MODEL ETC
BATTERY CHARGER

The Cragg Railcharger® ETC Battery Charger is a regulated battery charger that features built-in filtering and temperature compensation for use on Lead Acid and NiCad batteries.

CRAGG RAILCHARGER®

Instruction Manual for Models

10ETC-12V
20ETC-12V
30ETC-24V
40ETC-12V
60ETC-12V

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1.0 WARNINGS, CAUTIONS, AND NOTES

Please read the entire instruction manual before using the battery charger.

Also, read the warnings, cautions, and notes in Table 1. Failure to observe the warnings and cautions can lead to equipment damage or personal injury.

If you have any questions concerning the manufacture, design, function, installation, operation or maintenance, contact Railway Equipment Company before proceeding.

Table 1. Warnings, Cautions, and Notes

Symbol	Description
	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate personal injury. It may also be used to alert against unsafe practices.
NOTE	NOTE indicates explanatory information that applies to the next step in the procedure. It is used to clarify and expand upon the importance of the procedural step when needed.
	If incorrectly wired, charger can be damaged. Be sure to observe correct polarity on all DC wire connections, check the AC wiring instructions, and connect the ground wire.

2.0 OPERATION

The model ETC series battery chargers are equipped with an automatic analog circuit design.

The charger will regulate output voltage to less than ± 1 percent from full load to no load with a ± 15 percent supply voltage (115/230 VAC). The output ripple is less than one volt at full load.

The charger has easy front panel access for setting up charger for most battery and load possibilities, also LED's with volt and amp meters for easy monitoring of status of charger operation.

The charger has a built-in temp compensation circuit to permit the longest battery life possible. Also available is a remote voltage sense capability to compensate for voltage drop between charger and battery.

The charger is equipped with a voltage monitor that is independent from charger circuits, if the charger output voltage deviates more than ± 10 percent from cell select settings an isolated relay will drop out. This circuit runs from battery power. The charger also features an adjustable current limit circuit to protect both the charger and battery.

2.1 Front Panel Features and Components

This section describes the features and components that are on the front panel of the battery charger (see Figure 1).

