



**MOTOROLA**

Note: Applies to SABER, HT600, HT1000, MT1000, P200, MT2000, and VISAR radios.

## Multi-Unit Rapid-Charge Battery Chargers

Models: NTN4668, NTN4796, NTN4797, NTN4922, NTN1177, NTN1178, NTN1179, NTN7621, NTN7622, and NTN7623  
Instruction Manual 68P81106C66-D

### 1. INTRODUCTION

#### WARNING

**Do not discard batteries in fire; they may explode.**

Motorola recommends proper recycling of all rechargeable batteries.

#### a. NTN4796 and NTN4797 Chargers (SABER)

The NTN4796 (110Vac) and NTN4797 (220-240Vac) Multi-Unit Rapid-Charge Battery Chargers are accessory items for Handie-Talkie® portable radios using rechargeable nickel-cadmium and nickel-metal hydride (NI-MH) batteries. These chargers are approved for use with the following rapid-charge batteries.

BATTERY NUMBER	CAPACITY
NTN4537, NTN4592	Light
NTN4819, NTN4820	Medium-Light
NTN4538, NTN4593, NTN4657, NTN4671, NTN5155, NTN5156, NTN7014, NTN7058, NTN7396	Medium
NTN4539, NTN4594, NTN7398, NTN7395	High
NTN4595, NTN4596, NTN4992, NTN7394, NTN7397	Ultra-High

#### b. NTN4668A and NTN4922A Chargers (P200, HT600, and MT1000)

The NTN4668 (110Vac) and NTN4922 (220-240Vac) Multi-Unit Rapid-Charge Battery Chargers are accessory items for Handie-Talkie portable radios using rechargeable nickel-cadmium and nickel-metal hydride (NI-MH) batteries. These chargers are approved for use with the following rapid and standard-charge batteries.

BATTERY NUMBER	CAPACITY	
NTN4583, NTN4867	Rapid	Light
NTN4564, NTN4584, NTN4822, NTN4823, NTN4871, NTN5160, NTN5161	Rapid	Medium
NTN4585, NTN4586, NTN5414, NTN5415, NTN5447, NTN5448, NTN4824, NTN4825	Rapid	High
NTN4563, NTN4868	Standard	Medium
NTN4588, NTN4869	Standard	High
NTN7015, NTN7016	Rapid (NI-MH)	High

### IMPORTANT SAFETY INSTRUCTIONS SAVE THESE INSTRUCTIONS

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

#### WARNING

**To reduce risk of injury, charge only Motorola nickel-cadmium and nickel-metal hydride (NI-MH) 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 the electric plug and cord, pull by the plug rather than the cord when disconnecting the charger.
- Make sure the 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 an improper extension cord could result in a risk of fire and electric shock. If an extension cord must be used, make sure that :
  - (1) The pins on the extension cord plug are the same number, size, and shape as those on the charger plug;
  - (2) The 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 the charger with a damaged cord or plug - replace them immediately.
- Do not operate the charger if it has received a sharp blow, been dropped, or otherwise damaged in any way; take it to a qualified service shop.
- Do not disassemble the charger; take it to a qualified service shop 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 the charger from the outlet before attempting any maintenance or cleaning. Turning off controls will not reduce this risk.

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**c. NTN1177, NTN1178, and NTN1178 Chargers**

The NTN1177 (117Vac), NTN1178 (220Vac), and NTN1179 (240Vac) Multi-Unit Rapid-Charge Battery Chargers are accessory items for Handie-Talkie portable radios using rechargeable nickel-cadmium and nickel-metal hydride (NI-MH) batteries. These chargers are approved for use with the following rapid-charge batteries:

BATTERY NUMBER	CHARGE TYPE	CAPACITY
NTN7145*	Dual Charge	Medium
NTN7143, NTN7146*	Dual Charge	High
NTN7150**, NTN7372*		
NTN7144, NTN7147*, NTN7319, NTN7341	Dual Charge	Ultra-High

\* = Intrinsically Safe - Class 1, 2, 3; Division 1; Group D, E, F, G

\*\* = MSHA Approved

\*\*\* = CSA

**NOTE**

Nickel-metal hydride batteries, as offered by Motorola, are free of lead, mercury, and cadmium; they are considered "environmentally friendly." Additionally, with proper care and use, these batteries deliver increased capacity over nickel-cadmium batteries of similar size.

**TO ASSURE MAXIMUM BATTERY LIFE, RAPID CHARGE ONLY!**

Although nickel-metal hydride batteries are compatible with existing product chargers, long-term use of continuous slow or standard rate charging will reduce the useful life and capacity of these batteries. Battery life can be optimized if batteries are removed from the rapid charger after the charge cycle is completed. The charge cycle is completed when the red indicator light goes out and the green light comes on.

For optimal charge performance, nickel-metal hydride batteries should be at room temperature (20 - 30° C) prior to placement into the charger.

**2. SPECIFICATIONS**

<b>INPUT VOLTAGE:</b> 110VAC, 220-240VAC; 50/60 Hz
<b>SIZE:</b> 17.6" x 12.0" x 5.5" (45cm x 31cm x 14cm)
<b>WEIGHT:</b> 8 lbs., 14 oz. (4 kg)
<b>RAPID CHARGE RATE:</b> Approximately one hour
<b>OPERATING TEMPERATURE RANGE:</b> 0° C - 50° C
<b>RAPID-CHARGE TEMPERATURE WINDOW:</b> 10° C - 40° C

**3. DESCRIPTION**

The multi-unit rapid chargers are constant-current devices which can charge up to six nickel-cadmium or nickel-metal hydride batteries simultaneously. Each charging pocket provides two different charge rates: a one-hour rate and a 16-hour rate. A rapid-charge nickel-cadmium battery is charged initially at the 1-hour rate, after which the charging rate is automatically reduced to the 16-hour rate. A standard-charge battery charges only at the 16-hour rate. The battery may be left in the battery charger indefinitely without any resultant harm.

The NTN1177, NTN4798, NTN4668, and NTN7621 chargers require a 110Vac, 50/60 Hz power source, whereas the NTN4797, NTN1178, NTN1179, NTN4922, NTN7622, and NTN7623 chargers used a 220-240Vac, 50/60 Hz power source. The appropriate ac power cord is provided with the charger.

**NOTE**

The multi-unit rapid chargers are powered by an auto-ranging, switching power supply. The power supply will operate on input source voltages between 90 and 265Vac. Some early unit power supplies used a line-voltage selector switch at the bottom of the charger to select the input voltage.

**4. OPERATION**

a. Connect the ac power cord to the battery charger.

b. Plug the ac line cord into the proper ac receptacle. The battery charger performs a self test: pocket 1's three LEDs are simultaneously turned on, then off, followed, in numerical order, by the LEDs of pockets 2 through 6.

**NOTE**

Make certain that the ac power cord's plug is completely inserted into the charger socket and a good electrical connection is made.

c. Insert the battery, with or without the radio attached, into a vacant charger pocket and seat it firmly to ensure that proper contact has been made. The pocket's three LEDs turn on and off, then the red **CHARGING** LED turns on to indicate that the battery is being rapid-charged.

**IMPORTANT NOTE**

DO NOT press the PTT switch on the radio while the radio is in a charger pocket.

**NOTE**

1. If the yellow **STAND-BY** LED lights instead of the red LED, the battery is either too hot or too cold to be rapid-charged. Refer to "Circuit Description" for details.

2. If both the red **CHARGING** LED and the yellow **STAND-BY** LED light at the same time, the battery is being trickle-charged. Refer to "Circuit Description" for details.

d. After a period of use, a battery normally requires approximately one hour of rapid charging. The radio should be turned off while attached to a battery being recharged. Place the charger.

**NOTE**

When a rapid charge battery reaches full charge, the red **CHARGING** LED turns off, and the green **COMPLETE** LED turns on.

**5. IN CASE OF TROUBLE**

Before requesting service, refer to the following table for possible remedies.

**WARNING**  
Use only Motorola Nickel-Cadmium (NI-CD) or Nickel-Metal Hydride (NI-MH) batteries with this charger.

CONDITION	REMEDY
Red CHARGING LED does not light when battery is inserted in pocket.	<ul style="list-style-type: none"> <li>Check battery contacts for dirt, grease, or foreign material. Wipe with a soft cloth.</li> </ul>
Red CHARGING LED flashes.	<ul style="list-style-type: none"> <li>Try reseating the battery.</li> <li>Check battery contacts for dirt, grease, or foreign material. Wipe with a soft cloth.</li> <li>Try another battery. If problem goes away, the problem is with the first battery.</li> </ul>
Yellow STAND-BY LED lights.	<ul style="list-style-type: none"> <li>Battery is either too hot or too cold to be rapid-charged.</li> </ul>
No LEDs light.	<ul style="list-style-type: none"> <li>Make sure charger is plugged in.</li> <li>Check to see if charger has a fuse.</li> <li>Check to see if fuse is blown.</li> </ul>

The battery circuitry has been designed to regulate the rapid charge rates to provide optimum performance and maximum cycle life. In some cases, new batteries and batteries that have had periods of prolonged storage may require more than a 2-hour charge cycle to achieve rated capacity. If your charger has a maximum 2-hour rapid charge fault mode, it will time out even if the battery is not completely charged within the two hours.

