BALMAR®

MAX CHARGE MC-512
Owner's Manual

I. INTRODUCTION

The microprocessor-controlled MAX CHARGE MC-512 marine regulator is the most advanced charge controller available. Designed to monitor battery voltage and automatically optimize charging, the MC-512 uses up to 12 charging increments to ensure your batteries are constantly receiving the right amount of current to bring them to full charge quickly and safely.

The MAX CHARGE lets you choose from a variety of charging scenarios to maximize convenience and control. The Basic charging program allows you to connect the MC-512 to your alternator right out of the box. In addition to its Basic program setting, the MAX CHARGE provides six easy-to-use permanent programs that enable the user to customize charging characteristics to six popular battery types, including standard and deep-cycle flooded batteries, AGM, gel, and Spiral technologies. Programs are initiated with the simple flip of a dip switch.

Should your charging system require even greater precision, the MAX CHARGE MC-512 provides a wide range of user-defined programming options for customized charging times and voltages.

When used with its optional battery and alternator temperature sensors, the MC-512 monitors and automatically compensates for changes in temperature outside of established limits. At high limits, the regulator will lower voltages. At low limits, the regulator will automatically raise voltage above un-compensated rates to improve charging.

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CAUTION

The following instructions are intended for use by experienced marine electrical installers. If you are not experienced at installing electrical system components, we recommend a qualified marine electrician be used to install this regulator.

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II. SAFETY CONSIDERATIONS

Before installing your MC-512 marine regulator, please take a moment to consider the following guidelines for safe regulator installation. Failure to follow these guidelines could result in personal injury or damage to your electrical system.

1. Always disconnect your battery banks or ensure they are set to their "OFF" position prior to installing your regulator.
2. Remove any loose-fitting clothing or jewelry, which could become entangled in your motor or other machinery.
3. Wear ANSI-approved safety glasses.
4. DO NOT attempt to modify the regulator. The unit is sealed to protect its components from damage. Alterations to the regulator could result in damage to your charging system, and will void your warranty.
5. Do not attempt installation if tired or fatigued.
6. Ensure the engine has cooled sufficiently before initiating installation.
7. Drugs and alcohol do not mix with safe installation procedures. Do not attempt installation while using alcohol or any medication that could impair your judgment or reaction time.
8. Always use the right tool for the job. In addition to causing damage to the regulator or your boat, the use of incorrect or improperly-sized tools can result in personal injury.
9. Take time to read the manual. Equipment damage and possible injuries may result from an incomplete understanding of the installation and operation of the MC-512 regulator. If you are unfamiliar with marine electrical systems, consult with a

III. BASIC INSTALLATION

The MC-512 is encased in an anodized aluminum heat sink that is pre-drilled for four #8 or #10 fasteners for convenient attachment to bulkheads or other flat surfaces. The MC-512 can be purchased with or without a standard 54" harness. When installing without the harness, or if the wiring needs to be extended beyond the length of the harness, marine grade 12AWG (American Wire Gauge) wire should be used. To install the regulator:

1. Mount the regulator in a dry, well-ventilated location, well away from hoses and exhaust manifolds that may cause damage to the regulator or its wiring.
2. Attach the Ford-type harness plug to the regulator (see **Figure 1**). Connect the second BLACK (ground) to the additional ground terminal on the regulator.
2. The BLACK wires are both common system negative wires (grounds). Attach the BLACK wires to the preferred ground at the back of the alternator. If the alternator has an isolated ground, both wires must be connected at the isolated ground terminal.
3. The RED battery sense wire provides power to the alternator and inputs data that allows the regulator to properly control voltage output to the batteries. Attach RED wire as close to the battery as possible. Four common locations for attachment are 1) at the house battery if only one battery is being used; 2) at the "common" terminal of the battery selector switch for multi-bank charging; 3) at the output terminal of the alternator; or 4) the battery side of the isolator for the largest battery bank. This wire must see the battery being charged. On a 12V system, this wire can carry 8 amps and should be protected by a 10-amp fuse. A fuse is included on the Balmar wiring harness.
4. The BROWN wire activates the regulator when +12VDC is applied to the system. Attach the BROWN wire (ignition) to a switched +12VDC source. The auxiliary side of the ignition switch, or an independent (ungrounded) oil pressure switch are both acceptable connection points. A toggle switch may be added to this circuit to shut down the alternator load in cases where maximum propulsion is needed for smaller motors.
5. Plug duplex plug with BLUE wire (field) into rear of alternator (see **Figure 2**).
6. The WHITE wire (stator) will supply signal for electric tachometer, if used.

Figure 1

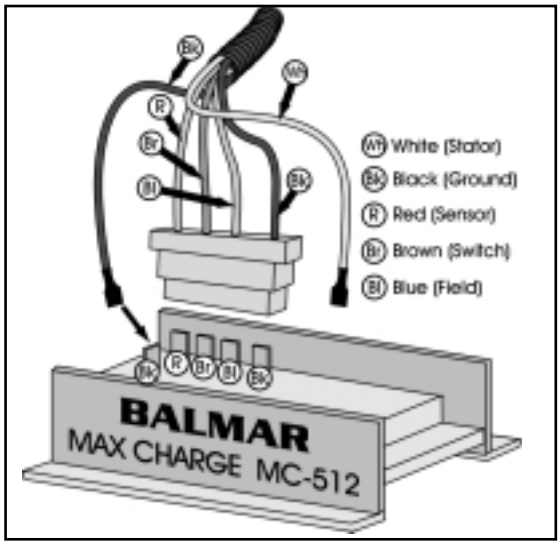
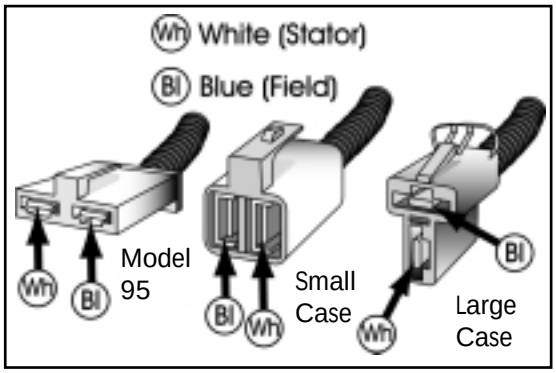


Figure 2



NOTE: You can operate two alternators with one MC-512 regulator: This is accomplished by tapping off the blue field wire with a second wire. We don't do that at the factory, as it is not possible to know whether the blue wire would be best placed at the regulator or at the engine for any specific application. If both alternators are on the same engine, there is no problem. Be aware, though, that, if the two alternators are on two separate engines, a DPDT relay driven by the ignition system will have to be installed on each engine. This is so that if an engine is not being used and the ignition is off, the field wire is broken to the alternator. Otherwise, the unused alternator will draw approximately 6 amps of field current.

