



CANR-002 CAN Based Relay Controller Install & Operating Instructions

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1 Introduction

The CANR-002 CAN Based Relay Controller can be used for controlling a variety of electrical devices, based on information received from the ECM through the vehicle's CAN bus. This bus is used in OEM applications to communicate between the various controllers and modules as well as with diagnostic tools via the diagnostic link connector (DLC).



1.1 CANR-002 Description

The CANR-002 module interprets vehicle CAN data, including GMLAN and J1939 data. It is capable of providing up to four (4) outputs per module and multiple modules can be used on the same vehicle. The module allows you to control relay operated devices without having to duplicate sensors already installed on the vehicle. These outputs can be used to control - via relays - fans, warning lights, reverse lights or other relay operated devices.

For some vehicle applications the CANR-002 module can also be purchased pre-configured for your vehicle application. Contact LPE with your vehicle details for more information. In order to configure the CANR-002 module for your vehicle, we will need the following information:

- Type of ECM and software being used to control the engine (year, make and model it came from or Operating System information from the ECM).

The CANR-002 module is currently configured to passively listen for existing data being transmitted on the CAN network. It does not currently offer the option to actively request data so if a variable you are interested in is not being broadcast on the CAN bus then the CANR-002 module will not be able to read that information. Contact LPE or your LPE dealer if you have a variable that you need displayed that is not available. An alternate variable may exist or we may be able to enable that data transmission in your ECM.

The CANR software has been tested for use with Windows XP, Windows 7 and Windows 8 (32 bit and 64 bit versions).

1.2 Features & Benefits

Features:

- Can be used to interpret almost any data on the vehicle data network.
- Four outputs
 - Multiple units can be used at once for additional outputs
- Provides programmable relay activation output
 - Relay output can be based off of one variable or a combination of two variables.
 - When based on two system variables, the output status can be either AND or OR for the two variables
 - Examples
 - Turn fans on when coolant temperature is above 190 degrees AND vehicle speed is below 50 mph
 - Turn on warning indicator when engine RPM is above 1500 RPM AND oil pressure is below 30 PSI
- Software includes a database of common CAN messages
 - GMLAN
 - For use with most newer GM vehicles and crate engines
 - J1939 messages
 - For use with many newer heavy duty truck, bus, marine and off-road equipment applications
 - More CAN messages for other OEM and aftermarket applications to be added over time
- Software allows users with knowledge of CAN information to configure almost any CAN message as an output

Benefits:

- Simplifies wiring
- No additional sensors needed for many applications
- Reduces cost

1.3 Parts List

#	Description	Item ID/PN
1	CAN based relay controller	CANR-002
1	72" of 0.25" wire loom	1773
1	6 foot USB 2.0 cable, 6', A Male to Mini-B	MONO-8634
2	Hook and loop tape, per inch	06483
2	Self tapping screw	AV16037
1	USB flash drive with CANR software	
1	LPE 9" decal	L920010000
1	Installation instructions	

1.4 Required or Recommended Tools & Materials

- Wire strippers
- Wire crimp tool
- Heat shrink
- Heat gun
- Phillips screw driver
- Scan tool (OEM or aftermarket)

Optional Items

When installing in custom vehicles/transplants you may also need:

- 120 Ohm terminating resistor
(Typically only one additional terminating resistor is needed unless no other module on the system is acting as termination for the network - see instructions page regarding Terminating Resistor for more details)

To connect to a Windows tablet (micro USB)

#	Description	Item ID/PN
1	2m USB OTG Cable - Black, Type Micro-B to Mini-B	LND-31719
1	Sealed Fuse Holder	L450130000
1	40 Amp Heavy Duty Relay Kit	L450100000

1.5 Advanced Users

For advanced users and shops that expect to work a lot with CAN equipped vehicles we recommend you purchase a CAN interface module to allow your PC to connect to the vehicle bus and view and log all of the CAN traffic. These devices can be used to determine if a particular data set exists on the vehicle and can be used to identify unknown variables and then enter them into the CANR software yourself. The CAN data can also be emailed to LPE for testing/reverse engineering the data on the particular vehicle being worked on.

Many CAN interfaces exist on the market. Some come with software while others require additional cost software. Several free CAN message related software programs also exist.

Some resources for fairly low cost CAN interfaces and software include:

- PCAN-USB by Peak-Systems (<http://www.peak-system.com/>)
- ValueCAN3 by Intrepid Control Systems (<http://www.intrepidcs.com/>)
- Kvaser (<http://www.kvaser.com/>)

For advanced users and shops that plan to configure and resell the CANR-002 modules we also recommend you have a +12Vdc power supply. The power supply will allow you to connect to and reprogram the CANR-002 modules without having to wire them into a vehicle.

Some engine management systems and other modules can be reprogrammed to enable broadcasting of specific CAN messages. Depending on your application it may also be helpful to have access to these programming tools in order to enable specific CAN messages on the bus.

1.6 Applications

The CANR-002 module is designed for use with automotive and marine CAN network equipped vehicles including:

- Most 2006 and newer GM vehicles that are equipped with high speed GMLAN such as:
 - 2010-2017 Camaro
 - 2005-2013 C6 Corvette
 - 2014-2017 C7 Corvette
 - 2009-2017 CTS-V
 - 2007-2017 Silverado, Sierra, Suburban, Yukon and Tahoe
 - 2014-2016 SS
- GMPP crate engines
- Heavy duty trucks, buses and marine engines equipped with SAE J1939
- Other CAN equipped vehicles if the user is familiar with the application's CAN messages

LPE intends to add additional vehicle specific CAN libraries and messages over time and some LPE dealers may also develop CAN libraries for specific vehicles they work with. Contact LPE or your LPE dealer before purchasing if your vehicle is not listed above.

2 Hardware Install

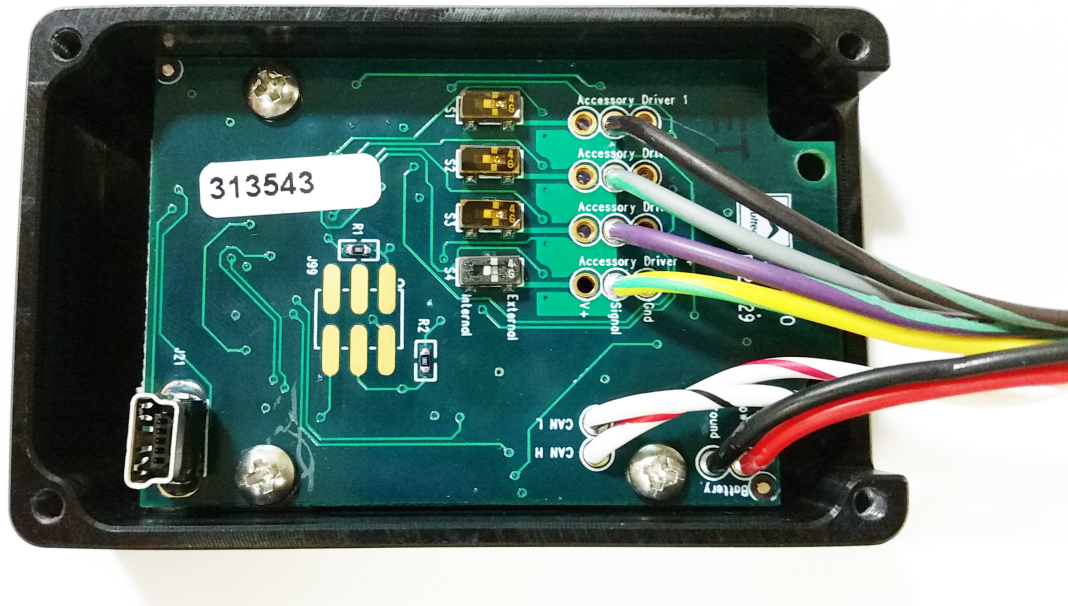
The following sections will cover installation and wiring of the CANR-002 module.



2.1 Mounting Location

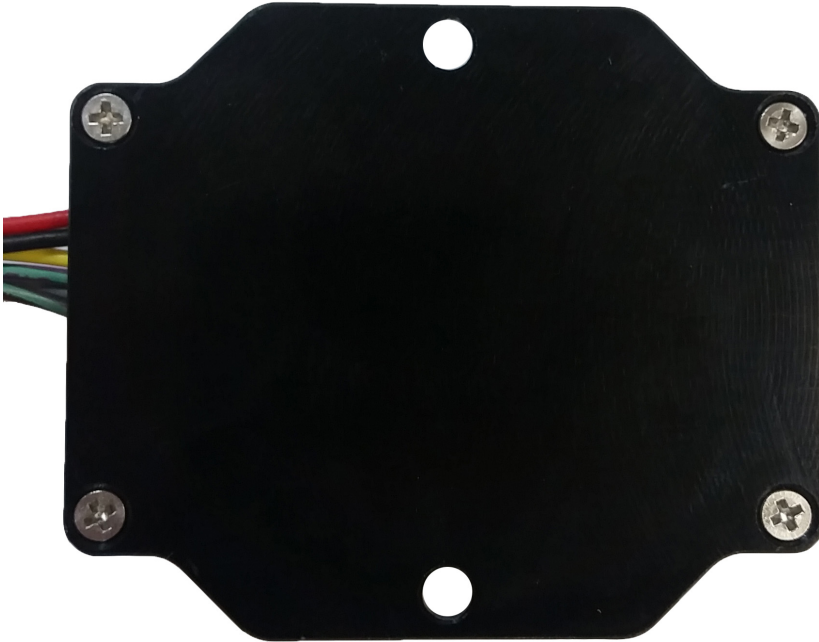
Choose a convenient mounting location that is away from extreme heat. For most applications the CANR-002 module should be mounted inside the vehicle passenger compartment. Do not mount the CANR-002 module in close proximity to the exhaust or other sources of heat. The CANR module is designed to withstand the temperatures of the automotive interior/passenger compartment. Due to the USB interface, the CANR module is not designed to be mounted in the vehicle engine compartment.

Make sure that where you mount the CANR module will allow you to access the rear cover of the module. You will need to be able to remove the cover and plug in the supplied USB cable in order to change your relay settings.



2.2 Back Cover

The cover is removed by removing the four screws located at the corners.

