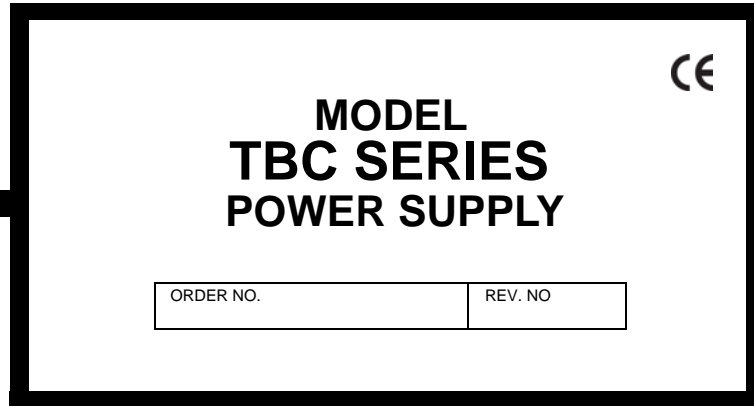


# OPERATOR'S MANUAL

## TBC SERIES POWER SUPPLY

### BATTERY CHARGER POWER SUPPLY WITH RELAY ALARM SIGNALS

KEPCO INC.  
An ISO 9001 Company.



#### 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 Instruction 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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**FIGURE 1-1. TBC SERIES RACK MOUNT BATTERY CHARGER POWER SUPPLY**

# SECTION 1 - INTRODUCTION

## 1.1 SCOPE OF MANUAL

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

## 1.2 GENERAL DESCRIPTION

The Kepco TBC Series of Telecommunications Battery Chargers, hereafter referred to as TBC, 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. In addition the TBC 60-25M can charge batteries ranging from 3 to 60 Volts. TBC are designed to Float-Charge large battery arrays such as those found in telephone operating systems.

A sensing circuit is used to indicate whether current is flowing into or out of the TBC. 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 SPECIFICATIONS

Table 1-2 lists specifications for Float, Equalize and Overvoltage Protection for all models. Table 1-2 indicates specifications for parameters that vary for different TBC models; Table 1-3 lists general specifications that apply to all TBC models.

## 1.4 GENERAL FEATURES

- Input Circuit Breaker
- Status Indicators
  - Power ON - green LED
  - Float Mode - green LED
  - Equalize Mode - amber LED (flashing)
  - Charging Stopped - red LED
- Meters, 3-1/2 Digit LCD
  - Voltmeter (separate connection also provided for remote monitoring)
  - Ammeter
- 50/60 Hz Operation
- Current Balance terminal provided for parallel operation
- Equalize Charger Timer built in
  - 00.0 -99.9 hours
  - Start/Reset pushbuttons
- Logic (TTL) output for status monitoring
  - Power ON
  - Float/Equalize mode
  - Charging Stopped

**TABLE 1-1. FLOAT, EQUALIZE, AND OVERVOLTAGE PROTECTION SPECIFICATIONS**

V <sub>N</sub> Nominal Voltage	V <sub>F</sub> Float Voltage		V <sub>X</sub> Extra Voltage Range <sup>(1)</sup>	V <sub>E</sub> = V <sub>F</sub> + V <sub>X</sub> Equalize Voltage <sup>(2)</sup> (Factory Set)	V <sub>OVP</sub> Overvoltage Protection Level <sup>(2)</sup>
	Range <sup>(1)</sup>	Factory Set			
12V	11.5 - 13.5V	13V	0 - 1.5V	14V	16V <sup>(3)</sup>
24V	23 - 27V	26V	0 - 3V	28V	34V <sup>(3)</sup>
48V	47 - 54V	52V	0 - 6V	56V	63V <sup>(3)</sup>
60V	0 - 60V	60V	0 - 3	63	120% ±7% of V <sub>SET</sub> <sup>(3)</sup>

- (1) The upper limits of the range adjustments have a tolerance of ±5%.
- (2) The Equalize voltage can not be set higher than the Overvoltage protection level.
- (3) For the following models V<sub>OVP</sub> is 120% ±7% of V<sub>SET</sub> - Latch-style tracking overvoltage protection: TBC 12-50M, TBC 12-100M, TBC 24-25M, TBC 24-50M, TBC 24-100M, TBC 48-12M, TBC 48-25M, and TBC 60-25M. Cycle power to reset. Setting the TBC to less than 13% below the battery voltage may trigger OVP protection that requires power cycle to reset.

