BALMAR®
WWW.BALMAR.NET

MAX CHARGE MC-614
MULTI-STAGE VOLTAGE REGULATOR

BALLARD COMMERCIAL INDUSTRIES, INC.
18930 59TH AVE., NE, ARLINGTON, WA 98223
ON THE INTERNET: WWW.BALMAR.NET

INSTALLATION AND OPERATION MANUAL

Introduction

The Balmar Max Charge MC-614 is the latest generation of smart, multi-stage Balmar Max Charge voltage regulators. Designed to provide precise voltage control for Balmar high-output 12-volt alternators and other externally regulated P-type alternators, the MC-614 features user selectable programs for the following battery types: Deep cycle flooded, standard flooded, gel, AGM and spiral wound AGM batteries. In addition, the regulator features a universal default program that's safe for most battery types, as well as a program that's designed for use in vessels utilizing voltage sensitive halogen equipment.

In addition to the user selectable preset programs, the MC-614 features a wealth of advanced programming modes which make it possible to tailor charging to a wide variety of environments.

When used in conjunction with optional MC-TS-A and MC-TS-B alternator and battery temperature sensors, the MC-614 features the ability to monitor and respond to a range of ambient temperature conditions, including reduction or discontinuation of charging voltages, should a catastrophic over-temperature condition occur at the alternator or the batteries.

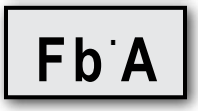
Safety Considerations

1. *Always disconnect your battery banks and ensure that switches are "OFF" prior to installing your regulator.*
2. *Remove loose-fitting clothing or jewelry, which could become entangled in your motor or other machinery prior to installing regulator.*
3. *Wear ANSI-approved safety eyewear and protective gear.*
4. *DO NOT attempt to modify the regulator. Modifications could result in damage to your charging system, and will void your warranty.*
5. *Do not attempt installation if you are tired or fatigued.*
6. *Ensure that the engine has cooled before initiating installation.*
7. *Do not attempt regulator installation while using alcohol or medication that could impair your judgment or reaction time.*
8. *Always use the right tool for the job. Improper tool use may damage regulator or your vessel, and could 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-614 regulator. If you are unfamiliar with marine electrical systems, consult with a licensed marine electrician.*

Float Voltage. Controls the target voltage for float stage. Adjustment spans from 13.0 to 13.8 volts. Default is based on battery program selected. To reverse direction of scroll, release magnet and wait for LED to display Fv code. Re-activate switch and release when desired value is indicated.

Float Time. Controls time setting for float mode. Standard value set is 18 minutes. Settings are from 6 minutes to 12 hours. To reverse direction of scroll, release magnet and wait for LED to display F1c code. Re-activate switch with magnet and release when desired value is indicated.

Low Voltage Limit. Allows user control of the regulator's low voltage limit.



Field Threshold - Bulk To Absorption . Controls the criteria used to determine field output required to maintain calculated bulk charging mode. Factory set at 65% field output. Raising "fba" shortens calculated bulk charge time. Lowering "fba" increases calculated bulk charge time. Span of adjustment is 16% to 96%. To reverse direction of scroll, release magnet and wait for LED to display "fba" code. Re-activate switch and release when desired value is indicated.

Field Threshold - Float To Absorption . Controls the criteria used to determine the field current threshold required to cycle between absorption and float charging modes. Factory set at 65%. Raising "ffl" increases calculated float charge time. Adjusted in 1% increments. Span of adjustment is 16% to 96%. To reverse direction of scroll, release "ffl" code. Reactivate switch with magnet and release when desired value is indicated.

Alternator Temperature Threshold. Controls the setpoint at which point field current is reduced when the the alternator temperature sensor indicates an over-temp condition at the alternator. Requires temperature sensor installation. Preset at 108˚.

Battery Temperature Threshold. Controls the setpoint at which point field current is discontinued when the the battery temperature sensor indicates an over-temp condition at batteries being sensed. Requires temperature sensor installation. Preset at 52°C.

Slope Voltage Correction. Adjusts the current (in miliamps) the regulator uses when monitoring battery temperature sensing. Can be custom adjusted to meet the needs of unique battery technologies. Consult with battery manufacturer for specific slope voltage recommendations.

