Professional Electronics
for Automotive and Motorsport

6 Repton Close | Basildon
Essex | SS13 1LE | United Kingdom
+44 (0) 1268 904124
info@liferacing.com
www.liferacing.com

# F90RX ECU
## Datasheet

**The F90RX ECU has been introduced to allow easy and cost effective control for challenging applications with high pin count and up to 12 fully sequential cylinders.**

This twin processor unit uses a high-speed RISC processor for code execution and an additional large FPGA for high-speed engine position tracking, allowing the scheduling of code to be independent of signal patterns, increasing flexibility, efficiency and accuracy under transient conditions. This powerful combination also allows advanced control algorithms but yet easy to map for the end user.

The F90RX is designed to control complex engines including, turbocharged, supercharged, twin drive by wire, quad cam, quad vvt, vtec, gdi, gearbox, differential and much more! The unique crank and cam sync logger allow the flexibility of controlling the most awkward trigger patterns capable of running all current known patterns and even future OEM timing wheels.

This powerful hardware is packaged within a lightweight CNC billet aluminium case. Designed to be installed in the harshest of motorsport environments.

## Processing:

- Powerful RISC CPU for advanced strategy execution
- Custom synchronous FPGA processor for engine position tracking up to 25,000rpm

## Outputs:

- 50 user configurable general purpose Pulse Width Modulated power outputs, including:
- 12 ignition coil outputs IGBT or TTL (software configurable)
- 24 general PWM/Fuel injector outputs
- 8 additional general PWM outputs pin shared with 8 analogue inputs (software configurable)
- 3 full bridges also configurable as 6 half bridges or 6 PWMs

## Inputs:

- 28 user configurable general purpose analogue sensor inputs, including 16 bipolar, inductive or hall effect speed / engine position inputs
- 8 additional analogue inputs pin shared with general PWM outputs (software configurable)
- 8 dedicated inputs, including:
- 4 acoustic knock sensor inputs
- 2 wideband (NTK) lambda sensor interface
- 2 K-type thermocouple sensor interfaces

## Interfaces:

- 100 MHz full duplex Ethernet for calibration, configuration and data download
- 3 CAN 2.0B interfaces for communication with other controllers or logging systems
- RS232 serial interface for communication with other controllers or logging systems

## Memory:

- 128MB battery backed internal logging memory
- Ultra-Fast data download via Ethernet
- Time/Date stamped data via real time clock

## Power Supply:

- 6V to 32V input voltage range with reverse polarity protection
- 2 regulated 5V sensor supply output with individual short circuit protection
- Software configurable (5V to 12V) sensor supply output (e.g. for 10V load cells)
- 5 Separately protected sensor and communication ground input

## Physical:

- Twin split sealed connector with a total of 121 pins
- CNC machined sealed anodised aluminium case
- Maximum dimensions, including the connector, are 178mm x 161mm x 41mm
- Max operating temperature 85°C
- Total mass 670 grams

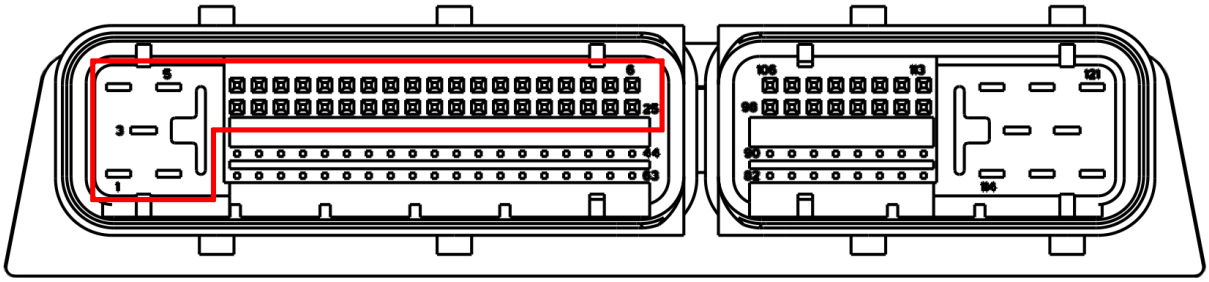
## Available Upgrade Features:

- Adaptive Knock Control
- Diesel Control
- Direct Injection Pump Control
- Direct Motor Control
- Gearbox Control
- Traction Control
- Custom Security

