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**1. Background:**

The E-MAAX CSR regulator addresses the historical problems associated with optimizing alternator charging capacity under typical marine applications. A marine charging system must perform under a highly variable charge / load state while often operating under limited time duration (sail boat). The ability to respond to large load variations, coordinate multiple charge inputs such as, solar or wind, as well as provide the specific charging profiles required for the various battery technologies is critical to a system’s performance.

The E-MAAX CSR ensures the alternator, whether a generic alternator or one of ElectroMaax’s high output alternators, provides the optimum charge profile to satisfy the various battery technologies and the current operating conditions. The E-MAAX CSR by continually monitors system voltage achieves this goal.

The control algorithms and a high-speed communication network ensure fast, accurate response to any of the charge / load conditions experienced in a marine application. The rapid response capability ensures any transient electrical events, even under the most extreme situations, are handled effectively with a fail-safe action.

The supplied *USI interface (Com Module required)* brings all available performance parameters to a single PC screen. Additional available temperature sensors collect real-time operating data allowing the owners to evaluate “at a glance” their vessel’s charging system. The same interface allows factory-based diagnostics through *E-Maax ReMote* technical support.

**2. System Components:**

The basic CSR system is comprised of 2 components;

**CSR Regulator Module:**

CSR Regulator Module is housed in a durable plastic enclosure 15x10 cm, with 5 connection ports; the first connection port is a 6 pin power connection. Any of the other four 4-pin connection ports will accept the various accessory devices. The face surface of the enclosure has 2 multi-color LEDs, used for status indication. CSR Regulator Module controls alternator output via Field output, and utilizes micro-processor based communications to monitor battery and alternator temperatures. The CSR is factory programmed specific to the end-users system, that is:

- System voltage ( 12 or 24)
- Battery Technology ( Lead acid / AGM / GEL / FireFly / Custom-LiFePO<sub>4</sub>)
- Alternator configuration (P or N)

**Power Cable:**

The 2-meter Power Cable is a 4-wire connection cable which plugs into the CSR module via the 6-pin quick-connector.

Wire color codes:

- Black = Battery Ground
- Red = Battery Positive
- White = Ignition (keyed)
- Brown = Field Output

Refer to the wiring schematics below for additional connection information.

### 3. Supported Peripherals:

The CSR Regulator Module and the Power Cable are a complete functioning charge control system; however, additional accessory peripherals are available to enhance capability and provide additional system operating control and diagnostics. All accessories use the standard 4-pin connector, allowing simple connection to the CSR module.

**Com Module (CM)** – Provides both a USB based display interface and a *Field Reduction Switch* for limiting alternator output to 50%. The CM is typically mounted in the “Nav Station” allowing computer connection via the 1m (3ft) supplied USB cable. Connection to the CSR is via any of the 4-pin ports. The operating parameters can be remotely displayed into a PC Laptop via the Com Module. The following data will be displayed:

- System Voltage
- Regulator Temperature
- Battery Temperature (sensor required)
- Alternator Temperature (sensor required)
- Field Output %
- Ignition Status
- Field Reduction Switch Status (sensor required)
- Critical Fault Status
- Setting Fault Status

Refer to the “[Com Module Datasheet](#)” for additional information regarding functionality.

#### Temperature sensors

The battery and alternator temperature sensors are colored coded (Black=Battery / Silver=Alternator). Provided with the standard 3 meter (10 ft.), extension cables can be purchased if required for additional length. The sensor end has the electronics encapsulated into the aluminum housing ready for mounting via the 8 mm (5/16”) hole. The face side of the sensor has a status indicating LED. The connection end is the 4-pin moisture tight connector for the module. Refer to the “[Temperature Sensor Datasheet](#)” for additional information regarding functionality.

### 4. Installation:

The CSR Regulator has been designed with marine environment and the boater in mind. The CSR is a compact, module system requiring minimal tools and spatial requirements, the system can be easily installed by a DIY boater. The module is secured using 2 screws; allow room for access to the connection ports along the lower edge. Refer to “[CSR Regulator Datasheet](#)” for wiring connection information. Various available peripherals allow for system enhancement with simple “Plug and Play” convenience. All connectors for the CSR regulator allow only a single orientation position connection, note when inserting.

