15 Amp Digital PWM Motor Speed Controller

The SPD-815 Analog / Digital PWM controller allows you to control the speed of a motor, brightness of a lamp or other device using an analog voltage input, push buttons, or digital logic pulses. Use of PWM and low ultra-low on-resistance MOSFETs allows for high efficiency control with minimal loss of power. The SPD-815 is a drop-in replacement for the SPD-2115B-E(D)(S) series of controllers, with all electrical and connecting specifications the same. The only difference is that the SPD-815 has configurable soft-start.

Absolute Maximum Ratings:

Parameter	Max	Units
Continuous Output Current	15	A
Instantaneous Output Current	25	A
Input Voltage	40	V

Warning – operating at or above the absolute maximum ratings may damage your controller or your equipment under control.

Operating Parameters:

Parameter	Min	Typical	Max	Units
Input Voltage	5.5	--	36	V
Input Voltage, Transient Low (0.5 sec)	0	--	--	V
Continuous Output Current	--	--	15	A
Digital Logic Input Low Level	0	--	1.5	V
Digital Logic Input High Level	3.5	--	5	V
Digital Input Capacitance	--	0.1	--	uF
Analog Voltage Input	0	--	5	V
Digital Pushbutton Mode Change Rate	--	33	--	% / s
Soft Start from Disabled Mode, Ramp Rate	--	100	--	% / s
PWM Frequency	150	200	250	Hz
Quiescent Current Drain	5	6	8	mA
Ambient Temperature	-40	25	+50	°C

Pin-out:

Pin Label	Function	Active H/L	Mode
EN	PWM output enable (internal pull-up)	H = enable L = disable	Both
UP	Increase Pulse Width (internal pull-up)	L = increase	Digital
POT+	Upper pin of potentiometer (5V)	--	Both
DN/Center	Wiper of potentiometer (analog) Decrease Pulse Width (digital) (internal pull-up in digital mode)	L = decrease (digital)	Both
POT-	Lower pin of potentiometer (GND)	--	Both
OUT-	Negative output to LOAD	--	Both
OUT+	Positive output to LOAD	--	Both
GND in	Ground from power supply	--	Both
V+ in	Positive Power Supply	--	Both

Modes of Operation:

The Analog/Digital PWM Controller can be operated in analog or digital mode. A set of on-board DIP switches configures the controller. Set DIP Switch 1 to ON to select analog mode. Switch 2 is used to select between digital modes: pulsed for microcontroller interface, or pushbutton speed control. Switch 3 is used to enable / disable soft start.

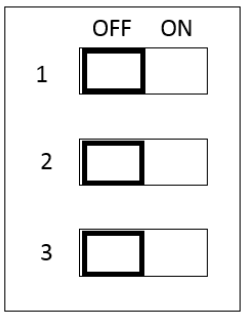


Table 1: DIP Switch Configuration

Switch Number	**OFF**	**ON**
1 – Analog / Digital Mode	Digital Mode	Analog Mode: Pot or 0-5V Input
2 – Digital Mode Options	Push Button Mode	Pulsed Input Mode
3 – Soft Start Option	Soft Start Disabled	Soft Start Enabled

Note: All DIP Switch changes take effect at power-up. Power down the board before changing settings.

Analog Mode:

When the board is configured for Analog operation, a varying voltage (0 – 5 V) level is converted to pulse width at the output (0 – 100%). A 5kΩ potentiometer (or any pot with a total resistance of 1kΩ up to 30kΩ) may be used for speed control.

There is a built-in dead-band for potentiometer operation that sets the duty cycle to:

0% for any voltage level < 0.10 V.
100% for any voltage level > 4.90 V.

This dead-band along with digital filtering ensures smooth and reliable operation even with dirty potentiometers.

Digital Modes:

There are two ways to operate in digital mode: Pulsed Mode and Pushbutton Mode.

Pulsed Mode:

In pulsed mode, the UP and DN inputs are pulsed to control the duty cycle. For every rising edge of the UP [DN] line, the output pulse width is increased [decreased] by approximately 0.4%. Once the pulse width reaches 0%, any further inputs on the DN line have no effect. Similarly, when the pulse width reaches 100%, any further inputs on the UP line have no effect.

