

Voltage Regulator Module User's Guide

Rev 1.1



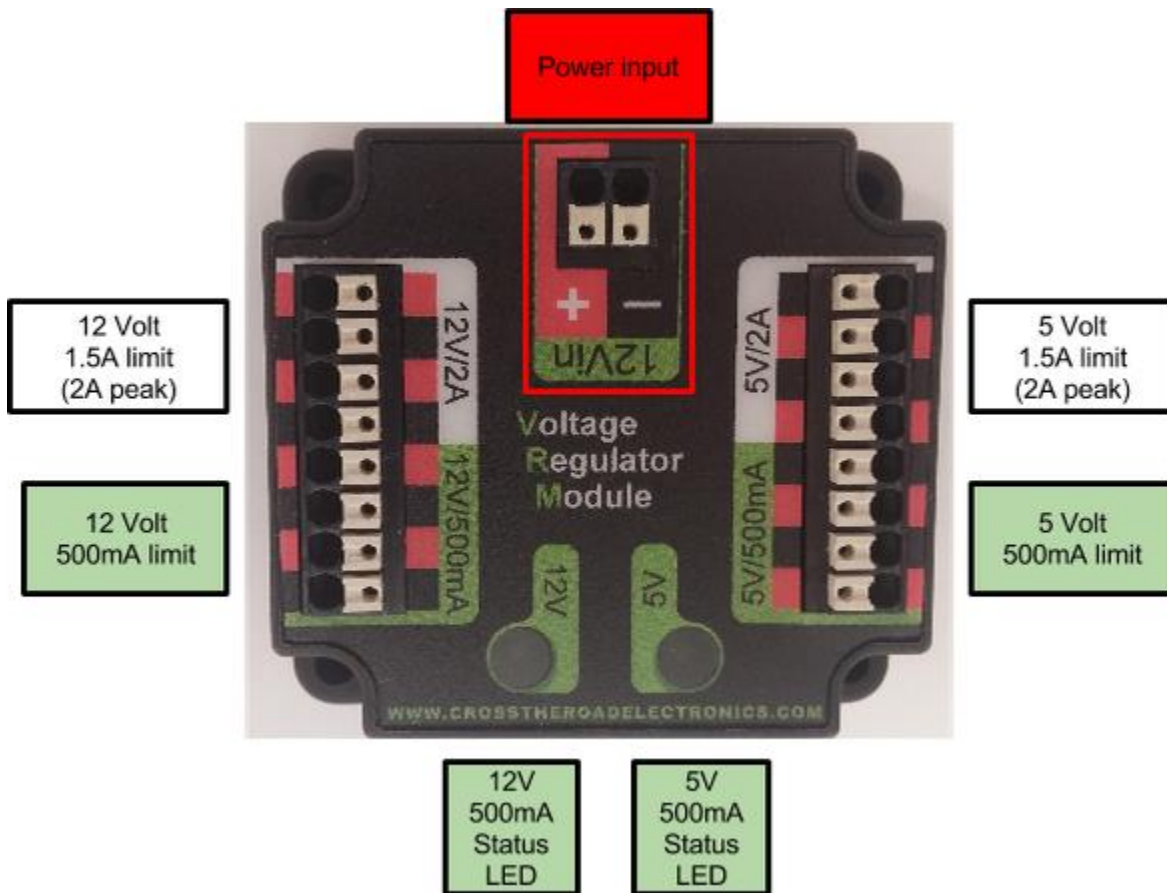
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1. Voltage Regulation Module at a Glance

