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PRC-PS

Power Supply/Battery Charger

Operator/Technical Manual

Manual Part No. PRC-PS-MS
Release Date: November 2006
Revision: D

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Change Description

Date of Revision	Revision Letter	Description of Changes	Pages Affected
11/06	D	Update format and overall content.	All

Datron World Communications, Inc.

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a. Model, serial number, and date of installation.
b. Name of dealer or supplier of the equipment.
c. Detailed explanation of problem.
d. Return shipping instructions.
e. Telephone or fax number where Buyer may be contacted.

Datron will return the equipment prepaid by United Parcel Service, Parcel Post, or truck. If alternate shipping is specified by Buyer, freight charges will be made collect.

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1. Part number
2. Serial number and model of equipment
3. Date of installation

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Safety Considerations

This product and manual must be thoroughly understood before attempting installation and operation. To do so without proper knowledge can result in equipment failure and bodily injury.

Caution: Before applying ac power, be sure that the equipment has be properly configured for the available line voltage. Attempted operation at the wrong voltage can result in damage and voids the warranty. See the manuals section on installation. DO NOT operate equipment with cover removed.

Earth Ground: All Datron products are supplied with a standard, 3-wire, grounded ac plug. DO NOT attempt to disable the ground terminal by using 2-wire adapters of any type. Any disconnection of the equipment ground causes a potential shock hazard that could result in personal injury. DO NOT operate any equipment until a suitable ground has been established. Consult the manual section on grounding.

Servicing: Trained personnel should only carry out servicing. To avoid electric shock, DO NOT open the case unless qualified to do so.

Various measurements and adjustments described in this manual are performed in ac power applied and the protective covers removed. Capacitors (particularly the large power supply electrolytics) can remain charged for a considerable time after the unit has been shut off. Use particular care when working around them, as a short circuit can release sufficient energy to cause damage to the equipment and possible injury.

To protect against fire hazard, always replace line fuses with ones of the same current rating and type (normal delay, slow-blow, etc.). DO NOT use higher value replacements in an attempt to prevent fuse failure. If fuses are failing repeatedly this indicates a probable defect in the equipment that needs attention.

Use only genuine Datron factory parts for full performance and safety of this product.

Made in the USA

CONTENTS

CHAPTER 1
INTRODUCTION

1.1 PRC-PS

The PRC-PS is a combination power supply and dual battery charger designed to power the PRC1099A transceiver, charge the BB-LA6 lead-calcium battery inside the transceiver and charge an additional BB-LA6 simultaneously. The PRC-PS can use a 50 or 60 Hz 110 VAC or 220 VAC (internally strapped) or a 20 Vdc to 30 Vdc power source.

The PRC-PS includes the following features:

- 12.5 Vdc power supply with two battery charging capacity
- 3-level charging circuitry
- AC or DC power source
- Front panel status LEDs for each charging station
- Front panel reset button
- Full short circuit protection

1.2 Specifications

Note: *All specifications subject to change without notice or obligation.*

1.2.1 PRC-PS Specifications

Characteristic	Description
General	
Input voltage	110/220 VAC or 20 to 30 Vdc (internally strapped)
Input current	1A (max.) at 110 VAC 0.75A (max.) at 220 VAC 9A (max.) at 20 Vdc to 30 Vdc
Reverse polarity protection	Fully protected on DC input and battery outputs.
Electrical	
Bulk charging rate	1.1A (C/5)
Bulk to overcharge transition voltage	14.0 Vdc
Overcharge terminate current	110 mA (C/50)
Float charge voltage	13.3 Vdc
Float to bulk transition voltage	12.0 Vdc
Temperature coefficient on voltage levels	-12 mV per °C
Current drain on battery	5 µA max. (with power off)
Nominal charge time	6 hrs (with 80% discharged battery)
Mechanical	
Weight	4.6 kg (10 lbs.)
Size (HWD)	10 cm x 24 cm x 28 cm (4.0 in. x 9.5 in. x 11.0 in.)
Panel indicators	POWER ON and FAULT CHARGING, READY for each charger circuit.
Operating controls	POWER on/off switch, RESET button for each charger circuit, GAIN control with SPKR OFF.

Characteristic	Description
Environmental	
Temperature Operating	0° C to +60°C (ambient)

1.2.2 BB-LA6 Battery Specifications

Characteristic	Description
Electrical	
Nominal capacity	6 Ah
Nominal voltage	12 Vdc
Max. instantaneous output current	30A at 20°C
Max. continuous output current	7A at 20°C
Internal resistance	0.02 ohms max. (fully charged)
Percent of original capacity versus storage time	90% after 3 months 80% after 6 months 60% after 12 months
Mechanical	
Weight	2.5 kg (5.5 lbs.)
Size (HWD)	9.4 cm x 24.2 cm x 5.8 cm (3.7 in. x 9.5 in. x 2.3 in.)

1.2.3 CY-2562 Battery Box Specifications

Characteristic	Description
Mechanical	
Weight	0.23 kg (0.5 lbs.)
Size	7.5 cm x 10 cm x 28 cm (3.0 in. x 4.0 in. x 11.0 in.)

CHAPTER 2
INSTALLATION

2.1 Unpacking

The PRC-PS is shipped in a heavy-duty corrugated cardboard carton. Do not discard the cartons and packing materials in case the equipment needs to be reshipped.

Inspect the PRC-PS for possible damage during shipment. Check all accessories against the packing list. The packing list should include the following items:

- PRC-PS Power supply and battery charger
- AC Power cord
- DC Power cord
- C991608 power cable
- CY-2562 Battery box

2.2 Power Configuration

2.2.1 AC Input Power

The PRC-PS can be configured for 110 VAC or 220 VAC by opening the case and changing the connections on the power transformer. A label on the case indicates to what voltage level the transformer is set, however it is prudent to visually inspect the power transformer to verify what input voltage it is configured to accept. Refer to the Power Transformer Connections figure on page 2-3.

CAUTION: Always remember to remove the AC power cable before opening the PRC-PS case. If the charger is energized, the technician is exposed to dangerous voltages that can cause personal injury or death from electrical shock.

To access the power transformer:

1. Make sure the PRC-PS is turned off and disconnected from any power source (see CAUTION above).

2. Place the PRC-PS so the front panel is faced away from you. Locate and remove the four captive screws that hold the front panel to the case.

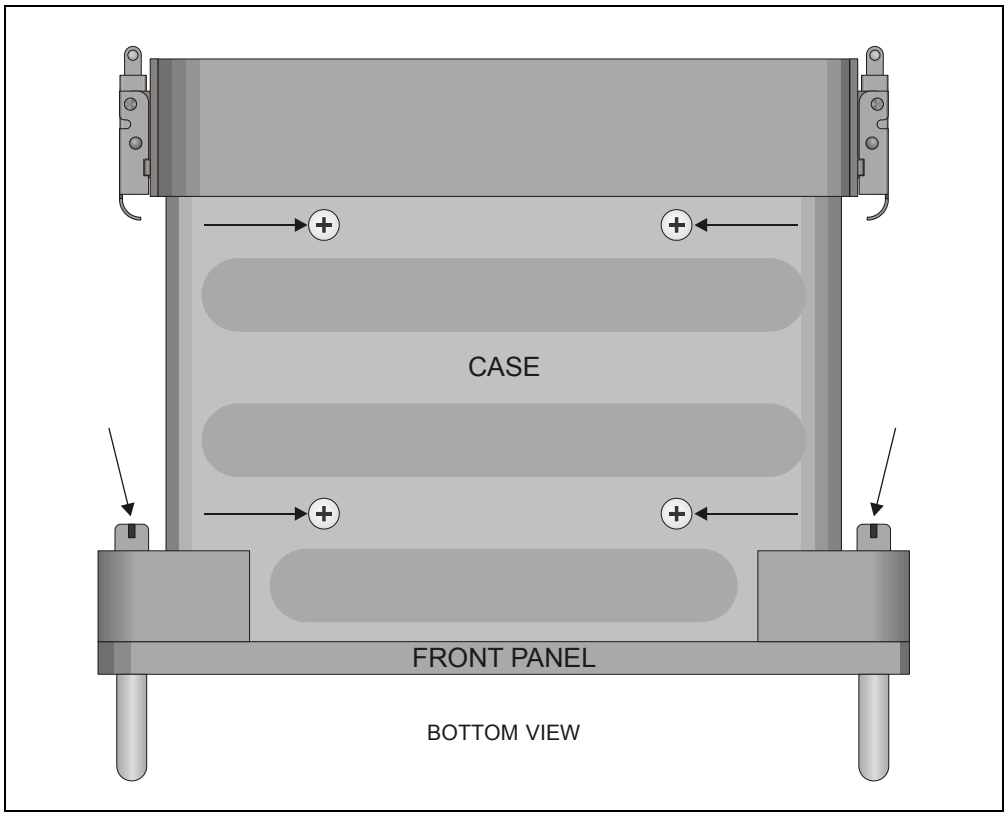


Figure 2-1. Captive and Chassis Screws

3. Position the PRC-PS so the bottom side is facing you. Remove the four screws that hold the inside chassis to the case (refer to the Captive and Chassis Screws figure above).
4. Slide the chassis out of the case (the connections on the power transformer behind the regulator circuit board).
5. If the transformer is configured for 110 VAC and you need it to be 220 VAC, desolder terminals 3, 4, 5 and 6. Remove the jumper wires between terminal 2 and terminal 3, and the jumper between terminal 5 and terminal 6. Refer to the Power Transformer Connections figure on page 2-3.
6. Install one of the jumpers between terminals 4 and 5. Resolder terminals 3, 4, 5, 6.
7. Reverse steps 2 through 4 to reassemble the PRC-PS.