IV. ALARM AND SENSOR INSTALLATION

The Model MC-512 is designed to work in conjunction with optional alternator and battery temperature sensors. These sensors enable the regulator to automatically react to temperature values outside of set limits.

Alternator Temperature Sensor (MC-TS-A) - Optional

When connected to the MC-512, the Alternator Temperature Sensor enables the regulator to sense when alternator temperature exceeds programmed limits. When limits are exceeded, the MC-512 responds by shutting down the voltage to the alternator and activating the alarm output. The alternator will then re-start after cooling. To install the Alternator Temperature Sensor:

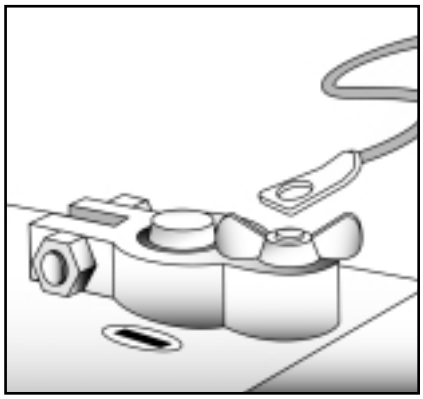
1. Attach the positive and negative wires to the Alternator Temperature Sensor terminals on the MC-512 (See Diagram 1 for terminal locations). This probe may or may not have been included with the wiring harness you may have received. If separate, remove the tie wraps and install the probe wire into the harness sheath.
2. Attach the heavy lug terminal to the mid-case mount on your alternator. Due to the number of alternator configurations, some installations may vary. The following are standard installation details:
   MID CASE MOUNT - Small Case Alternator - Remove (1) of (4) 5/32" Allen bolts, install probe, re-secure bolt.
   MID CASE MOUNT - Large Case Alternator - Remove (1) of (4) 3/16" Allen bolts, install probe, re-secure bolt.
   GROUND TERMINAL MOUNT - Small & Large Case - Install on the external diode plate at rear of alternator.

Caution: The alternator temperature sensor is not meant to be used as a method to maintain alternator temperature. If your alternator continually overheats, consult with a licensed marine electrician.

Battery Temperature Sensor (MC-TS-B) - Optional

When equipped with the optional Battery Temperature Sensor, the MC-512 will automatically raise or lower charging voltages to compensate for variation above and below normal ambient temperatures. If the sensor wiring was delivered separately from your harness, we suggest you remove the tie wraps and install the probe wire into the harness sheath. To ensure proper operation, be sure the battery terminals are completely clean and free of corrosion prior to the installation of the sensor probe. To install the Battery Temperature Sensor:

Figure 3



1. Secure the 3/8" copper probe to a clean, tight negative (-) battery terminal (see **Figure 3**). The 20' leads may be extended, if required. Note: An improperly installed or corroded battery terminal may generate heat and severely impede or stop charging.
2. While observing polarity, connect the battery temperature pins to the positive and negative terminals as shown on the Wiring diagram at the end of the manual.

Alarm Output

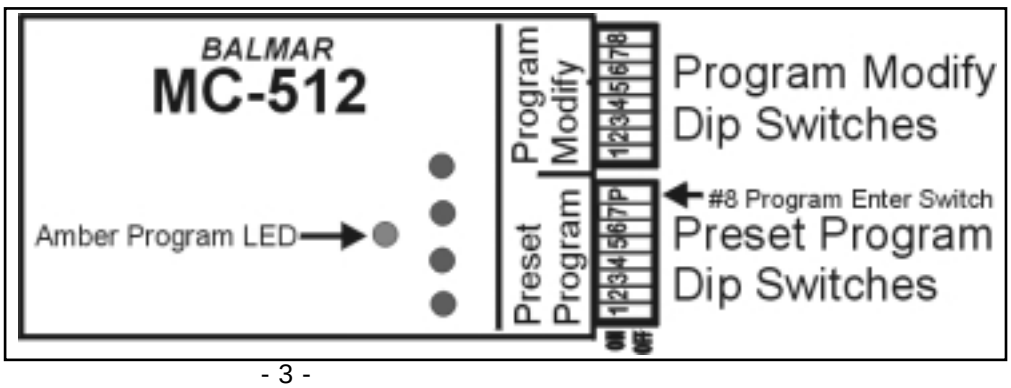
The MAX CHARGE has one pin that supplies a 1/2-amp negative output for a warning LED, light, or audio alarm. Positive source should be connected to the ignition circuit. This output will supply a ground whenever the regulator is turned on (engine running) and the battery voltage drops below or rises above alarm set points or, if optional temperature sensors are being used, temperature set points are violated. The alarm will also sound during the 45-second start up delay.

V. PROGRAMMING FOR BATTERY TYPE

The MC-512 has two sets of 8 dip switches: one "Pre-Set Program" set of switches and one "Program Modify" set of switches (see **Figure 4**). In all programming, except in "equalize" mode, the #8 switch "P" of the "Pre-Set Program" dip switches (the furthest switch to the right on the left bank of switches) is used to enter a new program or value. During the 45-second start-up delay, programs or values set with the dip switches will be entered into memory whenever the "P" switch is turned on. This "P" switch may be turned on before powering up and turned off any time after illumination of the amber "Program LED", which indicates acceptance of the new program or value. The regulator will then reset itself with the new program. Allow approximately 3 minutes for ramp-up.

For optimum charging performance, the MC-512 regulator should be programmed to meet the specific charging requirements of your battery type. (See **Figure 5** on following page.) To program the regulator for your specific battery:

Figure 4



1. Select the program that best reflects your battery type from **Figure 5** or from label on the underside of your regulator.
2. With the engine (power to brown wire) off, select the appropriate dip switch (1 through 6) from the "PRE-SET

PROGRAM SWITCHES" (as shown in **Figure 4**). Using a blunt instrument, such as a ballpoint pen or small screwdriver blade, flip the dip switch to the "ON" position. Use care not to puncture the protective membrane when setting the dip switches. There should be a click when the switch is engaged. The switch is to be left on until the programming is finished.

3. Move the "#8 Program Enter" (P), switch to its "on" position. Turn the key switch on or start the engine (if using an oil pressure switch, the engine must be started).

