

The Barnacle Widget FAQ

Announcing:

The Barnacle Widget.

It's been discussed on the Coupé Fiat Forum over a period of a few months; here are some of the questions I've been asked about it. Feel free to ask more; I'll add them to this list if they're of general interest.

Obligatory legal and safety stuff!

You attach this device to your ECU at your own risk. I will not be responsible for any damage – howsoever caused – other than replacement of the device or refund of the price (less postage) in the case of failure of the device.

The FCCUK have kindly allowed me to use their logo but accept no responsibility for damage caused by its use.

The device is intended to be used with an external voltage supply of 13.6V DC – normally supplied by the vehicle battery. Connection with an in-line fuse of no more than 3A is recommended. It should under **no circumstances** be attached to the mains electricity supply.

The electroluminescent back-light uses a high voltage (approx 200VAC) generated on board. You should have no access to this voltage unless the unit is disassembled; contact with this voltage is not recommended. If you choose to remount the unit in a box of your choice you need to ensure that all electrical contacts to the circuit boards are insulated.

The electrical interfaces used by this device have been designed to the published specifications for ISO9141 (for connection to the ECU) and EIA232 (for the computer connections).

- ***What is it?***

It's a device that can interrogate the status of the engine management system on most of the Coupé Fiat range (16v and 16vt; 20v and 20vt) on a continuous basis, and display a selection of information on an in-car display.

- ***Um, say again?***

It tells you what the engine management unit (also known as the ECU) thinks is going on in the world. It displays the information that the ECU is using – in real time – to calculate the fuel and ignition parameters of the engine. It will also display any fault information, including faults that might not cause the warning light to come on.

- ***What sort of things can it display?***

This depends on the ECU fitted to the vehicle. The 16v and 16vt version can display:

- ✓ Engine RPM
- ✓ Air and water temperature (the water temperature you see on the dash comes from a second sensor)
- ✓ Ignition timing
- ✓ Fuel injector period
- ✓ Manifold pressure
- ✓ Throttle position
- ✓ Battery voltage
- ✓ VAE position (idle control valve)

While the 20v can display all of the above, with the exception of the manifold pressure – instead, it reports the airflow in cubic metres per hour. Additionally, it will also report

- ✓ mixture ratio
- ✓ lambda sensor value
- ✓ lambda sensor integrated value (how close the mixture is to stoichiometric over the last few seconds)
- ✓ vehicle speed

- ***What about problems in the engine?***

The ECU in both the 16v and 20v coupé is capable of monitoring the state of various components in the engine management system – in particular, the main sensors. It can also monitor the health of various actuators – ICR valves, and for the 20v, the injectors.

When a fault arises in one of these items, the ECU will try and work around the failure; deriving alternate values from the state of other sensors. In most cases, the engine will continue operating, but errors in some components will result in the engine operating in 'limp-home' mode. Most – but not all – errors will also result in a red warning light appearing on the dash.

When a fault arises, the display will indicate what the fault is. Because faults are not cleared by the ECU until the next time the engine is started, they are displayed continuously until then. One exception is the lambda sensor on a 16v, which self-clears without restarting the engine.

On the 20v and 20vt, the red light also remains operational; in the 16v, the connection to the tester removes the red light circuit.

- ***Does the same unit work with all coupés?***

Almost. 20v VIS engines use a completely incompatible system, more akin to the current OBDII mandated connections on current (post 2001) vehicles. The 16v 1.8 engine uses a Hitachi ECU which is not currently supported, though the software is in development.

- ***Where does it fit in the car?***

As supplied, the unit is mounted in a laser-cut metal panel which fits nicely in the space left behind if the driver's side heater vent is removed. Daft as it sounds, the best way to secure it is with blu-tack^[tm] or similar sticky stuff; this doesn't damage the vehicle and lets you remove the unit at a later date.

Alternatively, if you're feeling enthusiastic, you can obtain a suitable metal or plastic box and use the provided metal panel as a template for the cut-outs.

