TECHNICAL MANUAL

for

BATTERY POWER SUPPLY

MODEL BPS( )-1

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y. OTTAWA, CANADA

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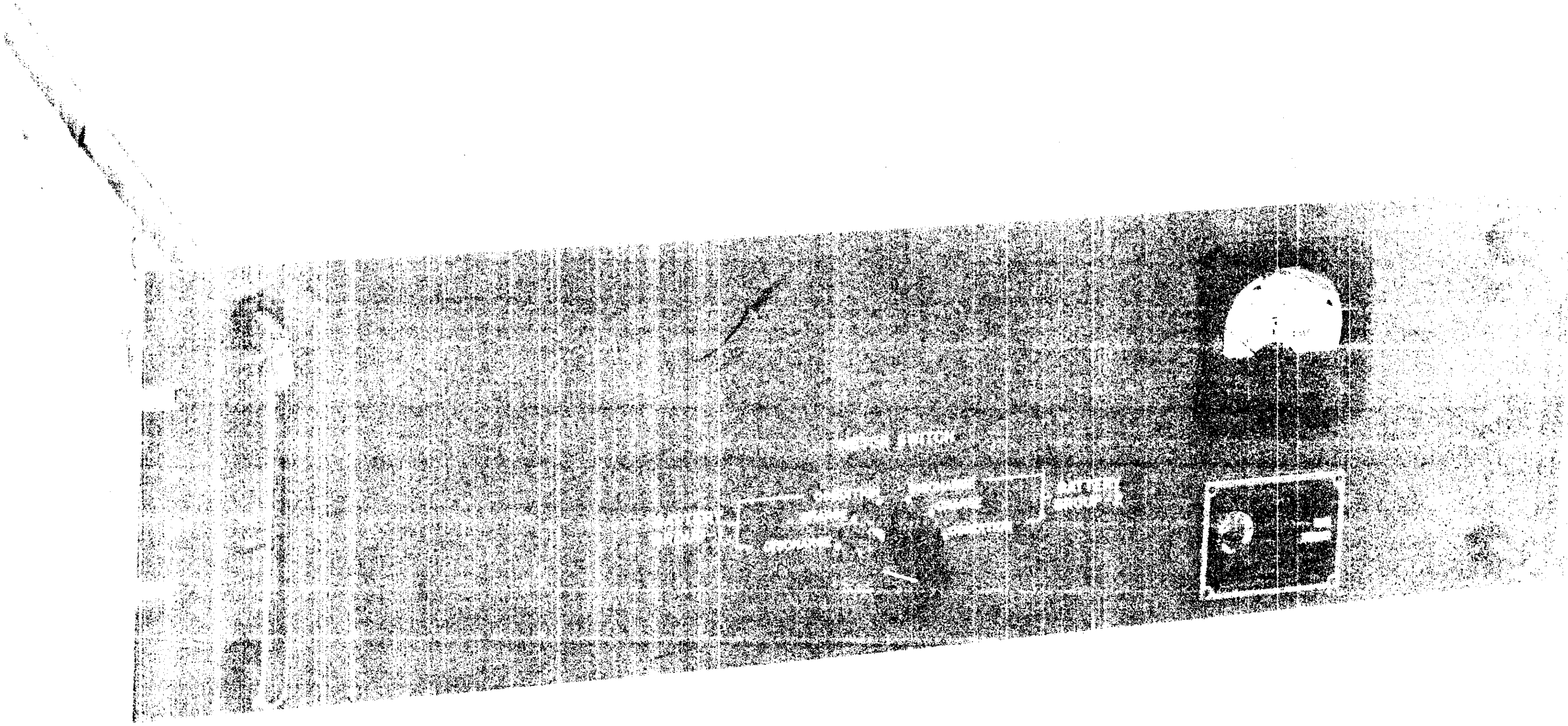


Figure 1-1. Model RBH, Battery Power Supply.

SECTION 1

GENERAL INFORMATION

1-1. PURPOSE AND DESCRIPTION OF EQUIPMENT.

The basic Model BPS(X)-1, Battery Power Supply (hereafter referred to as BPS), is designed with facilities for mounting two battery groups with maximum of four 24 volt matched nickel cadmium batteries. As a basic unit the BPS excludes batteries and contains a frame, with 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 with one, two, thr e, or four batteries, the basic model designator correspondingly changes to BPS(A)-1, BPS(B)-1, BPS(C)-1 and BPS(D)-1, respectively (refer to table 1-1 and see figure 1-1). The BPS when battery supplied, can be used with any piece of equipment requiring a 24 vdc source.

TABLE 1-1. BATTERY POWER SUPPLY MODELS EQUIPPED WITH BATTERIES

MODEL	BATTERIES SUPPLIED
BPS(X)-1	NONE
BPS(A)-1	1
BPS(B)-1	2
BPS(C)-1	3
BPS(D)-1	4

The prime function of the BPS is to provide operating voltag s of 24 vdc to externally connected units in the event of an a-c line power failure. At all other times the batteries contained within the BPS are normally receiving a trickle charge from an external source.

