# ANTARES 8

## Quick links

## COSWORTH

Enabling Greatness for over 65 years

# Antares 8

The Antares 8 is Cosworth's latest generation high-performance control and logging system. It features two microprocessors, one dedicated to control and the other for data collection and data logging. In addition, four Field Programmable Gate Arrays (FPGAs) provide class-leading performance.

Eight configurable GDI injector drivers and 16 configurable injector/PWM drivers, combined with eight IGBT ignition outputs and 12 logic level coil driving outputs make it capable of controlling  multiple-pulse GDI fuelling on engines up to eight cylinders, or fully sequential port injection fuelling on engines up to 12 cylinders and 24 Injectors. Combined GDI and PFI fuelling is supported for engines up to eight cylinders.

Dual fly-by-wire capability is included along with provision for Stepper and DC motors.

The Antares 8 crank and camshaft pattern recognition system allows the ECU to be used with virtually any OEM timing wheel. This sophisticated pattern recognition algorithm also facilitates synchronisation during slow and uneven cranking conditions.

The Antares 8 provides multiple functions for many of its pins:

- Unused injector and IGBT ignition outputs can be used as digital outputs.
- Unused digital inputs can be used as 12-bit analogue inputs.
- H-bridge outputs can be used in either full or half bridge mode.
- H-bridge outputs can be combined to drive a stepper motor or used to provide additional high or low-side drive capability.

All these features are configurable in software.

For reliability the Antares 8 includes reverse-battery, over-voltage protection as standard. Sensor supply and signal ground pins are also protected against short circuits to battery positive and negative.

Advanced software features include:

- In cylinder pressure monitoring
- Closed loop knock control
- Traction control
- Launch control
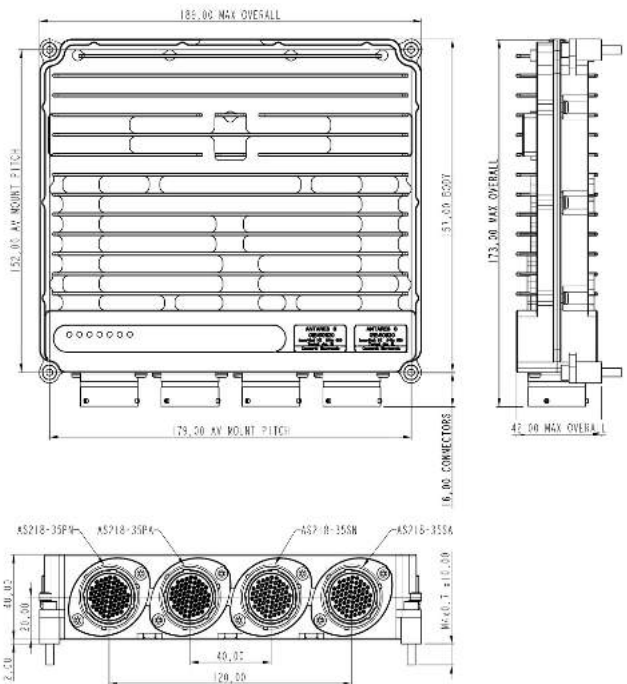
The Antares 8 is designed to function up to a maximum RPM of 16,000rpm when running GDI, or 22,000rpm when running with port fuelling only. There are four lambda sensor inputs, which will accept NTK/Bosch style wideband sensors. There are also eight specialised knock inputs with a software enabled gain stage.

The wide range of functionality makes the Antares 8 capable of working with almost any combination of coil, injector, OEM sensor, and actuator to deliver optimal engine performance.

- Integrated gearshift strategies
- Variable valve timing of up to four camshafts (including BMW VANOS)
- Ultra high speed data logging
- Scrutineering modes for single make championships

# Specifications

## Electrical Data

| | |
|---|---|
| Supply Voltage | 6.0V-16.5V<br>Reverse battery, over-voltage and load dump protection (see notes below) |
| Ethernet | 1x 1000MB/s PC Setup<br>2 x 100MB/s Ethernet Expansion[1]<br>1x 100MB/s EtherCat |
| CAN Ports | Up to 6 CAN ports<br>Max BAUD rate: 1MBit/s<br>64x message buffers per port<br>Software selectable 120Ω resistor |
| LIN Ports | Up to 2 LIN Master Ports |
| Serial Debug Port | 1x Bi-directional RS232<br>Fixed at 115200 BAUD Logger µP |
| Serial Ports | 1x Bi-directional RS232<br>Split Tx and Rx BAUD rates Logger side<br>Max BAUD rate: 115200<br>1x Bi-directional RS232 control side<br>Max BAUD rate: 115200 |
| Status LEDs | 7x LEDs |

## Mechanical Data

| | |
|---|---|
| Material | 6082-T6 Anodised Aluminium |
| Dimensions | 189 X 40 X 157MM |
| Weight | 1100g |
| Connecters | Deutsch Autosport |
| Temperature Rating | Operating -20 to +70°C<br>Storage -30 to +80°C |
| IP Rating | IP65 |

## Part Number

| | |
|---|---|
| 01E-501120 | Antares 8 Series |
| 60E-501130 | Antares 8 Comms Loom (C1 only) |
| 03A-06927 | Antares 8 Bench loom |
| Deutsch AS6-18-35SN | C1 mating connector |
| Deutsch AS6-18-35SA | C2 mating connector |
| Deutsch AS6-18-35PN | C3 mating connector |
| Deutsch AS6-18-35PA | C4 mating connector |

## Technical Data

| | |
|---|---|
| Engine configuration | 1 to 8 Cylinders (GDI)<br>1 to 12 Cylinders (PFI)<br>4 stroke, 2 stroke or rotary<br>Natural or forced induction |
| Digital outputs | 12x logic level driven TTL<br>16x Peak-Hold<br>(all support PWM) |
| Digital inputs | 16x Wheel Speed, Switch or 0-5V analogue alternate function (12-bit, 10kHz cut off) |
| Data logging | Up to 12GB memory<br>Continuous Logger: 1kHz logging rate<br>100k samples/s bandwidth<br>Burst logger: 200kHz[2] logging rate TBD |
| Crank and cam sensors | Dual crank input,<br>Single dedicated cam input,<br>4x general purpose VCAM<br>Hall effect or inductive |
| GDI Injector drivers | 8 x GDI outputs with boosted voltage |
| PFI Injector / PWM drivers | See [page 19](#) |
| Thermocouple inputs | 4x Type K (12-bit) |
| Analogue inputs (Up to 1kHz) | 32x (12-bit) |
| Analogue inputs (High speed 200kHz) | Up to 8x (12-bit) |
| Knock Sensor Inputs | 8 x 5kHz-30kHz Bandpass filter<br>Software gain (x1 or x30)<br>200kHz Sample Rate |
| Lambda Inputs | 4 x Wideband Closed Loop Lambda Inputs, Support for NTK, Bosch LSU /ADV |
| Auxiliary outputs | 4 x full H-bridge (10A peak)<br>1 x full H-bridge (5A peak)<br>2 x stepper motor alternate Function[2] |
| Ignition drivers | 8 x IGBT internal clamp<br>(+430V, 20A)<br>12 x logic level driven |
| Internal Monitoring | Battery voltage<br>Internal device temperatures<br>Excitation voltages<br>Injector current<br>Ignition current<br>H-Bridge Current<br>H-Bridge Temp |

[1] FlexRay support requires custom software development - contact Cosworth Applications Engineer for further details.

