



Installation Instruction for EMS100 Standalone Engine Management

This User Manual Only For Rev2 Boards

Warning

The EMS100 allows for total flexibility in engine tuning, misuse of this product will destroy your engine

SPTRONICS holds no responsibility for any engine damage that may results from the misuse of this product

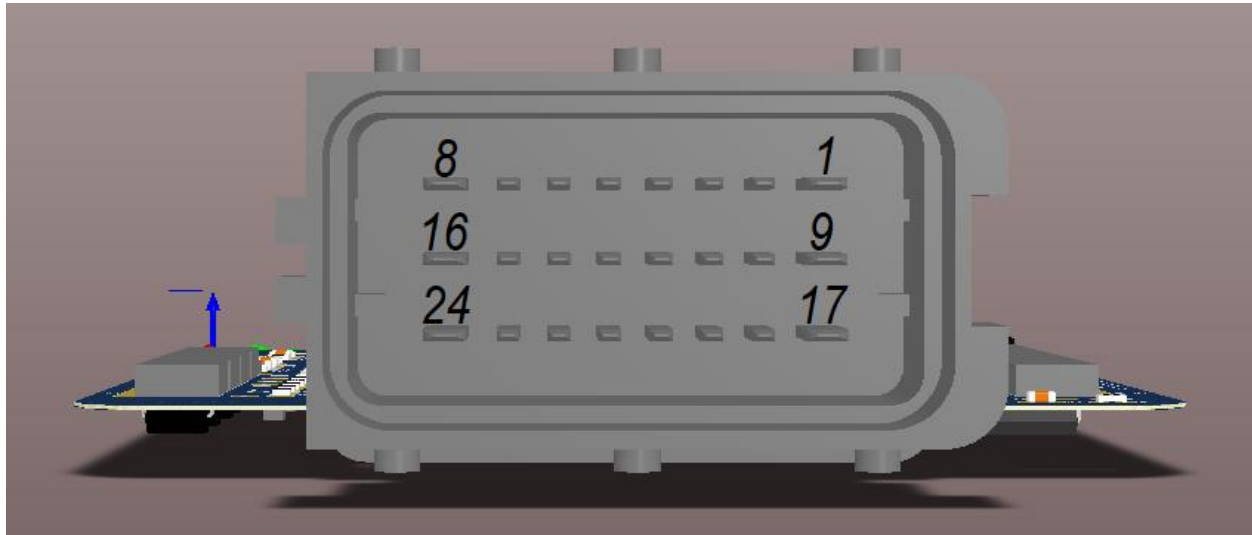
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EMS100 Specifications:

Standalone engine management system based on Megasquirt MS3x processor and firmware with enhanced inputs and output ports in aluminum sealed enclosure and sealed automotive grade connector. It can control up to 8 cylinders semi-sequential, combined with direct fire ignition for engines up to 4 cylinders or wasted spark ignition on engines up to 8 cylinders active (smart) coils only. Can be connected as a fully standalone ECU or as piggyback and share the sensor reading with the stock ECU as it has differential trigger inputs, The 2.5/4-bar internal MAP sensor can read up to 44psi of boost, 5V ref voltage, and software switches to pull up resistors. It has dedicated inputs (Crank, CLT, IAT, MAP, TPS and O2) and 6 low side outputs to drive injectors or any solenoid valve. 4 dedicated ignition outputs and to drive active coils, unused ignition output can be used as auxiliary output to drive any solenoid. 1 digital/frequency. 2 analog/digital inputs. It comes with a mating connector and terminals. USB as main connectivity and USB or Wi-Fi for monitoring. Bluetooth/Wi-Fi name and pin are configurable.

Trigger Inputs:	1 x Differential Crank Input (Hall or VR)
Injector Drivers:	4 x Saturated (8-ohm minimum, High Impedance Only)
Ignition Drivers:	4 x Logic level 5V (active coils only supported)
Outputs:	2 x Low Side Output 2.5A max.
Analog Inputs:	2 x inputs can be used as analog input or as switch input.
Digital/Frequency Input:	1 x Input as switch input or frequency input, only Hall sensor supported.
Throttle Position Input	1 x 0-5V analog input.
Internal 4 bar Map sensor	Internal 4 bar map sensor.
Coolant Temperature Sensor	1 x 0-5V analog input.
Inlet Air Temperature Sensor	1 x 0-5V analog input.
O2 Sensor	1 x 0-5V analog input.
USB	1 x PC Communication
5 Volt Reference	1 x 5V output for sensor supplies.
Sensor Ground	1x Ground for sensor supplies.
Bluetooth/Wi-Fi	Wireless communication port (Bluetooth or Wi-Fi).