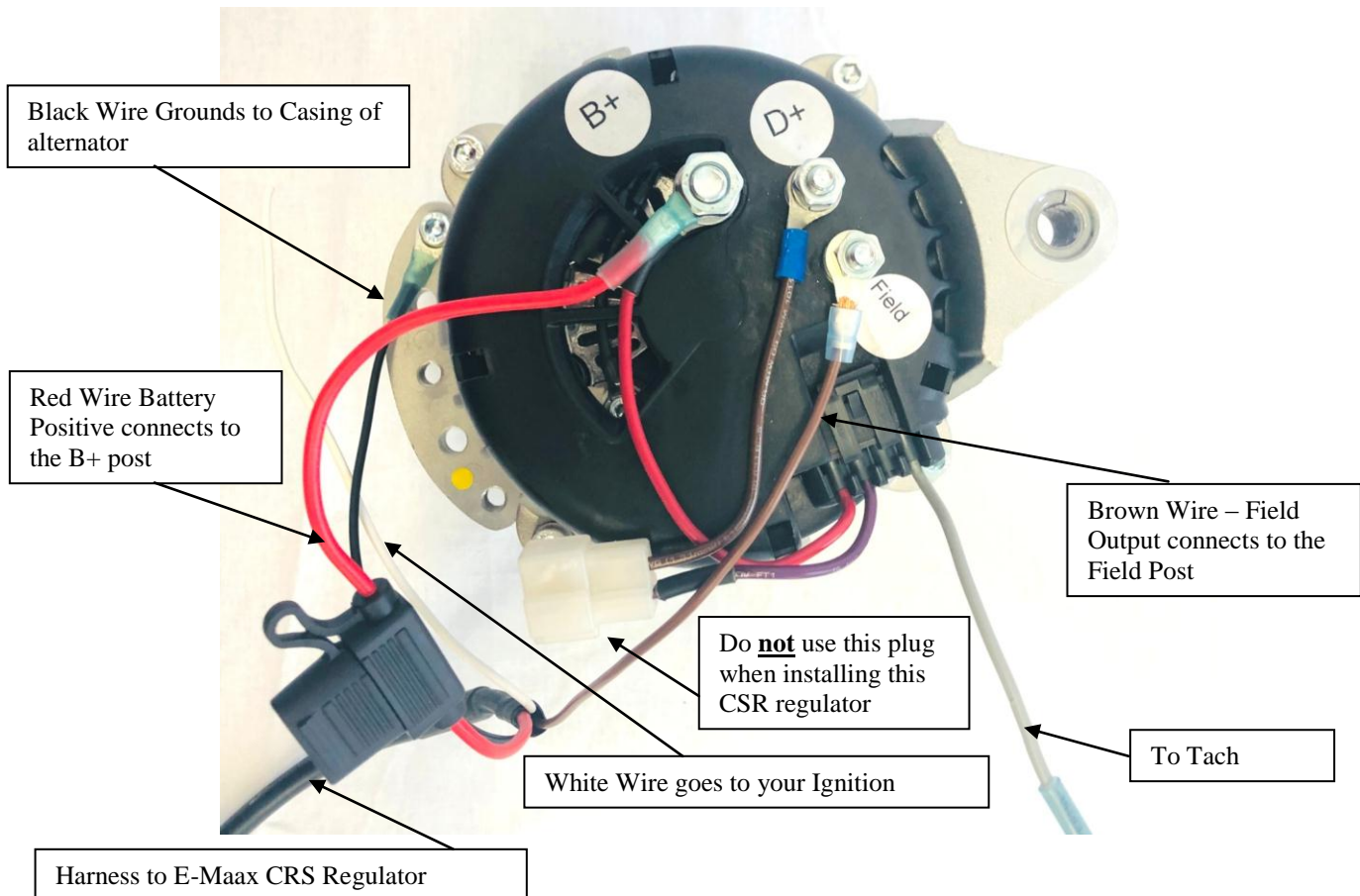
#### Order of actions:

- Mount the regulator in a suitable location close to the engine and battery using two M6 or ¼” screws. Plug the Power cable into the CSR regulator.
- If an Alternator Temperature Sensor is included in the package, mount it the on a suitable location on the alternator case, so the sensor’s LED indicator is visible. Good temperature transfer should be provided between the alternator case and the sensor. Connect sensor’s cable to any available port of the CSR regulator.
- If a Battery Temperature Sensor is included in the package, mount it onto the battery either to a stud or directly to the battery housing so the sensor’s indicator is visible. Good temperature transfer must be provided between the battery and the sensor. Connect sensor’s cable to any available port of the CSR regulator.