4. Within approximately 45 seconds from the time that the ignition is activated, the Amber Program LED will light, indicating that the new program has been accepted. Once the Amber Program LED indicates program acceptance, press the "# 8 Program Enter" (P) switch to its "off" position. The program is now entered and the Amber Program LED will go out.

The DIP switch for the program you have chosen (1 through 6) may now be turned off, or left on as a reminder of what battery program you are using.

Figure 5

PRG-B	Primary Prog. Settings	PRG-1	PRG-2	PRG-3	PRG-4	PRG-5	PRG-6
Base/Default Program *All Switches OFF*	**Mode** *Note: All values user adjustable. See Advanced Programming*	**Flooded Lead Acid (Deep Cycle)**	**Gel (Prevailer)**	**AGM (Lifeline)**	**Spiral (Optima**	**Flooded Lead Acid (Standard)**	**Halogen Lamp / Volt Sensitive**
45	**Start Delay (Seconds)**	45	45	45	45	45	45
60	**Ramp Up (Seconds)**	60	60	60	60	60	60
14.20	**Bulk (Max Voltage)**	14.60	14.10	14.38	14.60	14.40	14.00
0.5 Hr	**Voltage Analysis Time**	0.5 Hr	0.5 Hr	0.5 Hr	0.5 Hr	0.5 Hr	0.5 Hr
13.90	**Absorption Voltage**	14.40	13.90	14.18	14.40	14.20	13.80
0.2-2 Hr	**Absorption Time (Auto)**	0.2-3 Hr	0.2-2 Hr	0.2-2 Hr	0.2-2 Hr	0.2-3 Hr	0.2-4 Hr
0.2-25 Hr	**Absorption Time (Man)**	0.2-25 Hr	0.2-25 Hr	0.2-25 Hr	0.2-25 Hr	0.2-25 Hr	0.2-25 Hr
13.50	**Float Voltage**	13.35	13.70	13.38	13.40	13.40	13.50
** Program 7 is reserved for factory diagnostics*							
PRG-B	**Primary Prog. Settings**	**PRG-1**	**PRG-2**	**PRG-3**	**PRG-4**	**PRG-5**	**PRG-6**
Base/Default Program *All Switches OFF*	**Mode** *Note: All values user adjustable. See Advanced Programming*	**Flooded Lead Acid (Deep Cycle)**	**Gel (Prevailer)**	**AGM (Lifeline)**	**Spiral (Optima**	**Flooded Lead Acid (Standard)**	**Halogen Lamp / Volt Sensitive**
15.20	**High Voltage (Alarm)**	15.60	15.10	15.38	15.60	15.40	15.00
N/A	**Time EQ / Condition**	60 Min	N/A	60 Min	60 Min	60 Min	N/A
14.10	**Voltage EQ / Condition**	15.60	14.10	15.30	15.60	15.50	14.00
125°F/ 52°C	**Max Battery Temp**	125°F/ 52°C	125°F/ 52°C	125°F/ 52°C	125°F/ 52°C	125°F/ 52°C	125°F/ 52°C
225°F/107°C	**Max Alternator Temp**	225°F/107°C	225°F/107°C	225°F/107°C	225°F/107°C	225°F/107°C	225°F/107°C
Average	**Volt Analysis/ Switches**	Average	Volt Sensitive	Average	Average	Average	Volt Sensitive
On	**Auto Absorb Set Prgm**	On	On	On	On	On	On
100%	**Limit % Output**	100%	100%	100%	100%	100%	100%
On	**System Failure (Alarm)**	On	On	On	On	On	On
12.80	**Low Voltage (Alarm)**	12.80	12.80	12.80	12.80	12.80	12.80
Bulk + 1	**Max Voltage (Alarm)**	Bulk + 1	Bulk + 1	Bulk + 1	Bulk + 1	Bulk + 1	Bulk + 1
225°F/107°C	**Max Alt Temp (Alarm)**	225°F/107°C	225°F/107°C	225°F/107°C	225°F/107°C	225°F/107°C	225°F/107°C

VI. REGULATOR OPERATION

When used in its universal (default) mode, or in one of its six factory-set program modes, the micro-processor controlled MAX CHARGE regulator uses three time and voltage cycles to maximize the charging potential; Bulk, Absorption and Float modes.

When the key switch is turned on, or after engine is started and power is applied with an oil pressure switch, the regulator goes through a 45-second start up delay. This short delay gives the engine a chance to develop oil pressure and warm up a bit before the load of the alternator is applied.

Durning the initial start-up period, the amber "Delay & Program LED" is illuminated. It then takes one minute to ramp up to the maximum amperage the batteries will accept (Bulk Mode). The ramp up and bulk mode cycle is identified by the illumination of the "Bulk & Absorption LED". In "Auto Mode", the MAX CHARGE will initiate a 30 minute "state of battery" analysis period (Bulk mode). During that period, the regulator constantly analyzes the battery's ability to accept a charge, and automatically compensates with slightly higher or lower voltages to ensure optimum charging. If bulk voltage is reached in that period, the regulator will transition to Absorption voltage for 12 minutes. After the Absorption period is complete, the regulator will shift to Float voltage for the remainder of the time the engine is used.

If Bulk voltage is not reached in 30 minutes, the MAX CHARGE will add six more minutes to the Absorption time for each minute

it takes beyond 30 minutes for the voltage to reach Bulk Voltage (14.2 Volts in Base Program). For example: if 40 minutes (30 minutes + 10 minutes) were required to reach the target voltage, the Absorption time would equal 72 minutes (10 additional target minutes x 6 = 60 minutes, added to the base Absorption time of 12 minutes).

Once the Absorption period is complete, the MAX CHARGE will decrease the voltage to Float mode (13.5 Volts in Base Program) and the green "Float LED" will come on. This allows continuous engine operation without over-charging the batteries.

By using the Advanced Programming features, you may lengthen or shorten the 30-minute time period that the MAX CHARGE uses to analyze the state of battery charge (Bulk Mode.) Alternatively, you may turn off the "Auto Analyze Mode" and set the Bulk or Absorption time to any fixed time period.

Reading Your LED Display

The built-in LED panel on your MC-512 provides a powerful tool for monitoring the progress of your charging system.

When power is applied to the regulator, all LED's go through a 2-second test.

Yellow LED indicates 45-second delay and program mode.

Green LED indicates bulk and absorption mode.

Second green LED indicates float mode.

Red LED indicates equalization mode.

Single yellow LED indicates program entered.

All LED's are ON/OFF indicators.

