

SERVICE MANUAL

TBC 12V SERIES POWER SUPPLY

BATTERY CHARGER POWER SUPPLY WITH RELAY ALARM SIGNALS

KEPCO INC.

MODEL TBC 12-20M POWER SUPPLY

ORDER NO.

REV. NO.

IMPORTANT NOTES:

- 1) This manual is valid for the following Model and associated serial numbers:

MODEL	SERIAL NO.	REV. NO.
-------	------------	----------
- 2) A Change Page may be included at the end of the manual. All applicable changes and revision number changes are documented with reference to the equipment serial numbers. Before using this Service Manual, check your equipment serial number to identify your model. If in doubt, contact your nearest Kepco Representative, or the Kepco Documentation Office in New York, (718) 461-7000, requesting the correct revision for your particular model and serial number.
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KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, NY. 11352 U.S.A. • TEL (718) 461-7000 • FAX (718) 767-1102
email: hq@kepcopower.com • World Wide Web: <http://www.kepcopower.com>

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SECTION 1 - INTRODUCTION

1-1 SCOPE OF MANUAL

This Service Manual contains instructions for the installation, operation and maintenance of the TBC Series of Battery Charger Power Supplies, manufactured by Kepco Inc., Flushing, New York U.S.A.

Included in this documentation, is a separate, complete Service Manual for the Power Supply used in the TBC Battery Charger. That Service Manual contains all the diagrams, Parts List and technical details related to the Power Supply.

1-2 GENERAL DESCRIPTION

The Kepco TBC Series of Telecommunications Battery Chargers consists of three major groups of Power Supplies. They are used for charging 12, 24, and 48 Volt batteries respectively, and are capable of delivering up to 120 Amps.

The TBC Battery Charger Power Supplies are designed to Float-Charge large battery arrays such as those found in telephone operating systems. TBC supplies are fully stabilized and filtered "battery eliminators". They therefore can be used for diverse applications such as burn-in or margin testing. Kepco's TBC is designed with high frequency switching technology (150KHz FET-based Forward Converter topology) for high efficiency. High frequency switching translates into compact dimensions and lightweight. Sophisticated filtering is used to keep the spurious noise levels below recognized limits.

A sensing circuit is used to indicate whether current is flowing into or out of the TBC Power Supply. The internal logic reports Charging Stopped when it senses that the battery is not absorbing current from the Charger but rather is supplying current back to the TBC. This sensor is very sensitive. It can respond to a reverse current of less than 50 milliamperes for a Charger capable of delivering up to 120 Amperes.

1-3 ELECTRICAL SPECIFICATIONS

See Tables 1,2,3 and 4 below.

SPECIFICATIONS	CONDITION	RATING
Source Effect 115 Vac \pm 15 Vac 230 Vac \pm 30 Vac	Minimum – Maximum	0.8% typical
		1.6% maximum
Load Effect	10 to 100 percent	0.8% typical
		1.5% maximum
Temperature Effect	0 to 50 degrees C	1.0% typical
		2.0% maximum
Combined Effect	Source, Load and Temperature Effects	2.0% typical
		4.0% maximum
Time Effect	$\frac{1}{2}$ – 8 Hours	0.2% typical
		0.5% maximum

TABLE 1-1 OUTPUT EFFECTS FOR THE TBC BATTERY CHARGER POWER SUPPLY

TELECOMMUNICATION BATTERY CHARGER S

SINGLE PHASE 12A TO 120A 300 TO 3000 WATTS

	12 VOLTS			24 VOLTS			48 VOLTS		
	TBC 12-20M	TBC 12-50M	TBC 12-120M	TBC 24-25M	TBC 24-60M	TBC 24-120M	TBC 48-12M	TBC 48-30M	TBC 48-60M
I N P U T	VOLTAGE ¹	115/230 Vac	115/230 Vac	115/230 Vac	230 Vac	230 Vac	115/230 Vac	230 Vac	230 Vac
	CURRENT	4.6 / 2.8 A	12.5 / 8 A	12 / 8 A	16 A	32 A	12 / 8 A	16 A	32 A
	FREQUENCY	47 - 63 Hz							
	PROTECTION	CIRCUIT BREAKER							
O U T P U T	EFFICIENCY	77%	80%	82%	85%	83%	82%	85%	84%
	VOLTAGE RANGE	11.5 - 15 Volts			23.0 - 30 Volts			47 - 60 Volts	
	CURRENT RATING	20 A	50 A	120 A	25 A	60 A	120 A	12 A	30 A
	VOLTAGE REGULATION	± 1%							
	CURRENT LIMIT	CURRENT LIMITED TO ~ 112 PERCENT OF MAXIMUM CURRENT RATING							
	NOISE (p-p) DC TO 100 MHz	100 mV							

TABLE 1-2 TBC BATTERY CHARGER ELECTRICAL SPECIFICATIONS

NOTE #1: FOR 115/230 Vac MODELS THE INPUT VOLTAGE JUMPER MUST BE SET TO THE DESIRED INPUT VOLTAGE. REMOVE THE SCREWS ALONG THE SIDES OF THE SMALL PLATE ON THE REAR PANEL TO GAIN ACCESS TO FIVE TERMINALS. THE TERMINALS ON THE RIGHT SIDE SHOULD BE SHORTED FOR 115 Vac INPUT OPERATION. THESE TWO TERMINALS SHOULD BE OPEN FOR 230 Vac OPERATION. THE LEFT SIDE THREE TERMINALS ARE FOR (FROM LEFT TO RIGHT) LINE, NEUTRAL AND GROUND RESPECTIVELY. (SEE SECTION II - INSTALLATION, PARAGRAPH 2-5)

V_N NOMINAL VOLTAGE	V_F FLOAT VOLTAGE RANGE ⁽¹⁾	FACTORY SET	V_X EXTRA VOLTAGE RANGE ⁽¹⁾	$V_E = V_F + V_X$ EQUALIZE VOLTAGE (FACTORY SET)	V_{OVP} OVERVOLTAGE PROTECTION LEVEL
12V	11.5V – 15V	13V	0 – 1.5V	14V	16V
24V	23V – 30V	26V	0 – 3V	28V	32V
48V	47V – 60V	52V	0 – 6V	56V	63V

TABLE 1-3 TBC BATTERY CHARGER POWER SUPPLY FLOAT VOLTAGE, EQUALIZE VOLTAGE AND OVERVOLTAGE SPECIFICATIONS

NOTE: THE EQUALIZE VOLTAGE CAN NOT BE SET HIGHER THAN THE OVERVOLTAGE PROTECTION LEVEL

⁽¹⁾ THE UPPER LIMITS OF THE RANGE ADJUSTMENTS HAVE A TOLERANCE OF ± 5 PERCENT

Input Circuit Breaker**Status Indicators**

Power ON - green LED
Float Mode - green LED
Equalize Mode - amber LED (flashing)
Charging Stopped - red LED

Meter 3 1/2 Digit LCD

Voltmeter (separate connection also provided for remote monitoring)
Ammeter

Remote Voltage Sensing**Remote ON/OFF Control****Remote Start/Reset Equalize timer****50/60 Hz Operation****Current Balance terminal provided for parallel operation****Equalize Charger Timer built in**

00.0 - 99.9 hours
Start/Reset Push Buttons

Logic (TTL) output for status monitoring

Power ON
Float/Equalize mode
Charging Stopped

TABLE 1-4 GENERAL FEATURES OF THE TBC BATTERY CHARGER POWER SUPPLY

The general features of the TBC Battery Charger are listed in Table 1-4.

1-4 OVERLIMIT PROTECTIONS AND SPECIAL FEATURES

The TBC Charger series incorporates switching power supplies. A Control Board in the TBC controls and monitors critical functions of the Battery Charger. The front panel contains a main Circuit Breaker, voltage and current meters, status indicators (LED), and an Equalize Timer control.

The Charger provides remote control connections and monitoring connections for DC output, ON/OFF, Start/Reset, Equalize Timer, remote voltage sensing, and logic output for status monitoring.

The DC output has factory preset voltage and current limit adjustment.

The TBC Battery Charger Power Supply has an overvoltage protection circuit that senses the output at the Monitor terminals. It compares a part of the output voltage to a reference voltage. If an overvoltage occurs, Sensing Voltage Comparators shut off the oscillator, thereby resulting in zero output power. **NOTE:** Due to positive feedback from the output, one of the Sensing Comparators is locked in the conduction mode and the circuit must be reset by removing the AC input power and the battery for about 30 seconds and then turning the unit ON again.

