neoVI FLEX

Vehicle Network Interface for FlexRay

User's Guide

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1 Introduction and Benefits

Thank you for purchasing a neoVI FLEX vehicle network interface for FlexRay. The neoVI FLEX is a cost-effective, compact tool that enables monitoring and interaction with FlexRay networks. Conveniently powered by USB, the neoVI FLEX includes two FlexRay nodes supporting the FlexRay Channel A and Channel B physical layers.

With the neoVI FLEX, you can:

- Monitor traffic on FlexRay networks.
- Transmit messages on FlexRay networks.
- Receive all FlexRay messages on the network, including those not configured to be accepted by the controller.
- Receive corrupted frames for analysis.
- Monitor the network with just a baud rate selection and no other configuration.
- Cold start the Flex Ray network using the two included FlexRay nodes.
- Time-sync activity between the neoVI FLEX and neoVI FIRE hardware.

2 Package Contents

Your neoVI FLEX package includes the following:

- The neoVI FLEX device.
- A data cable, consisting of a single female DB-26 connector on one end for the neoVI FLEX, and a pair of female DB-9 connectors to attach to a FlexRay network.
- An industry-standard USB 2.0 A/B cable to connect the neoVI FLEX to a PC or USB hub.

If anything is missing from your package, please contact Intrepid for prompt assistance using the information at the end of this guide. More information about how to attach the cables to your hardware is provided later in this document.

3 Overview of Features and Operation

We'll now briefly outline the neoVI FLEX's main features and overall operation. This short overview will help you better understand the design of the device and get the most of its capabilities.

Essential Features and Components

Here's a summary of the most important features and components of the neoVI FLEX:

- One complete FlexRay node for transmitting and receiving, and a second FlexRay node to allow starting a network with two startup nodes.
- A Fujitsu ASSP MB88121C FlexRay controller for each node, used to transmit FlexRay messages.
- Two NXP TJA1082 FlexRay transceivers for each node, for FlexRay Channels A and B.
- A XILINX Spartan 3A FPGA processor to receive FlexRay messages and forward them to the PC for analysis.
- Full support for device setup and transmission/reception of FlexRay messages within Intrepid's Vehicle Spy software.
- A high-Speed USB to SPI / Parallel FIFO converter that links the PC and the FlexRay processor and controllers.
- USB-powered operation, so no special power cable required.

Basic Functionality and Block Diagram

Figure 1 illustrates the interconnection of the main functional components of the neoVI Flex. The USB to SPI / Parallel FIFO Converter receives configuration information from a PC running Vehicle Spy, and conveys it to the FlexRay Message Processor and FlexRay controllers using SPI. The converter also forwards FlexRay frames from the FPGA using a separate Parallel FIFO line. Each of the two nodes has a controller connected to a FlexRay transceiver. The four transceivers are connected to the controllers, the central Message Processor, and the DB-26 external connector.

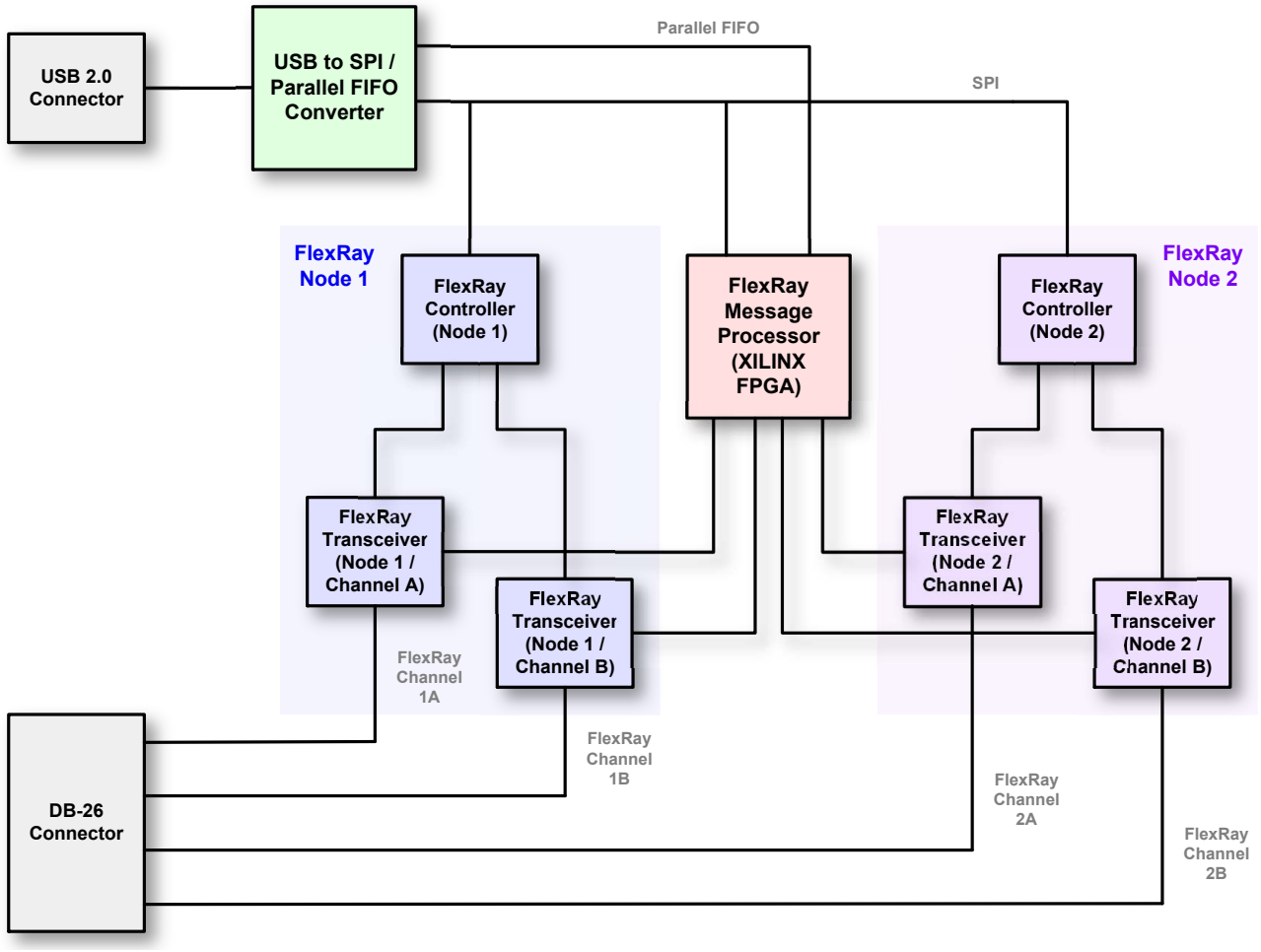

Figure 1: neoVI FLEX Block Diagram.

General Operation

The neoVI FLEX is configured before it is used by setting up appropriate databases and parameters within Vehicle Spy; we'll show examples of how this is done later in the guide. These settings are conveyed from VSpy to the converter in the neoVI Flex, and then passed on to the FlexRay controllers and FlexRay Message Processor FPGA using the SPI bus.

The settings sent to the FlexRay controllers dictate when and how they transmit FlexRay messages on the network. Each controller sends messages to one or both of the two transceivers attached to it, for Channel A or Channel B. The transceiver does the necessary low-level encoding of these messages and passes them on to the DB-26 connector where they will continue on to the connected network.

Data is received from the connected FlexRay network over the DB-26 connector and passes to the FlexRay transceivers for Node 1. From there, messages travel to the FlexRay Message Processor and are sent to the converter over the Parallel FIFO link to Vehicle Spy.

Figure 2 shows in graphical form a summary of the overall operation of the device, including the data flows described above. One purpose of this figure is to demonstrate that the flow of data within the device is asymmetric—data is transmitted from the neoVI FLEX using the FlexRay controllers for each node, while data received by the neoVI FLEX goes through the FPGA chip. This design provides several benefits:

- It allows the neoVI FLEX to receive all messages on the network, not just the ones that the controller was configured to receive.
- It ensures that even corrupted frames can be captured and analyzed.
- It means you can monitor the network with only the baud rate set and no other configuration.

