LH 2.4 Jetronic

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Contents

General information

Connector pinout

Note! All values shown are between the terminal shown in column 1 and terminal #5 on breakout box unless otherwise stated in brackets. It is important that this ground terminal is correctly installed on the battery battery negative terminal before taking measurements.

U_{bat} = Battery voltage
f= Frequency in Hertz (Hz)
U_{low} = voltage approaching 0 V
% duty= duty cycle in %

Terminal	Signal type Function	Ignition on	Idling	Engine speed (RPM) higher than idling
1	Engine speed (RPM) signal. Information from EZ 116 K (#17) that engine is turning. This information is used to calculate injection period.	700 - 750 mV	7-8 V approximately 27 Hz	Frequency increases with engine speed (RPM)
2	Throttle position switch (TP switch). Information that throttle position (TP) switch on. Used for a special idle program for idling speed, injection period etc. Also used when fuel shut-off perational.	U= U_{low}	U= U_{low}	> 10V
3	Full load switch (not used on turbocharged engines). Information that the throttle is at WOT (wide open throttle). Used for full load enrichment.	> 10 V	> 10 V	U_{low} (at maximum throttle angle)
4	Battery voltage (+ 30). power supply for the on-board diagnostic system (OBD) memory and adaptive functions.	U_{bat}	U_{bat}	U_{bat}
5	Signal ground. Signal ground on intake manifold for control module electronics	U_{low}	U_{low}	U_{low}
6	Mass air flow (MAF) sensor ground	U_{bat}	U_{bat}	
7	Mass air flow (MAF) sensor, signal	≈ 1.4 V	≈ 2.3 V	Increases with engine load
8	Burning off mass air flow (MAF) sensor. Burning off sensor wire in mass air flow (MAF) sensor.	U_{low}	U_{low}	≈ 4 V burn-off
9	Power supply. Power supply to control module via system relay.	U_{bat}	U_{bat}	
10	Engine cooling fan (FC) low-speed	Engine cooling fan (FC) on: U_{low} Engine cooling fan (FC) off: U_{bat}		
11	Engine cooling fan (FC) high-speed			
12	Data link connector (DLC). Communication with data link connector (DLC)	8 - 9 V.		
13	Engine coolant temperature (ECT) sensor. Information on engine coolant temperature. Used by the control module to calculate injection period during warming-up.	≈ 350 mV, warm engine, the signal drops as temperature rises, the signal increases as the temperature drops. NOTE! For cars from 1992 onwards the value is not stable		
14	Air conditioning (A/C) compressor. Information that the air conditioning (A/C) compressor is engaged. Used to keep idling speed constant when air conditioning (A/C) compressor starts.	Air conditioning (A/C) off: U_{low}	Air conditioning (A/C) off: U_{low} Air conditioning (A/C) on: U_{bat}	
15	Air conditioning (A/C) control. Information that the air conditioning (A/C) control is on. Used to prepare the CIS valve before air conditioning (A/C) compressor starts.	Air conditioning (A/C) off: U_{low}	Air conditioning (A/C) off: U_{low} OFF/ON: U_{bat}	
16	L-line, unused			
17	Power ground. Power ground connected at intake manifold. Used for pulse signals from injectors and idle air control (IAC) valve which demand power.	U_{low}	U_{low}	U_{low}