VII. ADVANCED PROGRAMMING

The seven pre-set programs included in the MC-512V memory (see **Figure 5**) can be altered to customize the charging regimen to your electrical system. To alter one of the pre-set values, you must first enter an address on the "Pre-Set Program" switches. Then, using the "Program Modify" switches, select a value of voltage or time to match your specific charging needs. Switching on the "P" switch during start-up will enter the new value. The amber "Program LED" will confirm acceptance of the new value. Once this LED has confirmed acceptance, turn off the "P" switch, allowing the regulator to continue operation.

To determine the program code for your desired time or voltage adjustment, refer to **Figure 6** and the advanced programming charts at the end of the manual.

Figure 6

Programmable Values	**Pre-Set Program Switches *Address*** *For addresses and codes, 1=ON, 0=OFF*	**Program Modify Switches** *Following figures are Base (default) program. Call or see our website for value codes.*	
Adjustable Functions	1234567 8	12345678	Value
1) Bulk Voltage	0111001 P	00001101	14.16
2) Time in Bulk (Analysis)	1111001 P	10100000	30 Minutes
3) Absorption Voltage	0000101 P	10110101	13.92
4) Absorption - Auto to Manual	1101101 P	01110100	Manual
5) Absorption - Manual to Auto	1101101 P	11110100	Auto
6) Time in Absorption (Manual)	1000101 P	N/A	12 Min. - 24 Hr.
7) Float Voltage	0100101 P	00010101	13.52
8) High Voltage Alarm	1100101 P	10111101	15.20
9) Low Voltage alarm	0101101 P	11111001	12.80
10) Time in Equalization	0010101 P	N / A	
11) Equalization Voltage	1010101 P	N / A	
12) Amp Manager	1001101 P	See Figure 5	
13) Averaging Detect Mode / Inverters	1101101 P	11110100	
14) Fast Detect Mode / Sensitive Equipment	1101101 P	11111100	

VIII. VOLTAGE DETECTION

There are two modes of measuring the battery voltage, "Averaging Detect Mode" and "Fast Detect Mode". Each allows the regulator to regulate to the same voltage if the battery is loaded with a pure DC load. If you are using an inverter, you will most likely find that the 'Averaging Detect Mode' will yield the best results. This is the factory default for most programs. If you have loads that are peak voltage sensitive, we suggest you select "fast detect". In this mode a new voltage measurement is made every four milliseconds and charge comparisons are made. In the averaging mode, a sliding average is calculated every four milliseconds and charge comparisons are made. If you use sodium lighting, you may prefer the fast mode. (See **Figure 6**, #13 & #14.)

IX. PROGRAMMING THE AMP MANAGER

The Amp Manager has two modes: "Standard Operation" and "Special Operation". Both modes are capable of eliminating the top 25, 50, or 75% of the maximum output of the alternator. The Amp Manager is factory set at 0% reduction, or 100% operation, for Standard Operation, and 50% reduction in Special Operation mode. To adjust these values, enter the Amp Manager address (1001101 P) with the "Preset Program" switches (see **Figure 6**, #12). The desired value is then selected using the Program Modify Switches.

"Standard Operation"- This controls normal operation of the regulator, it may be used to decrease the maximum output of an alternator. Values are adjusted using the "Program Modify" switches 1 through 4.

The "Special Operation" mode becomes operational when the alternator temperature sensor is activated, or when a switched circuit is closed between the alternator's temperature sense pins on the regulator. When combined with a toggle switch, the Amp Manager can be effectively used to cut back the alternator's maximum output when a large load is applied to save belt wear or allow for more engine power.

Figure 7

Standard Operation	Special Operation		Sample Setting Reductions*		
1234 - - - -	**Reduction***	**- - - - 5678**	**1234 5678**	**Standard**	**Special**
0001 - - - -	0%	- - - - 0001	0001 0100**	0%	50%
0010 - - - -	25%	- - - - 0010	0001 0010	0%	25%
0100 - - - -	50%	- - - - 0100	0010 0100	25%	50%
1000 - - - -	75%	- - - - 1000	0100 1000	50%	75%

**Reduction of 0% equals 100% operation, 25% reduction equals 75% operation, etc. **Values pre-set at factory.*

X. BATTERY EQUALIZATION

The primary purpose of equalization is to prevent premature aging by dissolving the build-up of lead sulfate that develops on the plates of flooded lead acid batteries. Periodic equalization should only be used on flooded batteries. We recommend that you use caution when using or altering the Equalization programs. Before attempting equalization, ensure that all voltage sensitive electronics are disconnected. See your batteries' manufacturer specifications for any specific warnings or instructions. Check battery voltage, temperature and water. Fully charge batteries before entering equalization. A special password for Equalize mode must be entered before powering up (see **Figure 8**).

Before starting the engine, set the password on the dip switches. After starting the engine the red 'Equalize LED' will come on. The regulator will ramp up in approximately 30 minutes to equalize voltage and will stay there for the appropriate time period. Set all dip switches back to off to prevent the regulator from seeing the password at the next powering up and re-entering equalize mode. When the unit is done with EQ, it will continue in the float mode.

Figure 8

PASSWORD for Battery Equalization	
'Pre Set Program' Dip Switches	'Program Modify' Dip Switches
10100010	10001010

XI. TROUBLESHOOTING

Your MAX CHARGE regulator works as part of a fairly complicated system of components and wiring that's required to stand up to heat, mechanical vibration, and the corrosive marine environment.

The MC-512's internal electronics are potted in a durable epoxy resin that serves to protect the regulator's sensitive circuits. As such, the likelihood of failure within the circuitry is quite unlikely. More typically, failures within charging systems are more likely to be traced to mechanical causes such as damaged or undersized wiring, loose or damaged connections, weak or worn-out batteries, or damaged alternator drive belts.

Determining the causes of failures in an electrical system is usually a "trial and error" process. We recommend that you begin your search by determining if the failure can be attributed to one of the two main components of your electrical system: the alternator, and/or the regulator. In order to test these systems, you will need a good, test-quality voltmeter (preferably a digital type) and a battery hydrometer with a thermometer.

An amp meter is also a helpful diagnostic tool. In an emergency, a light bulb can be used to help determine if power or working grounds exist.