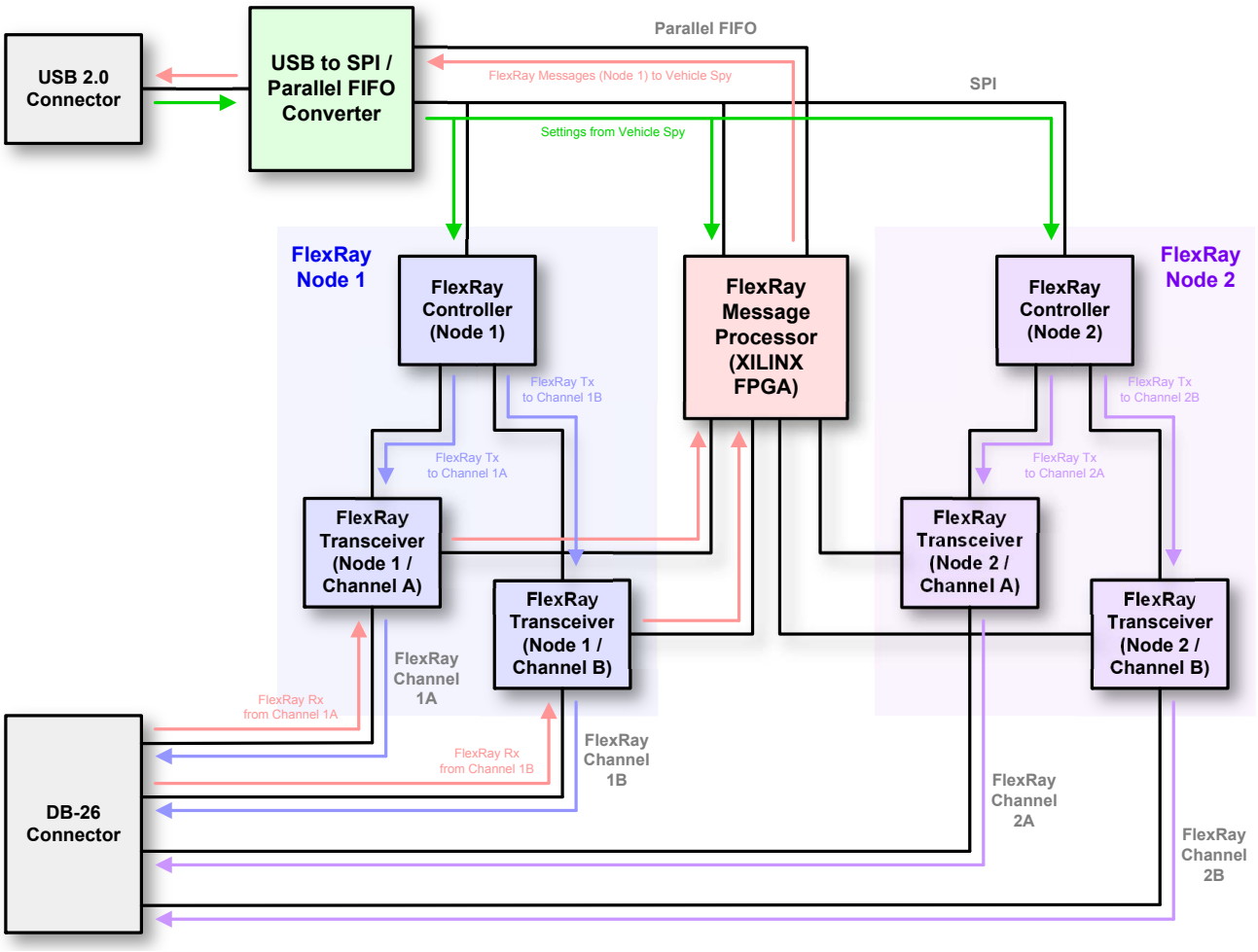

Figure 2: neoVI FLEX Data Flow Diagram. Settings and configuration information come from the PC over the USB connection, through the converter, and are sent over SPI to program the FlexRay Controllers and Message Processor FPGA (green arrows). Data is transmitted by the FlexRay Controllers (blue and purple arrows), through the Transceivers to the DB-26 connector, where they pass to attached FlexRay network. Messages received from the FlexRay network through the connector (red arrows) pass to the Transceivers for Node 1, then to the FPGA. From there, they pass over the Parallel FIFO link to the converter, the USB connector, and the PC.

4 Description of neoVI FLEX Interfaces and Indicators

Let's now take a tour of the neoVI FLEX, examining its external components and explaining what each does. The device is a simple one, so this will be a relatively short journey!

Like many Intrepid products, the neoVI FLEX is designed so that all of its interfaces are located on its sides, making the device easier to use in cramped quarters. We'll refer to these as the *left side* and *right side* of the unit, as seen when facing the device with its name readable in normal orientation. Notice the small PC and car icons on the top of the neoVI FLEX pointing to the left side, where the main interfaces can be found.

Left Side

On this side of the neoVI FLEX we find two connectors and four LEDs (Figure 3).

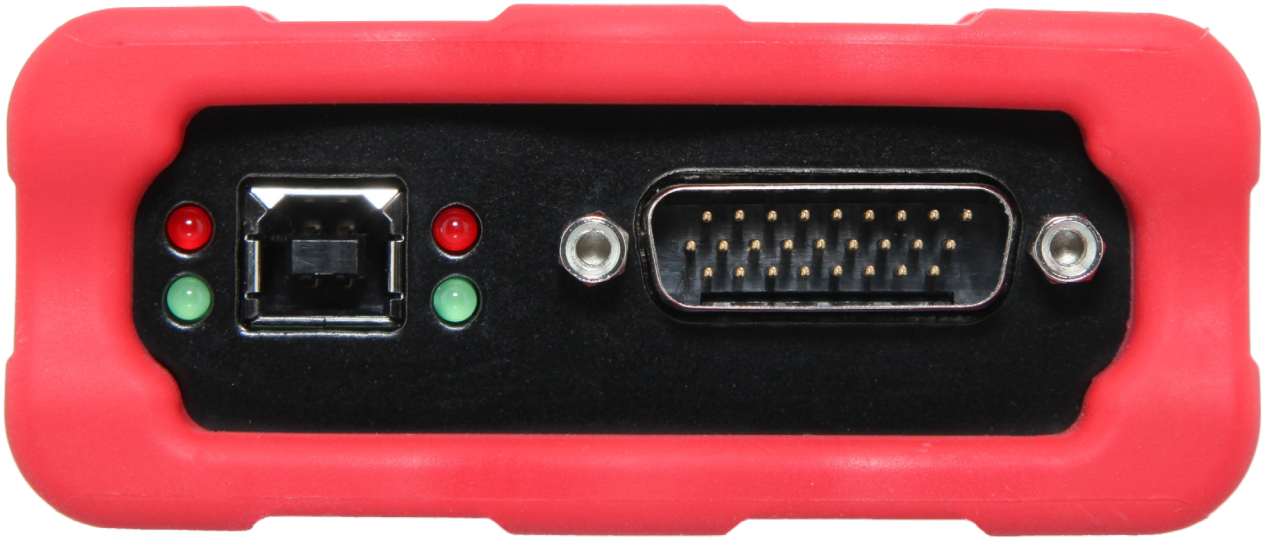

Figure 3: Left Side of neoVI Flex. On the left, a USB "B" connector, and on the right, a DB-26 connector. Four LEDs surround the USB connector: two red above and two green below.

Connectors

The two connectors are as follows:

- **DB-26 Connector:** This male 26-pin D-subminiature connector carries FlexRay data between the neoVI FLEX and the attached network.
- **USB 2.0 Type B Connector:** A USB "B" connector, which is the industry standard receptacle for USB connections on devices.

LEDs

Surrounding the USB port are a set of four LEDs, two red and two green. Here's a description of each and how it is used:

- **FPGA LED (Red, Top Left):** Lights solidly to indicate that the FlexRay Message Processor FPGA is active. The LED blinks while the FPGA is running with Vehicle Spy online.
- **Power LED (Red, Top Right):** Lights solid while the neoVI FLEX is powered.
- **Transmit LED (Green, Bottom Left):** Flickers when the neoVI FLEX is transmitting FlexRay frames.
- **USB LED (Green, Bottom Right):** Illuminates while USB communication is active with Vehicle Spy online.

