INSTRUCTION MANUAL

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KRR 24-50

24-VOLT, 50-AMPERE RAILROAD BATTERY CHARGER

I — INTRODUCTION

SCOPE OF MANUAL.

This instruction manual covers the installation and operation of the Model KRR 24-50 24-Volt, 50-Ampere Railroad Battery Charger.

WARNINGS and CAUTIONS

- **Do not operate the unit without proper grounding. Improper grounding risks an electric shock that could result in injury or death.**
- **Do not touch the unit's input or output terminals to avoid the risk of electric shock that could result in injury or death. Energy stored in the unit's output capacitor is present on the DC OUTPUT terminals for a few seconds even after the a-c input voltage is removed.**
- **The Float Voltage and Current Limit must be preset prior to starting the initial charge to avoid damage to the battery being charged.**
- **To avoid damage to the unit or the battery being charged, never obstruct the ventilation holes at the sides of the unit. The unit must be installed in a properly ventilated area, free of smoke and corrosive or explosive vapors.**

DESCRIPTION.

The Model KRR 24-50 24-Volt, 50-Ampere Railroad Battery Charger is a wall-mounted unit designed to charge 24-Volt lead-acid or nickel cadmium batteries used in railroad applications. The output voltage is set to 26.8V d-c, and is adjustable from 18.8 to 32.4V d-c from the front panel recessed trimpot. Similarly, the output current limit is set to 50A d-c and is adjustable from 10 to 50A d-c from the front panel recessed trimpot. An optional temperature compensation probe (not supplied) provides automatic adjustment of the float voltage to accommodate temperatures from 0° to 35°C. Units may be operated with a nominal 100V a-c to 240V a-c (input voltage range 85 to 265 Va-c), 50-100 Hz (see Table 1, Note 1). Both line and neutral lines are protected by 25A fuses. A front panel ammeter shows charging current.

The heart of the Model KRR 24-50 is a solid-state switching power supply which has an integral cooling fan. A front panel CHARGER ON indicator lights while input power is applied to the a-c input terminals and the unit is operational. The front panel TEMP PROBE NOT CONNECTED indicator lights to show that the temperature compensation probe is not attached to the unit. An internal diode network across the output provides protection in the event that the battery connections are reversed, causing the front panel circuit breaker to open.

FEATURES

- **Wide Range Input** - Operates from input voltage range of 85 to 265V a-c, input frequency range 47-100Hz (see Table 1, Note 1) with no adjustment or modification required.
- **Adjustable Float Voltage** - The float voltage is factory set to 26.8V d-c, and is adjustable, using the tool on the back of the front panel door (see Figure 1), from 18.8 to 32.4V d-c at the front panel by connecting a precision digital voltmeter to the + and – VOLTAGE MONITOR test points and adjusting the output using the V. FLOAT ADJ potentiometer.
- **Adjustable Current Limit** - The current limit is factory set to 50A d-c, and is adjustable, using the tool on the back of the front panel door (see Figure 1), from 10 to 50A d-c at the front panel using the C. LIMIT ADJ potentiometer.
- **Temperature Compensation** - Optional temperature compensation probes (Models TEMPCO-10 (10 ft. long), TEMPCO-50 (50 ft.), TEMPCO-100 (100 ft.) and TEMPCO-200 (200 ft.), not supplied) provide automatic adjustment of the float voltage to accommodate temperatures from 0° to 35°C for lead-acid batteries. For other lengths, consult factory.
- **CHARGER ON indicator** - on while a-c input power applied to unit and unit is operational.
- **Charging Current ammeter** - indicates charging current
- **Input protection** - Two line fuses (25A/250V) are provided.
- **Battery connection protection** - If battery connections are reversed, an internal diode network across the output is forward biased; the resulting current flow causes the front panel circuit breaker to pop open. The connections must be switched and the circuit breaker pushed in to reset.
- **Form C Relay Contact** - Used for Battery Charger fault alarm.
- **Remote ON-OFF** - Isolated Remote On-Off control of Battery Charger output.

II — INSTALLATION

If desired, the battery charger output voltage and current limit can be preset prior to mounting at a separate location.

