Four engine sensors on the CAN bus. Each input takes a **0 – 5 V sensor, a thermistor or a switch**, chosen on its setup page, and the module sends the reading in its unit: pressure, temperature, air-fuel ratio, voltage or a switch state. It wires in with **five cable pigtails**, and is set up from its own WiFi page in a phone's browser. There is no app; a laptop's browser works too, but is not needed.



CAN4

Specifications

4 ANALOG INPUTS · CAN 2.0B OUT

PARAMETER	CAN4
INPUTS	
Inputs	4, each set to 0 – 5 V, thermistor or switch from the setup page
0 – 5 V mode	0 – 5 V, 20 kΩ input, 16-bit conversion, 0.25 mV per count
Thermistor mode	10 kΩ 0.1 % pull-up to the module's own 5 V, switched in per input. Curves for the Bosch NTC M12 family, GM/Delphi coolant and air temperature sensors, a generic 10 kΩ NTC, or a three-point custom curve
Switch mode	Open or closed, to ground
Presets	0 – 5 V, read as volts · generic 0.5 – 4.5 V sender · GM MAP 2 bar (12247571) · GM MAP 3 bar (12223861), unverified · AEM X-Series UEGO (30-0300), 0.5 – 4.5 V · AEM UEGO Classic (30-4110), 0 – 5 V · Innovate LC-2, factory 0 – 5 V output, unverified · Bosch NTC M12 · GM / Delphi coolant or air · generic 10 kΩ thermistor, beta 3950 · switch to ground · custom voltage scale · custom thermistor curve. Unverified: built from published figures not yet checked against the sensor
Calibration	One or two points per input, entered as what the sensor should read
Smoothing	Per input, 0.1 to 5 s, off by default
Failed input	Sends a very high value, a very low value, or holds the last good one, chosen per input; the status frame says why
Refresh	Frames up to 200 Hz each, set on the page; the bus load the module may take is capped at 30 %. Each input is read about 130 times a second with all four set to 0 – 5 V. With one set to a thermistor, that input is read about 35 times a second and the other three over 140. Inputs set to Not used are skipped, and the others are read more often. A frame sent more often than its inputs are read repeats their latest readings. Design values, not yet measured

PARAMETER	CAN4
Accuracy	Design values: 0.1 % resistors, 16-bit conversion, the 5 V reference measured by the module itself. No measured system accuracy over temperature yet
SENSOR SUPPLY	
Output	5 V, 100 mA in all, on each sensor cable's red conductor
Protection	Survives a short to ground and a short to battery, and recovers when the fault clears. Design values, not yet tested
CAN	
Bus	CAN 2.0B, 50 kbit/s to 1 Mbit/s, 11-bit or 29-bit identifiers. 500 kbit/s by default
Frames	Up to four, each with its own identifier and rate. By default a data frame of four signed 16-bit readings at 0x6E0, 20 Hz, and a status frame at 0x6E1, 5 Hz. Every value's position, width, sign, byte order and scale is a setting
Byte order	MS byte first by default, LS first selectable, per value
Termination	120 Ω on board, switched from the setup page, off until first-run setup asks
Bus safety	Silent at power-on, and listens before it transmits. It does not transmit while it hears bus errors, as traffic at another bit rate gives. On a silent bus it transmits on probation, backs off if nothing acknowledges it, and stops after eight tries. It goes quiet on an identifier another device is sending. Firmware design, not yet tried on a bus
On one bus	Several modules, each on its own pair of identifiers: the first at 0x6E0 and 0x6E1, the second at 0x6E2 and 0x6E3, moved on its setup page. At its defaults each takes under 1 % of a 500 kbit/s bus
SETUP	
Interface	The module's own WiFi setup page, in a phone's browser. No app and no cable; a laptop's browser works too, but is not needed. Tried on one iPhone so far, on a development board
Window	The WiFi is up for 5 minutes after power-on, stays up while the setup page is open and for 5 minutes after, and can be closed from the page. It opens again at the next power-on
Security	Each unit has its own WPA2 password, printed on its label
Updates	Firmware updates from the setup page. A new image that does not reach a healthy bus is undone automatically
SUPPLY	
Voltage	8 – 16 V switched, 12 V nominal. Starts above about 7 V; resets below about 6 V, as during a cold crank, and is back on the bus a few seconds after the engine catches
Current	About 50 mA from 12 V, and up to 150 mA with the setup page open. Design values, not yet measured
Reverse polarity	Protected indefinitely. Design value, not yet tested
Jump start	24 V for 5 minutes. Design value, not yet tested