Note that the *Transmit LED* indicator may flicker so quickly that its flashing is not visible to the naked eye; instead it may just appear to be lit solidly, but dim. It is also valid only when the *FPGA LED* is blinking.

Right Side

This side of the device (Figure 4) contains a single DB-9 female connector, which is currently reserved for future use in hardware synchronization.

Figure 4: Right Side of neoVI Flex. This side of the device contains just a single female DB-9 connector, reserved for future use.

5 Hardware and Software Requirements

Only a small amount of support hardware and software is required to effectively use the neoVI FLEX:

- A FlexRay network to which the neoVI FLEX can be connected.
- A PC with a free USB 2.0 or 3.0 port. You can also use a USB hub connected to a PC.
- Intrepid Vehicle Spy 3 Professional software, version 3.7.1 or later.

Intrepid's Vehicle Spy software contains special configuration and control features designed to work with the neoVI FLEX. Please contact Intrepid Control Systems for more information on licensing Vehicle Spy.

6 Connector Pinouts

Like all Intrepid hardware devices, the pinouts for the neoVI FLEX's connectors are printed on the bottom of the device so they are always at hand if you need to refer to them (Figure 5).

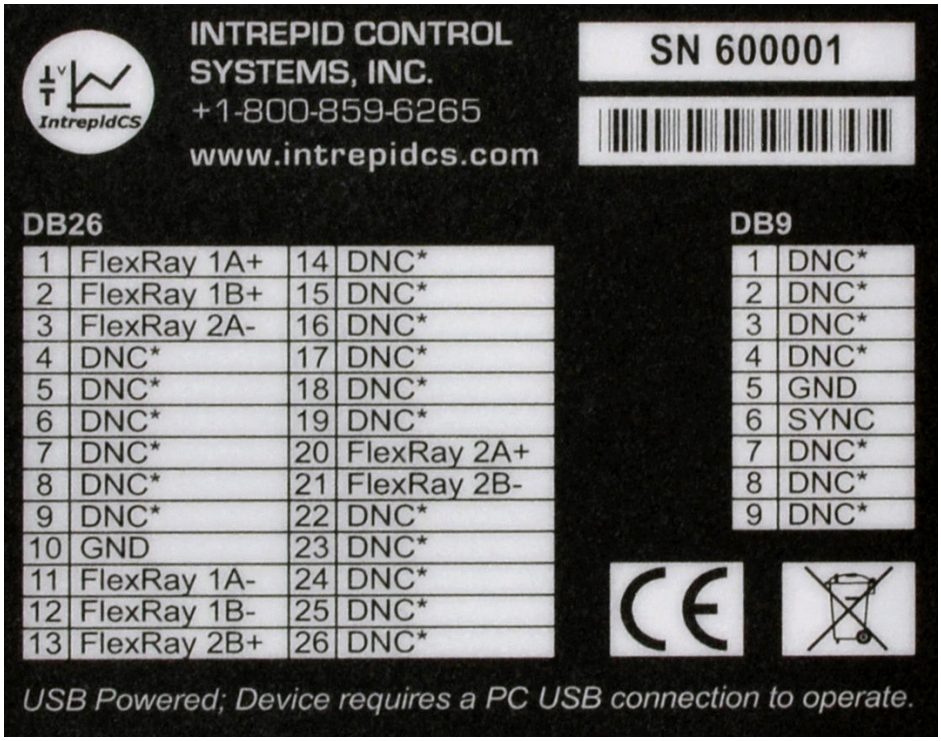

Figure 5: Bottom label of neoVI FLEX showing connector pinouts.

DB-9 and USB Connectors

The USB port is industry-standard. The DB-9 connector on the neoVI FLEX is not used at this time, though its planned future pinout can also be seen in Figure 5.

DB-26 Connector

A list of pin assignments for the DB-26 cable can be found in Table 1, with pin numbering for the connector illustrated in Figure 6.

Pin #	Label	Description
1	FlexRay 1A+	FlexRay Node 1, Channel A, positive
2	FlexRay 1B+	FlexRay Node 1, Channel B, positive
3	FlexRay 2A-	FlexRay Node 2, Channel A, negative
4	DNC*	No connection
5	DNC*	No connection
6	DNC*	No connection
7	DNC*	No connection
8	DNC*	No connection
9	DNC*	No connection
10	GND	Ground
11	FlexRay 1A-	FlexRay Node 1, Channel A, negative
12	FlexRay 1B-	FlexRay Node 1, Channel B, negative
13	FlexRay 2B+	FlexRay Node 2, Channel B, positive
14	DNC*	No connection
15	DNC*	No connection
16	DNC*	No connection
17	DNC*	No connection
18	DNC*	No connection
19	DNC*	No connection
20	FlexRay 2A+	FlexRay Node 2, Channel A, positive
21	FlexRay 2B-	FlexRay Node 2, Channel B, negative
22	DNC*	No connection
23	DNC*	No connection
24	DNC*	No connection
25	DNC*	No connection
26	DNC*	No connection

Table 1: neoVI FLEX DB-26 Jack Pinout.

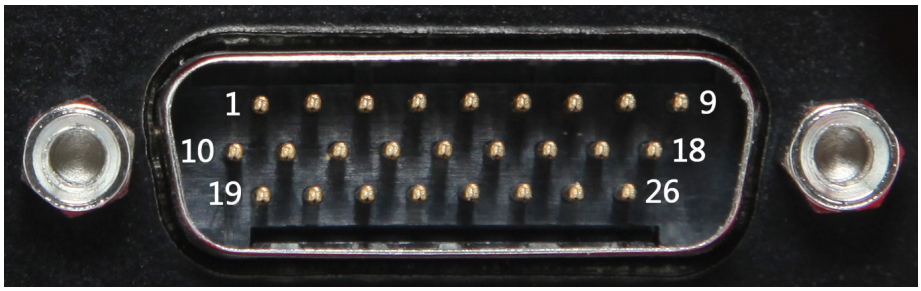

Figure 6: neoVI FLEX DB-26 Jack and Pin Numbering.

Data Cable DB-9 Connectors

The data cable attaches to the neoVI FLEX DB-26 jack in Figure 6, and breaks out to a pair of DB-9 female connectors. A photograph of one of these can be seen in Figure 7, and a list of pin assignments for Connector #1 and Connector #2 can be found in Table 2 and Table 3.

Note that you can differentiate between the two DB-9 connectors on the cable through the white bands on them, which are labeled "1" and "2".

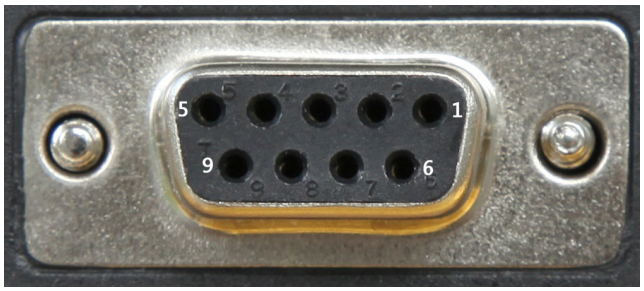

Figure 7: Data Cable DB-9 Connector. Note that the pin numbers are actually imprinted right on the connectors, but they can be hard to see, so we have labeled the edge pin numbers here.

Pin #	Name	Description
1	N/C	No connection
2	FlexRay 1A-	FlexRay Node 1, Channel A, negative
3	GND	Ground
4	FlexRay 1B-	FlexRay Node 1, Channel B, negative
5	N/C	No connection
6	GND	Ground
7	FlexRay 1A+	FlexRay Node 1, Channel A, positive
8	FlexRay 1B+	FlexRay Node 1, Channel B, positive
9	N/C	No connection

Table 2: Data Cable DB-9 Connector #1 Pinout.

Pin #	Name	Description
1	N/C	No connection
2	FlexRay 2A-	FlexRay Node 2, Channel A, negative
3	GND	Ground
4	FlexRay 2B-	FlexRay Node 2, Channel B, negative
5	N/C	No connection
6	GND	Ground
7	FlexRay 2A+	FlexRay Node 2, Channel A, positive
8	FlexRay 2B+	FlexRay Node 2, Channel B, positive
9	N/C	No connection

Table 3: Data Cable DB-9 Connector #2 Pinout.