PRESETTING THE OUTPUT VOLTAGE (FLOAT VOLTAGE)

1. Open the access door to gain access to input/output connections by pulling the latching retainer.
2. ***With a-c voltage not present*** route the a-c Input line wires through the appropriate openings in the top of the chassis and secure to L (L1) and N (L2) studs.
3. Connect the ground connection to the ground stud (see Figure 1) using the 10-32 x 3/8 ACF Brass Hex nut provided.
4. Turn a-c power on and connect a precision digital voltmeter (DVM) to the + and – VOLTAGE MONITOR test points at the front panel.
5. Monitor the DVM and set the float voltage as desired using the tool mounted on the back of the access door to adjust the V. FLOAT ADJ potentiometer at the front panel. It is recommended that the unit be tagged with the float voltage.
6. Turn a-c power off and disconnect DVM. If unit is to be mounted at a different location, disconnect ground and a-c input connections, then close the access door and snap in the retainer.

PRESETTING THE CURRENT LIMIT (CHARGING LIMIT CURRENT)

1. Open the access door to gain access to input/output connections by pulling the latching retainer.
2. ***With a-c voltage not present*** disconnect battery from the output terminals.
3. Place a short-circuit (jumper link, No. 8 AWG wire, minimum) between (+) and (–) DC OUTPUT terminals.
4. If not already connected, route the a-c Input line wires through the appropriate openings in the top of the chassis and secure to L (L1) and N (L2) studs.
5. Turn a-c input power on. Monitor the front panel ammeter and set the current limit as desired (see NOTE) using tool mounted on the back of the access door to adjust the C. LIMIT ADJ potentiometer at the front panel.

   NOTE: The unit incorporates a foldback characteristic for current limit to reduce power dissipation when there is a short across the output terminals. From a shorted output (e.g., for a brand new battery), the current limit increases linearly from 10% less than the full current limit to the full current limit as the battery charges. Consequently, if the desired current limit is I_{LIM}, adjust for $0.9I_{LIM}$ with shorted output.

6. Turn a-c power off and remove the short-circuit between (+) and (–) DC OUTPUT terminals.

MOUNTING THE BATTERY CHARGER

Two slotted holes, 8 inches apart, are provided on the upper rear chassis (See Figure 1) to wall mount the unit. The unit also has four feet for bench top operation. The unit has forced air cooling from a single fan located within the integral power supply, as well as ventilation holes in the chassis which must be kept clear from obstructions to ensure proper air circulation. Enough space must be provided around the chassis to allow the hot air to exhaust from the components inside the chassis.

1. Open the access door to gain access to input/output connections by pulling the latching retainer.
2. Route the AC source wires through the appropriate openings at the top of the chassis and install on the studs labeled AC INPUT LINE, L (L1) and N (L2).
3. Connect ground wire to the ground stud (see Figure 1) using the 10-32 x 3/8 ACF Brass Hex nut provided.
4. Proceed to CONNECTING THE BATTERY or, if the battery will be connected later, close the access door and snap in the retainer.

CONNECTING THE BATTERY

1. ***With a-c voltage not present*** open the access door and route the + and – battery connections through the appropriate openings at the top of the chassis and install on the studs labeled DC OUTPUT, + and – respectively. NOTE: Verify the polarity! If the polarity is reversed, the front panel circuit breaker will pop. If this occurs, reconnect the battery correctly and push in the circuit breaker.
2. Close the access door and snap in the retainer.

III — OPERATION

USING TEMPERATURE COMPENSATION FOR LEAD-ACID BATTERY (OPTIONAL)

Temperature compensation can prolong battery life by adjusting the float voltage automatically. Temperature compensation allows the output voltage of the Model KRR 24-50 battery charger to be automatically decreased or increased for temperatures above or below 77°F (25°C), respectively, in the 0°C to 35°C range. Beyond this range, the compensation is clamped to 0°C and 35°C for temperatures below 0°C and above 35°C, respectively. Compensation is 3mV/(°F)(cell) or 5.4mV/(°C)(cell), and can be calculated as follows: $\Delta V = -(K_T)(T_a - 77)(V_B/2.23)$ where V_B = Battery voltage, K_T = 0.003V/(°F)(cell), T_a = ambient temperature in °F and 2.23 = cell voltage at 77°F. Thus, for example, to calculate the float voltage V_F of a 27.4V battery charging at 80°F: $V_F = V_B + \Delta V = 27.4 - (0.003)(80-77)(27.4/2.23) = 27.4 - 0.111 = 27.289$V.

1. Connect the temperature probe cable to the TEMP PROBE connector at the front panel. Verify that the TEMP PROBE NOT CONNECTED indicator is not lit.
2. Attach the temperature probe to the negative (–) terminal of the battery being charged. If the threaded stud is long enough, mount the probe on the threaded stud and attach it with another nut. Otherwise, remove the existing nut and use it to attach the temperature probe. In either case observe torque requirements when tightening the nut.

