

DMC NI-CAN Channel J1939 Drivers

Project Information:

Latest S/W Revision: 1.0.0.0

Date: 01-21-2011

DMC Contact Information:

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Software Description:

DMC developed this set of SAE J1939 protocol drivers for LabVIEW using the NI-CAN channel API provided by National Instruments (NI). The drivers use the SAE J1939 protocol to communicate with an automotive ECU (Electronic Control Module) using NI CAN hardware that supports the channel API. This driver set is intended for use in automated testing and hardware in the loop (HiL) simulation environments.

Since this DMC implementation is written entirely in the LabVIEW development environment, which provides functions at a layer above the base CAN channel layer, there are several benefits to be realized:

- The drivers allow the simultaneous capture of data from both poll-and-response J1939 packets using the DMC drivers, and broadcast CAN frames using the simplicity of the NI Channel API.
- The J1939 CAN drivers integrate seamlessly with LabVIEW, since there are no external dll's or third party APIs involved.
- Additional J1939 functionality can be easily incorporated, since the source code is entirely LabVIEW based.
- These drivers will work on any LabVIEW Real Time (RT) targets which directly support the NI channel API, such as PXI and NI industrial PCs. (Unlocked Library version is required for RT support)

Supported J1939 Functions:

At this time, the following critical aspects of the SAE J1939 protocol specification are supported:

- User defined Tool, Target, and Global Source and Destination Addresses. (Advanced users can modify the CAN database for more flexibility.)
- Parameter Group Number (PGN) request message (0x18EA00), and get response.
- Retrieve Active Diagnostic Trouble Codes (DTCs) using Diagnostic Message 1 (DM1).
- Retrieve Inactive DTCs using DM2, via active request or passive mode.
- Clear Inactive DTCs using DM3.
- Clear Active DTCs using DM11.
- Memory Access Request (DM14), Memory Access Response (DM15), and Binary Data Transfer (DM16) for read and write operations of Diagnostic Data and Control Routines.
- Support for Short Seed/Key Security. (User must provide the required LabVIEW code and proper algorithm for key generation).
- Multi-packet capability for DM1, DM2, DM14/15/16 (Read Operations Only), and PGN Request/Response.
- Broadcast Announce Message (BAM) transactions are supported along with multi-frame transport packets.

Additional functionality will be added by DMC as this product matures. Alternatively, users may license an unlocked version to incorporate missing or custom functionality.

Software/Hardware Installation Requirements:

- (1) PC with Windows XP or Windows 7 OS.
- (2) Installed National Instruments LabVIEW Development Software Version 2009 or 2010.
- (3) Installed National Instruments NI CAN Hardware and Software supporting the NI Channel API.
- (4) Copy of the DMC Project and Library files accessible to LabVIEW.

Software Setup:

Follow the simple process below to setup the software.

- (1) Extract the provided ZIP file contents to a directory on the host PC. Suggested target location is `..\LabVIEW\vi.lib\DMC\NCC-J1939\`.
- (2) Leave the provided internal directory structure unchanged.
- (3) If you are running on Windows 7 operating system, ensure that your LabVIEW.exe program is set to 'Run as Administrator'. You can ensure this by right-clicking the LabVIEW shortcut and selecting 'Properties'. On the 'Compatibility' tab, check the box "Run this program as an administrator".
- (4) Open the "NCC-J1939" Project file with LabVIEW.
- (5) Open the 'DMC J1939 Simple Example.vi' for an example of typical library use.
- (6) Open the 'NCC-J1939 - TREE.vi' block diagram for a list of Vis in the library.

Technical Support

Technical support for this library is available to licensed users through DMC. Paid registration includes a limited amount of support time. Additional support time can be purchased at DMC's standard rates. Contact DMC for latest pricing and details.

Typical response time to authorized support requests is less than 48 hours.

Technical support is available through the following methods:

Telephone: 1-312-255-8757

Email: sales@dmcinfo.com

Web/Internet: www.dmcinfo.com

Product Registration

To register this library for unlimited use, run the 'Get Registration Info.vi' and call or email DMC with the displayed Registration Code and preferred payment method. Upon payment, DMC will issue a Registration Key. The Registration Key should be entered in the 'Get Registration Info.vi'. When this VI is run, the library will be set for unlimited use.

If specifically requested, unlocked versions of this library may also be available for purchase. Contact DMC with your specific request and details.