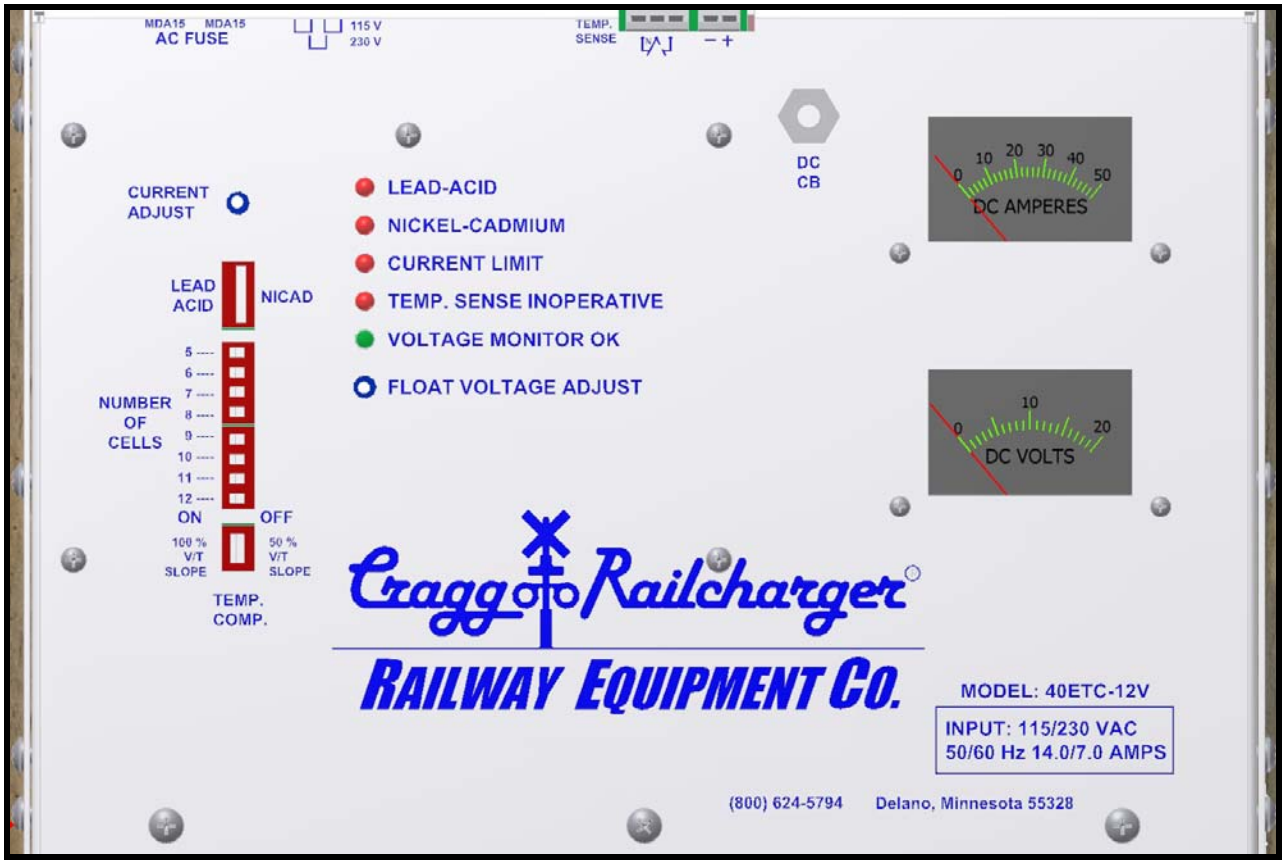


Figure 1. Front Panel of Battery Charger – Example (Model 40ETC-12V)

2.1.1 AC and DC Connection Terminals

At the front top of the battery charger there is a cover plate with a screw at each side. The AC and DC connections are made to the terminal posts within, with the wires entering through the holes in the top of the charger. The temp sensor, fuses, remote voltage, and voltage monitor contacts are also installed within this area. To wire the charger, loosen the two screws and remove the cover plate. On the front of the face plate are the AC wiring instructions. When selecting the input voltage, adjust the two jumper plugs on the "AC IN" header.

Table 2 defines the input power requirements and the AC terminal connections for the battery charger.

Table 2. AC Connection Terminals

A.C. INPUT	USE JUMPER PLUG(S)
115 V.A.C. 50/60 Hz	Two plugs on the AC IN header.
230 V.A.C. 50/60 Hz	One plug connected to the two center pins on the AC IN header.

2.1.2 LED Status Indicating Lights

Table 3 provides a description of the five LED status indicating lights on the front panel.

Table 3. LED Status Lights

Status Light	Description
Type of Cells	The applicable LED is lit to indicate the type of battery selected. The choices are: • Lead-Acid • Nickel-Cadmium
Current Limit	When this LED is lit, the load applied to the charger exceeds the current limit setting, or if the remote voltage sense is used, the unit senses a voltage drop of more than 2.5 volts, which rarely occurs.
No Temperature Compensation	When this LED is lit, the charger is operating without temperature compensation. (This condition typically is caused by the temperature sensor being disconnected or broken.)
Voltage Monitor	When this LED is lit, the battery voltage is within ± 10% of the battery voltage setting.

2.1.3 Battery Type Configuration Switch

There is one switch which is set for either "Lead Acid" or "Nickel Cadmium". A second series of "DIP" switches is used to set the number of cells. The single switch which corresponds to the number of cells being used should be set to the left. All other cell selection switches should be set to the right.

2.1.4 Temperature Sensor Cable

The temperature sensor cable connector, which is located behind the wire terminal cover plate, provides the input for the remote temperature sensor cable assembly.

To obtain the temperature of battery, connect the sensor end of the cable assembly on the battery surface or between cells. When the temperature sensor is connected, the battery charger will adjust the output voltage up or down depending on the temperature of the batteries.

Table 4 defines the temperature compensation rate when the battery charger adjusts the output voltage. If the remote temperature sensor is not used, the temperature compensation function will be fixed at 77°F.