Four-ampere hours of continuous operation is provided should the BPS contain two batteries (one battery per group). With four batteries included, (two batteries per group), better than seven-ampere hours of continuous operation is provided.

A front panel METER SWITCH S1001 selects the desired battery group. This switch in conjunction with a front panel meter M1001 serves to monitor the condition of the battery group, its charge rate and current drain.

Each of the batteries are composed of 19 "D" sealed nickel-cadmium cells connected in series. Since each cell has an open circuit 1.45 volts nominal (fully charged) and a closed circuit voltage of 1.22 volts nominal, each battery provides approximately 24-volts output.

Dimensionally, the BPS measures 5-1/4 inches high by 16 inches deep (excluding front panel controls), on a 19 inch wide front panel. Unit weight with two batteries supplied is 25-1/2 lbs approximately. With four batteries installed, unit weight is 42-1/2 lbs approximately. Top and bottom dust covers are also supplied.

1-2. ELECTRICAL CHARACTERISTICS.

Operating voltage	24 vdc nominal
Ampere hours/battery	4 ampere-hours. Current drain not greater than 800 ma/hour (800 milliamperes at 5 hours=4 ampere-hours)
Internal impedance/battery	0.228 ohms approx.
Trickle charge rate (one battery) . . .	Between 300 to 400 ma/hour
Time required for complete 4-ampere hour battery charge (one battery) . . .	18-2/3 hours at 300 ma

SECTION 2

INSTALLATION

2-1. INITIAL INSPECTION.

Each BPS is tested at the factory before shipment. Upon arrival at the operating site, inspect the packaging case and its contents immediately for possible damage. Unpack the equipment carefully. Inspect all packaging material for parts which may have been shipped as loose items.

With respect to damage to the equipment for which the carri r is liable, The Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

2-2. INITIAL INSTALLATION.

Installation of the BPS into a 19 inch wide equipment rack may be made with dimensions given in paragraph 1-2 and performing the following steps: (See figure 2-1).

NOTE

> The BPS is designed for rack installation. The unit is provided with a tilting side mechanism. The tilting slide permits the chasis to be pulled out of the equipment rack to expose the top or bottom of the chassis for greater accessibility and ease of maintenance.

a. Install unit in rack and secure front panel to rack with four suitable bolts and washers.

b. If a multiple load connection to the BPS is required, connect a battery power cable between BAT GROUP 2 jack J1006 and external loads.

c. If one external load connection is required, connect a battery power cable between BAT GROUP 1 jack J1005 and external loads.

