# SM3+ ECU User manual

Software,drivers and latest info can be downloaded at

www.Kperformance.be

## Introduction

Congratulations  buying the SM3 ECU. The circuit is based on Megasquirt 3. It was refined build 100% AEC-Q100 compliant and IP65 grade! A KPerformance Wideband Lambda Controller is also part of the SM3 ECU. A Bosch LSU 4.9 sensor can be connected directly without the need to buy a extra controller.

## Included in Delivery

- SM3 ECU

- USB cable pre-crimped

- User manual

- ECU Connector pins and cover

## Software

Recommended  free tuning software TUNERSTUDIO and/or Megalog viewer.

## USB Driver

The onboard FTDI chip simulates a serial RS232 connection:

Tunerstudio – Communications – Settings:

USB and Wireless (registered Version), Auto , 115200 Baud

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## Data Connections

Our SM3 is smart, it will automatic revert to master USB connection as soon as the USB cable is plugged in! Without USB connection it will switch to Bluetooth(if installed).

## OnBoard Bluetooth (optional)

Its Pre-configured and ready to use simulating a serial RS232 connection.

<span style="color:orange">Name: SM3+ with pin: 1234 or 0000</span>

## USB Port

The USB port of the SM3 is equipped with 8kV ESD protection of VBUS and Data lines. The data chip and ESD protection is "USB powered". This fact simplifies the optimization of the start-up behaviour significantly when you restart the ignition, the PC wont download the USB driver each time. The USB chip is of course downwards compatible, which means it can be used both with USB 3.0, 2.0 and 1. To achieve maximum water tightness IP65 grade, we pre-crimp the USB on to the ECU connector.

## Fuses

Recommended input fuse for protecting the SM3 :

**-3A slow blow single lambda**

**-5A slow blow dual lambda**
A automated 5A PTC SMD fuse is integrated on the board. It will reset itself after cooling down/solving issue or short circuit.

## Electrical connections

Like all other voltage supplied parts - must be preceded by a fuse in function of cable section.

Recommended cable types:

- Ignition: min 1.5 mm²
- Injection: min 1.5 mm²
- VR sensor: min 0.5 mm²
- Shielded Sensors: min 0.35 mm²
- Others: min 0.35 mm²

## Internal LED's functions

| LED Label | Color | Function |
|---|---|---|
| LD2 | GREEN | 5V power supply |
| LD3 | GREEN | O2 controller standby/power |
| LD4 | RED | O2 controller heating/measering |
| LD5 | GREEN | USB Data packets |
| LD6 | RED | USB Data packets |
| LDA | RED | Ignition pulse A |
| LDB | RED | Ignition pulse B |
| LDC | RED | Ignition pulse C |
| LDD | RED | Ignition pulse D |
| LDE | RED | Ignition pulse E |
| LDF | RED | Ignition pulse F |