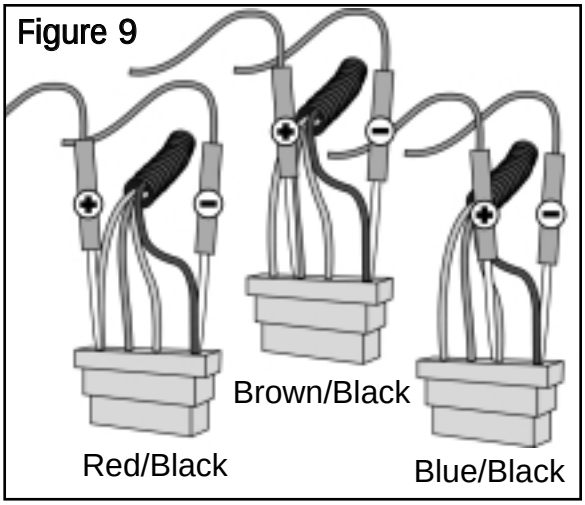
A general inspection of the following conditions prior to testing will ensure the accuracy of your test results. Before testing:

1. Remove and clean all charging system electrical connections (this includes the ground side). Also check the harness for resistance. The wires or terminals may become corroded and need to be cleaned or replaced.
2. Charge all batteries to their proper fully charged state and determine if they are serviceable. If your batteries are flooded-type, use your hydrometer to determine their condition.
3. Check and tighten alternator belt. If the belt show signs of wear or damage, now if an ideal time for replacement. Always replace existing belts with the finest quality replacements available.

Voltage Regulator Test

When you have inspected and repaired any wires and connections, inspected belts and replaced as needed, and after you have determined that your batteries are properly charged, set your voltmeter to 12V and connect the voltmeter's negative lead to the BLACK ground wire at the regulator. Normally, connection is accomplished by inserting the lead alongside the ground wire in the regulator harness plug (see **Figure 9**). When the voltmeter is securely connected to the regulator's ground, test for voltage following the steps listed below.

Figure 9



1. With the ignition in the OFF position and your voltmeter's ground wire connected to the regulator's ground, check for voltage on the RED (sensing), BLUE (field) and BROWN (ignition) wires in the regulator plug by inserting the positive lead of the voltmeter alongside each wire in the regulator harness plug. The voltmeter should read:

	Red Wire	Brown Wire	Blue Wire
Expected Reading	2 V *	0 V	0 V
Your Reading			

2. With the ignition in the ON position (engine not running) and your voltmeter's ground wire connected to the regulator's ground, check for voltage on the RED (sensing), BLUE (field) and BROWN (ignition) wires in the regulator plug. The voltmeter should read:

	Red Wire	Brown Wire	Blue Wire
Expected Reading	12 V*	12 V	7 - 12 V
Your Reading			

3. With the ignition in the ON position (with engine running at 1,400 rpm fast idle) and your voltmeter's ground wire connected to the regulator's BLACK wire, check for voltage on the RED (sensing), BLUE (field) and BROWN (ignition) wires in the regulator plug. The voltmeter should read:

	Red Wire	Brown Wire	Blue Wire
Expected Reading	12 - 14V**	12 V	4 - 12 V
Your Reading			

** 11.5 - 12.8 VDC battery voltage at rest (no charging occurring). If your batteries are isolated and your RED (sensing) wire shows voltages other than those shown above, make sure that the wire is connected on the "battery" side of the isolator. The RED wire must "see" the battery directly.*

*** 13.5 - 14.5 VDC battery voltage when charging.*

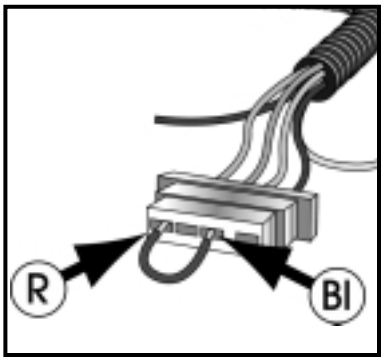
If your readings differ substantially from the "Expected Readings" listed in the charts above, the regulator may be malfunctioning, or there may be a continuity problem. Contact our technical support staff at (360) 435-6100. Keep your recorded readings in the spaces provided below the "Expected Readings" so you can share them with the technical support person. If your readings match those listed in the charts, your regulator should be working correctly. Continue with tests below to determine if your alternator may be the source of charging difficulties.

Alternator Field Tests

Test A - The alternator can be tested for function by determining if a magnetic field exists at the alternator's pulley shaft. To test:

1. With the ignition in the OFF position, place the head of a steel screwdriver near the nut on the pulley shaft or near the rear bearing of the alternator. There should be no evidence of a magnetic field pulling the screwdriver toward the alternator.
2. Engage the ignition (without turning on the engine).
3. After allowing time for the regulator's start-up delay, place the head of a steel screwdriver near the nut on the pulley shaft or near the rear bearing of the alternator. There should be evidence of a magnetic field pulling the screwdriver toward the alternator. If magnetic field is present, alternator is working properly. If not. proceed to **Test B.**

Figure 10



Test B - The presence of a magnetic field is an indicator that the rotor and brushes are functioning correctly. If there is little or no magnetic pull at the pulley shaft or at the rear bearing, initiate the following test:

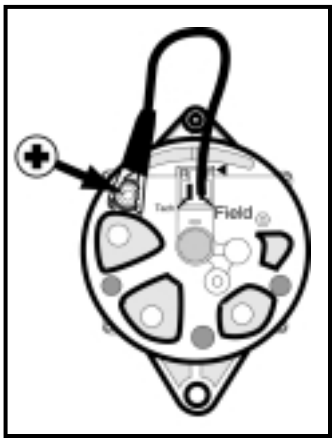
1. With the key off and the engine off, remove the large harness plug from the regulator.
2. Insert the end of a short length of electrical wire to the RED connector slot of the

regulator harness and the other end of the wire to the BLUE connector slot. (See **Figure 10**.) This bypasses the regulator and tests the alternator and the harness.

3. Using your steel screwdriver, inspect for a magnetic field as described above.

If a magnetic field is present. Both harness and alternator are working correctly. If no magnetic field is present, proceed with **Test 3**.

Figure 11



Test 3 - Testing the actual output of the alternator is known as "Full Field Testing". This can be accomplished by jumping a positive12VDC current to the field terminal at the rear of the alternator. This test eliminates both the regulator and the harness, making it easier to isolate your investigation to the alternator. CAUTION: Ensure that all voltage sensitive equipment is turned off prior to starting the engine. Voltage is unregulated during this test and could damage sensitive electronics. To test the alternator:

1. Clip a jumper wire to the positive post of the alternator, or on the battery side of the isolator, if an isolator is in use (see **Figure 11**). Use a SHIELDED alligator clip for post attachment.
2. Disconnect the field/stator plug from the rear of the alternator and attach the other end of the jumper wire to the alternator's Field terminal (F). Attach a female spade connector to the field end of the wire for a solid connection. CAUTION: Do not allow the wire to contact the case while it is attached to the positive post. The case is grounded and severe damage could occur.
3. The regulator is now bypassed. When the ignition is engaged and the motor is started, the voltage should rise and charging current should be present.
4. The motor should be run long enough to determine that charging voltage is present. Unregulated voltage can rise quickly. Do not allow extended unregulated charging to occur without carefully monitoring voltage levels.