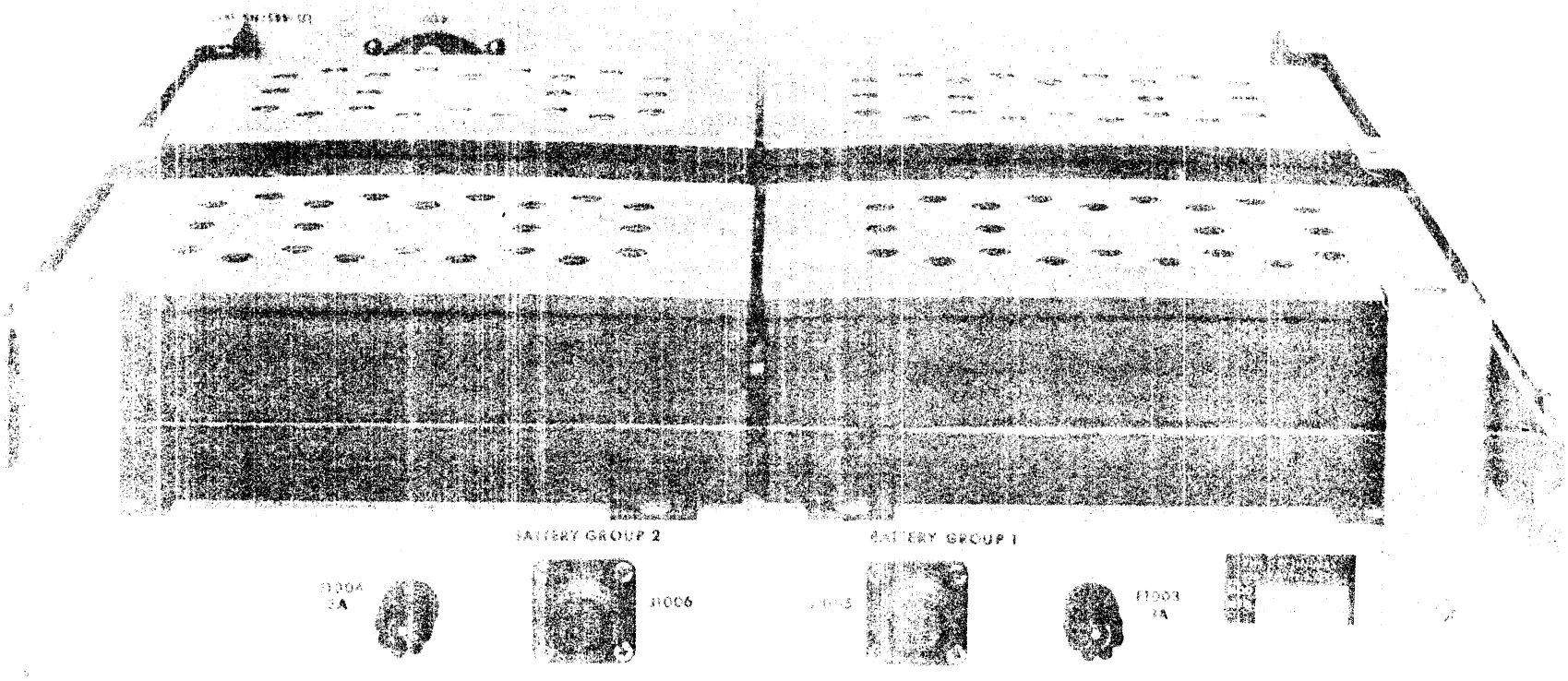


Figure 2-1. Battery Power Supply, Rear View

SECTION 3

OPERATOR'S SECTION

3-1. GENERAL.

Operation of the BPS has been designed for simplicity and versatility. The unit is divided into two battery groups: battery group 1 and battery group 2. During emergencies, the unit operates to supply source potentials of 24 vdc to externally connected loads.

A selector switch and milliammeter, are mounted on the front panel. These are used to monitor the condition (voltage) of each battery group, its charge and discharge rate.

3-2. OPERATING CONTROL AND INDICATOR.

Figure 3-1 shows front panel callouts for identifying and locating the operating control and indicator related to the BPS. Their functions are given in table 3-1.

3-3. OPERATOR'S INSTRUCTIONS.

The BPS contains one operating control and indicator. These are a six position METER SWITCH S1001 and meter M1001, which are used for monitoring purposes. The METER SWITCH S1001 is divided into two groups: BATTERY GROUP-1 and BATTERY GROUP-2. Each group contains three switch positions: CHARGE, DISCHARGE and CONDITION. These switch positions correspond to the charge rates, discharge rate and condition of battery group 1 and battery group 2. Refer to paragraph 1-2 for the charge and dischare rates and condition voltages of the BPS.

3-4. OPERATOR'S MAINTENANCE.

The operator may at times be required to perform operator's maintenance. This may consist of merely observing for unit

cleanliness, condition and connection of interconnecting cables and replacement of defective fuses. See figur s 2-2, 5-1 and 5-2 for identification and location of the various connectors and fuses on the BPS.

TABLE 3-1. FRONT PANEL CONTROL AND INDICATOR

CONTROL OR INDICATOR	FUNCTION
METER SWITCH S1001	Six position selector switch used in conjunction with meter M1001 to monitor the rate of charge, discharge and operating condition of Battery Group-1 and Battery Group-2.
Meter M1001	When manually selected by METER SWITCH S1001, monitors the rate of charge, discharge and operating condition of Battery Group-1 and Battery Group-2.

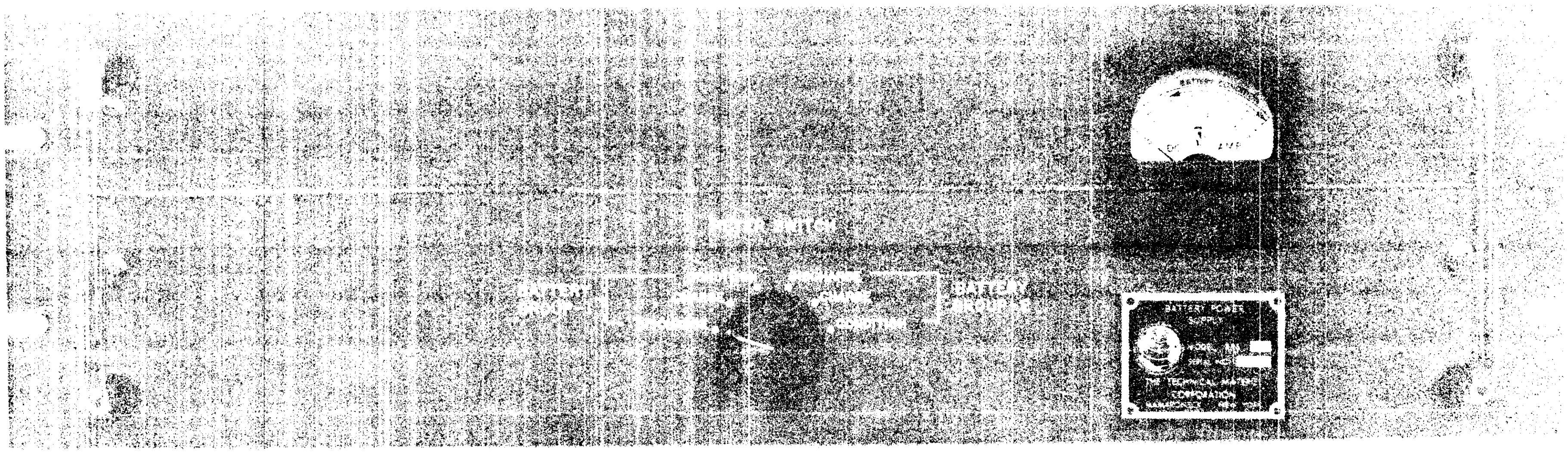


Figure 3-1. Battery Power Supply, Front Panel Control and Indicators

SECTION 4

TROUBLESHOOTING

4-1. OVERALL FUNCTIONAL DESCRIPTION AND TROUBLESHOOTING OF UNIT.

