



TECHNICAL MANUAL

for

BATTERY POWER SUPPLY

MODEL BPS



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y.

OTTAWA, CANADA



★
UNCLASSIFIED

TECHNICAL MANUAL

for

BATTERY POWER SUPPLY

MODEL BPS



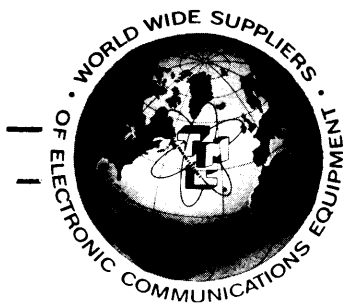
THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y.

OTTAWA, CANADA

★

NOTICE

THE CONTENTS AND INFORMATION CONTAINED IN THIS INSTRUCTION MANUAL IS PROPRIETARY TO THE TECHNICAL MATERIEL CORPORATION TO BE USED AS A GUIDE TO THE OPERATION AND MAINTENANCE OF THE EQUIPMENT FOR WHICH THE MANUAL IS ISSUED AND MAY NOT BE DUPLICATED EITHER IN WHOLE OR IN PART BY ANY MEANS WHATSOEVER WITHOUT THE WRITTEN CONSENT OF THE TECHNICAL MATERIEL CORPORATION.



THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

W a r r a n t y

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes* furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

TABLE OF CONTENTS

<u>Paragraph</u>		<u>Page</u>
<u>SECTION 1 - GENERAL INFORMATION</u>		
1-1	Functional Description	1-1
1-2	Physical Description	1-2
1-3	Electrical Characteristics	1-3
<u>SECTION 2 - INSTALLATION</u>		
2-1	Initial Inspection	2-1
2-2	Installation Procedure	2-1
<u>SECTION 3 - OPERATOR'S SECTION</u>		
3-1	Controls and Indicators	3-1
3-2	Operator's Maintenance	3-2
<u>SECTION 4 - CIRCUIT ANALYSIS AND TROUBLESHOOTING</u>		
4-1	Circuit Analysis	4-1
4-2	Troubleshooting	4-3
<u>SECTION 5 - MAINTENANCE</u>		
5-1	General	5-1
5-2	Special Tools and Test Equipment	5-1
5-3	Preventive Maintenance	5-1
5-4	Repair and Replacement of Components	5-3

TABLE OF CONTENTS (CONT)

<u>Paragraph</u>	<u>Page</u>
<u>SECTION 6 - PARTS LIST</u>	
6-1	Introduction 6-1
<u>SECTION 7 - SCHEMATIC DIAGRAMS</u>	

LIST OF ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
	<u>SECTION 1 - GENERAL INFORMATION</u>	
1-1	Model BPS, Battery Power Supply	1-0
	<u>SECTION 2 - INSTALLATION</u>	
2-1	Battery Power Supply, Rear View	2-3
	<u>SECTION 3 - OPERATOR'S SECTION</u>	
3-1	Battery Power Supply, Front Panel Control and Indicator	3-3

LIST OF TABLES

<u>Table</u>		<u>Page</u>
	<u>SECTION 1 - GENERAL INFORMATION</u>	
1-1	Battery Power Supply Models	1-2
	<u>SECTION 3 - OPERATOR'S SECTION</u>	
3-1	Front Panel Control and Indicator	3-1

