

Haltech

NEXUS R3

QUICK START GUIDE

NEXUS R3 OVERVIEW

What is a NEXUS R3 Vehicle Control Unit?

- A new generation engine management system
- A power distribution module
- A data logger
- A universal wideband controller
- A high speed Wi-Fi communications module
- All natively interconnected with each other
- All programmable with one single piece of software

The NEXUS R3 is one of Haltech's Vehicle Control Units (VCU) which features additional functionality that extends beyond just engine control. Boasting innovative yet user-friendly technology, it sets a new market standard for engine management and power distribution systems.

An ECU, PDM, Wi-Fi module, wideband controller and a data logger all in one.



NEX-US [noun]

- a connection or series of connections linking two or more things.
- a connected group or series
- the central or most important point or place

What's in the box?

- NEXUS R3
- SurLok Connectors (Red & Black)
- Wi-Fi Antenna RP-SMA 108mm
- Mounting Bolts
- USB-C Cable
- USB-C Dust Cap
- Reverse mount VCU label
- USB Key with NSP Software
- Haltech Product Catalogue



NEXUS R3 OVERVIEW

Optional accessories (sold separately)

- Plug and pins set. AMP 34 pin key 1, AMP 34 pin key 2, DTP 4 pin: HT-030013
- NEXUS R3 Universal Wiring Harness 2.5m: HT-183200
- Glass mount Wi-Fi antenna with 1.5m terminated lead. HT-011401
- Wideband Flying Lead Adaptor Harness 400mm. HT-010723
- LSU4.9 Wideband Hardware Pack. Inc sensor, adaptor harness and weld-in bung. HT-010746
- NTK Wideband Hardware Pack. Inc sensor, adaptor harness and weld in bung. HT-010747
- NEXUS R3 Tube Mount Kit 1.625" HT-039067. 1.25" HT-039065
- Hydraulic cable lug crimping tool. HT-070306

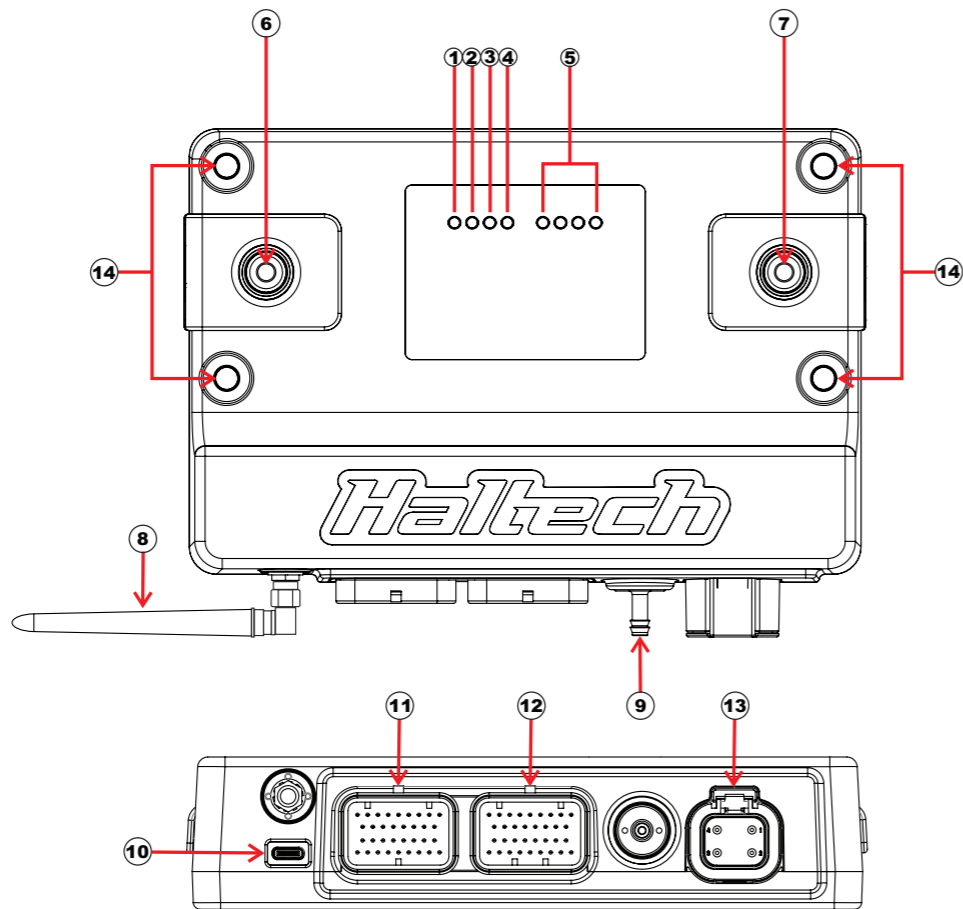
HT-010746

HT-010747

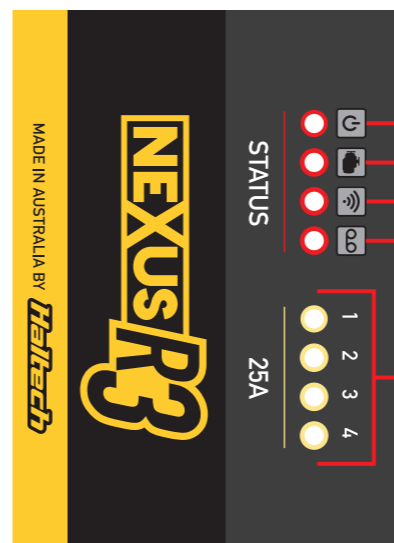
HT-010723

NEXUS R3 OVERVIEW

- 1 Power LED
- 2 DTC LED
- 3 Wi-Fi LED
- 4 Datalog LED
- 5 25A HCO LEDs
- 6 Battery Negative Stud
- 7 Battery Positive Stud
- 8 Wi-Fi Antenna (RP-SMA)
- 9 Onboard MAP sensor (4 BAR)
- 10 USB-C Port (Comms)
- 11 Connector A (AMP 34 pin Keyway 1)
- 12 Connector C (AMP 34 pin Keyway 2)
- 13 Connector E (DTP 4 pin)
- 14 Mounting Holes



