

Ferroresonant Constant Current Regulator Switchgear Design with Roll-Out Power Pack

Liberty Airport Systems' ferroresonant CCR is the result of forty years experience providing airfield lighting power and control solutions. Liberty has designed the next-generation *Freedom Series™* family of Switchgear style CCRs, suitable for all airfield lighting applications and budgets. *Freedom Series™* sets new standards in performance, ease of maintenance, and personnel safety, while providing the airport with the choice to configure each CCR to match specific control and monitoring requirements.

System Application

Ferroresonant CCRs are recommended for series circuits that have oscillating loads, where low output harmonic content is desired, or when used with power line carrier control technology.

Freedom Series™ CCRs may be individually powered or integrated into a switchgear line-up assembly and powered from a single supply. Applications include:

- General aviation, commercial, and military airports operating in visibility conditions ranging from VFR to CAT IIIb.
- Runway and taxiway edge lighting, centerline lighting, signs, approach systems, PAPI, VASIS.
- Flashing loads including series-powered ALSF or SSALR strobes, ODALs, REILs, LAHSO, Runway Guard Lights.
- Surface Movement and Guidance Control Systems (SMGCS) using power line carrier technology to control and monitor individual lamps or segments.

Standards Compliance

- FAA Advisory Circular 150/5345-10F, June 24/05, Type L-828 and L-829.
- Transport Canada CCR Specification K290-2.
- Canadian Department of National Defence Standards.
- ICAO Aerodrome Design Manual Doc 9157, Part 5.



Fig. 1 10 kW Ferroresonant Regulator

Technology Benefits

- Digital control for precise waveform accuracy, high-speed response, and local data storage using Digital Signal Processor technology.
- Digital output accuracy and drift-free circuitry for increased lamp life.
- Digital operator interface provides full monitoring, diagnostics, and alarm indication. Dedicated status LEDs provide clear indication of warning and fault conditions.
- Membrane keys with tactile response provide maintenance personnel with access to all display values and configuration parameters.
- Auto-calibration reduces maintenance costs by eliminating the need for scheduled preventative maintenance service.
- Ferroresonant design provides a stable output current that is not affected by flashing loads.
- True sine wave output provides high input power factor, low electromagnetic interference (EMI), low total harmonic distortion (THD) and excellent immunity to electrical transients and surges.

Maintenance Features

- All ratings are dry-type and convection air-cooled. No cooling fans are required.
- Roll-out Power Pack with locking 'service position' provides the ability to service components without reaching into the enclosure. No rear access is required.
- Roll-out Power Pack allows users to remove the output transformer for replacement or rating upgrade in less than five minutes.
- No output calibration tuning is required.
- Separate control electronics compartment is provided with hinged panel for ease of access.
- Control electronic components are modular with plug-in connectors for quick removal and insertion. Control wiring can be done without reaching into the enclosure.

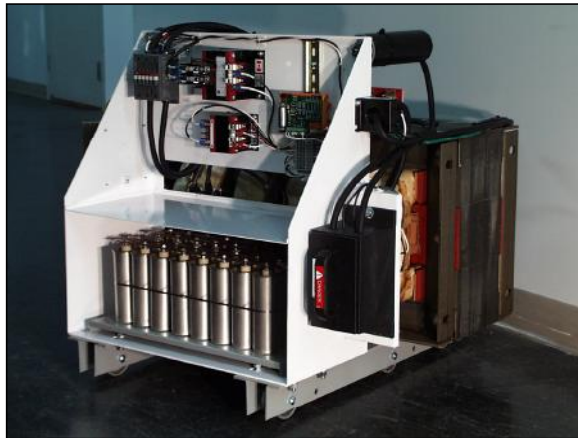


Fig. 2 30 kW Roll-Out Power Pack with S1 Cutout

Safety Features

- All high voltage connections are fully guarded for personnel safety.
- Control and power compartments are fully isolated for increased safety.
- Power compartment has a hinged door with a lockable handle. A safety interlock ensures power is disconnected when the door is opened.
- Only components operating below 30V are mounted on the CCR door, further enhancing personnel safety.
- The CCR is equipped with over-current, open-circuit and over-voltage protection as well as input and output lightning protection.