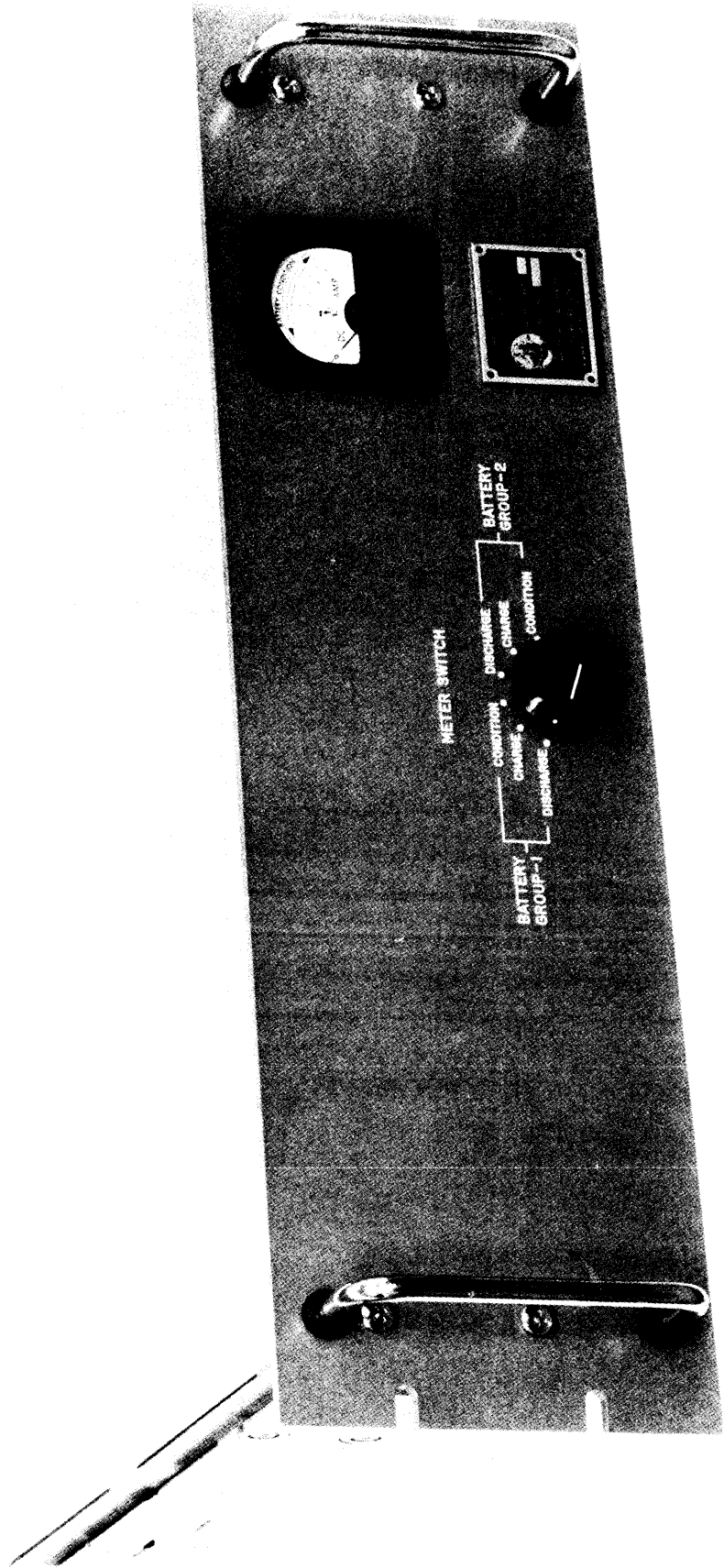


Figure 1-1. Model BPS, Battery Power Supply

SECTION 1

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION

Battery Power Supply, Model BPS()-1 (figure 1-1), is designed to supply 24 vdc to externally connected equipment in the event of a-c line power failure. The BPS is provided with facilities for mounting a maximum of four 24-volt matched batteries in two groups (Battery Group-1 and Battery Group-2). During normal a-c operation of the externally connected equipment, the batteries contained within the BPS receive a continuous trickle charge from the external equipment.

As a basic unit, the BPS consists of a frame, fuses F1001 through F1004, resistors R1001 through R1004, capacitor C1001, ammeter M1001, and METER SWITCH S1001 mounted as integral parts of the assembly. When supplied by the factory with one, two, three, or four batteries, the basic model designation changes to BPS(A)-1, BPS(B)-1, BPS(C)-1, and BPS(D)-1, respectively (refer to table 1-1).

When equipped with batteries BT1001 and BT1002, the BPS will provide four ampere hours of continuous operation when equipped with batteries BT1001, BT1002, BT1003, and BT1004, the BPS will provide better than seven ampere hours of continuous operation. METER SWITCH S1001 and meter M1001, mounted on the front panel, are used to monitor the charge rate, discharge rate, or operating condition of either battery group.

1-2. PHYSICAL DESCRIPTION

The BPS measures 5-1/4 inches high by 16 inches deep (excluding front-panel controls), and is mounted on a 19-inch wide front panel suitable for installation in a standard equipment rack. Top and bottom dust covers are supplied.

When supplied with factory-installed batteries (BT1001, BT1002, BT1003, and BT1004), the BPS with two batteries weighs approximately 25-1/2 pounds and with four batteries approximately 42-1/2 pounds. Each battery is composed of 19 "D" sealed nickel-cadmium cells connected in series. Since each cell has an open circuit voltage of 1.45 volts nominal (fully charged) and a closed circuit voltage of 1.22 volts nominal, each battery provides approximately 24-volts output.

TABLE 1-1. BATTERY POWER SUPPLY MODELS

MODEL	BATTERIES SUPPLIED
BPSX-1	None
BPSA-1	1
BPSB-1	2
BPSC-1	3
BPSD-1	4

1-3. ELECTRICAL CHARACTERISTICS

NOTE

The values specified here apply to the BPS when provided with batteries BT1001, BT1002, BT1003, and BT1004.