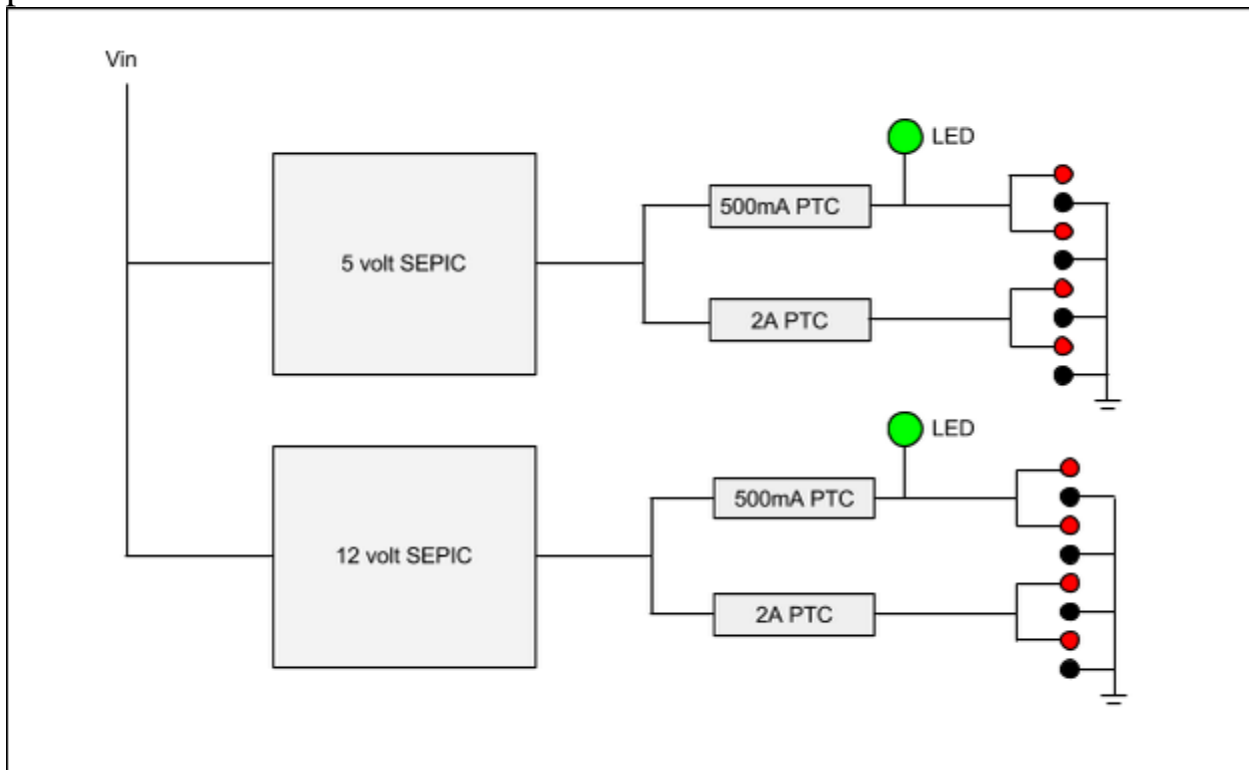


- 5V/500mA Status LED
 - **ON** when 5V channels are powered
 - **OFF** when breaker has tripped
- 12V/500mA Status LED
 - **ON** when 12V channels are powered
 - **OFF** when breaker has tripped

LEDs NOT affected when 2A channels are limited

Device Description

The VRM is a DC to DC convertor that is capable of both boost and buck voltage regulation. The device features two independent SEPIC (Single Ended Primary-inductor Converter) regulators allowing the **input** voltage to be above or below the desired **output** voltage. There are two regulators (one 5V and one 12V) each with two current limiting PTC's (500mA and 2A). Reverse polarity protection is included.



1.1. Connection Specifications

- **Power, 12V/500mA, 12V/2A, 5V/500mA, 5V/2A**
 - All connections are Weidmuller Connectors
 - **Max Size:** 16 AWG
 - **Min Size:** 24 AWG

See [Section 2.2. Weidmuller Connectors](#) for wire insert instructions.

1.2. Electrical Specifications

Rating	Min	Typical	Max	Unit
Input/Battery Voltage (V_{in})	5	12	16	V
Functional Min Input Voltage V_{in-MIN}		5		V
Functional Max Input Voltage V_{in-MAX}		16		
Absolute Max Input Voltage ⁽¹⁾			20	V
Output Voltage (no load, $V_{in} = 12.5$)				
12V/500mA Rail	11.93	12.197	12.49	V
12V/2A Rail	11.93	12.197	12.49	V
5V/500mA Rail	5.0	5.13	5.29	V
5V/2A Rail	5.0	5.13	5.29	V
Output Impedance				
12V/500mA Rail	0.15856		1.00942	Ω
12V/2A Rail	0.02356		0.10942	Ω
5V/500mA Rail	0.15818		1.009	Ω
5V/2A Rail	0.02318		0.109	Ω
Peak Current				
12V/500mA and 5V/500mA			500	mA
12V/2A and 5V/2A			2000	mA
Continuous Current				
12V/500mA and 5V/500mA			500	mA
12V/2A and 5V/2A			1500	mA