Control and Monitoring

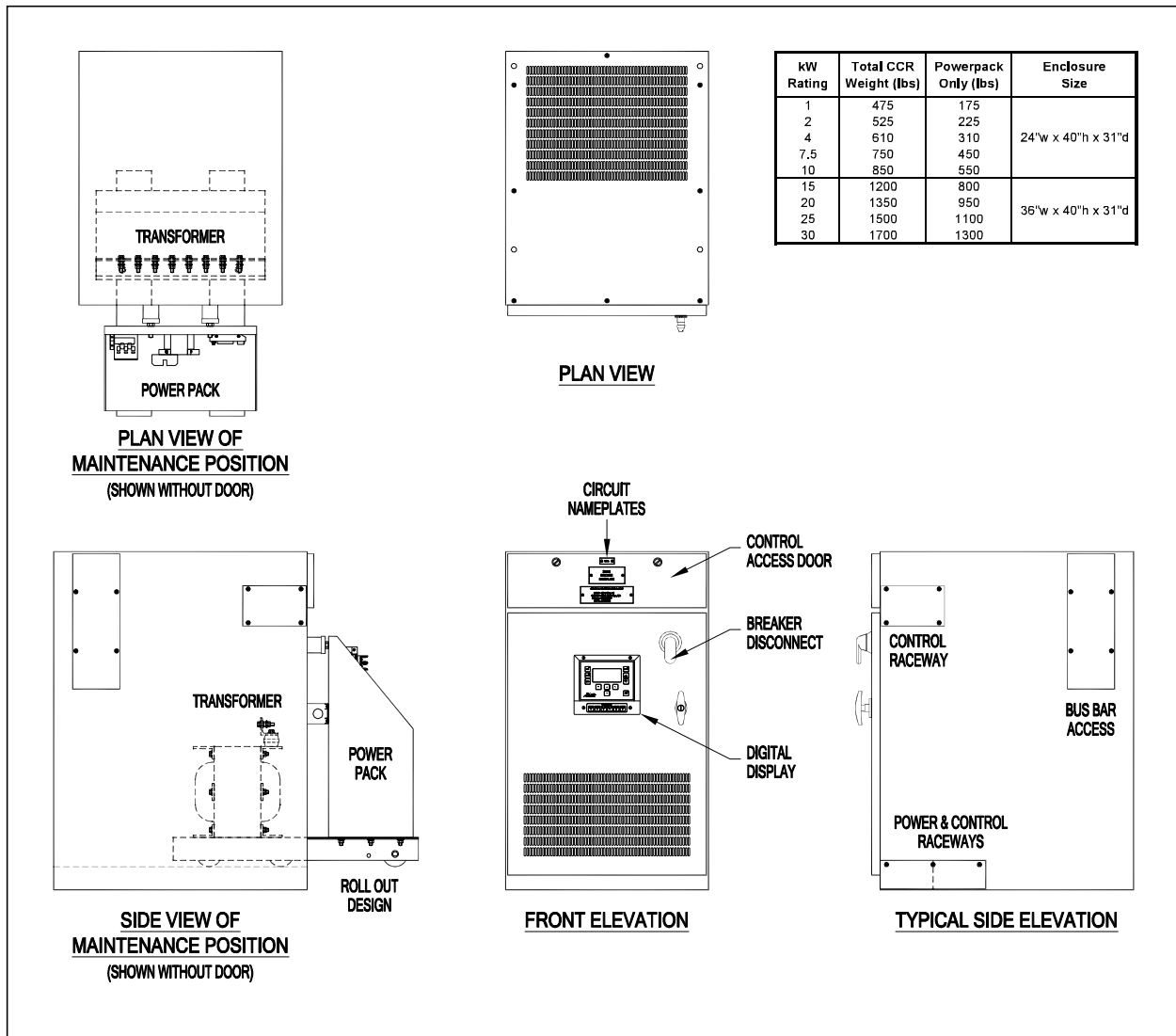
- Available in output ratings from 1 kW to 30 kW at 6.6 A; 20 kW to 30 kW at 20 A.
- All CCRs are user configurable, including selection of 1 to 5 brightness steps, output current adjustment, selection of monitoring features, operational parameters and alarm setpoints.
- User-configurable failsafe capabilities allow last state (latching) or preset brightness selection upon failure of control system.
- Monitoring of CCR status including commanded and actual brightness, warning and fault conditions including door interlock, local switch position, over current, over voltage or open circuit trips, communications or hardware failure.
- Analog monitoring of input and output current, voltage, VA, power, power factor, elapsed time at each brightness step and number of operations.
- Supports redundant 24 VDC external power from the control system allowing monitoring and indication even on power failure to the CCR.
- Available L-829 monitoring functions including primary power, circuit trips, loss of VA, brightness within specifications, number of failed lamps per circuit with warning and alarm indication.
- Available insulation resistance monitoring to ground (Auto-Megger) and ground fault alarm indications.
- Available control and monitoring of up to six L-847 circuit selectors from the CCR front panel display.