[2] Subject to applied Token.

## Product Variant Matrix

| Variant | Antares 810 | Antares 820 | Antares 830 | Antares 840 | Antares 850 |
|---|---|---|---|---|---|
| AC Customer | Included | Included | Included | Included | Included |
| AC Developer | N/A | N/A | Optional | Optional | Optional |
| In cylinder Pressure Monitoring | N/A | N/A | N/A | 4x Cylinder @ 200kHz | 8x Cylinder @ 200kHz |
| RLU Logging | YES | YES | YES | YES | YES |
| Capacity (MiB) | 1,024 | 2,048 | 8,192 | 12,280 | 12,280 |
| Bandwidth Low Speed (bytes/sec) | 35,000 | 50,000 | 150,000 | 250,000 | 500,000 |
| Bandwidth High Speed (bytes/sec) | 10000000 | 10000000 | 10000000 | 10000000 | 10000000 |
| No. of AIN | 40 | 40 | 40 | 36 +4 (HS 200kHz) | 32 +8 (HS 200kHz) |
| No. of DIN | 16 | 16 | 16 | 16 | 16 |
| Logging Tables | 1 | 1 | 2 | 2 +1 | 2 +1 |
| HS Burst Tables | 1 | 3 | 5 | 5 | 5 |
| Telemetry Tables | 3 | 3 | 3 | 3 | 3 |
| Math Channels | 100 | 250 | 250 | 350 | 500 |
| Logic Channels | YES | YES | YES | YES | YES |
| CAN Ports | 3 | 4 | 6 | 6 | 6 |
| Ethernet Displays (48x) | YES | YES | YES | YES | YES |
| Full Qualifying Mode | YES | YES | YES | YES | YES |
| I/O Expansion | CAN | CAN/EtherCAT | CAN/EtherCAT | CAN/EtherCAT | CAN/EtherCAT |
| Ethernet Ports | 3 | 3 | 3 | 3 | 3 |
| EtherCAT Ports | N/A | 1 | 1 | 1 | 1 |
| LIN Ports | 2 | 2 | 2 | 2 | 2 |
| Setup Locking | YES | YES | YES | YES | YES |
| Lambda | 4 | 4 | 4 | 4 | 4 |
| Thermocouple | 4 | 4 | 4 | 4 | 4 |
| Knock Sensors | 8 | 8 | 8 | 8 | 8 |
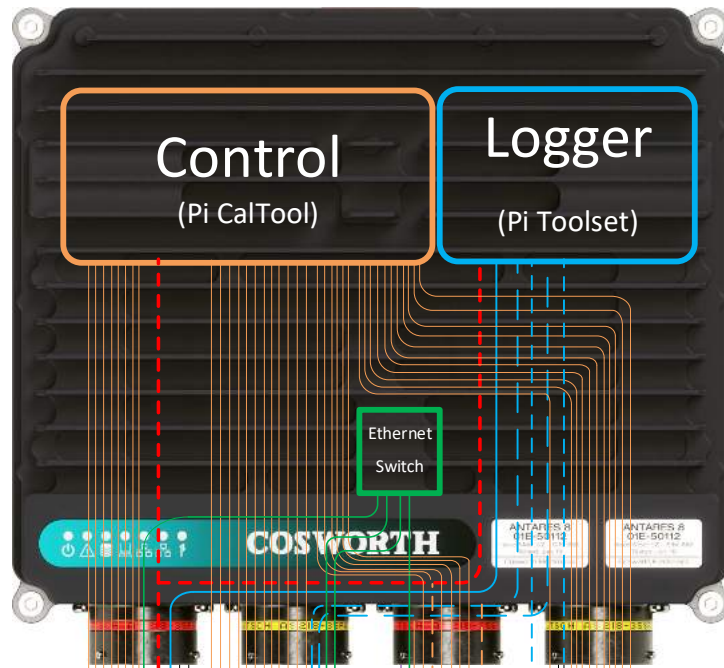
**Left column (top group):**

- 4x High Side GDI Injectors
- 4x Low Side GDI Injectors
- 8x Low Side Peak/Hold Outputs
- 2x 10A H-Bridge
- 4x Inductive Coils
- 4x TTL Coils
- Serial Port Logger Comms
- Serial Port Control Comms
- Ethernet 1 100BaseT
- CAN3 Shared Logger&Control
- Serial Port Debug Logger
- 12V Battery
- Main GND

**Left column (bottom group):**

- 4x TTL Coils
- 4x Sensor Excitations 5V
- 4x Sensor Excitations 5V / 12V
- 2x Analog Inputs
- 6x Analog Inputs (FBW)
- 2x Thermocouple inputs
- 2x Crank Inputs
- 1x CAM Inputs
- 2x Lambda Inputs
- 4x Knock Inputs
- 12x Digital Inputs
- 3x Sensor Grounds
- CAN 4 Logger only
- CAN 5 Logger only
- Ethernet 2 1000 BaseT
- Ethercat

**Right column (top group):**

- 4x High Side GDI Injectors
- 4x Low Side GDI Injectors
- 8x Low Side Peak/Hold Outputs
- 2x 10A H-Bridge
- 1x 3A H-Bridge
- 4x Inductive Coils
- 4x TTL Coils
- 2x Thermocouple inputs
- 2x Lambda Inputs
- 2x LIN Master
- 4x Sensor Grounds
- 12V Battery
- Main GND
- 2x Sensor Excitations 5V / 12V
- CAN 6 Logger only

**Right column (bottom group):**

- CAN 2 Control only
- 6x Sensor Excitations 5V
- 6x Sensor Excitations 5V / 12V
- 32x Analog Inputs
- 4x Sensor Grounds
- CAN 1 Control only
- 4x Knock Inputs
- 2x Digital Inputs 10KHz
- 2x Digital Inputs Turbo Speed
- Ethernet 3 100BaseT /FlexRay
- DAC Outputs

