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**INSTRUCTION MANUAL**

# AUTO CHARGE®

## 3 STEP

## AUTOMATIC BATTERY CHARGER

MODEL #091-120-XX-XX-(XXX)(XX)

3 YEAR WARRANTY

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*ENERGIZED AND READY, WHEN SECONDS COUNT*

# INTRODUCTION

The Auto Charge-3 STEP CHARGER, Model 091-120-XX-XX-(XXX)(XX) is a compact, completely automatic single channel battery charger designed specifically for periodic charging. Of rugged construction, the charger is made to withstand the shock and vibration encountered in vehicle mounted equipment. Utilizing components, which meet international safety standards, makes this charger ideal for worldwide applications.

# BATTERY CHARGER FEATURES

Completely automatic operation, charges battery on demand
Output Voltage regulated, eliminates overcharging battery
Output Voltage, temperature compensated (optional)
Output, current limited to protect charger from overloading
A 5-LED display indicating charge state and faults
Reverse polarity protection

# INSTALLATION

The 3 STEP CHARGER should be installed in an area with adequate ventilation.
Mount the charger using the four holes provided.
Connect wiring from the battery to the output terminal strip.
Double check battery wiring. Verify that the battery voltage appears at the charger output terminals (See Figure 2).

# PRINCIPLES OF OPERATION

A three-step lead acid battery charger operates in the three stages described below:

1) A discharged battery is recharged at a constant current (**bulk charge**) until its voltage reaches an overcharge level of 2.42 volts per cell (approximately 14.5 vdc for a 12V battery). At this time the charger will switch to Finish Charge. The battery accepts 75-85% of its capacity during bulk charge.

2) This overcharge voltage is now maintained constant at 2.42 volts per cell (**absorption or finish charge**) until the charge current tapers down to {battery capacity/35} amperes. For the 12 volt, 80 ampere charger this current is 11.9 amperes. The battery accepts 15-25% of it capacity during absorption charge.

3) Once the charge current reaches the tapered down value (see above), the voltage is set to a float voltage of 2.24 volts per cell (approximately 13.4 vdc for a 12V battery), and maintained at float charge. The battery is maintained at full charge during float charge, and the green indicator labeled “Battery Charged” is illuminated.

Figure 1 depicts the above described operation. Note that the term “absorption charge” is used interchangeably with “finish charge”. Upon application of AC power, the charger is placed into bulk charge. When the charger switches to finish charge, a timer starts. In the event that the charge current did not taper down to approximately C/35 amperes after 2 ½ hours, the charger will automatically go to float charge, and a timeout will be indicated. This timeout indicator can indicate an old or leaky battery, or it can indicate that the charger is undersized for the battery being charged.

A battery fault indicator is provided to indicate the absence of a battery, a battery connected with reverse polarity, or a battery with an open circuit terminal voltage of less than 1.35 volts per cell.

# TEMPERATURE COMPENSATION

Temperature compensation is provided as an optional feature. A temperature probe is provided which can be placed in the air surrounding the battery or bonded to the battery case.

