PCM INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5]

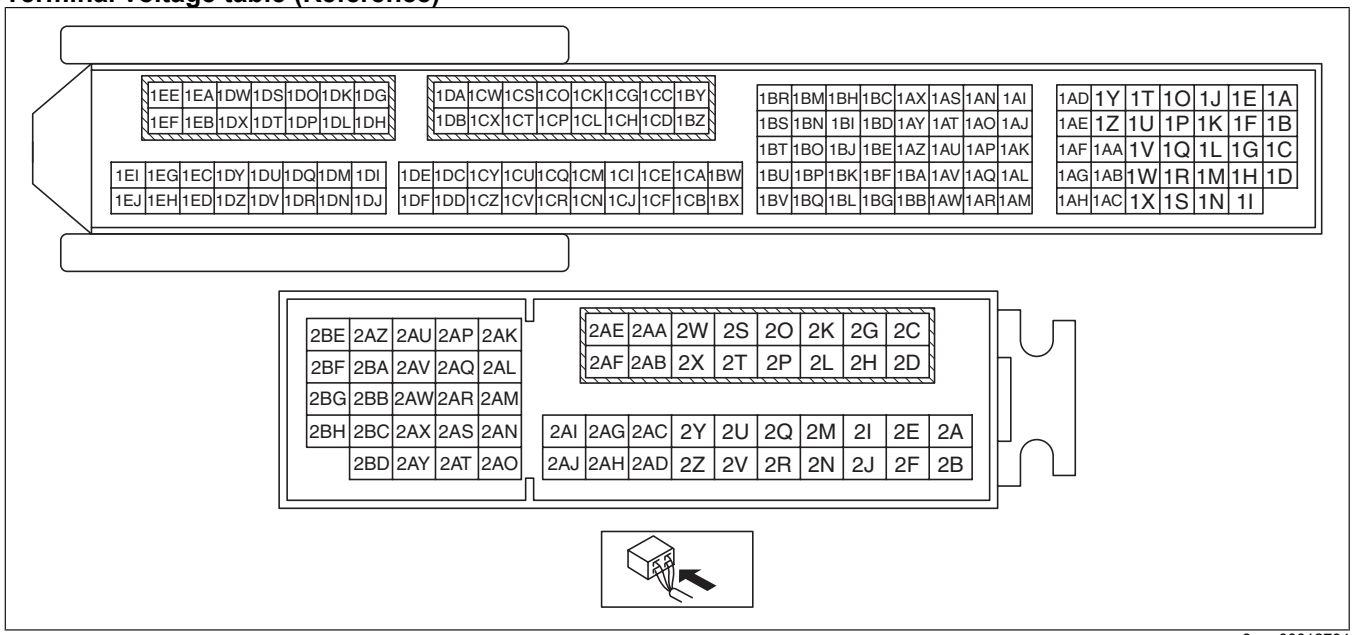
id0140g2802500

Without Using the M-MDS

Note

- Because the PCM uses a waterproof connector, the inspection for the voltage/wave pattern cannot be performed. The following values are for reference.

Terminal voltage table (Reference)



am3zzw00012794

Terminal	Signal	Connected to	Test condition		Voltage (V)	inspection item
1A*1	CAN_2H	CAN system related modules	Because this terminal is for CAN, integrity determination by terminal voltage is not possible.			• Related wiring harness
1B*1	CAN_2L	CAN system related modules	Because this terminal is for CAN, integrity determination by terminal voltage is not possible.			• Related wiring harness
1C	—	—	—		—	—
1D	Knocking (–)	KS	Switch ignition ON (Use digital type voltmeter, because measurement voltage will be detected less than true voltage when using analog type voltmeter)		Approx. 1.65	• KS • Related wiring harness
1E	—	—	—		—	—
1F	—	—	—		—	—
1G*5	Neutral switch No.2	Neutral switch No. 2	Switch ignition ON (engine off)	Neutral	Below 1.0	• Neutral switch No.2 • Related wiring harness
				Except above	B+	
1H	Knocking (+)	KS	Switch ignition ON (Use digital type voltmeter, because measurement voltage will be detected less than true voltage when using analog type voltmeter)		Approx. 3.38	• KS • Related wiring harness
1I	GND	Sensor shield	Under any condition		Below 1.0	• Related wiring harness
1J	Electric variable valve timing motor (rotation direction)	Electric variable valve timing motor/ driver	(See Electric variable valve timing motor (rotation direction) signal.)			• Electric variable valve timing motor/driver • Related wiring harness
1K*2	Neutral position	Neutral switch No. 1	Shift lever is at neutral position		Below 1.0	• Neutral switch No.1 • Related wiring harness
			Shift lever is not at neutral position		B+	
1L*2	Back up light	Back up light switch	Shift lever is at R position		Below 1.0	• Back up light switch • Related wiring harness
			Shift lever is not at R position		B+	

Terminal	Signal	Connected to	Test condition		Voltage (V)	inspection item
1M	—	—	—		—	—
1N	—	—	—		—	—
1O	Electric variable valve timing motor (rotation pulse)	Electric variable valve timing motor/ driver	(See Electric variable valve timing motor (rotation pulse) signal.)			• Electric variable valve timing motor/driver • Related wiring harness
1P	Oil pressure	Oil pressure switch	Switch ignition ON (engine off)		Below 1.0	• Oil pressure switch • Related wiring harness
			Idle (after warm up)		B+	
1Q	—	—	—		—	—
1R	—	—	—		—	—
1S	—	—	—		—	—
1T	Exhaust CMP	Exhaust CMP sensor	(See Exhaust CMP signal.)			• Exhaust CMP sensor • Related wiring harness
1U	—	—	—		—	—
1V	—	—	—		—	—
1W	A/F	A/F sensor	Idle (after warm up)		Approx. 4.2	• A/F sensor • Related wiring harness
1X	GND	Exhaust CMP sensor	Under any condition		Below 1.0	• Related wiring harness
1Y	Intake CMP	Intake CMP sensor	(See Intake CMP signal.)			• Intake CMP sensor • Related wiring harness
1Z	—	—	—		—	—
1AA	—	—	—		—	—
1AB	A/F	A/F sensor	Idle (after warm up): 0 mA			• A/F sensor • Related wiring harness
1AC	GND	Intake CMP sensor	Under any condition		Below 1.0	• Related wiring harness
1AD	CKP	CKP sensor	(See CKP signal.)			• CKP sensor • Related wiring harness
1AE	Electric variable valve timing driver (diagnostic)	Electric variable valve timing motor/ driver	(See Electric variable valve timing driver (diagnostic) signal.)			• Electric variable valve timing motor/driver • Related wiring harness
1AF	Generator output voltage	Generator (terminal P)	(See Generator output voltage.)			• Generator • Related wiring harness
1AG	A/F	A/F sensor	Idle (after warm up)		Approx. 3.48	• A/F sensor • Related wiring harness
1AH	GND	CKP sensor	Under any condition		Below 1.0	• Related wiring harness
1AI	Purge control	Purge solenoid valve	(See Purge control.)			• Purge solenoid valve • Related wiring harness
1AJ	IGT4	Ignition coil No.4	(See IGT1, IGT2, IGT3, IGT4 control.)			• Ignition coil No.4 • Related wiring harness
1AK	ECT	ECT sensor	Switch ignition ON (engine off)	ECT 20 °C {68 °F}	Approx. 3.10	• ECT sensor • Related wiring harness
				ECT 40 °C {104 °F}	Approx. 2.16	
				ECT 60 °C {140 °F}	Approx. 1.40	
				ECT 80 °C {176 °F}	Approx. 0.87	
				ECT 100 °C {212 °F}	Approx. 0.54	
1AL	—	—	—		—	—
1AM	GND	ECT sensor	Under any condition		Below 1.0	• Related wiring harness
1AN	Hydraulic variable valve timing control	OCV	(See Hydraulic variable valve timing control signal.)			• OCV • Related wiring harness
1AO	IGT3	Ignition coil No.3	(See IGT1, IGT2, IGT3, IGT4 control.)			• Ignition coil No.3 • Related wiring harness
1AP	—	—	—		—	—
1AQ	—	—	—		—	—
1AR	—	—	—		—	—
1AS	Engine oil control	Engine oil solenoid valve	(See Engine oil control signal.)			• Engine oil solenoid valve • Related wiring harness

