

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, terminal #A61, followed by the breakout box number in brackets, (terminal #B1).

Example: #A61 (#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	-	-	-	

#A7	#A7	Engine cooling fan (FC) control signal	Pulse width modulation (PWM) signal $U_{\text{high}} = 0.7 \cdot U_{\text{bat}}$ $U_{\text{low}} = 1.2 \text{ V}$ $F = 100 \text{ Hz}$ Pulse ratio = 10%-95%	-	
#A8	#A8	-	-		
#A9	#A9	EVAP control signal	$U = U_{\text{bat}}$		PWM signal during activation of the canister purge (CP) valve
#A10	#A10	Rear heated oxygen sensor (HO2S) signal (+) bank 2	$U \approx 0.50 \text{ V}$	Above 0.6 V or below 0.3 V	
#A11	#A11	Rear heated oxygen sensor (HO2S) signal (-) bank 2	$U = U_{\text{low}}$	$U = U_{\text{low}}$	
#A12	#A12				
#A13	#A13	Camshaft reset valve control signal	Pulse width modulation (PWM) signal $U_{\text{top}} = U_{\text{bat}}$ $t = 4 \text{ ms}$ pulse ratio = 12.5 %	Pulse width modulation (PWM) signal $U_{\text{top}} = U_{\text{bat}}$ $t = 4 \text{ ms}$ pulse ratio = 50 %	Pulse ratio changes with engine speed (RPM)
#A14	#A14	Injector no. 6 control signal	$U = U_{\text{bat}}$	$t = 2-3 \text{ ms}$	t increases with engine speed (RPM) and load
#A15	#A15	Injector no. 2 control signal	$U = U_{\text{bat}}$	$t = 2-3 \text{ ms}$	t increases with engine speed (RPM) and load
#A16	#A16	Injector no. 1 control signal	$U = U_{\text{bat}}$	$t = 2-3 \text{ ms}$	t increases with engine speed (RPM) and load
#A17	#A17	Control signal, front heated oxygen sensor (HO2S) preheating	$U = U_{\text{bat}}$	Preheating of $U = U_{\text{bat}}$ Preheating $U = U_{\text{low}}$	
#A18	#A18	Control signal, front heated oxygen sensor (HO2S) preheating	$U = U_{\text{bat}}$	Preheating of $U = U_{\text{bat}}$ Preheating $U = U_{\text{low}}$	
#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	Front heated oxygen sensor (HO2S), pump current	Pulsed power supply - cannot be measured	Pulsed power supply - cannot be measured	
#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. 5 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	Injector no. 4 control signal	U = U _{bat}	t _{low} =2-3 ms	t increases with engine speed (RPM) and load
#A33	#A33	Injector no. 3 control signal	U = U _{bat}	t _{low} =2-3 ms	t increases with engine speed (RPM) and load
#A34	#A34	Injector no. 5 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	Control signal, rear heated oxygen sensor (HO2S)	U = U _{bat}	Preheating of U=U _{bat}	

		preheating		Preheating $U = U_{\text{low}}$	
#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	$U = U_{\text{bat}}$	$U = U_{\text{bat}}$	active $U = \text{PWM}$ signal
#A39	#A39	Manifold absolute pressure (MAP) sensor, air conditioning (A/C) pressure sensor, mass air flow (MAF) sensor, 5 volt power supply	$U = 5 \text{ volt}$		
#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	Signal (+), front heated oxygen sensor (HO2S)	Pulsed current signal, cannot be measured	Pulsed current signal, cannot be measured	
#A44	#A44	Signal (-), front heated oxygen sensor (HO2S)	Pulsed current signal, cannot be measured	Pulsed current signal, cannot be measured	
#A45	#A45	Signal (+), rear knock sensor (KS)	$U = U_{\text{low}}$		
#A46	#A46	Signal (+) front knock sensor (KS)	$U = U_{\text{low}}$		
#A47	#A47	Signal (+), camshaft position (CMP) sensor	$U = 5 \text{ volts}$	$U = \text{quadratic wave voltage}$ $U_{\text{top}} = 5 \text{ volts}$	the frequency varies according to engine speed (RPM)
#A48	#A48	Signal (+), flywheel sensor	$U = 2.5 \text{ volts}$	$U = \text{sine wave voltage}$ $U_{\text{top}} = 5 \text{ volts}$ $U_{\text{offset}} = 2.5 \text{ volts}$	
#A49	#A49	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)
#A50	#A50	Ignition coil no. 2 control signal	$U = U_{\text{low}}$	$U = 2.5 \text{ V}$	the frequency varies

