4. Select either Ignore or Warn in the File signature verification box.
5. Click on OK to accept the new policy.
6. Click on OK again to close the System Properties dialog.
7. Unplug the NovAtel receiver USB cable, plug it back in and follow the installation instructions described in either the *Windows XP Installation* section starting below or the *Windows 2000 Installation* section starting on *Page 111*.

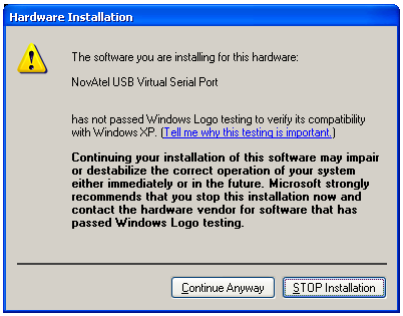
6.4.2 Windows XP Installation

If upgrading drivers, uninstall older versions using the NovAtel USB Configuration tool located in the Start Menu under Program Files | OEMV PC Software. If you have not installed NovAtel USB drivers before, the NovAtel USB Configuration tool will not be there until you install them.

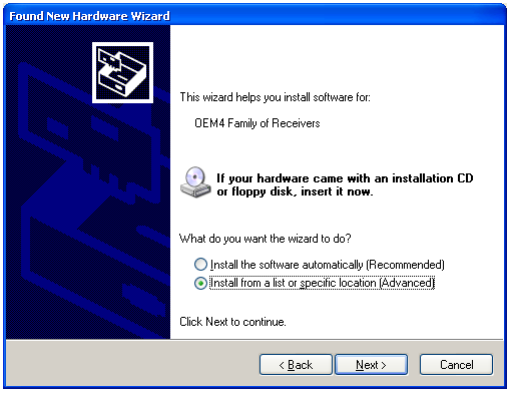
After connecting the NovAtel GPS receiver to a USB port on the PC, the Found New Hardware wizard appears.

✉ 1. The screens displayed in this section, from Windows XP, may vary from what you see and depend on your operating system.

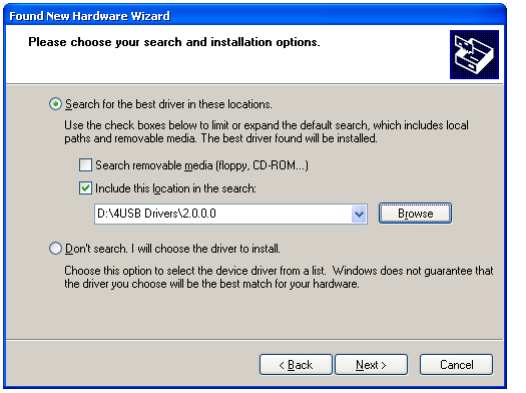
2. During the driver installation you may see a Window Logo testing warning if you skipped the steps in *Section 6.4.1,Windows Driver Signing* on *Page 108*. Our USB drivers are compatible with Microsoft Windows operating systems. Please click on *Continue Anyway* if you see a warning like this:



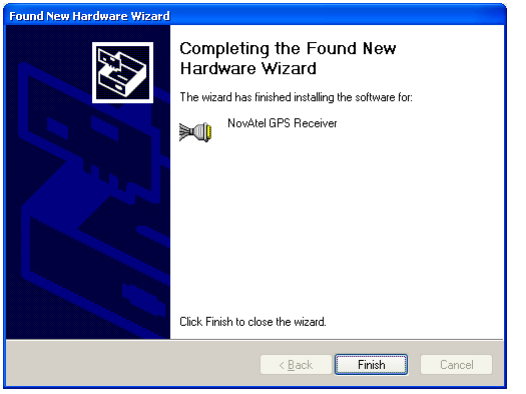
1. Click on *No, not this time* and then click on *Next*.
2. Select the *Install from a list or specific location (Advanced)* field and click on *Next*.



3. Clear the *Search removable media* check box, select the *Include this location in the search:* field and Browse to the USB driver install directory on the supplied OEMV family CD. Then click on *Next*.



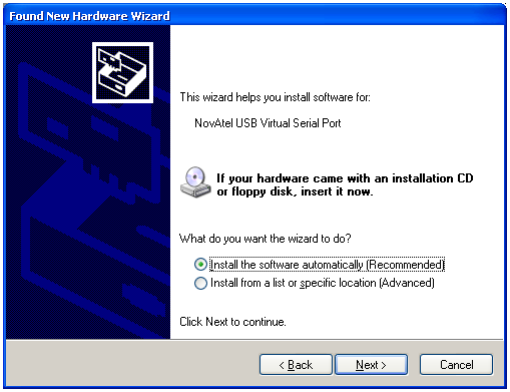
4. Click on *Finish* to complete the driver installation.



After installing the NovAtel USB driver, Windows detects the OEMV-2 or OEMV-3 receiver's new virtual COM ports and begins to initialize them. As each port is detected, the Found New Hardware wizard appears.

Complete the following steps for each port:

1. Select the Install the software automatically field (recommended) and click on *Next*.



2. Click on *Finish*.

Installation is complete when no more dialogs appear. The new COM ports corresponding to the receiver's USB1, USB2, and USB3 ports are numbered sequentially following the existing ports in the PC, and are ready to use with any existing application that communicates with the receiver's COM ports.

✉ The assignment of COM port numbers is tied to the USB port on the PC. This allows you to switch receivers without Windows assigning new COM ports. However, if you connect the receiver to a different USB port, Windows detects the receiver's presence on that USB port and assigns three new COM port numbers.

6.4.3 Windows 2000 Installation

If upgrading drivers, uninstall older version using NovAtel USB Configuration tool located in the Start Menu under Program Files | OEMV PC Software.

After connecting the NovAtel GPS receiver to a USB port on the PC, the Found New Hardware wizard appears. Click on *Next*. (see the example screens and notes in *Section 6.4.2, Windows XP Installation* starting on *Page 109*).

1. Select the Search for a suitable driver for my device field and click on Next.
2. Select the Specify a location field and click on Next.
3. Specify the location using the browse button, for example, on the supplied OEMV family CD: USB Drivers\Install
4. Click on OK.
5. Confirm that the driver found is, for example: \USB Drivers\Install\ngpsusb.inf

6. Click on Next.
7. Click on Finish to complete the driver installation.

After installing the drivers, Windows detects the NovAtel receiver's new virtual COM ports and begins to initialize them. Installation is complete when no more dialogs appear. The new COM ports corresponding to the receiver's USB1, USB2, and USB3 ports are numbered sequentially following the existing ports in the PC, and are ready to use with any existing application that communicates with the receiver's COM ports.

✉ The assignment of COM port numbers is tied to the USB port on the PC. This allows you to switch receivers without Windows assigning new COM ports. However, if you connect the receiver to a different USB port, Windows detects the receiver's presence on that USB port and assign three new COM port numbers.

6.5 Firmware Upgrades

The receiver stores its program firmware in non-volatile memory, which allows you to perform firmware upgrades without having to return the receiver to the distributor. New firmware can be transferred to the receiver through COM1, and the unit will immediately be ready for operation at a higher level of performance.

The first step in upgrading your receiver is to contact your local NovAtel dealer. Your dealer will assist you in selecting the best upgrade option that suits your specific GPS needs. If your needs are still unresolved after seeing your dealer then you can contact NovAtel directly through any of the methods described in the Customer Service section, *see Page 18*, at the beginning of this manual.

When you call, be sure to have available your receiver model number, serial number, and program revision level. This information can be found by issuing the LOG VERSION command at the port prompt.

After establishing which new model/revision level would best suit your needs, and having described the terms and conditions, you will be issued an authorization code (auth-code). The auth-code is required to unlock the new features according to your authorized upgrade model type.

To upgrade to a higher performance model at the same firmware revision level (for example, upgrading from an OEMV-3-L1 to an OEMV-3-RT2 on firmware version 3.000), you can use the AUTH command with the issued auth-code.

If you are upgrading to a higher firmware revision level (for example, upgrading an OEMV-3-RT2 firmware version 3.000 to OEMV-3-RT2 firmware version 3.100), you will need to transfer new program firmware to the OEMV family receiver using the WinLoad utility program. As WinLoad and the upgrade file are generally provided in a compressed file format, you will also be given a decompression password. WinLoad and the upgrade files can be found on NovAtel's FTP site at http://www.novatel.com, or can be sent to you on disk or by e-mail.

Your local NovAtel dealer will provide you with all the information that you require to upgrade your receiver.

6.5.1 Upgrading Using the AUTH Command

The AUTH command is a special input command which authorizes the enabling or unlocking of the various model features. Use this command when upgrading to a higher performance OEMV family model available within the same revision level as your current model (for example, upgrading from an OEMV-3-L1 to an OEMV-3-RT2 on firmware version 3.000). This command only functions in conjunction with a valid auth-code assigned by Customer Service.

The upgrade can be performed directly from **CDU**'s Command Line Screen, or from any other communications program. The procedure is as follows:

1) Power-up the OEMV family receiver and establish communications over a serial port (see *Chapter 4, Operation* on *Page 56*)

2) Issue the LOG VERSION command to verify the current firmware model number, revision level, and serial number.

3) Issue the AUTH command, followed by the auth-code and model type. The syntax is as follows:

Syntax:

auth auth-code

where auth is a special command which allows program model upgrades

auth-code is the upgrade authorization code, expressed as hhhh,hhhh,hhhh,hhhh,hhhh,model# where the h characters are an ASCII hexadecimal code, and the model# would be ASCII text

Example:

auth 17cb,29af,3d74,01ec,fd34,l1l2lrvrt2

Once the AUTH command has been executed, the OEMV family receiver will reboot itself. Issuing the LOG VERSION command will confirm the new upgrade model type and version number.