Battery Equalization

Due to the hazardous nature of equalization (the intentional overcharging of batteries to remove sulfation from the battery plates) we strongly recommend that the process be done at the dock with a voltage-adjustable shorepower charger. If it is absolutely impossible to do so, equalization can be done with the alternator and regulator by doing the following:

1. In Advanced programming, Pra, change the following values.
2. Cl to a voltage above the desired equalize voltage.
3. AHL to a voltage above the desired equalize voltage.
4. Bv to the desired equalize voltage.
5. Blc to the desired equalize time.
6. Disconnect ALL battery temperature sensors.
7. YOU MUST MONITOR THE BATTERIES DURING EQUALIZE PROCESS!
8. Once the equalization is complete, activate the regulator's basic programming and reset the battery program mode to UFP, and allow the program to save. Once saved, access the basic programming mode again and reset for the desired battery program.

WARNING: EQUALIZATION IS A MANUAL PROCESS WITH POTENTIAL DANGERS. DO NOT LEAVE SYSTEM UNATTENDED.

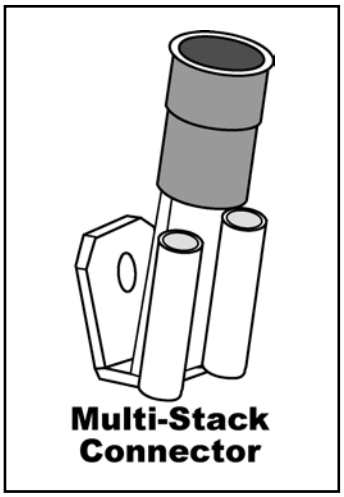
Default Program Settings By Battery Type

	UFP	FDC	GEL	AGM	OPS	FSB	HAL
START DELAY (SECS.)	1	1	1	1	1	1	1
SOFT RAMP (SECS.)	60	60	60	60	60	60	60
BULK VOLTAGE	14.1	14.6	14.1	14.38	14.6	14.4	14.0
BULK TIME (MINIMUM)	18 MIN	18 MIN	18 MIN	18 MIN	18 MIN	18 MIN	18 MIN
ABSORPTION VOLTS	13.9	14.4	13.9	14.18	14.4	14.2	13.8
ABSORPTION TIME (MINIMUM)	18 MIN	18 MIN	18 MIN	18 MIN	18 MIN	18 MIN	18 MIN
FLOAT VOLTS	13.4	13.4	13.7	13.4	13.4	13.4	13.5
FLOAT TIME (MINIMUM)	18 MIN	18 MIN	18 MIN	18 MIN	18 MIN	18 MIN	18 MIN
FLOAT TIME (MAXIMUM)	12 HRS.	12 HRS.	12 HRS.	12 HRS.	12 HRS.	12 HRS.	12 HRS.
HIGH VOLTAGE ALARM (VOLTS)	15.2	15.6	15.1	15.38	15.6	15.4	15.0
LOW VOLTAGE ALARM (VOLTS)	12.7	12.7	12.7	12.7	12.7	12.7	12.7
MAX BAT. 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	125˚F/52˚C
MAX ALT. 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	225˚F/107˚C

Additional Regulator Features

Small Engine Mode

In situations where additional power is needed for propulsion, the MC-614 provides the option to manually reduce regulator field output by approximately one half. This option, called Small Engine Mode, can be accessed by creating a direct pathway between the positive and negative Alternator #1 Temperature Sensor terminals. This can be done by splicing into the positive and negative wires of the Alternator Temperature Sensor cable (MC-TS-A) with a switched wire. With the switch in the OFF position, the Alternator #1 Temperature Sensor will work normally. With the switch in the ON position, the regulator will reduce field output by approximately 50%.



To enable the Small Engine Mode:

1. If the Alternator Temperature Sensor cable is being used, replace the female terminal connectors on the cable with Multi-Stack Connectors (Ancor Part # 230612).
2. Install a standard ON/OFF switch in a location that's easily reached from the helm.
3. Run wires from the switch back to the positive and negative terminals of the Alternator #1 Temperature Sensor terminals (terminals #5 and #6).
4. Add appropriate connectors to the switched wires and connect to the positive and negative terminal connections.

Dash Lamp

The MC-614 provides a Dash Lamp circuit that's capable of providing a signal to a user supplied and installed audible or visual alert if the following issues were to occur while the regulator is in operation;

- Low Battery Voltage <12.8V
- High Battery Voltage >15.5V
- High Alternator Temperature >225˚F (Requires installation of MC-TS-A sensor cable.) Temperature adjustable.
- High Battery Temperature >125˚F (Requires installation of MC-TS-B sensor cable.)
- Alternator Failure (No voltage on stator).

