TM 11-6130-356-34

TECHNICAL MANUAL

DIRECT SUPPORT
AND
GENERAL SUPPORT
MAINTENANCE MANUAL

POWER SUPPLY PP-6148/U

(NSN 6130-01-062-3618)

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY
10 MAY 1982

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 September 1987

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL POWER SUPPLY PP-6148/U (NSN 6130-01-062-3618)

TM 11-6130-356-34, 10 May 1982, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number.

Remove pages	*Insert pages*
A and B	A and B
i, ii, and iii	i through iii/(iv blank)
l-land l-2	l-1 and l-2
None	1-2.1/(1-2.2 blank)
l-3 through l-6	l-3 through l-6
2-l through 24	2-l through 2-4
3-l through 3-6	3-l through 3-6
3-15 through 3-30	3-15 through 3-30
3-33 and 3-34	3-33 and 3-34
4-l through 44	4-l through 4-4
Figure FO-3(l) through F0-3(1)	Figure FO-3(1) through FO-3(3)

2. File this change sheet in the front of the publication for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R.L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

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5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

4 SEND FOR HELP AS SOON AS POSSIBLE

5 AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNINGS

- High voltages and currents exist in this equipment. Serious injury or death may result from contact with the output terminals or internal circuitry. Reenergize the equipment before connecting or disconnecting test equipment.
- Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
- Be sure to discharge capacitors before troubleshooting and repair.
- Adequate ventilation must be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor must be avoided. The solvent must not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin must be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.
- Prevent personal injury when applying or removing steel strapping, by wearing heavy gloves and protective eyewear. Do not handle packing cartons by the steel strapping.
- Explosive gases may be released during battery charging operations. Be sure that the charging area is well ventilated. Do not use matches or an open flame in the charging area. Guard against short circuits; resulting arcs may cause an explosion. Do not disconnect the battery charger adapter cable from the battery until the DC ON-OFF circuit breaker is set to OFF, and the battery charger adapter cable is disconnected from the power supply. Do not attempt to charge a damaged or leaking battery.
- On serial numbers 1A through 154A, momentarily turn the AC ON-OFF circuit breaker first to the ON position, and then to the OFF position after disconnecting AC power input cable assembly W1. This action will discharge any voltage present at the terminals of AC INPUT connector J1, and is required to avoid electrical shock hazard.

TECHNICAL MANUAL
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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *10 May 1982*

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

POWER SUPPLY PP-6148/U

(NSN 6130-01-062-3618)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. lf you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA 2028-2 located in back of this manual direct to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, NJ 07703-5000. A reply will be furnished to you.

LIST OF ILLUSTRATIONS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual describes the lightweight battery charger Power Supply PP-6148/U (fig. 1-1) and covers its functions and maintenance at the direct support and general support levels. This manual includes functional descriptions, adjustments, testing, troubleshooting and repair of battery charger Power Supply PP-6148/U. Throughout this manual, battery charger Power Supply PP-6148/U is commonly referred to as the PP-6148/U. Appendix A contains a list of publications applicable to the PP-6148/U. Appendix B consists of the Expendable Supplies and Materials List applicable to the direct support and general support levels of maintenance. The Repair Parts and Special Tools List is located in TM 11-6130-356-34P.

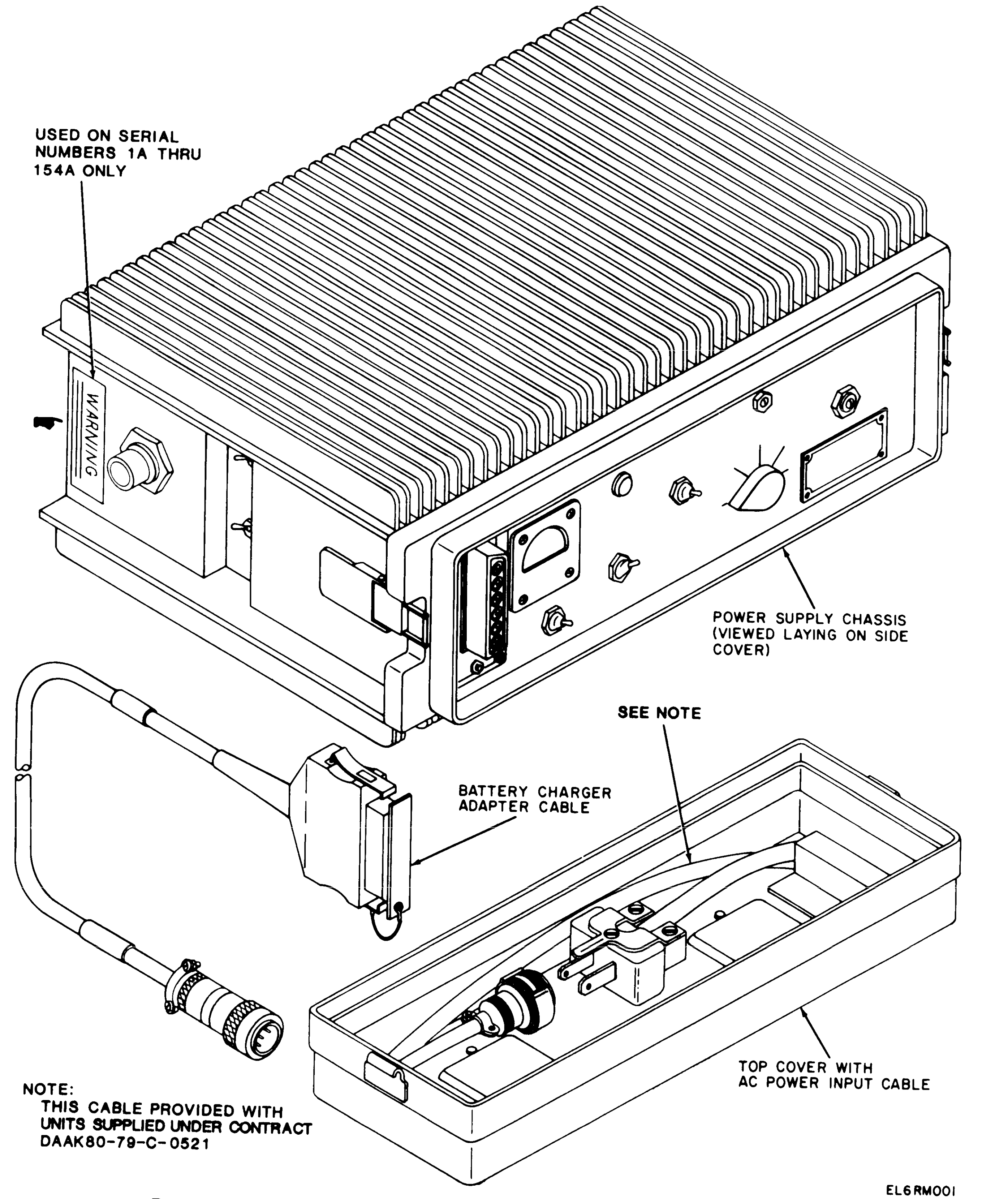


Figure 1-1(1). Power Supply PP-61481U and Battery Charger Cable Assembly (Sheet 1 of 2)

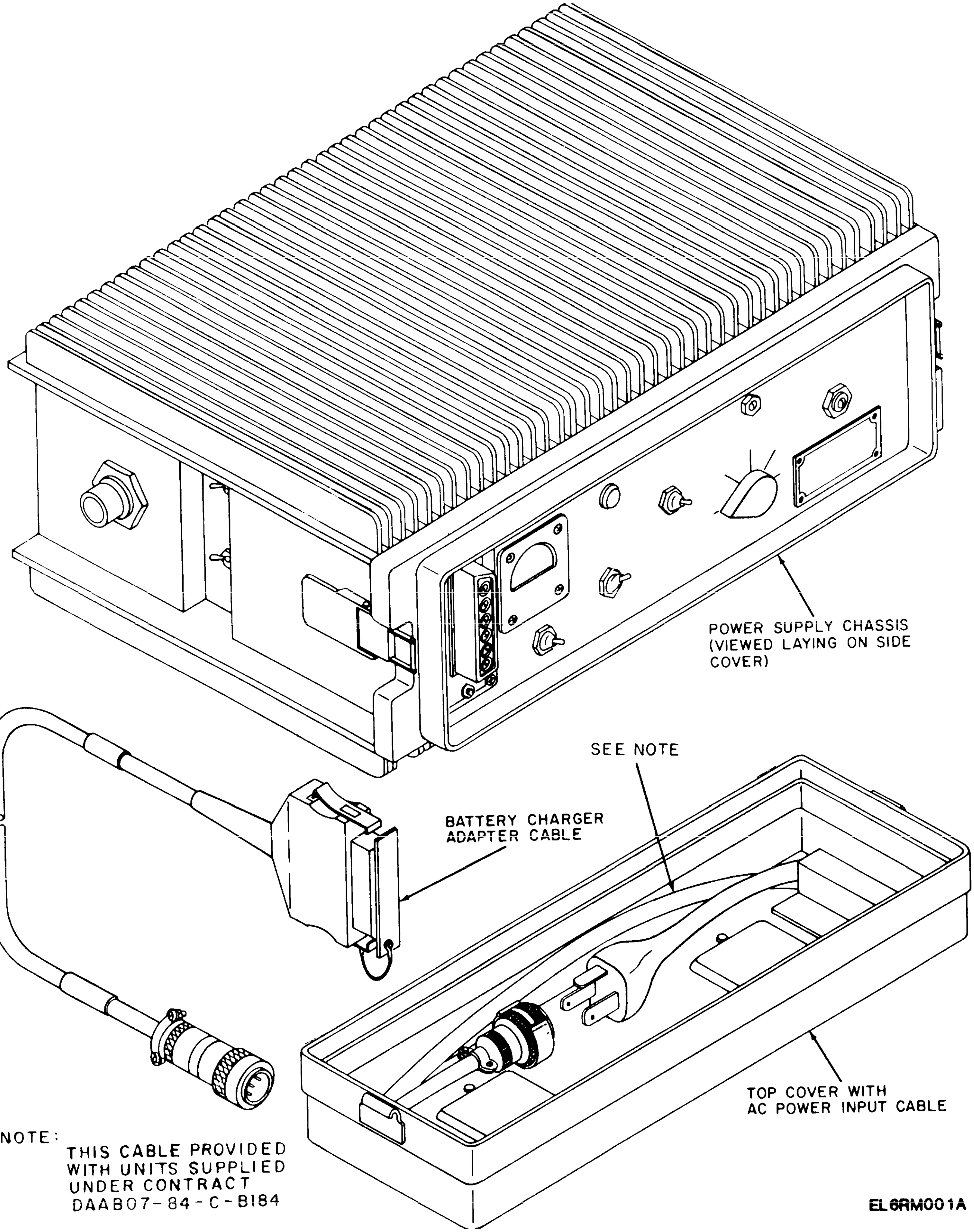


Figure 1-1(2). Power Supply PP-6148/U and Battery C'hargcr Cable Assemby (Sheet 2 of 2)

1-2. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-3. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, as contained in Maintenance Management Update.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-1l-2/DLAR 4140.55/ NAVMATINST 4355.73B/AFR 400-54\MC0 4430.3H.

c. *Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy In Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/ NAVSUPINST 4610.33C/AFR 75-18/MCO P461O.19D/DLAR 4500.15.

1-4. Administrative Storage

Before placing this instrument in storage, its complete operability must be verified and all deficiencies corrected by accomplishing the performance checks and adjustment procedures, and maintenance, as prescribed in chapters 4 and 5. Be sure that the ac power cable is in its storage location in the top cover panel, and that the cover is properly fastened on the top panel. Secure adapter cable to unit. Place the equipment in limited storage, i.e., organizational storage room. Protect equipment from dust, humidity, and extreme temperature changes.

1-5. Destruction of Army Electronics Materiel

Destruction of Army Electronics Materiel to prevent enemy use shall be as prescribed in TM 750-244-2.

1-6. Calibration

This equipment is to be calibrated in accordance with TB 43-180, Calibration Requirements for the Maintenance of Army Materiel.

1-7. Reporting Equipment Improvement Recommendations (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey 07703-5000. We'll send you a reply.

Section II. DESCRIPTION AND DATA

1-8. Description

A general description of the make-up of the PP-1648/U is contained in 'I'M 11-6130-356-12. A description of the internal configuration of the PP-6148/U (fig. 1-2) is provided in the following paragraph.

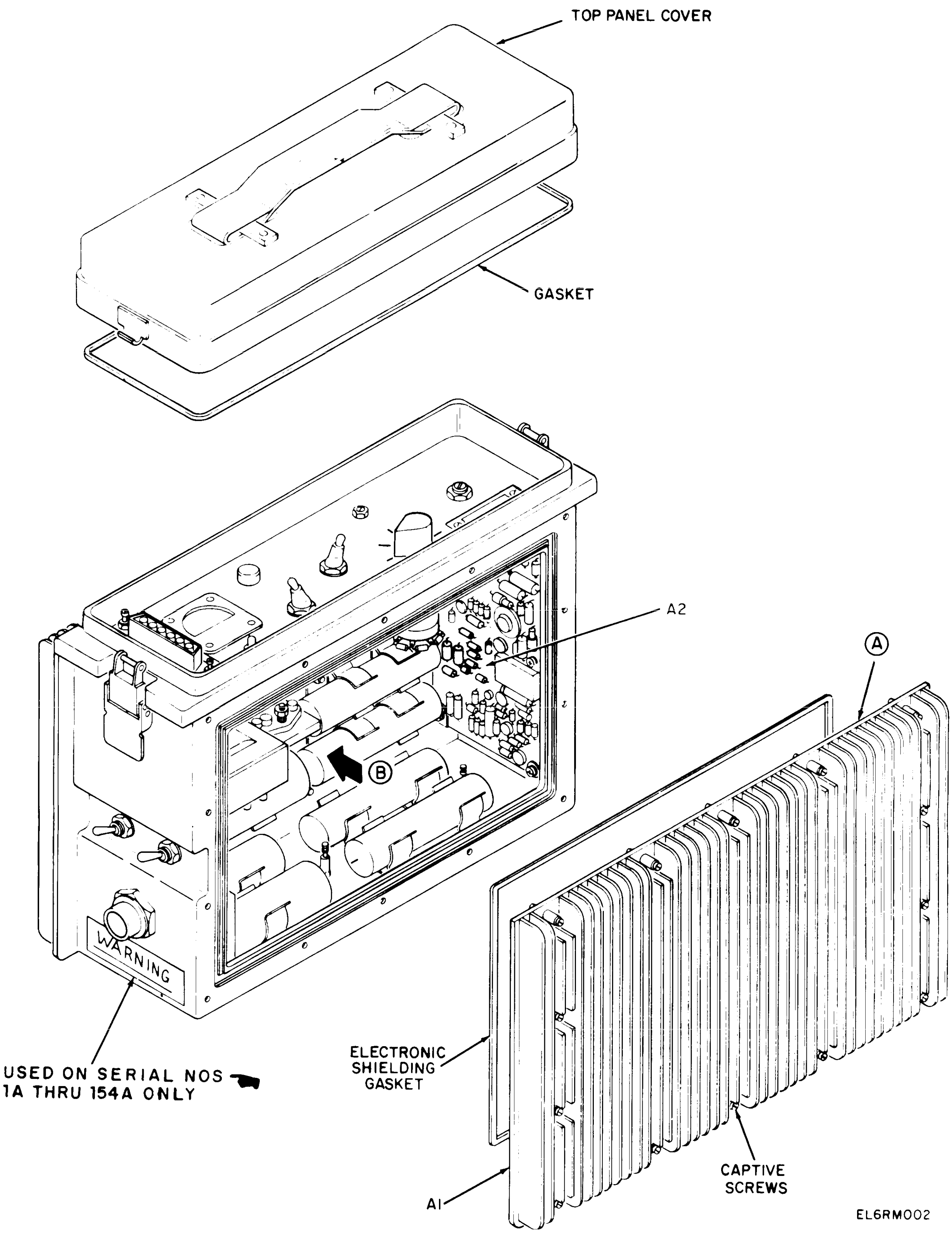


Figure 1-2(1). PP-6148/U Internal Configuration (Sheet 1 of 2).

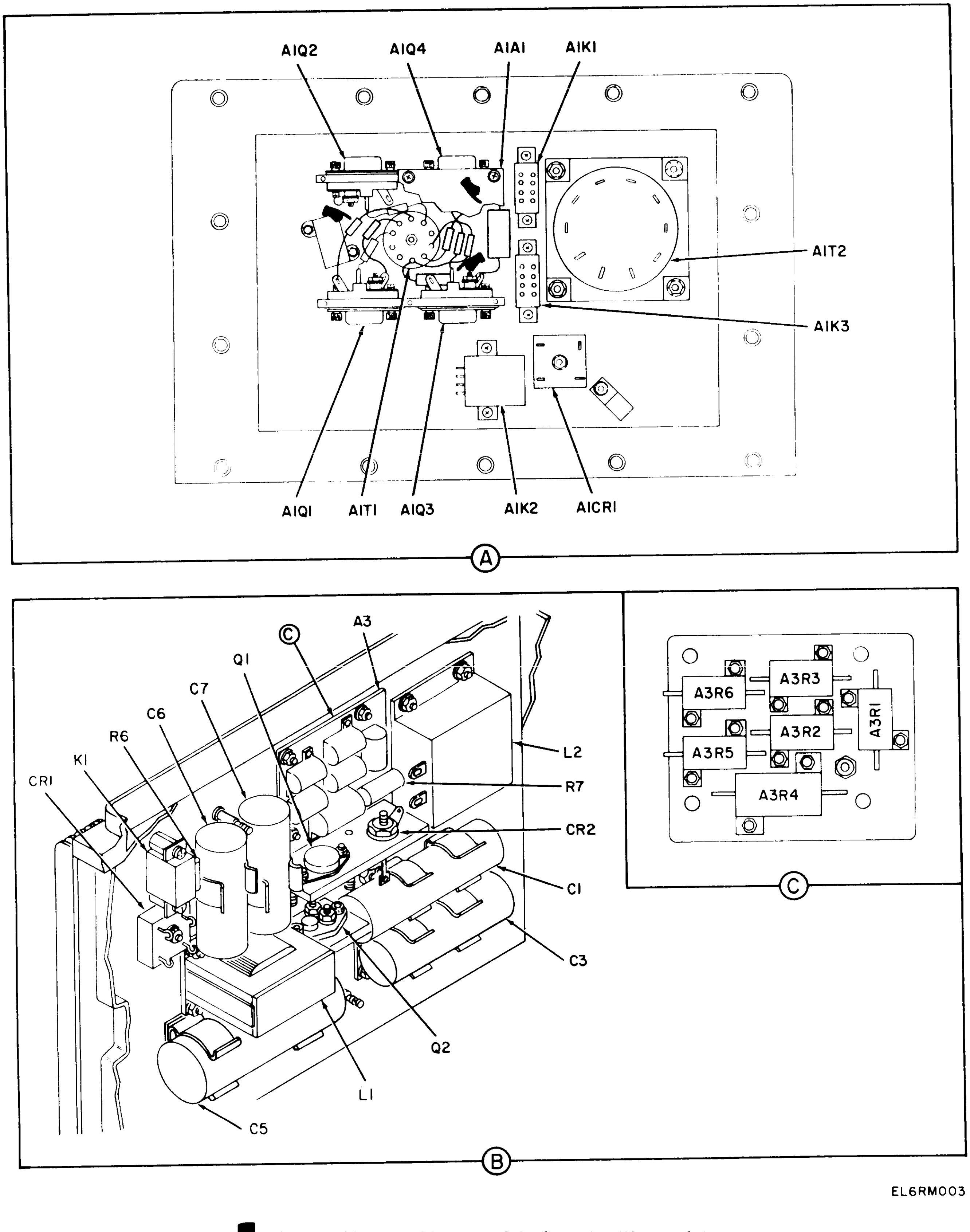


Figure 1-2(2). PP-6148/U Internal Configuration (Sheet 2 of 2)

a. The PP-6148/U is comprised of three major assemblies: (1) cover assembly Al, (2) control circuit card assembly A2, and (3) resistor plate assembly A3. Cover assembly Al is assembled to the chassis of the PP-6148/U with captive hardware. A gasket, recessed in the flange of the chassis, seals the surfaces of the chassis and cover assembly Al.

b. Cover assembly Al contains heat producing components mounted directly to it. These components are the saturable core feedback transformer A1T1, converter power transformer A1T2, rectifier A1CR1, power and filter switching relays A1K1 through A1K3, switching transistors A1Q1 through A1Q4, and converter circuit card assembly AlAl.

c. Control circuit card assembly A2 is mounted on standoffs to the inside of the right side of the PP-6148/U chassis. Control circuit card assembly AZ contains components of the input frequency sensing, output regulation and control, and associated auxiliary power supply circuits.

d. Additional heat producing components are mounted to the inside of the PP-6148/U chassis heat sink. These components include filter capacitors and inductors, the series pass elements of the output regulator, and resistor plate assembly A3. Resistor plate assembly A3 contains the current range limiting resistors A3R1 through A3R6.

e. All components of the PP-6148/U are secured to either cover assembly A1, the top panel, or to the inside of the chassis. Service access to all components is accomplished by removing cover assembly Al. When removed, electrical connection between cover assembly Al and the power supply chassis is maintained through a multiwire harness with enough service length to enable on-line maintenance.

1-9. Tabulated Data

For a listing of technical characteristics and a listing of components supplied, refer to TM 11-6130-356-12.

CHAPTER 2

FUNCTIONING OF EQUIPMENT

Section I. BLOCK DIAGRAM ANALYSIS

2-1. General

This chapter describes the theory of operation of the PP-6148/U. These descriptions are presented on a functional block and detailed circuit analysis level and are supported by the foldout diagrams (fig. FO-1, FO-2, and FO-3) located at the rear of this manual. Figures FO-2 and FO-3 illustrate the functional block and detailed schematic diagrams, respectively. Figure FO-1 explains the color coding system used to identify circuit component values and should be referred to when performing repair procedures.

2-2. Scope of Figure FO-2

The following paragraphs describe the PP-6148/U on a functional block level with reference to the block diagram, figure FO-2. The PP-6148/U is comprised of those circuit blocks illustrated on figure FO-2.

2-3. General Function

The PP-6148/U provides a regulated 12 to 16 V dc or 24 to 32 V dc output required to operate military communications equipment such as Radio Set AN/PRC-70 or to charge an external battery. The PP-6148/U maintains a constant output voltage regardless of variations in ac line voltage within +15 and – 10 percent. The PP-6148/U maintains a constant output voltage regardless of output current until its current limiting setting is reached, above which, output current is maintained constant and output voltage decreases proportionately with the resistance of the load. The operating power for the PP-6148/U is 115 or 230 V ac at a frequency of 50, 60, or 400 Hz ± 5 percent.

2-4. Ac-Dc Rectifier Circuit

The ac input voltage from AC INPUT connector J1 is applied through AC ON/OFF circuit breaker CB1, to the full wave bridge rectifier CR1, part of the ac-dc rectifier filter. The dc output of primary rectifier CR1 is filtered by inductor L1, part of the ac-dc rectifier filter, and capacitors Cl through C4 and provides a dc prime power source for the dc-to-dc converter circuits.

2-5. 400 Hz Sensing Circuit

The 400 Hz sensing circuit consists of a high pass filter network that activates relay A1K2 when the PP-6148/U is operated from a 400 Hz source. When activated, relay A1K2 shorts out filter inductor L1 in the ac-dc rectifier filter. The shorting of inductor LI is required to eliminate excessive voltage drop across the inductor to 400 Hz, and maintain an adequate dc power level to the dc-to-dc converter for input line variations.

2-6. Dc-to-Dc Converter

The dc-to-dc converter consists of high frequency converter switching transistors A1Q1, A1Q2 A1Q3, and A1Q4, power transformer A1T2, and saturable core feedback transformer A1T1, followed by full wave bridge rectifier A1CR1, current limiting resistor R6, shorting relay P/C) K1, and filter capacitor C5. This circuitry comprises a self-oscillating high frequency power converter by virtue of the saturating characteristics of feedback transformer A1T1. These transformer characteristics establish the oscillating frequency and provide alternating base drive pulses to the switching transistors.