If communicating using **CDU**, the communication path needs to be closed and re-opened using the Device menu.

6.5.2 Updating Using the WinLoad Utility

WinLoad is required (instead of the AUTH command) when upgrading previously released firmware with a newer version of program and model firmware (for example, upgrading an OEMV-3-RT2 firmware version 3.000 to OEMV-3-RT2 firmware version 3.100). WinLoad is a Windows utility program designed to facilitate program and model upgrades. Once WinLoad is installed and running, it will allow you to select a host PC serial port, bit rate, directory path, and file name of the new program firmware to be transferred to the OEMV family receiver via its COM1, COM2 or COM3 port. The port chosen must have an RS-232 interface to the PC.

Transferring Firmware Files

To proceed with your program upgrade, you must first acquire the latest firmware revision. You will need a file with a name such as OEMXXXX.EXE (where XXXX is the firmware revision level). This file is available from NovAtel's FTP site (http://www.novatel.com), or via e-mail (support@novatel.ca). If transferring is not possible, the file can be mailed to you on floppy disk. For

more information on how to contact NovAtel Customer Service please see *Page 18* at the beginning of this manual.

You will need at least 1 MB of available space on your hard drive. For convenience, you may wish to copy this file to a GPS sub-directory (for example, C:\GPS\LOADER).

The file is available in a compressed format with password protection; Customer Service will provide you with the required password. After copying the file to your computer, it must be decompressed. The syntax for decompression is as follows:

Syntax:

[filename] [password]

where filename is the name of the compressed file (but not including the .EXE extension) and password is the password required to allow decompression

Example:

oem1001 12345678

A windows-based dialog box is provided for password entry.

The self-extracting archive will then generate the following files:

WinLoad.exe	WinLoad utility program
HowTo.txt	Instructions on how to use the WinLoad utility
WhatsNew.txt	Information on the changes made in the firmware since the last revision
XXXX.hex	Firmware version upgrade file, where XXXX = program version level (for example, 1001.hex)

Using the WinLoad Utility

WinLoad is a windows based program used to download firmware to OEMV family cards. The main screen is shown in *Figure 35*.

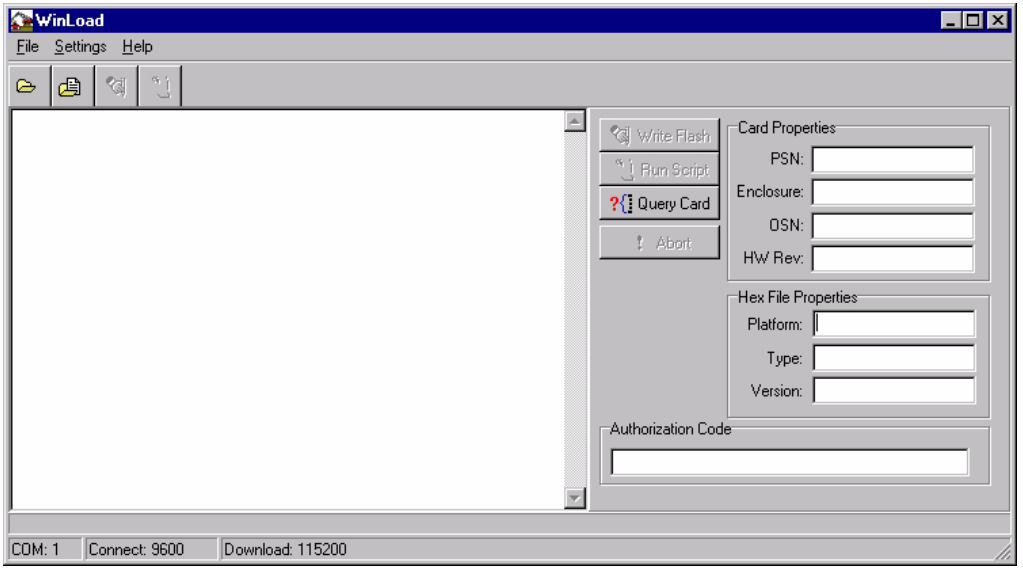


Figure 35: Main Screen of WinLoad

If you are running WinLoad for the first time you will need to make sure the file and communications settings are correct.

Open a File to Download

From the file menu choose Open. Use the Open dialog to browse for your file, see *Figure 36, WinLoad's Open Dialog on Page 115*.

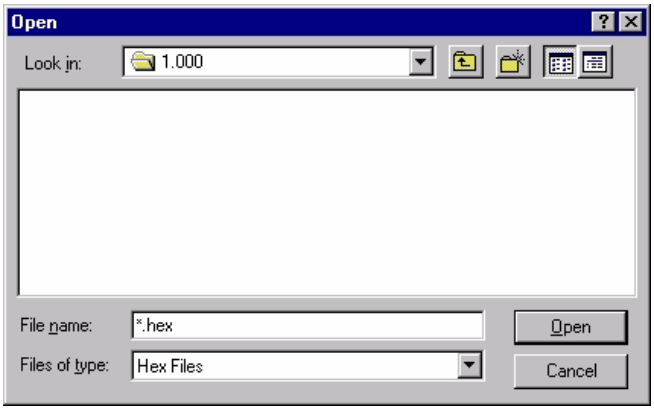


Figure 36: WinLoad's Open Dialog

Once you have selected your file, the name should appear in the main display area and in the title bar, see *Figure 37* below.

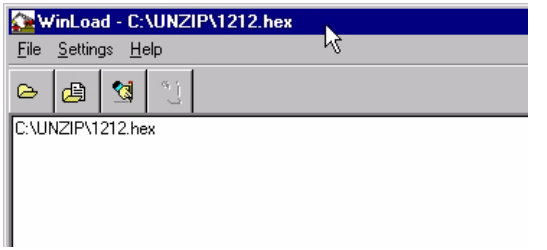


Figure 37: Open File in WinLoad

Communications Settings

To set the communications port and baud rate, select COM Settings from the Settings menu. Choose the port on your PC from the Com Port dropdown list and the baud rate from the Download Baudrate dropdown list. The baud rate should be as high as possible (the default of 115200 is preferred).

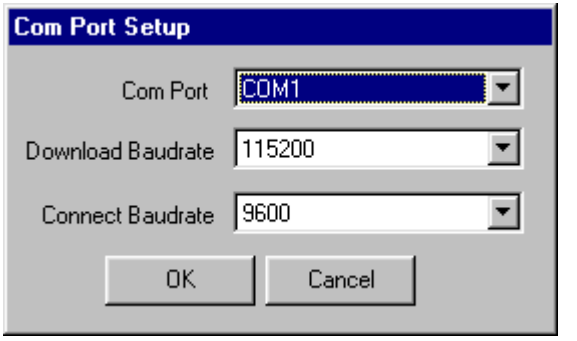


Figure 38: COM Port Setup

Downloading firmware

To download firmware follow these steps:

1. Set up the communications port as described in *Communications Settings above*.
2. Select the file to download, see *Open a File to Download* on *Page 115*.
3. Make sure the file path and file name are displayed in main display area, see *Figure 37, Open File in WinLoad on Page 116*.
4. Click on the Write Flash button to download the firmware.
5. Power down and then power up the receiver when “Searching for card” appears in the main display, see *Figure 39*.

Figure 39: Searching for Card

6. When the Authorization Code dialog opens, see *Figure 40*, enter the auth code and select OK

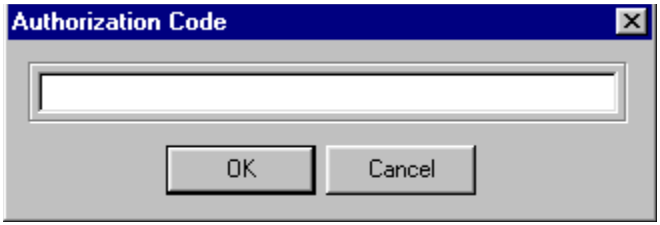


Figure 40: Authorization Code Dialog

7. The receiver should finish downloading and reset. The process is complete when “Done.” is displayed in the main display area, see *Figure 41*.

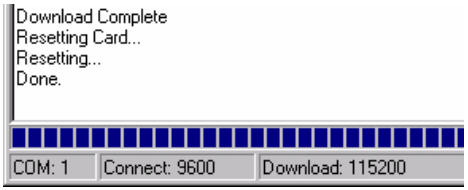


Figure 41: Upgrade Process Complete

8. Close WinLoad.

This completes the procedure required to upgrade an OEMV family receiver.

Chapter 7 Built-In Status Tests

7.1 Overview

The built in test monitors system performance and status to ensure the receiver is operating within its specifications. If an exceptional condition is detected, the user is informed through one or more indicators. The receiver status system is used to configure and monitor these indicators:

1. Receiver status word (included in the header of every message)
2. ERROR strobe signal (see *Section 3.3.1, Strobes* on *Page 44*)
3. RXSTATUSEVENT log
4. RXSTATUS log
5. Status LED

In normal operation the error strobe is driven low and the status LED on the receiver flashes green. When an unusual and non-fatal event occurs (for example, there is no valid position solution), a bit is set in the receiver status word. Receiver operation continues normally, the error strobe remains off, and the LED continues to flash green. When the event ends (for example, when there is a valid position solution), the bit in the receiver status word is cleared.

