

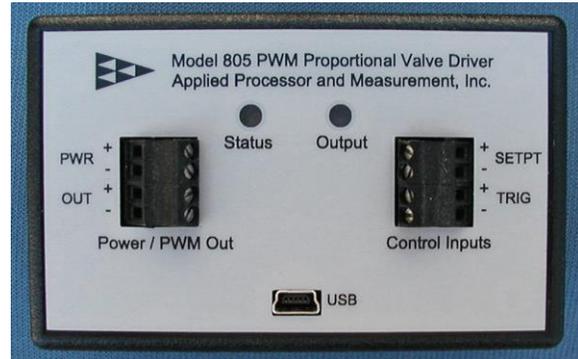
Model 805 PWM Proportional Valve / Solenoid Driver with Peak and Hold Control Modes

FEATURES

- Proportional Valve Driver with PWM output
 - 3.5A max proportional control, 6A peak
 - 400 to 5000 Hz PWM Frequency
- proportional control with internal current sensing maintains output current independent of changes in valve solenoid coil resistance (self-heating) and the supply voltage
- PWM Dither Frequency: 50 to 500Hz
- peak and hold operating modes
 - select from four peak and hold modes
 - three peak current ranges: 2A, 4A and 6A
 - peak current with timeout
 - external or self-timed trigger (10 to 80Hz)
- optically isolated input trigger
 - enable/disable for proportional control mode
 - trigger for peak and hold modes
- analog/USB control of output current setpoint
- fully differential analog input (5V, 10V, 4-20mA)
 - over +/- 100V common mode rejection
- remote setup and operation via USB port
 - read and save current settings in non-volatile memory
 - **NO** potentiometers - all settings modified using a PC Graphical User Interface (GUI)
 - digital control, no drift, high noise rejection
 - access to advanced control parameters: PID constants, start-up ramp, min/max duty %
- output monitor and status/fault indicator LEDs
- power MOSFET output with low side load control, PWM output sinks up to 4A at 12V (avg)
- operates from 9V to 28V DC
- signal conditioning style unit, small form factor

DESCRIPTION

The Model 805 PWM Proportional Valve / Solenoid Driver from Applied Processor and Measurement, Inc. generates a high frequency, pulse width modulated, self-controlled variable duty cycle electrical switching signal that controls the output to a constant average current across a solenoid. The product is used in industrial and automotive applications where valves, solenoids, injectors, or other magnetic / mechanical elements are developed, applied and / or tested. Its small size and low cost also make the Model 805 PWM Proportional Driver ideal for OEM and production applications.



APPLICATIONS

- Proportional PWM Control
 - PWM drive for valves, solenoids, injectors
 - solenoid development and life cycle testing
- Peak and Hold Solenoid Control
- analog / USB to proportional control output signal conditioner