a. FUNCTIONAL DESCRIPTION. - The Battery Power Supply (see figure 7-1), is basically composed of two battery groups and a metering circuit. Fuses are included in each group to assure maximum protection. Each battery group contains facilities for utilizing one or two 24-volt batteries. With one battery included in each group, the unit is capable of providing four ampere-hours of (discharge) operation. However, with two batteries in each group (connected in parallel), better than seven ampere-hours of operation is provided. Battery group 1, when supplied with two batteries, includes 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. A metering circuit, common to both groups, includes METER SWITCH S1001, meter M1001, Zener diode CR1001, resistor R1003 and pontentiometer R1004. The metering circuit is used to monitor the battery voltage (its condition), and the charge and discharge currents of each battery group. Since each battery group contains identical components, except for the multiple load connections at BAT GROUP 2 jack J1006, only battery group 1 will be discussed.

Battery group 1 operates under two modes of operation: normal and emergency. During normal operation, the battery group is receiving a trickle charge from an external source. In emergency operation, the battery group functions to provide a source

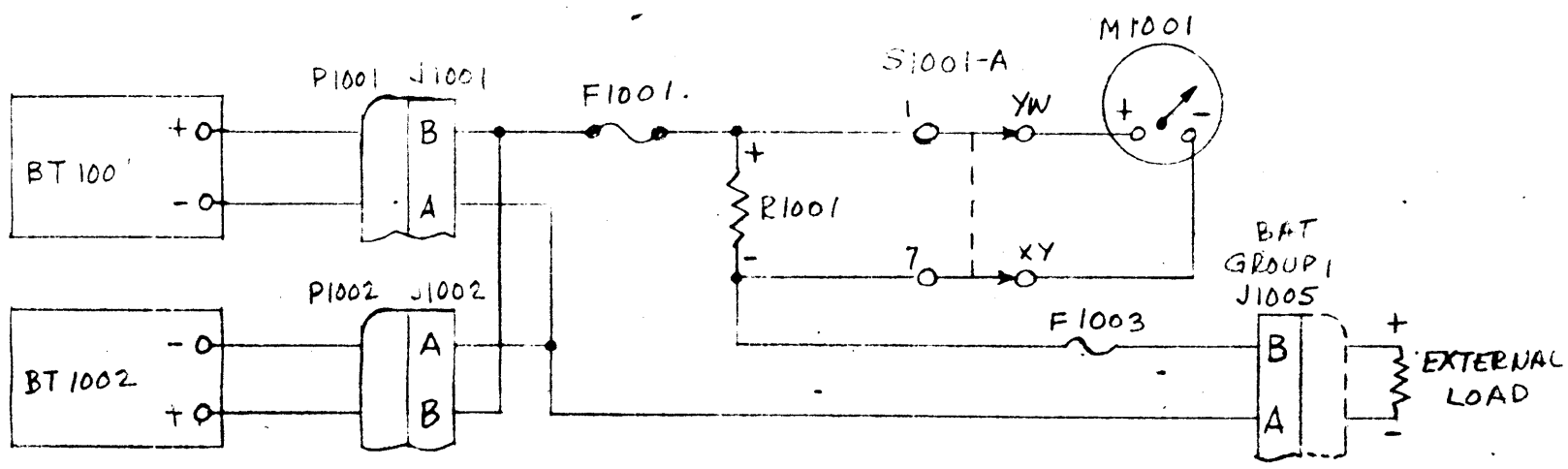
potential of 24 volts nominal to an externally connected load. Both modes of operation are unaffected by the switching and metering functions of METER SWITCH S1001 and meter M1001.

The CHARGE and DISCHARGE positions of METER SWITCH S1001 (see figure 4-1A and 4-1B), are used to check the charge and discharge currents of the battery (ies). In both positions, 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 supplied to the meter is reversed. With METER SWITCH S1001 set to CONDITION (see figure 4-1C), meter M1001 functions as a voltmeter. In this position, the 24 vdc nominal output of battery group 1 is fed across a voltage divider network consisting of Zener diode CR1001, resistor R1003 and potentiometer R1004. Diode CR1001, functions to breakdown at its Zener voltage level of 20 vdc. This provides for an expanded meter scale indication on meter M1001. Current flow through meter M1001 is manually set by potentiometer R1004 for a center meter reading indication of 0.35 milliamperes. At voltages between 20 and 26 vdc meter M1001 should indicate from zero to three-quarter full scale deflection. As the battery supply voltage decreases, a corresponding decrease is indicated on meter M1001. Fuses F1001 and F1003 serve to protect the BPS from internal as well as external malfunctions, respectively.