Terminal	Signal	Connected to	Test condition		Voltage (V)	inspection item
1AT	IGT2	Ignition coil No.2	(See IGT1, IGT2, IGT3, IGT4 control.)			• Ignition coil No.2 • Related wiring harness
1AU	—	—	—		—	—
1AV	Ion (No.4)	Ion sensor No.4	Idle (after warm up)		Approx. 4.55	• Ion sensor No.4 • Related wiring harness
1AW	—	—	—		—	—
1AX	—	—	—		—	—
1AY	IGT1	Ignition coil No.1	(See IGT1, IGT2, IGT3, IGT4 control.)			• Ignition coil No.1 • Related wiring harness
1AZ	Electric variable valve timing control	Electric variable valve timing motor/ driver	(See Electric variable valve timing control signal.)			• Electric variable valve timing motor/driver • Related wiring harness
1BA	Ion (No.3)	Ion sensor No.3	Idle (after warm up)		Approx. 4.55	• Ion sensor No.3 • Related wiring harness
1BB	GND	Sensor shield	Under any condition		Below 1.0	• Related wiring harness
1BC	—	—	—		—	—
1BD	—	—	—		—	—
1BE	Generator field coil control	Generator (terminal D)	(See Generator field coil control signal.)			• Generator • Related wiring harness
1BF	Ion (No.2)	Ion sensor No.2	Idle (after warm up)		Approx. 4.55	• Ion sensor No.2 • Related wiring harness
1BG	GND	Sensor shield	Under any condition		Below 1.0	• Related wiring harness
1BH	—	—	—		—	—
1BI	—	—	—		—	—
1BJ	Constant voltage (Vref)	Fuel pressure sensor	Switch ignition ON (engine off)		Approx. 5.0	• Related wiring harness
1BK	Ion (No.1)	Ion sensor No.1	Idle (after warm up)		Approx. 4.55	• Ion sensor No.1 • Related wiring harness
1BL	GND	Sensor shield	Under any condition		Below 1.0	• Related wiring harness
1BM	—	—	—		—	—
1BN	Constant voltage (Vref)	CKP sensor	Switch ignition ON (engine off)		Approx. 5.0	• Related wiring harness
1BO	Constant voltage (Vref)	MAP sensor	Switch ignition ON (engine off)		Approx. 5.0	• Related wiring harness
1BP	TP (No.1)	TP sensor No.1	Switch ignition ON (engine off)	Accelerator pedal released	Approx. 1.11	• TP sensor No.1 • Related wiring harness
				Accelerator pedal depressed	Approx. 4.59	
1BQ	GND	TP sensor No.1, TP sensor No.2	Under any condition		Below 1.0	• Related wiring harness
1BR	—	—	—		—	—
1BS	Constant voltage (Vref)	TP sensor No.1, TP sensor No.2	Switch ignition ON (engine off)		Approx. 5.0	• Related wiring harness
1BT	—	—	—		—	—
1BU	TP (No.2)	TP sensor No.2	Switch ignition ON (engine off)	Accelerator pedal released	Approx. 3.92	• TP sensor No.2 • Related wiring harness
				Accelerator pedal depressed	Approx. 0.41	
1BV	—	—	—		—	—
1BW	MAP	MAP sensor	Switch ignition ON (engine off)		Approx. 4.07	• MAP sensor • Related wiring harness
			Idle (after warm up)		Approx. 1.34	
			Racing (Engine speed: 2,000 rpm)		Approx. 1.05	
1BX	GND	MAP sensor, IAT sensor No.2	Under any condition		Below 1.0	• Related wiring harness
1BY	A/F sensor heater control	A/F sensor heater	(See A/F sensor heater control signal.)			• A/F sensor heater • Related wiring harness
1BZ	GND	GND	Under any condition		Below 1.0	• Related wiring harness

Terminal	Signal	Connected to	Test condition		Voltage (V)	inspection item
1CA	Fuel pressure	Fuel pressure sensor	Switch ignition ON (engine off)		Approx. 1.22	• Fuel pressure sensor • Related wiring harness
			Idle (after warm up)		Approx. 1.06	
1CB	GND	Fuel pressure sensor	Under any condition		Below 1.0	• Related wiring harness
1CC	Drive-by-wire control (–)	Throttle valve actuator	Switch ignition ON (engine off)		Approx. 10.51	• Throttle valve actuator • Related wiring harness
			Idle (after warm up)		B+	
1CD	—	—	—		—	—
1CE	IAT (No.2)	IAT sensor No.2	Switch ignition ON (engine off)	IAT 20 °C {68 °F}	Approx. 3.57	• IAT sensor No.2 • Related wiring harness
				IAT 40 °C {104 °F}	Approx. 2.70	
				IAT 60 °C {140 °F}	Approx. 1.87	
1CF	—	—	—		—	—
1CG	Drive-by-wire control (+)	Throttle valve actuator	(See Drive-by-wire control (+) signal.)			• Throttle valve actuator • Related wiring harness
1CH	—	—	—		—	—
1CI	—	—	—		—	—
1CJ	—	—	—		—	—
1CK	Battery voltage	Main relay	Switch ignition ON (engine off)		B+	• Related wiring harness
1CL	GND	GND	Under any condition		Below 1.0	• Related wiring harness
1CM	—	—	—		—	—
1CN	—	—	—		—	—
1CO	Battery voltage	Fuel injector relay	Switch ignition ON (engine off)		B+	• Related wiring harness
1CP	GND	GND	Under any condition		Below 1.0	• Related wiring harness
1CQ	—	—	—		—	—
1CR	—	—	—		—	—
1CS	Battery voltage	Fuel injector relay	Switch ignition ON (engine off)		B+	• Related wiring harness
1CT	GND	GND	Under any condition		Below 1.0	• Related wiring harness
1CU	—	—	—		—	—
1CV	—	—	—		—	—
1CW	Battery voltage	Fuel injector relay	Switch ignition ON (engine off)		B+	• Related wiring harness
1CX	GND	GND	Under any condition		Below 1.0	• Related wiring harness
1CY	—	—	—		—	—
1CZ	—	—	—		—	—
1DA	Battery voltage	Fuel injector relay	Switch ignition ON (engine off)		B+	• Related wiring harness
1DB	GND	GND	Under any condition		Below 1.0	• Related wiring harness
1DC	—	—	—		—	—
1DD	—	—	—		—	—
1DE	—	—	—		—	—
1DF	—	—	—		—	—
1DG	Battery voltage	Fuel injector relay	Switch ignition ON (engine off)		B+	• Related wiring harness
1DH	GND	GND	Under any condition		Below 1.0	• Related wiring harness
1DI	—	—	—		—	—
1DJ	—	—	—		—	—
1DK	Battery voltage	Fuel injector relay	Switch ignition ON (engine off)		B+	• Related wiring harness
1DL	GND	GND	Under any condition		Below 1.0	• Related wiring harness
1DM	—	—	—		—	—
1DN	—	—	—		—	—
1DO	Fuel injection control (–)	Fuel injector No.1	(See Fuel injection control (-) signal.)			• Fuel injector No.1 • Related wiring harness
1DP	Fuel injection control (+)	Fuel injector No.1	(See Fuel injection control (+) signal.)			• Fuel injector No.1 • Related wiring harness
1DQ	—	—	—		—	—
1DR	—	—	—		—	—
1DS	Fuel injection control (–)	Fuel injector No.4	(See Fuel injection control (-) signal.)			• Fuel injector No.4 • Related wiring harness

