



NATIONAL RAILWAY SUPPLY

Installing, Operating & Service
Instructions for the NRS-48/15
Solid State Charger

MODEL NRS-48/15 BATTERY CHARGER

PLEASE SAVE THESE IMPORTANT SAFETY AND OPERATING INSTRUCTIONS

For correct operation of the equipment, it is important to read and be familiar with this entire manual before installing and operating the charger.
DO NOT DISCARD THIS MANUAL AFTER READING.



LOOK FOR THIS SYMBOL TO POINT OUT SAFETY PRECAUTIONS. IT MEANS: BECOME ALERT—YOUR SAFETY IS INVOLVED. IF YOU DO NOT FOLLOW THESE SAFETY INSTRUCTIONS, INJURY OR PROPERTY DAMAGE CAN OCCUR.

1. IMPORTANT SAFETY INSTRUCTIONS

- a. Before using the battery charger, read all the instructions and caution markings on the battery charger, the battery, and all of the products using the battery.
- b. Do not touch the uninsulated parts of the AC input or the DC wires, the charger's terminal strip, or the battery terminals as there is a possibility of electrical shock.
- c. Batteries produce hydrogen gas while operating, which can explode if ignited. Never smoke, use an open flame, or create sparks in the vicinity of the battery. Ventilate the area well when the battery is charging in an enclosed place.
- d. Batteries contain caustic material which causes burns. Do not get in eyes, on skin, or clothing. If the gelled or liquid content of the batteries contacts the skin or clothing wash the area thoroughly with water. If contact with the eyes occurs, flush immediately with clean water for 15 minutes and obtain medical attention.
- e. Connect or disconnect the battery plug only when the charger output is off to prevent arcing or burning.
- f. Only qualified personnel should adjust or service this equipment.
- g. De-energize all AC and DC power connections before servicing this unit. If

injury does occur, apply standard treatment for electrical shock and, if necessary, consult with a physician.

- h. The charger is not for outdoor use. Do not expose the charger to rain or snow.
- i. Do not operate the charger if it has received a sharp blow, been dropped, or otherwise damaged. Take it to a qualified service center.
- j. Do not disassemble the charger. Have the charger examined by a service agent, or a local qualified service center. If the charger is assembled incorrectly, damage to the charger and the batteries or an electrical shock may result.

2. DESCRIPTION

The NRS charger model 48/15 is a convection cooled, solid state, SCR regulated charger that provides either a constant current or constant voltage output. The charger can be set to charge batteries within a voltage range of 40.00 to 60.00 volts for gel-cell, liquid lead-acid, nickel cadmium, nickel iron, and starved electrolytic batteries.

3. THEORY OF OPERATION

When the charger is connected to the desired AC voltage source, the transformer creates auxiliary voltages for the electronic control module. The

electronic control module controls and monitors the charger so it will perform properly. The transformer also supplies the power output used for charging the batteries and provides electrical isolation between the charger's output and the AC source.

The charger's output current flows through a shunt and is sensed by the electronic control module along with the charger's output voltage. These values are converted into drive pulses for the SCRs by the control module. This pulsating charge current (a pulse occurs each time an SCR is on) is then filtered by the batteries to provide a smooth output.

The charger has an "IE" profile which is: (a) High rate constant current, and (b) Constant voltage. When the charge is first started, the SCRs conduct for a certain portion of the sinusoidal anode voltage to provide the required charging current at the low level of battery voltage. In this start region a constant 15 amp current is applied to the battery. The SCR conduction increases as the battery voltage increases in order to provide a higher output voltage while maintaining a constant charging current.

When the battery voltage reaches the float voltage (the voltage set with the switches), the SCRs start to decrease their output. This causes the charger to automatically change from a constant current charge region to a constant voltage charge region. As the batteries become fully charged the output current decreases. A continuous constant float voltage is supplied to the batteries to maintain their charge.

Another feature of the charger is temperature compensation, which keeps the batteries from getting under- or over-charged. An optional external temperature probe will sense the temperature and let the charger compensate the battery voltage.

4. RECEIVING AND INSTALLING THE CHARGER

Proper installation of the charger is important to achieve good charger performance and to prevent damage to the charger and batteries. When a charger is received, a check for possible in transit damage should be made. If any damage is found, it should be reported as a claim to the carrier.