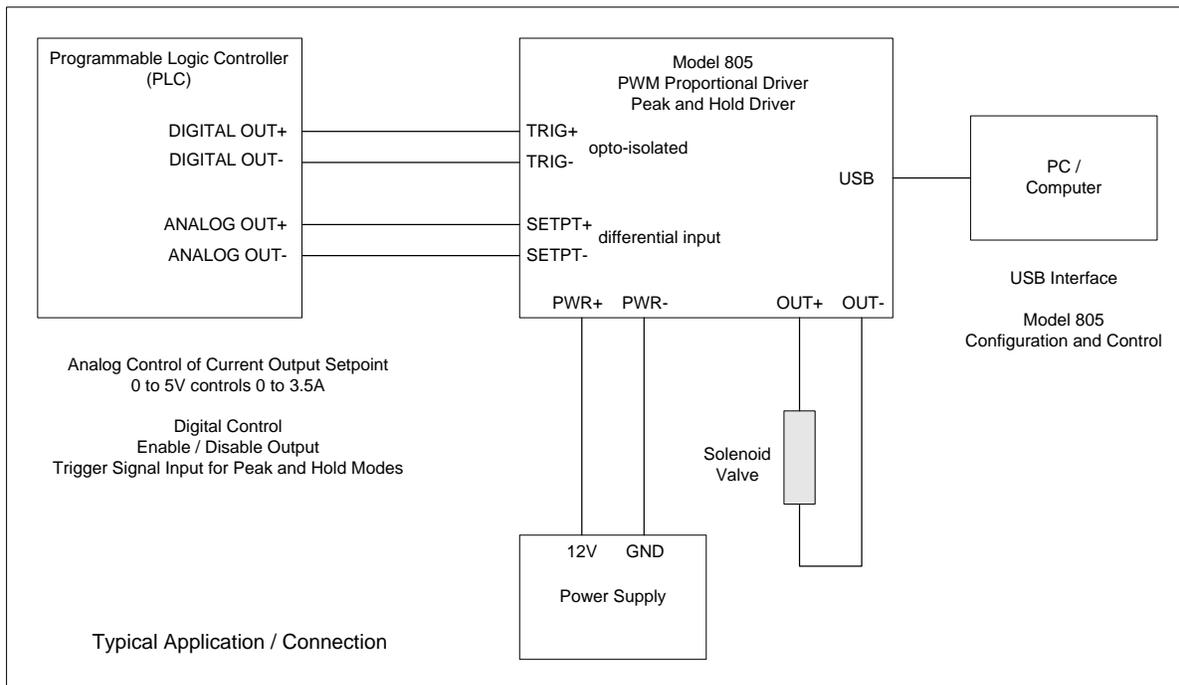
CONSTRUCTION

- industrial temperature range, DIN rail mountable, rugged construction
- multi-layer PCB, state of the art surface mount devices & assembly processes, Pb-free, RoHS
- designed for high reliability and long service using accurate and reliable digitally generated PWM technology

GENERAL OPERATION AND CONNECTION

The Model 805 PWM Proportional Driver is a low cost, small form factor module designed for applications driving proportional (and peak and hold) PWM controlled solenoids. The Model 805 may be used in computer, PC data system, or PLC controlled applications, or, can function as a stand-alone controller. The Model 805 also has the capability of operating in Peak and Hold PWM Driver modes (see next page), which will apply a controlled peak current to the solenoid prior to operating in a current controlled hold mode.

A typical connection using the Model 805 PWM Proportional Driver is shown in the diagram below. The Model 805 will control the average solenoid current to a setpoint (set from its analog input or via the USB interface). Solenoid current is internally measured and filtered, and is controlled to the setpoint using digital PID control processing in the Model 805 microcomputer to adjust the high frequency PWM output duty cycle appropriately. An optional PWM frequency dither feature is also available.



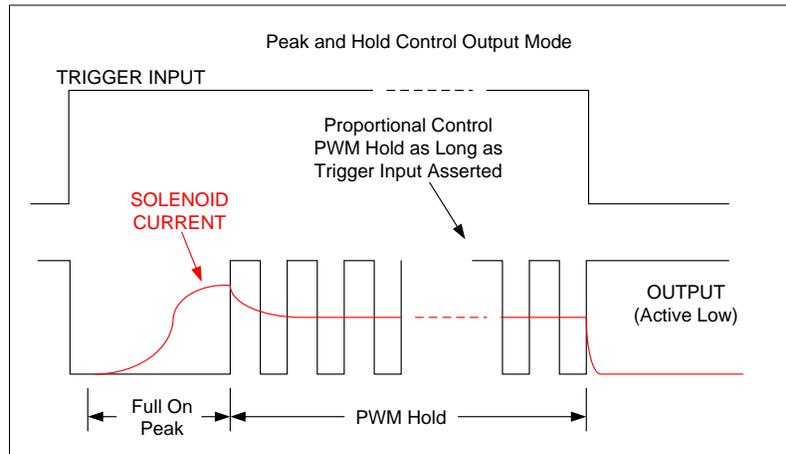
The Model 805 has an open drain power MOSFET output. This provides a low side drive of the solenoid load to be PWM controlled, switching between open and ground (PWR-). There is an internal diode (1N4001 equivalent) across the output for inductive kickback. The diode may be removed from the circuit by removing the circuit board jumper JP1 (remove cover of Model 805 unit, jumper is located on the circuit board under the OUTPUT connector). This allows the user to provide their own output diode(s) as required.

An external power source must be provided as PWM output power is not provided via the USB port. This power source is used to power both the load and the controller. The Model 805 has a low operating current requirement (35mA at 12V DC). Note that the input power connection is used to supply the power output to the valve. The internal path from PWR+ to OUT+ is used for the internal current measurement for solenoid proportional control.

The OUT- solenoid output is fuse protected, a 4A fuse is installed at the factory (Littelfuse p/n 0451004.MRL or equivalent). The fuse is sized for general proportional control and peak and hold control applications using the Model 805. Contact APM, Inc. regarding your application for fusing requirements. An external fuse may also be placed in line if desired.