**TABLE 1-2. MODEL PARAMETERS**

Model	Output Voltage (Volts d-c)		Output Current (Max) (Amps d-c)	Input Current (Max)		Efficiency @240V a-c	Size	Weight (lbs) [kilograms]
	Nominal	Range		@100 - 120V a-c	@200 - 240V a-c			
<b>12 VOLT MODELS</b>								
TBC 12-20M	12	11 - 15	22	9	3.7	90%	A <sup>(1)</sup>	21 [9.5]
TBC 12-50M	12	11 - 15	53	9	3.7	90%	A <sup>(1)</sup>	25 [11.4]
TBC 12-100M	12	11 - 15	100	18	9	90%	A <sup>(1)</sup>	
TBC 12-120M	12	11.5 - 15	120 <sup>(3)</sup>	22	11	81%	A <sup>(1)</sup>	33 [15]
<b>24 VOLT MODELS</b>								
TBC 24-25M	24	23 - 30	26	9	3.7	92%	B <sup>(2)</sup>	18.6 [11.5]
TBC 24-50M	24	23 - 30	50	18	9	92%	A <sup>(1)</sup>	
TBC 24-60M <sup>(4)</sup>	24	23 - 30	60	22	11	83%	A <sup>(1)</sup>	33 [15]
TBC 24-100M	24	23 - 30	100	36	18	91%	A <sup>(1)</sup>	
TBC 24-120M <sup>(5)</sup>	24	23 - 30	120	44	22	83%	A <sup>(1)</sup>	53 [24]
TBC 24-150M	24	23 - 30	150	54	27	92%	A <sup>(1)</sup>	
<b>48 VOLT MODELS</b>								
TBC 48-12M	48	47 - 60	13	9	3.7	93%	A <sup>(1)</sup>	25 [11.4]
TBC 48-25M	48	47 - 60	25	18	9	93%	A <sup>(1)</sup>	
TBC 48-30M <sup>(6)</sup>	48	47 - 60	30	22	11	84%	A <sup>(1)</sup>	29.2 [13.3]
TBC 48-50M	48	47 - 60	50	36	18	84%	A <sup>(1)</sup>	
TBC 48-60M <sup>(7)</sup>	48	47 - 63	60	44	22	84%	B <sup>(2)</sup>	53 [24]
<b>60 VOLT MODELS</b>								
TBC 60-25M	60	2 - 63	25	19.7	14.5	90%	A <sup>(1)</sup>	

- (1) Size A (Rack mount): 5-1/4H x 19W x 13-1/2D (inches), 133H x 483W x 343D (mm)  
Size A (Wall mount): 17H x 19W x 6.6D (inches), 432H x 483W x 168D (mm)
- (2) Size B (Rack mount): 8-3/4H x 19W x 15D (inches), 222H x 483W x 381D (mm)  
Size B (Wall mount): 15H x 19W x 8-3/4D (inches), 381H x 483W x 222D (mm)
- (3) 120A for input voltage higher than 180V a-c; 105A for input voltage 115 to 180V a-c.
- (4) Obsolete - TBC 24-60M replaced by TBC 24-50M.
- (5) Obsolete - TBC 24-120M replaced by TBC 24-100M.
- (6) Obsolete - TBC 48-30M replaced by TBC 48-25M.
- (7) Obsolete - TBC 48-60M replaced by TBC 48-50M.

**TABLE 1-3. GENERAL SPECIFICATIONS**

SPECIFICATION		RATING/DESCRIPTION	CONDITION
Input Characteristics			
Input Voltage	Nominal:	100 - 120V a-c, 220 - 240V a-c	Single Phase, Wide Range
	Range:	85 - 264V a-c	
Frequency	Nominal:	50 - 60Hz	
	Range:	47 - 63Hz	
Leakage Current	100 - 120V a-c Input	<1.0mA a-c max.	UL Method, 50-60Hz
	220 - 240V a-c Input	<2.0mA a-c max.	VDE Method, 50-60Hz, 2 terminal connection
Initial Surge at Turn-on	100 - 120V a-c Input	20A a-c max.	First surge after being off for more than 30 seconds.
	220 - 240V a-c Input	40A a-c max.	
Startup Time		900msec max.	
EMI		FCC Class A	
Power Factor		0.99 (typ.)	100V a-c input, rated output.
Output Characteristics			
Source Effect	typical:	0.8%	115 ±15V a-c, 230 ±30 V a-c Minimum - Maximum
	maximum:	1.6%	
Load Effect	typical:	0.8%	10 to 100%
	maximum:	1.5%	
Temperature Effect	typical:	1.0%	0 to 50°C
	maximum:	2.0%	
Combined Effect	typical:	2.0%	Source, Load and Temperature effects
	maximum:	4.0%	
Time Effect	typical:	0.2%	1/2 to 8 hours
	maximum:	0.5%	
Environmental Characteristics			
Temperature	Operating:	0 to 50°C	
	Storage:	-30 to 75°C	
Humidity		95%, non condensing	
Cooling		Built-in d-c fans with fan stop sensor <sup>(1)</sup>	
Isolation		500V d-c, 100MegOhms	Output to case:

## 1.5 OVERVOLTAGE PROTECTIONS AND SPECIAL FEATURES

The TBC incorporates switching power supplies with power factor correction (PFC). A Control Board in the TBC controls and monitors critical functions of the TBC 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 outputs for status monitoring.

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

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

The TBC 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. Similar circuits provide overcurrent and overtemperature protection, resulting in zero output power if either condition is detected. In all cases, if the unit shuts off, the unit must be reset by either a) removing a-c input power and the battery for about 30 seconds and then turning the unit back on again or b) using the remote control (RC) terminals of TB2 at the rear panel to toggle the unit to OFF, then ON for immediate reset. For overtemperature, the unit must cool sufficiently for reset to be effective.