Terminal	Signal	Connected to	Test condition		Voltage (V)	inspection item
1DT	Fuel injection control (+)	Fuel injector No.4	(See Fuel injection control (+) signal.)			• Fuel injector No.4 • Related wiring harness
1DU	—	—	—		—	—
1DV	—	—	—		—	—
1DW	Fuel injection control (–)	Fuel injector No.2	(See Fuel injection control (-) signal.)			• Fuel injector No.2 • Related wiring harness
1DX	Fuel injection control (+)	Fuel injector No.2	(See Fuel injection control (+) signal.)			• Fuel injector No.2 • Related wiring harness
1DY	—	—	—		—	—
1DZ	—	—	—		—	—
1EA	Fuel injection control (–)	Fuel injector No.3	(See Fuel injection control (-) signal.)			• Fuel injector No.3 • Related wiring harness
1EB	Fuel injection control (+)	Fuel injector No.3	(See Fuel injection control (+) signal.)			• Fuel injector No.3 • Related wiring harness
1EC	—	—	—		—	—
1ED	—	—	—		—	—
1EE	High pressure fuel pump control (+)	High pressure fuel pump	(See High pressure fuel pump control (+) signal.)			• High pressure fuel pump • Related wiring harness
1EF	High pressure fuel pump control (–)	High pressure fuel pump	(See High pressure fuel pump control (-) signal.)			• High pressure fuel pump • Related wiring harness
1EG	—	—	—		—	—
1EH	—	—	—		—	—
1EI	—	—	—		—	—
1EJ	—	—	—		—	—
2A	—	—	—		—	—
2B	—	—	—		—	—
2C	HO2S heater control	HO2S heater	(See HO2S heater control signal.)			• HO2S heater • Related wiring harness
2D	—	—	—		—	—
2E	—	—	—		—	—
2F	—	—	—		—	—
2G	Brake (No.1)	Brake switch (No.1 signal)	Brake pedal released		Below 1.0	• Brake switch (No.1 signal) • Related wiring harness
			Brake pedal depressed		B+	
2H	Ignition (IG1)	IG1 relay	Switch ignition ON (engine off)		B+	• IG1 relay • Related wiring harness
2I*4	Ambient temperature	Ambient temperature sensor	Switch ignition ON (engine off)	AAT 20 °C {68 °F}	Approx. 2.70	• Ambient temperature sensor • Related wiring harness
				AAT 30 °C {104 °F}	Approx. 1.80	
2J*2	CPP	CPP switch, Start stop unit	Clutch pedal depressed		Below 1.0	• CPP switch • Start stop unit • Related wiring harness
			Clutch pedal released		B+	
2K	Main relay control	Main relay	Switch ignition ON (engine off)		Approx. 0.8	• Main relay • Related wiring harness
2L	—	—	—		—	—
2M*5	Clutch stroke sensor	Clutch stroke sensor	Switch ignition ON (engine off)	Clutch pedal released	Approx. 0.6	• Clutch stroke sensor • Related wiring harness
				Clutch pedal depressed	Approx. 4.5	
2N	—	—	—		—	—
2O	Battery voltage	Battery	Switch ignition ON (engine off)		B+	• Battery • Related wiring harness
2P*3	DC-DC converter control	DC-DC converter	Switch ignition ON (engine off)		Below 1.0	• DC-DC converter • Related wiring harness
2Q*3	Power brake unit vacuum	Power brake unit vacuum sensor	Idle (after warm up)	Brake pedal released	Approx. 0.44	• Power brake unit vacuum sensor • Related wiring harness
2R	Brake (No.2)	Brake switch (No.2 signal)	Brake pedal released		Below 1.0	• Brake switch (No.2 signal) • Related wiring harness
			Brake pedal depressed		B+	
2S	Battery voltage	Main relay	Switch ignition ON (engine off)		B+	• Related wiring harness

Terminal	Signal	Connected to	Test condition		Voltage (V)	inspection item
2T	Battery voltage	Main relay	Switch ignition ON (engine off)		B+	• Related wiring harness
2U	IAT (No.1)	IAT sensor No.1	Switch ignition ON (engine off)	IAT 20 °C {68 °F}	Approx. 2.70	• IAT sensor No.1 • Related wiring harness
				IAT 40 °C {104 °F}	Approx. 1.80	
				IAT 60 °C {140 °F}	Approx. 1.20	
2V	—	—	—		—	—
2W	—	—	—		—	—
2X	—	—	—		—	—
2Y	—	—	—		—	—
2Z	—	—	—		—	—
2AA	GND	GND	Under any condition		Below 1.0	• Related wiring harness
2AB	—	—	—		—	—
2AC	—	—	—		—	—
2AD	GND	Sensor shield	Under any condition		Below 1.0	• Related wiring harness
2AE	Fuel pump control	Fuel pump control module	(See Fuel pump control signal.)			• Fuel pump control module • Related wiring harness
2AF*4	A/C cut-off control	A/C relay	A/C relay OFF		B+	• A/C relay
			A/C relay ON		Below 1.0	• Related wiring harness
2AG	HO2S (–)	HO2S	Idle (after warm up)		Approx. 1.65	• HO2S • Related wiring harness
2AH*3	GND	Power brake unit vacuum sensor, clutch stroke sensor*2	Under any condition		Below 1.0	• Related wiring harness
2AI	HO2S (+)	HO2S	Idle (after warm up)		Approx. 2.49	• HO2S • Related wiring harness
2AJ*4	GND	Refrigerant pressure sensor	Under any condition		Below 1.0	• Related wiring harness
2AK	CAN_H	CAN system related modules	Because this terminal is for CAN, integrity determination by terminal voltage is not possible.			• Related wiring harness
2AL	CAN_L	CAN system related modules	Because this terminal is for CAN, integrity determination by terminal voltage is not possible.			• Related wiring harness
2AM	Fuel pump control module (diagnostic)	Fuel pump control module	(See Fuel pump control module (diagnostic) signal.)			• Fuel pump control module • Related wiring harness
2AN	APP (No.1)	APP sensor No.1	Switch ignition ON (engine off)	Accelerator pedal released	Approx. 0.75	• APP sensor No.1 • Related wiring harness
				Accelerator pedal depressed	Approx. 4.1	
2AO	GND	APP sensor No.1	Under any condition		Below 1.0	• Related wiring harness
2AP	—	—	—		—	—
2AQ	Fuel pump control	Fuel pump relay	Switch ignition ON (engine off)		B+	• Fuel pump relay
			Idle (after warm up)		Below 1.0	• Related wiring harness
2AR	Constant voltage (Vref)	APP sensor No.1	Switch ignition ON (engine off)		Approx. 5.0	• Related wiring harness
2AS	APP (No.2)	APP sensor No.2	Switch ignition ON (engine off)	Accelerator pedal released	Approx. 0.38	• APP sensor No.2 • Related wiring harness
				Accelerator pedal depressed	Approx. 2.05	
2AT	GND	APP sensor No.2	Under any condition		Below 1.0	• Related wiring harness
2AU	Cooling fan control	Cooling fan relay No.1	Cooling fan operating		Below 1.0	• Cooling fan relay No.1
			Cooling fan not operating		B+	• Related wiring harness

Terminal	Signal	Connected to	Test condition		Voltage (V)	inspection item
2AV	Cooling fan control	Cooling fan relay No.2, No.3	Cooling fan operating		Below 1.0	• Cooling fan relay No.2, No.3 • Related wiring harness
			Cooling fan not operating		B+	
2AW	Constant voltage (Vref)	APP sensor No.2	Switch ignition ON (engine off)		Approx. 5.0	• Related wiring harness
2AX*4	Refrigerant pressure	Refrigerant pressure sensor	Refrigerant pressure: 1.0 MPa {10 kgf/cm^2, 145 psi}		Approx. 1.58	• Refrigerant pressure sensor • Related wiring harness
			Refrigerant pressure: 1.1 MPa {11 kgf/cm^2, 160 psi}		Approx. 1.75	
			Refrigerant pressure: 1.2 MPa {12 kgf/cm^2, 174 psi}		Approx. 1.88	
2AY	GND	MAF sensor, IAT sensor No.1	Under any condition		Below 1.0	• Related wiring harness
2AZ	Starter cut-off control	Starter relay, start stop unit	Switch ignition ON (engine off)	**MTX** • Clutch pedal released **ATX** • Selector lever position is not P or N position	B+	• Starter relay • Start stop unit • Related wiring harness
				MTX • Clutch pedal depressed **ATX** • Selector lever position is P or N position	Below 1.0	
2BA	—	—	—		—	—
2BB	Constant voltage (Vref)	Refrigerant pressure sensor*4, MAF sensor	Switch ignition ON (engine off)		Approx. 5.0	• Related wiring harness
2BC	MAF	MAF sensor	Switch ignition ON (engine off)		Approx. 0.72	• MAF sensor • Related wiring harness
			Idle (after warm up)		Approx. 0.86	
			Racing (Engine speed: 2,000 rpm)		Approx. 1.07	
2BD	Selector lever position*1	TCM, start stop unit	Selector lever position is not P or N position		B+	• TCM • Start stop unit • Related wiring harness
			Selector lever position is P or N position		Below 1.0	
	Starter interlock*2	Starter interlock switch, start stop unit	Clutch pedal depressed		Below 1.0	• Starter interlock switch • Start stop unit • Related wiring harness
			Clutch pedal released		B+	
2BE	—	—	—		—	—
2BF	—	—	—		—	—
2BG*3	Constant voltage (Vref)	Power brake unit vacuum sensor, clutch stroke sensor*2	Switch ignition ON (engine off)		Approx. 5.0	• Related wiring harness
2BH	—	—	—		—	—

*1 : ATX
*2 : MTX
*3 : With i-stop system
*4 : With air conditioner
*5 : With i-stop system (MTX)