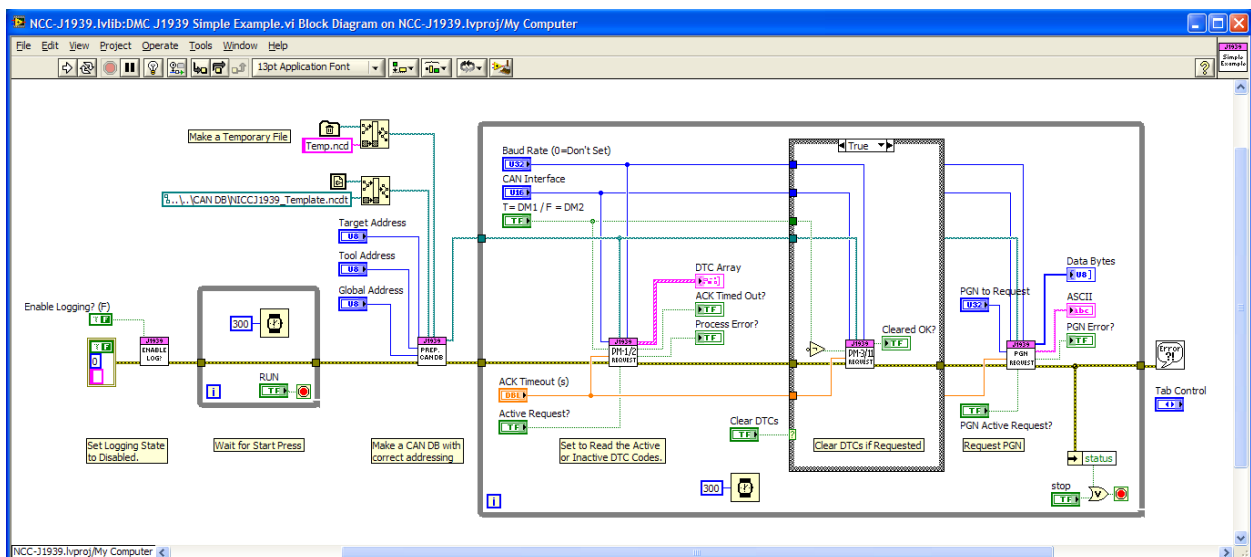
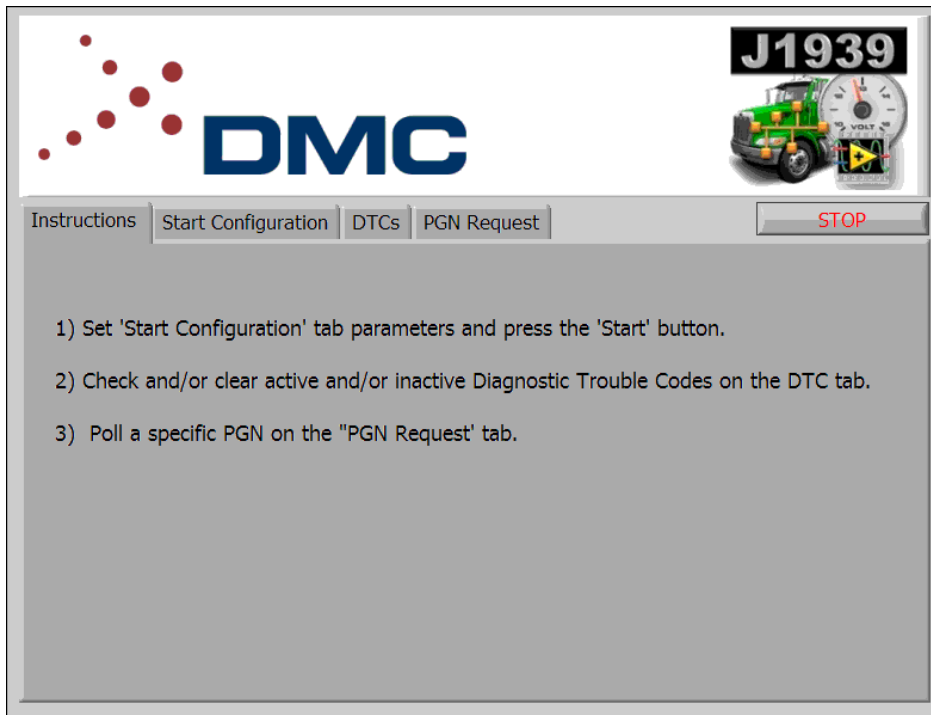
Revision History:

Program Rev 1.0.0.0

This is the initial release by DMC on 01-25-2011.

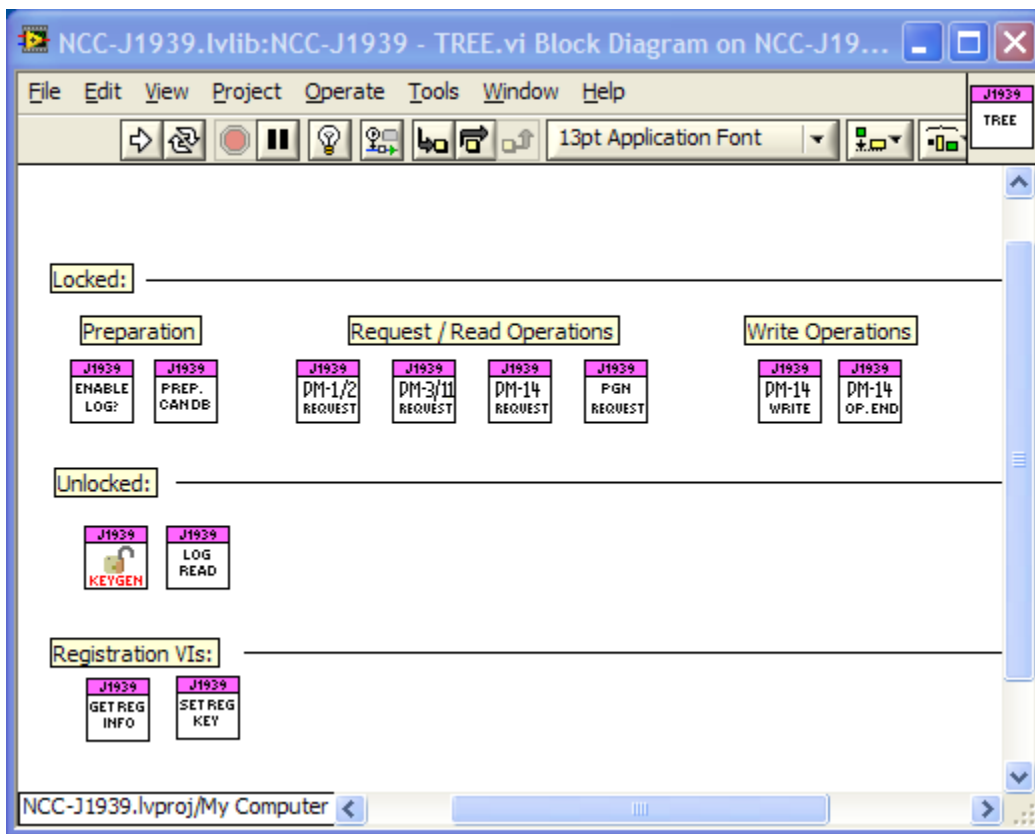
VI Documentation:

NCC-J1939.lvlib:DMC J1939 Simple Example.vi



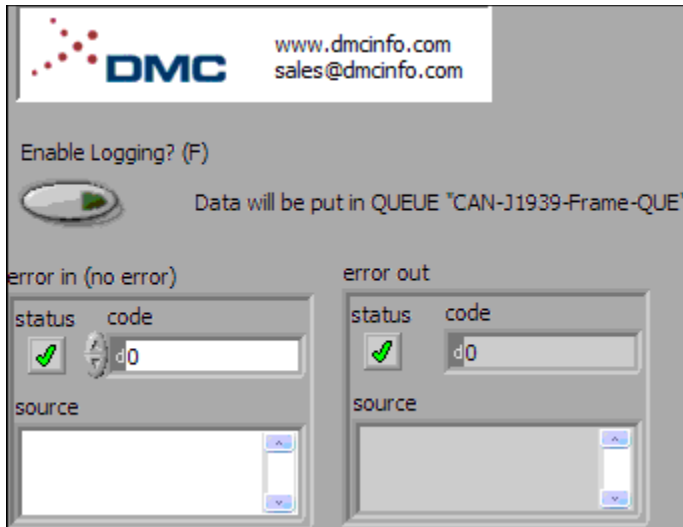
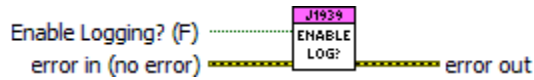
NCC-J1939.lvlib:NCC-J1939 - TREE.vi

This VI serves as a VI Tree. It has no function other than to display and organize all usable VIs in this library on its Block Diagram.



NCC-J1939.lvlib:NCC-J1939 - Enable Logging.vi

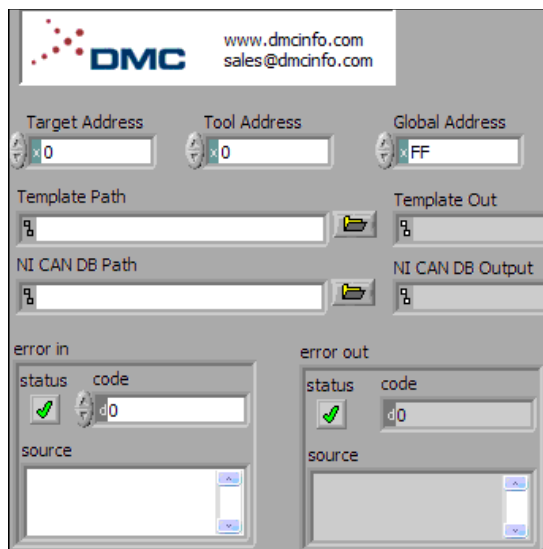
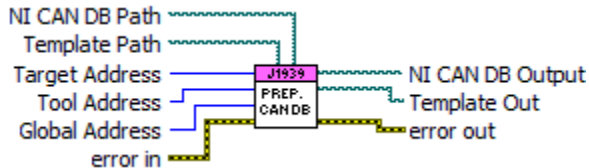
This SubVI will enable logging of CAN frames that are sent and received by this library and the remote controller. Only frames part of the J1939 transactions will be logged. Logging functions may slow down the process rate, and make use of CAN256 and CAN 257 virtual ports. The queue name is "CAN-J1939-Frame-QUE". For the queue data type, see "Frame Log Reader.vi" example.



TF **Enable Logging? (F)** Enables (T) or Disables (F) logging of J1939 transactions at the frame level.

NCC-J1939.lvlib:Prepare CAN DB File.vi

This VI is used to Produce an NI CAN Database File (*.ncd) from a template file (*.ncdt). This VI sets the required Tool, Target, and Global address for the transactions. After running this VI and producing a NCD file, the output path should be wired to all functions, or the NCD should be loaded and stored as default in MAX.



U8 **Target Address** The address of the targeted CAN network node with which you want to communicate. Messages you send will be targeted to this destination address.

U8 **Tool Address** The address of the CAN network node you are communicating from (the tool you are running this program on). Messages you send using this library will appear with this source address.

U8 **Global Address** The global address to use for the network. J1939 standard sets this to 0xFF.

D **Template Path** Path to the NI CAN Database template file (*.ncdt) that shipped with this library.