Wiring Diagram:



Looking at PCB connectors

Main Connector:

Pin	Name	Comment
1	GND	Main ground.
2	Injector 1 output	
3	Injector 2 output	
4	Injector 3 output	
5	Injector 4 output	
6	IDLE Output	
7	FIDLE Output	
8	GND	
9	Ignition 1 output	
10	ADC6 Input	
11	ADC7 Input	
12	CAM Input	
13	Switched 12V Input	
14	Sensors 5V Output	
15	Sensors Ground Output	
16	Ignition 3 output	
17	Ignition 2 output	
18	Crank Positive Input	
19	Crank Negative Input	
20	Throttle Position Sensor Input	

21	Coolant Temp. Sensor Input	
22	Intake Air Temp. Sensor Input	
23	O2 Analog sensor input	
24	Ignition 4 output	

Installation:

Grounding:

The ECU must have an electrically secure ground connection, which means that the battery negative must be properly grounded to the chassis AND engine. The ground wire, whether it is from the battery or to the chassis and engine, must have perfect electrical conductivity. This means that there must not be any paint or rust under the wire terminal. Make sure that when you install the ground wire there is bare metal exposed where the wire contacts the vehicle component. Both of black wires should be connected to secure ground and we also recommend that the ground wire be as short as possible.

It is recommended to connect the main ground directly to the car battery ground and the ignition ground should be connect via separate wire to the chassis.

Separating the ignition ground from the main ground will reduce the noise generating from ignition coil when driving coil directly (passive coil).

2 mm wires is recommended for ground wires, minimum is 1 mm.

Power Requirement:

The EMS100 requires a minimum supply voltage of 10V or greater to run. We recommend that the ECU be supplied with 13.8V nominal operating voltage. Ensure that the vehicle's charging system is in perfect operating condition prior to installation. The Vbatt wire should be connected to ignition switched and fused to the battery source.

Sensors Reference Voltage and Sensor Ground:

The EMS100 has one 5V sensor voltage supply that will be needed during standalone installation. Use the Vref and Sgnd to supply all the sensors with power needed.

The Vref is fused protected by 0.5A resettable fuse.

Trigger Inputs:

EMS100 has one differential trigger input crank input+ and crank input- for the Crank signal. Each one has an option to be connected as differential or as single input.

Mode	Connection
VR Sensor	<ul style="list-style-type: none">Connect VR Sensor to Input+/Input- for Standalone connection
Hall Input	<ul style="list-style-type: none">Connect Hall sensor Input+, connect Input- to ground.

For pull up option and set point adjusting please check trigger settings from software part.

Throttle Position Sensor (TPS):

Throttle position sensor work as potentiometer which needs to be supplied with 5v and ground to generate 0-5v signal according to the throttle position. Use the Vref and Sgnd for sensor supply and connect the signal output to TPS input.

Coolant Temp Sensor (CLT):

Coolant temperature sensor works as resistor which changes its resistance with temperature, there is internal resistor inside EMS100 valued at 2.49 Kohm to be connected with coolant sensor to form voltage divider. Use Sgnd for ground supply to sensor and CLT input from EMS100 to second sensor pin.

For pull up option please check pull up settings.

Air Temp Sensor (IAT):

Intake air temperature sensor works as resistor which changes its resistance with temperature, there is internal resistor inside EMS100 valued at 2.49 Kohm to be connected with IAT sensor to form voltage divider. Use Sgnd for ground supply to sensor and IAT input from EMS100 to second sensor pin.

For pull up option please check pull up settings.

O2 Sensor:

Oxygen sensor input can be connected to narrow band sensor 0-1V or wideband controller output 0-5V

Analog/Digital Inputs:

EMS100 has 2 analog/digital inputs, each can be used as analog input or as digital input.

An/Dig input 0-5 can be connected directly to the input to read the analog value or can be used as digital input which need negative voltage to be activated (active low).

Digital/Frequency Inputs:

EMS100 has 1 digital/Frequency input, it can be used as digital input or as frequency counter.

Digital input which needs negative voltage to be activated (active low). Frequency input to count pulses input such as vss sensor or second cam signal. Digital sensor (Hall sensor) is only supported type of input.

There is pull up 10kohm resistor to 5v connected to the input.