## Ordering Information:

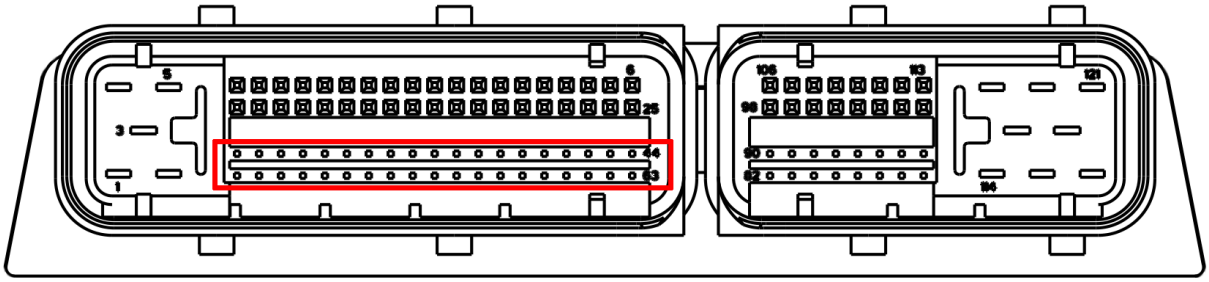
| Description | Part number |
|---|---|
| F90RX ECU | ECU-B01 |
| 121Way Connector Kit | CON-B02 |
| Adaptive Knock Control | ECU-FEAT-K |
| Diesel Control | ECU-FEAT-D |
| Direct Injection Pump Control | ECU-FEAT-I |
| Direct Motor Control | ECU-FEAT-E |
| Gearbox Control | ECU-FEAT-G |
| Traction Control | ECU-FEAT-T |

## Wiring Information:



*View looking into the 121 way connector highlighting pins 1-43 in red*

| Pin | Gauge | Signal Name | Signal Notes |
|---|---|---|---|
| 1 | 18AWG | POWER GROUND | ECU negative, must be engine ground and as short as possible |
| 2 | 18AWG | IGNITION #01 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 3 | 18AWG | IGNITION #02 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 4 | 18AWG | IGNITION #03 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 5 | 18AWG | IGNITION #04 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 6 | 22AWG | INPUT #25 | Analogue input 0-5V |
| 7 | 22AWG | KNOCK #04[1] | Knock sensor input |
| 8 | 22AWG | KNOCK GROUND[1] | Knock sensor ground |
| 9 | 22AWG | THERMO+ #02 | Thermocouple positive [K-Type] |
| 10 | 22AWG | INPUT #21 | Thermistor input; analogue 0-5V with fixed 3kΩ pullup to 5V |
| 11 | 22AWG | INPUT #18 | Analogue input 0-5V |
| 12 | 22AWG | INPUT #14 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 13 | 22AWG | INPUT #11 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 14 | 22AWG | INPUT #07 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 15 | 22AWG | INPUT #04 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 16 | 22AWG | INPUT #01 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 47kΩ (software pullup) |
| 17 | 22AWG | LAMBDA I #01 | Lambda current pump [Ip] |
| 18 | 22AWG | CAN LO #02 | CAN communication port 120Ω terminated |
| 19 | 22AWG | RS232 TX | RS232 transmit |
| 20 | 22AWG | LAN RX- | Ethernet PC communication port |
| 21 | 22AWG | FUEL #07 | Port fuel injector or low-side PWM 10A peak |
| 22 | 22AWG | FUEL #03 | Port fuel injector or low-side PWM 10A peak |
| 23 | 22AWG | BATTERY SUPPLY | ECU positive, must be as short as possible |
| 24 | 22AWG | POWER GROUND | ECU negative, must be engine ground and as short as possible |
| 25 | 22AWG | INPUT #26 | Analogue input 0-5V |
| 26 | 22AWG | 5V OUT #01 | Regulated 5V sensor supply rail, maximum current capability of 100mA |
| 27 | 22AWG | KNOCK #01[1] | Knock sensor input |
| 28 | 22AWG | THERMO- #01 | Thermocouple negative [K-Type] |
| 29 | 22AWG | INPUT #22 | Thermistor input; analogue 0-5V with fixed 3kΩ pullup to 5V |
| 30 | 22AWG | INPUT #19 | Analogue input 0-5V |
| 31 | 22AWG | INPUT #15 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 32 | 22AWG | INPUT #12 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 33 | 22AWG | INPUT #08 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 34 | 22AWG | SENSOR GROUND #01 | Protected sensor ground |
| 35 | 22AWG | INPUT #02 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 36 | 22AWG | LAMBDA V #01 | Lambda voltage signal [Vs] |
| 37 | 22AWG | CAN HI #03 | CAN communication port 120Ω terminated |
| 38 | 22AWG | RS232 RX | RS232 receive |
| 39 | 22AWG | LAN RX+ | Ethernet PC communication port |
| 40 | 22AWG | FUEL #08 | Port fuel injector or low-side PWM 10A peak |
| 41 | 22AWG | FUEL #04 | Port fuel injector or low-side PWM 10A peak |
| 42 | 22AWG | BATTERY SUPPLY | ECU positive, must be as short as possible |
| 43 | 22AWG | POWER GROUND | ECU negative, must be engine ground and as short as possible |