If this condition occurs, the charger's red indicator lights will flash. When this happens, remove the battery from the charger, allow the battery temperature to cool, and then reinsert the battery into the charger to complete the charge. The time required for the battery to reach normal temperatures should not exceed one hour. After the battery has been reinstalled, if the red indicator lights continue to flash, a problem has been detected, indicating the need for repair or replacement.

## 6. CIRCUIT DESCRIPTION

(refer to the schematic diagrams)

### a. Power Supply

A line-voltage selector switch on the bottom of the power supply (on some early unit chargers) determines the input source voltage. Later version chargers are powered by an auto-ranging, switching power supply, accepting input source voltages between 90Vac and 265Vac. Operating B+ (12.5Vdc for NTN4796, NTN4797, NTN1177, NTN1178, NTN7621, NTN1179 and NTN7622 chargers, or 16Vdc for NTN4668, NTN7623 and NTN4922 chargers) is developed within the power supply and fed to the main circuit board via plug P1. The power supply's output voltage (B+) is determined by the position of a jumper on the side of the power supply. On the main circuit board, B+ is distributed to LED boards 1 and 2, to charging circuit transistors Q5, Q7, Q9, Q11, Q13, and Q15, to ICs U18 and U23, and to 5-volt regulator U13. The 5-volt regulator provides regulated +5Vdc to the microcomputer (U15) and all other ICs.

### b. Microcomputer and Display Circuits

All of the timing, monitoring, and sensing of the circuits is performed by the microcomputer (U15). Upon power-up, with no battery inserted, the microcomputer performs a self-check of its erasable programmable read-only memory (EPROM), random-access memory (RAM), and internal timer.

Next, the microcomputer tests the display circuitry by turning all three LEDs for each pocket on and off in numerical order starting with pocket 1. To control the display, the microcomputer sends pocket display data via the PA0 through PA5, and PA7 lines (U15, pins 33 through 38, and 40) to hex D flip-flop ICs U4 through U6 as follows:

POCKET	DATA LINES	IC	PINS IN	PINS OUT	LEDs
1	PA0-2, 7	U4	1, 3, 4, 6	2, 5, 7	1-3
2	PA3-5, 7	U4	1, 11, 13, 14	10, 12, 15	4-6
3	PA0-2, 7	U5	1, 3, 4, 6	2, 5, 7	7-9
4	PA3-5, 7	U5	1, 11, 13, 14	10, 12, 15	10-12
5	PA0-2, 7	U6	1, 3, 4, 6	2, 5, 7	13-15
6	PA3-5, 7	U6	1, 11, 13, 14	10, 12, 15	16-18

At the same time, the microcomputer selects the pocket display to be changed by sending positive-going clock pulses via the PB5 through PB7 lines (U15, pins 30 through 32) to the clock inputs (pin 9) of ICs U4 through U6. These ICs multiplex and latch the display data from the microcomputer, and send control signals to the appropriate LEDs via lamp drivers in ICs U1 through U3. A logic high output from one of the flip-flops will turn an LED on; a logic low will turn the LED off.

If the microcomputer fails its self-check, all LEDs will light simultaneously and will remain lit until the charger is reset by removing ac power. If the self-check is completed without any problems being encountered, the microcomputer turns all LEDs off; the LEDs will remain off until a battery is inserted into one of the pockets.

### c. Monitoring and Sensing Circuits

Before any batteries can be charged, the microcomputer (U15) must first determine the charger type (NTN4796, NTN4797, NTN1177, NTN1178, NTN1179, NTN4668, NTN4922, NTN7621, NTN7622 and NTN7623) by checking the value of B+. This is accomplished by applying B+ across voltage divider network R142 and R143, and feeding the network's output to the pin 4 input of multiplexer U22. The microcomputer selects this input by sending its binary address, via control lines PB0 through PB2, to pins 9 through 11 of U22. U22 outputs this voltage, via the PD2 line (U22, pin 3), to the AN2 input (pin 22) of U15. This voltage (see Tables 3 and 4) is then used by the microcomputer to set up its internal charging parameters.

The microcomputer searches for the presence of a battery in any of the pockets by continually monitoring their battery type and temperature

values, cycling through the pockets in ascending order. The microcomputer selects the pocket to be sensed by sending the desired pocket's binary address (0 through 5), via control lines PBO through PB2, to pins 9 through 11 of all four multiplexers.

When the presence of a battery in a pocket is indicated by a valid capacity resistor (RC) value (see Table 1), and a thermistor (RT) value between 10° (3.33Vdc on the RT contact) and 40° Celsius (1.87Vdc on the RT contact) is detected, the pocket's charge cycle will begin.

If the RC value is not valid, the red **CHARGING LED** will flash. If the thermistor is neither shorted nor open but its value is not within the rapid-charging

window, the yellow **STAND-BY LED** will light and no charging will occur. When the battery temperature is within the prescribed window, the yellow LED will turn off, the red LED will light, and the normal charging cycle will begin. If the thermistor is shorted, the red LED will flash; if the thermistor is open, the battery will first be pre-charged as described under "Charging Circuits," then it will be trickle-charged, and both red and yellow LEDs will light.

#### d. Charging Circuits

Following the power-up, microcomputer self-check, battery installation, and normal battery RC, RT, and voltage checks, rapid charging begins. There are several different rapid-charge rates as determined by the battery RC (see Table 1).

**Table 1. Product, Battery, and Charger Information**

RADIO	KIT NO.	OHMS	CAPACITY (MAH)	CHARGE RATE (MA)	
		RC	Rated/Average	Rapid	Trickle
HT600™	NTN5160	5.6K	500 / 630	640	30
HT600/P200	NTN4584/NTN5531	5.6K	500 / 630	640	30
HT600	NTN4564	5.6K	500 / 630	640	30
HT600	NTN7016 (NiMH)	5.6K	880 / 950	640	30
HT600 /P200	NTN5414/NTN5521	3.3K	1000 / 1200	890	55
HT600/P200	NTN5415/NTN5545	3.3K	1000 / 1200	890	55
MT1000™	NTN5161	5.6K	500 / 630	640	30
MT1000	NTN4822	5.6K	500 / 630	640	30
MT1000	NTN4823	5.6K	500 / 630	640	30
MT1000	NTN7015 (NiMH)	5.6K	880 / 950	640	30
MT1000	NTN7046	3.3K	1000 / 1100	890	55
MT1000	NTN5447	3.3K	1000 / 1200	890	55
MT1000	NTN5448	3.3K	1000 / 1200	890	55
SABER™	NTN4592	2.4K	600 / 700	920	55
SABER	NTN4537	2.4K	600 / 700	920	55
SABER	NTN7014 (NiMH)	33K	900 / 950	790	30
SABER	NTN4671	5.1K	1000 / 1100	1200	55
SABER	NTN4657	5.1K	1000 / 1100	1200	55
SABER	NTN4538	5.1K	1000 / 1100	1200	55
SABER	NTN4593	5.1K	1000 / 1100	1200	55
SABER	NTN4992	18K	1500 / 1800	1600	90
SABER	NTN4596	18K	1500 / 1800	1600	90
SABER	NTN4595	18K	1500 / 1800	1600	90
SABER	NTN7058	18K	1500 / 1800	1600	90
HT1000™ MT2000	NTN7145	2.4K	500 / 600	920	55
	NTN7143	10K	1100 / 1200	1600	70
	NTN7146	10K	1100 / 1200	1600	70
	NTN7150	10K	1100 / 1200	1600	70
	NTN7372	10K	1100 / 1200	1600	70
	NTN7144	18K	1300 / 1500	1600	90
	NTN7147	18K	1300 / 1500	1600	90
	NTN7319	18K	1300 / 1500	1600	90
	NTN7341	18K	1300 / 1500	1600	70
	NTN7148	TBA	TBA	TBA	TBA
	NTN7149	TBA	TBA	TBA	TBA
Visar	NTN7394	1.5K	1500/1600	1510	70
	NTN7395	10K	1200/1300	1415	55
	NTN7396	510	550/650	530	30

The microcomputer first precharges the battery at 600mA for 30 seconds. The microcomputer selects the pocket to be charged by sending that pocket's address, via the PB0 through PB2 lines, to triple "AND" gates U17A through U17C. At the same time, a high pulse is sent over the PC7 line to U17 to enable the gates. The resulting address is fed over the A1 through A3 lines to binary-to-octal decoder U16. U16 then sends a clock pulse, via one of the Q1 through Q6 lines, to the hex D flip-flop IC (U7 through U12) for the desired pocket.

