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## Monitoring J1939 Diagnostic Trouble Codes

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## Overview

The J1939 protocol provides several standard ways to retrieve diagnostic and service information from an ECU. The BridgeWay supports the 2 most commonly used diagnostic messages. This document explains what information is contained within these messages and how it can be monitored by a controller using the BridgeWay.

## J1939 Diagnostics Explained

This section provides background information for J1939 diagnostic messages. The use of the messages in the BridgeWay and by a controller is covered in the succeeding sections.

### J1939 Diagnostic Message Types

J1939 provides 19 different diagnostic messages that can be used to monitor, test, and clear diagnostic information in devices on the network. These messages are commonly referred to as DM messages. The BridgeWay provides support for 2 diagnostic messages: DM1 and DM2.

The diagnostic message DM1 provides a list of the Active Diagnostic Trouble Codes. These are the DTC's that are currently active on the device.

The DM2 diagnostic message provides the list of Previously Active Diagnostic Trouble Codes. These are the DTC's which are not currently active but have been active at some time in the past.

### Diagnostic Trouble Codes

A Diagnostic Trouble Code, or DTC, is a collection of values that are used to specify an issue in the device. A DTC is not a single value, or code, but a set of information.

The following information is contained within a DTC.

**Suspect Parameter Number (SPN)** The SPN identifies the J1939 data parameter that is the source of the issue. Each J1939 parameter is assigned an SPN. See the *J1939 Data Mapping Explained.pdf* document for details on J1939 parameter definitions.

**Failure Mode Indicator (FMI)** The FMI value indicates the type of issue that has occurred. FMI values are defined in Appendix A of the *J1939-73* specification.

**Occurrence Count** The number of times this DTC issue has occurred.

**Conversion Method** Specifies how the SPN and FMI are to be handled or translated. This is primarily used to handle older versions of the diagnostic protocols.

## Contents of a DM1 Message

An Active DTC message contains the following parameters.

Protect Lamp Status	Lamp to indicate a problem with a vehicle system that is most likely not electronic subsystem related. e.g. Coolant Temperature has exceeded its defined range.
Amber Warning Lamp Status	Lamp to indicate a problem with the vehicle system but the vehicle does not need to be stopped immediately.
Red Stop Lamp Status	Lamp to indicate a problem that is severe enough to warrant stopping the vehicle.
Malfunction Indicator Lamp Status	Lamp to indicate when there is an emission related trouble code active.
DTC[0] DTC[1] ... DTC[n]	The DTC list contains 1 or more DTC's. Each entry in the list contains an SPN, FMI, Occurrence Count, and Conversion Method.

## Contents of a DM2 Message

The Previously Active DTC message data is in the same format as described above for the DM1 message.

The lamp status values in the DM2 message indicate the current status of the lamps for the ECU. i.e. The lamp status values for the DM1 and DM2 message will be the same for a given point in time.

## Configuring Diagnostic Tables in the BridgeWay

The BridgeWay provides a means to easily configure monitoring of the DM1 or DM2 messages. The DM1 and DM2 input data point type handles all data parsing transparently.

### Configuring a DM1 Message Data Point

DM1 messages from a device can be monitored through the BridgeWay by configuring an Active DTC Table input data point in the input I/O table.

The screenshot shows a dialog box titled "Edit J1939 Active DTC Table". On the left, there is a list box labeled "Table Address" containing values from 300003.0 to 300009.0, with 300004.0 selected. To the right of the list are several input fields: "PGN" is set to 65226, "PGN Acronym" is set to DM1, "Target Address" is set to 0, "Diagnostic Entries" is set to 10, "Update Rate" is set to 0 ms, and "Description" is set to "Retrieve up to 10 Active DTCs". At the bottom right, there are "OK" and "Cancel" buttons.

An Active DTC Table data point is configured by selecting the Active DTC Table from the Type drop down list.

The PGN and Message Offset fields are automatically populated when the Active DTC Table type is selected.

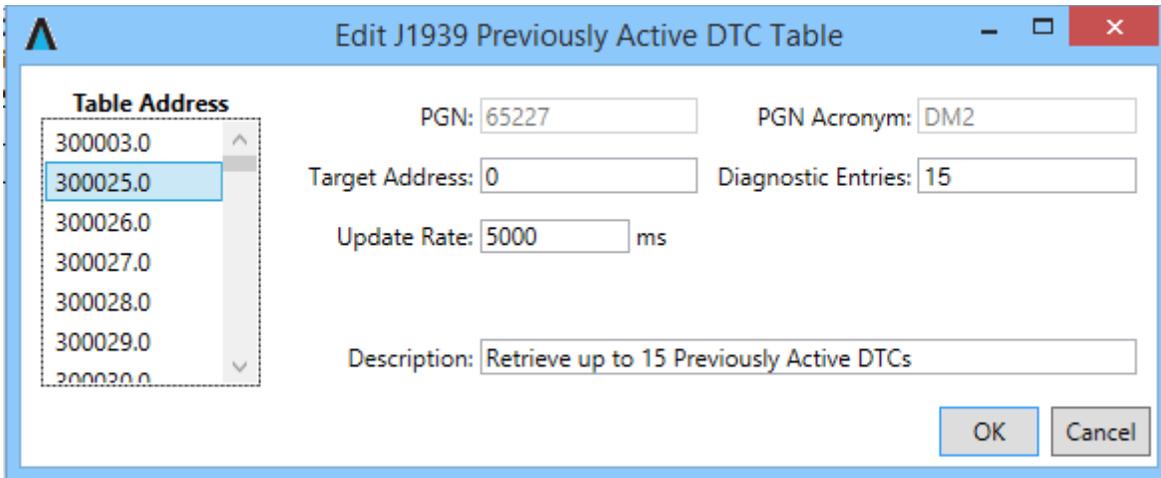
The Data Table Offset and Target Address fields are set in the same manner as in normal input data points. (See *J1939 Data Mapping Explained.pdf*)

The Table Size field should be set to the maximum number of DTC entries that will be stored by the BridgeWay. The BridgeWay will allocate this much space in the input data table for the DTC list. If the device sends more DTC's in the DM1 message, the list will be truncated when transferred to the input data table.