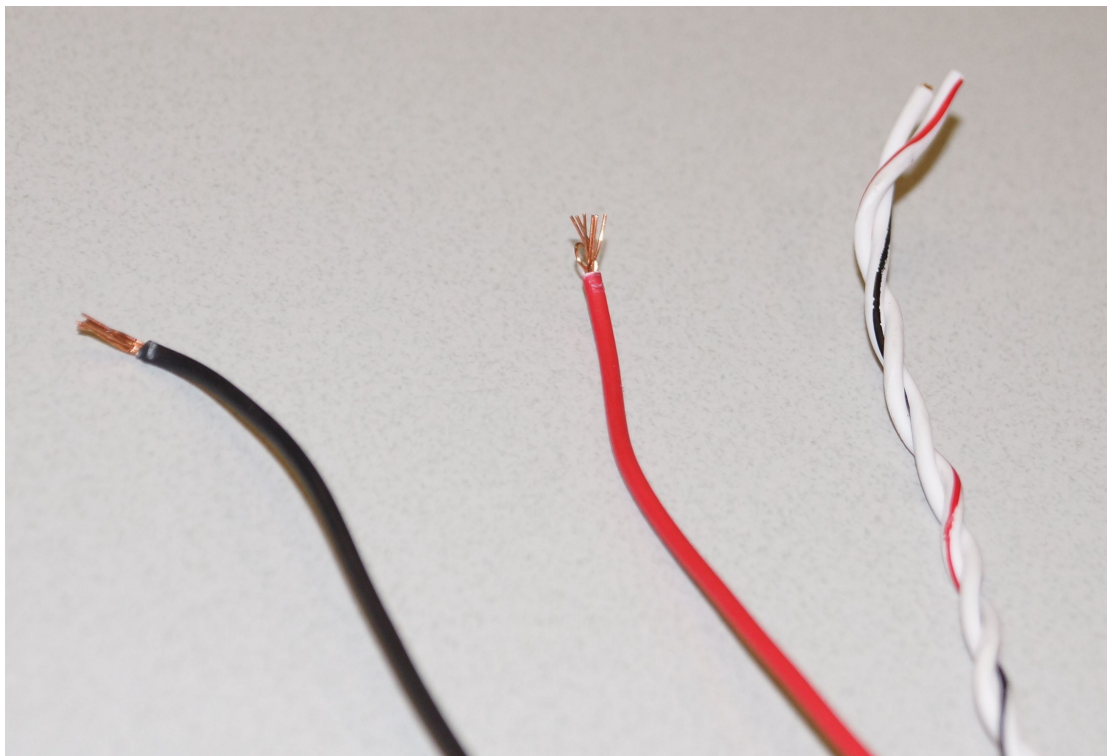


2.3 CANR-002 wires

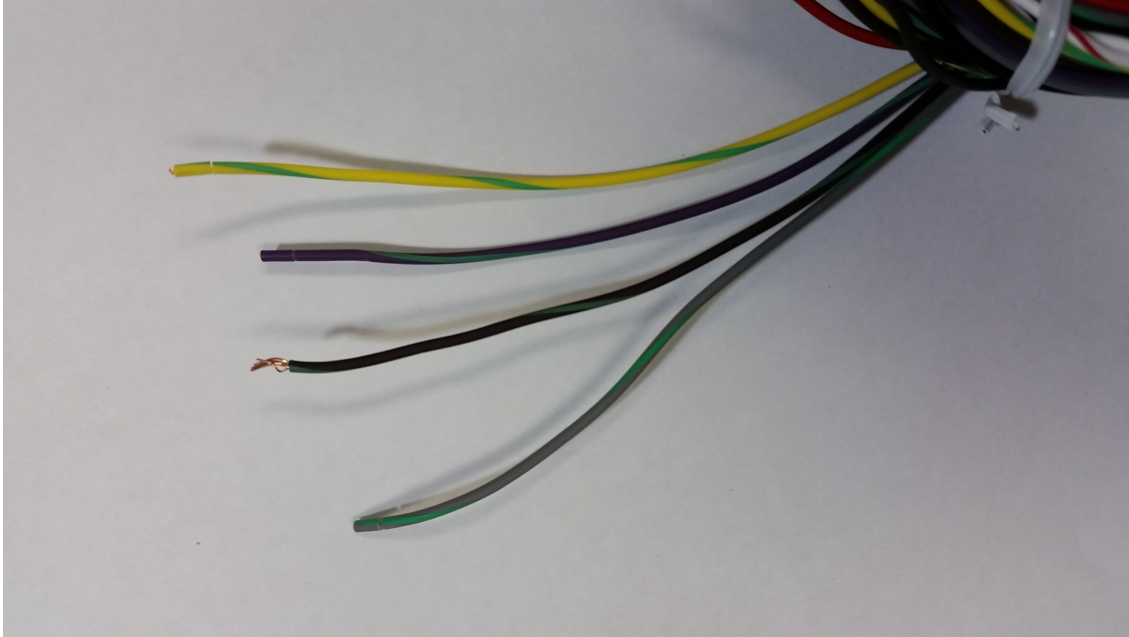
The CANR-002 has eight (8) loose wires:

Red wire	+12Vdc	connect to a 12v ignition switched circuit
Black wire	Ground	connect to a chassis ground
White with red tracer	CAN+	connect to CAN+
White with black tracer	CAN-	connect to CAN-
Yellow w/ green tracer	Output 4	connect to relay 4
Purple w/ green tracer	Output 3	connect to relay 3
Gray w/ green tracer	Output 2	connect to relay 2
Brown w/ green tracer	Output 1	connect to relay 1

The two white CAN wires are twisted together and should remain twisted together. This is done to help reduce the chance of electrical noise getting into the CAN network.



The four programmable output wires:



2.4 Wiring The CAN & Power Wires

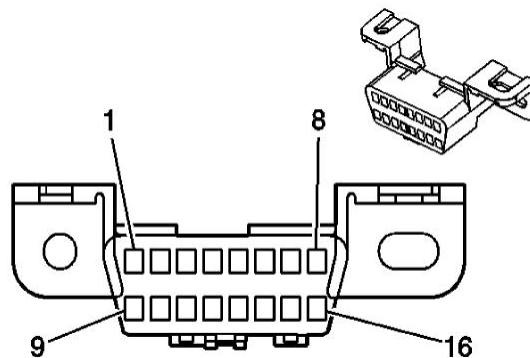
In this section we will cover wiring the CAN signal wires along with the power and ground wires for the CANR-002 module.

2.4.1 DLC

In most applications the easiest place to splice into the CAN bus will be at or before the Diagnostic Link Connector (DLC), sometimes also known as the ALDL connector.

If you are connecting to the back of the DLC, the pins are as follows on most vehicles (consult the service manual for your vehicle to confirm the locations):

- CAN+ DLC pin 6 (*tan/black on most GM vehicles*)
- CAN- DLC pin 14 (*tan on most GM vehicles*)



See next page for location of DLC.

The following vehicles may not have access to the vehicle's CANbus at the DLC connector:

- Alfa Romeo
- Audi
- BMW
- Chrysler
- Fiat
- Hyundai
- Jeep
- Lamborghini
- Land Rover
- Mini Cooper
- Porsche
- Smart
- Volkswagen

The DLC is generally located on the driver's side of the vehicle underneath the steering wheel near the firewall.



Note: this specific example is from a 2012 Chevrolet Caprice

2.4.2 Terminating resistor

High speed CAN networks operate on twisted pair wires with termination resistors at each end of the network.

In custom vehicle applications that involve engine swaps into vehicles that did not originally have CAN, it may be necessary to add a terminating resistor to the CAN network. The CANR-002 module does not provide any internal termination. This is done to allow the device to be installed almost anywhere in an existing CAN network.

High speed GMLAN and most other CAN configurations use two 120 Ohm termination resistors placed between the GMLAN+ and the GMLAN- circuits. One termination resistor is usually located inside the engine control module (ECM)*. The other is sometimes located inside another module but it is most often a stand-alone resistor taped into the harness. The network can operate with one open resistor (with one missing resistor) but the signal will be less stable and communication errors may occur.

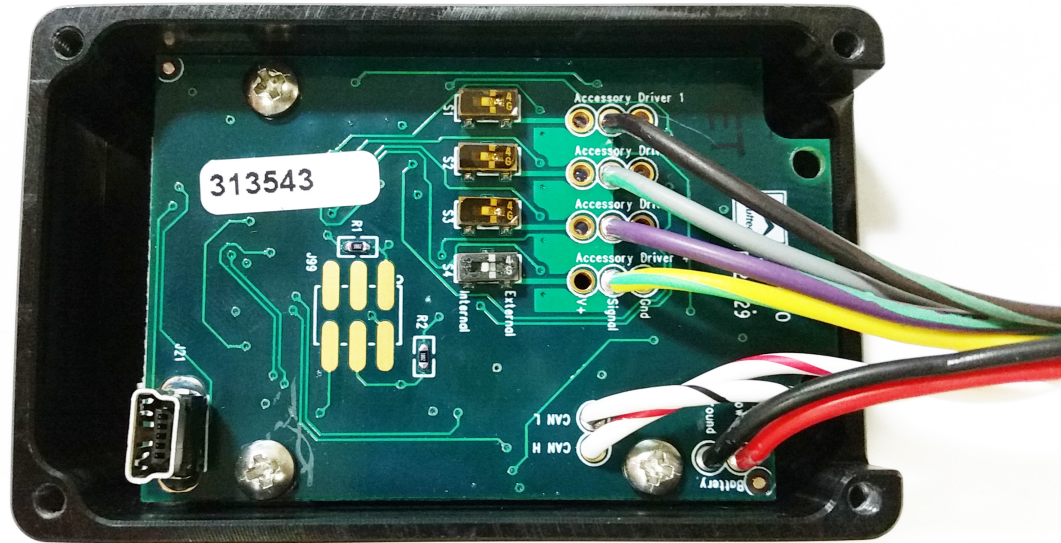
To test the CAN network for the existence of the termination resistors, connect an Ohmmeter (or DVOM set to resistance measurement) across terminals 6 and 14 of the DLC with the key OFF.

- The resistance should read 60 Ohms if both resistors are ok (since the resistors are in parallel).
- If the resistance reads 120 Ohms you have one open resistor (one missing resistor).
- If the resistance reads infinity (open connection) you may have 2 open resistors but it is much more likely that you have a poor connection at the DLC.
- If the resistance reads 0 Ohms (or close to it) the GMLAN +/- circuits are shorted together.

*On some engine control modules (ECM) and other vehicle modules, two sets of CAN terminals may exist on the module with one set of terminals configured with internal termination for use when the module is going to be at the one end of the circuit and another set of terminals that do not have internal termination for use when the module is not going to be at the end of the circuit and then some other module or a stand-alone resistor will be used for the termination for that end of the network. Be sure to consult the vehicle service information to determine that you are connected to the correct pins.

2.5 Configuring the CANR DIP Switches

Each output channel has a corresponding DIP switch inside the CANR-002 module. These DIP switches labeled **S1**, **S2**, **S3** and **S4** must be set to the internal position in order to activate the relays using an internal 5 Volt reference voltage from the CANR-002. The CANR comes preconfigured to have GND and Open outputs. The CANR is capable of outputting GND, Open, and +5V if the DIP switch is set to internal.



2.6 Wire Routing

Route the wiring to the device(s). Make sure the wiring is secured and out of the way of moving parts and extreme heat sources.

Avoid placing the CANR-002 module or any of the wiring near potential sources of electrical noise including line lock solenoids, trans-brake solenoids, nitrous or fuel solenoids, fuel injectors and coils. Do not route the CAN wires alongside high voltage wires. If they must cross each other, have them cross at 90 degree angles to each other.

2.7 Example Wiring Diagrams

The following sub-sections detail the installation of the CANR-002 Nitrous Controller in a vehicle. Each sub-section will have a description of the configuration and a wiring diagram. Please note that the following configurations represent just a small number of possible wiring configurations for the CANR-002 Controller.

