

Model 500 Peak and Hold PWM Driver



OVERVIEW

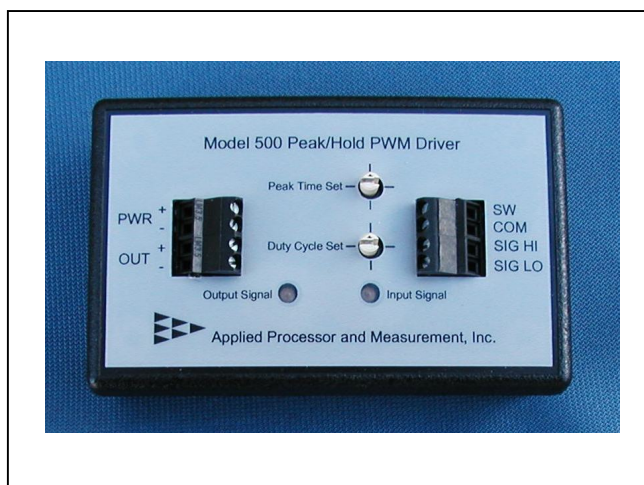
- peak (full on) solenoid pull-in followed by high frequency PWM output to reduce hold current
- on/off solenoid control with coil power reduction feature
- reduce power consumption, save energy
- reduce solenoid coil heat and extend coil life

FEATURES

- adjustable peak time and hold PWM duty cycle using miniature rotary switches - digitally set, known precise timing, no parameter drift with temperature or age
- dual input trigger source – use either:
 - 5 to 28V DC digital input – optically isolated
 - contact closure
- jumper option: contact closure input may be used for PWM hold disable – for override of PWM hold feature in high load conditions
- adjustable PWM frequency: 500 to 25,000 Hz
- power MOSFET output with low side load drive
 - output sinks up to 4A at 12V during hold
 - up to 6A during peak time
- controller operating voltage 9 to 28 V DC
- load may be operated with up to 50V DC
- built-in back emf protection diode
- I/O connection using screw-down terminal strip
- stand-alone controller, small signal conditioning size package, DIN mountable option available
- operating temperature: -40 °C to +60 °C
- designed for long service life, high reliability, and high availability (24/7) using components rated for industrial temperature range

DESCRIPTION

The Model 500 Peak and Hold Pulse Width Modulation Driver from Applied Processor and Measurement, Inc. is designed to drive solenoid-based devices with an initial full-on pull-in pulse, then provide a reduced power hold-in current by pulse width modulating the output. The Model 500 can reduce overall current in on/off based solenoid drive applications, reducing the operating solenoid coil heat, thereby extending coil life and protecting the coil from burn-out. The Model 500 may also be used to save overall installation power consumption and energy.