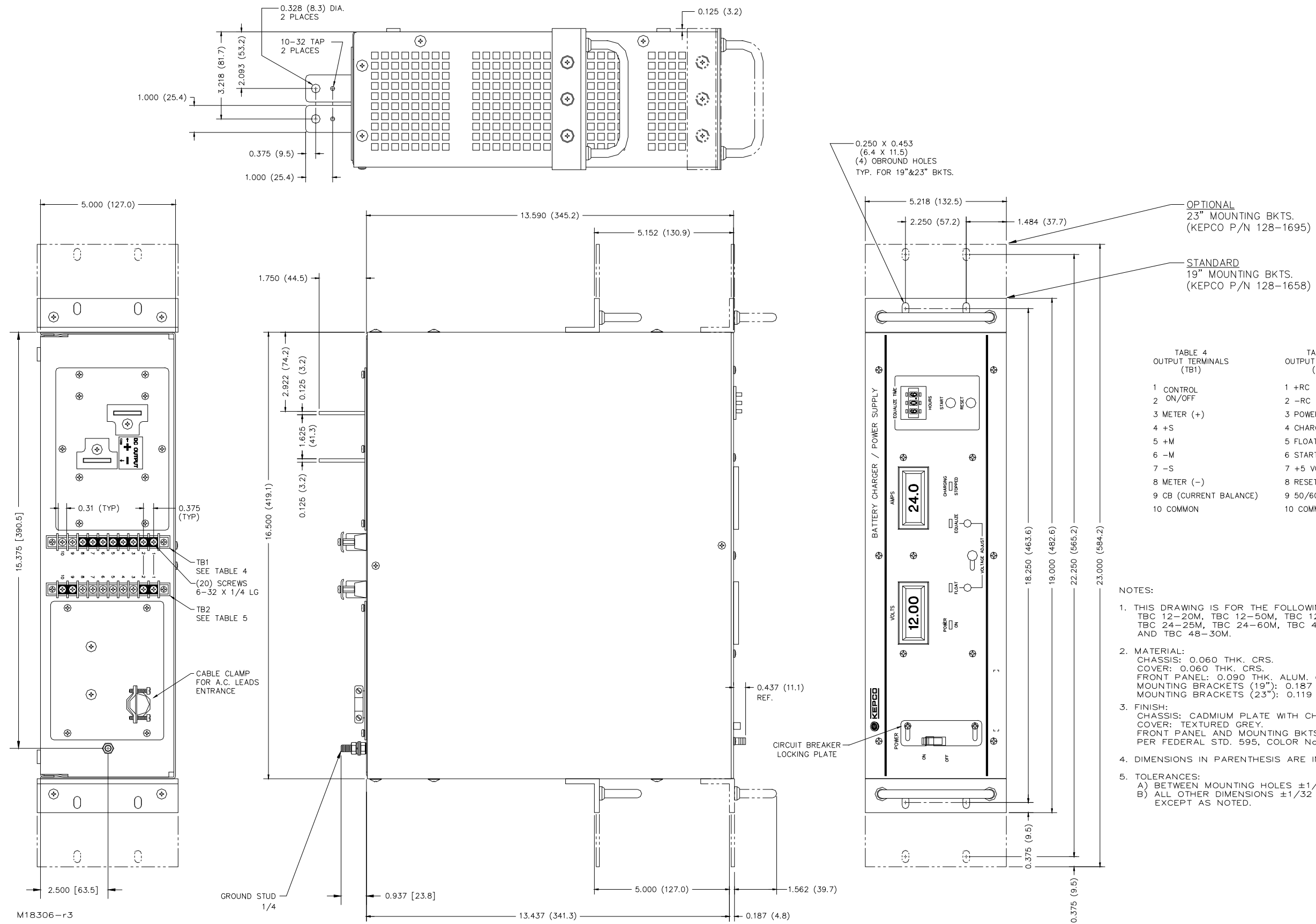


TABLE 4 OUTPUT TERMINALS (TB1)	TABLE 5 OUTPUT TERMINALS (TB2)
1 CONTROL	1 +RC
2 ON/OFF	2 -RC
3 METER (+)	3 POWER ON
4 +S	4 CHARGING STOPPED
5 +M	5 FLOAT/EQUALIZE
6 -M	6 START
7 -S	7 +5 VOLTS
8 METER (-)	8 RESET
9 CB (CURRENT BALANCE)	9 50/60 Hz
10 COMMON	10 COMMON

- 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:  
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. 26440
  - DIMENSIONS IN PARENTHESIS ARE IN MILLIMETERS.
  - TOLERANCES:  
A) BETWEEN MOUNTING HOLES  $\pm 1/64$  ( $\pm 0.4$ )  
B) ALL OTHER DIMENSIONS  $\pm 1/32$  ( $\pm 0.8$ )  
EXCEPT AS NOTED.

FIGURE 1-2. TBC MECHANICAL OUTLINE DRAWING



## SECTION 2 - INSTALLATION

### 2.1 UNPACKING AND INSPECTION

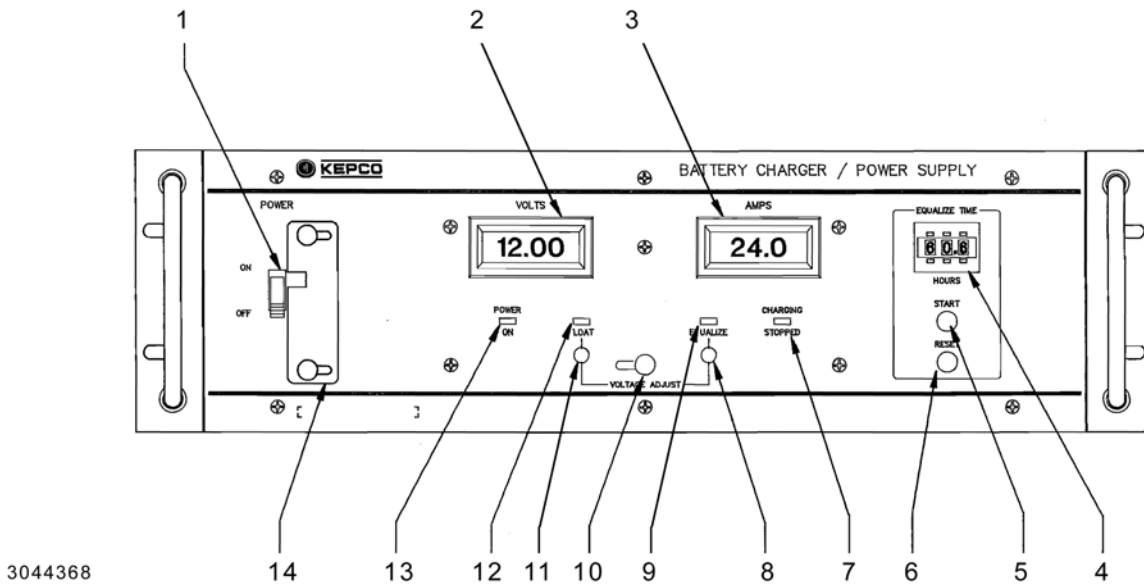
This instrument has been thoroughly inspected and tested prior to packing and is ready for operation. After unpacking, inspect for shipping damage before attempting to operate. Perform the preliminary inspection as outlined in the following paragraph. If any indication of damage is found, file an immediate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