## LED Indicator Definitions



| Legend | Colour | LED Modes | LED Definitions |
|--------|--------|-----------|-----------------|
|  | Red | Off<br>Single (1Hz, 250ms On, 750ms Off)<br>Flash<br>Blinking | No Power to the Unit<br>Initialising and looking for clock sync<br>Sync achieved unit operational |
|  | Red | Off<br>On | Normal running condition<br>Logger error or no dataset (logging config) loaded<br>(During startup the LED performs a quick light test) |
|  | Red | Off<br>On | Normal running condition<br>Logger full and overwriting data<br>(During startup the LED performs a quick light test) |
|  | Green | Off<br>On (10Hz 50ms On 50ms Off<br>Flickering | 1000Base T Ethernet Port 2, No connection established<br>Connection established<br>Communication active |
|  | Green | Off<br>On10Hz 50ms On 50ms Off<br>Flickering | 100Base T Ethernet Port 1, No connection established<br>Connection established<br>Communication active |
|  | Green | Off<br>On 10Hz 50ms On 50ms Off<br>Flickering | 100Base T Ethernet Port 3, No connection established<br>Connection established<br>Communication active |
|  | Green | Off<br>On<br>Flickering | EtherCAT Port, no connection established<br>Connection established<br>Communication active |

## Installation

When you install the Antares 8:

- Make sure that the unit is protected against severe vibrations by mounting using supplied AV mounting kit. Also make sure that the unit is not fouling other structures which may experience severe vibrations. The warranty will be void if mounted differently.

- Make sure that the unit is positioned in an area with an ambient temperature of less than 70°C or with sufficient cooling air flow to prevent over heating.

- Make sure that the unit is mounted away from sources of electrical interference.

- Make sure that the unit is mounted in position where unit will not come into contact with water.

- Do not ground the case. Use the ground pins provided by the Autosport connectors.

## Connector Information

All pin outs are grouped in function order, rather than pin order.

## C1 Connector

| Connector | Mating Connector |
|---|---|
| AS218-35PN-943B | AS618-35SN |

## C1 Pinout

| Pin | Signal | Description |
|---|---|---|
| C1-18 | BATT+ | |
| C1-26 | BATT+ | |
| C1-27 | BATT+ | |
| C1-29 | BATT+ | |
| C1-35 | BATT+ | Battery Positive (all pins must be connected— See page 18). |
| C1-36 | BATT+ | |
| C1-38 | BATT+ | |
| C1-44 | BATT+ | |
| C1-61 | BATT- | |
| C1-54 | BATT- | |
| C1-46 | BATT- | |
| C1-37 | BATT- | |
| C1-28 | BATT- | Battery Negative (all pins must be connected—See page 18). |
| C1-20 | BATT- | |
| C1-19 | BATT- | |
| C1-12 | BATT- | |
| C1-11 | BATT- | |
| C1-6 | BATT- | |
| C1-50 | ETHTX+1 | |
| C1-42 | ETHTX-1 | Ethernet 1 Expansion 100BaseT. |
| C1-41 | ETHRX+1 | |
| C1-33 | ETHRX-1 | |
| C1-47 | CANH3_CTRL-LOG | CAN3—shared CAN port between Logger and Control. Software selectable 120Ω termination. |
| C1-55 | CANL3_CTRL-LOG | |
| C1-30 | SerialDBG_TX_LOG | RS232 serial, Logger side only (debug and alternative firmware loading) |
| C1-22 | SerialDBG_RX_LOG | |
| C1-24 | Serial1_TX_LOG | RS232 serial, Logger side only (auxiliary device comms. For example, Telemetry streams) |
| C1-32 | Serial1_RX_LOG | |
| C1-13 | Serial2_TX_CTRL | RS232 serial, Control side only (firmware loading, auxiliary device comms) |
| C1-21 | Serial2_RX_CTRL | |

## C1 Pinout (continued)

| Pin | Signal/alternative use | Description |
|---|---|---|
| C1-5 | INJHS1/PWM1 | 4x High Side Injector outputs Please refer to capabilities and combinations as shown on page 19 |
| C1-2 | INJHS2/PWM3 | |
| C1-43 | INJHS3/PWM5 | |
| C1-10 | INJHS4/PWM7 | |
| C1-4 | INJLS1/PWM2 | 4x Low Side Injector outputs for GDI & PF Please refer to capabilities and combinations as shown on page 19 |
| C1-1 | INJLS2/PWM4 | |
| C1-51 | INJLS3/PWM6 | |
| C1-17 | INJLS4/PWM8 | |
| C1-58 | INJLS9/PWM17 | 8x Low Side Injector general purpose outputs Please refer to capabilities and combinations as shown on page 19 |
| C1-59 | INJLS10/PWM18 | |
| C1-25 | INJLS11/PWM19 | |
| C1-34 | INJLS12/PWM20 | |
| C1-66 | INJLS13/PWM21 | |
| C1-62 | INJLS14/PWM22 | |
| C1-64 | INJLS15/PWM23 | |
| C1-65 | INJLS16/PWM24 | |

## C1 Pinout (continued)

| Pin | Signal/alternative use | Description | | |
|-----|------------------------|-------------|---|---|
| C1-57 / C1-49 | HBA1/PWM33 | 1 x half-H bridge output 50kHz current logging[1] | 1x full-H bridge 50kHz[1] current logging | 2 Channels may be used to form a stepper motor output (4 pins) Maximum current 10A, Maximum operating frequency 10kHz Current measurement with up to 50kHz[1] is available. |
| C1-63 / C1-56 | HBB1/PWM34 | 1 x half-H bridge output 50kHz current logging[1] | | |
| C1-53 / C1-60 | HBA2/PWM35 | 1 x half-H bridge output 50kHz[1] current logging | 1x full-H bridge 50kHz[1] current logging | |
| C1-45 / C1-52 | HBB2/PWM36 | 1 x half-H bridge output 50kHz current logging[1] | | |
| C1-16 / C1-23 | IGN1/PWM43 | 4 x IGBT outputs **Mode1:** Inductive Ignition high voltage coil drive **Mode2:** PWM output. The driver cannot pull down to 0V. The low voltage level will be around 1.2V. PWM output with limited frequency of 1kHz. (future) **Mode3:** Analog Input with limited bandwidth 10Hz, and resolution (10bit ADC) (future) **Output capabilities:** 20A peak, 3A continuous, 430V | | |
| C1-9 / C1-15 | IGN2/PWM44 | | | |
| C1-8 / C1-14 | IGN3/PWM45 | | | |
| C1-3 / C1-7 | IGN4/PWM46 | | | |
| C1-39 | DOUT1/PWM51 | 4 x logic level outputs (TTL) **Mode1:** TTL Ignition drive **Mode2:** PWM output with max frequency of 10kHz **Output capabilities:** Source 5V clamped to 25mA with a thermal fuse shutting down if overstressed, auto recovering Sink 0V @ 3.5A | | |
| C1-31 | DOUT2/PWM52 | | | |
| C1-48 | DOUT3/PWM53 | | | |
| C1-40 | DOUT4/PWM54 | | | |

[1] Hardware arrangements in place, subject to software release

⌐► = doubled up pins to split current load. Same function on either pin.