The configurations that will be shown in the following sub-sections are:

- [CANR-002 Connected to a 1-Speed Fan](#)

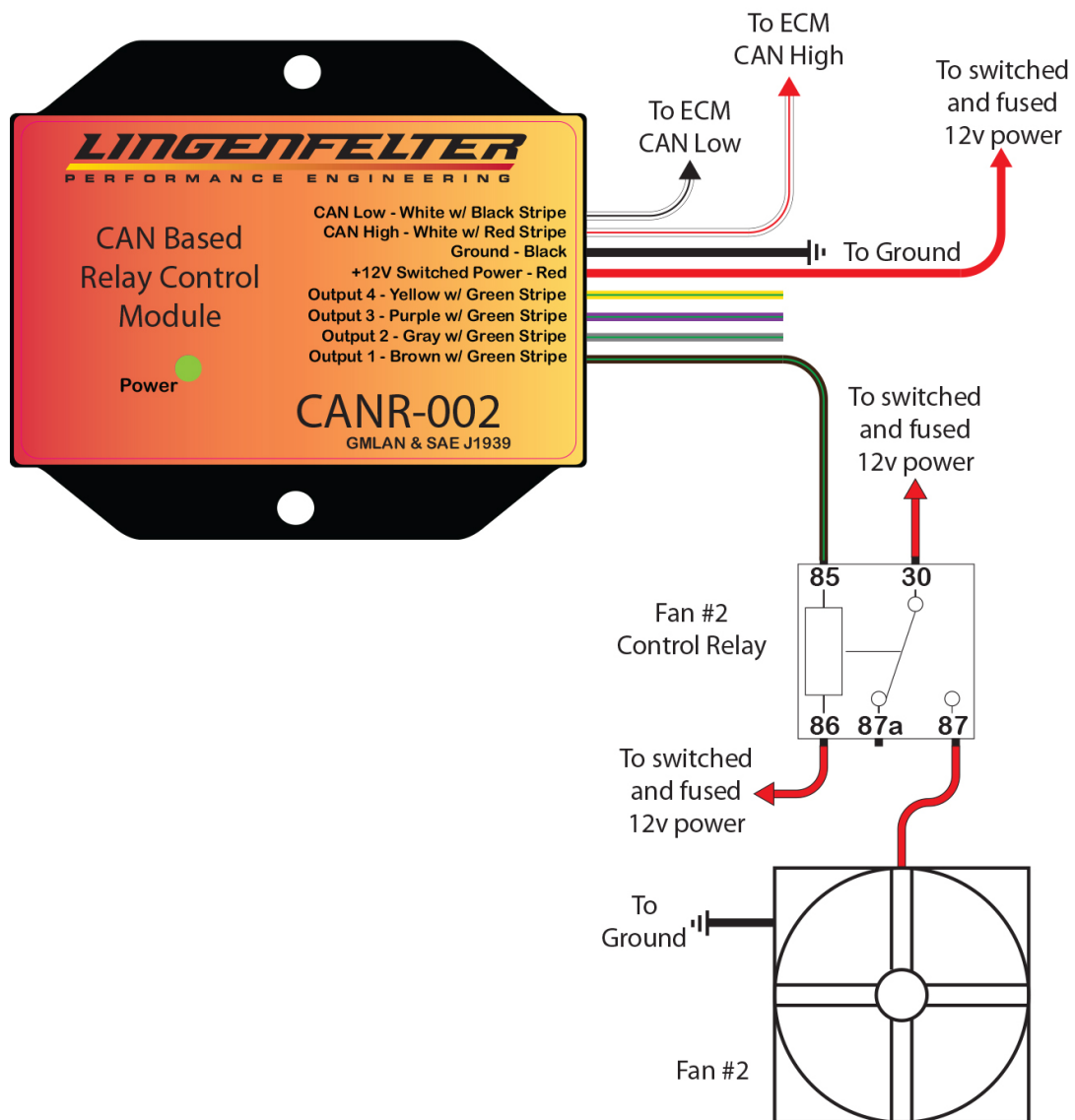
NOTE: The wire colors in the wiring diagrams below will most likely differ from the wiring in your vehicle. Identify the wires of all applicable components in your vehicle and confirm their individual functions before beginning to wire the CANR-002 controller.

WARNING: Relays must be used if the device you are controlling requires more than _____ Amps.

NOTE: The wiring of the CANR-002 Nitrous Controller may require additional lengths of wire depending on where the CANR-002 will be mounted on the vehicle.

2.7.1 CANR-002 Connected to a 1-Speed Fan

Use this configuration to control a 1-Speed fan using a relay. For example, the fan can be turned off above a certain speed.



3 Software Install

This section will cover the installation of the CANR PC software and the CANR-002 drivers.

The CANR PC software is designed for use with Windows XP, Windows 7 and Windows 8.

3.1 PC Software Installation

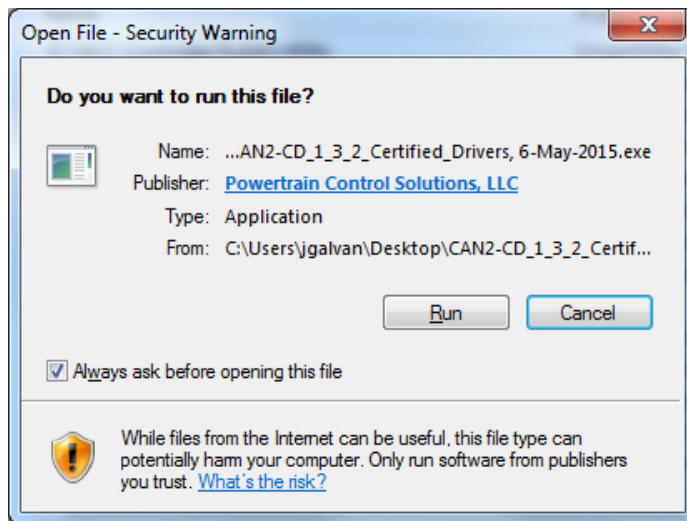
Your CANR-002 module was supplied with a USB Flash drive that contains the PC software. You can also download the latest CANR software from the *Instructions* section of our web site:

http://www.lingenfelter.com/category/Software_Downloads.html

Copy the installation file off of the Flash drive or download and unzip the file from our web site to your PC. Then run the CANR executable program by double clicking on the file or right clicking and selecting "Run As":



When you run the software you will get the following security warning from Windows:



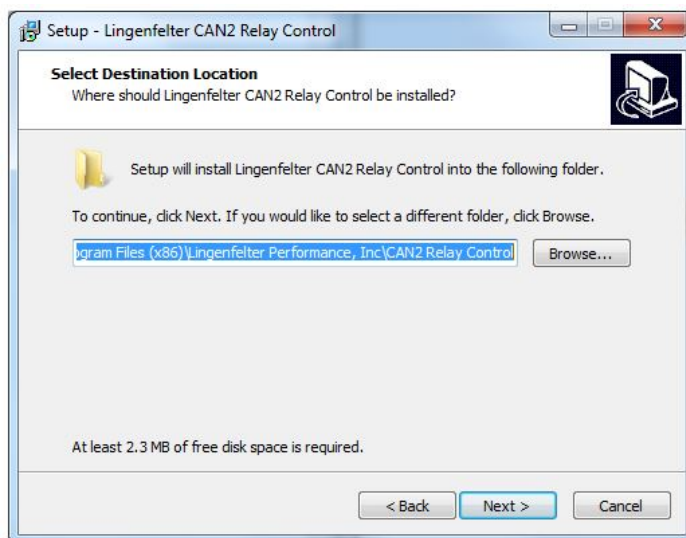
Click "Run" to install the software.

That will then bring you to the Setup Wizard screen:



Click on the "Next" button.

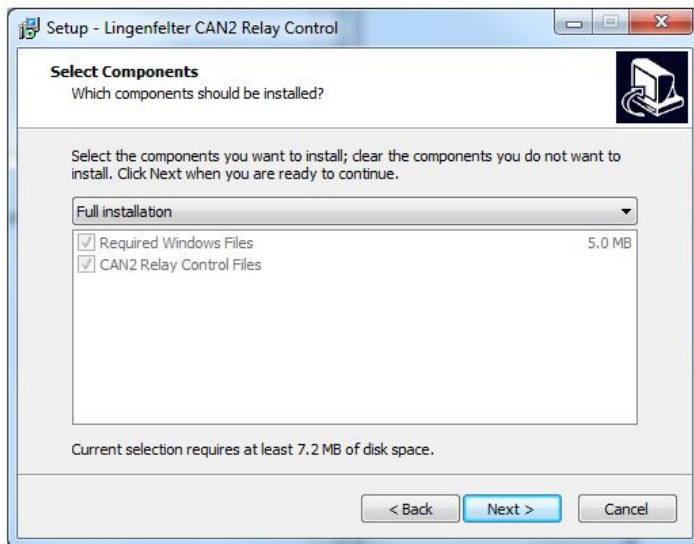
This will bring you to the Select Destination Location prompt:



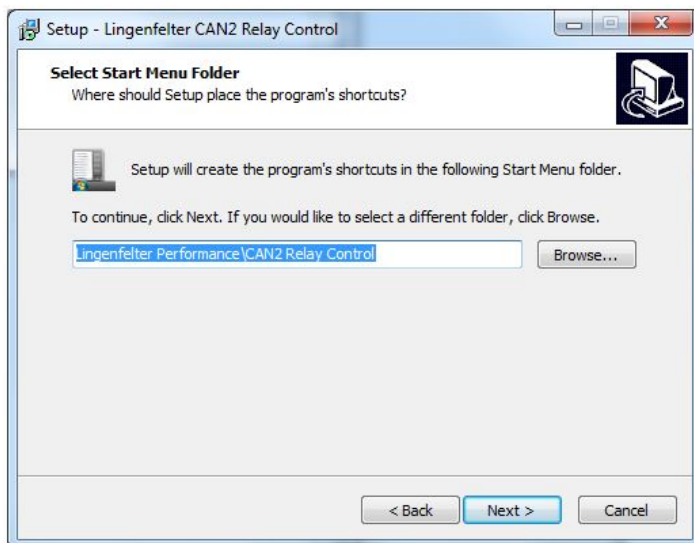
We recommend that you leave the software in the default location unless you are sure you want to save it to an alternate folder or drive.

Click on the "Next" button.

That will take you to the Select Components screen:



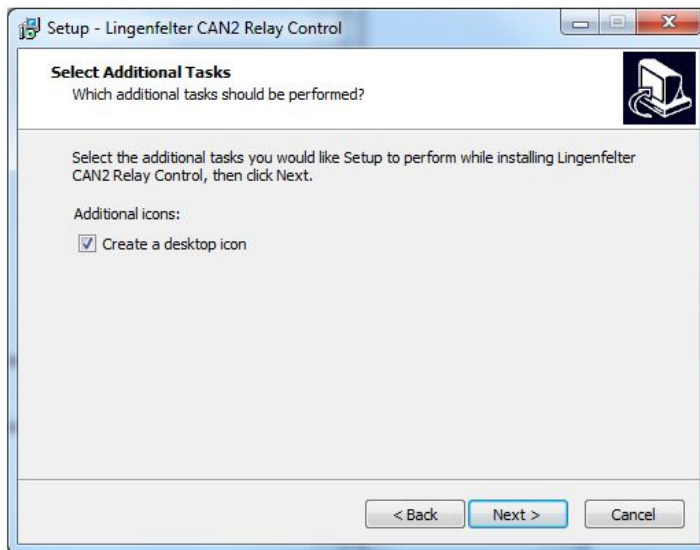
The default selection is for a full installation and we recommend you use this option. Click the "Next" button to take you to the Select Start Menu Folder:



Again, unless you are sure you want this to be saved in a different folder we recommend leaving the default location in place.

