

Emtron Motorsport KV16M ECU

PRODUCT
DATASHEET

Rev 1.1



KV16M

EMtron
Australia

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1.0 General

Emtron's KV16M is a motorsport wire-in ECU with extreme flexibility built on the race proven KV16 ECU platform with additional flexibility and reliability utilising a 136-way Deutsch Autosport connector system. This ECU will support up to 16 Channels of fuel and 12 Channels fully sequential Ignition. Every KV16M is housed in a durable billet Aluminium enclosure and includes up to 32MB permanent memory for on board logging, 4-channel oscilloscope function, 24 high resolution analog inputs, DBW control up to 4 channels, dual on-board LSU4.9 Lambda controllers, dual digital Knock control, Ethernet communications and 3 axis G-force sensing to name a few.

Power Supply

- Operating voltage: 6.0 to 22.0 Volts DC (ECU shutdowns at 24.0V)
- Operating current: 450mA at 14.0V (excluding sensor and load currents)
- Reverse battery protection via external fuse
- "Smart" battery transient protection
- "Smart" internal ECU hold power control

Operating Temperature

- Max operating range: -30 to 110°C (-22 to 230°F)
- Recommended operating range: -30 to 85°C (-22 to 185°F)

Physical

- Aluminium 6061 grade CNC billet enclosure
- Enclosure size 134 mm x 162 mm x 27 mm
- Weight: 750g
- Waterproof
- Connector system: 136-way waterproof connectors with gold plated contacts
 - 1 x 55 Way, shell size 16 Deutsch Autosport (Red)
 - 1 x 26 Way, shell size 16 Deutsch Autosport (Red)
 - 1 x 55 Way, shell size 16 Deutsch Autosport (Yellow)

Internal

- Dual 100MHz processors
- 500Mb DDR RAM (0.5Gb)
- 32MB ECU logging memory
 - Over 1200 channels available
 - 1Hz to 500Hz logging rate
- Oscilloscope 4-channel function with 32MB storage
 - Sampling at 100k samples/second
 - Includes Crank and Cam sensors inputs
 - Includes Digital Inputs 1-4
- 3-Axis accelerometer
 - 16 Bit resolution
 - $\pm 2g/\pm 4g/\pm 8g$ dynamically selectable full-scale
 - Output data rate 500Hz

2.0 Outputs

16x Injector Outputs—high or low ohm.

- Flyback Voltage Clamp 70V
- Independent Saturated or Peak & Hold control per channel
- 8A Peak, 4A hold, 10A Limit Injector Control
- Outputs can be used for ground switching, 6A Continuous, 10A Limit
- All outputs are short circuit and over current protected
- No Flywheel diodes (external diode(s) required for VVT control)

12x Ignition Outputs

- Open collector outputs with Logic Level outputs
- Adjustable Ignition drive current (35mA or 70mA)
- Outputs can be used for Auxiliary ground switching, 1A Continuous, 3A Limit
- All outputs are short circuit and over current protected
- No Flywheel diodes (external diode(s) required for VVT control)
Ignitor must be used between ECU and coil

16x Auxiliary Outputs

- Variable Valve Timing (VVT) and Variable Valve Timing Electric (VTiE), Drive by Wire(DBW) up to 4 throttle bodies, dual boost control, gearshift solenoids, stepper motor and many more.
- All Outputs have PWM Control, maximum frequency = 15 kHz
- Flywheel diodes integrated into all outputs
 - Aux 1-8 Flywheel to the “Constant 14V Supply” pin 53 Connector C
 - All other Auxiliaries Flywheel to the “ECU 14V Supply” pins
- All Outputs are short circuit and over current protected

Low Side Drivers

- Auxiliary 1-4: Low Side 4A continuous, 6A peak modulated, 8A limit
- Auxiliary 5-8: Low Side 2.5A continuous, 4A peak modulated, 5A limit

High Side Drivers

- Auxiliary 1-8: High Side 4A continuous, 9A limit

Half Bridge Drivers

- Auxiliary 9-12: Half Bridge 5A continuous and 8A limit. Can be used as Low Side, High Side or together for DC motor control (DBW up to 2x channels)
- Auxiliary 13-16: Half Bridge 7.5A continuous (pin limited). Can be used as Low Side, High Side or together for DC motor control (DBW up to 2x channels)
(NOTE: Auxiliary 9 -16 can be used to control up to 4x DBW throttle bodies)

1x Analog Output Buffered

- Voltage range 0 - 5.0V, Output current 100mA

2x Shield Outputs

- Connection for Trigger and Knock shielded cables. Short to battery protection.