NEXUS R3 LED BEHAVIOUR



LED	COLOUR	CONDITION
Power	Green	Normal operation (on main power or low power mode)
	Blue	Connect to unit and install firmware
	Red	Hardware fault
DTC	None	DTCs not present
	Yellow	A DTC is present (of any kind, past/present/not severe/severe)
WiFi	None	Wi-Fi is disabled
	Green solid	Wi-Fi is enabled
Datalog	Green flashing	Wi-Fi is enabled and connected to NSP
	None	Unit is not logging
HCO (25A)	Yellow flashing	Unit is logging, unit is not looping or not full
	Yellow	Unit is logging, unit is looping or full
HCO (25A)	None	Channel is off
	Green	Channel is on - duty cycle is >0% and operating correctly
HCO (25A)	Red	Channel is not allowed to be driven. Usually caused by (but not limited to) an overcurrent this drive cycle

NEXUS R3 SPECIFICATIONS



FEATURES	
Drive-By-Wire Throttle Support	2
Flex Fuel	YES
Closed Loop O2 Control	Dual Bank
Knock Control	Dual
Variable Cam Control	Up to 4
Long Term Learning	Up to 4D
Data Logging	Laptop + Onboard
Anti-Lag Rotational Idle	YES
Launch Control	YES
Traction Control	YES
Tuning Table Resolution	32 x 32 x 8 4D
Engine Protection	Multi Level

FEATURES continued	
CAN Networks	2
Nitrous Control Stage	6
Boost Control	4D Closed Loop
CO2 Control	YES
Intake Air Bleed Control	YES
Flat Shift Control	Advanced
Shock Travel & Ride Height	YES
Trans Brake	YES
Race Timer	YES
Advanced Torque Management	YES
On-board Wideband	Single Channel LSU 4.9 / NTK

OUTPUTS	
Ignition	8
Injector (peak and hold)	8
Digital Pulsed Outputs (DPO)	6
Power for Ignition Switch	1
Half Bridge Outputs (HBO)	6
25A High Current Outputs (25A HCO)	4

INPUTS	
Analog Voltage Inputs (AVI)	11
Differential Engine Position Inputs	2 (Trigger and Home)
Synchronised Pulsed Inputs (SPI)	6
Knock Inputs	2
Universal Wideband Controllers (NTK/LSU 4.9)	1
Ignition Switch Input	1

OTHER	
Inertial Measurement Sensor	Onboard, 6 Axis
4 Channel Oscilloscope	50kSa/s per channel, 2ms/Div limit, optional external trigger
5V Sensor Supply	1
8V Sensor Supply	1
Sensor Ground	1
Spare Ground pins for shields, sensors and low current CAN devices	2

COMMUNICATIONS	
CAN Bus Networks 1000, 500 or 250 kbit/s	2
High Speed USB 2.0 (USB-C interface) 480 Mbit/s connection	1
Power up over USB	Datalogging, settings and firmware upgrade available
Wi-Fi	900 kB/s datalog extraction. Hardware lockout for security

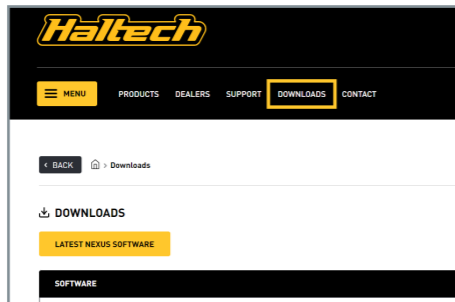
DATA LOGGING	
Location	Onboard
Storage	128MB
Max sampling frequency	1kHz
Maximum channels per log	300

DIMENSIONS	
Enclosure (Not including connector protrusion)	196 x 130 x 44.5 mm (7.7 x 5.2 x 1.8 in)
Overall (Including connector protrusion)	196 x 149 x 44.5 mm (7.7 x 5.9 x 1.8 in)
Weight	1.15 kg (2.53 lbs)
Operating Temperature (ambient)	-40 to 85°C (-40 to 185°F)
12 x Onboard Temperature Sensing Zones	ECU: -40 to 125°C (-40 to 255°F) PDM: -40 to 150°C (-40 to 302°F)

ELECTRICAL	
Power Supply (across power terminals)	8 to 22V
No output static current draw	< 1A
Low Power Mode (USB)	4 to 5.5V
Static current draw from USB port	< 500mA

Installing the software

1. Insert the supplied USB Key into your PC. If you have lost your USB key, you can download the Haltech NSP software from the DOWNLOADS section of the Haltech website.
2. If the window does not open automatically, open My Computer and find the USB drive. Double click on the USB drive icon.
3. Double click on the installer icon located in the root directory of the USB drive.
4. Once the Haltech NSP software is installed, run the software.



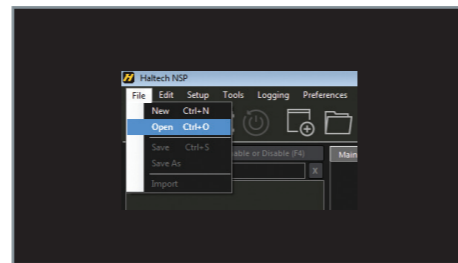
Going Online with the VCU

1. Plug the supplied USB-C cable into the USB-C Port on the front of the NEXUS R3.
2. The USB-C connection will power the VCU in a low power mode.

This mode allows the user to connect to NSP for map configuration and data-log extraction without powering the VCU completely. VCU inputs and outputs are disabled in low power mode.



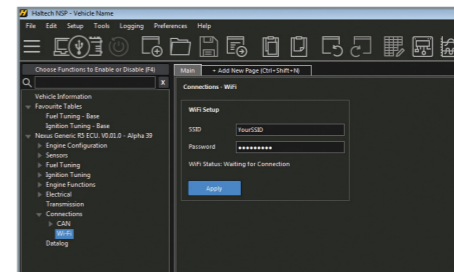
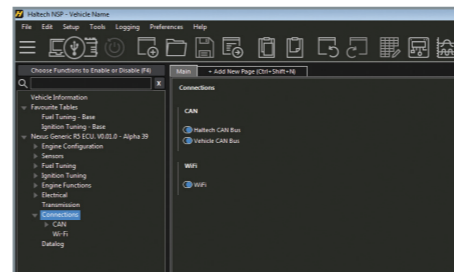
3. NSP will recognise the VCU automatically.



4. Click File/Open to choose your base map.



NOTE: The VCU must be powered on main power for Wi-Fi communication. Up to two computers may be connected to the VCU over Wi-Fi and one over USB-C at any one time.