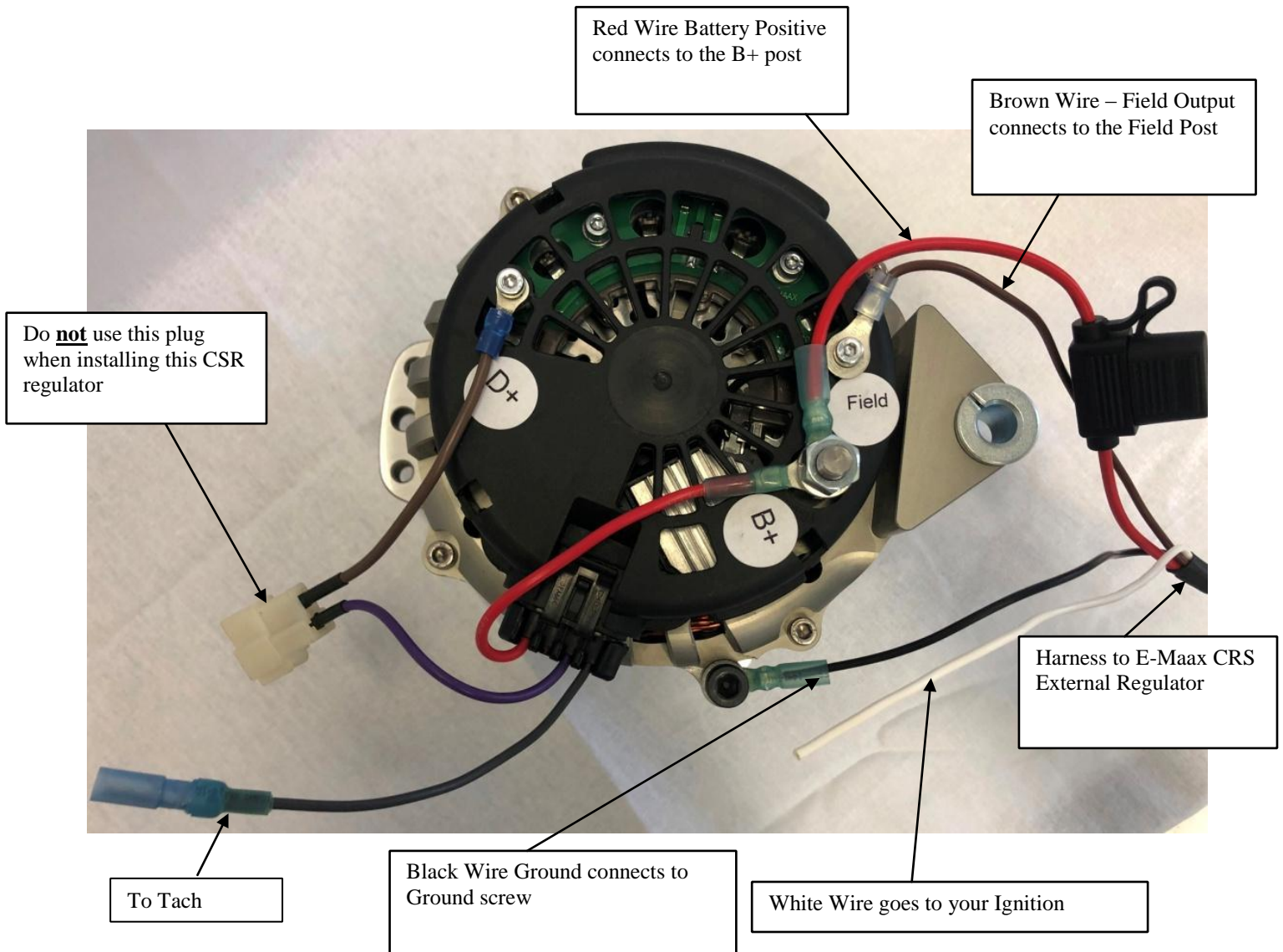
- If the optional Com Module has been purchased, mount it in a suitable location such as the "Nav Station" to allow connection to a PC via the 1m USB cable. Connect the 4-pin plug to any available port of the CSR regulator (extension cable available if required).
- The Power Cable consists of 4 wires, (Black / Red / White / Brown) requiring the following connections;
  - Black – The primary ground connection on the alternator or bus-bar.
  - Red – The primary positive connection on the alternator ( B+ post)
  - White – The switched side of the ignition switch. Ensure voltage is present only when the ignition switch is "ON" (first position).
  - Brown – Field input of the alternator.
  - The Power cable is connected to the CSR regulator via the 6-pin connector in the 6-pin port (see schematic below)