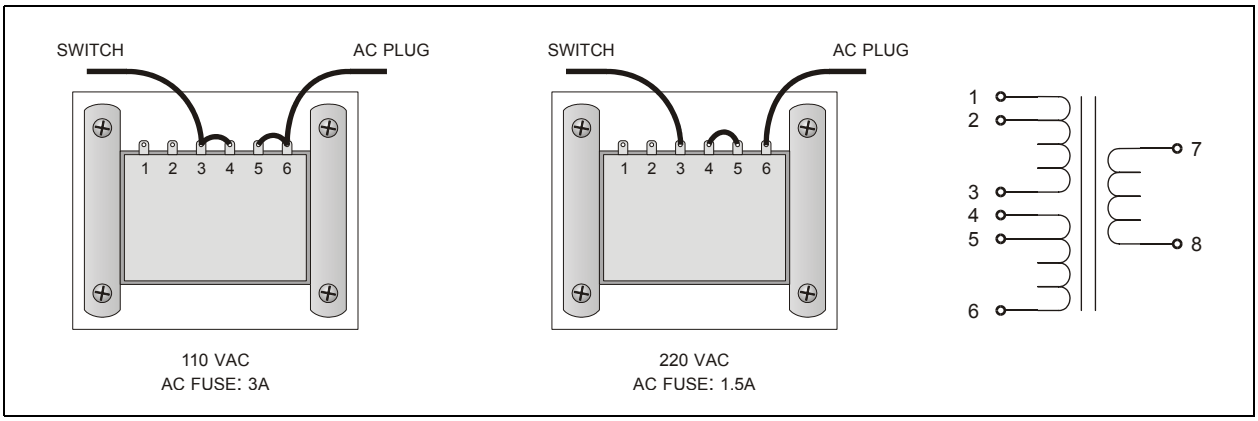


Figure 2-2. Power Transformer Connections

The PRC-PS is shipped with a molded AC power cable with a 3-wire plug and jack. It may be necessary to modify the plug to fit non-standard US AC receptacles. The following table provides the color codes for the AC power cable.

Wire Type	US Standard Color Code	International Color Code
Phase	Black	Brown
Neutral	White	Blue
Ground	Green	Green/yellow stripe

2.2.2 DC Input Power

The PRC-PS also ships with a 2-wire DC input (14 AWG) cable. One end of the cable does not have a connector so that the appropriate connector can be added to connect to a DC power source. The power source must provide 20 Vdc to 30 Vdc and be capable of supplying 9A. A 24V vehicle battery is a typical DC power source.

The front panel DC INPUT connector is wired according to the figure below.

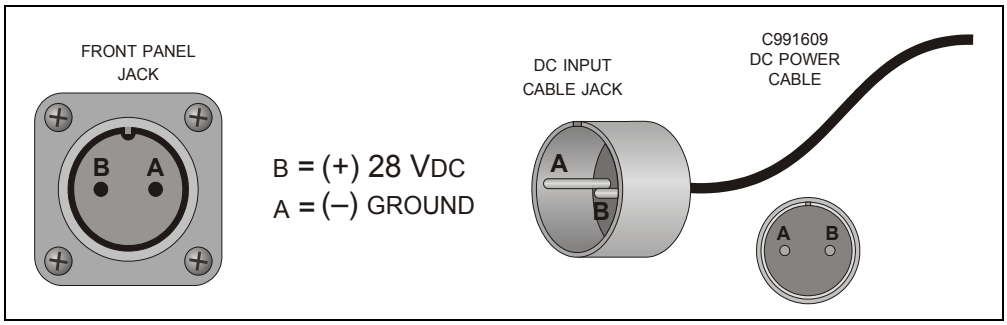


Figure 2-3. DC Power Connection

CAUTION: Do not operate the PRC-PS when connected to both an AC and DC power source.

The PRC-PS does not require any alignment or adjustment for normal operation.

2.2.3 DC Output Power

The PRC-PS is designed to provide 12 Vdc to the PRC1099A transceiver to power the radio and charge a BB-LA6 attached to the radio through the front panel J1 connector. It can also charge an additional BB-LA6 lead-calcium through the rear power connector J4.

CHAPTER 3
OPERATION

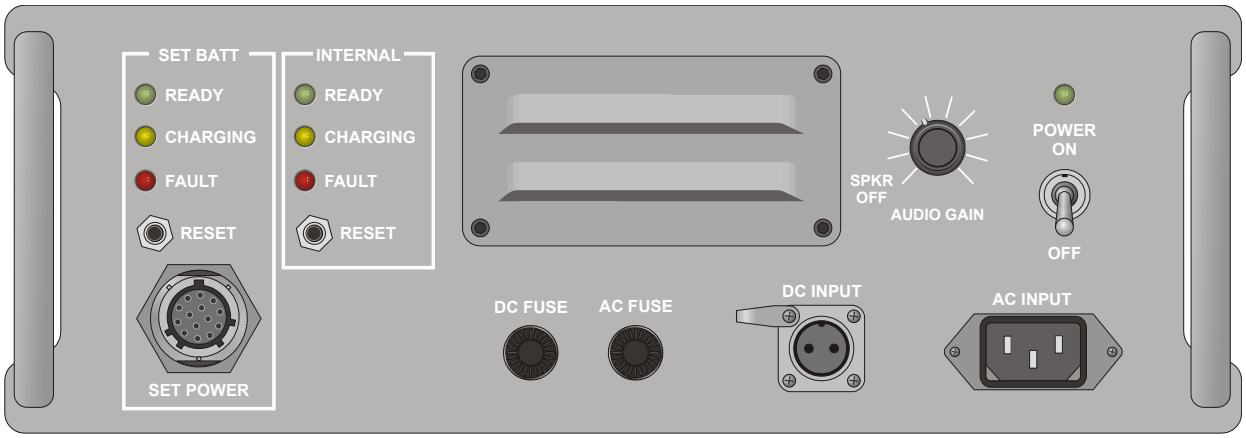


Figure 3-1. PRC-PS Front Panel

The PRC-PS front panel provides the following interfaces and controls.

Interface or Control	Description
SET BATT Charging Station	Provides 12.5 Vdc to power the PRC1099A and charge the BB-LA6 installed in the PRC1099A. The SET POWER connector (J1) interfaces with the PRC1099A through the C991608 cable.
INTERNAL Charging Station	Charges a BB-LA6 attached to the back of the PRC-PS.
Speaker	Provides audio for the PRC1099A in receive mode.
AC FUSE (F1)	1.5A 250 VAC fuse. 3A 115 VAC fuse
DC FUSE (F2)	10A 250 Vdc fuse.
AC INPUT Voltage Connector (J3)	Accepts the 3-conductor AC cable provided with the power supply.
DC INPUT Voltage Connector (J2)	Accepts the 2-conductor C991609 DC power cable also provided with the power supply.

Interface or Control	Description
POWER Switch (S1)	2-position on/off toggle switch that controls both the AC and DC input lines.
AUDIO GAIN Control	Adjusts the volume to the speaker.

CAUTION: Use the PRC-PS to charge BB-LA6 lead-calcium batteries only. Attempting to recharge lithium, magnesium or other battery types may result in explosion or release of toxic material.

To set up the PRC-PS for powering the PRC1099A and charging BB-LA6 batteries:

1. Make sure the power transformer is configured correctly for the intended power source. Refer to the AC Input Power section on page 2-1.
2. Connect the AC power cable to the front panel AC INPUT connector and an AC (110 VAC or 220 VAC) power source, or connect the DC power cable C991609 to the front panel DC INPUT connector and a DC (20 Vdc to 30 Vdc) power source.
3. Connect the C991608 cable from the PRC-PS front panel SET POWER connector to the PRC1099A accessory (ACC) connector.
4. Install an additional BB-LA6 battery to the rear of the PRC-PS.
5. Turn the front panel POWER switch to ON.
6. Push the front panel RESET button to start charging on one or both charging stations.
7. Observe the front panel status LEDs for the charging stations in use. The yellow CHARGING LED should be lit. For other LED indications, refer to the Status LED Indications table below.

Table 3-1. Status LED Indications

LED	Meaning	Required Action
FAULT	Battery fuse is blown or battery voltage is below 5 Vdc. **Note:** *It is normal for the FAULT LED to go on if you press RESET when a battery is not installed.*	Check battery fuse. If the battery fuse is okay, the battery is faulty. Discard the battery.

Table 3-1. Status LED Indications (continued)

LED	Meaning	Required Action
CHARGING	Battery is charging normally.	None.
READY	Battery is fully charged.	Remove battery. The battery may be left connected to the charger.

