

**NATIONAL
RAILWAY
SUPPLY, INC.**

Operating and Service Instructions for
VVR Portable Battery Charger

VVR PORTABLE BATTERY CHARGER

MODEL 21120 VVR 85-60P

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 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, battery, and all products using the battery.
- b. Do not touch the uninsulated parts of the DC output connectors, 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 use an open flame, smoke, or create sparks in the vicinity of the battery. Ventilate the area well when the battery is charging in an enclosed area.
- d. Batteries contain caustic material that may cause 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. In the case of contact with the eyes, flush immediately with clean water for 15 minutes and obtain medical attention.
- e. The charger must be programmed for the proper battery voltage and amperage before the charge is started.
- f. Verify charger display says "OFF" before connecting or disconnecting DC charger cables from battery.
- 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 unprotected 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.
- j. Do not disassemble the charger. Have the charger examined by a NATIONAL RAILWAY SUPPLY, INC. service agent. If the charger is assembled incorrectly, damage to the charger and the batteries or an electrical shock may result.

2. OPERATING INSTRUCTIONS

- a. Connect DC cables to battery cells to be charged: RED clamp to battery positive (+) and BLACK to battery negative (-).

- b. Connect AC cord to selected 60 Hz voltage.
- c. Charger will power up with no DC output, unless programmed otherwise.
- d. Program the controller for desired output (see Programming functions).
- e. Press voltage button to check for proper polarity and battery voltage before starting charge cycle.
- f. Press START/STOP button to start charge cycle.
- g. Press current button to observe output current and voltage button to observe battery voltage.
- h. Press START/STOP button to stop charger when battery voltage and charge current have reached desired level.
- i. Make sure charger is stopped before disconnecting AC cord and DC clamps from battery.
- j. If charger display shows an "Er" (error) followed by a number, clear the error using function 17 and try starting charge cycle again. If an error returns, consult error code descriptions.

3. DESCRIPTION

The NATIONAL RAILWAY SUPPLY, INC. battery charger is a convection-cooled, solid state, SCR regulated charger that provides either a constant current or constant voltage output. It is designed to make battery charging simple and has a variety of programmable options to personalize the charge profile. The charger can be programmed to charge batteries within a cell range of 1 to 85 cells for gel-cell, liquid lead-acid, valve regulated, nickel cadmium and nickel iron batteries. The charger has a comprehensive, self-checking diagnostic program to monitor the quality of charge and check its own safety conditions. A four-digit display will show charge data, the programmed charger settings, and error codes. These values are useful to monitor and correct problems, if needed, with the charging system and with the battery.

4. THEORY OF OPERATION

When the charger is connected to the desired AC voltage source (208, 240 or 480), the transformer creates auxiliary voltages for the electronic control module. The electronic control module has a microprocessor that 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. The pulsating charge (a pulse occurs each time an SCR is on) current is 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 will 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 current is applied to the battery. The SCR conduction will then increase 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 SCRs will 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 will be supplied to the batteries to maintain their charge until the charge cycle is stopped.

The electronic control module also senses the internal components of the charger for any change in their performance. The charger's internal temperature sensor will be used to protect the charger from damage due to overheating. If the internal temperature of the charger rises above 160 degrees Fahrenheit (°F), 71 degrees Centigrade (°C), the charger will reduce its output current. When the internal temperature reaches 170°F (77°C), the charger will stop until the temperature is reduced.

5. RECEIPT AND SET-UP OF THE CHARGER

Proper set-up of the charger is important in order 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. To permit free air flow for convection cooling, allow three inches (3") minimum between the charger sides and other equipment and four inches (4") minimum on top of the charger.

⚠ WARNING: THE CHARGER MUST BE PROGRAMMED FOR THE PROPER USER SPECIFICATIONS BEFORE THE INITIAL CHARGE IS STARTED.

6. AC ELECTRICAL SUPPLY

⚠ WARNING: THE CHARGER IS SHIPPED FROM FACTORY SET FOR EITHER 208 VAC, 240 OR 480 VAC. IMPROPER JUMPER CONNECTION MAY CAUSE SEVERE DAMAGE TO THE CHARGER AND BATTERIES.