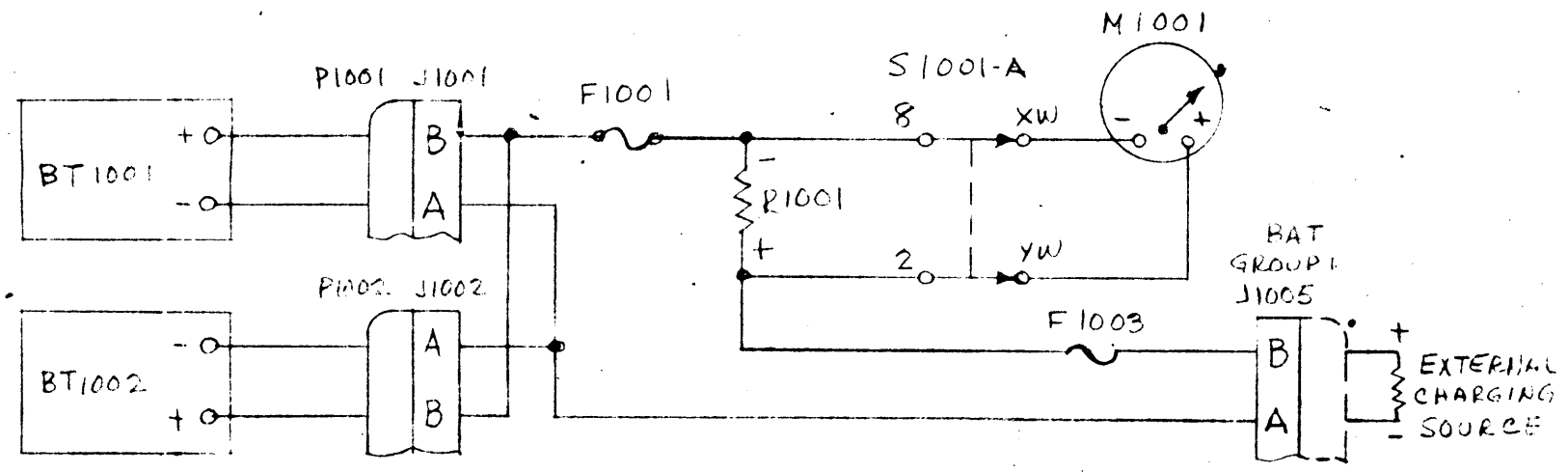
b. TROUBLESHOOTING. - As an aid to troubleshooting the BPS refer to the simplified and detailed schematic diagrams, figures 4-1 and 7-1. The only test equipment required for troubleshooting is a multimeter (Simpson Model 260 or equivalent).

At the first indication of trouble use METER SWITCH S1001 to monitor for proper charge and discharge rates and voltage condition

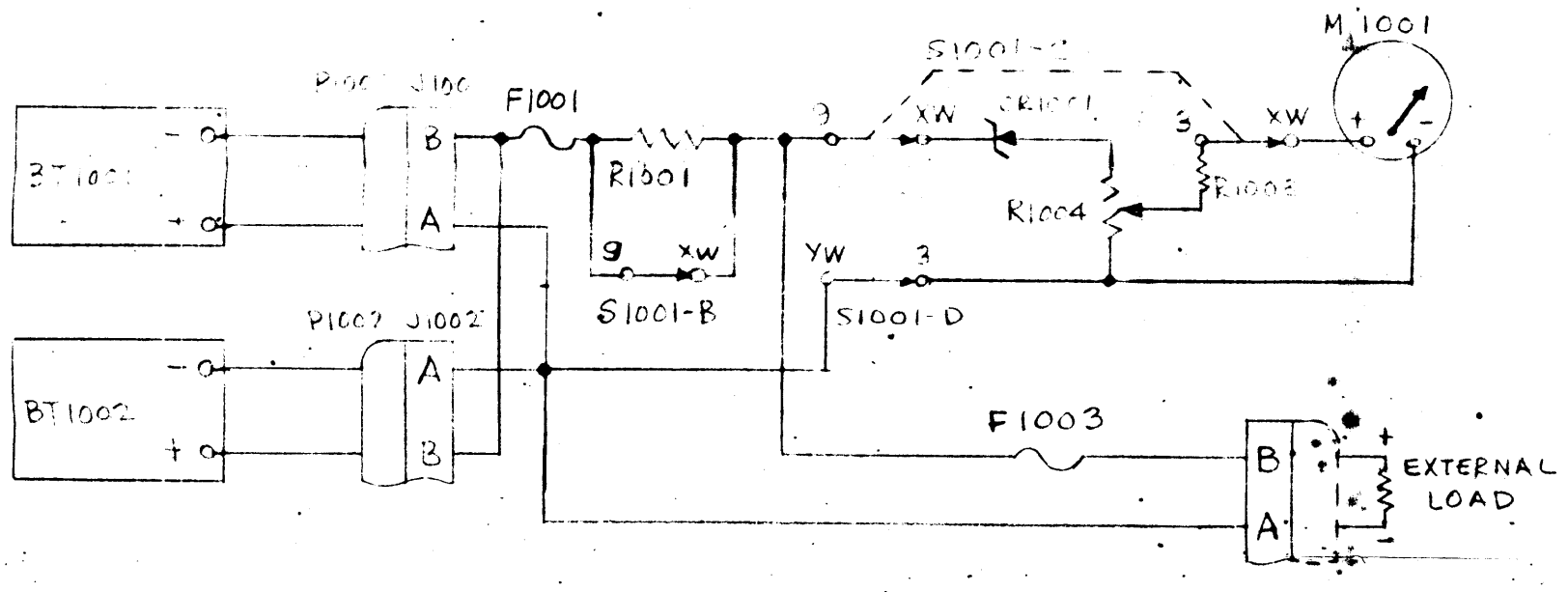
of the battery group suspected of being defective. An erroneous meter reading or no meter indication may be due to a defective switch, meter, or component. Using a multimeter check the voltage across Zener diode CR1001. The multimeter should indicate 20 volts $\pm$5 percent. Check fuses F1001 through F1004 for a blown condition. Also, it should be noted that the external generator source or connecting load to the BPS may not be operating properly. Consequently, the trouble may be external to the BPS.



