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INSTALLATION AND OPERATING

MODEL MBC-19 BATTERY CHARGER

INSTALLATION INSTRUCTIONS

The Charger cabinet must be mounted in a vertical position preferably on a wall in close proximity to the battery. The areas above and below the Charger must be clear for at lest 5 inches to allow free air flow for cooling. The Charger cabinet must not be located in areas subject to falling or spraying water.

The Charger should not be subject to severe shock or vibration. If it is necessary to mount the unit on an engine skid, select a point subject to the least amount of shock and vibration and install suitable vibration dampers when needed.

For wiring, use wire having insulation which is unaffected by the environment of the installation. For engine starting battery installations, use flexible stranded copper wire having insulation which is unaffected by oil or engine heat.

The bushings supplied with the Charger are in 7/8 (2.2 cm) diameter holes for ½ inch nominal (1.2 cm nominal) conduit fittings. Discard bushing(s) when conduit(s) is used.

See Drawings for Mounting Dimensions and External Wiring Information.

OPERATING PROCEDURES

GENERAL: The Model MBC-19 Battery Chargers are constant voltage single rate (semi-float) regulated (line compensated) battery chargers. They have a Crank Disconnect (DK) Relay as standard equipment.

OUTPUT CAPACITY: These Chargers are capable of supplying up to 100% of their D.C. rated output current without allowing the battery to be depleted. Loads across the battery which are less than the Charger's rated current will be supplied by the Charger with the remaining Charger output being available to charge the battery, if required. For loads greater than the rated output the Charger will supply at least its rated output (if the crank disconnect terminals DK1 and DK2 are not energized) with the battery supplying the remainder.

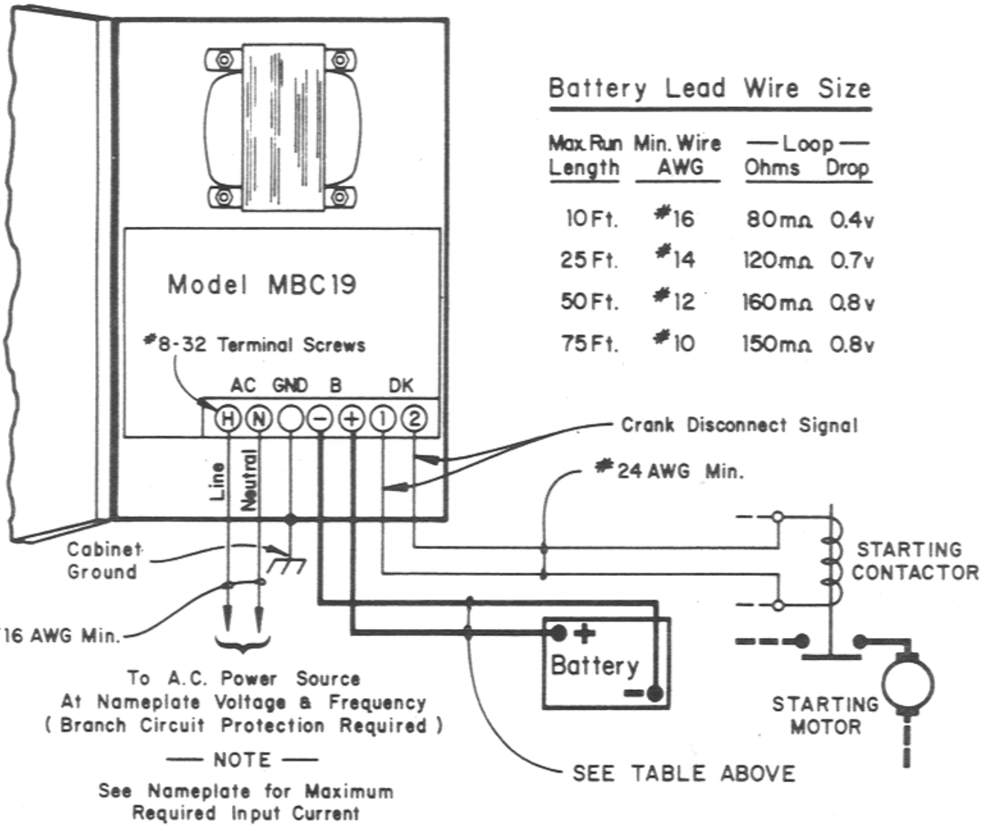
BATTERY CAPACITY: is limited to 115 ampere hours; except, where A.C. line voltage is not abnormally high, the maximum battery may be twice the 115 ampere hour limit.