1-5 MECHANICAL SPECIFICATIONS

See Figure 1-1 and Table 1-5.

TBC MODELS	12-20M	12-50M	12-120M	24-25M	24-20M	24-120M	48-12M	48-30M	48-60M
SIZE (HxWxD) INCHES (mm) ¹	5/4x19 x13 1/2 (133.35x482.6 x342.9)	5/4x19 x13 1/2 (133.35x482.6 x342.9)	5/4x19 x13 1/2 (133.35x482.6 x342.9)	5/4 x19x13 1/2 (133.35x482.6 x342.9)	5/4x19x13 1/2 (133.35x482.6 x342.9)	8 9/16x19 x 15 (222.25 x 482.6 x 381)	5 1/4x19x13 1/2 133.35x482.6 x342.9)	5 1/4x19x13 1/2 (133.35x482.6 x342.9)	8 3/4 x19 x15 (222.25 x 482.6 x 381)
WEIGHT LBS	21	25	33	25	33	53	25	33	53
(kg)	(9.5)	(11.4)	(15)	(11.4)	(15)	(24)	(11.4)	(15)	(24)

TABLE 1-5 TBC BATTERY CHARGER MECHANICAL SPECIFICATIONS

LEAKAGE TO GROUND	115 Vac UL MEHTOD 1.0 mA 230 Vac VDE METHOD 2.0 mA
EMI	SATISFIES FCC 20780 CLASS A REQUIREMENTS
OPERATING TEMPERATURE	0 TO 50 DEGREES C
STORAGE TEMPERATURE	- 40 TO + 75 DEGREES C
HUMIDITY	NON-CONDENSING - 95% RELATIVE HUMIDITY
ISOLATION	OUTPUT TO CASE 500Vdc, 100 MEGOHMS
COOLING	BUILT IN DC FANS WITH FAN-STOP SENSOR ²

TABLE 1-6 TBC BATTERY CHARGER GENERAL SPECIFICATIONS

NOTE #1 DIMENSIONS IN PARENTHESES ARE IN METRIC

NOTE #2 TBC MODELS 12-20M, 12-50M, 24-25M AND 48-12M HAVE SINGLE FAN FORCED AIR COOLING

NO.	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY	DATE
1	TB2(7) +5 VOLTS WAS COMMON	RC	RC	SN	12-28-91
2	ADDED OPTIONAL 23" MTC. BKTS.	LF	NS	EA	1-18-95

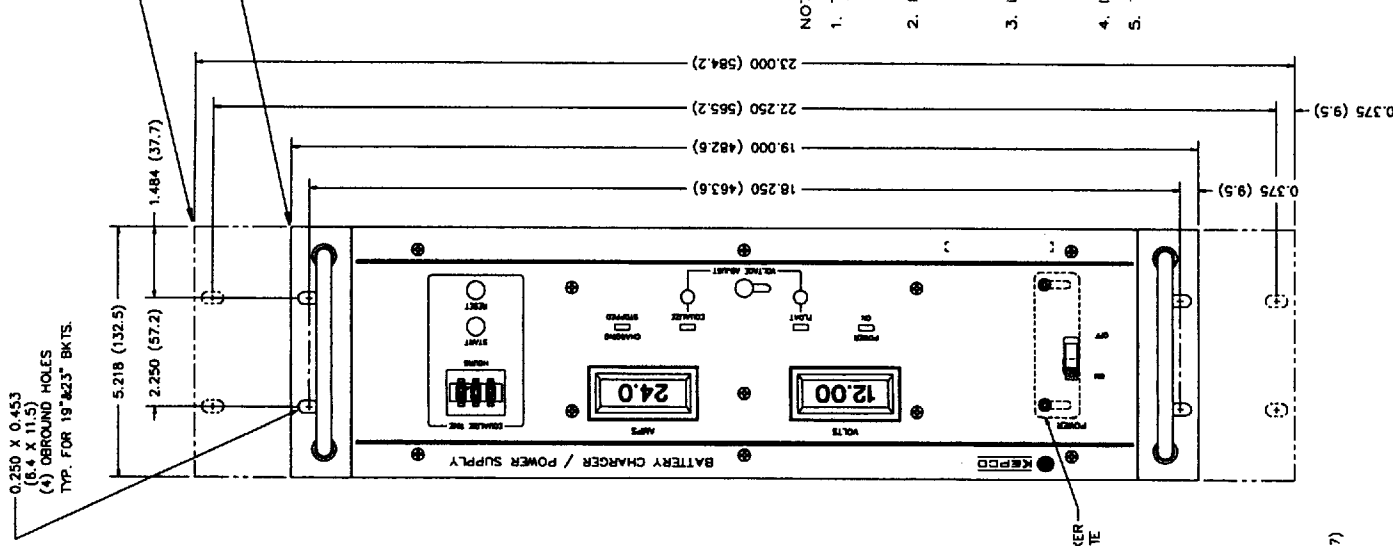
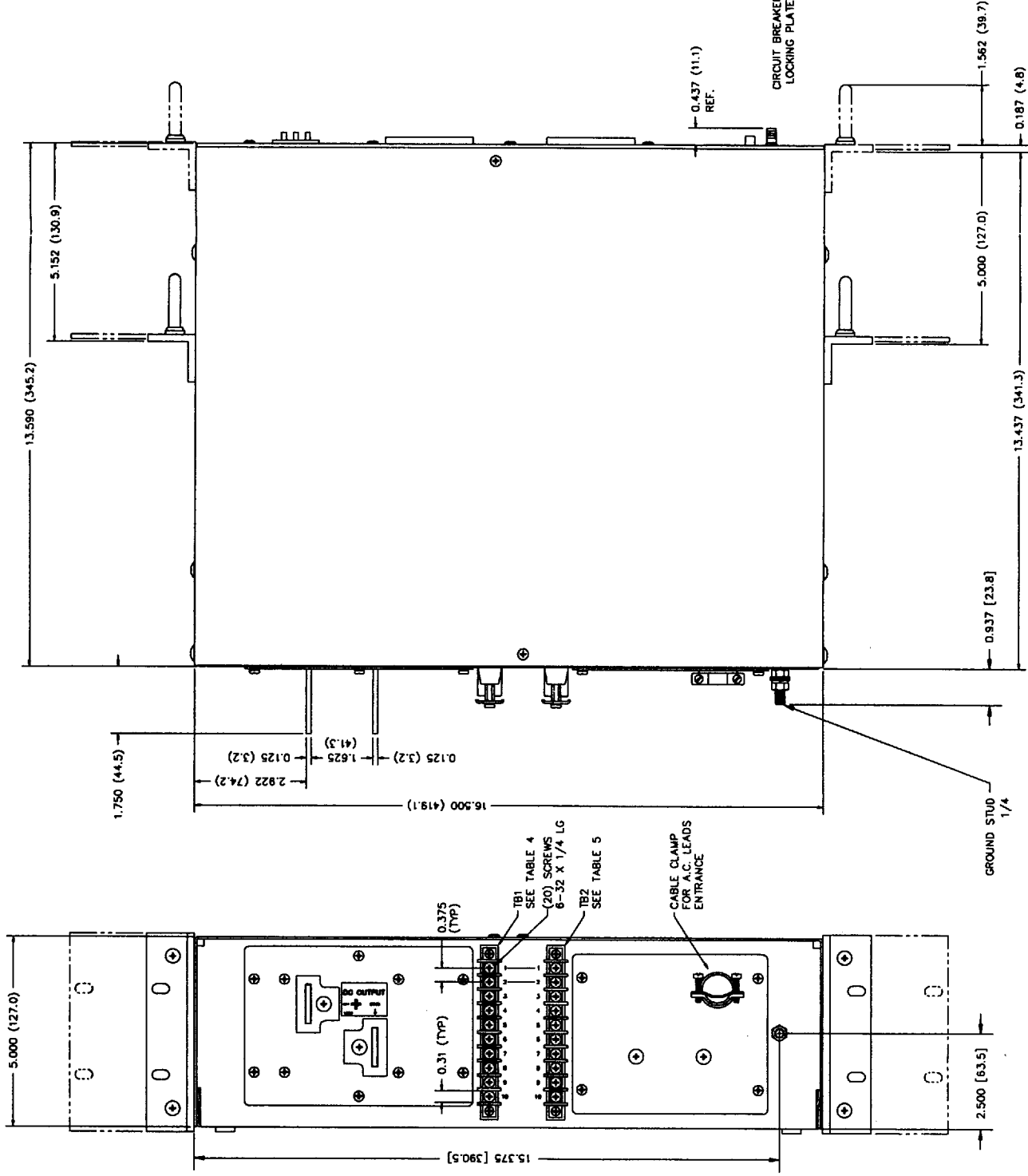
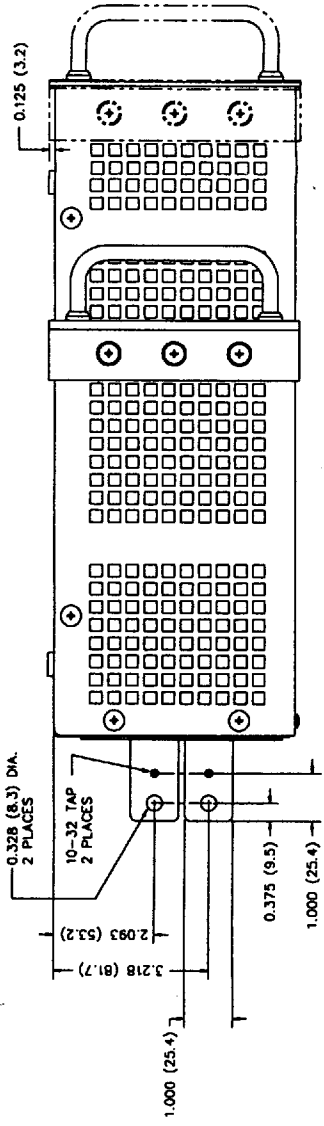