7 Hardware Setup

In this section we explain the process of setting up the neoVI FLEX for use, step by step. Setup is relatively straightforward given the limited number of connections. Also note that while the directions are listed in a particular order, the exact sequence in which devices and cables are linked does not affect operation.

The instructions and figures below cover both connecting the neoVI FLEX directly to a PC running Vehicle Spy, or to a USB hub attached to that PC. A powered hub is recommended to ensure that enough current is supplied to power the neoVI FLEX, but some unpowered hubs may work.

The hookup diagram in Figure 8 shows you at a glance how to set up the cables to use the neoVI FLEX.

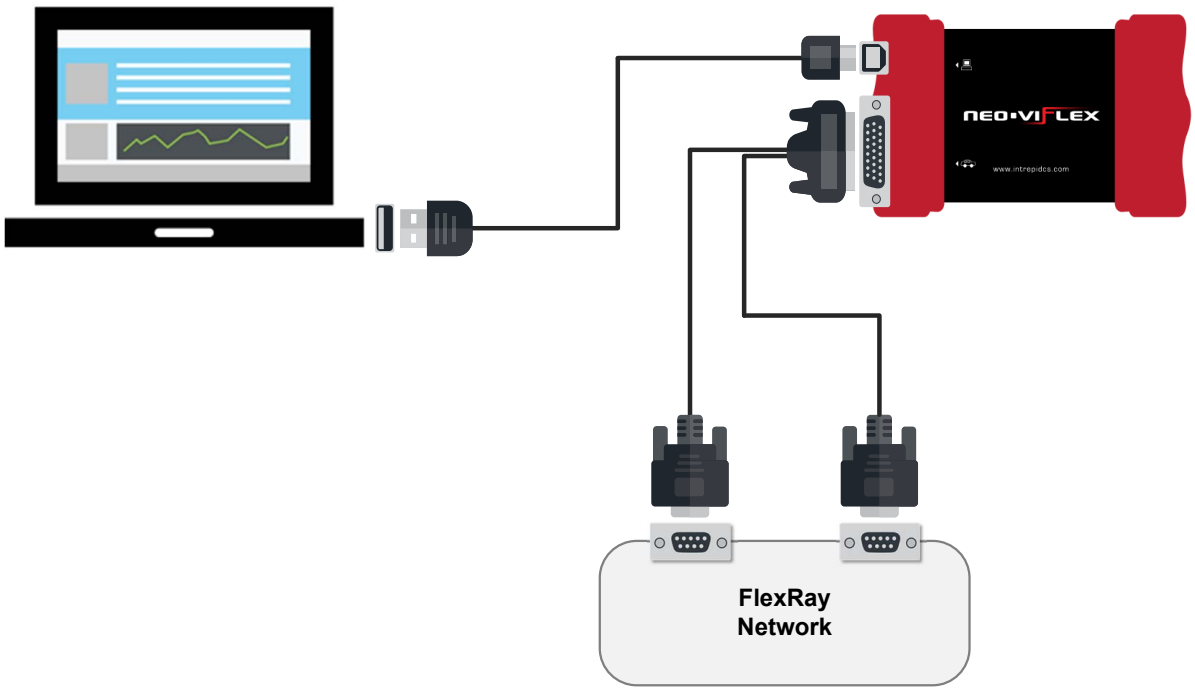

Figure 8: neoVI FLEX Hookup Diagram.

Please follow these steps to complete the necessary connections:

1. **Connect USB Cable to PC:** Attach the flat connector on the USB cable to a standard USB port on your PC. Again, you can also use a hub if this is more convenient.
2. **Connect USB Cable to neoVI FLEX:** Connect the square USB cable connector to the neoVI FLEX (Figure 9). Assuming that the PC is powered on, you should see the red Power LED above and to the right of the USB port illuminate.

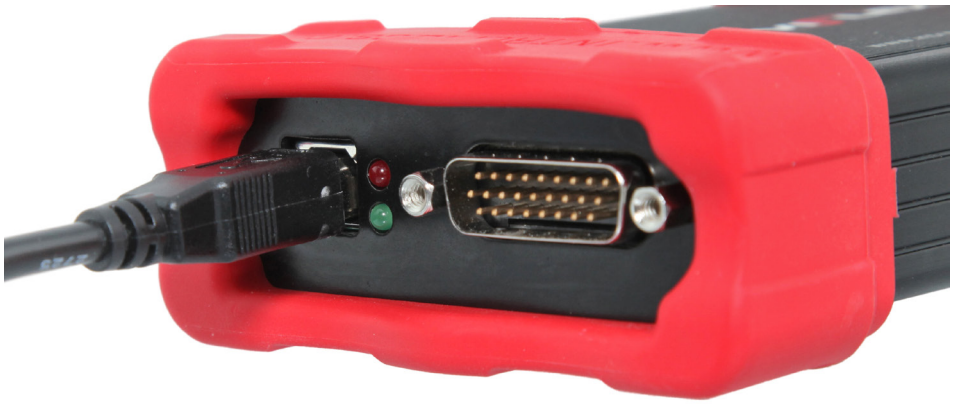

Figure 9: Connecting the USB cable to the neoVI FLEX.

3. **Connect Data Cable to neoVI FLEX:** Attach the DB-26 female connector on the supplied data cable to the DB-26 male connector on the left side of the neoVI FLEX (FIGURE).

Figure 10: Connecting the data cable to the neoVI FLEX.

4. **Connect Data Cable to FlexRay Nodes:** Attach the two DB-9 connectors on the data cable to the FlexRay network you wish to work with.

Congratulations, your neoVI FLEX is ready for operation. In Figure 11 we have shown a sample configuration, which uses as an example the FlexRay network on an Intrepid FlexRay evaluation board. We've also shown the neoVI FLEX connected to a USB hub rather than to a PC.

If you experience any issues setting up the hardware, please refer to the enclosed troubleshooting and support information.

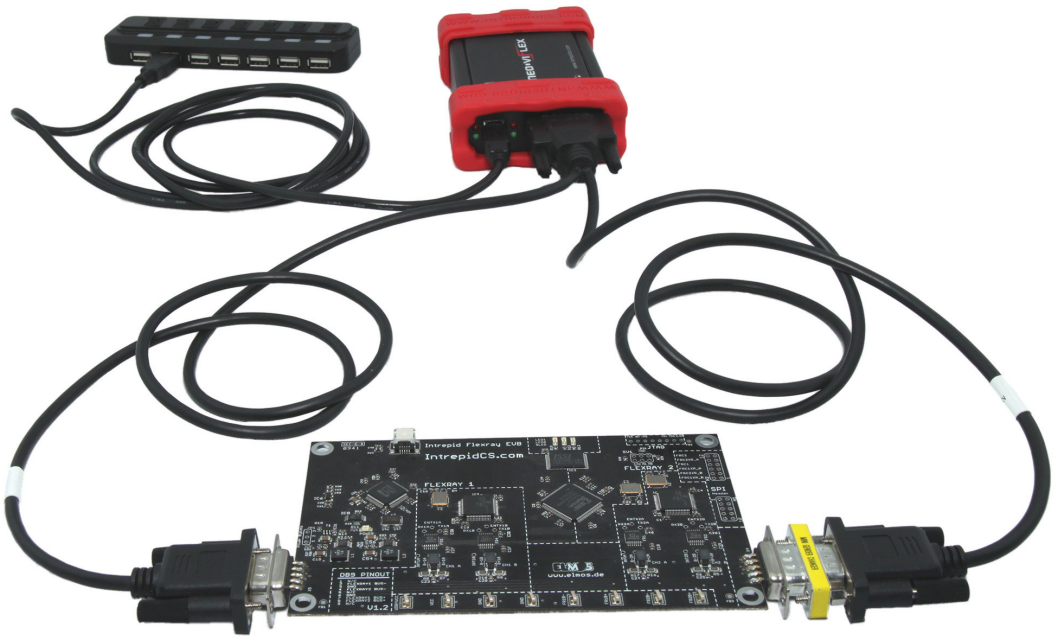

Figure 11: neoVI FLEX Sample Configuration.

8 FlexRay Support in Vehicle Spy

The latest versions of Intrepid's Vehicle Spy software include new tools to support working with FlexRay in general, and the neoVI FLEX in particular. Below is a quick tour of the new menu items, options, views and features you will find when you use Vehicle Spy.

