



MOTOROLA INC.
Communications
Sector

NTN5540A AND NTN5541A SINGLE-UNIT COMPACT BATTERY CHARGERS FOR P200 SERIES HANDIE-TALKIE PORTABLE RADIOS

1. INTRODUCTION

The NTN5540A (117 V ac) and the NTN5541A (220 V ac) Compact Battery Chargers are accessory items for charging rechargeable nickel-cadmium batteries. The chargers are approved for use with the following standard-charge and rapid-charge batteries:

Battery Number	Capacity	Charge Type
NTN5531A	Medium	Rapid
NTN5521A, NTN5545A	High	Rapid

2. SPECIFICATIONS

Input Power	117 V ac, 220 V ac, 50/60 Hz
Size	4.28 × 3.43 × 2.28 in. (108.6 × 87 × 57.3mm)
Weight	0.71 lbs (322.3g) with Power Supply 0.32 lbs (145 g) without Power Supply
Charge Rate	Approximately 16 hours
Operating Temperature Range	0°C to 50°C

3. DESCRIPTION

These single-unit compact chargers are current sensing, voltage sensing, current regulating devices which provide a 16-hour charge rate. The batteries can be left in the charger indefinitely without any resultant harm.

The NTN5540A charger operates from a 117 V ac, 60 Hz power source and the NTN5541A operates from a 220 V ac, 50 Hz power source. A red light-emitting diode (LED) indicates a charging condition when a battery is inserted into the charger.

4. SAFETY INSTRUCTIONS

This manual contains important safety and operating instructions. Before using battery charger, read all instructions and cautionary markings on (1) battery charger, (2) battery, and (3) radio using battery.

WARNING

- To reduce risk of injury, charge only Motorola nickel-cadmium type rechargeable batteries listed. Other types of batteries may burst, causing personal injury and damage.
- Do not expose charger to rain or snow.
- Use of an attachment not recommended or sold by Motorola may result in a risk of fire, electric shock, or injury to persons.
- To reduce risk of damage to electric plug and cord, pull by plug rather than cord when disconnecting charger.
- Make sure cord is located so that it will not be stepped on, tripped over, or otherwise subjected to damage or stress.
- An extension cord should not be used unless absolutely necessary. Use of improper extension cord could result in a risk of fire and electric shock. If extension cord must be used, make sure:
 1. That pins on plug of extension cord are same number, size, and shape as those on plug on charger:

technical writing services

WARNING (Cont'd.)

2. That extension cord is properly wired and in good electrical condition; and
 3. The cord size is 18AWG for lengths up to 100 ft., and 16AWG for lengths up to 150 ft.
- Do not operate charger with damaged cord or plug — replace them immediately.
 - Do not operate charger if it has received a sharp blow, been dropped, or otherwise damaged in any way; take it to a qualified serviceman.
 - Do not disassemble charger; take it to a qualified serviceman when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire.
 - To reduce risk of electric shock, unplug charger from outlet before attempting any maintenance or cleaning. Turning off controls will not reduce this risk.

5. OPERATION

Normal battery operation is eight hours of use followed by approximately 16 hours of charge. Place the charger in operation as follows:

- a. Visually check the battery and charger charging contacts for dirt, grease or other material which may prevent good conduction, and clean if necessary.
- b. Connect the charger's transformer power supply to the appropriate ac power source.
- c. Insert the battery, with or without radio, into the charger pocket. When the battery contacts mate with the charger's charging contacts, charging begins and the red LED indicator will light.

NOTE

To insure proper charging, make certain that the battery is pushed fully into the charger pocket.

- d. Allow sufficient time for the battery to fully charge (approximately 16 hours). After this time the battery will reach 100% full charge. The battery can be removed from the charger or remain in the charger indefinitely.