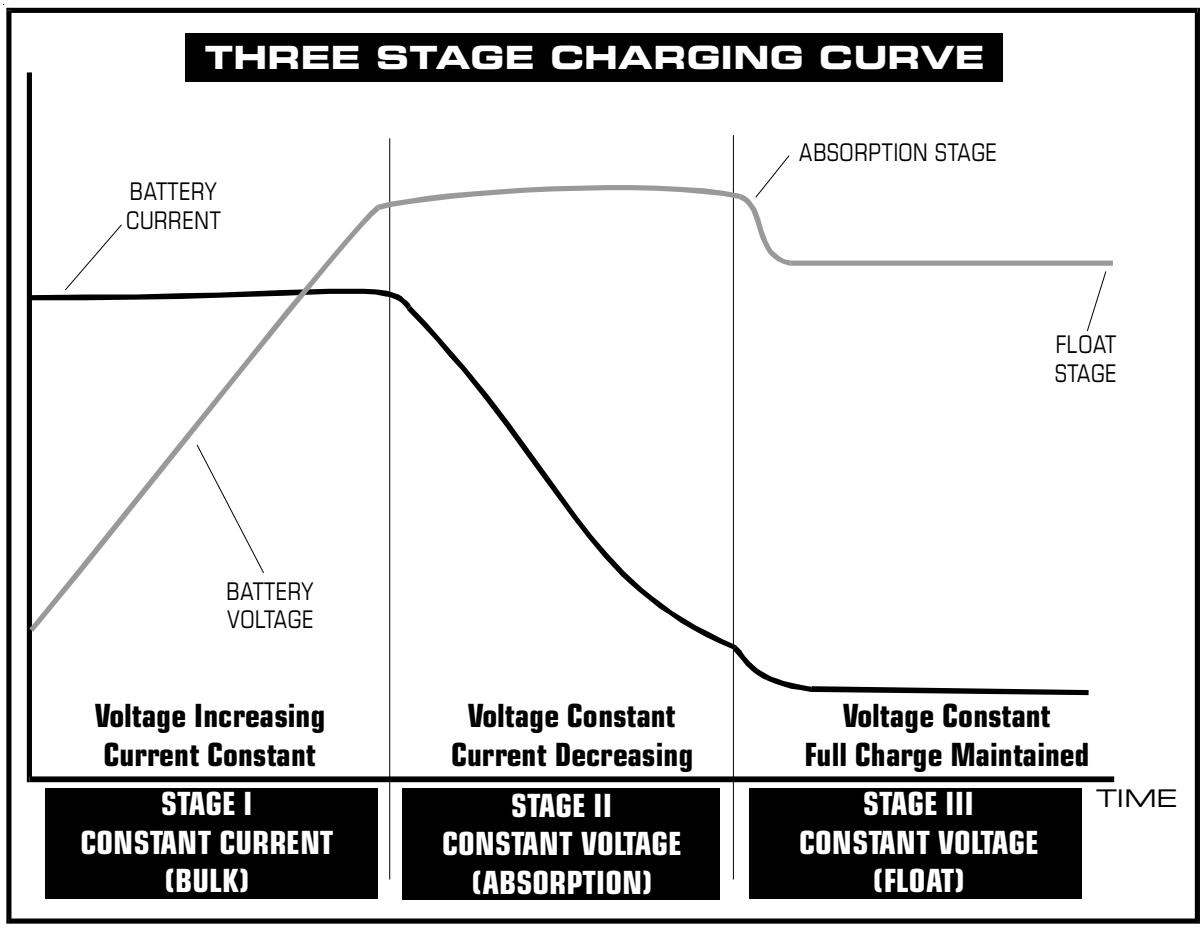

THREE STAGE CHARGING CURVE
ABSORPTION STAGE
BATTERY CURRENT
FLOAT STAGE
BATTERY VOLTAGE
Voltage Increasing Current Constant
Voltage Constant Current Decreasing
Voltage Constant Full Charge Maintained
TIME
STAGE I CONSTANT CURRENT (BULK)
STAGE II CONSTANT VOLTAGE (ABSORPTION)
STAGE III CONSTANT VOLTAGE (FLOAT)

Figure 1

CHARGING WIRE SIZE

| VOLTS | AWG |
|---|---|
| 12 | 10 |
| 24 | 12 |
| 32 | 12 |
| 36 | 14 |
| 48 | 16 |
| 72 | 16 |
| 96 | 16 |
| 120 | 16 |