PEAK AND HOLD MODE OPERATION

The Model 805 is able to operate in a peak and hold current driving mode. A typical peak and hold waveform illustration is shown below. The trigger controls the peak and hold sequence with a full-on peak pulse, followed by a proportional (current) controlled hold. The control output remains in the constant current hold state until the trigger is removed. This trigger mode allows for external synchronization of the peak and hold output to an application control signal. Peak and hold sequence rep rates of up to 100Hz are possible using the external trigger.

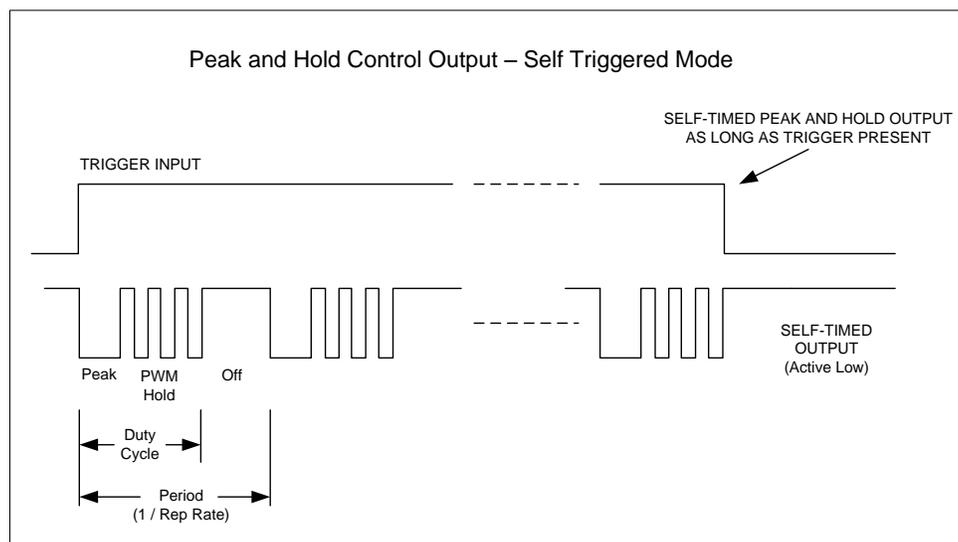


The peak and hold mode may be configured to operate in one of the following four modes:

- drive full-on to peak current with a timeout, control to hold current (proportional control)
- drive full-on to peak current with a timeout, duty cycle hold
- drive full-on for a preset time, control to hold current (proportional control)
- drive full-on for a preset time, duty cycle hold

All settings are managed through the USB user interface program available on the APM, inc. website.

The Model 805 may also be configured to operate in a self-timed peak and hold mode for solenoid valve test applications. In this mode (see figure below) the peak and hold sequence is timed in the Model 805 and continues repeating peak, hold, and off as long as the trigger signal is present.