3.0 Inputs

24x Analog Voltage/Temperature Inputs.

- Fully configurable including custom calibrations
- Switchable 1k ohm pull-up resistors on ANV 7-12 (available on 6 channels)
- Accepts a 0.0 - 5.000V analog input range. Resolution is 1.22mV (12-Bit)
- Input Impedance 100k Ohms to ground
- 160Hz Low pass filter

8x Digital/Speed Inputs (DI 1 - 8)

- Frequency range from 0.0Hz up to 30.0kHz on all 8 channels
- Magnetic and hall/optical effect sensor compatible with programmable trigger edge(s)
- Independent programmable frequency-based arming threshold control, range 0.0 - 12.0V
- Wheel speed, output shaft speed, turbo speed and other frequency-based signals
- VVT position(s) up to 4 channels available on DI 1- 4.
- Accepts a 0.0 - 20.0V analog input. Effective resolution is 4.88mV (10-Bit)
- On/Off switched inputs: AC request, launch enable, cruise switch, table control switching etc with programmable switch-based arming threshold control, range 0.0 - 20.0V
- Switchable 4k7 ohm pull-up resistors on all 8 channels to 10.0V
- Maximum/Minimum input signal amplitude +/- 80V

6x Digital/Switched Inputs (DI 9 - 14)

- On/Off switched inputs: AC request, Launch enable, cruise switch, table control switching etc with programmable switch-based arming threshold control, range 0.0 - 20.0V
- Accepts a 0.0 - 20.0 V analog input. Effective resolution is 19.61mV (8-Bit)
- Switchable 4k7 ohm pull-up resistors on all 6 channels to 10.0V

2x Crank and Cam Inputs

- Magnetic and Hall effect sensor compatible with programmable trigger edge(s)
- "True" zero crossing detection on magnetic signals for precise engine position decoding.
- Programmable independent arming threshold control from 0.1V to 12.0V
- Switchable 4k7 ohm pull-up resistor to 5V
- OEM patterns supported
- Maximum input signal amplitude +/- 80V
- Input Impedance 39k ohms to ground

4.0 Lambda

This ECU supports on-board dual Lambda controllers using the Bosch LSU4.9 wide band oxygen sensor.

2x Lambda channels supporting the Bosch LSU 4.9 sensor

- Using Bosch integrated circuit technology for precise sensor control
- Nernst cell temperature measurement for dynamic PID closed loop heater control
- Lambda range: 0.580 La to 10.000 La
- Diagnostics available for each pin and includes, Short to ground, Short to Vbat, Open Load

5.0 Knock Control

This ECU supports dual Knock control using inputs from a piezoelectric sensor. Each knock input is fully differential, giving superior common-mode noise rejection in the harsh automotive environment.

2x Knock Inputs

- 2 Independent knock input channels
- Using Bosch, Digital Knock Integrated Circuit Technology with programmable digital filter coefficients
- Center frequency configurable from 500Hz - 25kHz
- Bandwidth window from 100Hz - 5kHz
- Digital filter window; Hamming or Blackman
- Gain control(x1, x2, x4, x8)
- Cylinder selectable knock input
- Knock control available on ALL Ignition modes (Direct, Wasted, Distributor etc)

6.0 Voltage and Ground Supplies

4x ECU Supply Inputs

- 7.5A per pin, total 30A
- 6V - 22.0V Range
- Supplies ECU power
- Supplies Auxiliary 1-8 High Side Drivers
- Supplies Auxiliary 9 -16 Half bridge Drivers