New FlexRay Network and Menu Items

A new *FlexRay* entry has been added to the *Network List*, as shown in Figure 12.

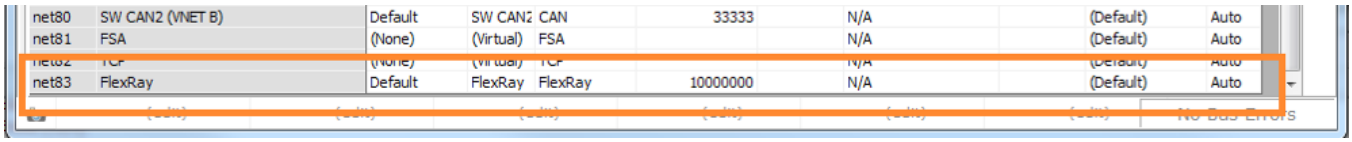

Figure 12: New FlexRay Network in Vehicle Spy.

Two new menu items, *FlexRay Clusters* and *FlexRay Cycles*, can be found under the *Spy Networks* menu (Figure 13).

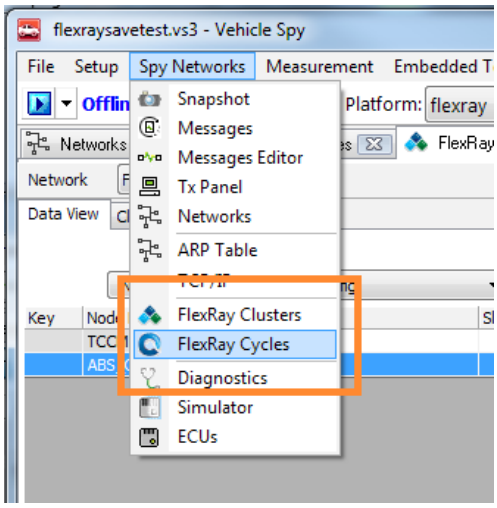

Figure 13: FlexRay Clusters and FlexRay Cycles menu items in Vehicle Spy.

Adding a FIBEX File, FlexRay ECUs and Cluster Configuration Data

To load FlexRay configuration information, assign a FIBEX file for a FlexRay network in the *Network Databases* area (Figure 14).

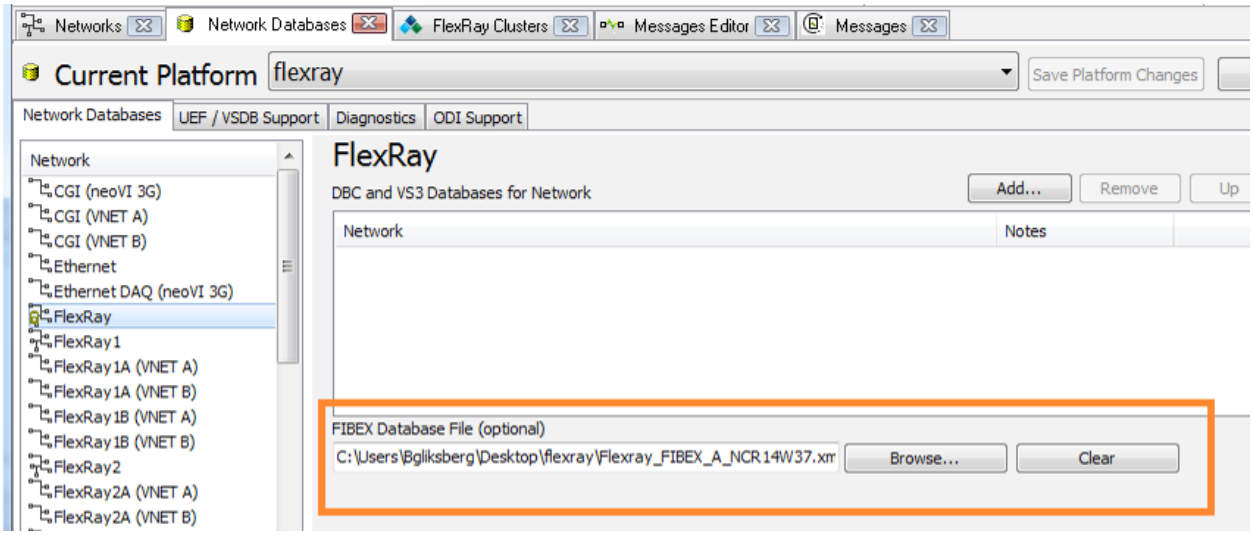

Figure 14: Specifying a FIBEX database file.

After saving your selection, FlexRay ECUs will be added to *ECU View* (Figure 15) and cluster configuration will be added to *FlexRay Clusters View* (Figure 16).

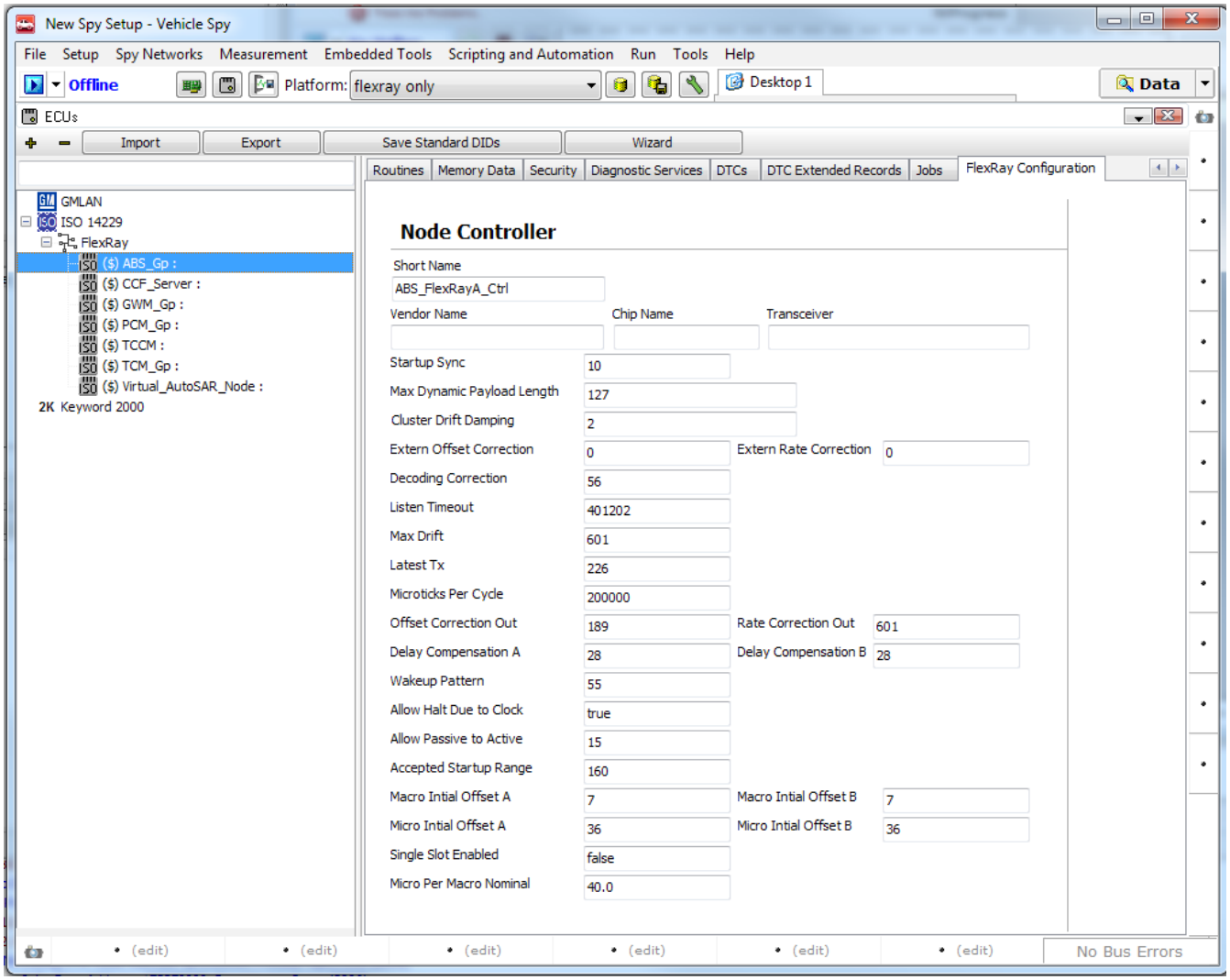

Figure 15: FlexRay Data in ECUs View.