Note 1: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

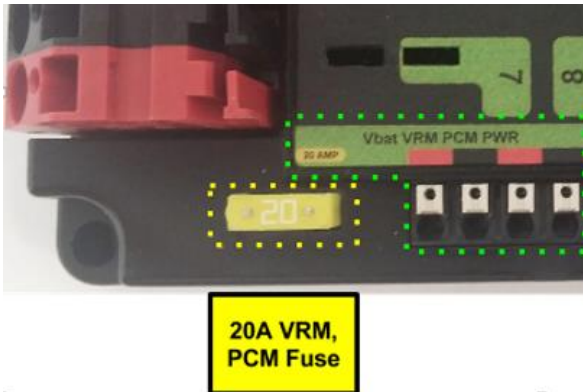
1.3. Mechanical Specifications

Length	2.220 in.
Width	2.030 in.
Height	0.784 in.
Weight	1.8 oz.

2. Installing a VRM

Powering VRM

- Disconnect PDP from Battery before adding or modifying connections
- Connect VRM to 20A Fused Power Supply on PDP.



Either of the left two pairs of Weidmuller (red/black) can be used for VRM power. Red is for positive, black is for ground.



- Connect PDP to Battery

12V Output Voltage Channels

- 500mA Channel
 - Connect devices requiring constant 12V power supply that draw less than 500mA
- 2A (peak) Channel
 - May be used to devices with high current requirements

5V Output Voltage Channels

- 500mA Limit
 - Connect devices requiring constant 5V power supply that draw less than 500mA
- 2A (peak) Limit
 - May be used to devices with high current requirements

Limitations

- Current draw must not exceed 500mA on 500mA-channel.
- Continuous current draw must not exceed 1.5A on 2A-channel.
- Peak current draw must not exceed 2A on 2A-channel.
- Input voltage **must** be between V_{in-MIN} and V_{in-MAX} to maintain constant Output Voltage.

2.1. Powering Radio (FIRST Robotics Competition)

A common use of the VRM is to power a wireless router for the purpose of remotely controlling a robotic mechanism. Consult the radio/router's voltage requirements to determine whether to use 5V or 12V. Consult the radio/router's current/power requirements to determine if the radio can be adequately powered by the VRM.

Example tested radios...

OpenMesh OM5P-AN



Use the **12V 2A** connection on the VRM. FRC teams should consult the FRC documentation.

DAP1522



Use the **5V 2A** connection on the VRM. However this radio is **not legal** to use in the FRC2016 season.

2.2. Weidmuller Connectors

Wire Insertion

- Disconnect PDP from Battery before adding or modifying connections
- Strip wire back **~0.375" (3/8")**
- Press and hold down connector button. Though this isn't necessary, it ensures the stripped wire does not deform and split into "whiskers" after excessive use. A small screwdriver can be used to easily hold down the connector button.
- Insert wire into connector opening
- Release connector button
- Pull wire to ensure wire is locked in connector
- Confirm wire strands are not extruded

Wire Inspection

- Verify that there are no "whiskers" outside of the connector that may cause a short.
- Verify that the stripped portion of the wire is not excessive enough to cause a short.
- Tug on the wire and verify wire does not pull out. If it does then recheck gauge and/or strip the wire back further.