Table 4. Temperature Compensation Rate

Battery Type	Temp Switch	Compensation Slope	Low Temp Limit	High Temp Limit
Lead Acid	50% V/T	1.47mV/°F/cell	2.35 volts/cell@ +3°F	2.20 volts/cell@ +116°F
Lead Acid	100% V/T	3.0mV/°F/cell	2.35 volts/cell@ +37°F	2.20 volts/cell@ +95°F
Ni-Cad	50% V/T	0.967mV/°F/cell	No Limit	No Limit
Ni-Cad	100% V/T	1.94mV/°F/cell	No Limit	No Limit

2.1.5 Remote Voltage Sensor Input Terminals

The two remote voltage sensor terminals behind the wiring terminal cover plate provide input for the remote battery voltage sensing. If the batteries to be charged are located more than 12 feet from the charger, there can be voltage drop through the wires. It is recommended that two separate wires be connected from the battery terminals to the remote voltage sensor input terminals on the charger. This is done by removing the two pre-installed jumper wires from the remote voltage sense terminals and the DC output terminals and replacing them with wires from the battery terminals to the remote voltage sense terminals.

CAUTION: WHEN CONNECTING WIRES FROM THE BATTERY TERMINALS TO THE CHARGER, WATCH THE VOLTAGE POLARITY.

(Wire size: 18GA minimum, 14GA maximum.) If the remote voltage sensing function is not used, leave the two jumpers from remote voltage sense terminals to the D.C. output terminals connected.

2.1.6 Voltage Monitor Output Terminals

Three terminals are provided for connection to the voltage monitor relay. This is a Form C dry contact relay. The voltage monitor terminals are for the common, the normally open, and the normally closed contacts.

The voltage monitor draws its power from the battery (75 mA maximum). The set points for the voltage monitor are ± 10% of the voltage setting. When the voltage is within the set points, the relay will be energized, and the normally open contact will be closed. If the voltage is above or below by 10% of the voltage setting, the relay will be de-energized and the normally open contact will be open.

2.1.7 Float Voltage Adjustment Potentiometer

The float voltage adjustment potentiometer is used to set the float voltage. ***Adjusting the float voltage is a very important setting.*** Check with the battery manufacturer for the correct float voltage per cell, and then calculate the number of cells being used to determine your float adjustment.

2.1.8 Current Limit Adjustment Potentiometer

The current limit adjustment potentiometer can be used to set the current limit of the charger. The factory setting for current limit is 100% of the chargers rated capability, which is, for example: 10 Amps for the 10ETC12V charger. The current limit can be adjusted down to a minimum of 50% of the chargers rated capability, which is 5 Amps.

2.1.9 AC Input Fuses

Table 5 lists the AC input fuses for the different model numbers. The fuses, which are type “MDA” fuses, are located in the wire terminal area behind the cover plate.

Table 5. AC Input Fuses

Model No.	MDA Fuse Rating
10ETC12	6 Amp
20ETC12	6 Amp
40ETC12	15 Amp
60ETC12	15 Amp
30ETC24	15 Amp

2.1.10 DC Output Circuit Breaker

The DC circuit breaker protects both customer load and the battery charger from malfunction. When the circuit breaker trips, the problem must be determined and repaired. Then the circuit breaker can be reset.

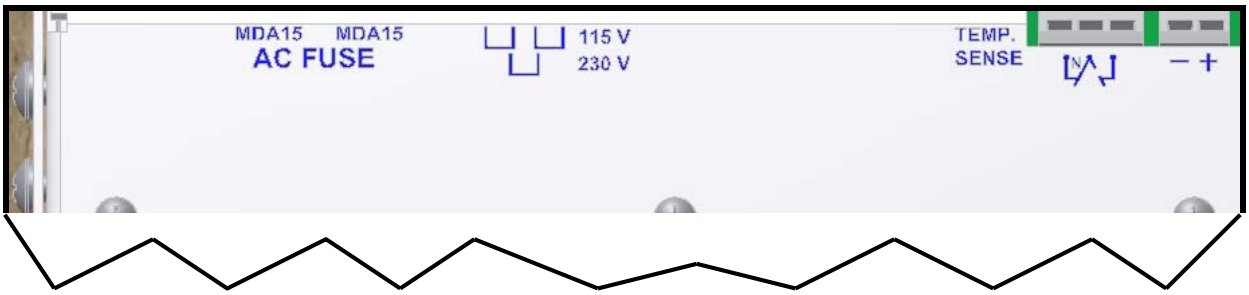
2.2 Set Up Procedures

This section describes the set up procedures for the battery charger.