2-7. 115/230 V ac Switching

The 115/230 V ac switching circuit (imcluding transistors A1A1Q1 through A1A1Q4 is a level-sensing circuit that activates relays A1K1 and A1K3 when the power supply is operated from a 115 V ac power source. When not activated, the contact configuration of relay A1K1 places the dual primary windings of power transformer A1T2 in series for 230 V ac operation. When activated, the contact configuration of relay A1K1 places the dual primary windings of power transformer A1T2 in parallel for 115 V ac operation. Similarly, relay A1K3 switches the tapped feedback winding to equalize switching circuit drive.

2-8. 14V/28V Switching

The secondary winding of power transformer A1T2 is center-tapped to provide output level switching for 14 V dc and 28 V dc output requirements. When set in the 28V position VOLT SELECT 14V/28V switch S1, located on the top panel, connects the entire secondary winding to the output regulator circuits, and connects one-half the secondary winding to these circuits when VOLT SELECT 14V/28V switch S1 is set in the 14V position.

2-9. Control Circuit Power Supply

The control circuit power supply provides regulated dc power to critical control circuits and for operation of 28 V dc relays. The control circuit power supply uses the full secondary winding of power transformer A1T2 as its ac power source. This ac power is rectified by the full wave bridge rectifier A2CR1 through A2CR4, filtered, and regulated by zener-controlled, chassis-mounted transistor Q3.

2-10. Output Rectifier

The ac power output of power transformer AlT2 is. rectified by full wave rectifier bridge AlCR1 and faltered by capacitor C5 to provide the dc power source for the output voltage regulator. At initial turn-on, current limiting resistor R6 is placed between rectifier bridge AlCR1 and filter capacitor C5 to limit the charging current. The resistor is shorted out by shorting relay P/O K1 after a short time delay period.

2-11. Output Voltage Regulator

The output voltage regulator is a high frequency voltage switching regulator that is pulse width and frequency controlled by the regulator control A2U2. Two series pass transistors, Q1 and Q2, are used in parallel to accommodate the output voltage and current requirements and to distribute heat losses on the heat sink surface. The series pass transistors are followed by a filtering network consisting of an energy storing inductor, L2, and filter capacitors C6 and C7. A shunt diode, CR2, permits current continuation when transistors Q1 and Q2 are switched off.

2-12. Output Voltage Control/Adjust Circuits

The output voltage control/adjust circuits include resistor divider networks with potentiometers for top panel control (VOLTAGE ADJUST Rl) and voltage throw-off (CHARGE OVER) level adjustments (A2R26 and A2R33). VOLT SELECT SWITCH S1 reconnects pertinent control and monitor components according to the selected 14V or 28V position.

2-13. Output Current Control/Adjust Circuits

The output current limit is selected by CURRENT RANGE switch S2 and the load current is sensed across the current limit sense selected precision resistor(s) A3R1 through A3R6. The current control/adjust circuit consists of A2U1 and CURRENT ADJUST (FINE) potentiometer R2. Within the selected range (to 8 amperes), the limit is varied by the CURRENT ADJUST (FINE) potentiometer R2 and controlled through A2U1's effect on the switthing regulator control A2U2.

2-14. Monitoring Output Voltage and Output Current

Dc output voltage, available when DC ON/OFF circuit breaker CB2 is in the ON position, is normally monitored on OUTPUT meter M1, and output current can be selected for meter indication by the use of VOLTS/AMPS switch S4. S4 is a spring-loaded switch, which reverts to the VOLTS position upon release. DC ON/OFF circuit breaker CB2 also functions as an overload protection device.

2-15. Protective Circuitry and Reset

Both the voltage throw-off (CHARGE OVER) and the battery reverse polarity protection circuits function by de-energizing output relay K1, which disconnects the power supply negative output lead from dc output connector J2. Relay A2K1 functions to light CHARGE OVER lamp DS1, while CHARGE RESET switch S3 is used to restore the circuit to the operational mode.

Section II. DETAIL ED CIRCUIT ANALYSIS

2-16. Scope of Figure FO-3

The following paragraphs describe the PP-6148/U on a detailed level with reference to the schematic diagram, figure FO-3. Each block described in Section I is expanded in the following discussion.

2-17. Input Power

The ac input voltage is applied to AC INPUT connector J1. This voltage, which is RFI-suppresed by EMI filters FL1 and FL2, is applied to AC ON/OFF circuit breaker CB1. This circuit breaker limits input current to 7.5 amperes for an extended period and will withstand 12 ampere surges for periods up to 300 milliseconds. On serial No’s 155A and up, bleeder resistors R8 through R11 are provided as a safety measure to discharge filters FL1 and FL2 after ac power is removed from the PP45148/U. When AC ON/OFF circuit breaker CB1 is set to the ON position, the ac input voltage is applied to the ac-dc rectifier filter network. This network is comprised of diode bridge CR1, capacitors Cl through C4, and

Diode bridge CR1 provides full-wave rectified dc to filter capacitors Cl through C4 and inductor L1. This inductor corrects the power supply input power factor for 50 or 60 Hz operation. The full-wave rectified and filtered dc from the ac-dc rectifier filter is applied to the 115/230 Vac switching and de-to-de converter circuits.

2-18. Relays A1K1 and A1K3

Transistors Q1 through Q4 (on converter circuit card assembly AlAl) and their associated circuits function to energize relay A1K1, which reconnects the primary windings of power transformer A1T2 for operation from a 115 V ac input line. Relay A1K3, similarly, operates and functions to equalize drive to feedback transformer AIT1. With 230 V ac input, the base-to-emitter bias keeps transistors A1A1Q4 cut off and relays A1K1 and A1K3 de-energized.

2-19. Dc-to-DC Converter

The ac-dc rectifier filter output operates a dc-to-dc converter network consisting of panel-mounted power transistors A1Q1 through A1Q4, components on converter circuit card assembly, panel-mounted transformers A1T1 andhAlT2, diode bridge A1CR1, and chassis-mounted capacitor C5. On cover assembly Al, when the output of the ac-dc rectifier filter first rises, transistors A1Q1 and A1Q4 start to conduct, and current flows through the primary winding of transformer A1T2 from terminal 1 to terminal 4. Feedback from secondary winding (terminals 5, 6 and 7) of transformer A1T2 to the primary winding of transformer A1T1 (terminals 1 and 2), and so to its secondary windings (terminals 9 and 10 and terminals 3 and 4), quickly drives transistors A1Q1 and A1Q4 to full conduction. The core flux density of transformer A1T1 rises to saturation, at which time the transformer action reverses, cutting off transistors AlAl and A1Q4 and turning on transistors A1Q2 and A1Q3. Current now flows through the primary winding of transformer A1T2 from terminal 4 to terminal 1. Current flow is thus reversed, until transformer core saturation results, when the sequence is again reversed. These alterations occur at approximately 3000 cycles per second.

2-20. Converter Rectifier and Filter

With the initial surge limited by resistor R6, the resulting square wave output on A1T2 secondary windings (terminals 8 to 9 or 8 to 10) is rectified by diode bridge A1CR1 and faltered capacitor C5. This converter output dc is then applied to the output voltage regulator, regulator control, and associated circuits.

2-21. Output Voltage Regulator and Regulator Control

The output voltage regulator consists of two series pass transistors in parallel, chassis-mounted transistors Q1 and Q2, circuit elements on control circuit card assembly A2, and storage inductor L2. The top panel VOLTAGE ADJUST control R1 and CURRENT ADJUST (FINE) control R2 provides vernier adjustment of these control circuits. As the de-de converter output voltage starts to rise from zero, the regulator control, consisting of integrated circuit A2U2 (functioning as a Schmitt trigger) and the drive transistor A2Q4 and A2Q5, maintains the series pass elements of the output voltage regulator in a full conduction state. Load current is through storage inductor L2. When the voltage exceeds the trigger level of Schmitt trigger A2U2, it changes state and the series pass elements are turned off. The magnetic field of inductor L2 collapses, maintaining current flow until the output voltage falls below the trigger level of Schmitt trigger A2U2. The series pass elements are again saturated. Switching transition periods are a few hundred nanoseconds, power losses are minimized, and relatively high efficiency is achieved. Output voltage adjustment within the selected 14V or 28V range is obtained by changing the voltage input to Schmitt trigger A2U2. Fine adjustment is by means of VOLTAGE ADJUST control R1 on the top panel.

2-22. Current Limit Sense

The current from the output voltage regulator is sensed in a series resistance network connected in the positive dc output line. The voltage drop is proportion to the output current within a selected range, and part of it is applied through integrated circuit amplifier A2U1 to the integrated circuit Schmitt trigger A2U2 to effect a reduction in output voltage when the output current reaches the selected and adjusted value. The output current limit range is selected by switching the precision series resistors (A3R1 through A3R6) according to the position of the CURRENT RANGE switch S2. In the 10 position the current limit is fixed at 10 amperes. Within the selected (1, 2, 4, or 8) current limit range, vernier adjustment is provided by the CURRENT ADJUST (FINE) control R2 connected (in combination with resistor A2R42) across the current limiting series resistor in use. The adjustable contact of CURRENT ADJUST (FINE) control R2 provides the finely adjusted limiting potential to the integrated circuits.

2-23. Overload Protection

Additional protection from electrical damage due to overload is provided by the DC ON/OFF circuit breaker CB2 in the dc output circuit. It is a fast-acting, trip-free, hydraulic-magnetic type which serves the additional function of a switch. The overload trip function will operate even if the toggle lever is manually held in the ON position. The DC ON/OFF circuit breaker CB2 is a single-pole unit rated at 11.2 amperes, and will trip instantaneously on severe overloads.

2-24. Voltage Throw-Off (CHARGE OVER)

The output voltage level is additionally applied to a sensing and control network on control circuit card assembly A2, for use in effecting output disconnect at pre-set limits. Components selectively connected by the positioning of the VOLT SELECT 14 V/28bv switch S1 provide for automatic disconnect of the dc output line at a level of 16.0 to 16.4 V dc in the 14V position, and 32.0 to 32.8 V dc in the 28V position. These levels are precisely set during final factory tests by the use of internal adjustment (potentiometer A2R33 for the 14V range and potentiometer A2R26 for the 28V range). When the output voltage reaches the pertinent voltage limit, the control and drive circuits associated with tram sisters A2Q6 through A2Q8 operate to gate on transistor A2Q9 and energize output relay A2K1 in the voltage throw-off circuit. Normally-closed contacts of output relay A2K1 open to release chassis-mounted K1, which in turn opens the dc output negative (—) line, disconnecting the battery from the charging circuits. The LC network in the emitter circuit of transistor A2Q8 prevents operation of the cutoff relay as a function of transients. A normally-open contact of A2K1 closes to light the CHARGE OVER lamp DS1. Momentary operation of CHARGE RESET SWITCH S3 restores the circuit to the operational mode.

2-25. Reverse Polarity Protection (Serial Nos 1A Thru 206A)

Circuits on control circuit card assembly A2, in association with chassis-mounted relay K1, prevent damage to the power supply conversion and control circuits in the event that the battery for charging is inadvertently connected with the polarity reversed. In normal operation, with the battery properly connected, the gate of SCR A2Q11 is back-biased, preventing operation of relay A2K2, and relay K1 is energized through normally-closed contacts of relays A2K1 and A2K2 when control circuit voltage has gated on SCR A2Q10 to provide a return path for the coil of relay K1. With relay K1 energized, its normally-open contacts connect the dc output negative (–) line to dc output connector J2. If a battery is connected with polarity reversed, the gate of SCR A2Q11 is forward-biased, and relay A2K2 can be energized. If the battery, so connected, has a voltage potential and current capability that would inflict damage on the power supply conversion and control circuits, relay A2K2 will be energized, its normally-closed contacts are open, relay K1 cannot be energized, and the power supply negative (–) dc output line remains open between the battery and the power supply conversion and control circuits.

2-26. Reverse Polarity Protection (Serial Nos 207A and Up)

Circuits on control circuit card assembly A2, in association with chassis-mounted relay K1, prevent damage to the power supply conversion and control circuits in the event that the battery for charging is inadvertently connected with the polarity reversed, In normal operation, with the battery properly connected, diode CR7 is back-biased, preventing operation of relay A2K2, and relay K1 is energized through normally-closed contacts of relays A2K1 and A2K2 when control circuit voltage has gated on SCR A2Q10 to provide a return path for the coil of relay K1. With relay K1 energized, its normally-open contacts connect the dc output negative (—) line to dc output connector J2. If a battery is connected with polarity reversed, diode CR7 is forward-biased, and relay A2K2 can be energized. If the battery, so connected, has a voltage potential and current capability that would inflict damage on the power supply conversion and control circuits, relay A2K2 will be energized, its normally-closed contacts are open, relay K1 cannot be energized, and the power supply negative (—) dc output line remains open between the battery and the power supply conversion and control circuits.

CHAPTER 3

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

3-1. Direct Support

Maintenance at the direct support level includes all procedures outlined for operator and organizational maintenance, and additional procedures which require test equipment and/or skills not available at the operator and organizational level. These additional procedures include all the required testing, troubleshooting and maintenance of the PP-6148/U at the direct support level. Direct support maintenance restricts the converter circuit card assembly (AlA1) and the control circuit card assembly (A2) to testing and replacement only. Paragraphs 3-2 through 3-25 provide these additional procedures for maintenance of the PP-6148/U at the direct support level.

3-2. Use of Test Equipment for Measurements

WARNING

High voltages and currents exists in this equipment. Serious injury or death may result from contact with the output terminals or internal circuitry. To avoid injury, be sure that the AC ON/OFF circuit breaker and the DC ON/OFF circuit breaker are set to OFF before connecting or disconnecting any external equipment. On serial numbers 1A through 154A, momentarily turn the AC ON–OFF circuit breaker first to the ON position, and then to the OFF position after disconnecting AC power input cable assembly W1. This action will discharge any voltage present at the terminals of AC INPUT CONNECTOR Jl, and is required to avoid electrical shock hazard.

a. Resistance Measurement Precautions. The PP-6148/U is transistorized. Strictly adhere to the directions governing the use of the test equipment required to maintain the PP-6148/U.

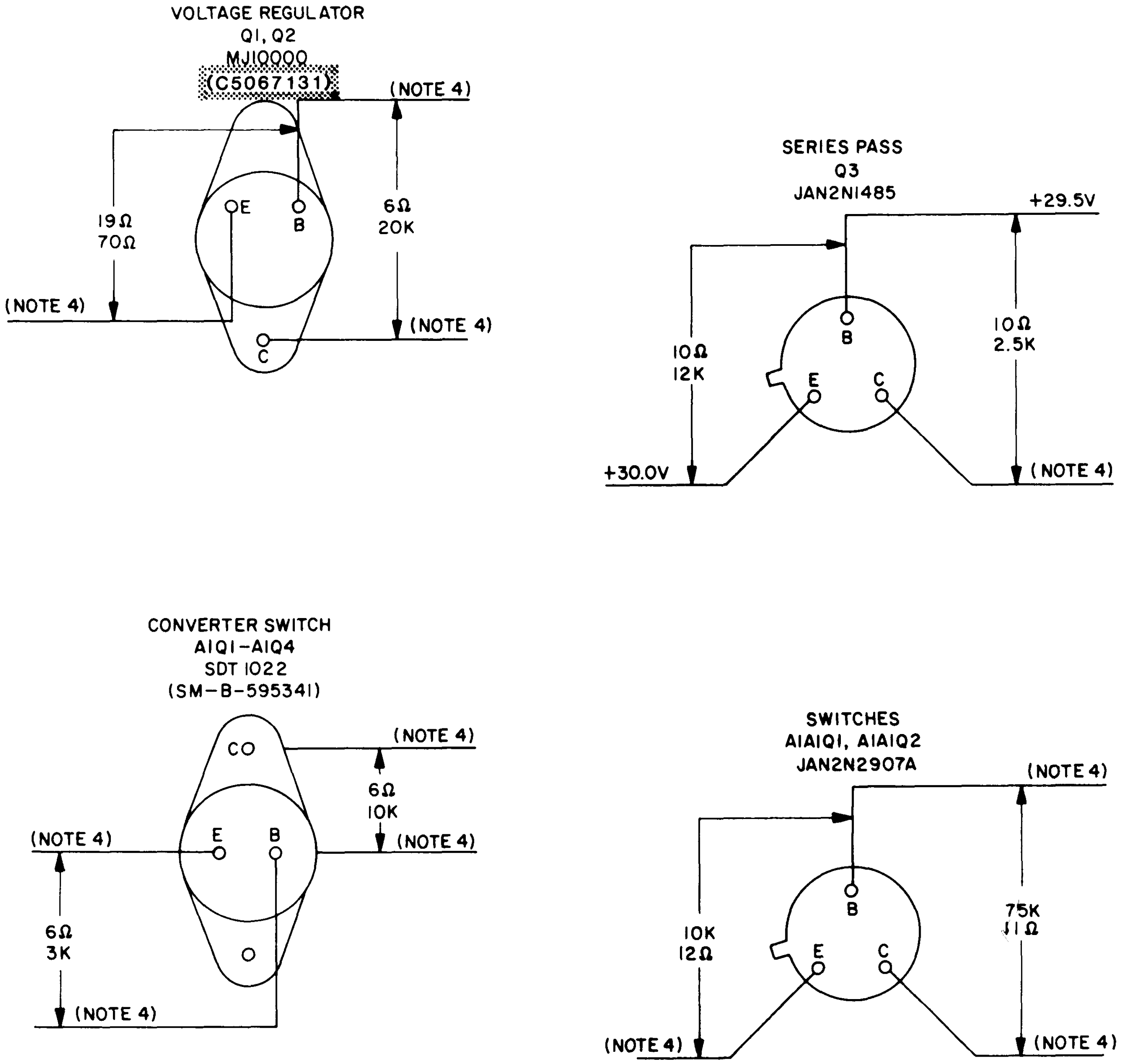
CAUTION

Do not make any resistance measurements on the PP-6148/U other than those specified, or while the ac power cable is connected.

b. Voltage Measurement Precautions. When measuring voltages, use tape or sleeving to insulate the entire test probe, except for the extreme tip. A momentary short circuit can damage a transistor. (For example, if the bias resistor of a transistor is shorted out by touching both its emitter and base with the test probe, excessive current between the emitter and the base would damage the transistor.) Use the voltage and resistance diagram (fig. 3-1), to find the normal readings, and compare them with the readings taken.

3-3. Voltage and Resistance Measurements

The voltage and resistance measurements for all transistors in the PP-6148/U are indicated in the voltage and resistance diagram (fig. 3-1). Table 3-1 provides the dc voltage measurements for all integrated circuits and silicon control rectifiers (SCR's). Before making measurements, determine whether faulty operation is due to one of the components listed in figure 3-1 or table 3-1. To do this, follow the troubleshooting procedures (section III) and make the checks given in the applicable chart. Do not use resistance measurements as the sole basis for discarding any transistor as defective. Because of tolerances during manufacture, resistances of identical transistors may vary from the chart values.



NOTES

1. ALL VOLTAGE MEASUREMENTS ARE FROM DESIGNATED TERMINAL TO CHASSIS USING SEMICONDUCTOR DEVICE TEST SET TS-1836( )/U, NO SIGNAL CONDITIONS.
2. MAKE RESISTANCE MEASUREMENTS BETWEEN INDICATED TERMINALS WITH SEMICONDUCTOR DEVICE TEST SET TS-1836( )/U.
3. WHERE TWO RESISTANCE READINGS BETWEEN TERMINALS ARE GIVEN, THE TOP READING IS THE RESISTANCE MEASURED WITH THE POSITIVE OHMMETER LEAD CONNECTED TO THE BASE, THE BOTTOM READING IS THE RESISTANCE MEASURED WITH THE NEGATIVE OHMMETER LEAD CONNECTED TO THE BASE. BE SURE TO CHECK THE ACTUAL POLARITY OF THE OHMMETER LEADS BEFORE MAKING MEASUREMENTS.
4. SEE WAVEFORM DIAGRAM, FIGURE 3-2.

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Figure 3-1(1). Voltage and ResistanceDiagram (Sheet l of 9).

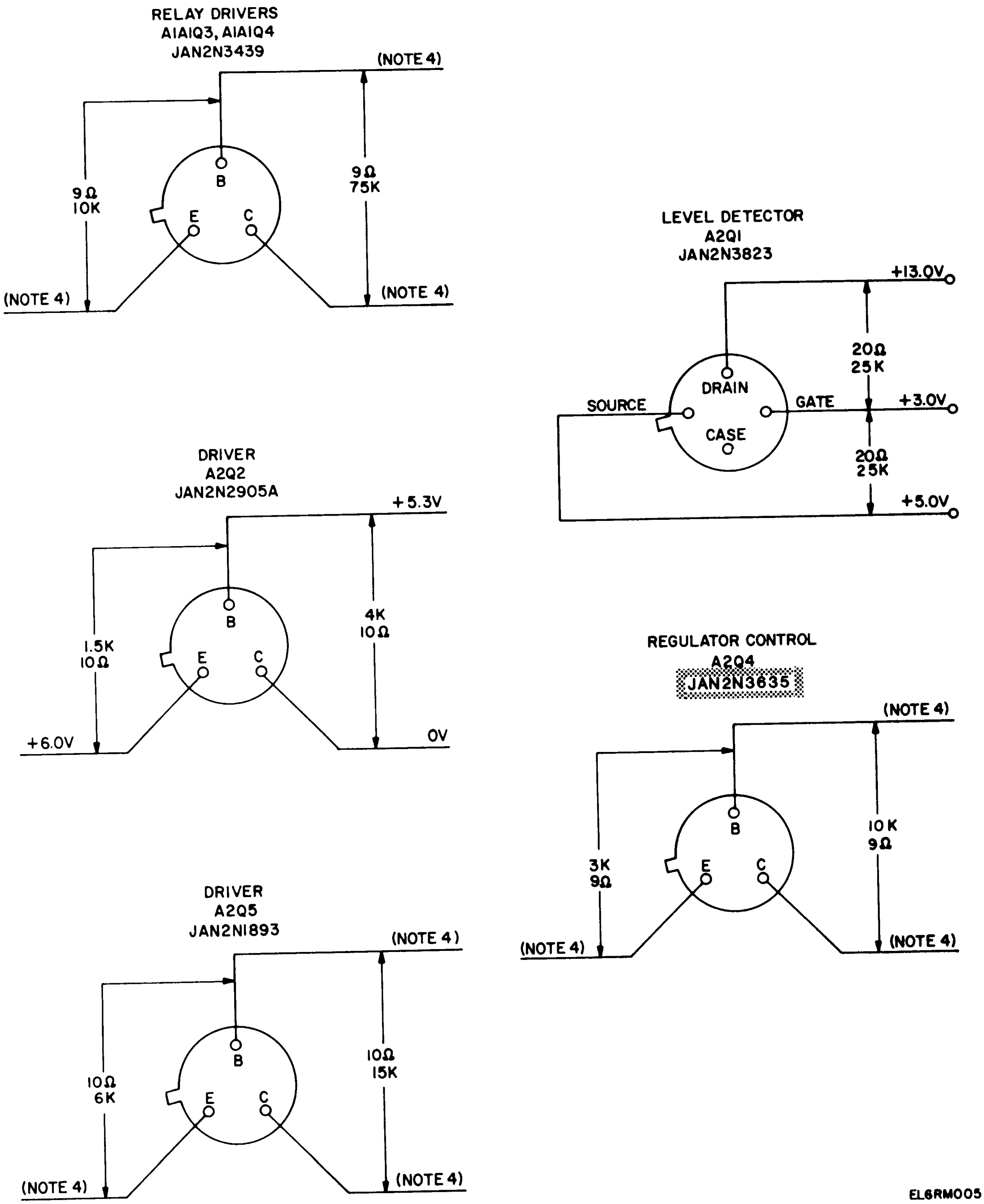


Figure 3-1(2) Voltage and Resistance Diagram (Sheet 2 of 3).