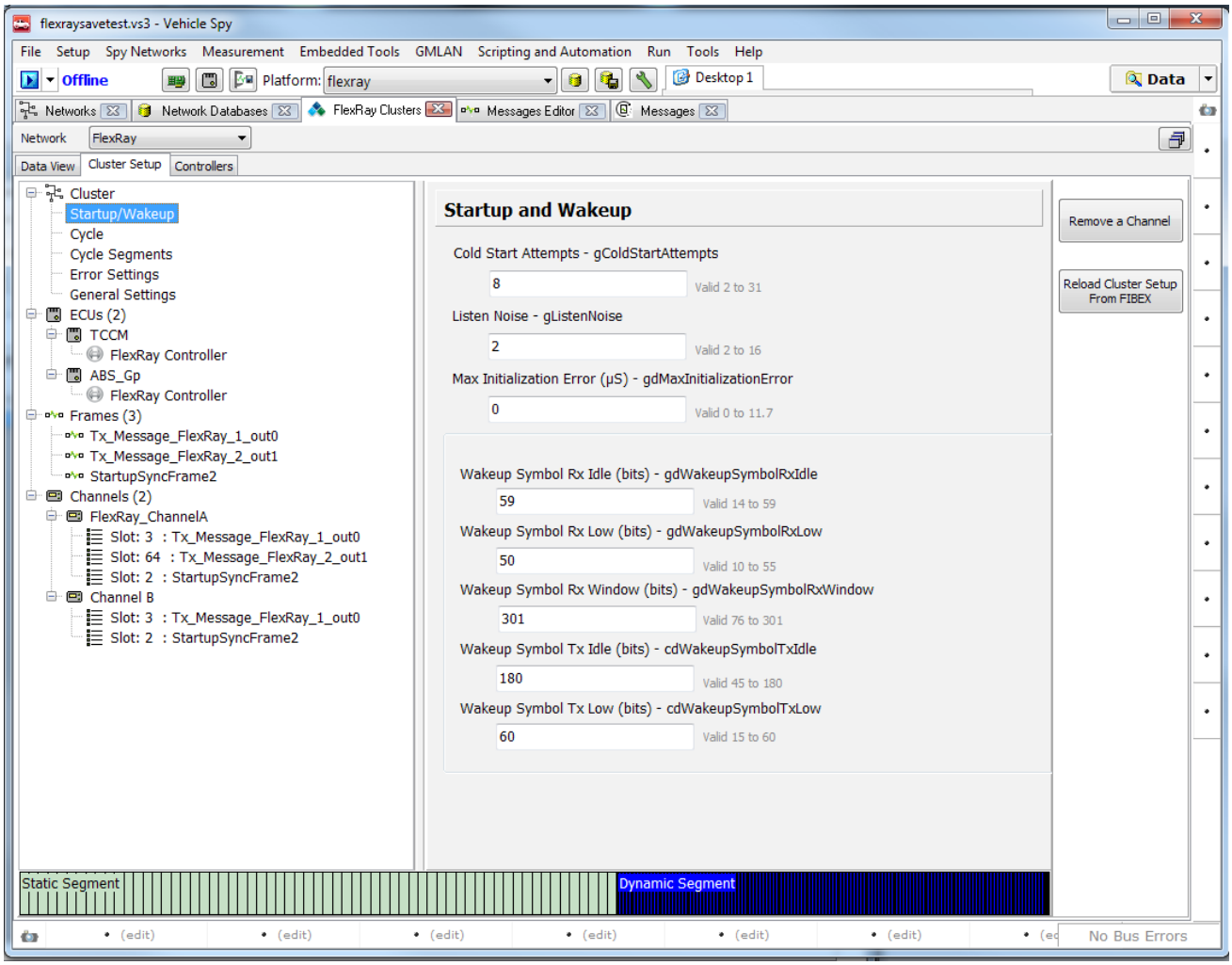

Figure 16: Cluster configuration in FlexRay Clusters View.

FlexRay Clusters View

Select the *FlexRay* network from the list within *FlexRay Clusters View* (Figure 17).

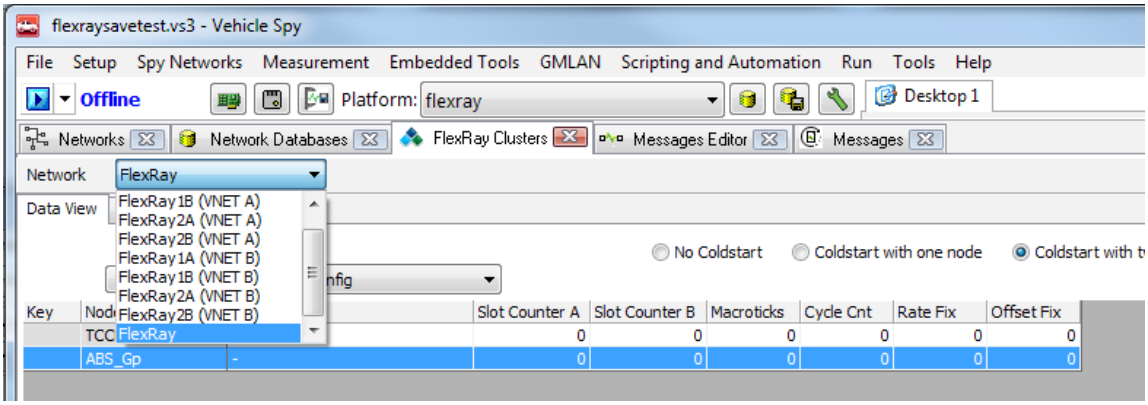

Figure 17: Select FlexRay network in FlexRay Clusters View.

Coldstart Mode

Select a coldstart mode (Figure 18). A node is added to the configuration for coldstart with two nodes.

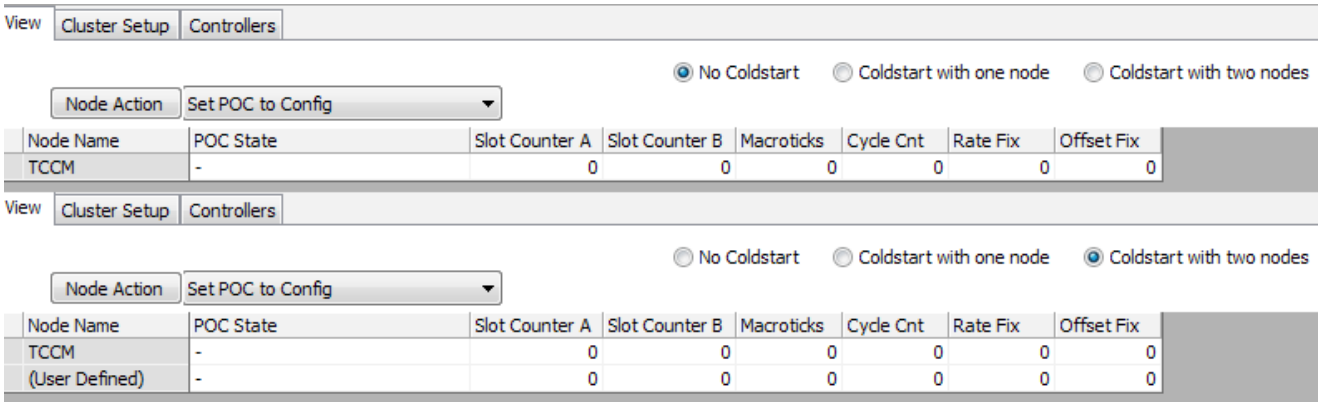

Figure 18: No Coldstart selected (above) and Coldstart with two nodes (below) in FlexRay Clusters View.

Node Selection and Configuration Editing

You can use node configuration from ECUs, or your own configuration (Figure 19).