Charging current is set and latched by sending a six-bit word from U15, pins 9 through 14, via the PC0 through PC5 lines, to pins 3, 4, 6, 11, 13, and 14 of hex D flip-flop ICs U7 through U12, and setting the PA7 line (U15, pin 40) high. The six-bit word is determined by the value of the battery's RC. At the flop-flop IC of the selected pocket, the clock pulse (Q1 through Q6) from U16 latches the six-bit word; the flip-flop IC's six output lines (Q0 through Q5) select a resistive network which determines the charge rate. If the charge current is not within specified limits (see Table 2), the microcomputer will stop charging current to the pocket, and will indicate a pocket fault condition by lighting all three of the pocket's LEDs.

At the end of the 30-second precharge, the battery voltage is read. If the voltage reading falls between 7Vdc and 11Vdc (for NTN4796, NTN4797, NTN1177, NTN1178, and NTN1179 chargers) or 9Vdc and 15Vdc (for NTN4668 and NTN4922 chargers), the charger switches to the rapid-charge mode. If the voltage is outside of this range, the charger signals a battery problem by flashing the red CHARGING LED.

Every three minutes, the microcomputer stops the charging current and checks the temperature of the battery. As the battery reaches full charge in the rapid-charge mode, the battery temperature rises. When the battery temperature reaches 45°C, or the rate of increase within the three minutes exceeds 1.6°C (80mV), the charger switches to the trickle-charge mode, turning off the red CHARGING LED and turning on the green COMPLETE LED.

#### e. Reset Circuit

Integrated circuit U14 is a "watchdog" timer. At least once every second, a positive signal from U15, pin 28 (PB3 line), is received at U14, pin 2. This signal keeps Q1 from resetting the microcomputer. If a problem occurs in the microcomputer, such as the

microcomputer's internal timer's ceasing to function correctly, the microcomputer stops sending the signal at U15, pin 28. As a result, the following sequence occurs: U14, pin 3, goes low, turning off Q2. This turns on Q1, which resets the microcomputer. When the microcomputer is reset, Q3 is turned on, pulling U14, pin 2, low, and resetting the U14 timer. Resetting the timer causes U14, pin 3, to go high, which turns on Q2, turns off Q1, and pulls the microcomputer out of reset via U15, pin 2.

#### f. Shutdown Circuit

The charger also contains a shutdown circuit which the microcomputer controls via the PA6 line (U15, pin 39). During normal operation, a logic high appears at pin 39 which keeps Q17 turned on. If the microcomputer senses current flow when current should not be flowing, it outputs a logic low in pin 39, turning off Q17 and pulling pin 1 of P1 high. This triggers an SCR within the power supply which ceases to send power to the main circuit board. AC power must be removed from the power supply to reset the unit.

### 7. MAINTENANCE

#### a. Fuse

If the charger does not operate, check the fuse, and replace if necessary. If the replaced fuse "blows" again, check for shorts in the power supply output, charger circuits, and 5-volt regulator U13.

#### b. Contacts

If the red CHARGING LED does not turn on with a radio or battery inserted into the pocket, check the contacts of the battery or charger for dirt, grease, or other foreign materials. Clean the contacts with a soft cloth, if necessary.

#### CAUTION

The following maintenance procedures should only be performed by qualified service personnel.

#### c. DC Voltage Measurements

The following dc voltage measurements tables list typical voltage levels that should be present with varying chargers, batteries, and operating conditions. Measurements shown are for pocket 1.

**Table 2. NTN4796, NTN4797, NTN1177, NTN1178, and NTN1179 DC Voltages (SABER, HT1000, and MT2000)**

BATTERY AND CONDITION	B+	U22	Q7		Q8		U8						U18			U15						P1	U1				CURRENT CHARGING (mA)	RC
		4	B	C*	B	E	2	5	7	10	12	15	1	3	9	2	21	22*	23	24**	29	1	16	15	14			
NO BATTERY	12.7	3.7	12.7	8.8	0	0	0	0	0	0	0	0	0	0	0	0	5.0	0	2.5	4.9	4.9	4.8	0	11.2	11.2	11.2	0	NA
RAPID CHARGE NTN4537, NTN4592, NTN7145A, NTN7014	12.7	3.7	12.0	9.6	2.2	1.5	5.0	0	0	5.0	5.0	0	1.70	0.36	0.36	5.0	1.70	2.8	0.60	2.7	4.8	0	11.2	0.7	11.2	920	2.4K	
CHARGE COMPLETE NTN4537, NTN4592, NTN7145A, NTN7014	12.7	3.7	12.0	9.0	0.9	0.2	5.0	5.0	0	0	0	0	0.16	0.04	0.04	5.0	0.16	2.6	0.28	0.5	4.8	0	11.2	11.2	0.7	55	2.4K	
RAPID CHARGE NTN4538, NTN4593, NTN4657, NTN4671	12.7	3.7	12.0	10.0	4.0	3.3	5.0	0	0	5.0	0	5.0	3.00	0.64	0.64	5.0	3.0	2.9	1.10	2.8	4.8	0	11.2	0.7	11.2	1200	5.1K	
CHARGE COMPLETE NTN4538, NTN4593, NTN4657, NTN4671	12.7	3.7	12.0	9.2	1.0	0.3	5.0	0	5.0	0	0	0	0.27	0.06	0.06	5.0	0.27	2.6	0.45	0.5	4.8	0	11.2	11.2	0.7	55	5.1K	
RAPID CHARGE NTN7143	12.7	3.7	12.0	10.4	6.2	5.4	0	0	5.0	5.0	5.0	5.0	4.20	0.90	0.90	5.0	4.20	3.0	1.60	2.9	4.8	0	11.2	0.7	11.2		10K	
CHARGE COMPLETE NTN7143	12.7	3.7	12.0	9.0	1.0	0.3	0	5.0	5.0	0	0	0	0.32	0.07	0.07	5.0	0.32	2.6	0.88	0.5	4.8	0	11.2	11.2	0.7		10K	
RAPID CHARGE NTN4595, NTN4596, NTN4992, NTN7058, NTN7144	12.7	3.7	12.0	10.4	6.2	5.4	0	0	5.0	5.0	5.0	5.0	4.20	0.90	0.90	5.0	4.20	3.0	2.00	2.9	4.8	0	11.2	0.7	11.2	1600	18K	
CHARGE COMPLETE NTN4595, NTN4596, NTN4992, NTN7058, NTN7144	12.7	3.7	12.0	9.0	1.0	0.3	5.0	5.0	5.0	0	0	0	0.37	0.08	0.08	5.0	0.37	2.6	1.36	0.6	4.8	0	11.2	11.2	0.7	90	18K	

**NOTES:**

1. All voltages referenced to charger ground.
2. Voltages designated \* will vary with the voltage of the battery; battery voltage for this table is 9Vdc.
3. Voltages designated \*\* will vary with the temperature of the battery. For this table, Rapid-Charge kit = 10K $\Omega$  and Charge Complete kit = 1K $\Omega$

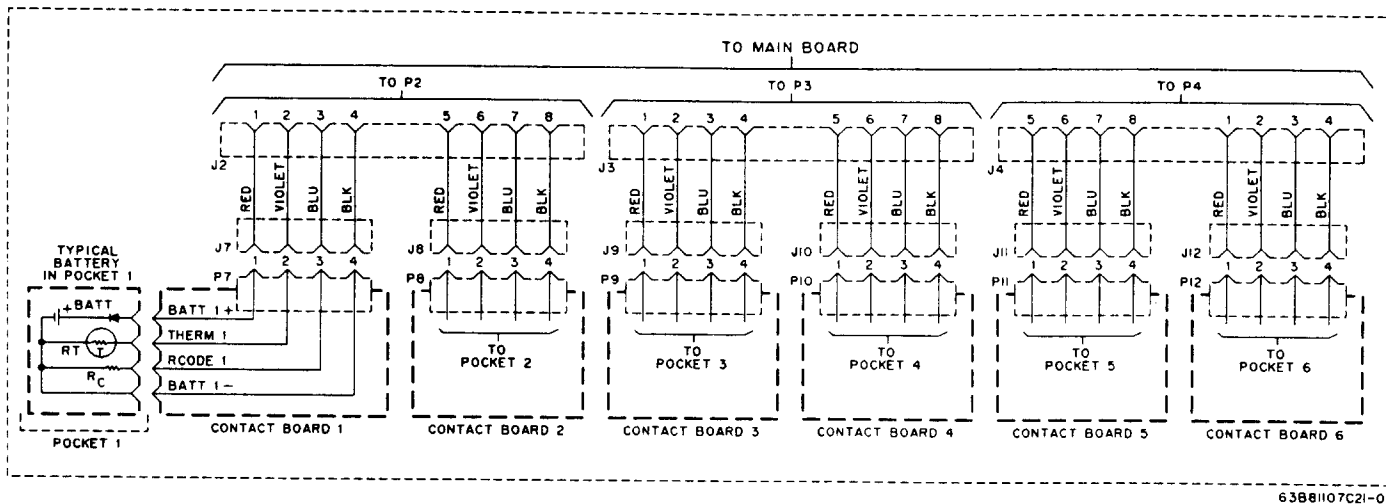
**Table 3. NTN4668 and NTN4922 DC Voltages** (HT600, P200, and MT1000)