Front view looking into connector
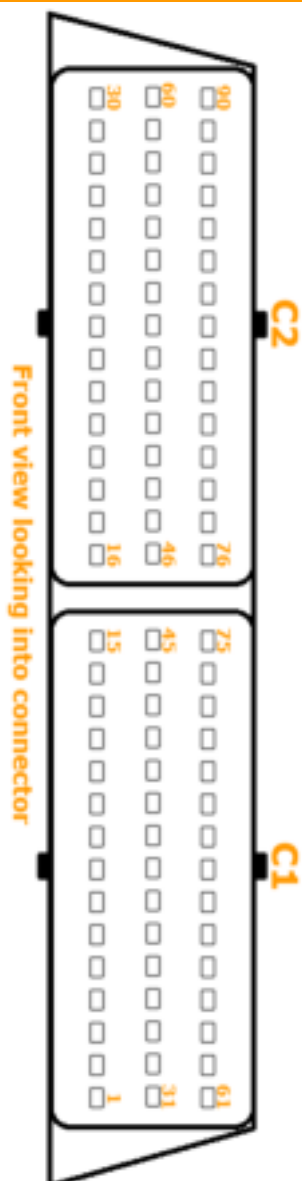
| Pin | Pin Label | Function |
|---|---|---|
| 1 | High Power IGN A | Ignition output Passive A |
| 2 | High Power IGN D | Ignition output Passive D |
| 3 | INJ output F | Injection valve F |
| 4 | TTL level IGN A1 | Ignition output Smart A |
| 5 | TTL level IGN D1 | Ignition output Smart D |
| 6 | IGN GND | Ignition Ground separately |
| 7 | INJ output E | Injection valve E |
| 8 | Engine GND | Engine/Main Ground |
| 9 | Power input | Input Voltage 8-16V |
| 10 | Power input | Input Voltage 8-16V |
| 11 | Power input | Input Voltage 8-16V |
| 12 | VR-2P | VR2 positive/CAM Input |
| 13 | VR-2N | VR2 negative input |
| 14 | VR-1P | VR1 positive/CRANK Input |
| 15 | VR-1N | VR1 negative input |
| 16 | CAN H | CANBUS HIGH input |
| 17 | CAN L | CANBUS LOW input |
| 18 | CLT | Coolant sensor input |
| 19 | MAT | Air Temp sensor input |
| 20 | MAP | MAP sensor input |
| 21 | TPS | Throttle sensor input |
| 22 | Additional LSU4.9 | Additional LSU4.9 GREEN |
| 23 | Additional LSU4.9 | Additional LSU4.9 BLACK |
| 24 | Additional LSU4.9 | Additional LSU4.9 RED |
| 25 | Additional LSU4.9 | Additional LSU4.9 YELLOW |
| 26 | Additional LSU4.9 | Additional LSU4.9 WHITE |
| 27 | EGO2 | Analog OXY bank 2 input |
| 28 | +5V | +5V Power Supply Sensors |
| 29 | +5V | +5V Power Supply Sensors |
| 30 | +12V Power Supply LSU4.9 | LSU4.9's GREY |

| 31 | High Power IGN B | Ignition output Passive B |
|----|------------------|---------------------------|
| 32 | High Power IGN E | Ignition output Passive E |
| 33 | INJ output D | Injection valve D |
| 34 | TTL level IGN B1 | Ignition output Smart B |
| 35 | TTL level IGN E1 | Ignition output Smart E |
| 36 | IGN GND | Ignition Ground separately |
| 37 | INJ output C | Injection valve C |
| 38 | GND | Spare Ground |
| 39 | AIN0/Ext MAP | Programmable Analog Input |
| 40 | AIN1/Flex | Programmable Analog input |
| 41 | GPO1/PT4 | Programmable Output 1A |
| 42 | DIN6/PT6/DataLog in | Digital Input |
| 43 | AIN3/AD7 | Programmable Analog Input |
| 44 | AIN2/JS12 | Programmable Analog Input |
| 45 | DIN1/NitroIN | Programmable Digital Input |
| 46 | Knock1 | Knock Sensor1 input |
| 47 | Knock GND | Common Knock Ground |
| 48 | Knock2 | Knock Sensor2 input |
| 49 | GPO2/PP1 | Programmable Output 1A |
| 50 | GPO3/PP0 | Programmable Output 1A |
| 51 | GPO8/Idle | Programmable Output 1A |
| 52 | Onboard LSU4.9 | LSU4.9 GREEN |
| 53 | Onboard LSU4.9 | LSU4.9 BLACK |
| 54 | Onboard LSU4.9 | LSU4.9 RED |
| 55 | Onboard LSU4.9 | LSU4.9 YELLOW |
| 56 | Onboard LSU4.9 | LSU4.9 WHITE |
| 57 | EGO1 | Analog OXY bank 1 input |
| 58 | GND | Spare Ground |
| 59 | EGT1+ | K-type Thermocouple |
| 60 | EGT1- | K-type Thermocouple |
| | | |