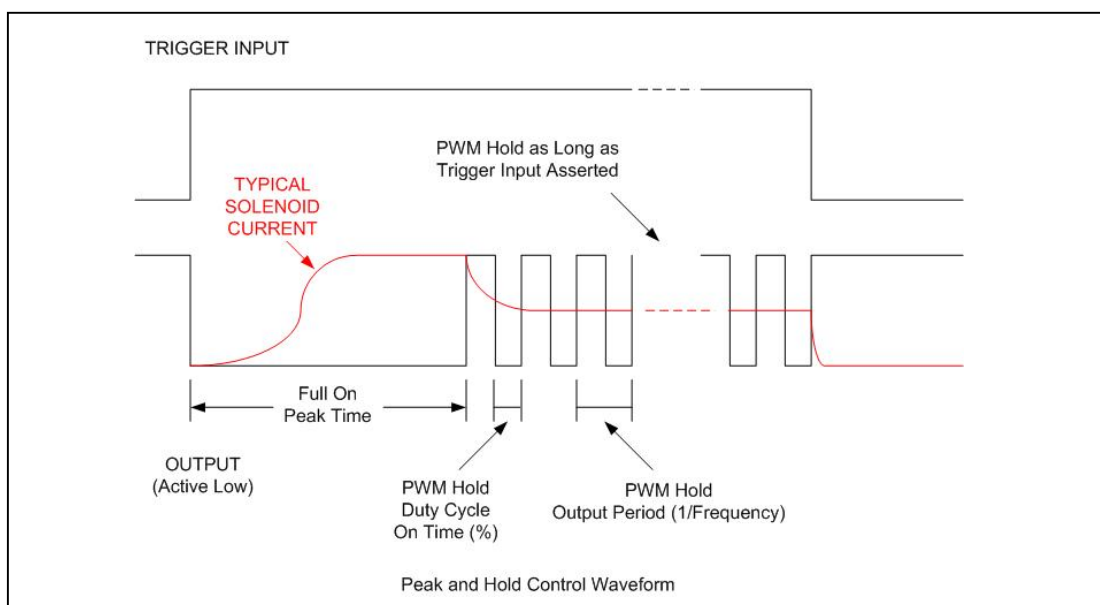


APPLICATIONS

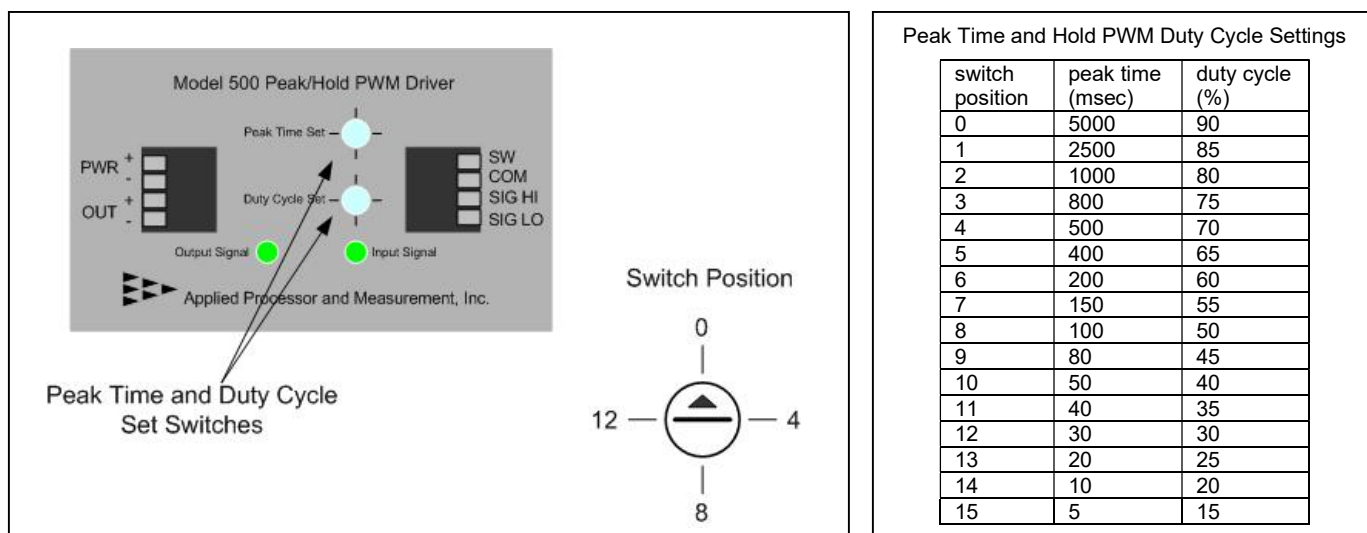
- power reduction on any on/off coil operated device, peak and hold solenoid control
 - valves, actuators, solenoids
 - clutch coils
 - fuel injectors
 - DC motor speed control
 - LED's / lighting systems / dimming
- extend coil life, protect coil burn-out
- save energy and costs
- easy to install in-line with existing installations to gain benefits of reduced current and solenoid wear due to overheating
- 25 KHz PWM fan speed controller
- drive with PLC or PC, virtually any digital input signal, or contact closure
- industrial, automotive test, refrigeration system applications
- OEM / production applications