BATTERY AND CONDITION	B+	U22	Q7		Q8		U8						U18			U15						P1	U1				CURRENT CHARGING (mA)	RC
		4	B	C*	B	E	2	5	7	10	12	15	1	3	9	2	21	22*	23	24**	29	1	16	15	14			
NO BATTERY	16.0	4.7	16.0	10.9	0	0	0	0	0	0	0	0	0	0	0	5.0	0	3.1	4.9	4.9	4.8	0	14.7	14.7	14.7	0		
RAPID CHARGE NTN4564, NTN4584, NTN4822, NTN4823, NTN7015, NTN7016 and NTN5531	16.0	4.7	15.3	12.4	2.2	1.5	5.0	0	0	5.0	5.0	0	1.70	0.36	0.36	5.0	1.70	3.6	0.8	2.7	4.8	0	14.7	0.7	14.7	640	5.6K	
CHARGE COMPLETE NTN4564, NTN4584, NTN4822, NTN4823, NTN7015, NTN7016 and NTN5531	16.0	4.7	15.3	12.0	0.9	0.2	5.0	5.0	0	0	0	0	0.16	0.04	0.04	5.0	0.16	3.4	0.5	0.5	4.8	0	14.7	14.7	0.7	30	5.6K	
RAPID CHARGE NTN5414, NTN5415, NTN5447, NTN5448 NTN5521, NTN5545	16.0	4.7	15.3	12.5	3.2	2.5	5.0	0	0	0	0	5.0	2.40	0.51	0.51	5.0	2.40	3.6	0.8	2.8	4.8	0	14.7	0.7	14.7	890	3.3K	
CHARGE COMPLETE NTN5414, NTN5415, NTN5447, NTN5448 NTN5521, NTN5545	16.0	4.7	15.3	12.0	1.0	0.3	5.0	0	5.0	0	0	0	0.27	0.06	0.06	5.0	0.27	3.4	0.4	0.5	4.8	0	14.7	14.7	0.7	55	3.3K	

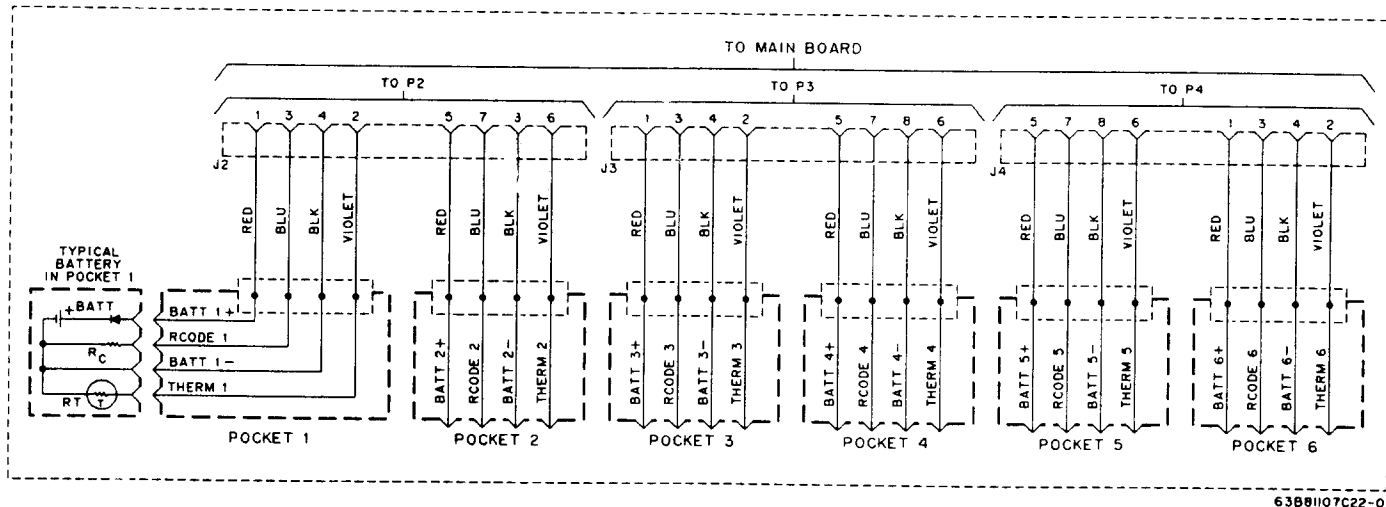
**NOTES:**

1. All voltages referenced to charger ground.
2. Voltages designated \* will vary with the voltage of the battery; battery voltage for this table is 12Vdc.
3. Voltages designated \*\* will vary with the temperature of the battery. For this table, Rapid-Charge kit = 10K $\Omega$  and Charge Complete kit = 1K $\Omega$
4. Except for color, these P200 and HT600 batteries are identical: NTN5521=NTN5414, NTN5531=NTN4584, NTN5545=NTN5415.

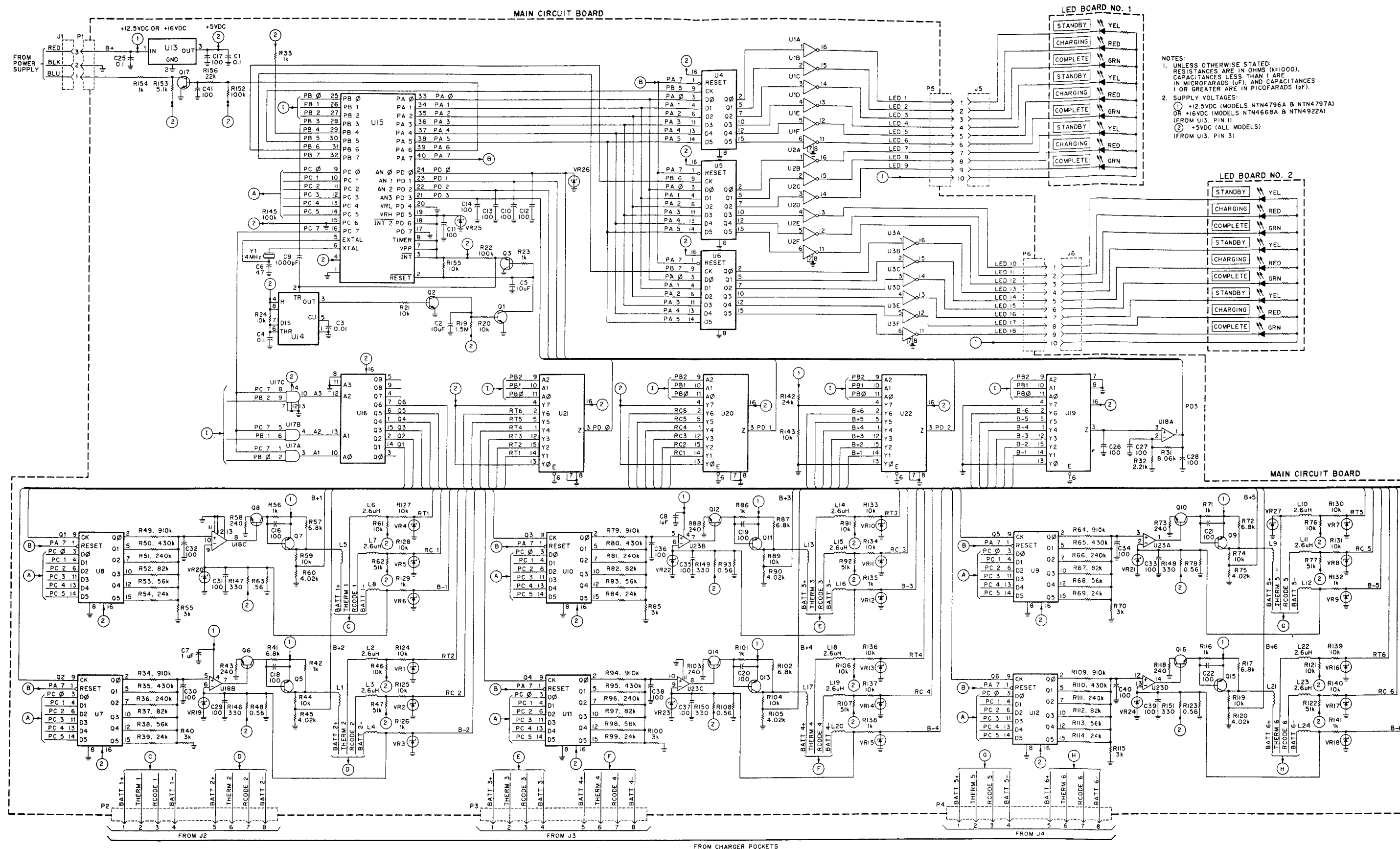
4796  
MODEL NTN4976 AND NTN4977 CHARGE POCKETS (SABER)



