

## ON-BOARD DIAGNOSTIC [INSTRUMENT CLUSTER]

id092200021843

### Outline

- The on-board diagnostic function consists of the following functions: a malfunction detection function, which detects overall malfunctions in the instrument cluster-related parts; a memory function, which stores detected DTCs; a display function, which indicates malfunction locations and status via DTC output; and a PID/data monitoring function, which reads out specific input/output signals and verifies the input/output condition.
- Using the Mazda Modular Diagnostic System (M-MDS), DTCs can be read out and deleted, and the PID/data monitoring function can be activated.

### Malfunction detection function

- Detects malfunctions in input/output signals.
- If a malfunction occurs, the instrument cluster records the malfunction as a DTC. A recorded DTC can be read by the Mazda Modular Diagnostic System (M-MDS).

×: Applicable  
—: Not applicable

DTC No.	Warning/ indicator light	Description	Fail-safe function	Drive cycle	Self test type*1	Memory function
B11D4:53*2	—	Laser sensor malfunction	×	—	C, D	×
U0001:88	—	Unit communication error (HS-CAN)	—	—	C, D	×
U0010:88	—	Unit communication error (MS-CAN)	—	—	C, D	×
U0100:00	—	Communication error with PCM	—	—	C, D	×
U0101:00*3	—	Communication error with TCM	—	—	C, D	×
U0114:00*4	—	4WD control module communication error	—	—	C, D	×
U0121:00	—	Communication error with DSC HU/CM	—	—	C, D	×
U0131:00	—	Communication error with EPS control module	—	—	C, D	×
U0140:00	—	Communication error with front body control module (FBCM)	—	—	C, D	×
U0142:00	—	Communication error with rear body control module (RBCM)	—	—	C, D	×
U0151:00	—	Communication error with SAS control module	—	—	C, D	×
U0182:00*5	—	Communication error with AFS control module	—	—	C, D	×
U0214:00	—	Communication error with start stop unit	—	—	C, D	×
U0232:00*6	—	Communication error with rear vehicle monitoring control module (RH)	—	—	C, D	×
U0233:00*7	—	Communication error with BSM control module (RH)	—	—	C, D	×
U0235:00*2	—	Communication error with laser sensor	—	—	C, D	×
U023A:00*8	—	Communication error with forward sensing camera (FSC)	—	—	C, D	×
U0300:00	—	Instrument cluster configuration error	—	—	C, D	×
U0401:68	—	Error signal received from PCM	—	—	C, D	×
U0402:68*3	—	Error signal received from transmission/transaxle	—	—	C, D	×
U0422:68	—	Error signal received from front body control module (FBCM)	—	—	C, D	×
U0433:00*2	—	Error signal received from laser sensor	×	—	C, D	×
U0433:68*2	—	Error signal received from laser sensor	×	—	C, D	×
U0515:68	—	Error signal received from start stop unit	—	—	C, D	×
U053B:00*8	—	Error signal received from forward sensing camera (FSC)	—	—	C, D	×
U2005:86	—	Error signal received from PCM	—	—	C, D	×
U2013:13	—	Cluster switch circuit malfunction	—	—	C, D	×
U2100:00	—	Instrument cluster configuration error	—	—	C, D	×
U2300:41	—	Instrument cluster configuration error	—	—	C, D	×
U2300:51	—	Instrument cluster configuration error	—	—	C, D	×
U2300:56	—	Instrument cluster configuration error	—	—	C, D	×

DTC No.	Warning/ indicator light	Description	Fail-safe function	Drive cycle	Self test type*1	Memory function
U2300:57	—	Instrument cluster configuration error	—	—	C, D	×
U3000:41	—	Malfunction inside instrument cluster	—	—	C, D	×
U3003:16	—	Low power supply voltage input to instrument cluster	—	—	C, D	×

\*1 : C: CMDTC self test, D: ODDTC self test

\*2 : With smart city brake support

\*3 : ATX

\*4 : 4WD

\*5 : With AFS

\*6 : With rear vehicle monitoring system

\*7 : With BSM

\*8 : With forward sensing camera (FSC)