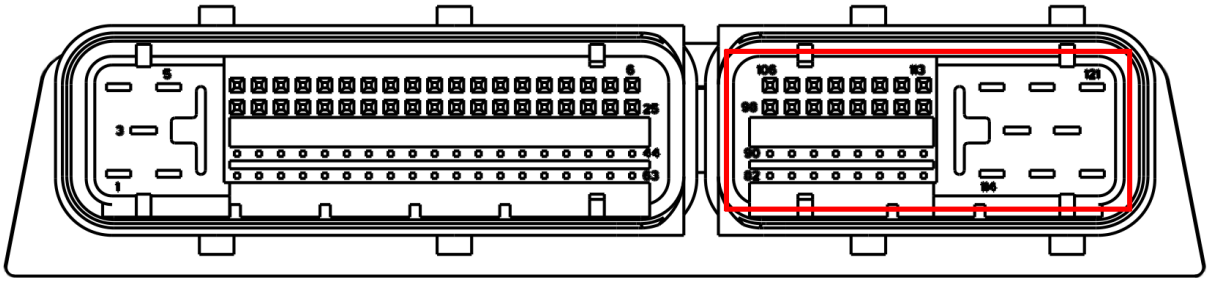


*View looking into the 121 way connector highlighting pins 44-81 in red*

| Pin | Gauge | Signal Name | Signal Notes |
|---|---|---|---|
| 44 | 22AWG | INPUT #27 | Analogue input 0-5V |
| 45 | 22AWG | 5V OUT #02 | Regulated 5V sensor supply rail, maximum current capability of 100mA |
| 46 | 22AWG | KNOCK #02(1) | Knock sensor input |
| 47 | 22AWG | THERMO+ #01 | Thermocouple positive [K-Type] |
| 48 | 22AWG | INPUT #23 | Thermistor input; analogue 0-5V with fixed 3kΩ pullup to 5V |
| 49 | 22AWG | INPUT #20 | Analogue input 0-5V |
| 50 | 22AWG | INPUT #16 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 51 | 22AWG | SENSOR GROUND #02 | Protected sensor ground |
| 52 | 22AWG | INPUT #09 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 53 | 22AWG | INPUT #05 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 54 | 22AWG | SENSOR GROUND #01 | Protected sensor ground |
| 55 | 22AWG | LAMBDA V #02 | Lambda voltage signal [Vs] |
| 56 | 22AWG | CAN LO #03 | CAN communication port 120Ω terminated |
| 57 | 22AWG | COMMS GROUND | Protected communication ground |
| 58 | 22AWG | CAN HI #01 | CAN communication port 120Ω terminated |
| 59 | 22AWG | LAN TX- | Ethernet PC communication port |
| 60 | 22AWG | FUEL #05 | Port fuel injector or low-side PWM 10A peak |
| 61 | 22AWG | FUEL #01 | Port fuel injector or low-side PWM 10A peak |
| 62 | 22AWG | H-BRIDGE #05 | H-bridge, low-side PWM or full bridge(1), 20A peak |
| 63 | 22AWG | INPUT #28 | Analogue input 0-5V |
| 64 | 22AWG | 10V OUT | Variable voltage supply pin, maximum current capability of 15mA |
| 65 | 22AWG | KNOCK #03(1) | Knock sensor input |
| 66 | 22AWG | THERMO- #02 | Thermocouple positive [K-Type] |
| 67 | 22AWG | INPUT #24 | Thermistor input; analogue 0-5V with fixed 3kΩ pullup to 5V |
| 68 | 22AWG | SENSOR GROUND #02 | Protected sensor ground |
| 69 | 22AWG | INPUT #17 | Analogue input 0-5V |
| 70 | 22AWG | INPUT #03 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 71 | 22AWG | INPUT #10 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 72 | 22AWG | INPUT #06 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 73 | 22AWG | INPUT #03 | Generic input; analogue or frequency; 0-5V, -5V to +5V, 3kΩ (software pullup) |
| 74 | 22AWG | LAMBDA I #02 | Lambda current pump [Ip] |
| 75 | 22AWG | LAMBDA GROUND | Lambda ground [Vs/Ip] |
| 76 | 22AWG | CAN HI #02 | CAN communication port 120Ω terminated |
| 77 | 22AWG | CAN LO #01 | CAN communication port 120Ω terminated |
| 78 | 22AWG | LAN TX+ | Ethernet PC communication port |
| 79 | 22AWG | FUEL #06 | Port fuel injector or low-side PWM 10A peak |
| 80 | 22AWG | FUEL #02 | Port fuel injector or low-side PWM 10A peak |
| 81 | 22AWG | H-BRIDGE #06 | H-bridge, low-side PWM or full bridge(1), 20A peak |