Pushbutton Mode:

In pushbutton mode, the UP and DN inputs are designed for interfacing to push buttons. When the UP line is brought LOW, the duty cycle is continuously increased at a rate of

about 33% per second. Similarly, when the DN line is brought low, the duty cycle is decreased at a rate of about 33% per second. Any additional increase [decrease] after the pulse width has reached 100% [0%] will have no effect on the output.

Automatic digital de-bouncing of the inputs is implemented in pushbutton mode.

Output Enable:

The output is enabled by default and is internally pulled up. Bringing this pin low immediately brings the PWM output to 0%. Allowing the pin to go back to high re-enables the PWM output at the previous duty cycle.

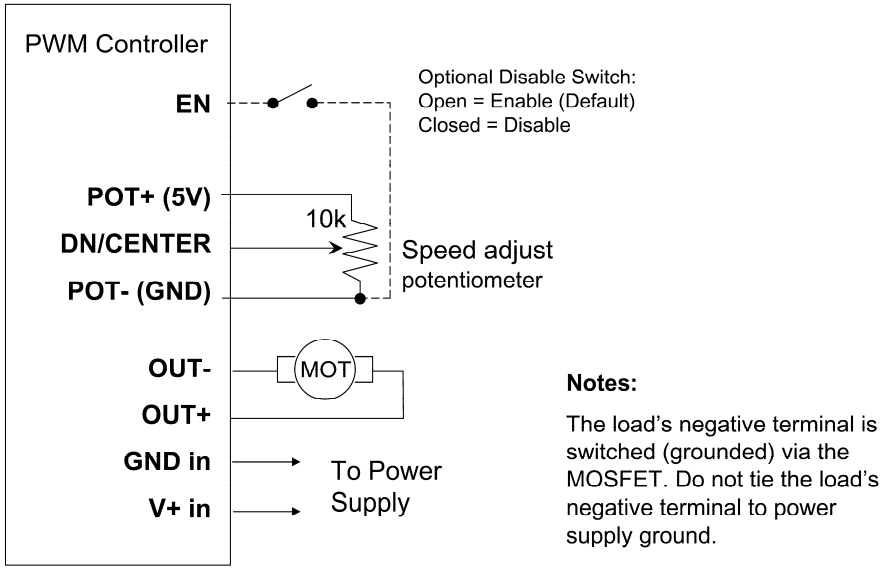
When in digital mode, the duty cycle may be changed by the UP and DN pins at all times, even in PWM output disabled mode. Thus, it is possible to turn off the output, change the duty cycle, and turn on the output again, but at the new duty cycle.

Soft Start:

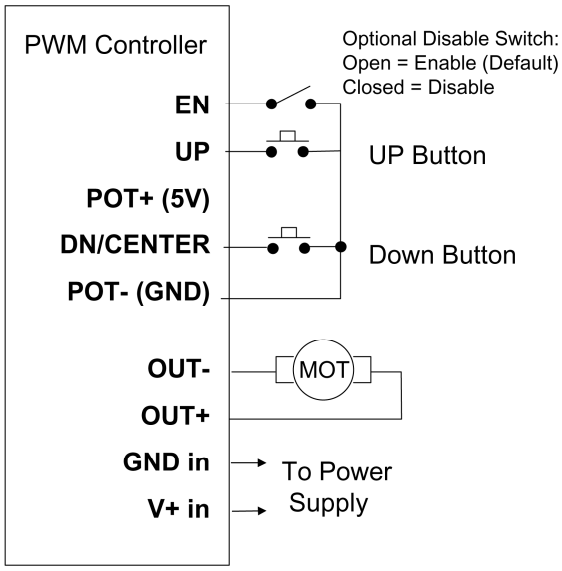
To enable soft-start, set DIP switch 3 to ON. In this mode, the output is automatically ramped up to the selected PWM level at a rate of 100% per second. This reduces the stress placed on power supplies and mechanical linkages as motors come back up to speed, or as high temperature resistive loads heat up (such as light bulbs).