If the alternator fails to generate voltage during field testing, a malfunction of the alternator is likely. Contact your local alternator repair shop or Balmar's technical service staff for recommendations. If the preceding tests do not prove the existence of a failure within the regulator or alternator, we recommend you contact a licensed marine electrician who can test your system for wiring and circuit damage or other system failures that could be responsible for charging difficulties. If you determine that repair service is necessary for either your alternator or regulator, please gather the following information before contacting our service technicians.

1. Model of alternator.
2. Model of voltage regulator.
3. Voltage readings on red, brown and blue wire at regulator with engine off, key on.
4. Voltage readings on red, brown and blue wire at regulator with engine running at a fast ideal 1400 rpm.

XII. LIMITED PRODUCT WARRANTY

BALMAR warrants to the original consumer/purchaser the product is free from any defects in material or workmanship for a period of one year from the date of purchase. If any such defect is discovered within the warranty period, BALMAR will replace the regulator free of charge, subject to verification of the defect or malfunction upon delivery or shipping prepaid to BALMAR.

This warranty DOES NOT apply to defects or physical damage resulting from abuse, neglect, accident, improper repair, alteration, modification, or unreasonable use of the products resulting in breakdown, cracked or broken cases nor are parts damaged by fire, water, freezing, collision, theft, explosion, rust, corrosion or items damaged in shipment in route to BALMAR for repair. BALMAR assumes no responsibility for consequential damage or loss or expense arising from these products or any labor required for service or repair.

BALMAR WILL NOT repair or be held responsible for any product sent without proper identification and return address or RA number clearly marked on the package. You must include proof of date and place of purchase (photocopy of purchase invoice) or we cannot be responsible for repairs or replacement. In order to expedite warranty claims more efficiently, BALMAR asks that prior to returning a defective product for repair, you call their customer service department for a warranty return authorization number .

If factory service is required, you can contact our BALMAR Customer Service Department Monday through Thursday, 7:30 AM to 5:30 PM, (PST)1-360 435-6100 ext "3".

Material required for the repair or replacement for the defective part or product is to be supplied free of charge upon delivery of the defective regulator to BALMAR, 19009 61st Ave. NE, Arlington, WA 98223. Customer is responsible for all return transportation charges and any air or rush delivery expense. BALMAR reserves the right to determine whether to repair or replace defective components.

THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS. NO PERSON, AGENT, DEALER IS AUTHORIZED TO GIVE ANY WARRANTY

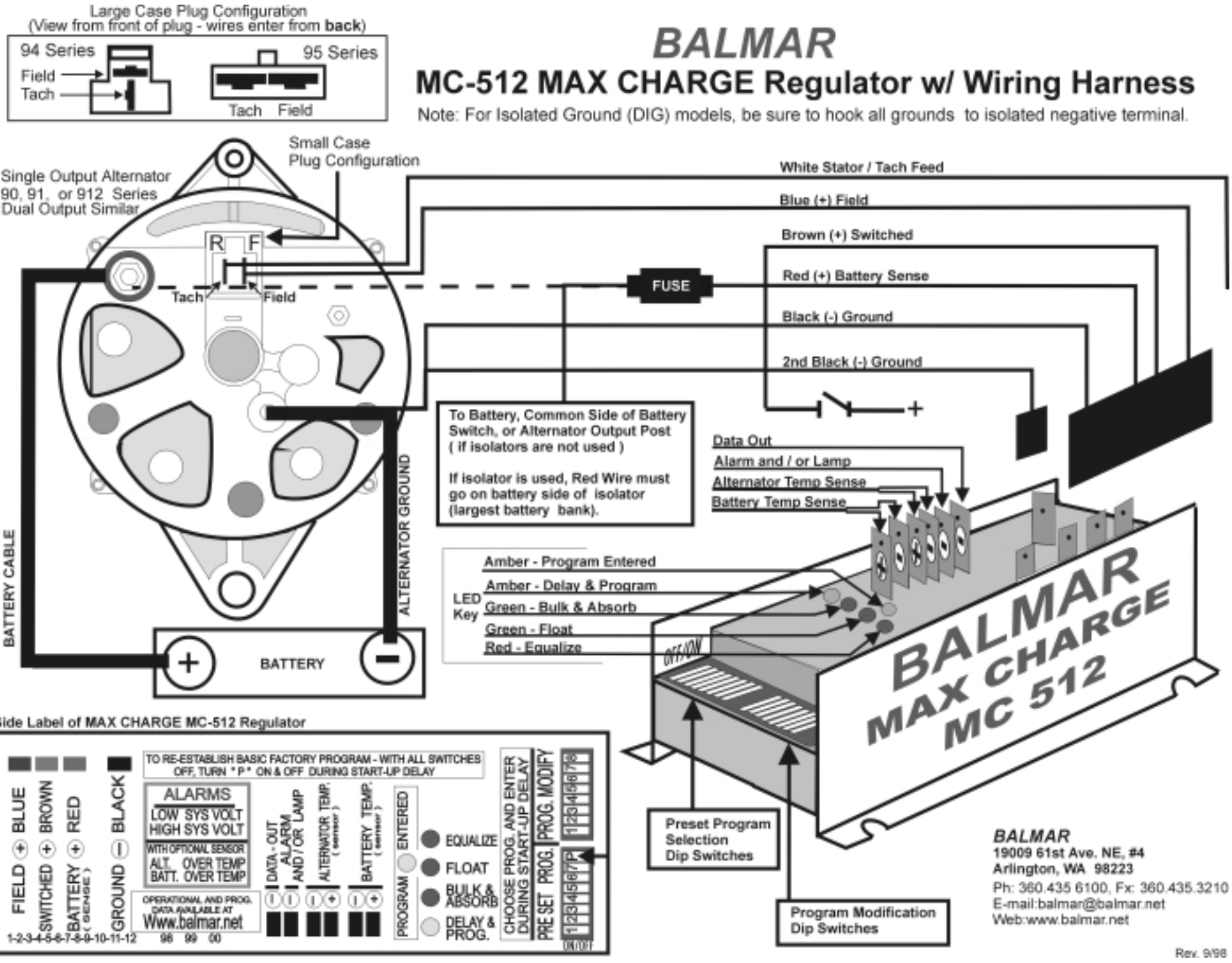
BALMAR 19009 61st Ave. NE, Arlington, WA 98223 Ph: (360) 435-6100, Fx; (360) 435-3210

E-mail: balmar@balmar.net, Web: www.balmar.net

BALMAR

MC-512 MAX CHARGE Regulator w/ Wiring Harness

Note: For Isolated Ground (DIG) models, be sure to hook all grounds to isolated negative terminal.