Operating voltage	24 vdc
Ampere hours/battery	4 ampere hours
Internal impedance/battery	0.228 ohms approx.
Trickle charge rate (BATT GROUP-1)	Between 100 to 300 ma/hr.
Trickle charge rate (BATT GROUP-2)	Between 100 to 300 ma/hr.
Time required for complete 4 ampere hour BATT GROUP-1 charge	11 hrs. nominal @ 300 ma.
Time required for complete 7 ampere hour BATT GROUP-1 charge	11 hrs. nominal @ 600 ma.
Time required for complete 4 ampere hour BATT GROUP-2 charge	11 hrs. nominal @ 300 ma.
Time required for complete 7 ampere hour BATT GROUP-2 charge11 hrs. nominal @ 600 ma.

SECTION 2
INSTALLATION

2-1. INITIAL INSPECTION

Each BPS is tested at the factory, and is carefully packaged to prevent damage during shipment. When it is delivered at the operating site, inspect the packing case and its contents for damage that might have occurred during transit. Unpack the equipment carefully, and inspect all packaging material for parts that may have been shipped as loose items. With respect to damage to the equipment for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and furnishing of replacement parts.

2-2. INSTALLATION PROCEDURE

The BPS is designed for installation in a standard 19-inch wide equipment rack. Each BPS is equipped with tilt-lock slide mechanisms which permit the unit to be pulled forward and tilted to expose the top, bottom, or rear of the chassis for greater accessibility and ease of maintenance. To install the BPS in an equipment rack, proceed as follows:

- a. Pull out center sections of tracks located in equipment rack until they lock in an extended position.
- b. Position slide mechanisms of BPS in tracks, and ease BPS into rack until release buttons engage holes in tracks.
- c. Depress release buttons and slide BPS completely into rack.

Secure front panel of BPS to rack with screws and washers.

d. Make necessary electrical connections. If one external unit is to be connected to BPS, connect applicable battery power cable between BATTERY GROUP-1 jack J1005 and external unit. If more than one external unit is to be connected to the BPS, connect applicable battery power cable between BATTERY GROUP-2 jack J1006 and external unit. (See figure 2-1).

NOTE

To prevent BPS cables from snagging, attach the reel-mounted springs (NEGATOR B motors) located inside the rack to the cables.