6. CIRCUIT DESCRIPTION

(Refer to the schematic diagram)

a. General

Operating voltage (B+) is developed from a remote ac to dc converter power supply (T1). The B+ voltage (approximately 30 V dc — no load, to 20 V dc — full load) is applied to transistor Q1 and resistor R1.

Initially, when the charger is plugged in (without a battery inserted), Q1 conducts and Q4 turns on, which provides a turn-on voltage for Q3. The conduction of Q3 effectively shorts out resistor R8, and a quiescent drive current is established for Q1, by components R1, VR1 and R9. Transistors Q3 and Q4 are components of the charger's short-circuit protection circuitry and are active during both the quiescent and charging states.

When a battery is placed in the charger pocket, a current path is established through the battery. This allows current to flow through diode CR2 and the base-emitter junction of transistor Q5, which turns on Q5 and diode CR1 (the red LED). Charging current for the battery is provided by the current regulator circuitry consisting of transistors Q1 and Q2. Base current for Q1 is controlled by transistor Q2, resistors R2, R7, and R9, and the internal battery resistor RC. The value of RC determines the charge rate for a particular battery capacity. RC is electrically placed across the base-emitter junction of Q2. The RC value, combined with the resistance of R7 and R9, determines the amount of conduction of Q2, which limits the amount of base drive for Q1, thus regulating the charge current. The following chart lists the three different capacity batteries and their respective RC and trickle charge currents.

Battery Capacity	RC	Charge Current
Medium	5.6k	50 mA
High	3.3k	80 mA

b. Over-Voltage Protection

Battery over-voltage protection is achieved by Zener diode VR1 during the charging mode. If the voltage between the base of Q1 and the battery ground terminal approaches 16 volts, VR1 conducts. This conduction removes the base drive from Q1, thus maintaining a safe battery voltage of approximately 14.5 volts. Also, if Q1 should fail (e.g. collector to emitter short), the diode combination of CR3 and VR1 will hold the battery terminal voltage to a safe level.

c. Short-Circuit Protection

Transistor Q4 and resistors R3, R4, and R5, together with transistor Q3 and resistor R8 help to protect the charger if the charging contacts are shorted. During normal operation, transistor Q4 is biased "on" to insure

that transistor Q3 is always saturated, thus bypassing resistor R8. However, if B+ is shorted to ground (e.g. charging contacts are shorted together), Q4 is cut off, which removes the base drive of transistor Q3. Consequently, R8 (a high resistance component), is placed in the charging path, which limits the current to a value of less than 1 mA.

7. MAINTENANCE

a. General

There are no user serviceable parts in the compact charger. If the charger fails to operate properly, contact a local Motorola Service Shop (MSS) for repairs.

b. Radio Contacts

If the red LED does not turn on when a battery is inserted into the pocket, check the contacts of the radio

for dirt, grease, or other foreign material. Clean the contacts if necessary.