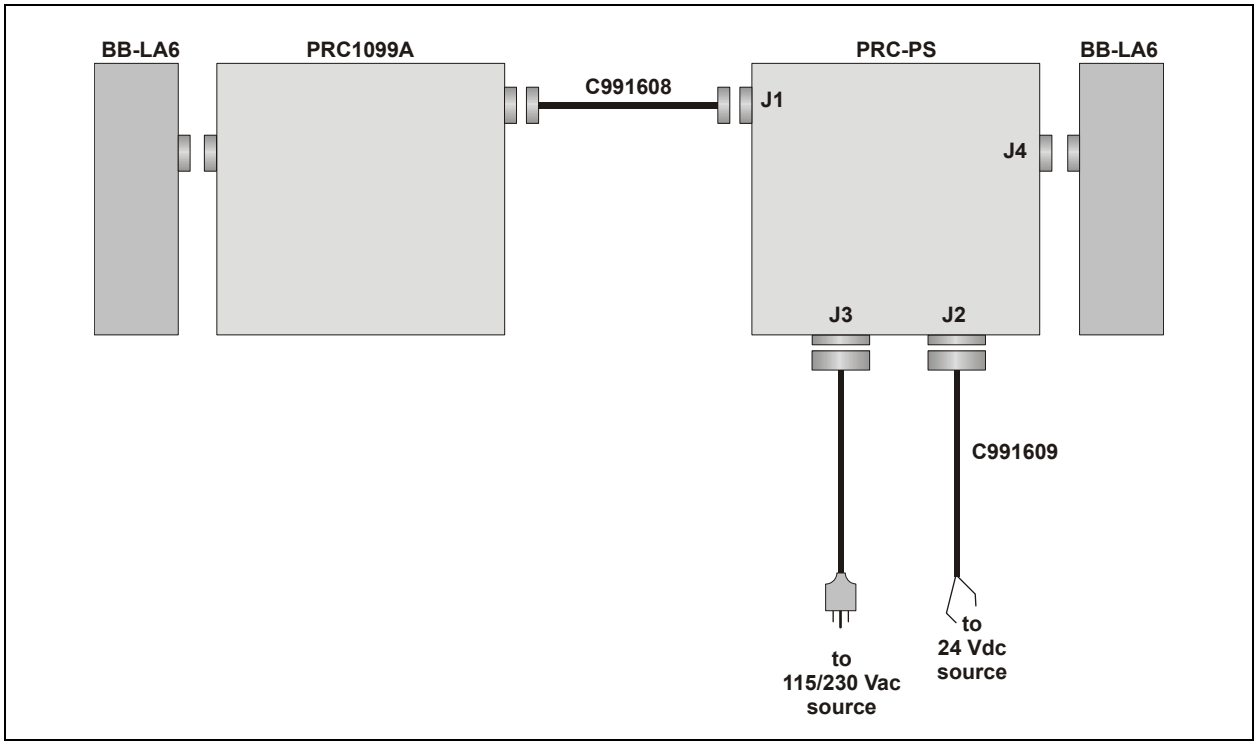


Figure 3-2. Charging Configuration

CHAPTER 4
THEORY OF OPERATION

This chapter provides a detailed description of the circuitry the PRC-PS uses to power the PRC1099A and charge BB-LA6 batteries.

4.1 Input Power

The PRC-PS derives input power for either an AC (115 VAC or 230 VAC) or DC (20 Vdc to 30 Vdc) power source. The front panel POWER switch controls both power input lines.

4.1.1 AC Power Supply

The internal AC power supply uses a standard, monolithic full-wave diode bridge as the rectifier. The power transformer uses a split primary coil configurable for 110 VAC or 220 VAC operation. The phase line is switched and fused.

The capacitor C2 filters the AC input limiting ripple to about 2 Vpp at the full rated output. The input circuitry includes a normally-closed thermostat TH1 that opens at approximately 75°C. The thermostat switch is wired in series with the DC fuse F2 so that if the chassis temperature exceeds 75°C, the PRC-PS turns off until it cools down below 75° C.

A transient-absorbing diode D1, located at the DC fuse, provides protection against large spikes. If D1 detects a transient greater than 32 Vdc, it goes into a short mode, pulling the raw DC supply line to ground, which causes the DC fuse F2 to blow.

4.1.2 DC Power Supply

The PRC-PS can operate from a 20 Vdc to 30 Vdc DC power source. Capacitor C2 filters the DC power line. Diode D1 provides reverse-current protection so that current does not flow to the DC input connector when the PRC-PS is using an AC power source.

4.2 Charging Circuit

The PRC-PS consists of two charging circuits with one charging station interfaced through the front panel and another charger through the rear power connector J4. Since both charging circuits are identical, this technical description only references the INTERNAL charging circuit.

The PRC-PS charges BB-LA6s in three charging state levels:

- Bulk charge
- Overcharge
- Float charge

4.2.1 Bulk Charge State

The INTERNAL charging station includes the charger IC U3 that detects voltage and controls the charge levels. When an operator connects a BB-LA6 to the charge station, the charger IC detects voltage on the output line and initiates the bulk charge state. The charger IC samples voltage through divider resistors R20 and R21 to the sampling input pin 12. Pin 7, normally at ground, provides the lower reference for the divider. When power is removed, pin 7 floats so that no current can flow out of the battery when the power is turned off.

The bulk charge begins when voltage on pin 12 exceeds 2.5 Vdc, which corresponds to 5.0 Vdc from the battery. If the battery voltage is lower than 5V, the charger remains in fault condition and no current flows to the battery. This protects the PRC-PS from BB-LA6s with shorted cells.

Series pass transistor Q3 controls the charge current to the BB-LA6. In the bulk charge state, the charger IC drives Q3 through pin 16. Resistor R23, in series with the Q3 emitter, provides current-limiting and current-sensing that allows the charger IC to maintain the charge current at 1.1A. Capacitor C18 provides filtering for the Q3 internal driver. Pin 5 is the supply input and pin 6 is ground. Diode D5 prevents the BB-LA6 from discharging when the PRC-PS is turned off.

The bulk charge state continues until the BB-LA6 voltage reaches a preset level (14.0 Vdc) determined by the ratio of resistors R18, R19 and R22 sampled at pin 13. When the battery voltage reaches 14.0 Vdc, the charging circuit goes into the overcharge state.

4.2.2 Overcharge State

The overcharge state maintains the battery voltage at 14.0 Vdc until the current decreases by 10% of the bulk charge current (110 mA). This state brings the BB-LA6 back to full capacity without damaging the cells.

Charger IC pin 1, the charge state output, toggles when the charge current drops by 10% of the bulk charge current. The overcharge terminate pin (pin 8) connects to pin 1. When pin 1 toggles, it forces the charger into float state.

4.2.3 Float State

The float state maintains the battery voltage at 13.3 Vdc. The charger IC changes the cutoff voltage by changing pin 10 from ground (in the bulk charge state) which places R18 in parallel with R19, to a high impedance that places R18 in series with R19, shifting the Vcutoff to 13.3V. The PRC-PS uses

whatever current (up to 1.1A) is necessary to maintain this voltage. The BB-LA6 is now fully charged and can be left on the charger in this state for extended periods of time.

If for some reason the BB-LA6 voltage drops below 12 Vdc, the PRC-PS returns to the bulk charge state and repeats the charge cycle.

The following chart shows the charge levels in the three charging states.

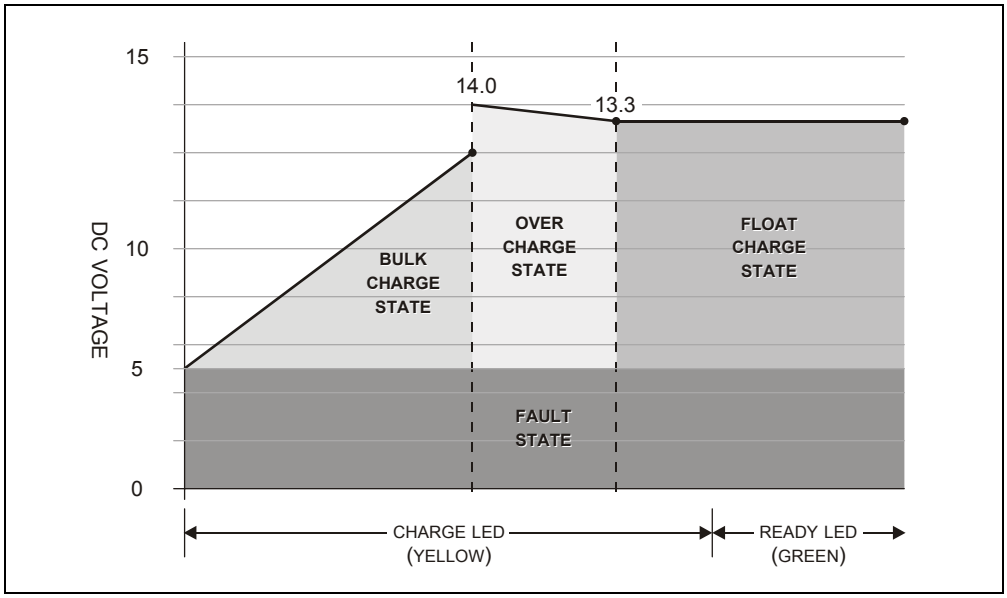


Figure 4-1. Charge States

4.3 Status LEDs

The front panel LEDs provide charge level status. The charger IC provides two signals to control the status LEDs: the enable comparator output at pin 11 and the state level output at pin 10.