| | | |
|---|---|---|
| 61 | **High Power IGN C** | Ignition output Passive C |
| 62 | **High Power IGN F** | Ignition output Passive F |
| 63 | **INJ output B** | Injection valve B |
| 64 | **TTL level IGN C1** | Ignition output Smart C |
| 65 | **TTL level IGN F1** | Ignition output Smart F |
| 66 | **IGN GND** | **Ignition Ground separately** |
| 67 | **INJ output A** | Injection valve A |
| 68 | **GND** | Spare Ground |
| 69 | **DIN2/JS7** | Programmable Digital Input |
| 70 | **GPO7/VTT** | Programmable Output 2A |
| 71 | **DIN3/TBL** | Programmable Digital Input |
| 72 | **1k Sensor Pull-Up 5V** | Pull Up Output |
| 73 | **1k Sensor Pull-Up 5V** | Pull Up Output |
| 74 | **DIN4/Launch** | Programmable Digital Input |
| 75 | **PT5** | !!Direct CPU pin!! |
| 76 | **VBUS** | External USB Connection Red |
| 77 | **DPUSB** | External USB Connection Green |
| 78 | **GNDUSB** | External USB Connection Black |
| 79 | **DMUSB** | External USB Connection White |
| 80 | **GPO12/PT1** | Programmable Output 1A |
| 81 | **GPO4/Boost** | Programmable Output 1A |
| 82 | **GPO5/Tacho** | Programmable Output 1A |
| 83 | **GPO2/Nitro2** | Programmable Output 2A |
| 84 | **GPO3/Nitro1** | Programmable Output 2A |
| 85 | **GPO11/PK7** | Programmable Output 1A |
| 86 | **IDLO** | Idle Valve Open |
| 87 | **IDLC** | Idle Valve Close |
| 88 | **GPO9/IAC2** | Programmable Output 2A |
| 89 | **GPO10/IAC1** | Programmable Output 2A |
| 90 | **FP** | Fuel Pump relay Output |

Front view looking into connector

**Pin numbering is also marked on both plastic connectors**

-Spare "**Power Input**"pins can also be used to power low current devices as HALL, Boost,Idle -valves,LSU4,9's etc
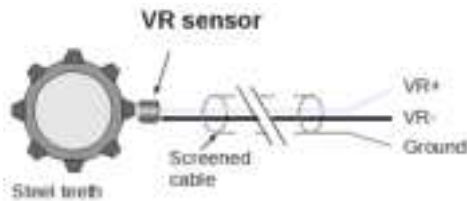
 **-DirectCPU pins have no safety nor short circuit protection!** Be careful using these pins.

**Pulling down to ground is safest way to use any digital input**

**Engine Speed Measurement**
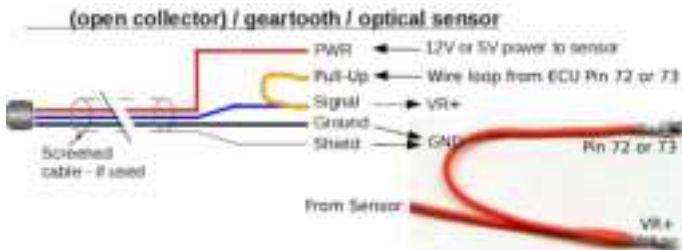
VR sensors inputs:

- CRANK: VR-1N&VR-1P

- CAM: VR-2N&VR-2P



Rising Edge is  most accurate for VR-type sensor !

**Very hot VR signals: only connect VR positive inputs.**

Hall & Optical inputs:

- CRANK: VR-1P

- CAM: VR-2P



!Leave VR-1N & VR-2N floating (do not connect)

**Signal Pull-Up: wire loop (see image above)**

**Throttle Position Sensor**

The throttle potentiometer is connected up by a 3-wire cable. +5V and GND are connected to the outer static pins of the potentiometer. The corresponding calibration is done under TunerStudio via

"Tools" – "Calibrate TPS"

**Temp Sensor Inputs (CLT+IAT)**

This sensor measures the temperature of the engine coolant (or cylinder head for air-cooled engines.) It is primarily used to provide additional fuel during engine warm-up.