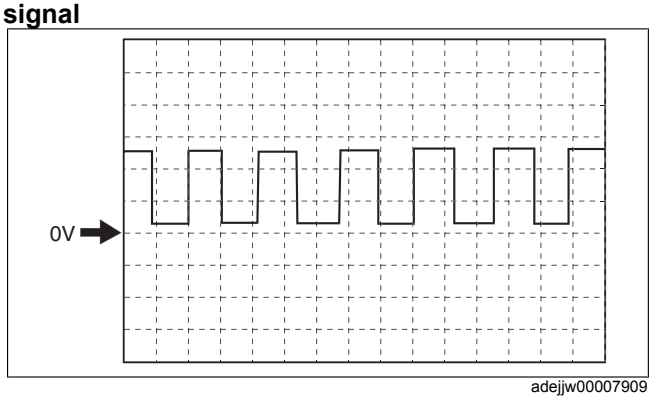
Inspection Using An Oscilloscope (Reference)

Electric variable valve timing motor (rotation direction) signal

PCM terminals
- 1J(+)—body ground(–)

Oscilloscope setting
- 2 V/DIV (Y), 5 ms/DIV (X), DC range

Vehicle condition
- Idle (after warm up)



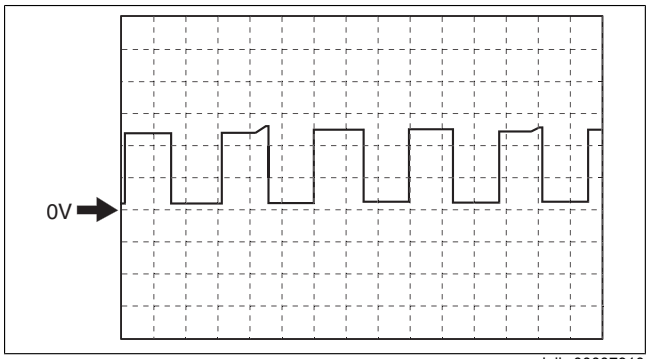
adejjw00007909

Electric variable valve timing motor (rotation pulse) signal

PCM terminals
- 1O(+)—body ground(–)

Oscilloscope setting
- 2 V/DIV (Y), 5 ms/DIV (X), DC range

Vehicle condition
- Idle (after warm up)



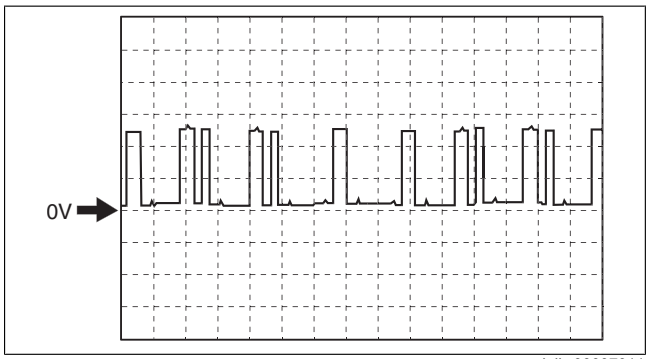
adejjw00007910

Exhaust CMP signal

PCM terminals
- 1T(+)—body ground(–)

Oscilloscope setting
- 2 V/DIV (Y), 20 ms/DIV (X), DC range

Vehicle condition
- Idle (after warm up)



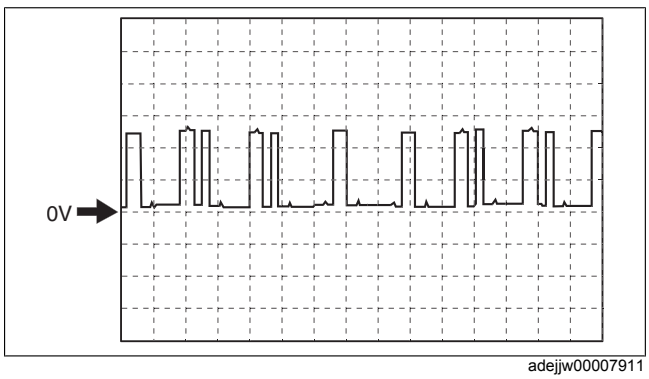
adejjw00007911

Intake CMP signal

PCM terminals
- 1Y(+)—body ground(–)

Oscilloscope setting
- 2 V/DIV (Y), 20 ms/DIV (X), DC range

Vehicle condition
- Idle (after warm up)

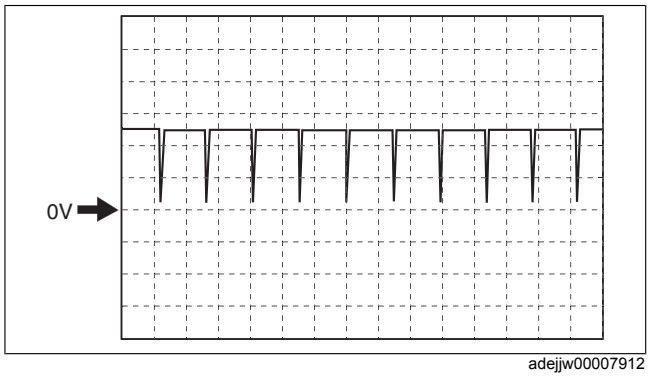


adejjw00007911

CKP signal
PCM terminals
- 1AD(+)—body ground(–)

Oscilloscope setting
- 2 V/DIV (Y), 1 ms/DIV (X), DC range

Vehicle condition
- Idle (after warm up)

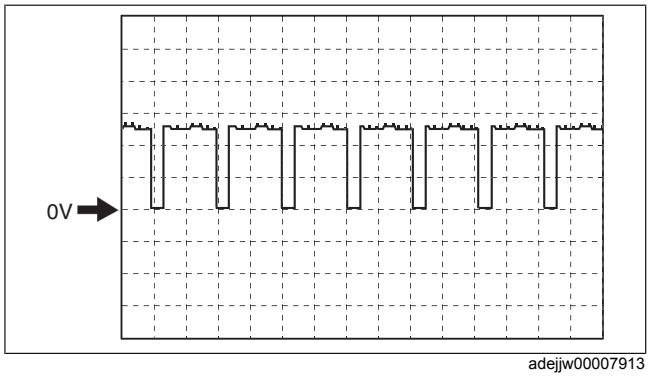


adejjw00007912

Electric variable valve timing driver (diagnostic) signal
PCM terminals
- 1AE(+)—body ground(–)

Oscilloscope setting
- 2 V/DIV (Y), 100 ms/DIV (X), DC range

Vehicle condition
- Idle (after warm up)

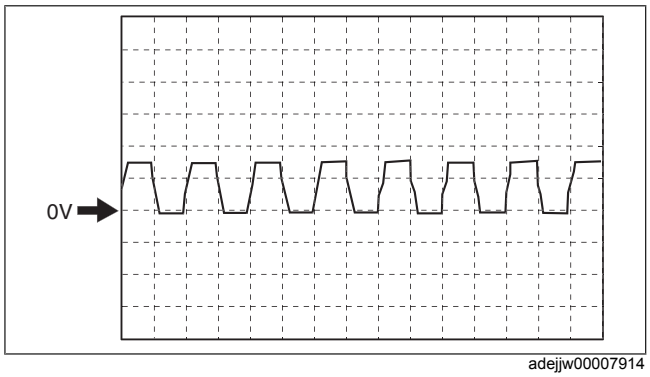


adejjw00007913

Generator output voltage
PCM terminals
- 1AF(+)—body ground(–)

Oscilloscope setting
- 5 V/DIV (Y), 2 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

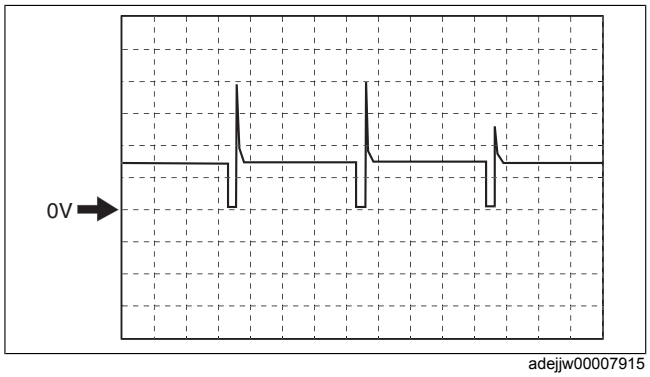


adejjw00007914

Purge control
PCM terminals
- 1AI(+)—body ground(–)