4.3.1 Fault LED

The enable comparator output (pin 11) goes directly to the display board where it drives the FAULT LED through current limiting resistor R2. It also drives the base of Q1 that shunts voltage away from diodes D1 and D2 when it is conducting, preventing the CHARGING and READY LEDs from lighting.

4.3.2 Charge LED

The state level output (pin 10) drives the inverting input to operational amplifier U2. The non-inverting input is fixed at 1.3 Vdc. Pin 10 is at ground potential during the bulk charge and overcharge states keeping the output of U2B high. When U2B is high (near B+ voltage but always greater than 12 Vdc), the CHARGING LED conducts through R4; it also reverse-biases the READY LED so that it cannot light up.

4.3.3 Ready LED

During the float charge state, pin 10 goes to a high impedance condition with the voltage level equal to pin 13 (normally about 2.5 Vdc). This causes U2B to go low. When the U2B output is low (near ground potential), the READY LED conducts through D3 and R4. The 12V supply provides the voltage for the CHARGE and READY LEDs.

4.4 DC Power Supply

In addition to charging BB-LA6 batteries, the PRC-PS provides 14 Vdc to the PRC1099A. The power supply circuitry uses an adjustable 5 Vdc reference diode D2 to control the output voltage. Series resistors R2 and R3 forward-bias the diode and R4 adjusts the reference voltage which is typically about 4.6 Vdc. This reference voltage feeds the non-inverting input of operational amplifier U1B (pin 5).

The output of U1A (pin 1) connects to the U1B inverting input and is typically at ground potential. Resistors R11 and R12 bias U1B to provide a stage gain of 3, setting the output to about 14.0 Vdc. This output drives the Darlington pass transistor array formed by Q1, Q8, Q7, Q6 and Q5. Emitter resistors R33 through R36 ensure each transistor conducts an equal portion of the current.

Series resistor R6 acts as a current sensor for the output current path. When the voltage dropped across R6 exceeds 0.3 Vdc, the output differential amplifier U1A begins to rise from its typically low state. Adjustable resistor R8 provides current limiting by controlling the trigger voltage level required to cause the output of U1A to start increasing. Since the output of U1A is connected to the inverting input of U1B, as the output of U1A increases, the output of U1B decreases. This drives the pass transistor array to decrease the power supply current. R8 is set so that by the time the total output current reaches 6A, the power supply output voltage is 0V. Refer to Figure 4.2 below.

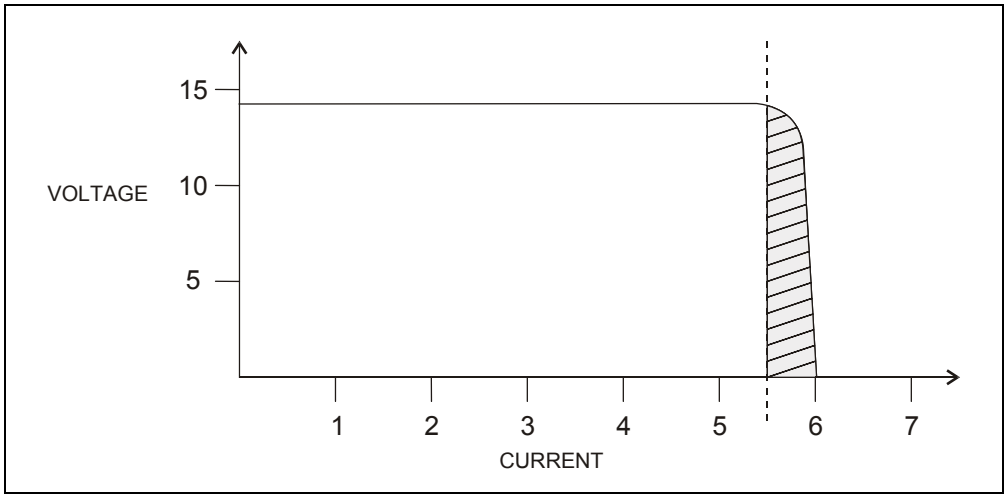


Figure 4-2. Power Supply Output Voltage and Current Chart

CHAPTER 5
MAINTENANCE

This chapter provides a test procedure for verifying the PRC-PS functionality and a troubleshooting procedure for isolating a fault.

5.1 Functional Test

Use the following test procedure to verify that the PRC-PS is working properly. If the PRC-PS fails one of the checks, refer to the Troubleshooting Index table on page 5-6.

5.1.1 Required Materials

Use the following materials to perform the PRC-PS functional tests:

- DC Power supply (6 Vdc to 20 Vdc output at 9A minimum)
- Electrolytic capacitor (30,000 µF to 150,000 µF 25 Vdc)
- Resistor (6.8 ohms 10W)
- Resistor (1.5 ohms 50W)
- Resistor (2.2 ohms 50W)
- Resistor (82 ohms 50W)
- DC VOM (high impedance input)
- DC Ammeter (3A scale minimum)
- Clip jumpers
- Heat gun or blow torch
- 1 kHz audio source (0.5 Vpp output minimum)

5.1.2 Test Procedure

The following checks use the electrolytic capacitor to simulate a BB-LA6 battery.

Charging Circuit Check

1. Set up the PRC-PS using an AC input power source.
2. Use the DC power supply to charge the electrolytic capacitor between 6 Vdc and 13 Vdc.
3. Remove the battery from the back of the PRC-PS. Use the clip jumpers to attach the rear panel power connector J4 to the capacitor as if it were a BB-LA6. Refer to the Charger Output Check Setup figure on page 5-2.

4. The READY LED for the INTERNAL charging station should light up in a few seconds. If it does not, measure the capacitor voltage to make sure it is greater than 6 Vdc. If the capacitor voltage is above 6 Vdc, the charger circuit has a fault.

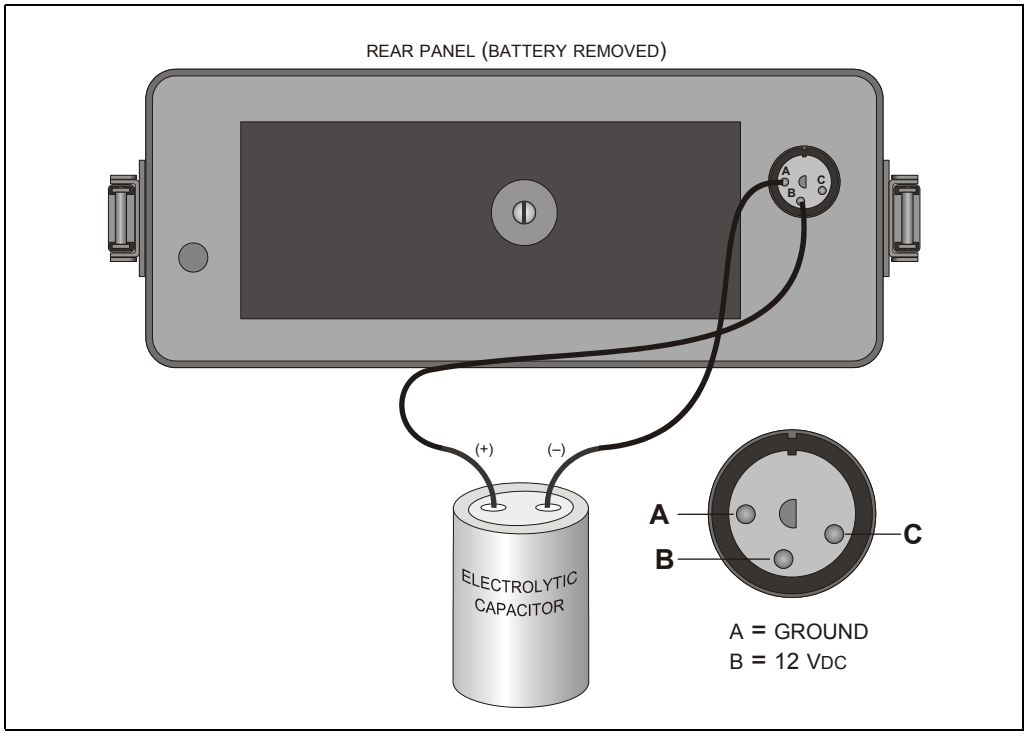


Figure 5-1. Charger Output Check Setup

DC Current Check

1. Connect a DC ammeter, and 6.8 ohm and 2.2 ohm resistors in series and connect them across the capacitor. Refer to the DC Current Check Setup figure on page 5-3.
2. Measure the DC current. It should be 1.1A ±0.1A. The CHARGING LED for the INTERNAL charging station should be lit when the ammeter and resistors are connected.
3. Disconnect the ammeter and resistors. The READY LED should light up after a few seconds.