BALMAR
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Rev. 9/98

APPENDIX B ADVANCED PROGRAMMING
Adjusted time in seconds (for start delay), minutes and hours (for time in bulk, etc. and volts (for bulk voltage, etc.

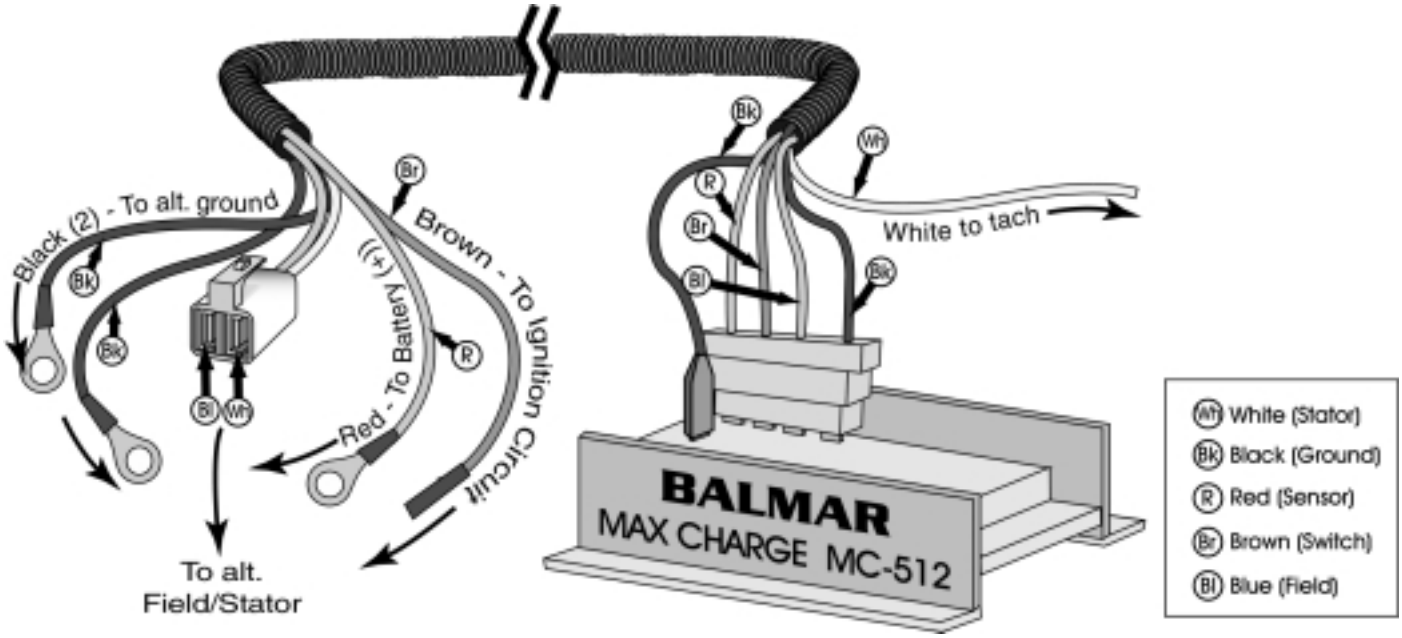
TIME				TIME				TIME				TIME			
Sec.	Hr / Min	Volts	Values	Sec.	Hr / Min	Volts	Values	Sec.	Hr / Min	Volts	Values	Sec.	Hr / Min	Volts	Values
0	0	N/A	00000000	26	2:36	N/A	01011000	52	5:12	N/A	00101100	78	7:48	N/A	01110010
1	:06	N/A	10000000	27	2:42	N/A	11011000	53	5:18	N/A	10101100	79	7:54	N/A	11110010
2	:12	N/A	01000000	28	2:48	N/A	00111000	54	5:24	N/A	01101100	80	8:00	N/A	00001010
3	:18	N/A	11000000	29	2:54	N/A	10111000	55	5:30	N/A	11101100	81	8:06	N/A	10001010
4	:24	N/A	00100000	30	3:00	N/A	01111000	56	5:36	N/A	00011100	82	8:12	N/A	01001010
5	:30	N/A	10100000	31	3:06	N/A	11111000	57	5:42	N/A	10011100	83	8:18	N/A	11001010
6	:36	N/A	01100000	32	3:12	N/A	00000100	58	5:48	N/A	01011100	84	8:24	N/A	00101010
7	:42	N/A	11100000	33	3:18	N/A	10000100	59	5:54	N/A	11011100	85	8:30	N/A	10101010
8	:48	N/A	00010000	34	3:24	N/A	01000100	60	6:00	N/A	00111100	86	8:36	N/A	01101010
9	:54	N/A	10010000	35	3:30	N/A	11000100	61	6:06	N/A	10111100	87	8:42	N/A	11101010
10	1:00	N/A	01010000	36	3:36	N/A	00100100	62	6:12	N/A	01111100	88	8:48	N/A	00011010
11	1:06	N/A	11010000	37	3:42	N/A	10100100	63	6:18	N/A	11111100	89	8:54	N/A	10011010
12	1:12	N/A	00110000	38	3:48	N/A	01100100	64	6:24	N/A	00000010	90	9:00	N/A	01011010
13	1:18	N/A	10110000	39	3:54	N/A	11100100	65	6:30	N/A	10000010	91	9:06	N/A	11011010
14	1:24	N/A	01110000	40	4:00	N/A	00010100	66	6:36	N/A	01000010	92	9:12	N/A	00111010
15	1:30	N/A	11110000	41	4:06	N/A	10010100	67	6:42	N/A	11000010	93	9:18	N/A	10111010
16	1:36	N/A	00001000	42	4:12	N/A	01010100	68	6:48	N/A	00100010	94	9:24	N/A	01111010
17	1:42	N/A	10001000	43	4:18	N/A	11010100	69	6:54	N/A	10100010	95	9:30	N/A	11111010
18	1:48	N/A	01001000	44	4:24	N/A	00110100	70	7:00	N/A	01100010	96	9:36	N/A	00000110
19	1:54	N/A	11001000	45	4:30	N/A	10110100	71	7:06	N/A	11100010	97	9:42	N/A	10000110
20	2:00	N/A	00101000	46	4:36	N/A	01110100	72	7:12	N/A	00010010	98	9:48	N/A	01000110
21	2:06	N/A	10101000	47	4:42	N/A	11110100	73	7:18	N/A	10010010	99	9:54	N/A	11000110
22	2:12	N/A	01101000	48	4:48	N/A	00001100	74	7:24	N/A	01010010	100	10:00	N/A	00100110
23	2:18	N/A	11101000	49	4:54	N/A	10001100	75	7:30	N/A	11010010	101	10:06	N/A	10100110
24	2:24	N/A	00011000	50	5:00	N/A	01001100	76	7:36	N/A	00110010	102	10:12	N/A	01100110
25	2:30	N/A	10011000	51	5:06	N/A	11001100	77	7:42	N/A	10110010	103	10:18	N/A	11100110