Oscilloscope setting
- 10 V/DIV (Y), 50 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

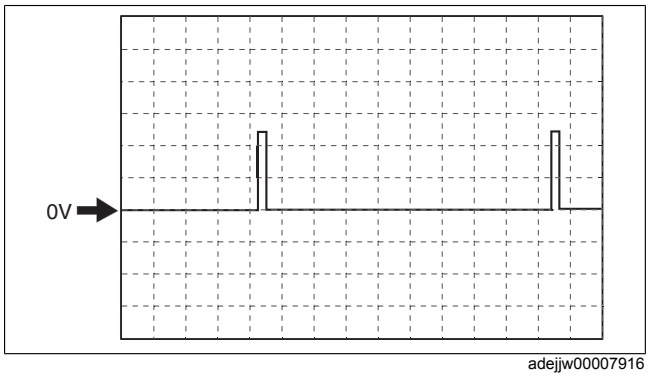


adejjw00007915

IGT1, IGT2, IGT3, IGT4 control
PCM terminals
- IGT1 (ignition coil No.1): 1AY(+)—body ground(–)
- IGT2 (ignition coil No.2): 1AT(+)—body ground(–)
- IGT3 (ignition coil No.3): 1AO(+)—body ground(–)
- IGT4 (ignition coil No.4): 1AJ(+)—body ground(–)

Oscilloscope setting
- 2 V/DIV (Y), 20 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

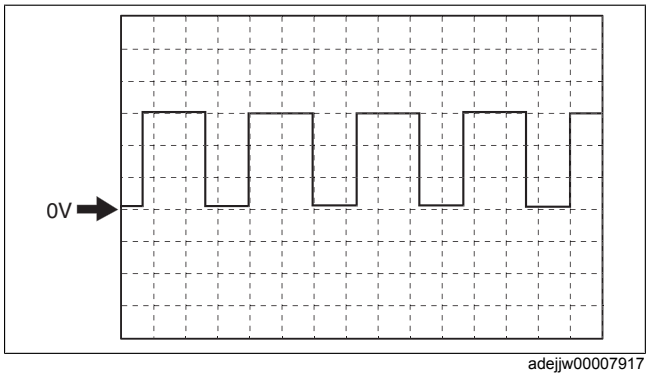


adejjw00007916

Hydraulic variable valve timing control signal
PCM terminals
- 1AN(+)—body ground(–)

Oscilloscope setting
- 5 V/DIV (Y), 1 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

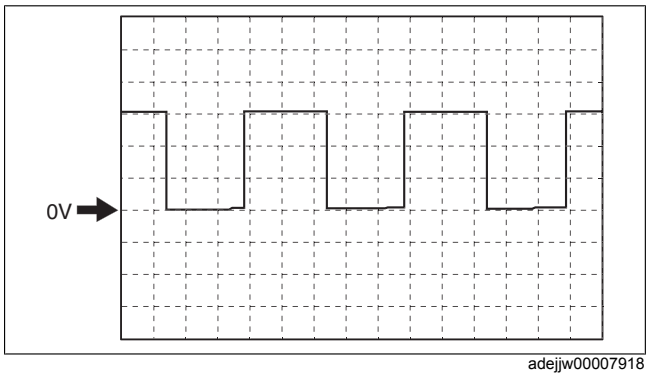


adejjw00007917

Engine oil control signal
PCM terminals
- 1AS(+)—body ground(–)

Oscilloscope setting
- 5 V/DIV (Y), 1 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

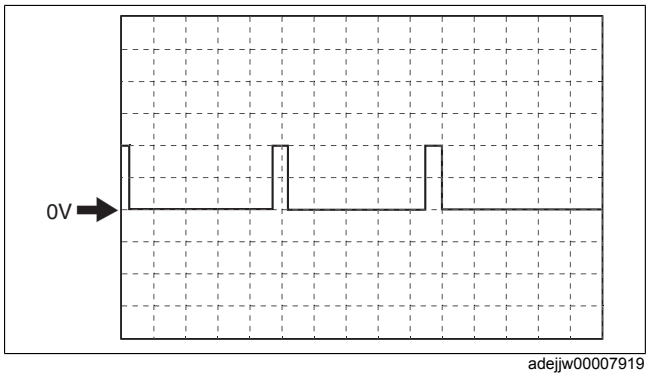


adejjw00007918

Electric variable valve timing control signal
PCM terminals
- 1AZ(+)—body ground(–)

Oscilloscope setting
- 2 V/DIV (Y), 2 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

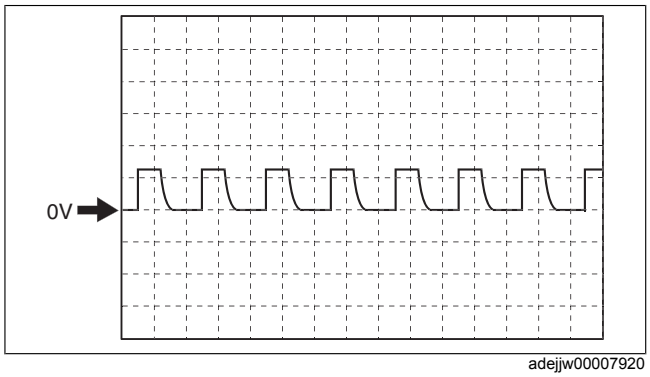


adejjw00007919

Generator field coil control signal
PCM terminals
- 1BE(+)—body ground(–)

Oscilloscope setting
- 1 V/DIV (Y), 2 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

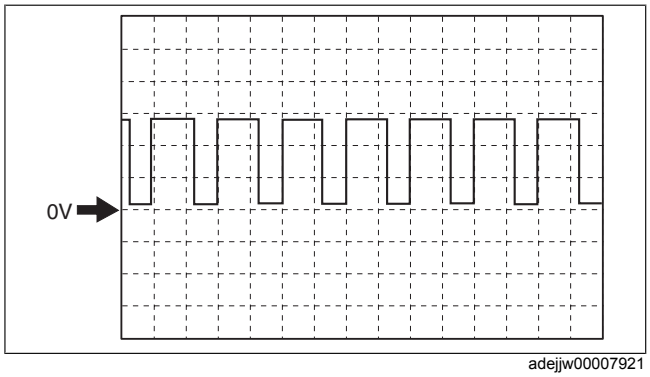


adejjw00007920

A/F sensor heater control signal
PCM terminals
- 1BY(+)—body ground(–)

Oscilloscope setting
- 5 V/DIV (Y), 50 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

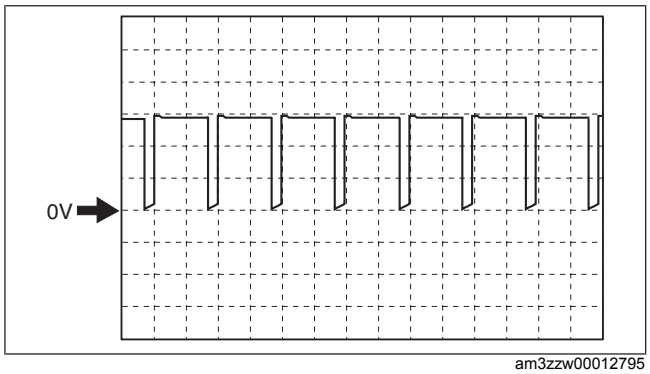


adejjw00007921

Drive-by-wire control (+) signal
PCM terminals
- 1CG(+)—body ground(–)

Oscilloscope setting
- 5 V/DIV (Y), 1 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

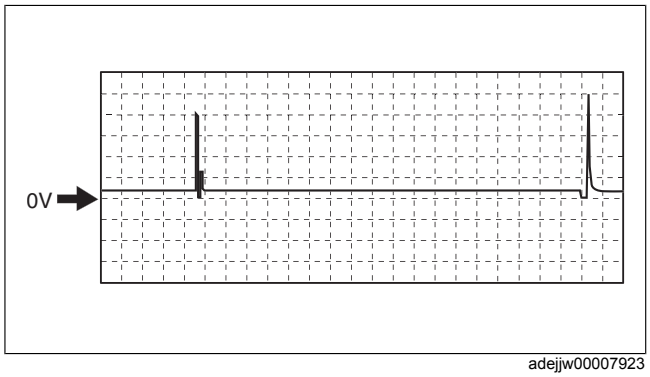


am3zzw00012795

Fuel injection control (-) signal
PCM terminals
- Fuel Injection No.1: 1DO(+)—body ground(–)
- Fuel Injection No.2: 1DW(+)—body ground(–)
- Fuel Injection No.3: 1EA(+)—body ground(–)
- Fuel Injection No.4: 1DS(+)—body ground(–)

