

30 Amp Constant Current/Current Limiting PWM Resistive Load Controller RLC-230

The RLC-230 is our second-generation constant current PWM controller designed for resistive (non-inductive) loads. The control input is via any 5k potentiometer or 0-5V control signal, and the resulting output is a variable 0-100% pulse-width modulated output. The controller features two modes of operation – current limiting, where the maximum allowable current is limited by the onboard potentiometer, or constant current, where the current level is controlled by the external pot, and the full scale range from 0 – 30 Amps is selected via the onboard pot.

In addition, sophisticated algorithms ensure safe operation through automatic fault detection and onboard diagnostics, overload protection, over-temperature protection and reverse polarity protection.

Features:

- Two modes – current control and current limiting
 - 0 - 30 Amps
 - 0 – 100% pulse width output range
 - 5 k pot or 0-5V control
 - 12 volt nominal operation, low battery shutoff
 - Integrated power relay with optional external control
- Up to 99% efficiency
 - Over-current, over-temperature, over-voltage protection
 - Reverse polarity protection
 - Potentiometer fault detection
 - Automatic fault detection and diagnostics
 - Onboard current limit potentiometer
 - LED status indicator
 - High temperature, low ESR, long-life filter capacitors

Absolute Maximum Ratings:

Parameter	Max	Units
Continuous Output Current	30	A
Input Voltage	17	V

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

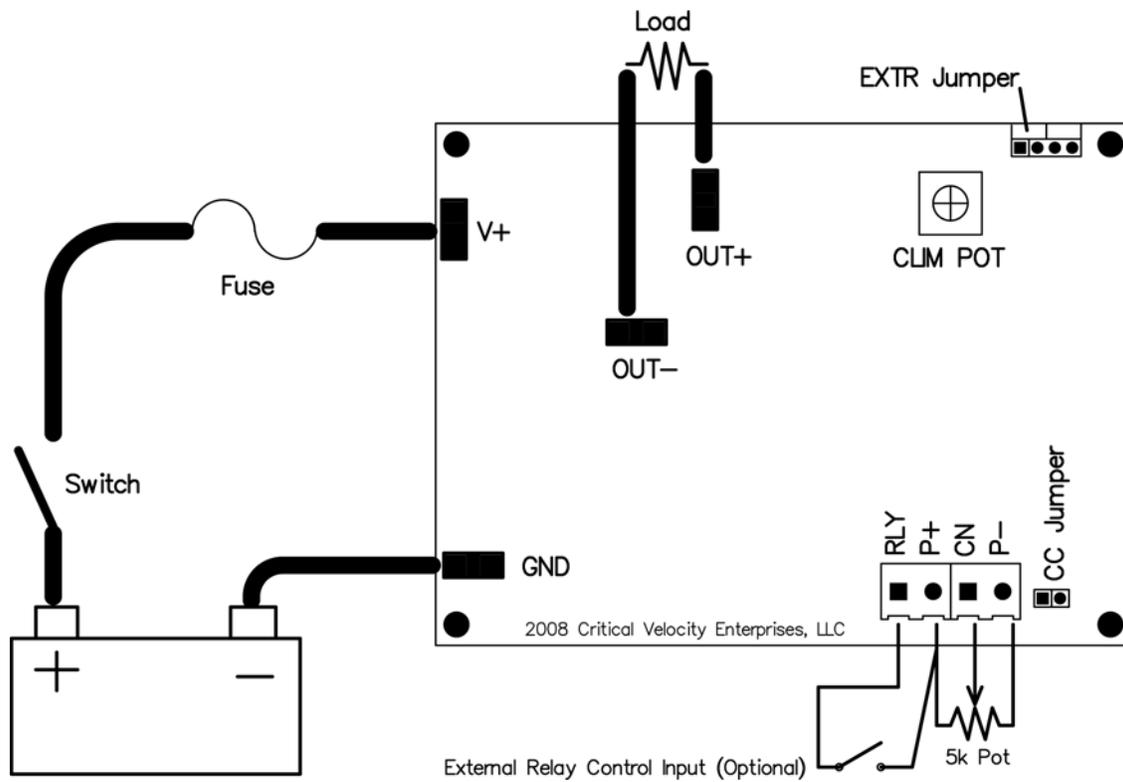
Operating Parameters:

Parameter	Min	Typical	Max	Units
Input Voltage	11	12	15	V
Continuous Output Current	--	--	30 *	A
Analog Control Voltage Input	0	--	5	V
Analog Control Current	0	--	0.1	mA
Soft Start from Disabled Mode, Ramp Rate	--	20	--	% / s
PWM Frequency	180	200	220	Hz
Quiescent Current Drain	10	150	200	mA
Temperature	-40	25	+65**	°C

* Automatically Limited.

** Current output will be limited at high operating temperatures

Wiring Diagram:



Pin-out:

Pin Label	Function	Active H/L
RLY	Power control signal – turns on and off controller.	H
P+	Upper pin of potentiometer (5V)	--
CN	Wiper of potentiometer or Analog 0-5V input	--
P-	Lower pin of potentiometer (GND)	--
OUT-	Negative output to load	--
OUT+	Positive output to load	--
GND	Ground from power supply	--
V+	Positive Power Supply	--

Modes of Operation:

The RLC-230 can operate in two modes: Current Limiting and Constant Current.

Current Limiting:

In Current Limiting mode, the external potentiometer directly controls the PWM level, from 0 – 100%. Thus, when the external pot is set to the maximum setting, the controller will output a 100% pulse width (full on). However, if the current drawn exceeds the level set by the onboard CLIM potentiometer (0-30 amps), the PWM output level automatically reduces to keep the current below the current limit.