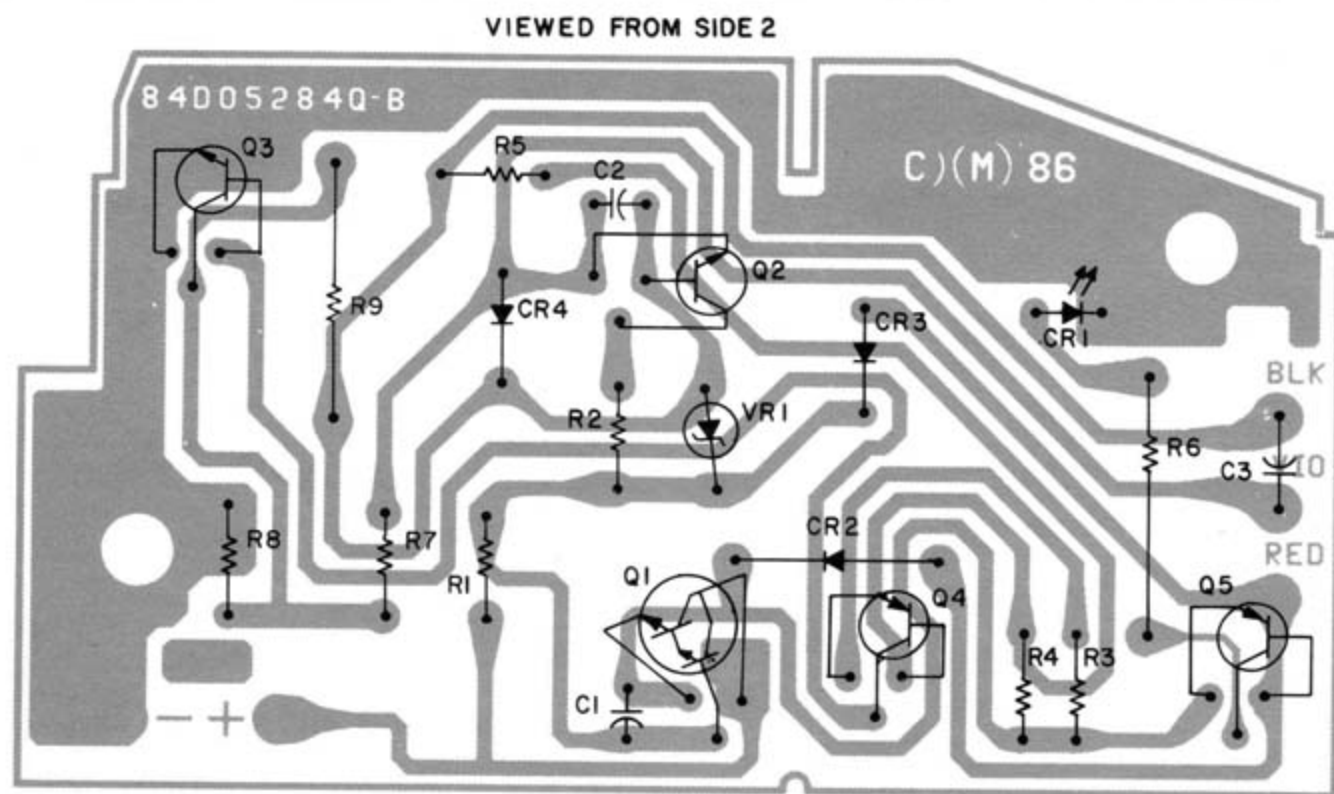
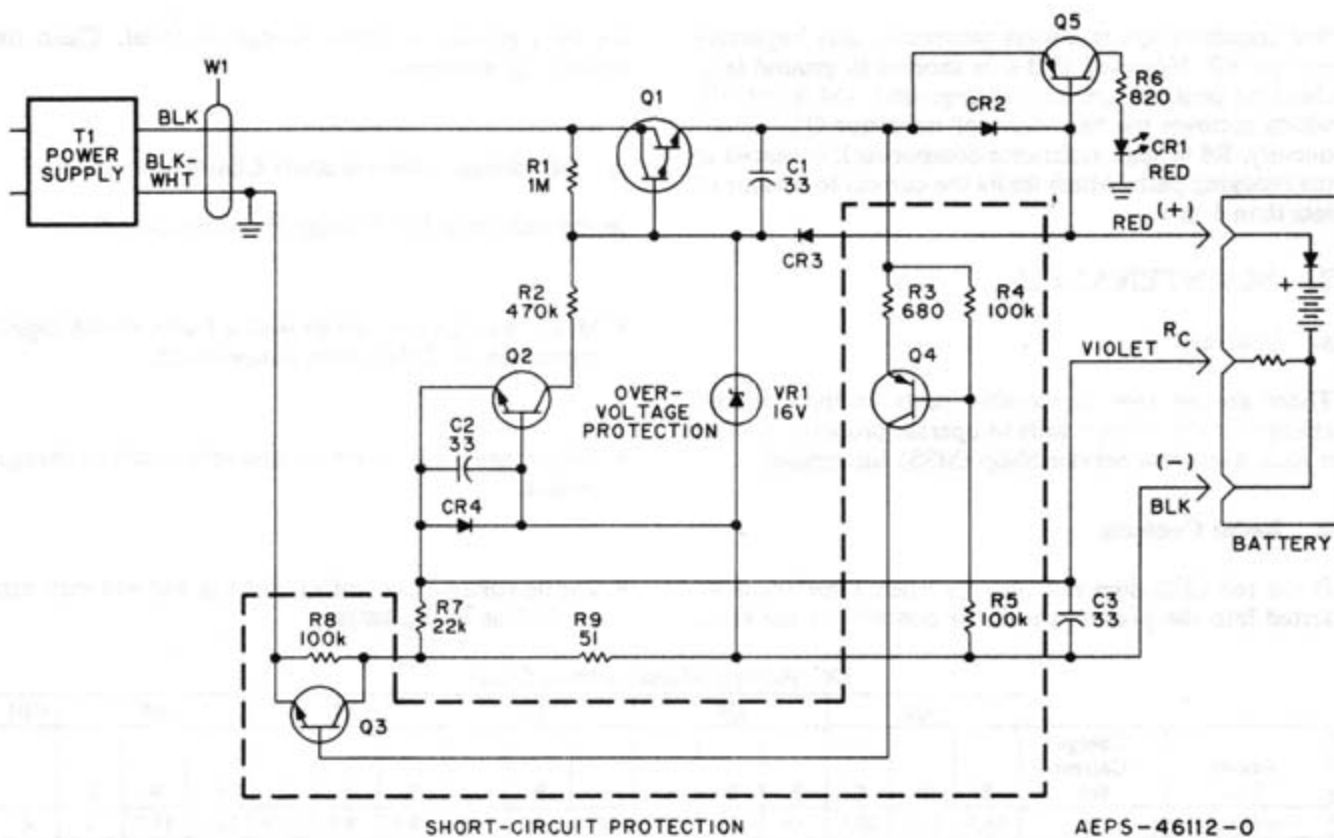
c. DC Voltage Measurements Charts