### 2.2 TERMINATIONS, CONTROLS AND INDICATORS

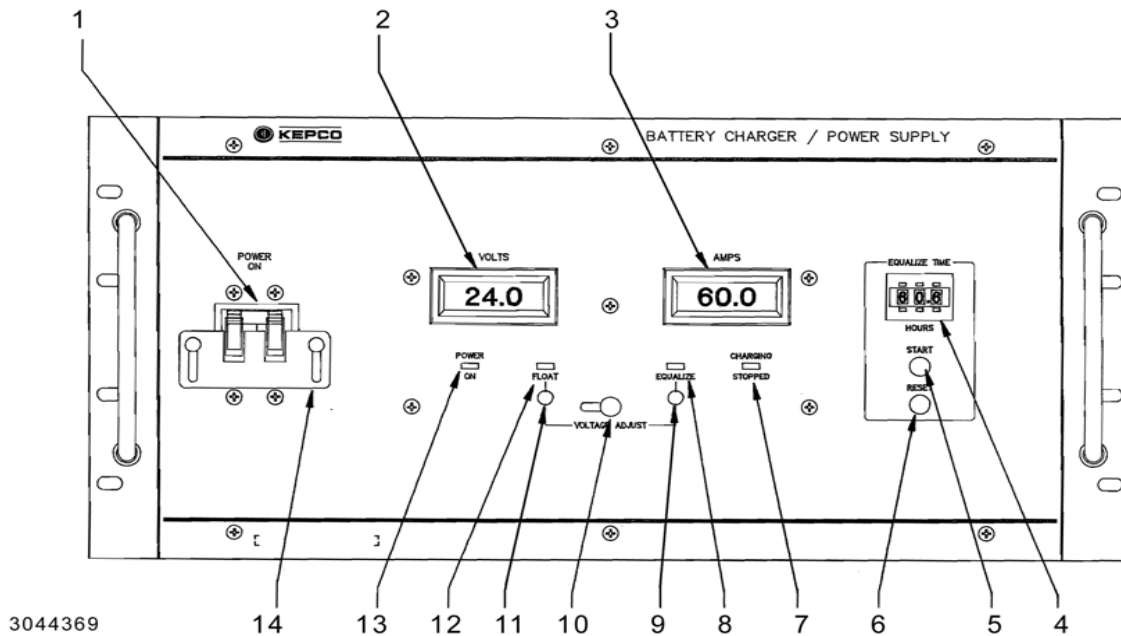
- a. **Front Panel:** See Table 2-1 for a description of front panel controls and indicators. Refer to Figure 2-1 for all models except TBC 24-120M and TBC 48-60M. Refer to Figure 2-2 for TBC 24-120M and TBC 48-60M.

**TABLE 2-1. FRONT PANEL CONTROLS AND INDICATORS**

FIG. 2-1 OR FIG. 2-2 INDEX NO.	NAME	FUNCTION
1	POWER ON/OFF circuit breaker	Main AC input power circuit breaker.
2	VOLTS, LCD display (2)	3-1/2 digit LCD meter for reading voltage.
3	AMPS LCD display	3-1/2 digit LCD meter for reading current.
4	EQUALIZE TIME timer	0.1 to 99.9 hour timer that can be set to establish the duration of the Equalize cycle.
5	START switch	Pressing START button starts the EQUALIZE TIME timer as the Equalize mode begins.
6	RESET switch	Pressing RESET button resets the EQUALIZE TIME timer as the TBC returns to the Float mode.
7	CHARGING STOPPED indicator	Red LED to indicate that the TBC has stopped charging.
8	EQUALIZE adjustment control	Screwdriver adjustment of equalize voltage.
9	EQUALIZE indicator	Amber LED that flashes when the TBC is in the Equalize mode (high rate of charging).
10	VOLTAGE ADJUST lock	A sliding plate behind the panel allows access to the Float and Equalize voltage controls. For precise settings of these controls refer to the battery's manufacturer.
11	FLOAT adjustment control	Screwdriver adjustment of float voltage.
12	FLOAT indicator	Green LED to indicate when the TBC is in the Float mode (slow rate of charging).
13	POWER ON indicator	Green LED power on indicator.
14	POWER ON/OFF Locking Plate	Prevents accidental shutoff of TBC. See PAR. ?? for details.



**FIGURE 2-1. TBC SERIES (EXCEPT TBC 24-120M AND TBC 48-60M) FRONT PANEL CONTROLS AND INDICATORS**



**FIGURE 2-2. TBC 24-120M AND TBC 48-60M FRONT PANEL CONTROLS AND INDICATORS**

b. **Rear Panel:** 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 2-2 and 2-3 for a description of TB1 and TB2 terminals, respectively. Refer to Figure 2-3 for terminal locations.