OPERATION

A typical on/off sequence of the Model 500 Peak and Hold PWM driver is shown below. The output control is triggered by assertion of either trigger input. When the input is asserted, the controller will set the output at full-on for the set peak time. The peak time should be set to allow for complete solenoid engagement. When the peak time is complete, the controller will PWM at the hold duty cycle. The PWM output is cycled on and off at a high frequency (1,000 Hz for example) so that the solenoid will not mechanically respond, however, the average current through the solenoid is sufficient to hold the actuator in place. The hold duty cycle should be selected to reduce current, but guarantee solenoid hold. The waveform below shows the trigger, the output (which is active low) and a typical average output current (shown in red in the figure). When the full-on peak time is executed, the solenoid current drives to its maximum. During the hold time, the output current is reduced, based on the percentage of the duty cycle that is set. The output remains at PWM hold until the trigger input is removed.



The Model 500 PWM Peak and Hold PWM Controller has two rotary switches on the face of the unit which allow for precise setting of the peak time and the hold PWM duty cycle. Timing and PWM control are generated using microcomputer circuitry internal to the Model 500 unit. Refer to the figure and tables below to set the Model 500 peak time and hold PWM duty cycle.

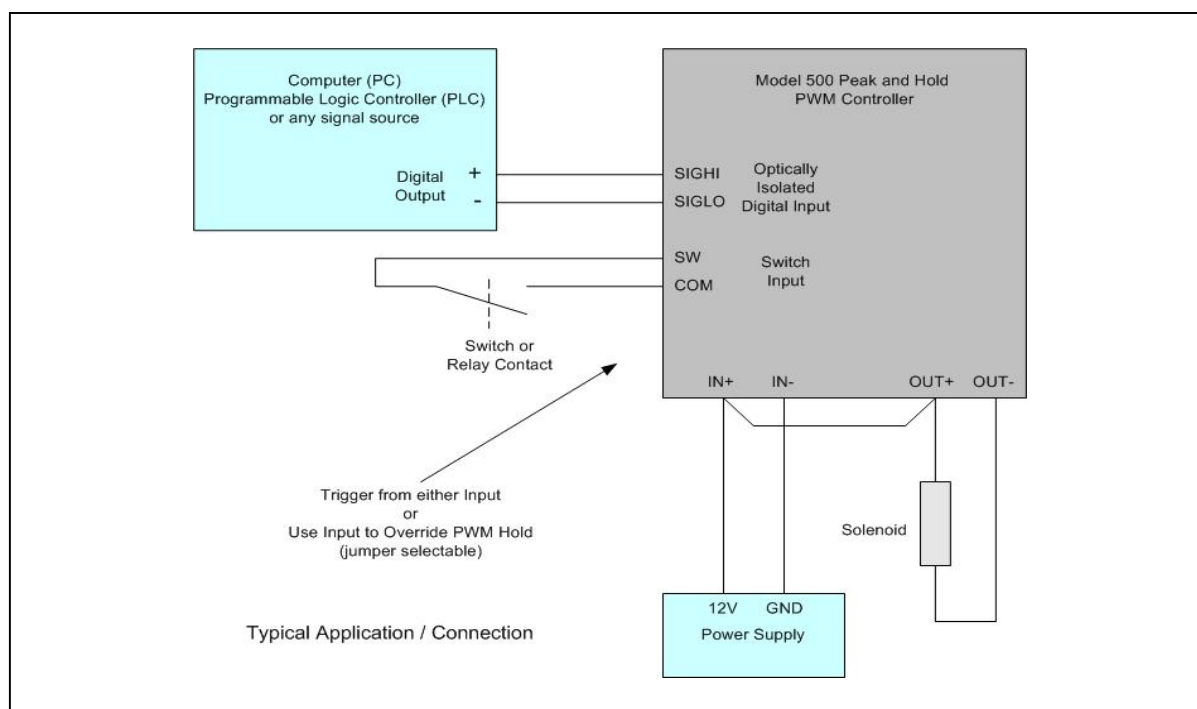


INSTALLATION

A typical connection using the Model 500 Peak and Hold PWM controller in a single power supply configuration is shown in the diagram below.