⚠ DANGER: THIS CHARGER CONTAINS LETHAL VOLTAGES WHEN CONNECTED TO BATTERIES OR THE AC POWER SOURCE. DISCONNECT FROM BATTERIES AND AC POWER SOURCE BEFORE OPENING DOOR.

The charger must be connected to a single-phase, 60 hertz AC power source, which can be either 208, 240 or 480 VAC. The AC voltage tap strip is located behind the door on the front of the transformer. Follow the labels above each connection.

6.1 AC Fuse Mounting

From Table 1, locate the proper type and rating AC fuse size to insert for fuses F1 and F2 (cartridge type fuses). Insert the fuses into the fuse block located on the side of charger.

Table 1

VVR Model	Maximum Current	208 VAC INPUT		240 VAC INPUT		480 VAC INPUT	
		Fuse Size (FRS)	Input Current	Fuse Size (FRS)	Input Current	Fuse Size (FRS)	Input Current
85-60P	60	60	46	50	40	35	20

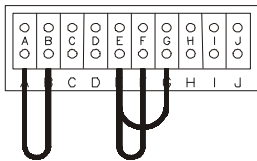
Note: All input fuses are time delay, 600-volt, at the amp rating specified.

6.2 Configuration of Jumpers

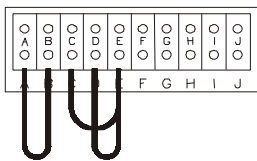
Locate the AC tap strip found inside the charger on the transformer. Figure 1 illustrates the correct way to configure the AC jumpers based on the AC voltage range. Use the instructions on the inside of the charger door to configure the AC jumpers. Connect the jumpers as shown in the figure and torque the screws to 18-inch pounds for proper connection.

FIGURE 1

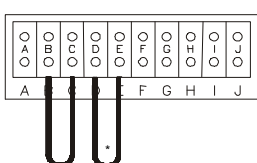
208 VAC JUMPER SETTING



240 VAC JUMPER SETTING



480 VAC JUMPER SETTING



*PUT EXTRA JUMPER IN PARALLEL

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

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

7. CONTROLLER OPERATION

The battery charger is operated with the four buttons on the front of the charger. The buttons are used for two different modes of operation: DISPLAY FUNCTIONS and PROGRAMMING FUNCTIONS. The charger also has a four-digit display used for showing charge data and programming function values.

When reference is given to a number or word that is displayed in this section, it will be shown in quotation marks as actually displayed.

If the charger is off (with AC power on), "OFF" will be displayed. If the charger detects a problem, "Erxx" will be displayed to let you know there is some kind of error condition (xx will be error code number).

7.1 Display functions

The labels on the right side of the buttons are for the display functions. When the charger is running and is not in the programming mode, pushing one of the buttons will display data about the charge cycle.

7.1.1 Voltage

When the voltage button is pressed and held, the display will read the voltage present at the charger terminals. If the button is pushed and released, it displays the voltage present at the battery terminals.

7.1.2 Current

Pressing the current button will display the current being provided by the charger to the load.

7.1.3 Temperature

When the temperature button is pressed, the display will show the internal temperature of the charger.

7.1.4 Start/Stop

The bottom button is the start/stop button which toggles the charger's output on and off. If the charger is stopped, "OFF" is periodically flashed on the display.

7.2 Programming functions

A new quick programming mode has been added. This allows rapid access to the five programming functions used most often. Activated as the default from factory, only Functions 8, 9, 10, 11 and 17 are available.

If other function numbers are available, then go to function 1 and push ENTER and CLEAR to go back to factory setting.

To operate the battery charger in the programming mode, use the labels on the left side of the buttons. From the top down, the button functions are: UP, DOWN, CLEAR, and ENTER. To use the programming mode, follow the steps below.

a. Press and hold the UP button in, then press and release in order the CLEAR, DOWN, and CLEAR buttons, then release the UP button.