				$t_{\text{high}} = 2 \text{ ms}$	according to engine speed (RPM)
#A51	#A51	Ignition coil no. 6 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)
#A52	#A52	Ignition coil no. 3 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% - 88%		Between the engine control module (ECM) and the throttle unit
#A57	#A57	Brake 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 sensor, engine coolant temperature (ECT) sensor, EGR valve temperature sensor	$U = U_{\text{low}}$		
#A61	#B1	Signal, rear heated oxygen sensor (HO2S)	$U \approx 0.50 \text{ V}$	Above 0.6 V or below 0.3 V	
#A62	#B2	Signal ground, 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	$U = U_{\text{low}}$		

		(KS)			
#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	Front heated oxygen sensor (HO2S), calibration current	Cannot be measured	Cannot be measured	
#A70	#B10	Power supply	$U = U_{\text{bat}}$		Measured via the system relay

Terminal	Break 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, analogue sensor	$U = 5 \text{ V}$		
#B10	#B20	Fuel tank pressure sensor power supply	$U = 5 \text{ V}$		
#B11	#B21	30-supply (Power supply from the battery)	$U = U_{\text{bat}}$		
#B12	#B22	-	-	-	
#B13	#B23	Control module			Data

		communication cable (CAN H)			communication, high speed network
#B14	#B24	-	-	-	
#B15	#B25	Clutch pedal sensor signal	U=3.3 V (unaffected) U=2.2 V (fully depressed, 100 mm)		Varies depending on the position of the clutch pedal
#B16	#B26	Brake pedal sensor signal	U=3.1 V (unaffected) U=2.6 V (25 mm depressed)		Varies according to the position of the brake pedal
#B17	#B27	Accelerator pedal (AP) position sensor, analogue signal	U=0.4 V (idle) U=4.4 V (wide open throttle (WOT))		Varies depending on the position of the accelerator pedal (AP)
#B18	#B28	-	-	-	
#B19	#B29	-	-	-	
#B20	#B30	-	-	-	
#B21	#B31	Output signal (+), engine speed (RPM)	$U = U_{\text{low}}$	U = quadratic wave voltage $U_{\text{top}} = U_{\text{bat}}$	frequency increases with engine speed (RPM)
#B22	#B32	Diagnostic lead C-link	U=90% of U_{bat}	Other values apply if a generic fault- tracing instrument is connected to the data link connector (DLC)	
#B23	#B33	Signal (+) crank, terminal 50	$U = U_{\text{low}}$	$U = U_{\text{low}}$	$U = U_{\text{bat}}$ at the crank
#B24	#B34	-	-	-	
#B25	#B35	Signal (+) accelerator pedal (AP) position sensor, PWM signal	$U_{\text{top}} = U_{\text{bat}}$ $t = 4\text{ms}$ pulse ratio = 8%-88%		Between the accelerator pedal (AP) position sensor and the engine control module (ECM)
#B26	#B36	Signal (+), brake lamp switch	$U = U_{\text{bat}}$ when the brake pedal is		

			affected $U=U_{\text{low}}$ when the brake pedal is unaffected		
#B27	#B37	Engine coolant temperature (ECT) output signal to the air conditioning (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	Signal, outside temperature sensor	(0 °C) $U=2.92\text{ V}$ (+10 °C) $U=2.40\text{V}$ (+20 °C) $U=1.90\text{ V}$ (+30 °C) $U = 1.46\text{ V}$	-	Temperature range: -40 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	-	-	-	
#B33	#B43	-	-	-	
#B34	#B44	-	-	-	
#B35	#B45	-	-	-	
#B36	#B46	-	-	-	
#B37	#B47	Ignition on signal, terminal 15	$U = U_{\text{bat}}$		
#B38	#B48	System relay, control signal	$U=U_{\text{low}}$	$U=U_{\text{low}}$	Relay activated: $U=U_{\text{low}}$ Relay not activated: $U = U_{\text{bat}}$ 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	-	-	-	
#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 central electronic unit for the control of 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	-	-	-	
#B48	#B58	-	-	-	
#B49	#B59	-	-	-	
#B50	#B60	-	-	-	