TABLE 4 OUTPUT TERMINALS (TB1)	TABLE 5 OUTPUT TERMINALS (TB2)
1 CONTROL	1 +RC
2 ON/OFF	2 -RC
3 METER (+)	3 POWER ON
4 +S	4 CHARGING STOPPED
5 +M	5 FLOAT/EQUALIZE
6 -M	6 START
7 -S	7 +5 VOLTS
8 METER (-)	8 RESET
9 CB (CURRENT BALANCE)	9 50/60 Hz
10 COMMON	10 COMMON

NOTES:

- THIS DRAWING IS FOR THE FOLLOWING MODELS:
TBC 12-20M, TBC 12-50M, TBC 12-120M,
TBC 24-25M, TBC 24-60M, TBC 48-12M,
AND TBC 48-30M.
- MATERIAL: 0.060 THK. CRS.
CHASSIS: 0.060 THK. CRS.
COVER: 0.060 THK. CRS.
FRONT PANEL: 0.090 THK. ALUM. 6061-T6
MOUNTING BRACKETS (19"): 0.187 THK. ALUM. 6063-T5
MOUNTING BRACKETS (23"): 0.119 THK. CRS.
- FINISH:
CHASSIS: CADMIUM PLATE WITH CHROMATE WASH.
COVER: TEXTURED GREY
FRONT PANEL AND MOUNTING BKTS.: LIGHT GREY
PER FEDERAL STD. 595, COLOR No. 28440
- DIMENSIONS IN PARENTHESIS ARE IN MILLIMETERS.
- TOLERANCES:
A) BETWEEN MOUNTING HOLES ±1/64 (±0.4)
B) ALL OTHER DIMENSIONS ±1/32 (±0.8)
EXCEPT AS NOTED.

TOLERANCES UNLESS OTHERWISE SPECIFIED:		DRAWN BY	DATE
FRACTIONS: ±		PTD	8-22-90
DECIMALS 2 PLACES: ± 3 PLACES: ±		CHECKED BY	DATE
ANGLES: ±		ATA	12-13-90
MATERIAL:		DESIGNED BY	DATE
FINISH:		VC	12-17-90
		APPROVED BY	DATE
		JKL	12-17-90
		DWG. NO.	SHEET
		CM18306	PAGE 1-6 2
TITLE			
OUTLINE DRAWING (TBC 300W-1800W)			
MODEL NO.		PART NO.	
SEE NOTE 1		SCALE:	



Flushing, NY, USA

SECTION II - INSTALLATION

2-1 UNPACKING AND INSPECTION

The TBC Battery Charger Power supply has been thoroughly inspected and tested prior to packing and is ready for operation. After unpacking, inspect for shipping damage before attempting to operate. Perform the preliminary inspection as outlined in the following paragraph. If any indication of damage is found, file an immediate claim with the responsible transport service.

2-2 REAR PANEL TERMINALS

The TBC has two output power terminals for connecting to the battery and/or load. It also has two terminal blocks TB1 and TB2 (see Tables 2-1 and 2-2 and Figure 2-1). The terminals for TB1 (see Table 2-1) are described as follows:

- 1) and 2) **Control ON/OFF** With a jumper between these terminals and the battery connected, the TBC Control Board will remain ON even if the AC Circuit Breaker is OFF. With the jumper removed the Control Board will go OFF if the AC Circuit Breaker is OFF.
- 3) **Meter (+)** This terminal provides for an outside contact from the positive side of the LCD voltmeter for remote monitoring of the output voltage.
- 4) **+S** This terminal is the positive Remote Sensing terminal for the TBC output voltage.
- 5) **+ Monitor** This terminal is connected to the positive output terminal of the TBC Battery Charger and it is used for Local Sensing.
- 6) **- Monitor** This terminal is connected to the negative output terminal of the TBC Battery Charger and it is used for Local Sensing.
- 7) **- S** This terminal is the negative Remote Sensing terminal for the TBC output voltage.
- 8) **Meter (-)** This terminal provides for an outside contact from the negative side of the LCD voltmeter for remote monitoring of the output voltage.
- 9) **CB (Current Balance)** This terminal is used when two or three TBC units (except for the TBC 12-20M, which doesn't require Current Balance) are connected in parallel (consult the factory for details).
- 10) **Common** This is logic ground.

The terminals for TB2 are described as follows:

- 1) and 2) **+ RC, - RC Remote Control ON/OFF Input Command** A short (logic low) between the +RC and -RC terminals will turn OFF the TBC. An open circuit (logic high) between these two terminals will return the TBC to operation.
- 3) **Power On Output Flag** A logic high at this terminal (with respect to Common) indicates that the AC input power is ON. A logic low indicates that the AC input power is OFF.
- 4) **Charging Stopped Output Flag** A logic low at this terminal (with respect to Common) indicates that the battery voltage is equal to or greater than the Power Supply voltage and that the battery has been charged. A logic high

indicates that the Power Supply voltage is higher than the battery voltage and that the battery is being charged

- 5) **Float/Equalize Output Flag** A logic high at this terminal indicates that the TBC is in the Float (low charging rate) mode. A logic low at this terminal with respect to Common indicates that the TBC is in the Equalize (high charging rate) mode.
- 6) **Start Input Command** A short circuit condition (provided by a computer low signal or momentarily closing a switch) at this terminal with respect to Common starts the TBC timer and the TBC goes into the Equalize mode.
- 7) +5 Volts
- 8) **Reset Input Command** A short circuit condition (provided by a computer low signal or momentarily closing a switch) at this terminal with respect to Common resets the Equalize Timer and the TBC goes back to the Float mode.
- 9) **50/60 Hz Input Command** A jumper between this terminal and Common sets up the TBC for 60Hz input power operation. With jumper removed the TBC is set for 50Hz input power operation.
- 10) **Common** This terminal is the logic ground.

2-3 FRONT PANEL CONTROLS

The front panel control layout of the TBC features the following (see Figures 2-2A and 2-2B):

- 1) Main AC input power circuit breaker.
- 2) A 3 ½ digit LCD for reading voltage and a 3½ digit LCD for reading current.
- 3) A green LED power on indicator.
- 4) A green LED to indicate when the TBC is in the Float mode (slow rate of charging).
- 5) An amber LED that flashes when the TBC is in the Equalize mode (high rate of charging).
- 6) A red LED to indicate that the TBC has stopped charging.
- 7) A 0.1 to 99.9 hour timer that can be set to establish the period of the Equalize cycle.
- 8) A Start button that (when pressed) starts the TBC Timer as the Equalize mode begins.
- 9) A Reset button that (when pressed) resets the TBC Timer as the Battery Charger returns to the Float mode.
- 10) A sliding door to gain access to two voltage controls that are used to set the Float voltage and the Equalize voltage. For precise settings of these controls refer to the battery's manufacturer.
- 11) A Locking Plate for the AC Input Power Circuit Breaker

2-4 FLOAT/EQUALIZE VOLTAGE CONTROLS

The TBC contains two (Float and Equalize) voltage controls accessible from the front panel, behind a sliding door. These controls are used to set the Float voltage and the Equalize voltage. The levels are set according to the chemistry of the battery cells and in accordance with the recommendations of the battery's manufacturer. The TBC has a built-in timer that can be set from 0.1 to 99.9 hours to control the period of the Equalize cycle.