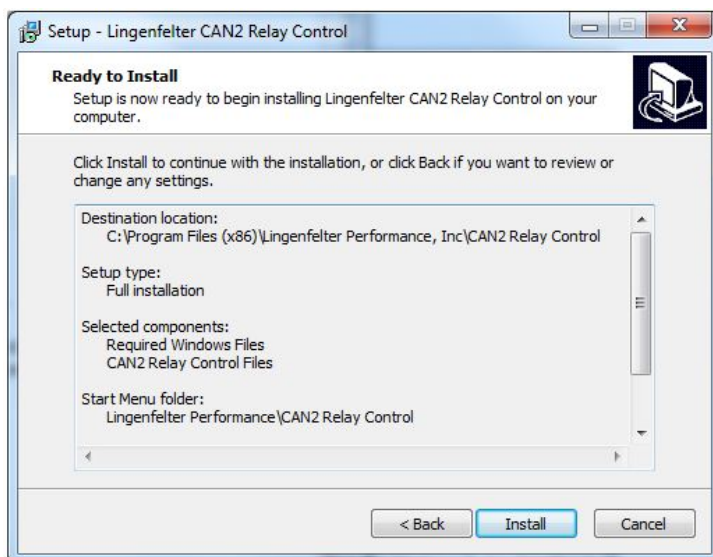
Click on "Next" to make your selection.

That will take you to the Select Additional Tasks window:



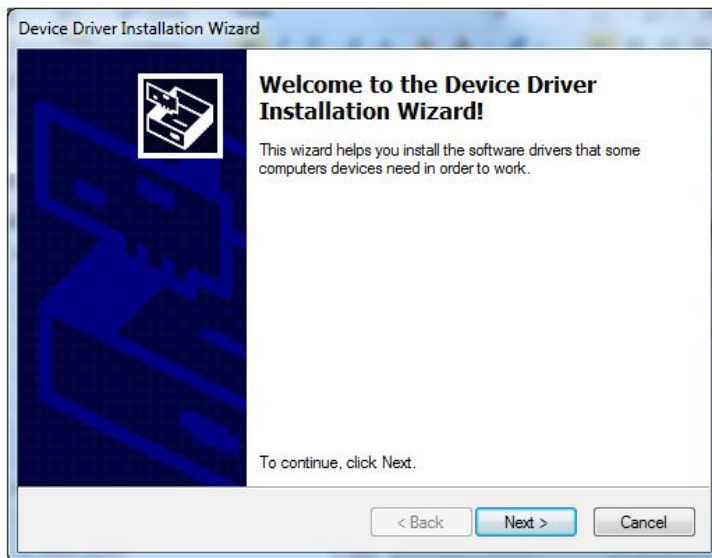
If you would like the installation to add a desktop icon for the CANR software, click on the checkbox next to the option. If you do not want the desktop icon, leave the check box blank.

Now click "Next" to go to the Ready To Install window:

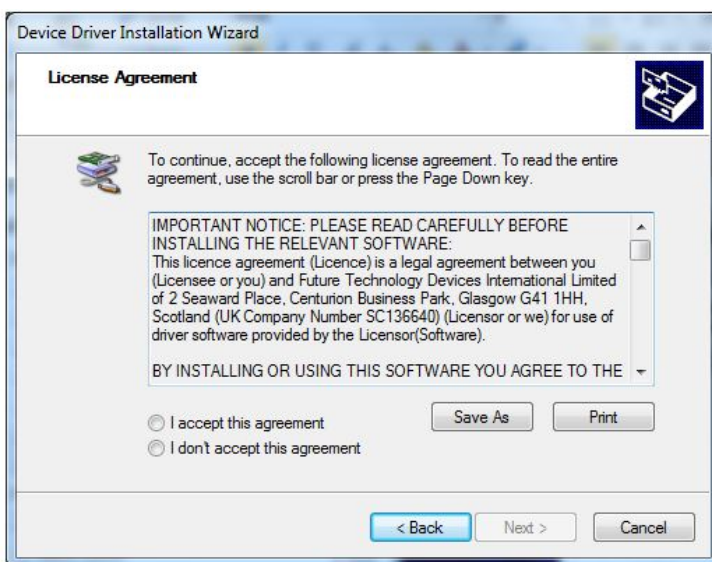


Confirm that the installation configuration is how you want it and then click on "Install" to begin the installation process.

After the software installation, it should now go to the window for Device Driver Installation Wizard:



Now click "Next" to go to the License Agreement window:



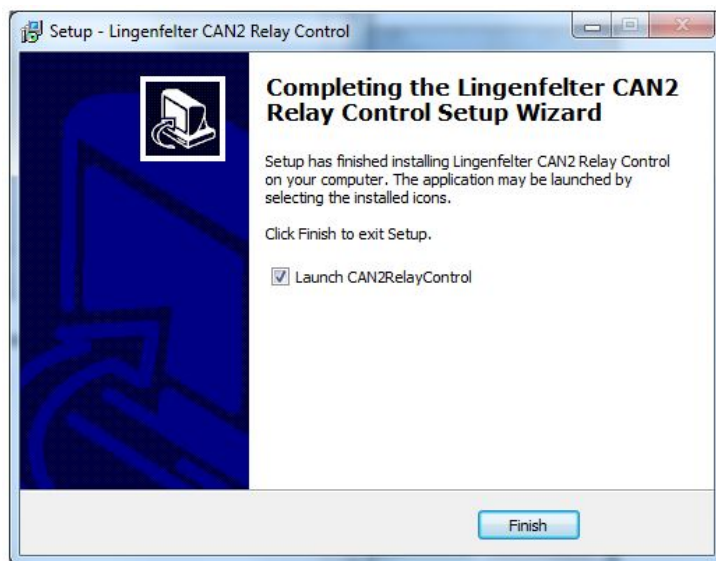
Read the license agreement. You can choose to print the license agreement or read the license agreement in the window. If you agree with the terms of the agreement, select "I accept this agreement."

Now click "Next" to complete the driver installation.

The following window will show the list of the drivers that have been installed.



Now click "Finish" to go to the window indicating installation has been completed:



It will default to Launch CANR. If you don't want to start the program when you click on the "Finish" button, uncheck the box next to "Launch CANR". Now click on the "Finish" button and your installation is complete.

3.2 Driver Install

On PC's running Windows 7 or Windows 8 the drivers should get installed automatically when you plug in the CANR-002 module.

On a PC running Windows XP, the first time you connect a CANR-002 module to your PC you will get the Windows found new hardware message:



and then the Found New Hardware Wizard will open:



Click the "No, not this time" check-box and then click Next and you will get to the following window:



Select "Install the software automatically" and click Next.



You will then get the following Windows Logo testing warning:



Click "Continue Anyway" to proceed.

The installation process will then continue:



You should then get the following window indicating the installation process is complete:



Click on the "Finish" button. Now at the lower right of your screen you should get a pop up window indicating your new hardware is ready to use:



The driver installation is now complete and you should be able to begin configuring the CANR-002 module.

4 Using the software

This section of the user manual will explain how to operate the CANR software in order to open a configuration file, read a configuration file from a CANR-002 module, save a configuration file and create a new configuration file.

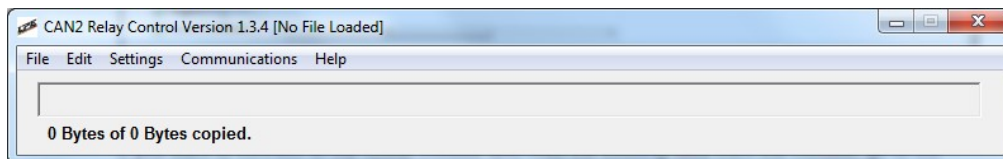
Note: in most fields in this software you must hit enter to make your change active so be sure to press the ENTER key after typing in values in the different user adjustable fields

4.1 Opening a file or connecting to the CAN2

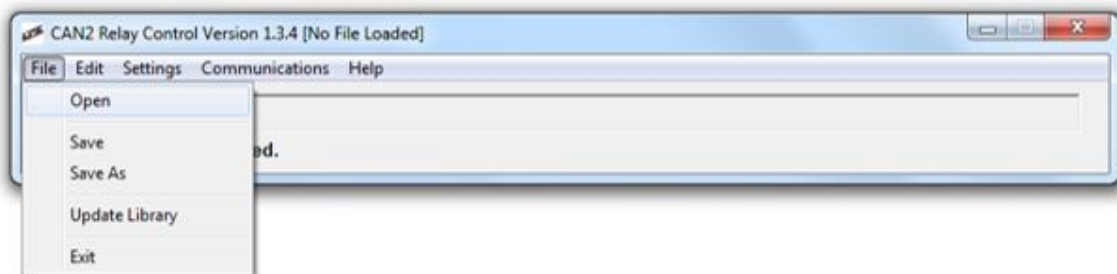
To run the CANR software, click on the CANR icon on your desktop (if you created one) or click on the CANR icon in the Start Menu under Lingenfelter Performance>CANR.