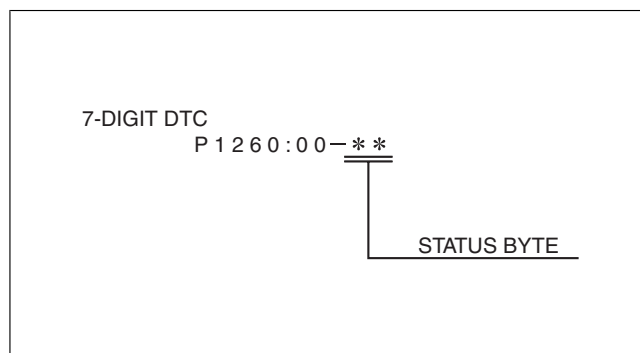
### DTC 7-digit code definition

- When related systems or components have failed, the CM stores the DTC of the malfunctioning part in the CM memory, and allows for the retrieval of the store data using scanning tool when necessary. The DTCs are indicated using seven digits. Each digit indicates the following.

B	1	0	D	5	1	3
. Specify the area failure sub type 00: No sub type information 05: System programming malfunctions 13: Open circuit 14: Circuit short to ground or open 16: Circuit voltage below threshold 41: General checksum malfunction . Manufacturer controlled						
. Indicates subgroup <b>Powertrain (P code)</b> 0: Fuel and air metering and auxiliary emission controls <b>Network Electrical (U code)</b> 0: Network Electrical 1: Network communication 2: Network communication 3: Network software 4: Network data 5: Network data						
. Indicates who was responsible for DTC definition 0: ISO/SAE controlled 1: Manufacturer controlled 2: There are ISO/SAE controlled just for powertrain, all others are manufacturer controlled. 3: For P3000 to P3399 is manufacturer controlled, all others are ISO/SAE controlled.						
. Indicates DTC function P: Powertrain B: Body C: Chassis U: Network Electrical						
86: Signal invalid 87: Missing message 88: Bus off 92: Performance or incorrect operation 94: Unexpected operation						
<b>Body (B code)</b> Manufacturer controlled						
<b>Chassis (C code)</b> Manufacturer controlled						

## Status byte for DTC

- The status byte is the two digits (two digits after hyphen (-)) after the 7-digit DTC.
- The status byte is a code which indicates the pending code, current/past malfunction status, or warning illumination status.
- The status byte can be read by performing a CMDTC self-test using the Mazda Modular Diagnostic System (M-MDS).
- For details on the status byte, refer to the explanation on the Mazda Modular Diagnostic System (M-MDS) when reading the DTC.



ac5wzn00002008

## Detection condition for the applicable DTC

DTC No.	System malfunction location	Detection condition
B11D4:53 <sup>*1</sup>	Laser sensor malfunction	<ul style="list-style-type: none"> <li>• Instrument cluster detects the following malfunctions <ul style="list-style-type: none"> <li>— Laser sensor malfunction</li> <li>— Malfunction in smart city brake support related system (laser sensor, DSC HU/CM, PCM)</li> </ul> </li> </ul>
U0001:88	Module communication error (HS-CAN)	The instrument cluster detects a CAN bus communication line (HS-CAN) malfunction.
U0010:88	Unit communication error (MS-CAN)	The instrument cluster detects a CAN bus communication line (MS-CAN) malfunction.
U0100:00	Communication error with PCM	The instrument cluster cannot receive CAN signal from the PCM.
U0101:00 <sup>*2</sup>	Communication error with TCM	The instrument cluster cannot receive CAN signal from the TCM for 1 s or more.
U0114:00 <sup>*3</sup>	4WD control module communication error	The instrument cluster cannot receive CAN signal from the 4WD control module for 1 s or more.
U0121:00	Communication error with DSC HU/CM	The instrument cluster cannot receive CAN signal from the DSC HU/CM for 1 s or more.
U0131:00	Communication error with EPS control module	The instrument cluster could not receive CAN signal from the EPS control module for 1 s or more.
U0140:00	Communication error with front body control module (FBCM)	The instrument cluster cannot receive CAN signal from the front body control module (FBCM) for 5 s or more.
U0142:00	Communication error with rear body control module (RBCM)	The instrument cluster cannot receive CAN signal from the rear body control module (RBCM) for 5 s or more.
U0151:00	Communication error with SAS control module	The instrument cluster cannot receive CAN signal from the SAS control module for 2 s or more.
U0182:00 <sup>*4</sup>	Communication error with AFS control module	The instrument cluster cannot receive CAN signal from the AFS control module for 5 s or more.
U0214:00	Communication error with start stop unit	The instrument cluster could not receive CAN signal from the start stop unit.
U0232:00 <sup>*5</sup>	Communication error with rear vehicle monitoring control module (RH)	The instrument cluster cannot receive CAN signal from the rear vehicle monitoring control module (RH) for 5 s or more.
U0233:00 <sup>*6</sup>	Communication error with BSM control module (RH)	The instrument cluster cannot receive CAN signal from the BSM control module (RH) for 1.5 s or more.
U0235:00 <sup>*1</sup>	Communication error with laser sensor	The instrument cluster cannot receive CAN signal from the laser sensor for 1 s or more.
U023A:00 <sup>*7</sup>	Communication error with forward sensing camera (FSC)	The instrument cluster cannot receive CAN signal from the forward sensing camera (FSC) for 1 s or more.
U0300:00	Instrument cluster configuration error	Instrument cluster configuration error (incorrect value write) detected.
U0401:68	Error signal received from PCM	The instrument cluster receives error signals from the PCM with the ignition switched ON (engine off or on).
U0402:68 <sup>*2</sup>	Error signal received from transmission/transaxle	The instrument cluster received error signals from the transmission/transaxle for 1 s or more with the ignition switched ON (engine off or on).
U0422:68	Error signal received from front body control module (FBCM)	The instrument cluster receives error signals from the front body control module (FBCM) for 5 s or more with the ignition switched ON (engine off or on).