A. DISCHARGE POSITION



B. CHARGE POSITION



C CONDITION POSITION

FIGURE 4-1 BATTERY POWER SUPPLY, SIMPLIFIED PARTIAL SCHEMATIC DIAGRAM

SECTION 5

MAINTENANCE

5-1. GENERAL

Maintenance may be divided into three catagories: operator's maintenance, preventive maintenance and corrective maintenance. Corrective maintenance is sometimes considered as consisting of information useful in locating and diagnosing equipment troubles and maladjustments, existing and/or pending, and information necessary to remedy the equipment troubles and maladjustments. Corrective procedures in this section are those necessary to correct a trouble due to a maladjustment of a control or adjustment. By using this procedure along with the information presented in Section 4, a trouble may be localized. Operator's maintenance is included in Section 3.

5-2. PREVENTIVE MAINTENANCE.

In order to prevent failure of the equipment due to corrosion, dust or other destructive elements, it is suggested that a preventive maintenance schedule be set up and adhered to.

At periodic intervals, the equipment should be removed from its mounting for cleaning and inspection. All accessible covers should be removed and the wiring and all components inspected for dirt, corrosion, charring, discoloring or grease. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease from other parts with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichlorethylene or methyl chloroform may be used, providing the necessary precautions are observed.

WARNING

When using toxic solvents, make certain that adequate ventilation exists. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with skin. Flammable solvents shall not be used on energized equipment or near any equipmnet from which a spark may be received. Smoking, "hot work", etc. is prohibited in the immediate area.

CAUTION

When using trichlorethylene, avoid contact with painted surfaces, due to its paint removing effects.

5-3. CORRECTIVE MAINTENANCE.

a. GENERAL. - Corrective maintenance is essentially The Technical Materiel Corporation's factory adjustment procedure as modified for use in the field. Corrective maintenance also consists of replacing defective fuses, resistors and batteries. Figures 5-1 and 5-2 illustrate the major components of the BPS.

b. REPLACEMENT OF COMPONENTS. - Replacement of a component in the BPS (excluding all fuses, resistors R1001 and R1002, and METER SWITCH S1001), requires a re-adjustment of control R1004 (refer to paragraph 5-4). When replacing diode CR1001 (IN3027B), use a heat sink, such as alligator clips to hold the wire lead being soldered. In this manner, heat is transferred away from the diode junction.

c. SPECIAL TOOLS AND TEST EQUIPMENT. - The only test equipment required is multimeter, Simpson Model 260, or equivalent and one or two 100-ohm, 10 watt resistors. The multimeter is used during the battery condition adjustment procedure (refer to paragraph 5-4). There are no special tools required for corrective maintenance.

