MasterCharger

BATTERY CHARGER-ANALYZER

- **TRUE CONSTANT CURRENT**
  Adjustable, 0 to 50A on Charge and 0 to 60A on Discharge
- **DUAL RATE CHARGING**
  Automatic Main to Topping
- **SERVICES NICKEL-CADMIUM AND LEAD-ACID BATTERIES**
- **SERVICES ONE OR TWO BATTERIES**
  Charge or Discharge
  0 to 50 cells total, 80V max
- **SINGE CELL CHARGING**
- **100% SOLID STATE**
- **DIGITAL METERS**
  Voltmeter and Ammeter
  Input for external leads for Individual Cell measurements
- **SAFE OPERATION**
  Reverse Polarity, Short Circuit and Open Circuit protected
  Battery Overtemperature
- **THREE MODES OF OPERATION**
  Constant Current
  Constant Voltage
  Peak Voltage
- **INTERFACING**
  BTAS16 Computerized Battery Test System

The MasterCharger is an instrument designed to charge, trickle charge and analyze (discharge) Nickel-Cadmium, Sealed Lead-Acid and other types of rechargeable batteries.

With its multiple modes of operation of Constant Current, Constant Voltage and Peak Charge and Analysis and Deep Cycle discharge modes, the MasterCharger can satisfy the requirements of most small (up to 100A-hr) rechargeable battery systems.

The MasterCharger is an instrumentation quality Charger-Analyzer, augmented with safety features to protect the operator, the charger and the battery in the event of reversed polarity connection, short circuit, open circuit (no load) and overvoltage conditions.

A microprocessor based timer permits programming in three speeds: Hours, Minutes and Test (with battery back-up protection in case of power failures). Two large digital meters permit the simultaneous monitoring of voltage and current while audible and visual indicators inform of the status of the operation on each channel.

Interfacing to the BTAS16 Computerized Battery Test System is a standard part of the MasterCharger ("C" model designation).

The MasterCharger is basically a precision voltage controlled current source/sink, with programmable current and voltage endpoints, capable of providing various charge and discharge modes.

In the **Constant Current** Charge mode, the current is set by the current selectors. Its setting is independent of the battery voltage, from 0 volts (short circuit) up to 80V. The charge current is also independent of the line voltage, within the specified line voltage limits.

In the **Constant Voltage** (Float) Charge mode, the current starts constant (as per the CC mode) and remains constant until the battery voltage is within a fraction of the selected value (0.5V approximately). At this point, the current is automatically reduced and regulated to maintain the programmed battery voltage.

In the **Peak Xfer** Charge mode, the current starts as programmed by the Main Current Selector and transfers to the programmed Topping Current when the battery programmed Peak Voltage is sensed.

In the **Peak Stop** Charge mode, charge is terminated when the battery reaches the programmed peak voltage.

In the **Capacity** (Auto, Analysis) Discharge mode, the current starts constant and it is terminated automatically when the battery drops below the programmed voltage.

In the **Full** Discharge mode, the current starts constant but gradually drops to zero after the battery voltage reaches the 3V to 2V level.

A monitor circuit provides the following safety features:

REVERSE POLARITY: If the charger is connected in reverse to a battery (or single cell) having at least 0.25V of charge, the MasterCharger will signal a voltage fault and inhibit further operation.

OPEN CIRCUIT: If the charger is started without a battery connected to it, or if the battery is open, or if the battery voltage rises abnormally (overvoltage), the MasterCharger will signal a voltage fault and inhibit further operation. The MasterCharger does not allow for current to flow until it detects that it is properly connected to a battery.

Many chargers, specially the very simple ones, have live terminals from the moment that power is turned on. Connection to a battery under the above mentioned conditions can result in sparks and current surges that can damage the battery terminals, connectors and the charger, and it may also be hazardous if battery fumes are present. The MasterCharger is fully protected under such conditions.

SHORT CIRCUIT: The MasterCharger is current limited, therefore, a short circuit will not result in any more current that the programmed level.

NOTES: Short circuiting of a charger, as it may occur if the output leads accidentally touch, can be quite damaging. A similar situation can be found with chargers connected to totally discharge batteries. Also, chargers designed for constant voltage or for a specific number of cells, may be overloaded when connected to a battery with a shorted cell, or with fewer cells. Prolonged output under such conditions could be detrimental to the charger and the batteries.

The MasterCharger, being inherently a current source, will not deliver any more current than it is programmed for, and it will sustain a continuous short circuit with no damage or degradation. Thus, it is perfectly normal in the MasterCharger to charge a single cell.

General Battery Charging Notes:

Note these are general notes provided for reference. Consult the CMM or OMM for specific charging specifications.

NICKEL-CADMIUM

For Nickel-Cadmium cells, the standard method of charge is constant current over time. In the absence of any particular instructions from the battery manufacturer, charging at C/l0 for 12 to 16 hours will insure a complete charge (particularly applicable to sealed cells). For vented cells, the charge rates are normally set to higher values, which results in shorter charge times. Typically, Nickel-Cadmium cells are charged at C/5 for two hours (Main rate), followed by four hours at C/10 (Topping charge). An alternate method is to charge at the main rate until the end voltage is equal to 1.55V/cell, at which time the battery can be charged at the topping rate) provided that all cells have reached this level).

