Bosch KE2 Jetronic Fuel ECU pin-out measurements (Bentley Turbo R Early 89 22888)

The Fuel ECU is the black box above the Accelerator pedal (RHD Cars). The silver box is the ignition ECU.

To access the connections, turn battery power off!!!!!!
Remove the plug from the fuel ECU, the ignition ECU plug can remain connected. Undo the retainer screw at the end of the back shell of the plug. Fold back the rubber boot, being in the car they remain reasonably flexible and mine didn't tear. Undo the clamp screws, gently pull out the plug insert with some long nose pliers then rotate the backing shell out of the way.

The connector can then be reinserted in the fuel ECU with access to the signals. It will go in easily if you have the pins/sockets lined up. Don't force it!!!!!

Make sure the connector is firmly seated. Turn the battery power back on and run the engine.

To make life easier rotate the diagram below to figure out the connection orientation as the ECU is mounted upside down from the diagram. Note some of the signals will be different on warm up phase. The below measurements are at operating temperature.

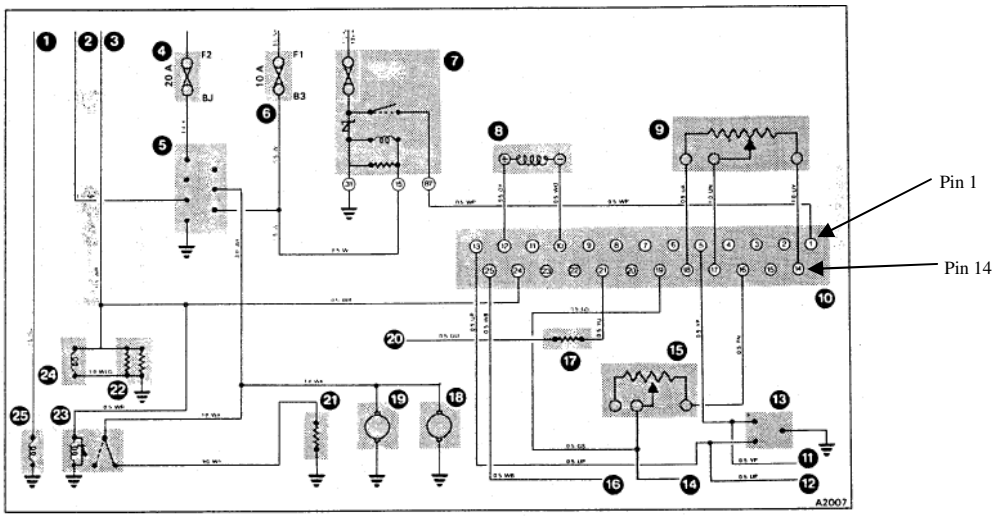


Fig. B3-19 Theoretical wiring diagram

1	From gearchange actuator	13	Throttle position switch
2	From starter	14	To knock sensor ECU
3	From gearchange actuator	15	Air pressure transducer
4	Fuel injection fuse	16	To ignition system ECU (engine speed)
5	Engine running sensor	17	Coolant temperature sensor
6	Ignition fuse	18	Fuel pump
7	Fuel injection control relay (with integral fuse)	19	Fuel pre-pump
8	Electro-hydraulic actuator	20	To ignition system ECU
9	Air flow sensor potentiometer	21	Auxiliary air valve heater
10	Electronic control unit	22	Thermal time switch
11	To ignition system ECU	23	Inhibit relay
12	To ignition system ECU	24	Cold start injector
		25	Idle speed control solenoid

Pin 1 12V Supply from Ignition via Fuel Injection Relay, measured 14V
Pin 2 Not described in manual, based on circuit diagram of Bosch 0280 800 100 this should be 0V supply to unit

Pin 5 Full Load map position from Throttle Position Sensor, TPS. 12.7V idle position, Full throttle (can be done without engine running) 0V (Connects to Ignition ECU as well)

Pin 10 EHA Voltage nominal 8V, current based on Fuel Mapping selected from TPS (5.8ma idle load map, 16.7ma full load map)
Pin 12 EHA 8V less drop through EHA based on current mapping, Idle 7.8V
Pin 13 Idle or Part Load Map from TPS. 0R(aka 0V) on idle, nominal 8V any other accelerator position (also goes to Ignition ECU)

Pin 14 0V Excitation to Air Flow Sensor Pot
Pin 15 Black pink Wire not indicated in manual 2R measured 0V. Based on circuit of 0280 800 100 this is pulling down a 12 V signal internally.
Pin 16 Excitation for Air Pressure Transducer (APT) Nominal 5.25V
Pin 17 0.3V >> 4V depending on air flow from Air Flow Sensor Pot
Pin 18 Excitation for Air Flow Sensor Pot 7.7V
Pin 19 Signal from APT 0.7V Idle to over 2V and about 0.2V depending on Boost (Later Bentleys have dual APT so this shouldn't go to boost controller). Engine off, ignition on 2.187V @600m with sea level barometric pressure 1007.

Pin 21 Signal from ECU through Engine Coolant sensor. Operating temperature 0.37V nominal @ 12 degrees 3.54k (See coolant chart below)

Pin 24 Signal from Gear change actuator, 0V doesn't seem to change in any gear position. Coupled to Cold Start Injector so makes sense this would be 0V when running at operating temperature. Only operates on cold start (based on thermal switch) and within 8 second window when cranking.