The controller output is an open-drain power MOSFET output, providing low side drive of the load to be controlled. An external power source must be provided. This power source may be used to power both the load and the controller, however, the controller need not be powered by the same power source. A dual supply configuration (see next diagram below) may be used to power the controller (9 to 28V DC) and the load (1 to 50V DC) separately. The Model 500 may be triggered using either the wide input range optically isolated digital input or a contact closure (non-isolated). This allows for virtually any digital output, relay contact, or computer or PLC based control to be used as the load trigger. Note that an internal jumper defines the function of the SW/COM input. By default (jumper removed), the SW/COM input is a trigger input. If the jumper is installed, the SW/COM input becomes a PWM hold disable input. This is used to disable the PWM hold feature for high load conditions when full power is necessary for the application.

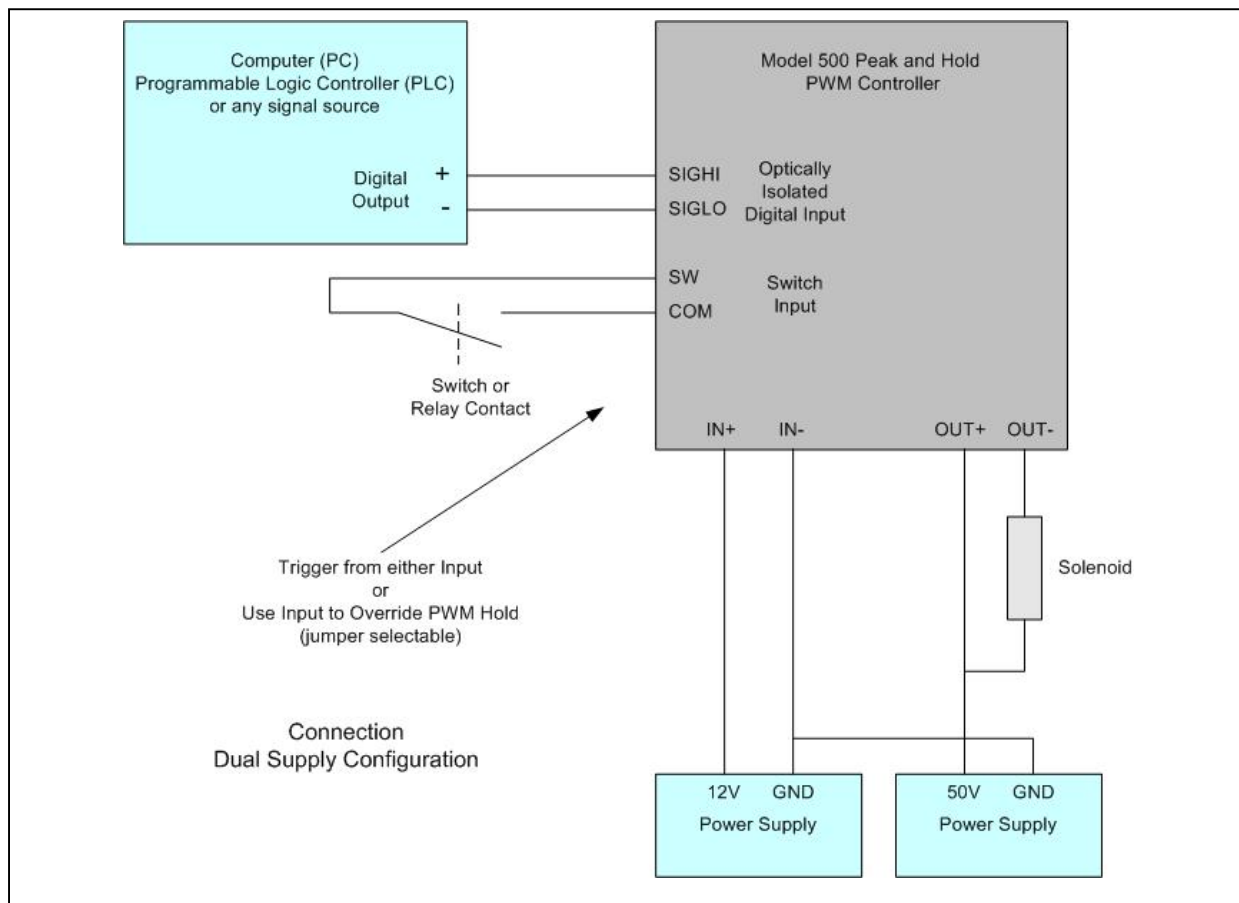
A trigger input signal is not required. The input power may be used to trigger the peak and hold sequence. Simply apply power to the IN+/- input and wire the SW/COM terminal together. The output sequence will begin with the full-on pulse, followed by the PWM hold as long as power is applied to the Model 500.