PARAMETER	CAN4
Load dump	Transient to 40 V. Designed for a load dump that peaks at 40 V, and for its bench test: 4,700 microfarads charged to 40 V and discharged into the module's 12 V input through 1 Ω. Design values, not yet tested
ENVIRONMENT	
Component rating	−40 to +105 °C
Recommended ambient	Under 100 °C. Mount away from the exhaust side
Ingress	Sealed by design. Not yet tested to an IP rating
MECHANICAL	
Enclosure	73.5 × 56 × 18.1 mm, 88.3 mm long over the zip-tie saddles, ASA
Mounting	Two zip-tie saddles, one at each cable end
Power and CAN cable	150 mm, 4-core 22 AWG, black jacket, marked CAN: red 12 V, black ground, white CAN H, yellow CAN L. Jacket stripped back 13 mm, the conductor tips bare
Sensor cables	Four, 150 mm, 3-core 22 AWG, black jacket, marked 1 to 4 on the cable and on the module: red 5 V, black ground, yellow signal. Jacket stripped back 13 mm, the conductor tips bare
Connectors	None. ECU makers wire their CAN plugs differently, and sensors come with plugs of their own, so a plug fitted here would most often be cut off. Each cable comes stripped, ready for the connector your ECU or sensor takes, or a splice. Orders of 10 or more can have a connector fitted to your pinout, quoted on request

Setup guides, at thirdshiftelectronics.com/guides: wiring and software setup for Link ECU and Haltech Nexus, written from each maker's documentation and not yet run on an ECU. For anything else that reads a user-defined CAN frame, the frame layout below. What differs between ECUs, and the setting for each: thirdshiftelectronics.com/can. Each of those settings is on the module's setup page.

Wiring

FIVE CABLE PIGTAILS

One black cable for power and CAN at one end, and four black sensor cables at the other, one per input, numbered on the cable and on the module. Each ships with its jacket stripped back 13 mm and its conductor tips bare, ready to splice or crimp. Splice them into the harness, or fit the connector your ECU or sensor takes. Wire by function, not by colour: other makers use other colours.

Power and CAN cable · black, marked CAN

CONDUCTOR	GOES TO
Red	Switched, fused 12 V. Not the ECU's 5 V sensor supply
Black	Ground. The ECU's ground, or the chassis ground the ECU uses
White	CAN H
Yellow	CAN L

Sensor cables 1 to 4 · black, one per input

CONDUCTOR	GOES TO
Red	5 V to the sensor, 100 mA for all four together. Insulate a red you do not use: one touching ground cuts the 5 V to all four
Black	Sensor ground
Yellow	The sensor's signal: input 1 to 4, by the cable's number

A 0 – 5 V sensor — a pressure sender, a wideband's analog output, an EGT amplifier — takes its cable's three conductors: red to its supply, black to its ground, yellow to its signal. If the sensor has its own supply, join only the cable's black and yellow, and insulate its red. An EG12 on switched 12 V is one: black to black, yellow to yellow.

A thermistor — coolant, oil, air or fuel temperature — takes two: yellow to one terminal, black to the other. Choose the sensor on the setup page and the module switches its pull-up in. Ground it at the cable's black conductor, not the block. By the firmware's design, the module zeroes a steady ground offset before each reading, but ground noise from engine loads still shows as jitter: modelled at about 2 °C for 5 mV on a coolant sensor near 100 °C, not yet measured. Smoothing on the input evens it out.

A switch takes yellow; the switch closes to ground, or to the cable's black.

A pre-converted EGT reaches the module as a 0 – 5 V signal from a separate amplifier. Choose **Custom voltage scale** for the input and enter the amplifier's two points from its datasheet: 0 V = 0 °C and its full-scale point.

- **Carry CAN H and CAN L on as a twisted pair** from the cable to the bus, one turn every couple of centimetres.
- **Use a fused feed.** The module is designed to draw under a quarter of an amp from 12 V; a 3 A fuse protects the wire.
- **Decide whether the bus needs the module's terminator** before setup. It does when the module is alone on an ECU's CAN port, or the farthest from the ECU of several CAN4s on one: its termination goes on. It does not when the bus already has a terminator at each end: its termination stays off, even with the module spliced on last. Cut its CAN pair so the joint is within 200 mm of the module. First-run setup asks this question, and a wrong answer shows up as errors once the car is hot.

Setup

ITS OWN WIFI PAGE

1. **Power the module** with the ECU. Its WiFi network, CAN4- followed by four characters, is up for 5 minutes, and stays up while the setup page is open. If it has closed, switch the ignition off and on.
2. **Join it** from a phone, with the password on the module's label. The phone may open the setup page by itself. If it does not, open the phone's WiFi settings, or go to 192.168.4.1 in a browser. On Android, if the page does not open, tap the network's sign-in notification or turn mobile data off.
3. **Answer the termination question** at the top of the Inputs tab: does the bus need this module's terminator? The question stays there until it is answered, and the terminator stays off until then.
4. **CAN tab:** pick the bit rate, identifiers and byte order your ECU expects. A new bit rate, identifier, frame length or rate is tried on the bus and kept once the bus acknowledges it; one that never reaches a healthy bus is undone after 30 seconds. Byte order, termination and value changes apply at once.
5. **Inputs tab:** choose each input's sensor. That sets its mode and the unit it sends. Calibrate if the reading is off: hold the sensor at a value you know and type what it should read. Set smoothing and the failed-input value if the defaults do not suit.
6. **Bus tab** shows what the bus is doing, the counters, and what to check if the module has stopped transmitting.
7. **Unit tab:** firmware updates, a settings backup, display units, and the measured 5 V reference.