Response: The display will respond by showing "F8", the first function number available.

b. Use the UP and DOWN buttons (function numbers move up or down in numerical order) to select the function that is to be executed or programmed. Each push of the UP or DOWN button will select the next numerical function number.

Response: The display will show the function numbers as you scan through them.

c. Press and release ENTER after selecting the proper function number.

Response: The function will be executed, the display will show the function number or the present value in the programmable function.

d. To change a programmable functions value (only functions 8-11 may be programmed), press the UP and DOWN buttons until the new value desired is displayed. Holding in the UP or DOWN buttons will rapidly advance through the numbers. Then press ENTER.

Response: The new value is stored in memory and the function number is displayed. If CLEAR is pressed, the new value is ignored and the function number is displayed.

e. To exit programming, press CLEAR from the function selection mode. If the charger is left in programming for over ten minutes, it will automatically switch back to the display mode.

Response: After the programming mode has been exited, if any values were changed, the display will go through a counting sequence while updating the permanent charger memory.

7.2.1 Function descriptions

The descriptions below are given in the following order: function number, factory setting (if one is applicable), function name, and function definition.

8 "1" CELLS IN THE BATTERY –

THE USER MUST SET THIS TO THE NUMBER OF CELLS IN THE BATTERY FOR THE CHARGER TO OPERATE PROPERLY. The battery cell range is from "1" to "85".

9 "1.00" FLOAT VOLTAGE PER CELL –

The user must set this to the float voltage per cell for the battery. The range is from "1.00" to "3.00" volts. For gel electrolytic batteries, use a typical float voltage of "2.23". Set the value to the battery manufacturer's specifications. THIS FUNCTION MUST BE SET FOR THE CHARGER TO OPERATE PROPERLY.

10 "0" TEMPERATURE COMPENSATION –

This function is set to zero. No temperature compensation is done.

11 "1.00" MAXIMUM CURRENT –

Set this function to the maximum current the charger should provide to the batteries (the range is from "1.0" to "60.0" amps). THIS FUNCTION MUST BE SET UP FOR THE BATTERY SIZE FOR THE CHARGER TO OPERATE PROPERLY.

17 CLEAR ERRORS –

This function will clear all of the error indicators.

8. ERROR CODE DESCRIPTIONS

The message "Erxx" is displayed when the charger recognizes a problem has occurred, where xx is the error code number that the charger has recognized. If more than one error occurs, a short pause will be taken between showing the error code numbers. To clear an error code see Function 17. If an error has been cleared but the problem still exists, the error will be detected again after leaving the program mode.

Some errors the charger detects are more serious than others. When a fatal error occurs, the charger will shut off to avoid possible further damage to the charger or batteries. The error code descriptions are given below in the following order: error code number, fatal error status (NF = non-fatal; F = fatal), error code name, and error code definition.

1 (F) **Improper Output** - The charger is unable to reach either the set output current or the set output voltage. It will also occur if the input line voltage drops too low to maintain proper output levels. Verify the charger's output setting, line voltages, and battery voltages before clearing this error.

2 (NF) **Stuck Button** - A button on the front of the charger is not working properly. If the button cannot be made to work, the charger needs servicing.

3 (F) **Internal** - This occurs if the control module has an internal problem. The charger needs servicing.

4 (NF) **Defective External Temperature Probe** - This option is not available.

5 (NF) **Defective Internal Temperature Probe** - The temperature probe internal to the charger is not operating properly. The charger will need to be serviced.

6 (F) **Voltage Set Over Limit** - The voltage plateau has been set over the maximum level that the charger is capable of producing.

7 (NF) **Charger Is Warm** - This error occurs when the charger's internal temperature reaches 160°F (71°C) to prevent damage to the charger.

8 (NF) **Battery Over Temperature** - This option is not available.

9 (NF) **Charger Over Temperature** - This error occurs when the charger's temperature reaches 170°F (77°C). At 160°F (71°C), the output of the charger is reduced to protect the charger from damage (error code 7), but when 170°F (77 °C) is reached the charger will stop until the temperature decreases.

