIT, 208-480 VAC
	METER KITS: (L-828 ONLY)
94A0118	DIGITAL VOLTAGE METER KIT
94A0119	DIGITAL CURRENT METER KIT
94A0127	ANALOG VOLTAGE METER KIT, 4KW
94A0128	ANALOG VOLTAGE METER KIT, 7.5 KW
94A0129	ANALOG VOLTAGE METER KIT, 10-15 KW
94A0130	ANALOG VOLTAGE METER KIT, 20-30 KW
94A0306	URC SMI KIT

100 SERIES WIRES - PRIMARY POWER

POWER	208 V	220 V	240 V	480 V	2400 V
4 kW	14AWG/600V 89A0060/1	14AWG/600V 89A0060/1	14AWG/600V 89A0060/1	14AWG/600V 89A0060/1	
7.5 kW	10AWG/600V 89A0068/1	10AWG/600V 89A0068/1	10AWG/600V 89A0068/1	14AWG/600V 89A0060/1	
10 kW	10AWG/600V 89A0068/1	10AWG/600V 89A0068/1	10AWG/600V 89A0068/1	14AWG/600V 89A0060/1	
15 kW	6AWG/600V 89A0081/1	6AWG/600V 89A0081/1	6AWG/600V 89A0081/1	10AWG/600V 89A0068/1	12AWG/25KV 89A0086/1
20 kW	6AWG/600V 89A0081/1	6AWG/600V 89A0081/1	6AWG/600V 89A0081/1	10AWG/600V 89A0068/1	12AWG/25KV 89A0086/1
25 kW	2AWG/600V 89A0083/1	2AWG/600V 89A0083/1	2AWG/600V 89A0083/1	6AWG/600V 89A0081/1	12AWG/25KV 89A0086/1
30 kW	2AWG/600V 89A0083/1	2AWG/600V 89A0083/1	2AWG/600V 89A0083/1	6AWG/600V 89A0081/1	12AWG/25KV 89A0086/1
50 kW				2AWG/600V 89A0083/1	8AWG/25KV 89A0087/1
70 kW				2AWG/600V (2X) 89A0083/1	8AWG/25KV 89A0087/1

200 SERIES WIRES HIGH VOLTAGE

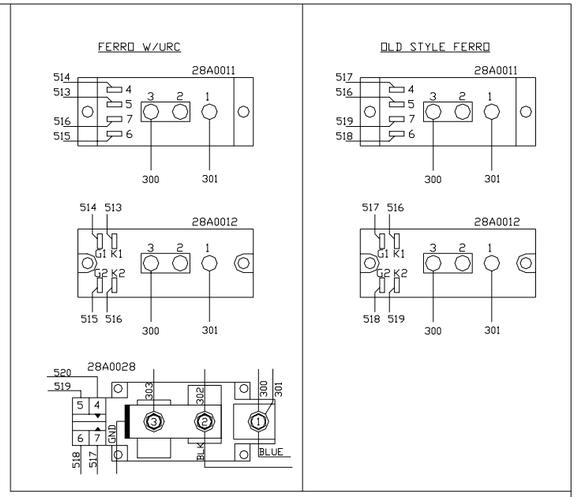
POWER	ALL
4 kW	12AWG/25KV 89A0086/1
7.5 kW	12AWG/25KV 89A0086/1
10 kW	12AWG/25KV 89A0086/1
15 kW	12AWG/25KV 89A0086/1
20 kW	12AWG/25KV 89A0086/1
25 kW	12AWG/25KV 89A0086/1
30 kW	12AWG/25KV 89A0086/1
50 kW	12AWG/25KV 89A0086/1
70 kW	12AWG/25KV 89A0086/1

300 SERIES WIRES TANK LOOP

POWER	ALL
4 kW	14AWG/600V 89A0060/1
7.5 kW	6AWG/600V 89A0081/1
10 kW	6AWG/600V 89A0081/1
15 kW	2AWG/600V 89A0083/1
20 kW	2AWG/600V 89A0083/1
25 kW	2AWG/600V 89A0083/1
30 kW	2AWG/600V 89A0083/1
50 kW	2AWG/600V (2X) 89A0083/1
70 kW	2AWG/600V (2X) 89A0083/1

400 SERIES WIRES MEDIUM CURRENT

POWER	ALL
4 kW	14AWG/600V 89A0060/1
7.5 kW	14AWG/600V 89A0060/1
10 kW	14AWG/600V 89A0060/1
15 kW	12AWG/600V 89A0012/9
20 kW	12AWG/600V 89A0012/9
25 kW	12AWG/600V 89A0012/9
30 kW	12AWG/600V 89A0012/9
50 kW	10AWG/600V 89A0068/1
70 kW	10AWG/600V 89A0068/1



NOTES:

1. WIRE NUMBERS REASSIGNED AT THE CREATION OF THIS DOCUMENT.
2. WIRE SIZES:
   100-109: PRIMARY POWER, SEE TABLE.
   200-212: HIGH VOLTAGE, SEE TABLE.
   300-305: TANK LOOP, SEE TABLE.
   400-410: MEDIUM CURRENT, SEE TABLE.
   500-552: STD CONTROL, 22AWG, 600V, 89A0002/9.
   600-632: L-828 ONLY, 22AWG, 600V, 89A0002/9.
   700-710: SCANNING MONITOR READY, 22AWG, 2 COND SHLD, 89A0126
   750-775: SCANNING MONITOR INTERFACE, 22AWG, 600V, 89A0002/9
   800-804: GROUND, 12AWG, 600V, GN/YL, 89A163/5.
   900-906: 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 INDIVIDUAL WIRES TO EACH CAPACITOR BANK.
5. REFERENCE DWG. #94A0318 FOR WIRES #521 & 522 CORE WINDING.