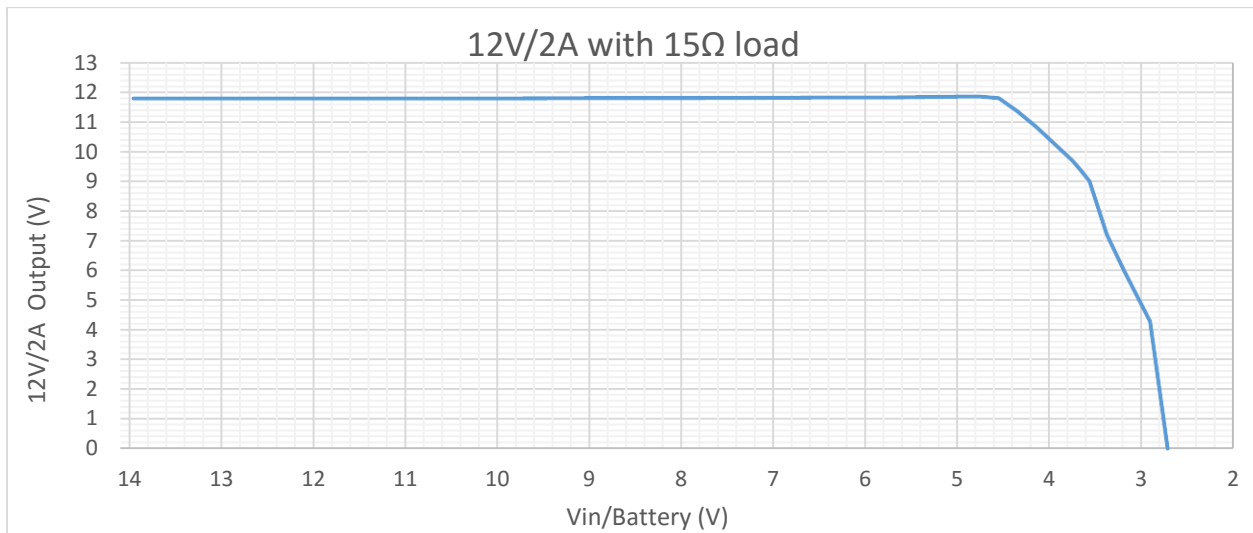
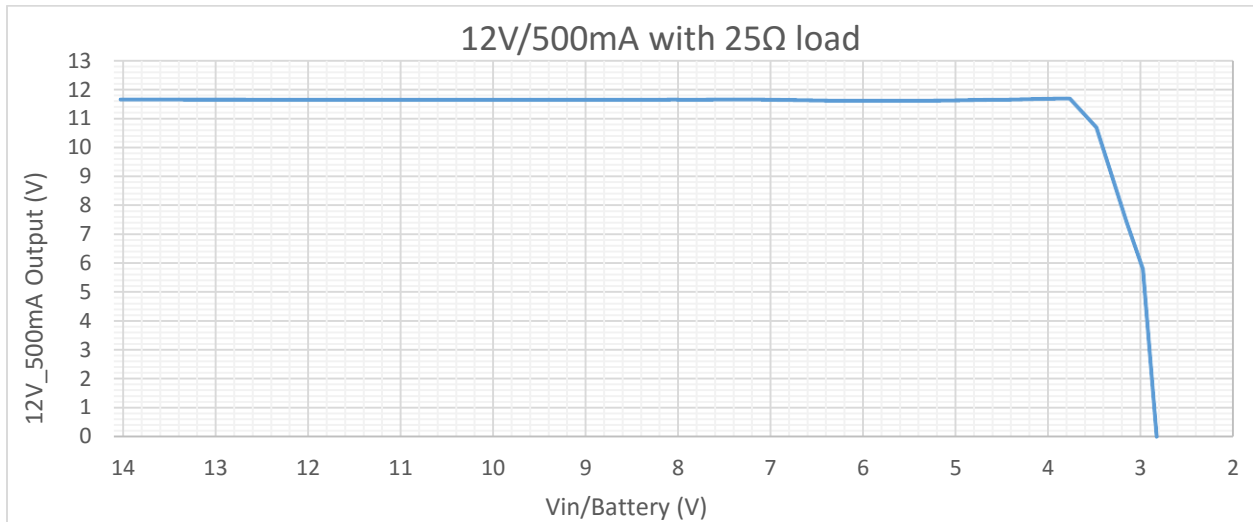
Wire Removal