LINE REGULATION: The Charger is regulated (line compensated) and requires no tap settings. The line voltage regulation (output change) is 1% maximum for a 10% line voltage change. The Charger will operate with line changes of up to +15% of nominal with reduced current rating on low line voltages.

WATER CONSUMPTION: The unit is a semi-float Charger which has an output voltage somewhat higher than float level voltages. This allows the Charger to charge a battery in reasonable time and maintain the charge with minimal gassing. With semi-float Chargers, the battery water level should be checked at least once a month until a water consumption pattern is established. Longest battery life will be obtained when distilled water is used to fill batteries.

EQUALIZING: The MBC-19 Models are single rate semi-float Chargers. They do not have means for equalizing the battery. In engine starting applications, running the engine periodically will allow a battery charging generator or alternator, to equalize the battery after the cranking energy has been returned to the battery. A battery equalized in this manner will be indicated by a zero charge current reading of the battery charger ammeter after the engine is stopped. After a time interval the battery voltage will drop and the Charger will show a small output current (which is dependent upon leakage and load current).

CRANK DISCONNECT: In applications requiring battery output currents which exceed the Charger output ratings, such as engine cranking, a crank disconnect signal must be supplied to the Charger. This signal should be a DC voltage of the same nominal value as the Charger DC rated voltage. The signal may be either polarity and is supplied to terminals DK1 and DK2. The current required by the disconnect relay is less than 20mA on 12 volt units and 10mA on 24 volts units. Wiring these terminals to the starter contactor or starter motor terminals would provide the required signal on engine starting application.



Battery Lead Wire Size

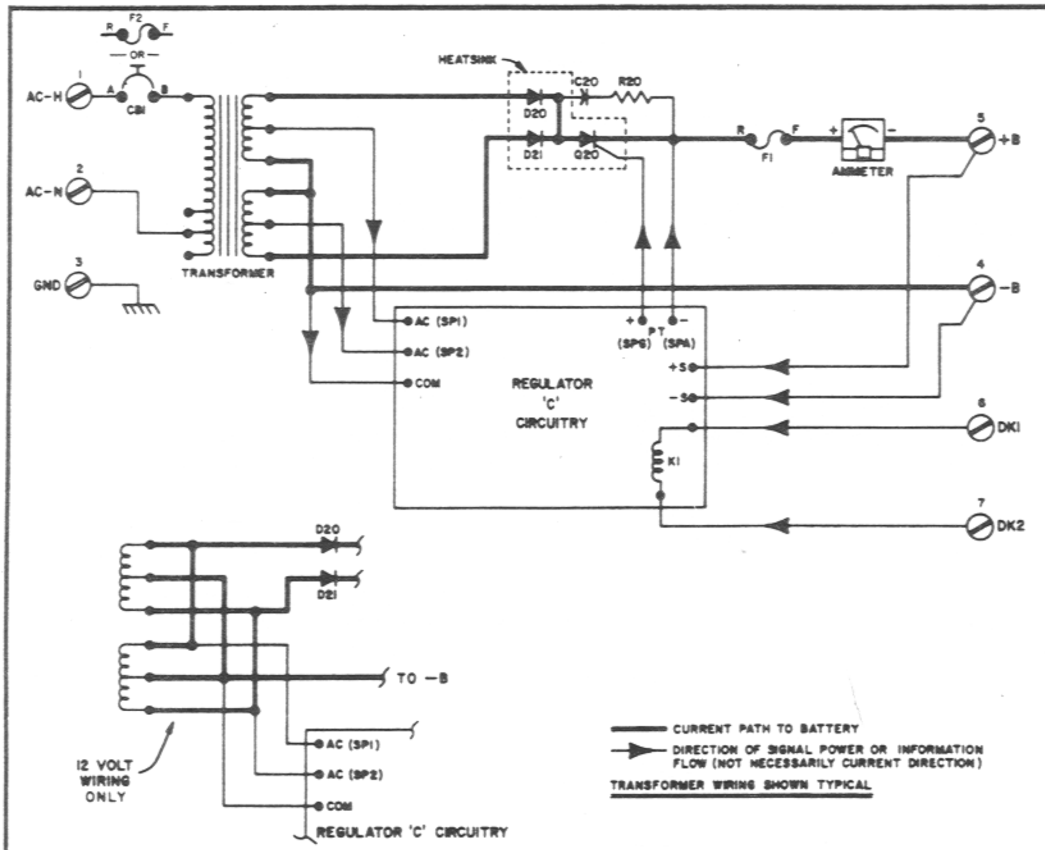
Max. Run Length	Min. Wire AWG	Loop Ohms	Loop Drop
10 Ft.	#16	80mΩ	0.4v
25 Ft.	#14	120mΩ	0.7v
50 Ft.	#12	160mΩ	0.8v
75 Ft.	#10	150mΩ	0.8v