2-5 AC INPUT REQUIREMENTS

The TBC Battery Charger Power Supply is normally supplied for operation on a single phase, 115Vac or 230Vac line. For conversion to other AC source voltages, refer to the next paragraph and Figure 2-3. Select your nominal source voltage and change the links on the Terminal Block TB3 accordingly. The Circuit Breaker remains equally effective at all input voltages.

Remove the four screws from the small panel located on the right side of the TBC Battery Charger rear panel. Insert the AC power line through the hole in the panel, tighten the cable clamp; and connect the line, neutral and ground wires to their respective terminals on the Terminal Block (see Figure 2-3). The terminals on the right hand side of the Terminal Block should be shorted for 115 Vac operation, and should be open for 230 Vac operation. Fasten the panel in place on the TBC Battery Charger rear panel.

2-6 COOLING

The power transistors and rectifiers in the TBC Battery Charger Power Supply are maintained within their operating temperature range by means of special heat sink

TABLE 2-1 TBC INPUT/OUTPUT CONTROL TERMINALS (TB1)	
1	Control ON/OFF
2	
3	Meter (+)
4	+S
5	+M
6	-M
7	-S
8	Meter (-)
9	CB (Current Balance)
10	Common

TABLE 2-1 TBC INPUT/OUTPUT CONTROL
TERMINALS FOR TB1 LOCATED ON THE REAR PANEL
OF THE BATTERY CHARGER

TABLE 2-2 TBC INPUT/OUTPUT CONTROL TERMINALS (TB2)	
1	+RC
2	-RC
3	Power On
4	Charging Stopped
5	Float/Equalize
6	Start
7	+ 5 Volts
8	Reset
9	50/60 Hz
10	Common

TABLE 2-2 TBC INPUT/OUTPUT CONTROL
TERMINALS FOR TB2 LOCATED ON THE REAR
PANEL OF THE BATTERY CHARGER

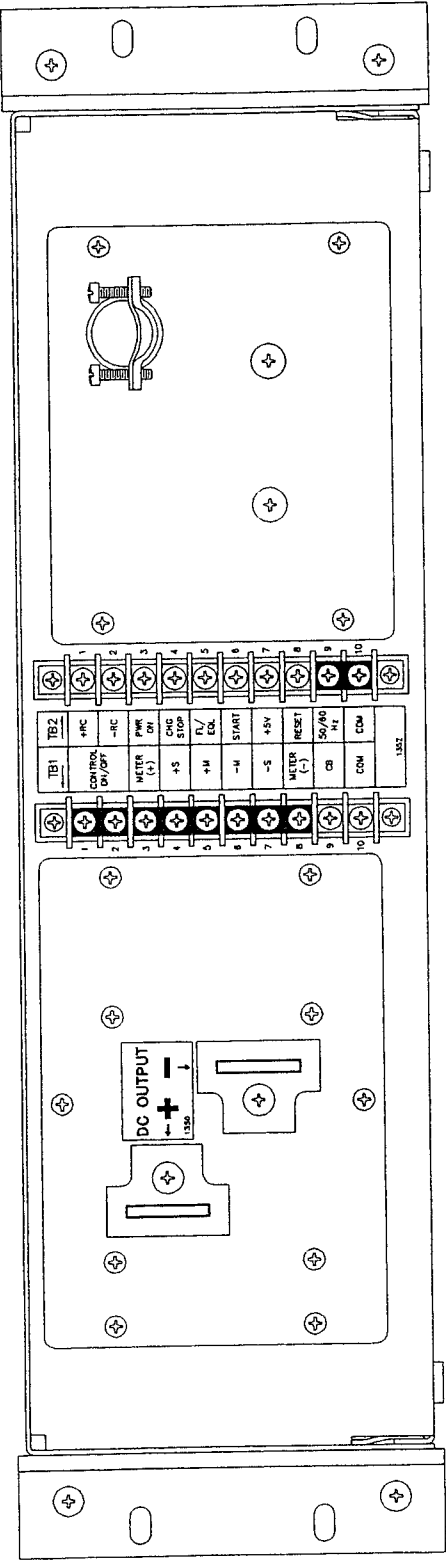


FIGURE 2-1 REAR PANEL OF THE TBC BATTERY CHARGER POWER SUPPLY

NOTE: The Rear Panel of the TBC 24-120M and TBC 48-60M is the same as the other Models but is 8.75 inches (222.25) high instead of 5.25 (133.35).