**TABLE 2-2. TB1 INPUT/OUTPUT TERMINAL ASSIGNMENTS**

TERMINAL NO.	NAME	DESCRIPTION OR FUNCTION
1	Control	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.
2	ON/OFF	
3	Meter (+)	This terminal provides an outside contact point from the positive side of the LCD voltmeter for remote monitoring of the output voltage.
4	+S (Sense)	This terminal is the positive Remote Sensing terminal for the TBC output voltage.
5	+M (Monitor)	This terminal is connected to the positive output terminal of the TBC Battery Charger and is used for Local Sensing.
6	-M (Monitor)	This terminal is connected to the negative output terminal of the TBC Battery Charger and is used for Local Sensing.
7	-S (Sense)	This terminal is the negative Remote Sensing terminal for the TBC output voltage.
8	Meter (-)	This terminal provides an outside contact point 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 terminal is logic ground.

**TABLE 2-3. TB2 INPUT/OUTPUT TERMINAL ASSIGNMENTS**

TERMINAL NO.	NAME	DESCRIPTION OR FUNCTION
1	+RC (Remote Control)	Remote Control ON/OFF Input Command. An open (logic high) between the +RC and -RC terminals will turn OFF the TBC. A short circuit (or logic low) between these two terminals will return the TBC to operation. Logic high is between 2.4V and 24V d-c; logic low is between 0V and 0.4V d-c. When high, this terminal can sink 1.0 mA maximum; when low this terminal can source 1.6mA maximum.
2	-RC (Remote Control)	
3	Power On	Power On Output Flag. A logic high at this terminal (with respect to Common) indicates that AC input power is ON. A logic low indicates that AC input power is OFF.
4	Charging Stopped	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	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	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	+5 Volts d-c
8	Reset	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	50/60Hz	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 logic ground.

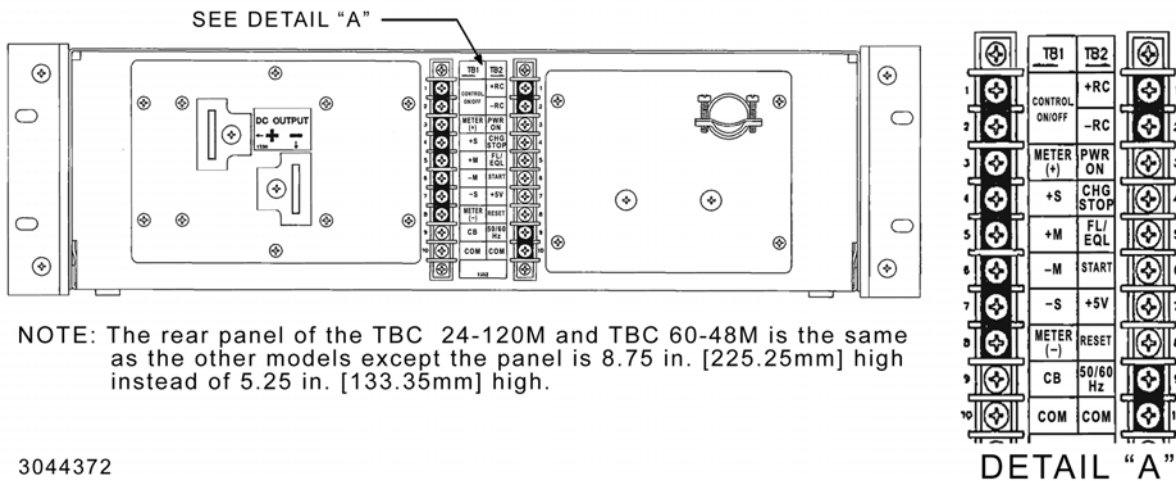


FIGURE 2-3. TBC REAR PANEL

### 2.3 AC SOURCE POWER REQUIREMENTS

The TBC Battery Charger Power Supply is supplied for operation on a single phase line with a-c input voltage between 100V and 250V a-c nominal (universal a-c input). The circuit breaker remains effective at all input voltages.



**WARNING: Input current may be hazardous. Refer to Table 1-2 for input current specifications and ensure source power is off and TBC Power ON/OFF is set to OFF before proceeding.**

- 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 2-4).
- Fasten the panel in place on the TBC Battery Charger rear panel.