When you first open the software it will look like this with no file loaded. The software will indicate that no file is loaded by having "No File Loaded" listed in brackets after the software Version number at the top of the software window, as shown below:



If you want to open an existing file, go to the File menu option and select Open:

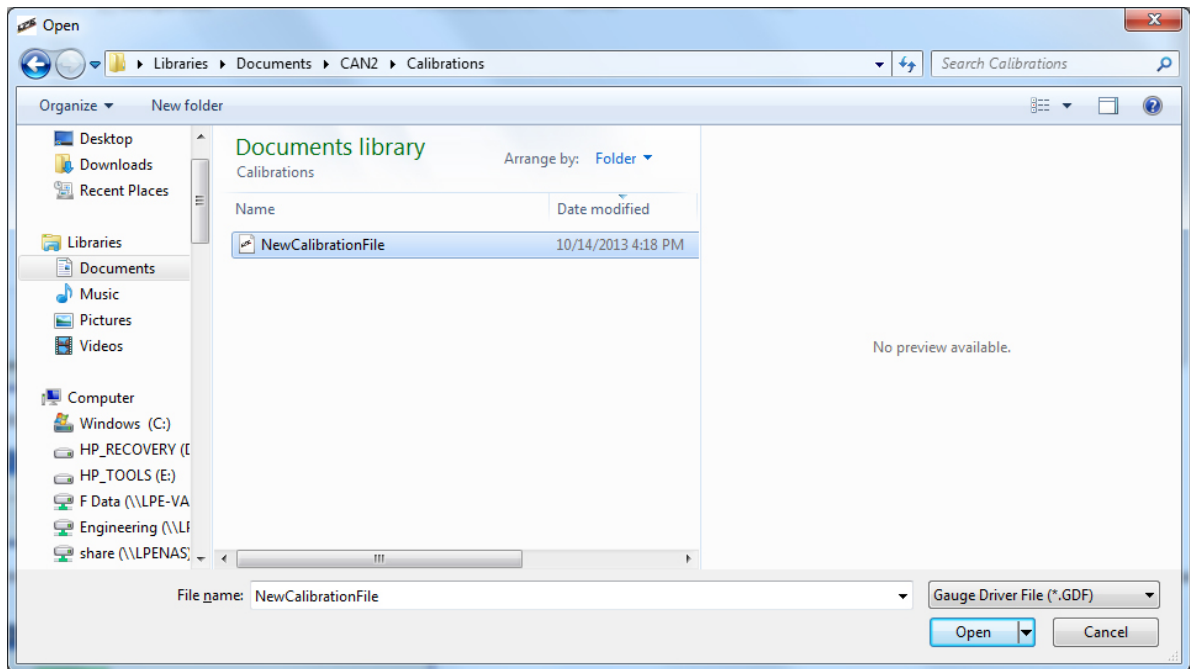


A sample file is included as part of the installation process. By default the sample file is saved in the folder:

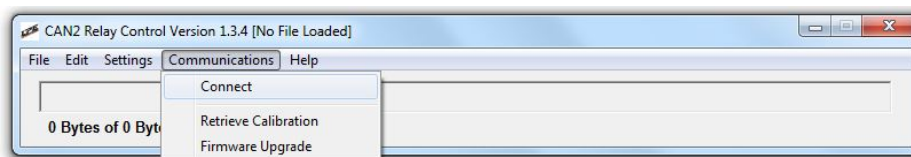
My Documents>CAN2 Relay Control>Calibrations [for Windows XP]
Documents>CAN2 Relay Control>Calibrations [for Windows 8]

This is also the recommended location for saving any files LPE or your LPE dealer may send you.

Select the file you want from the Open Window:



If you want to connect to the CANR module and read the existing data from the module, go to the Communications menu and select Connect:



The CANR software will then connect to the CANR-002 module and read the existing configuration from the module. The software will then show the settings for Output1 and will change to "Auto Retrieved File" in brackets after the software Version as shown:

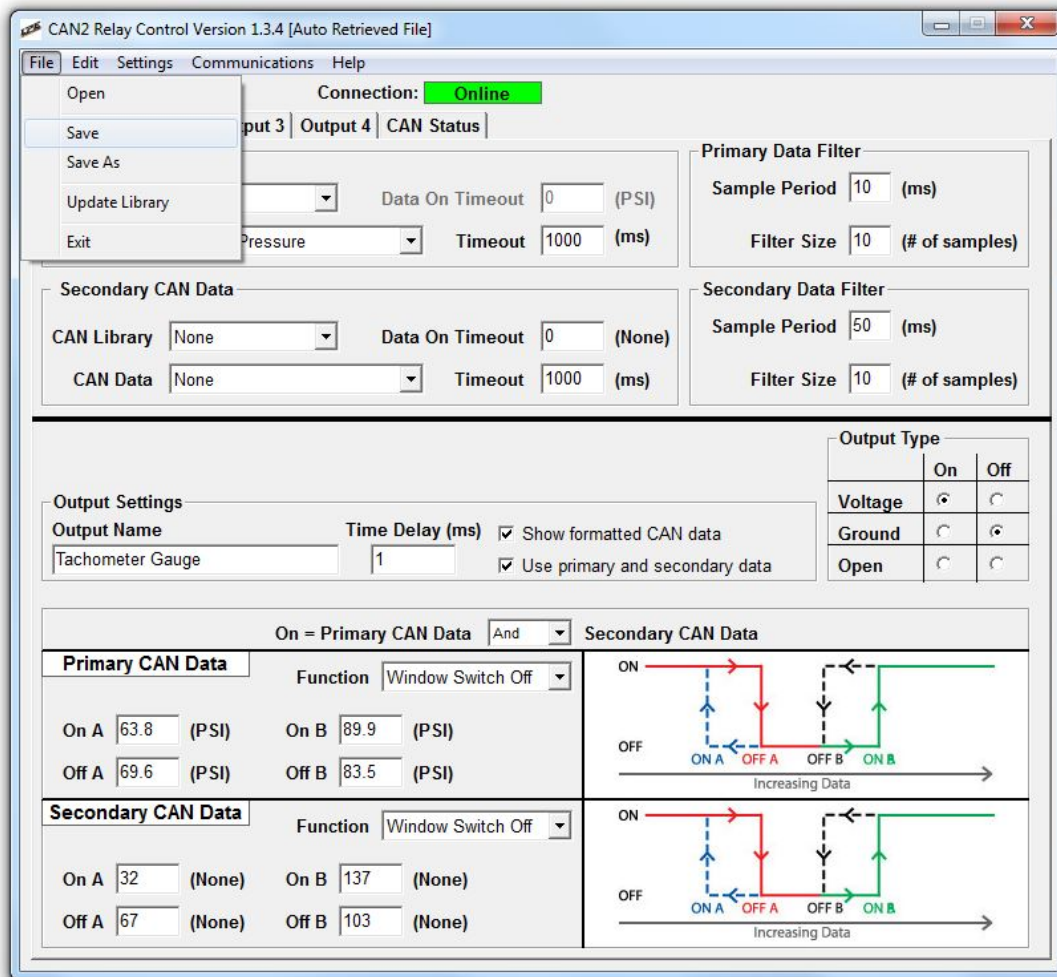
The screenshot shows the CAN2 Relay Control software interface. The title bar indicates "CAN2 Relay Control Version 1.3.4 [Auto Retrieved File]". The menu bar includes File, Edit, Settings, Communications, and Help. The status bar shows "Firmware Version: 5.5.4" and "Connection: Online".

The interface is divided into several sections:

- Output Selection:** Output 1 is selected, with tabs for Output 2, Output 3, Output 4, and CAN Status.
- Primary CAN Data:**
 - CAN Library: GMLAN
 - CAN Data: E67 Oil Pressure
 - Data On Timeout: 0 (PSI)
 - Timeout: 1000 (ms)
- Secondary CAN Data:**
 - CAN Library: None
 - CAN Data: None
 - Data On Timeout: 0 (None)
 - Timeout: 1000 (ms)
- Primary Data Filter:**
 - Sample Period: 100 (ms)
 - Filter Size: 10 (# of samples)
- Secondary Data Filter:**
 - Sample Period: 50 (ms)
 - Filter Size: 10 (# of samples)
- Output Settings:**
 - Output Name: Oil Pressure
 - Time Delay (ms): 1
 - ☒ Show formatted CAN data
 - ☒ Use primary and secondary data
- Output Type:**

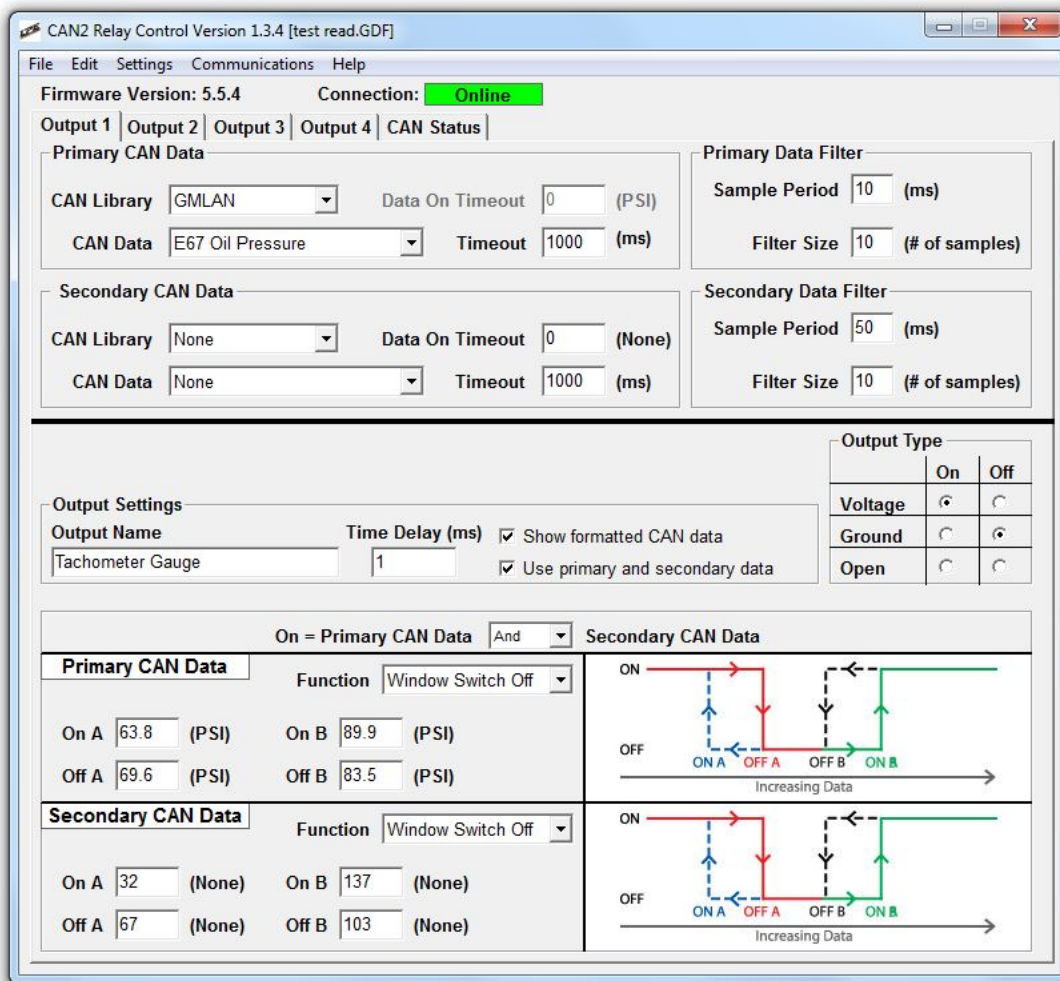
	On	Off
Voltage	<input checked="" type="radio"/>	<input type="radio"/>
Ground	<input type="radio"/>	<input checked="" type="radio"/>
Open	<input type="radio"/>	<input type="radio"/>
- Logic Configuration:**
 - On = Primary CAN Data And Secondary CAN Data
 - Primary CAN Data:**
 - Function: Window Switch Off
 - On A: 63.8 (PSI)
 - On B: 89.9 (PSI)
 - Off A: 69.6 (PSI)
 - Off B: 83.5 (PSI)
 - Secondary CAN Data:**
 - Function: Window Switch Off
 - On A: 32 (None)
 - On B: 137 (None)
 - Off A: 67 (None)
 - Off B: 103 (None)
- Logic Diagrams:** Two diagrams show the logic for the output. The top diagram is for the Primary CAN Data, and the bottom diagram is for the Secondary CAN Data. Both diagrams show a red line for "ON" and a green line for "OFF", with arrows indicating the direction of data flow. The diagrams are labeled "ON A", "OFF A", "OFF B", and "ON B".