All pin outs are grouped in function order, rather than pin order.

## C2 Connector

| Connector | Mating Connector |
|---|---|
| AS218-35PA-943B | AS618-35SA |

## C2 Pinout

| Pin | Signal/alternative use | Description |
|---|---|---|
| C2-24 | ETH1000+1 | Ethernet Port 2 (high speed)<br><br>1000BaseT for high speed PC comms (logger and calibration interface) and download data logging |
| C2-32 | ETH1000-1 | |
| C2-16 | ETH1000+2 | |
| C2-23 | ETH1000-2 | |
| C2-15 | ETH1000+3 | |
| C2-9 | ETH1000-3 | |
| C2-3 | ETH1000+4 | |
| C2-8 | ETH1000-4 | |
| C2-13 | CANH4_LOG | CAN4— Logger only<br>Software selectable 120Ω termination. |
| C2-12 | CANL4_LOG | |
| C2-22 | CANH5_LOG | CAN5— Logger only<br>Software selectable 120Ω termination. |
| C2-14 | CANL5_LOG | |
| C2-1 | ECATTX+ | EtherCat master for system expansion. |
| C2-6 | ECATTX- | |
| C2-7 | ECATRX+ | |
| C2-2 | ECATRX- | |
| C2-26 | EXTPSU1 | 4x fixed protected 5V supply outputs.<br><br>Each output is independently protected and clamps the current at 50mA if required. |
| C2-18 | EXTPSU2 | |
| C2-25 | EXTPSU3 | |
| C2-17 | EXTPSU4 | |
| C2-4 | EXTPSU11 | 4x Software selectable 5V/VBatt supply outputs.<br><br>When in 5V mode each output is independently protected and clamps the current at 50mA if required. |
| C2-5 | EXTPSU12 | |
| C2-10 | EXTPSU13 | If any of those outputs are used in VBatt mode those outputs are grouped together. The current is clamped at 700mA. If overstressed a thermal shutdown protects and shuts down all outputs which are set to VBatt mode. |
| C2-11 | EXTPSU14 | |

## C2 Pinout (continued)

| Pin | Signal/alternative use | Description |
|-----|------------------------|-------------|
| C2-33 | DIN1/AIN41 | 4x general purpose digital inputs<br>**Mode1:** Switch Inputs |
| C2-41 | DIN2/AIN42 | **Mode2:** Rate measurement (wheel, shaft, etc)., Software selectable 3kΩ pull-up resistor to 5V<br>**Mode3:** 0-5V analogue alternate function (12 bit, 10kHz cut off)<br>**Mode4:** VCAM capability |
| C2-56 | DIN3/AIN43 | **Capabilities:**<br>Max sampling rate for switch type inputs: 10ms<br>Max sampling rate for specific strategies such as transmission control switch type inputs: 1ms |
| C2-53 | DIN4/AIN44 | Thresholds are software configurable between 0V and 5V |
| C2-55 | DIN5/AIN45 | 4 x general purpose digital inputs<br>**Mode1:** Switch Inputs |
| C2-45 | DIN6/AIN46 | **Mode2:** Rate measurement (wheel, shaft etc), Software selectable 3kΩ pull-up resistor to 5V<br>**Mode3:** 0-5V analogue alternate function (12 bit, 10kHz cut off)<br>**Mode4:** 220Ω Pull down for current signal based wheel speed sensors (Bosch DF11i) |
| C2-52 | DIN7/AIN47 | **Capabilities:**<br>Max sampling rate for switch type inputs: 10ms<br>Max sampling rate for specific strategies such as transmission control switch type inputs: 1ms<br>Max input pulse train 10KHz |
| C2-58 | DIN8/AIN48 | Thresholds are software configurable between 0V and 5V |
| C2-31 | DIN9/AIN49 | 4 x general purpose digital inputs<br>**Mode1:** Switch Inputs |
| C2-40 | DIN10/AIN50 | **Mode2:** Rate measurement (wheel, shaft etc), Software selectable 3kΩ pull-up resistor to 5V<br>**Mode3:** 0-5V analogue alternate function (12 bit, 10kHz cut off) |
| C2-54 | DIN11/AIN51 | **Capabilities:**<br>Max sampling rate for switch type inputs: 10ms<br>Max sampling rate for specific strategies such as transmission control switch type inputs: 1ms<br>Max input pulse train 10KHz |
| C2-59 | DIN12/AIN52 | Thresholds are software configurable between 0V and 5V |
| C2-60 | PROT-GND2 | 2x Protected sensor grounds grouped together |
| C2-65 | PROT-GND2 | Driver clamps at 3.5A and eventually shuts down if thermally overloaded |
| C2-64 | PROT-GND1 | 1x Protected GND reserved, but not exclusively for cam and crank, Driver clamps the current at 3.5A and eventually shuts down if thermally overloaded. |

