

Signal specification

General

All the values given below are between the respective terminal in column 1 and terminal #B3 in column 2 (power ground) unless otherwise stated in brackets after the table entry. Control module terminals #A1-# A60 correspond to terminals #A1-# 60 on the breakout box, terminals #A61-# A70 correspond to terminals #B1-# B10 on the breakout box and terminals #B1-# B50 correspond to terminals #B10-# B60 on the breakout box.

Note! It is important to connect the breakout box and check the ground terminals before taking readings.

Hint: If the numbering of the connector is different from the numbering on the breakout box, the connector number is given first, #A61, followed by the breakout box number in brackets, (#B1).

Example: #A51 (#B1)

$U =$ DC voltage in volts (V)

$U_{AC} =$ AC voltage in volts (V)

$U_{bat} =$ Battery voltage (V)

$f =$ Frequency in Hertz (Hz)

$U_{low} =$ Voltage approximately 0 V

% duty = Duty cycle (pulse ratio) as a percentage (%)

$t =$ Time in milliseconds (ms)

Terminal	Breakout box	Signal type	Ignition on	Engine idling	Other
#A1	#A1	-	-	-	
#A2	#A2	-	-	-	
#A3	#A3	-	-	-	
#A4	#A4	Signal (+) engine coolant temperature (ECT) sensor		(+30° C) $U=1.22V$ (+80° C) $U=0.29V$ (+100° C) $U=0.17V$	
#A5	#A5	Signal (-) intake air temperature (IAT) sensor		(+20° C) $U=3.50V$ (+30° C) $U=3.00V$	

				(+40° C) U=2.50V	
#A6	#A6	Control signal, engine cooling fan (FC) high-speed	Engine cooling fan (FC) off: $U = U_{bat}$ Engine cooling fan (FC) on: $U=U_{low}$		
#A7	#A7	Control signal, engine cooling fan (FC) low-speed	Engine cooling fan (FC) off: $U = U_{bat}$ Engine cooling fan (FC) on: $U=U_{low}$		
#A8	#A8	-	-	-	
#A9	#A9	EVAP control signal	$U = U_{bat}$		PWM signal during activation of the canister purge (CP) valve
#A10	#A10	-	-	-	
#A11	#A11	-	-	-	
#A12	#A12	Pulsed secondary air injection system (PAIR) valve, control signal	$U = U_{bat}$		
#A13	#A13	Camshaft reset valve control signal	Pulse width modulation (PWM) signal $U_{top}=U_{bat}$ $t = 4 \text{ ms}$ pulse ratio=12.5 %	Pulse width modulation (PWM) signal $U_{top}=U_{bat}$ $t = 4 \text{ ms}$ pulse ratio = 50 %	The pulse ratio increases with engine speed (RPM)
#A14	#A14	Control signal injector 5	$U = U_{bat}$	$t= 2-3 \text{ ms}$	t increases with engine speed (RPM) and load
#A15	#A15	Control signal injector 3	$U = U_{bat}$	$t= 2-3 \text{ ms}$	t increases with engine speed (RPM) and load
#A16	#A16	Control signal injector 1	$U = U_{bat}$	$t= 2-3 \text{ ms}$	t increases with engine speed (RPM) and load
#A17	#A17	-	-	-	
#A18	#A18	Control signal, front heated oxygen sensor (HO2S)	$U = U_{bat}$	Preheating of	