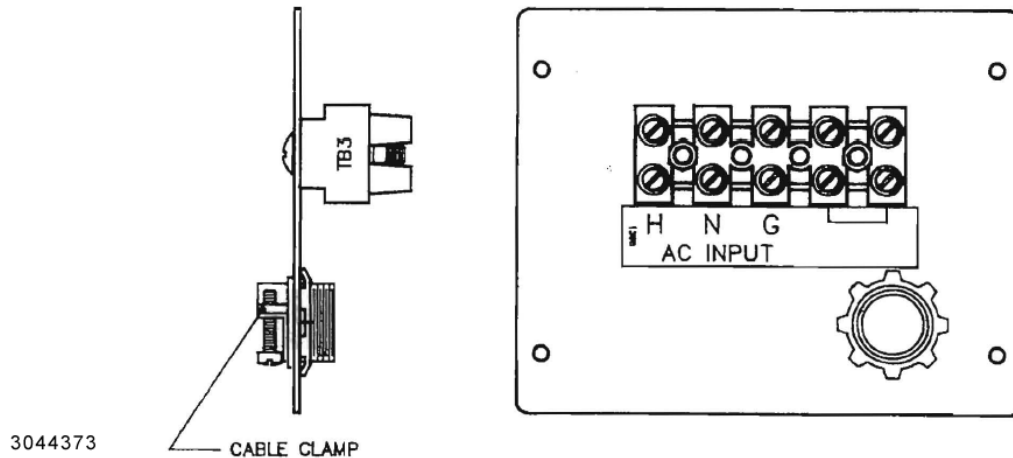


FIGURE 2-4. AC INPUT POWER TERMINAL BLOCK, TB3

## 2.4 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 assemblies, cooled by internal fans.



**CAUTION: 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 Table 1-3).

## 2.5 GROUNDING



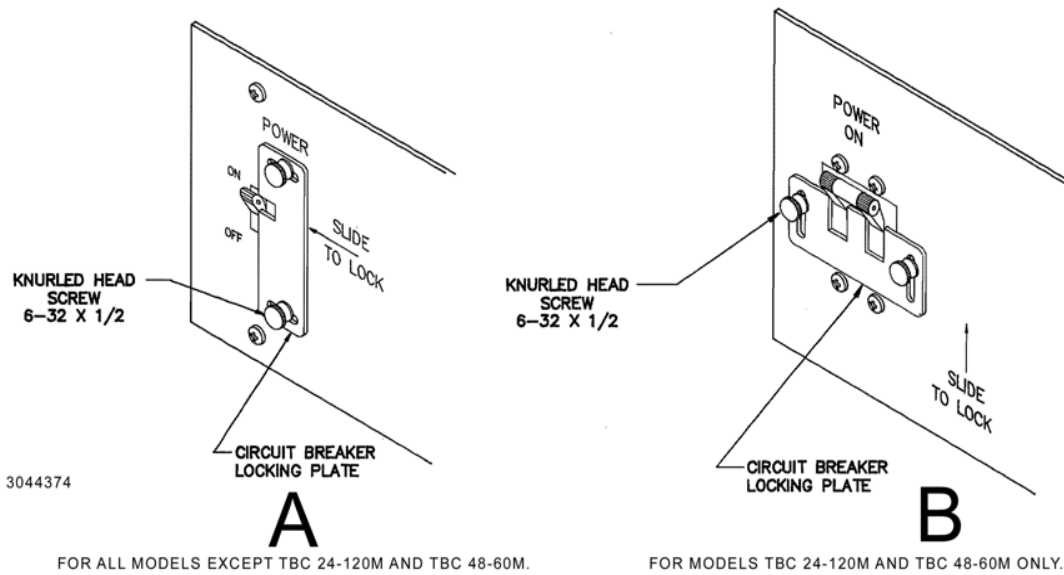
**WARNING: For safety reasons it is imperative that the chassis of the power supply be returned to AC ground with a separate lead. A grounding terminal is provided (on Terminal Block TB3) for this purpose.**

- a. Terminal Block TB3 on the Chassis Assembly has three terminals: Ground, Neutral and High. The Ground terminal is a chassis ground, and is not the logic ground, nor the Common found on PC Board 1 and pin 10 of Terminal Blocks 1 and 2 (see Figure 2-3).
- 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 500V d-c. Either side of the output may be connected to chassis or Earth ground

## 2.6 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.

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 2-5A). For models TBC 24-120M and TBC 48-60M slide the locking plate down (see Figure 2-5B).