ISSUE	REVISIONS

MODEL MBC 19
BATTERY CHARGER
EXTERNAL WIRING

MASTER CONTROL SYSTEMS INC.
LAKE BLUFF, ILLINOIS

USED ON	ISS.	SCALE ——	
DRN. L. Silles		DES. E. Tracky	
APP. R. Veit		DATE 2-7-77	
DRG. 10046	ISS.	SHEET 1 OF 1	



ISSUE	REVISIONS	
2	Rem. Transf. Tap No.'s	7-25-79
3	Add F2 Option	4 Aug 87

SCHEMATIC DIAGRAM
MODEL MBC-19
BATTERY CHARGER

MASTER CONTROL SYSTEMS INC.
LAKE BLUFF, ILLINOIS

USED ON	ISS.	SCALE ——	
DRN.		DES.	
APP. E. Tracky		DATE 2/22/77	
DRG. 10047	ISS. 3	SHEET 1 OF 1	

SCAN LINES, INC. CHICAGO

BATTERY CONDITION: A fully charged battery will be indicated by a low Charger output current and, for lead acid batteries, a full charge specific gravity hydrometer reading in all cells. A battery which has approached end of life will have a reduced ampere hour capacity (something less than the battery's rate capacity). An adequate check of a battery for capacity in an engine starting application is to monitor the battery voltage while it is cranking the engine during expected worst case starting attempt. If the battery was fully charged its cranking voltage should be at least 75% of nominal voltage (9 volts minimum on a 12 volt lead acid battery). Batteries which have sufficient capacity but which are not fully charged may not pass this test.

TO PUT THE CHARGER INTO OPERATION: Connect per installation instructions and apply A.C. power.

WARNING: Always disconnect, turn off, or remove A.C. power from the Charger before attempting to service the Charger or before connecting or disconnecting Charger or battery leads. Similarly, do not connect or disconnect battery leads with any loads connected to prevent arcs or sparks at the battery.

CAUTION: If the battery leads (+B and -B) are to be disconnected from the Charger they must either be insulated or disconnected at the battery first to prevent short circuiting the battery.

NORMAL OPERATION: When power is first applied the Charger will normally supply at least rated current as indicated on the Charger ammeter. As the battery charge builds up the charge current will reduce finally to a level required to maintain the battery charge and supply any additional loads. The charge current should reduce to lower values within 30 hours or less for properly sized Chargers. The following voltages apply to 12 volt systems and are proportional to other systems.

When connected to a fully discharged battery the charge current will be higher than rated current for part of the charge cycle. A very deep discharged battery can cause Charger shutdown (if its terminal voltage is less than 5 volts) for up to several hours before high charge currents can flow. Note that for a deep discharged battery to eventually allow Charger to turn on, there must be no other loads on the Charger (or battery).