		preheating		$U=U_{bat}$ Preheating $U=U_{low}$	
#A19	#A19	-	-	-	
#A20	#A20	-	-	-	
#A21	#A21	-	-	-	
#A22	#A22	Mass air flow (MAF) sensor signal	$U=1$ volt	$U=1.7$ volt	U increases with increasing air mass
#A23	#A23	Boost pressure sensor signal	$U=1.96$ volts		U increases with increasing boost pressure
#A24	#A24	Front heated oxygen sensor (HO2S), pump current	Pulsed power supply - cannot be measured	Pulsed power supply - cannot be measured	
#A25	#A25	-	-	-	
#A26	#A26	Oil pressure switch signal	$U=U_{low}$	$U = U_{bat}$	
#A27	#A27	-	-	-	
#A28	#A28	Front heated oxygen sensor (HO2S), calibration current	Cannot be measured	Cannot be measured	
#A29	#A29	Power supply, camshaft position (CMP) sensor	$U = 5$ V		
#A30	#A30	Ignition coil no. 2 control signal	$U=U_{low}$	$U=2.5$ V $t_{high}=2$ ms	the frequency varies according to engine speed (RPM)
#A31	#A31	Ignition coil no. 1 control signal	$U=U_{low}$	$U=2.5$ V $t_{high}=2.5$ ms	the frequency varies according to engine speed (RPM)
#A32	#A32	-	-	-	
#A33	#A33	Injector no. 4 control signal	$U = U_{bat}$	$t_{low}=2-3$ ms	t increases with engine speed (RPM) and load
#A34	#A34	Injector no. 2 control signal	$U = U_{bat}$	$t_{low}=2-3$ ms	t increases with engine speed (RPM) and load
#A35	#A35	Control signal, rear heated oxygen sensor (HO2S) preheating	$U = U_{bat}$	Preheating of $U=U_{bat}$ Preheating $U=U_{low}$	

#A36	#A36	-	-	-	
#A37	#A37	Control modules communication cable (CAN H)		Between the engine control module (ECM) and the throttle unit	
#A38	#A38	Turbocharger (TC) control valve control signal	$U = U_{bat}$	$U = U_{bat}$	active U =PWM signal
#A39	#A39	Manifold absolute pressure (MAP) sensor, air conditioning (A/C) pressure sensor, mass air flow (MAF) sensor, 5 volt power supply	$U=5$ volt		
#A40	#A40	-	-	-	
#A41	#A41	Signal (+), front heated oxygen sensor (HO2S)	Pulsed current signal, cannot be measured	Pulsed current signal, cannot be measured	
#A42	#A42	Signal (-), front heated oxygen sensor (HO2S)	Pulsed current signal, cannot be measured	Pulsed current signal, cannot be measured	
#A43	#A43	-	-	-	
#A44	#A44	-	-	-	
#A45	#A45	Signal (+), rear knock sensor (KS)	$U=U_{low}$		
#A46	#A46	Signal (+) front knock sensor (KS)	$U=U_{low}$		
#A47	#A47	Signal (+), camshaft position (CMP) sensor	$U=5$ volts	U = quadratic wave voltage $U_{top}=5$ volts	the frequency varies according to engine speed (RPM)
#A48	#A48	Signal (+), flywheel sensor	$U=2.5$ volts	U = sine wave voltage $U_{top}=5$ volts $U_{offset}=2.5$ volts	
#A49	#A49	-	-	-	
#A50	#A50	Ignition coil no. 3 control signal	$U=U_{low}$	$U= 2.5$ V $t_{high}=2$ ms	the frequency varies according to engine speed (RPM)
#A51	#A51	Ignition coil no. 5 control signal	$U=U_{low}$	$U= 2.5$ V $t_{high}=2$ ms	the frequency varies according to engine speed (RPM)

#A52	#A52	Ignition coil no. 4 control signal	$U=U_{\text{low}}$	$U=2.5\text{ V}$ $t_{\text{high}}=2\text{ ms}$	the frequency varies according to engine speed (RPM)
#A53	#A53	Power ground 3	U_{low}		
#A54	#A54	Power ground 4	U_{low}		
#A55	#A55	Control modules communication cable (CAN L)			Between the engine control module (ECM) and the throttle unit
#A56	#A56	Control signal, accelerator pedal (AP) position sensor PWM signal	$U_{\text{top}}=12\text{ V}$ $t=4\text{ ms}$ pulse ratio= $8\%\pm 2\%$ with unaffected accelerator pedal (AP) and 50% – 90% with fully depressed accelerator pedal (AP) On certain vehicles the accelerator pedal (AP) will be at the limit before the signal reaches 90%.		Between the engine control module (ECM) and the throttle unit
#A57	#A57	Stop lamp switch control signal	$U=U_{\text{low}}$ (not activated) $U=U_{\text{high}}$ (activated)		Between the engine control module (ECM) and the throttle unit
#A58	#A58	Signal ground, mass air flow (MAF) sensor	$U=U_{\text{low}}$		
#A59	#A59	-	-	-	
#A60	#A60	Signal ground for the Air conditioning (A/C) pressure sensor, boost pressure sensor, oil level sensor, oil pressure	$U=U_{\text{low}}$		