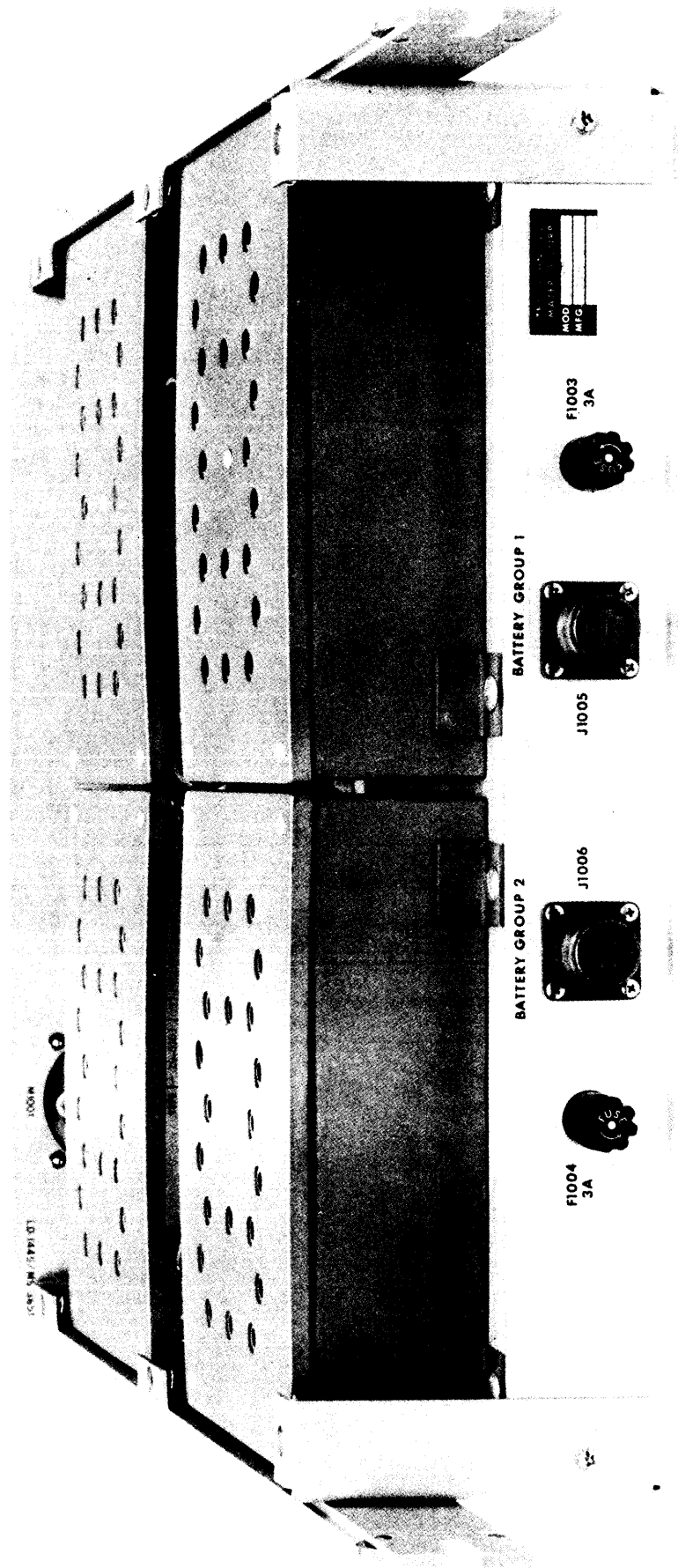


Figure 2-1. Battery Power Supply, Rear View

SECTION 3

OPERATOR'S SECTION

3-1. CONTROLS AND INDICATORS

The BPS is provided with one operating control (METER SWITCH S1001) and an indicating meter (M1001), used for monitoring purposes (refer to figure 3-1 and table 3-1).

METER SWITCH S1001 is used to select discharge, charge, or operating condition (voltage) of either Battery Group-1 or Battery Group-2 to be monitored by meter M1001. Indications on meter M1001 will depend upon the loading requirements and number of batteries used. Refer to paragraph 1-3 for the charge and discharge rates, and condition voltages, for the BPS.

TABLE 3-1. FRONT PANEL CONTROL AND INDICATOR

CONTROL OR INDICATOR	FUNCTION
METER SWITCH S1001	Six-position switch used to select discharge, charge, or operating condition of either Battery Group-1 or Battery Group-2, for monitoring on meter M1001.
Meter M1001	When any one of six positions is selected by METER SWITCH S1001, meter M1001 will indicate rate of discharge, charge, or operating condition of either Battery Group-1 or Battery Group-2.

3-2. OPERATOR'S MAINTENANCE

Maintenance of the BPS consists of checking connection and condition of interconnecting cables, replacing defective fuses, and insuring cleanliness of the unit. See figures 2-1, 5-1, and 5-2 for identification and location of connectors and fuses.