- ***How do I go about mounting it, then?***

You'll need to:

- ◆ Remove the end panel of the dashboard, driver's side. There's a thumbscrew inside at the bottom of the panel which should be released, and then the panel can be wiggled off the clips at the top of it.
- ◆ Remove the vent unit. It's clipped with two compression points on the top and bottom of the plastic casting; release the top ones and the casting will pivot forwards. You may find it easier to do the next stage first.
- ◆ Remove the right-angled plastic conduit between the vent and the dashboard vent. Wiggling helps.
- ◆ Blank off the remaining outlet – where you just remove the conduit – with tape. This isn't strictly necessary, but will stop it blowing on your knee.
- ◆ Insert the widget into the hole you have left. Put the wires through first.
- ◆ Route the fatter black wire with the connector on it into the engine compartment. I have used a route that goes through the door seal and then under the bonnet; the connector is too large to go through any of the grommets.
- ◆ Connect the diagnostic connector to the ECU port. On the 16v the connector is on the right-hand-side bulkhead, close to the MAP sensor, and it's already connected to something. On the 20v, the connector is on the front of the windscreen washer fluid container, and is protected by a plastic cap.
- ◆ Connect the remaining red lead to a convenient source of 12v power, switched by the ignition. I recommend that you use an in-line fuse of 2A to protect the wiring. If you have mounted the unit in an external box, the simplest way to get power is from the accessory/cigarette lighter socket – again, you should use a fused plug.
- ◆ If you're considering doing live logging from the widget, or expect to want to change the display parameters frequently, it's worth attaching a serial lead to the supplied socket – you need a standard 9-pin male-female serial cable, using pins 2, 3, and 5, with no crossover – and hiding it behind a suitable bit of the dashboard. See below for what to do with it.

- ***Now what?***

Now you can turn on the ignition. You should see a logo indicating the vehicle for which the widget has been preset.

The image is included by kind permission of the Fiat Coupé Club UK. The FCCUK in no way endorses this device, nor are they in any way responsible for any loss or damage which may arise from its use.

After a short delay, on the 16v vehicles you'll see an immediate display of your selected parameters (or a fault report, if a fault exists). On 20v vehicles, the synchronisation between the ECU and the widget is more complex, and this will not occur unless the engine speed is under 2000 rpm while the device tries to start the communication. You'll see a message 'initialising comms' and then 'id:' on the next line of the display. After a second or so, the ECU responds with a string of numbers and letters which are the Fiat internal ID for the ECU. After that, the device will switch to displaying the engine data you've selected.

- ***So how do I select what to display?***

Two ways. When the widget is delivered to you, it will be preset with the parameters you've chosen and preselected for your engine type.

If you want to change either of these, you can attach a terminal to the serial port.

Set the terminal parameters to: 2400 Baud, 8 data bits, 1 stop bit, no parity.

Hyperterminal in Windows 2000 is a suitable terminal program to use.

When the widget starts, it first sends a short message identifying itself and describing the current screen layout.

```
Fiat Coupe engine monitor version 2.0735 (c) nailed barnacle 2005
Engine type is: 16V NA
Display layout is:
Line 1: Revs/minute
Line 2: Throttle position
Line 3: Air temperature
Line 4: Water temperature
```

After a short delay while connection with the engine is established, a menu is displayed on the terminal.

The menus are pretty simple-minded; all the choices are either numbers or lower-case letters. Pressing an unrecognised key will return as if you had pressed 'q' which is always used to quit without changes. There's also an automatic time-out – if you don't do anything for thirty seconds it assumes you want to quit.

```
Main menu -  
(1) select engine type  
(2) select display layout  
(3) get engine status  
(4) get engine error reports  
(5) reset
```

A point to remember: if you try and use the terminal while the ignition is not on or when communications with the engine management unit have not been established – as may be with a box-mounted widget – then there may be a delay of several seconds before the widget responds to the terminal. This isn't a bug; it's just the widget waiting for responses from the ECU and it returns to the terminal when it gets bored. You'll only see this from the top level menu; once you're actually making changes, the terminal has priority.

The selections on the menu are:

1. *Select engine type*

Here you can make sure the engine type matches that in your car. If you select the wrong engine, then either communications will not be established, or some of the sensor values from the ECU will not be displayed properly. The engine type is also indicated when the widget starts operating, with a graphic on the display.

```
Select engine type -  
(1) 16v NA  
(2) 16v Turbo  
(3) 20v NA  
(4) 20v Turbo  
(q) cancel without change
```

2. *Set display layout*

This lets you select which engine parameter you want to display on which line of the display. The first menu selects the line you wish to change – 1 is at the top, 4 at the bottom – and then leads you to a further menu which selects the actual parameter to be displayed.

```
(1) select line 1  
(2) select line 2  
(3) select line 3  
(4) select line 4  
(q) cancel without change
```

Not all parameters can be displayed for all engine types; the ECU does not provide the information. If you choose something unavailable, e.g. lambda sensor on a 16v, then the parameter will be displayed but the data will be invalid (most likely zero). Normally four parameters are displayed, but there is the ability to display double-height value bars if you choose; thus, you can display two, three, or four parameters.

```
Select function for this line
(1) revs/minute
(2) injector period
(3) ignition advance
(4) intake pressure (16v)\mass air flow (20v)
(5) air temperature
(6) water temperature
(7) throttle valve angle
(8) battery voltage
(9) idle control valve (16v only)
(a) lambda sensor voltage (20v only)
(b) integrated lambda voltage (20v only)
(c) vehicle speed (20v only)
(q) cancel without change
```

To show the double-height bars, just select the same parameter to two adjacent lines.