## Footnotes:

(1)Relevant upgrade feature must be enabled



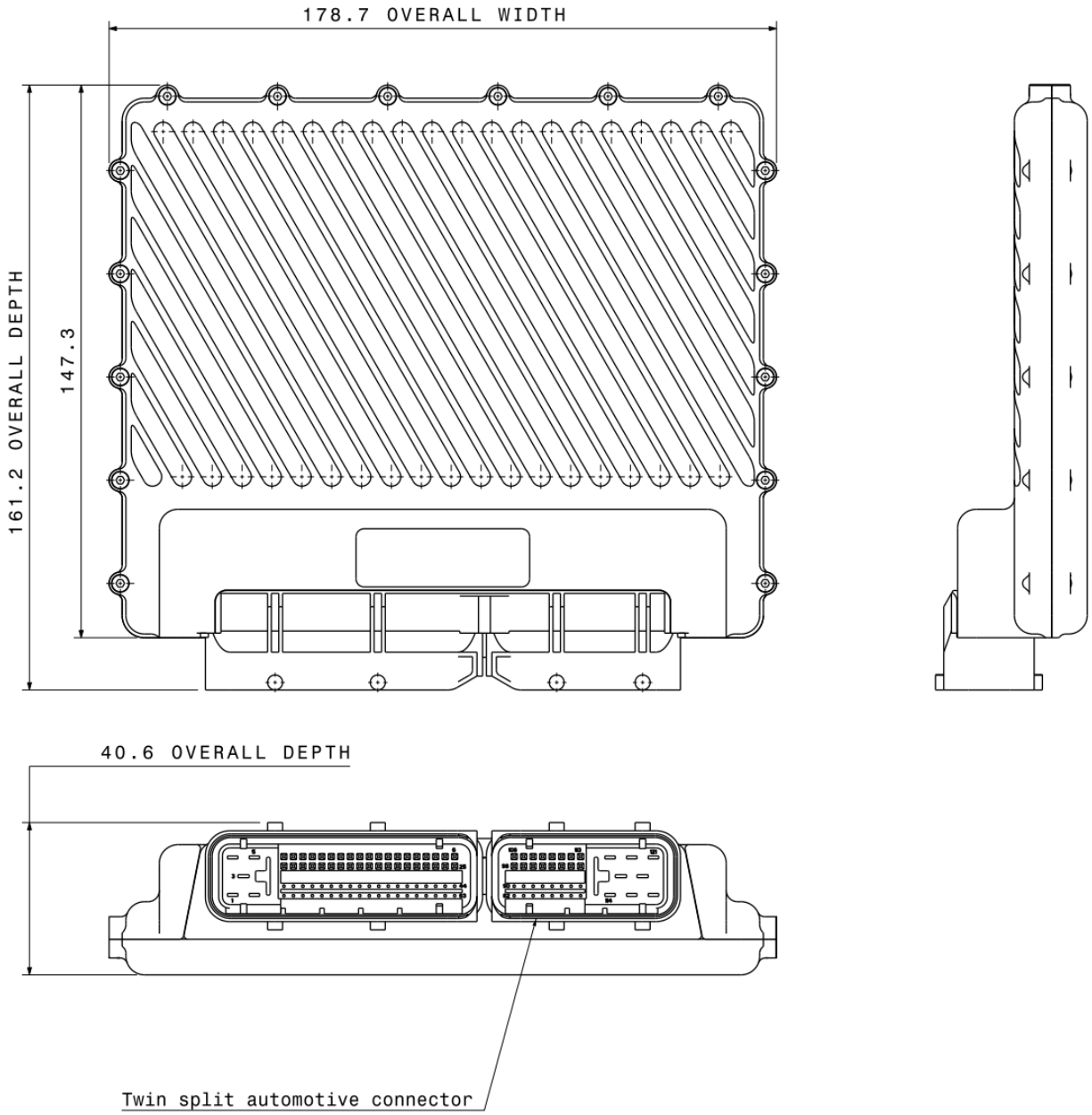
*View looking into the 121 way connector highlighting pins 82-121 in red*