USB OPERATION AND CONFIGURATION

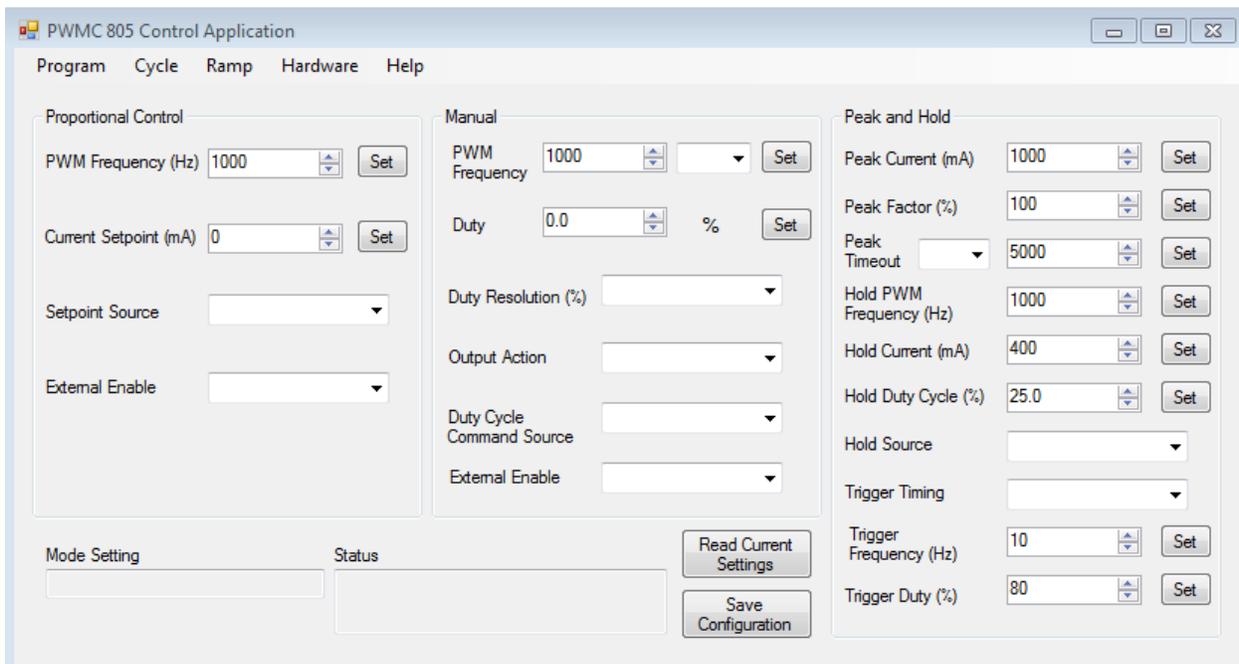
The Model 805 is configured and may be directly controlled during operation from the USB port. Features may be adjusted and saved in the Model 805 internal non-volatile memory such that the unit will operate using the saved parameters on the next power-on. Note that while the unit may be powered from the USB for configuration, the USB power is not used to supply PWM power. An external power source is required to drive the high power PWM output.

Configuration of the Model 805 is accomplished using a PC based graphical user interface (GUI) software program (available from our website at no cost). For configuration, no extra cables or I/O connections are required, only a single USB cable to the host PC. There are two main GUI screens for operation and advanced parameter adjustment. The screens are shown in the figures below.

The GUI also provides functions to cycle and ramp the current setpoint in the proportional (current) control and manual (duty cycle) mode. The functions can be used for various valve/solenoid test and development applications.

For custom PC or computer applications, a command guide is provided on our website which describes the interface drivers and command interface of the Model 805 controller.

The main screen of the GUI is shown below. Settings are grouped into three columns, dependent of the mode of operation selected: Proportional (Current) Control, Manual Control, and Peak and Hold Control Mode. The user can change the operation of the Model 805 by accessing a pop-up dialog box under the program command bar selection.



Model 805 – Configuration and Control User Interface, Main Screen

The advanced parameter screen of the GUI is shown below. This screen allows user interface access to additional features with respect to the proportional current control of the Model 805 Controller (listed below). The settings may be modified and tested as necessary for the application, then saved in Model 805 non-volatile memory.



Model 805 – Configuration and Control User Interface, Advanced Parameter Screen

Additional features available from the Advanced Parameter screen include:

- PWM Frequency Dither to reduce stiction effects during proportional current control
- start-up ramp duty cycle for current control
 - ramp up to a target current before running in automatic proportional control
 - can be used to avoid large inductive spike on start-up
- minimum and maximum duty cycle output during automatic proportional control
 - prevent solenoid from operating at 100% duty cycle
 - eliminate extreme non-linear control areas (for example, below 15% duty cycle) and improve start-up response
- maximum allowable duty cycle output change during automatic proportional control
- access to the PID tuning constants and PID update rate
 - adjust current control response to your solenoid valve application

A comprehensive help guide describing all Model 805 settings is included with the GUI and is also available in pdf format for download from the website Model 805 product page.

SPECIFICATIONS

- Proportional Control
 - available operating ranges: 2A, 4A (max 3.5A setting)
- Peak and Hold Control
 - up to 6A peak for peak and hold modes
 - peak time-out setting: 500usec to 25msec, or, 100msec to 5sec
- PWM Output: open drain Power MOSFET, maximum power dissipation 50W
 - up to 3.5A @ 12V, PWM proportional control
 - must operate within safe area of IRLR2905
 - built-in fuse on output, standard value 4A
- PWM Frequency:
 - proportional control, peak and hold control: 400 to 5000Hz, configurable in 1Hz
 - manual: 0.08 to 5000 Hz, configurable in 1Hz, 1mHz resolution below 1Hz
 - typical error < +/- 1%
- PWM Dither Frequency:
 - 50 to 500Hz
 - PWM dither allowable over 1000 to 5000 Hz PWM frequency
- Current Control Setpoint: 50mA to 3.5A, +/-5% accuracy
- Duty Cycle: 0 to 100 %, typical error < +/- 0.1% duty
- Analog Input: over +/- 100V common-mode voltage rejection
 - available analog input options:
 - 0 to 5V
 - 0 to 10V
 - 4 to 20mA
- External Enable / Digital Input: opto-isolated, 5V to 24V required to enable, 0V to disable
- Power: requires 9V to 28V DC external source
 - controller power consumption: 35 mA (approximate) at 12V DC
- standard USB mini-B connector and pinout
- Operating Temperature: -40 °C to +80 °C
- Size: 3.625 in. x 2.25 in. x 1 in. (1.25 in. height including I/O connectors)
- Construction: rugged, plastic enclosure, DIN mounting option
- Warranty: 1 year, for manufacturing defects
- Made in USA