Aux #1 Lamp

The MC-614 provides an Auxiliary Lamp circuit that's capable of providing a signal to a user supplied and installed audible or visual alert to indicate the following while the regulator is in operation:

- Small Engine Mode is activated,
- Regulator is at full field.

System Troubleshooting

Regulator Troubleshooting

The majority of charging difficulties can be attributed to damage, corrosion or wear at wiring, fusing or wiring connections. Before attempting to troubleshoot alternator or regulator issues, be sure to address the following:

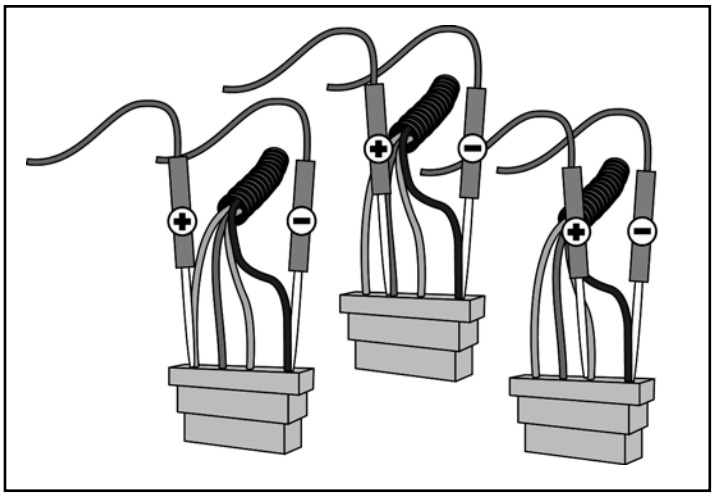
1. Remove and clean all charging system electrical connections (positive and negative). Check the voltage regulator's harness for continuity. Wires and terminals can and will become corroded, and need to be cleaned or replaced. Ensure that the regulator's ground wires are provided with a clean connection to system ground.
2. Inspect and replace 10A and 1A ATC type fuses in the regulator wiring harness if fuses appear to be damaged or corroded. Ensure that the fuse holder is also free of corrosion.
3. 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.
4. Check and tighten alternator belt. If the belt show signs of wear or damage, replace it. Always replace existing belts with the finest quality replacements available.

If batteries and wiring are in suitable condition, use the tests on the following page to determine if charging problems are a result of a faulty alternator or regulator. These tests provide an opportunity to isolate the alternator, regulator and wiring harness in order to determine the problem source. In order to perform these tests, you will need an independent DC meter (preferably a digital type). In an emergency, a 12V light bulb or test light can be used to help determine if power or working grounds exist. An amp meter and a battery hydrometer with a thermometer are also helpful diagnostic tools.

Voltage Regulator Testing

Set your voltmeter to 12VDC and connect the negative lead to the BLACK ground wire at the regulator as shown at in the diagram at right.

1. With the ignition turned OFF, check voltage on the RED (power), Voltage Sense (Terminal #9), BLUE (field) and BROWN (ignition) wires in the regulator plug.



Voltages should be as follow:

- RED wire equal to battery voltage
- Terminal #9 RED wire equal to battery voltage
- BLUE wire zero volts
- BROWN wire zero volts

2. With the ignition in the ON position (engine not running), check voltage on the RED (power), Secondary RED on Terminal #13 (voltage sense) BLUE (field) and BROWN (ignition) wires in the regulator plug:

- RED wire equal to battery voltage
- Terminal #9 RED wire equal to battery voltage
- BLUE wire between 4V and 11V
- BROWN wire equal to battery voltage

PLEASE NOTE: In systems where the ignition (BROWN) wire is supplied power via an oil pressure switch, jump directly from test #1 to test #3.

3. With the ignition in the ON position (with engine running at 1,400 rpm fast idle), check voltage on the RED (power), Secondary RED on Terminal #9 (voltage sense) BLUE (field) and BROWN (ignition) wires in the regulator plug. Voltages should be as follow:

- RED wire equal to battery voltage
- Terminal #9 RED wire equal to battery voltage
- BLUE wire between 4V and 11V
- BROWN wire equal to battery voltage

If voltage is not present on the RED, the BROWN and the Positive Battery Sense Wire, the regulator will not work. If voltage is as expected at the RED the BROWN and Positive Battery Sense wire, and there is zero, or an unexpected voltage reading at the BLUE wire, contact our technical support staff at (360) 435-6100, or e-mail us at balmar@balmar.net.