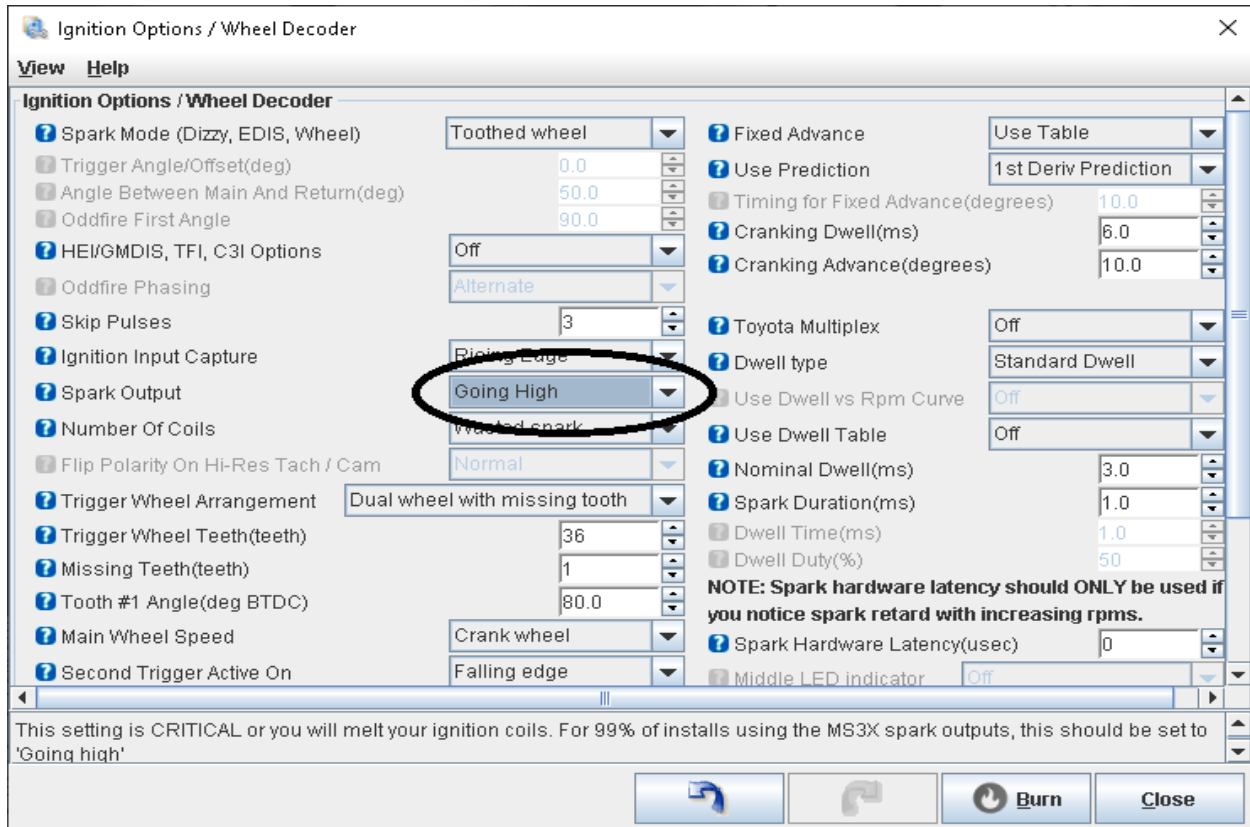
Injectors:

Four low side output each rated at 2.5A (can drive 2 high impedance injectors 12ohm and more), can be connected for 4 cylinder in sequential configuration or to 6, 8 cylinder in semi sequential/batched configuration.

One side of injector to be connected to switched 12v and injector negative signal from EMS100.

Ignition:

Four logic level 5V output to drive smart (active) coils, each output can driver up to 2 smart coils. Ignition output to be connected to the signal input in the smart coil and select "Going High" from "Spark Output" under "Ignition Options" in TunerStudio as in picture below.



General Purpose Outputs:

EMS100 has 2 additional low side outputs, each capable of generation ground signal to drive solenoid vale, relay, etc. max current 2.5A.

Fuel Pump:

Fuel pump relay can be driven by any unused output, here is the setting for TunerStudio.

Fuel Pump and Pressure Control
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View Help

Fuel Pump and Pressure Control

Fuel Pump Mode Open-Loop PWM

Control Interval(ms) 20

Fuel Pump Output Output 1

Output Frequency 11.1Hz

Fuel Pump Output Polarity Normal

Pressure Regulation/Correction Vac referenced

'Fixed' automatically adjusts fuel PW.