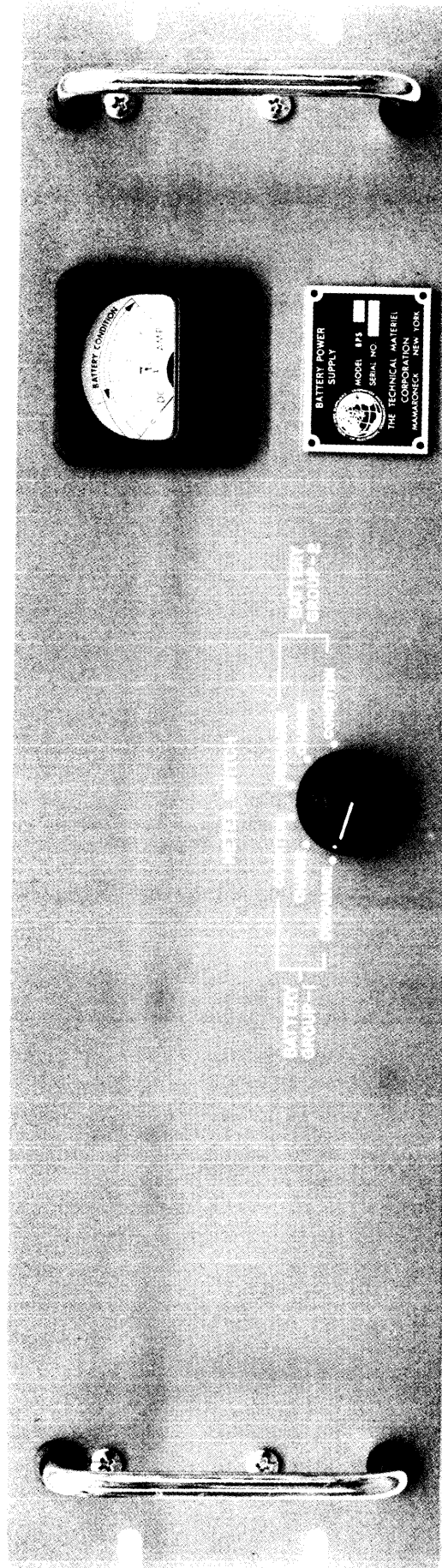


Figure 3-1. Battery Power Supply, Front Panel Control and Indicator

SECTION 4

CIRCUIT ANALYSIS AND TROUBLESHOOTING

4-1. CIRCUIT ANALYSIS

a. GENERAL. - Battery Power Supply BPS consists of two battery groups (Battery Group-1 and Battery Group-2) and a metering circuit. Each battery group may contain one or two 24-volt batteries. With one battery included in each group, the BPS is capable of providing four ampere hours of discharge (operation). However, with two batteries (connected in parallel) in each group, approximately eight ampere hours of operation are provided. The metering circuit, common to both groups, is used to monitor the battery condition (voltage), and the charge and discharge currents of each battery group. Fuses are included in each battery group to assure maximum protection.

b. BATTERY GROUPS 1 AND 2 (SEE FIGURE 7-1). - When supplied with two batteries, Battery Group-1 consists of batteries BT1001 and BT1002, fuses F1001 and F1003, and resistor R1001. Similarly, Battery Group-2 consists of batteries BT1003 and BT1004, fuses F1002 and F1004, and resistor R1002. Fuses F1001 and F1003 protect Battery Group-1 from internal and external malfunctions, respectively; likewise, fuses F1002 and F1004 protect Battery Group-2. During normal operation, with a-c line power applied to the externally connected equipment, Battery Groups 1 and 2 continually receive a trickle

charge. During emergency operation (a-c line power failure), Battery Groups 1 and 2 provide a potential of 24 volts nominal to the externally connected equipment. The normal and emergency modes of operation are not affected by the switching and metering functions of METER SWITCH S1001 and meter M1001 (refer to paragraph c).

c. METERING CIRCUIT (SEE FIGURE 7-1). - The metering circuit, comprising METER SWITCH S1001, meter M1001, Zener diode CR1001, resistor R1003, and potentiometer R1004, is used to monitor the operating condition (voltage), and the charge and discharge currents of each battery group as described in paragraphs (1) and (2) below. Since the components of each battery group are identical, except for the multiple load connector at BATTERY GROUP-2 jack J1006, only Battery Group-1 operation is explained in the following paragraphs.

- (1) The CHARGE and DISCHARGE positions of METER SWITCH S1001 are used to check the discharge and charge currents of the batteries (see figure 4-1A and 4-1 B). In either position of the switch, meter M1001 is connected in parallel with meter shunt resistor R1001, which is in series with the battery group. By switching METER SWITCH S1001 from CHARGE to DISCHARGE, the polarity of the current to the meter is reversed.
- (2) When METER SWITCH S1001 is set at CONDITION, meter M1001 functions as a voltmeter (see figure 4-1C). With the switch in this position, the 24 vdc nominal output of the battery group is fed across a voltage divider network consisting of Zener diode CR1001, resistor R1003, and potentiometer R1004. Diode CR1001 breaks down at its Zener voltage level of 20 vdc; this action expands the meter scale indication on

SECTION 5
MAINTENANCE

5-1. GENERAL

Maintenance of the BPS is divided into three categories: operator's maintenance, preventive maintenance, and repair and replacement of components. Preventive maintenance includes information necessary to insure optimum performance of the BPS. For this reason, alignment and adjustment information is included under preventive maintenance (paragraph 5-3). Information concerning the repair and replacement of BPS components is given in paragraph 5-4. Operator's maintenance for the BPS is described in Section 3.

5-2. SPECIAL TOOLS AND TEST EQUIPMENT.

A Simpson Model 260 VOM (or equivalent) and a maximum of two 100-ohm, 10-watt resistors are the only pieces of test equipment required for maintenance of the BPS.

5-3. PREVENTIVE MAINTENANCE

a. CLEANING AND INSPECTION. At scheduled intervals the BPS should be removed from the rack for cleaning and inspection. Remove the top and bottom dust covers, and inspect all components and wiring for dirt, corrosion, charring, discoloring and grease. Remove dust or foreign matter with a soft brush, compressed air, or vacuum cleaner. Remove dirt or grease with a

non-flammable dry cleaning fluid.

WARNING

Trichlorethelene, or methyl chloroform, may be used if precautions relative to adequate ventilation and minimum contact with skin are observed. Disconnect all power to the equipment before beginning cleaning procedure.