## C2 Pinout (continued)

| Pin | Signal/alternative use | Description |
|---|---|---|
| C2-47 | KNOCK1 | 4x Dedicated Knock inputs, 5kHz-30kHz Bandpass filter<br><br>Software controlled gain (x1 or x30) |
| C2-50 | KNOCK2 | |
| C2-48 | KNOCK3 | |
| C2-46 | KNOCK4 | |
| C2-49 | LAMIP1 | Lambda 1 Wideband sensor input (see page 20)<br>Only use PWM29 for Lambda Sensor 1 Heater control for CL Heater Resistance mode<br>Only use AIN29 for connecting to Lambda 1 Trim (Bosch) or Label resistors (NTK) |
| C2-42 | LAMVS1 | |
| C2-63 | LAMIP2 | Lambda 2 Wideband sensor input (see page 20)<br>Only use PWM30 for Lambda Sensor 2 Heater control<br>Only use AIN30 for connecting to Lambda 2 Trim (Bosch) or Label resistors (NTK) |
| C2-57 | LAMVS2 | |
| C2-66 | CAM | Hall effect or inductive engine position inputs |
| C2-62 | CRANK1 | |
| C2-61 | CRANK2 | |
| C2-44 | TCPOS1 | 2x Type K thermocouple inputs, voltage range −4.5mV to +45mV |
| C2-51 | TCNEG1 | |
| C2-43 | TCPOS2 | |
| C2-34 | TCNEG2 | |
| C2-28 | AIN1 | 6x Analogue inputs (12 bit) with redundant ADC processing to be used for FBW related sensors (PPS, TPS)<br><br>**Mode1:** general purpose analogue input with software selectable 3kΩ pull-up resistor to 5V, 250 Hz low pass filter |
| C2-27 | AIN2 | |
| C2-39 | AIN3 | |
| C2-29 | AIN4 | |
| C2-37 | AIN5 | |
| C2-38 | AIN6 | |
| C2-36 | AIN29/LamTrim1 | 2x Analogue inputs (12 bit)<br>**Mode1:** general purpose analogue input with software selectable 3KΩ pull-up resistor to 5V, 250 Hz low pass filter<br>**Mode2:** Lambda trim inputs for compensation Resistors (Bosch LSU) |
| C2-35 | AIN30/LamTrim2 | |
| C2-30 | DOUT5/PWM55 | 4 x logic level Digital outputs (TTL)<br>**Mode1:** TTL Ignition drive<br>**Mode2:** PWM output with max frequency of 10kHz<br>**Output capabilities:**<br>Source 5V clamped to 25mA with a thermal fuse that shuts down if overstressed, auto-recovering<br>Sink 0V @ 3.5A |
| C2-20 | DOUT6/PWM56 | |
| C2-21 | DOUT7/PWM57 | |
| C2-19 | DOUT8/PWM58 | |

All pin outs are grouped in function order, rather than pin order.

## C3 Connector

| Connector | Mating connector |
|---|---|
| AS218-35SN-943B | AS618-35PN |

## C3 Pinout

| Pin | Signal/alternative use | Description |
|---|---|---|
| C3-59 | EXTPSU5 | 6x fixed protected 5V supply outputs. Each output is independently protected and will clamp the current at 50mA if required. |
| C3-60 | EXTPSU6 | |
| C3-61 | EXTPSU7 | |
| C3-64 | EXTPSU8 | |
| C3-65 | EXTPSU9 | |
| C3-66 | EXTPSU10 | |
| C3-62 | EXTPSU15 | 6x Software selectable 5V/VBat supply outputs. When in 5V mode each output is independently protected and will clamp the current at 50mA if required. If any of those outputs are used in VBat mode those outputs are grouped together. The current is clamped up 700mA. If overstressed a thermal shutdown protect and shuts down all outputs which are set to VBat mode. When in 12V mode the following grouping applies: Group 2: EXTPSU15, EXTPSU16, EXTPSU17 and EXTPSU18 Group 3: EXTPSU19, EXTPSU20, EXTPSU21 and EXTPSU22 |
| C3-50 | EXTPSU16 | |
| C3-63 | EXTPSU17 | |
| C3-49 | EXTPSU18 | |
| C3-2 | EXTPSU19 | |
| C3-6 | EXTPSU21 | |
| C3-16 | CANH1_CTRL | CAN1— Control only Software selectable 120Ω termination. |
| C3-15 | CANL1_CTRL | |
| C3-14 | CANH2_CTRL | CAN2— Control only Software selectable 120Ω termination. |
| C3-13 | CANL2_CTRL | |
| C3-7 | ETH2_TX+/FP1 | Mode1: Ethernet port 3, 100BaseT, connected to internal Ethernet Hub Mode2: FlexRay[1] |
| C3-3 | ETH2_TX-/FM1 | |
| C3-9 | ETH2_RX+/FP2 | |
| C3-8 | ETH2_RX-/FM2 | |
| C3-44 | PROT-GND3 | 2x individually Protected sensor ground groups Driver clamps at 3.5A and eventually shuts down if thermally overloaded |
| C3-51 | PROT-GND3 | |
| C3-52 | PROT-GND4 | |
| C3-58 | PROT-GND4 | |
| C3-34 | KNOCK5 | 4x Dedicated Knock inputs Software controlled gain (x1 or x30) |
| C3-25 | KNOCK6 | |
| C3-43 | KNOCK7 | |
| C3-35 | KNOCK8 | |

[1] FlexRay support requires custom software development - contact Cosworth Applications.

| Pin | Signal/alternative use | Description |
|---|---|---|
| C3-53 | AIN7 | 2x Analogue inputs (12-bit) with redundant ADC processing to be used for FBW related sensors (PPS, TPS) |
| C3-45 | AIN8 | Mode1: general purpose analogue input with software selectable 3KΩ pull-up resistor to 5V, 250 Hz, low pass filter |
| C3-41 | AIN9 | |
| C3-42 | AIN10 | |
| C3-32 | AIN11 | |
| C3-33 | AIN12 | |
| C3-23 | AIN13 | |
| C3-24 | AIN14 | |
| C3-47 | AIN15 | |
| C3-39 | AIN16 | |
| C3-31 | AIN17 | |
| C3-22 | AIN18 | 20x Analogue inputs (12 bit) |
| C3-46 | AIN19 | Mode1: general purpose analogue input with software selectable 3KΩ pull-up resistor to 5V, 250 Hz, low pass filter |
| C3-38 | AIN20 | |
| C3-29 | AIN21 | |
| C3-30 | AIN22 | |
| C3-37 | AIN23 | |
| C3-28 | AIN24 | |
| C3-21 | AIN25 | |
| C3-1 | AIN26 | |
| C3-5 | AIN27 | |
| C3-11 | AIN28 | |
| C3-20 | AIN31/LamTrim3 | 2x Analogue inputs (12 bit) |
| C3-12 | AIN32/LamTrim4 | Mode1: general purpose analogue input with software selectable 3KΩ pull-up resistor to 5V, 250 Hz, low pass filter |
| C3-4 | AIN33/CPM1 | |
| C3-18 | AIN34/CPM2 | |
| C3-10 | AIN35/CPM3 | 8x Analogue inputs (12 bit) |
| C3-17 | AIN36/CPM4 | Mode1: general purpose analogue input with software selectable 3KΩ pull-up resistor to 5V, 30kHz, low pass filter |
| C3-26 | AIN37/CPM5 | Mode2: High speed Cylinder pressure sensors, 200kHz logging rate |
| C3-19 | AIN38/CPM6 | |
| C3-27 | AIN39/CPM7 | |
| C3-36 | AIN40/CPM8 | |