Static/Target Rail Differential Pressure(psi.g) 43.5

Static/Target Rail Differential Pressure(kPa.g) 300.0

Priming Duty(%) 100.0

Off Duty(%) 0.0

Minimum Duty(%) 0.0

Maximum Duty(%) 100.0

Pressure Sensor Input (kPa) Off

Sensor Type Gauge

Temperature Sensor Input Off

Temperature Correction Off

Closed-Loop PID settings

Proportional Gain(%) 10.0

Integral Gain(%) 5.0

Derivative Gain(%) 3.0

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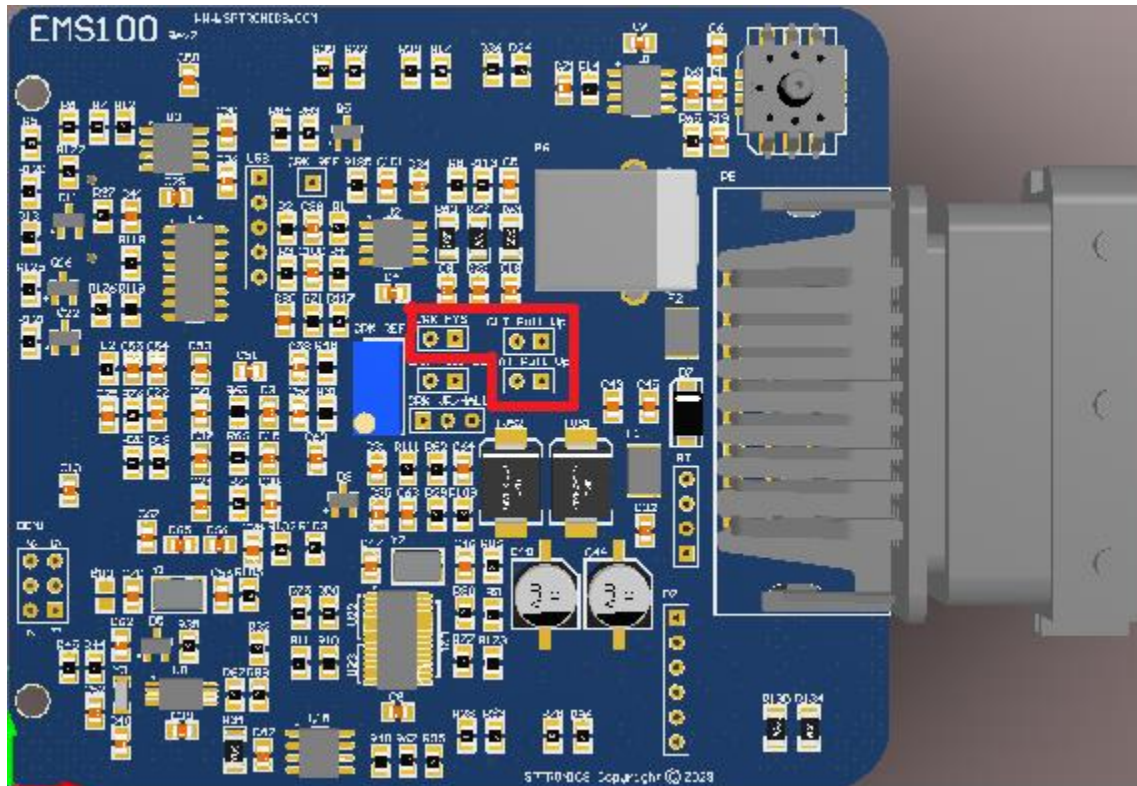
100.0	100.0	100.0	100.0	100.0	100.0	100.0
80.0	100.0	100.0	100.0	100.0	100.0	100.0
60.0	100.0	100.0	100.0	100.0	100.0	100.0
40.0	100.0	100.0	100.0	100.0	100.0	100.0
20.0	100.0	100.0	100.0	100.0	100.0	100.0
10.0	100.0	100.0	100.0	100.0	100.0	100.0
↶	0	1000	2000	3000	4000	6000

rpm

The values in the table specify the duty cycle percent of the control output to the pump or controller based on the RPM/load axes.