You should now save the file to your PC. Do so by going to the File drop down menu and selecting Save:



You will then be prompted to give the file a name. Be sure to confirm that the file is being saved in the folder location you are expecting it to be saved in.

Once you save the file then the filename will show up in the brackets after the software Version as shown:



As an indicator that you have modified the open file, if you make changes to the file, an asterisk (*) will be placed after the filename that is in brackets after the Version # at the top of the screen. The asterisk will remain until you save your changes.

If you try to exit the software or open a new file with unsaved changes the software will prompt you to save the changes prior to performing your requested action.

If you want to save the modified file with a different name as the original file, select the "Save As" command.

4.2 Key Elements of the CANR Software Interface

In this section we will go over the key elements of the CANR software.

The program window has three primary sections:

- Menu options (at the top)
- Configuration for the input signals for Output1, Output2, Output3 and Output4 along with CAN status tab (above the solid horizontal black line)
- Output configuration for the output relay settings (below the black line)

4.2.1 Menu Options



As shown above, across the top of the program window you have the following drop down menus with the following options available:

- **File**
 - Open
 - Save
 - Save As
 - Update Library
 - Exit
- **Edit**
 - Copy
 - Paste
- **Settings**
 - Units
 - CAN Message Setup
- **Communications**
 - Connect
 - Set CAN Speed *[this option is not visible unless a file is open]*
 - Retrieve Calibration
 - Firmware Upgrade
- **Help**
 - About
 - Installation Manual

Menu option changes apply to the entire CANR-002 module so they are universal across all of the outputs.

The options within the **File**, **Edit** and **Help** drop down menus are fairly self explanatory other than the Update Library option.

The Update Library menu option under **File** is used to update the CAN message library. If new CAN messages have been added or you have requested a specific CAN message, LPE or your LPE dealer may send you an updated CAN message library file (Gauge Driver Message Library or ".GDF" file) and then you would use this menu option to import that file.

The **Settings** and **Communications** drop down menus are explained in more detail in the following sub-sections.

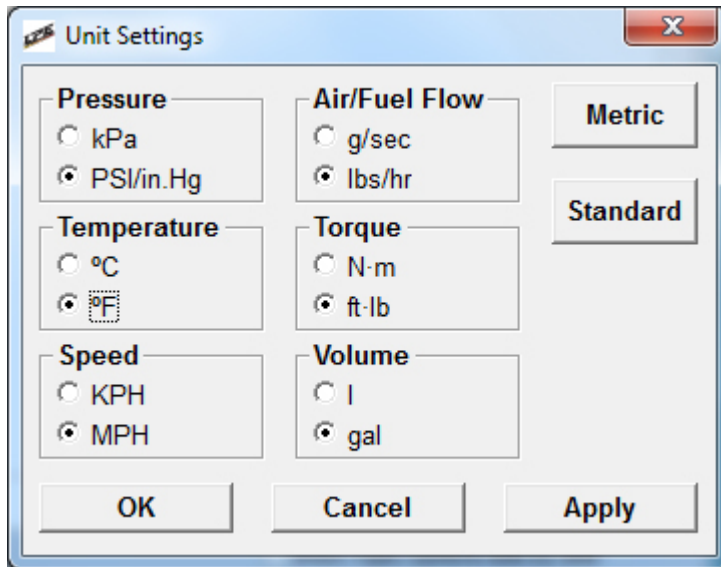
4.2.1.1 Settings Menu

The settings menu has two options:

- Units
- CAN Message Setup

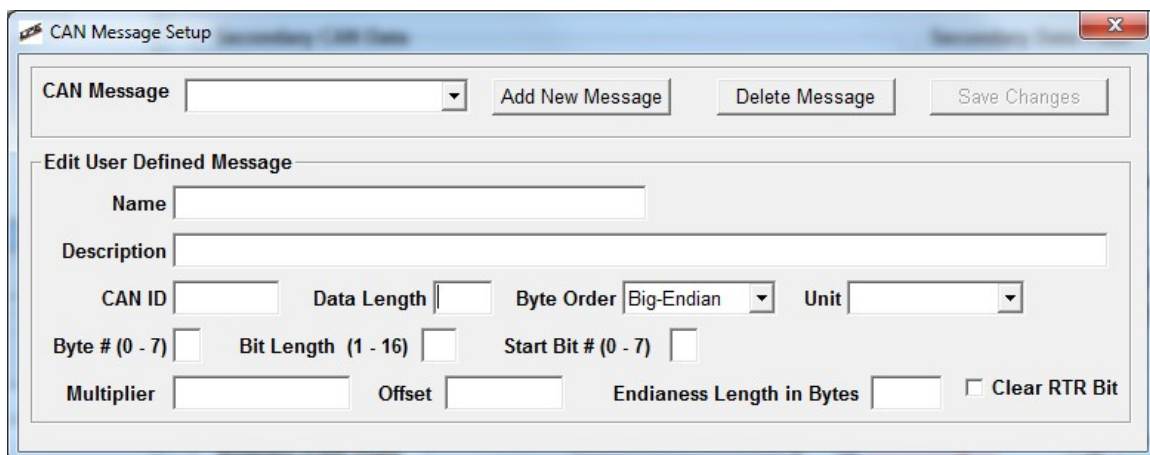
4.2.1.1.1 Unit Settings

The Units option is used to select the desired units for all of the outputs. These settings apply to all four tabs.

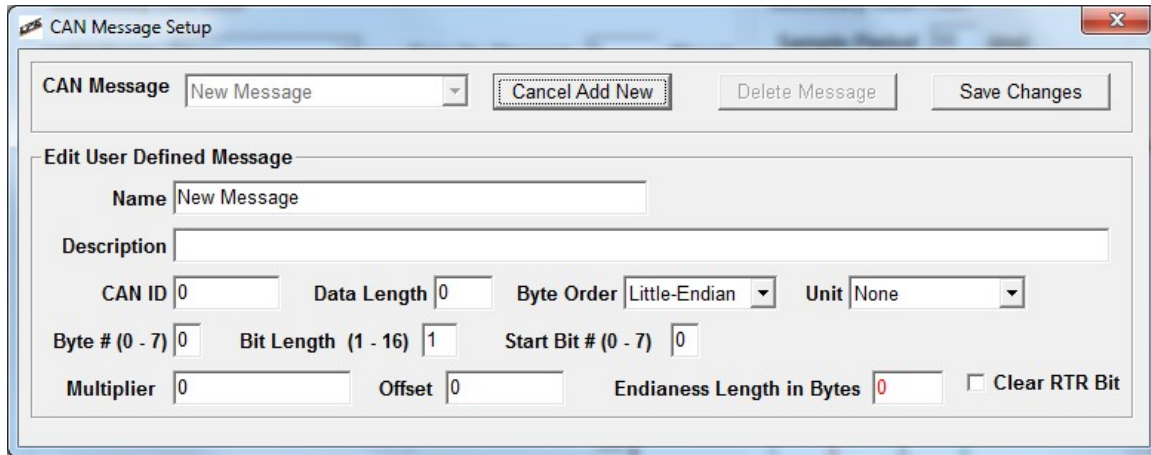


4.2.1.1.2 CAN Message Setup

The CAN Message Setup option is for advanced users. This section allows users to manually configure new CAN messages. The CAN Message Setup window appears as follows:



To create a new CAN message, click on the "Add New Message" button:



When you do this the data entry areas in the bottom part of the window will become accessible (no longer grayed out).

You can now manually enter the CAN message details in the "Edit User Defined Message" area. By default the name "New Message" will be assigned to the message. We recommend that you name this something unique to this CAN message. In the "Description" field you may want to add details about what vehicle model years this CAN message information applies to.

The remaining fields are as follows:

- CAN ID
- Data Length
- Byte Order
- Unit
- Byte # (0-7)
- Bit Length (1-16)
- Start Bit # (0-7)
- Multiplier
- Offset
- Endianess Length in Bytes

Enter these values for your new CAN message and then click on the "Save Changes" button at the top of the window.

If you don't want to save the new CAN message, click on "Cancel Add New".

The "Clear RTR Bit" check box at the bottom right of the screen is primarily for use with the MEFI5a ECM in some applications where the exact J1939 protocol has not been followed by the OEM manufacturer. In most cases this check box should be left alone.

You will need to determine the values for CAN ID and other variables based on manufacturer supplied data or by reverse engineering the data using one of the CAN interface cables mentioned at the beginning of this manual. Here is an example of what the logged CAN data may look like:

```

; Message Number
; | Time Offset (ms)
; | Type
; | ID (hex)
; | Data Length Code
; | Data Bytes (hex) ...
; |
; +---+ +---+ +---+ +---+ + + + + + + + + + +
; 1) 1.4 Rx 00AA 8 29 80 32 CB 02 4D 34 00
; 2) 1.6 Rx 00BE 6 00 FE 00 00 01 02
; 3) 1.9 Rx 00C9 8 00 00 00 00 00 01 18 00
; 4) 2.0 Rx 00D3 2 29 7A
; 5) 2.2 Rx 018E 8 03 03 00 63 46 34 06 34

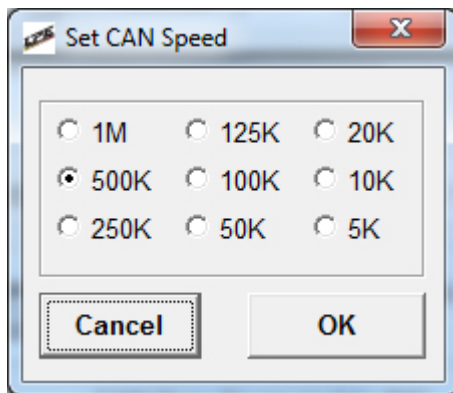
```

4.2.1.2 Communications Menu

The Communications Menu is used to connect to the CANR-002 module and to set the speed of the CAN network on the CANR-002 module.

Selecting the "Connect" option from the menu will cause the CANR software to attempt to connect with the CANR-002 module. This same function can be performed by clicking on the red "Offline" box after the "Connection:" text in the upper right corner of the main software window. Disconnecting from the CANR-002 module can also be performed from the drop down menu or by clicking on this same button (when it is green and connected). If no module is connected an error message will be reported to the user.

The "Set CAN Speed" menu option is used to configure the speed of the CAN network you are connecting the CANR-002 module to.



This setting **MUST** be configured correctly or the CANR-002 module will not function correctly. This setting, like the other menu option settings, is universal and applies to the entire CANR-002 module (not per output).

Most vehicle CAN networks, including Highspeed two wire GMLAN, operate at 500K. Most J1939 networks operate at 250K. If you are not certain what setting to use, contact LPE or your LPE dealer.

4.2.2 CANR-002 Connection Information

At the top of the software window is the connection status information. This area is used to indicate the connection status of the software to the CANR module via the USB cable.