Example 1: A 20 cell, 40 A-hr battery would be charged at 20A for two hours and at 4A for four hours.

Example 2: The charge current would transfer from Main to Topping when the end voltage reaches 31.0V

Nickel-Cadmium batteries can also be charged in the Constant voltage mode, with an end voltage equivalent to 1.4 Volts per cell (a 20 cell battery would be set to 28.0V). Prolonged use of the constant voltage method, however, will result in cell imbalance, which could eventually lead to premature cell failure due to uneven charge acceptance and uneven discharge capacity. If Nickel-Cadmium cells are to be charged with the constant voltage method (as it is normally done in aircraft applications) they must be charged periodically with constant current allow for all the cells to equalize at the higher peak voltage.

LEAD-ACID

The Constant Voltage (Float) and the Peak charge modes are particularly useful with Lead-Acid batteries, where the battery voltage is a better indicator of the state at charge, as compared with Nickel-Cadmium batteries where terminal voltage gives little information on the state of charge.

Lead-Acid batteries are normally charged in the constant voltage mode, typically at the rate of 2.33V/ cell. A pack with 6 cells (12V, nominal) will then be charged with a 13.8V float voltage. In this mode, the charge current is set to the highest rate that the cells will safely accept (typically up to 1C depending on the battery type and specific manufacturer instructions). This will be the charge current until the battery reaches the programmed voltage, at which time the current will diminish to the level needed to maintain the battery at the programmed voltage. In the MasterCharger, current begins to drop when the voltage is about 0.5V less than the programmed voltage. *Note: the current needed to maintain the battery at the programmed voltage will vary according to the type and size (A-hr) of the battery and also from battery to battery, as a function of the condition of the battery (new, used, abused, etc.).*

Lead-Acid batteries can also be charged in a manner in which it is possible to know much better the end of charge. When a Lead-Acid cell is charged with constant current at the C/15 rate, voltage will rise rapidly at about 90 to 95% of charge, which occurs at about 2.4 to 2.45 V/cell. A 20A-hr, 12 cell pack (24V nominal), can then be charged at 1.33A, with the peak voltage programmed at 29.4V The MasterCharger will stop the charge operation when the rapid rise of end-of-charge voltage is detected.

Although constant voltage charging is the most common form of charging for Lead-Acid batteries (mainly because of the simplicity of the hardware required to make a basic charger), it is not the best method. Constant voltage charging relies on the end voltage of the battery pack, which is the sum total of the individual cells. Consequently, it is possible to have an acceptable end voltage made up of very unbalanced cells. This imbalance will occur over time, over several cycles of constant voltage charging. It is necessary then, to periodically charge at a constant current (to a peak voltage) to allow the cells with lower voltage to equalize with those at higher levels. This is known as equalization charge.

For best results, always consult first the battery manufacturer for specific charging specifications.

The MasterCharger, with its highly regulated constant current and its high accuracy voltage sensing provides the battery technician with the best charging methods for optimum battery servicing.

OTHER CHEMISTRIES

Consult the manual of the manufacturer of the battery for the required Current, Voltage and Time settings.

SPECIFICATIONS

1. CURRENT
   Charge: constant current, adjustable, 0 to 50A (in increments of 0.1A)
   Discharge: constant current, adjustable, 0 to 60A (in increments of 0.1A)

2. VOLTAGE:
   Charge: 0 to 80.0V
   Discharge: 3 to 30V (22 cells) at full current, and at reduced currents (30A) for up to 60V.

3. MODES:
   Constant Current Charge
   Constant Voltage Charge
   Peak Voltage Charge
   Capacity Test
   Full Discharge

4. CELLS/VOLTAGE CONTROL:
   # of cells (Nickel-Cadmium) for Constant Current Charge and for Capacity Test.
   Nominal Battery Voltage for Constant Voltage and Peak Voltage Charge (using the Cell Selector).

5. METERS:
   Voltage: 3-1/2 digit LED digital panel meter, 0 to 19.99V and 0 to 199.9V scales.
   System accuracy: ±0.25%, ±1 digit
   Current: 3-1/2 digit LED digital panel meter, 0 to 199.9A scale.
   System accuracy: ±1%, ±1 digit

6. VISUAL STATUS INDICATORS:
   Output ON/Cycle End, Voltage Fault, Capacity Failure.

7. AUDIBLE STATUS INDICATORS:
   Beeper, End of Cycle or Fault condition.

8. CONTROLS:
   Function Selector Keypad, Time Selectors, Voltmeter Source and Scale Selector Switch.
   Voltage and Current Selectors.
   Charge Mode Selector Switch.

9. TIMER:
   Crystal Controlled with HH:MM, MM:SS and Test programming speeds. Battery backed-up for power line interruption protection..

10. PROTECTION:
    Reverse polarity, short circuit, open circuit, over/ under current, internal overheat, power failure and battery overtemperature.

11. LINE VOLTAGE:
    208, 220-240VAC, ±10%, 50-60 Hz

12. AMBIENT:
    $+5^{o}$ C to $+35^{o}$ C

13: INTERFACING:
    Connections to the BTAS16 for Status Monitoring and Control.

14: WARRANTY:
    One year parts and labor.

Price and Specifications subject to change without notice

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