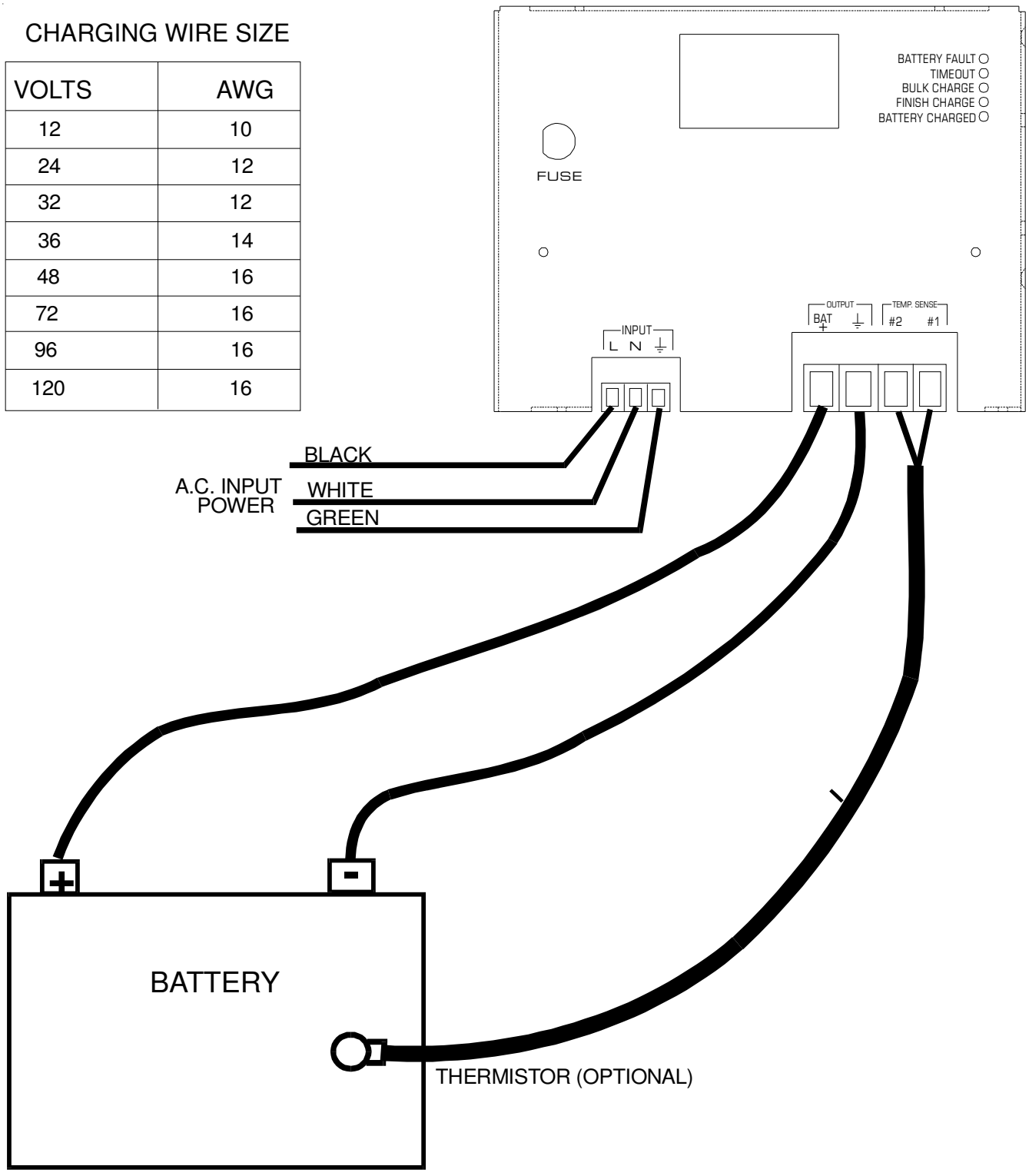


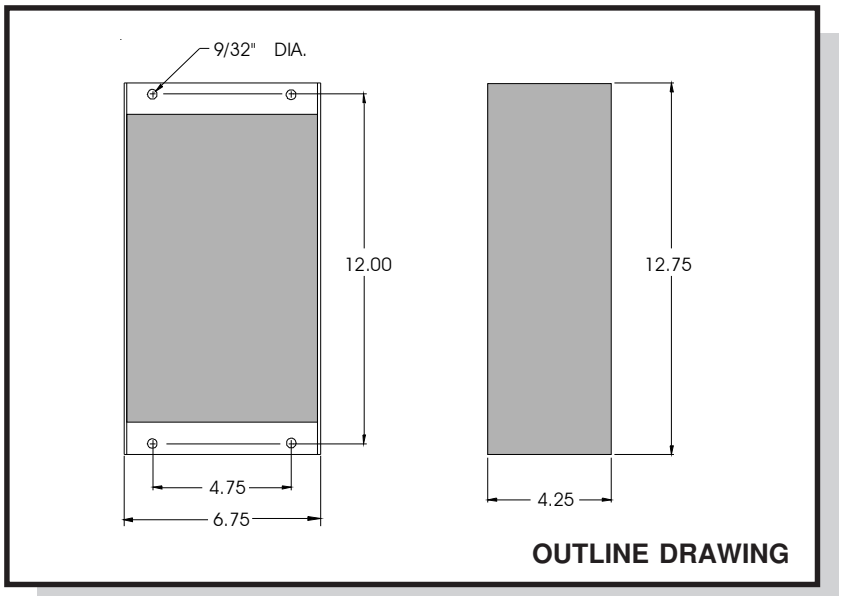

Figure 2

INSTALLATION WIRING

# Specifications

**Input Power & Fuse:** See Chart
**Output Power:** See Chart
**Charge Indicator:** See Chart
**Mode Indicators:** Battery Fault, Timeout, Bulk Charge, Finish Charge, and Battery Charged
**Recommended Battery Size:** See Chart
**Weight:** 22 pounds
**Temperature Compensation:** Add suffix “TC” to Model Number shown in Table below