Then set up the ECU to read the two frames: the setup guides, at thirdshiftelectronics.com/guides.

CAN output

TWO FRAMES BY DEFAULT

Two 8-byte frames, set up for a Link ECU by default. Everything about them is a setting: the bit rate, each frame's identifier, length and rate, and each value's position, width, sign, byte order, scale and offset, so an ECU or dash that reads a user-defined CAN frame of byte-aligned 8- or 16-bit values can be given the bytes it wants. The CAN tab shows the layout and gives it as a text file and as a DBC file. These are the defaults.

Default frames

FRAME	IDENTIFIER	RATE	BYTES 0 – 1	2 – 3	4 – 5	6 – 7
Data	0x6E0	20 Hz	Input 1	Input 2	Input 3	Input 4
Status	0x6E1	5 Hz	Input 1 and 2 states	Input 3 and 4 states	Flags, counter	Firmware version

Each reading is a signed 16-bit value in the unit its sensor sets, MS byte first:

Units on the bus

QUANTITY	ONE COUNT IS	READS FROM, TO
Pressure	0.1 kPa	−3,276.7 to +3,276.6 kPa (about ±475 psi)
Temperature	0.1 °C	−3,276.7 to +3,276.6 °C
Voltage	1 mV	−32.767 to +32.766 V
Air-fuel ratio	0.01	−327.67 to +327.66
Lambda	0.001	−32.767 to +32.766
Percent	0.1 %	−3,276.7 to +3,276.6 %
Switch	1	0 open, 1 closed

The bus stays metric; convert for display at the ECU or dash. A failed input sends 0x7FFF, 0x8000 or its last good reading, as set on the page, and its state byte says why: 1 below the sensor's range, 2 above it, 3 the wire is driven by something else while set to thermistor or switch, 4 set to Not used, 5 the converter did not answer. The two fault values sit outside the ranges above, so a valid reading never takes either. The status frame's counter steps by one each frame, so a receiver can tell a live module from a frozen value.

More than one on a bus: splice each module's CAN pair onto the bus within 200 mm of the module, cutting its cable short to do it. Then, with the ECU on, move its identifiers: on the second module's CAN tab, move the data frame to 0x6E2 and the status frame follows to 0x6E3; a third takes 0x6E4 and 0x6E5, and so on. On a bus not at 500 kbit/s, set the bus's bit rate in the same save. The change is kept once the bus acknowledges it, and undone after 30 seconds if nothing does. A module that hears another on its identifiers stops sending until its identifiers change, Try again is pressed on its Bus tab, or it is powered off and on. Either module can be the one that stops, or both: after the move, press Try again on any module whose Bus tab still shows ID in use, or switch the ignition off and on. On a bus of CAN4s of their own, only the module farthest from the ECU turns its terminator on; on a bus that already has both terminators, every module's termination stays off. Set the ECU up to read each module's frames as the setup guides at thirdshiftelectronics.com/guides show.

Frames 3 and 4 are off by default, and start on 0x6E2 and 0x6E3, the second module's pair. Give them identifiers outside the modules' pairs before turning them on.

Three fitting rules

READ BEFORE FITTING

1. Terminate once, at the ends.

A CAN bus has one 120 Ω at each physical end and none in between. This module's own terminator is electronic and only there while it is powered, so with everything off a meter across CAN H and CAN L reads the rest of the bus: about 120 Ω where the bus needs a module's terminator, about 60 Ω where it already has both terminators. A meter never sees a module's own terminator, so check each module's setting on its CAN tab.

2. Feed it switched 12 V that stays on while cranking, through a fuse.

The module resets below about 6 V and comes back on the bus a few seconds after the engine catches. On a supply that drops with the starter, it does that on every start.

3. Sensor ground is the sensor cable's black conductor, not the block.

A 0 – 5 V sender referenced to the engine reads every millivolt of ground offset as signal. By design, a thermistor's steady offset is zeroed, but ground noise still reaches its reading. Keep sensor wiring short, and away from ignition leads.

For the WiFi setup page, mount the module with its long side away from sheet steel where you can: a firewall between the module and the phone costs more range than anything else.

In the box

MODULE

The module and its card.

- **The module**, its five cables marked CAN and 1 to 4, each stripped back 13 mm with the conductor tips bare
- **A card** with the unit's WiFi name and password, and a link to the setup guides

Warranty

12 MONTHS

12 months, replaced, no questions asked.

Support: the question form on thirdshiftelectronics.com, or sales@thirdshiftelectronics.com. Include the ECU it is fitted to, and what the Bus tab shows.

Full terms: thirdshiftelectronics.com/support