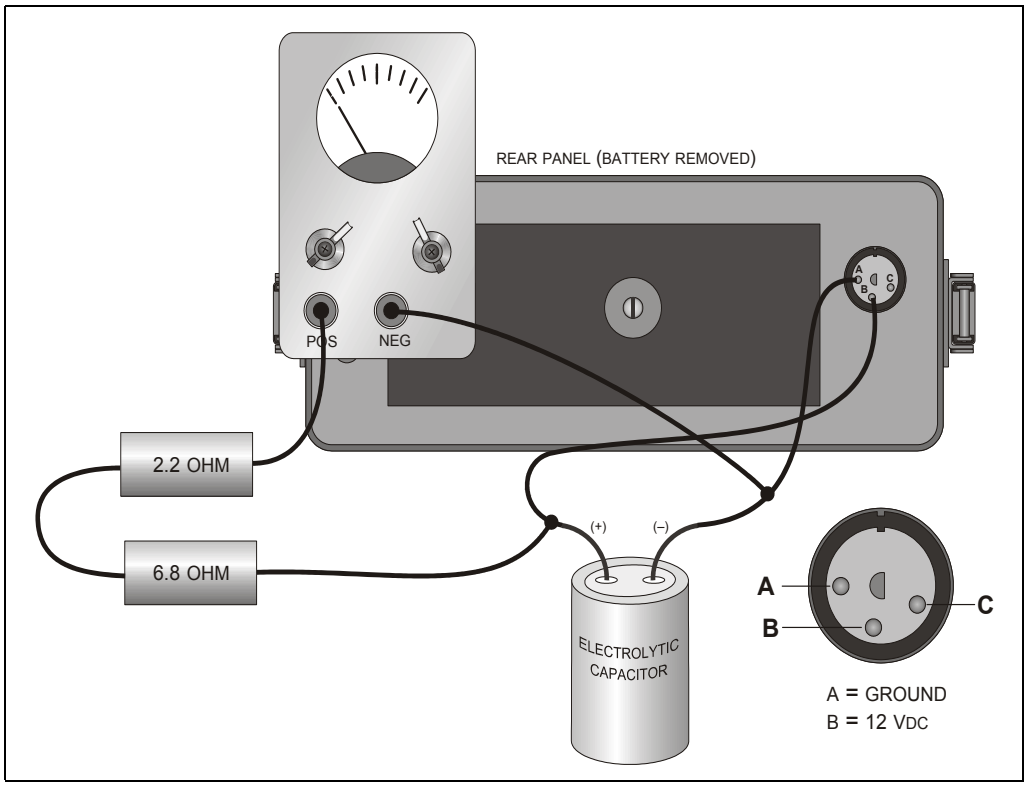


Figure 5-2. DC Current Check Setup

DC Output Check

1. Connect the DC voltmeter across the capacitor.
2. Connect the 82 ohm resistor across the capacitor.
3. Measure the DC voltage. It should be 13.3 Vdc ±0.2 Vdc.

Reset Circuit Check

1. Press and hold the RESET button and observe the capacitor discharging.
2. Release the RESET button when the capacitor voltage is between 6 Vdc and 10 Vdc. The CHARGING LED should light up.

Overcharge Voltage Check

1. Measure the DC voltage across the 82 ohm resistor. It should be 14.0 Vdc ±0.2 Vdc.

Undervoltage Protection Circuit Check

1. Connect the 2.2 ohm resistor across the capacitor.
2. Observe that the FAULT LED lights up after a few seconds.

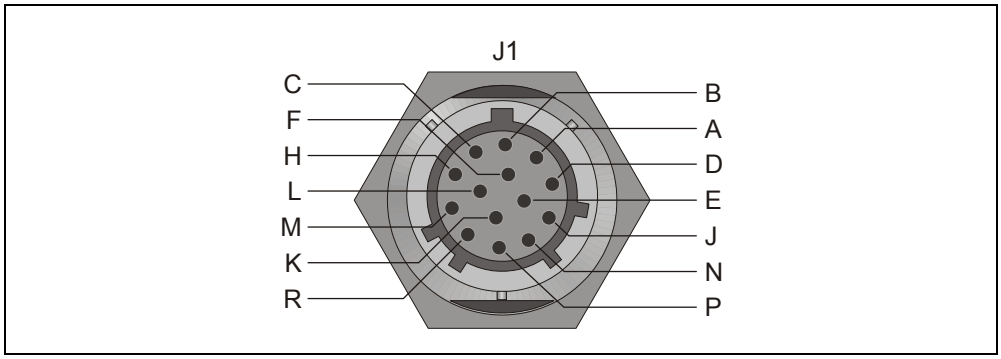


Figure 5-3. J1 Pin Assignments

Pin	Description
A	GND
C	PTT
E	12 Vdc (jumpered)
F	12 Vdc battery
P	RX Audio

Connect the C991608 cable to the SET POWER connector (J1) on the PRC-PS front panel. Carefully insert a short bus wire (18 AWG) into pin A and another one into pin E on the C991608 cable connector. Repeat the previous checks.

Note: *For the following steps, mount the 8.2 ohm and the 1.5 ohm resistors on a heat sink. Each resistor dissipates close to 50W during these tests and will get extremely hot if they are not installed on a heat sink.*

Power Supply DC Voltage and Current

1. Using the clip jumpers to connect the 2.2 ohm resistor across pins A and E on the C991608 cable connector.
2. Measure the DC voltage at these pins. The DC voltage should be 12.5 Vdc ±0 Vdc.
3. Disconnect the 2.2 ohm resistor and connect the 1.5 ohm resistor in series with the DC ammeter to pins A and E on the C991608 cable connector. The DC current should be 6A ± 0.3A.
4. Remove the 1.5 ohm resistor and reconnect the ammeter across pins A and E on the C991608 cable connector. Measure the DC current. It should be 6A ±0.3A.

Reverse Current Protection

1. Connect the 82 ohm resistor across the front panel DC input pins.
2. Measure the DC voltage across the 82 ohm resistor. It should be 0 Vdc ±0 Vdc.

DC Input Circuitry Check

1. Disconnect the AC input power source and connect the DC input power source.
2. Adjust the DC supply voltage to between 20 Vdc and 30 Vdc.
3. Verify that the charger is working normally by performing the previous checks (exclude the reverse-current protection check) on the INTERNAL charging station.

Chassis Over-Temperature Protection

1. Remove the PRC-PS chassis from the case (refer to the AC Input Power section on page 2-1).
2. Use a heat source such as a heat gun or blow torch to heat the thermostat until it trips.
3. Verify that the PRC-PS shuts off until the thermostat trips back on.

Audio Circuit Check

1. Use an AC voltmeter to monitor the AC voltage across the speaker (pins P and A on the SET POWER connector).
2. Turn the front panel AUDIO GAIN control to the SPKR OFF position.
3. Adjust the 1 kHz audio source for 0.5 Vpp and apply the audio signal to pins A and P on the SET POWER connector (J1).
4. Slowly turn the AUDIO GAIN control clockwise until the AC voltmeter reads 2.8 Vrms. Listen for excessive audible distortion.
5. Adjust the AUDIO GAIN control to a normal listening level. Ground pin C (PTT) on the SET POWER connector and verify the speaker audio shuts off.
6. Remove the ground from pin C and verify the speaker audio comes back on.

This concludes the functional test. If the PRC-PS failed any of the previous steps, refer to the Troubleshooting Index table on page 5-6.

5.2 Troubleshooting

5.2.1 Index to Test Procedure

The following table refers the technician to a specific place in the troubleshooting procedure if the PRC-PS fails the indicated step in the test procedure.

Table 5-1. Troubleshooting Index

Failed Test Section	Troubleshooting Section
Charging Circuit Check section on page 5-1	Refer to the Current Source section on page 5-6.
DC Current Check section on page 5-2, step 2	Refer to the Bulk Charging Current Regulation section on page 5-7.
DC Current Check section on page 5-2, step 3	Refer to the Current Source section on page 5-6.
DC Output Check section on page 5-3	Refer to the Float Charge Voltage section on page 5-8.
Reset Circuit Check section on page 5-3	Refer to the Reset Function section on page 5-8.
Overcharge Voltage Check section on page 5-3	Refer to the Overcharge Voltage section on page 5-8.
Undervoltage Protection Circuit Check section on page 5-3	Refer to the Undervoltage Protection section on page 5-8.
Power Supply DC Voltage and Current section on page 5-4	Refer to the Power Supply Output Voltage section on page 5-10.
Reverse Current Protection section on page 5-4	Refer to the Reverse Current Protection section on page 5-8.
DC Input Circuitry Check section on page 5-5	Refer to the Reverse Current Protection section on page 5-8.
Audio Circuit Check section on page 5-5	Refer to the Audio Amplifier Output section on page 5-11.

5.2.2 Troubleshooting Procedures

The following troubleshooting procedures provide specific steps to isolate faults. Since the two charging circuits are identical, procedures that deal with them refer to components in the INTERNAL charging station.

Note: *The term IC refers to the UC3906N charger IC, and the term op amp refers to the LM358N operational amplifier.*

Current Source

This section assumes a failure in the DC Input Circuitry Check section on page 5-5 if the READY LED does not light up.