3x 5.0V Sensor Supply

- 5V Vref1 output current 400mA
- 5V Vref2 output current 400mA
- 5V Vref3 output current 400mA
- Accuracy: +/- 1.0% at 25 °C
- Short circuit, Reverse Battery Protection, Thermal overload protection
- Operating temperature range -40°C ~ 125°C

1x 8.0V Sensor Supply

- Output current 600mA
- Accuracy: +/- 1.0% at 25 °C
- Short circuit, Reverse battery protection, Thermal overload protection
- Operating temperature range -40°C ~ 125°C

1x Constant 14V Battery Supply

- Internal ECU EFI Relay Control (Keep-alive function)
- Flywheel supply for Auxiliary Channels 1-8

6x ECU Main Grounds

- 7.5A per pin, total 45A

4x Analog Sensor 0V Reference

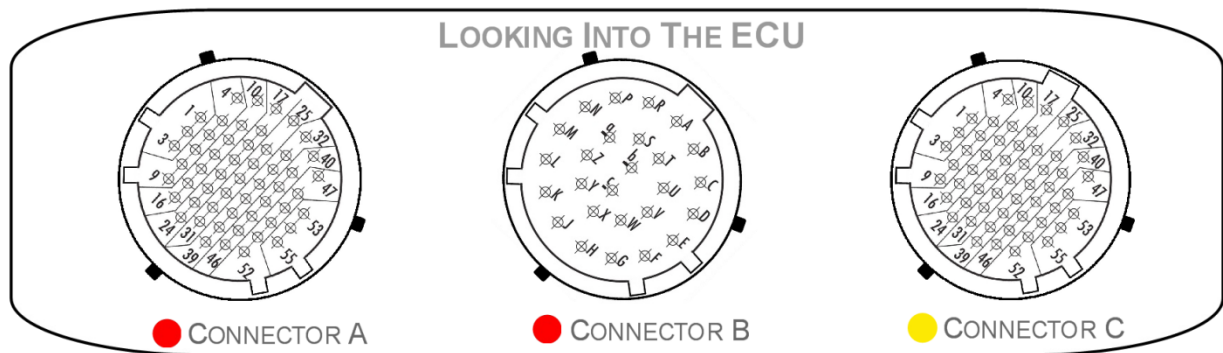
- Analog Sensor 0V Reference with short to battery protection

NOTE: The **Analog Sensor 0V Ref** pin(s) are specialised ground outputs for all analog sensors. Connect direct to the sensor 0V pin, **DO NOT** connect to the Engine Block or ECU Ground.

7.0 Communications

- 1x High Speed Ethernet 100Mbps for tuning software connection
- 2x CAN 2.0B 1Mbps/ 6 Channels per node, total 128 messages

8.0 KV16M Pinout



Mating Connectors Loom Side (Deutsch Autosport AS Series; S = Socket)

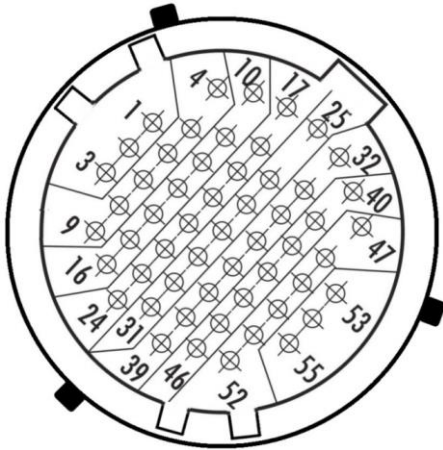
Mating connector A
AS616-35SN (Red)

Mating connector B
AS616-26SN (Red)

Mating connector C
AS616-35SA (Yellow)

Connector A: Injection/Ignition/Digital Inputs.