18	Injectors control. Grounded when the injectors are to open	U_{bat}(#5)	Turbo 190-200 mV (#35). Others: 250 - 350 mV	Increases as engine speed (RPM) increases
19	Code plug or ground. Ground terminal on intake manifold. Grounds control module internally.	U_{low}	U_{low}	
20	Fuel pump relay control. Grounded when engine speed (RPM) signal on #1. Used for activating pump relay.	U_{bat}	≈ 0.9 V	
21	System relay control. Grounded when voltage on #35. Used for activating the system relay.	≈ 1.1 V	≈ 1.1 V	
22	Malfunction indicator lamp (MIL), a.k.a. Check engine light (CEL)	≈ 1.5 V	U_{bat}	
23	CO_2 adjusting potentiometer from AMM or unconnected.			
24	Heated oxygen sensor (HO2S) signal. Information from heated oxygen sensor (HO_2S) on oxygen content in exhaust gases. Adjusts injection period so that the HO_2S value is always 1.	≈ 0.5 V	≈ 0.1 - 0.9 V.	
25	Load signal (TQ). Digital output signal to ignition system (# 8) for engine load data.	250 - 300 mV	≈ 370 mV	Increases with engine load
26	Shift indicator (USA/Calif, manual)			
27	Canister purge (CP) valve control (Only B234 F). Output signal to canister purge (CP) valve. Control module regulates the opening status of the canister purge (CP) valve so that the EVAP canister is ventilated to optimum level.	U_{low}	U_{low}	Increases with throttle opening.
28	Knock enrichment (not B204 FT/GT, B230 F) or EGT enrichment (B204 FT/GT)	900 - 950 mV	≈ 7.5 V	Drops during knock/EGT enrichment
29	Signal ground. Ground connected on intake manifold, grounds control module internally	U_{low}	U_{low}	
30	Park/Neutral position (PNP) switch (automatic transmission). Information on gear selector position. Used to keep idling speed constant when gear is selected.	P N position: U_{low}, D 1 2 3 R positions: U_{bat}, Manual: U_{low}		
31	Unused			
32	Cold start valve control signal. Grounded when the temperature is below -16 °C when it activates the cold start valve.	U_{bat}	U_{bat}	Drops at temperatures below -16 °C
33	Idle air control (IAC) valve, signal. Grounded output signal. The control module adjusts idle air control (IAC) valve opening so that idling speed is kept constant regardless of load. During engine braking the signal is used together with engine speed (RPM) and load signal too keep a constant pressure in the intake	U_{bat}	7.5 - 9.5 V, approximately 42%	Drops on load at idle. % increases with load

	manifold in order to control crankcase ventilation			
34	Speedometer signal. Vehicle speed signal from the speedometer. Used to adjust idling speed during engine braking and for constant idle speed compensation.	U_{low}/U_{bat}	U_{low}/U_{bat}	≈ 6-7 V, v > 10 km/h
35	Power supply (Ignition). Power supply to certain control module internal functions	U_{bat}	U_{bat}	

Characteristics of LH2.4 fuel system

It is used together with the EZ116K ignition sys tem. It is an adaptive system being capable of multiple adjustments based on driving experience. It is monitored by a self-diagnostic system that lights up a warning lamp on the instrument panel. It has a memory capability of up to three fault codes (Scandinavia/USA Federal) plus seventeen additional codes (USA/California). Subsequent fault tracing can be carried out by actively utilizing the diagnostic program. It measures intake air mass via air mass meter supplied with a hot wire. It utilizes a primary pump in the fuel tank and a fuel pump with fuel filter on the fuel line to the engine. II works on a fuel pressure of 300 kPa (42 psi). It utilizes a separate cold slart valve which supplies extra fuel at or below 15 °C (60 °F) or cotder. It provides a richer fuel mixture to counteract knock when the fuel system's anti-knock control system has been unsuccessful at reducing knock by adjusting downward several degrees. It requires no adjustment of CO because of the adaptive function. It has a "limp home" setting at the idle valve in case of loss of current the idle valve remains open to provide emergency air intake. In the USA: It has an integrated shift indicator related to vehicle speed and engine rpm. The indicator lamp lights up if the rpm for the next gear are higher than the pre-programmed limits. - It uses an induction sensor on the flywheel to indicate rpm and crankshaft position via the ignition system control unit. It is fitted with the same model Lambda-sond as for previous LH fuel systems. The resistance of the Lambda-sond is affected by the exhaust-gas oxygen concentration The Lambda-sond is mounted on the exhaust manifold between the engine and the catalytic converter. It is fitted with a three-way catalytic converter. It utilizes an EVAP system to handle fuel vapors in the fuel tank.