| Model Number | Input Power | Input Fuse | Output | Charge Indicator | Recommended Battery Size |
|---|---|---|---|---|---|
| 091-120-12-20 | 115 Volts 60 Hz, 6 Amps | 8 amp Slow Blow | 12 Volts, 20 Amps | 25 Ampere | 75 to 150 ampere-hours |
| 091-120-24-12 | 115 Volts 60 Hz, 6 Amps | 8 amp Slow Blow | 24 Volts, 12 Amps | 15 Ampere | 40 to 80 ampere-hours |
| 091-120-32-9 | 115 Volts 60 Hz, 6 Amps | 8 amp Slow Blow | 32 Volts, 9 Amps | 15 Ampere | 30 to 60 ampere-hours |
| 091-120-36-8 | 115 Volts 60 Hz, 6 Amps | 8 amp Slow Blow | 36 Volts, 8 Amps | 15 Ampere | 27 to 54 ampere-hours |
| 091-128-48-6 | 115 Volts 60 Hz, 6 Amps | 8 amp Slow Blow | 48 Volts, 6 Amps | 8 Ampere | 20 to 40 ampere-hours |
| 091-128-72-4 | 115 Volts 60 Hz, 6 Amps | 8 amp Slow Blow | 72 Volts, 4 Amps | 8 Ampere | 13 to 26 ampere-hours |
| 091-128-96-3 | 115 Volts 60 Hz, 6 Amps | 8 amp Slow Blow | 96 Volts, 3 Amps | 4 Ampere | 10 to 20 ampere-hours |
| 091-128-120-2 | 115 Volts 60 Hz, 6 Amps | 8 amp Slow Blow | 120 Volts, 2 Amps | 4 Ampere | 7.5 to 15 ampere-hours |
| 091-120-12-20-230 | 230 Volts 60 Hz, 3 Amps | 5 amp Slow Blow | 12 Volts, 20 Amps | 25 Ampere | 75 to 150 ampere-hours |
| 091-120-24-12-230 | 230 Volts 60 Hz, 3 Amps | 5 amp Slow Blow | 24 Volts, 12 Amps | 15 Ampere | 40 to 80 ampere-hours |
| 091-120-32-9-230 | 230 Volts 60 Hz, 3 Amps | 5 amp Slow Blow | 32 Volts, 9 Amps | 15 Ampere | 30 to 60 ampere-hours |
| 091-120-36-8-230 | 230 Volts 60 Hz, 3 Amps | 5 amp Slow Blow | 36 Volts, 8 Amps | 15 Ampere | 27 to 54 ampere-hours |
| 091-128-48-6-230 | 230 Volts 60 Hz, 3 Amps | 5 amp Slow Blow | 48 Volts, 6 Amps | 8 Ampere | 20 to 40 ampere-hours |
| 091-128-72-4-230 | 230 Volts 60 Hz, 3 Amps | 5 amp Slow Blow | 72 Volts, 4 Amps | 8 Ampere | 13 to 26 ampere-hours |
| 091-128-96-3-230 | 230 Volts 60 Hz, 3 Amps | 5 amp Slow Blow | 96 Volts, 3 Amps | 4 Ampere | 10 to 20 ampere-hours |
| 091-128-120-2-230 | 230 Volts 60 Hz, 3 Amps | 5 amp Slow Blow | 120 Volts, 2 Amps | 4 Ampere | 7.5 to 15 ampere-hours |




**OUTLINE DRAWING**

# INSTALLATION RECORD & WARRANTY

**Date Installed** _____

**Installed By** _____

**Vehicle Identification** _____

**Vehicle Owner** _____

## WARRANTY

All products of Kussmaul Electronics Company Inc. are warranted to be free of defects of material or workmanship. Liability is limited to repairing or replacing at our factory, without charge, any material or defects which become apparent in normal use within 3 years from the date the equipment was shipped.

Kussmaul Electronics Company, Inc. shall have no liability for damages of any kind to associated equipment arising from the installation and /or use of the Kussmaul Electronics Company, Inc. products. The purchaser, by the acceptance of the equipment, assumes all liability for any damages which may result from its installation, use or misuse, by the purchaser, his or its employes or others.