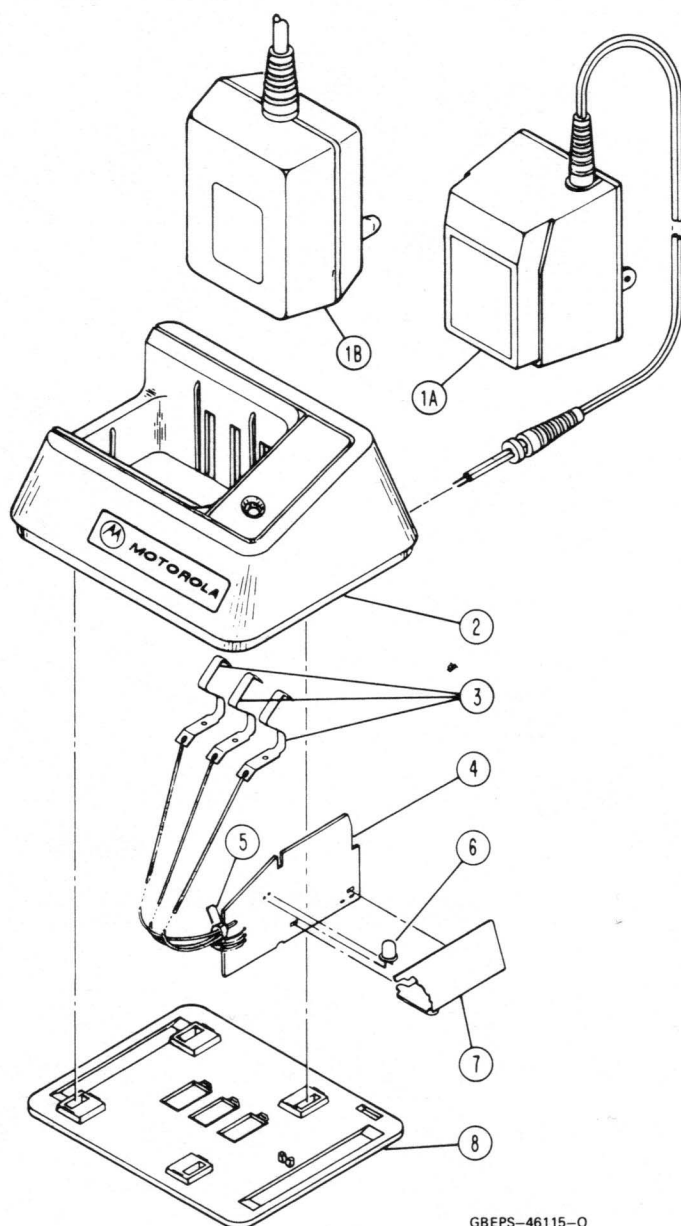
In the following DC Voltage Measurements chart,