Datalogging with LH2.4

Methods for datalogging

Two methods exists. The first does not require any modifications on the LH2.4 hardware, but needs a custom firmware patched, works slower and is not very noise immune. It reuses the DLC pin for communication. To use it one will also need a cheap ebay blue "VAG-COM KKL OBD2 FT232RL " adapter. Note the **FT232RL**, because there are some based on the older FTDI chipsets which does not work reliably.

The second method requires some (reversible) hardware modifications. The advantage is that it works much faster, uses the original, built in Bosch logging code and is very stable because of direct connection to the CPU serial port.

Serial port settings

Both methods use the following settings: 187500 bps, 1 stop bit, 8 data bits, parity (space initially).

Built-in Bosch protocol with direct CPU connection

The built in Bosch protocol is fairly simple - you just send a address to the LH2.4 and then read it's content with the response. The value of the parity bit determines which memory is read - 0 (space parity) reads internal RAM, while 1 (mark parity) reads XRAM. If XRAM is not fitted, attempting to read it return 0xFF.

Custom protocol with KKL cable connected to the DLC

The custom firmware patch hooks the place of original logging code and redirects to the custom program that handles

K-Line "echo" on each write. There exists several protocols, one of them is very advanced and allows not only to read the RAM and CPU port contents, but also to write it.

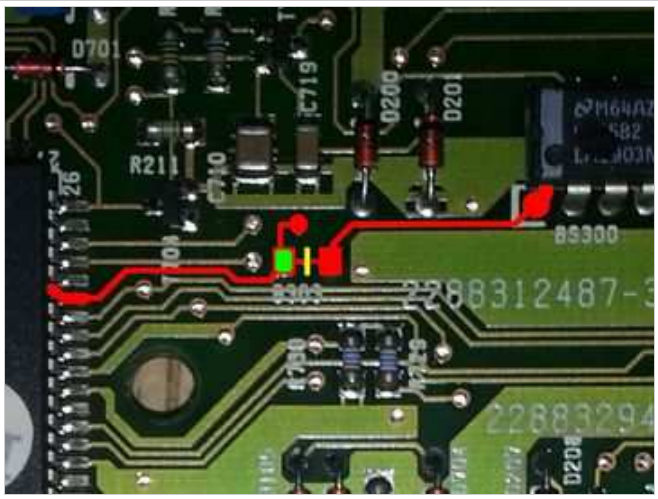
The first method could also use custom protocol, but for basic datalogging this is not needed.

Hardware Requirements for Bosch protocol

- TTL-to-USB converter or TTL-to-RS232 converter (FT232RL or MAX232)
- Cutting two traces on the LH2.4 board.
- Soldering GND, Tx and Rx wires of the USB or RS232 converter to the LH2.4 board.

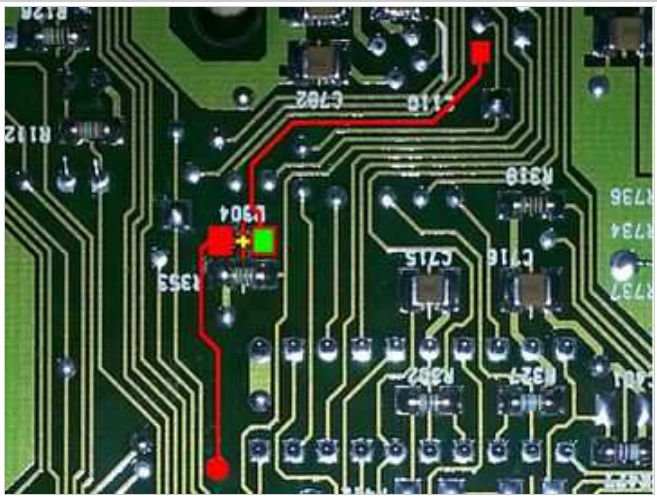
- On the bottom pictures RED shows the trace,
- YELLOW where the trace must be cut and
- GREEN where to solder the Tx or Rx wires.

Connection to the RX line (top of the LH2.4 board)



This shows **Rx** line. Cut at the yellow mark and solder your wire to the pad with the green mark.

Connection to the TX line (bottom of the LH2.4 board)



This is the bottom side of the LH2.4 board and shows **Tx** line

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