Once the CSR system is installed and connected, the boat electrics can be enabled. Visual status and diagnostics are provided via the LED indicators. Refer to "[CSR Regulator Datasheet](#)" for details regarding the LED functions.

### ...Cruiser Wiring Connections



**...Genmaax Wiring Connections**



## 5. Fault Diagnostics:

The CSR module is programmed to detect and display various system alarm states, with a corresponding mitigating action. The specific alarm is defined by the LED indicators.

Refer to the "*CSR Regulator Datasheet*" for information regarding reading the alarm state, the corresponding CSR action and required remedy. The following information regarding alarm states is taken from the "*CSR Regulator Datasheet*";

### Half Field condition:

Half Field condition is a special mode of regulation when the Field Output is reduced to 50% of its nominal value for the current charging conditions. The regulator is placed into the Half Field condition due to one or more of the following conditions:

- a) The battery's temperature reaches 40°C (if equipped)
- b) The alternator's temperature reaches 90°C (if equipped)
- c) The regulator's temperature reaches 60°C
- d) The Field Reduction Switch (FRS) in the Com Module is enabled (if equipped)

The Half Field condition is indicated by the right LED flashing red once per second. Half Field condition is re-set automatically when the following situations occur;

- ignition is switched off
- alarm condition is cleared
- manually via Field Reduction Switch (FRS) if equipped and enabled

### Critical Fault condition:

Critical Fault condition is an alarm mode (right LED flashing red two times quickly) when Field output is restricted to 10% in order to avoid damage to the charging system. The regulator is placed into the Critical Fault condition due to one or more of the following conditions:

- a) The battery's temperature reached 50°C (if equipped)
- b) The alternator's temperature reaches 100°C (if equipped)
- c) The regulator's temperature has exceeded the 90°C
- d) In-line fuse on the power supply line is blown

Critical Fault condition does not require restart of the regulator; it is re-set automatically when the fault condition is cleared.

### Settings Fault condition:

Settings Fault condition is an alarm mode (periodically flashes red three times) when no Field output is supplied to the alternator in order to avoid damage to the charging system. The regulator is placed into the Settings Fault condition due to one or more of the following conditions:

- a) The regulator has not been configured by ElectroMaax
- b) The regulator is configured for a 12-Volt system and a 24-Volt system has been detected
- c) The regulator is configured for a 24-Volt system and a 12-Volt system has been detected
- d) "LiFePO<sub>4</sub> MAAX" charging profile has been selected; the CSR regulators do not support that.

To clear the Settings Field condition requires the trigger condition to be eliminated and the restart of the regulator.

**6. Visual Indications:**

CSR Regulator has two LED indicators.

Left indicator works only when the ignition is inactive and there is no regulation.