CAUTION

Trichlorethylene may act as a paint remover; avoid contact with painted surfaces.

b. METER M1001 CALIBRATION. - When meter M1001 or Zener diode CR-1001 has been replaced, meter M1001 should be re-calibrated. To calibrate meter M1001, proceed as follows.

NOTE

Each battery group consists of one or two 24-volt batteries, depending upon the BPS model designation (see table 1-1).

(1) Disconnect BATTERY GROUP-1 jack J1005 and/or BATTERY GROUP-2 jack J1006 from the external equipment.

(2) Connect a 100 ohm, 10 watt resistor across pins A and B of jack J1005 and/or jack J1006.

NOTE

Step (3) below assumes that all four batteries are available and connected to their appropriate connectors. If only one, two, or three batteries are used, the VOM must be connected accordingly.

(3) To insure that batteries are providing required voltage, successively connect test leads of VOM between pins A and B (black lead to pin A, red lead to pin B) of connector P1001, P1002, P1003, and P1004. With a 100 ohm 10 watt load, the VOM should indicate 24 ± 0.5 volts d-c.

(4) Disconnect VOM test leads.

(5) Set METER SWITCH S1001 to CONDITION on BATTERY GROUP-1.

(6) Adjust potentiometer R1004 for center indication (0.35 amps) on meter M1001.

(7) Remove load resistor from pins A and B of jack J1005 and/or jack J1006

(8) Reconnect BATTERY GROUP-1 jack J1005 and/or BATTERY GROUP-2 jack J1006 to external equipment.

5-4. REPAIR AND REPLACEMENT OF COMPONENTS.

The major components contained in the BPS are illustrated in figures 5-1 and 5-2; repair and replacement procedures for components are obvious upon inspection and therefore are not included in this manual. When replacing diode CR1001 (1N3027B), use long-nosed pliers or alligator clips to hold wire leads while soldering, thus transferring heat away from the diode junction.

NOTE

If a component is replaced (excluding fuses, R1001 and R1002, and S1001), readjustment of R1004 will be necessary.