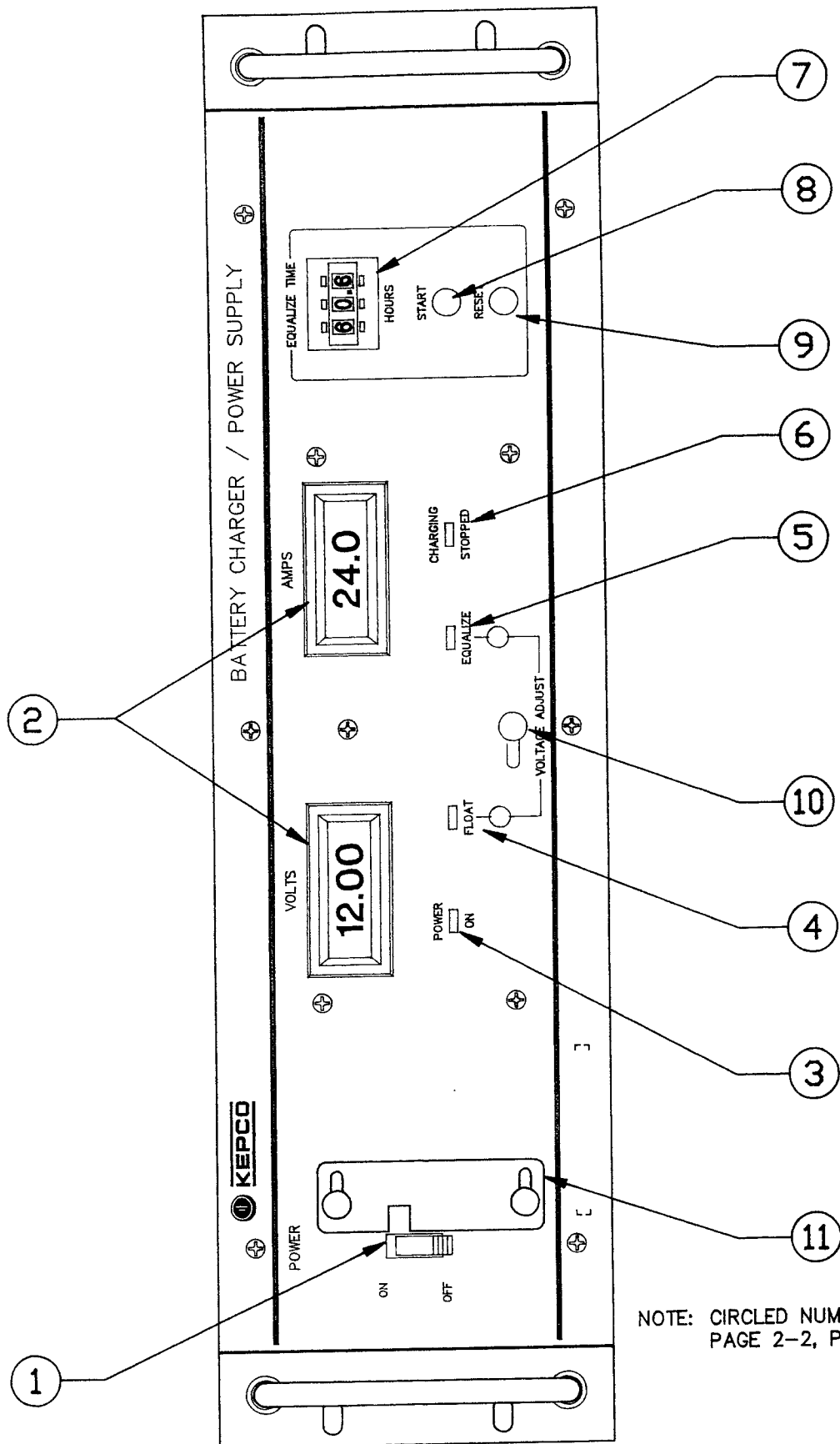


FIGURE 2-2A FRONT PANEL LAYOUT OF THE TBC BATTERY CHARGER POWER SUPPLY EXCEPT FOR MODELS TBC 24-120M AND TBC 48-60M

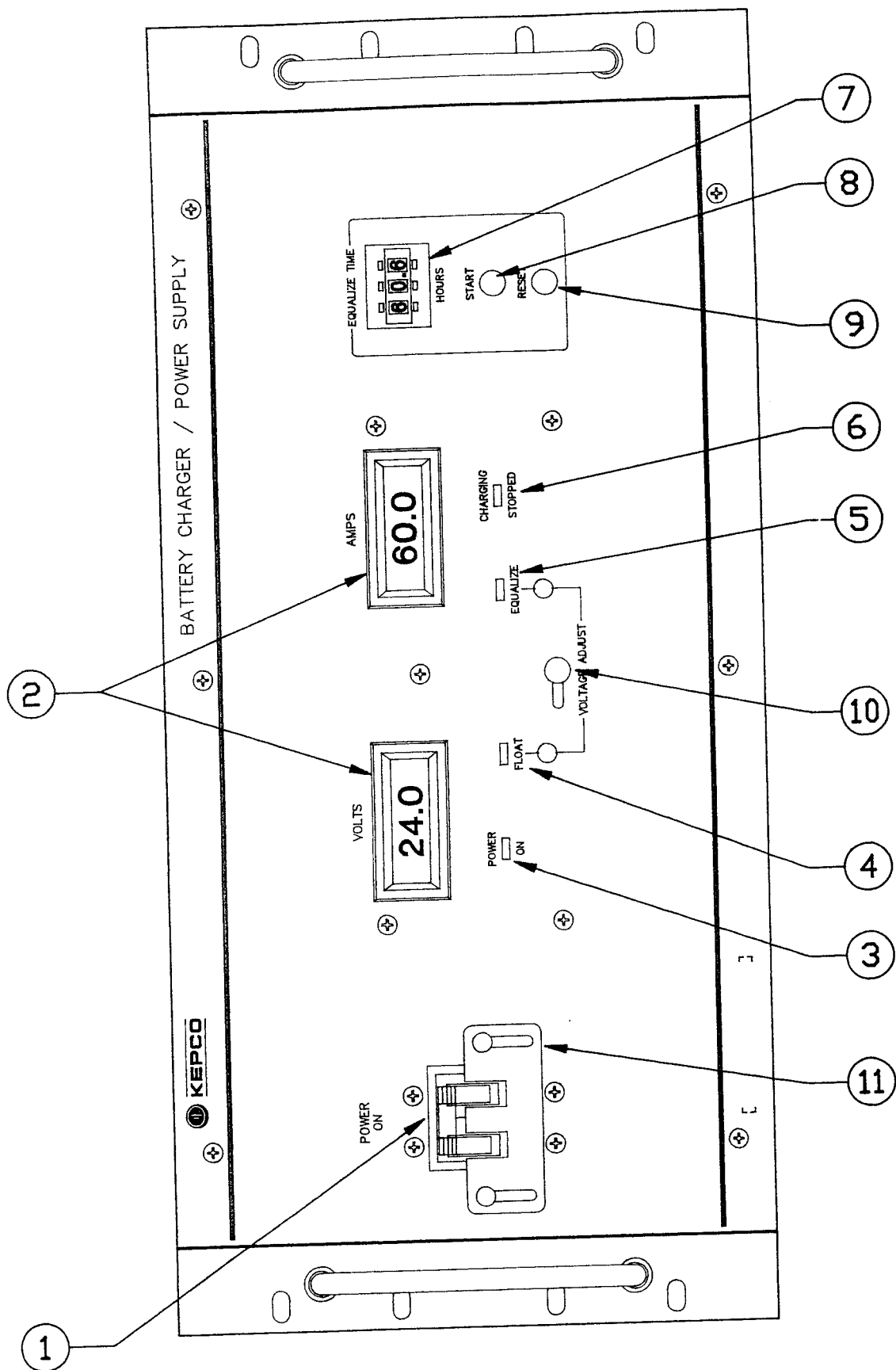


FIGURE 2-2B FRONT PANEL LAYOUT OF THE TBC BATTERY CHARGER POWER SUPPLY FOR MODELS TBC 24-120M AND TBC 48-60M

assemblies, cooled by internal fans. **SIDE PANEL OPENINGS AND THE TOP OF THE CASE MUST BE KEPT CLEAR FROM OBSTRUCTIONS TO ENSURE PROPER AIR CIRCULATION.** Periodic cleaning of the interior of the Power Supply is recommended. If the TBC unit is rack mounted, or installed in confined spaces, care must be taken that the ambient temperature (the temperature immediately surrounding the Power Supply) does not rise above the limit specified (refer to Section 1).

2-7 GROUNDING

- a) It is imperative that the chassis of the Power Supply be returned to AC ground with a separate lead. A grounding terminal is provided (on Terminal Block 3) for this purpose.

Terminal Block 3 on Chassis Assembly A2 has three terminals , Ground, Neutral and High. The Ground terminal is a chassis ground and is not the logic ground or Common on PC Board 1.

- b) Isolation From Ground. The DC output is isolated from the AC source and from any direct connection to chassis or ground. The maximum output voltage that can be supported between either output terminals and ground or chassis is 500 Vdc. Either side of the output may be grounded.

2-8 CIRCUIT BREAKER LOCKING PLATE

A locking Plate for the Circuit Breaker is provided to prevent accidental turn OFF of the TBC unit. It does not affect the circuit breaker tripping action in the event of overload.

Refer to Figures 2-4A and 2-4B for instructions regarding the Locking Plate. For all models except for the TBC 24-120M and TBC 48-60M in order to release the Circuit Breaker Locking Plate loosen the two Knurled Head Screws (6-32 x 1/2) and slide the Locking Plate to the right (see Figure 2-4A). For models TBC 24-120M and TBC 48-60M to release the Circuit Breaker Locking Plate loosen the two Knurled Head Screws (6-32 x 1/2) and slide the Locking Plate down (see Figure 2-4B).

2-9 RACK PANEL MOUNTING

An Assembly Kit that contains two handles (each one with two Ferrule mounts) and two flanges (Ears) for rack mounting is provided with the TBC Battery Charger. Four screws, Flat

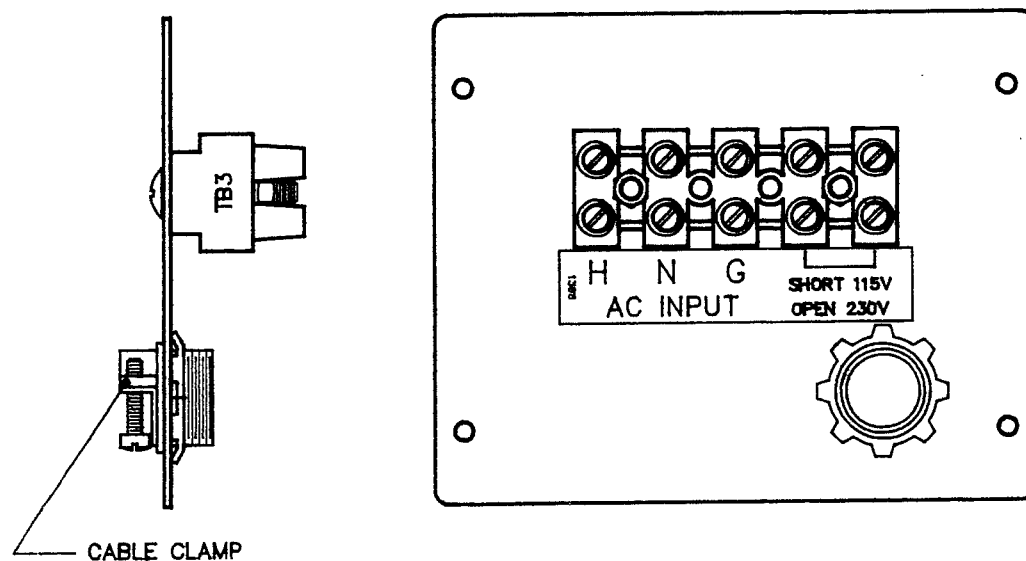


FIGURE 2-3 AC INPUT POWER TERMINAL BLOCK TB3

Head 10-32 x 1/2 (100 degrees countersink); six screws, Truss Head Phillips 10-32 x 3/8 Black; and six Internal Lockwashers, No. 10 are also included.