1. Measure the DC voltage at the rectifier bridge BR1 (+) terminal. It should be 20 Vdc ± 3.0 Vdc for AC operation; if not, refer to the AC Power Supply section on page 5-9. For DC operation the DC voltage at the rectifier bridge should be about 1 Vdc less than the DC supply voltage; if not, refer to the Reverse Current Protection section on page 5-8.
2. Observe the front panel status LEDs. If none of them is lit, refer to the Status LEDs section on page 5-10.
3. If the CHARGING LED is lit, skip to step 7.
4. With more than 6 Vdc across the capacitor, the FAULT LED should now be lit. On the IC, measure the DC voltage at pin 7. If it is more than 100 mV, replace the IC.
5. On the IC, measure the DC voltage at pin 12. If it is less than 3 Vdc, check the resistive divider (R20, R21) at pin 12.
6. On the IC, check for a short circuit at pin 11 (pin 11 should be high). This output pin drives the FAULT LED through a series resistor on the display board. If the FAULT LED is not lit, replace the IC.
7. The CHARGING LED should now be lit. If more than one LED is lit, refer to the Status LEDs section on page 5-10.
8. On the pass transistor Q3, measure the voltage from the emitter to the base. If it is between 0.6 Vdc to 1.0 Vdc, skip to step 9. If the voltage is below 0.6 Vdc, replace the IC. If the voltage is above 1.0 Vdc, replace the transistor.
9. Using an ohmmeter (or a diode checker), measure the forward and reverse resistance of the IN5400 (D5) series diode. If the forward resistance is less than 10 ohms and the reverse resistance is very high (mega ohms), the diode is okay; replace the pass transistor; if not, replace the diode.

Bulk Charging Current Regulation

This section assumes a failure in the DC Current Check section on page 5-2 if the CHARGING LED does not light up.

1. If the DC current is okay, but the CHARGING LED is not lit, refer to the Current Source section on page 5-6.
2. Measure the DC voltage across the 0.22 ohm current sense resistor R23. If it is not 0.25 Vdc ± 0.02 Vdc, refer to the Status LEDs section on page 5-10.
3. Turn off the power and measure the resistance of the 0.22 ohm resistor R23. If it is not within 5% tolerance, replace the resistor.

Float Charge Voltage

This section assumes a failure in the Float Charge Voltage section on page 5-8 if the float charge voltage is out of specification. The float charge voltage should be 13.3 Vdc.

1. R19 (20 k ohm) and R22 (100 k ohm) are 1% resistors that form a voltage divider that sets the float charge voltage. Turn the PRC-PS off (remove the AC power cable) and measure the resistance of these resistors to verify they are within 5% of their stated value.
2. Turn the PRC-PS on and verify that the float charge voltage is within specification (13.3 Vdc). If it is significantly out of specification, refer to the Current Source section (step 8) on page 5-7.

Reset Function

This section assumes a failure in the Reset Circuit Check section on page 5-3 if the DC voltage does not drop when pressing the RESET button. Turn the PRC-PS on for the following checks.

1. On the IC, measure the DC voltage on pin 3. Press and hold the RESET button and observe that the voltage drops to 0 Vdc.
2. If the voltage does not drop, inspect the RESET switch and associated wiring.

Overcharge Voltage

This section assumes a failure in the Overcharge Voltage Check section on page 5-3 if the overcharge voltage is not set at 14.0 Vdc. Turn the PRC-PS on for the following checks.

1. R19 (20 k ohms), R22 (100 k ohms) and R18 (330 k ohms) are 1% resistors that set the overcharge voltage. Turn the PRC-PS off (remove the AC power cable) and measure the resistance of these resistors to verify they are within 5% of their stated value.
2. Turn the PRC-PS on and verify that the overcharge voltage is within specification (it should be 14.0 Vdc).

Undervoltage Protection

This section assumes a failure in the Undervoltage Protection Circuit Check section on page 5-3 in the test procedure if the FAULT LED does not light when an under-voltage condition (possible shorted battery cell) exists. Turn the PRC-PS on for the following checks.

1. If no status LEDs are lit, refer to the Status LEDs section on page 5-10, also refer to the Current Source section (step 5) on page 5-7.

Reverse Current Protection

This section assumes a failure in the Reverse Current Protection section on page 5-4 if diode D1 fails to provide reverse-current protection. Turn the PRC-PS off for the following checks.

1. On the DC input power line, measure the resistance across the MBR1645 diode D1. If the forward resistance is less than 10 ohms and the reverse resistance in very high (mega ohms) the diode is okay; if not, replace the diode.
2. Measure the resistance from the DC input connector J2 pin B to J6 pin 3. If it is not a dead short, check S1 and the associated wiring, also refer to the AC Power Supply section on page 5-9.

AC Power Supply

This section assumes a problem with the AC input power circuit. Turn the PRC-PS off for the following checks.

CAUTION: Always turn the power off and remove the power source before making any resistance measurements.

1. Visually inspect the AC and DC fuses. If either fuse is blown, skip to step 4.
2. Measure the resistance across the thermostat TH1. The thermostat is closed until the chassis temperature reaches 75°C. Use a heat source to open the thermostat; it should measure infinity when open and a dead short when closed.
3. If the fault only occurs when using an external DC power source, check all internal and external wiring and connections.
4. Check rectifier bridge BR1 by measuring the resistance across each of the four internal diodes. If the forward resistance is less than 10 ohms and the reverse resistance is very high (mega ohms), the diode is okay; if it is not, replace the diode.
5. On rectifier bridge BR1, measure the resistance from the (+) terminal to the (–) terminal. If the resistance shows a short, lift all the connections to the bridge and remeasure. If the measurement still shows a short, replace the rectifier bridge. If there is no short, skip to step 8.
6. Remove the DC fuse F2. If the resistance measurement in step 5 still shows a short, check each of the power supply filter capacitors for short circuits. Replace any capacitors that are shorted and remeasure across the bridge terminals.
7. If the resistance measurement in step 6 still shows a short with the DC fuse removed, the short is on the inboard side of the fuse. The short can be isolated by lifting the various connectors or pressing each RESET button one at a time.
8. Measure the resistance of the power transformer windings. The resistance should be a very low resistance (typically less than 10 ohms).

Status LEDs

This section assumes the status LEDs are either not lighting or lighting at the wrong time.

1. Turn on the PRC-PS. If more than one LED lights up at one time, turn the PRC-PS off and measure the resistance across each diode on the display board.
2. If the FAULT LED lights up properly, skip to step 1 in the CHARGE LED Failure section.

FAULT LED Failure:

1. If the FAULT LED is not lighting up correctly, measure the voltage at charger IC pin 11. The measured voltage should be at least 10 Vdc during a fault (battery is under 4 Vdc) condition; if it is not, replace the charger IC.
2. If the voltage measured in step 3 is okay but the FAULT LED does not light up, check the LED and the series resistor wiring.
3. Measure the voltage on the op amp non-inverting input pin. It should be 1.2 Vdc to 1.5 Vdc; if it is not, turn the PRC-PS off and measure the resistance to determine if it is shorted to ground. If there is no short, measure the resistance across the bias diodes and series 10 k ohms resistor R17.
4. If the READY LED does not light up properly, skip to step 8.
5. If the FAULT LED lights up at the same time as other LEDs, replace the transistor Q1 on the display board and go back to step 3.

CHARGE LED Failure:

1. If the CHARGING LED does not light up properly, measure the op amp output voltage during the bulk charge or overcharge states. If it is not 15 Vdc or more, measure the voltage on the op amp inverting pin. If it is not at 0 Vdc, replace the charger IC.
2. Measure the voltage across the transistor on the display board; it should be near ground potential if it is conducting. If it is always conducting, the CHARGING and READY LEDs never light up. If this is the case check the associated wiring.
3. On the display board, measure the DC voltage. If it is not 12.5 Vdc, check the following Power Supply Output Voltage section.

Power Supply Output Voltage

This section assumes the DC power supply circuitry is not outputting 12.5 Vdc.

1. On the charger board, measure the DC voltage across the regulator diode D2 (LM336Z-5.0). If voltage across D2 is not 12.5 Vdc, adjust R4 (VOLTAGE ADJUST control) until the output reads 12.5 Vdc. If

adjusting R4 returns the voltage across D2 to 12.5V but the power supply output power (J1 connector pins A and E) is not 12.5V, skip to step 3.