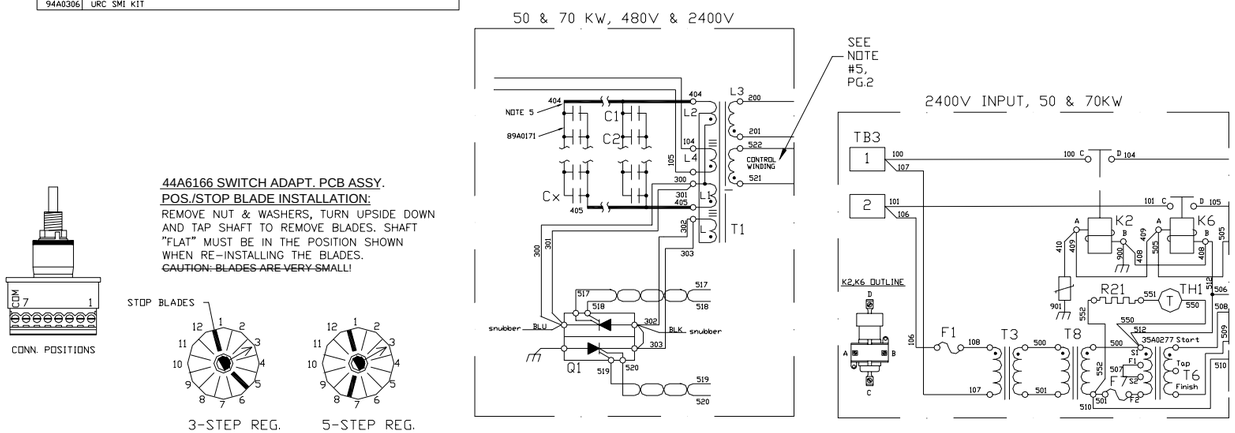
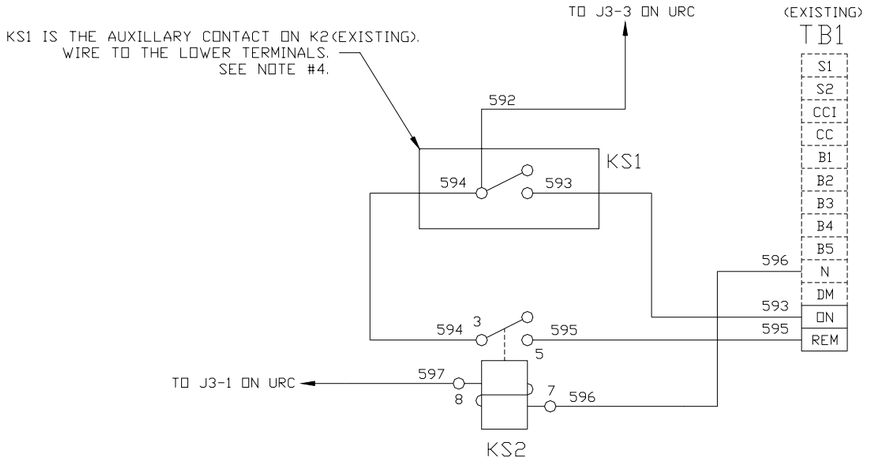
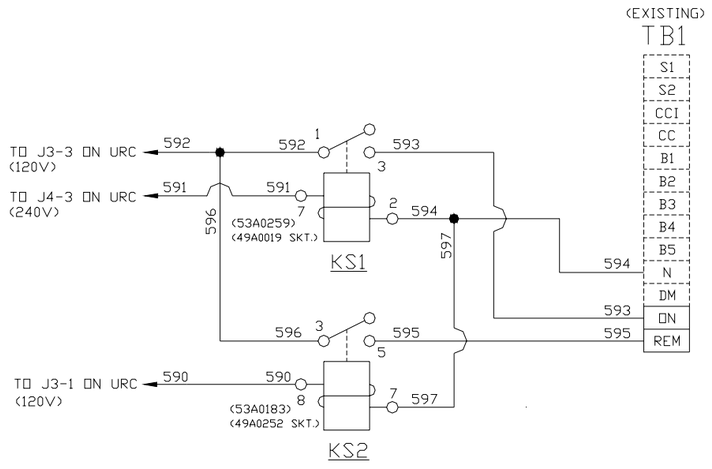


Figure 8-1. L-828 CCR with URC Internal Wiring Schematic (Part 2 of 2)



208-480VAC INPUT ONLY



2400VAC INPUT ONLY

Figure 8-2. L-828 Ferro 208-480 V and 2400 V with URC On and Remote Auxiliary Contact Modification Kits