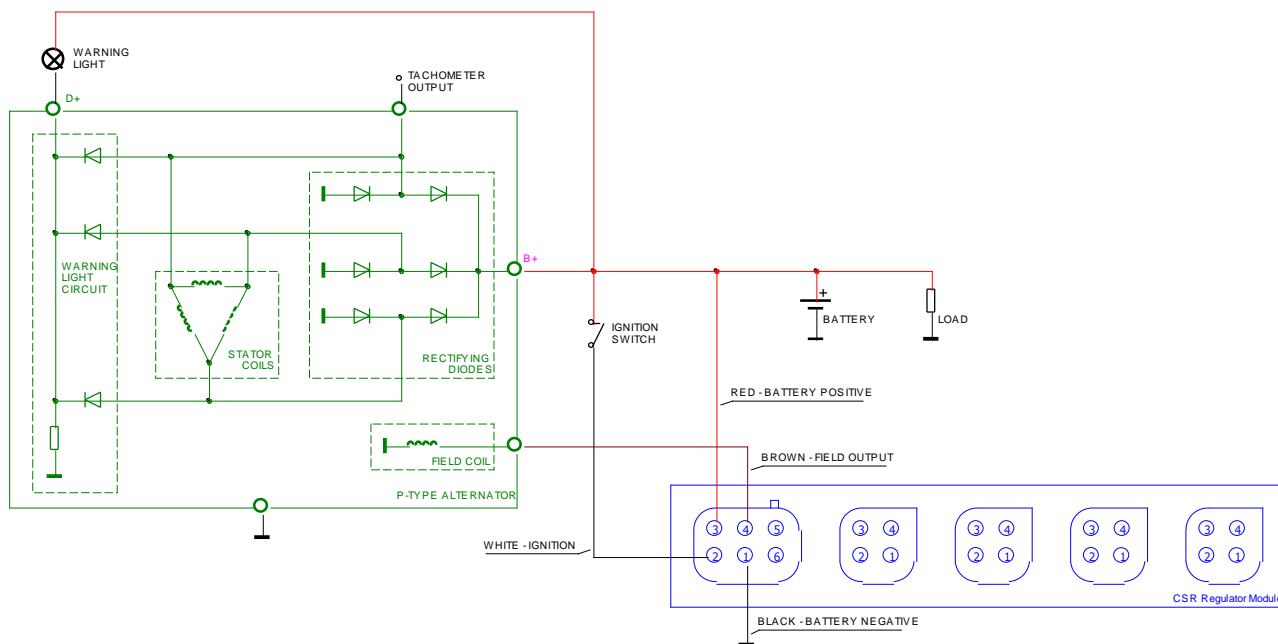
Lighting sequence	Meaning
	Regulator is powered up, ignition is switched off. It flashes (ISO) green every 6 seconds.
	Regulator is busy reporting its settings to external PC
	Regulator is busy updating its settings from external PC

Right indicator works only when the ignition is active and there is regulation.

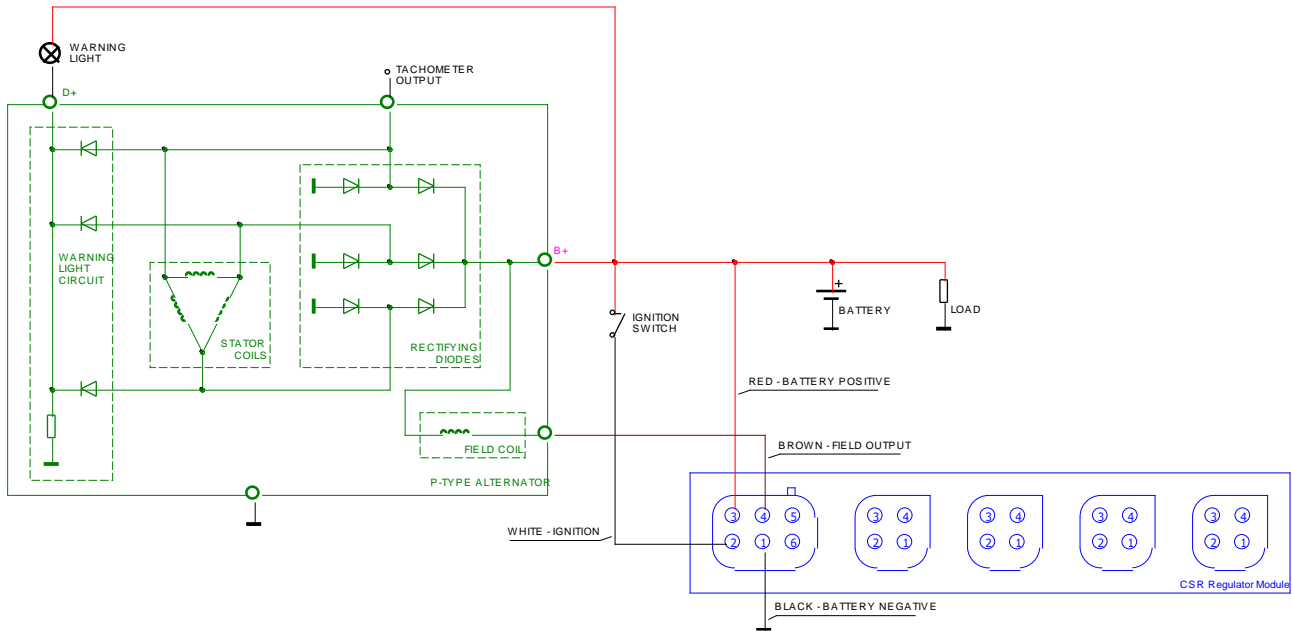
Lighting sequence	Meaning
	<b>Warm-up</b> stage of regulation
	<b>Bulk+Absorb</b> stage of regulation
	<b>Float</b> stage of regulation
	Half Field condition, when regulator allows 50% of the alternator's output
	Critical Fault condition, when regulator allows only 10% of the alternator's output
	Settings Fault condition, where the regulator disables the alternator's output (0%).
	<b>CSR</b> mode of regulation