The mounting flanges (Ears) for mounting the TBC Battery Charger in a Rack can be installed in either position 1 or position 2 with three screws (Truss Head Phillips 10-32 x 3/8 Black); and three Internal Locking washers, No. 10 (see Figure 2-5). Position 1 is for regular front panel rack mounting, and position 2 is for rack mounting with part [5 inches (127)] of the TBC Battery Charger extended beyond the front of the rack. Install one mounting Ear on each side of the TBC unit.

2-10 GROUND STUD

The TBC Battery Charger Power Supply has a ground stud on the rear panel of the Power Supply (see Mechanical Outline Drawing, Figure 1-1). The ground stud assembly consists of one (1) Brass Hex Screw (1/4-20x1), Kepco P/N 101-0384, two (2) Brass Hex Nuts 1/4-20, Kepco P/N 102-0046, two (2) Brass Flat Washers, Kepco P/N 103-0010, one (1) Split Washer, Kepco P/N 103-0039 and one (1) External Lock (1/4) Washer, Kepco P/N 103-0056.

NOTE: Use only one ground point to avoid ground loops. If the ground terminal of the TBC is being used, the ground stud should not be used or vice versa. The ground stud is used mainly to ground one of the DC output terminals.

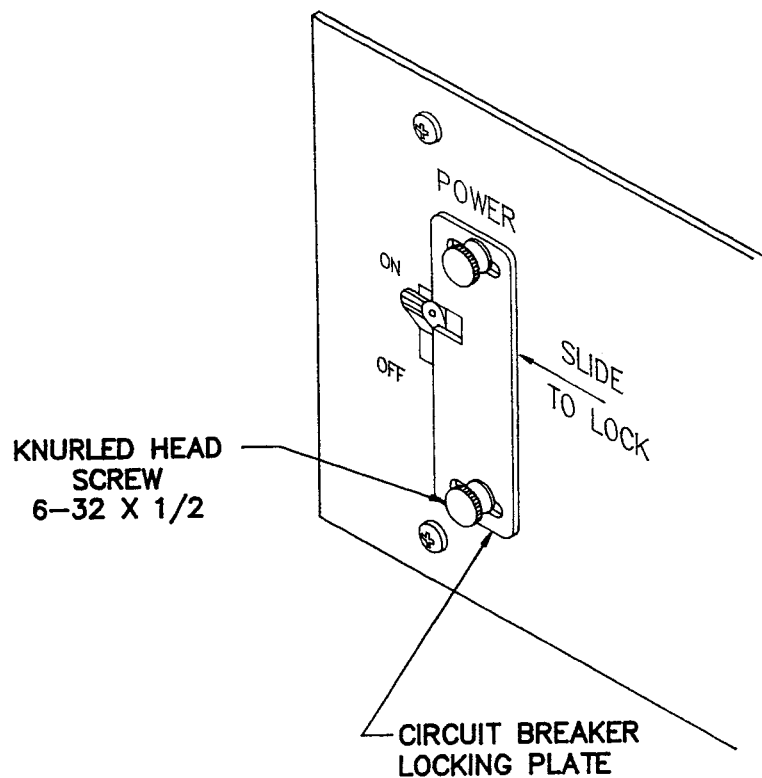


FIGURE 2-4A CIRCUIT BREAKER LOCKING PLATE FOR THE TBC BATTERY CHARGER POWER SUPPLY EXCEPT FOR MODELS TBC 24-120M AND TBC 48-60M

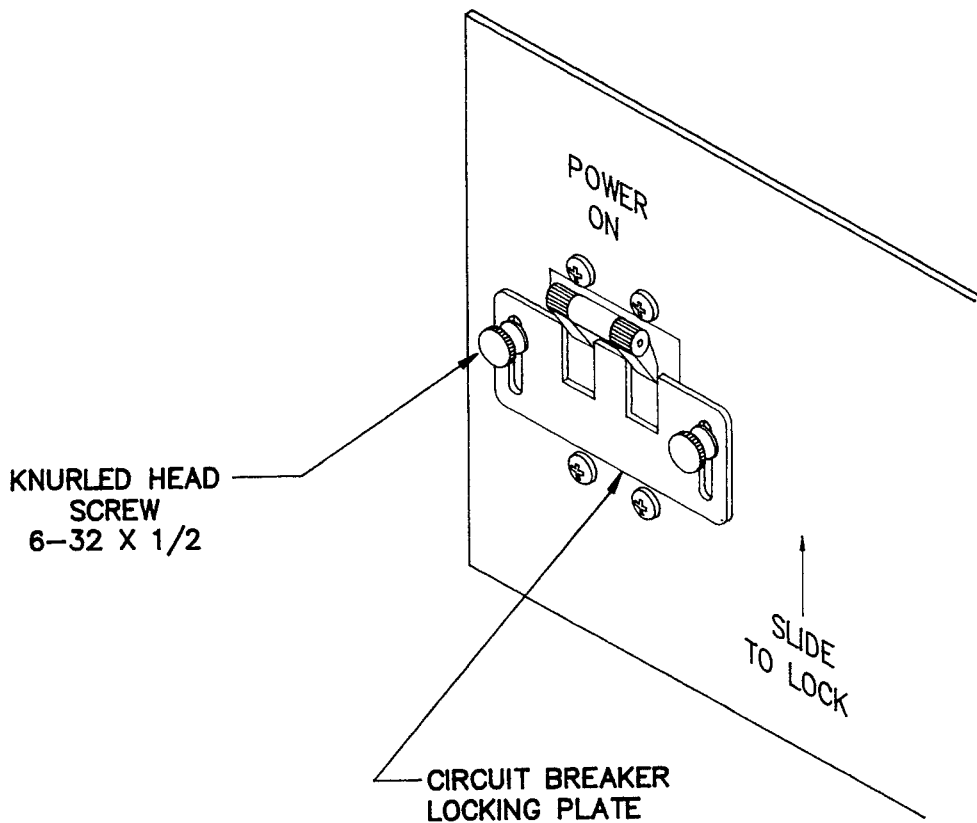


FIGURE 2-4B CIRCUIT BREAKER LOCKING PLATE FOR THE TBC BATTERY CHARGER POWER SUPPLY FOR MODELS TBC 24-120M AND TBC 48-60M

The Handles can be set in place using two Ferrule Mounts and two screws, Flat Head 10-32 x 1/2 (100 degrees countersink) as illustrated (see Figure 2-5)