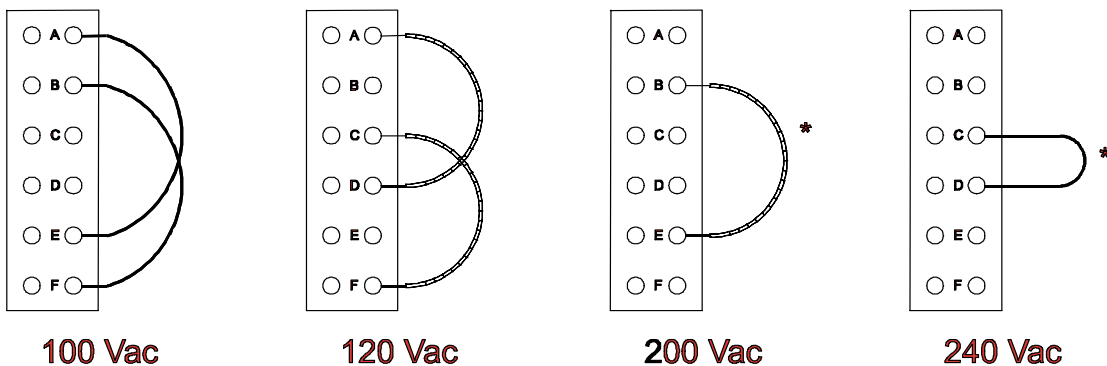
! WARNING: THE CHARGER MUST BE SET UP FOR THE PROPER USER SPECIFICATIONS BEFORE STARTING THE INITIAL CHARGE.

5. AC ELECTRICAL SUPPLY

The charger is equipped with an input cord having an equipment-grounding conductor and a 120 volt, 20 amp polarized grounding plug. The plug must be connected to an outlet that is properly installed and grounded in accordance with all local codes and ordinances. The AC voltage selection jumpers are factory set for 120 volt AC input application. The AC selection jumpers are located behind the small panel on the front of the charger.

! WARNING: IMPROPER GROUNDING CAN RESULT IN THE RISK OF AN ELECTRIC SHOCK. DO NOT OPERATE THE CHARGER WITHOUT PROPER GROUNDING.

If a change in the AC supply voltage is required, remove the input cords plug and connect an appropriate plug for the proper voltage and outlet required. The jumper wires on the AC voltage terminal strip will also have to be changed for the proper AC voltage to be used for the application (see diagram for proper jumper configuration).



* Use both jumpers in parallel

!WARNING: FAILURE TO CONNECT THE AC VOLTAGE CONDUCTORS PROPERLY COULD CAUSE SERIOUS DAMAGE TO THE CHARGER.

6. DC OUTPUT

The charger is equipped with an output cord to which a plug or terminals must be connected. The plug or terminals MUST be rated for a minimum of 20 volts and 25 amps. The white wire is to be connected to battery positive (+) and the black wire to battery negative (-). If the polarity of the wires is reversed to the battery, a circuit breaker will open to protect the charger from internal damage. Correct the reversed wires and push the circuit breaker button in to reset it.

!WARNING: DO NOT TOUCH THE CHARGER DC OUTPUT OR THE BATTERY TERMINALS UNTIL THE AC POWER IS DISCONNECTED OR AN ELECTRIC SHOCK COULD OCCUR.

7. TEMPERATURE COMPENSATION

Temperature compensation uses a temperature reference of 77°F (25°C), a voltage reference of 2.23 volts (the voltage of a standard gel-cell battery at 77°F), and a compensation value of 3.0 mV per °F, or 5.4 mV per °C). The equivalent equation for the compensated voltage is:

$$V_{\text{comp}} = V - k(t - 77^{\circ}\text{F})$$

Where V is the voltage of the battery at 77°F, t is the temperature in °F, and $k = V \cdot (.003 / 2.23)$.

The control module has a temperature compensation range between 32°F and 95°F (0°C and 35°C) that does not allow charger voltage to increase or decrease beyond the calculated values.