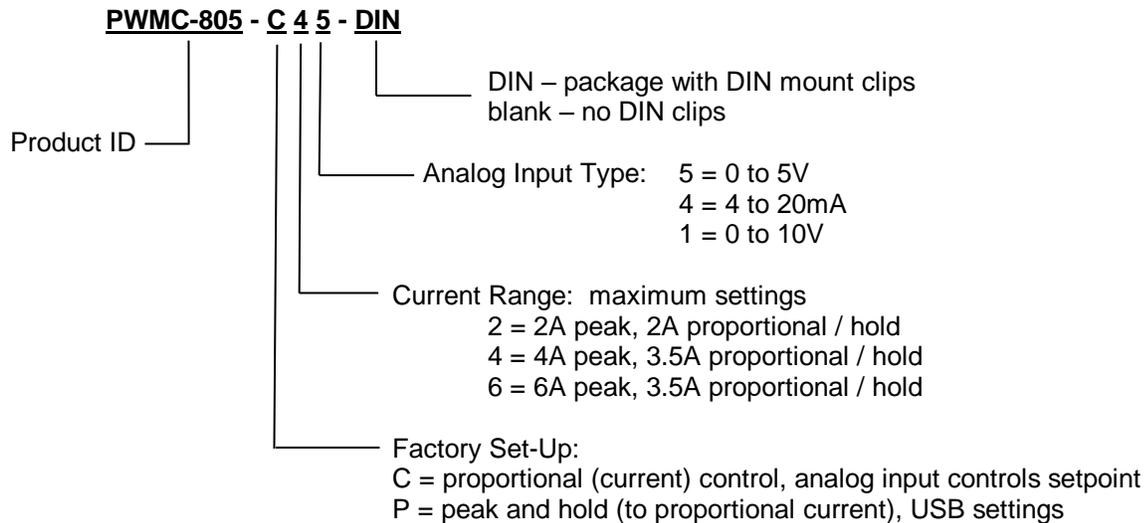
ANALOG INPUT TRANSFER FUNCTIONS

The analog input may be used to control the current setpoint during proportional control. The transfer functions are based on the input range / type selected, and the output current range selected at the time of purchase. Transfer functions (analog input to setpoint current) are provided in the table below. Analog input setpoint resolution in all cases is 10mA.

Output Current Range	Analog Input Range/Type	Transfer Function (Vin or lin to proportional Iout)
2A	0 to 5V input	2V = 1A
2A	0 to 10V input	4V = 1A
2A	4 to 20mA input	4mA = 0.5A with 4mA offset
4A or 6A	0 to 5V input	1V = 1A
4A or 6A	0 to 10V input	2V = 1A
4A or 6A	4 to 20mA input	4mA = 1A with 4mA offset

ORDER NUMBER

The order number is built based on the options required for your application using the following:



The Factory Set-Up configuration may be changed using the GUI program from our website and the USB interface. Any configuration can be set at the factory – provide your configuration details at the time of order.

The GUI program displays the hardware settings on the Device Information screen. Hardware options (current range and analog input type) may not be modified via the GUI configuration program.

Contact APM, Inc. for customizations optimized for your application (e.g. other current range).

ACCESSORIES

PWMCA-CB03 USB Cable, USB-A to USB mini-B
PWMCA-FS44 Model 805 and 400 output fuses, 4A, fast-blo, package of 10

CUSTOM / SEMICUSTOM CONTROLLERS

All standard products from Applied Processor and Measurement, Inc. including the Model 805 PWM Proportional Driver are available for customization. The Model 805 can be designed to exacting specifications for your application, reducing cost for high volume applications, changing functionality, 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.