One wire connects to ground, the other to the CLT/IAT input on the ECU. One-wire sensors are not recommended.

Common sensor presets available under TunerStudio!

**Digital Input**

There are digital inputs(DIN) that can be used for example as "Launch Control". The corresponding function has to be defined in Tunerstudio. Preferable use Ground activated.

Never connect more than 5V on any input!

**Analog Input**

There are analog inputs(AIN) that can be user programmed The corresponding function has to be defined in Tunerstudio. Additional pressure, Flex, temp sensors can all be connected.

Never connect more than 5V on any input

**Programmable Output**

There are General Purpose Outputs(GPO) that can be user programmed and have to be defined in Tunerstudio.

**Idle Speed Controller (Fidle)**

The SM3 supports both the 2-pin and the 3-pin idle speed valves.

Pin connections of the idle speed control:

2-pin: +12V & FDLO

3-pin: +12V & FDLO (open) & FDLC (closed)

The FDLO & FDLC are automatic inverted on the PCB, use Fidle control under TunerStudio,

**Ignition**

The ignition coils can be activated directly by the integrated power drivers. We recommend using a shielded multi-conductor cable . The SM3 is equipped with 6 power drivers enabling sequential activation of 6 passive ignition coils or 12 in wasted spark. We designed the outputs so it's possible to trigger 6 Passive coils **OR** 6 smart coils by using the correct ECU connector output pins!

- 6x Passive Coils Power Ignition outputs (Ground Activated Coils)

- 6x Smart Coils Ignition Outputs (5V TTL Activated Coils)

  **Do not connect/use both Ignition methods at the same time!**
  Spare un-used Ignition outputs, can be used as additional programmable outputs.

**TTL level outputs = smart coils**

**High Power IGN outputs = passive coils**

**Passive coils NEED atleast 2x IGN GND pins(6-36-66) to be connected directly to a good high current capable ground. Ex Chassis,Engine,battery etc**

SM3 firing sequence ABCDEF,please wire accordingly

**We prefer active coils to keep high feedback voltages out of the SM3 ECU! 12V powering of coils and injectors is done by relays, PMU, switches etc ,never via the ECU pins!**

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**Onboard Wideband Lambda Controller (Optional Dual)**

A Bosch LSU 4.9 sensor can be connected directly without the need to buy a further controller. (connect according onboard LSU4.9 pin numbers)
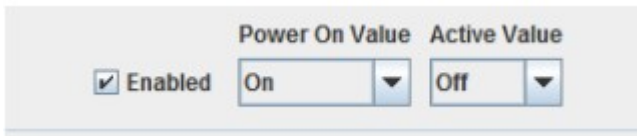
**Calibration data TUNERSTUDIO custom linear wideband:**

**0V = Lambda 10.20 = AFR 22.35**

**4V = Lambda 0.650 = AFR 9.50**

Starting of the Lambda controller is done by software grounding selecting :

Output "Ignition G/O2controller" if necessary with optional customer requirements settings.

**Not grounding the output will result in standby lambda controller(s).**

**Onboard Knock**

The knock IC uses a purpose designed dual knock sensing amplifier chip to filter knock signals.

Inputs Knock1 & Knock GND & Knock2

**Onboard Baro**

The SM3 is equiped with an onboard barometric MPX6115 sensor.

Input Spare ADC13/Baro

**Onboard EGT**

The EGT IC uses a purpose designed amplifier chip to filter K-type sensor signals and uses "EGT/AD6 input" selectable via tunerStudio.

Optional pre-crimped K-thermocouple connection kit available

**CAN Bus**

Like for MegaSquirt the CAN Bus hardware is populated on the board, but has to be setup accordingly by the user/hardware if desired.

Couple of CAN pre-sets are available under TunerStudio