MODEL NTN4668 AND NTN4922 CHARGE POCKETS (HT600, P200, and MT1000)

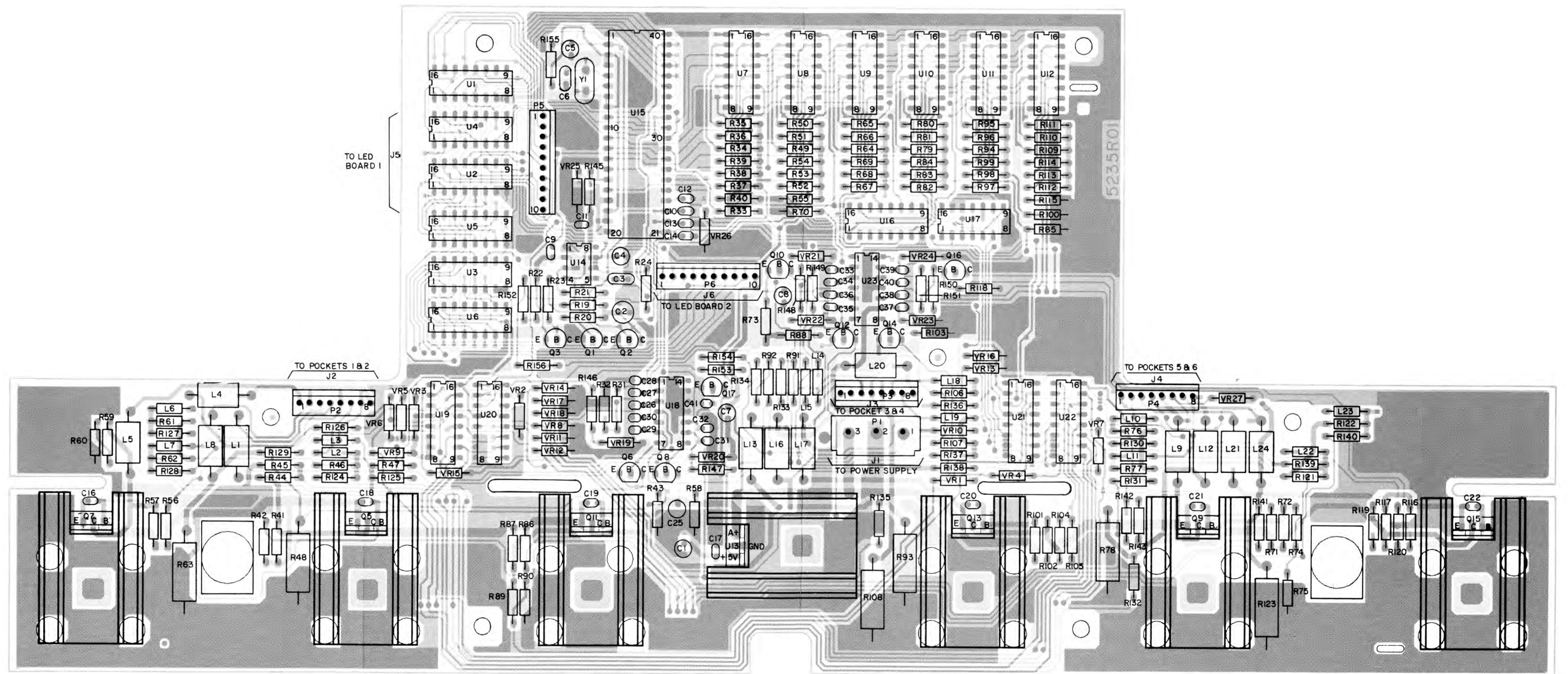






NOTES:  
 1. UNLESS OTHERWISE STATED:  
 RESISTANCES ARE IN OHMS (K=1000).  
 CAPACITANCES LESS THAN 1 ARE  
 IN MICROFARADS (UF), AND CAPACITANCES  
 1 OR GREATER ARE IN PICOFARADS (PF).  
 2. SUPPLY VOLTAGES:  
 (1) +12.5VDC (MODELS NTN4796A & NTN4797A)  
 OR +16VDC (MODELS NTN4668A & NTN4922A)  
 (FROM U13, PIN 11)  
 (2) +5VDC (ALL MODELS)  
 (FROM U13, PIN 3)

VIEWED FROM COMPONENT SIDE



SS-DEPF-17826-D  
OL-DEPF-17828-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<b>CAPACITOR, Fixed: uF ± 10%; 63V unless stated</b>
C1	2383441B20	0.1 ±20%; 35V
C2	2305499G16	10; 16V
C3	2105457G14	.01 +30 - 80%
C4	2383441B20	0.1 ±20%; 35V
C5	2305499G16	10; 16V
C6	2105529B11	47pF ±5%; N150
C7, 8	2383441B15	1 ±20%; 35V
C9	2105457G09	.001
C10 thru 14	2105455G12	100pF; N750
C15	-----	Not Used
C16 thru 22	2105455G12	100pF; N750
C23, 24	-----	Not Used
C25	2383441B20	0.1 ±20%; 35V
C26 thru 41	2105455G12	100pF; N750
		<b>COIL, RF: unless stated</b>
L1	2483977B02	Choke
L2, 3	2412015H39	2.6uH
L4, 5	2483977B02	Choke
L6, 7	2412015H39	2.6uH
L8, 9	2483977B02	Choke
L10, 11	2412015H39	2.6uH
L12, 13	2483977B02	Choke
L14, 15	2412015H39	2.6uH
L16, 17	2483977B02	Choke
L18, 19	2412015H39	2.6uH
L20, 21	2483977B02	Choke
L22, 23	2412015H39	2.6uH
L24	2483977B02	Choke
		<b>PLUG:</b>
P1	0905367R01	Connector, 3-Position
P2 thru 4	2805350R03	Connector, 8-Position
P5, 6	2805350R04	Connector, 10-Position
P7 thru 11	2805350R01	Connector, Header, Right Angle, 4-Position
		<b>TRANSISTOR: See Note 1</b>
Q1, 2	4800869642	NPN; type M9642
Q3	4800869643	PNP; type M9643
Q4	-----	Not Used
Q5	4800869677	PNP; type M9677
Q6	4800869642	NPN; type M9642
Q7	4800869677	PNP; type M9677
Q8	4800869642	NPN; type M9642
Q9	4800869677	PNP; type M9677
Q10	4800869642	NPN; type M9642
Q11	4800869677	PNP; type M9677
Q12	4800869642	NPN; type M9642
Q13	4800869677	PNP; type M9677
Q14	4800869642	NPN; type M9642
Q15	4800869677	PNP; type M9677
Q16, 17	4800869642	NPN; type M9642
		<b>RESISTOR, Fixed Ω ±5%; 1/4W unless stated</b>
R1 thru 18	-----	Not Used
R19	0610164K38	1.5M
R20, 21	0611009C73	10k
R22	0611009C97	100k
R23	0611009C49	1k
R24	0611009C73	10k
R25 thru 30	-----	Not Used
R31	0610621C82	8.06k ±1%
R32	0610621C28	2.21k ±1%
R33	0611009C49	1k
R34	0611009D21	910k
R35	0611009D13	430k
R36	0611009D07	240k
R37	0611009C95	82k
R38	0611009C91	56k
R39	0611009C82	24k
R40	0611009C60	3k
R41	0611009C69	1k