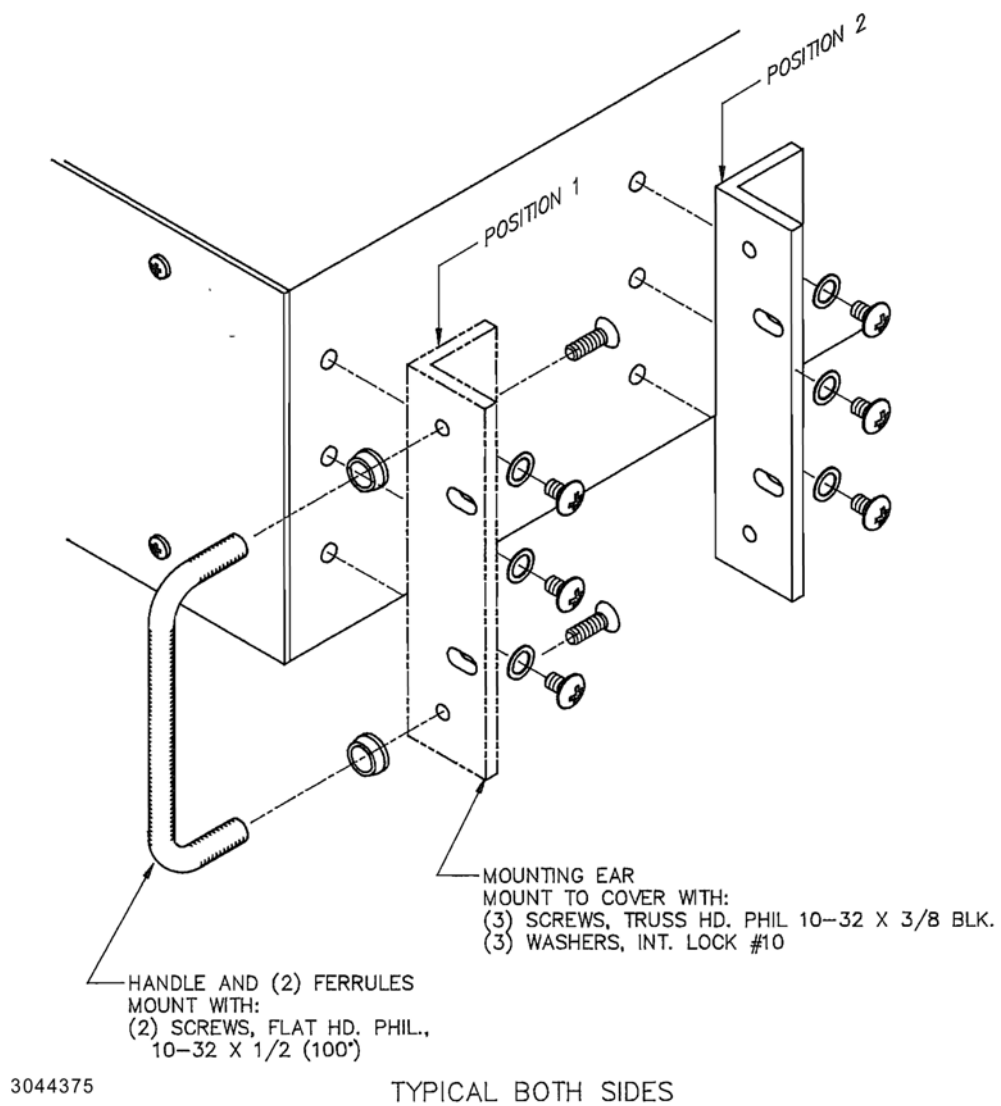


**FIGURE 2-5. CIRCUIT BREAKER LOCKING PLATE**

## 2.7 RACK PANEL MOUNTING

A kit that contains two handles (each one with two ferrule mounts) and two flanges (ears) for rack mounting is provided with the TBC. Four screws (flat 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 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.





**FIGURE 2-6. RACK MOUNTING**



## SECTION 3 - OPERATING INSTRUCTIONS

### 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.

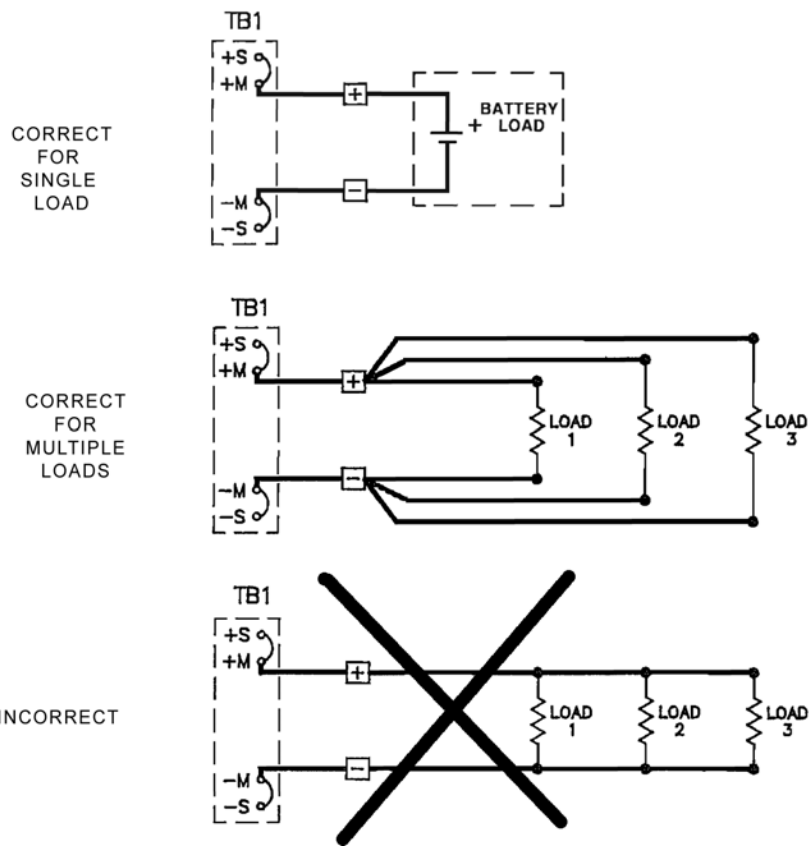
### 3.3 LOAD WIRE SELECTION

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.

Figure 3-1 shows the correct and incorrect methods of connecting single and multiple loads with local sensing. Remote Sensing should be used for the most critical load (see PAR. 3.5). Local 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 links (jumpers) that connect the Sensing terminals directly to the Monitor terminals. These links should be removed when remote sensing is employed.



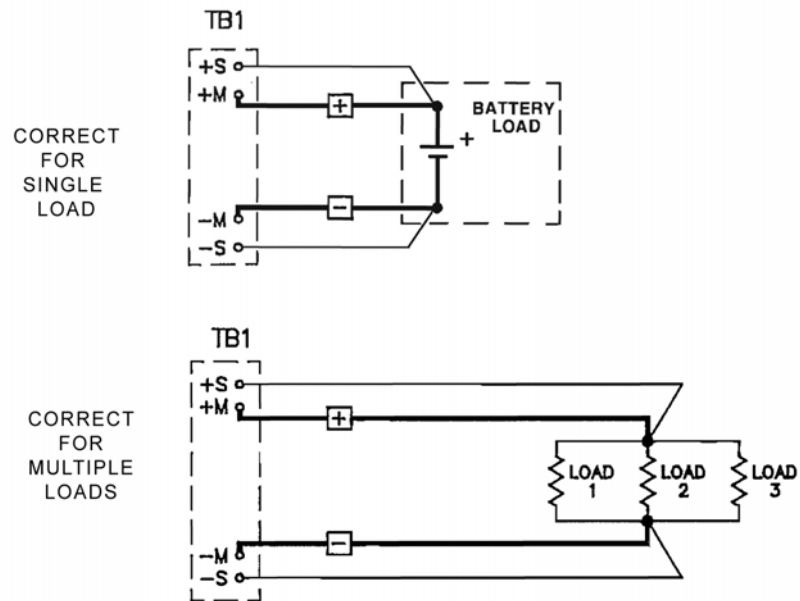
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FIGURE 3-1. LOCAL ERROR SENSING CONNECTIONS

### 3.5 LOAD CONNECTION, METHOD 2 (REMOTE ERROR SENSING)

To avoid excessive output effects at remote loads, remote 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 0.40 Volts per cable. Figure 3-2 shows the TBC connected to a battery and multiple loads using remote sensing.