DM1 messages are automatically transmitted whenever there are active DTC's, or if there is a change in the active DTC list. Hence, there is no need to request the messages, so the Update Rate field should be set to 0.

## Configuring a DM2 Message Data Point

DM2 messages from a device can be monitored through the BridgeWay by configuring a Previously Active DTC Table input data point in the input I/O table.



**Edit J1939 Previously Active DTC Table**

Table Address

PGN: 65227 PGN Acronym: DM2

Target Address: 0 Diagnostic Entries: 15

Update Rate: 5000 ms

Description: Retrieve up to 15 Previously Active DTCs

OK Cancel

A Previously Active DTC Table data point is configured by selecting the Previously Active DTC Table from the Type drop down list.

The PGN and Message Offset fields are automatically populated when the Previously Active DTC Table type is selected.

The Data Table Offset and Target Address fields are set in the same manner as in normal input data points. (See *J1939 Data Mapping Explained.pdf*)

The Table Size field should be set to the maximum number of DTC entries that will be stored by the BridgeWay. The BridgeWay will allocate this much space in the input data table for the DTC list. If the device sends more DTC's in the DM2 message, the list will be truncated when transferred to the input data table.

DM2 messages are transmitted only on request. In order to receive DM2 messages from the device the Update Rate field must be non-zero. Since DM2 message may be fairly large it is recommended to set the Update Rate field to at least several seconds (several thousand milliseconds).

## Monitoring Diagnostic Tables

Once Active or Previously Active DTC Tables have been configured in the BridgeWay input table, the DTC information is available to the controller to read.

### DTC Table Format in the Input Table

Both the Active and Previously Active DTC tables have the same format within the input table. The format consists of a 16-bit table header followed by the 16-bit DTC entries.

#### DTC Table Header

The DTC Table header is located at the front of the location allocated for the DTC Table in the input table. The 16-bit header consists of the following fields.

Bit Location	Size	Description	Data Range
0	2 bits	Protect Lamp Status	00 – Off 01 – On
2	2 bits	Amber Warning Lamp Status	00 – Off 01 – On
4	2 bits	Red Stop Lamp Status	00 – Off 01 – On
6	2 bits	Malfunction Lamp Status	00 – Off 01 – On
8	6 bits	Entry Count The number of DTC entries in the table.	0 – <i>Table Size</i>
15	1 bit	Overflow Indicator	0 – DM1 message entries fit in DTC table 1 – DM1 message had more than Table Size entries.

#### DTC Table Entries

The DTC list in the DTC table consists of an array of 32-bit DTC entries that are each in the following format.

Bit Location	Size	Description
0	3 bits	SPN bits 16-18
3	5 bits	FMI
8	8 bits	Occurrence Count
16	16 bits	SPN bits 0-15

## Example DTC Monitoring

Based on the example configuration for the Active and Previously Active DTC Tables shown in the *Configuring Diagnostic Tables in the BridgeWay* section above the DTC data will be at the following data table offsets and registers for a controller.

Based on the Data point configuration, the Active DTC Table had a data table offset of 6 bytes, and the Previously Active DTC Table had an offset of 48 bytes.

Note that the BW4031 adds 32 bits of Status Data at the start of the input table, so we have added 4 bytes to the offset of the Active and Previous Diagnostic Data for that module.

BW4031 Data Table Offset (bytes)	BW4031 Modbus Register	BW2031 Modbus Register	Data Description
10	30006	30004	Active DTC Table Header
12	30007	30005	Active DTC Entry 1
16	30009	30007	Active DTC Entry 2
20	30011	30009	Active DTC Entry 3
24	30013	30011	Active DTC Entry 4
28	30015	30013	Active DTC Entry 5
32	30017	30015	Active DTC Entry 6
36	30019	30017	Active DTC Entry 7
40	30021	30019	Active DTC Entry 8
44	30023	30021	Active DTC Entry 9
48	30025	30023	Active DTC Entry 10
52	30027	30025	Previously Active DTC Table Header
54	30028	30026	Previously Active DTC Entry 1
58	30030	30028	Previously Active DTC Entry 2
62	30032	30030	Previously Active DTC Entry 3
66	30034	30032	Previously Active DTC Entry 4
70	30036	30034	Previously Active DTC Entry 5
74	30038	30036	Previously Active DTC Entry 6
78	30040	30038	Previously Active DTC Entry 7
82	30042	30040	Previously Active DTC Entry 8
86	30044	30042	Previously Active DTC Entry 9
90	30046	30044	Previously Active DTC Entry 10
94	30048	30046	Previously Active DTC Entry 11
98	30050	30048	Previously Active DTC Entry 12
102	30052	30050	Previously Active DTC Entry 13
106	30054	30052	Previously Active DTC Entry 14
110	30056	30054	Previously Active DTC Entry 15

## Support

### Technical Product Assistance

If you require BridgeWay product technical support by phone:

- Call 248-549-1200
- Dial 0 for the Operator
- Ask for BridgeWay Support

If you require support by email:

- [productsupport@pyramidsolutions.com](mailto:productsupport@pyramidsolutions.com)
- Subject: "BW4031 Support Request"
- Provide a detailed explanation of your question or issue in the email text.

You can also obtain BW4031 files and information online at the following URL:

<http://pyramidsolutions.com/support/network-connectivity-support/>

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