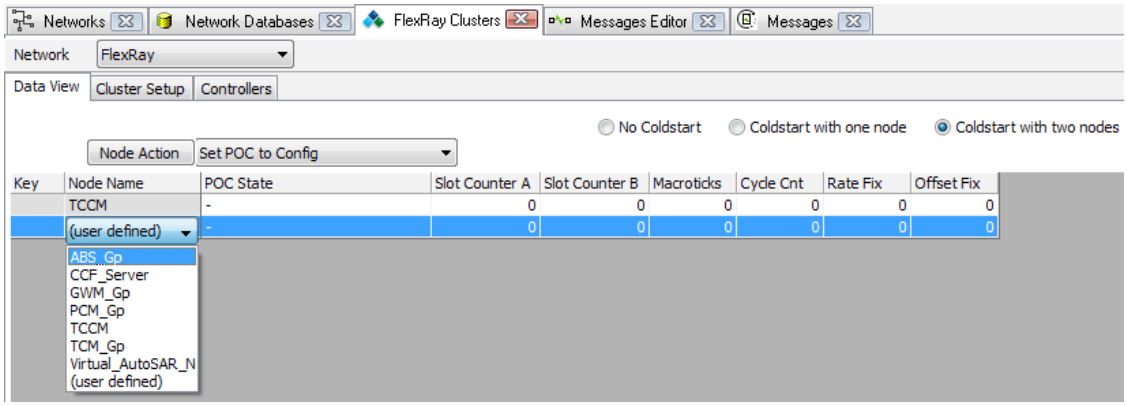

Figure 19: Selecting a Node in FlexRay Clusters View.

Then edit the configuration on the *Cluster Setup* tab (Figure 20).

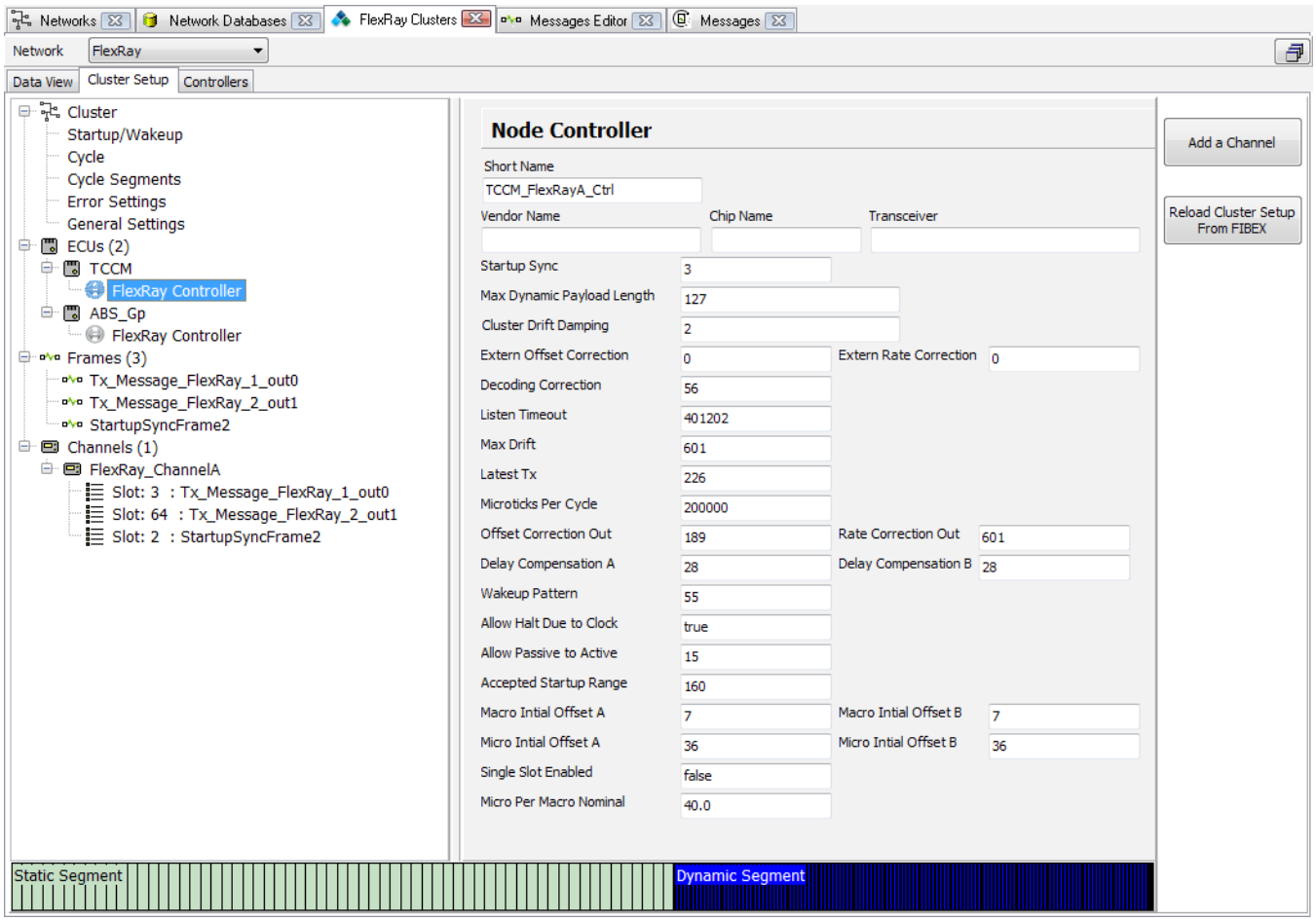

Figure 20: Editing Configuration in the Cluster Setup Tab of FlexRay Clusters View.

Configure Startup Sync Frame

In the *Cluster Setup Tab* you can configure the Startup Sync frame for coldstart nodes. A corresponding transmit message must be created for the first node; the message for the second node is created automatically (Figure 21).

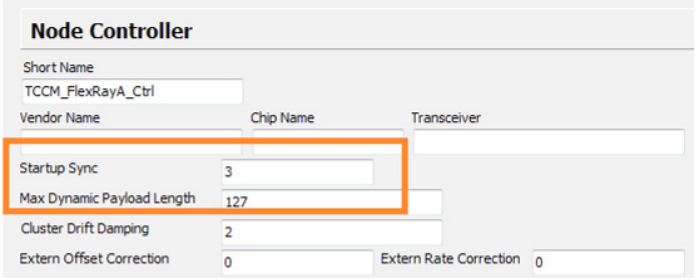

Figure 21: Configuring Startup Sync.

Remove Channel or Reload Cluster Setup

On the far right side of the *Cluster Setup Tab* you will find buttons to allow you to remove a channel, or reload the cluster setup from the FIBEX file (Figure 22).

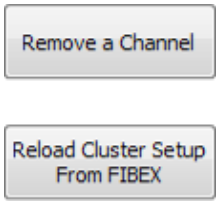

Figure 22: Remove a Channel and Reload Cluster Setup From FIBEX Buttons.

Node Actions and Runtime Information Display

In the *Data View* tab you can select a node action from a list and execute it by pressing the *Node Action* button (Figure 23).

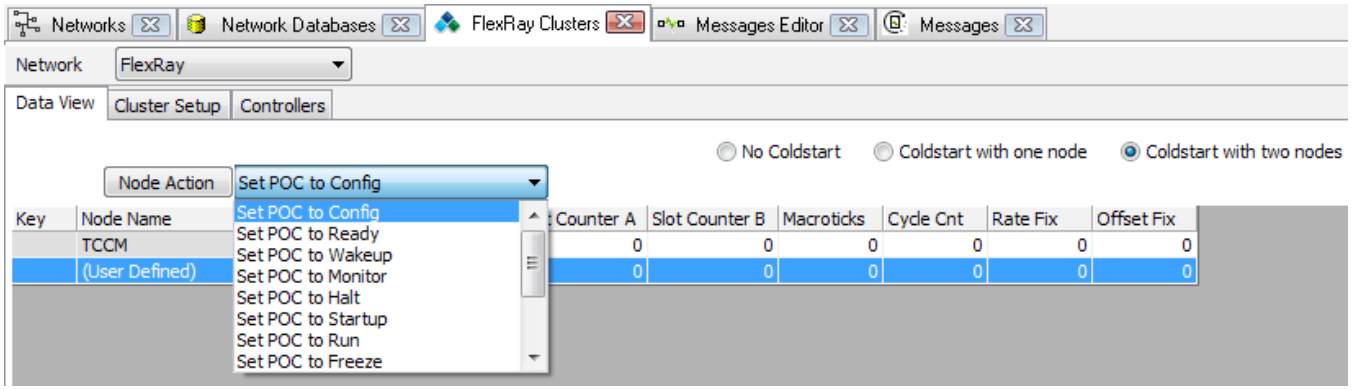

Figure 23: Selecting FlexRay Node Actions.