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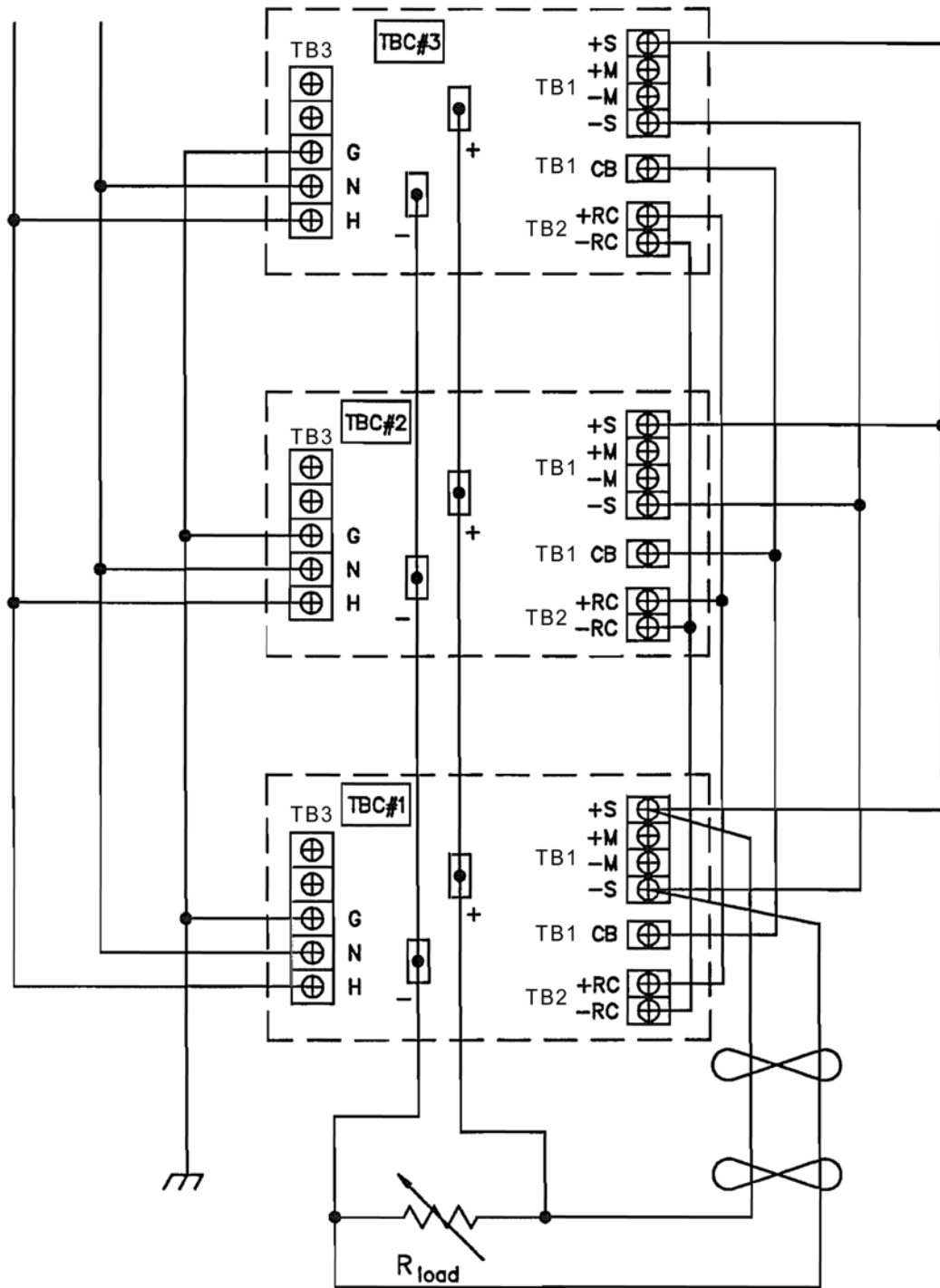
**FIGURE 3-2. REMOTE ERROR SENSING CONNECTIONS**

### 3.6 PARALLEL OPERATION

Up to three identical TBC Battery Charger Power Supplies can be connected 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. For the TBC 48-60M or TBC 24-120M only one additional TBC unit can be connected in parallel. For parallel operation it is necessary to connect the Current Balance terminals together (terminal 9 on TB1) for all the TBC units in operation (see Figure 2-3).

**NOTE:** To operate up to three TBC Battery Charger Power Supply units in parallel, set the desired output voltages, 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 TB1 and TB3 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 in to them. Therefore only one other TBC Battery Charger can be placed in parallel with either one of these two models.

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NOTE: On each TBC remove links between +S and +M terminals and between -S and -M terminals

FIGURE 3-3. SUGGESTED WIRING FOR UP TO THREE TBC UNITS WITH REMOTE SENSING AND REMOTE CONTROL