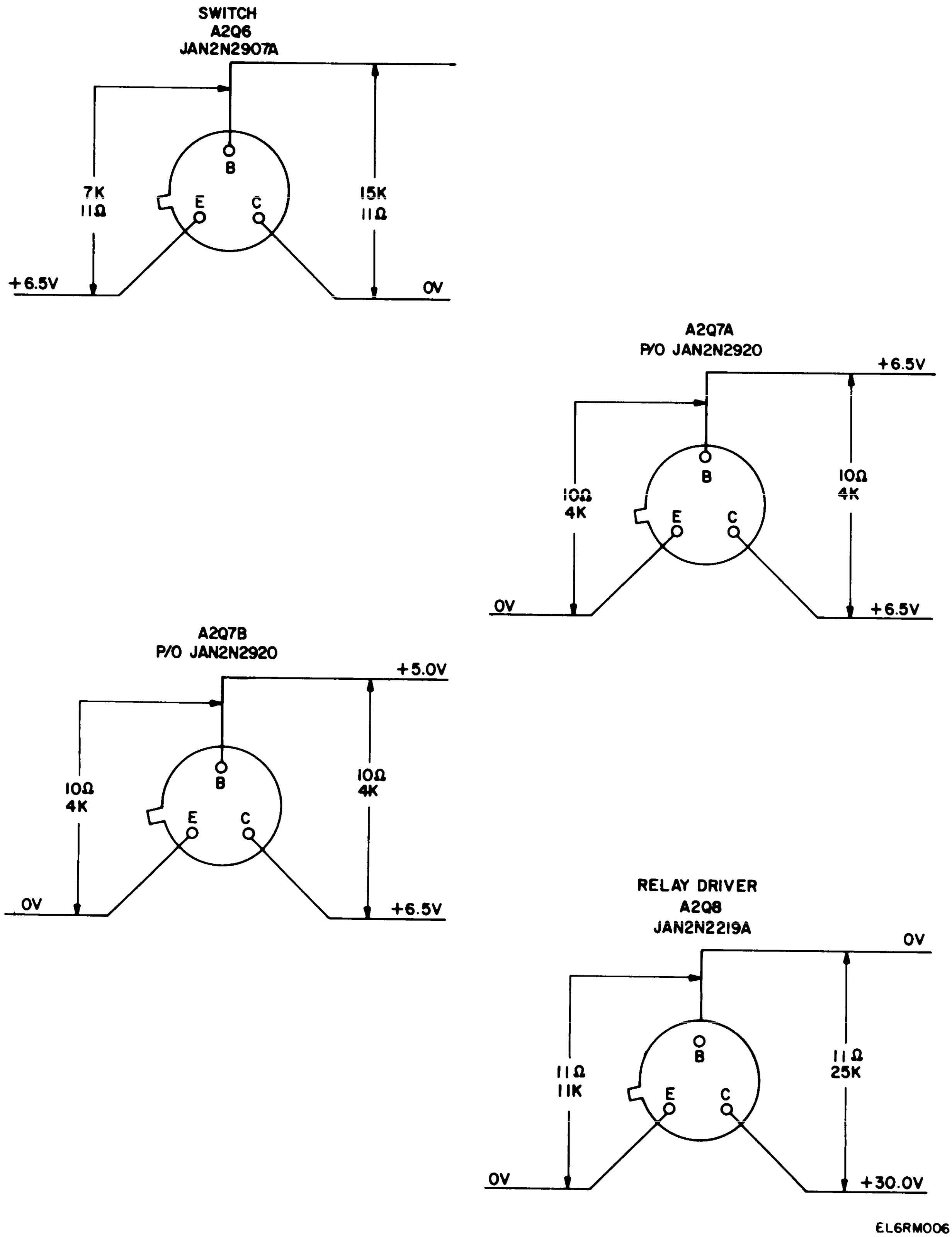


Figure 3-1(3). Voltage and Resistance Diagram (Sheet 3 of 3).

Preliminary Instructions for Table 3-1:

1. PP-6148/U connected to a 115 V ac, 60 Hz source.
2. PP-6148/U set for 28 V dc as indicated on the OUTPUT meter.
3. No output load.
4. AC and DC ON/OFF circuit breakers set to ON.
5. Oscilloscope internal sync used as applicable.
6. All readings are+ V dc measured to ground (anode VR3 or VR4 as indicated).

a. Table 3-1. Integrated Circuit and SCR Dc Voltage Measurement Chart

Integrated Circuit Measurements			SCR Measurements		
Ref des/ part number	Pin	**Reading**	Ref des/ part number	Terminal	Reading
A2U1/SM-C-595345 (GND VR3)	1	28	A2Q3/2N2324 (GND VR3)	Gate	o
	2,3,4	Not used		Cathode	0
	6	Ground		Anode	31
	6	8			
	7	Not used	A2Q9/2N2324 (GND VR4)	Gate	0
	8	31		Cathode	0
	9	28.6		Anode	28
	10	27.6			
			A2Q1O/VN67AB (GND VR3)	Gate	0.75
A2U2/SM-C-596345 (GND VR4)	1	Not used		Cathode	0
	2	7.3		Anode	0.8
	3	7.3			
	4	7.3	A2Q11/2N2324 (GND VR4)	Gate	12.6
	6	Ground		Cathode	12
	6	30			
	7,8	37		Anode	28
	9	29			
	10	Not used			

3-4. Waveform Diagram

Where a voltage meter level alone gives inadequate indication of circuit condition, the general nature of oscilloscope waveforms as shown in figure 3-2 should be observed. These waveforms are obtained with the PP-6148/U setup as follows:

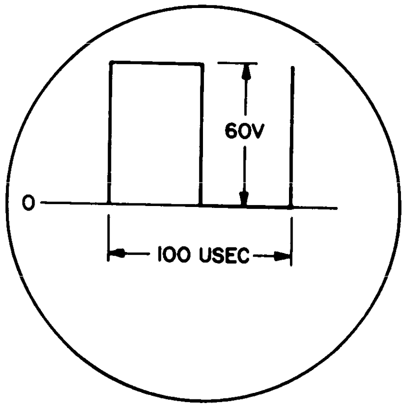
a. PP-6148/U connected to a 115 V ac, 60 Hz source.

b. PP-6148/U set for 28 V dc, as indicated on the OUTPUT meter.

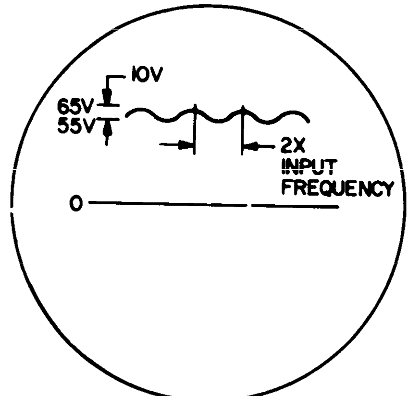
c. Approcimately 5.5 amperes output load.

d. AC and DC ON/OFF circuit breakers set to ON.

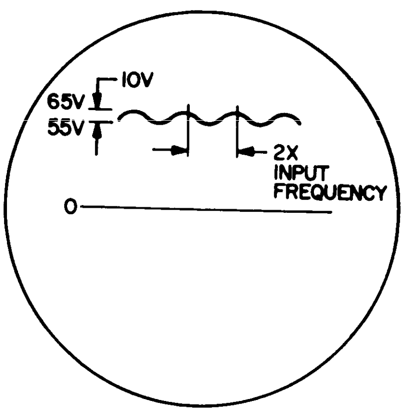
e. Oscilloscope internal sync used as applicable.



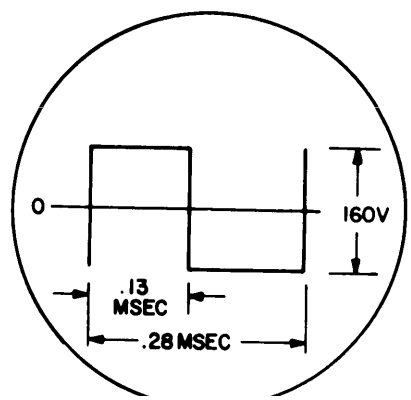
(A)
WAVEFORM AT EMITTER AND BASE 0F QI AND Q2 AND collector OF A204 TO DC OUTPUT CONNECTOR J2 (-) (J2-I OR KI-A2)



(e)
WAVEFORM AT COLLECTOR OF QI ANO Q2 AND EMITTER OF A2Q4 TO DC OUTPUT CONNECTOR J2 (-) (J2-I OR KI-A2)



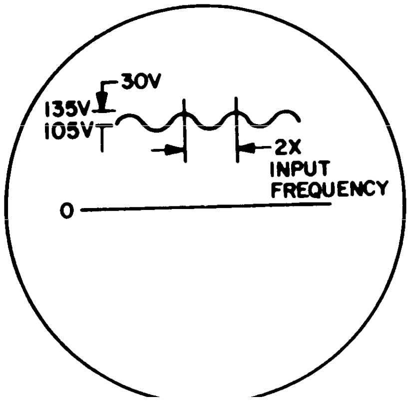
(C)
WAVEFORM AT COLLECTOR OF Q3 T0 DC OUTPUT CONNECTOR J2 (-) (J2-I OR KI-A2)



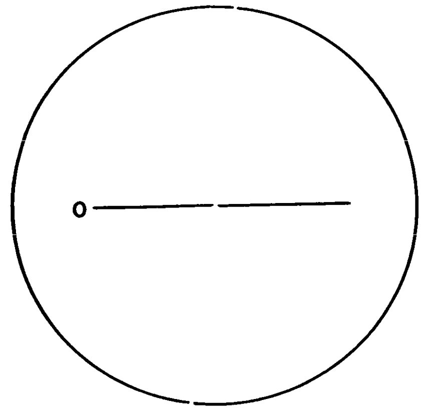
(D)
WAVEFORM AT EMITTER AND BASE OF AIQI AND AIQ3, AND COLLECTOR 0F AIQ2 AND AIQ4 TO GROUND

EL6RM007

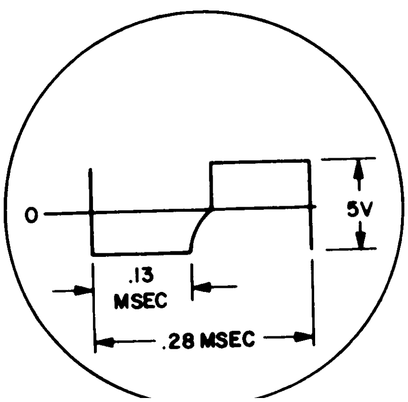
Figure 3-2(1). Waveform Diagram (Sheet 1 of 4).



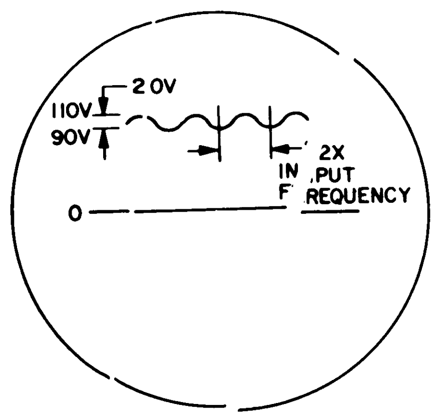
(E)
WAVEFORM AT COLLECTOR OF AIQI
AND AIQ3 TO GROUND



(F)
WAVEFORM AT EMITTER OF
AIQ2 AND AIQ4 To GROUND



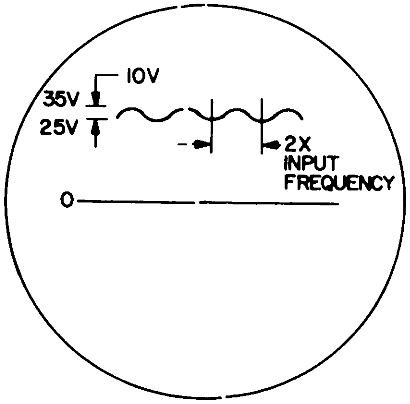
(G)
WAVEFORM AT BASE OF AIQ2 AND
AIQ44 TO GROUND



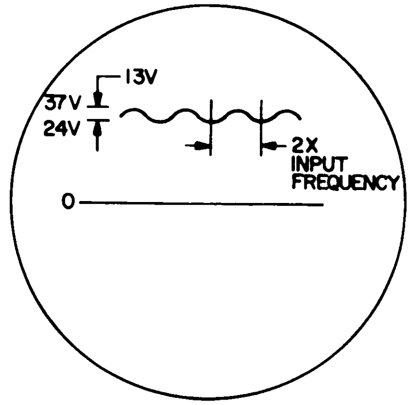
(H)
WAVEFORM AT EMITTER,BASE,
AND COLLECTOR OF AIAIQI AND
BASE OF AIAIQ3 TO GROUND

EL6RMOO

Figure 3-2(2). Waveform Diagram (Sheet 2 of 4).

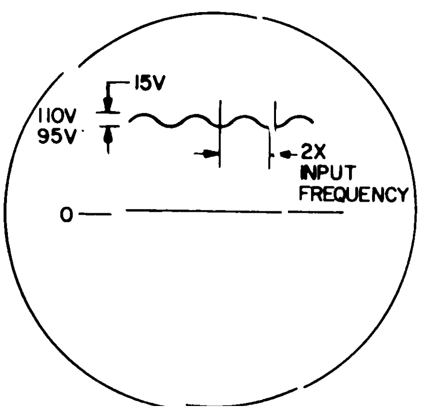


(1)
WAVEFORM AT EMITTER AND BASE
OF AIAIQ2 TO GROUND

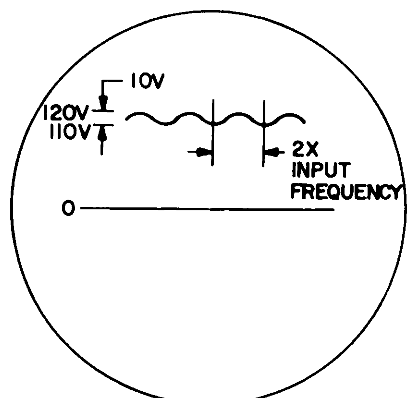


(J)
WAVEFORM AT COLLECTOR OF

TO GROUND



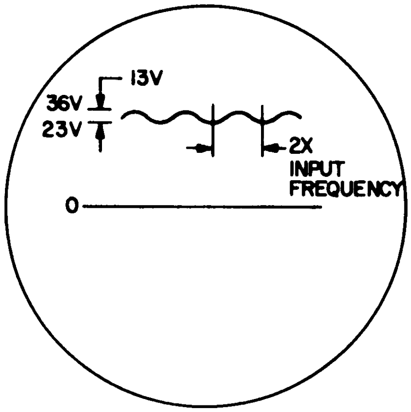
(K)
WAVEFORM AT EMITTER OF AIA103
TO GROUND



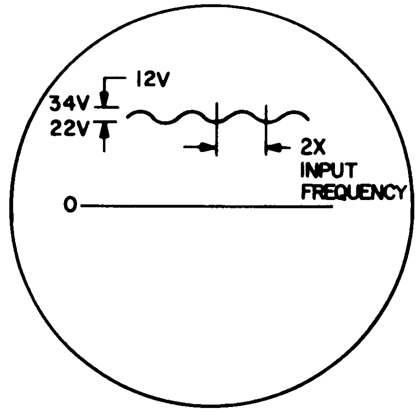
(L)
WAVEFORM AT COLLECTOR OF
AIAIQ3 TO GROUND

EL6RM009

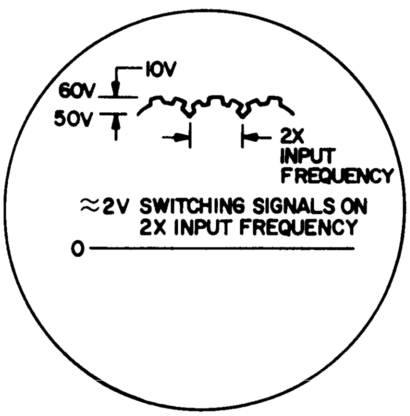
Figure 3-2(3). Waveform Diagram (Sheet 3 of 4).



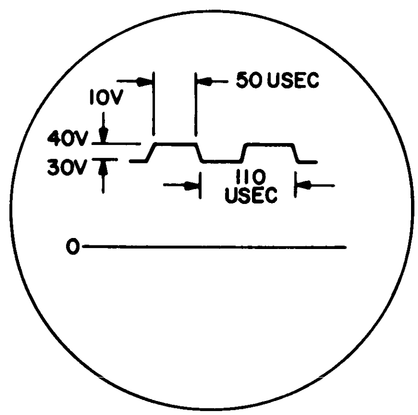
(M)
WAVEFORM AT EMITTER OF AIAIQ4
TO GROUND



(N)
WAVEFORM AT COLLECTOR OF
AIAIQ4 TO GROUND



(O)
WAVEFORM AT BASE OF A2Q4 AND
COLLECTOR OF A2Q5 TO DC OUTPUT
CONNECTOR J2 (-) (J2-I OR KI-A2)



(P)
WAVEFORM AT EMITTER AND BASE
OF A2Q5 TO DC OUTPUT
CONNECTOR J2(-) (J2-I OR KI-A2)

EL6RMOIO

Figure 3-2(4). Waveform Diagram (Sheet 4 of 4).

Section II. TOOLS AND EQUIPMENT

3-5. General

Refer to the repair parts and special tools list (RPSTL), TM 11-6130-356-34P, and the maintenance allocation chart, appendix D, TM 11-6130-356-12, for tools and equipment required to maintain the PP-6148/U.

3-6. Test Equipment Required

To perform maintenance tasks of this section, properly calibrated test equipment items of the following types (or suitable substitutes) are required:

a. Multimeter AN/USM-223/U,
b. Oscilloscope AN/USM-281.
c. Test Set, Semiconductor Device TS-1836( )/U.
d. Tool Kit, Electronic Equipment TK-105/G.
e. Transformer, Variable Power TF-510/U.
f. Voltmeter, Electronic ME-202( )/U.
g. Dummy Load, Electrical DA-638/U.

Section III. TROUBLESHOOTING

3-7. General

The first step in servicing a defective PP-6148/U is to localize the fault to a defective stage or circuit responsible for the abnormal condition. The second step is to isolate the fault to a specific defective part or parts. In localizing or isolating a fault, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble may be made to reappear by tapping or jarring the equipment. Check all internal wiring for poor solder connections or loose terminals if intermittent troubles are evident.

a. Localization. The defective stage or circuit can often be located by one of the following methods:

(1) Top panel OUTPUT meter indications (para 3-8).

(2) Visual inspection, the purpose of which is to localize faults without testing or measuring circuit voltages or resistances. Through this inspection, the repair technician frequently can discover troubles, such as burned resistors or arcing transformer, or determine the circuit in which the trouble exists. This inspection is valuable in avoiding additional damage which might occur through improper servicing methods, and in preventing future failures.

b. Isolation. Most defective parts must be isolated by checking voltages and resistances. Refer to paragraphs 3-2, 3-3, and 3-4 for voltage and resistance measurement procedures. In addition, the indications listed in the troubleshooting charts (table 3-2 thru 3-6) will aid in isolating the trouble.

3-8. Troubleshooting Procedures

Refer to the troubleshooting charts (tables 3-2 thru 3-6) for step-by-step procedures for systematic troubleshooting and fault isolation or localization of the rnalfunctioning PP-6148/U subassemblies or compon rots. In addition, using only the OUTPUT meter, CHARGE OVER indicator, and operator controls, and by carefully observing the results obtained while performing the operational checks of paragraph 3-4, TM 11-6130-356-12, a preliminary but effective analysis of fault location can be made of faults occurring from the voltage switching regulator to the output. (Refer to chapter 2 and figures FO-1, FO-2 and FO-3 for circuit descriptions, related component reference designations, and explanation of component color codes.)

a. When the input power source and output load have been verified as normal, and with both AC and DC circuit breakers in the ON position, if there is no OUTPUT meter indication in either 14V or 28V VOLT SELECT switch position, or in any CURRENT RANGE switch position while holding the VOLTS/AMPS switch at AMPS, the fault(s) could be in the regulator, converter, or input power circuits. However, in paragraph 3-4b, TM 11-6130-356-12, if the CHARGE OVER indicator does light, the fault location is in the meter, its switch(es) or connections.

b. In the absence of meter indications as in sub paragraph *a* above, if the CHARGE OVER indicator lights in only one VOLT SELECT switch position (14V or 28 V), correction of any meter circuit faugts should be followed by attention to the CHARGE OVER voltage cutoff level adjustment procedure (para 3-10) for the VOLT SELECT switch position in which the CHARGE OVER indicator did not light. If associated OUTPUT meter indications are subsequently observed to be normal, but the CHARGE OVER voltage cutoff level cannot be properly adjusted for one VOLT SELECT — switch positiion, the components and connections peculiar to that adjusting network are the probable fault location(s).

c. In circumstances where part of the OUTPUT meter indications (or responses) are normal, and others are not, the particular positions of the switches or the operation of control(s) associated with abnormal indications will reflect limited areas of probable fault location

(1) Abnormal indication observed only in one VOLT' SELECT switch positiion effectively eliminate input power/switching and H-switch conversion circuits from fault consideration. Fault location effort can be confined to circuits, components, and Connections, starting at the secondary of converter output transformer A1T2 through the limited circuit elements associated peculiarly with the pertinent switch positiin. It can be expected that consideration of all details of the abnormal indications will further limit the probable area of fault.

(2) If OUTPUT meter indications are normal (on both VOLT SELECT positions) in only one, two or three poditions of the CURRENT RANGE switch (while VOLTS/AMPS switch is held in AMPS position), the fault will be associated with the pertinent series (current limiting) resister on resistor plate assembly A3.

(3) If such abnormal meter indications are observed on CURRENT RANGE swich positions 1, 2, 4, and 8, A2R42 and CURRENT ADJUST control R2 should be checked.

(4) An abnormal meter indication observed only in position 10 of CURRENT RANGE switch (in both positions of VOLT SELECT) eliminates A2R42 and CURRENT ADJUST control R2 from fault consideratiom

(6) If OUTPUT meter voltage indications appear normal, except that abnormal variations are observed with line or load changes, attention is directed to the regulator circuit, primarily the integrated circuit module A2U2 and the transistor series pass elements,

d. If all panel meter indications (or responses) are normal, but the PP-6148/U does not operate an external load, probable fault locations(s) are either CB2 (the DC ON/OFF circuit breaker), or K1 and associated components/connections which could cause the dc output negative line to fail to close.

Table 3-2. PP-6148/U Troubleshooting Chart

Item of check	Test conditions	Meter Connection	Normal readings	Additional checks and remarks
Relay K1	Disconnect PP-6148/U from power source and load. AC: OFF DC: OFF	Use Multimeter AN/USM-223/U, RX1OO scale, to measure resistance between terminals Xl and X2.	300 ohms.	Replace relay K1 if shorted or open:
Power reactor L1	Same as above.	Use Multimeter AN/USM-229/U, RX1 scale, to measure resistance between terminals and 2.	0.31 ohm.	Replace power reactor L1 if open.
Power reactor L2	Same as above.	Same as above.	0.0175 ohm.	Replace power rdactor L2 if open.
Coil *L3*	Same as above.	Use Multimeter AN/USM-228/U, RX1 scale, to measure resistance between terminals 1 and 2.	B ohms.	Replace coil L9 if open.
Transformer T1	Same as above.	Use Multimatar AN/USM-223/U, RX1000 scale, to measure resistance between terminal 1 and 2; and RX10 8cale, to measure resistance between terminals 3 and 4.	6500/ ohms between terminals 1 and 2; 8.6 ohms between terminals 3 and 4.	Replace transformer T1 if short or open between either or both pairs of terminals.
Rectifier bridge CR1	PP-6148/U conneced to power source and load. AC: ON DC: ON	Use Multimeter AN/USM-223/U, to measure voltage across + and - terminals, and to verify ac input at appropriate terminals, if necessary.	140 to 360 V dc acrods + and - terminals, with ac input at appropriate terminals.	If 140 to 360 V dc across + and - terminals is absent, verify ac input at appropriate terminals; replace rectifier bridge CR1 if ac input is normal and no dc output.