**7. Reference schematic diagrams:**

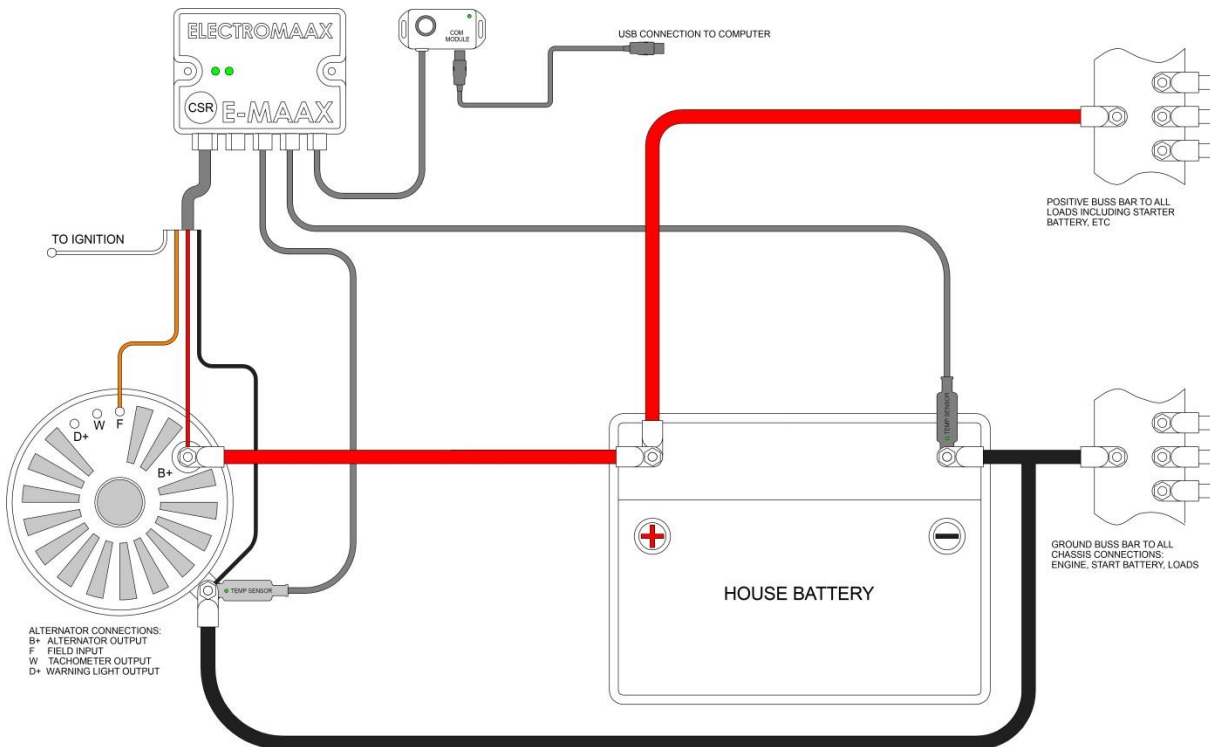
Reference schematic for P-type alternator



Reference schematic for N-type alternator



**8. Reference connection diagram:**



## **9. Summary:**

A properly installed CSR Regulator system does not require any user adjustments.

The CSR Regulation system provides a robust, reliable technology developed to optimize marine electrical charging requirements, while providing both system safe-guards and basic diagnostics. Designed to reduce system connection complexity allowing DIY boaters the ability to fault diagnose and remedy most common problems, thereby providing confidence and security in this critical area of marine service. The CSR is designed to provide years of reliable performance.