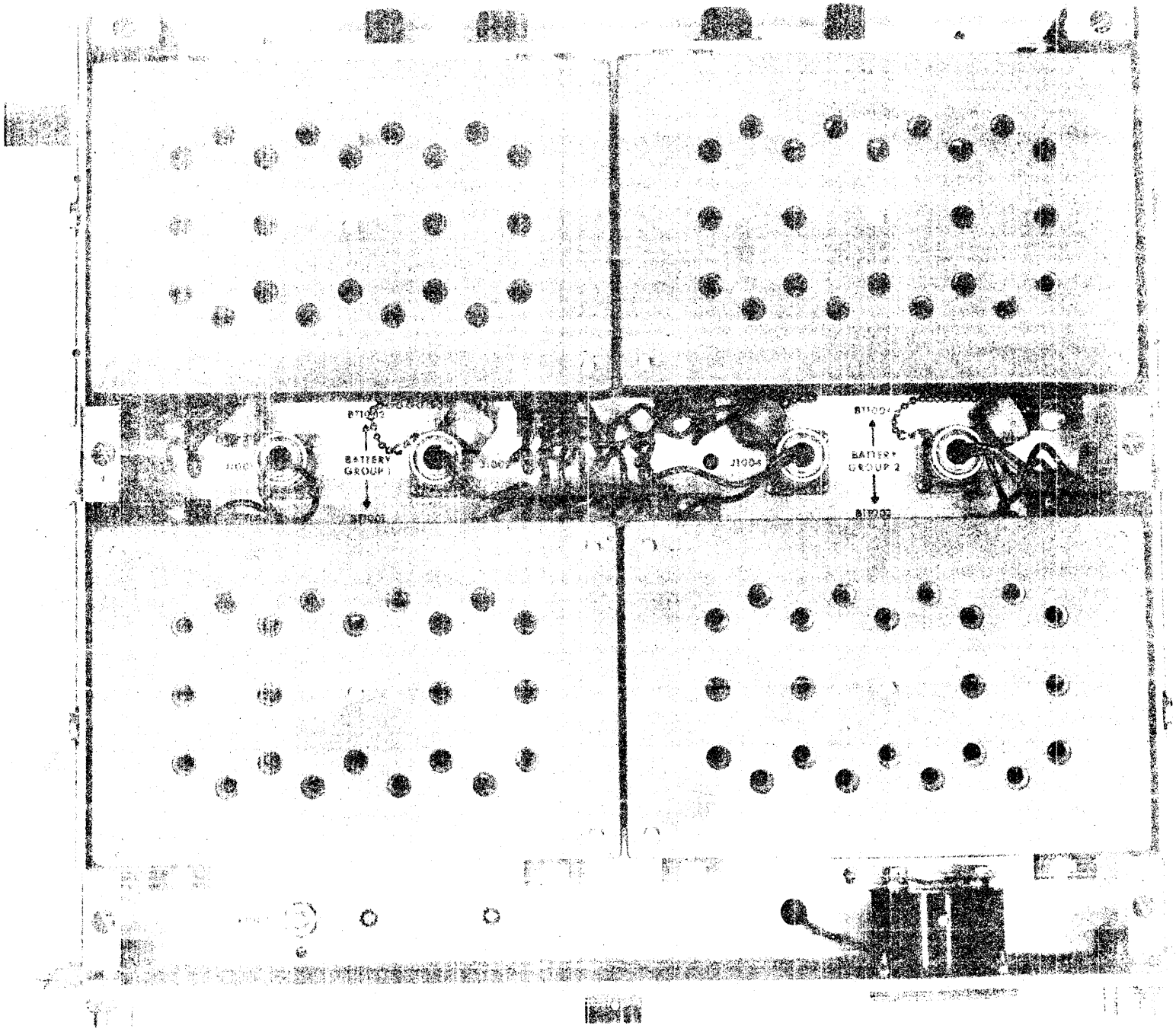


Figure 5-1. Battery Power Supply, Top View

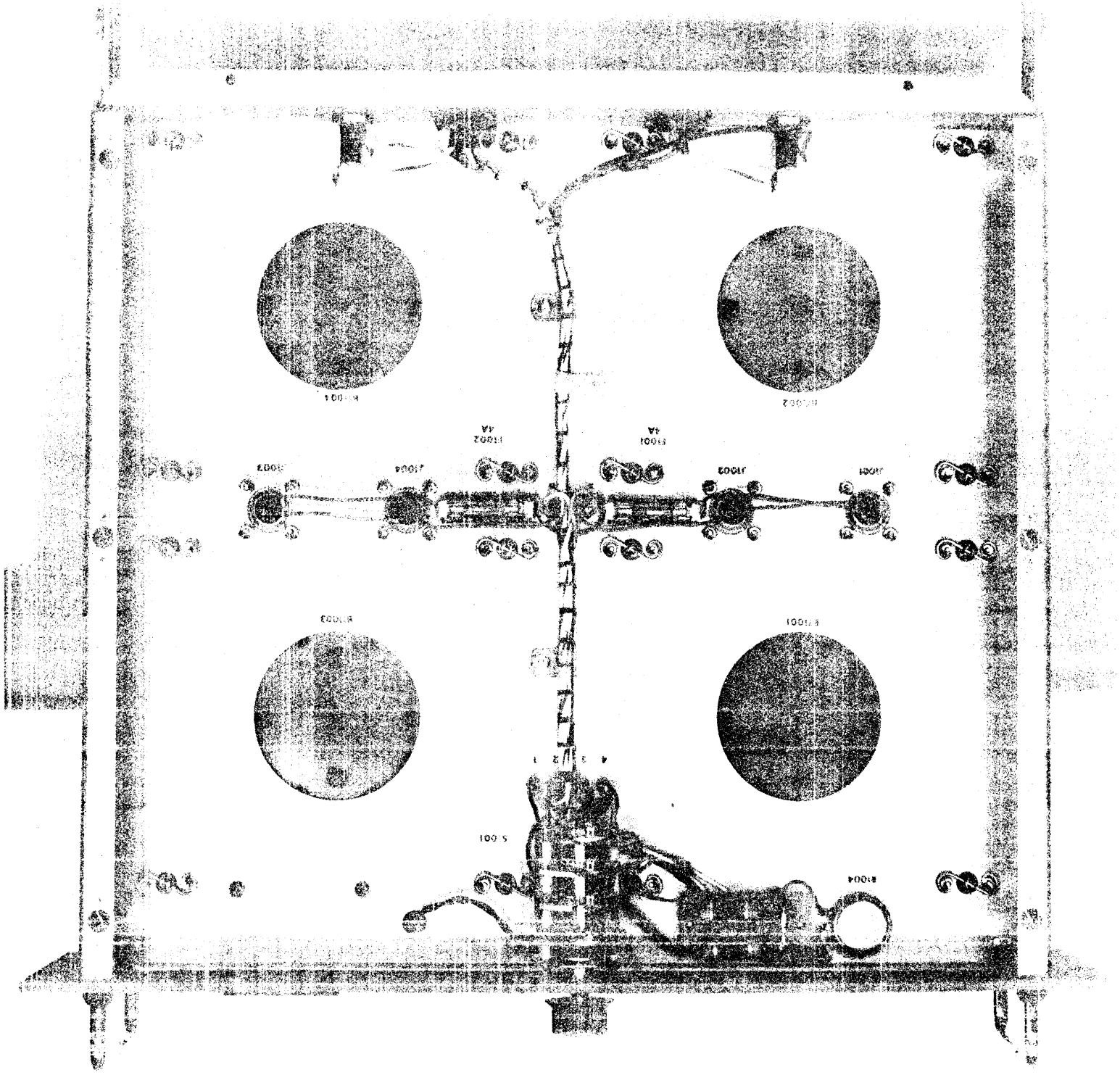


Figure 5-2. Battery Power Supply, Bottom View

5-4. BATTERY CONDITION ADJUSTMENT.

The battery condition adjustment procedure is performed to insure that the correct battery condition (voltage) is indicated on meter M1001.

(1) TEST EQUIPMENT. - The only test equipment required to perform the battery condition adjustment is a multimeter, Simpson Model 260, or equivalent and a maximum of two-100 ohm, 10 watt resistors.

(2) PROCEDURE. - To perform the battery condition adjustm nt, proceed as follows.

NOTE

Each battery group consists of one or two 24-volt batteries, depending upon customer's requirements.

(a) Disconnect BAT. GROUP 1 jack J1005 and/or BAT GROUP 2 jack J1006 from external load (s), if connected.

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

(c) Successively connect black and red test leads of multimeter between pins A and B of connector P1001, P1002, P1003 and P1004, r spectively. Multimeter should indicate 24 $\pm$0.5 volts dc.

NOTE

Step (c) assume that all four batteries are available and connected to their appropriate internal connectors. If only one, two or three batteries are used, connect multimeter accordingly.

(d) Remove multimeter test leads.

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

(f) Adjust control R1004 for a center reading indication (0.35 amps) on meter M1001.

(g) Remove load resistor(s).

(h) If necessary, reconnect BAT GROUP 1 jack J1005 and/or BAT GROUP 2 jack J1006 to external load(s) or source.