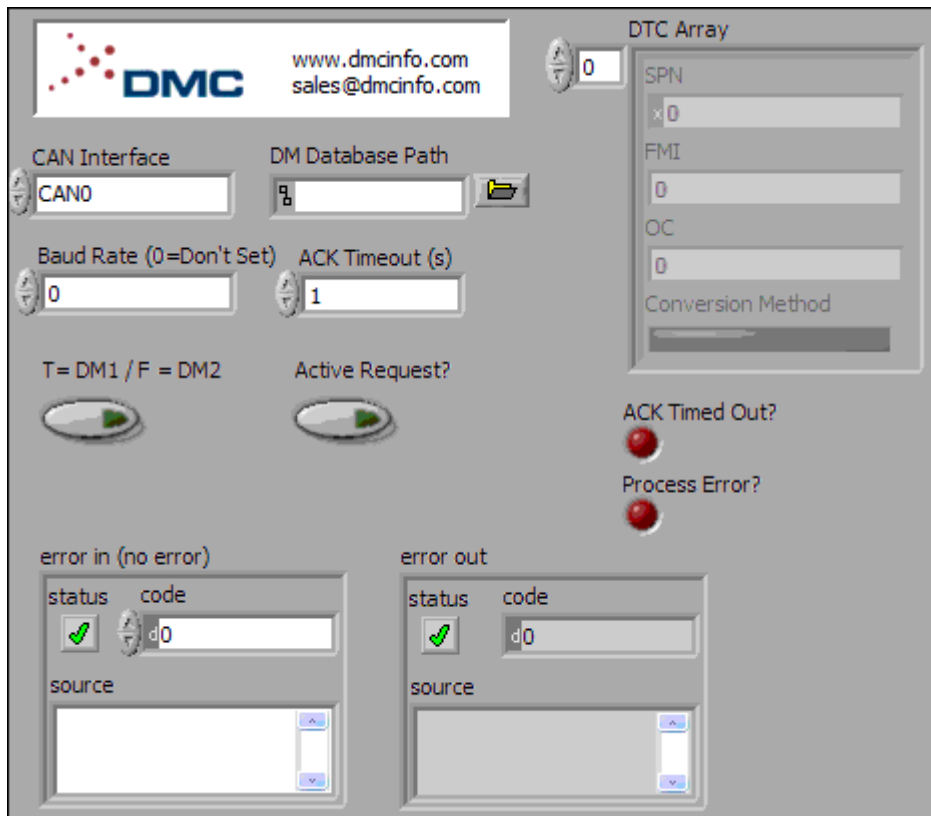
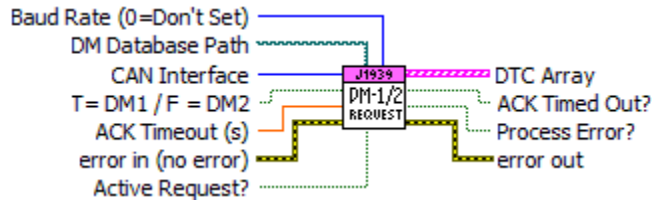
D **NI CAN DB Path** The link specific NI CAN Database File (*.ncd) that will be produced as output.







D **Template Out** Duplicate of template file path.

D **NI CAN DB Output** Duplicate of NCD CAN DB file path.


NCC-J1939.lvlib:DM1 Request.vi


This VI reads DM1 (Active DTC codes) or DM2 (Inactive DTC codes) from the remote controller. Optionally an active request for the DTCs can be made using the request specific PGN function.




-  **DM Database Path** Link specific J1939 database file generated from the template with requested tool, target, and global addresses.
-  **CAN Interface** Physical CAN Interface to Use.
-  **ACK Timeout (s)** Time for this VI to wait for a valid DM1 or DM2 Packet.
-  **T= DM1 / F = DM2** Choose to request/read DM1 if set to True, or DM2 if set to False.
-  **Active Request?** Choose to actively request DM1/2 if set to True, or passively wait for a packet to come in.
-  **Baud Rate (0=Don't Set)** Baud rate for the interface. If set to zero, the baud rate will not


be set.

 **ACK Timed Out?** True indicates that a packet was not seen within the ACK Timeout Period.


 **Process Error?** True indicates that general process error occurred.

 **DTC Array** The array of collected DTCs

 **DTC Info**

 **SPN** Suspect Parameter Number

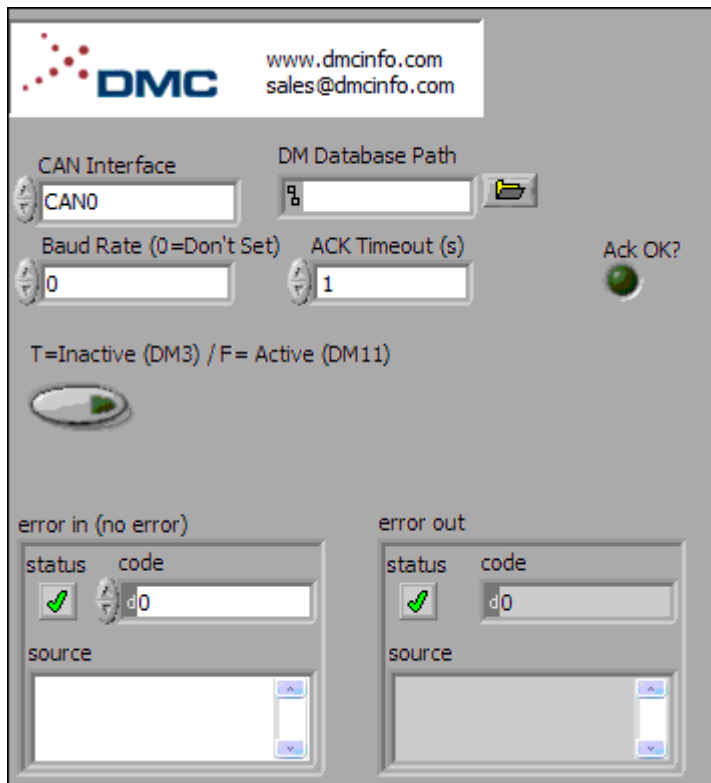
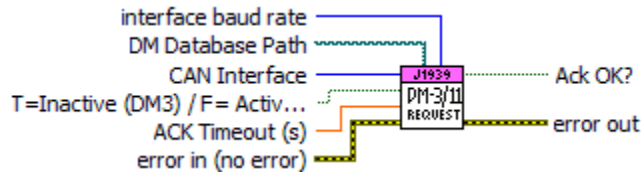
 **FMI** Failure Mode Indicator