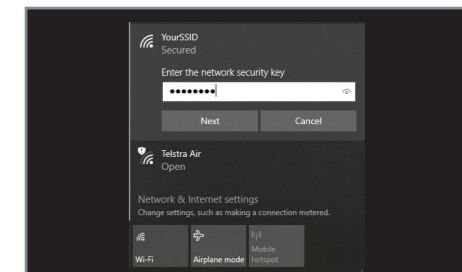
Setting up Wi-Fi communications

Wi-Fi communications can be enabled using NSP in the Wi-Fi Module Settings.

When disabled, the module is held in an OFF state and is completely inactive.

To set up your Wi-Fi connection follow these steps:

1. Open NSP and connect to your NEXUS R3 via the supplied USB-C cable.
2. Click on Connections in the feature tree and enable the Wi-Fi module setting.
3. Under Connections click on Wi-Fi to setup your SSID and password. Your SSID must be at least 1 character and your password must be at least 8 characters.
4. Press Apply.
5. With the VCU powered up on main power go to your computer's Network settings and connect to your NEXUS R3 by selecting your chosen SSID and typing in your password.

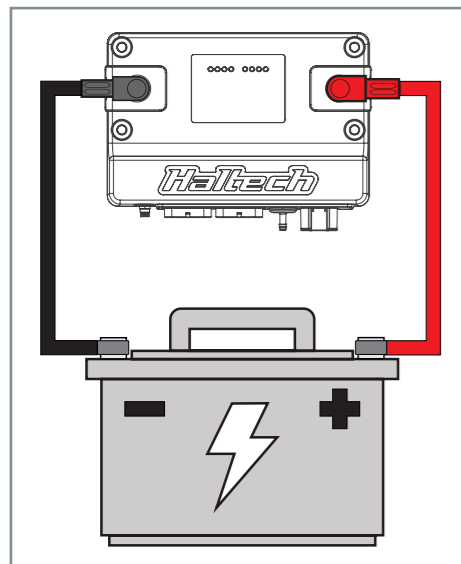


NEXUS R3 CONNECTIONS

Main Power and Ground

The NEXUS R3 must be connected to battery positive and battery negative at all times for correct operation.

Connect the NEXUS R3 to the positive battery terminal via the supplied RED SurLok connector using a 4AWG cable and to the negative battery terminal via the black SurLok connector using a 4AWG cable.

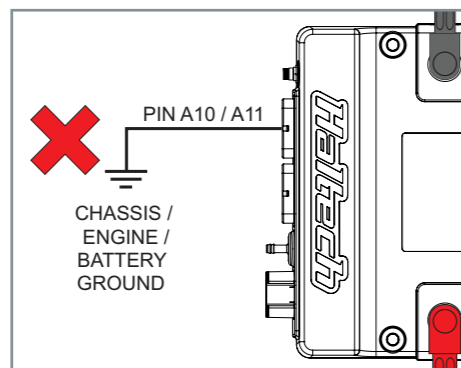


Battery Ground Output

The battery ground output pins (A10, A11) are capable of 3A per pin and are directly linked to the battery negative stud internal to the NEXUS R3.

These pins can be used for cable shielding connections or to ground low current CAN devices, digital sensors, or switch grounds.

These battery ground output pins are NOT meant to ground the VCU and should not be connected to battery negative or the chassis.



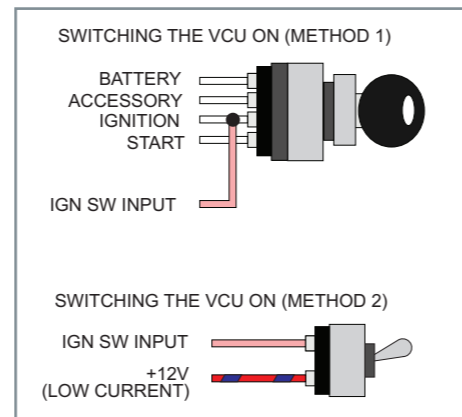
Ignition Switch

The ignition switch input pin (A13) must be connected to a switched +12V source to turn the NEXUS R3 on.

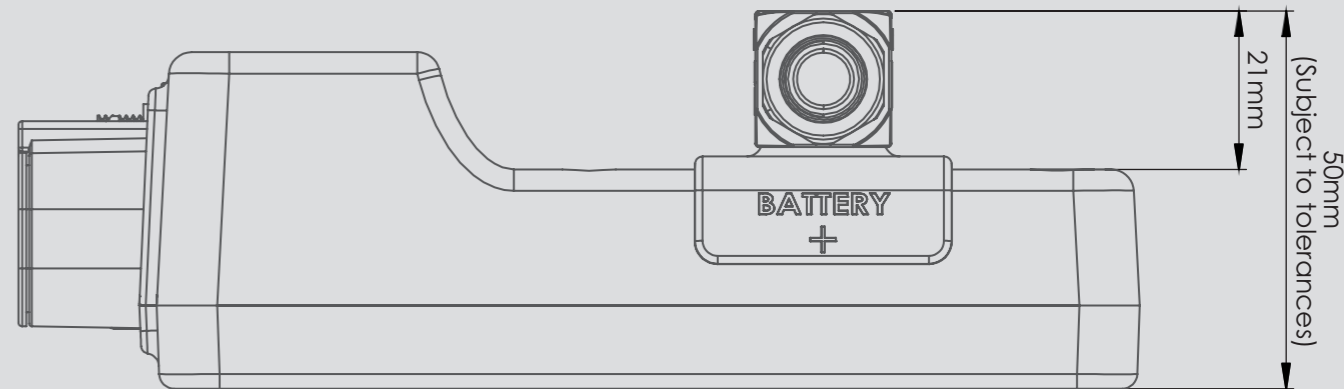
Method 1: If wiring to an existing ignition key switch in the vehicle, it is important to make sure to wire A13 to the main ignition wire (i.e. not accessory) so it doesn't lose power while the engine is cranking causing the VCU to momentarily turn off.

Method 2: Alternatively, the ignition switch input (A13) and the low current +12V power source (A26) can be switched together to turn the VCU On or Off.

NOTE: Pin A26 is a low current +12V source and must not be used to power any other device in the vehicle. Insulate and isolate if not used.