## C3 Pinout (continued)

| Pin | Signal/alternative use | Description |
|-----|------------------------|-------------|
| C3-57 | ScopeOut1 | Programable digital scope outputs, for CAM, Crank, and Knock. (Requires custom firmware, contact Cosworth for details). |
| C3-56 | ScopeOut2 | |
| C3-54 | DIN13/AIN53 | 2 x general purpose digital inputs<br>**Mode1:** Switch Inputs<br>**Mode2:** Rate measurement (wheel, shaft, etc.), Software selectable 3kΩ pull-up resistor to 5V<br>**Mode3:** 0-5V analogue alternate function (12-bit, 10kHz cut off)<br><br>**Capabilities:**<br>Max sampling rate for switch type inputs: 10ms<br>Max sampling rate for specific strategies such as transmission control switch type inputs: 1ms<br><br>Thresholds are software configurable between 0V and 5V |
| C3-55 | DIN14/AIN54 | |
| C3-48 | DIN15/AIN55 | 2 x general purpose high speed digital inputs, for example, Turbospeed (no cut off Filter)<br>**Mode1:** Switch Inputs<br>**Mode2:** Rate measurement (wheel, shaft etc), Software selectable 3kΩ pull-up resistor to 5V<br>**Mode3:** 0-5V analogue alternate function (12-bit, no low pass filtering)<br><br>**Capabilities:**<br>Max sampling rate for switch type inputs: 10ms<br>Max sampling rate for specific strategies such as transmission control switch type inputs: 1ms<br>Maximum pulsetrain 100kHz<br><br>Thresholds are software configurable between 0V and 5V |
| C3-40 | DIN16/AIN56 | |

All pin outs are grouped in function order, rather than pin order.

## C4 Connector

| Connector | Mating Connector |
|---|---|
| AS218-35SA-943B | AS618-35PA |

## C4 Pinout

| Pin | Signal/alternative use | Description |
|---|---|---|
| C4-4 | INJHS5/PWM9 | |
| C4-1 | INJHS6/PWM11 | 4x high side injector outputs |
| C4-51 | INJHS7/PWM13 | Please refer to capabilities and combinations as shown on page 19 |
| C4-17 | INJHS8/PWM15 | |
| C4-10 | INJLS5/PWM10 | |
| C4-5 | INJLS6/PWM12 | 4x low side injector outputs for GDI &PFI |
| C4-58 | INJLS7/PWM14 | Please refer to capabilities and combinations as shown on page 19 |
| C4-25 | INJLS8/PWM16 | |
| C4-59 | INJLS17/PWM25 | |
| C4-64 | INJLS18/PWM26 | 4x low side injector general purpose outputs |
| C4-34 | INJLS19/PWM27 | Please refer to capabilities and combinations as shown on page 19 |
| C4-43 | INJLS20/PWM28 | |
| C4-62 | INJLS21/PWM29 | |
| C4-63 | INJLS22/PWM30 | 4x low side injector general purpose outputs. |
| C4-65 | INJLS23/PWM31 | Please refer to capabilities and combinations as shown on page 19 |
| C4-66 | INJLS24/PWM32 | |

# C4 Pinout (continued)

| Pin | Signal/alternative use | Description | | |
|-----|------------------------|-------------|---|---|
| C4-60 | HBA3/PWM37 | 1 x half-H bridge output 50kHz[1] current logging | 1x full-H bridge 50kHz[1] current logging | 2 Channels may be used to form a stepper motor output (4 pins) |
| C4-54 | | | | |
| C4-46 | HBB3/PWM38 | 1 x half-H bridge output 50kHz[1] current logging | | Maximum current 10A, Maximum operating frequency 10kHz |
| C4-53 | | | | Current measurement with up to 50kHz[1] is available. |
| C4-41 | HBA4/PWM39 | 1 x half-H bridge output 50kHz[1] current logging | 1x full-H bridge 50kHz[1] current logging | |
| C4-32 | | | | |
| C4-31 | HBB4/PWM40 | 1 x half-H bridge output 50kHz[1] current logging | | |
| C4-40 | | | | |
| C4-36 | HBA5/PWM41 | 1x full-H bridge 10kHz. Max current 5A | | |
| C4-18 | HBB5/PWM42 | | | |
| C4-2 | IGN5/PWM47 | 4 x IGBT outputs **Mode1:** Inductive Ignition high voltage coil drive **Mode2:** PWM output. The driver cannot pull down to 0V. The low voltage level is around 1.2V. PWM output with limited frequency of 1kHz. **Mode3:** Analog Input with limited bandwidth, and resolution (10bit ADC) **Output capabilities:** 20A peak, 3A continuous | | |
| C4-6 | | | | |
| C4-3 | IGN6/PWM48 | | | |
| C4-7 | | | | |
| C4-8 | IGN7/PWM49 | | | |
| C4-14 | | | | |
| C4-9 | IGN8/PWM50 | | | |
| C4-15 | | | | |
| C4-24 | DOUT9/PWM59 | 4 x logic level outputs (TTL) **Mode1:** TTL Ignition drive **Mode2:** PWM output with max frequency of 10kHz **Output capabilities:** Source 5V @ 25mA with a thermal fuse that shuts down if overstressed, auto-recovering Sink 0V @ 1A PWM61 May be used for CRANK Signal Output PWM62 May be used for CAM Signal Output | | |
| C4-16 | DOUT10/PWM60 | | | |
| C4-23 | DOUT11/PWM61 | | | |
| C4-22 | DOUT12/PWM62 | | | |

[1] Hardware arrangements in place, subject to software release

= double the amount of pins to relief current draw per pin.