(5.0A continuous current, Shell size 16, 55 Pin, 22 AWG)

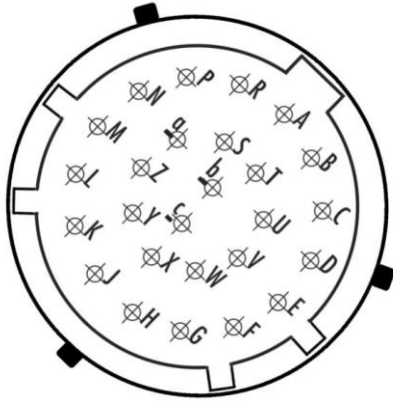


Looking into ECU Connector

Pin	Channel Name	Pin	Channel Name
1	Injection Channel 1	29	Lambda 2 Heater +
2	Injection Channel 2	30	Lambda 2 Heater -
3	Injection Channel 3	31	Digital Input Ground Out
4	Injection Channel 4	32	Ignition Channel 1
5	Injection Channel 5	33	Ignition Channel 2
6	Injection Channel 6	34	Ignition Channel 3
7	Injection Channel 7	35	Ignition Channel 4
8	Injection Channel 8	36	Ignition Channel 5
9	Injection Channel 9	37	Ignition Channel 6
10	Injection Channel 10	38	Ignition Channel 7
11	Injection Channel 11	39	Ignition Channel 8
12	Injection Channel 12	40	Ignition Channel 9
13	Injection Channel 13	41	Ignition Channel 10
14	Injection Channel 14	42	Ignition Channel 11
15	Injection Channel 15	43	Ignition Channel 12
16	Injection Channel 16	44	Digital Input 3
17	Lambda 1 Nernst Cell (Vs)	45	Digital Input 2
18	Lambda 1 Cal Resistor (CalR)	46	Digital Input 1
19	Lambda 1 Pump Cell (Ip)	47	Digital Input 9
20	Lambda 1 Virtual Ground (VGnd)	48	Digital Input 8
21	Lambda 1 Heater +	49	Digital Input 7
22	Lambda 1 Heater -	50	Digital Input 6
23	Digital Input 13	51	Digital Input 5
24	Digital Input 14	52	Digital Input 4
25	Lambda 2 Pump Cell (Ip)	53	Digital Input 10
26	Lambda 2 Virtual Ground (VGnd)	54	Digital Input 11
27	Lambda 2 Nernst Cell (Vs)	55	Digital Input 12
28	Lambda 2 Cal Resistor (CalR)		

Connector B: Power/Ground/Auxiliary Outputs

(7.5A continuous current, Shell size 16, 26 Pin, 20 AWG)

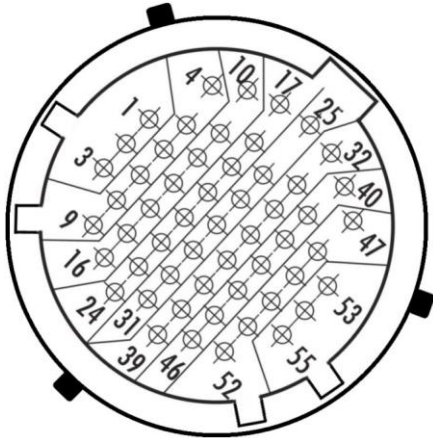


Looking into ECU Connector

Pin	Channel Name
A	ECU 14V Supply
B	ECU 14V Supply
C	ECU 14V Supply
D	ECU Ground
E	ECU Ground
F	Auxiliary Output 16
G	Auxiliary Output 15
H	Auxiliary Output 14
J	Auxiliary Output 12
K	Auxiliary Output 10
L	Auxiliary Output 8
M	Auxiliary Output 7
N	Auxiliary Output 5
P	Auxiliary Output 3
R	Auxiliary Output 1
S	Auxiliary Output 2
T	ECU 14V Supply
U	ECU Ground
V	ECU Ground
W	Auxiliary Output 13
X	Auxiliary Output 11
Y	Auxiliary Output 9
Z	Auxiliary Output 6
a	Auxiliary Output 4
b	ECU Ground
c	ECU Ground

Connector: C Signal.