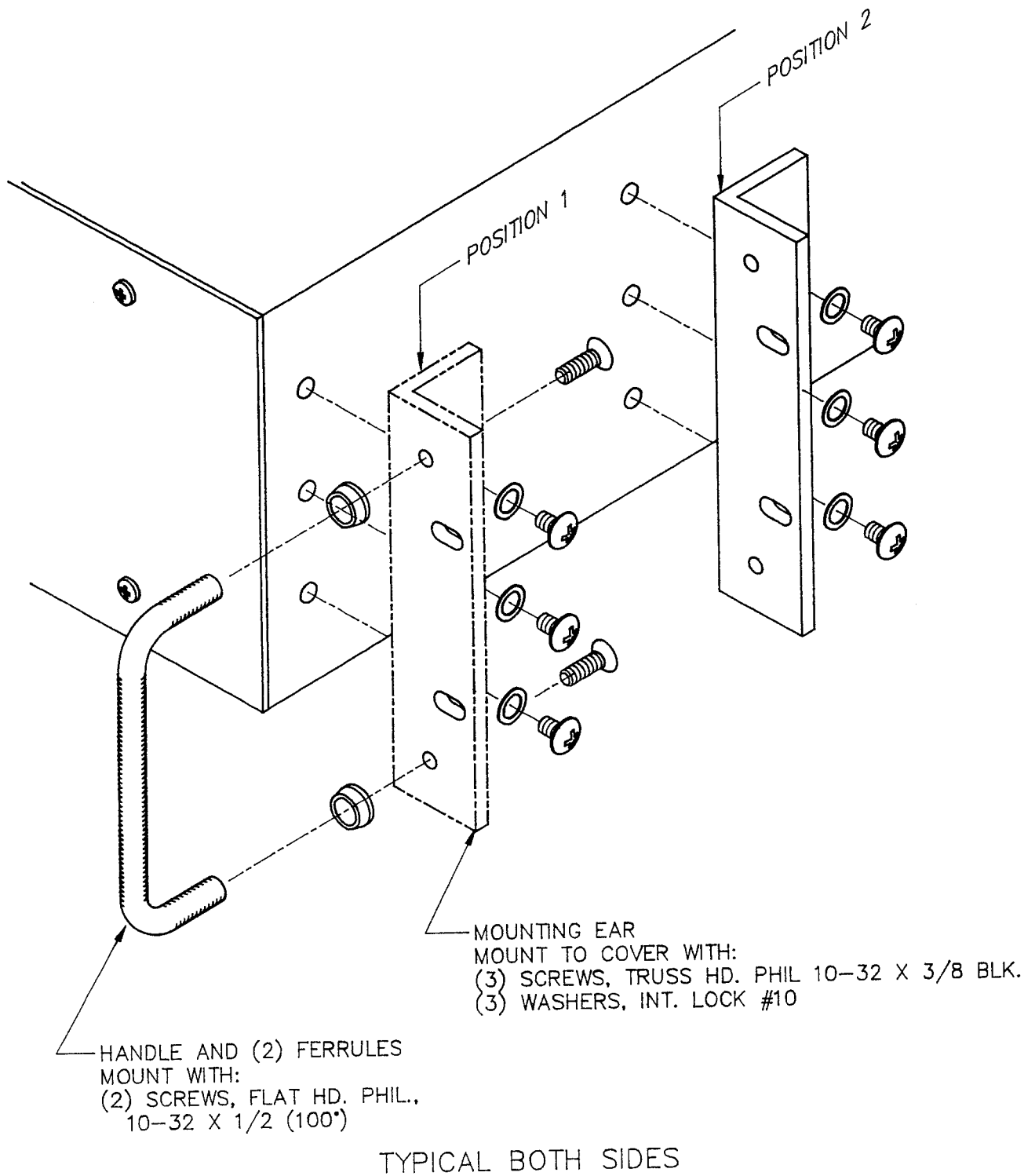


FIGURE 2-5 RACK MOUNTING OF THE TBC BATTERY CHARGER

SECTION III - OPERATION

3-1 GENERAL

Interconnections between a stabilized Battery Charger Power Supply, and its load are as critical as the interface between other types of electronic equipment. If optimum performance is expected, certain rules for the interconnections must be observed by the user. These rules are described in detail in the following paragraphs.

3-2 DC (OUTPUT) GROUNDING

Connections between the Battery Charger Power Supply and the load (load and sensing connections) may, despite all precautions such as shielding, twisting of wire-pairs, etc., "pick-up" radiated noise of a wide frequency spectrum. To minimize these undesired effects, one side of the Battery Charger Power Supply output/load circuit must be grounded.

Successful DC grounding depends on careful analysis of the individual situation and only general guide lines can be provided here. One of the major points, however, is to avoid GROUND LOOPS. Ground loops are created when two (or more) points are grounded along the output circuit. Due to the wire impedance between the grounded points, a noise voltage is developed which is superimposed on the load. The only way to avoid ground loops is to investigate the output circuit (including the connected load) with an ohmmeter, for any resistance to ground. A single DC ground point can be selected only if the output circuit is completely isolated. A single point is selected along the Power Supply output/load circuit and this point is returned to ground with a single wire. The exact location of this "best" DC ground-point is entirely dependent on the application at hand. For single, isolated loads, the DC ground-point may be located directly at one of the output terminals of the Power Supply which may be connected to ground. If Error Sensing is employed, DC ground can be established at the remote load. In case of an internally grounded load, the DC ground is automatically established directly at the load.

3-3 LOAD WIRE SELECTION

A realistic model for a voltage stabilized Battery Charger Power Supply must, for example, include a series resistance, representing a small DC and low frequency source impedance; in series with an inductance, representing the source impedance at higher frequencies. This is because of the variation in the equivalent characteristic output circuit impedance as the frequency changes. Load wire selection should be made with those facts in mind. The load wire size should not only be selected for minimum voltage drop (Error Sensing, as discussed below, will take care of that), but also the series inductance of the load wire must be kept as small as possible compared to the source inductance of the Battery Charger Power Supply (Error Sensing cannot compensate for this).

3-4 LOAD CONNECTION, METHOD 1 (LOCAL ERROR SENSING)

The most basic Battery Charger Power Supply interconnection, for maintaining Batteries connected across a load, consists of 2-wire connection from the rear output terminals. The load leads should be tightly twisted to reduce "pick-up" from stray magnetic fields.

Figures 3-1A, 3-1B and 3-1C show the correct and incorrect methods of connecting multiple loads with either Local or Remote Sensing. Remote Sensing is applied to the most critical load (Load No.2 as shown). Error sensing links must be connected with the proper polarity +S to +M and -S to -M. The TBC Battery Charger Power Supplies are shipped with jumpers

that connect the Sensing Terminals directly to the Monitor Terminals. These jumpers should be removed when Remote Sensing is employed.

3-5 LOAD CONNECTION METHOD II (REMOTE ERROR SENSING)

To avoid excessive output effects at remote loads, Error Sensing must be used. The links between the +S and +M terminals and between the -S and -M terminals must be removed. Use a twisted, shielded pair of wires from the Sensing Terminals directly to the load to compensate for load wire voltage drops. Observe polarities: The negative Sensing wire must go to the negative load wire, and the positive Sensing wire goes to the positive load wire.

The Remote Sensing terminals must be connected to their respective output terminals, either at the load or at the TBC output; otherwise the TBC will not operate properly. Connecting the +S and -S terminals directly to the + and - load automatically compensates for voltage drops in the connecting cables of up to a maximum of 0.35 Volts per cable in Models TBC 12-50M, TBC 24-25M and TBC48-12M; and of up to a maximum of 0.40 Volts per cable in Models TBC 12-20M, TBC 12-120M, TBC 24-60M, TBC 24-120M, TBC 48-30M and TBC 48-60M.

3-6 PARALLEL OPERATION

Up to three TBC Battery Charger Power Supplies can be placed in parallel operation, except for models TBC 48-60M and TBC 24-120M, which have two power supplies in parallel that are built into the units. Only one additional TBC unit can be placed in parallel the TBC 48-60M or with the TBC 24-120M. For parallel operation it is necessary to connect the Current Balance terminals together (Terminal No.9 on Terminal Block 1) for all the TBC units in operation (see Figure 3-2).

NOTE: To operate up to three TBC Battery Charger Power Supply units in parallel, first select the desired AC input power by adjusting the jumper on Terminal Block 3 (see paragraph 2-6 and Figure 2-3); Then set the desired output voltage, at the load, for each TBC Battery Charger. Remove the links between the + Sense and + Monitor Terminals and between the - Sense and - Monitor Terminals for each TBC Battery Charger. Connect all the Terminal Blocks (1 and 3) for all the TBC units as indicated in Figure 3-2. This diagram is not valid for the TBC 24-120M and TBC 48-60M since these units already have two Power Supplies in parallel that are built into them. Therefore only one other TBC Battery Charger can be placed in parallel with either one of these two models.

The terminals H, N, G in Figure 3-2 are located on Terminal Block 3 on the back of the TBC Battery Charger, behind the small panel containing the cable clamp. The terminals + M, - M, + S, - S in Figure 3-2 are located on terminal Block 1 on the back of the TBC Battery Charger. The Output Power terminals (+) and (-) are located on the back of the TBC Battery Charger.