 **OC** Occurance Counter

 **Conversion Method** Conversion Method

NCC-J1939.lvlib:DM3 Request.vi

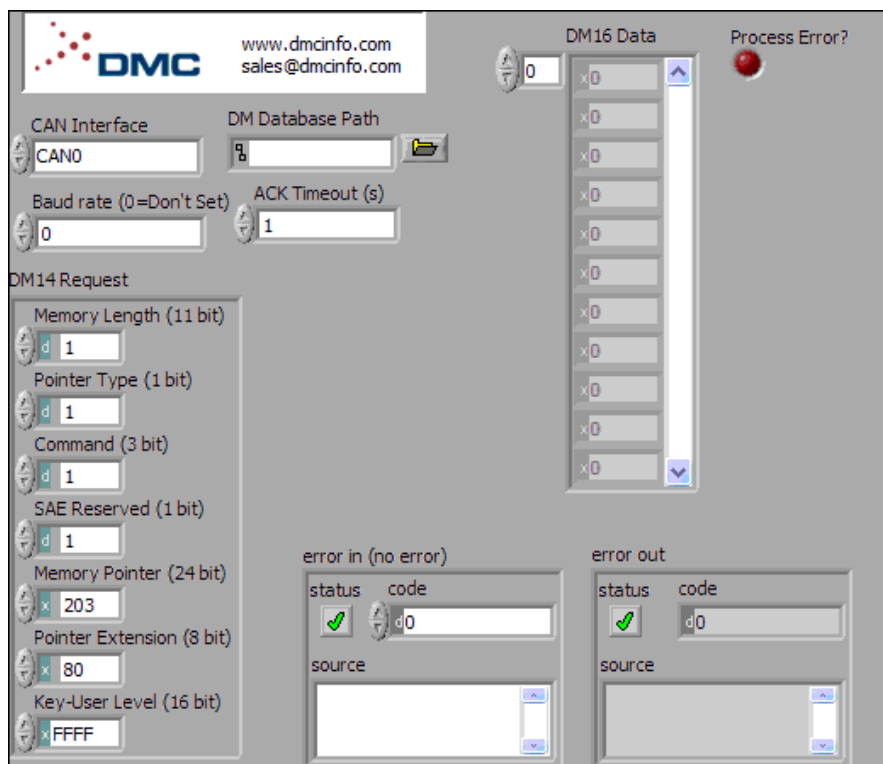
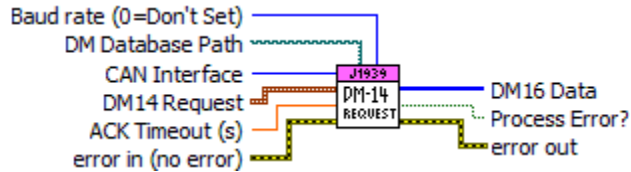
This VI sends a DM3 (Clear Active DTC List) or DM11 (Clear Inactive DTC List) request. It waits the Ack Timeout value for an acknowledgement from the remote controller.




-  **DM Database Path** Link specific J1939 database file generated from the template with requested tool, target, and global addresses.
-  **CAN Interface** Physical CAN Interface to Use.
-  **ACK Timeout (s)** Time for this VI to wait for a valid ACK Packet.
-  **T=Inactive (DM3) / F= Active (DM11)** Choose to request clear of Inactive DTCs (DM3) if set to True, or Active DTCs (DM11) if set to False.
-  **Baud Rate (0=Don't Set)** Baud rate for the interface. If set to zero, the baud rate will not be set.
-  **Ack OK?** If set true an ack packet was recieved before the timeout.


NCC-J1939.lvlib:DM14 Request.vi

This VI handles a DM14/DM15/DM16 exchange to read data. Multipacket return data is supported, so the returned DM16 data may be longer than 7 bytes. "Command" and "Key-User Level" values of the DM14 Request Input are ignored. This VI handles short seed key security using the KeyGen.vi.



 **DM Database Path** Link specific J1939 database file generated from the template with requested tool, target, and global addresses.

 **CAN Interface** Physical CAN Interface to Use.

 **DM14 Request** Type Definition for a DM14 Read operation request. Note that the Command input is ignored, and is set to Read for this operation. Similarly the Key-User Level is ignored, and set as needed to handle short seed/key security.