When a fatal event occurs (for example, in the event of a receiver hardware failure), a bit is set in the receiver error word, part of the RXSTATUS log, to indicate the cause of the problem. Bit 0 is set in the receiver status word to show that an error occurred, the error strobe is driven high, and the LED flashes red and yellow showing an error code. An RXSTATUSEVENT log is generated on all ports to show the cause of the error. Receiver tracking is disabled at this point but command and log processing continues to allow you to diagnose the error. Even if the source of the error is corrected at this point, the receiver must be reset to resume normal operation.

The above two paragraphs describe factory default behavior. Customizing is possible to better suit an individual application. RXSTATUSEVENT logs can be disabled completely using the UNLOG command. RXSTATUSEVENT logs can be generated when a receiver status bit is set or cleared by using the STATUSCONFIG SET and STATUSCONFIG CLEAR commands. Bits in the receiver status word can also be promoted to be treated just like error bits using the STATUSCONFIG PRIORITY command.

7.2 Receiver Status Word

The receiver status word indicates the current status of the receiver. This word is found in the header of all logs and in the RXSTATUS log. In addition the receiver status word is configurable.

The receiver gives the user the ability to determine the importance of the status bits. This is done using the priority masks. In the case of the Receiver Status, setting a bit in the priority mask will cause the condition to trigger an error. This will cause the receiver to idle all channels, turn off the antenna, and disable the RF hardware, the same as if a bit in the Receiver Error word is set. Setting a bit in an Auxiliary Status priority mask will cause that condition to set the bit in the Receiver Status word corresponding to that Auxiliary Status.

The STATUSCONFIG command is used to configure the various status mask fields in the

RXSTATUSEVENT log. These masks allow you to modify whether various status fields generate errors or event messages when they are set or cleared. This is meant to allow you to customize the operation of your OEMV family receiver for your specific needs.

Refer to the RXSTATUS log, RXSTATUSEVENT log and STATUSCONFIG command in the *OEMV Firmware Reference Manual* for more detailed descriptions of these messages.

7.3 Error Strobe Signal

The error strobe signal is one of the I/O strobes and is driven low when the receiver is operating normally. When the receiver is in the error state and tracking is disabled, the error strobe is driven high. This can be caused by a fatal error or by an unusual receiver status indication that the user has promoted to be treated like a fatal error. Once on, the error status will remain high until the cause of the error is corrected and the receiver is reset. See also *Section 3.3.1, Strobes* on *Page 44*.

7.4 RXSTATUSEVENT Log

The RXSTATUSEVENT log is used to output event messages as indicated in the RXSTATUS log.

On start-up, the OEMV family receiver is set to log the RXSTATUSEVENTA log ONNEW on all ports. You can remove this message by using the UNLOG command.

Refer to the RXSTATUSEVENT log in the *OEMV Firmware Reference Manual* for a more detailed description of this log.

7.5 RXSTATUS Log

7.5.1 Overview

The Receiver Status log (RXSTATUS) provides information on the current system status and configuration in a series of hexadecimal words.

The status word is the third field after the header, as shown in the example below.

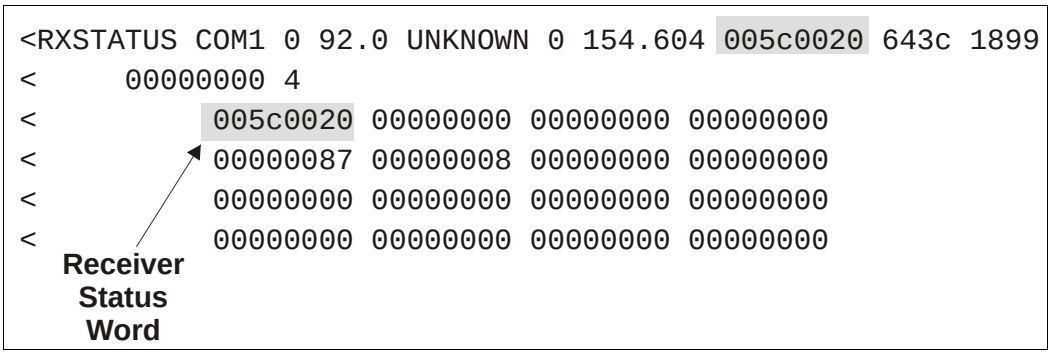


Figure 42: Location of Receiver Status Word

Each bit in the status word indicates the status of a specific condition or function of the receiver. If the status word is 00000000, the receiver is operating normally. The numbering of the bits is shown in *Figure 43, Reading the Bits in the Receiver Status Word on Page 120* below.

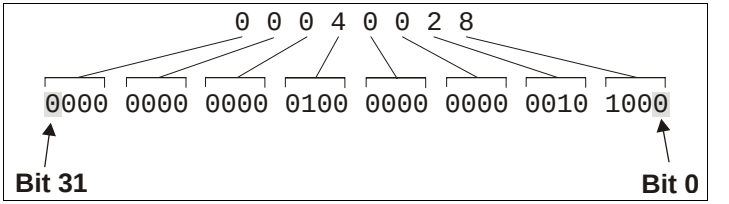


Figure 43: Reading the Bits in the Receiver Status Word

If the receiver status word indicates a problem, please also see *Section 8.1, Examining the RXSTATUS Log* on *Page 126.*

7.5.2 Error Word

The error field contains a 32 bit word. Each bit in the word is used to indicate an error condition. Error conditions may result in damage to the hardware or erroneous data, so the receiver is put into an error state. If any bit in the error word is set, the receiver will set the error strobe line, flash the error code on the status LED, broadcast the RXSTATUSEVENT log on all ports (unless the user has unlogged it), idle all channels, turn off the antenna, and disable the RF hardware. The only way to get out of the error state is to reset the receiver.

It is also possible to have status conditions trigger event messages to be generated by the receiver. Receiver Error words automatically generate event messages. These event messages are output in RXSTATUSEVENT logs (see also *Section 7.5.6, Set and Clear Mask for all Status Code Arrays* on *Page 122*).

The error word is the first field after the log header in the RXSTATUS log, as shown in the example below, or the third from last field in the header of every log.

```
<RXSTATUS COM1 0 92.0 UNKNOWN 0 154.604 005c0020 643c 1899
<       00000000 4
<            005c0020 00000000 00000000 00000000
<            00000087 00000008 00000000 00000000
<            00000000 00000000 00000000 00000000
<            00000000 00000000 00000000 00000000
```

Receiver Error Word

Figure 44: Location of Receiver Error Word

Here is another example of a receiver error word. The numbering of the bits is shown in *Figure 45*.

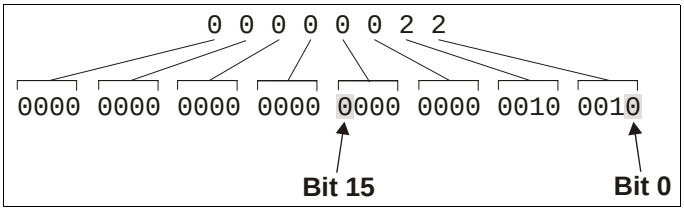


Figure 45: Reading the Bits in the Receiver Error Word

Refer to the RXSTATUS and the RXSTATUSEVENT logs in the *OEMV Firmware Reference Manual* for more detailed descriptions of these logs. If the receiver error word indicates an error, please also see *Section 8.1, Table 23, Resolving a Receiver Error Word* on *Page 126.*

7.5.3 Status Code Arrays

There are 4 status code arrays – the receiver status word, the auxiliary 1 status, the auxiliary 2 status and the auxiliary 3 status. Each status code array consists of 4, 32 bit words (the status word, a priority mask, a set mask and a clear mask). The status word is similar to the error word, with each of the 32 bits indicating a condition. The mask words are used to modify the behavior caused by a change in one of the bits in the associated status words. Each bit in any of the masks operates on the bit in the same position in the status word. For example setting bit 3 in the priority mask changes the priority of bit 3 in the status word.

7.5.4 Receiver Status Code

The receiver status word is included in the header of all logs. It has 32 bits, which indicate certain receiver conditions. If any of these conditions occur, a bit in the status word is set. Unlike the error word bits the receiver will continue to operate, unless the priority mask for the bit has been set. The priority mask bit will change that of the receiver status word into an error bit. Anything that would result from an error bit becoming active would also occur if a receiver status and its associated priority mask bits are set.

7.5.5 Auxiliary Status Codes

The auxiliary status codes are only seen in the RXSTATUS log. The three arrays representing the auxiliary status codes give indication about the receiver state for information only. The events represented by these bits typically do not cause degradation of the receiver performance. The priority mask for the auxiliary codes does not put the receiver into an error state. Setting a bit in the auxiliary priority mask results in the corresponding bit in the receiver status code to be set if any masked auxiliary bit is set. Bit 31 of the receiver status word indicates the condition of all masked bits in the auxiliary 1 status word. Likewise, bit 30 of the receiver status word corresponds to the auxiliary 2 status word, and bit 29 to the auxiliary 3 status word.

Refer also to the RXSTATUS log in the *OEMV Firmware Reference Manual* for a more detailed description of this log.

7.5.6 Set and Clear Mask for all Status Code Arrays

The other two mask words in the status code arrays operate on the associated status word in the same way. These mask words are used to configure which bits in the status word will result in the broadcast of the RXSTATUSEVENT log. The set mask is used to turn logging on temporarily while the bit changes from the 0 to 1 state. The clear mask is used to turn logging on temporarily while the bit changes from a 1 to a 0 state. Note the error word does not have any associated mask words. Any bit set in the error word will result in the broadcast of the RXSTATUSEVENT log (unless unlogged).