| Pin | Gauge | Signal Name | Signal Notes |
|---|---|---|---|
| 82 | 22AWG | H-BRIDGE #01 | H-bridge, low-side PWM or full bridge(1), 20A peak |
| 83 | 22AWG | PWM #04 / INPUT #32 | low-side PWM 10A or Analogue input 0-5V (software selectable) |
| 84 | 22AWG | PWM #08 / INPUT #36 | low-side PWM 10A or Analogue input 0-5V (software selectable) |
| 85 | 22AWG | FUEL #12 | Port fuel injector or low-side PWM 10A peak |
| 86 | 22AWG | FUEL #16 | Port fuel injector or low-side PWM 10A peak |
| 87 | 22AWG | FUEL #20 | Port fuel injector or low-side PWM 10A peak |
| 88 | 22AWG | FUEL #24 | Port fuel injector or low-side PWM 10A peak |
| 89 | 22AWG | BATTERY SUPPLY | ECU positive, must be as short as possible |
| 90 | 22AWG | H-BRIDGE #02 | H-bridge, low-side PWM or full bridge(1), 20A peak |
| 91 | 22AWG | PWM #03 / INPUT #31 | low-side PWM 10A or Analogue input 0-5V (software selectable) |
| 92 | 22AWG | PWM #07 / INPUT #35 | low-side PWM 10A or Analogue input 0-5V (software selectable) |
| 93 | 22AWG | FUEL #11 | Port fuel injector or low-side PWM 10A peak |
| 94 | 22AWG | FUEL #15 | Port fuel injector or low-side PWM 10A peak |
| 95 | 22AWG | FUEL #19 | Port fuel injector or low-side PWM 10A peak |
| 96 | 22AWG | FUEL #23 | Port fuel injector or low-side PWM 10A peak |
| 97 | 22AWG | POWER GROUND | ECU negative, must be engine ground and as short as possible |
| 98 | 22AWG | H-BRIDGE #03 | H-bridge, low-side PWM or full bridge(1), 20A peak |
| 99 | 22AWG | PWM #02 / INPUT #30 | low-side PWM 10A or Analogue input 0-5V (software selectable) |
| 100 | 22AWG | PWM #06 / INPUT #34 | low-side PWM 10A or Analogue input 0-5V (software selectable) |
| 101 | 22AWG | FUEL #10 | Port fuel injector or low-side PWM 10A peak |
| 102 | 22AWG | FUEL #14 | Port fuel injector or low-side PWM 10A peak |
| 103 | 22AWG | FUEL #18 | Port fuel injector or low-side PWM 10A peak |
| 104 | 22AWG | FUEL #22 | Port fuel injector or low-side PWM 10A peak |
| 105 | 22AWG | POWER GROUND | ECU negative, must be engine ground and as short as possible |
| 106 | 22AWG | H-BRIDGE #04 | H-bridge, low-side PWM or full bridge(1), 20A peak |
| 107 | 22AWG | PWM #01 / INPUT #29 | low-side PWM 10A or Analogue input 0-5V (software selectable) |
| 108 | 22AWG | PWM #05 / INPUT #33 | low-side PWM 10A or Analogue input 0-5V (software selectable) |
| 109 | 22AWG | FUEL #09 | Port fuel injector or low-side PWM 10A peak |
| 110 | 22AWG | FUEL #13 | Port fuel injector or low-side PWM 10A peak |
| 111 | 22AWG | FUEL #17 | Port fuel injector or low-side PWM 10A peak |
| 112 | 22AWG | FUEL #21 | Port fuel injector or low-side PWM 10A peak |
| 113 | 22AWG | POWER GROUND | ECU negative, must be engine ground and as short as possible |
| 114 | 18AWG | IGNITION #05 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 115 | 18AWG | IGNITION #06 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 116 | 18AWG | IGNITION #07 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 117 | 18AWG | IGNITION #08 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 118 | 18AWG | IGNITION #09 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 119 | 18AWG | IGNITION #10 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 120 | 18AWG | IGNITION #11 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |
| 121 | 18AWG | IGNITION #12 | Ignition coil can be “NORMAL” or “TTL” (set via software) or low-side PWM |

## Footnotes:

(1)Relevant upgrade feature must be enabled

## Dimensions:




## Warranty and Servicing:

- This equipment comes with a 1 year warranty against manufacturing defects and failures however misuse or damage will not be covered under warranty.
- Warranty may be extended on an annual basis via a system refurbishment scheme.
- This ECU contains a battery which can be returned to Life Racing for a replacement, a charge may be made for this service.