Pin 25 Engine Speed from Ignition ECU Nominal 12V with 2 Pulses per Rev. The Sensor to the Ignition ECU has 124 pulses per rev with one of those being a large pulse to indicate TDC. The Ignition ECU must change this to 2 per rev for distribution to Boost and Fuel ECU. This pulse coincides with cylinder A1 ignition.

Notes on measurements.

A digital multi-meter was used and all readings are to chassis.

If you measure the current of the EHA then you will nee to be in series with the EHA.

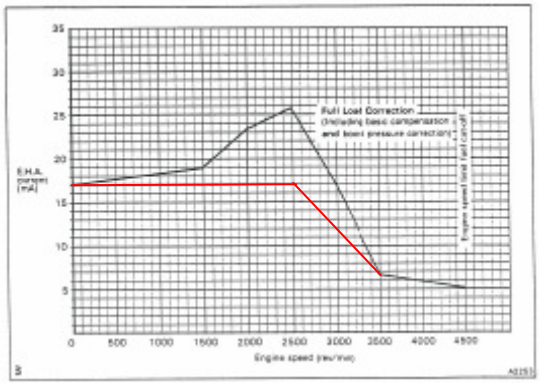
For the Engine RPM a CRO was used as there is 2V ripple on the 12V that coincides with the Ignition coils being turned on. A DMM will give readings that jump occasionally owing to this ripple. An analogue meter however would show stable readings across the RPM range and I think given the age of the manual I think they would assume an analogue meter. See below for an analogue meter.

Engine speed signal
Remove the cover from the fuel injection ECU multiple plug and with the plug connected, measure the voltage between pins 15 and 25 (black/pink and white/black). Start the engine. Check for 11.5 volts ± 0.5 at 1000 rev/min. Check for 7.5 volts ± 0.5 at 3000 rev/min
Are the readings within specification?
NO

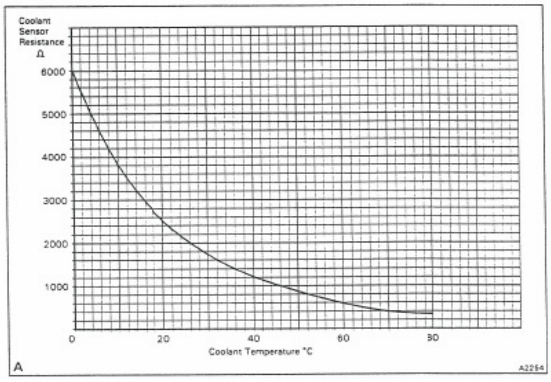
Note
I have a problem with my car in that I appear to be operating on base fuel mapping of 5.8ma to the EHA. I am yet to determine the root cause of the problem but these measurements are a reasonable guide.

I will be replacing the TPS as my full load map never comes into play, the contacts are dud as adjustment makes no difference. Aside from that most cars with Oxygen sensors turn the car into limp mode if the ECU determines the 02 sensor is faulty. I have no idea if the KE2 does the same as most of the early KE2 didn't have the O2 sensors and the manual doesn't make reference to them in relation to the Turbo cars. The later motronic did have them as standard.

If the 02 sensor is the problem and the KE2 does revert to a default limp mode then it will account for my lack of performance and no change in current to the EHA irrespective of manifold or airflow pressures. The manual isn't clear on the part load mapping to the EHA nor if it changes when on part load mapping. Only the full load mapping, in either case my full load mapping does change to base 16.5ma (correct full load map) to the EHA on shorting the TPS contacts, but it doesn't change as per the below in response to engine RPM increase.



EHA Current in response to Full Load Map



Engine Coolant Temperature Sensor

These notes are only my findings use at your risk.

I will be doing a simplified sheet of the turbo related systems once I sort the Fuel ECU issues.

Any comments, additions and omissions please send to Stefan@geckovision.com.au

O2 Sensor note

My car doesn't have an O2 sensor. What I thought was an O2 sensor is a thermocouple after the Catalytic converter required for Japanese spec.

Comments Related to Boost Controller

I did accurate tests on the RPM the boost controller turns off the waste-gate solenoid (thereby allowing pressure to build up in the waste-gate diaphragm and eventually open the waste-gate to bypass exhaust gasses around the turbine). It turns off at 2150 rpm. There is a small leeway either side where power to the solenoid is cycled but 2150rpm the unit is off. This is very repeatable.

What is telling the Boost controller to turn of the solenoid, and is there a common thread with this and the fixed value of the Fuel Map to the EHA. I had disconnected the speed signal to the boost controller in the hope that this was being interpreted as twice the real RPM causing the boost controller to open the waste gate in an over speed condition.

Question in relation to the Ignition ECU. Is the 2 pulses per rev right for distribution to the Boost and Fuel ECU's. The Tacho indicates the right RPM. If this was wrong we would see twice the RPM on the TACHO. So it must be right.

At some stage it appears I have some control from the Fuel ECU to the EHA. Not the right control but control none the less. When I get above 2500rpm the current to the EHA starts dropping, goes to zero if the RPM is high enough. I wasn't getting this action a couple of days ago. But maybe I didn't get the RPM high enough.