Refer also to the RXSTATUSEVENT log in the *OEMV Firmware Reference Manual* for a more detailed description.

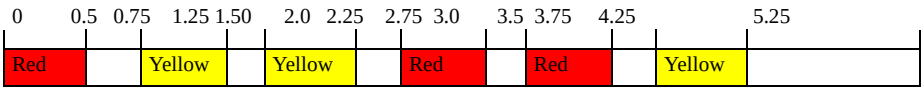
7.6 Status LEDs

7.6.1 OEMV Cards

The diagnostic LED provided on the OEMV family cards blinks green on and off at approximately 1 Hz to indicate normal operation.

Error bits and status bits that have been priority masked, as errors, will cause the LED to flash a code in a binary sequence. The binary sequence will be a 6 flash (0.5 second on and 0.25 second off per flash) sequence followed by a 1 second delay. The sequence will repeat indefinitely. If there is more than one error or status present, the lowest number will be output. The codes are ordered to have the highest priority condition output first.

The first flash in the 6 flash sequence indicates if the code that follows is an error bit or a status bit. Error bits will flash red and status bits will flash yellow. The next 5 flashes will be the binary number of the code (most significant bit first). A red flash indicates a one and a yellow flash indicates a zero. For example, for an error bit 6, the binary number is 00110 so the output sequence would be:



followed by a 1 second delay. The sequence repeats indefinitely until the receiver is reset.

In the example on *Page 123*, the first flash in the sequence is red, which means that a bit is set in the receiver error word. The next five flashes give a binary value of 00111. Converting this value to decimal results in a value of 7. Therefore, bit 7 of the receiver error word is set, indicating there is a problem with the supply voltage of the receiver's power circuitry.

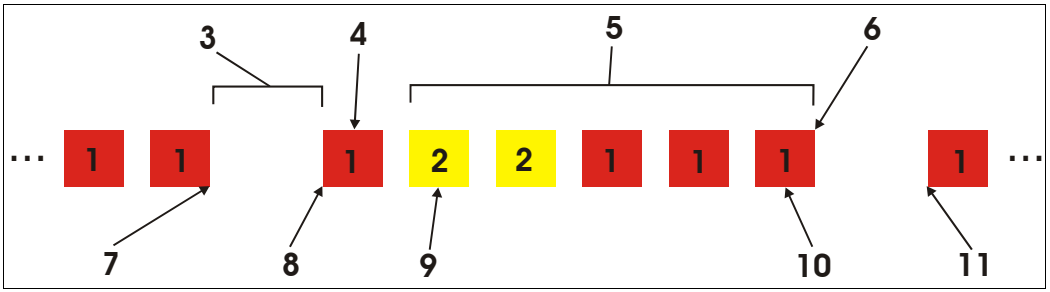


Figure 46: Status LED Flash Sequence Example

Reference	Description
1	Red
2	Yellow
3	1 Second Pause
4	Word Identifier Flash
5	Bit Identifier Flashes
6	End of Sequence
7	End of Previous Sequence
8	Beginning of Sequence
9	Most Significant Bit of Binary Value
10	Least Significant Bit of Binary Value
11	Start of Next Sequence

For a complete hexadecimal to binary conversion list, refer to the *Unit Conversion* section of the *GPS+ Reference Manual*. Refer also to the RXSTATUS log, and its tables for more details on this log and receiver error status.

7.6.2 DL-V3 Enclosure

The status LED on the front of DL-V3, with the  icon, is described in *Section 3.3.5, DL-V3 Status Indicators* on *Page 48*.

Chapter 8 Troubleshooting

When your receiver appears not to be working properly, often there are simple ways to diagnose and resolve the problem. In many cases, the issue can be resolved within a few minutes, avoiding the hassle and loss of productivity that results from having to return your receiver for repair. This chapter is designed to assist you in troubleshooting problems that occur and includes navigational instructions to bring you to the part of this manual that details resolutions to aid your receiver's operation.

If you are unsure of the symptoms or if the symptoms do not match any of those listed, use the RXSTATUS log to check the receiver status and error words. See *Section 8.1, Examining the RXSTATUS Log, Page 126*.

If the problem is not resolved after using this troubleshooting guide, contact NovAtel Customer Service, see *Page 18*.

Table 22: Troubleshooting based on Symptoms

Symptom	Related Section
The receiver is not properly powered	Check for and switch a faulty power cable. See *Section 3.1.3, Power Supply Requirements, Page 34* and *Section 3.3.3, CAN Bus, Page 46*.
The receiver cannot establish communication	Check for and switch faulty serial cables and ports. See *Section 3.3.3, CAN Bus, Page 46* and *Section 7.6, Status LEDs, Page 122*. Refer also to the COMCONFIG log in the *OEMV Firmware Reference Manual*.
The receiver is not tracking satellites	Ensure you have an unobstructed view of the sky from horizon to horizon. Check for and replace a faulty antenna cable. See *Section 3.1.1, Selecting a GNSS Antenna, Page 33*, *Section 3.1.2, Choosing a Coaxial Cable, Page 34*, *Section 3.2.4, Connecting the Antenna to the Receiver, Page 40*, *Section 3.3.7, Antenna LNA Power, Page 51* and refer to the *Time to First Fix and Satellite Acquisition* section of the *GPS+ Reference Manual*.
No data is being logged	See *Section 3.3.3, CAN Bus, Page 46*, and *Section 4.1, Communications with the Receiver, Page 57*.
Random data is being output by the receiver, or binary data is streaming	Check the baud rate on the receiver and in the communication software. Refer to the COMCONFIG log and FRESET command in the *OEMV Firmware Manual*. See also *Section 3.3.3, CAN Bus, Page 46*.

Continued on Page 125

Symptom	Related Section
A command is not accepted by the receiver	Check for correct spelling and command syntax. See *Section 4.1, Communications with the Receiver, Page 57* and refer to the FRESET command in the *OEMV Firmware Reference Manual*.
Differential mode is not working properly	See *Section 4.3, Transmitting and Receiving Corrections, Page 60* and refer to the COMCONFIG log in the *OEMV Firmware Reference Manual*.
There appears to be a problem with the receiver's memory	Refer to the NVMRESTORE command in the *OEMV Firmware Reference Manual*.
An environmental or memory failure. The receiver temperature is out of acceptable range or the internal thermometer is not working	See the ENVIRONMENTAL sections in the tables of *Appendix A, Technical Specifications* starting on *Page 129.* Move the receiver to within an acceptable temperature range or increase the baud rate.
Overload and overrun problems. Either the CPU or port buffers are overloaded	Reduce the amount of logging. See also *Section 4.1.1, Serial Port Default Settings, Page 57*.
The receiver is indicating that an invalid authorization code has been used	Refer to the Version log, VALIDMODELS log and the MODEL command in the *OEMV Firmware Reference Manual*.
The receiver is being affected by jamming	Move the receiver away from any possible jamming sources.
The receiver's automatic gain control (AGC) is not working properly	See *Section 3.1.2, Choosing a Coaxial Cable, Page 34* and the jamming symptom in this table.

8.1 Examining the RXSTATUS Log

The RXSTATUS log provides detailed status information about your receiver and can be used to diagnose problems. Please refer to the *OEMV Firmware Reference Manual* for details on this log and on how to read the receiver error word and status word. *Tables 23 and 24 on pages 126 to 128* give you actions to take when your receiver has an error flag in either of these words.

Table 23: Resolving a Receiver Error Word

Bit Set	Action to Resolve
0	Issue a FRESET command
1	Issue a FRESET command
2	Issue a FRESET command
4	Contact Customer Service as described on *Page 18*
5	Check the VERSION log
6	Issue a FRESET command
7	See *Section 3.1.3, Power Supply Requirements, Page 34*
8	Issue a NVMRESTORE command
9	Check temperature ranges in the ENVIRONMENTAL table sections of *Appendix A, Technical Specifications* starting on *Page 129*
10	Contact Customer Service as described on *Page 18*
11	
12	
13	
14	
15	Move the receiver away from any possible jamming sources

Table 24: Resolving an Error in the Receiver Status Word

Bit Set	Action to Resolve
0	Check the Error Word in the RXSTATUS log. See also *Table 23, Resolving a Receiver Error Word* on *Page 126.*
1	Check temperature ranges in the ENVIRONMENTAL table sections of *Appendix A, , Technical Specifications* starting on *Page 129.*
2	See *Section 3.1.3, Power Supply Requirements, Page 34*.
3	See *Section 3.1.1, Selecting a GNSS Antenna, Page 33*, *Section 3.1.2, Choosing a Coaxial Cable, Page 34*, *Section 3.2.4, Connecting the Antenna to the Receiver, Page 40*, *Section 3.3.7, Antenna LNA Power, Page 51* and refer to the *Time to First Fix and Satellite Acquisition* section of the *GPS+ Reference Manual*.
4	
5	
6	
7	See *Section 4.1.1, Serial Port Default Settings, Page 57*.
8	
9	
10	
11	
14	Move the receiver away from any possible jamming sources.
15	See *Section 3.1.2, Choosing a Coaxial Cable, Page 34* and move the receiver away from any possible jamming sources.
16	Move the receiver away from any possible jamming sources.
17	See *Section 3.1.2, Choosing a Coaxial Cable, Page 34* and move the receiver away from any possible jamming sources.
18	None. Once enough time has passed for a valid almanac to be received, this bit will be set to 0. Also, refer to the *Time to First Fix and Satellite Acquisition* section of the *GPS+ Reference Manual*.
19	None. This bit only indicates if the receiver has calculated a position yet. Refer to the *Time to First Fix and Satellite Acquisition* section of the *GPS+ Reference Manual*
20	None. This bit is simply a status bit indicating if the receiver's position has been manually fixed and does not represent a problem. Refer also to the FIX command in the *OEMV Firmware Reference Manual*.