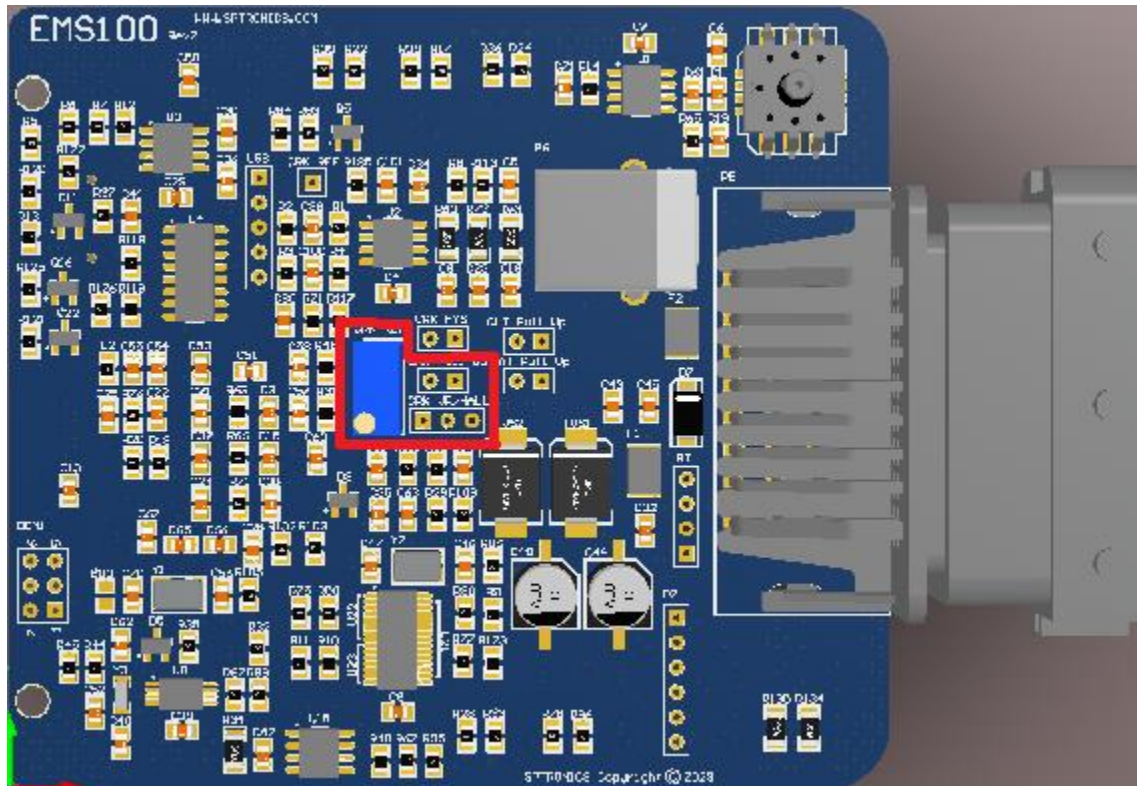
↶ ↷ 🔥 Burn Close

Pull Up Settings:



- Coolant Sensor Pullup: will connect CLT input to 5V through 2.49 Kohm resistor.
- Intake Air Temp. Sensor Pullup: will connect IAT input to 5V through 2.49 Kohm resistor.
- Crank Sensor Pullup: will connect CRK+ input to 5V through 10 Kohm resistor.

Crank Trigger Setting:



- Sensor Type: the type of sensor being used VR or Hall sensor.
- Enable or disable hysteresis jumpers
- POT to adjust reference voltage to both crank and cam.
- Ref check point to check the voltage adjusted from the POTs.

USB Communication:

There USB port will be configured as virtual serial port (COM port), once the driver installed and the device connected you should find the new COM port in "Device Manger" menu, under "Ports (COM & LPT)" new item will be add named "USB Serial Device (COMx)", you will use this COM port number when you connect to TunerStudio.

Here is the USB driver:

https://sptronics.com/?attachment_id=4329

Warranty

SPTRONICS warrants to the consumer that all High-Performance products will be free from defects in material and workmanship for a period of twelve (12) months from date of the original purchase. Products that fail within this 12-month warranty period will be repaired or replaced at SPTRONICS's option, when determined by SPTRONICS that the product failed due to defects in material or workmanship.

This warranty is limited to the repair or replacement of the SPTRONICS part. In no event shall this warranty exceed the original purchase price of the SPTRONICS part nor shall SPTRONICS be responsible for special, incidental, or consequential damages or cost incurred due to the failure of this product. Warranty claims to SPTRONICS must be transportation prepaid and accompanied with dated proof of purchase. This warranty applies only to the original purchaser of product and is non-transferable. All implied warranties shall be limited in duration to the said 12-month warranty period. Improper use or installation, accident, abuse, unauthorized repairs or alterations voids this warranty. SPTRONICS disclaims any liability for consequential damages due to breach of any written or implied warranty on all products manufactured by SPTRONICS.

SPTRONICS will not be responsible for electronic products that are installed incorrectly, installed in a non-approved application, misused, or tampered with.

Any SPTRONICS electronics product can be returned for repair if it is out of the warranty period.

There is a minimum charge of \$20.00 for inspection and diagnosis of SPTRONICS electronic parts. Parts used in the repair of SPTRONICS electronic components will be extra.

SPTRONICS will provide an estimate of repairs and receive written or electronic authorization before repairs are made to the product.