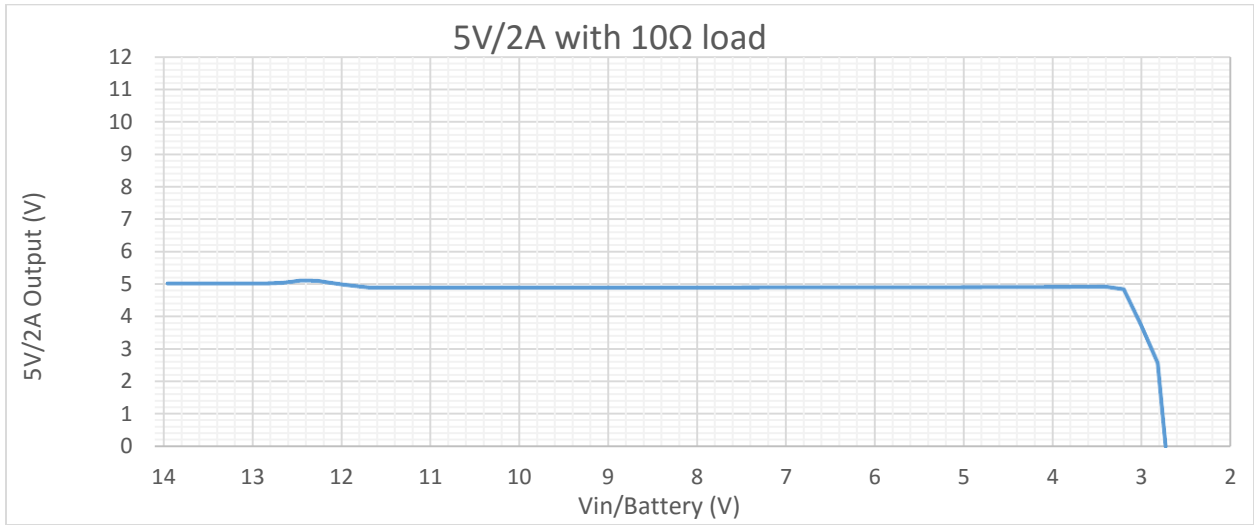
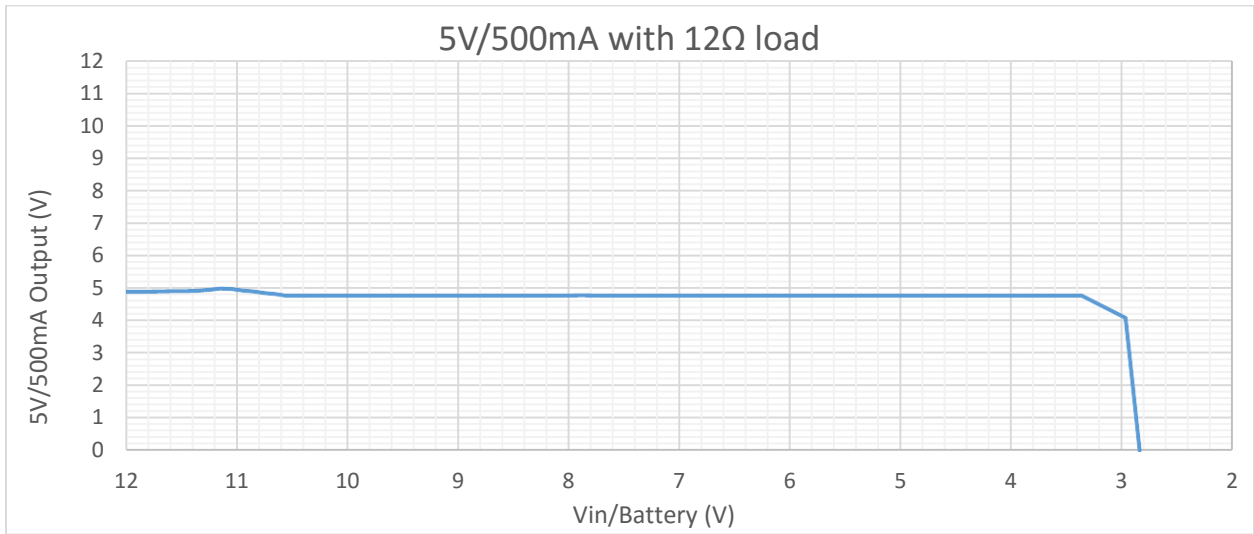
- Press and hold down connector button immediately above connector opening
- Pull wire to remove from connector

Limitations

- Wire should **not be frayed** upon insertion. Extruded wire may short to adjacent channels.
- Wire should be **no larger than 16 AWG**, larger gauges will not properly fit in connector
- Wire should be **no smaller than 24 AWG**, smaller gauges will not lock in connector

3. Typical Performance Characteristics





4. Troubleshooting Tips and Common Questions

4.1. My OpenMesh OM5P-AN doesn't seem to power up.

Make sure the OpenMesh OM5P-AN radio is plugged into the **12V-2A** connector. Be mindful of the connector polarity (center-positive).

4.2. Why does the VRM have a "radio sticker" on the 5V rail?

Previous FRC seasons leveraged a 5V radio. However the FRC2016 radio (OM5P-AN) is a 12V device.

4.3. If the radio requires 12V, does that mean radio will "brown-out" if battery voltage dips below 12V?

No, the VRM will boost voltage to 12V if the input is less than 12V. See section 3 for the performance plots.

5. Revision History

Rev	Date	Description
1.1	17-Jan-2016	Updated radio references
1.0	30-Dec-2014	Initial Creation