Example 1: If a 53.5 volt battery is charging and the temperature increases to 95°F, then the output voltage decreases to 52.2 volts.

$$53.5 - .072(95^{\circ}\text{F} - 77^{\circ}\text{F}) = 52.2$$

Example 2: If a 58.0 volt battery is charging and the temperature increases to 95°F, then the output voltage decreases to 56.6 volts.

$$58.0 - .078(95^{\circ}\text{F} - 77^{\circ}\text{F}) = 56.6$$

Example 3: If 53.5 volt batteries are charging and the temperature decreases to 32°F, the output voltage increases to 56.7 volts.

$$53.5 - .072(32^{\circ}\text{F} - 77^{\circ}\text{F}) = 56.7$$

8. TEMPERATURE PROBE

The external temperature probe is an optional way of extending battery life by using temperature

compensation. One end of the temperature probe cable has a three-pin plug, which plugs into a receptacle labeled TEMP PROBE on the front of the charger. The other end of the cable has the temperature sensor sealed either in a terminal or small metal box.

!WARNING: IT IS IMPORTANT TO MOUNT THE TEMPERATURE PROBE ON THE BATTERIES FOR PROPER TEMPERATURE COMPENSATION. IF THIS CANNOT BE DONE, LOCATE THE PROBE AS LOW AS POSSIBLE IN THE BUNGALOW OR CABINET.

Terminal-Type Probe

The terminal-type probe should be attached to the negative (-) battery post near the center of the battery pack. If the threaded stud is long enough above the battery jumper nut, attach the probe with another nut. Torque this nut to proper specifications. If the stud is too short, the nut holding the jumper wire will need to be removed. Open or remove the load and charging circuits to the batteries. Remove the nut holding the jumper and add the probe, then torque the nut to the proper specifications. Then close or connect the load and charging circuits back to the batteries.

Box-Type Probe

The metal box has a high performance contact adhesive tape for attaching it to the battery. To attach, clean a spot for the probe on the middle battery about three inches (3") down from the top of the battery. Make sure the spot is free of all dirt and oil or the probe will not adhere properly. For proper adhesion, the battery surface must be cleaned with isopropyl alcohol. Ideal application temperature range is between 70 and 100°F. Initial application to surfaces at temperatures below 50°F is not recommended. Under cold conditions, the surface should be warmed before application. Once properly applied, low temperatures will not affect the bond strength.

Remove the adhesive's protective strip and press the probe firmly against the battery to ensure good adhesion.

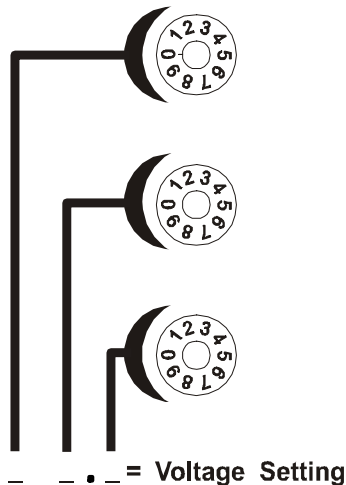
Securely fasten the temperature probe cable to protect the probe from being torn from the battery. Secure the probe's cable to a fixed object to ensure the probe will not be pulled loose. Use a cable tie mount on the battery or on the adjacent battery, if necessary.

!WARNING: SECURELY FASTEN THE TEMPERATURE PROBE CABLE TO PROTECT THE PROBE FROM BEING TORN FROM THE BATTERY.

9. OPERATION

The battery charger is adjustable with the three rotary switches on the front of the charger. The switches determine the float voltage for the batteries. If the switches are set over 60.00 volts, the charger will not maintain the "IE" charge profile. SET THE FLOAT VOLTAGE TO THE BATTERY MANUFACTURER'S SPECIFIED VOLTAGE FOR 77°F. The charger will then electronically charge the batteries to the voltage specified on the switches. To set the switches use a small screwdriver and turn the switch so the arrowhead on the slot is pointing to the desired number.

Set the switches in the following manner. If the desired battery voltage is 53.5 volts, set the top switch to 5, the middle switch to 3, and the bottom switch to 5 (see the figure below). This will provide you with the proper charging voltage. BE SURE EACH SWITCH IS SET ON A NUMBER AND NOT BETWEEN NUMBERS.



The charger does not have a power switch. When the AC power is applied to the charger, the DC output will start and the yellow LED will be on. To turn off the charger, disconnect the AC power source.

The charger has two LEDs to indicate charge conditions.

1. The red LED is used to indicate a problem with the external temperature probe. When this LED is on either the probe or its cable are functioning improperly, or no temperature probe in use.
2. The yellow LED when on solid indicates the chargers output is on. If it is flashing then one of the float voltage switches is set between numbers and the output is turned off.