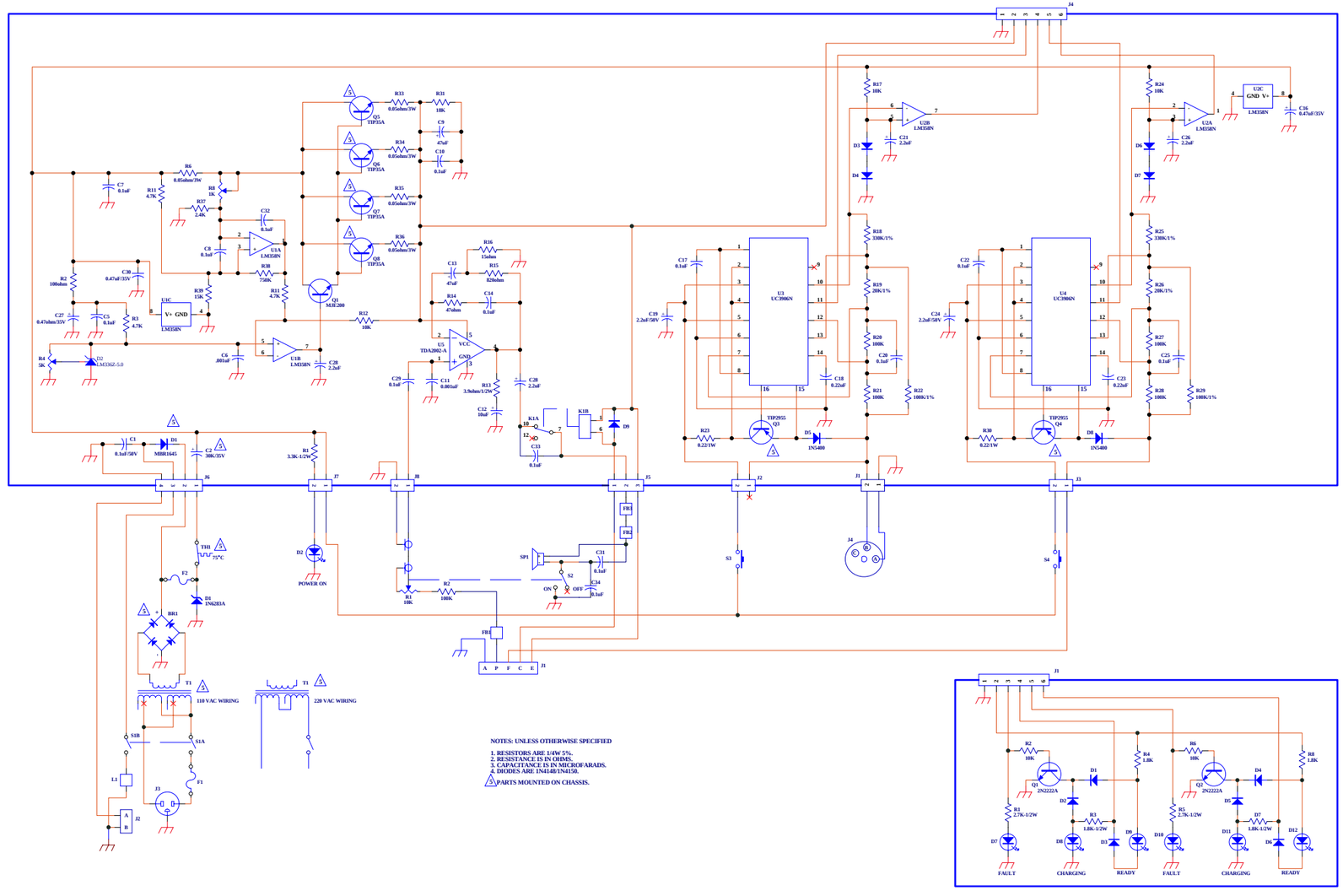
2. If adjusting R4 does not return the voltage across D2 to 12.5 Vdc, measure the resistance across R2 (100 ohms), R3 (4.7 k ohms) and R4 (5 k ohms). If any of these resistances are out of specification (greater than 5%), replace the resistor. If the resistors are within specification, replace the D2.
3. Measure the op-amp U1A output voltage at pin 1. If it is not 1.5 Vdc or less, adjust R8 (CURRENT ADJUST control) until the output of U1A changes. If adjusting R8 does not change the output of U1A, measure the resistance across R6 (0.05 ohms), R7 (4.7 k ohms), R8 (5 k ohms) and R37 (2.4 k ohms). If these resistors are within specification (greater than 5%) replace U1.
4. Measure the output of op-amp U1B at pin 7. If it is not 14.0 Vdc, measure the resistance across R11 (4.7 k ohms) and R12 (10 k ohms). Replace any shorted components.
5. If the output of U1B (pin 7) is 14.0 Vdc, but the power supply output power (J1 connector pins A and E) is not 12.5V, measure the collector-to-base and emitter-to-base resistance of the pass transistors Q1, Q5 through Q8). It may be necessary to lift the legs of these transistors to get accurate measurements. Replace any defective transistors.

Audio Amplifier Output

This section assumes there is no audio output at the speaker.

1. Measure the DC voltage at the audio amplifier U5 output (pin 4). If it is not 6 Vdc, check for shorts at pins 1, 2 and 4. Also check the resistance of R13 (3.9 ohms).
2. Turn the AUDIO GAIN control fully clockwise and measure the AC voltage at U5 pin 1. If it is not the same as the voltage at the SET POWER connector (J1) pin P, measure the resistance of R1 (10 k ohms). Also inspect the wiring to R1.
3. Check the speaker by measuring the resistance from the minus (–) side of C15 to the plus (+) side of the speaker. This should show a short circuit. If it does not, remove the ground from the SET POWER connector J1 pin C. Measure the DC voltage at pin C. If it is not 12.5 Vdc, measure the resistance across diode D9. If it is okay, replace transformer K1.
4. Measure the AC voltage at the output of U5 pin 4. If it is not 2.8 Vrms, replace capacitor C15.

REV	ECO	DESCRIPTION		DATE	APPR
H	99-0437	REVISED PER ECO	TW		
J	01-0603	ADDED FB1-3, C33 AND C34	BB		
K	02-0724	D2 was drawn as a 2 lead device	BB	01-16-03	



NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTORS ARE 1/4W 5%.
2. RESISTANCE IS IN OHMS.
3. CAPACITANCE IS IN MICROFARADS.
4. DIODES ARE 1N4148/1N4150.

△5 PARTS MOUNTED ON CHASSIS.

Figure 5-4
PRC-PS Mainframe
Schematic Diagram
(994004 Rev. K)

PRC-PS-MS

DATRON WORLD COMMUNICATIONS INC.
3030 Enterprise Ct.
Vista, CA 92083
(760)597-3777

Title: *Schematic*
PRC-PS BATTERY CHARGER

Size:	Drawn: A. MARTINEZ	Date:	Drawing Number:	Rev:
D	Appr:	Date:	994004	K

File: 994004K.Sch Date: 26-Oct-2006 Time: 11:57:12 Sheet 1 of 1

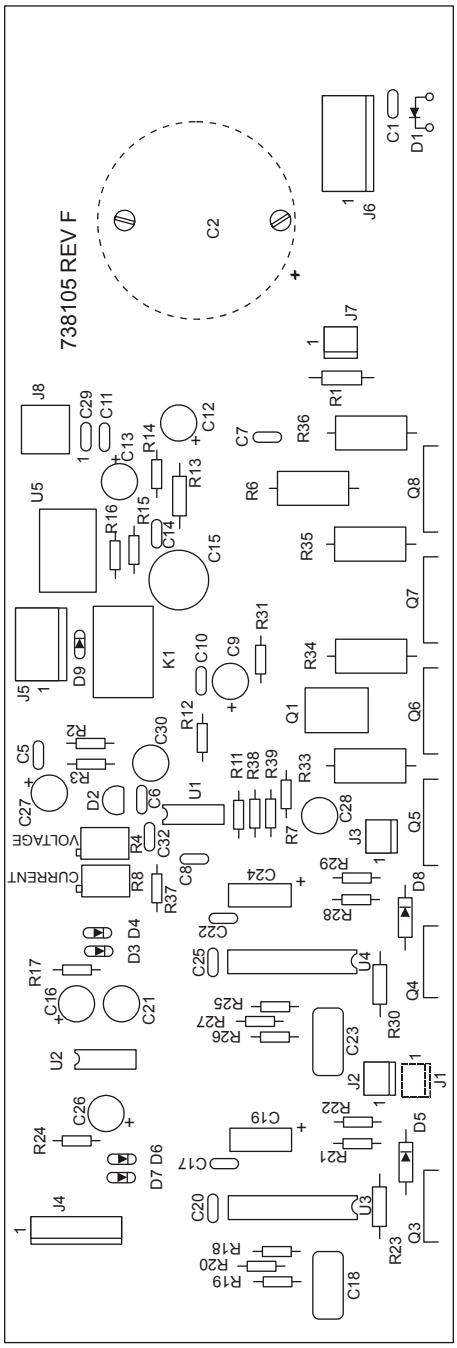


Figure 5-5. Charger Board Component Locations (738105 Rev. F)

Note: *The charger board schematic diagram is included in the PRC-PS Mainframe Schematic Diagram on page 5-13.*

Table 5-1. Charger Board Parts List (PRC-PS-CHG Rev. K)