CHARGER MAINTENANCE: There are no field adjustments to be made on these Chargers. The only adjustable device is the float voltage adjustment on the regulator P.C. board which is factory set using precision equipment.

LOW VOLTAGE SHUTDOWN: These Chargers are normally supplied with low voltage shutdown which causes the Chargers to reduce its output current at any time the battery output terminal voltage drops below 5 volts. The charger will shut off completely if the output terminal voltage drops below 2.5 volts. This provides reverse polarity and short circuit protection.

THEORY OF OPERATION

GENERAL: Refer to wiring diagram for schematic representation. Note that while the transformer winding configuration changes with Charger voltage and current ratings, the typical winding configuration is representative of the Charger operation.

A.C. PATH: The A.C. power is applied to the power transformer primary through circuit breaker CB1 or A.C. Fuse F2. Note that the primary taps shown are factory wiring options to accommodate different battery types. The 'GND' terminal is tied directly to the chassis which is in electrical contact with the cabinet. The primary and secondary circuits are electrically isolated from each other and from chassis or cabinet ground. The transformer, then, isolates the A.C. power and transforms the voltage to the level required by the battery. The regulator circuits has its own regulated power supply to power the circuitry and the reference element providing the double regulated reference voltage for the highly regulated operation.

D.C. PATH: The Main power rectifiers (D20 & D21) and SCR are all mounted on the heat sink. Rectification is full wave center tap with the rectifier output going directly to the SCR (Q20). Battery charger current will flow when the SCR (Silicon Controlled Rectifier) is turned on and vice versa. The resistor R20 and capacitor C20 form a 'snubber' network to prevent false SCR turn on due to line surges or transients. When the SCR is turned on by the regulator circuit charge current will flow through the SCR, fuse F1, and ammeter, and terminal '+B' to the battery positive post. The charge current return path is from battery negative through terminal '-B' to the transformer center tap.

The regulator board has its own regulated power supply which is supplied via the 'AC' pins and terminals 15 and 16. The wiring options shown on the drawing are to provide approximately 12 VAC to the regulator board. The return line for this supply is the 'RET' pin which connects to the transformer center tap via terminal '-B'. The local regulated supply on the board supplies the reference element providing the double regulated reference voltage for low line regulation error.

VOLTAGE SENSING: The regulator senses the battery terminal voltage via the '+B' and '-B' terminals. The regulator will turn on the SCR sooner in each half line cycle when the sensed battery voltage is below the internal regulated reference voltage. Turning on the SCR sooner in each half cycle will allow more charge current to flow. When the battery voltage increases (with charge level) above the fixed reference voltage, the regulator will turn on the SCR later in each half cycle causing reduced charge currents. The battery voltage sensing network is high in impedance (approximately 3K ohm) and will not cause battery discharge on power outage.

CRANK DISCONNECT: The crank disconnect relay is supplied by the 'DK' terminals. This reed relay shunts the SCR pulse transformer input, when operated, which prevents SCR turn on.

SHUTDOWN: Shutdown sense signal comes from the '+B' terminal. Any time the voltage on that terminal drops below 5.0 volts the shutdown sense circuit begins to 'steal' the SCR drive signal which reduces charge current. If the terminal voltage falls below 2.5 volts, sufficient SCR drive signal is stolen to prevent SCR turn-on causing all charge current to stop. Output current will return when the +B voltage rises above 2.5 volts.

TROUBLESHOOTING HINTS

FOR MODEL MBC19 BATTERY CHARGER

GENERAL: Record the battery voltage and charger output current before proceeding with any tests. (Whenever possible, battery voltage readings should be taken at the battery posts, battery terminals, and charger output terminals with an accurate voltmeter). It is important to check voltages initially at all three points since a poor connection will vary readings and effect charger performance.

If battery post voltage is equal to that in Table A, and the charger shows no output, the charger is operating properly.

NOTE: Do not adjust the sealed trimpot on the printed circuit board since accurate field adjustments are extremely difficult to obtain. Improper settings will lead to either undercharging or overcharging of the battery.