DTC No.	System malfunction location	Detection condition
U0433:00*1	Error signal received from laser sensor	<ul style="list-style-type: none"> <li>Instrument cluster detects the following conditions: <ul style="list-style-type: none"> <li>The smart city brake support operated normally in the past.</li> <li>Malfunction of laser sensor or smart city brake support related system (laser sensor, DSC HU/CM, PCM)</li> <li>Laser sensor control is temporarily inhibited.</li> </ul> </li> </ul>
U0433:68*1	Error signal received from laser sensor	Instrument cluster detects a malfunction in the laser sensor.
U0515:68	Error signal received from start stop unit	The instrument cluster receives error signals from the start stop unit with the ignition switched ON (engine off or on).
U053B:00*7	Error signal received from forward sensing camera (FSC)	The instrument cluster receives error signals from the forward sensing camera (FSC) for 1 s or more with the ignition switched ON (engine off or on).
U2005:86	Error signal received from PCM	The instrument cluster receives vehicle speed signal error from the PCM for 1 s or more with the ignition switched ON (engine off or on).
U2013:13	Cluster switch circuit malfunction	The instrument cluster detects an open circuit in the cluster switch circuit for 5 s or more with the ignition switched ON (engine off or on).
U2100:00	Instrument cluster configuration error	<ul style="list-style-type: none"> <li>Instrument cluster configuration error detected as follows: <ul style="list-style-type: none"> <li>No configuration of instrument cluster</li> <li>Instrument cluster configuration has not been correctly performed.</li> </ul> </li> </ul>
U2300:41	Instrument cluster configuration error	Instrument cluster configuration error (data error) detected.
U2300:51	Instrument cluster configuration error	Instrument cluster configuration error (no configuration) detected.
U2300:56	Instrument cluster configuration error	Instrument cluster configuration error (incorrect value write) detected.
U2300:57	Instrument cluster configuration error	Instrument cluster configuration error (data size error) detected.
U3000:41	Malfunction inside instrument cluster	Malfunction inside instrument cluster detected.
U3003:16	Low power supply voltage input to instrument cluster	Instrument cluster power supply circuit voltage of 10 V or less is detected with the ignition switched ON (engine off or on).

\*1 : With smart city brake support

\*2 : ATX

\*3 : 4WD

\*4 : With AFS

\*5 : With rear vehicle monitoring system

\*6 : With BSM

\*7 : With forward sensing camera (FSC)

### Snapshot Data

- The data for all DTCs currently detected is stored.