(5.0A continuous current. Shell size 16, 55 Pin. 22 AWG)



Looking into ECU Connector

Pin	Channel Name	Pin	Channel Name
1	Analog Input Channel 1	29	Analog Sensor 0V Reference
2	Analog Input Channel 2	30	Analog Sensor 0V Reference
3	Analog Input Channel 3	31	Analog Sensor 0V Reference
4	Analog Input Channel 4	32	Knock 2 +
5	Analog Input Channel 5	33	Analog Out
6	Analog Input Channel 6	34	CAN 2L
7	Analog Input Channel 7	35	CAN 2H
8	Analog Input Channel 8	36	CAN 1L
9	Analog Input Channel 9	37	CAN 1H
10	Analog Input Channel 10	38	Sensor Supply Vref2: 5.0V
11	Analog Input Channel 11	39	Sensor Supply Vref2: 5.0V
12	Analog Input Channel 12	40	Knock 1 -
13	Analog Input Channel 13	41	Sync Sensor -
14	Analog Input Channel 14	42	Sync Sensor +
15	Analog Input Channel 15	43	Crank Index Sensor -
16	Analog Input Channel 16	44	Crank Index Sensor +
17	Analog Input Channel 17	45	Sensor Supply Vref1: 5.0V
18	Analog Input Channel 18	46	Sensor Supply Vref1: 5.0V
19	Analog Input Channel 19	47	Knock 1 +
20	Analog Input Channel 20	48	Ethernet Tx +
21	Analog Input Channel 21	49	Ethernet Tx -
22	Analog Input Channel 22	50	Ethernet Rx +
23	Analog Input Channel 23	51	Ethernet Rx -
24	Analog Input Channel 24	52	Sensor Supply 8V
25	Knock 2 -	53	Constant 14V Supply(Backup)
26	SHIELD (Crank/Cam/ Knock)	54	Sensor Supply Vref3: 5.0V
27	SHIELD (Crank/Cam/ Knock)	55	Sensor Supply Vref3: 5.0V
28	Analog Sensor 0V Reference		

8.1 Important Notes

Auxiliary Output Channels 13-16

These are high current Half bridge drivers which switch either to ground or 14V i.e. they do not have a high impedance or OFF state. When the ECU is powered OFF these Auxiliary Channels by default will be switching to ground. This means:

- 1) Solenoids or relays connected to these outputs should not use a constant or hot battery feed.
- 2) During the ECU powerup sequence, any solenoid or relay connected to these outputs should have a managed power feed to avoid momentary switching during powerup.

Constant 14V Supply/Backup (Pin C53)

This pin has two features:

1) Flywheeling for Auxiliary Channels 1-8. Any Inductive energy will be sent to the "Constant 14V Supply" pin. To minimise any EMI and allow solenoid current recirculation to operate correctly this pin should be connected to a constant power supply. If this pin is left unconnected the back EMF will be clamped at 45V.

2) Internal ECU EFI Relay function. When power is removed from pins " ECU 14V Supply" the ECU automatically switches to the "Constant 14V Supply" to keep the ECU powered. This will allow the ECU to complete critical tasks before shutting itself down (for example, DBW Self calibration and ECU Logging data storage).

To enable this function, set the EFI Relay Control Channel to "Internal EFI Relay Ctrl"

NOTE: With a Constant 14V supply wired, the ECU draws no additional current when OFF.

Analog Sensor 0V Reference (Pin C28, C29, C30, C31)

As the name indicates these should be connected directly to the 0V (Ground) pin on any low current analog sensor, for example Pressure or Temperature.

- **DO NOT** connect these pins directly to the Engine Block or ECU Ground. These are dedicated and specialised ground outputs for all analog channels and should be connected directly to the sensor.
- **DO NOT** connect frequency-based sensors to this ground; for example, an Ethanol content sensor. Use either the Digital Input Ground Out pin (A31) or the main ECU ground.