NOTE

Before connecting power to the battery charger, make sure AC power is turned off.

1. Connect AC power to the battery charger per label below the terminal posts.



2. Connect AC jumper plugs on the “AC IN” header for 115VAC or 230VAC per instructions printed on the front of the face plate.

2.2.1 Setting the Battery Cell Switches

1. Using Table 6, verify the battery type and Number of Cells in the battery being charged.

Table 6. Number of Cells Guide

10ETC-12V/ 20ETC-12V/ 40ETC-12V/ 60ETC-12V/	30ETC-24V
5 to 8 Lead Acid Cells	11 to 18 Lead Acid Cells
5 to 12 NiCad Cells	19 to 26 NiCad Cells

2. Set the two-position switch to the battery type (Lead Acid or NiCad) being charged.
3. Set the Number of Cell switches on the front of the battery charger, as follows:
   a. Set the switch that corresponds to the Number of Cells on the battery charger to the left (on position).
   b. Set the other Number of Cell switches to the right (off position).

   For example: Figure 2 illustrates that the battery being charged has 6 cells. This denotes that the number 6 cell switch is set to the left position. The other Number of Cells switches are set to the right position.

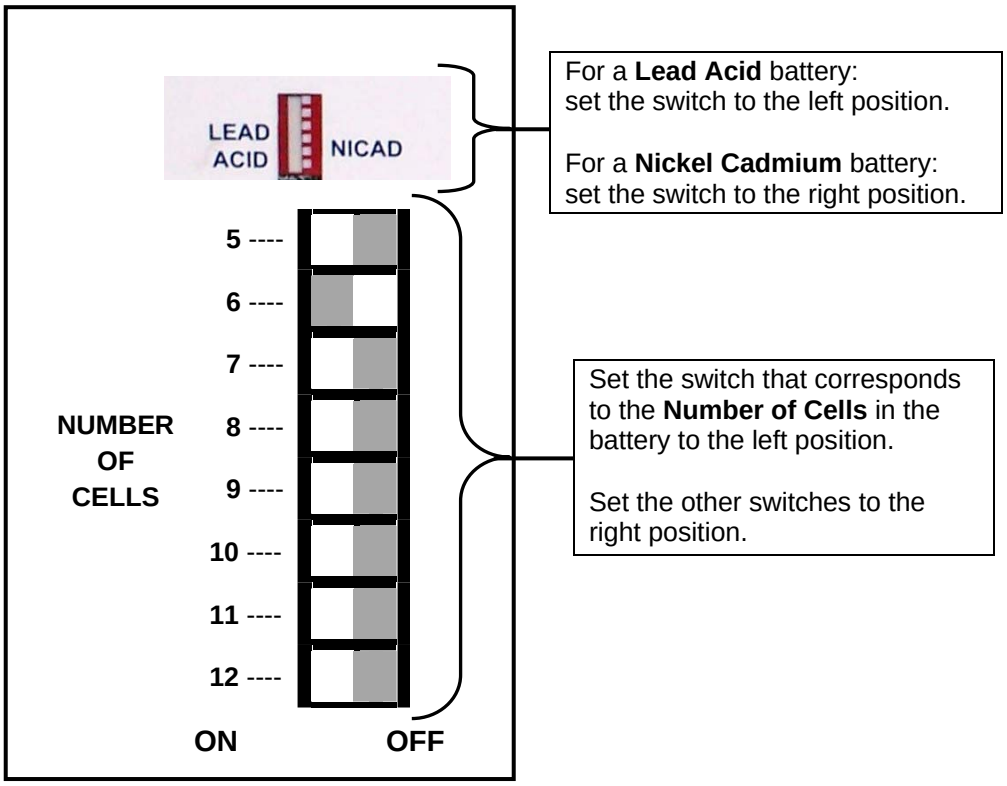


Figure 2. Cell Switch Settings for Battery Chargers (Except 30ETC)

NOTE

When setting the cell switches for the 30ETC battery charger:

- For Lead Acid batteries, use the cell switches numbered 11 thru 18.
- For NiCad batteries, use cell switches numbered 19 thru 26.