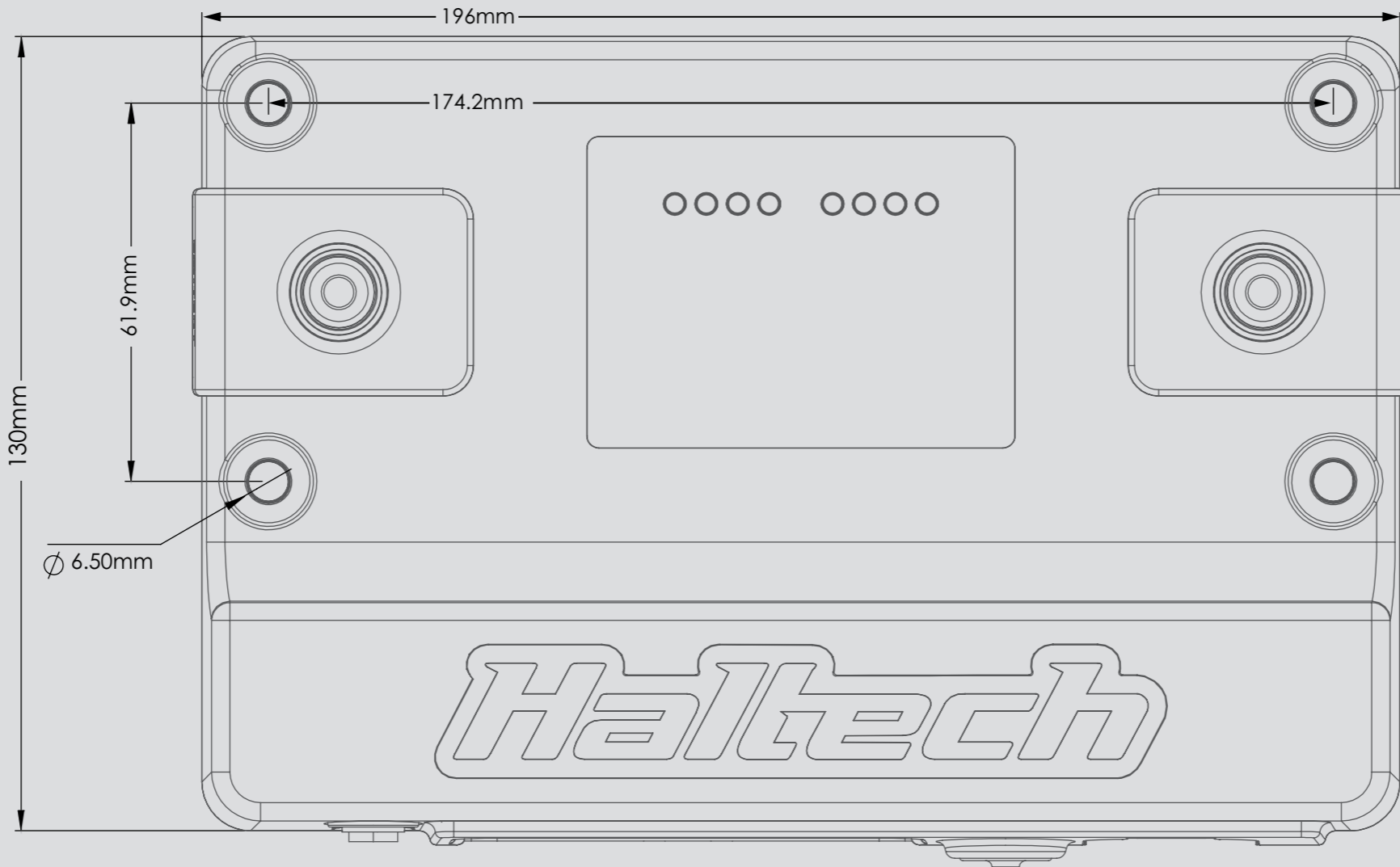


MOUNTING TEMPLATE



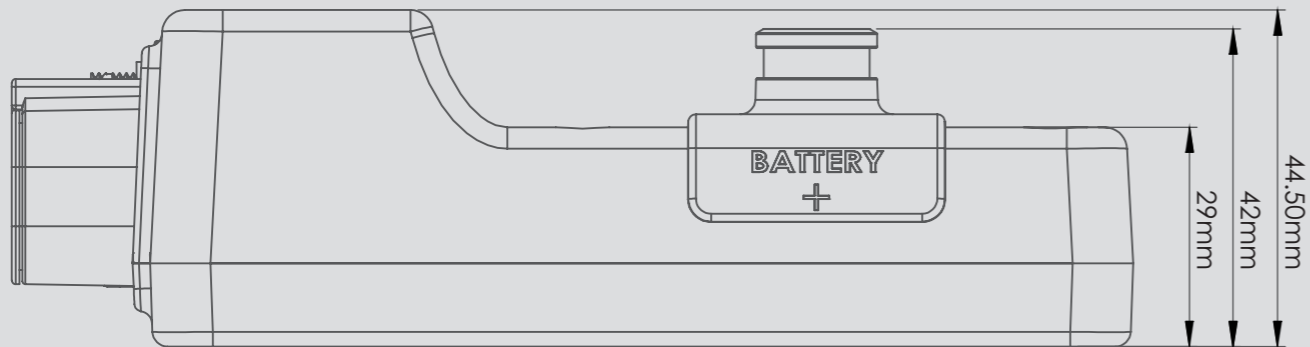
SurLok terminals installed

MOUNTING TEMPLATE



MOUNTING TEMPLATE

MOUNTING TEMPLATE



Crank (Trigger) and Cam (Home) Inputs

The crank and cam position sensors are required so that the VCU has the necessary information available to determine engine speed and position at any point in time.

Generally two sensors are required - a cam position and crank position, however many engines will have just a cam position sensor that is capable of giving the VCU enough information to run the engine correctly.

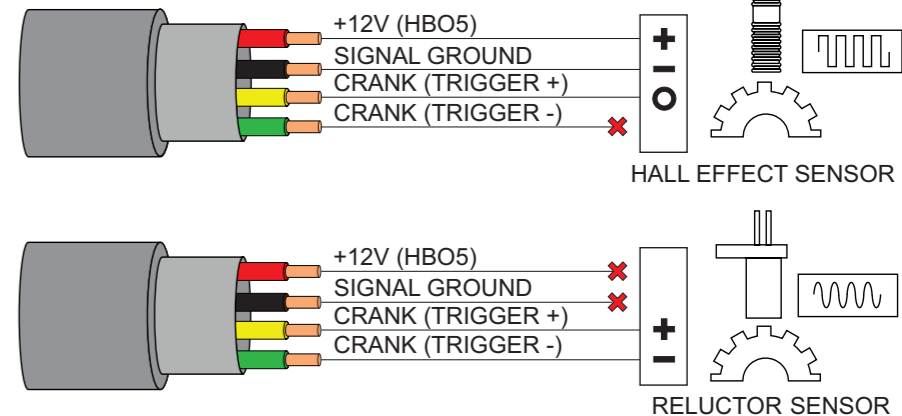
Vehicles that have a crank position sensor only are not capable of determining the difference between compression stroke and exhaust stroke and therefore are not suitable for sequential fire applications. In this case a cam position sensor may need to be added.