Built-in Networking

- Available fully redundant RS-485 network support using Allen-Bradley DF1 or Modbus protocols.
- Available redundant 100 Mb Ethernet network support using Ethernet/IP, or Modbus TCP protocols.
- Direct communication interface to Liberty *Freedom Series™* or *Spirit SE Series™* Airfield Lighting Control and Monitoring Systems using Ethernet or RS-485 networks.
- Locally re-configurable using serial port. Remotely re-configurable via dial-up modem or internet using VPN access.
- Custom communications protocols or interface gateways can be provided.

Available Switchgear Features

- CCRs may be stacked two-high and mounted side by side to form a continuous switchgear line-up.
- Integral 2, 3, or 4 conductor 600 A, 600 V power bus in both the upper and lower cells provides up to 1200 A capacity. An internal ground bus is standard in switchgear assemblies.
- Bus guards are removable from the front for ease of service and inspection of bus connections.
- Integral circuit breaker eliminates the need to install remote breakers in a separate wall-mounted panel board.
- Integral horizontal power and control raceways allow all field and control cables to be routed within the switchgear assembly with no external conduit or cable trays required.
- Integral vertical power and control raceways (two each) allow top or bottom cable exit from each cell or from selected cells.
- *Freedom Series™* CCRs are cable raceway and bus work-compatible with existing Westinghouse, Hughey & Phillips or Honeywell switchgear installations. Close-coupling to Siemens and Crouse-Hinds CCR installations is also available.



Ordering Information

Type:

FSF8 - Ferroresonant L828 Series
 FSF9 - Ferroresonant L829 Series

Construction:

S - Switchgear

Output kW Rating:

01 - 1 kW	07 - 7.5 kW	20 - 20 kW
02 - 2 kW	10 - 10 kW	25 - 25 kW
04 - 4 kW	15 - 15 kW	30 - 30 kW

Class:

A - 6.6 A Output B - 20 A Output

Input Voltage:

1 - 208 VAC, 60 Hz	4 - 600 VAC, 60 Hz	7 - 380 VAC, 50 Hz
2 - 240 VAC, 60 Hz	5 - 220 VAC, 50 Hz	8 - 400 VAC, 50 Hz
3 - 480 VAC, 60 Hz	6 - 230 VAC, 50 Hz	9 - 220 VAC, 60 Hz

Control Voltage:

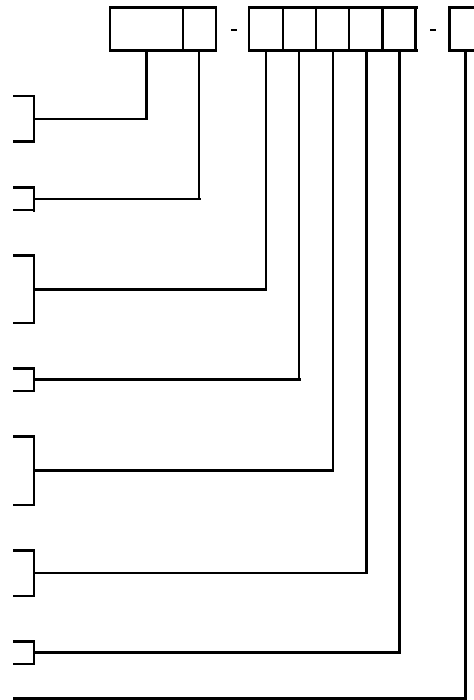
A - 24VDC Internal	C - 48VDC Internal	E - 120VAC Internal
B - 24VDC External	D - 48VDC External	F - 120VAC External

Brightness Steps:

1 - Single Step 3 - Three Step 5 - Five Step

Options (Select as Many as Required):

- 01 - Non-Fusible Disconnect Switch
- 02 - Breaker (std with Switchgear)
- 03 - Breaker, high kAIC (specify)
- 04 - 25 kAIC Power Bus (std with Switchgear)
- 05 - 65 kAIC Power Bus
- 22 - Internal Field Circuit (S1) Cutout
- 23 - Insulation Resistance Monitor (Megger)
- 25 - Output Load Taps (25% Increments)
- 26 - Output Power Monitoring (voltage, VA, power, power factor)
- 27 - Input Power Monitoring (current, voltage, VA, power, power factor)
- 41 - Redundant Ethernet Network Interface
- 42 - Redundant RS485 Network Interface
- 43 - Single Ethernet Network Interface
- 44 - Single RS485 Network Interface
- 51 - Circuit Selector Control & Monitoring Interface (up to 4 external L-847)
- 52 - Integral L-847 Circuit Selector (Direction Changer)
- 53 - Integral L-847 Circuit Selector (2 Independent Circuits)



Application Engineering

If you have any unique power or control system requirements or applications, please do not hesitate to contact us.

Our engineering staff would be pleased to work with you on finding a cost-effective solution using current technology.



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