Table 3-2. PP-6148/U Troubleshooting Chart-Continued

Item of check	Test conditions	Meter connections	Normal readings	Additional checks and remarks
Transistors Q1 and Q2	a Disconnect PP-6148/U from power source and load. AC: OFF DC: OFF	a Use Semi-conductor Device Test Set TS-1836 ( )/U to check transistors Q1 and Q2.	a See figure 3-1.	*a* Replace transistors Q1 and Q2 if abnormal readings are obtained.
	b. PP-6148/U connected to power source and load. AC: ON DC: ON	*b.* See figure 3-2 (A) and (B)	*b. See figure* 3-2 (A) and (B).	*b.* Replace transistors Q1 and Q2 if abnormal waveforms are observed.
Transistor Q3	*a* Disconnect PP-6148/U from power source and load. AC: OFF DC: OFF	a None.	a None	a Remove transistor Q3 and connect PP-6148/U to power source and load. With AC and DC ON-OFF circuit breaker ON, determine if unit operates. If it does, replace transistor Q3. If it does not, see table 3-5 and check integrated circuit A2U2.
	b. PP-6148/U connected to power source and load. AC: ON DC: ON	*b.* See figures 3-1 and 3-2 (c).	*b. See* figures 3-1 and 3-2 (C).	*b.* Replace Q3 if abnormal voltages and/or waveforms are observed.

Table 3-3. Cover Assembly Al Troubleshooting Chart

Item of check	Test conditions	Meter connections	Normal readings	Additional checks and remarks
Relay A1K1	Disconnect PP-6148/U from power source and load. AC: OFF DC: OFF	Use Multimeter AN/USM-223/U, RX1000 scale, to measure resistance between terminals Xl and X2.	7500 ohms.	Replace relay AlK1 if short or open.
Relay A1K2	Same as above.	Use Multimeter AN/USM-223/U, RX100 scale, to measure resistance between terminals Xl and X2.	300 ohms,	Replace relay A1K2 if short or open.
Relay A1K3	Same as above.	Use Multimeter AN/USM-223/U, RX1000 scale, to measure resistance between terminals Xl and X2.	7500 ohms.	Replace relay A1K3 if short or open.
Transformer A1T1	Same as above.	Use Multimeter, AN/USM-223/U, RX1 scale, to measure resistances between following terminals 1 and 2 3 and 4 5 and 6 7 and 8 9 and 10	1 and 2:0.175 ohm 3 and 4:0.066 ohm 5 and 6:0.055 ohm 7 and 8:0.055 ohm 9 and 10:0.055 ohm.	Replace transformer AIT1 if open between one or more pairs of terminals.

Table 3-3. Cover Assembly Al Troubleshooting Chart-Continued

Item of check	Teat conditions	Meter connections	Normal readings	Additional checks and remarks
Transformer A1T2	Same as above.	Use Multimeter AN/USM-223/U, RX1 scale, to measure resistances between following terminals: 1 and 2 3 and 4 5 and 7 8 and 10	1 and 2: 0.170 ohm 3 and 4: 0.185 ohm 5 and 7: 0.080 ohm 8 and 10: 0.019 ohm.	Replace transformer A1T2 if open between on a or more pairs of terminals.

Table 3-4. Converter Circuit Card Assembly AlAl Troubleshooting Chart

NOTE

When replacement of component(s) on converter circuit card assembly A1A1 is indicated in Additional check and remark column, refer to higher maintenance echelon.

Item of check	Test conditions	Meter connections	Normal readings	Additional checks and remarks
Diodes A1A1CR4 through A1A1CR15	Disconnect PP-6148/U from power source and load. AC: OFF DC: OFF	Remove one end of each diode, and use Semi-conductor Device Test Set TS-1836( )/U, to compare forward-to-back resistance.	Ratio of forward-to-back resistance should be greater than 1 to 100.	Replace if ratio of forward-to-back resistance for any diode is not greatar than 1 to 100. **NOTE** Check all of these diodes; checking only part of this group of diodes is not recommended
Transistors A1A1Q1 through A1A1Q4	Same as above.	Remove each transistor, and use Semi-conductor Device Test Set TS-1836( )/, RX1000 scale, to measure for high collector-to-emitter resistance.	Collector-to-emitter resistance should be greater than 100 ohms.	Replace transistor if collector-to-emitter resistance is less than 1000 ohms.

Table 3-5. Control Circuit Card Assembly A2 Troubleshooting Chart

NOTE

When replacement of component(s) on control circuit card assembly A2 is indicated in Additional checks and remarks column, refer to higher maintenance echelon.

Item of check	Test Conditions	Meter connections	Normal readings	Additional Check and remarks
Relay A2K1	Disconnect PP-6148/U from power source and load. AC: OFF DC: OFF	Use Multimeter AN/USM-223/U, RX100 scale to measure resistance between terminals Xl and X2.	700 ohms.	Replace relay A2K1 if short or open.
Relay A2K2	Same as above.	Use Multimeter AN/USM-229/U, RX1000 scale, to measure resistance between terminals Xl and X2.	10000 ohms.	Replace relay A2K2 if shorter or open.
Coil A2L1	Same as above.	Use Multimetar AN/USM-223/U, RX10 scale, to measure resistance between terminals 1 and 2.	72 ohms.	Replace coil A2L1 if tlhat or open.
Coil A2L2	Same as above.	Same as above.	Same as above.	Replace coil A2L2 if short or open.
Coil A2L3	Same as above.	Same as above.	Same as above.	Replace coil A2L3 if short or open.

Table 3-5. Control Circuit Card Assembly A2 Troubleshooting Chart-Continued

Item of check	Test conditions	Meter connections	Normal readings	Additional checks and remarks
Transistor A2Q3	PP-6148/U connected to power source and load; power source set for 400 Hz input. AC: ON DC: ON	Use Multimetar AN/USM-223/U, to measure voltage from terminal A2-36 to terminal A2-2.	Less than l V dc.	Replace transistor A2Q8 if voltage from terminal A2-36 to terminal A2-2 is greater than 1 V dc.
Integrated Circuit A2U1	PP-6148/U connected to power source and load AC: ON DC: ON CURRENT RANGE: 1	Connect a 10 amp load to output terminals and use output meter to check current.	Not greater than 2 amps.	Replace A2U1 if current is greatar than 2 amps.
Integrated Circuit A2U2	a. PP-6148/U connected to power source and load. AC: ON DC: ON	a. Use Multimeter AN/USM-29/U, to measure voltage across A2Q5.	a. Greater than 0.8 V dc.	a Replace integrated circuit A2U2 if voltage across A2Q5 is less than 0.8 V dc.
	b. Disconnect PP-6148/U from powor source and load, AC: OFF DC: OFF	b. None	b. None.	b. Remove transistor Q3 and Connect PP-6148/U to power source and load. With AC and DC ON-OFF circuit breakers ON, determine if unit operates. If it does not replace transister Q3 and integrated circuit A2U2.

Table 3-6 Resistor Plate Assembly A3 Troubleshooting Chart

Item of check	Test conditions	Meter connections	Normal readings	Additional checks and remarks
Resistors A3R1 through A3R6	Disconnect PP-6148/U from power source and load. AC: OFF DC: OFF	Use appropriate scale of Multimeter AN/USM-229/U to measure resistance of resistors A3R1 through A3R6.	A3R1: 2.2 ohms A3R2: 1 ohm A3R3: 0.45 ohm A3R4: 0.2 ohm A3R5: 0.05 ohm A3R6: 0.2 ohm.	Replace any open resistor. **NOTE** For resistance measurements of A3R5 and A3R6, one end of resistor A3R5 or A3R6 must be disconnected.

Section IV. MAINTENANCE OF PP-6148/U

3-9. General

This section consists of adjustment/alinement procedures, general parts replacement techniques, removal and replacement instructions, and disassembly and reassembly instructions applicable to the direct support maintenance level.

3-10. Adjustment/Alinement

This paragraph details the procedure for correctly and accurately readjusting the voltage throw-off (CHARGE OVER) levels. Readjustment of these levels should not be undertaken unless it has been demonstrated that the power supply output voltage is not within the specified range (i.e.) 16.0 to 16.4 V dc with VOLT SELECT 14V/28V switch at 14V or 32.0 to 32.8 V dc with VOLT SELECT 14V/28V switch at 28V. Refer to TM 11-6130-356-12, paragraph 3-4, Operational Checks. out-of-range voltage throw-off (CHARGE OVER) level should be verified by measurement using an electronic voltmeter with 0.2 percent accuracy or better, such as the ME-202( )/U, before the following adjustments are made. Similarly, the output voltage throw-off (CHARGE OVER) level must be monitored, with the ME-202( )/U at 0.1 V dc full scale sensitivity as the final adjustment are made.

a. Be sure that the maximum dc output voltage level of the PP-6148/U reasonably exceeds the voltage throw-off (CHARGE OVER) level to be set

(1) If the levels indicated on the front panel OUTPUT meter are not greater than 16.4 V dc with the VOLT SELECT 14V/28V switch at 14V, and greater than 32.8 V dc with the VOLT SELECT 14V128V switch at 28V, unlock and operate the VOLTAGE ADJUST control to verify that these output levels can be obtained (If necessary, operate and hold the CHARGE RESET switch to prevent trip-out while making these checks. Be sure the switch returns to the normal (up) position.)

(2) With the VOLT SELECT 14V/28V switch at 14V, operate the VOLTAGE ADJUST control for a front panel OUTPUT meter indication of 16 V dc, or just below trip-out level, whichever is lower.

b. Set the AC and DC ON/OFF circuit breakers to OFF, remove cover assembly Al and connect the ME-202( )/U to suitably monitor the dc output level. Use an internal negative connection to facilitate voltmeter nulling at the tripout level.

c. Set the AC and DC ON/OFF circuit breakers to ON, and operate the VOLTAGE ADJUST control to obtain an exact 16.9 V dc level as indicated on the ME-202( )/U (nuol function).

NOTE

If necessary, operate and hold the CHARGE RESET switch to prevent voltage throw-off circuit trip-out.

d. With the output level precisely set, observe the CHARGE OVER indicator, and adjust potentiometer A2R33 (fig. 4-2) carefully for trip-out threshold at this set level.

NOTE

If the trip-out level was low, potentiometer A2R33 should be adjusted in the clockwise direction if high, potentiometer A2R33 should be adjusted in the counterclockwise direction.

e. Operate CHARGE RESET switch and VOLTAGE ADJUST control alternately to verify that trip-out does not occur below 16.2 V dc, nor hold above 16.4 V dc as finally adjusted.

f. Repeat subparagraph c and d above with VOLT SELECT 14V/28V switch at 28V, with the output level set at 32.6 V dc, and adjusting potentiometer A2R26 (fig. 4-2) to obtain the desire trip out level for this range.

g. Repeat subparagraph e above to verify that trip-out does not occur below 32.4 V dc, nor hold above 32.8 V dc as finally adjuted

h. Set the AC and DC ON/OFF circuit breakers to OFF, disconnect the ME-202( )/U and reassemble and secure cover assembly Al.

i. Reconnect the ME-202( )/U to suitably monitor the dc output level, again operate the PP-6148/U, and make a final check to verify that the voltage throw-off levels remain within 16.1 to 16.4 V dc on the 14V range, and 32.2 to 32.8 V dc on the 28V range before the PP-6148/U is returned to service.

3-11. General Parts Replacement Techniques

All subassemblies and components of the PP-6148/U can be replaced without special procedures. The following precautions apply, hewer, specifically to this equipment.

a. Do not disturb the setting of any potentiometer.

b. The PP-6148/U is transistorized. Use a pencil-type soldering iron with a 25-watt maximum capacity. If the iron must be used with ac voltage, use on isolating transformer between the iron and the line. Use a higher-wattage soldering iron for heavier-duty soldering.

CAUTION

Do not use a soldering gun; damaging voltage may be induced into components.

c. When soldering semiconductor leads, solder quickly. Whenever wiring permits, use a heat sink (such as long-nosed pliers) between the soldered joint and the semiconductor. Use approximately the same length and dress of leads as used originally.

3-12. Repair

Locate the defective component or part with the aid of the parts location illustration: figure 3-3 for cover assembly Al, figure 3-4 for resistor plate assembly A3, and figure 3-5 for chassis mounted components.

3-13. Disassembly Instructions

Disassembly of the PP-6148/U is to be accomplished to the extent necessary to correct malfunctions. The instructions have been separated by areas. Disassemble the PP-6148/U in accordance with the applicable area to be repaired. Disconnect the power source, and set the AC and DC ON/OFF switches to OFF before beginning disassembly. Comply with precautionary instructions to avoid injury to personnel and damage to equipment. Before disconnecting a component, tag and identify all its connecting leads, connecting terminals or connecting points to facilitate reconnection.

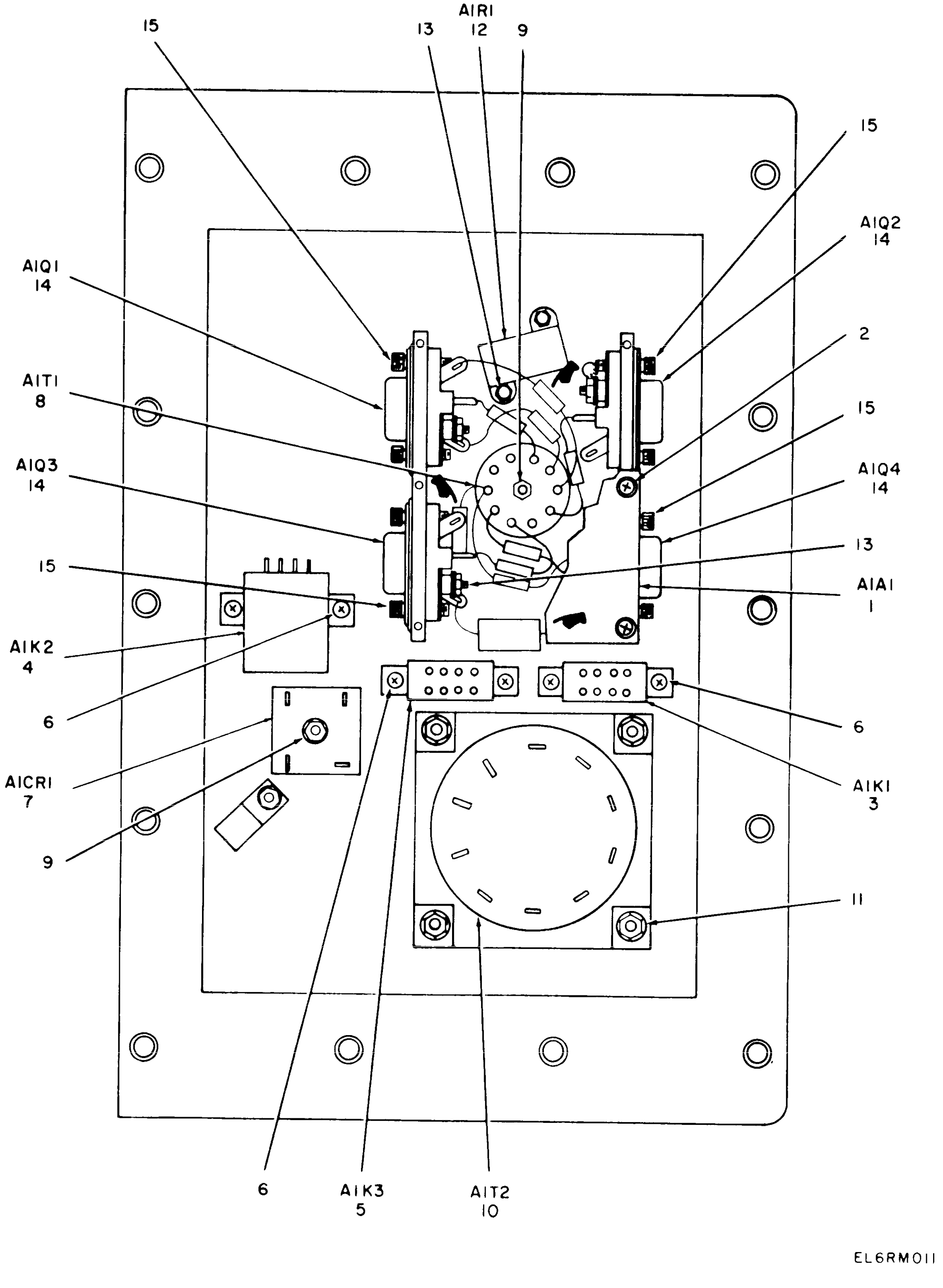


Figure 3-3. Cover Assembly A1, Parts Location Diagram.

3-14. Removal, Disassembly and Reassembly of Cover Assembly Al (fig. 3-3)

Legend for figure 3-3:
1. Converter cicuit card assembly AlAl
2. Screws (6) and washers (12)
3. Relay A1K1
4. Relay A1K2
5. Relay A1K3
6. Screws (2), washers (4), and spacers (2)
7. Semiconductor device A1CR1
8. Transformer A1T1
9. Nut and washers (2)
10. Transformer A1T2
11. Nuts (4) and washers (8)
12. Resistor AlR1
13. Nuts (2) and washers (4)
14. Transistors A1Q1 through A1Q4
15. Screws (2), washers (2), and disk

a. Removal. Remove cover assembly A1 (3, fig. 3-5) by loosening 14 captive screws (4).

b. Disassembly.

(1) Disconnect leads and remove converter circuit card assembly Al Al (1, fig. 3-3) by removing six screws and 12 washers (2).

NOTE

Components of converter circuit card assembly AlA1 are to be removed and replaced at the general support level only.

(2) Remove relay A1K1 (3), A1K2 (4) and A1K3 (5) by disconnecting leads and removing two screws, four washers, and two spacers (6) in each case.

(3) Remove semiconductor device A1CR1 (7) and transformer A1T1 (8) by disconnecting the leads and removing one nut and two washers (9) in each case.

(4) Remove transformer A1T2 (10) by disconnecting its leads, and removing four nuts and eight washers (11).

(5) Remove resistor AlR1 (12) by disconnecting its leads, and removing two nuts and four washers (13).

(6) Remove transistors A1Q1 through A1Q4 (14) by disconnecting the leads, and removing two screws, two washers and one disk (15) in each case.

c. Reassembly.

(1) Reinstall card assembly A1A1 (1) with six screws and twelve washers (2). Reconnect leads.

(2) Remount relays A1K1 (3), A1K2 (4), and A1K3 (5) by coating threads of spacers with sealing compound MIL-S-22473 (item 1, appx B), then reinstalling with two screws, four washers and two spacers (6) in each case. Reconnect leads.

(3) Remount semiconductor device A1CR1 (7) and transformer AlT1 (8) with one nut and two washers (9) in each case. Reconnect leads.

(4) Remount transformer A1T2 (10) with four nuts and eight washers (11). Reconnect leads.

(5) Remount resistor A1R1 (12) with two nuts and four washers (13). Reconnect leads.

(6) Remount transistors A1Q1 through A1Q4 (14) by applying a thin layer of grease DC340-50Z (item 2, appx B) to both sides of disk, and then reinstalling with two screws, two washers, and one disk (15) in each case. Reconnect leads.

3-15. Removal, Disassembly and Reassembly of Control Circuit Card Assembly AZ

a. Removal. Remove cover assembly Al (3, fig. 3-5) by loosening 14 captive screws (4).

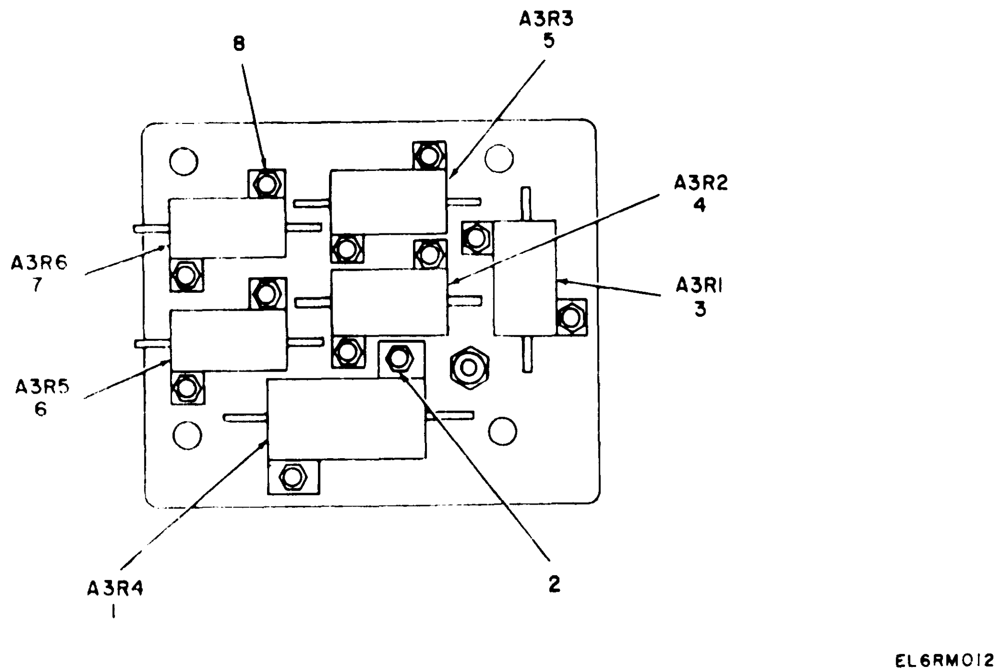
b. Disassembly. Disconnect all leads from control circuit card assembly A2 (6, fig. 3-5). Remove control circuit card assembly A2 by removing two screws and mounting clips (7), and four screws and eight washers (8).

NOTE

Components of control circuit card assembly A2 are to be removed and replaced at the general support level only.

c. Reassembly. Replace control circuit card assembly A2 (6) in the PP-6148/U with two screws and mounting clips (7), and four screws and eight washers (8). Reconnect leads. Apply sealing compound MIL-S-22473 (item 1, appx B) to the two screws and mounting clips (7) after replacement.

3-16. Removal, Disassembly and Reassembly of Resistor Plate Assembly A3 (fig. 3-4).



1. Resistor A3R4
2. Nuts (2) and washers (4)
3. Resistor A3R1
4. Resistor A3R2
5. Resistor A3R3
6. Resistor A3R5
7. Resistor A3R6
8. Nuts (2) and washers (2)

Figure 3-4. Resistor Plate Assembly A3, Parts Location Diagram

a. Removal. Remove cover assembly Al (3, fig. 3-5) by loosening 14 captive screws (4).

b. Disassembly.

(1) Disconnect all leads from resistor plate assembly A3 (9, fig. 3-5). Remove resistor plate assembly A3 by removing four nuts and eight washers (10).

(2) Disconnect leads from resistor A3R4 (1, fig. 3-4). Remove A3R4 by removing two nuts and four washers (2).

(3) Disconnect leads from resistors A3R1 (3), A3R2 (4), A3R3 (5), A3R5 (6), and A3R6 (7). Remove resistors by removing two nuts and two washers (8) in each case.

c. Reassembly.

(1) Reinstall resistor A3R4 (1) with two nuts and four washers (2). Reconnect leads.

(2) Replace resistors A3R1 (3), A3R2 (4), A3R3 (5), A3R5 (6), and A3R6 (7) with two nuts and two washers (8) in each case. Reconnect leads.

(3) Replace resistor plate assembly A3 (9, fig. 3-5) in the PP-6148/U with four nuts and eight washers (10). Reconnect leads.

