

**1. Description**

E-MAAX PLUS Regulator offers all the features of the PRO regulators while having the ability to regulate two alternators mounted on the same engine and work with another E-MAAX PLUS regulator on a different engine so both engines can charge the same battery bank.

The E-MAAX PLUS Regulator optimizes alternator output based on:

- System load
- Battery type
- Battery state of charge
- Current and voltage sensing
- Another E-MAAX PLUS Regulator, working to charge same battery

The battery charging profile is programmed based of battery type for the common batteries (Lead Acid / AGM / Gel / Carbon Foam / Lithium) in both 12 and 24 volt and "P" or "N" alternator configurations.

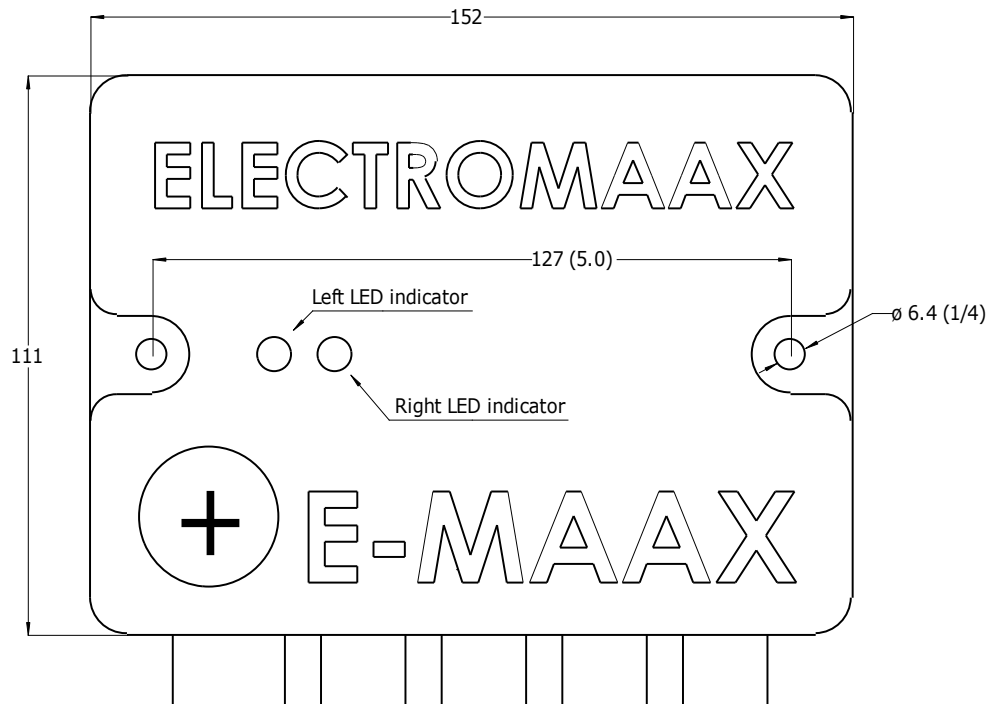
A PLUS regulator that is in "slave" mode does not cycle through the charge profile; the output is controlled by the "master" regulator, in a 2 regulator system.

The PLUS has two LED's which function as visual status indicators and fault diagnostics.

**2. Specifications**

Parameter	Value	Units
Weight	200	grams
Housing material	PVC	-
Operating range	-20 .. +100	Celsius deg
Protection	IP 56	-
Maximum allowable shock	3	G
Maximum allowable relative humidity	95	%

**3. Dimensional outline**

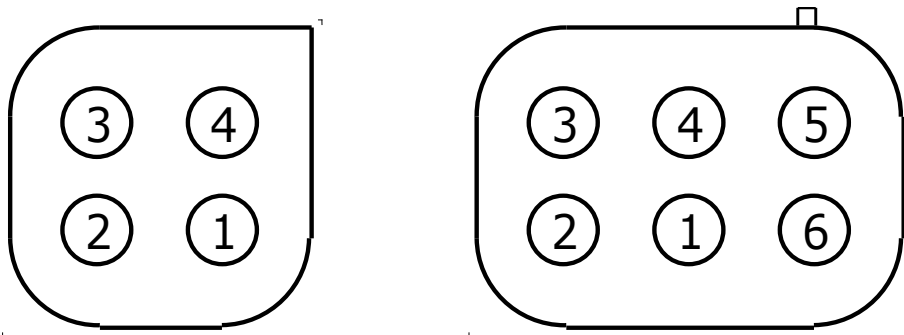


All units are millimeters (inches)