R42	0611009C49	6.8k
R43	0611009C34	240
R44	0610621C91	10k ±1%
R45	0610621C53	4.02k ±1%
R46	0610621C91	10k ±1%
R47	0611009C90	51k
	061109C73	10k (Visar only)
R48	1782036G18	0.56; 2W
R49	0611009D21	910k
R50	0611009D13	430k
R51	0611009D07	240k
R52	0611009C95	82k
R53	0611009C91	56k
R54	0611009C82	24k
R55	0611009C60	3k
R56	0611009C49	1k
R57	0611009C69	6.8k
R58	0611009C34	240
R59	0610621C91	10k ±1%
R60	0610621C53	4.02k ±1%
R61	0610621C91	10k ±1%
R62	0611009C90	51k
	061109C73	10k (Visar only)
R63	1782036G18	0.56; 2W
R64	0611009D21	910k
R65	0611009D13	430k
R66	0611009D07	240k
R67	0611009C95	82k
R68	0611009C91	56k
R69	0611009C82	24k
R70	0611009C60	3k
R71	0611009C49	1k
R72	0611009C69	6.8k
R73	0611009C34	240
R74	0610621C91	10k ±1%
R75	0610621C53	4.02k ±1%
R76	0610621C91	10k ±1%
R77	0611009C90	51k
	061109C73	10k (Visar only)
R78	1782036G18	0.56; 2W
R79	0611009D21	910k
R80	0611009D13	430k
R81	0611009D07	240k
R82	0611009C95	82k
R83	0611009C91	56k
R84	0611009C82	24k
R85	0611009C60	3k
R86	0611009C49	1k
R87	0611009C69	6.8k
R88	0611009C34	240
R89	0610621C91	10k ±1%
R90	0610621C53	4.02k ±1%
R91	0610621C91	10k ±1%
R92	0611009C90	51k
	061109C73	10k (Visar only)
R93	1782036G18	0.56; 2W
R94	0611009D21	910k
R95	0611009D13	430k
R96	0611009D07	240k
R97	0611009C95	82k
R98	0611009C91	56k
R99	0611009C82	24k
R100	0611009C60	3k
R101	0611009C49	1k
R102	0611009C69	6.8k
R103	0611009C34	240
R104	0610621C91	10k ±1%
R105	0610621C53	4.02k ±1%
R106	0610621C91	10k ±1%
R107	0611009C90	51k
	061109C73	10k (Visar only)
R108	1782036G18	0.56; 2W
R109	0611009D21	910k
R110	0611009D13	430k
R111	0611009D07	240k
R112	0611009C95	82k

R113	0611009C91	56k
R114	0611009C82	24k
R115	0611009C60	3k
R116	0611009C49	1k
R117	0611009C69	6.8k
R118	0611009C34	240
R119	0610621C91	10k ±1%
R120	0610621C53	4.02k ±1%
R121	0610621C91	10k ±1%
R122	0611009C90	51k
	061109C73	10k (Visar only)
R123	1782036G18	0.56; 2W
R124, 125	0611009C73	10k
R126	0611009C49	1k
R127, 128	0611009C73	10k
R129	0611009C49	1k
R130, 131	0611009C73	10k
R132	0611009C49	1k
R133, 134	0611009C73	10k
R135	0611009C49	1k
R136, 137	0611009C73	10k
R138	0611009C49	1k
R139, 140	0611009C73	10k
R141	0611009C49	1k
R142	0611009C82	24k
R143	0611009C73	10k
R144	-----	Not Used
R145	0611009C97	100k
R146 thru 151	0611009C37	330
R152	0611009C97	100k
R153	0611009C66	5.1k
R154	0611009C49	1k
R155	0611009C73	10k
R156	0611009C81	22k
		<b>CIRCUIT MODULE: See Note 1</b>
U1 thru 3	5183629M93	IC, Peripheral Driver Array; MC1413
U4 thru 12	5184887K70	IC, Hex D Flip-Flop; MC14174
U13	5184320A47	IC, 5V Regulator, MC7805
U14	5184320A35	IC, Timing; NE555
U15	5195012D04	IC, Microcomputer; MC68705R3
	5195012D03	Microcomputer(Visar only)
U16	5105461G32	IC, Binary-to-Octal Decoder; MC14028
U17	5184887K75	IC, Quad 2-Input "AND" Gate; MC14081
U18	5184561L75	IC, Quad Low-Power Op Amp; MC34074
U19 thru 22	5105461G33	IC, 8-Channel Analog Mux/Demux; MC14051
U23	5184561L75	IC, Quad Low-Power Op Amp; MC34074
		<b>DIODE: See Note 1</b>
VR1 thru 27	4811034G13	Zener, 6.2V
		<b>CRYSTAL:</b>
Y1	4805664G25	4MHz
<b>NONREFERENCED ITEMS</b>		
	0905035J12	SOCKET, IC
	2505237R08	POWER SUPPLY, Switch Mode, 120-Watt (includes J1)
	3005351R01	ASSEMBLY, Cable (includes J2 thru 4, J7 thru 11) for NTN4796 and NTN4797 Chargers)
	3060665A04	CORD, Power; 110Vac (for NTN1177, NTN4796, and NTN4668 Chargers)
	or 3060665A05	CORD, Power; 220Vac (for NTN1178, NTN4797, and

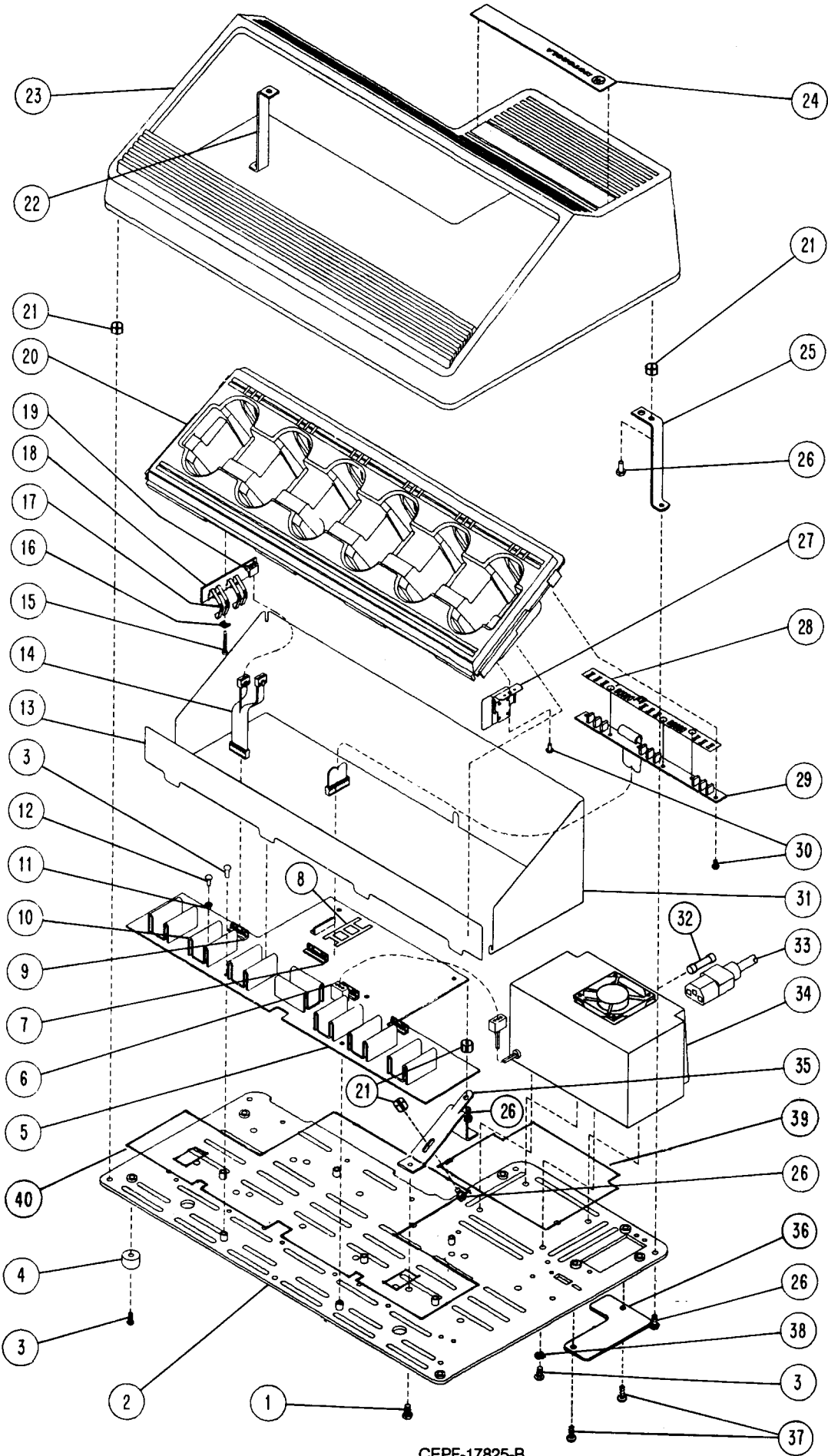
	or 3002120F02	NTN4922 Chargers)
	3905560Q05	CORD, Power; 240Vac (for NTN7165 and NTN1179 Chargers)
	6505700Q07	CONTACT (for NTN4796, NTN4797, NTN1177, NTN1178, and NTN1179 Chargers)
	0105956S37	FUSE, 3-Amp; 250V
	8405236R01	ASSEMBLY, Main PCB
	8405366R01	PRINTED CIRCUIT BOARD, Contact (for NTN4796 and NTN4797 Chargers)
	0105955N09	PRINTED CIRCUIT BOARD, LED (includes J5, 6)
		ASSEMBLY, Contact (includes J2 thru 4) (for NTN4668 and NTN4922 Chargers)

**NOTE:**  
1. For optimum performance, order replacement diodes, transistors, and circuit modules by Motorola part number only.