4. For 30ETC battery chargers, set the switch that corresponds to the Number of Cells on the battery charger to the left (on position). Set the other Number of Cell switches to the right (off position).

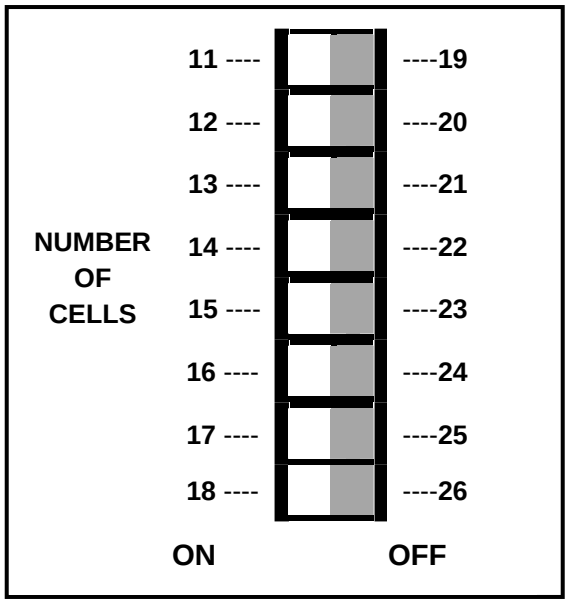


Figure 3. Cell Switch Settings for 30ETC Battery Chargers

2.2.2 Adjusting the Float Voltage

NOTE

DO NOT CONNECT THE BATTERIES to the charger.

1. Make sure the remote temperature sensor cable is disconnected from charger at this time. (This preliminary step is required in order to adjust the float voltage.)
2. Verify that the two jumper wires are connected between the remote voltage terminals and the DC output terminals.
3. Connect a DC voltmeter to charger output terminals.
4. Turn ON AC main power. Then wait for output voltage to stabilize.
5. Calculate what the correct output float voltage should be by taking the battery manufacturers recommended per cell float voltage and multiplying by the number of cells.

   For example: The desired output float voltage is 1.53 volts per cell for nine nickel cadmium cells: 1.53 X 9 = 13.77 volts.
6. Adjust the float voltage as follows:
   a. Locate the potentiometer labeled “Float Voltage Adjust.”
   b. Turn the potentiometer clockwise to increase the float voltage.
   c. Or, turn the potentiometer counterclockwise to decrease the float voltage.
7. Turn OFF AC main power.
8. Connect the temperature sensor cable to its connector.

NOTE

Before connecting the battery terminals to the battery charger, make sure the polarity is correct.

9. Connect the batteries to the battery terminals on the charger.
10. Turn ON AC main power. The ammeter will indicate the load current.

2.2.3 Setting the Temp Comp Switch

The Temp Comp switch is based on the voltage/temperature (V/T) slope. The Temp Comp switch is a two-position switch setting that provides a method to set the slope of temperature charge rate.

1. Set the Temp Comp switch (see Figure 4) to the applicable position.
2. Refer to Table 4, “Temperature Compensation Rate” (see page 4) for detailed information.

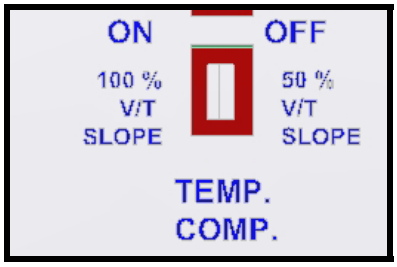


Figure 4. Setting the Temperature Compensation Switch

2.2.4 Setting the Current Limit

The factory setting for current limit is 100% of the rated current capability. The current limit may be adjusted from the chargers full rating to 50% of the rated current capability.

For example: The 20 amp charger can be adjusted down to 10 amps.

1. Locate the current limit potentiometer on the front panel.

NOTE

When the potentiometer is turned fully clockwise, the charger current limit is set for 100% of rated capacity. When the potentiometer is turned fully counterclockwise, the charger current limit is set for 50% of rated capacity.