		sensor, engine coolant temperature (ECT) sensor, EGR valve temperature sensor			
#A61	#B1	Signal (+), rear heated oxygen sensor (HO2S)	$U \sim 0.50 \text{ V}$	Above 0.6 or below 0.3 V	
#A62	#B2	Signal (-), rear heated oxygen sensor (HO2S)	$U = U_{\text{low}}$	$U = U_{\text{low}}$	
#A63	#B3	Body signal ground	$U = U_{\text{low}}$		
#A64	#B4	Signal (-) front knock sensor (KS)	$U = U_{\text{low}}$		
#A65	#B5	Camshaft position (CMP) sensor signal ground	$U = U_{\text{low}}$		
#A66	#B6	Signal (-) flywheel sensor	$U = 2.5 \text{ volt}$	$U = \text{sine wave voltage}$ $U_{\text{top}} = 3.5 \text{ volts}$ $U_{\text{offset}} = 2.5 \text{ volts}$	the frequency increases with engine speed (RPM)
#A67	#B7	Signal (-) rear knock sensor (KS)	$U = U_{\text{low}}$	$U = U_{\text{low}}$	
#A68	#B8	Air conditioning (A/C) pressure sensor signal	$U = 0.9 \text{ V}$ (at approximately 20°C)		U increases with pressure in the air conditioning (A/C) system
#A69	#B9	-	-	-	
#A70	#B10	Power supply	$U = U_{\text{bat}}$		Measured via the system relay

Terminal	Breakdown box	Signal type	Ignition on	Engine idling	Other
#B1	#B11	Control modules communication cable (CAN L)			Data communication, high speed network
#B2	#B12	-	-	-	
#B3	#B13	-	-	-	
#B4	#B14	Signal ground for the intake air temperature (IAT) sensor, fuel tank pressure sensor, fuel level sensor, clutch pedal sensor, brake pedal sensor	$U = U_{\text{low}}$		
#B5	#B15	Signal ground, accelerator pedal (AP) position sensor	$U = U_{\text{low}}$		
#B6	#B16	-	-	-	
#B7	#B17	-	-	-	
#B8	#B18	Signal (+), coolant level sensor			

			$U = U_{\text{low}}$		
#B9	#B19	Accelerator pedal (AP) position sensor power supply, analog sensor	$U \approx 5 \text{ V}$		
#B10	#B20	Fuel tank pressure sensor power supply	$U \approx 5 \text{ V}$		
#B11	#B21	30-supply (Power supply from the battery)	$U = U_{\text{bat}}$		
#B12	#B22	-	-	-	
#B13	#B23	Control module communication cable (CAN H)			Data communication, high speed network
#B14	#B24	-	-	-	
#B15	#B25	Clutch pedal sensor signal	$U = 3.3 \text{ V}$ (unaffected) $U = 2.2 \text{ V}$ (fully depressed, 100 mm)		Varies according to the position of the clutch pedal
#B16	#B26	Brake pedal sensor signal	$U = 3.1 \text{ V}$ (unaffected) $U = 2.6 \text{ V}$ (25 mm depressed)		Varies according to the position of the brake pedal
#B17	#B27	Accelerator pedal (AP) position sensor signal, analog signal	$U = 0.4 \pm 0.1 \text{ V}$ with unaffected accelerator pedal (AP) $U = 2.5\text{--}4.4 \text{ V}$ = the accelerator pedal (AP) fully depressed On certain vehicles the accelerator pedal (AP) will be at the limit position before the signal reaches 4.4 V.		Varies according to the position of the accelerator pedal (AP)
#B18	#B28	-	-	-	