Continued on Page 128

Bit Set	Action to Resolve
21	None. This bit simply indicates if clock steering has been manually disabled. Refer also to the FRESET command in the *OEMV Firmware Reference Manual*.
22	None. This bit only indicates if the clock model is valid. Refer also to the FRESET command in the *OEMV Firmware Reference Manual*.
23	None. This bit indicates whether or not the phase-lock-loop is locked when using an external oscillator. Refer also to the FRESET command in the *OEMV Firmware Reference Manual*.
30	None. This bit indicates if any bits in the auxiliary 2 status word are set. The auxiliary 2 word simply provides status information and does not provide any new information on problems. Refer also to the FRESET command in the *OEMV Firmware Reference Manual*.
31	None. This bit indicates if any bits in the auxiliary 1 status word are set. The auxiliary 1 word simply provides status information and does not provide any new information on problems.Refer also to the FRESET command in the *OEMV Firmware Reference Manual*.

Appendix A Technical Specifications

A.1 OEMV Family Receiver Performance

PERFORMANCE *(Subject To GPS System Characteristics)*		
Position Accuracy [a]	Standalone:	
	L1 only	1.8 m RMS
	L1/L2	1.5 m RMS
	WAAS:	
	L1 only	1.2 m RMS
	L1/L2	0.9 m RMS
	DGPS	0.45 m RMS
	RT-20	0.20 m RMS
	RT-2	0.01 m + 1 ppm RMS
	CDGPS:	1.0 m RMS (OEMV-1 and OEMV-3 only)
	OmniSTAR:	
	VBS	0.7 m RMS (OEMV-1 and OEMV-3 only)
	XP	0.15 m RMS (OEMV-3 only)
	HP	0.10 m RMS (OEMV-3 only)
	Post Processed	5 mm + 1 ppm RMS
Time To First Fix	Hot: 30 s (Almanac and recent ephemeris saved and approximate position) Warm: 40 s (Almanac, approximate position and time, no recent ephemeris) Cold: 50 s (No almanac or ephemeris and no approximate position or time)	
Reacquisition	0.5 s L1 (typical) 1.0 s L2 (typical) (OEMV-2 and OEMV-3 only)	
Data Rates	Raw Measurements:	20 Hz
	Computed Position:	20 Hz
	OmniSTAR HP Position:	20 Hz (OEMV-3 only)
Time Accuracy [a b]	20 ns RMS	
Velocity Accuracy	0.03 m/s RMS	
Measurement Precision	C/A code phase	6 cm RMS
	L1 carrier phase:	
	Differential	0.75 mm RMS
	L2 P code	25 cm RMS (OEMV-2 and OEMV-3 only)
	L2 carrier phase:	
	Differential	2 mm RMS (OEMV-2 and OEMV-3 only)
Dynamics	Velocity	515 m/s [c]
	Height	18,288 m [c]

a. Typical values. Performance specifications are subject to GPS system characteristics, U.S. DOD operational degradation, ionospheric and tropospheric conditions, satellite geometry, baseline length and multipath effects.
b. Time accuracy does not include biases due to RF or antenna delay.
c. In accordance with export licensing.

A.2 OEMV-1 Card

PHYSICAL	
Size	46 mm x 71 mm x 10.3 mm with connectors
Weight	21.5 grams

MECHANICAL DRAWINGS

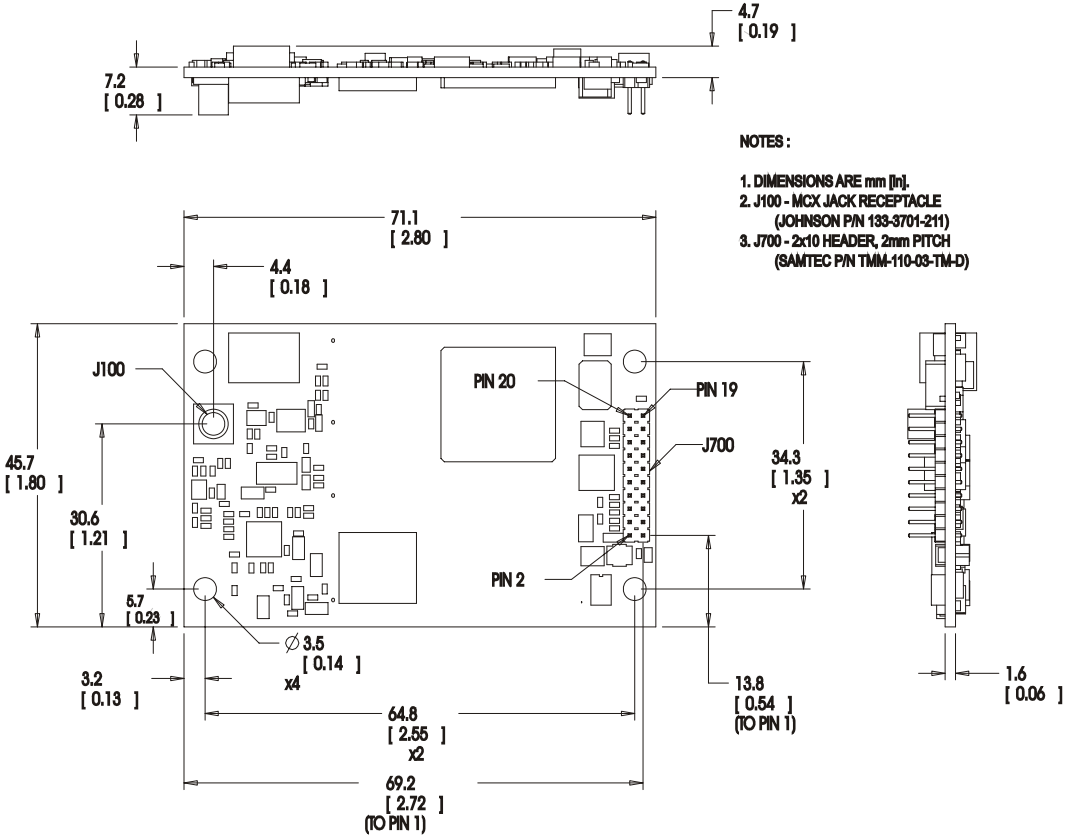


Figure 47: OEMV-1 Board Dimensions

ENVIRONMENTAL	
Operating Temperature	-40°C to +85°C
Storage Temperature	-45°C to +95°C
Humidity	Not to exceed 95% non-condensing
Random Vibe	RTCA D0-160D (4g)
Bump/Shock	MIL-STD 810F (40g)
POWER REQUIREMENTS	
Voltage	+3.3 V DC +5%/-3%
Allowable Input Voltage Ripple	100 mV p-p (max.)
Power consumption	1.1 W (typical, GPS only) 1.6 W (typical, GPS and L-Band)
RF INPUT / LNA POWER OUTPUT	
Antenna Connector	MCX female, 50 Ω nominal impedance (See *Figure 47* on *Page 130*)
Acceptable RF Input Level	-80 to -105 dBm
RF Input Frequencies	GPS L1: 1575.42 MHz OmniSTAR or CDGPS: 1525 to 1560 MHz
LNA Power External (Optional Input) Output to antenna	(See also *Section 2.3.1* on *Page 32*) +5.5 to +16 V DC, 100 mA max. (user-supplied) +4.75 to +5.10 V DC @ 0 - 100 mA
INPUT/OUTPUT DATA INTERFACE	
COM1	
Electrical format	LVTTL
Bit rates [a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400, 460800, 921600 bps
Signals supported	COM1_Tx and COM1_Rx
COM2	
Electrical format	LVTTL
Bit rates [a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400, 921600 bps
Signals supported	COM2_Tx and COM2_Rx
COM3	
Electrical format	LVTTL [b c d]
Bit rates [a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400 bps
Signals supported	COM3_Tx and COM3_Rx

Continued on Page 132

CAN BUS [ef g]	
Electrical format	LVTTL (requires external CAN transceiver)
Bit rates	500 kb/s maximum. CAN Bus throughput is determined by slowest device on the bus.
Signals supported	CAN1 is on Pins 6 and 7. CAN2 is on Pins 8 and 20. [g]
USB	
Electrical format	Conforms to USB 1.1
Bit rates	5 Mb/s maximum
Signals supported	USB D (+) and USB D (-)

a. Baud rates higher than 115,200 bps are not supported by standard PC hardware. Special PC hardware may be required for higher rates, including 230400 bps, 460800 bps, and 921600 bps.
b. Upon power-up, USB is enabled and COM3 is disabled by default. COM3_Tx and COM3_Rx are multiplexed with USB D (+) and EVENT1, respectively.
c. The receiver cannot prevent the host system from enumerating USB while using COM3 on the OEMV-1. This is due to the plug-and-play nature of USB. **Do not connect a USB cable while using COM3.**
d. Enable COM3 using the INTERFACEMODE command.
e. CAN1_RX and CAN1_TX are multiplexed with VARF and EVENT2, respectively. The default behavior is that EVENT2 is active. For VARF, refer to the FREQUENCYOUT command.
f. CAN Bus behavior must be asserted through the NovAtel API software. See *Section 3.3.3, CAN Bus* on *Page 46* for further details.
g. See also *Figure 48* on *Page 135* and its table.