CHARGING THE BATTERY

1. If the float voltage has been preset, proceed to step 2. Otherwise, refer to PRESETTING THE OUTPUT under INSTALLATION and set the float voltage for the battery to be charged.
2. Remove a-c input power, then connect the battery (see INSTALLATION). If the circuit breaker pops, the battery connections are reversed; reverse the battery connections, and push in the circuit breaker.
3. Install temperature compensation if desired (see previous paragraph). Verify all battery and a-c line connections are tight.
4. Apply a-c source power to the unit. The front panel ammeter indicates the charging current. NOTE: If the CHARGER ON indicator fails to light, verify that a-c source power is present and that the AC INPUT fuses have not blown. As charging begins, the battery forces the unit into current limit. At this time the desired charging limit current can be readjusted with the front panel C. LIMIT ADJ potentiometer (using the tool provided on the inside of the access door) while monitoring the front panel ammeter.
5. When the charging current as indicated on the front panel ammeter falls to near zero, the battery is fully charged.

USING THE ALARM OUTPUT

The isolated internal relay contacts are connected to the Battery Charger terminals as follows: NC (normally closed contact to ALARM OPEN terminal, NO (normally open) to ALARM CLOSED terminal and relay common to ALARM ARMATURE terminal. If the Battery Charger fails, the circuit between ALARM ARMATURE and ALARM OPEN opens, and the circuit between ALARM ARMATURE and ALARM CLOSED closes. The outputs from the form “C” relay can be used to alert other equipment, a computer, or an operator about a Battery Charger failure (overvoltage, internal overcurrent, overtemperature, fan failure or low output current (<1% maximum current limit).

USING REMOTE ON-OFF CONTROL

To use remote ON-OFF control first remove the jumper between ±RC terminals. Then connect an external NC relay contact or d-c voltage (see Table 1 for specifications) across ±RC terminals to turn the output on or off. A short or low voltage turns the output on; An open circuit or high voltage turns the output off.

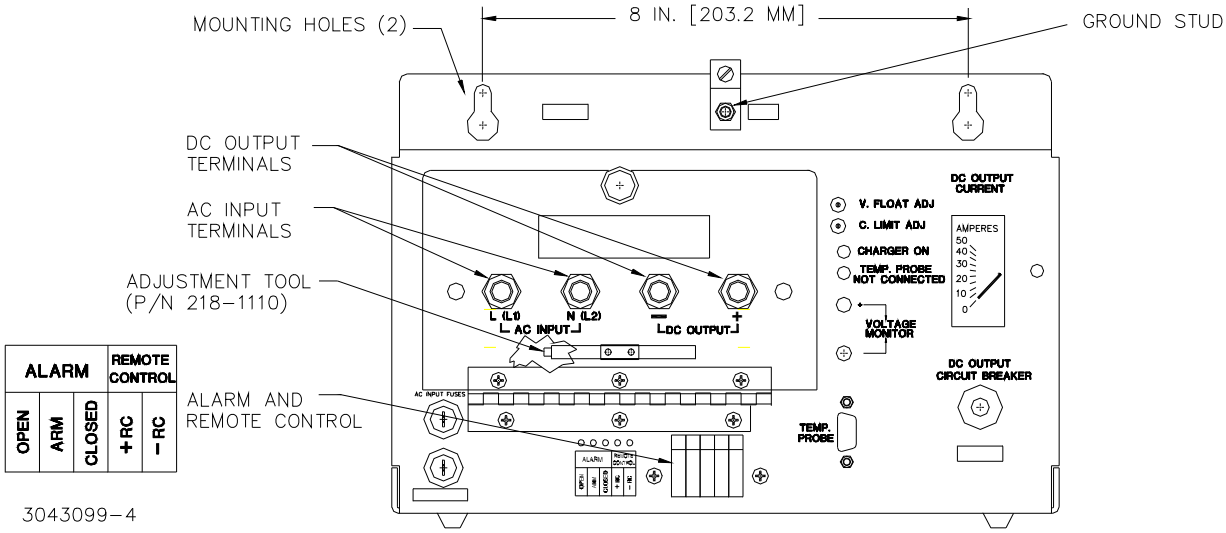

FIGURE 1. MODEL KRR 24-50, FRONT VIEW

IV — SPECIFICATIONS

Specifications listed in Table 1 are at nominal input voltage and at 25°C unless otherwise specified.