- Measurements were taken with a Fluke 8010A digital multimeter at 25°C room temperature.
- All voltage readings are dc and referenced to charger ground.
- The dc voltages are typical readings and will vary with conditions of the battery.

DC Voltage Measurements Chart

Battery Type	Charge Current mA	Q1			Q2			Q3			Q4			Q5			CR1
		E	B	C	E	B	C	E	B	C	E	B	C	E	B	C	
No Battery	0	15.1	16.2	29.1	.01	.02	15.4	0	0.79	.01	9.6	8.9	0.79	15.1	14.7	0	0
500 mAh	50	15.5	16.6	25.0	2.2	2.7	12.9	0	0.84	.08	10.9	10.2	0.84	15.5	14.8	15.4	2.0
900 mAh	80	16.7	17.7	23.6	3.6	4.1	15.3	0	0.86	0.12	12.1	11.4	0.86	16.7	15.9	16.6	2.03





GBEPS-46115-O

parts list

Electrical Parts List

PL-11092-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1, 2, 3	2105455G09	capacitor, fixed: 33 pF $\pm 5\%$; 63 V
CR1	4805729G07	diode: (see note) LED, RED
CR2	4805746G10	silicon
CR3, 4	4805746G13	silicon
Q1	4805474G40	transistor: (see note) NPN, Darlington
Q2, 3	4805474G42	NPN
Q4, 5	4805474G41	PNP
R1	0660075B22	resistor, fixed: ohms $\pm 5\%$; 1/8 W; unless otherwise stated
R2	0660075B14	1 meg
R3	0660075A45	470k
R4, 5	0660075A97	680
R6	0660075L47	100k
R7	0660075M57	820; 3/4 W
R8	0660075M57	22k; 2%
R9	0660075L18	100k
T1	2505225Q01 or 2505533R01	transformer: power supply; ac to dc converter (NTN4666A) power supply; ac to dc converter (NTN4667A)
VR1	4805249R14	diode, Zener: (see note) 16 V
W1	—	cable: 2-wire; part of T1

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

Exploded View Parts List

PL-11091-O

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1A	see note	POWER SUPPLY, 117 V ac (T1)
1B	see note	POWER SUPPLY, 220 V ac (T1)
2	0105952Q67	ASSEMBLY, housing; includes HOUSING and CONTACTS
3	—	CONTACTS, part of item 2
4	0105950N69	ASSEMBLY, PC board; includes electrical components
5	4210217A26	TIE WRAP
6	see note	LED (CR1)
7	2605171Q01	HEAT SINK
8	0105950N70	ASSEMBLY, baseplate (NTN4666A); includes BASEPLATE, RUBBER FEET, and LABEL
	or 0105950N72	ASSEMBLY, baseplate (NTN4667A); includes BASEPLATE, RUBBER FEET, and LABEL

note: refer to electrical parts list for part number and description.