#B19	#B29	Cruise control signal (+)	See terminal #B47		
#B20	#B30	Cruise control signal (+)	See terminal #B47		
#B21	#B31	Output signal (+), engine speed (RPM)	$U=U_{low}$	$U = \text{quadratic wave voltage}$ $U_{top}=U_{bat}$	frequency increases with engine speed (RPM)
#B22	#B32	Diagnostic lead communication link / Communication cable Immobilizer	$U=90\%$ of U_{bat}	Other values apply if a generic fault-tracing instrument is connected to the data link connector (DLC)	The communication cable functions both as a communication link and as a start inhibition link (immobilizer)
#B23	#B33	Signal (+) crank, terminal 50	$U=U_{low}$	$U=U_{low}$	$U=U_{bat}$ at the crank
#B24	#B34	-	-	-	
#B25	#B35	Signal (+) accelerator pedal (AP) position sensor, PWM signal	$U_{top}=12\text{ V}$ $t = 4\text{ ms}$ pulse ratio= $8\%\pm 2\%$ with unaffected accelerator pedal (AP) and 50% – 90% with fully depressed accelerator pedal (AP) On certain vehicles the accelerator pedal (AP) will be at the limit before the signal reaches 90%.		Between the accelerator pedal (AP) position sensor and the engine control module (ECM)
#B26	#B36	Signal (+), stop lamp switch	$U=U_{bat}$ when the brake pedal is		

			affected $U=U_{\text{low}}$ when the brake pedal is unaffected		
#B27	#B37	Engine coolant temperature output signal to the A/C system	$U_{\text{top}}=U_{\text{bat}}$ $t = 4\text{ms}$ pulse ratio = varies according to the engine temperature		
#B28	#B38	-	-	-	
#B29	#B39	Outside temperature sensor signal	(0° C) $U=2.92\text{ V}$ (+10° C) $U=2.40\text{V}$ (+20° C) $U=1.90\text{ V}$ (+30°C) $U =$ 1.46 V		Temperature range: - 40°C to +30°C
#B30	#B40	-	-	-	
#B31	#B41	Fuel tank pressure sensor signal	$U=2.5\text{ V}$ at 1kPa $U=3.3\text{ V}$ at atmospheric pressure (0 kPa overpressure) $U=4.1\text{ V}$ at 1 kPa overpressure		
#B32	#B42	Air conditioning (A/C) request signal	$U=U_{\text{bat}}$ during request $U=U_{\text{low}}$ when there is no request		
#B33	#B43	Cruise control on/off signal	See terminal #B47		
#B34	#B44	Cruise control signal -	See terminal #B47		
#B35	#B45	-	-	-	
#B36	#B46	-	-	-	

#B37	#B47	Ignition on signal, terminal 15	$U = U_{bat}$		
#B38	#B48	System relay, control signal	$U = U_{low}$	$U = U_{low}$	Relay activated: $U = U_{low}$ Relay not activated: $U = U_{bat}$ the system relay runs on (2-5 minutes)
#B39	#B49	-	-	-	
#B40	#B50	EVAP canister shut-off valve control signal	$U = 3.82$ volts		
#B41	#B51	Electronic throttle system (ETS) warning lamp control signal	$U = U_{low}$	$U = U_{bat}$ (not activated) $U = U_{low}$ (activated)	
#B42	#B52	-	-	-	
#B43	#B53	-	-	-	
#B44	#B54	Air conditioning (A/C) activation control signal	$U = U_{bat}$ (not activated) $U = U_{low}$ (activated)		
#B45	#B55	Fuel pump (FP) activation control signal			control signal to the fuel pump (FP) relay
#B46	#B56	Malfunction indicator lamp (MIL) control signal	$U = U_{low}$	$U = U_{bat}$ (not activated) $U = U_{low}$ (activated)	
#B47	#B57	Cruise control power supply	$U = U^{bat}$ (not activated) $U =$ pulse train $U^{top} = U^{bat}$ $t = 20ms$ $t^{high} = 0.5 ms$		
#B48	#B58	Control signal for engine start inhibiting	$U = U_{low}$ (activated) $U = U_{high}$ (not activated)		in certain markets, the engine can only be started with the clutch pedal

					depressed ($U=U_{low}$)
#B49	#B59	-	-	-	
#B50	#B60				