SABER

NTN4796A and NTN4797A  
Exploded View Parts List

TPLF-3515-A



CEPF-17825-B

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	0300129890	SCREW, Machine; 10-32 x .375" (4 req'd.)
2	0105952P82	ASSEMBLY, Baseplate
3	0300121057	SCREW, Machine; 6-32 x .375" (16 req'd.)
4	7505413D01	BUMPER, Rubber (5 req'd.)
5	See Note	ASSEMBLY, Main PCB (includes items 6 thru 12)
6	See Note	CONNECTOR, 3-Position (P1) (part of item 5)
7	See Note	CONNECTOR, 10-Position (P5, 6) (2 req'd.) (part of item 5)
8	See Note	SOCKET, IC (part of item 5)
9	See Note	CONNECTOR, 8-Position (P2 thru 4) (3 req'd.) (part of item 5)
10	2605239R01	HEAT SINK, 5-Watt (7 req'd.) (part of item 5)
11	0410057A13	WASHER, Shoulder, Plastic (7 req'd.) (part of item 5)
12	0300002951	SCREW, Machine; 4-40 x .250" (7 req'd.) (part of item 5)
13	2605541L02	SHIELD, Thermal
14	See Note	ASSEMBLY, Cable (includes J2 thru 4, J7 thru 11) (3 req'd.)
15	0300140396	SCREW, Tapping; 4-24 x .875" (6 req'd.)
16	4205378S01	BRACKET, Contact (6 req'd.)
17	See Note	CONTACT (24 req'd.)
18	See Note	PRINTED CIRCUIT BOARD, Contact (6 req'd.)
19	See Note	CONNECTOR, Header, Right-Angle, 4-Position (P7 thru 11) (6 req'd.)
20	1505196R01	HOUSING, Pocket
21	4205722C02	CLIP, Fastener (10 req'd.)
22	0705466Q01	BRACKET, Charger Housing
23	1505277L02	HOUSING, Multi-Unit Charger
24	3305543L06	NAMEPLATE, Charger
25	0705193L01	BRACKET, Cover, Tin-Plated (2 req'd.)
26	0300131632	SCREW, Tapping; 8-32 x .375" (13 req'd.)
27	0105955H89	ASSEMBLY, Kicker (6 req'd.)
28	2605407S01	SHIELD, Static (2 req'd.)
29	See Note	PRINTED CIRCUIT BOARD, LED (2 req'd.)
30	0300008158	SCREW, Tapping; 4-24 x .25" (12 req'd.)
31	2605238R01	SHIELD, Thermal
32	See Note	FUSE, Power Supply
33	See Note	CORD, AC Power (110Vac or 220Vac)
34	See Note	POWER SUPPLY, Switch Mode, 120-Watt
35	0705169L01	BRACKET, Pocket (2 req'd.)
36	6405636L03	COVER, Switch
37	0300002941	SCREW, Machine; 6-32 x .25" (2 req'd.)
38	0400007666	WASHER, External Tooth, #6 (4 req'd.)
39	1405899W01	INSULATOR, Power Supply
40	1405899W02	INSULATOR, P. C. Board

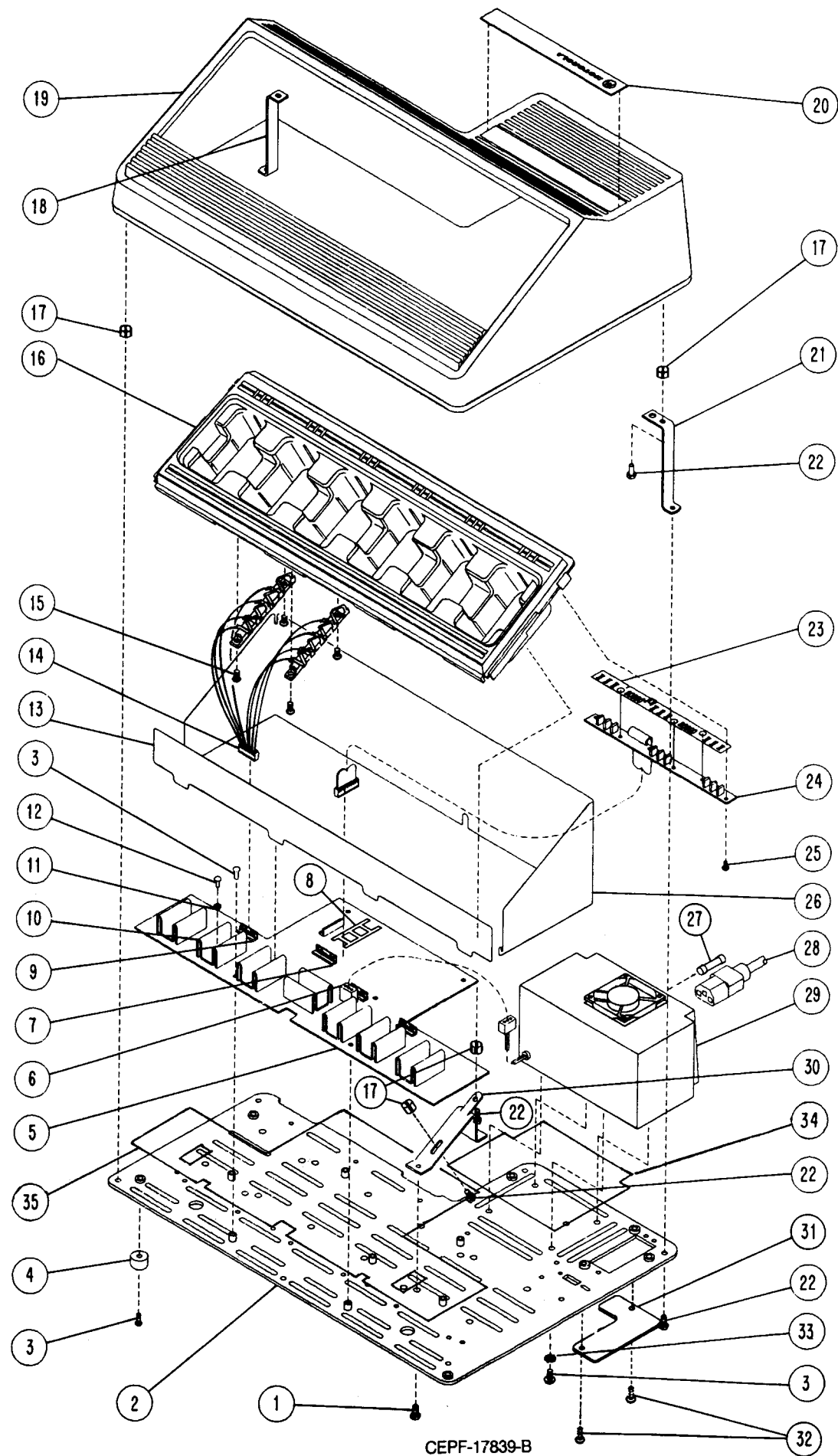
NOTE:  
Refer to Electrical Parts List for part number and description.  
\* Items are not required when using replacement power supply (Motorola part number 2505237R08).