Connection Diagrams:

Analog Control Mode:



Push Button Interface Mode:



Notes:

Press and hold the UP button to increase the power. Press and hold the DOWN button to decrease the power.

The load's negative terminal is switched (grounded) via the MOSFET. Do not tie the load's negative terminal to power supply ground.

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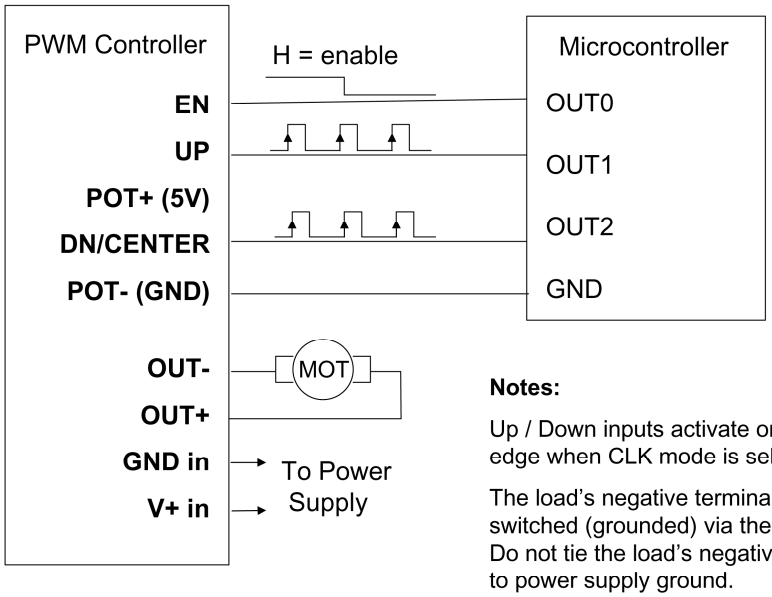
Microcontroller Interface (Pulsed) Mode:



Notes:

Up / Down inputs activate on the rising edge when CLK mode is selected.

The load's negative terminal is switched (grounded) via the MOSFET. Do not tie the load's negative terminal to power supply ground.

Application Notes:

A fuse appropriately rated for the load device is required to ensure safe operation.

This controller is not reverse-polarity protected. **Ensure that it is wired correctly before applying power.** Always turn off the power supply before making any changes to the wiring.

PWM controllers switch currents at high frequencies to vary the average power to the load. This switching can cause undesirable RF interference. To minimize such interference, it is recommended to twist the input V+ and Ground wire pair as well as the Out+ and Out- wire pair.

Ensure that the controller has adequate air flow for proper cooling. If operating for extended periods of time in high temperature environments, a cooling fan may be necessary.

Use the shortest possible wiring between the load and controller, and between the controller and the power source. Ensure that the cables carrying the load current are adequately sized. If the wiring from the power source to the controller is more than 12 inches long, a 2200 uF 50V filter capacitor should be connected to the V+ and GND terminals of the PWM controller. Inadequate power supply filtering or other causes leading to a high impedance path to the power supply will result in higher losses in the filter capacitor and wiring, and may damage the load and/or controller.

The heat sink area around the MOSFET on the circuit board is electrically live. Do not connect anything to the holes, and do not use it as a mounting location. Use only the holes provided on the four corners of the board for mounting.

30-Day Limited Warranty:

Subject to the provisions described below, CRITICAL VELOCITY ENTERPRISES, LLC ("Critical Velocity") warrants this product to be free from defects in material and workmanship for thirty (30) days from the date of purchase by the original consumer. If any part is found to be defective during the warranted period, it will be repaired or replaced with the same or functionally equivalent product by Critical Velocity, at its discretion, free of charge provided you: (1) return the failed product to Critical Velocity with shipping prepaid, and (2) provide Critical Velocity with proof of the original date of purchase. Repaired or replacement products will be returned to you with shipping charges prepaid.

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