Oscilloscope setting
- 10 V/DIV (Y), 5 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

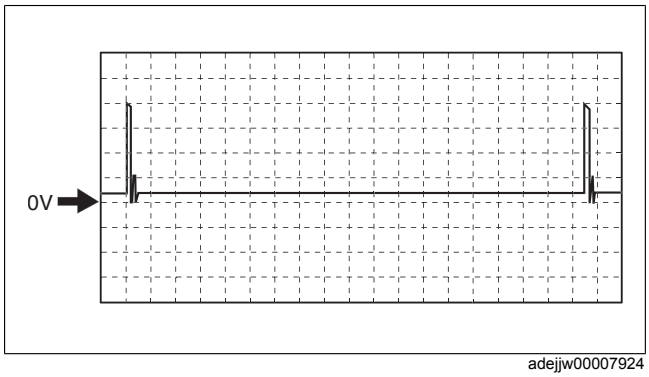


adejjw00007923

Fuel injection control (+) signal
PCM terminals
- Fuel Injection No.1: 1DP(+)—body ground(–)
- Fuel Injection No.2: 1DX(+)—body ground(–)
- Fuel Injection No.3: 1EB(+)—body ground(–)
- Fuel Injection No.4: 1DT(+)—body ground(–)

Oscilloscope setting
- 10 V/DIV (Y), 5 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

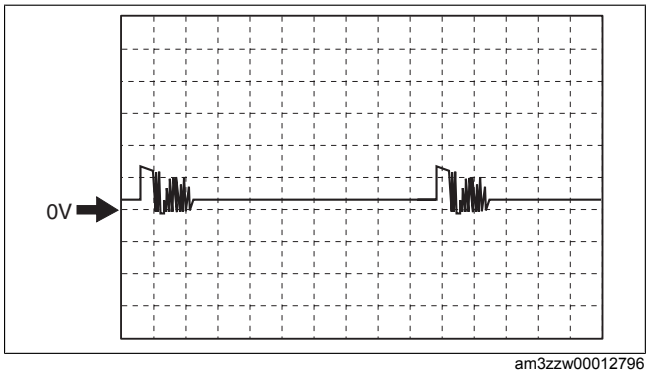


adejjw00007924

High pressure fuel pump control (+) signal
PCM terminals
- 1EE(+)—body ground(–)

Oscilloscope setting
- 10 V/DIV (Y), 5 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

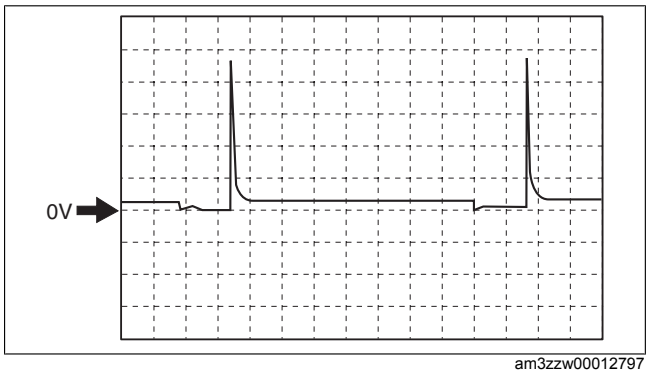


am3zzw00012796

High pressure fuel pump control (-) signal
PCM terminals
- 1EF(+)—body ground(–)

Oscilloscope setting
- 10 V/DIV (Y), 5 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

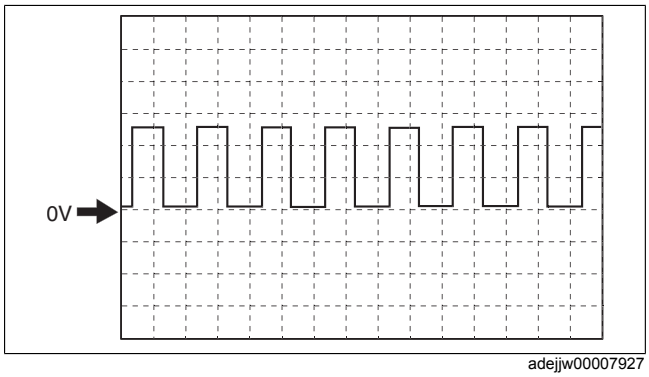


am3zzw00012797

HO2S heater control signal
PCM terminals
- 2C(+)—body ground(–)

Oscilloscope setting
- 5 V/DIV (Y), 50 ms/DIV (X), DC range

Vehicle condition
- Idle (immediately after starting engine)

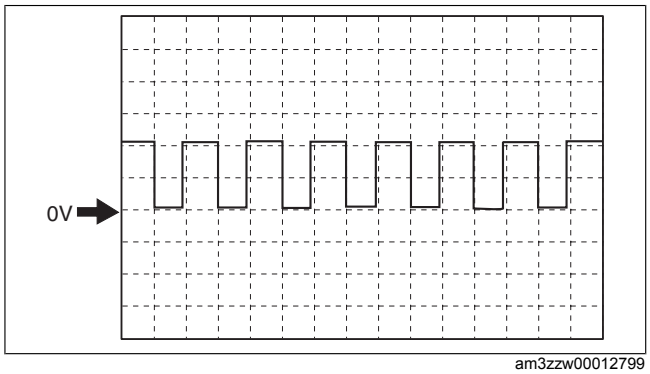


adejjw00007927

Fuel pump control signal
PCM terminals
- 2AE(+)—body ground(–)

Oscilloscope setting
- 5 V/DIV (Y), 2 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up

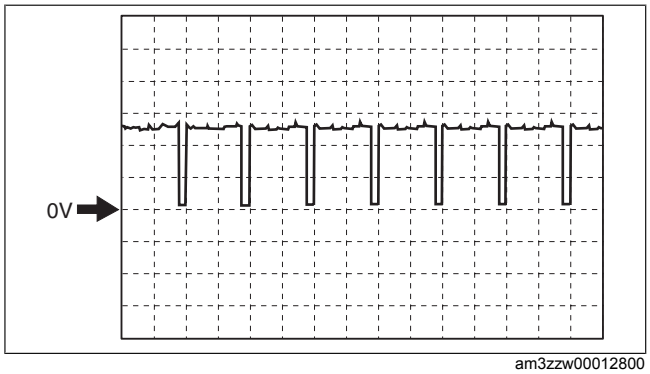


am3zzw00012799

Fuel pump control module (diagnostic) signal
PCM terminals
- 2AM(+)—body ground(–)

Oscilloscope setting
- 2 V/DIV (Y), 50 ms/DIV (X), DC range

Vehicle condition
- Idle after warm up



am3zzw00012800

Using the M-MDS

Note
- PIDs for the following parts are not available on this model. Go to the appropriate part inspection page.
  - — Intake CMP sensor and exhaust CMP sensor (See CAMSHAFT POSITION (CMP) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
  - — Main relay (See RELAY INSPECTION.)

1. Connect the M-MDS to the DLC-2.
2. Switch the ignition ON (engine off).
3. Measure the PID value.
   - If PID value is not within the specification, follow the instructions in action column.

Note
- The PID/DATA MONITOR function monitors the calculated value of the input/output signals in the PCM. Therefore, an output device malfunction is not directly indicated as a malfunction of the monitored value for the output device. If a monitored value of an output device is out of specification, inspect the monitored value of the input device related to the output control.
- The simulation items that are used in the ENGINE CONTROL SYSTEM OPERATION INSPECTION are as follows.
  - — ACCS, ARPMDES, EVAPCP, FAN1, FAN3, FP, INJ_1, INJ_2, INJ_3, INJ_4, OIL_P_SOL, Test, VT EX_DES