TABLE 1. MODEL KRR 24-50 SPECIFICATIONS

SPECIFICATION	DESCRIPTION/CONDITION	RATING
Input Voltage	Nominal	100V a-c to 240V a-c
	Range	85V a-c to 265V a-c
	Nominal Frequency	50Hz/60Hz/100Hz(1)
	Frequency Range	47Hz to 100Hz(1)

(1) KRR units can operate with source power frequency up to 400Hz. Power factor, efficiency and leakage current will derate as frequency increases. Consult factory for additional information.

TABLE 1. MODEL KRR 24-50 SPECIFICATIONS (CONTINUED)

SPECIFICATION	DESCRIPTION/CONDITION	RATING
Input Current	100V a-c to 120V a-c	22A a-c max.
	200V a-c to 240V a-c	11A a-c max.
	Surge, cold start, interval > 30 sec 100V a-c to 120V a-c	20A p-p max.
	Surge, cold start, interval > 30 sec 200V a-c to 240V a-c	40A p-p max.
Power Factor	100V a-c input, rated output	0.99 typical
Efficiency	100V a-c Input	82% typ.
	240V a-c Input	86% typ.
Leakage Current:	Per IEC 950 and UL 1950, 120V a-c, 60Hz	0.65mA a-c typ.
	Per IEC 950 and UL 1950, 240V a-c, 60Hz	1.25mA a-c typ.
Output Voltage	Floating	Factory set to 26.80V d-c, Adjustable range: 18.8-32.4V d-c
Output Current Limit	Ta = -10°C to 50°C	Factory set to 50A d-c, Adjustable range: 10-50A d-c
	Short circuit value, 10% foldback	45A d-c @ 50A d-c factory-set current limit
Output Voltage Ripple & Noise(2)	Ripple	200mV p-p
	Noise	300mV p-p
Stabilization	Source Effect (85 to 132 V a-c and 170 to 265V a-c)	0.2% maximum
	Load effect, measured at front panel test points, 0-100% load	0.6% maximum
	Temperature effect (–10° to 65°C)	1.0% maximum
	Time effect (8 hours at 25°C)	0.5% maximum
Output Voltage Temperature Compensation	Use optional temperature compensation probe, 0°C to +35°C for Lead-Acid battery	3mV/(°F)(cell), 5.4mV/(°C)(cell) 0.5% accuracy @ 2.23V cell voltage (3)
Output Protection	Overvoltage(4)	44V d-c max.
	Overcurrent(4)	70A d-c
	Internal Overtemperature(4)	Detected
	Fan Failure(4)	Detected
	Battery Reversed	Output limited to a negative Schottky diode drop. Output disconnected for output current > 72.5A d-c
Input Protection	Overcurrent	Fuses (2) 25A, 250V (Bussman P/N MDA-10)
Front Panel Display	Analog meter for output (charging) current	0 to 50A d-c, 5% accuracy
	“Charger ON” LED	Green indicates charger is operational
	“Temp Probe Not Connected” LED	Yellow indicates that the probe is not connected
Alarm Output	One form “C“ Relay contact Terminals: ARMATURE, OPEN, CLOSED.(5)	Contact Ratings: 120V a-c/0.5A a-c, 24V d-c/1A d-c 0.1 Ohm (max. ON resistance)
Remote On-Off Input	Isolated control terminals ±RC	ON: Requires short or low voltage (0.4V max., 1.6mA source current) +RC to -RC terminal. OFF: Requires open or high voltage (2.4V to 24V d-c, 1 mA sink current) +RC to -RC terminal.
Operation Temperature	Output performance derated above 50°C and below 0°C	-10°C to +65°C
Storage Temperature		-30°C to 75°C
Cooling		Forced air flow - one fan (exhaust to the left side)
Weight		approx. 22 lbs. (10 Kg.)
Dimensions		9.25 in (H). x 15.14 in. (W) x 9 in. (D)
		235mm (H) x 384.6mm (W) x 228.6mm (D)

(2) Ripple and noise specification is 1.5 times the indicated values for a temperature range of -10 to 0°C. Ripple and noise levels above are satisfied when conditions are 0 to 100% load, 0 to 65°C, and measuring bandwidth ≤ 100MHz.

(3) To calculate temperature compensation for cell voltage other than 2.23V, see Section III - Using Temperature Compensation for Lead-acid Battery.

(4) Specification applies to internal power module and results in unit shutdown. To recover, disconnect a-c input, wait about 40 seconds, then reconnect a-c input.; to recover immediately, toggle the RC control signal OFF, then ON (see Remote On-Off Input, above).

(5) Alarm activates upon detection of missing a-c input, charger not operational, or output current falls below 500mA.