HT600, P200, and MT1000

NTN4668 and NTN4922  
Exploded View Parts List

TPLF-3516-A



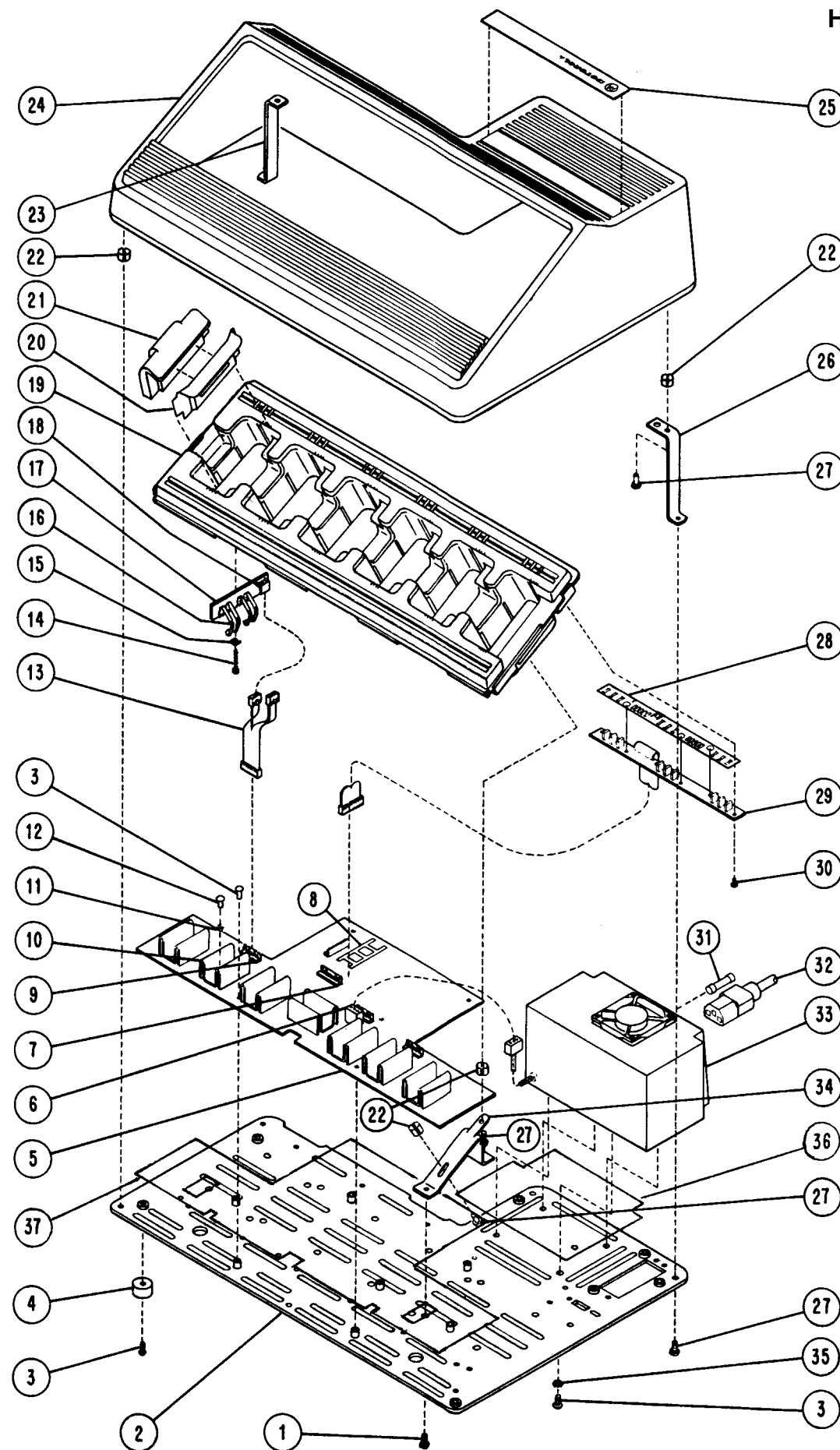
ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	0300129890	SCREW, Machine; 10-32 x .375" (4 req'd.)
2	0105952P82	ASSEMBLY, Baseplate
3	0300121057	SCREW, Machine; 6-32 x .375" (16 req'd.)
4	7505413D01	BUMPER, Rubber (5 req'd.)
5	See Note	ASSEMBLY, Main PCB (includes items 6 thru 12)
6	See Note	CONNECTOR, 3-Position (P1) (part of item 5)
7	See Note	CONNECTOR, 10-Position (P5, 6) (2 req'd.) (part of item 5)
8	See Note	SOCKET, IC (part of item 5)
9	See Note	CONNECTOR, 8-Position (P2 thru 4) (3 req'd.) (part of item 5)
10	2605239R01	HEAT SINK, 5-Watt (7 req'd.) (part of item 5)
11	0410057A13	WASHER, Shoulder, Plastic (7 req'd.) (part of item 5)
12	0300002951	SCREW, Machine; 4-40 x .250" (7 req'd.) (part of item 5)
13 *	2605541L02	SHIELD, Thermal
14	See Note	ASSEMBLY, Cable (includes J2 thru 4, (3 req'd.)
15	0300139982	SCREW, Machine; 2-56 x 5/32" (12 req'd.)
16	1505411R01	HOUSING, Pocket
17	4205722C02	CLIP, Fastener (10 req'd.)
18	0705466Q01	BRACKET, Charger Housing
19	15052277L02	HOUSING, Multi-Unit Charger
20	3305543L06	NAMEPLATE, Charger
21	0705193L01	BRACKET, Cover, Tin-Plated (2 req'd.)
22	0300131632	SCREW, Tapping; 8-32 x .375" (13 req'd.)
23	1605407S01	SHIELD, Static (2 req'd.)
24	See Note	PRINTED CIRCUIT BOARD, LED (2 req'd.)
25	0300008158	SCREW, Tapping; 4-24 x .25" (6 req'd.)
26 *	2605238R01	SHIELD, Thermal
27	See Note	FUSE, Power Supply
28	See Note	CORD, AC Power (110Vac or 220Vac)
29	See Note	POWER SUPPLY, Switch Mode, 120-Watt
30	0705189L01	BRACKET, Pocket (2 req'd.)
31 *	6405636L03	COVER, Switch
32 *	0300002941	SCREW, Machine; 6-32 x .25" (2 req'd.)
33	0400007666	WASHER, External Tooth; #6 (4 req'd.)
34	1405899W01	INSULATOR, Power Supply
35	1405899W02	INSULATOR, P. C. Board

NOTE:

Refer to Electrical Parts List for part number and description.

\* Items are not required when using replacement power supply (Motorola part number 2505237R08).

# HT1000 AND VISAR



CEPF-22777-A

END OF DOCUMENT

## NTN1177, NTN1178, NTN1179, NTN7621, NTN7622, and NTN7623 Exploded View Parts List

TPLF-4098-A

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	0300129890	SCREW, Machine; 10-32 x .375" (4 req'd.)
2	0105952P82	ASSEMBLY, Baseplate
3	0300121057	SCREW, Machine; 6-32 x .375" (16 req'd.)
4	7505413D01	BUMPER, Rubber (5 req'd.)
5	See Note	ASSEMBLY, Main PCB (includes items 6 thru 12)
6	See Note	CONNECTOR, 3-Position (P1) (part of item 5)
7	See Note	CONNECTOR, 10-Position (P5, 6) (2 req'd.) (part of item 5)
8	See Note	SOCKET, IC (part of item 5)
9	See Note	CONNECTOR, 8-Position (P2 thru 4) (3 req'd.) (part of item 5)
10	2605239R01	HEAT SINK, 5-Watt (7 req'd.) (part of item 5)
11	0410057A13	WASHER, Shoulder, Plastic (7 req'd.) (part of item 5)
12	0300002951	SCREW, Machine; 4-40 x .250" (7 req'd.) (part of item 5)
13	See Note	ASSEMBLY, Cable (includes J2 thru 4, (J7 thru 11) (3 req'd.)
14	0300140396	SCREW, Tapping; 4-24 x .875" (6 req'd.)
15	4205378S01	BRACKET, Contact (6 req'd.)
16	See Note	CONTACT (24 req'd.)
17	See Note	PRINTED CIRCUIT BOARD, Contact (6 req'd.)
18	See Note	CONNECTOR, Header, Right-Angle, 4-Position (P7 thru 11) (6 req'd.)
19	1505731V02	HOUSING, Pocket
20	0105951T87	HOUSING, Pocket (Visar only)
21	0705164W01	BRACKET (Thin Spacer)
22	4205165W01	RETAINER (Thick Spacer)
23	4205722C02	CLIP, Fastener (10 req'd.)
24	0705466Q01	BRACKET, Charger Housing
25	1505277L02	HOUSING, Multi-Unit Charger
26	3305543L06	NAMEPLATE, Charger
27	0705193L01	BRACKET, Cover, Tin-Plated (2 req'd.)
28	0300131632	SCREW, Tapping; 8-32 x .375" (13 req'd.)
29	2605407S01	SHIELD, Static (2 req'd.)
30	See Note	PRINTED CIRCUIT BOARD, LED (2 req'd.)
31	0300008158	SCREW, Tapping; 4-24 x .25" (12 req'd.)
32	See Note	FUSE, Power Supply
33	See Note	CORD, AC Power (110Vac or 220Vac)
34	See Note	POWER SUPPLY, Switch Mode, 120-Watt
35	0705169L01	BRACKET, Pocket (2 req'd.)
36	0400007666	WASHER, External Tooth, #6 (4 req'd.)
37	1405899W01	INSULATOR, Power Supply
	1405899W02	INSULATOR, P. C. Board

### NOTE:

Refer to Electrical Parts List for part number and description.

**CE** This product conforms with the Protection requirements of Council Directive 89/336/EEC of 3rd May 1989 (EMC) on the approximation of the laws of the Member States relating to electromagnetic compatibility.