10. SERVICING

The battery charger requires minimal maintenance. It should be kept clean and all connections are to be periodically tightened. If the battery charger operates improperly, follow the steps below.

- a. Begin by checking the voltage switches to verify their settings against the specifications of the batteries.
- b. Check the AC voltage power jumper settings to be sure they are set for the proper AC voltage and that all of the screws on the terminal block are tight.
- c. Check the polarity between the DC output and the battery and make sure their connections are tight.
- d. Check the fuses to make sure they have not blown.
- e. If following the steps above does not solve the problem, contact your local service agent.

11. CHARGER SPECIFICATIONS

AC INPUT VOLTAGE : single phase

100 VAC (90-110)

120 VAC (108-132)

200 VAC (180-220)

240 VAC (216-264)

AC INPUT CURRENT :

16.2 amps for 100 VAC (full power)

13.6 amps for 120 VAC (full power)

8.1 amps for 200 VAC (full power)

6.8 amps for 240 VAC (full power)

AC INPUT FREQUENCY:

50 or 60 (48 - 62) Hertz, single phase

AC LINE REGULATION :

transformer reserve with constant current at voltage limiting

+25.2% at 48.0 volts

+10.4% at 55.2 volts

+ 5.2% at 58.8 volts

AC INPUT WIRE SIZE :

10 AWG

AC FUSES :

MDA 10 or equivalent

POWER FACTOR:

high rate, at 15 amps DC and 120 VAC

- .61 at 48.0 volts
- .70 at 55.2 volts
- .74 at 58.8 volts

WEIGHT, NET :

41.5 lb.

DC OUTPUT VOLTAGE:

Constant Voltage Regulation - 40.0 - 60.0 volts

Load Regulation - ± .VDC for any change within the input rating at less than .5 amp DC.

The voltage changes less than .1 volts per amp not including changes because of battery resistance.

DC OUTPUT CURRENT:

Constant Current Regulation - 15.0 amps

Load Regulation - ± .5 amps for any change within the input rating

DC OUTPUT RIPPLE (at battery terminals, 120 VAC):

- 1.1 Vp-p at 15.0 amps 48.0 volts
- .35 Vp-p at 2.0 amps 48.0 volts

DC OUTPUT WIRE SIZE:

10 AWG

OPERATING AMBIENT TEMPERATURE RANGE:

-20°C to 50°C (4°F to 122°F) inside enclosure

ELECTROMAGNETIC COMPATIBILITY EMC:

The charger has RFI filtering and has been tested to meet FCC class B and VDE class B compatibility.

FACTORY SETTINGS:

Float voltage - 53.5 Volts (2.23 x 24 cells)

Temperature compensation - 3mv/°F cell

12. PARTS LIST

The following is a list of parts found in the NRS MODEL 48/15. When replacing a part, USE ONLY ORIGINAL FACTORY REPLACEMENT PARTS of the correct size and rating.

<u>DESCRIPTION</u>	<u>PART NO.</u>
TRANSFORMER ASSEMBLY	16305S
SHUNT ASSEMBLY	18696S
ELECTRONIC CONTROL MODULE	21954S
AMMETER, 20 AMP	15337S
CONTROL CABLE	18806S
TERMINAL TAP STRIP, 6 POLE	18892S
FUSEHOLDER, AC	03837S
FUSE, AC, 10 AMP, MDA-10 (2)	15028S
EXTERNAL TEMP PROBE, 10' (BOX W/ ADHESIVE)	14123S
EXTERNAL TEMP PROBE, 30' (BOX W/ ADHESIVE)	14126S
TEMP TRANSDUCER, 10' (W/ TERMINAL)	29741S
TEMP TRANSDUCER, 30' (W/ TERMINAL)	29742S
CORDSET, AC, NO PLUG	21986S
CORDSET, DC, NO PLUG	20738S
HEATSINK ASSEMBLY, W/ SCR	20734S
CASE ASSEMBLY	21933S
CAPACITOR, 2MFD, 660 VAC	03820S
SUPPRESSOR, RFI	20731S
CIRCUIT BREAKER, 30 AMP	20741S

The adhesive used on the temperature probes (#14123S and #14126S) is 3M Scotch #Y-9473 which is a thermally conducting two-sided adhesive tape. If a replacement adhesive is needed, use this type of tape or an equivalent adhesive.

13. WIRING DIAGRAM