This mode is most suitable for loads where the current draw does not change much over time and the maximum draw is under 30 amps at 100% PWM. Such loads include heaters and lamps.

Current Control:

In Current Control mode, the external potentiometer directly controls the desired current draw. In this mode, the onboard CLIM pot determines the full scale current range of the external potentiometer. The PWM output automatically ramps up or down to maintain the desired current draw.

For example, if the onboard CLIM potentiometer is set to 50%, this corresponds to a full scale output of (50% of 30 amps) = 15 amps. The external potentiometer then adjusts the current level within this range of 0 - 15 amps. If the external potentiometer is adjusted to 100%, the desired current will be set to 15 amps. Similarly, if the external potentiometer is adjusted to 25%, the desired current will be set to 25% of 15 amps, or about 3.7 amps.

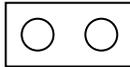
This mode is most suitable for loads where the current draw changes over different operating conditions and a constant power output is desired. Such loads include electrolytic cells, where current draw increases as the operating temperature of the cell increases. This mode is also suitable for loads that would normally draw more than 30 amps when directly connected to a power supply.

Setup:

The RLC-230 comes with 0.25 inch quick-connect terminals for the power connections, and terminal blocks for signal connections.

Controller Configuration:

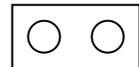
Mode Selection:

	Jumper Label	Position	Function
	CC	Open	Current Limiting
	CC	Closed	Constant Current

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

External Relay Control Signal Configuration:

This controller includes an external relay control terminal, labeled RLY. This terminal allows you to enable and disable the main power to the controller using a small switch or a 5V control signal. This feature can be enabled or disabled using the jumper as follows:

	Jumper Label	Position	Function
	EXTR	Open	External Relay Control Signal is connected.
	EXTR	Closed	External Relay Control is not used.

Please note that for maximum safety, a separate power disconnect switch connected in series with the V+ line should be installed, in series with an appropriately rated fuse.

Signal Connections:

Connect a potentiometer between the P+, CN and P- terminals. The center pin or wiper of the potentiometer should be connected to the CN terminal. If using an analog input voltage instead of a potentiometer, connect a 4.7k resistor between the P+ and P- terminals.

If the external power control feature is used, connect a switch between the RLY terminal and the P+ terminal. When the switch is closed, the controller's power relay will be enabled.

Power Connections:

Connect the load to the OUT+ and OUT- terminals. Ensure that the wire you are using is adequately sized for the expected operating current.

Connect the V+ terminal to an appropriately rated fuse, and then to the positive supply. Connect the GND terminal to the ground of the power supply.

Testing:

- Turn the onboard CLIM pot to the desired current limiting position. Full scale is 30 amps.
- Set the external potentiometer to the minimum level (or 0 volts at the CN pin).
- Turn on the power supply. The voltage should be 12 volts.
- If the external relay control signal is used, enable the switch.
- If everything is ok, the relay will activate, and the LED should flash slowly (about once every two seconds)
- Slowly turn up the external potentiometer. The pulse width at the output should increase and current should now be flowing through the load. The LED may start flashing a little faster if the controller starts to limit current.

LED Status Definitions:

Slow Flashing (0.5 Hz)	Normal operation, current limiting is not active.
Medium Flashing (1 Hz)	Current limiting operation – the controller is actively adjusting the PWM output to limit the current to the desired level.
Rapid Flashing (2 Hz)	One or more parameters are not in operating range (under/over voltage, excessive current, over temperature, pot wiring fault)

Protection Features:**Over-Current**

The maximum current is limited to 30 Amps. If there is a short circuit, the controller will enter shut down mode and attempt to restart after a short delay.

Over-Voltage

The maximum operating voltage is about 15 volts. If the voltage exceeds about 16 volts, the controller will shut down until the voltage is back in range.

Under-Voltage

The minimum startup voltage is about 11 volts. Under load, the input voltage may sag due to voltage drops in the wiring and the internal resistance of the power source. If the voltage drops below about 9 volts, the controller shuts down until the voltage is back in range.

Over-Temperature

The maximum operating temperature is 120°C. If this limit is exceeded, the controller will shut off until the temperature drops. Above 90°C, the maximum allowable current output decreases until 120°C is reached, at which the maximum current allowed is 0A.

Reverse Polarity

If the V+ and GND connections are reversed to the power supply, the controller will not activate, but remains undamaged.

Potentiometer Fault

If one of the connections of the potentiometer becomes disconnected, the output shuts off.

Soft Start:

At startup, the output is automatically ramped up to the full PWM level at a rate of about 20% per second. This reduces the stress placed on the power supply and the load.

Wiring and Installation Notes:

Cooling:

The controller should be installed in a location that allows air flow over the board to provide cooling. If it is installed into an enclosure, ensure there is adequate ventilation for proper cooling. A cooling fan may be necessary in high temperature environments to stay within limits. If the controller becomes overheated, it will shut off until the unit cools down.

Wiring:

Ensure that properly sized wire is used for the high current connections. The voltage input to the controller should be connected as close to the power source as possible using the shortest possible wire lengths to minimize wire inductance.

PWM controllers switch currents at high frequencies to vary the power output. To minimize interference this may cause, the V+ and GND wires should be twisted together, and the OUT+ and OUT- wires should be twisted together. The bundle of P+, CN, P- and RLY wires should be twisted together to minimize any noise pickup. This becomes especially important when the wire lengths exceed 12 inches.

Triple-check the wiring before applying power to minimize risk of damage due to incorrect wiring.

Installation:

If installed in an environment with a lot of vibration, use vibration damping grommets or mounts to reduce the chance of damage. The controller should be protected from the elements if used in an outdoor environment.

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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