Designator	Part Number	Description
C1	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C10	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C11	210102	CAP,.001UF Y5P 50V 20% 0.1LS
C12	241100	CAP,10MF DIP TANTALUM
C13	231500	CAP, A,47U,16V,20%,RA,.1SP
C14	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C15	231471	CAP,A,470UF,16V,20%,RA,.20SP
C16	241047	CAP,0.47MF 35V DIP TANT
C17	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C18	254224	CAP,0.22MF 100V MYLAR
C19	230020	CAP,2.2MF ELECT
C20	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C21	241020	CAP,2.2MF DIP TANTALUM
C22	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C23	254224	CAP,0.22MF 100V MYLAR
C24	230020	CAP,2.2MF ELECT
C25	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C26	241020	CAP,2.2MF DIP TANTALUM
C27	241047	CAP,0.47MF 35V DIP TANT
C28	241020	CAP,2.2MF DIP TANTALUM
C29	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C30	241047	CAP,0.47MF 35V DIP TANT
C32	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C33	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C5	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C6	210102	CAP,.001UF Y5P 50V 20% 0.1LS
C7	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C8	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C9	231500	CAP, A,47U,16V,20%,RA,.1SP
D2	330133	IC LM336Z-5.0
D3	320002	DIODE, 1N4148/1N4150 DO-35

Table 5-1. Charger Board Parts List (PRC-PS-CHG Rev. K)

Designator	Part Number	Description
D4	320002	DIODE, 1N4148/1N4150 DO-35
D5	320103	DIODE, 1N5400 3A 50V DO-201AD
D6	320002	DIODE, 1N4148/1N4150 DO-35
D7	320002	DIODE, 1N4148/1N4150 DO-35
D8	320103	DIODE, 1N5400 3A 50V DO-201AD
D9	320002	DIODE, 1N4148/1N4150 DO-35
J1	610105	HEADER, 1X2 W/LB-LOCK 0.1 TH
J2	610105	HEADER, 1X2 W/LB-LOCK 0.1 TH
J3	610105	HEADER, 1X2 W/LB-LOCK 0.1 TH
J4	610103	HEADER,MLX,6PIN,.100
J5	610209	HEADER,MLX,3PIN,.156,POLAR
J6	610211	HEADER,MLX,4PIN,.156,POLAR
J7	610105	HEADER, 1X2 W/LB-LOCK 0.1 TH
J8	610511	CONNECTOR SMB PC JACK
K1	540067	RELAY, NON-LATCH SEALED DS1E
Q1	310098	XISTOR,NPN,MJE200,TO126
R1	137332	RES, 3.3K 1/2W, 2% FILM
R11	124472	RES,4.7K 1/4W 5% CARBON FILM
R12	124103	RES,10K 1/4W 5% CARBON FILM
R13	134039	RES,3.9 OHM 1/2W 5% FILM
R14	124470	RES,47 OHM 1/4W 5% CARBON FILM
R15	124821	RES,820 OHM 1/4W 5% CF
R16	124150	RES,15 OHM 1/4W 5% CARBON FILM
R17	124103	RES,10K 1/4W 5% CARBON FILM
R18	127334	RES,330K 1/4W 1% FILM MTL
R19	127203	RES,20K 1/4W 1% FILM MTL
R2	124101	RES,100 OHM 1/4W 5% CF
R20	124104	RES,100K 1/4W 5% CARBON FILM
R21	124104	RES,100K 1/4W 5% CARBON FILM
R22	127104	RES,100K 1/4W 1% FILM MTL
R23	144002	RES,0.22 OHM 1W MTL FILM
R24	124103	RES,10K 1/4W 5% CARBON FILM
R25	127334	RES,330K 1/4W 1% FILM MTL

Table 5-1. Charger Board Parts List (PRC-PS-CHG Rev. K)

Designator	Part Number	Description
R26	127203	RES,20K 1/4W 1% FILM MTL
R27	124104	RES,100K 1/4W 5% CARBON FILM
R28	124104	RES,100K 1/4W 5% CARBON FILM
R29	127104	RES,100K 1/4W 1% FILM MTL
R3	124472	RES,4.7K 1/4W 5% CARBON FILM
R30	144002	RES,0.22 OHM 1W MTL FILM
R31	124183	RES,18K 1/4W 5% CARBON FILM
R33	161005	RES,0.05 OHM 3W POWER
R34	161005	RES,0.05 OHM 3W POWER
R35	161005	RES,0.05 OHM 3W POWER
R36	161005	RES,0.05 OHM 3W POWER
R37	113242	RES,2.4K 1/8W 5% CARBON FILM
R38	113754	RES,750K 1/8W 5% CARBON FILM
R39	113153	RES,15K 1/8W 5% CARBON FILM
R4	170223	RES,5K TRIMMER
R6	161005	RES,0.05 OHM 3W POWER
R7	124472	RES,4.7K 1/4W 5% CARBON FILM
R8	170345	RES,1K TRIM SIDE ADJ
U1	330081	IC,LIN,LM358N,DIP8,OP-AMP
U2	330081	IC,LIN,LM358N,DIP8,OP-AMP
U3	330325	IC, UC3906N
U4	330325	IC, UC3906N
U5	330043	IC TDA2002-H TO220
XQ1	812406	SCREW PAN PHIL 4-40X3/8
XQ1	821403	NUT HEX 4-40X1/4 SS
XQ1	831403	WASHER INTERNAL LOCK #4 SS
XU5	812406	SCREW PAN PHIL 4-40X3/8
XU5	821403	NUT HEX 4-40X1/4 SS
XU5	831403	WASHER INTERNAL LOCK #4 SS

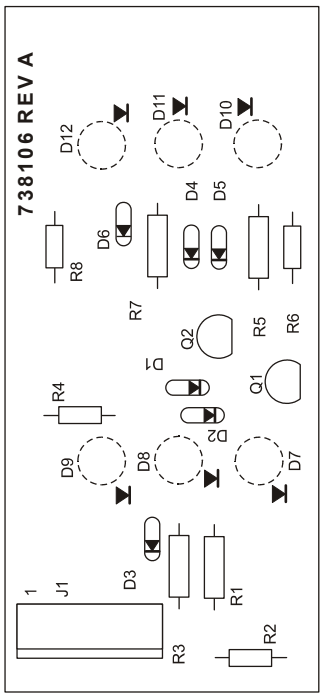


Figure 5-6. Display Board Component Locations (738106 Rev. A)

Note: *The charger board schematic diagram is included in the PRC-PS Mainframe Schematic Diagram on page 5-13.*

Table 5-2. Display Board Parts List (PRC-PS-DIS Rev. B2)

Designator	Part Number	Description
D1	320002	DIODE, 1N4148/1N4150 DO-35
D10	320415	LED,RED
D11	320417	LED,YELLOW
D12	320416	LED,GREEN
D2	320002	DIODE, 1N4148/1N4150 DO-35
D3	320002	DIODE, 1N4148/1N4150 DO-35
D4	320002	DIODE, 1N4148/1N4150 DO-35
D5	320002	DIODE, 1N4148/1N4150 DO-35
D6	320002	DIODE, 1N4148/1N4150 DO-35
D7	320415	LED,RED
D8	320417	LED,YELLOW
D9	320416	LED,GREEN
J1	610103	HEADER,MLX,6PIN,.100
Q1	310057	XISTOR,NPN,PN2222A,TO92
Q2	310057	XISTOR,NPN,PN2222A,TO92
R1	137272	RES,2.7K 1/2W 5% FILM
R2	124103	RES,10K 1/4W 5% CARBON FILM
R3	134182	RES,1.8K 1/2W 5% CARBON FILM
R4	124182	RES,1.8K 1/4W 5% CARBON FILM
R5	137272	RES,2.7K 1/2W 5% FILM
R6	124103	RES,10K 1/4W 5% CARBON FILM
R7	134182	RES,1.8K 1/2W 5% CARBON FILM
R8	124182	RES,1.8K 1/4W 5% CARBON FILM

Table 5-3. Front Panel Parts List (PRC-PS-FPL Rev. M)

Designator	Part Number	Description
C31	210104	CAP,.1MF 25V DISC
C34	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
D1	320211	DIODE, 1N6283A 28V TVS DO-204
D2	320416	LED,GREEN
F1	630001	HOLDER FUSE POST
F2	630001	HOLDER FUSE POST
FB1	490302	BEAD FERRITE SHIELD 43 MAT
FB2	490302	BEAD FERRITE SHIELD 43 MAT
FB3	490302	BEAD FERRITE SHIELD 43 MAT
J1	610089	CONN,CHAS,14P,U318/U
J2	610106	CONN,MLX,2PIN,SHELL,.100,W/LK
J2	613097	CONN,CHAS,2P,MS3102A10SL-4S
J3	610106	CONN,MLX,2PIN,SHELL,.100,W/LK
J3	610401	RECEPTACLE 3 PIN AC
J5	610176	CONN,MLX,3PIN,SHELL,.156,
J6	610179	CONN,MLX,4PIN,SHELL,.156,
J7	610106	CONN,MLX,2PIN,SHELL,.100,W/LK
J8	610512	CONNECTOR SMB PLUG RT AGL
L1	490302	BEAD FERRITE SHIELD 43 MAT
R1	124104	RES,100K 1/4W 5% CARBON FILM
R2	124104	RES,100K 1/4W 5% CARBON FILM
S1	520018	SWITCH TOGGLE DPDT 15 AMP
S3	530030	SWITCH, PUSH BUTTON NC
S4	530030	SWITCH, PUSH BUTTON NC
SP1	710002	LOUD SPEAKER OVAL 3 OHM