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. The Battery Power Supply models and the batteries supplied with each are 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 sloted 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.	1N3027B
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 ±.003.	RW124
R1002	Same as R1001.	
R1003	RESISTOR, FIXED, COMPOSITION: 3,900 ohms, ±10%; 1/2 watt.	RC20GF329K
R1004	RESISTOR, VARIABLE, COMPOSITION: 1,000 ohms, ±10%; 2 watts.	RV4LAYSA102A
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

P1001 J1001

BT1001

BATTERY GROUP-1

P1002 J1002

BT1002

P1003 J1003

BT1003

P1004 J1004

BT1004

F1001 4A

R1001 .064

F1002 4A

R1002 .064

S1001-C-REAR

S1001-D-REAR

BATTERY GROUP-1		BATTERY GROUP-2	
1.	DISCHARGE	4.	DISCHARGE
2.	CHARGE	5.	CHARGE
3.	CONDITION	6.	CONDITION

~UNLESS OTHERWISE SPECIFIED~

1- ALL RESISTORS ARE IN OHMS.

2- ALL CAPACITORS ARE IN MICROFARADS.

3- SWITCH S1001 SHOWN IN [illegible] POSITION.

4- SWITCH S1001 [illegible]

5- NUMBERS IN [illegible] CORRESPOND TO [illegible]

6- ALL MATERIAL [illegible] CONNECTED FRONT AND [illegible]

			DATE	E.C.N. NO.	DRAFT	CHKD	APPD
E2 B2	X1	ADDED PINS "D" & "F" TO J1006; " PIN "D" TO J1005, CUNET ADDED	2/24/64	1	JL		
	X2	EXTENSIVE CHANGES MADE TO S1001	5-1-64	2			
	X3	ON J1006 CONNECTION ADDED BETWEEN D & B, C & A	5/19/64	X3	A.M.		
E1	X4	J1006 - CONNECTIONS "F" & "E" ADDED	7.10.64		WB	ⓐ	
	Ø	ORIGINAL RELEASE FOR PRODUCTION	10-23-64	Ø	JL		

M1001

S1001-A-REAR

S1001-A-FRONT

C1001
.02

S1001-B-REAR

S1001-B-FRONT

J1006

F1004
3A

S1001-C-REAR

R1003
3.9K

R1004

S1001-C-FRONT

C1002

J1005

F1003
3A

DIAGRAM & SCHEMATIC