Table 25: OEMV-1 Strobes

Strobes	Default Behavior	Input/ Output	Factory Default	Comment [a]
Event1 (Mark 1)	Multiplexed pin with COM3	Input Leading edge triggered	Active low	An input mark for which a pulse greater than 150 ns triggers certain logs to be generated. (Refer to the MARKPOS and MARKTIME logs and ONMARK trigger.) Polarity is configurable using the MARKCONTROL command. The mark inputs have 10K pull-up resistors to 3.3 V
Event2 (Mark 2)	Multiplexed pin	Input Leading edge triggered	Active low	An input mark for which a pulse greater than 150 ns triggers certain logs to be generated. (Refer to the MARK2POS and MARK2TIME logs.) Polarity is configurable using the MARKCONTROL command. The mark inputs have 10K pull-up resistors to 3.3 V.
PV (Position Valid)	Dedicated pin	Output	Active high	Indicates a valid GPS position solution is available. A high level indicates a valid solution or that the FIX POSITION command has been set (refer to the FIX POSITION command). VDD is 3.3V.
VARF (Variable Frequency)	Multiplexed pin	Output	Active low	A programmable variable frequency output ranging from 0 - 20 MHz (refer to the FREQUENCYOUT command).
RESETIN	Dedicated pin	Input	Active low	Reset LVTTL signal input from external system; active low, > 20 µs duration
TIMEMARK	Dedicated pin	Output	Active low	A time synchronization output. This is a pulse where the leading edge is synchronized to receiver-calculated GPS Time. The polarity, period and pulsewidth can be configured using PPSCONTROL command.

a. The commands and logs shown in capital letters (for example, MARKCONTROL) are discussed in further detail in the *OEMV Family Firmware Reference Manual.*

Table 26: OEMV-1 Strobe Electrical Specifications

Strobe	Sym	Min	Typ	Max	Units	Conditions
Event1 (Mark 1) Event2 (Mark2) TIMEMARK	V_{IL}			0.8	V	VDD = 3.3 V; 85°C
	V_{IH}	2.0			V	VDD = 3.3 V; 85°C
PV VARF	V_{OL}			0.4	V	VDD = 3.3 V; 85°C
	V_{OH}	3.0			V	VDD = 3.3 V; 85°C
RESETIN	V_{IL}			0.8	V	VDD = 3.3 V; 85°C
	V_{IH}	2.3			V	VDD = 3.3 V; 85°C

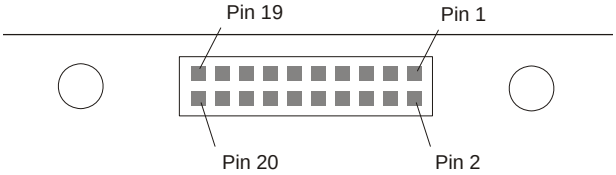


Figure 48: Top-view of 20-Pin Connector on the OEMV-1

Signal	Behavior [a]	Descriptions	Pin
LNA_PWR	Input DC	Power supply for external antenna LNA	1
V_{IN}	Input DC	DC power supply for card	2
USB D (-)	Bi-directional	USB interface data (-)	3
USB D (+) / COM3_Rx	Multiplexed	Multiplexed pin behavior default: USB D (+)	4
RESETIN	See strobes	Card reset	5
VARF / CAN1_Rx	Multiplexed	Multiplexed pin behavior, see strobes default: VARF	6
Event2 / CAN1_Tx	Multiplexed	Multiplexed pin behavior, see strobes default: Event2	7
CAN2_RX	Bi-directional	CAN Bus dedicated port	8
Event1 / COM3_Tx	Multiplexed	Multiplexed pin behavior, see strobes default: Event1	9
GND	Ground	Digital Ground	10
COM1_Tx	Output	Transmitted Data for COM 1 output	11
COM1_Rx	Input	Received Data for COM 1 input	12
GND	Ground	Digital Ground	13
COM2_Tx	Output	Transmitted Data for COM 2 output	14
COM2_Rx	Input	Received Data for COM 2 input	15
GND	Ground	Digital Ground	16
PV	See strobes	Output indicates 'good solution' or valid GPS position when high	17
GND	Ground	Digital Ground	18
TIMEMARK	See strobes	Pulse output synchronized to GPS Time	19
CAN2_TX	Bi-directional	CAN Bus dedicated port	20

a. A bi-directional Transient Voltage Suppressor (TVS) device is included between 3.3V and ground. Input/Output (I/O) lines are protected by TVS devices. Series resistance is included for the following I/O lines: COM1/COM2/COM3 Tx and Rx, RESETIN, Event1 and Event2. Lines that do not have series resistance include: CAN1_Tx, CAN1_Rx, CAN2_Tx, CAN2_Rx, USB D (+) and USB D (-).

A.3 OEMV-1G Card

PHYSICAL	
Size	46 mm x 71 mm x 9.8 mm with connectors
Weight	21.5 grams

MECHANICAL DRAWINGS

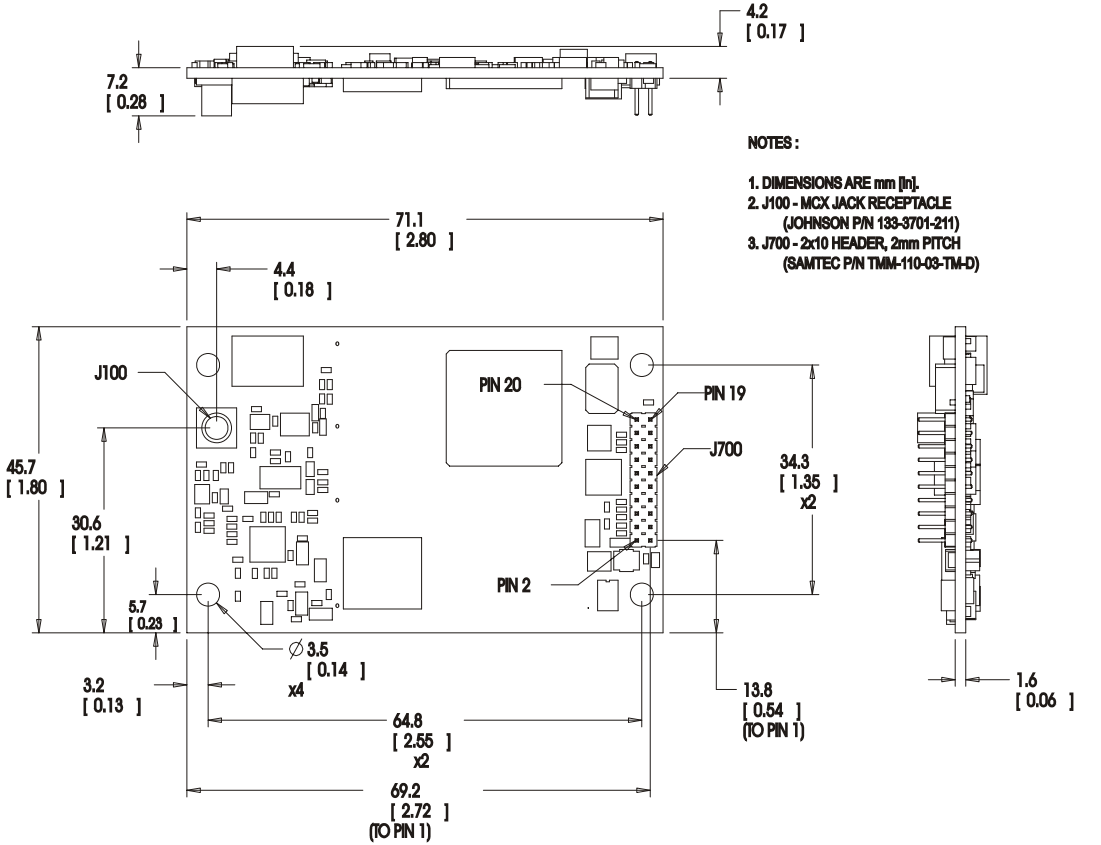


Figure 49: OEMV-1G Board Dimensions

ENVIRONMENTAL	
Operating Temperature	-40°C to +85°C
Storage Temperature	-45°C to +95°C
Humidity	Not to exceed 95% non-condensing
Random Vibe	RTCA D0-160D (4g)
Bump/Shock	MIL-STD 810F (40g)
POWER REQUIREMENTS	
Voltage	+3.3 V DC +5%/-3%
Allowable Input Voltage Ripple	100 mV p-p (max.)
Power consumption	1.1 W (typical, GPS and GLONASS)
RF INPUT / LNA POWER OUTPUT	
Antenna Connector	MCX female, 50 Ω nominal impedance (See *Figure 49* on *Page 136*)
Acceptable RF Input Level	-80 to -105 dBm
RF Input Frequencies	GPS L1: 1575.42 MHz GLONASS L1: 1602.0 MHz for Fk=0 where k = (-7 to +13) Channel spacing 562.5 kHz
LNA Power External (Optional Input) Output to antenna	(See also *Section 2.3.1* on *Page 32*) +5.5 to +16 V DC, 100 mA max. (user-supplied) +4.75 to +5.10 V DC @ 0 - 100 mA
INPUT/OUTPUT DATA INTERFACE	
COM1	
Electrical format	LVTTL
Bit rates [a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400, 460800, 921600 bps
Signals supported	COM1_Tx and COM1_Rx
COM2	
Electrical format	LVTTL
Bit rates [a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400, 921600 bps
Signals supported	COM2_Tx and COM2_Rx
COM3	
Electrical format	LVTTL [b c d]
Bit rates [a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400 bps
Signals supported	COM3_Tx and COM3_Rx