The screenshot shows the 'CAN2 Relay Control Version 1.3.4 [Auto Retrieved File]' window. At the top, the 'Connection' status is 'Online' in a green box. Below this are tabs for 'Output 1', 'Output 2', 'Output 3', 'Output 4', and 'CAN Status'. The 'Primary CAN Data' section shows 'CAN Library' as 'GMLAN', 'Data On Timeout' as '0 (PSI)', 'CAN Data' as 'E67 Oil Pressure', and 'Timeout' as '1000 (ms)'. The 'Primary Data Filter' section shows 'Sample Period' as '100 (ms)' and 'Filter Size' as '10 (# of samples)'. The 'Secondary CAN Data' section shows 'CAN Library' as 'None', 'Data On Timeout' as '0 (None)', 'CAN Data' as 'None', and 'Timeout' as '1000 (ms)'. The 'Secondary Data Filter' section shows 'Sample Period' as '50 (ms)' and 'Filter Size' as '10 (# of samples)'. The 'Output Settings' section shows 'Output Name' as 'Oil Pressure', 'Time Delay (ms)' as '1', and checkboxes for 'Show formatted CAN data' and 'Use primary and secondary data'. The 'Output Type' table shows 'Voltage' selected, 'Ground' selected, and 'Open' unselected. The 'On = Primary CAN Data And Secondary CAN Data' section shows 'Function' as 'Window Switch Off'. The 'Primary CAN Data' table shows 'On A' as '63.8 (PSI)', 'On B' as '89.9 (PSI)', 'Off A' as '69.6 (PSI)', and 'Off B' as '83.5 (PSI)'. The 'Secondary CAN Data' table shows 'On A' as '32 (None)', 'On B' as '137 (None)', 'Off A' as '67 (None)', and 'Off B' as '103 (None)'. Two diagrams show the output logic for 'Increasing Data'.

Output Type		
	On	Off
Voltage	<input checked="" type="radio"/>	<input type="radio"/>
Ground	<input type="radio"/>	<input checked="" type="radio"/>
Open	<input type="radio"/>	<input type="radio"/>

On = Primary CAN Data		And		Secondary CAN Data	
Function: Window Switch Off					
On A	63.8 (PSI)	On B	89.9 (PSI)		
Off A	69.6 (PSI)	Off B	83.5 (PSI)		
Primary CAN Data		Secondary CAN Data			
On A	32 (None)	On B	137 (None)		
Off A	67 (None)	Off B	103 (None)		

After the "Connection:" text is a box that will be red and indicate "Offline" when the CANR-002 is not connected and will be green and show "Connected" when the CANR-002 module is connected.

You can also use this to connect or disconnect from the CANR-002 module. When you are connected you can click on the green box to disconnect. When you are disconnected you can click on the red box to connect. This performs the same function as going to the drop down menu under "Communications" and using the "Connect" option.

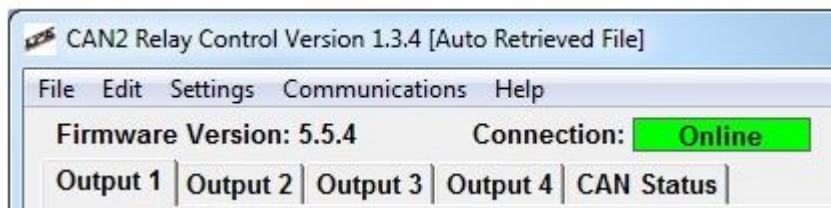
When you are connected to the CANR-002 module it will also show you the firmware level of the CANR-002 module. This will be listed after the text "Firmware Version:".

4.2.3 Output Tabs

The CANR-002 module can provide up to four outputs. The programming of the CAN signal each output will use and what it will do with that signal is configured using the four Output tabs found at the top of the software window, just below the drop down menu items. These tabs are labeled:

- Output 1
- Output 2
- Output 3
- Output 4

The output tabs are shown below:



Note: before beginning to configure the Outputs you MUST make sure you have set the CAN network speed from the Communications menu.

Within each Output tab is an upper and lower section divided by a solid black line.

- Above the line relates to the configuration of the CAN data being read into the CANR-002 module for that particular output channel.
- Below the line relates to the configuration of the output signal for the data to your relay.

In the upper area you have two sections, "Primary CAN Data" and "Secondary CAN Data".

In the "Primary CAN Data" area you have the following selections:

- CAN Library
- CAN Data
- Data On Timeout (units vary with variable)
- Timeout (milliseconds, ms)

The "CAN Library" menu allows you to select from the existing groups of CAN signals. The current options are:

- None
- GMLAN
- J1939
- MEF15A
- User Defined

None should be selected if you aren't using that output.

GMLAN should be selected when connecting to most GM vehicles.

J1939 should be selected when connecting to marine, heavy duty track, bus and other off-road and agricultural/industrial vehicles.

MEF15A should be selected when connecting marine vehicles.

User Defined should be selected when you want to use variables you have already defined yourself from the "CAN Message Setup" menu option.

Each CAN network should only have one CAN profile so all of the outputs should have the same CAN library selected unless you have created user defined variables for that same type of CAN network. For example, all of your variables should be from the GMLAN library if you are connected to a GM vehicle.

Once you have selected a CAN Library then the predefined CAN variables that have been identified by LPE will be shown in the CAN Data selection menu.

For example, if you have selected GMLAN, the list of variables currently available includes:

- AC Pressure
- Accelerator Pedal
- Battery Voltage
- Brake Pedal Position AT1
- Brake Pedal Position AT2
- Clutch Pedal Position
- Commanded Fan %
- Current Gear Position
- E40 Coolant Temperature
- E40 Engine RPM
- E40 Intake Air Temp
- E40 Oil Pressure
- E40 Oil Temperature
- E40 Vehicle Speed
- E67 Coolant Temperature
- E67 Engine RPM
- E67 Intake Air Temp
- E67 MAP 1
- E67 MAP 2
- E67 Oil Pressure
- E67 Oil Temperature
- E67 Vehicle Speed
- E92 TPS
- Engine Coolant Temp
- Engine RPM
- Ethanol Fuel %
- Gear Requested
- Intake Air Temperature
- Left Front Wheel Speed
- Left Rear Wheel Speed
- Mass Air Flow
- Oil Pressure
- Oil Temperature
- PRNDL
- Right Front Wheel Speed
- Right Rear Wheel Speed
- T43 Driveshaft RPM
- T76 Driveshaft RPM
- Throttle Position
- Vehicle Speed
- **More to be added**

[NOTE - variable naming convention to be updated. Currently ECM/TCM based grouping. Note E92, E67, and E38 share most parameters.]

Not every variable is broadcast and different vehicle model years and platforms may broadcast the same data at a different address. If the variable you are looking for doesn't show up under one variable name, try one of the other variables of the same description. If you are still not able to obtain the variable you need, contact LPE or your LPE dealer.

Once you have selected the CAN Library and the CAN Data for this particular output, the next value you must enter is the "Data On Timeout" value. This is the value you want the CANR-002 module to transmit when no data is received from the CAN bus.

The entry is the "Timeout" value. This is the length of time that the CANR-002 module should wait for data before it considers a timeout event to have occurred and for it to display the "Data On Timeout" value. For most applications this will be 1000 ms (1second).

To the right of the window you also have the subsection "Primary Data Filter" with the following selections:

- Sample Period (milliseconds, ms)
- Filter Size (# of samples)

The "Sample Period" is the time between samples in milliseconds. The larger this value the less often the data is updated. The smaller this value the more often the data is updated. Most variables will default to a 50 ms sample period. 50 ms is 20 times a second (20 Hz) since $1000 \text{ ms} = 1 \text{ second}$ and $1000/50 = 20$. Be aware that this is only how often the CANR-002 module reads the data and does not determine how often the transmitting device is updating the data. It is possible to read the data more often than it is being updated and then you would just get the same value repeated.

The "Filter Size" is the number of samples the CANR-002 module averages before updating the output data. If the filter size is set to 1 then no filtering exists and the CANR-002 module outputs each new value it reads from the CAN network (at the sample period selected in the previous section).

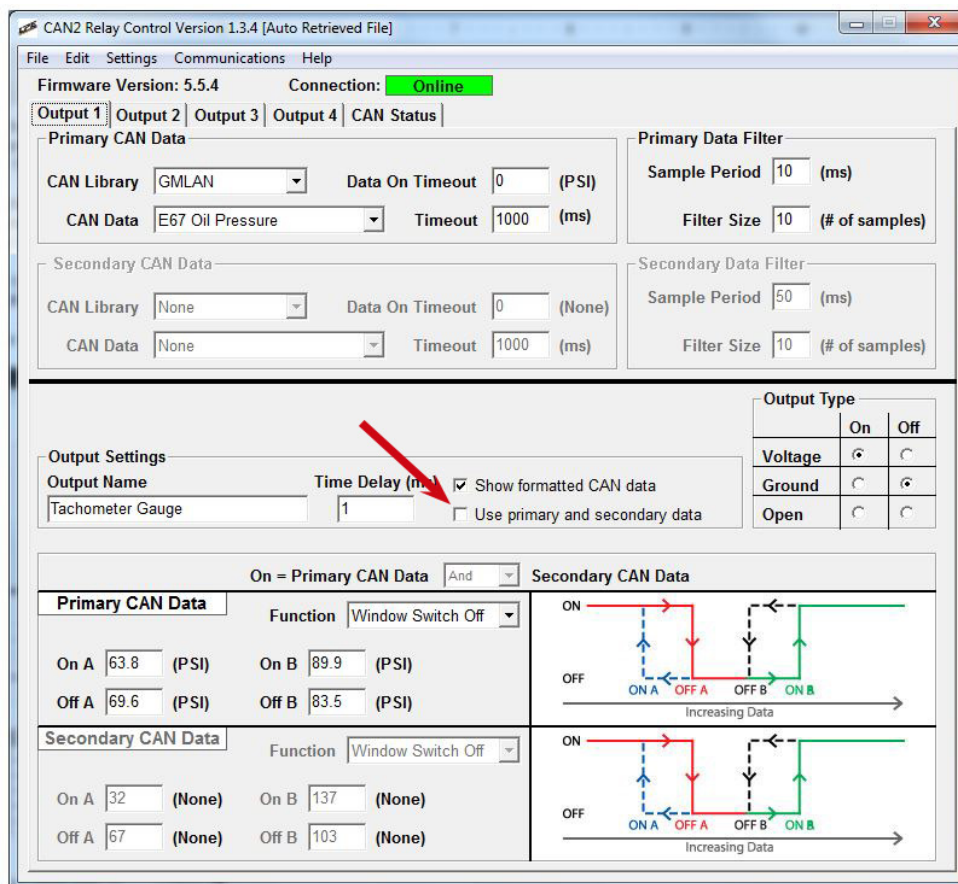
If you have a value of 10 listed for the filter size then the CANR-002 module averages the ten samples together and then reports that average value as the new output. Small filter values will tend to make the output fluctuate. Large filter values will tend to make the output slow to respond to sudden changes. If you have 10 for a filter and 50 ms for a sample period then the CANR-002 module will take the average of 10 samples, 50 ms apart each and then report a new value so the output will be updated every 500 ms (half a second) since $50 \text{ ms} \times 10 = 500 \text{ ms}$.