The Model 500 output can operate from 1 to 50V DC. A dual supply configuration, as shown in the figure below, is required for operation in this case.

In the dual supply configuration, there is a separate power supply for the Model 500 controller and a separate power supply for the load. Note that the negative terminals (ground) must be connected together in this configuration. The internal inductive kickback diode is wired between the OUT+/- terminal. The diode may be removed from the circuit if a specific external diode is preferred.

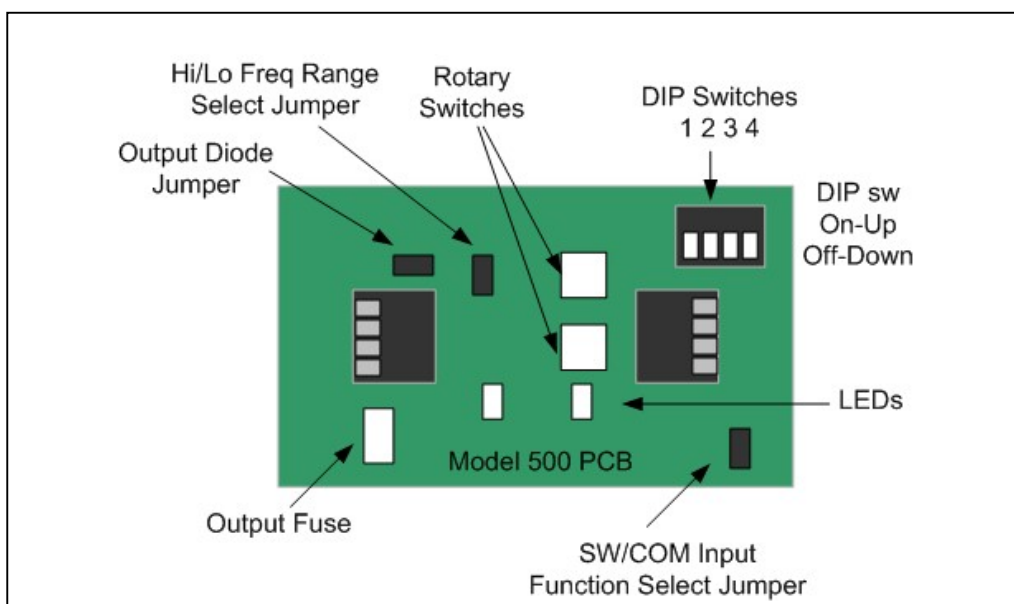
The power supply for the load must be rated for the voltage and current necessary to drive the load. The power supply for the Model 500 must only be rated for powering the Model 500 unit, typically less than 20mA at 12V DC (suitable for a small AC/DC power adapter).



ADDITIONAL SETTINGS

Additional settings for the Model 500 Peak and Hold Controller include: a jumper for the SW/COM contact closure input function (see above paragraph for jumper settings), an output fuse, a back emf protection diode jumper, the PWM hold High/Low frequency setting jumper and DIP switches to set the PWM hold frequency. Refer to the illustration below for switch and jumper locations.

The cover may be removed to expose the top of the circuit board in the Model 500 unit and the switch and jumper adjustments.