10 (NF) **Excessive Cable Drop** - The battery voltage measured at the charger's terminals has exceeded the voltage measured at the batteries by 4 volts. This indicates there may be a problem with the cables between the charger and the batteries or between the batteries.

11 (NF) **Battery Sense Cable** - This option is not available.

12 (F) **Programming Lost** - If this occurs the charger sensed one of the function variables to be invalid and the charger will shut down. All of the functions will have to be reprogrammed, and then restart the charger.

13 (F) **Calibration Lost** - This occurs when the charger senses a problem with the electronic control module. If this occurs the charger will need to be repaired.

14 (NF) **Battery Is Warm** - This option is not available.

15 (NF) **Battery Is Very Cold** - This option is not available.

16 (NF) **Voltage Outside Limits** - If the battery voltage is sensed to be either higher than 3.00 VDC or lower than 1.00 VDC, this error will occur.

9. MAINTENANCE

The battery charger requires minimal maintenance. It should be kept clean and all connections tightly secured. In the event of an intermittent operation, examine and tighten, if necessary, all connections. **BE SURE THE CHASSIS IS SECURELY GROUNDED.** If any problem cannot be resolved, contact NATIONAL RAILWAY SUPPLY, INC.

10. SERVICING

If the battery charger operates improperly, check for a possible error code number. When a problem occurs that is not recognized by the charger, use the following steps:

- a. Begin by pressing all four buttons on the front of the charger simultaneously. This resets the charger and may correct the problem.
- b. Check the fuse(s) to see if it has blown and replace if necessary.
- c. Also check for proper AC voltage jumper selection.
- d. Check the polarity between the DC output and the battery and make sure their connections are good.
- e. If the steps above do not solve the problem, contact NATIONAL RAILWAY SUPPLY, INC.

11. PARTS LIST

The following is a list of all the parts found in the NATIONAL RAILWAY SUPPLY, INC. BATTERY CHARGERS. When replacing a part, USE ONLY ORIGINAL FACTORY REPLACEMENT PARTS of the correct size and rating.

<u>PART NO.</u>	<u>QTY.</u>	<u>DESCRIPTION</u>
21125S	1	TRANSFORMER ASSEMBLY
30072S	1	BASE, CASE
13716S	2	THYRISTOR ASSEMBLY
10690S	1	SHUNT
21565S	1	BOARD, ELECT
18278S	1	BEZEL ASSEMBLY
30162S	1	CONTROL CABLE
29109S	2	WHEEL, 10"
15878S	1	ROD, STEEL (AXLE)
29928S	1	BRACKET, TERMINAL STRIP
29944S	2	GLIDE, LEVELING
10910S	2	FUSE, DC
12871S	2	FUSE, AC, 60 AMP
13633S	2	FUSE, AC, 50 AMP
13636S	2	FUSE, AC, 35 AMP
13619S	2	HEATSINK
30074S	1	HEATSINK, MOUNTING PLATE
12616S	1	PLATE, INSULATOR, FUSEHOLDER
12947S	1	PLATE, INSULATOR, SHUNT
17689S	1	LATCH, SPRING
22851S	1	HANDLE ASSEMBLY
30407S	1	HANDLE, CHARGER
18278S	1	TERMINAL STRIP
30073S	2	CORD, BRACKET
30077S	2	PANEL, SIDE
30081S	1	PANEL, COVER
22758S	1	PANEL, FRONT
25357S	1	PANEL, BACK
30082S	2	SUPPORT, RAIL, BASE
30076S	2	TRANSFORMER, RAIL
12869S	1	FUSE, BLOCK, AC
30022S	2	BUSHING, FLANGED (AXLE)
30021S	2	PUSH, CAP (AXLE)
30531S	1	SNUBBER ASSEMBLY
30017S	1	DOOR ASSEMBLY
03820S	1	CAPACITOR, AC, 2 MFD, 660 VAC

12. WIRING DIAGRAM FOR 208/240/480 VVR 85-60P