It is recommended that four-core or twin-core shielded cable is used for crank and cam position sensors. Shields must be terminated to battery ground at one end only.

Specs:

- -10V to +10V input
- Selectable 1k2 or 440R pull-up to 5V
- Selectable ground reference (full differential standard mode)
- -75 to +75V indefinite withstand
- 48kHz max signal frequency

Example Wiring Connections



✗ indicates not connected. Please insulate and isolate to avoid damage to the ECU.

There are two common types of crank/cam sensor signals:

• Hall effect/optical signal

(0-5V digital square wave signal)

This type of sensor sends out a digital square wave signal. Hall effect sensors usually have 3 wires; a power supply (5V, 8V or 12V), a ground and a signal out wire. The power supply can be taken from the Sensor +5V pin, sensor +8V pin or a HBO as required. The internal pullup will typically need to be enabled in the settings for Hall effect / optical sensors.

• Reluctor signal (analog style signal)

This type of sensor sends out a sine wave type of signal and will generally use two wires, signal positive (+) and signal negative (-)

Reluctor sensors do not require external power as these sensors can generate their own voltage signal as the sensor reads a moving tooth or trigger. The internal pullup will need to be disabled in the settings in NSP for reluctor sensors.

Injector Outputs

All injectors are to be wired directly to the VCU's corresponding cylinder output pins.

When an injection event occurs the VCU will ground the output pin, opening the injector.

All injectors must be wired to a common +12V supply from one of the High Current Outputs on the NEXUS R3.

When not used for injection, pins can be used as generic Digital Pulsed Outputs (DPO) capable of switching 2A to ground.

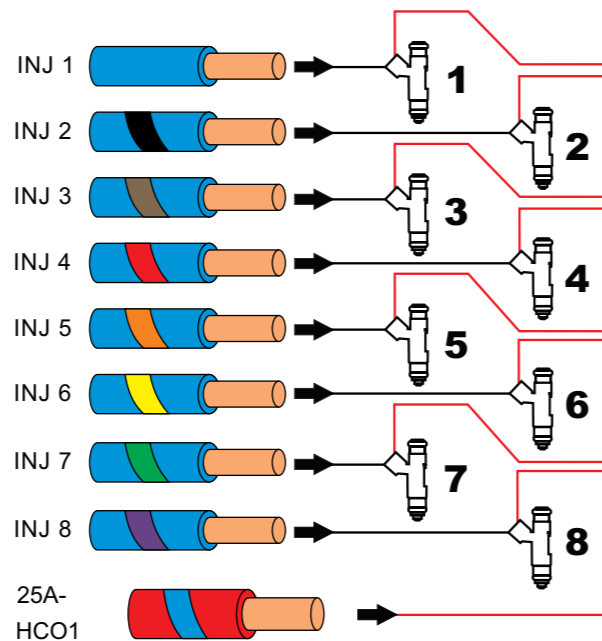
Specs:

- Number of channels: 8
- Current controlled output
- 8A Peak, 2A Hold
- 0 to 55V voltage feedback

Unused injector outputs can also be used as:

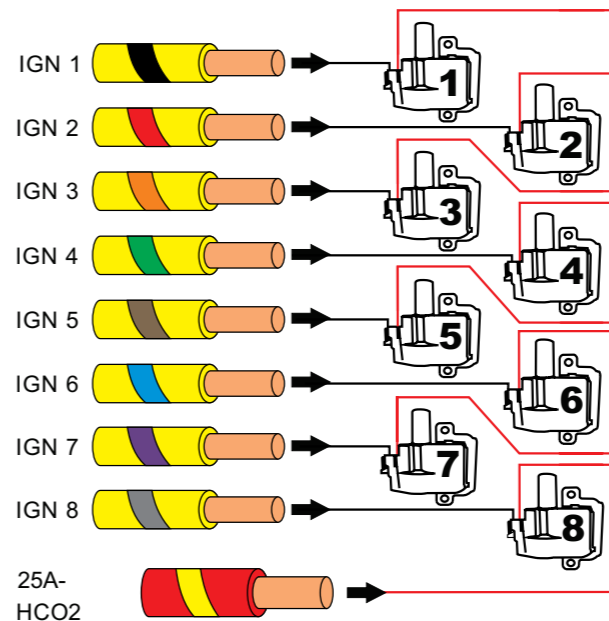
- Generic switched or PWM outputs (2A)
- Low speed digital switch inputs (0-12V)

**8-CYL SEQUENTIAL INJECTION
(WIRE AS PER CYLINDER ORDER)**



Example wiring connection shown: Sequential injection wiring with 25A-HCO1 used as injector 12V. Ensure the high current output used to power the injectors is capable of supplying the required current.

**8-CYL DIRECT FIRE IGNITION
(WIRE AS PER CYLINDER ORDER)**



Example wiring connection shown: Direct fire ignition wiring with 25A-HCO2 used as ignition coil 12V. Ensure the high current output used to power the ignition coils is capable of supplying the required current.

NOTE: The coils depicted in this diagram (HT-020102) have internal ignitors. Do not connect ignition outputs directly to coils unless they have internal ignitors as this will damage the VCU. If your coils are without internal ignitors an external ignitor must be used.

Ignition Outputs

The ignition outputs produce a signal between 12V and ground to control the charging and firing of an ignition coil. Ignition outputs can only be connected directly to ignition coils if the coils are equipped with internal ignitors.

Ignition coils without internal ignitors draw large amounts of current and thus must use an external ignitor module to be safely triggered by the VCU. Connecting directly to ignition coils without internal ignitors will damage the VCU.

Specs:

- Number of channels: 8
 - Software selectable global 12V or 5V pull-up
 - Software selectable individual 270R pull-up
 - 10kHz switching speed
 - Automatic overtemp, overcurrent, flyback protection
 - 0 to 27V voltage feedback
- Unused ignition outputs can also be used as:
- Generic DPO (3A sink) or PWM outputs
 - Low speed digital switch inputs (0-12V)

WARNING

Connecting the VCU to an ignition module before setting the ignition firing edge correctly may damage the module and coils, therefore it is advised to disconnect the module or disable the power to the ignition system until the unit has been setup and configured.