The CANR-002 module allows you to assign a secondary CAN variable to each output in case the primary output does not exist on that vehicle type or for some other reason the primary variable may not always exist. When the Secondary CAN Data is selected, if a timeout occurs on primary data (it reaches your "Timeout" value without receiving data for that variable) then, instead of transmitting the "Data On Timeout" value for the Primary CAN Data it would then look for the Secondary CAN Data value and transmit that value if it exists. If the Secondary CAN Data times out then the Data On Timeout from the Secondary CAN Data is used. When Secondary CAN Data is selected the Data On Timeout for the Primary CAN Data is not used.

The primary and secondary data should be the same type of variable with the same units (both engine coolant temperature variables, for example). You would probably not want the CANR-002 module to read oil pressure if operating a relay which requires a coolant temperature reading.

The secondary output can be used in conjunction with the primary output

By default only the Primary CAN Data is active. If you want to enable the secondary CAN data you must click the check box to the left of the "Use primary and secondary data" as shown by the arrow below:

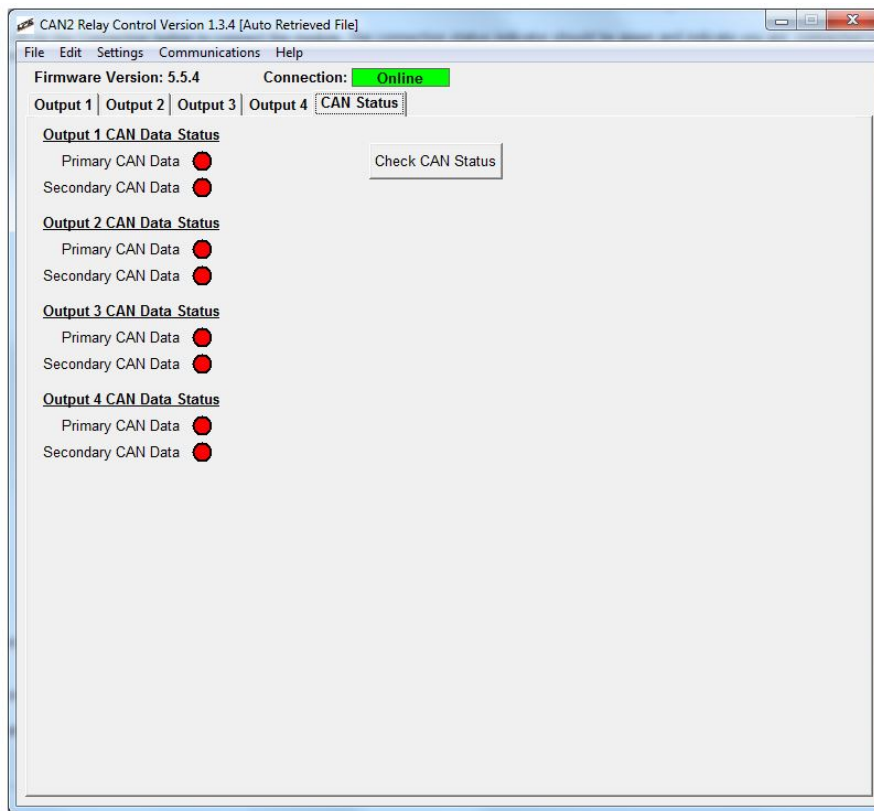


4.2.4 CAN Status Tab

Once you have entered the proper values in for the Primary CAN Data (and the Secondary CAN Data if applicable), you can now connect to the CAN network and see if the CAN data you have selected is being broadcast.

If the CANR-002 module is not connected to the PC, connect the two with the USB cable and click on the Connection button to connect the module. The connection status indicator should be green and indicate you are connected to the CANR-002 module (Online). Make sure the CANR-002 module is connected to the CAN bus then and that the network is powered up (ignition on).

Click on the CAN Status tab and you will be brought to this screen in the software:



Click on the "Check CAN Status" button.

The indicator circles after the primary and secondary for each output should now indicate if the selected CAN message is being broadcast and received by the CANR module. A red circle indicates that the selected CAN message is not being read. A green circle indicates the selected CAN message is being read by the CANR-002 module.

If none of your messages show up make sure you have a good CAN bus connection and that the connection speed is set correctly in the CANR module.

If some of your messages do show as valid but others don't then you are receiving CAN data but that particular message doesn't exist on the CAN bus at that address. Try a different variable of the same name. If that doesn't work contact LPE or your LPE dealer for additional assistance.

4.2.5 Output Signal Related Items

The lower half of main software window represents primarily output signal related items.

These items are:

- Output Name
- Time Delay
- Show formatted CAN data (check box)
- Use primary and secondary data (check box)
- Output Type
 - Voltage (on/off)
 - **Note: The CANR-002 is preconfigured to output a Ground/Open signal. If you wish to output a +5V signal, the DIP switch for that channel must be set to "Internal." If the voltage output is selected and the DIP switch is set to "External," the output will behave like an open output.**
 - Ground (on/off)
 - Open (on/off)
- And/ Or selection box
- Function
- Primary CAN Data
 - On A
 - Off A
 - On B (only visible when window switch mode is selected)
 - Off B (only visible when window switch mode is selected)
- Secondary CAN Data
 - On A
 - Off A
 - On B (only visible when window switch mode is selected)
 - Off B (only visible when window switch mode is selected)
- Relay digital display

When "and" is selected in the "On = Primary CAN Data and/or Secondary CAN data" selection box, both the primary and secondary CAN data conditions must be met in order to trigger the relay function. When "or" is selected, only one of the conditions must be met in order to trigger the relay function.

The function options for relay operation are:

- Simple off to on
- Simple on to off
- Window switch off
- Window switch on

The window switch option allows for the relay operation to be controlled within a specified range. For example: a relay may be used to activate nitrous at 120 MPH and deactivate the nitrous at 160 MPH.

4.2.5.1 Relay Outputs

To calibrate the Relay output you will need to make sure the following items have been taken care of:

- Installation and wiring of the CANR-002 module including power, ground, CAN hi/low and relay output wires.
- Have the the PC powered up with the CANR software running and connected to the CANR-002 module.
- Determine how you want your relay control logic to operate.

Once you have confirmed the above items, you can now begin to create a calibration for your new relay output.

Example 1:

- Ground side control of a relay to turn on at a desired engine coolant temperature (ECT) below a desired vehicle speed.
1. Make sure the CAN Data output settings are configured correctly (for the Primary and, if applicable, the Secondary CAN Data)
 - a. For a relay to be controlled by two variables the Secondary CAN data will need to be populated. For this example:
 - i. Coolant Temperature should be selected for your Primary CAN data
 - ii. Vehicle Speed should be selected as your Secondary CAN data
 2. Under **Output Settings**
 - a. Type a name for the output type in the "Output Name" field.
 - b. Enter a value in the Time Delay field.
 - i. For this example we will set it at 0 ms.
 - c. Make sure "Show formatted CAN data" is selected.
 - d. Make sure "Use primary and secondary data" is checked [for this example]
 - i. Required because we are using two CAN variables to control the output to the relay.
 3. Set the **Output Type** to the correct type your relay control logic
 - a. For this application it should be "Ground" On and "Open" Off.
 4. Select "And" in the "and/or" drop down for:
 - a. "On Primary CAN Data" And " Secondary CAN Data"
 5. Primary CAN Data configuration
 - a. For Function select Simple Off to On from the drop down menu
 - b. For On A enter 180 (degrees F)
 - c. For Off A enter 175 (degrees F)
 6. Secondary CAN Data configuration
 - a. For Function select Simple On to Off from the drop down menu
 - b. For On A enter 55 (MPH)
 - c. For Off A enter 60 (MPH)

The configuration screen should now look like this:

CAN2 Relay Control Version 1.3.4 [Auto Retrieved File]

File Edit Settings Communications Help

Firmware Version: 5.5.4 Connection: **Offline**

Output 1 | Output 2 | Output 3 | Output 4 | CAN Status

Primary CAN Data

CAN Library: GMLAN Data On Timeout: -40 (°F)

CAN Data: E67 Coolant Temperature Timeout: 1000 (ms)

Primary Data Filter

Sample Period: 10 (ms)

Filter Size: 10 (# of samples)

Secondary CAN Data

CAN Library: GMLAN Data On Timeout: 0 (MPH)

CAN Data: E67 Vehicle Speed Timeout: 1000 (ms)

Secondary Data Filter

Sample Period: 50 (ms)

Filter Size: 10 (# of samples)

Output Settings

Output Name: Time Delay (ms): 0

☒ Show formatted CAN data

☒ Use primary and secondary data

Output Type

	On	Off
Voltage	<input type="radio"/>	<input type="radio"/>
Ground	<input checked="" type="radio"/>	<input type="radio"/>
Open	<input type="radio"/>	<input checked="" type="radio"/>

On = Primary CAN Data And Secondary CAN Data

Primary CAN Data Function: Simple Off to On

On A: 180 (°F)

Off A: 175 (°F)

Secondary CAN Data Function: Simple On to Off

On A: 55 (MPH)

Off A: 60 (MPH)

ON OFF OFF ON Increasing Data

ON OFF ON OFF Increasing Data

In the above example the relay output would be off until the engine coolant temperature reached 180 degrees F. Once it achieved that temperature the relay output would be enabled as long as the vehicle speed remained below 60 mph. Once the vehicle speed exceeded 60 mph the output would turn off and would not turn back on again until the vehicle speed dropped below 55 mph. If the coolant temperature dropped to below 175 degrees F then the output would also be disabled and would not enable again until the temperature exceeded 180 degrees F. This example could be used to control a fan.

If you want to delay the relay output, use the "Time Delay (ms)" to provide this output delay. Keep in mind this value is in milliseconds (1000 ms = 1 second). The Time Delay delays both the activation and the deactivation (the On and the Off).

Be VERY careful on the "Output Type" settings in Relay Control. You can switch the logic from Normally Off to Normally On.

5 Notices & Warranty

NOTICES:

It is the responsibility of the purchaser to follow all guidelines and safety procedures supplied with this product and any other manufacturer's product used with this product. It is also the responsibility of the purchaser to determine compatibility of this device with the vehicle and other components. Lingenfelter Performance Engineering assumes no responsibility for damages resulting from accident, improper installation, misuse, abuse, improper operation, lack of reasonable care, or all previously stated reasons due to incompatibility with other manufacturer's products.

Limited Warranty:

LPE warrants the CANR-002 module to be free from defects in material and workmanship under normal use and if properly installed for a period of one year from date of purchase. If the module is found to be defective as mentioned above, it will be replaced or repaired if returned prepaid along with proof of date of purchase. This shall constitute the sole remedy of the purchaser and the sole liability of LPE. To the extent permitted by law, the foregoing is exclusive and in lieu of all other warranties or representations whether expressed or implied, including any implied warranty of merchantability or fitness. In no event shall LPE be liable for special or consequential damages.

Disclaimer:

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For additional product installation information and technical support, contact LPE or your LPE products distributor. You can also find technical support and usage discussions regarding this product and many other LPE products in our Internet forums:

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