Continued on Page 132

CAN BUS [e f g]

Electrical format	LVTTL (requires external CAN transceiver)
Bit rates	500 kb/s maximum. CAN Bus throughput is determined by slowest device on the bus.
Signals supported	CAN1 is on Pins 6 and 7. CAN2 is on Pins 8 and 20. [g]
USB	
Electrical format	Conforms to USB 1.1
Bit rates	5 Mb/s maximum
Signals supported	USB D (+) and USB D (-)

a. Baud rates higher than 115,200 bps are not supported by standard PC hardware. Special PC hardware may be required for higher rates, including 230400 bps, 460800 bps, and 921600 bps.
b. Upon power-up, USB is enabled and COM3 is disabled by default. COM3_Tx and COM3_Rx are multiplexed with USB D (+) and EVENT1, respectively.
c. The receiver cannot prevent the host system from enumerating USB while using COM3 on the OEMV-1G. This is due to the plug-and-play nature of USB. **Do not connect a USB cable while using COM3.**
d. Enable COM3 using the INTERFACEMODE command.
e. CAN1_RX and CAN1_TX are multiplexed with VARF and EVENT2, respectively. The default behavior is that EVENT2 is active. For VARF, refer to the FREQUENCYOUT command.
f. CAN Bus behavior must be asserted through the NovAtel API software. See *Section 3.3.3, CAN Bus* on *Page 46* for further details.
g. See also *Figure 50* on *Page 141* and its table.

Table 27: OEMV-1G Strobes

Strobes	Default Behavior	Input/ Output	Factory Default	Comment [a]
Event1 (Mark 1)	Multiplexed pin with COM3	Input Leading edge triggered	Active low	An input mark for which a pulse greater than 150 ns triggers certain logs to be generated. (Refer to the MARKPOS and MARKTIME logs and ONMARK trigger.) Polarity is configurable using the MARKCONTROL command. The mark inputs have 10K pull-up resistors to 3.3 V
Event2 (Mark 2)	Multiplexed pin	Input Leading edge triggered	Active low	An input mark for which a pulse greater than 150 ns triggers certain logs to be generated. (Refer to the MARK2POS and MARK2TIME logs.) Polarity is configurable using the MARKCONTROL command. The mark inputs have 10K pull-up resistors to 3.3 V.
PV (Position Valid)	Dedicated pin	Output	Active high	Indicates a valid GPS position solution is available. A high level indicates a valid solution or that the FIX POSITION command has been set (refer to the FIX POSITION command). 3.3 V.
VARF (Variable Frequency)	Multiplexed pin	Output	Active low	A programmable variable frequency output ranging from 0 - 20 MHz (refer to the FREQUENCYOUT command).
RESETIN	Dedicated pin	Input	Active low	Reset LVTTL signal input from external system; active low, > 20 µs duration
TIMEMARK	Dedicated pin	Output	Active low	A time synchronization output. This is a pulse where the leading edge is synchronized to receiver-calculated GPS Time. The polarity, period and pulsewidth can be configured using PPSCONTROL command.

a. The commands and logs shown in capital letters (for example, MARKCONTROL) are discussed in further detail in the *OEMV Family Firmware Reference Manual.*

Table 28: OEMV-1G Strobe Electrical Specifications

Strobe	Sym	Min	Typ	Max	Units	Conditions
Event1 (Mark 1) Event2 (Mark2) TIMEMARK	V_{IL}			0.8	V	VDD = 3.3 V; 85°C
	V_{IH}	2.0			V	VDD = 3.3 V; 85°C
PV VARF	V_{OL}			0.4	V	VDD = 3.3 V; 85°C
	V_{OH}	3.0			V	VDD = 3.3 V; 85°C
RESETIN	V_{IL}			0.8	V	VDD = 3.3 V; 85°C
	V_{IH}	2.3			V	VDD = 3.3 V; 85°C

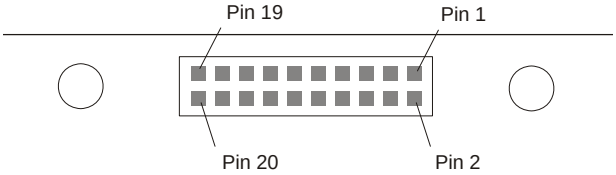


Figure 50: Top-view of 20-Pin Connector on the OEMV-1G

Signal	Behavior [a]	Descriptions	Pin
LNA_PWR	Input DC	Power supply for external antenna LNA	1
V_{IN}	Input DC	DC power supply for card	2
USB D (-)	Bi-directional	USB interface data (-)	3
USB D (+) / COM3_Rx	Multiplexed	Multiplexed pin behavior default: USB D (+)	4
RESETIN	See strobes	Card reset	5
VARF / CAN1_Rx	Multiplexed	Multiplexed pin behavior, see strobes default: VARF	6
Event2 / CAN1_Tx	Multiplexed	Multiplexed pin behavior, see strobes default: Event2	7
CAN2_RX	Bi-directional	CAN Bus dedicated port	8
Event1 / COM3_Tx	Multiplexed	Multiplexed pin behavior, see strobes default: Event1	9
GND	Ground	Digital Ground	10
COM1_Tx	Output	Transmitted Data for COM 1 output	11
COM1_Rx	Input	Received Data for COM 1 input	12
GND	Ground	Digital Ground	13
COM2_Tx	Output	Transmitted Data for COM 2 output	14
COM2_Rx	Input	Received Data for COM 2 input	15
GND	Ground	Digital Ground	16
PV	See strobes	Output indicates 'good solution' or valid GPS position when high	17
GND	Ground	Digital Ground	18
TIMEMARK	See strobes	Pulse output synchronized to GPS Time	19
CAN2_TX	Bi-directional	CAN Bus dedicated port	20

a. A bi-directional Transient Voltage Suppressor (TVS) device is included between 3.3V and ground. Input/Output (I/O) lines are protected by TVS devices. Series resistance is included for the following I/O lines: COM1/COM2/COM3 Tx and Rx, RESETIN, Event1 and Event2. Lines that do not have series resistance include: CAN1_Tx, CAN1_Rx, CAN2_Tx, CAN2_Rx, USB D (+) and USB D (-).