### Snapshot data table

—: Not applicable

Snapshot data item	Unit		Data contents	Data read/use method	Corresponding data monitor items
AAT	°C	°F	Ambient temperature	—	—
APP_STATUS	Accelerator Pedal Off/Under20%/ Over20%/FAIL		Accelerator pedal position status	—	—
CFG_STATUS	Config Complete/ Not Configured/ Config Error		Instrument cluster configuration status	—	—
ECT_STATUS	Under 0 degrees C/0-Under 80 degrees C/Over 80 degrees C/ FAIL		Engine coolant temperature status	—	—

Snapshot data item	Unit		Data contents	Data read/use method	Corresponding data monitor items
IC_VPWR	V		Instrument cluster power supply voltage	When DTC is detected, instrument cluster displays power supply voltage value of instrument cluster in Mazda Modular Diagnostic System (M-MDS).	VPWR
IG-ON_TIMER	hh:mm:ss*1		Elapsed time since ignition was switched ON  <b>Note</b> • The instrument cluster records the elapsed time since the ignition was switched ON.	When DTC is detected, instrument cluster displays elapsed time since ignition was switched on in Mazda Modular Diagnostic System (M-MDS).	—
PWR_MODE_KEY	Key Out/Key Recently Out/Key Approved (Position 0)/Post Accessory (Position 0)/Accessory (Position 1)/Post Ignition (Position 1)/Ignition On (Position 2)/Running - Starting In Progress (Position 2)/Crank (Position 3)		<ul style="list-style-type: none"> <li>• Key Out: Ignition switched to off</li> <li>• Key Recently Out (Position 0): Elapsed time <b>within 3 s</b> since ignition was switched to off</li> <li>• Accessory (Position 1): Ignition is switched to ACC</li> <li>• Post Ignition (Position 2): Elapsed time <b>within 3 s</b> since ignition was switched ON</li> <li>• Ignition On (Position 2): Ignition switched ON (engine off)</li> <li>• Running (Position 2): Ignition switched ON (engine on)</li> <li>• Running - Starting: Cranking condition</li> </ul>	When DTC is detected, instrument cluster displays ignition switch status in Mazda Modular Diagnostic System (M-MDS).	—
RPM_STATUS	Engine Stop/ Under1500rpm/ Over1500rpm/ FAIL		Engine speed status	When DTC is detected, instrument cluster displays engine speed in Mazda Modular Diagnostic System (M-MDS).	TACHOMTR
SHIFT_STATUSES	P/N/ D/ R/ FAIL		Selector lever position status	When DTC is detected, instrument cluster displays selector lever position in Mazda Modular Diagnostic System (M-MDS).	—
TOTAL_DIST	Km	miles	Accumulated total traveled distance from completion of vehicle until instrument cluster detects DTC (Odometer value in instrument cluster)	The distance traveled when the instrument cluster detected a DTC can be calculated by performing the following procedure. 1. Verify the odometer value in the instrument cluster. 2. Verify the snap shot data item TOTAL_DIST. 3. Subtract 2 from 1.	—
TOTAL_TIME	hh:mm:ss*1		Accumulated total elapsed time since vehicle completion until instrument cluster detects a DTC  <b>Note</b> • When the ROOM removed, and the ignition is switched to off, the time is not included in the elapsed time.	The elapsed time when the instrument cluster detected a DTC can be calculated by performing the following procedure. 1. Verify the PID item TOTAL_TIME of the instrument cluster. 2. Verify the snap shot data item TOTAL_TIME. 3. Subtract 2 from 1.	TOTAL_TIME
VPWR	V		Instrument cluster power supply voltage	—	VPWR
VSPD_STATUSES	Stop/ 0-10km/h/ Over10km/h/ FAIL		Vehicle speed status	When DTC is detected, instrument cluster displays vehicle speed in Mazda Modular Diagnostic System (M-MDS).	SPEEDOMTR

Snapshot data item	Unit	Data contents	Data read/use method	Corresponding data monitor items
VSS	KPH, MPH	Vehicle speed	—	—

\*1 : The seconds may be indicated after the decimal point.

### Data Monitor Function

- The PID/data monitor function performs reading in real time of optionally selected input/output signal monitor items that are set in the instrument cluster.