A replaceable cartridge fuse (Littelfuse series R451, p/n 0451004.MRL) is used to protect the MOSFET output (OUT-) terminal. The default fuse value installed is 4A.

For coils with built-in back emf diodes, or a customer specific diode requirement, the Model 500 output diode may be removed by removing the output diode jumper.

The PWM hold frequency may be changed. The standard PWM frequency is 1,000 Hz and is suitable for most applications. With the jumper not installed, the DIP switches adjust the frequency in the low frequency range (compatible with older Model 500 units). With the jumper installed, the DIP switches adjust the frequency in the high frequency range.

sw1	sw2	sw3	sw4	Low Range Setting (Hz)	High Range Setting (Hz)
off	off	off	off	500	1000
off	off	off	on	600	5000
off	off	on	off	700	10000
off	off	on	on	800	15000
off	on	off	off	900	20000
off	on	off	on	1000	25000
off	on	on	off	1100	10000
off	on	on	on	1200	10000
on	off	off	off	1300	10000
on	off	off	on	1400	10000
on	off	on	off	1500	10000
on	off	on	on	1000	10000
on	on	off	off	1000	10000
on	on	off	on	1000	10000
on	on	on	off	1000	10000
on	on	on	on	1000	10000

SPECIFICATIONS

- PWM Output: open drain Power MOSFET, maximum power dissipation 50W
 - up to 4A continuous
 - maximum of 6A during peak time (<100msec, depending on output fuse value)
 - must operate within safe area of IRLR2905Z
 - built-in fuse on output, standard value 4A
 - back emf output protection diode across output +/- terminals (S2BA-13-F)
- PWM Output Operating Voltage: 50V maximum, 1V minimum
 - optional 5V only output low-drive signal available
- Control Type: digital control, microcomputer based
- Peak, Full-On Times: selectable from 5 msec to 5 sec.
- Hold PWM Frequency: default 1,000 Hz low range
 - low range: configurable in 100 Hz resolution from 500 to 1,500 Hz
 - high range: configurable from 1,000 to 25,000 Hz
 - typical error < +/- 2%
- Hold PWM Duty Cycle: 15 to 90 %, adjustable in 5 % steps, typical error < +/- 1%% duty
- Trigger Digital Input – trigger peak and hold cycle with either input
 - opto-isolated signal input, 5V to 24V required to enable, 0V to disable
 - switch / contact input, short SW and COM pins, non-isolated, internal pull-up to 5V
- Power: requires 9V to 28V DC, regulated or un-regulated external source
 - controller power consumption: 20 mA (approximate) at 12V DC
 - dual supply required for operating loads outside of 9V to 28V controller operating range
- Operating Temperature: -40 °C to +60 °C
- Size: 3.625 in. x 2.25 in. x 1 in. (1.25 in. height with I/O connectors, not including DIN mounts)
- Warranty: 1 year, for manufacturing defects

ORDER NUMBERS – CONTROLLERS AND ACCESSORIES

PWMC-500	Model 500 Peak and Hold PWM Driver
PWMC-500-DIN	Model 500 Peak and Hold PWM Driver, DIN Rail Mountable
PWMCA-FS42	Model 500 fuses, 2A, package of 10 (Littelfuse p/n 0451002.MRL)
PWMCA-FS44	Model 500 fuses, 4A, package of 10 (Littelfuse p/n 0451004.MRL)

CUSTOM / SEMICUSTOM CONTROLLERS

All standard products from Applied Processor and Measurement, Inc. including the Model 500 Peak and Hold PWM Driver are available for customization.

Inquire with APM, Inc. regarding different peak and hold settings tables and other PWM frequencies. Customized settings tables are available (often at no extra charge). Also, fixed value controllers may be supplied for any application. Additionally, the Model 500 can be designed to exacting specifications for your application, reducing cost for high volume applications, changing functionality, packaging, or adding features.

For more information, contact APM, Inc. via our website, or, call to talk to one of our engineers. APM, Inc. has been supplying embedded electronic controls for over 30 years for a wide variety of industrial, automotive and commercial applications.