 **Memory Length (11 bit)**

 **Pointer Type (1 bit)**


 **Command (3 bit)**


 **SAE Reserved (1 bit)**

 **Memory Pointer (24 bit)**

 **Pointer Extension (8 bit)**

 **Key-User Level (16 bit)**

 **ACK Timeout (s)** Time for this VI to wait for a valid DM15 exchange, and following that, a valid DM16 exchange.

 **Baud rate (0=Don't Set)** Baud rate for the interface. If set to zero, the baud rate will not be set.

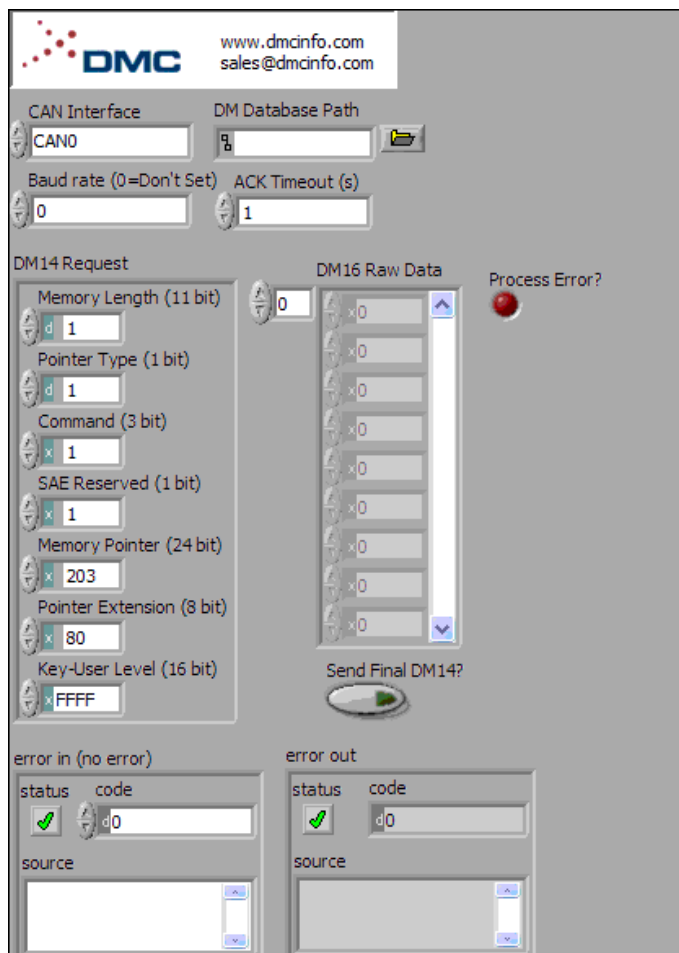
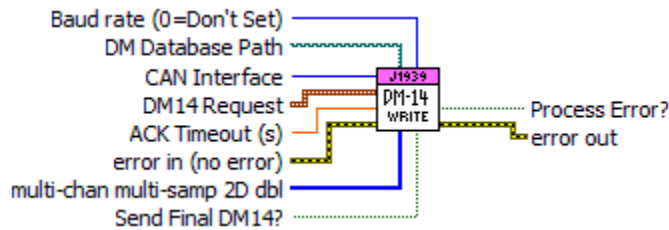
 **DM16 Data** The Array of Bytes from the DM16 Transfer process.

 **Data**

 **Process Error?** True indicates that general process error occurred.

NCC-J1939.lvlib:DM14 Write.vi

This VI handles a DM14/DM15/DM16 exchange to write data. Multipacket write data is NOT yet supported, so the input DM16 data must be 7 bytes or shorter. "Command" and "Key-User Level" values of the DM14 Request Input are ignored. This VI handles short seed key security using the KeyGen.vi. If the option to send the final DM14 operation complete/failed is set to False, then it should be sent later using the DM14- Just send Op Complete.vi



U16 CAN Interface Physical CAN Interface to Use.

902 DM14 Request Type Definition for a DM14 Write operation request. Note that the Command input is ignored, and is set to Write for this operation. Similarly the Key-User Level is ignored, and set as needed to handle short seed/key security.

U16 Memory Length (11 bit)

U8 Pointer Type (1 bit)

U8 Command (3 bit)

U8 SAE Reserved (1 bit)

U32 Memory Pointer (24 bit)

U8 Pointer Extension (8 bit)

U16 Key-User Level (16 bit)

DBL **ACK Timeout (s)** Time for this VI to wait for a valid DM15 exchange, and following that, a valid DM16 exchange.

U8 **DM16 Raw Data** This is the raw data payload to send in the DM16 write operation. This must be 7 bytes or less, since the first byte of the CAN frame is a length byte, and a mutlipacket write is not supported yet.

U8 **Data**

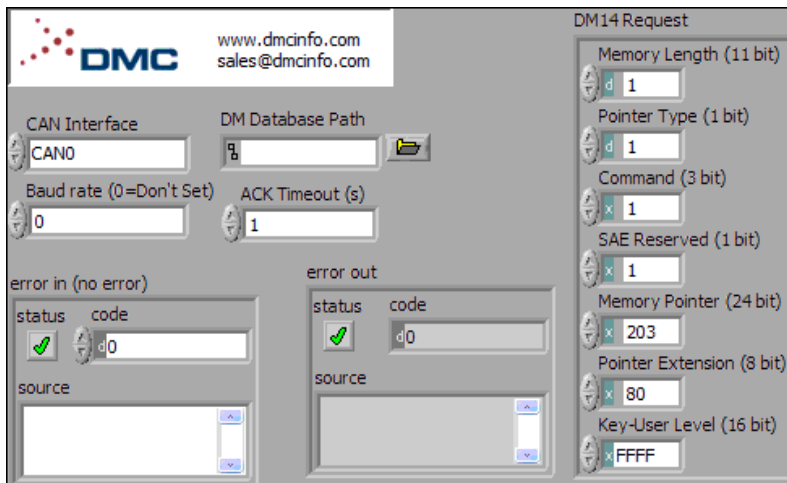
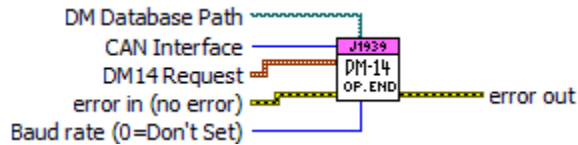
U32 **Baud rate (0=Don't Set)** Baud rate for the interface. If set to zero, the baud rate will not be set.


TF **Send Final DM14?** If this option set to True, a final DM14 operation complete or failed is sent to the target. If set to False, the final DM14 will not be send by this VI, and should be sent later using the DM14- Just send Op Complete.vi.

TF **Process Error?** True indicates that general process error occured.