APPENDIX B ADVANCED PROGRAMMING
Adjusted time in seconds (for start delay), minutes and hours (for time in bulk, etc. and volts (for bulk voltage, etc.

Reminder: Switching on the "P" switch during startup will enter the new values. The amber "Program LED" will confirm acceptance of these values. Once this LED has confirmed acceptance of these values, turn off the "P" switch.

TIME				TIME				TIME				TIME			
Sec.	Hr / Min	Volts	Values	Sec.	Hr / Min	Volts	Values	Sec.	Hr / Min	Volts	Values	Sec.	Hr / Min	Volts	Values
108	10:48	N/A	00110110	132	13:12	N/A	00100001	156	15:36	N/A	00111001	179	17:54	14.4	11001101
109	10:54	N/A	10110110	133	13:18	N/A	10100001	157	15:42	N/A	10111001	180	18:00	14.48	00101101
110	11:00	N/A	01110110	134	13:24	N/A	01100001	158	15:48	N/A	01111001	181	18:06	14.56	10101101
111	11:06	N/A	11110110	135	13:30	N/A	11100001	***Beginning of Voltage Settings***				182	18:12	14.64	01101101
112	11:12	N/A	00001110	136	13:36	N/A	00010001	159	15:54	12.8	11111001	183	18:18	14.72	11101101
113	11:18	N/A	10001110	137	13:42	N/A	10010001	160	16:00	12.88	00000101	184	18:24	14.8	00011101
114	11:24	N/A	01001110	138	13:48	N/A	01010001	161	16:06	12.96	10000101	185	18:30	14.88	10011101
115	11:30	N/A	11001110	139	13:54	N/A	11010001	162	16:12	13.04	01000101	186	18:36	14.96	01011101
116	11:36	N/A	00101110	140	14:00	N/A	00110001	163	16:18	13.12	11000101	187	18:42	15.04	11011101
117	11:42	N/A	10101110	141	14:06	N/A	10110001	164	16:24	13.2	00100101	188	18:48	15.12	00111101
118	11:48	N/A	01101110	142	14:12	N/A	01110001	165	16:30	13.28	10100101	189	18:54	15.2	10111101
119	11:54	N/A	11101110	143	14:18	N/A	11110001	166	16:36	13.36	01100101	190	19:00	15.28	01111101
120	12:00	N/A	00011110	144	14:24	N/A	00001001	167	16:42	13.44	11100101	191	19:06	15.36	11111101
121	12:06	N/A	10011110	145	14:30	N/A	10001001	168	16:48	13.52	00010101	192	19:12	15.44	00000011
122	12:12	N/A	01011110	146	14:36	N/A	01001001	169	16:54	13.6	10010101	193	19:18	15.52	10000011
123	12:18	N/A	11011110	147	14:42	N/A	11001001	170	17:00	13.68	01010101	194	19:24	15.6	01000011
124	12:24	N/A	00111110	148	14:48	N/A	00101001	171	17:06	13.76	11010101	195	19:30	15.68	11000011
125	12:30	N/A	10111110	149	14:54	N/A	10101001	172	17:12	13.84	00110101	196	19:36	15.76	00100011
126	12:36	N/A	10111110	150	15:00	N/A	01101001	173	17:18	13.92	10110101	197	19:42	15.84	10100011
127	12:42	N/A	01111110	151	15:06	N/A	11101001	174	17:24	14	01110101	198	19:48	15.92	01100011
128	12:48	N/A	00000001	152	15:12	N/A	00011001	175	17:30	14.08	11110101	199	19:54	16	11100011
129	12:54	N/A	10000001	153	15:18	N/A	10011001	176	17:36	14.16	00001101	200	20:00	N/A	00010011
130	13:00	N/A	01000001	154	15:24	N/A	01011001	177	17:42	14.24	10001101				
131	13:06	N/A	11000001	155	15:30	N/A	11011001	178	17:48	14.32	01001101				

APPENDIX C. INSTALLATION BASICS



MC-512 MAX CHARGE REGULATOR INSTALLATION BASICS

CAUTION: The MC-512 Max Charge Regulator is intended for installation by a qualified marine electrician. If you are not experienced at marine electrical installations, we strongly recommend investing in the services of a qualified technician. The following is a brief description of a typical Max Charge installation. This basic installation procedure is based on the preset (default) program that is set at the factory. For specific information regarding preset and user-customizable programming, please refer to Section Five or Section Seven in this manual. To install the Max Charge regulator:

1. Fasten the regulator to a clean, well-ventilated location well away from hoses or manifolds.
2. Plug the Ford-style harness plug to the regulator. Attach the additional ground wire to the independent ground connection on the regulator.

This is all that is required at the regulator for basic installations. The next step is to connect the wires at the opposite end of the harness to the alternator and other components of the electrical system. Proceed as follows:

1. Attach the duplex plug (blue and white wires) to the field/tach connection at the rear of the alternator.
2. Attach the two black (ground wires) to the preferred ground at your alternator (refer to your alternator manual for proper grounding instructions).
3. Attach the red (sensing) wire to the positive terminal of the battery. This wire can also be attached at the battery side of the battery ON/OFF switch. This wire MUST sense the battery voltage.
4. Attach the brown (ignition circuit) wire to the auxiliary side of your ignition switch or an independent (ungrounded) oil pressure switch.
5. If an electric tachometer is used, connect the loose end of the white wire to your tachometer.

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