2. Adjust the current limit set point between 50% and 100% of rated capacity, as follows:
   a. Apply an excessive load to the charger.
   b. Adjust the current limit potentiometer to the desired current level.

2.2.5 Remote Voltage Sensing

1. Disconnect the two jumper wires from the remote voltage sense terminals inside the wire terminal area and the DC battery output terminals.

CAUTION

Before connecting the two wires to the battery terminals, make sure that the polarity is correct to avoid equipment damage and prevent personnel injury.

2. Using minimum 18GA, maximum 14GA wire, connect two wires to the remote voltage sensing input terminals using a small flat blade screw driver on the terminal insertion tabs.
3. Watching the polarity, connect the two wires to the battery terminals.

2.2.6 Using the Voltage Monitor

The voltage monitor provides a Form C dry contact relay which can be used to indicate when the battery voltage is either above or below 10% of the voltage setting.

The voltage monitor circuit is independent from the battery charger system and the AC power, and operates from the battery voltage.

The “normally open” contact is closed when the battery voltage is within ± 10% of the voltage setting.

The relay is rated for 2 Amp at 60 VDC, or 2 Amps at 120 VAC resistive loads. The mechanical contact life is 5,000,000 operations. Minimum inductive life @ .5 Amp 12vdc is 50,000 times.

The voltage monitor can be used for an alarm by connecting the coil of an indication relay to the normally open relay contact terminals on the battery charger. Wire size should be minimum 18GA, maximum 14GA.

3.0 STANDARD FEATURES

The standard features of the battery charger are listed as follows:

- Fully Automatic and Convection Cooled
- For Lead Acid and NiCad Batteries
- Switch Selectable Voltage/Cell Configuration
- LED Status Indicating Lights
- Amp Meter
- Volt Meter
- Temperature Compensation with Controlled Limits
- Adjustable Current Limit
- Battery Voltage Monitor with Relay Output
- Remote or Local Battery Voltage Sensing
- AAR/AREMA Terminals
- Delayed Power-up, 5-10 seconds
- AC & DC Circuit, Transient Protection
- Meets or Exceeds AAR/AREMA Specifications
- Rack mounting kit available
- 2-Year Warranty

4.0 SPECIFICATIONS

Table 7 provides the general specifications for all the battery chargers in the manual. Table 8 provides the specifications for the each individual battery charger model number in this manual.

Table 7. General Specifications

Description	Specification
Input Voltage	115/230VAC ± 15%, 50, 60, 100 Hz
Voltage Regulation	± 1%
Voltage Ripple	Less than 1 volt ripple, peak to peak at maximum output current
Operating Temperature	-40°F to +158°F (-40°C to +70°C) with 0-95% non-condensing humidity

Table 8. Model Specifications

Model No.	Cells	Input Volts Amps	Output Amps	Output Volts	Width x Height x Depth	Ship Weight
10ETC-12V	5–8 Lead Acid 5–12 NiCad	115VAC – 4.2 Amps 230VAC – 2.1 Amps	10 Amps	7 to 18.8 volts	12.00 x 10.12 x 8.75 inches	40 Lbs.
20ETC-12V	5–8 Lead Acid 5–12 NiCad	115VAC – 8 Amps 230VAC – 4 Amps	20 Amps	7 to 18.8 volts	12.00 x 10.12 x 8.75 inches	40 Lbs.
40ETC-12V	5–8 Lead Acid 5–12 NiCad	115VAC – 14 Amps 230VAC – 7 Amps	40 Amps	7 to 18.8 volts	13.00 x 13.75 x 11.75 inches	52 Lbs.
60ETC-12V	5–8 Lead Acid 5–12 NiCad	115VAC – 18 Amps 230VAC – 9 Amps	60 Amps	7 to 18.8 volts	13.00 x 13.75 x 11.75 inches	74 Lbs.
30ETC-24V	11–18 Lead Acid 19–26 NiCad	115VAC – 20 Amps 230VAC – 10 Amps	30 Amps	24 to 42.5 volts	13.00 x 13.75 x 11.75 inches	63 Lbs.