Half Bridge Outputs (HBO)

Half Bridge Outputs are push-pull Pulse Width Modulated (PWM) outputs that can be used to control DBW throttle motors, idle air stepper motors or electronic wastegates.

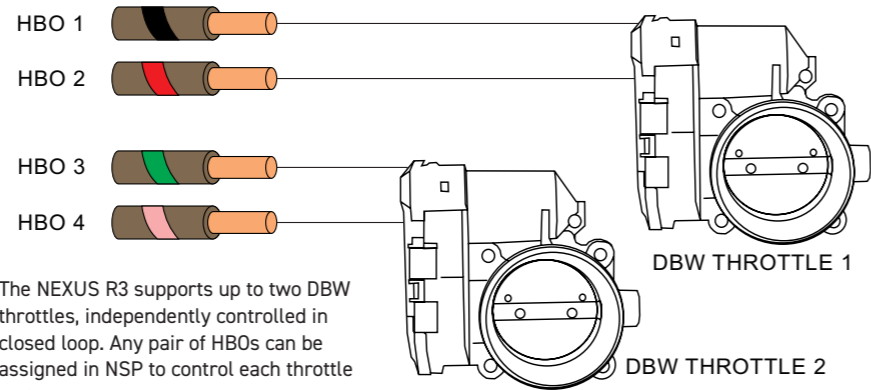
If not being used as push-pull drivers, Half Bridge Outputs on the NEXUS R3 can also be used as generic high side or low side outputs capable of driving 8A to 12V, or sinking 8A to ground.

When used for DBW throttle motors, any HBO pair can be arbitrarily used and assigned (e.g. HBO 1 and HBO 4) in the DBW wiring settings in the NSP software.

Specs:

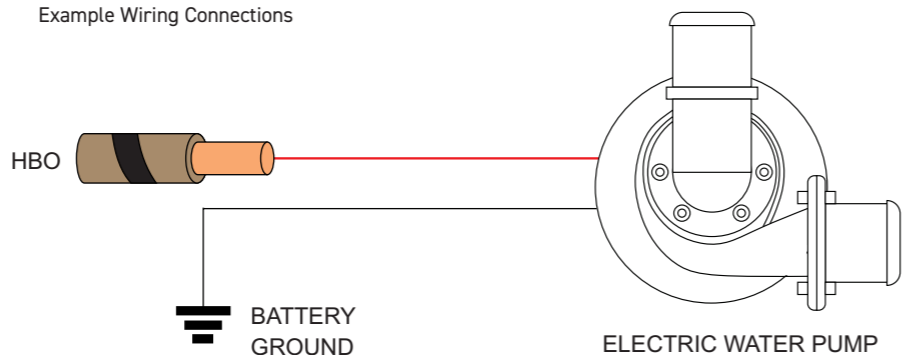
- Number of channels: 6
 - 8A to 12V (high), or 8A to ground (low) output
 - 5A max when used as push-pull PWM (eg DBW)
 - Automatic overcurrent and overtemperature protection
 - 0 to 27V feedback
 - High side current feedback
 - 18kHz switching speed in DBW mode
- Unused HBOs can be used as:
- Generic push/pull 2.2kHz PWM output

Example Wiring Connections



The NEXUS R3 supports up to two DBW throttles, independently controlled in closed loop. Any pair of HBOs can be assigned in NSP to control each throttle motor.

Example Wiring Connections



Digital Pulsed Outputs (DPO)

Digital Pulsed Outputs are capable of producing pulsed waveforms with varying duty, varying frequency, or switched states. When a DPO is activated by the VCU the output will switch to ground.

DPOs can be used to control various low-current devices such as shift lights, bypass air control valves, boost control solenoids, tachometers etc.

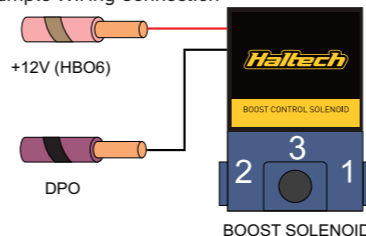
Specs:

- Number of channels: 6
- Selectable 4k7 pullup to 12V, to 5V, or disable.
- Overcurrent, overheat, and flyback protection
- Low side drive (3A max current)
- 10kHz switching speed
- 0 to 27V feedback

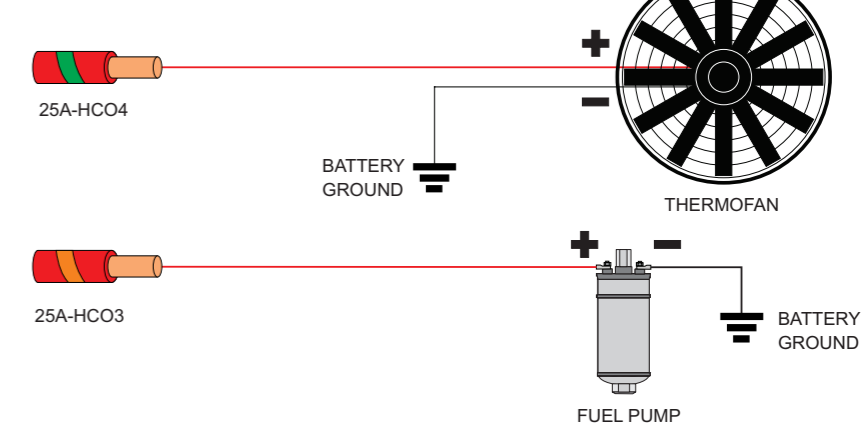
Unused DPOs can be also be used as:

- Generic PWM outputs
- Low speed digital switch inputs (0-12V) with pullup enable

Example Wiring Connection



Example Wiring Connections



25A High Current Outputs

The NEXUS R3 features four high/low outputs capable of sinking 25A to ground and driving 25A to 12V. Each output has a programmable fuse current, slow-start current and duration. Once the electronic fuse blows the output turns off for a pre-programmed delay duration before reactivating the output. You can use the NSP software to define the maximum number of retries before the output is deactivated until the next VCU reboot. The VCU LEDs conveniently display the output state.

25A HCOs are PWM capable and can be used for ignition power and injector power as well as to PWM thermofans and fuel pumps, control

transbrake solenoids, nitrous solenoids etc.