3. *Get engine status*

This is intended to supply an instantaneous readout of the current engine values. It's not really people-readable, but if you want to develop a small piece of software to interrogate the unit you have my blessing; it's possible that in the future either my Star Trek software or Furby's software will be extended to provide this functionality.

Alternatively, you can use the repeat key function in Hyperterminal to grab a whole slab of datapoints in one go and then use something like Excel or the OpenOffice Spreadsheet to import as 'delimiter separated' data and then display as a graph.

The data itself is formatted as a series of decimal values separated by spaces.

The first item is a time-stamp with four digits of minutes, two digits of seconds, and two digits of hundredths of a second, so 00012345 represents a time of one minute, twenty-three seconds, and forty-five hundredths. This is the time at which the message was sent, **not** the time at which the data was sampled; that might differ by up to a couple of seconds.

The remaining data consists of the revs (revolutions per minute), the injector period (microseconds), ignition advance (degrees), inlet manifold pressure (millibar) or airflow (cubic metres per hour), air temperature (degrees C), water temperature (degrees C), throttle position (degrees), battery voltage (millivolts), ICR operating ratio (percentage), lambda voltage (millivolts), integrated lambda voltage (percentage), and vehicle speed (in kilometres per hour).

```
(specimen output data - 16v)
>00134706 4823 12000 30 512 38 84 35 13650 20 0 0 0
```

4. *Get Engine Error Reports*

Again, this is intended for external software to read the error memory of the ECU. The error reports are completely different between the 16v and 20v engines – the first provides just three bytes which must be decoded to provide the data, while the second provides historical data and engine condition data as well as the actual error. When errors are requested, both the 16v and 20v error codes are sent; whichever is not in use will contain garbage values.

The data is sent as twenty-eight decimal values separated by spaces; none of these values will be greater than 255. The first three values are the 16v data; they are the current 'uniram' values. The remaining values are five groups of five bytes each from the 20v; to decode these bytes, you'll need to refer to the Fiat specification documents 300608 and 300612. Remember that more faults can be logged than will trigger the warning light, and are remembered for up to sixty engine starts after the fault occurs.

5. *Reset*

This performs a hard reset of the widget; it's recommended after you've made any changes to the system just to make sure the display tidies itself up. If you're working on a 20v you will probably find that communications channel to the ECU has timed out and it will restore itself automatically (provided that the engine is doing less than 2000 rpm).

Any setting changes you've made are stored internally in the widget and won't be lost when the ignition is turned off; however, if some circumstance causes the eeprom memory to be scrambled, it will detect this on start-up and re-initialise to a 16v NA. You'll probably have to change this, unless you're me. ☺

● *Display problems*

The display used is an LCD graphical dot-matrix display which has an electro-luminescent back-light. While the display is usually very clear, there are a couple of conditions where the display becomes difficult to see:

If the in-car temperature becomes too high, the display can become black in all pixels. When the temperature cools down, it returns to normal – we're talking 40 degrees C or so, the sort of temperatures you get parking in the sun in summer.

If you're wearing Polaroid sunglasses you will find that the display isn't visible as you tilt your head to certain angles. This is because the display is also polarised; you either have to live with it or take the glasses off. If the unit is mounted to the right of the driver, the head automatically tilts in the best direction for visibility.

At night, the display back-light may appear a little dim. Unfortunately, there's little that can be done about this; the displays dim as they become older. Sorry...

● *Can I reset the ABS/Airbag warning light?*

No. These are separate systems, and I have no intention of interfering with safety systems on the vehicle.

● *Can I clear errors from the ECU?*

No. The errors will clear themselves in time if the fault is not repeated, and only important errors are displayed. Also, errors are only displayed when they have recently occurred. If an error in a sensor occurs, it is important that the fault be investigated. Leaving the error memory intact allows tracking the error with a professional code reader at a maintenance facility.

- ***Can I change values in the fuelling or timing maps?***

No. On both the 16v and 20v models, the ECU maps are held in an external memory. It's easy to change the chip for alternate versions, and the widget will still communicate properly with modified chips (provided the basic functionality of the chip has not been altered.)