PID/DATA monitor item table

—: Not applicable

Item	Definition	Unit/Condition	Condition/Specification (Reference)
AC_PRES	Refrigerant pressure	KPa {MPa}, mBar {Bar}, psi, in H20	• Displays refrigerant pressure
		V	• Refrigerant pressure is 1.0 MPa {10 kgf/cm^2, 145 psi}: Approx. 1.58 V • Refrigerant pressure is 1.1 MPa {11 kgf/cm^2, 160 psi}: Approx. 1.75 V • Refrigerant pressure is 1.2 MPa {12 kgf/cm^2, 174 psi}: Approx. 1.88 V
AC_REQ	A/C request signal	Off/On	• A/C switch off: Off • A/C switch on: On
ACCS	A/C relay	Off/On	• A/C relay is off: Off • A/C relay is on: On
ALTF	Generator field coil control duty value	%	• Switch ignition ON (engine off): 0% • Idle: Approx. 42% • Racing (Engine speed is 2,000 rpm): Approx. 29%
ALTT V	Generator output voltage	V	• Idle (no E/L): Approx. 14 V (This is an internal calculation value and differs from the terminal voltage.)
AMB_TEMP	Ambient air temperature	°C, °F	• Displays ambient air temperature
APP	Accelerator pedal position	%	• Accelerator pedal released: Approx. 0% • Accelerator pedal depressed: Approx. 100%
APP1	APP sensor No.1	%	• Accelerator pedal released: Approx. 15% • Accelerator pedal depressed: Approx. 82%
		V	• Accelerator pedal released: Approx. 0.75 V • Accelerator pedal depressed: Approx. 4.1 V
APP2	APP sensor No.2	%	• Accelerator pedal released: Approx. 7.45% • Accelerator pedal depressed: Approx. 41%
		V	• Accelerator pedal released: Approx. 0.38 V • Accelerator pedal depressed: Approx. 2.05 V
ARPMDES	Target engine speed	RPM	• Displays target engine speed
BARO	Barometric pressure	KPa {MPa}, mBar {Bar}, psi, in H20	• Displays BARO
		V	• Ignition switched ON (at sea level): Approx. 4.08 V
BATT_CUR*1	Current sensor	A	• Displays battery charge/discharge current value
BATT_DAY*1	Vehicle battery - days in service	—	• Displays vehicle battery days in service
BATT_RES*1	Battery inferred internal resistance	—	• Displays battery inferred internal resistance
BATT_SOC*1	Battery estimated state of charge	%	• Displays battery estimated state of charge
BATT_TEMP*1	Battery fluid temperature sensor	°C, °F	• Displays battery fluid temperature
BATT_V*1	Battery voltage	V	• Displays battery voltage
BBP*1	Power brake unit vacuum sensor	KPa {MPa}, mBar {Bar}, psi, in H20	• Displays power brake unit vacuum
		V	• Power brake unit vacuum is 7.54 kPa {0.0769 kgf/cm^2, 1.09 psi}: approx. 0.29 V • Power brake unit vacuum is 96.7 kPa {0.986 kgf/cm^2, 14.0 psi}: approx. 3.81 V

Item	Definition	Unit/Condition	Condition/Specification (Reference)
BFP*1	Brake fluid pressure	KPa {MPa}, mBar {Bar}, psi, in H20	• Displays brake fluid pressure
BOO	Brake switch	High/Low	• Brake pedal released: Low • Brake pedal depressed: High
BPA	Brake pressure applied switch	High/Low	• Brake pedal released: Low • Brake pedal depressed: High
CATT11_DSD	Estimated catalytic converter temperature	°C, °F	• Displays estimated catalytic converter temperature
CHRGLP	Charging system warning light	Off/On	• Charging system warning light not illuminated: Off • Charging system warning light illuminated: On
CLU_CUT_SW*2	Starter interlock	Off/On	• Starter interlock switch off: Off • Starter interlock switch on: On
CPP*2	Clutch pedal position	Off/On	• Clutch pedal released: Off • Clutch pedal depressed: On
CPP*3	Clutch stroke sensor	%	• Clutch pedal released: Approx. 3% • Clutch pedal depressed: Approx. 99%
CPP/PNP*2	Shift lever position	Off/On	• Other than neutral: Off • Neutral: On
ECT	Engine coolant temperature	°C, °F	• Displays ECT
		V	• ECT is 20 °C {68 °F}: Approx. 3.10 V • ECT is 40 °C {104 °F}: Approx. 2.16 V • ECT is 60 °C {140 °F}: Approx. 1.40 V • ECT is 80 °C {176 °F}: Approx. 0.87 V • ECT is 100 °C {212 °F}: Approx. 0.54 V
EQ_RAT11	Equivalence ratio (lambda)	—	• Idle (after warm up): Approx. 1
EQ_RAT11_DSD	Desired equivalence ratio (lambda)	—	• Indicate the target lambda (Excess air factor = supplied air amount / theoretical air/fuel ratio)
ETC_ACT	Electric throttle control actual	° (deg)	**Switch ignition ON (engine off)** • Accelerator pedal released: Approx. 12.89 ° • Accelerator pedal depressed: Approx. 86.03 ° **Idle (after warm up)** • Accelerator pedal released: Approx. 3.2 °
ETC_DSD	Electric throttle control desired	%	• Displays target TP angle (percent)
		° (deg)	• Displays target TP angle
EVAPCP	Purge solenoid valve duty value	%	• Idle (after warm up): Approx. 0% • Racing (Engine speed 2,000 rpm): 4.3—35% • Racing (Engine speed 4,000 rpm): Approx. 66%
FAN1	Cooling fan relay No.1	Off/On	• Cooling fan relay No.1 not operating: Off • Cooling fan relay No.1 operating: On
FAN3	Cooling fan relay No.3	Off/On	• Cooling fan relay No.3 not operating: Off • Cooling fan relay No.3 operating: On
FIA	Fuel injection amount	mg/cylinder	• Displays fuel injection amount
FLI	Fuel level	%	• Fuel gauge level F: Approx. 100% • Fuel gauge level E: Approx. 0%
FP	Fuel pump relay	Off/On	• Switch ignition ON (engine off): Off • Cranking: On • Idle (after warm up): On
FP_DUTY	Fuel pump control module	%	• Switch ignition ON (engine off): Approx. 55.74% • Cranking: Approx. 95% • Idle (after warm up): Approx. 55.74%
FUEL_P_DSD	Fuel pressure desired	KPa {MPa}, mBar {Bar}, psi, in H20	• Displays target fuel pressure

Item	Definition	Unit/Condition	Condition/Specification (Reference)
FUEL_PRES	Fuel pressure sensor	KPa {MPa}, mBar {Bar}, psi, in H20	• Displays fuel pressure
		V	• Fuel pressure is 3.0 MPa {31 kgf/cm^2, 435 psi}: Approx. 0.92 V • Fuel pressure is 4.8 MPa {49 kgf/cm^2, 696 psi}: Approx. 1.17 V
FUELPW	Fuel injector duration	Sec	• Idle (after warm up): Approx. 1.4 ms • Racing (engine speed is 2,000 rpm): Approx. 1.1 ms • Racing (engine speed is 4,000 rpm): Approx. 1.0 ms
FUELSYS	Fuel system status	OL/CL/ OL-Drive/ OL-Fault/ CL-Fault	• Idle (after warm up): OL or CL • Racing (engine speed is 2,000 rpm): CL • Deceleration fuel cut (accelerator pedal released from engine speed of 4,000 rpm or more): OL-Drive
GEAR*4	Gear commanded	Unknown/1st/2nd/ 3rd/4th/5th/6th/7th/ 8th/Not in P/Park/ Neutral/Drive/ Reverse	• Selector lever at P position: Park • Selector lever at R position: Reverse • Selector lever at N position: Neutral • Selector lever is in D or M position while vehicle is stopped: 1st
HTR11	A/F sensor heater	Off/On	• Switch ignition ON (engine off): Off • Idle (after warm up): On
		%	• Switch ignition ON (engine off): 0% • Idle (after warm up): Approx. 42%
HTR12	HO2S heater control)	Off/On	• Switch ignition ON (engine off): Off • Idle (after warm up): On
		%	• Switch ignition ON (engine off): 0% • Idle (after warm up): Approx. 40%
IAT	Intake air temperature No.1	°C, °F	• Displays IAT (No.1)
		V	• IAT is 20 °C {68 °F}: Approx. 2.70 V • IAT is 40 °C {104 °F}: Approx. 1.80 V • IAT is 60 °C {140 °F}: Approx. 1.20 V
IAT2	Intake air temperature No.2	°C, °F	• Displays IAT (No.2)
		V	• IAT2 is 20 °C {68 °F}: Approx. 3.57 V • IAT2 is 40 °C {104 °F}: Approx. 2.70 V • IAT2 is 60 °C {140 °F}: Approx. 1.87 V
INGEAR	Gears are engaged	Off/On	**MTX** • When the following conditions are satisfied: On — Other than neutral — Clutch pedal released • Except above: Off **ATX** • Selector lever at P or N position: Off • Except above: On
ISC_FBK	ISC feedback value	%	• Displays ISC feedback value
I-Stop_OFF*1	i-stop OFF switch	Off/On	• i-stop OFF switch off: Off • i-stop OFF switch on: On
I-Stop_TRD*1	i-stop transmission D position selected status	Off/On	• D position: On • Except above: Off
I-Stop_VSP*1	i-stop vehicle speed history flag	Off/On	• Vehicle speed in which engine stop condition is met via i-stop control is detected: On • Except above: Off
I-Stop_VST*1	i-stop vehicle stop flag	Off/On	• Vehicle stop predicted: On • Except above: Off
IVS	CTP condition	Off Idle/Idle	• Racing: Off Idle • Idle: Idle
KNOCKR	Knocking retard	° (deg)	• Switch ignition ON (engine off): 0 ° • Idle (after warm up): 0 °