NCC-J1939.lvlib:DM14- Just send Op Complete.vi


If the option to send the final DM14 operation complete/failed of a DM14 Write Operation was set to false, then this VI can be used to send the final Operation Complete DM14 message.



 **DM Database Path** Link specific J1939 database file generated from the template with requested tool, target, and global addresses.

 **CAN Interface** Physical CAN Interface to Use.

 **Baud rate (0=Don't Set)** Baud rate for the interface. If set to zero, the baud rate will not be set.

 **DM14 Request** Type Definition for a DM14 Write operation request. Note that the Command input is ignored, and is set to "Operation Complete" for this operation. Similarly the Key-User Level is ignored, and set as needed to handle short seed/key security.

 **Memory Length (11 bit)**

 **Pointer Type (1 bit)**

 **Command (3 bit)**

 **SAE Reserved (1 bit)**

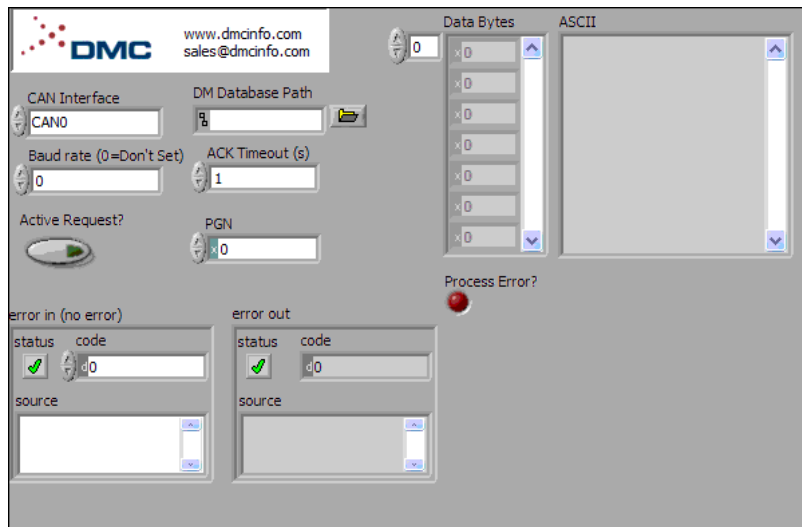
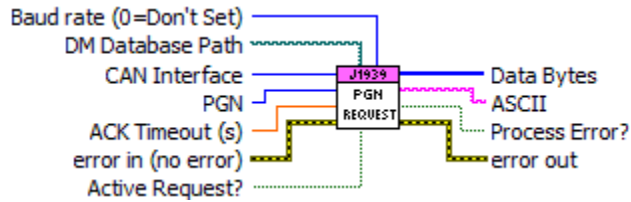
 **Memory Pointer (24 bit)**











 **Pointer Extension (8 bit)**

 **Key-User Level (16 bit)**

NCC-J1939.lvlib:PGN Request.vi

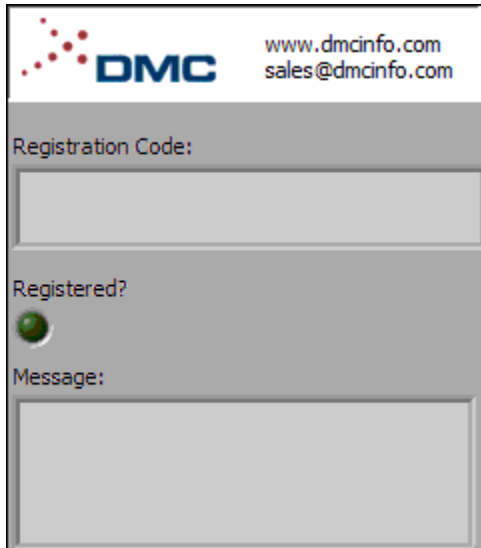
This VI will read a specific PGN . It will wait the ACK Timeout for a packet with that PGN to arrive. If Active Request is set True, the code will make a request for the PGN first.



-  **DM Database Path** Link specific J1939 database file generated from the template with requested tool, target, and global addresses.
-  **CAN Interface** Physical CAN Interface to Use.
-  **ACK Timeout (s)** Time for this VI to wait for a valid PGN Packet to be returned.
-  **Active Request?** Choose to actively request this PGN if set to True, or passively wait for a packet to come in.
-  **Baud rate (0=Don't Set)** Baud rate for the interface. If set to zero, the baud rate will not be set.
-  **PGN** The specific PGN to request.
-  **Process Error?** True indicates that general process error occurred.
-  **Data Bytes** The array of Bytes from the PGN request.
-  **Sample**
-  **ASCII** The ASCII representation of the array of Bytes from the PGN request.

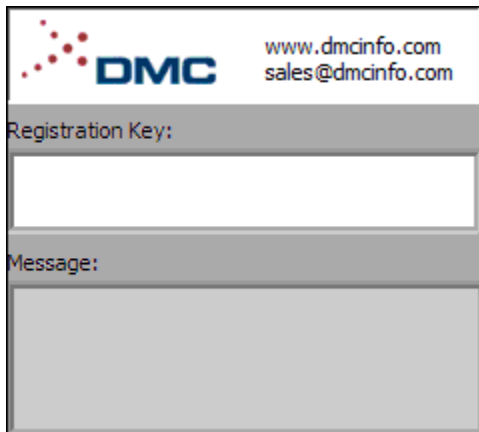
NCC-J1939.Ivlib:Get Registration Info.vi

This VI is used to gather registration code. The code can be sent to DMC to get a valid license key.



NCC-J1939.Ivlib:Set Registration Key.vi

This VI is used to enter a valid licence key from DMC.