| Pin | Signal/alternative use | Description |
|-----|------------------------|-------------|
| C4-55 | TCPOS3 | 2x Type K thermocouple inputs, voltage range −4.5mV to +45mV |
| C4-38 | TCNEG3 | |
| C4-61 | TCPOS4 | |
| C4-47 | TCNEG4 | |
| C4-29 | LAMIP3 | Lambda 3 Wideband sensor input (see page 20) |
| C4-30 | LAMVS3 | Only use PWM31 for Lambda Sensor 3 Heater control for CL Heater Resistance mode<br>Only use AIN31 for connecting to Lambda 3 Trim (Bosch) or Label resistors (NTK) |
| C4-37 | LAMIP4 | Lambda 4 Wideband sensor input (see page 20) |
| C4-21 | LAMVS4 | Only use AIN32 for connecting to Lambda 4 Trim (Bosch) or Label resistors (NTK)<br>Only use PWM32 for Lambda Sensor 4 Heater control for CL Heater Resistance mode |
| C4-33 | EXTPSU20 | 2x Software selectable 5V/VBat supply outputs.<br>When in 5V mode each output is independently protected and will clamp the current at 50mA if required.<br>If any of those outputs are used in Vbat mode those outputs will be grouped together. The  current will be clamped up 700mA. If overstressed a thermal shut down will protect and therefor shutdown all outputs together which are set to 12V mode. |
| C4-42 | EXTPSU22 | Only when set to 12V mode the following grouping will apply:<br>Group 1: EXTPSU11, EXTPSU12, EXTPSU13 and EXTPSU14<br>Group 2: EXTPSU15, EXTPSU16, EXTPSU17 and EXTPSU18<br>Group 3: EXTPSU19, EXTPSU20, EXTPSU21 and EXTPSU22 |
| C4-35 | BATT+ | Battery Positive (all pins must be connected, see page 7) |
| C4-44 | BATT+ | |
| C4-45 | BATT+ | |
| C4-52 | BATT+ | |
| C4-11 | BATT- | Battery Negative (all pins must be connected, see page 7) |
| C4-12 | BATT- | |
| C4-13 | BATT- | |
| C4-19 | BATT- | |
| C4-26 | BATT- | |
| C4-27 | BATT- | |
| C4-49 | PROT-GND5 | 2x individually Protected sensor ground groups<br><br>Driver clamps  at 3.5A and eventually shuts down if thermally overloaded |
| C4-50 | PROT-GND5 | |
| C4-56 | PROT-GND6 | |
| C4-57 | PROT-GND6 | |
| C4-48 | CANH6_LOG | CAN6— Logger only<br>Software selectable 120Ω termination. |
| C4-39 | CANL6_LOG | |
| C4-20 | LIN1 | LIN Bus Master 1&2 |
| C4-28 | LIN2 | |

# Injector Wiring Guide

The ECU provides a highly flexible level of connectivity for fuel injectors.

- 8x High Side GDI injector, which are distributed over two connectors (C1&C4), must be used with one of the 8 corresponding low side output if GDI is desired (Mode1).
- Up to 24x high or low impedance PFI injectors are supported if PFI-only mode is chosen.
- GDI and PFI can be combined with 8 GDI and 16 PFI injectors.
- Alternatively the output of every injector can be used for general purpose PWM functions including Lambda heater.

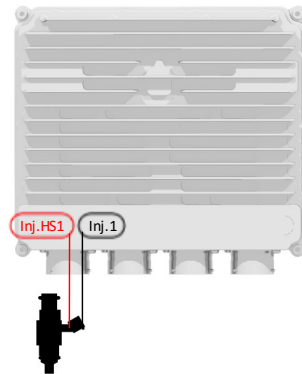Please refer to the limits for each mode as shown below.

## Mode 1: GDI, Boost supply + Control
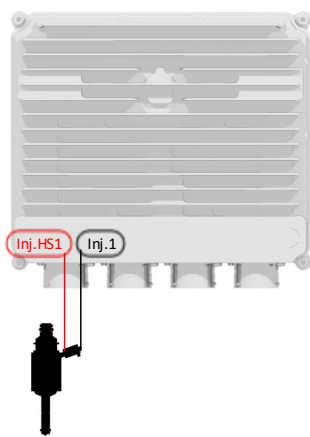


-Connected in Pairs

-Max. Boost Current 14A

-Max. Boost Voltage 90V

-Max. Peak Current 7A

-Max. Hold Current 5A

-50kHz Current Logging[1]

**Availability: 8x**
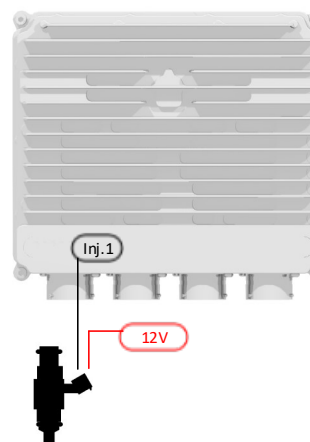
## Mode 2: PFI, 12V supply + Control



-Connected in Pairs

-Max. Peak Current 7A

-Max. Hold Current[2] 5A

-50kHz Current Logging[1]