### PID/data monitor table

PID	Unit/Operation	Data contents	Inspection item(s)
AFS_OFF_SW*1	Off/On	<ul style="list-style-type: none"> <li>Off: AFS OFF switch is off.</li> <li>On: AFS off switch is on.</li> </ul>	AFS OFF switch
AFS_ST*1	Off/On	<ul style="list-style-type: none"> <li>Off: AFS not operated</li> <li>On: AFS operated</li> </ul>	<ul style="list-style-type: none"> <li>AFS OFF switch</li> <li>AFS control module</li> </ul>
AT_MAN_M_SW*2	Off/On/Reserved/Unknown	<ul style="list-style-type: none"> <li>Off: M range switch is off.</li> <li>On: M range switch is on.</li> <li>Unknown: M range switch signal is not determined.</li> </ul>	M position switch
AT_S_DWN_SW*2	Off/On/Reserved/Unknown	<ul style="list-style-type: none"> <li>Off: Down switch switch is off.</li> <li>On: Down switch is on.</li> <li>Unknown: Down switch is not determined.</li> </ul>	Down switch
AT_S_UP_SW*2	Off/On/Reserved/Unknown	<ul style="list-style-type: none"> <li>Off: Up switch is off.</li> <li>On: Up switch is on.</li> <li>Unknown: Up switch is not determined.</li> </ul>	Up switch
BSM/RVM_SW*3	Off/On	<ul style="list-style-type: none"> <li>Off: BSM OFF switch is off.</li> <li>On: BSM OFF switch is on.</li> </ul>	BSM OFF switch
BSM/RVM_SW*4	Off/On	<ul style="list-style-type: none"> <li>Off: RVM OFF switch is off.</li> <li>On: RVM switch is on.</li> </ul>	RVM switch
DSC_OFF_SW	Off/On	<ul style="list-style-type: none"> <li>Off: TCS OFF switch is off.</li> <li>On: TCS off switch is on.</li> </ul>	TCS OFF switch
FUEL_GAUGE	L	Fuel gauge is displayed.	Fuel gauge (instrument cluster)
FUEL_SEN_M	ohm	Fuel gauge sender unit resistance is displayed.	<ul style="list-style-type: none"> <li>Fuel gauge sender unit</li> <li>Rear body control module (RBCM)</li> </ul>
FUEL_SEN_S*5	ohm	Displays the fuel gauge sender unit (sub) resistance value.	<ul style="list-style-type: none"> <li>Fuel gauge sender unit (sub)</li> <li>Rear body control module (RBCM)</li> </ul>
I_ILLUMI_M	Off (Day)/On (Night)	<ul style="list-style-type: none"> <li>Off (Day): TNS switch is off.</li> <li>On (Night): TNS switch is on.</li> </ul>	<ul style="list-style-type: none"> <li>Instrument cluster</li> <li>Front body control module (FBCM)</li> </ul>
I-ST_OFF_SW*6	Off/On	<ul style="list-style-type: none"> <li>Off: i-stop OFF switch is off.</li> <li>On: i-stop OFF switch is on.</li> </ul>	i-stop OFF switch
LDWS_ON_SW*7	Off/On	<ul style="list-style-type: none"> <li>Off: LDWS switch is off.</li> <li>On: LDWS switch is on.</li> </ul>	LDWS switch
MULTI_SW_ST	O.K./FAULT	<ul style="list-style-type: none"> <li>O.K.: Cluster switch is normal.</li> <li>FAULT: Cluster switch is malfunctioning.</li> </ul>	Cluster switch
ODO_CNT	km, ft, mi	Displays the rolling count of the odometer.	Odometer (instrument cluster)
P_BRAKE_SW	Off/On	<ul style="list-style-type: none"> <li>Off: Parking brake not applied</li> <li>On: Parking brake applied</li> </ul>	Parking brake switch
R_GEAR_SW	Off/On	ATX: <ul style="list-style-type: none"> <li>Off: Selector lever is in R position.</li> <li>On: Selector lever is in R position.</li> </ul> MTX: <ul style="list-style-type: none"> <li>Off: Back-up light switch is off.</li> <li>On: Back-up light switch is on.</li> </ul>	ATX: <ul style="list-style-type: none"> <li>Transaxle range sensor (TCM)</li> <li>TCM</li> </ul> MTX: <ul style="list-style-type: none"> <li>Back-up light switch</li> <li>PCM</li> </ul>