3-17. Disassembly and Reassembly of Chassis Mounted Components (fig. 3-5)

Legend for figure 3-5(1):

1. Cover assembly
2. Gasket
3. Cover assembly Al
4. Captive screws (14)
5. Electronic shielding gasket
6. Control circuit card assembly A2
7. Screws (2) and mounting clips (2)
8. Screws (4) and washers (8)
9. Resistor plate assembly A3
10. Nuts (4) and washers (8)
11. Filters FL1 and FL2
12. Filters FL3 and FL4
13. Capacitors C1 through C4
14. Capacitor C5
15. Capacitors C6 and C7
16. Capacitor CR
17. Knob
18. Switch S1
19. Switch S2
20. Switches S3 and S4
21. Boot
22. Resistor R1
23. Resistor R2
24. CHARGE OVER indicator DS1, housing and lens
25. OUTPUT meter Ml
26. Washers (4)
27. DC output connector J2
28. Screws (4), washers (10), plate, and flat washer
29. Power reactor L1
30. Power reactor L2
31. Nuts (4) and washers (8)
32. Relay K1
33. Screws (2), washers (4), and spacers (2)
34. Rectifier bridge CR1
35. Nut and washers *(2)*
36. Diode CR2
37. Nut, flat washer, lock-washer, insulating washers (2), terminal lug, and bushing
38. Transistors Q1 and Q2
39. Screws (2), washers (2), and insulator
40. Transistor Q3
41. Heat sink
42. Screw
43. Transformer T1
44. Nuts (2) and washers (4)
45. Diode plate assembly
46. Screws (2) and washers (4)
47. Circuit breaker CB1
48. Circuit breaker CB2
49. Plate
50. Screws (5) and washers (10)
51. AC INPUT connector J1

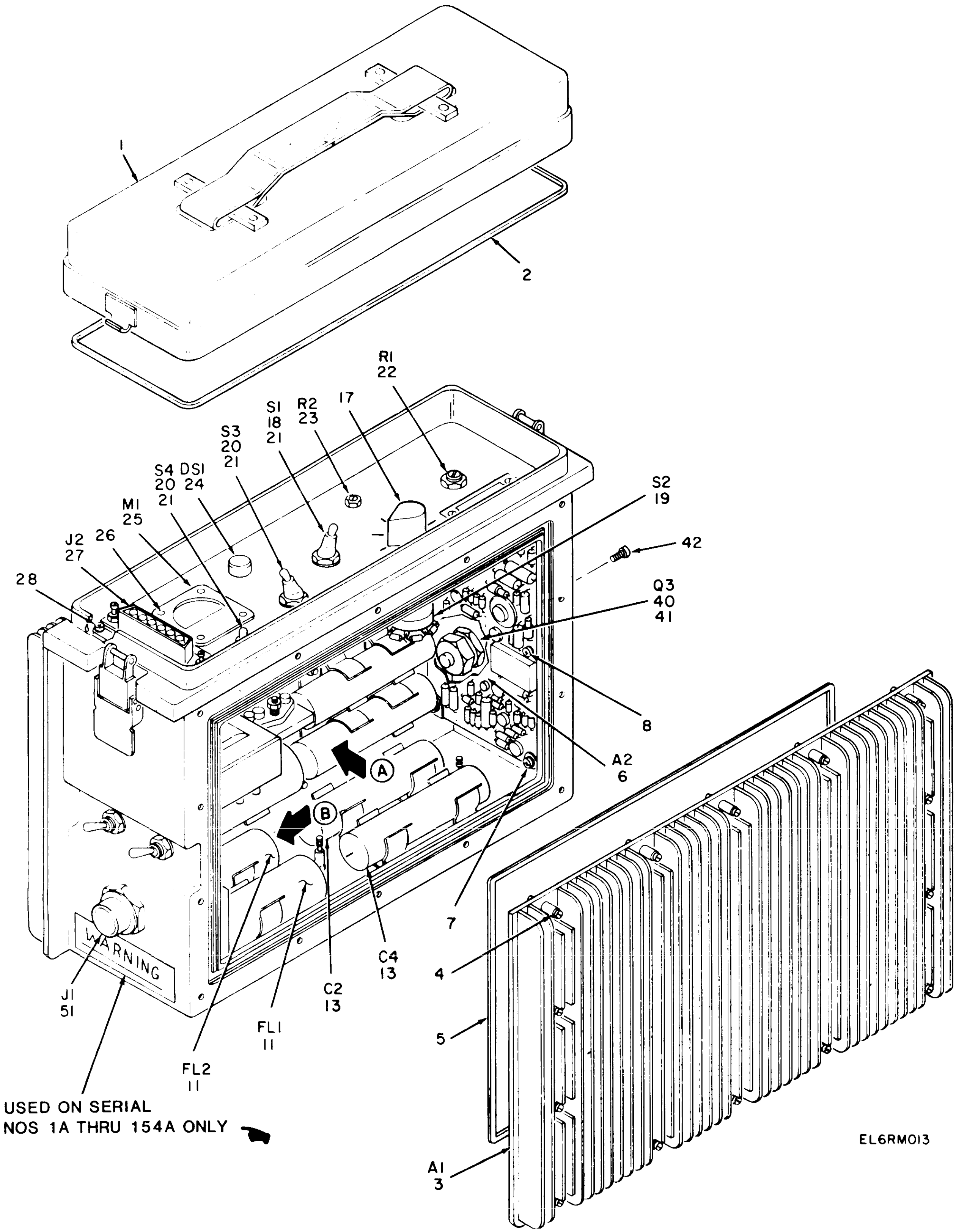
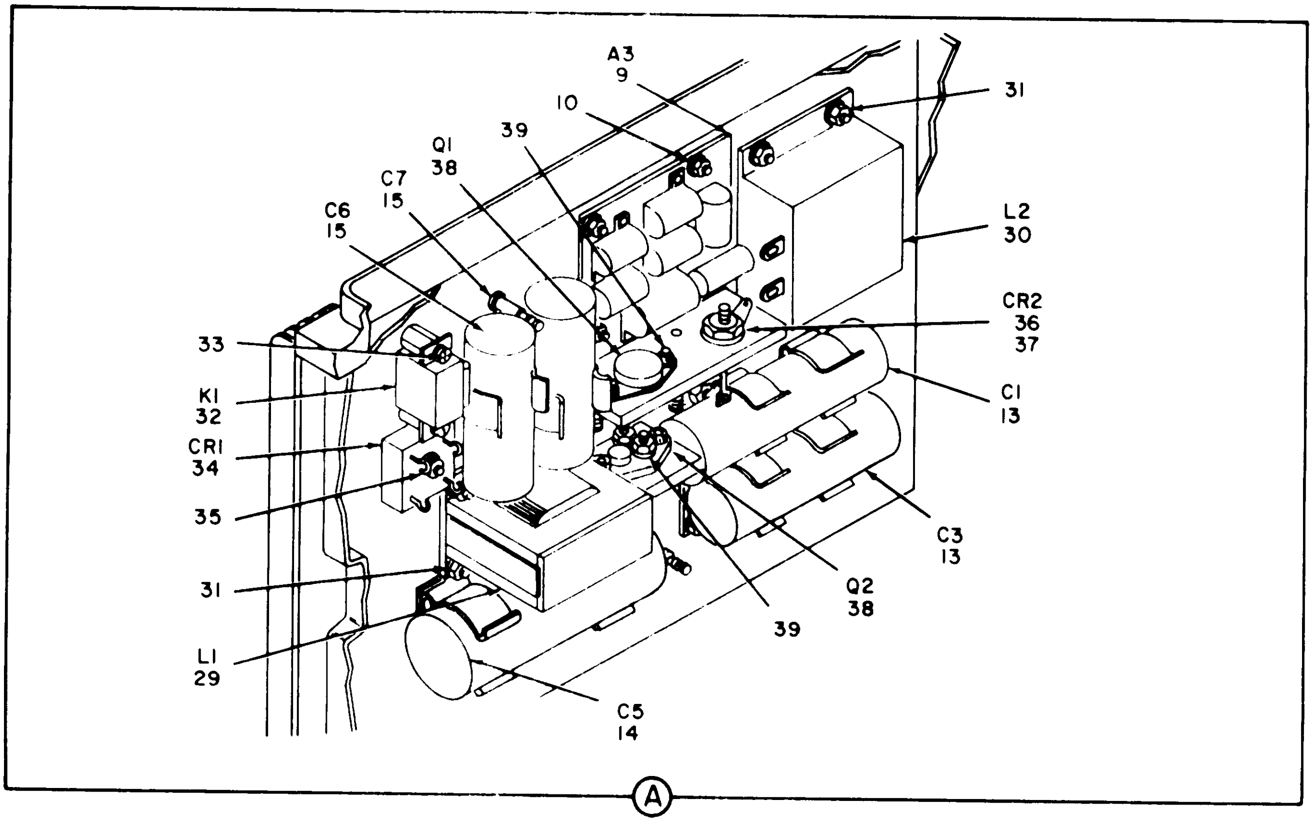


Figure 3-5(1). PP-6148/U Chassis Mounted Components, Parts Location Diagram (Sheet 1 of 2).



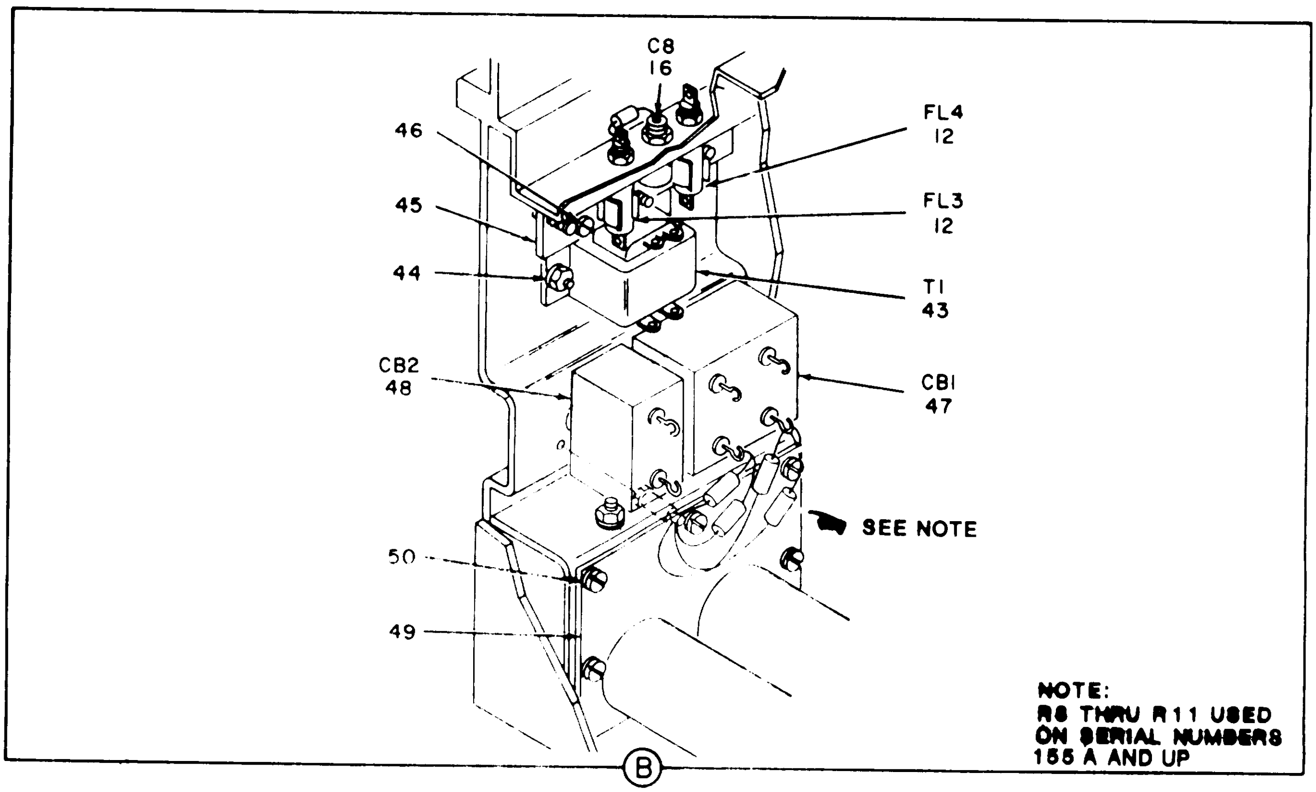


Figure 3-5(2). PP-6148/U Chassis Mounted Components, Parts Location Diagram (Sheet 2 of 2).

a. Cover Assembly. Unclamp and remove cover assembly (1). Remove gasket (2), if necessary.

b. Cover Assembly A1. Remove cover assembly A1 (3) by loosening 14 captive screws (4), and remove electronic shielding gasket (5) if necessary.

WARNING

Discharge capacitors before continuing with following procedures.

c. *Filters FL1 and FL2 (11), FL3 and FL4 (12).* Disassembly and reassembly of these filters is accomplished employing standard shop techniques. Apply sealing compound RTV-732 (item 3, appx B) to FL3 and FL4 (12) after replacement.

d. Capacitors C1 through C4 (13), C5 (14), C6 *and C7 (15), and C8 (26).* Disassembly and reassembly of these capacitors is accomplished employing standard shop techniques. Apply sealing compound RTV-732 (item 3, appx B) to C8 (16) after replacement,

e. *Switches S1 (18), S2 (19), S3 and S4* (20).

(1) *Disassembly.* Remove knob (17) from S2 (19) by loosening its setscrew. Disconnect leads from switch. S1 through S4 are removed by loosening and removing attaching hardware. Remove boot (21) from S1 (18), and S3 and S4 (20).

(2) Reassembly. Reinstall knob (17) on switch S2 (19), and reinstall S1 through S4 with hardware previously removed. Replace boot (21) on S1 (18), and S3 and S4 (20). Reconnect leads.

f. Resistors R1 (22) and R2 (23).

(1) Disassembly. Disconnect leads and remove attaching hardware.

(2) Reassembly. Remount resistors with hardware previously removed. Reconnect leads.

g. CHARGE OVER Indicator DSl (24).

(1) Disassembly. Unscrew counterclockwise until threads are disengaged, If necessary, separate the indicator from the lens.

(2) *Reassembly.* Replace housing with indicator and lens (24), with rubber O-ring in place. Reengage threads and tighten fingertight, making sure that the rubber O-ring seats and seals properly.

h. OUTPUT Meter Ml (25).

(1) Disassembly. Remove leads. Remove meter (25) by loosening and removing attaching hardware and four washers (26).

(2) *Reassembly.* Remount meter (25) with attaching hardware and four washers (26). Reconnect leads.

i. De Output Connector J2 (27).

(1) Disassembly. Disconnect leads. Remove connector (27) by removing four screws, ten washers, one plate and one flat washer (28).

(2) *Reassembly.* Reinstall connector *(27)* with four screws, ten washers, one plate, and one flat washer (28).

j. Power Reactors L1 (29) and L2 (30).

(1) Disassembly. Disconnect leads from reactors (29) and (30). Remove reactors by removing four nuts and eight washers (31).

(2) *Reassembly.* Reinstall reactors (29) and (30) with four nuts and eight washers (31). Reconnect leads.

k. Relay Kl (32). Disconnect leads, Remove K1 (32) by removing two screws, four washers, and two spacers (33). Reinstall relay (32) with two screws, four washers, and two spacers (33). Reconnect leads. Apply sealing compound MII.-S-22473 (item 1, appx B) to the relay.

1. Rectifier Bridge CR1 (34). Disconnect leads. Remove CR1 (34) by removing one nut and two washers (35). Reinstall CR1 (34) with one nut and two washers (35). Reconnect leads.

m. Diode CR2 (36). Disconnect leads. Remove CR2 (36) by removing one nut, one flat washer, one lockwasher, two insulating washers, one terminal lug, and one bushing (37). Reinstall CR2 (36) with one nut, one flat washer, two insulating washers, one terminal lug, and one bushing (37). Reconnect leads.

n. Transistor Q1 and Q2 (38).

(1) *Disassembly.* Disconnect leads. Remove transistors by removing two screws, two washers, and one insulator (39).

(2) *Reassembly.* Apply a thin layer of grease DC 340-502 (item 2, appx B) to insulator, and reinstall transistor (38) with two screws, two washers, and insulator (39), Reconnect leads.

o. *Transistor* Q3 (40).

(1) *Disassembly.* Disconnect leads. Remove transistor (40) and its heat sink (41) by removing one screw (42).

(2) *Reassembly.* Apply a thin layer of grease DC 340-502 (item 2, appx B) to heat sink (41). Reinstall transistor (40) and heat sink (41) with screw (42). Reconnect leads.

p. Transformer TI (43). Disconnect leads. Remove T1 (43) by removing two nuts and four washers (44). Reinstall T1 (43) with two nuts and four washers (44). Reconnect leads,

q. Diode Plate Assembly (45) Disconnect leads. Remove diode plate assembly (45) by removing two screws and four washers (46). Remount diode plate assembly (45) with two screws and four washers (46). Reconnect leads.

r. Circuit Breakers CB1 (47) and CB2 (48). Disconnect leads. On serial numbers 155A and up, disconnect leads and resistors R8 through R11 from CB1. Remove circuit breaker by removing its attaching hardware. Reinstall circuit breaker with attaching hardware. Reconnect leads. On serial numbers 155A and up, reconnect leads and resistors R8 thru R11 to CB1. Apply insulating compound RTV-3 140(item 4, appx B) after replacement.

s. AC INPUT Connector Jl (51).

(1) Disassembly. Remove plate (49) by removing five screws and 10 washers (50). Disconnect leads to connector J1. Remove connector J1 (51) by loosening and removing its attaching hardware.

(2) *Reassembly*. Reinstall connector J1 (51) with its attaching hardware. Reconnect leads. Replace plate (49) with five screws and 10 washers (50).

t. If previously removed, replace gasket (5) by cutting gasket 07-0101-004 (item 5, appx B) to required length and affixing with adhesive 1711 SCOTCH -GRIP (item 6, appx B). Replace cover assembly A1 (3) by tightening 14 captive screws (4).

u. If previously removed, replace gasket (2) by cutting gasket R431N (item 7, appx B) to required length and affixing with adhesive 1711 SCOTCH-GRIP (item 6, appx B). Clamp cover assembly (1) to PP-6148/U.

Section V. DIRECT SUPPORT TESTING PROCEDURES

3-18. General

Direct support testing procedures are required to determine whether the performance of repaired equipment is satisfactory for its return to users. Each of the following test procedure charts is preceded by appropriate instructions for setting up and interconnecting any applicable test equipment to the equipment to be tested. Be sure to follow the procedural steps in the order given and set all controls accurately.

3-19. Modification Work Orders

Currently, MWO 11-6130-50-1 is applicable to the PP-6148/U .

3-20. Physical Test and Inspection

a. Test Equipment and Materials. Tool Kit, Electronic Equipment TK-105/G.

b. Procedure.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	Tool Kit, Electronic Equipment TK-105/G	Controls may be in any position.	Inspect all controls and switches for loose or missing hardware.	Hardware must be tight; none missing.
2	N/A	Controls may be in any position.	Inspect ac power input cable for any evidence of corrosion, loose connections, or damaged insulation.	No corrosion, loose connections, or damaged insulation.
3	N/A	Controls may be in any position.	Inspect battery charger adapter cable for any evidence of corrosion, loose connections, or damaged insulation,	No corrosion, loose connections, or damaged insulation.
4	N/A	Controls may be in any position.	Inspect handle for any evidence of cuts, tears, or weakening when the protective top panel cover is secured to the PP-6148/U	No cuts, tears, or weakening.
5	Tool Kit, Electronic Equipment TK-105/G	Controls may be in any position.	Inspect external terminals for loose hardware or any evidence of dirt or corrosion.	Hardware must be tight; no dirt or corrossion evident.
6	N/A	Controls may be in any position.	Inspect exterior metal surfaces of the PP-6148/U for excessive dust, dirt, grease, or moisture and any evidence of rust or corrosion.	No dust, dirt, grease moisture, rust, or corrosion.

3-21. Voltage Tests, Input and Output

a Test Equipment and Materials.

(1) Transformer, Variable Power TF-510/U.
(2) Ac power input cable.
(9) Multimeter AN/USM-223/U (2 required).
(4) Voltmeter, Electronic ME-202( )/U.
(5) Dummy Load, Electrical DA-638/U.
(6) 115-230 volt, 400 Hz power source.

b. Test Connections and Conditions. The test procedures for performing the voltage tests are to be performed with the PP-6148/U disconnected from its operational load (communications equipment or battery to be charged). Figure 3-6 shows the basic teat setup to be used for performing the voltage tests, as well as other tests in this section

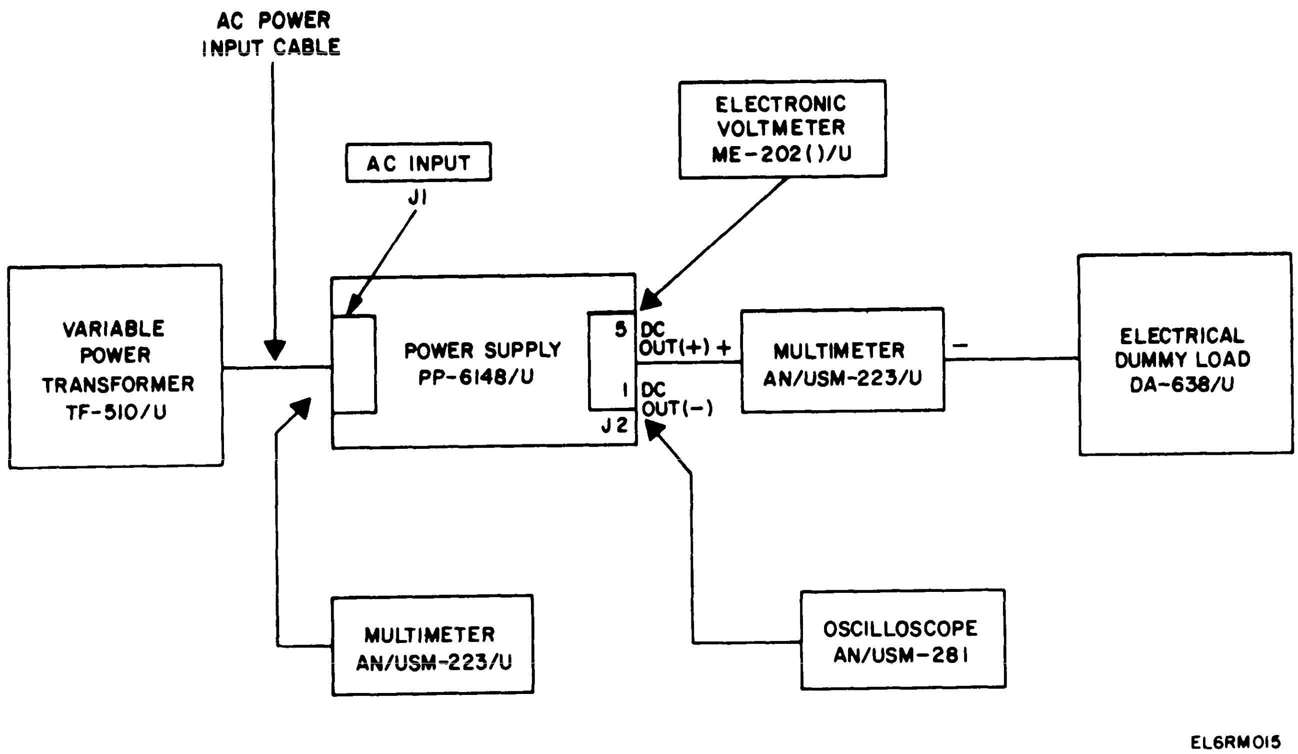


Figure 3-6. Basic Tent Setup Diagram

c. Initial Test Equipment Settings. Connect the test equipment to the power source and allow a 10-minute warmup period before starting the procedure in paragraph *d* below.

d. Procedure.

Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Teat procedure	Performance standard
1	TF-510/U, AN/UsM-229/U, and ME-202( )/U: POWER: OFF	*AC:* OFF DC: OFF	Connect the test equipment to the power supply as shown in figure 3-6.	None
2	TF-510/U: Set for 116 Vac/60 Hz operation as read on AN/USM-229/U. (Readjust during test as necessary.) DA-638/U: Set for an Ammeter AN/USM-223/U reading of 0 amps. (Disconnect load if necessary.)	VOLT SELECT 14V/ 28V: 14V CURRENT RANGE: 10 VOLTAGE ADJUST: Set fully counterclockwiee AC: ON DC: ON	*a.* Set AC ON-OFF and DC ON-OFF switches to ON position. *b.* Slowly rotate VOLTAGE ADJUST control clockwise.	a. ME-202( )/U indicates no more than 12.0 V dc. b. CHARGE OVER indicator lights when output voltage is between 16.0 and 16.4 V dc (as read on ME-202( )/U.

d. Procedure-Continued.

Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Test procedure	Performance standard
(cont)			*c.* Reduce output voltage below 16.0V dc and press CHARGE RESET switch to down position.	*c.* CHARGE OVER indicator goes out.
			d. Rotate VOLTAGE ADJUST control fully clockwise, while holding CHARGER RESET switch down.	*d.* ME-202( )/U indicates at least 16.5 V dc.
			e. Set the DA-638/U for an AN/USM-223/U reading of 5.0 ± 0.2 amps and rotate VOLTAGE ADJUST control counterclockwise until ME- 202( )/U indicates 16.0 ± 0.1 V dc.	e. ME-202( )/U indicates 16.0 ± 0.1 V dc.
			Set the DA-638/U for an AN-USM-223/U reading of 8.5 ± 0.5, 0.0 amps.	*f.* ME-202( )/U indicates 16.0 ± 0.1 V dc ± 2.0%
			g. Set the DA-638/U for an AN/USM-223/U reading of 0 amps. (Disconnect load if necessary.)	g. ME-202( )/U indicates 16.0 ± 0.1 V dc ± *2.0%*
			h. Set the DA-638/U for an AN/USM-223/U reading of 5.0 ± 0.2 amps and rotate VOLTAGE ADJUST control counterclockwise until ME- 202( )/U indicates 12.0 ± .01 V dc.	*h.* ME-202( )/U indicates 12.0 ± 0.1 V dc.
			i. Set the DA-638/U for an AN/USM-223/U reading of 8.5 + 0.5, 0.0 amps	*i.* ME-202( )/U indicates 12.0 ± 0.1 vdc ± 2.0
			j. Set the DA-638/U for an AN/USM-223/U reading of 0 amps. (Disconnect load if necessary.]	*j.* ME- 202( )/U indicates 12.0 ± .01 V dc ± 2.0%
3	Same as step No. 2.	Same as step No. 2, excep VOLT SELECT 14 V/28V: 28V.	*a.* Verify AC ON-OFF and DC ON-OFF switches in ON position.	*a.* ME-202( )/U indicates no more than 24.0 V dc.
			b. Slowly rotate VOLTAGE ADJUST control clockwise.	*b.* CHARGE OVER indicator lights when output voltage is between 32.0 and 32.8 V dc (as read on ME-202( )/U.
			c. Reduce output voltage below 32.0 V dc and press CHARGE RESET switch to down position.	c. CHARGE OVER indicator goes out.
			d. While holding CHARGE RESET switch down, rotate VOLTAGE ADJUST CONTROL clockwise until ME-202( )/indicates at least 33.0 V dc.	*d.* ME- 202( )/U indicates at least 33.0 V dc.

d. Procedure-Continued.

Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Test procedure	Performance standard
3 (cont)			Set the DA-638/U for an AN/USM-223/U reading of 5.0 ± 0.2 amps and rotate VOLTAGE ADJUST control counterclockwise until ME-202( ) U indicates 24.0 ± 0.1 V dc.	e ME - 202( )\U indicates 24.0 ± 0.1 V dc.
			Set the DA-638/U for an AN/USM-223/U reading of 8.5 + 0.5, -0.0 amps.	*f.* ME-202( )/U indicates 24.0 ± 0.1 V dc ± 1.5%
			Set the DA-638/U for an AN/USM-223/U reading of 0 amps (Disconnect load if necessary.)	*g.* ME-202( )/U indicates 24.0 ± 0.1 V dc ± 1.5%
			Set the DA-638/U for an AN/USM-223/U reading of 5.0 ± 0.2 amps and rotate VOLTAGE ADJUST control clockwise until ME-202( )/U indicates 32.0 ± 0.1 V dc.	*h.* ME-202( )/U indicates 32.0 ± 0.1 V dc.
			Set the DA-638/U for an AN/USM-223/U reading of 10.0 ± 0.5 amps.	*i.* ME-202( )/U indicates 32.0 ± 0.1 V dc ± 1.5%.
			Set the DA-638/U for an AN/USM-223/U reading of 0 amps. (Disconnect load if necessary.)	*j.* ME-202( )/U indicates 32.0 ± 0.1 V dc ± 1.5%.
4	Same as step No. 2.	Same as step No. 2.	Rotate VOLTAGE ADJUST control clockwise until ME-202( )/U indicates 14.0 ± 0.1 V dc.	a. OUTPUT meter on PP-6148/U top panel indicates 14.0 ± 0.1 V dc ± approximately one-half a meter face division.
			Set the DA338/U for an AN/USM-223/U reading of 8.5 + 0.5, –0.0 amps, and hold the VOLTS/ AMPS switch on PP-6148/U top panel in AMPS Position.	*b.* OUTPUT meter on PP-6148/U top panel indicates 10.0 ± 0.5 amps ± approximately one-half a meter face division.
			c. Set the DA-638/U for an AN/USM-223/U reading of 0 amps (Disconnect load if necessary.)	*c.* ME-202( )/U indicates 14.0 ± 0.1 Vdc ± 2.0%.
5	Same as step No. 2.	Same as step No. 2, except VOLT SELECT 14 V/28V: 28V.	*a.* Rotate VOLTAGE ADJUST control clockwise until ME-202( )/U indicates 28,0 ± 0.1 V dc.	*a.* OUTPUT meter on PP-6148/U top panel indicates 28.0 ±0.1 V dc ± approximately one-half a meter face division.
			b. Set the DA-638/U for an AN/USM–223/U reading of 8.5 + 0.5, –0.0 amps, and hold the VOLTS/ AMPS switch.	*b.* OUTPUT meter on PP-6148/U top panel indicates 10.0 ±0.5 amps ± approximately one-

d. Procedure–Continued.

Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Tes procedure	Performance standard
5 (cont)			on PP-6148/U top panel in AMPS position.	half a meter face division.
			c. Set the DA-638/U for an AN/USM-223/U reading of 0 amps. (Disconnect load if necessary.)	*c.* ME-202( )/U in. dicates 28.0 ± 0.1 V dc ± 1.5%.
6	Same as step No. 2	VOLT SELECT 14V/28V: 14V CURRENT RANGE: 10 VOLTAGE ADJUST: Set fully counterclockwise AC: ON DC: ON	*a.* Set the DA-638/U for an AN/USM-223/U reading of 5.0 ± 0.2 am-ps.	*a.* None.
			b. Rotate VOLTAGE ADJUST control clock-wise until ME-202( )/U indicates 14.0 ± 0.l V dc.	*b.* ME-202( )/U in-dicates 14.0 ± 0.1 V dc.
			c. Set the DA 638/U for an AN/USM-223/U reading of 8.5 ± 0.5, 0.0 amps.	*c.* ME-202( )/U in-dicates 14.0 ± 0.1 V dc ± 2.0%.
			d. Set the DA-638/U for an AN/USM-223/U reading of 0 amps. (Disconnect load if necessary).	*d.* ME-202( )/U in-dicates 14.0 ± 0.1 V dc 2.0%.
7	Same as step No. 2.	Same as step No. 6, except VOLT SELECT 14 V/28V: 28V.	*a.* Set the DA-638/U for an AN-USM-223/U reading of 5.0 ± 0.2 am-ps.	*a.* None.
			b Rotate VOLTAGE ADJUST control clock-wise until ME-202( )/U indicates 28.0 ± 0.1 V dc.	*b.* ME-202( )/U in-dicates 28.0 ± 0.1 V dc.
			c. Set the DA638/U for all AN/USM-223/U reading of 8.5± 0.5, 0.0 amps	*c.* ME -202( )/U in-dicates 28.00.1 V dc ± 1.5%.
			d Set the DA-638/U for an AN/USM-223/U reading of 0 amps. (Disconnect load if necessary.)	*d.* ME-202( )/U in-dicates 28.0 ± 0.1 V dc ± 1.5%.
8	TF-510/U: Set for 230 Vac/60 Hz operation as read on AN/USM-223/U. (Readjust during test as necessary.) DA-638/U: Set for an AN/USM-223/U reading of **0** amps. (Disconnect load if necessary.)	Same as step No. 6.	*a* Set the DA-638/U for an AN/USM-223/U reading of 5.0 ± 0.2 am-ps.	a. None
			b. Rotate VOLTAGE ADJUST control clock-wise until ME-202( )/U indicates 14.0 to 0.1 V dc.	*b.* ME-202( )/U in-dicates 14.0 ± 0.1 V dc.
			c. Set the DA-638/U for an AN/USM-223/U reading of 8.5 + 0. 5, 0.0 amps.	*c.* ME-202( )/U in-dicates 14.0 ± 0.1 V dc 2.0%.
			d. Set the DA-638/U for an AN/USM-223/U reading of 0 amps. (Disconnect load if necessary)	*d.* ME-202( )/U in-dicates 14.0 ± 0.1 V dc 2.0%.

d. Procedure–Continued.

Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Test procedure	Performance standard
9	Same as step No. 8.	Same as step No. 6, except VOLT SELECT 14V/28V: 28V.	*a.* Set the DA-638/U for an AN/USM-223/U reading of 5.0 ± 0.2 amps. *b.* Rotate VOLTAGE ADJUST control clockwise until ME-202( )/U indicates 28.0 ± 0.1 V dc. *c.* Set the DA-4338/U for an AN/USM-223/U reading of 8.5 + 0.5, –0.0 amps. *d.* Set the DA-638/U for an AN/USM-223/U reading of 0 amps. (Disconnect load if necessary.)	*a.* None. *b.* ME-202( )/U indicates 28.0 ± 0.1 V dc. *c.* ME-202( )/U indicates 28.0 ± 0.1 V dc ± 1.5%. *d.* ME-202( )/U indicates 28.0 ± 0.1 V dc + 1.5%.
10	TF-510/U: Set for 115 Vat/ 400 Hz operation as read on AN/U SM-223/U. (Readjust during test as necessary.) DA-638/U: Set for an AN/ USM-223/U reading of 0 amps. (Disconnect load if necessary.)	Same as step No. 6 and 7.	Same as step No. 6 and 7.	Same as step No. 6 and 7.
11	TF-510/U: Set for 230 Vat/ 400 Hz operation as read on AN/USM-223/U. (Readjust during test as necessary.) DA-638/U: Set for an AN/USM-223/U reading of 0 amps, (Disconnect load if necessary.)	Same as step No. 6 and 7.	Same as step No. 6 and 7.	Same as step No. 6 and 7.
12	TF-510/U, AN/USM-223/U, and ME-202( )/U: POWER: OFF	DC: OFF AC: OFF	Disconnect all test equip ment from the PP-6148/U.	None

3-22. Recovery Time Test

a. Test Equipment and Materials.

(1) Ac power input cable.

(2) Multimeter AN/USM-223/U.

(3) Voltmeter, Electronic ME-202( )/U.

(4) Oscilloscope AN/USM-281.

(5) Dummy Load, Electrical DA-638/U.

b. Test Connections and Conditions. The test procedures for performing the recovery time test are to be performed with a power source input voltage of 115 Vac/60Hz. Figure 3-7 shows the test setup to be used for performing the recovery time test.

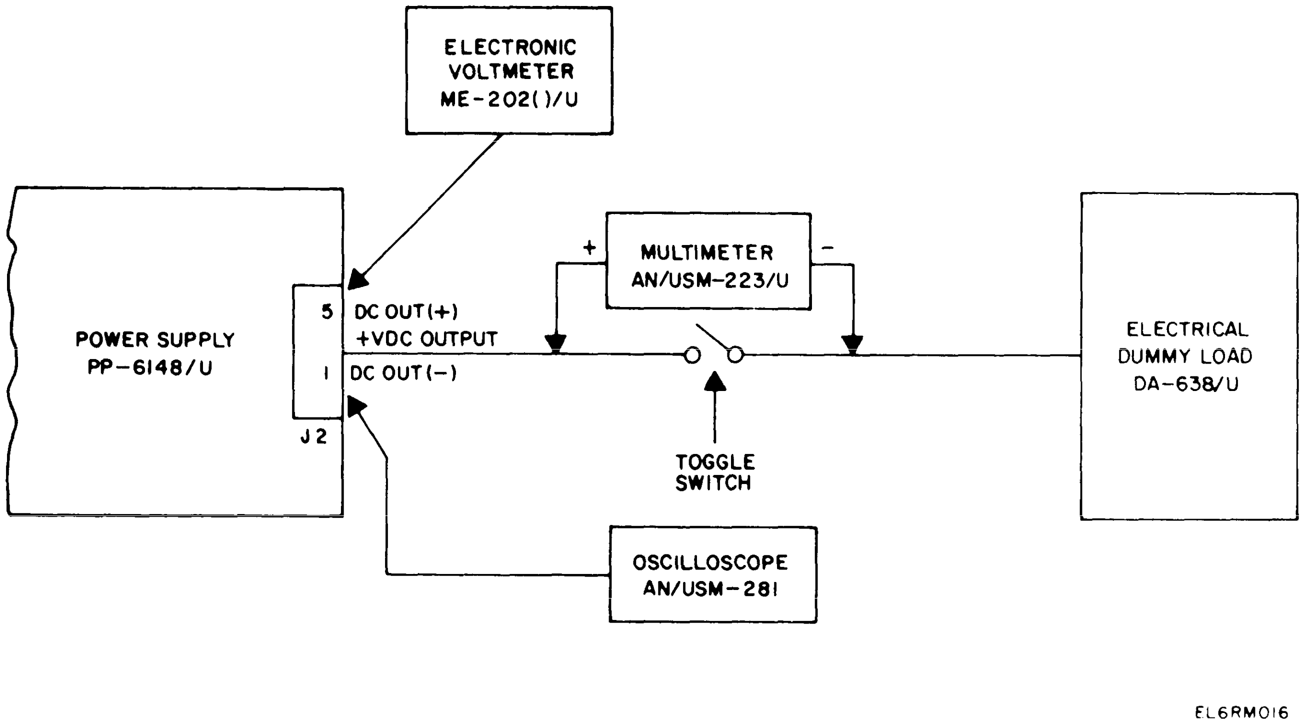


Figure 3-7. Recovery Time Test Setup Diagram.

c. Initial Test Equipment Settings. Connect the test equipment to the power source and allow a 10-minute warmup period before starting the procedure in subparagraph *d* below.

d. Procedure.

Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Test procedure	Performance standard
1	AN/USM-223/U, ME-202( )/U, and AN/USM-281: POWER: OFF	AC: OFF DC: OFF	Connect the test equipment to the PP-6148/U as shown in figure 3-7.	None.
2	DA-638/U: Set for an AN/USM-223/U reading of 10.0 ± 0.5 amps.	VOLT SELECT 14V/28V: 14V CURRENT RANGE: 10 AC: ON DC: ON	Adjust VOLTAGE ADJUST control for a reading on the ME-202 ( )/U of 14.0 ± 0.1 V dc.	ME-202( )/U indicates 14.0 ± 0.1 Vdc and AN/USM-223/U indicates 8.5 + 0.5, 0.0 amps.
3	Same as step No. 2.	Same as Step No. 2, except DC: OFF	Disconnect the AN/USM-223/U from between the equipment under test and DA-638/U, and insert a toggle switch in its place as shown in figure 3-7, making sure that toggle switch is in the open position.	
4	Same as step No. 2; in addition, set AN/USM-281 time base and vertical amplitude to convenient scales (calibrated), to measure 25 milliseconds and dc voltage as required.	Same as step No. 2, except AC: OFF	*a.* Observing AN/USM-281, set AC ON-OFF circuit breaker to ON.	*a.* Output voltage returns to 14.0 ± 0.1 V dc ±2% within 25 milliseconds, and any transient (volts peak-to-peak (vpp))

d. Procedure-Continued.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
4 (cont)				occuring does not exceed 20% of above level.
			b. Observing AN/U SM - 281, set AC ON-OFF Circuit breaker to OFF.	*b.* Any transient (vpp) occuring does not exceed 20% of 14.0 ±0.1 V dc ± 1%.
			c. Observing AN/USM - 281, set AC ON-OFF circuit breaker to ON, and set toggle switch to the closed position.	*c.* Output voltage returns to 14.0 ±0.1 V dc ±1% within 26 milliseconds, and any transient (vpp) occurring does not exceed 20% of above level.
			d. Observing AN/USM-281, set AC ON-OFF circuit breaker to OFF.	*d.* Any transient (vpp) occurring does not exceed 20% of 14.0 ±0.l V dc ±l%.
			e. Set DC ON-OFF circuit breaker to OFF and set AC ON-OFF circuit breaker to ON; then, set DC ON-OFF circuit breaker to ON.	*e.*. None.
			f. Set toggle switch to the open position.	*f.* Output voltage returns to 14.0 ±0.1 V dc ± 1% within 26 milliseconds, and any transient (vpp) occurring does not exceed 20% of above level.
5	Same as step No. 2.	Same as step No. 2, except VOLT SELECT 14V/28V: 28V and AC: OFF.	Set AC ON-OFF circuit breaker to OFF, set VOLT SELECT 14V/2)V to 28V, hen return AC ON-OFF circuit breaker to ON (leaving CURRENT RANGE switch set to 10). Adjust VOLTAGE ADJUST control for a rading on ME-202( )/U of 28.0 ±0.1 V dc.	ME-202( )/U indicates 28.0 ±0.1 V dc.
6	Same as step No. 2, except DA-638/U: Set for *maximum* resistance.	*Same* as step No. 2, except DC: OFF.	With toggle switch in the *open* position, connect the AN/USM-223/U across the toggle switch as shown in figure 3-7. Set DC ON-OFF circuit breaker to ON, and adjust the DA-638/U for an AN/USM-223/U reading of 8.5 + 0.5, –0.0 amps.	AN/USM-223/U indicates 8.5 + 0.5, –0.0 amps.
7	Same as step No. 4.	Same **as** step No. 4	*a.* Remove the AN/USM-223/U from the circuit. Observing AN/USM-81, set AC ON-OFF circuit breaker to ON.	*a.* Output voltage returns to 28.0 ±0. 1 V dc ± 1% within 25 milliseconds, and any transient (vpp) occurring does not exceed 20% of above level.

d. Procedure-Continued

Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Test procedure	Performance standard
7 (cont)			*b.* Observing AN/USM-281, set AC ON-OFF circuit breaker to OFF.	*b.* Any transient (vpp) occurring does not exceed 20% of 28.0 ±0.1 V dc ±1%.
			c. Observing AN/USM-281, set AC ON-OFF circuit breaker to ON, and set toggle switch to the *closed* position.	*c.* Output voltage returns to 28.0 ±0.1 V dc ±1% within 25 milliseconds, and any transient (vpp) occurring does not exceed 20% of above level.
			d. Observing AN/USM-281, set AC ON-OFF circuit breaker to OFF.	*d.* Any transient (vpp) occurring does not exceed 20% of 28.0 ±0.l V dc ±l%.
			e. Set DC ON-OFF circuit breaker to OFF and set AC ON-OFF circuit breaker to ON; then, set DC ON-OFF circuit breaker to ON.	*e.* None.
			f. Set toggle switch to the *open* position.	*f.* Output voltage returns to 28.0 ±0.1 V dc ± 1%. within 25 milliseconds, and any transient (vpp) occurring does not exceed 20% of above level.
8	AN/USM-223/U, ME-202( )/U, and AN/USM-281: POWER: OFF	DC: OFF AC: OFF	Disconnect all test equipment from the PP-6148/U.	None.

3-23. Ripple Voltage Test

a. Test Equipment and Materials.

(1) Ac power input cable.

(2) Multimeter AN/USM-223/U.

(3) Voltmeter. Electronic ME-202( )/U.

(4) Oscilloscope AN/USM-281.

(5) Dummy Load, Electrical DA-638/U.

b. Test Connections and Conditions. The test procedures for performing the ripple voltage test are to be performed with an input power source of 115 Vac/60 Hz and nominal power supply output voltage of 28.0 V dc, 10 amperes load current. The basic test setup shown in figure 3-6 is the test setup to be used for the ripple voltage test. The only exception is that the Variable Power Transformer TF-510/U and Multimeter AN/USM-223/U used with it are not required for the ripple voltage test.

c. Initial Test Equipment Settings. Connect the test equipment to the power source and allow a 10-minute warmup period before starting the procedure in sub-paragraph *d* below.

d. Procedure.

Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Test procedure	Performance standard
1	AN/USM-223/U, ME-202( ) /U, and AN/USM-281: POWER. OFF	AC: OFF DC: OFF	Connect the teat equipment to the PP-6148/U as shown in figure 3-6.	None
2	DA-638/U: Set for an AN/USM-223/U reading of O amps. (Disconnect load if necessary.)	VOLT SELECT 14V/28V: 28V CURRENT RANGE: 10 AC: ON DC: ON	Adjust VOLTAGE AD-JUST control for a reading on the ME-202( )/U of 28 ± 0.1 V dc.	AN/USM-281 displays a maximum peak to peak ripple voltage of ± 2% of 28.0 ± 0.1 v dc and the ME-202( )/U displays a maximum rms voltage of ± 1% of 28.0 ± 0.1 V dc.
3	DA-638/U: Set for an AN/USM-223/U reading of 10.0 ± 0.5 amps.	Same as step No. 2.	Same as step No. 2.	Same as step No. 2.
4	AN/USM-223/U, ME-202( )/U, and AN/USM-281: POWER OFF	DC: OFF AC: OFF	Disconnect all test equip ment from the PP-6148/U.	None

3-24. Overload Protection and Current Landing Test

a Test Equipment and Materials.

(1) Voltmeter, Electronic ME-202( )/U.
(2) Ac power input cable.
(3) Multimeter AN/USM-223/U.
(4) Dummy Load, Electrical DA-638/U.

b. Test Connections and Conditions. The test procedures for performing the overload protection and current limiting test are to be performed under standard ambient temperatures. The input power to the PP-6148/U should be 115 Vac/60 Hz. Upon completion of the performance of the overload protection and current limiting test, verify that no electrical damage may have occurred by performing the procedures contained in paragraphs 3-21,3-22 and 3-23. Figure 3-8 shows the test setup to be used for performing the overload protection and current limiting test.

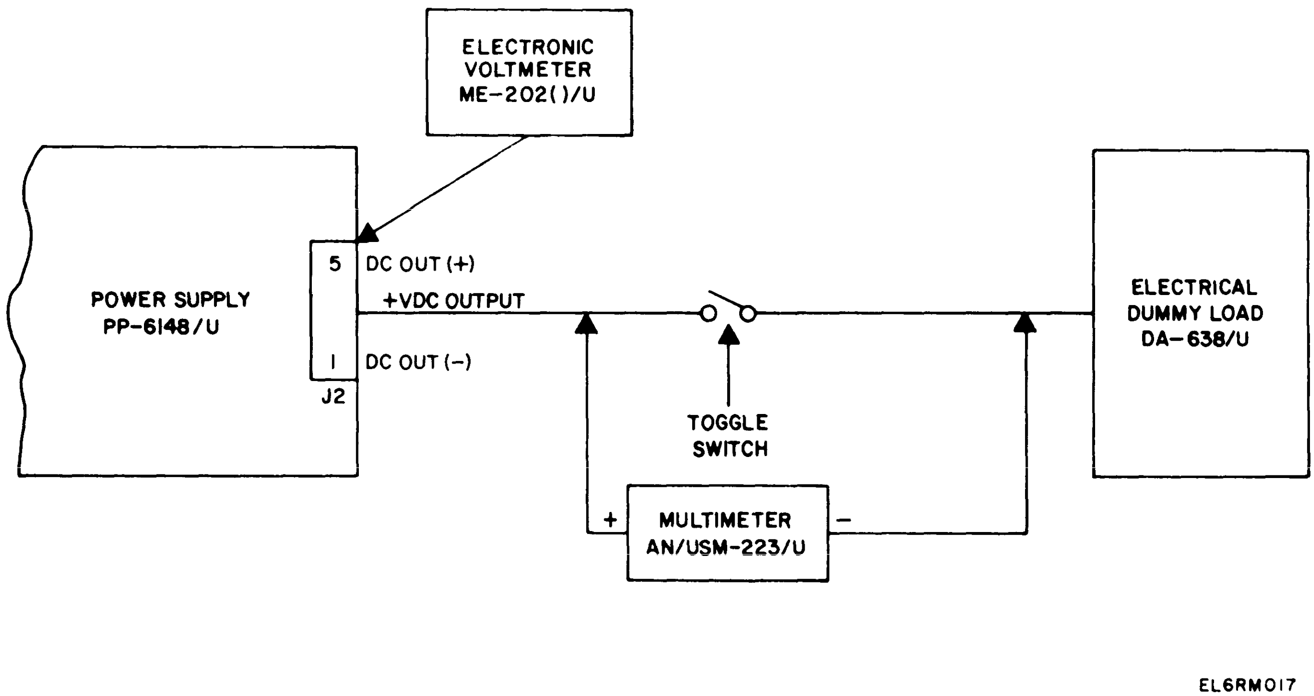


Figure 3-8. Overload Protection and Current Limiting Test Setup Diagram.

c. Initial Test Equipment Settings. Connect the test equipment to the power source and allow a 10-minute warmup period before starting the procedure in subparagraph *d* below.

d. Procedure.

Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Test procedure	Performance standard
1	AN/USM-223/U and ME-202( )/U: POWER: OFF	AC: OFF DC: OFF	Connect the test equipment to the power supply as shown in figure 3-8.	None
2	DA-638/U: Set for an AN/USM-223/U reading of 5.0 ± 0.2 amps.	VOLT SELECT 14V/28V: 28V CURRENT RANGE: 10 VOLTAGE ADJUST: Set fully counterclockwise. CURRENT ADJUST (FINE): Set fully clockwise. AC: ON DC: ON	Rotate VOLTAGE ADJUST control clockwise until ME-202( )/U indicates 28.0 ±0.1 Vdc.	ME-202( )/U indicates 28.0 ± 0.1 V dc.
3	DA-638/U: Set for an AN/USM-223/U reading of 10.0 ± 0.5 amps.	Same as step No. 2	Same as step 2.	ME-202( )/U indicates 28.0 ± 0.1 V dc ± 1.5%.
4	Same as step No. 3.	Same as step No. 2, except CURRENT RANGE: 8	a. Rotate CURRENT ADJUST (FINE) control counterclockwise until AN/USM-223/U indicates 8.0 ± 0.4 amps. *b.* Slowly rotate CURRENT ADJUST (FINE) control until AN/USM-223/U indicates 4.0 ± 0.2 amps.	*a.* AN/USM-223/U indicates 8.0 ± 0.4 amps. *b.* AN/USM-223/U indicates 4.0 ± 0.2 amps.

d. Procedure-Continmd.

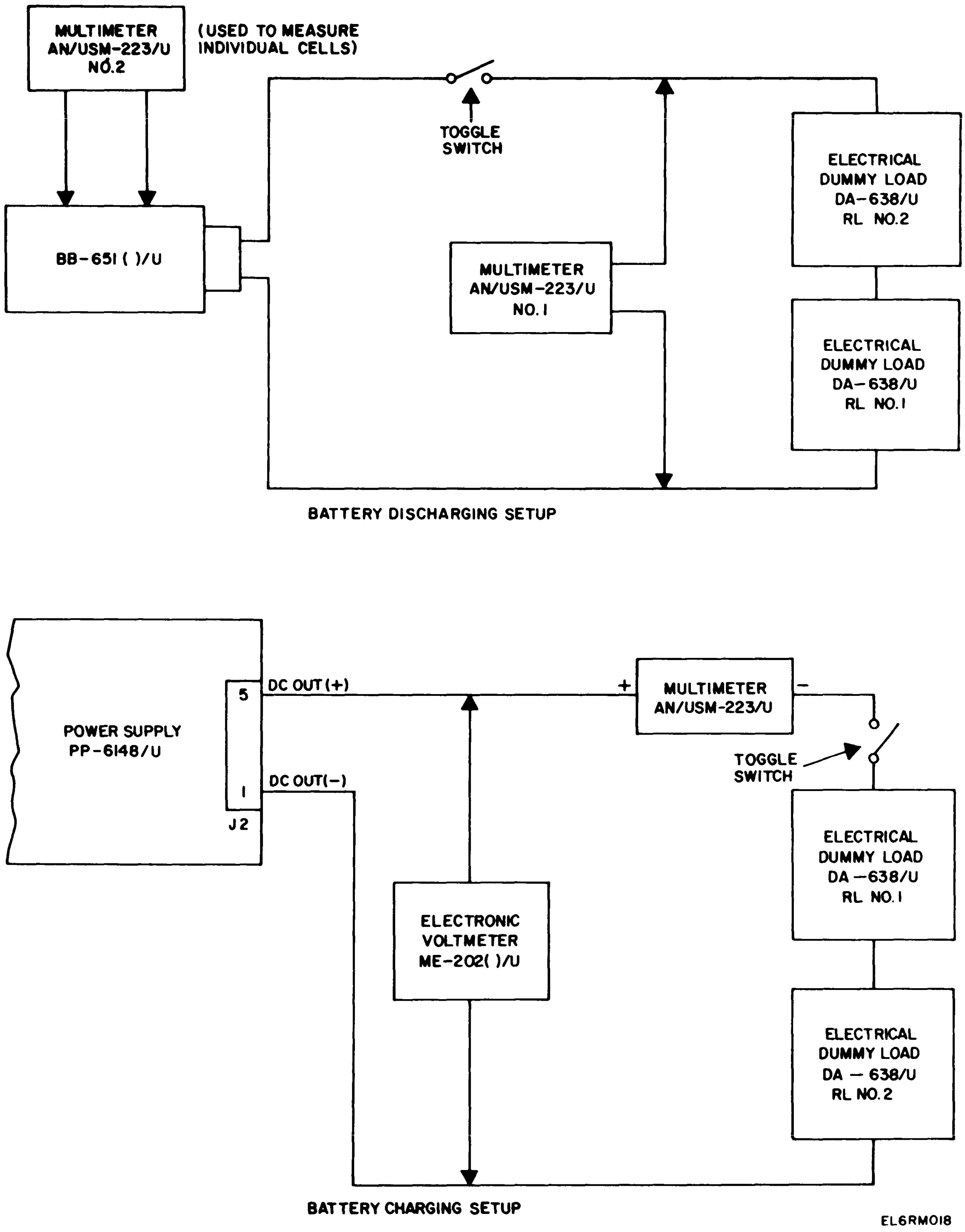
Step No.	Control Settings: Test Equipment	Control Settings: Equipment under test	Test procedure	Performance standard
6	Same as step No. 3.	Same as step No. 2, except CURRENT RANGE: 4	*a.* Rotate CURRENT ADJUST (FINE) control until AN/USM-223/U reads 2.0 ± 0.1 amps. *b.* Rotate CURRENT ADJUST (FINE) control until AN/USM-223/U indicates 4.0 ±0.2 amps.	*a* AN/USM-2231U indicates 2.0 ± 0.1 amps. *b.* AN/USM-223/U indicates 4.0 ±0.2 amps.
6	Same as step No. 3.	Same as step No. 2, except CURRENT RANGE: 2	*a.*. Rotate CURRENT ADJUST (FINE) control until AN/USM-223/U indicates 2,0 ±0.1 amps *b.* Rotate CURRENT ADJUST (FINE) control until AN/USM-223/U indicates 1.0 ±0.05 amps.	*a.*. AN/USM-223/U indicates 2.0 ±O.1 amps. *b.* AN/USM223/UJ indicates 1.0 ±0.05 amps.
7	Same as step No. 3.	Same as step No. 2, except CURRENT RANGE: 1	*a.* Rotate CURRENT ADJUST (FINE) control until AN/USM-223/U indicates 0.6 ±0.026 amps. *b.* Rotate CURRENT ADJUST (FINE) control until AN/USM-223/U indicates 1.0 ±0.05 amps.	AN/USM-223/U indicates 0.5 ±0.025 amps. *b.* AN/USM-223/U indicates 1.0 ±0.05 amps.
8	DA-638/U: Set for an AN/USM-223/U reading of approximately 7 amps.	Same as step No. 2, except DC: OFF and CURRENT RANGE: 10	*a.* Set DC ON- OFF circuit breaker to ON. *b.* Slowly increase current by adjusting the DA-638/U until the AN/USM-223/U indicates 8.5 + 0. 5 -0.0 amps *c.* Continue adjusting the DA-638/U in the same direction up to and including the short circuit condition. Maintain the short circuit condition for 10 seconds, then remove the short.	*a.* ME-202( )/U indicates 28.0 ±0.1 V dc. *b.* AN/USM-223/U indicates 8.5 + 0.5, -0.0 amps. *c.*. AN/USM-223/U indicates 13.0 ±1.0 amps through out the adustment up to and including the short circuit condition; ME-202 ( )/U indicates 28.0 ±0.1 V dc ±1% when the short is removed. In addition, there shall be no evidence of physical damage that might have occurred due to overload conditions.
9	AN/USM-223/U: POWER: OFF	DC: OFF AC: OFF	Disconnect all test equipment from the PP-6148/U.	None.

3-25. Battery Discharging/Charging Test

a. Test Equipment and Materials.

(1) Battery charger adapter cable.
(2) Ac power input cable.
(3) Multimetxer AN/USM-223/U (2 required).
(4) Voltmeter, Electronic ME-202( )/U.
(5) Battery, Vented Nickel-Cadmium BB-651 ( )/U.
(6) Dummy Load, Electrical DA-638/U (2 required).

b. Test Connections and Conditions. The test procedures for performing the battery discharging/charging test are to be performed under standard ambient temperatures. The input power to the PP-6148/U should be 115 Vac/60 Hz. Figures 3-9 and 3-10 show the test setups to be used for performing the battery discharging/charging test.



Fgure 3-9. Battery Discharging/Charging Test Setup Diagram.

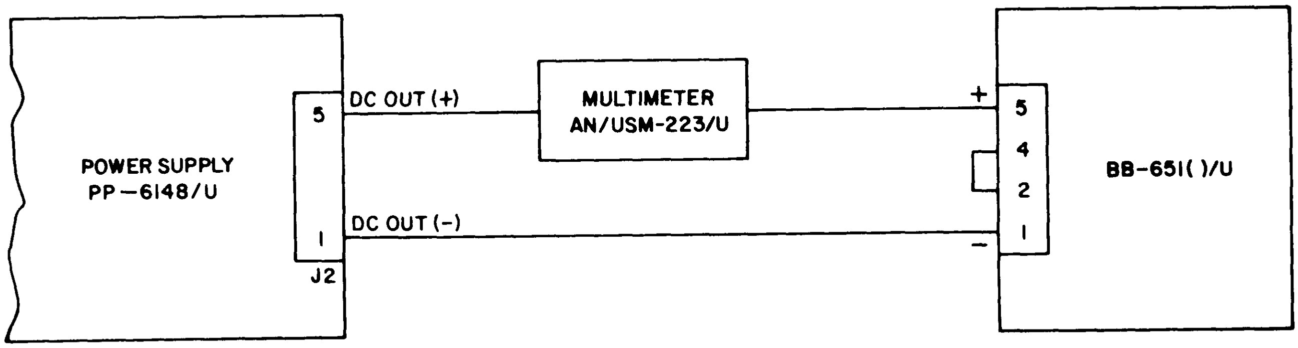


Figure *3-10. Battery Discharging Test Setup Diagram.*

c. Initial Test Equipment Settings. Connect the test equipment to the power source and allow a 10-minute warmup period before starting the procedure in subparagraph *d* below.

d. Procedure.

NOTE

In order to perform the battery charging test (step No. 4 thru 6 below), a discharged battery is required that provides 20 volts with a 10 ohm load connected to it. If such a battery is available, skip step No. 1,2 and 3 below.

CAUTION

Do not add electrolyte to the battery in the discharged condition.

WARNING

Explosive gases may be released during battery charging operations. Be sure that the charging area is well ventilated. Do not use matches or an open flame in the charging area. Guard against short circuits; resulting arcs may cause an explosion Do not disconnect the battery charger adapter cable from the battery until the DC ON-OFF circuit breaker is set to OFF, and the battery charger adapter cable is disconnected from the power supply. Do not attempt to charge a damaged or leaking battery.

d. Procedure-Continued.

Step No.	Control Settings: Teat Equipment	Control Settings: Equipment under test	Test procedure	Performance standard
1	AN/USM-223/U, and ME-202( )/U: POWER: OFF	None	Connect the test equipment and battery to be discharged as shown in figure 3-9 (Battery Discharging Setup).	None
2	Set one AN/USM-223/U (marked #1) to the RX1 ohms scale, and *zero* the meter as required.	None	Set toggle switch to open position, and set one DA-638/U (marked RL#l) for a reading on AN/USM-223/U #1 of 10 ohms.	AN/USM-223/U #l indicates 10 ohms.
3	Set AN/USM-223/U #l to a scale suitable for reading 20 V dc.	None	*a.* Set toggle switch to *closed* position, and allow BB-651( )/U to discharge until AN/USM-223/U #l indicates 20 Vdc (this will probably take a few hours to accomplish). *b.* Using the second AN/USM-223/U (marked #2), measure voltage of each individual cell of BB-651( )/U. *c.* Set toggle switch to *open* position.	*a.* AN/USM-223/U #1 indicates 20 V dc. *b.* AN/USM-223/U #2 indicates at least 1.0 V dc for each individual cell of BB-651( )/U. (A lower voltage indicates a bad cell.) None
4	Same as step No. 1,	AC: OFF DC: OFF	Connect the test equipment to the PP-6148/U as shown in figure 3-9 (Battery Charging Setup). Be sure that toggle switch is in *open* position.	None
5	115 Vac/60 Hz source.	VOLT SELECT 14V/28V: 28V CURRENT RANGE: 1 VOLTAGE ADJUST: Set fully counterclockwise. CURRENT ADJUST (FINE): Set fully clockwise AC: ON DC: ON	*a.* Rotate VOLTAGE ADJUST control clockwise until ME-202( )/U indicates 29.5 V dc. Observe and note the front panel OUTPUT meter voltage reading. *b.* Set toggle switch to closed position, and set CURRENT ADJUST (FINE) control for an AN/USM-223/U reading of 1.0 amps. Hold the VOLTS/AMPS switch on PP-6148/U top panel in AMPS position, and note meter reading.	*a.* ME-202( )/U indicates 29.5 V dc. *b.* AN/USM-223/U reads 1.0 amps.
6	Same as Step No. 5.	Same as step No. 5, except DC: OFF.	*a.* Disconnect ME-202( )/U, AM/USM-223/U, and DA-638/U from PP-6148/U. Connect battery charger adapter cable between battery to be charged and dc output connector J2 on PP-6148/U. Set DC	*a.* Top panel OUTPUT meter indicates the same voltage reading ±1% as noted in step No. 5 *a* above, and indicates no more than the current reading as

d. Procedure- Continued.

Step No.	Control Settings: Test Equipment	Control Settings: Equipmentt under test	Test procedure	Performance standard
6 (cont)			ON-OFF circuit breaker to ON, and observe top panel OUTPUT meter. *b.* Periodically disconnect the battery from the battery charger adapter cable, *being sure to set DC ON-OFF circuit breaker to OFF before doing so,* and measure the battery voltage. Charging is completed when battery voltage measures 24.0 V dc (approximately 8 hours).	noted in step No. *5b* above. *b.* Battery voltage measures 24.0 V dc to indicate successful completion of battery charging test .
7	AN/USM-223/U: POWER: OFF	AC: OFF DC: ON	Connect fully charged battery to PP-6148/U as shown in figure 3-10.	None
8	AN/USM-2231U: Set up as a milliam-meter.	Same as step No. 7.	*a* Observe current reading on AN/USM-223/U. *b.* Reverse the leads at dc output connector J2 on PP-6148/U, and observe current reading on AN/USM-223/U.	*a.* Current reading on AN/USM-223/U does not exceed 50 milliamps. *b.* Current reading on AN/USM-2231U does not exceed 50 rnilliamps.
9	AN/USM-223/U, and ME-202( )/U POWER: OFF	DC: OFF AC: OFF	Disconnect all test equipment and batteries from the PP-6148/U.	None

CHAPTER 4

GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

4-1. General Support

Maintenance of the PP-6148/U at the general support level is the same as that for maintenance of the PP-6148/U at the direct support level, except for the addition of repair Procedures for converter circuit card assembly A1Al and control circuit card assembly A2. These additional procedures are covered in paragraphs 4-2 through 4-5. Refer to chapter 3, Direct Support Maintenance Instructions, for all direct support information and procedures that also apply to the general support level.

Section II. MAINTENANCE OF PP-6148/U

4-2. General

This section consists of removal and replacement instructions and disassembly and reassembly instructions applicable to the general support maintenance level. Refer to chapter 3, Direct Support Maintenance Instructions, for adjustment/alinement procedures, general parts replacement techniques, removal and replacement instructions, and disassembly and reassembly instructions which are also applicable to the general support maintenance level.

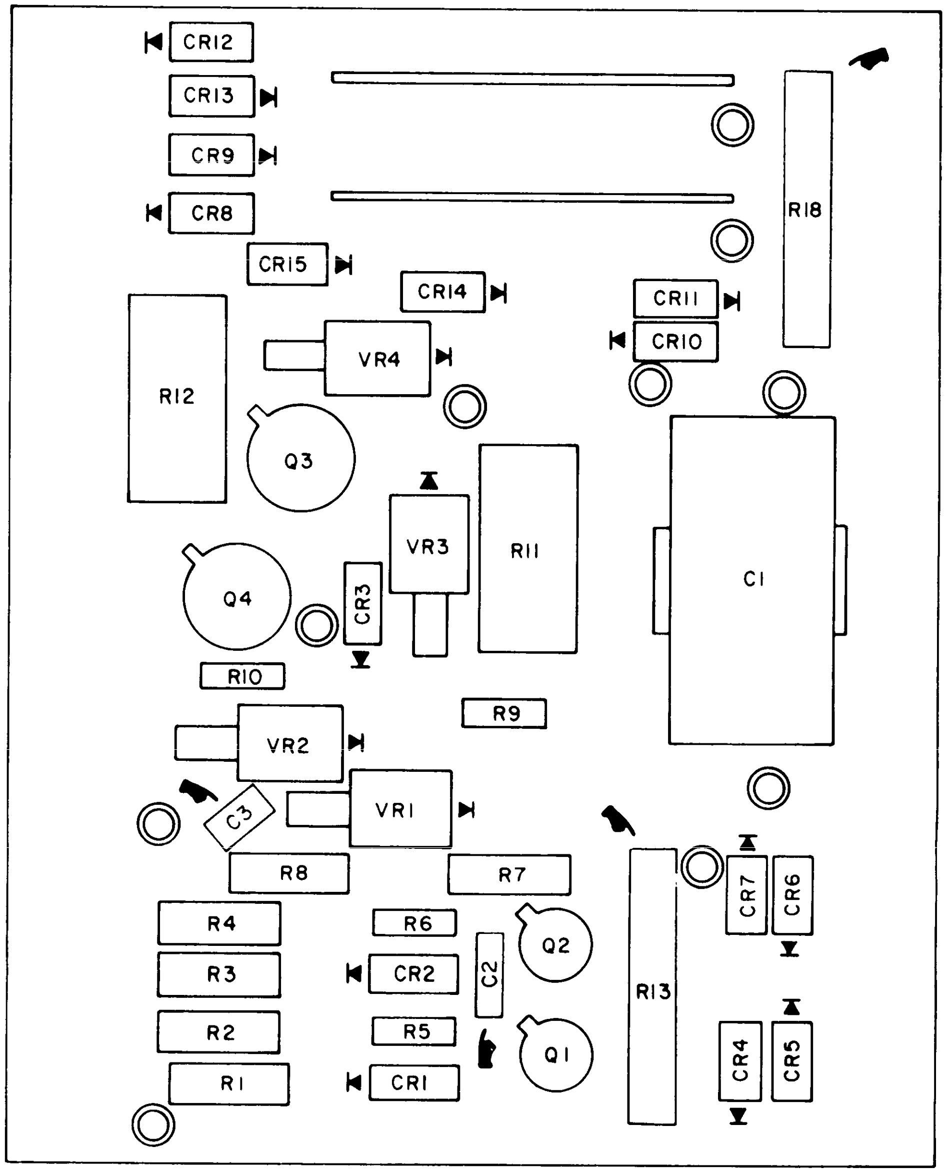
4-3. Repair

Locate the defective component or part with the aid of the parts location illustrations: figure 3-3 for cover assembly Al, figure 3-5 for chassis-mounted components, figure 4-1 for converter circuit card assembly AlA1, and figure 4-2 for control circuit card assembly A2.

4-4. Disassembly Instructions

Disassembly of the PP-6148/U at the general support level involves converter circuit card assembly AlAl and control circuit card assembly A2. Disconnect the power source and set the AC and DC ON/OFF switches to OFF before beginning disassembly. Comply with precautionary instructions to avoid injury to personnel and damjge to equipment. Before disconnecting a component, tag and identify all its connecting leads, connecting termïnals or connecting points to facilitate reconnection.

4-5. Removal, Disassembly and Reassembly of Converter Circuit Card Assembly A1Al and Control Circuit Card Assembly A2 (fig. 4-1 and 4-2)



PREFIX ALL REFERENCE
DESIGNATIONS WITH A1A1

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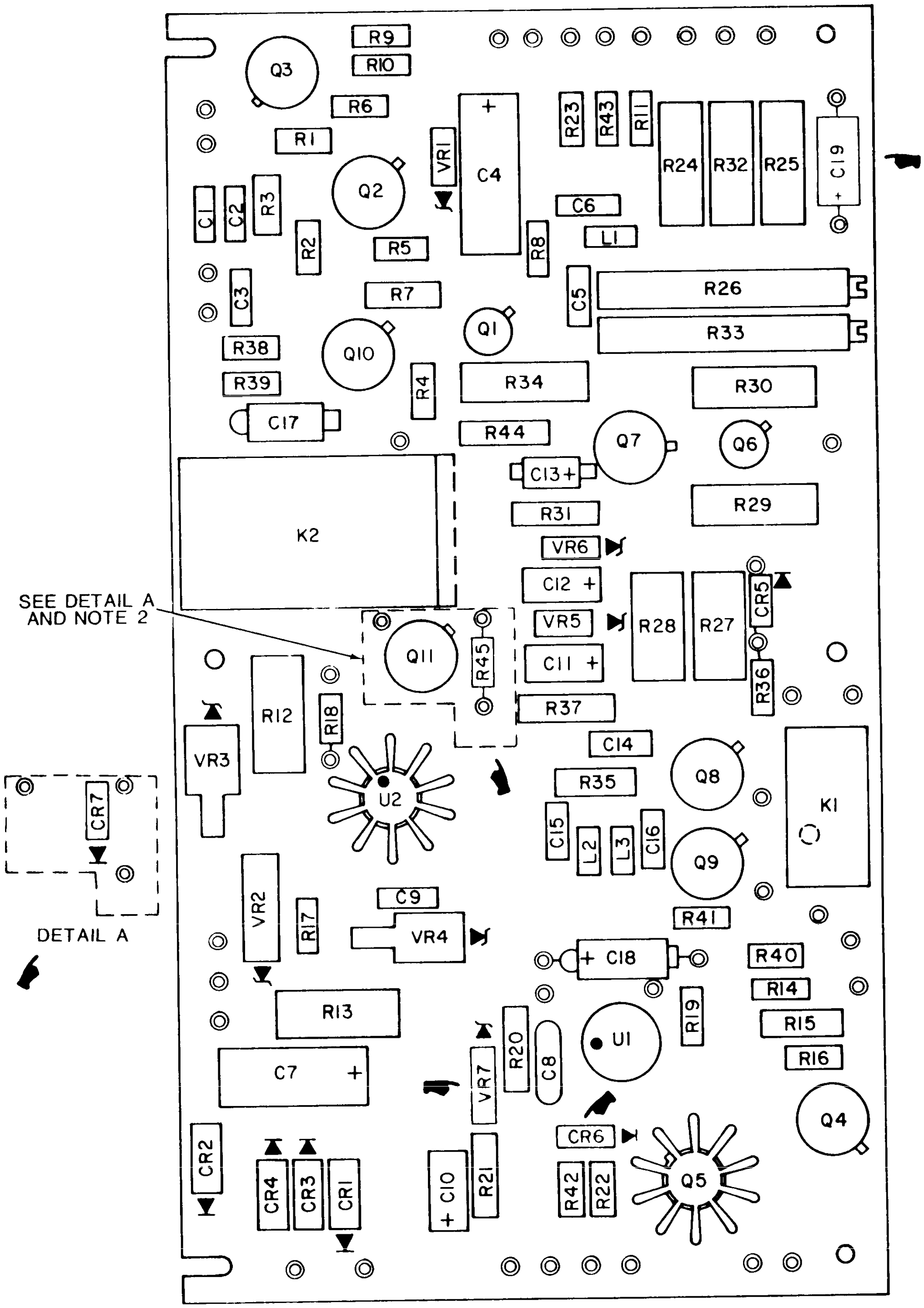
Figure 4-1. Converter Circuit Card Assembly (A1A1), Parts Location Diagram.



NOTES:
1. PREFIX ALL REFERENCE DESIGNATIONS WITH A2.
2. Q11 and R45 USED ON SERIAL NUMBERS 1A THRU 206A CR7 USED ON SERIAL NUMBERS 207A AND UP.