SYMPTOM I. No Output (charger will not turn on unless connected to a battery. Output will not be apparent when connected to a fully charged battery unless a load is applied).

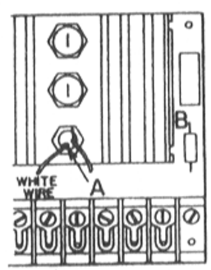
CHECK:

A. If battery voltage is low (See Table A) and no output is indicated:
   1. Verify nameplated input voltage is present at A.C. input terminals.
   2. Check input (A.C.) circuit breaker (or fuse) and D.C. fuse.
   3. Remove wires from the DK1 and DK2 terminals (an improperly wired disconnect circuit can cause charger to turn off).
   4. Verify that battery voltage is above charger shutdown voltage (5 volts). This feature provides reverse polarity and short circuit protection.
   5. The SCR assembly can be checked by momentarily connecting a jumper between the gate of the SCR (Point A) and the capacitor side lead (Point B) of the R20 resistor (See Fig. 1). If the ammeter deflects, the SCR is operational. (Since this will cause the SCR to be wide open, the jumper can only be connected momentarily or a fuse may be blown).

TABLE A*

CHARGER MODEL	BATTERY TYPE	VOLTAGE
MBC19	Lead Acid	2.3 VPC
	Maint. Free (Lead Calcium)	2.35 VPC
	Nicad	1.45 VPC

FIGURE 1



*NOTE: Number of cells stamped on nameplate must correspond with number of cells in battery bank. Proper voltages can be determined by multiplying number of cells by VPC listed above. Example: Typical 24 volt battery bank consists of 12 lead acid cells at 2.3 VPC = 27.6 volts.

SYMPTOM II. Battery is incapable of cranking engine or carrying substantial loads.

CHECK: Standing battery voltage:

A. If the measured battery post voltage is equal to voltages shown in Table A, but drops 75% of nominal when the engine is cranking, then the batteries do not have sufficient capacity and should be replaced. (This battery charger monitors battery voltage and will supply sufficient output to bring battery voltage up to the proper level; however, batteries with diminished capacities are still capable of reaching normal voltages).

B. If the measured battery post voltage is lower than the values shown in Table A and charger output current is indicated on the ammeter, the condition may be normal die to recent deep discharge of the battery. If the voltage does not increase and the charger output does not decrease within 24 hours, the condition may be caused by a shorted battery cell or an improperly coordinated charger and battery system. (See III., Overcharging/Excessive Gassing).

C. If the measured battery port voltage is lower than the values shown in Table A an no charger output current is indicated on the ammeter, a bad connection may exist. To verify proper connections, measure the voltage at the charger output terminals and compare them to the battery post voltage reading. If they differ by more that 1%, then a bad connection between the battery posts and the charger output terminals exists. Clean and tighten all connections.

D. If the measured battery post voltage is lower than the values shown in Table A and charger output is only indicated on the ammeter immediately after engine cranking , Consult factory.

SYMPTOM III. Overcharging/Excessive Gassing (Ammeter indicating charge rate in excess of any continuous load)

CHECK:

A. If battery voltage is equal to voltages in Table A, disconnect any load, interrupt A.C. supply, and wait approximately 15 minutes. If voltage drops below voltages in Table A, the battery is not capable of maintaining a full charge, and higher than normal output is needed to maintain proper voltage at the battery. This may cause excessive gassing. Battery should be replaced.

NOTE: Anytime battery voltage is equal to voltage in Table A, the battery charger is not overcharging.

B. If battery voltage is higher than voltage in Table A, consult factory.

SYMPTOM IV. Fuse Blowing

CHECK:

A. Fuses blow immediately when installed.
   1. Verify fuses being used match ratings on fuse nameplated.
   2. Disconnect charge leads at charger, install new fuse.
      a. If problem clears, an external short exists.
      b. If fuse still blows, consult factory.

B. Fuse blow during engine cranking.
   1. Disconnect terminals are not properly wired.