9.0 Software

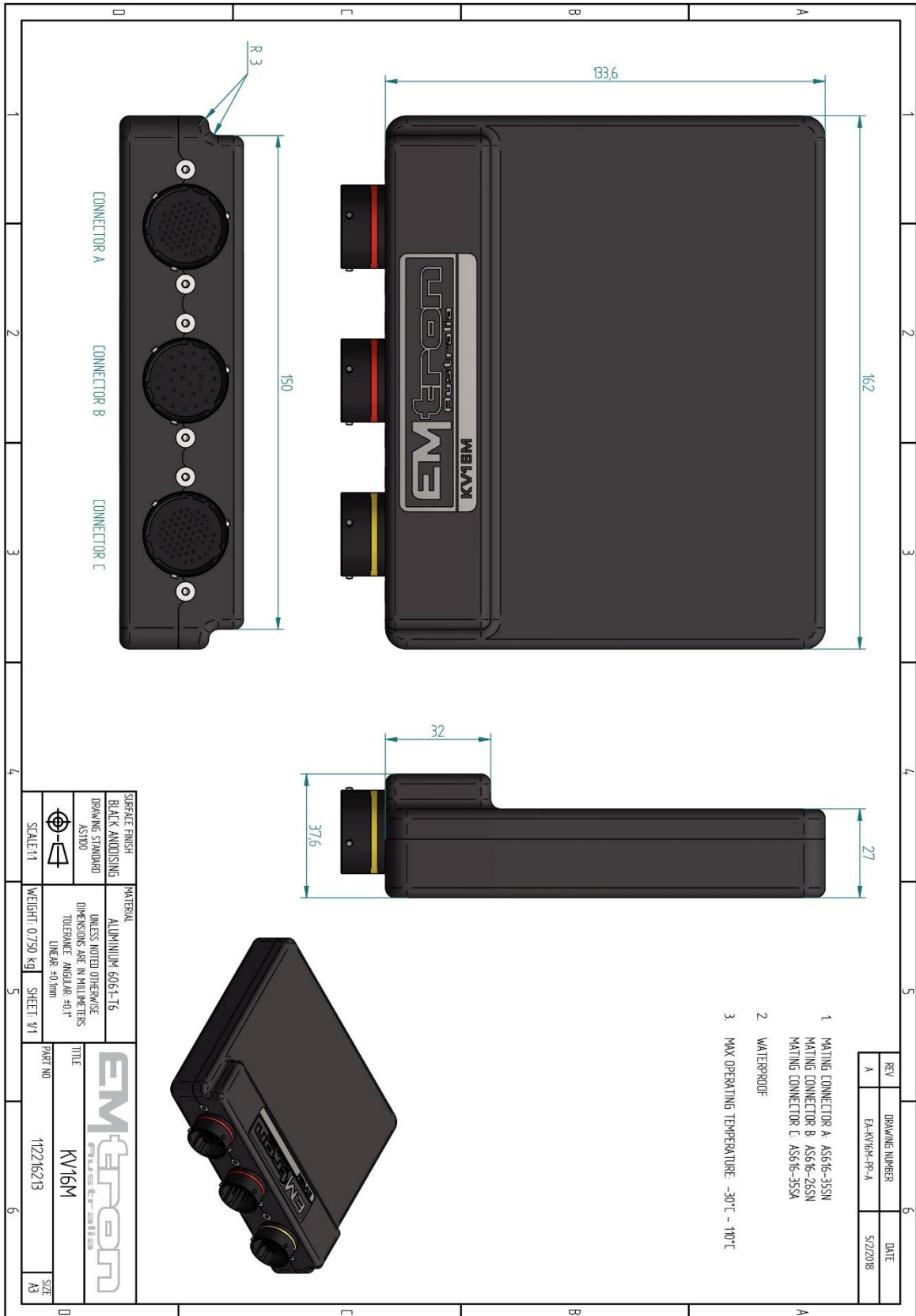
Emtron's comprehensive Emtune™ tuning software is used to connect to the ECU.

- Microsoft Windows™ 7 -10 compatible
- Free licence
- Memory requirements: 0.5GB RAM
- ECU connection using Ethernet, IPV4 protocol
- Tuning and data analysis
- PC and ECU data logging
- Live pause and data playback
- Advanced tuning functions
- Diagnostics
- Oscilloscope display

10.0 Ordering Information

Product	Part Number
Emtron KV16M ECU	1122-16213
Emtron Ethernet Tuning Cable (1.5m)	553-15

Appendix A – Enclosure Dimensions (EA-KV16M-PP-A)



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