### 3. Electrical specifications

Parameter	Value	Units
DC supply voltage	6-40	Volts
Current consumption	0.030	Amps
Maximum Field current	8	Amps
Power Cable ratings	Gauge: 14 AWG Material: tinned copper strands Insulator Material: PVC Jacket Color: black Diameter: 13 mm	-
Communications format	RS-485	-
Peripherals connector pin functions	1 - black - battery negative 2 - red - DC supply 3 - white - communication lead "A" 4 - yellow - communication lead "B"	-
Power cable connector pin functions	1 - black - battery negative 2 - white - Ignition input 3 - red - battery positive 4 - brown - Field output #1 5 - green - Field output #2 6 - yellow - tachometer signal	-

4-pin and 6-pin connector pins, view from the cable side







### 4. Description of functions

The PLUS regulator provides alternator output by controlling the "Field" input into the alternator. As the Field signal is increased or decreased so the alternator output follows. As the functions of the PLUS regulator are described below the terms "Field output" and "Alternator input" are interchangeable. The term Field Output refers to Field condition from the Regulator, whereas Field Input is the same value from the Alternator's perspective.


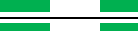


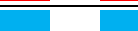



### 5. Visual Indication

PLUS 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 importing its settings from external PC and the settings have not been accepted
	Regulator is busy importing its settings from external PC and the settings have been updated

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
	Warning condition, when regulator allows 50% of the alternator's output
	<i>Critical Fault condition</i> , when regulator allows only 10% of the alternator's output
	<i>Settings Fault condition</i> , where the regulator disables the alternator's output (0%).
	<i>The regulator is the <b>slave</b> while working together with another regulator</i>
	<i>The regulator is the <b>master</b> while working alone or together with another regulator</i>

\*\* - A PLUS regulator that is in "slave" mode follows the charge profile of the Master regulator.

### Supported Optional Peripherals:

PLUS Regulator supports any of the following peripherals:

- a) Alternator Temperature Sensor
- b) Battery Temperature Sensor
- c) Com Module or Com Module Plus
- d) Alternator Current Sensor
- e) Battery Current Sensor
- f) Battery Voltage Sensor
- g) Battery Hub Plus
- h) Tachometer Compensator

The peripherals can be hot-plugged at any time into any available port without restarting the regulator. The regulator detects the presence of any compatible peripheral and acquires data from it automatically.

### Charging stages and supported chemistries:

PLUS Regulator supports the following battery chemistries, in both 12 and 24 Volts:

- a) Lead-acid
- b) AGM
- c) Gel
- d) Carbon Foam
- e) Lithium MAAX LiFePO4
- f) Lithium

The manufacturer configures the PLUS Regulator for use with a particular battery type.

Upon the activation of the Ignition lead, the PLUS Regulator regulates the battery charge through the following charge profile stages:

- a) Warm-up

- b) Bulk + Absorb
- c) Float

Depending on the charging conditions, such as immediate load requirements and engine speed, the PLUS Regulator switches between the charge profile stages to achieve the optimal charging.

**Field reduction:**

Com Module PLUS, when connected to the regulator, allows reduction of the regulator's Field Output to divert engine power from generating electricity to rotating the propellers if needed. Com Module PLUS reduces Field Output in 10% increments, down to 30% of its nominal value for the current charging conditions. Field reduction is indicated by the right LED flashing red once and is re-set automatically when the ignition is switched off.

**Warning condition:**

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

- a) The battery's temperature reaches 40°C
- b) The alternator's temperature reaches 90°C
- c) The regulator's temperature reaches 60°C
- d) Engine's RPM is below the limit (if enabled)

The Warning condition is indicated by the right LED flashing red once per second. Warning condition is re-set automatically when the ignition is switched off.

**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 reaches 50°C
- b) The alternator's temperature reaches 100°C
- c) The regulator's temperature reaches 90°C
- d) In-line fuse on the power supply line is blown
- e) Overvoltage

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) Alternator parameters have not been set in the regulator
- b) The regulator is not configured for the correct system voltage (12 or 24)
- c) Battery parameters have not been set in the regulator

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

**CSR regulation mode:**

CSR is a fail-safe mode of regulation based solely on the battery voltage.

- a) The alternator current sensor is not connected
- b) The battery voltage sensor is not connected
- c) Alternator produces current less than 3 A

This mode does not have corresponding visual indication with the regulator's LED, but it produces a notification on the USI screen.

**Master regulation mode:**

When a PLUS regulator is working as a standalone unit or has been assigned the master status while working in tandem with another PLUS regulator, the Master regulation mode is invoked. In fact, while in this mode, the PLUS regulator acts as a PRO regulator and additionally provides the current value of the Field outputs for the slave regulator to follow. The master mode is indicated by three blue flashes of the right LED on the regulator.

**Slave regulation mode:**

When a PLUS regulator has been assigned the slave status while working in tandem with another PLUS regulator, the Slave regulation mode is invoked. In the Slave mode, the PLUS regulator follows the behavior of the master regulator and its Field output under the given charging conditions. If the charging system is properly configured, the alternators on both engines provide equal amount of energy to the battery. The slave mode is indicated by two blue flashes of the right LED on the regulator.

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