Specs:

- Number of channels: 4
- 25A source or sink current output
- Automatic high and low side overcurrent and undervoltage lockout protection
- 0 to 30V feedback
- High and low side current feedback
- 1kHz switching speed
- Capable of 0-100% duty cycle

Analog Voltage Inputs (AVI)

Analog Voltage Inputs are inputs to the VCU that accept variable voltage signals from 0V to 5V such as signals from pressure, temperature and position sensors.

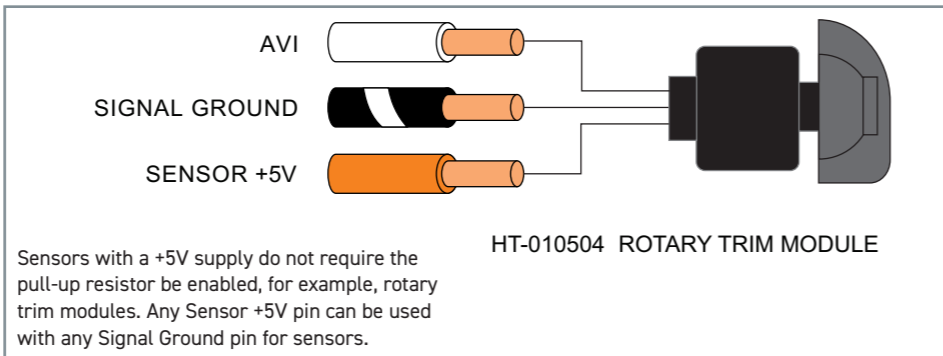
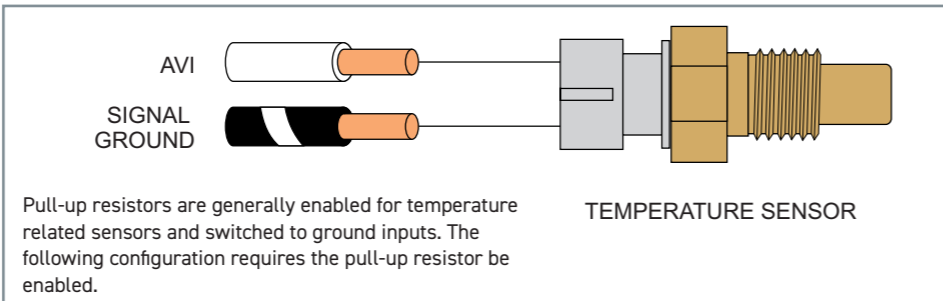
These inputs can also accept switched inputs that change between two different voltage levels. The On Voltage and Off Voltage set in NSP defines what the thresholds are between the On and Off states. Common examples of switched inputs include A/C Request switch and intercooler spray switch.

AVIs have a software selectable 1K pull-up resistor to 5V, which can be enabled or disabled within the setup page.

Pull-up resistors are generally enabled for temperature related sensors and switched to ground inputs. Any Sensor +5V pin can be used with any Signal Ground pin for sensors.

Specs:

- Number of channels: 11
- 0 to 5V analog inputs
- 1000 samples per second
- Selectable 1k pull-up to 5V
- -10 to +30V indefinite withstand
- 1.5kHz signal frequency max



Synchronised Pulsed Inputs (SPI)

Synchronised Pulsed Inputs are capable of measuring the position, duty cycle, frequency or state of a signal, as well as analog voltage inputs.

These inputs are suitable for sensors such as cam position sensors, fuel composition sensors, road speed sensors and flat shift switch.

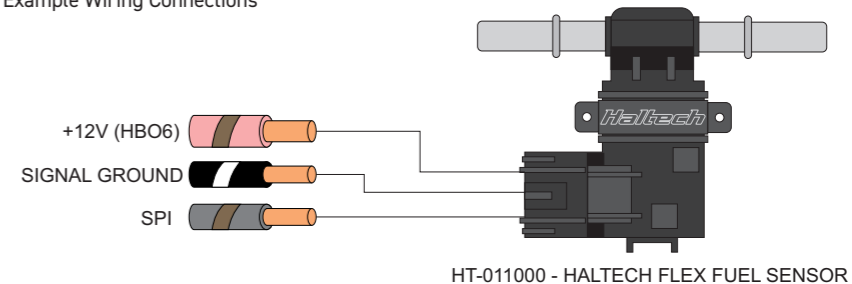
Synchronised Pulsed Inputs are compatible with digital (hall effect or optical) and analog (reluctor) based sensors, have a maximum input voltage rating of 25V and can measure up to 22.5kHz Maximum frequency.

Specs:

- Number of channels: 6
- -10 to +10V digital input
- 0 to 5V analog input
- Selectable 1k pull-up to 5V
- -15 to +30V indefinite withstand
- 22.5kHz signal frequency max



Example Wiring Connections



Knock Inputs

A knock sensor detects engine knock and sends a voltage signal to the VCU.

The NEXUS R3 VCU uses the knock sensor signal to modify ignition timing if knocking occurs. Knock detection can be performed by the VCU by installing a compatible piezoelectric knock sensor mounted to the engine block.

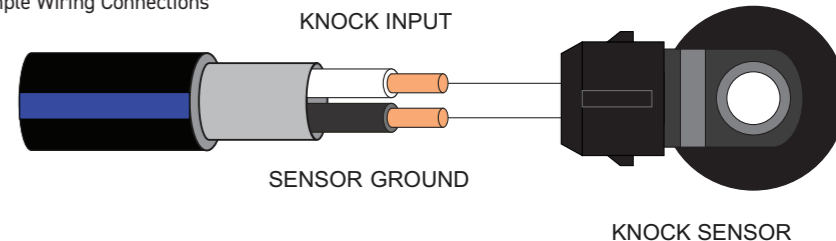
It is recommended that twin-core shielded cable

is used for knock sensors. Shields must be terminated to battery ground at one end only.

Specs:

- Number of channels: 2
- -2.5 to +2.5V AC input only
- 160Hz to 48kHz signal frequency band
- +/-3V indefinite AC voltage withstand
- 50V indefinite DC withstand

Example Wiring Connections



Wideband Sensor Input

A wideband O2 sensor can be connected directly to the NEXUS R3's onboard wideband controller.

A wideband O2 sensor, by definition, measures a broad section of the Air Fuel Ratio (AFR) scale which is a useful tool for fuel tuning, closed loop O2 control, or for engine protection.

The NEXUS R3 supports onboard wideband control for Bosch LSU 4.9 or NTK wideband sensors, which can be selected in the wideband O2 sensor settings in NSP.