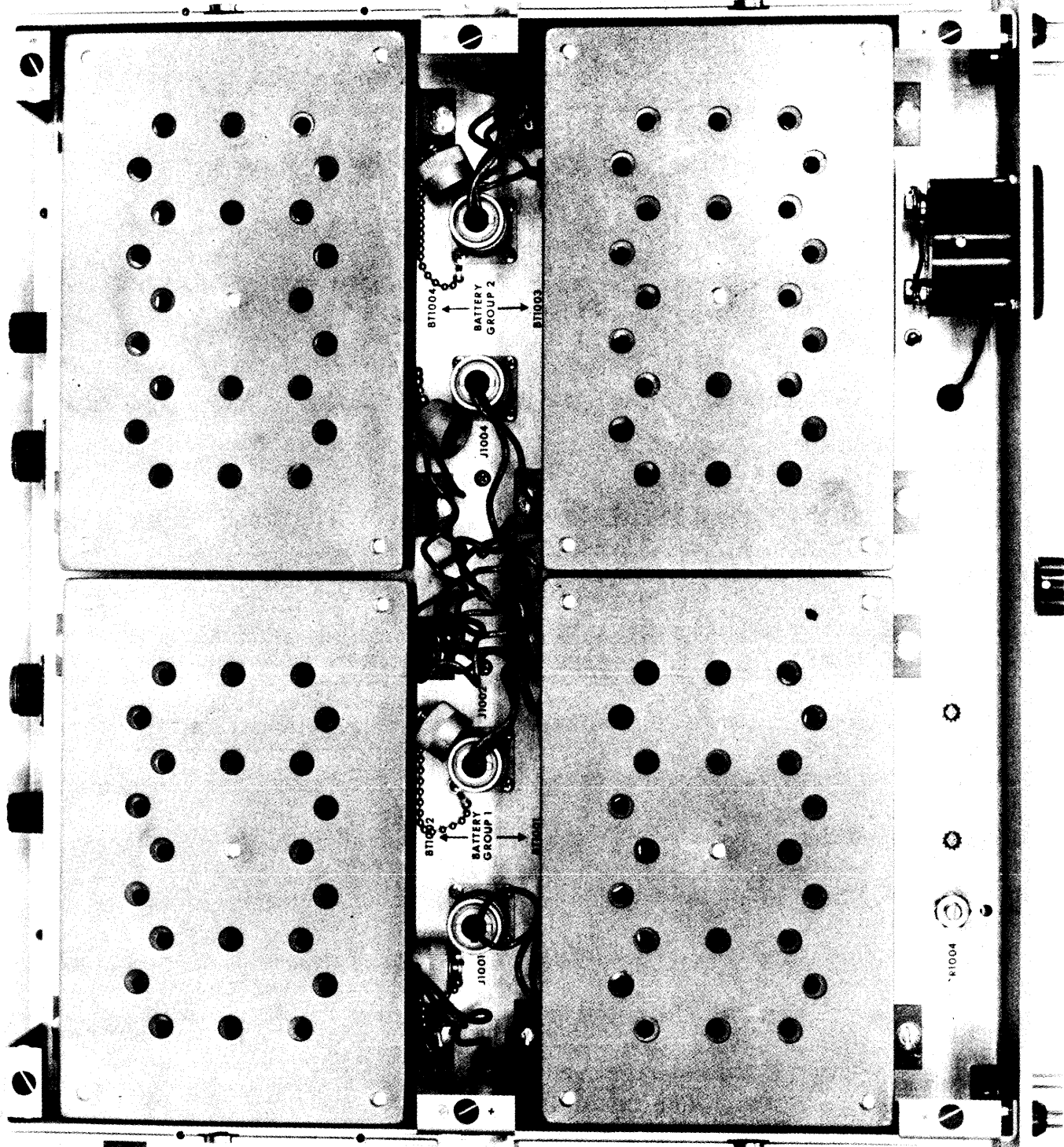


Figure 5-1. Battery Power Supply. Top View

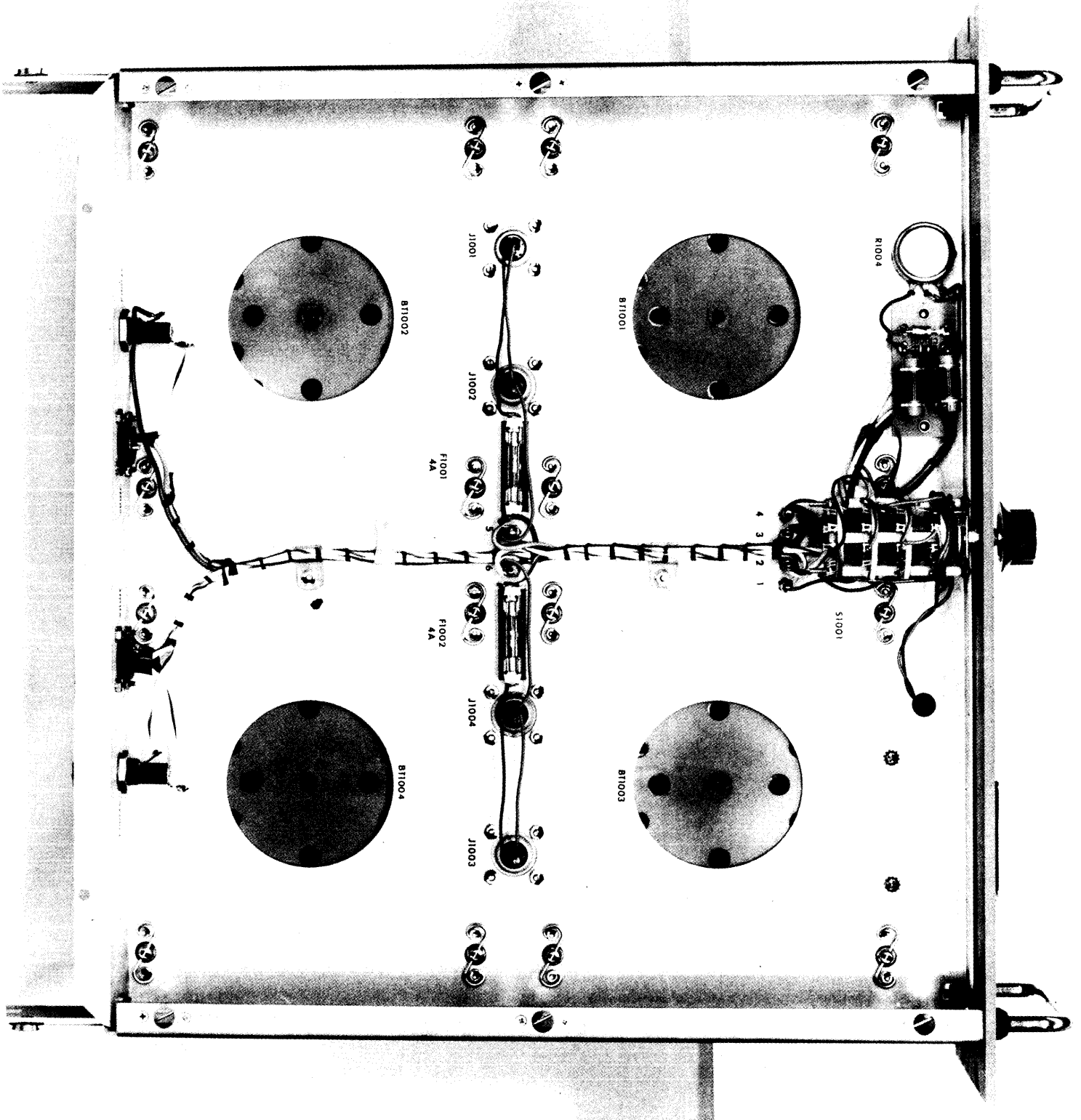


Figure 5-2. Battery Power Supply. Bottom View

SECTION 6

PARTS LIST

INTRODUCTION. - Reference designations have been assigned to identify all maintenance parts of the equipment. These designations appear on wiring schematics and are marked on the equipment adjacent to the part. The following is a listing of all maintenance parts and their corresponding designations. The TMC part number is the number by which the part may be ordered.

NOTE

The Battery Power Supply is available in five models. These models differ only in the quantity of batteries supplied as follows:

BPS(X)-1 - No batteries
BPS(A)-1 - 1 battery
BPS(B)-1 - 2 batteries
BPS(C)-1 - 3 batteries
BPS(D)-1 - 4 batteries

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
BT1001	BATTERY ASSEMBLY, STORAGE: consists of 4 slotted head studs, 4 stud retaining rings, battery and 1 connector symbol number P1001.	AB104
BT1002	Same as BT1001.	
BT1003	Same as BT1001.	
BT1004	Same as BT1001.	
C1001	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, +60% -40%; 150 WVDC.	CC100-35
CR1001	SEMICONDUCTOR DEVICE, DIODE: silicon; diffused junction; voltage range 6.8 to 200 V; nom. rating 20 V, +5% at 12.5 Ma; 22 ohms max. impedance; 1 watt; max. operating temperature -65 to +175°C; DC power dissipation 3/4 watt; polarized; hermetically sealed metal and glass welded case.	IN3027B
F1001	FUSE, CARTRIDGE: 32 V, 4 amps; 1-1/4" long x 1/4" dia.; slow blowing.	FU102-4
F1002	Same as F1001.	
F1003	FUSE, CARTRIDGE: 32 V, 3 amps; 1-1/4" long x 1/4" dia.; slow blowing.	FU102-3
F1004	Same as F1003.	
J1001	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 #16 male contacts; rated at 17.0 amps.	JJ200-5
J1002	Same as J1001.	
J1003	Same as J1001.	
J1004	Same as J1001.	
J1005	CONNECTOR, RECEPTACLE, ELECTRICAL: female; 4 round #16 contacts; straight type.	MS3102A14S-2S
J1006	CONNECTOR, RECEPTACLE, ELECTRICAL: female; 6 round #16 contacts; straight type.	MS3102A14S-6S
M1001	AMMETER, DC: level indicating; 0-.7 milliamp DC scale; resistance, 75 ohms +50%, FS deflection 0-1 MA +2%; phenolic black case.	MR176-1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
P1001	CONNECTOR, PLUG, ELECTRICAL: 3 #16 round female contacts; rated at 17.0 amps; straight type.	PL212-5
P1002	Same as P1001.	
P1003	Same as P1001.	
P1004	Same as P1001.	
R1001	RESISTOR, FIXED, WIREWOUND: rated at .064 ohms \pm .003.	RW124
R1002	Same as R1001.	
R1003	RESISTOR, FIXED, COMPOSITION: 3,900 ohms, \pm 10%; 1/2 watt.	RC20GF329K
R1004	RESISTOR, VARIABLE, COMPOSITION: 1,000 ohms, \pm 10%; 2 watts.	RV4LAYS102A
S1001A,B, C,D	SWITCH, ROTARY: 4 sections, 6 positions, 30° angle of throw; non-shorting type contacts.	SW345
XF1001	FUSEHOLDER: clip type; single pole; accomodates 1/4" dia. x 1-1/4" long AGC fuse.	FH105
XF1002	Same as XF1001.	
XF1003	FUSEHOLDER: extractor post type; accomodates cartridge fuse 1/4" dia. x 1-1/4" long; rated at 15 amps 250 V max.; o/a length 1-3/4"; bushing mounted.	FH103
XF1004	Same as XF1003.	

SECTION 7

SCHEMATIC DIAGRAMS