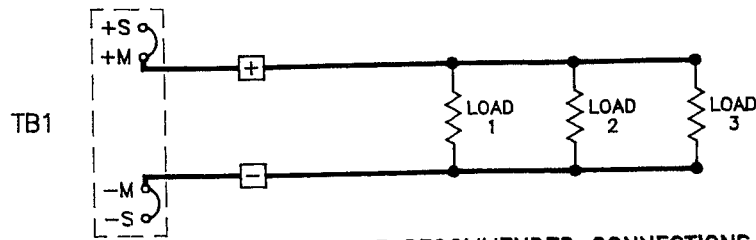


FIGURE 3-1A NOT RECOMMENDED CONNECTIONS OF MULTIPLE LOADS FOR LOCAL SENSING

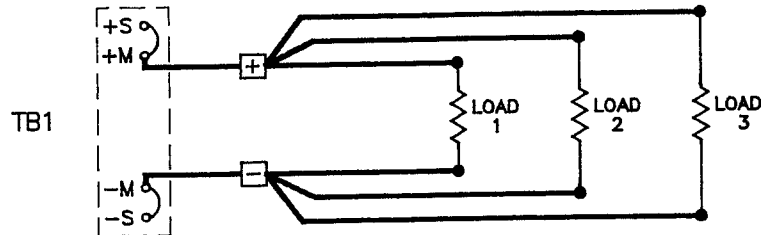


FIGURE 3-1B CORRECT CONNECTIONS OF MULTIPLE LOADS WITH LOCAL SENSING AT THE OUTPUT TERMINALS

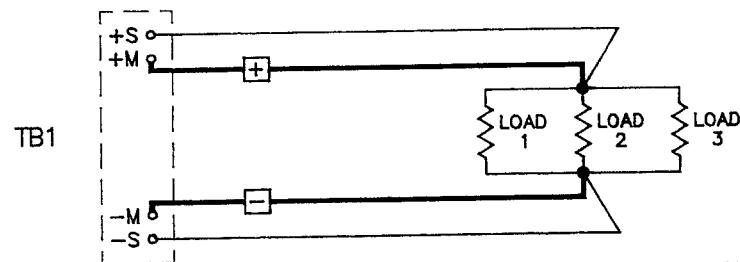
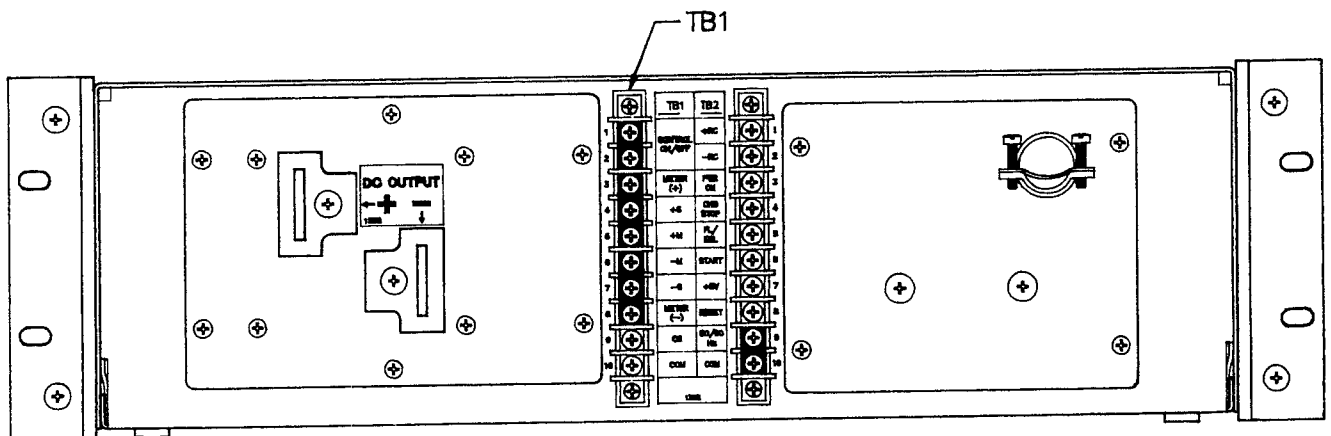
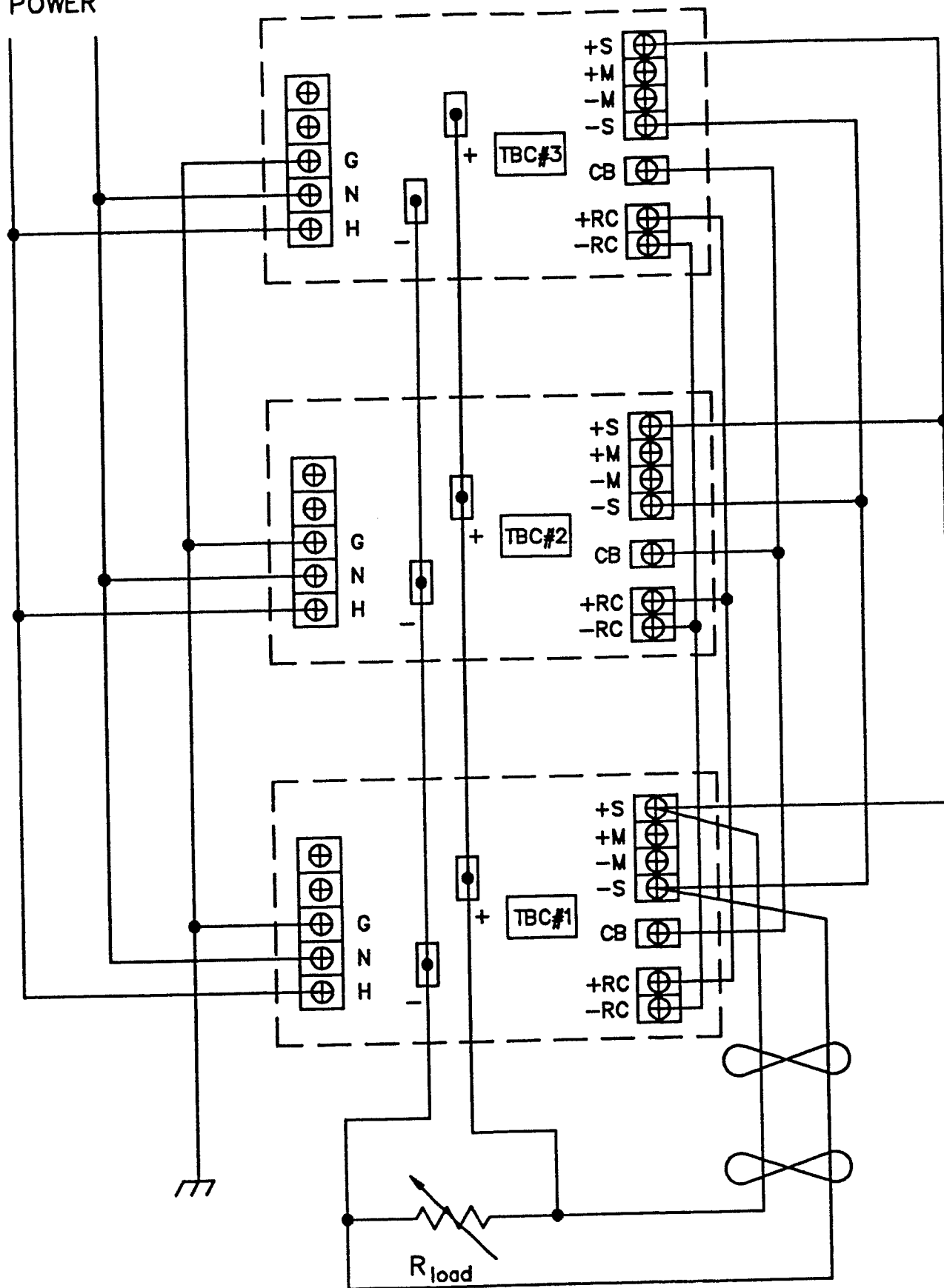


FIGURE 3-1C CORRECT CONNECTIONS OF MULTIPLE LOADS WITH REMOTE SENSING



THE REAR PANEL OF THE TBC BATTERY CHARGER POWER SUPPLY SHOWING TERMINAL BLOCK TB1 AS INDICATED IN FIGURES 3-1A, 3-1B, AND 3-1C

AC INPUT
POWER



NOTE: ON EACH TBC BATTERY CHARGER/POWER SUPPLY REMOVE LINKS BETWEEN THE +S AND + M TERMINALS AND BETWEEN THE -S AND -M TERMINALS.

FIGURE 3-2 SUGGESTED WIRING FOR PARALLEL CONNECTION OF UP TO THREE TBC BATTERY CHARGER POWER SUPPLIES WITH REMOTE SENSING AND REMOTE CONTROL