If more than one wideband O2 sensor is required, the NEXUS R3 can be further expanded to use



multiple wideband O2 sensors by using external Haltech CAN wideband controller kits such as the Haltech WB1 or Haltech WB2. The diagram below shows an example of a dual wideband sensor connection with one sensor connected directly to the NEXUS R3 and the other through an external CAN WB controller.

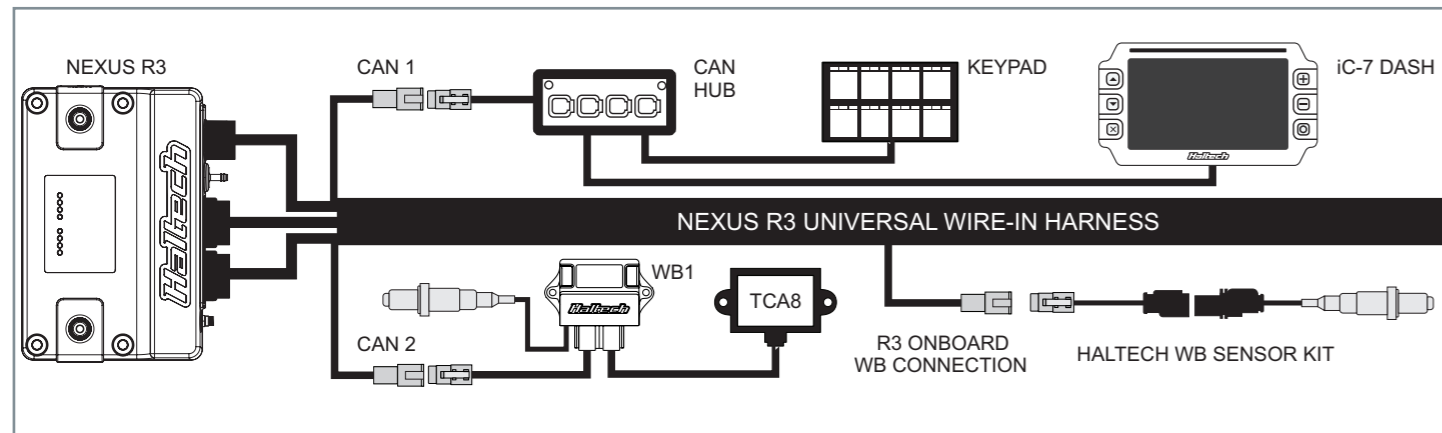
Haltech CAN System

The NEXUS R3 includes two channels of CAN: CAN 1 and CAN 2 - which may be used with a range of Haltech CAN expansion products, or to work with a supported vehicle CAN device (eg factory cluster).

The diagram below shows an example connection to multiple Haltech CAN devices (sold separately).

Specs

- Supports CAN speeds up to 1 Mbit/s
- Selectable 120ohm termination resistor per CAN channel
- Supports all Haltech CAN expansion products
- Selectable preconfigured vehicle CAN interface (OBDII compliant)



WARRANTY CERTIFICATE

At Haltech we make every effort to design and manufacture fault-free products that perform up to or above the market expectations. All our products are covered by a Limited 12 Month Warranty.

Haltech Limited Warranty

Unless specified otherwise, Haltech warrants its products to be free from defects in material or workmanship for a period of 12 months from the date of purchase.

If the Haltech product is found to be defective as mentioned above, it will be replaced or repaired if returned prepaid along with proof of purchase. Proof of purchase in the form of a copy of the original purchase invoice, receipt or bill of sale which indicates that the product is within the warranty period, must be presented to obtain warranty service.

Replacement or repair of a defective product shall constitute the sole liability of Haltech. To the extent permitted by law, the foregoing is exclusive and in lieu of all other warranties or representations, either expressed or implied, including any implied warranty of merchantability or fitness. In no event shall Haltech, be liable for special or consequential damages.

Product Returns

Please include a copy of the original purchase invoice, receipt or bill of sale along with the unused, undamaged product and its original packaging. Any product returned with missing accessory items or packaging will incur extra charges to return the item to a re-saleable condition.

All product returns must be sent via a freight method with adequate tracking, insurance and proof of delivery services. Haltech will not be held responsible for product returns lost during transit.

Returns of Products Supplied in Sealed Packaging

The sale of any sensor or accessory supplied in sealed packaging is strictly non-refundable if the sealed packaging has been opened or tampered with. This will be clearly noted on the product packaging. If you do not accept these terms please return the sensor in its original unopened packaging within 30 days for a full refund.

A sensor or accessory product may be returned after 30 days of purchase (with its sealed packaging intact) for credit only (no refunds given) and will be subject to a 10% restocking fee.

Installation of Haltech Products

No responsibility whatsoever is accepted by Haltech for the fitment of Haltech Products. The onus is clearly on the installer to ensure that both their knowledge and the parts selected are correct for that particular application. Any damage to parts or consequential damage or costs resulting from the incorrect installation of Haltech products are totally the responsibility of the installer.

Always disconnect the battery when doing electrical work on your vehicle. Avoid sparks, open flames or use of electrical devices near flammable substances. Do not run the engine with a battery charger connected as this could damage the ECU and other electrical equipment.

Do not overcharge the battery or reverse the polarity of the battery or any charging unit. Disconnect the Haltech ECU from the electrical system whenever doing any welding on the vehicle by unplugging the wiring harness connector from the ECU.

After completing the ECU installation, make sure there is no wiring left un-insulated. Uninsulated wiring can cause sparks, short circuits and in some cases fire. Before attempting to run the engine ensure there are no leaks in the fuel system.

All fuel system components and wiring should be mounted away from heat sources, shielded if necessary and well ventilated. Always ensure that you follow workshop safety procedures. If you're working underneath a jacked-up car, always use safety stands!

Haltech Off-Road Usage Policy

In many states it is unlawful to tamper with your vehicle's emissions equipment. Haltech products are designed and sold for sanctioned off-road/competition non-emissions controlled vehicles only and may never be used on a public road or highway.

Using Haltech products for street/road use on public roads or highways is prohibited by law unless a specific regulatory exemption exists (more information can be found on the SEMA Action Network website www.seman.com/emissions for state by state details in the USA).

It is the responsibility of the installer and/or user of this product to ensure compliance with all applicable local and federal laws and regulations. Please check with your local vehicle authority before purchasing, using or installing any Haltech product.



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