When you go online, essential runtime information is displayed in the same screen area (Figure 24).

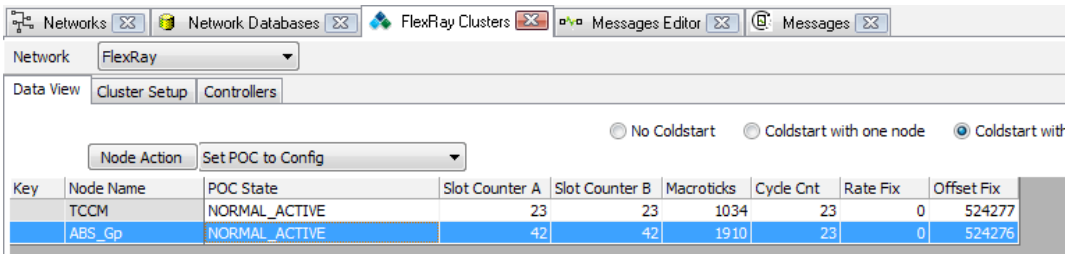

Figure 24: FlexRay Runtime Information.

FlexRay Cycles View

The *FlexRay Cycles View* menu option shows you a graphical display of network traffic at runtime (Figure 25).

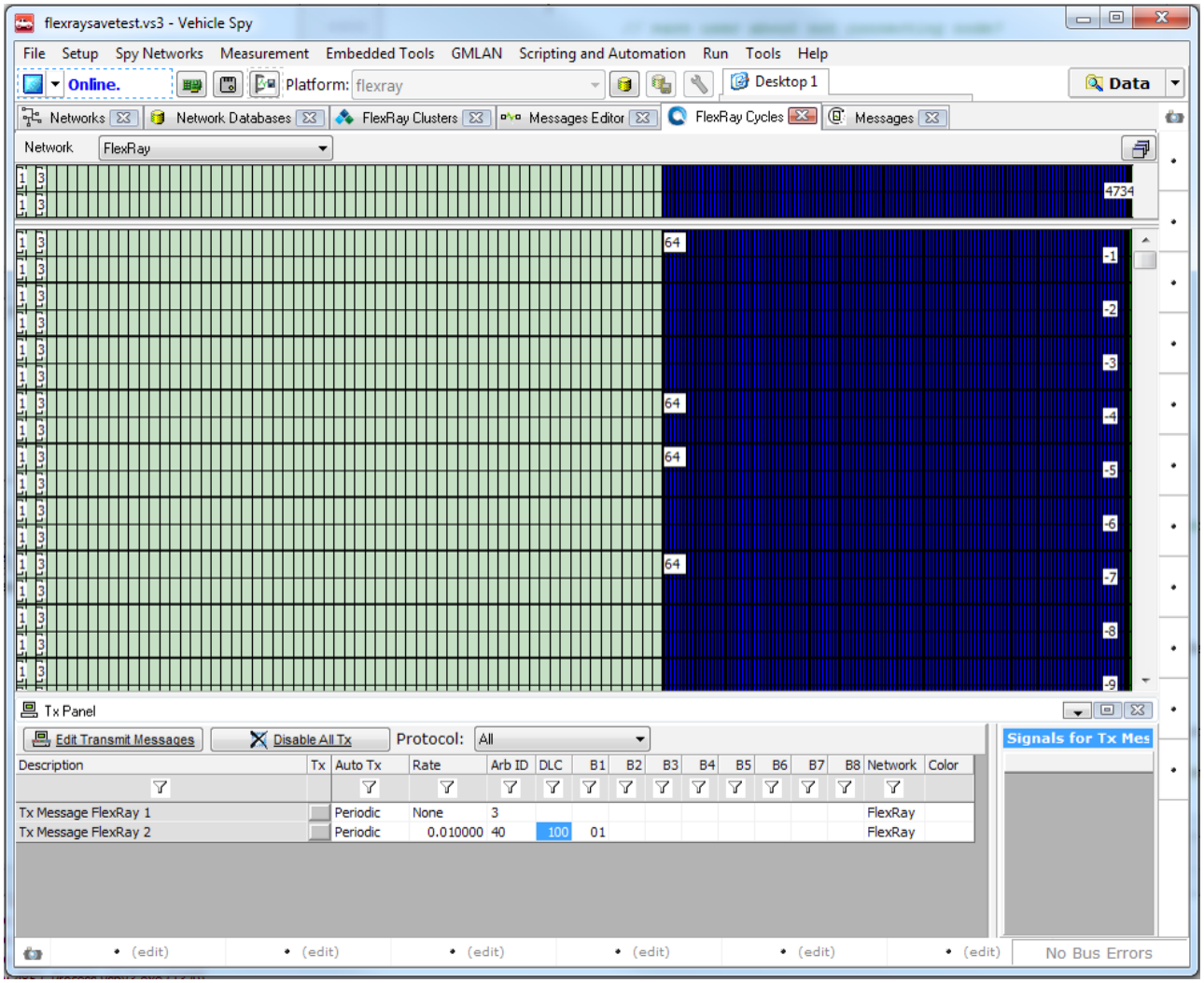

Figure 25: FlexRay Cycles View.

9 Troubleshooting

The neoVI FLEX, like all Intrepid products, has been designed, manufactured and tested to provide you with years of trouble-free service. However, as with any complex engineered device, problems can occasionally arise, either with the product itself, or with the process of setting up and using it.

If you're experiencing difficulties with your neoVI FLEX, please try some of the troubleshooting ideas in this section. Note, however, that many potential issues with setting up, configuring and running FlexRay depend on the characteristics of the specific networks and nodes to which the neoVI FLEX is attached. For this reason, it is only possible to provide limited generalized troubleshooting assistance here. For more advanced help, please contact Intrepid support using the information at the end of this guide.

Ensure the Device is Powered

The Power LED, which is the red LED top right when looking at the side of the neoVI FLEX, should always be lit up while the device is operating. If it is not, this means the device is not receiving power. Check that the USB cable is properly connected to the neoVI FLEX, and also to the PC or USB hub to which it is connected.

If using a USB hub, try connecting directly to a PC instead. If this works, it likely means that your USB hub is not providing sufficient power to the neoVI FLEX. Try a different hub (preferably one with its own power supply) or just use a PC USB port.

Typical LED Behavior While the Network is Active

During normal operation, you should see the following behavior from the LEDs:

- **Power LED (Red, Top Right):** Solidly lit.
- **USB LED (Green, Bottom Right):** Solidly lit.
- **FPGA LED (Red, Top Left):** Blinking while the device is active, solid otherwise.
- **Transmit LED (Green, Bottom Left):** Flickering rapidly.

The Transmit LED may flicker so quickly that instead of it seeming to flash, it just appears to be continuously but dimly lit. Look carefully at it straight on and you should see that it is pale green when transmissions are in progress. This may be difficult in a brightly-lit room.

If the LEDs are not illuminating in the expected manner, this may indicate a problem with the device or configuration; please contact Intrepid support.

Messages Incorrectly Transmitted and/or Received

There are a number of reasons why this may happen. Start by double-checking all connections, and verifying the FlexRay configuration within the relevant devices and networks. Also ensure the FlexRay setup is correct within Vehicle Spy.

If you cannot resolve the problem, or need more assistance with your application, please get in touch with us and we will help.

10 Support

If you have a problem you cannot resolve on your own, or need any other assistance in using your neoVI FLEX, feel free to contact Intrepid Control Systems by phone or email:

- **Phone:** (800) 859-6265 or (586) 731-7950, extension 1.
- **Fax:** (586) 731-2274.
- **Email:** icssupport@intrepidcs.com

Intrepid's normal support hours are from 8 am to 5 pm, Monday to Friday, United States Eastern time. If you require assistance outside standard business hours, feel free to contact us and a member of our support team will get back to you as soon as possible.