If all voltages at the regulator meet expectations, yet the alternator is not producing charging current, test the alternator. The following tests are recommended for determining alternator functionality.

Alternator Testing

TEST #1- The following test is used to isolate the alternator and determine if the failure is a result of the alternator. Once again, testing at either the alternator or regulator is only effective if the wiring, fusing and batteries have been determined to be in correct working order. The alternator and regulator can be tested for function by determining if a magnetic field exists at the alternator's pulley shaft or rear bearing. To test:

1. With the ignition in the OFF position, place the tip of a non-magnetic 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. (A slight amount of magnetism may be present, due to residual voltage in the alternator.)

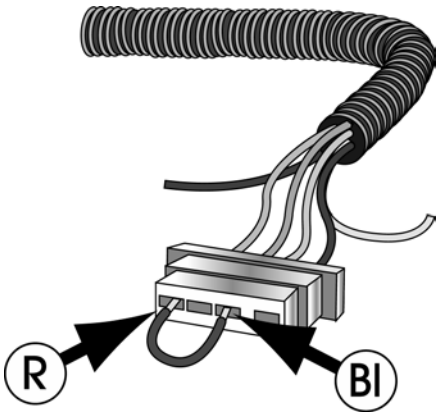
2. Engage the ignition, without starting the engine, to activate the voltage regulator. If an oil pressure switch is used, a jumper between the RED and BROWN wires in the Ford-style plug will activate the regulator.

3. After allowing time for the regulator's start-up delay, place the head of a steel screwdriver near the nut on the pulleyshaft or near the rear bearing of the alternator. There should be substantial magnetic pull. If a magnetic field is present, the voltage regulator, alternator brushes and rotor are likely to be working properly.

If there is little or no magnetic pull at the pulley shaft or at the rear bearing, initiate the following test:

With the key off and the engine off, remove the large harness plug from the regulator.

1. 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. This bypasses the regulator and tests the alternator and the harness.
2. Using your steel screwdriver, inspect for a magnetic field as described above.
3. With your voltmeter, check for voltage on the blue wire at the alternator. If voltage does not exist, the harness may be at fault. If voltage does exist at the harness, but no magnetism is present, the alternator is likely to be malfunctioning.
4. If a magnetic field is present. Both harness and alternator brushes and rotor appear to be working properly. If no magnetic field is present, proceed with the next test.



Testing the actual output of the alternator is known as “Full Field Testing”. This can be accomplished by jumping a positive 12VDC 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. DO NOT let the engine run any longer than necessary to detect charging. If the system is not charging, remove the alternator and have it inspected by a qualified alternator shop, or call Balmar for warranty evaluation.

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). Use a SHIELDED alligator clip for post attachment. Unintentional contact between the alligator clip and the alternator case could result in damage to your electrical system.
2. Disconnect the field wire from the rear of the alternator and attach the other end of the jumper wire to the alternator’s Field terminal (F). 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.

Conclusion

If your readings differ substantially from the “Expected Readings” listed in the troubleshooting charts, the regulator may be malfunctioning, or there may be a continuity problem. Contact our technical support staff at (360) 435-6100. If you determine that repair service is necessary for either your alternator or regulator, please gather the following information before contacting our service technicians: Make and model of alternator. Model of voltage regulator and date of mfg. (date punched on rear side label of regulator). Voltage readings on red, brown and blue wire at regulator with engine off, key on. Voltage readings on red, brown and blue wire at regulator with engine running at a fast ideal 1400 rpm.

NOTES:

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, 18930 59 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 Phone: (360) 435-6100, Fax: (360) 435-3210 E-mail: balmar@balmar.net, Web: www.balmar.net

For more information, contact Balmar Customer Service or Technical Support at 360-435-6100 or visit the Balmar website at www.balmar.net. Ballard Commercial Industries, Inc. (Balmar) believes all information herein to be factual and accurate, yet maintains no liability for factual or typographic error. In addition, Balmar retains the right to revise or update products without notification. Visit the Balmar website for product updates or bulletins that may apply to your alternator or voltage regulator.

NOTES: