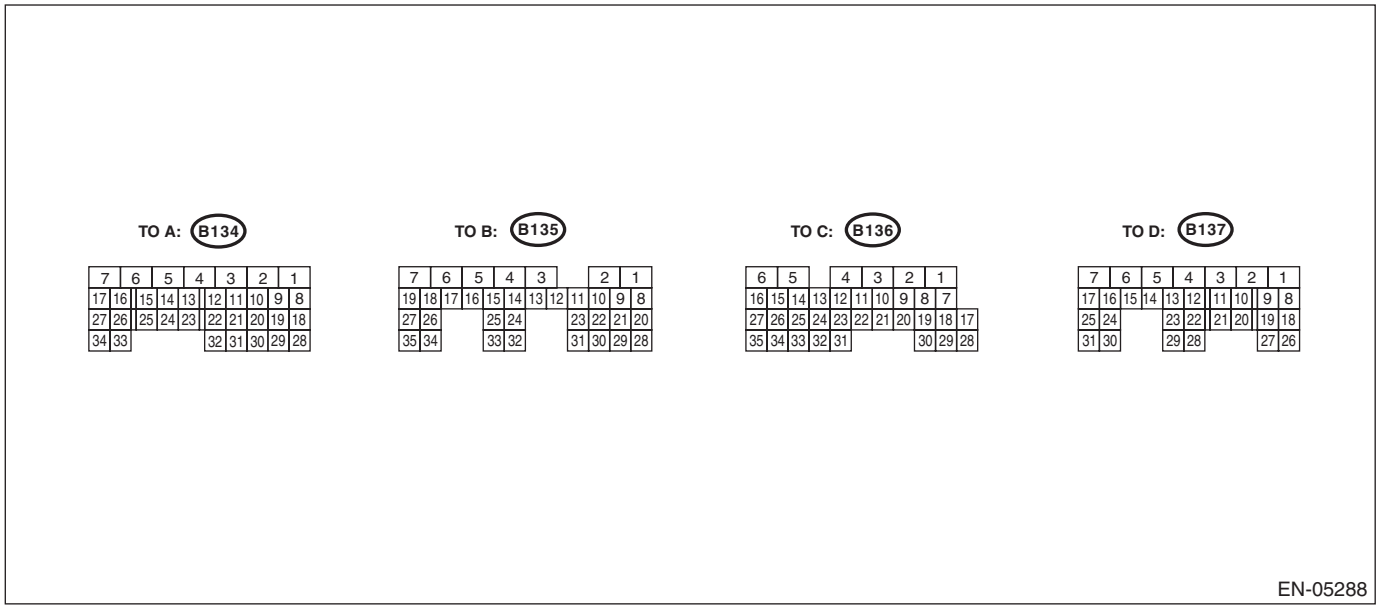
5. Engine Control Module (ECM) I/O Signal

A: ELECTRICAL SPECIFICATION

1. ENGINE CONTROL MODULE (ECM)



DESCRIPTION		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Crankshaft position sensor	Signal (+)	B136	16	5	0 or 5	Waveform
	Signal (–)	B136	27	0	0	—
Front oxygen (A/F) sensor	Signal (+)	B136	19	2.8 — 3.2	2.8 — 3.2	—
	Signal (–)	B136	18	2.4 — 2.7	2.4 — 2.7	—
	Shield	B136	30	0	0	—
Rear oxygen sensor	Signal	B136	21	0	0 — 0.9	—
	Shield	B136	30	0	0	—
Front oxygen (A/F) sensor heater signal		B136	5	Battery voltage	0 or battery voltage	Waveform
Rear oxygen sensor heater signal		B134	6	Battery voltage	0 or battery voltage	Waveform
Engine coolant temperature sensor	Signal	B134	30	1.0 — 1.4	1.0 — 1.6	—
Air flow sensor	Signal	B137	22	—	0.3 — 4.5	—
	Shield	B137	28	0	0	—
	Ground	B137	29	0	0	—
Intake air temperature sensor signal		B137	12	0.3 — 4.6	0.3 — 4.6	—
Engine oil temperature sensor signal		B134	20	1.0 — 1.4	1.0 — 1.6	—
Starter switch		B137	17	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform
Accessory cut request		B135	32	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform

Engine Control Module (ECM) I/O Signal

DESCRIPTION		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Starter switch 2		B137	14	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform
Starter cut relay		B135	34	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform Waveform
Ignition switch		B137	27	Battery voltage	Battery voltage	—
Neutral position switch		B137	16	ON: 0 OFF: Battery voltage	ON: 0 OFF: Battery voltage	—
Delivery mode switch		B137	13	Battery voltage	Battery voltage	When fuse is installed: 0
Knock sensor	Signal	B136	28	2.5	2.5	—
	Shield	B136	29	0	0	—
Back-up power supply		B137	2	Battery voltage	Battery voltage	—
Control module power supply		B136	6	Battery voltage	Battery voltage	—
		B137	1	Battery voltage	Battery voltage	—
Sensor power supply		B134	19	5	5	—
		B135	22	5	5	—
Ignition control	#1	B134	21	0	0 or 5	Waveform
	#2	B134	10	0	0 or 5	Waveform
	#3	B134	31	0	0 or 5	Waveform
	#4	B134	8	0	0 or 5	Waveform
Fuel injector	#1	B134	12	Battery voltage	0 or battery voltage	Waveform
	#2	B134	22	Battery voltage	0 or battery voltage	Waveform
	#3	B134	32	Battery voltage	0 or battery voltage	Waveform
	#4	B134	13	Battery voltage	0 or battery voltage	Waveform
Fuel pump relay control		B135	19	Battery voltage	ON: 0.5 or less OFF: Battery voltage	—
A/C relay control		B135	35	ON: 0.5 or less OFF: Battery voltage	ON: 0.5 or less OFF: Battery voltage	—
A/C switch		B137	26	ON: Battery voltage OFF: 0	ON: Battery voltage OFF: 0	Manual A/C model
Blower fan switch		B137	20	ON: 0 OFF: Battery voltage	ON: 0 OFF: Battery voltage	Manual A/C model
A/C middle pressure switch		B137	8	ON: 0 OFF: Battery voltage	ON: 0 OFF: Battery voltage	—
Main fan relay control		B135	12	ON: 0.5 or less OFF: Battery voltage	ON: 0.5 or less OFF: Battery voltage	—
Sub fan relay control		B135	11	ON: 0.5 or less OFF: Battery voltage	ON: 0.5 or less OFF: Battery voltage	—
Engine speed output		B135	15	—	0 or battery voltage	Waveform
Purge control solenoid valve		B134	11	Battery voltage	Battery voltage	In operation: Waveform
EGR control valve	Signal 1	B136	11	Battery voltage	0 or battery voltage	—
	Signal 2	B136	13	Battery voltage	0 or battery voltage	—
	Signal 3	B136	31	Battery voltage	0 or battery voltage	—
	Signal 4	B136	32	Battery voltage	0 or battery voltage	—
Manifold absolute pressure sensor signal		B136	20	3.4 — 3.8	1.0 — 1.6	—

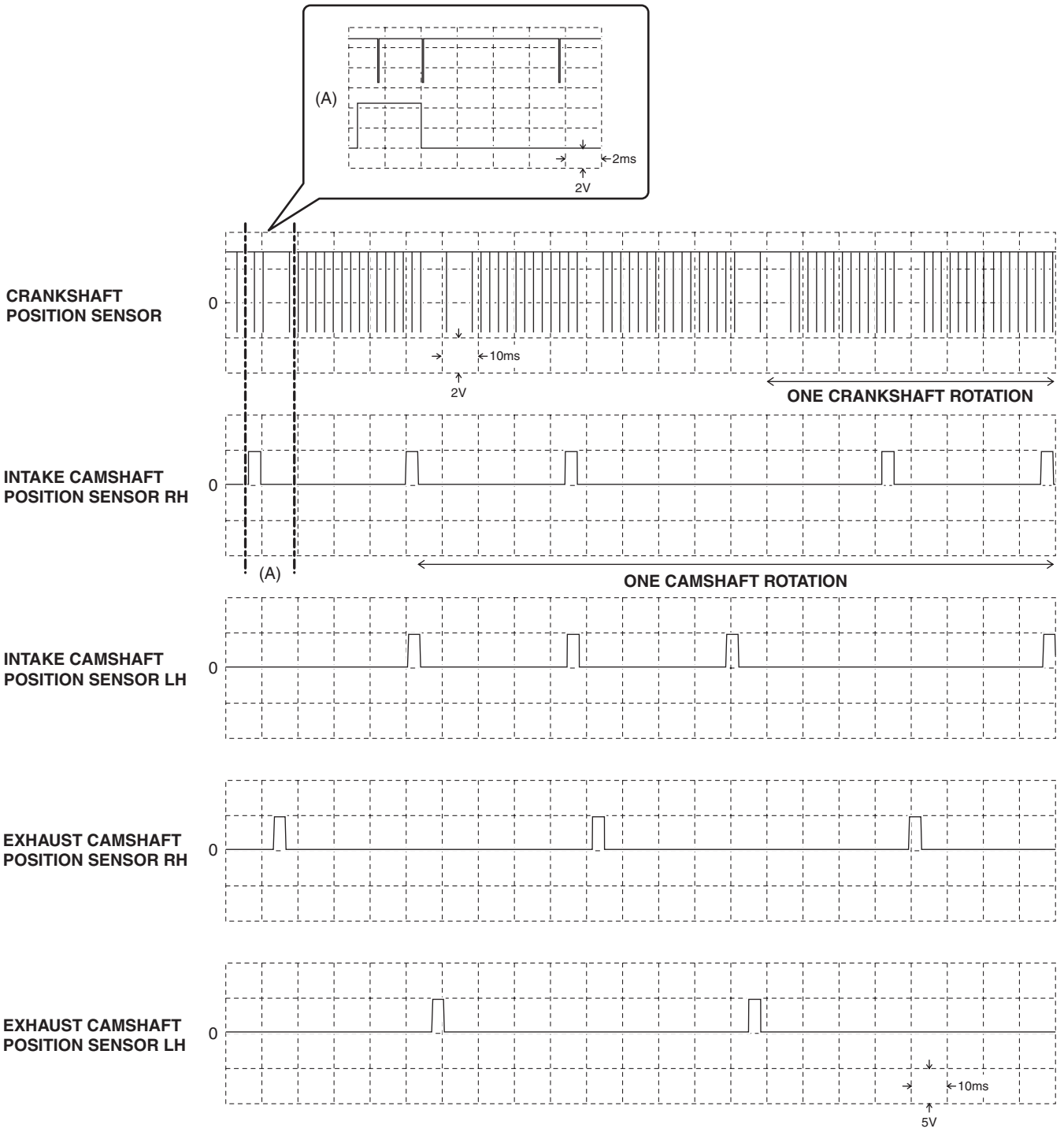
DESCRIPTION		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Electronic throttle control	Main	B134	18	Approx. 0.7	Approx. 0.6 — 0.7	Fully closed: Approx. 0.6 Fully open: Approx. 4.0
	Sub	B134	28	Approx. 1.6	Approx. 1.5 — 1.6	Fully closed: Approx. 1.5 Fully open: Approx. 4.2
Electronic throttle control motor (+)		B134	2	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor (–)		B134	1	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor power supply		B135	7	Battery voltage	Battery voltage	—
Electronic throttle control motor relay		B135	17	0	0	—
Intake oil control solenoid (LH)		B134	16	Battery voltage	0 or battery voltage	Waveform
Intake oil control solenoid (RH)		B134	17	Battery voltage	0 or battery voltage	Waveform
Exhaust oil control solenoid (LH)		B134	5	Battery voltage	0 or battery voltage	Waveform
Exhaust oil control solenoid (RH)		B134	7	Battery voltage	0 or battery voltage	Waveform
Intake camshaft position sensor (LH)		B136	15	0 or 5	0 or 5	Waveform
Intake camshaft position sensor (RH)		B136	26	0 or 5	0 or 5	Waveform
Exhaust camshaft position sensor (LH)		B136	25	0 or 5	0 or 5	Waveform
Exhaust camshaft position sensor (RH)		B136	14	0 or 5	0 or 5	Waveform
Camshaft position sensor ground		B136	34	0	0	—
Accelerator pedal position sensor	Main sensor signal	B135	23	Fully closed: 0.4 — 1.0 Fully opened: 2.4 — 3.7	Fully closed: 0.4 — 1.0 Fully opened: 2.4 — 3.7	—
	Main power supply	B135	21	5	5	—
	Ground (main sensor)	B135	29	0	0	—
	Sub signal sensor	B135	31	Fully closed: 0.3 — 1.1 Fully opened: 2.3 — 3.8	Fully closed: 0.3 — 1.1 Fully opened: 2.3 — 3.8	—
Starter relay		B135	26	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform
Clutch switch		B137	15	ON: 0 OFF: Battery voltage	ON: 0 OFF: Battery voltage	—
Brake switch 1 (brake switch)		B137	7	When brake pedal is depressed: 0 When brake pedal is released: Battery voltage	When brake pedal is depressed: 0 When brake pedal is released: Battery voltage	—
Brake switch 2 (stop light switch)		B137	3	When brake pedal is depressed: Battery voltage When brake pedal is released: 0	When brake pedal is depressed: Battery voltage When brake pedal is released: 0	—

DESCRIPTION		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Cruise control command switch		B137	30	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating CANCEL: 0 — 0.5	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating CANCEL: 0 — 0.5	—
Cruise control main switch		B137	23	ON: 0 OFF: 5	ON: 0 OFF: 5	—
CAN communication (MAIN-CAN)	(Hi)	B137	19	—	—	—
	(Lo)	B137	18	—	—	—
Self-shutoff control		B135	13	0	0	—
Generator control		B135	18	0 or 6.5	0 or 6.5	Waveform
Battery current sensor		B137	11	2.6 — 2.8	2.4 — 2.6	—
Battery temperature sensor		B137	24	1.1 — 2.4	1.1 — 2.4	When battery temperature is 20 — 50°C (68 — 122°F)
Oil level switch		B136	24	0	0	Oil level LOW: Battery voltage
Tumble generator valve opening angle switch signal (LH)		B136	9	0	Fully closed: 0.5 or less Fully opened: 4.5 or more	While operating: Waveform
Tumble generator valve actuator (LH open)		B134	23	0	0	While operating: Waveform
Tumble generator valve actuator (LH closed)		B134	24	0	0	While operating: Waveform
Tumble generator valve opening angle switch signal (RH)		B136	23	0	Fully closed: 0.5 or less Fully opened: 4.5 or more	While operating: Waveform
Tumble generator valve actuator (RH open)		B134	25	0	0	While operating: Waveform
Tumble generator valve actuator (RH closed)		B134	14	0	0	While operating: Waveform
Immobilizer communication		B135	25	—	—	—
ELCM	Switching valve	B135	1	Battery voltage	Battery voltage	Operating: 0
	Pressure sensor	B135	20	1 — 4	1 — 4	—
	Vacuum pump	B135	8	Battery voltage	Battery voltage	Operating: 0
Ground	Sensor	B134	29	0	0	—
		B135	30	0	0	—
	Engine 1	B134	4	0	0	—
	Engine 2	B134	3	0	0	—
	Engine 3	B136	1	0	0	—
	Engine 4	B136	2	0	0	—
	Engine 5	B136	3	0	0	—
	Body	B137	4	0	0	—

NOTE:
- Measurement should be performed after warming up the engine.
- Place the select lever in “P” range or “N” range position.
- Turn the A/C to OFF.
- Turn all the accessory switches to OFF.
- Waveforms vary depending on a measurement environment and vehicle condition.

Input/output name:

- Crankshaft position sensor
- Intake camshaft position sensor RH
- Intake camshaft position sensor LH
- Exhaust camshaft position sensor RH
- Exhaust camshaft position sensor LH
- At idling



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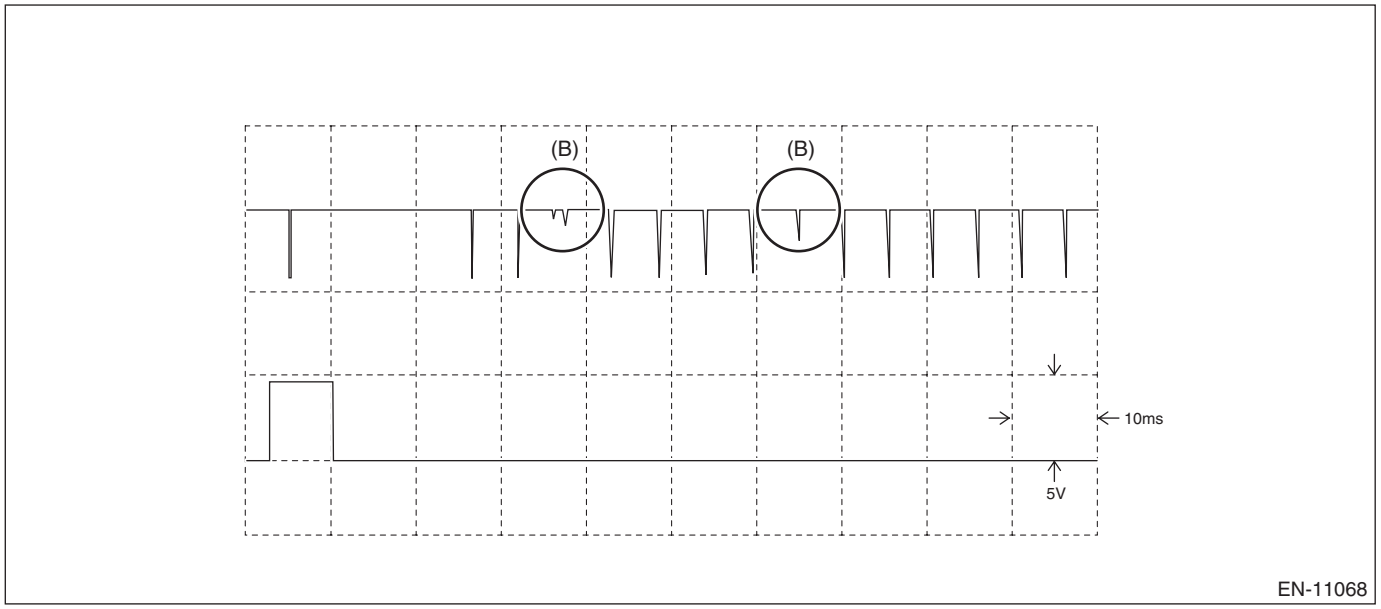
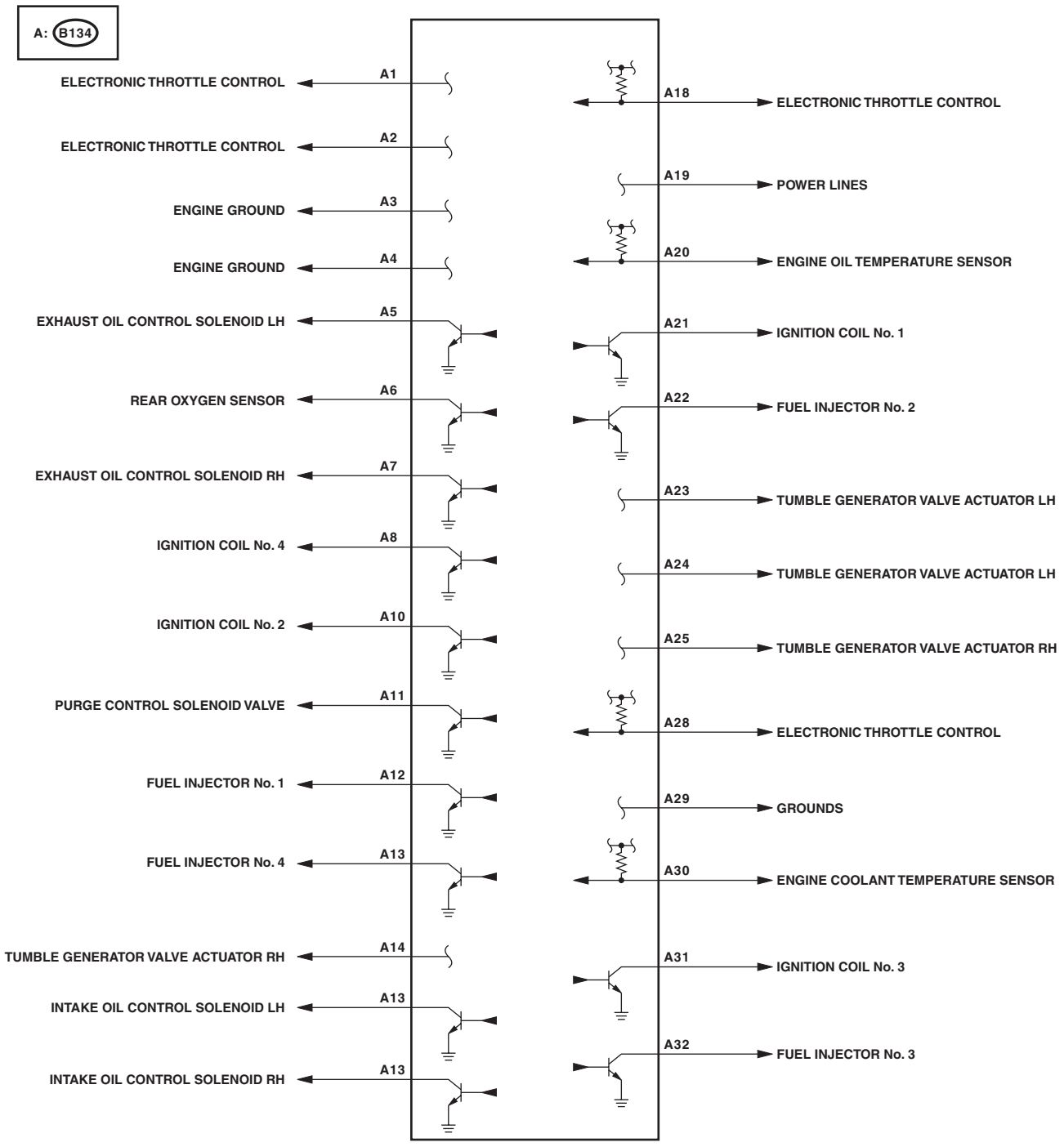
(A) Magnified waveform of crankshaft position sensor and camshaft position sensor

NOTE:
- For measuring the waveforms of the crankshaft position sensor, use of oscilloscope function of DST-i or an ordinary oscilloscope is recommended.
- If the oscilloscope function of the Subaru Select Monitor is used, the waveform of the crankshaft position sensor may be shown as in diagram (B).

This is not a malfunction of the Subaru Select Monitor or crankshaft position sensor, because the unit of output from the crankshaft position sensor is smaller than the minimal measurement unit of the Subaru Select Monitor.




A: B134
ELECTRONIC THROTTLE CONTROL
A1
ELECTRONIC THROTTLE CONTROL
A2
ENGINE GROUND
A3
ENGINE GROUND
A4
EXHAUST OIL CONTROL SOLENOID LH
A5
REAR OXYGEN SENSOR
A6
EXHAUST OIL CONTROL SOLENOID RH
A7
IGNITION COIL No. 4
A8
IGNITION COIL No. 2
A10
PURGE CONTROL SOLENOID VALVE
A11
FUEL INJECTOR No. 1
A12
FUEL INJECTOR No. 4
A13
TUMBLE GENERATOR VALVE ACTUATOR RH
A14
INTAKE OIL CONTROL SOLENOID LH
A13
INTAKE OIL CONTROL SOLENOID RH
A13
A18
ELECTRONIC THROTTLE CONTROL
A19
POWER LINES
A20
ENGINE OIL TEMPERATURE SENSOR
A21
IGNITION COIL No. 1
A22
FUEL INJECTOR No. 2
A23
TUMBLE GENERATOR VALVE ACTUATOR LH
A24
TUMBLE GENERATOR VALVE ACTUATOR LH
A25
TUMBLE GENERATOR VALVE ACTUATOR RH
A28
ELECTRONIC THROTTLE CONTROL
A29
GROUNDS
A30
ENGINE COOLANT TEMPERATURE SENSOR
A31
IGNITION COIL No. 3
A32
FUEL INJECTOR No. 3

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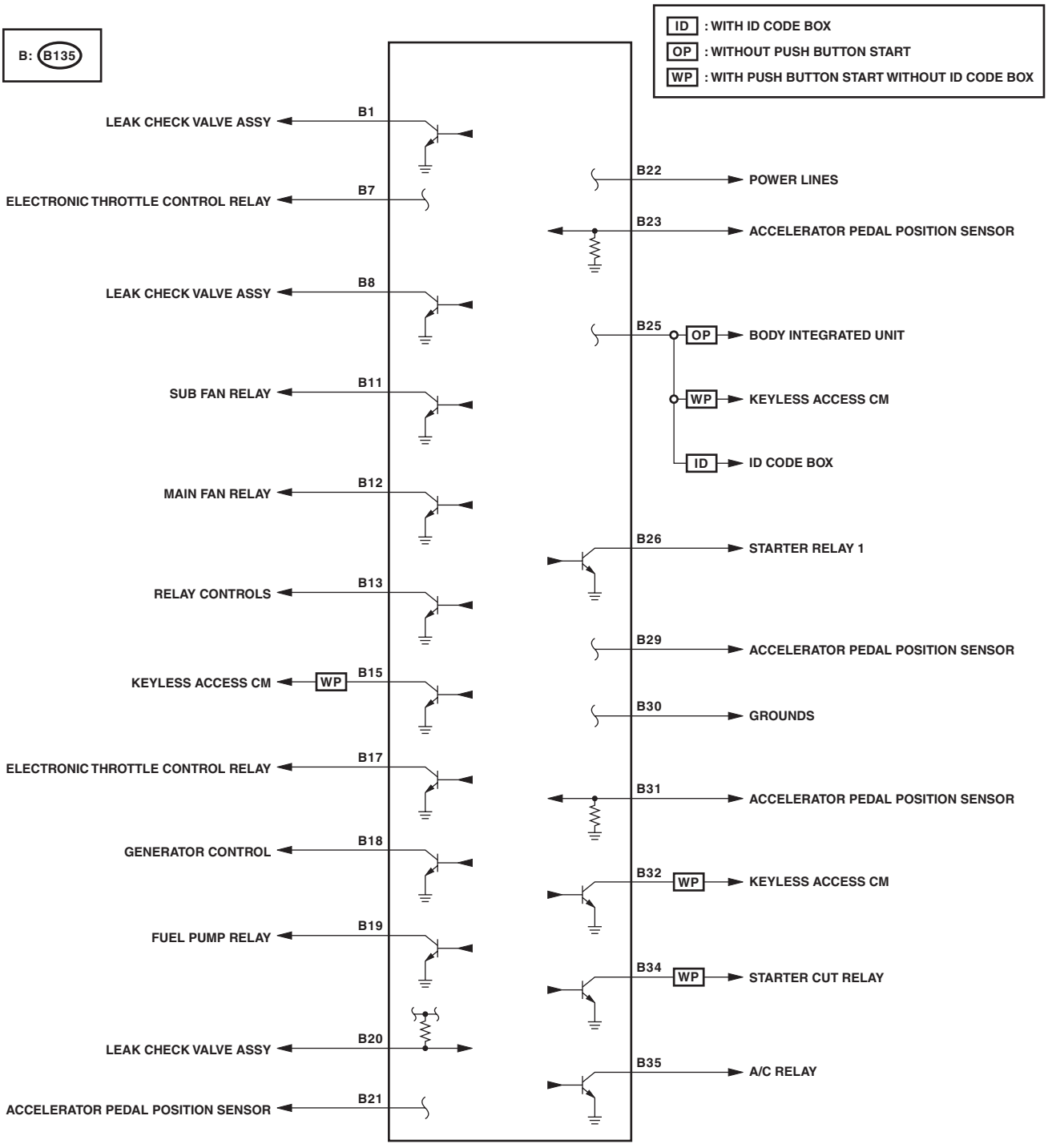
ID : WITH ID CODE BOX
OP : WITHOUT PUSH BUTTON START
WP : WITH PUSH BUTTON START WITHOUT ID CODE BOX
B: B135
B1
LEAK CHECK VALVE ASSY
B7
ELECTRONIC THROTTLE CONTROL RELAY
B8
LEAK CHECK VALVE ASSY
B11
SUB FAN RELAY
B12
MAIN FAN RELAY
B13
RELAY CONTROLS
B15
KEYLESS ACCESS CM
WP
B17
ELECTRONIC THROTTLE CONTROL RELAY
B18
GENERATOR CONTROL
B19
FUEL PUMP RELAY
B20
LEAK CHECK VALVE ASSY
B21
ACCELERATOR PEDAL POSITION SENSOR
B22
POWER LINES
B23
ACCELERATOR PEDAL POSITION SENSOR
B25
OP
BODY INTEGRATED UNIT
WP
KEYLESS ACCESS CM
ID
ID CODE BOX
B26
STARTER RELAY 1
B29
ACCELERATOR PEDAL POSITION SENSOR
B30
GROUNDS
B31
ACCELERATOR PEDAL POSITION SENSOR
B32
WP
KEYLESS ACCESS CM
B34
WP
STARTER CUT RELAY
B35
A/C RELAY

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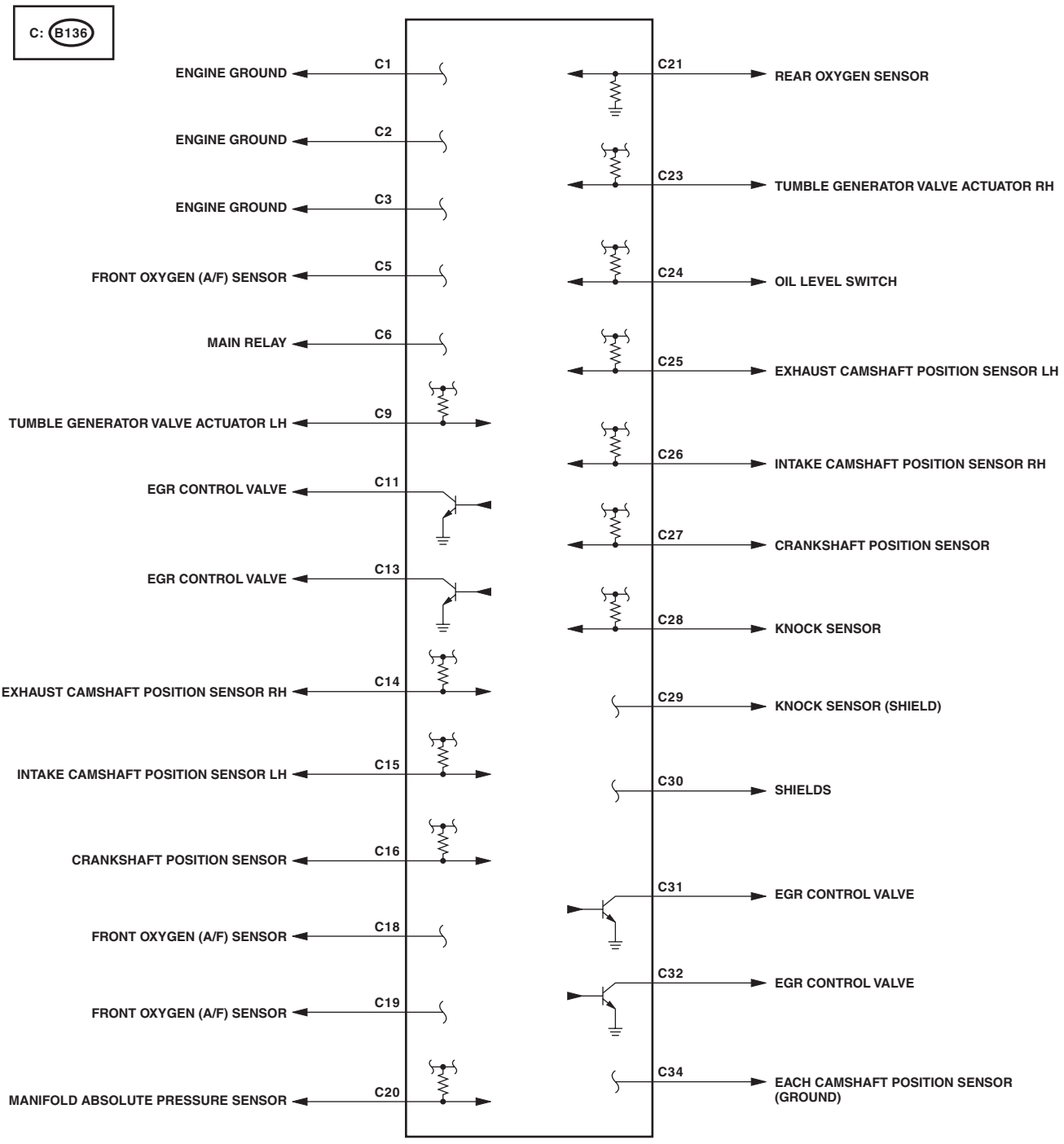
C: B136
ENGINE GROUND
C1
ENGINE GROUND
C2
ENGINE GROUND
C3
FRONT OXYGEN (A/F) SENSOR
C5
MAIN RELAY
C6
TUMBLE GENERATOR VALVE ACTUATOR LH
C9
EGR CONTROL VALVE
C11
EGR CONTROL VALVE
C13
EXHAUST CAMSHAFT POSITION SENSOR RH
C14
INTAKE CAMSHAFT POSITION SENSOR LH
C15
CRANKSHAFT POSITION SENSOR
C16
FRONT OXYGEN (A/F) SENSOR
C18
FRONT OXYGEN (A/F) SENSOR
C19
MANIFOLD ABSOLUTE PRESSURE SENSOR
C20
C21
REAR OXYGEN SENSOR
C23
TUMBLE GENERATOR VALVE ACTUATOR RH
C24
OIL LEVEL SWITCH
C25
EXHAUST CAMSHAFT POSITION SENSOR LH
C26
INTAKE CAMSHAFT POSITION SENSOR RH
C27
CRANKSHAFT POSITION SENSOR
C28
KNOCK SENSOR
C29
KNOCK SENSOR (SHIELD)
C30
SHIELDS
C31
EGR CONTROL VALVE
C32
EGR CONTROL VALVE
C34
EACH CAMSHAFT POSITION SENSOR (GROUND)

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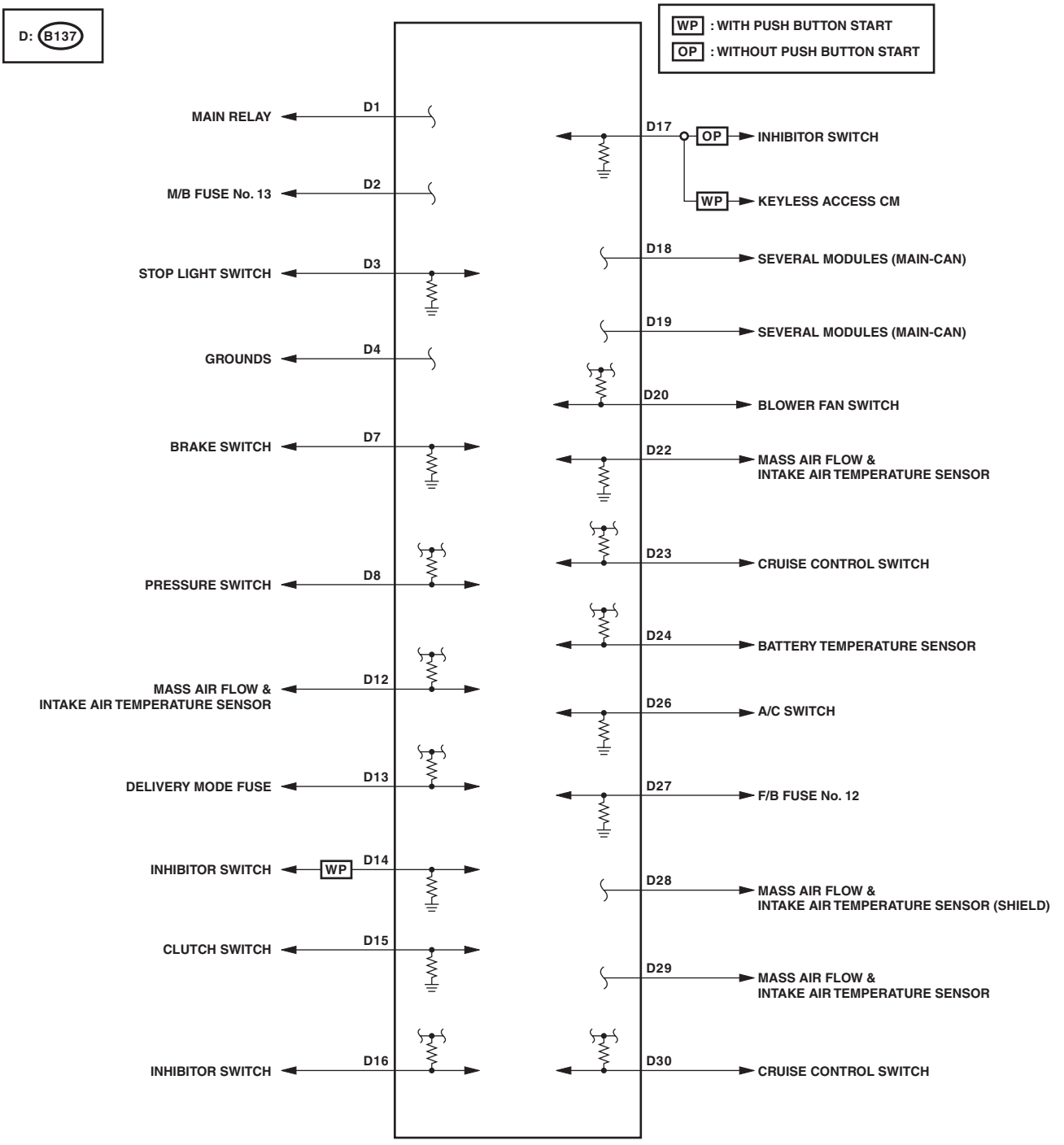
D: B137
WP : WITH PUSH BUTTON START
OP : WITHOUT PUSH BUTTON START
MAIN RELAY
D1
M/B FUSE No. 13
D2
STOP LIGHT SWITCH
D3
GROUNDS
D4
BRAKE SWITCH
D7
PRESSURE SWITCH
D8
MASS AIR FLOW &
INTAKE AIR TEMPERATURE SENSOR
D12
DELIVERY MODE FUSE
D13
INHIBITOR SWITCH
WP
D14
CLUTCH SWITCH
D15
INHIBITOR SWITCH
D16
D17
OP
INHIBITOR SWITCH
WP
KEYLESS ACCESS CM
D18
SEVERAL MODULES (MAIN-CAN)
D19
SEVERAL MODULES (MAIN-CAN)
D20
BLOWER FAN SWITCH
D22
MASS AIR FLOW &
INTAKE AIR TEMPERATURE SENSOR
D23
CRUISE CONTROL SWITCH
D24
BATTERY TEMPERATURE SENSOR
D26
A/C SWITCH
D27
F/B FUSE No. 12
D28
MASS AIR FLOW &
INTAKE AIR TEMPERATURE SENSOR (SHIELD)
D29
MASS AIR FLOW &
INTAKE AIR TEMPERATURE SENSOR
D30
CRUISE CONTROL SWITCH

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