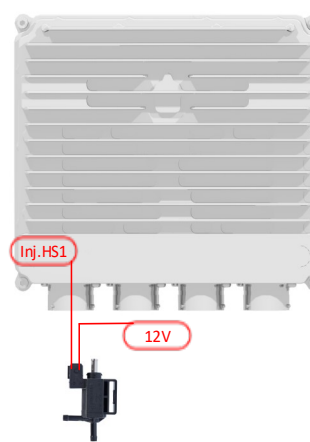-High and Low Impedance Support

**Availability: 8x**

## Mode 3: PFI, control only



-Max. Peak Current 7A

-Max. Hold Current[2] 5A

-No High Speed Current Logging

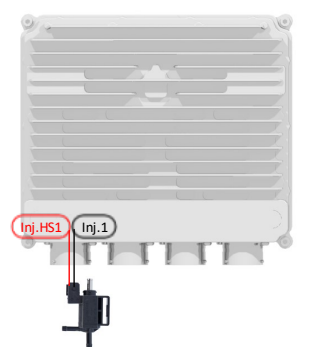-High and Low Impedance Support

**Availability: 24x**

## Mode 4: PWM, control using high side pins



-Max. Frequency 10kHz

-No Peak and Hold available

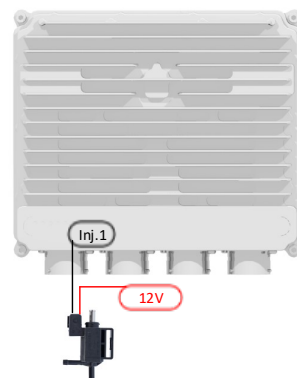-No high speed current Logging

-Max. Current 3A

**Availability: 8x**

## Mode 5: PWM, 12V supply and control



-Max. Peak Current 7A

-Max. Hold Current[2] 5A

-Max. Frequency 10kHz

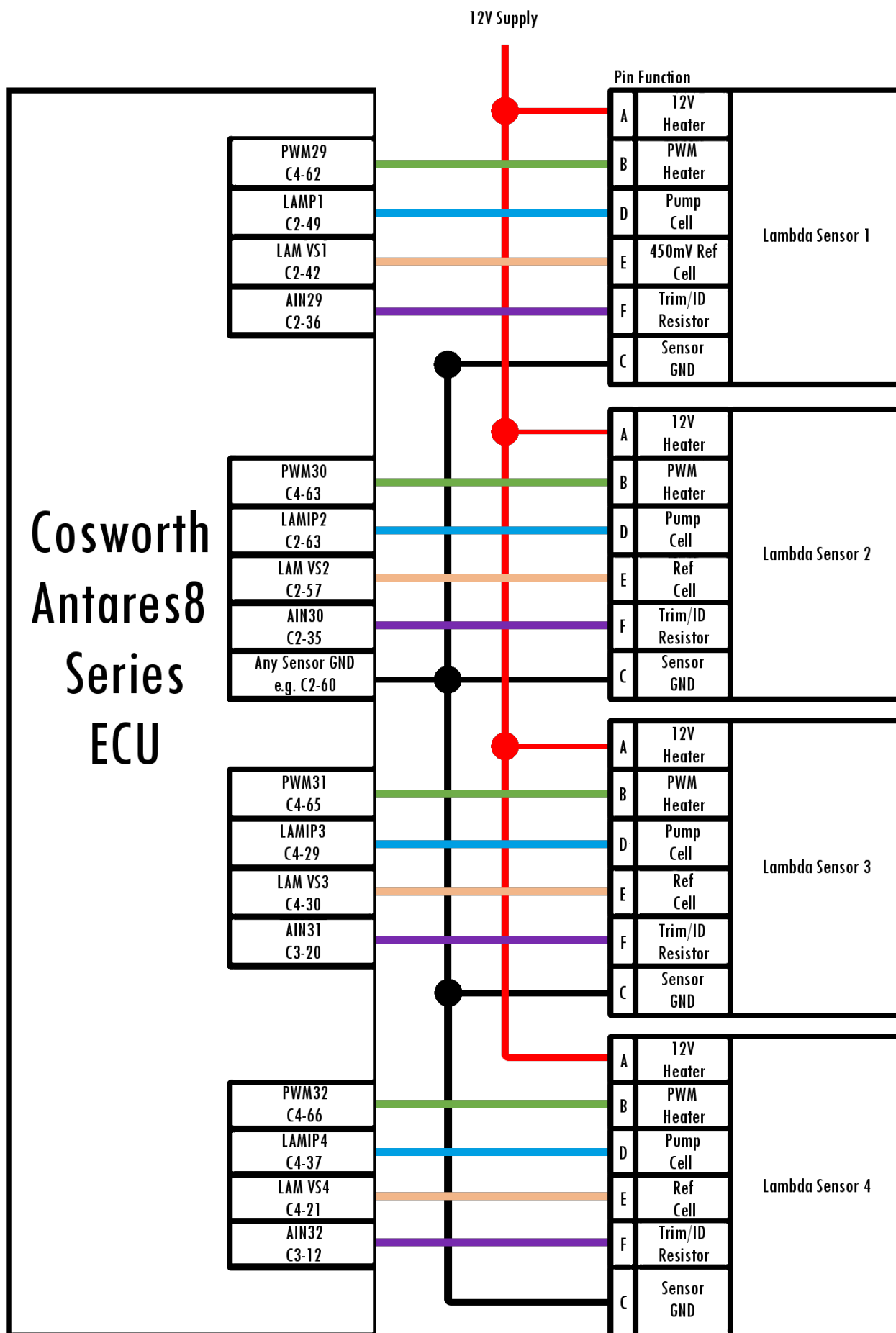-50kHz Current Logging[1]

-Current Control available

**Availability: 8x**

## Mode 6: PWM, control low side only



-Max. Peak Current 7.5A

-Max. Hold Current[2] 5A

-Max. Frequency 10kHz

-No High Speed 50kHz Logging

-Current Control available

**Availability: 24x**

12V Supply

Pin Function

**Cosworth Antares8 Series ECU**

| ECU Pin | | Pin Function | Sensor |
|---|---|---|---|
| | A | 12V Heater | |
| PWM29 C4-62 | B | PWM Heater | |
| LAMP1 C2-49 | D | Pump Cell | |
| LAM VS1 C2-42 | E | 450mV Ref Cell | Lambda Sensor 1 |
| AIN29 C2-36 | F | Trim/ID Resistor | |
| | C | Sensor GND | |
| | A | 12V Heater | |
| PWM30 C4-63 | B | PWM Heater | |
| LAMIP2 C2-63 | D | Pump Cell | |
| LAM VS2 C2-57 | E | Ref Cell | Lambda Sensor 2 |
| AIN30 C2-35 | F | Trim/ID Resistor | |
| Any Sensor GND e.g. C2-60 | C | Sensor GND | |
| | A | 12V Heater | |
| PWM31 C4-65 | B | PWM Heater | |
| LAMIP3 C4-29 | D | Pump Cell | |
| LAM VS3 C4-30 | E | Ref Cell | Lambda Sensor 3 |
| AIN31 C3-20 | F | Trim/ID Resistor | |
| | C | Sensor GND | |
| | A | 12V Heater | |
| PWM32 C4-66 | B | PWM Heater | |
| LAMIP4 C4-37 | D | Pump Cell | |
| LAM VS4 C4-21 | E | Ref Cell | Lambda Sensor 4 |
| AIN32 C3-12 | F | Trim/ID Resistor | |
| | C | Sensor GND | |

# Recycling and Environmental Protection

Cosworth Electronics is committed to conducting its business in an environmentally responsible manner and strive for high environmental standards.

**Manufacture**: Cosworth products comply with the appropriate requirements of the Restriction of Hazardous Substance (RoHS).

**Battery:** This equipment contains a rechargeable battery (Lithium 6.5mAh) for the Real Time Clock.

To maintain battery health especially when the ECU is not in use for long periods of time, please power on the device for a minimum of 6 hours every 12 months. In typical use the battery should last > 5 years.

**Service:** Should the battery need replacing the equipment may be returned to Cosworth Electronics for a battery replacement. (A charge will be made for this service).

Removal of the battery by the user may void any warranty on the equipment.

**Disposal**: Electronic equipment should be disposed of in accordance with the regulations in force and in particular in accordance with the Waste in Electrical and Electronic Equipment directive (WEEE).

To remove the battery for recycling:

Remove the case cover(s).

Remove the printed circuit boards from the case.

Remove the battery from the printed circuit board.

Dispose of the battery in accordance with regulations in force.

**Document:** 29E-501120-P

**Rev:** 4

**All Information in this document is correct as of 21/10/2024**


**T (UK)** +44 (0) 1604 598 300

**T (US)** +1 (317) 644 1037

**E** enquiries@cosworth.com

**W** www.cosworth.com

**COSWORTH**

Enabling Greatness for over 65 years