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Figure 4-2. Control Circuit Card Assembly (A2), Parts Location Diagram *a Removal Remove cover* assembly Al (3, fig. 3-5) by loosening 14 captive screws(4).

b. Disassembly.

(1) Disconnect leads and remove converter circuit card assembly AlA1 (1, fig. 3-3) by removing six screws and twelve washers (2). Components of converter circuit card assembly A1A1 (fig. 4-1) are to be removed and replaced using standard shop techniques.

(2) Disconnect, all leads from control circuit card assembly A2 (6, fig. 3-5). Remove control circuit card assembly A2 by removing two screws and mounting clips (7), and four screws and eight washers (8). Components of control circuit card assembly A2 (fig. 4-2) are to be removed and replaced using standard shop techniques.

c. Reassembly.

(1) Reinstall converter circuit card assembly A1A1 (1, fig. 3-3) with six screws and twelve washers (2). Reconnect leads.

(2) Reinstall control circuit card assembly A2 (6, fig. 3-5) with two screws and mounting clips (7), and four screws and eight washers (8). Reconnect leads. Apply sealing compound MIL-S-22473 (item 1, appx B) to the two screws and mounting clips (7) after replacement.

(3) If previously removed, replace gasket (5) by cutting gasket 07-0101-004 (item 5, appx B) to required length and affixing with adhesive 1711 SCOTCH-GRIP (item 6, appx B). Replace cover assembly Al (3) by tightening 14 captive screws (4).

APPENDIX A

REFERENCES

The following list of references is applicable to Power Supply PP-6148/U:

DA Pam 310-4	Index of Technical Publications.
SB 11-573	Painting and Preservation of Supplies Available for Field Use for Electronic Command Equipment.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TB 43-180	Calibration Requirements for the Maintenance of Army Materiel.
TM 11-6130-356-12	Operator's and Organizational Maintenance Manual for Power Supply PP-6148/U.
TM 11-6130-356-20P	Organizational Maintenance Repair Parts and Special Tools List for Power Supply PP-6148/U.
TM 11-6130-356-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools List for Power Supply PP-6148/U.
TM 11-6140 -203-14-3	Operator's, Organizational, Direct Support, and General Support Maintenance Manual: Nonaircraft Nickel-Cadmium Batteries.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX B

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

B-1. Scope

This appendix lists expendable supplies and materials you will need to operate and maintain the PP-6148/U. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

B-2. Explanation of Columns

a. Column 1—Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, App. D").

b. Column 2—Level This column identifies the lowest level of maintenance that requires the listed item.

C–Operator/Crew
O—Organizational Maintenance
F–Direct Support Maintenance
H—General Support Maintenance

c. *Column 3—National Stock Number*. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4–Description Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for manufacturer (FSCM) in parentheses, if applicable.

e. Column 5— Unit of Measure (U/M). Indicates the measure used in performing by the actual maintenance function. This measure is expressed a two-character alphabetical abbreviation (e.g., ea, in pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

B-3. Special Information

National stock numbers (NSN's) that are missing from section 11 have been applied for and will be added to this TM by future Change/Revision when they are entered in the Army Master Data File (AMDF). Until the NSN's are established and published, submit exception requisitions to Commander, US Army Electronics Command, ATTN: DRSEL-MM, Fort Monmouth, NJ 07703 for the part required to support your equipment.

SECTION II EXPENDABLE SUPPLIES AND MATERIALS LIST

(i) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS
1	F	8030-00-081-2330	SEALING COMPOUND, GRADE CV, MIL-S-22473 (81349)	02
2	F	6850-00-927-9461	GREASE, SILICONE, DC340-50Z (71984)	02
3	F	8040-01-010-8758	SEALING COMPOUND, RTV-732 (71984)	02
4	F	5970-01-081-1733	INSULATING COMPOUND, RTV-3140 (71984)	02
5	F	5999-00-992-5541	SHIELDING GASKET, ELECTRONIC, 07-0101-004 (12881)	FT
6	F		ADHESIVE, SCOTCH-GRIP, 1711 (76381)	FT
7	F		GASKET, R431N (82942)	FT

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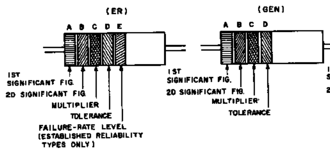
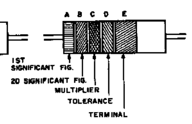


COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.



COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE 1
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E		
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL	TERM.
BLACK.....	0	BLACK.....	0	BLACK.....	1			BROWN...	M=1.0	
BROWN.....	1	BROWN	1	BROWN....	10			RED......	P=0.1	
RED.......	2	RED.......	2	RED.......	100			ORANGE..	R=0.01	
ORANGE....	3	ORANGE....	3	ORANGE...	1,000			YELLOW..	S=0.001	
YELLOW....	4	YELLOW....	4	YELLOW...	10,000	SILVER.	±10 (COMP. TYPE ONLY)	WHITE...	....	SOLD-ERABLE
GREEN.....	5	GREEN.....	5	GREEN....	100,000	GOLD...	±5			
BLUE......	6	BLUE......	6	BLUE.....	1,000,000	RED....	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY).			
PURPLE.... (VIOLET)	7	PURPLE.... (VIOLET)	7							
GRAY......	8	GRAY......	8	SILVER...	0.01					
WHITE	9	WHITE.....	9	GOLD	0.1					

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH.)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE.

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE.

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL (PERCENT FAILURE PER 1,000 HOURS). ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL.

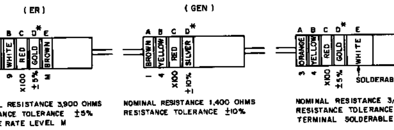
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS
(THESE ARE NOT COLOR CODED)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS   10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED, IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

EXAMPLES OF COLOR CODING



NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±10%

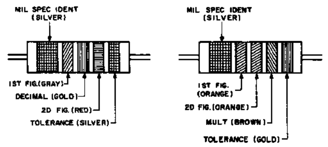
NOMINAL RESISTANCE 3,400 OHMS
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

COMPOSITION-TYPE RESISTORS

FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD.

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS.



(A) 6.2 UH ± 10%   (B) 330 UH ± 5%

COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF OF THE CODING FOR AN 6.2 UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330 UH INDUCTOR ARE ILLUSTRATED.

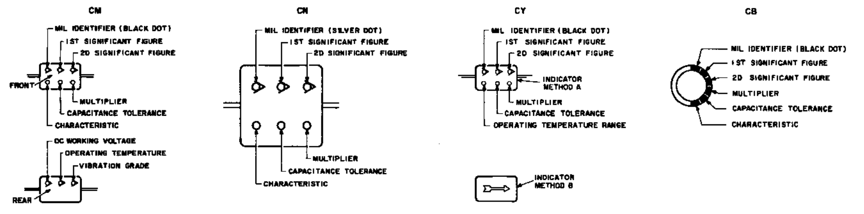
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD	DECIMAL POINT		5

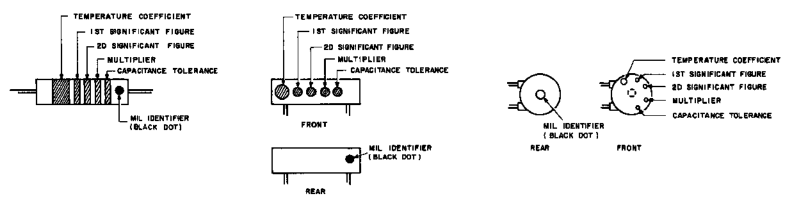
MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB.



MICA-DIELECTRIC   PAPER-DIELECTRIC   GLASS-DIELECTRIC, GLASS CASE   MICA, BUTTON TYPE



AXIAL LEAD   RADIAL LEAD   DISK-TYPE

C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS.

TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB.

COLOR	MIL ID	1ST SIG FIG.	2D SIG FIG.	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]			DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY, CM	CM
BLACK	CM, CY CB	0	0	1			±20%	±20%		A			-55° TO +70°C	10-55 Hz
BROWN		1	1	10					B	E	B			
RED		2	2	100	±2%		±2%	±2%	C				-55° TO +85°C	
ORANGE		3	3	1,000		±30%			D		D	300		
YELLOW		4	4	10,000					E				-55° TO +125°C	10-2,000Hz
GREEN		5	5		±5%				F			500	*	
BLUE		6	6										-55° TO +150°C	
PURPLE (VIOLET)		7	7											
GRAY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN			0.01	±10%	±10%	±10%	±10%						

TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC.

COLOR	TEMPERATURE COEFFICIENT[4]	1ST SIG FIG.	2D SIG FIG.	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0	1		±2.0 UUF	CC
BROWN	−30	1	1	10	±1%		
RED	−80	2	2	100	±2%	±0.25 UUF	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		±5%	±0.5 UUF	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GRAY		8	8	0.01*			
WHITE		9	9	0.1*	±10%		
GOLD	+100			0.1		±1.0 UUF	
SILVER				0.01			

1. THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.

2. LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS: MIL-C-5, MIL-C-20D, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY.

3. LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.

4. TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.

* OPTIONAL CODING WHERE METALLIC PIGMENTS ARE UNDESIRABLE.

ESC-FM 913-7

Figure FO-1. Color Code Chart.

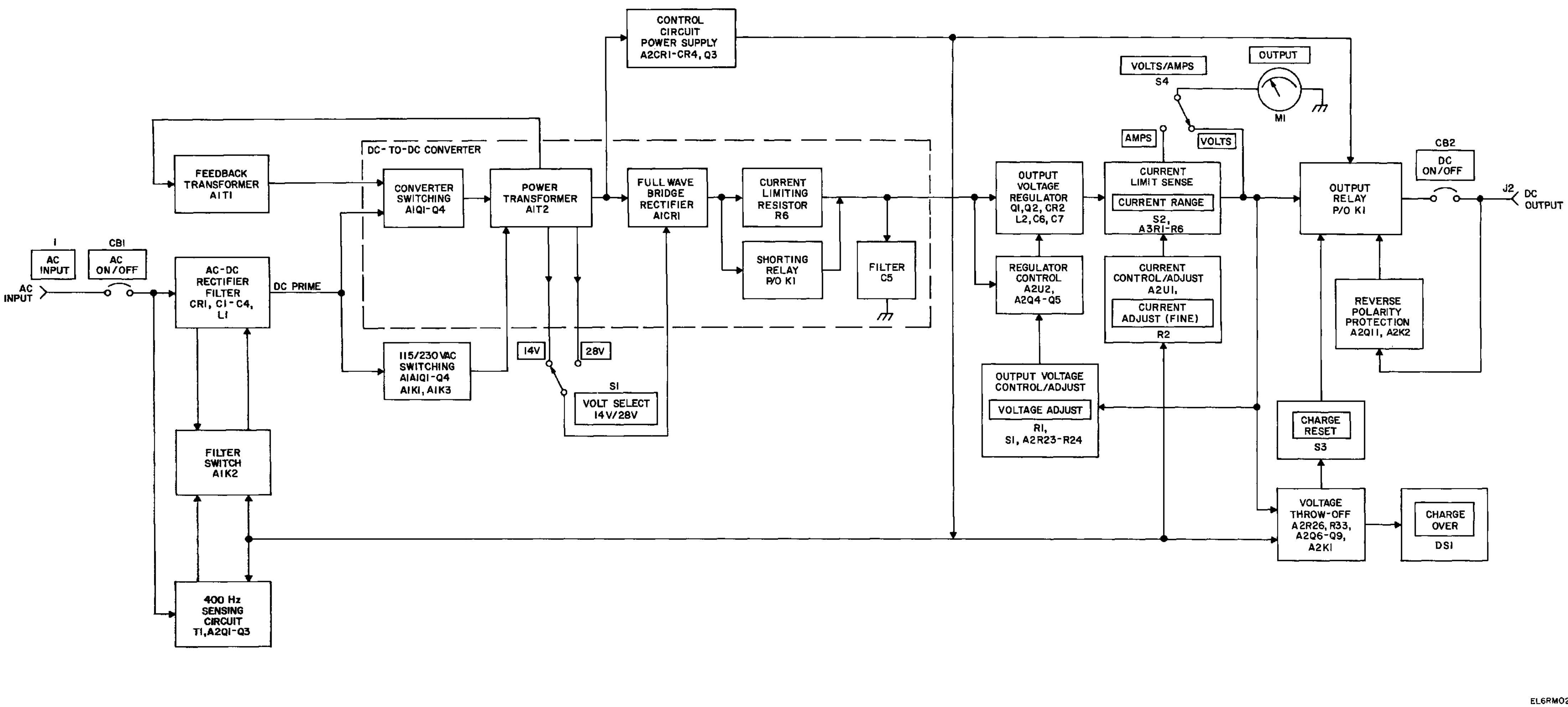
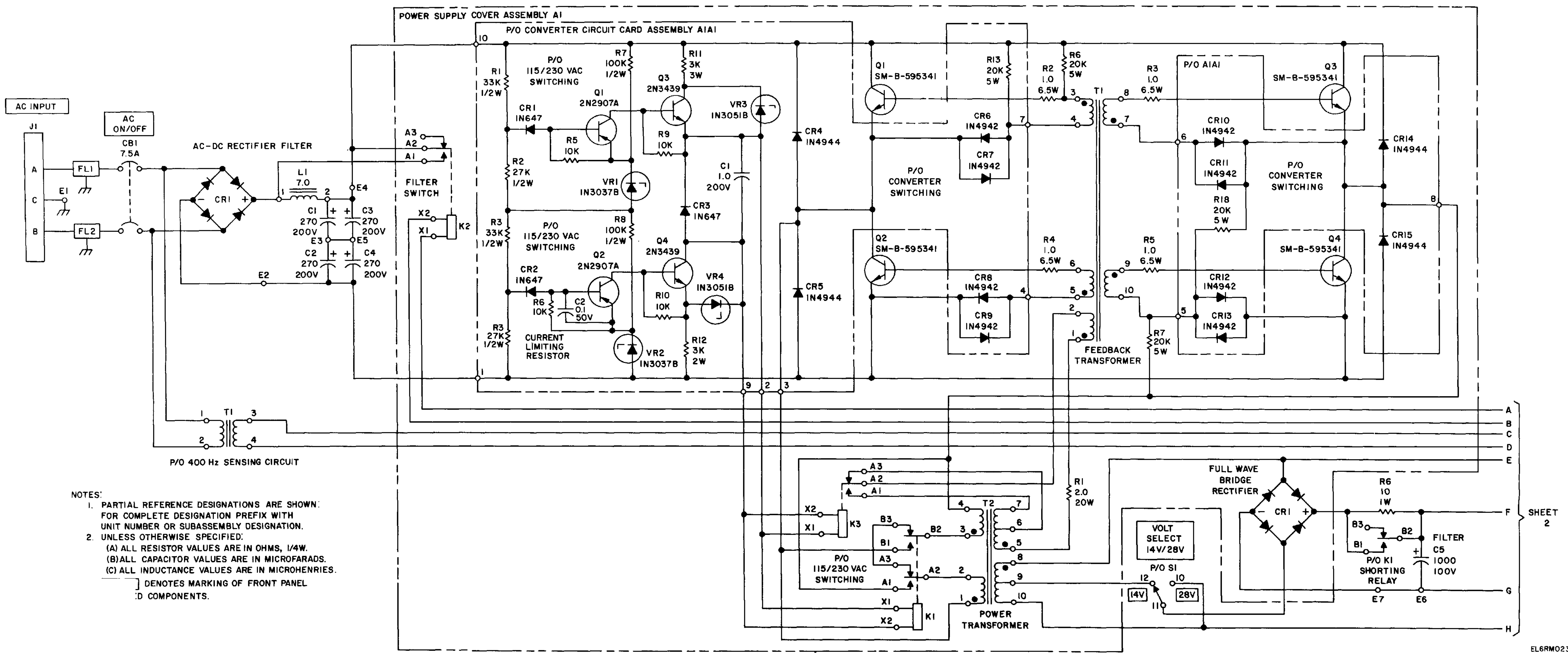


Figure FO-2. Power Supply PP-6148/U Functional Block Diagram.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE SPECIFIED:
   (A) ALL RESISTOR VALUES ARE IN OHMS, 1/4W.
   (B) ALL CAPACITOR VALUES ARE IN MICROFARADS.
   (C) ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
   ] DENOTES MARKING OF FRONT PANEL :D COMPONENTS.

Figure FO-3(1). Power Supply PP-6148/U Schematic Diagram (Sheet 1 of 3).

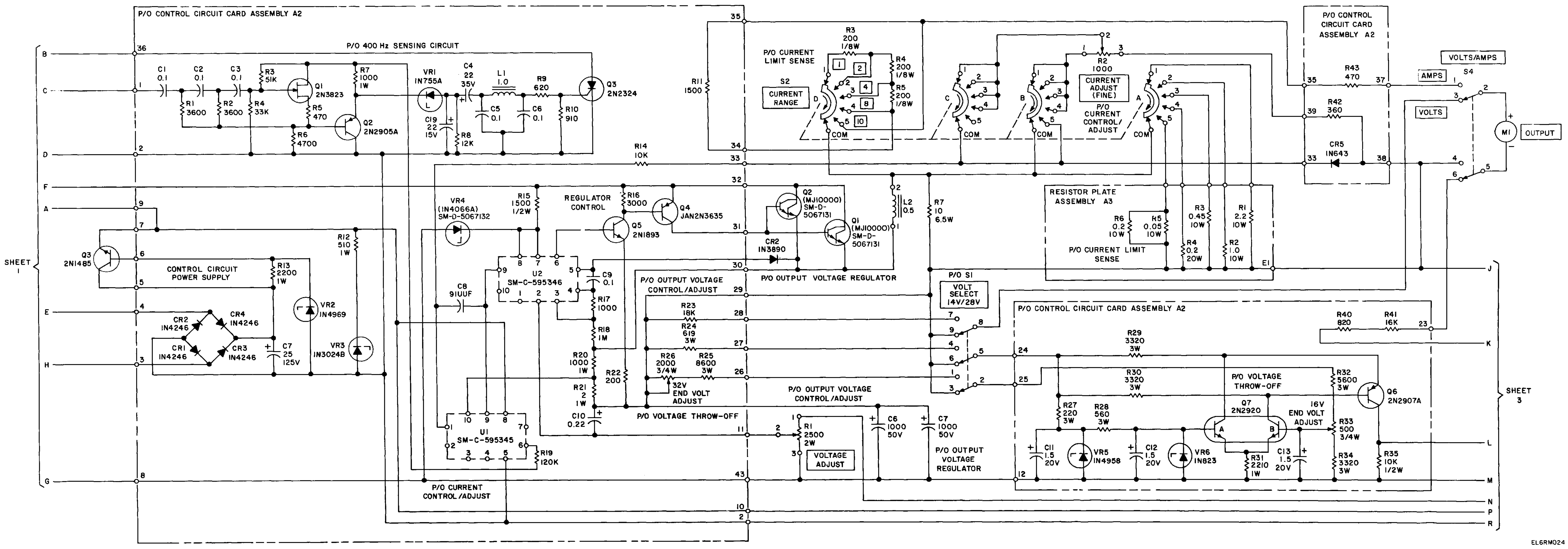


Figure FO-3(2). Power Supply PP-6148/U Schematic Diagram (Sheet 2 of 3).

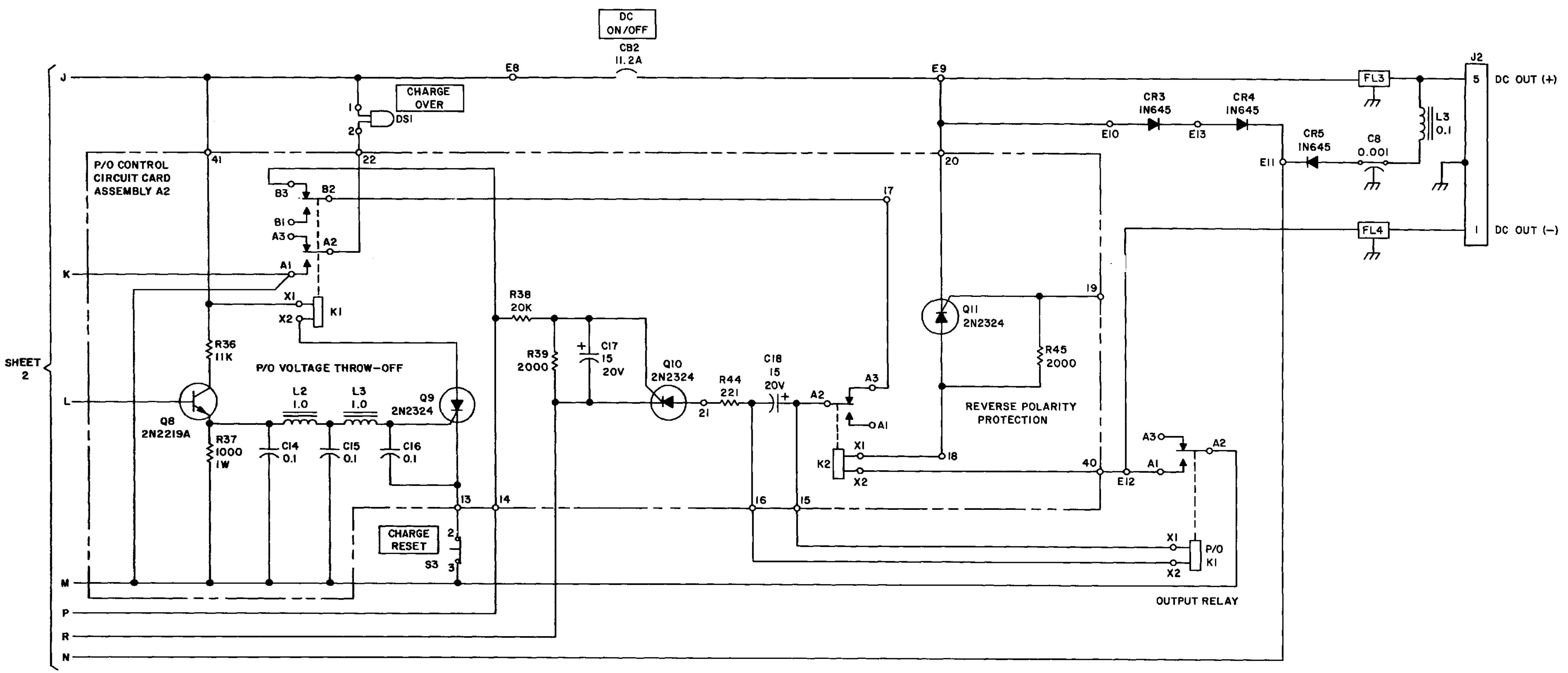


Figure FO-3(3). Power Supply PP-6148/U Schematic Diagram (Sheet 3 of 3).

By Order of the Secretary of the Army

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

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DATE SENT
10 July 1975

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PRC-76

BE EXACT PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2^{o} IFF antenna lag rather than 1^{o}. REASON: Experience has shown that with only a 1^{o} lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2^{o} without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure the the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

SAMPLE

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REVERSE OF DA FORM 2028-2

THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'VEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

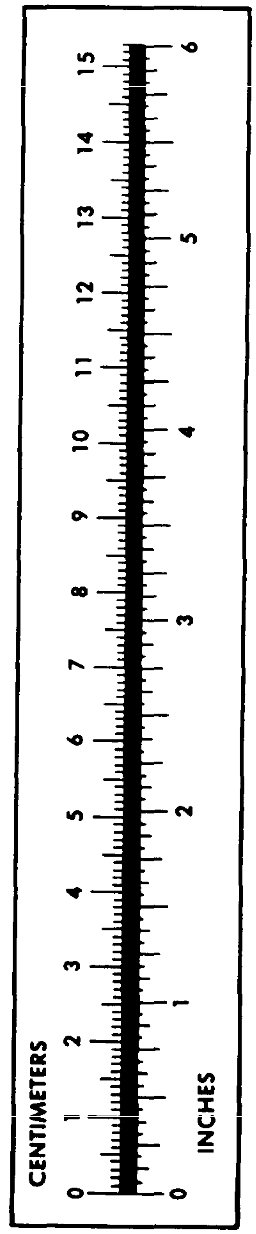
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
'ers	Gallons	0.264
.ms	Ounces	0.035
.ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
'lometers per Liter	Miles per Gallon	2.354
›meters per Hour	Miles per Hour	0.621



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