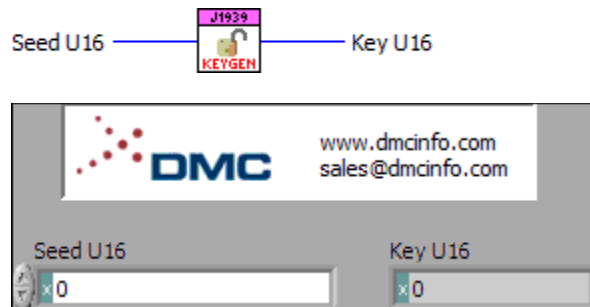


The screenshot shows the graphical user interface for the 'Set Registration Key' VI. At the top left is the DMC logo. To its right, the website 'www.dmcinfo.com' and email 'sales@dmcinfo.com' are listed. Below this is a label 'Registration Key:' followed by a text input field. Underneath the input field is a label 'Message:' followed by a large, empty rectangular area for displaying a message.



NCC-J1939.lvlib:KeyGen.vi

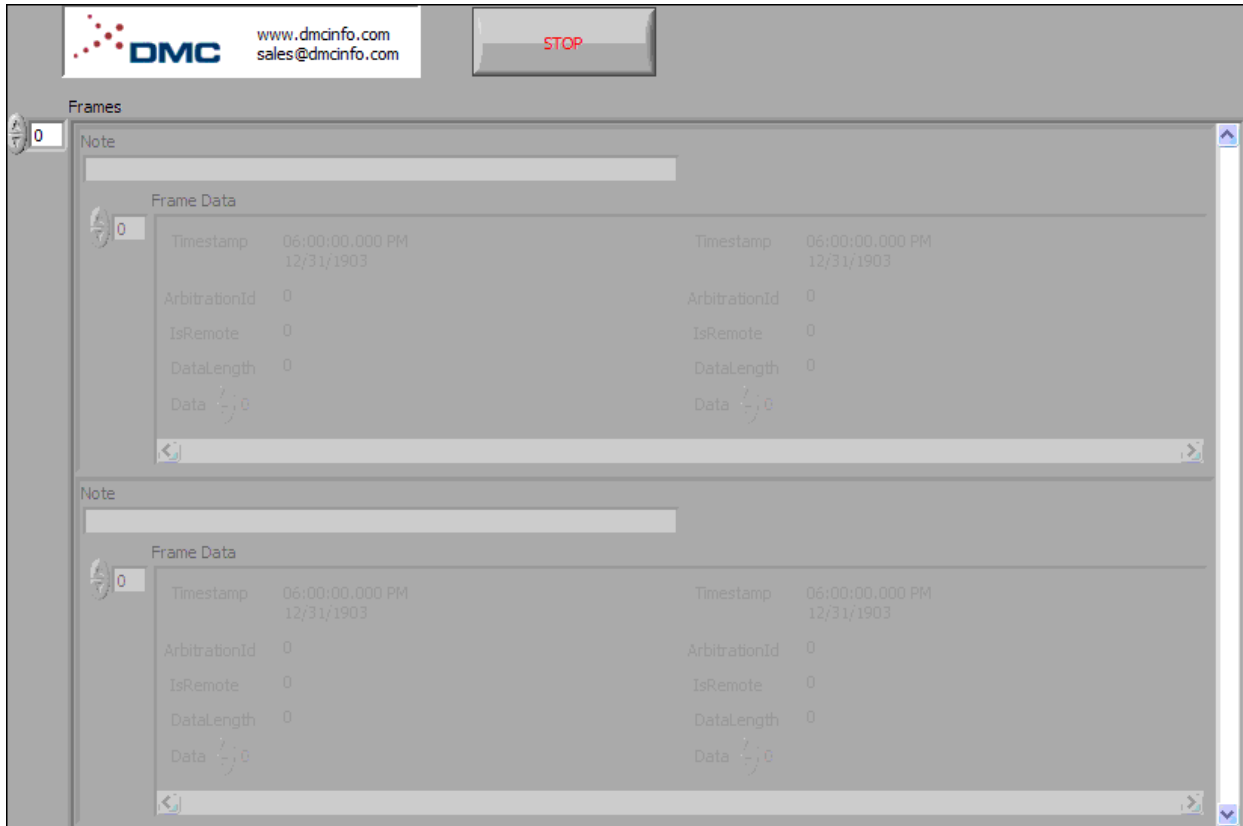
This subVI is called by DM processes that require short seed/key security. If the device you are communicating with has security enabled, you need to modify this VI with the seed/key computation. The seed value returned by the remote controller will be entered in the seed input. You must return a key value that will be accepted based on that seed.



- U16** **Seed U16** This is the seed value that was returned by the remote controller requesting a secure mode.
- U16** **Key U16** This is the key that will grant secure access to the controller, based on the seed given.

NCC-J1939.lvlib:Frame Log Reader.vi

Example VI that reads from the J1939 CAN Frame Log Queue. This queue is filled during CAN operations is logging is enabled. Optionally, one can use the NI CAN Bus Monitor Tool in NI MAX to see all frames.

The screenshot shows the graphical user interface for the 'Frame Log Reader' VI. At the top left is the DMC logo and contact information: www.dmcinfo.com and sales@dmcinfo.com. To the right is a 'STOP' button. Below this is a 'Frames' section containing two identical 'Frame Data' tables. Each table has a 'Note' field above it and a 'Frame Data' section below. The 'Frame Data' section contains the following fields:

Field	Value
Timestamp	06:00:00.000 PM 12/31/1903
ArbitrationId	0
IsRemote	0
DataLength	0
Data	0