PID	Unit/ Operation	Data contents	Inspection item(s)
R_LMP	Off/On/ Unknown/ Fault	<ul style="list-style-type: none"> <li>Off: Back-up light is turned off.</li> <li>On: Back-up light is turned on.</li> <li>Unknown: Back-up light signal is not determined.</li> <li>Fault: Back-up light malfunction</li> </ul>	ATX: <ul style="list-style-type: none"> <li>Transaxle range sensor (TCM)</li> <li>TCM</li> <li>Instrument cluster</li> </ul> MTX: <ul style="list-style-type: none"> <li>Back-up light switch</li> <li>PCM</li> <li>Instrument cluster</li> </ul>
SPEEDOMT R	KPH, MPH	Vehicle speed is displayed. (100 % = 300 km/h {186 mph})	Speedometer (instrument cluster)
TACHOMT R	RPM	Displays the engine speed. (100 % = 10,000 rpm)	Tachometer (instrument cluster)
TOTAL_TIM E	hh:mm:ss	Cumulative elapsed time since vehicle completion is displayed.	Instrument cluster
TPMS_CAL _SW	Off/On	<ul style="list-style-type: none"> <li>Off: Tire pressure monitoring system set switch is off.</li> <li>On: Tire pressure monitoring system set switch is on.</li> </ul>	Tire pressure monitoring system set switch
VPWR	V	Displays the power supply voltage.	<ul style="list-style-type: none"> <li>Instrument cluster</li> <li>IG1 relay</li> <li>Battery</li> </ul>

\*1 : With AFS

\*2 : ATX

\*3 : With BSM

\*4 : With rear vehicle monitoring system

\*5 : 4WD

\*6 : With i-stop

\*7 : With LDWS

#### Active Command Modes Function

- The active command modes are shown below.

Simulation item	Unit/ Operation	Data contents	Output part name
ALARM	On/Off	<ul style="list-style-type: none"> <li>On: Warning alarm sounds.</li> <li>Off: Warning alarm does not sound.</li> </ul>	Warning alarm (instrument cluster)
LCD_SEG	Off/On	Vehicles without TFT LCD display: <ul style="list-style-type: none"> <li>Off: Turns off the LCD.</li> <li>On: Fully displays LCD.</li> </ul> Vehicles with TFT LCD display: <ul style="list-style-type: none"> <li>Off: Turns off the LCD.</li> <li>On: Illuminates the LCD.</li> </ul>	Vehicles without TFT LCD display: <ul style="list-style-type: none"> <li>LCD (instrument cluster)</li> </ul> Vehicles with TFT LCD display: <ul style="list-style-type: none"> <li>TFT LCD display (instrument cluster)</li> </ul>
SPEEDOMT R	Off/60 Km/h/ 120 Km/h	European (L.H.D./U.K.), General (L.H.D./R.H.D.) specs., Australian specs.: <ul style="list-style-type: none"> <li>Off: Moves speedometer needle to the bottom-most position.</li> <li>60 Km/h: Moves speedometer needle to <b>61—66 km/h {38—41 mph}</b>.</li> <li>120 Km/h: Moves speedometer needle to <b>122—129 km/h {75.9—80.1 mph}</b>.</li> </ul> General (L.H.D./R.H.D.) specs.: <ul style="list-style-type: none"> <li>Off: Moves speedometer needle to the bottom-most position.</li> <li>60 Km/h: Moves speedometer needle to <b>58—62 km/h {36—39 mph}</b>.</li> <li>120 Km/h: Moves speedometer needle to <b>117—123 km/h {72.8—76.4 mph}</b>.</li> </ul>	Speedometer (instrument cluster)
TACHOMT R	Off/3000 RPM/6000 RPM	<ul style="list-style-type: none"> <li>Off: Moves tachometer needle to the bottom-most position.</li> <li>3000 RPM: Moves tachometer needle to <b>approx. 3,050 rpm</b>.</li> <li>6000 RPM: Moves tachometer needle to <b>approx. 6,100 rpm</b>.</li> </ul>	Tachometer (instrument cluster)

---

Simulation item	Unit/ Operation	Data contents	Output part name
WL+IL	Off/On	<ul style="list-style-type: none"><li>• Off: Turns off all warning lights, indicator lights.</li><li>• On: Illuminates all warning lights, indicator lights.</li></ul>	Warning lights, indicator lights (instrument cluster)