Item	Definition	Unit/Condition	Condition/Specification (Reference)
LOAD	Engine load	%	• Idle (after warm up): Approx. 17.64% • Racing (engine speed is 2,000 rpm): Approx. 14.51% • Racing (engine speed is 4,000 rpm): Approx. 21.17%
LONGFT1	Long term fuel trim	%	• Idle (after warm up): Approx. -2.34% • Racing (engine speed is 2,000 rpm): Approx. -0.78% • Racing (engine speed is 4,000 rpm): Approx. -0.78%
LONGFT12	Long term fuel trim (HO2S)	%	• Idle (after warm up): Approx. 0%
LOW_OIL	Engine oil level status	Never Detected/ Detected	• Switch ignition ON (engine off): Detected • Idle (after warm up): Never Detected
M_GEAR*2	Manual gear position	Neutral/1st gear/ 2nd gear/3rd gear/ 4th gear/5th gear/ 6th gear/Reverse/ Undefined/Auto/ In_Progress/YSF/ Error	• Displays manual gear position
MAF	Mass airflow	g/Sec	• Displays MAF
		V	• Switch ignition ON (engine off) (MAF: 0.59 g/s {0.078 lb/min}): Approx. 0.72 V • Idle (after warm up) (MAF: 2.17 g/s {0.287 lb/min}): Approx. 0.86 V • Racing (engine speed is 2,000 rpm) (MAF: 4.73 g/s {0.626 lb/min}): Approx. 1.07 V
MAP	Manifold absolute pressure	KPa {MPa}, mBar {Bar}, psi, in H20	• Displays MAP
		V	• Switch ignition ON (engine off) (MAP: 101 kPa {1.03 kgf/cm^2, 14.6 psi}): Approx. 4.07 V • Idle (after warm up) (MAP: 33 kPa {0.34 kgf/cm^2, 4.8 psi}): Approx. 1.34 V • Racing (engine speed is 2,000 rpm) (MAP: 26 kPa {0.27 kgf/cm^2, 3.8 psi}): Approx. 1.05 V
MF_CAT_2	Number of misfires corresponding to possible catalytic converter damage (No. 2 cylinder)	—	• Displays number of misfires corresponding to possible catalytic converter damage (No.2 cylinder)
MF_CAT_3	Number of misfires corresponding to possible catalytic converter damage (No. 3 cylinder)	—	• Displays number of misfires corresponding to possible catalytic converter damage (No.3 cylinder)
MF_CAT_4	Number of misfires corresponding to possible catalytic converter damage (No. 4 cylinder)	—	• Displays number of misfires corresponding to possible catalytic converter damage (No.4 cylinder)
MF_CAT_FCC	Number of misfire determinations (for catalytic converter)	—	• Displays number of misfire determinations (for catalytic converter)
MF_CAT_TTL	Number of misfires corresponding to possible catalytic converter damage (total)	—	• Displays number of misfires corresponding to possible catalytic converter damage (total)
MF_CAT1	Number of misfires corresponding to possible catalytic converter damage (No. 1 cylinder)	—	• Displays number of misfires corresponding to possible catalytic converter damage (No.1 cylinder)
MF_EMI_2	Number of misfires possibly affecting emission (No.2 cylinder)	—	• Displays number of misfires possibly affecting emission (No.2 cylinder)
MF_EMI_3	Number of misfires possibly affecting emission (No.3 cylinder)	—	• Displays number of misfires possibly affecting emission (No.3 cylinder)
MF_EMI_4	Number of misfires possibly affecting emission (No.4 cylinder)	—	• Displays number of misfires possibly affecting emission (No.4 cylinder)

Item	Definition	Unit/Condition	Condition/Specification (Reference)
MF_EMI_FCC	Number of misfire determinations (for emission)	—	• Displays number of misfire determinations (for emission)
MF_EMI_TTL	Number of misfires possibly affecting emission (total)	—	• Displays number of misfires possibly affecting emission (total)
MF_EMI1	Number of misfires possibly affecting emission (No.1 cylinder)	—	• Displays number of misfires possibly affecting emission (No.1 cylinder)
MIL	Check engine light	Off/On	• Check engine light not illuminated: Off • Check engine light illuminated: On
MIL_DIS	Travelled distance since the check engine light illuminated	km, ft, mi	• Displays travelled distance since the check engine light illuminated
NEUTRAL_SW1*3	Neutral switch No.1	Off/On	• Other than neutral: Off • Neutral: On
NEUTRAL_SW2*3	Neutral switch No.2	Off/On	• Other than neutral: Off • Neutral: On
O2S11	A/F sensor	μA	• Idle (after warm up): Approx. -39 μA • Deceleration fuel cut (accelerator pedal released from engine speed of 4,000 rpm or more): Approx. 3.84 mA
O2S12	HO2S	V	• Idle (after warm up): 0—1.0 V • Deceleration fuel cut (accelerator pedal released from engine speed of 4,000 rpm or more): Approx. 0 V
OIL_P_SOL	Engine oil solenoid valve	Off/On	• ECT above 98 °C {208 °F} or engine speed above 4,000 rpm: Off • ECT below 98 °C {208 °F} and engine speed below 4,000 rpm: On
OIL_TEMP	Estimated engine oil temperature	°C, °F	• Displays estimated engine oil temperature
PN_SW*4	Parking/neutral	Open/Closed	• Selector lever at P position or N position: Closed • Except above: Open
RO2FT1	HO2S fuel trim	%	• Idle (after warm up): Approx. 0.5% • Deceleration fuel cut (accelerator pedal released from engine speed of 4,000 rpm or more): Approx. 3.99%
RPM	Engine speed	RPM	• Displays engine speed
SHRTFT1	Short term fuel trim	%	• Idle (after warm up): Approx. 1.56% • Racing (engine speed is 2,000 rpm): Approx. -3.12% • Racing (engine speed is 4,000 rpm): Approx. -8.59%
SHRTFT12	Short term fuel trim (HO2S)	%	• Idle (after warm up): Approx. 0%
SPARKADV	Ignition timing	° (deg)	• Displays ignition timing
Test	Test mode	Off/On	• Test mode off: Off • Test mode on: On
TP_REL	Relative throttle position	%	• Accelerator pedal released: Approx. 12% • Accelerator pedal depressed: Approx. 82%
TP1	TP sensor No.1	V	• Accelerator pedal released: Approx. 1.11 V • Accelerator pedal depressed: Approx. 4.59 V
		%	• Accelerator pedal released: Approx. 22% • Accelerator pedal depressed: Approx. 92%

Item	Definition	Unit/Condition	Condition/Specification (Reference)
TP2	TP sensor No.2	V	• Accelerator pedal released: Approx. 3.92 V • Accelerator pedal depressed: Approx. 0.41 V
		%	• Accelerator pedal released: Approx. 22% • Accelerator pedal depressed: Approx. 82%
TPCT	TP sensor No.1 voltage at CTP	V	• Switch ignition ON: Approx. 0.5 V
TPCT2	TP sensor No.2 voltage at CTP	V	• Switch ignition ON: Approx. 4.5 V
VPWR	Battery positive voltage	V	• Displays battery voltage
VSS	Vehicle speed	KPH, MPH	• Displays vehicle speed
VT EX_DES	Desired exhaust valve timing	° (deg)	• Displays desired exhaust valve timing
VT IN_ACT	Actual intake valve timing	° (deg)	• Displays actual intake valve timing
VT IN_DES	Desired intake valve timing	° (deg)	• Displays desired intake valve timing
VT_EX_ACT	Actual exhaust valve timing	° (deg)	• Displays actual exhaust valve timing
VT_EX_DUTY	OCV control	%	• Idle (after warm up): Approx. 0% • Racing (engine speed is 2,000 rpm): Approx. 46%

*1 : With i-stop system
*2 : MTX
*3 : With i-stop system (MTX)
*4 : ATX