A.4 OEMV-2 Card

PHYSICAL	
Size	60 mm x 100 mm x 11.4 mm with connectors
Weight	56 grams

MECHANICAL DRAWINGS

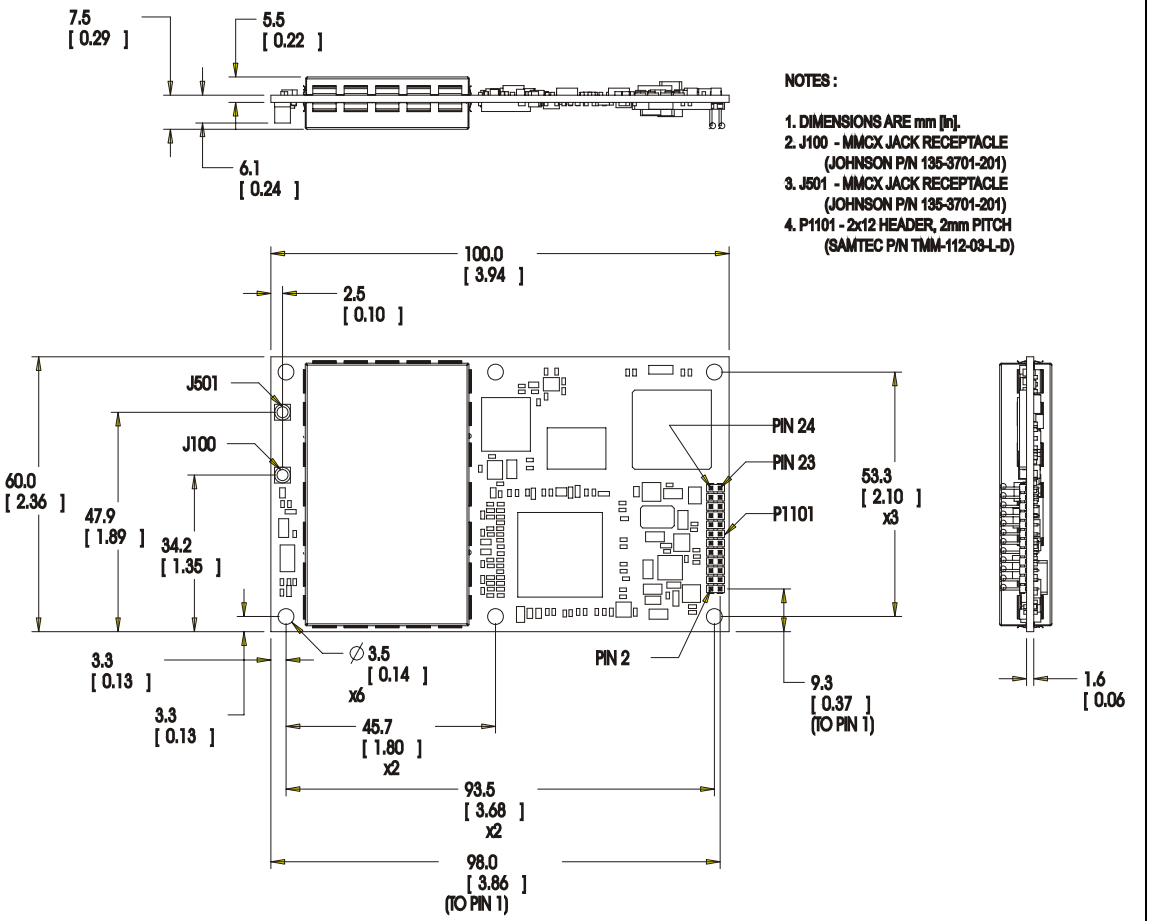


Figure 51: OEMV-2 Board Dimensions

ENVIRONMENTAL	
Operating Temperature	-40°C to +85°C
Storage Temperature	-45°C to +95°C
Humidity	Not to exceed 95% non-condensing
Random Vibe	MIL-STD 810F (7.7g)
Sine Vibe	SAEJ1211 (4g)
Bump/Shock	IEC 68-2-27 (30g)
POWER REQUIREMENTS	
Voltage	+3.3 V DC +5%/-3%
Allowable Input Voltage Ripple	100 mV p-p (max.)
Power consumption	1.2 W (typical, GPS only) 1.6 W (typical, GPS and GLONASS)
RF INPUT / LNA POWER OUTPUT	
Antenna Connector	MMCX female, 50 Ω nominal impedance (See *Figure 51* on *Page 142*)
Acceptable RF Input Level	-80 dBm to -105 dBm
RF Input Frequencies	GPS L1: 1575.42 MHz GPS L2: 1227.60 MHz GLONASS L1: 1602.0 MHz for Fk=0 where k = (-7 to +13) Channel spacing 562.5 kHz GLONASS L2: 1246.0 MHz for Fk=0 where k= (-7 to +13) Channel spacing 437.5 kHz
LNA Power Internal	(See *Section 2.3.1* on *Page 32*) +4.75 to +5.10 V DC @ 0 - 100 mA (output from card; only option)
EXTERNAL OSCILLATOR INPUT	
Connector	MMCX female (See *Figure 53* on *Page 148)* Connections between the MMCX and an external oscillator, or interface board, must be impedance controlled. To accomplish this, use 50 ohm coaxial cable and 50 ohm connectors.
External Clock Input (Refer to the EXTERNALCLOCK command)	Frequency: 5 MHz or 10 MHz Input Impedance: 50 Ω nominal Input VSWR: < 2.0 : 1 Signal Level: 0 dBm minimum to +13.0 dBm maximum Frequency Stability: ± 0.5 ppm maximum Wave Shape: Sinusoidal

INPUT/OUTPUT DATA INTERFACE	
COM1	
Electrical format	RS-232
Bit rates [a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400, 460800, 921600 bps
Signals supported	COM1_Tx, COM1_Rx, RTS1, CTS1
COM2	
Electrical format	LVTTL
Bit rates [a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400 bps
Signals supported	COM2_Tx, COM2_Rx, RTS2, CTS2
COM3	
Electrical format	LVTTL [b c d]
Bit rates [a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400 bps
Signals supported	COM3_Tx, COM3_Rx
CAN BUS [e]	
Electrical format	LVTTL [b] (requires external CAN transceiver)
Bit rates	500 kb/s maximum. CAN Bus throughput is determined by slowest device on the bus.
Signals supported	CAN1 is on Pins 7 and 19 [f g]
USB	
Electrical format	Conforms to USB 1.1
Bit rates	5 Mb/s maximum

a. Baud rates higher than 115,200 bps are not supported by standard PC hardware. Special PC hardware may be required for higher rates, including 230400 bps, 460800 bps, and 921600 bps.
b. COM3 is the default. COM3_Tx and COM3_Rx are multiplexed with CAN1_Tx and GPIO, AND CAN1_Rx AND EVENT2.
c. Upon power-up, COM3 (COM3_Tx and COM3_Rx) is enabled by default unless the default is overridden by a changed configuration, previously saved using the SAVECONFIG command. When COM3 is enabled, CAN1, GPIO0 and EVENT2 are not available. USB is always available.
d. Enable COM3 using the INTERFACEMODE command. GPIO on Pin 19 is configured by the MARKCONTROL command.
e. CAN Bus behavior must be asserted through the NovAtel API software. See *Section 3.3.3, CAN Bus* on *Page 46* for further details.
f. See also *Figure 52* on *Page 147* and its table.
g. Driven by an open collector source when configured as GPIO

Table 29: OEMV-2 Strobes

Strobes	Default Behavior	Input/ Output	Factory Default	Comment [a]
Event1 (Mark 1)	Dedicated pin	Input Leading edge triggered	Active low	An input mark for which a pulse greater than 150 ns triggers certain logs to be generated. (Refer to the MARKPOS and MARKTIME logs and ONMARK trigger. Polarity is configurable using the MARKCONTROL command. The mark inputs have 10K pull-up resistors to 3.3 V
Event2 (Mark 2)	Multiplexed pin	Input Leading edge triggered	Active low	An input mark for which a pulse greater than 150 ns triggers certain logs to be generated. (Refer to the MARK2POS and MARK2TIME logs. Polarity is configurable using the MARKCONTROL command. The mark inputs have 10K pull-up resistors to 3.3 V.
PV (Position Valid)	Dedicated pin	Output	Active high	Indicates a valid GPS position solution is available. A high level indicates a valid solution or that the FIX POSITION command has been set (refer to the FIX POSITION command).
VARF (Variable Frequency)	Dedicated pin	Output	Active low	A programmable variable frequency output ranging from 0 - 20 MHz (refer to the FREQUENCYOUT command).
RESETIN	Dedicated pin	Input	Active low	Reset LVTTL signal input from external system; active low, > 20 µs duration
PPS	Dedicated pin	Output	Active low	A time synchronization output. This is a pulse where the leading edge is synchronized to receiver-calculated GPS Time. The polarity, period and pulsewidth can be configured using PPSCONTROL command.
ERROR	Dedicated pin	Output	Active high	See *Chapter 7, Built-In Status Tests* starting on *Page 118*

a. The commands and logs shown in capital letters (for example, MARKCONTROL) are discussed in further detail in the *OEMV Family Firmware Reference Manual.*

Table 30: OEMV-2 Strobe Specifications

Strobe	Sym	Min	Typ	Max	Units	Conditions
Event1 (Mark 1) Event2 (Mark2) PPS	V_{IL}			0.8	V	VDD = 3.3 V; 85°C
	V_{IH}	2.0			V	VDD = 3.3 V; 85°C
PV VARF ERROR	V_{OL}			0.4	V	VDD = 3.3 V; 85°C
	V_{OH}	3.0			V	VDD = 3.3 V; 85°C
RESETIN	V_{IL}			0.8	V	VDD = 3.3 V; 85°C
	V_{IH}	2.3			V	VDD = 3.3 V; 85°C

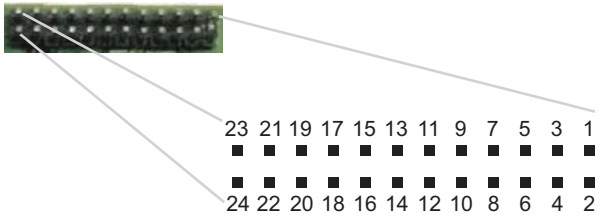


Figure 52: Top-view of 24-Pin Connector on the OEMV-2

Signal	Behavior [a]	Descriptions	Pin
GND	Ground	Digital ground	1
GPIO_USER1	Reserved	Do not use	2
VARF0	See strobes	Variable frequency out	3
PPS	See strobes	Pulse output synchronized to GPS Time	4
VCC	Input DC	Card power	5
VCC	Input DC	Card power	6
Event2, CAN1_Rx and COM3_Rx	Multiplexed	Multiplexed pin behavior, see strobes default: COM3_Rx	7
Event1	See strobes	Input trigger	8
ERROR	See strobes	Card error, see *Chapter 7, Built-In Status Tests* starting on *Page 118*	9
PV	See strobes	Output indicates valid GPS position when high	10
CTS2/VARF1	Input	Clear to Send for COM 2 input or variable frequency default: CTS2	11
RESETIN	See strobes	Card reset	12
RTS2	Output	Request to Send for COM 2 output	13
COM2_Rx	Input	Received Data for COM 2 input	14
CTS1	Input	Clear to Send for COM 1 input	15
COM2_Tx	Output	Transmitted Data for COM 2 output	16
RTS1	Output	Request to Send for COM 1 output	17
COM1_Rx	Input	Received Data for COM 1 input	18
GPIO0, CAN1_Tx and COM3_Tx	Multiplexed	Multiplexed pin behavior, see strobes default: COM3_Tx	19
COM1_Tx	Output	Transmitted Data for COM 1 output	20
USB D (-)	Bi-directional	USB interface data (-)	21
USB D (+)	Bi-directional	USB interface data (+)	22
GND	Ground	Digital Ground	23
GND	Ground	Digital Ground	24

a. There is no TVS between 3.3 V and ground. All other I/O signal lines have TVS protection. Series resistance is included for the GPIO0 and RESETIN lines.

A.5 OEMV-3 Card

PHYSICAL	
Size	85 mm x 125 mm x 14.3 mm with connectors
Weight	85 grams

MECHANICAL DRAWINGS

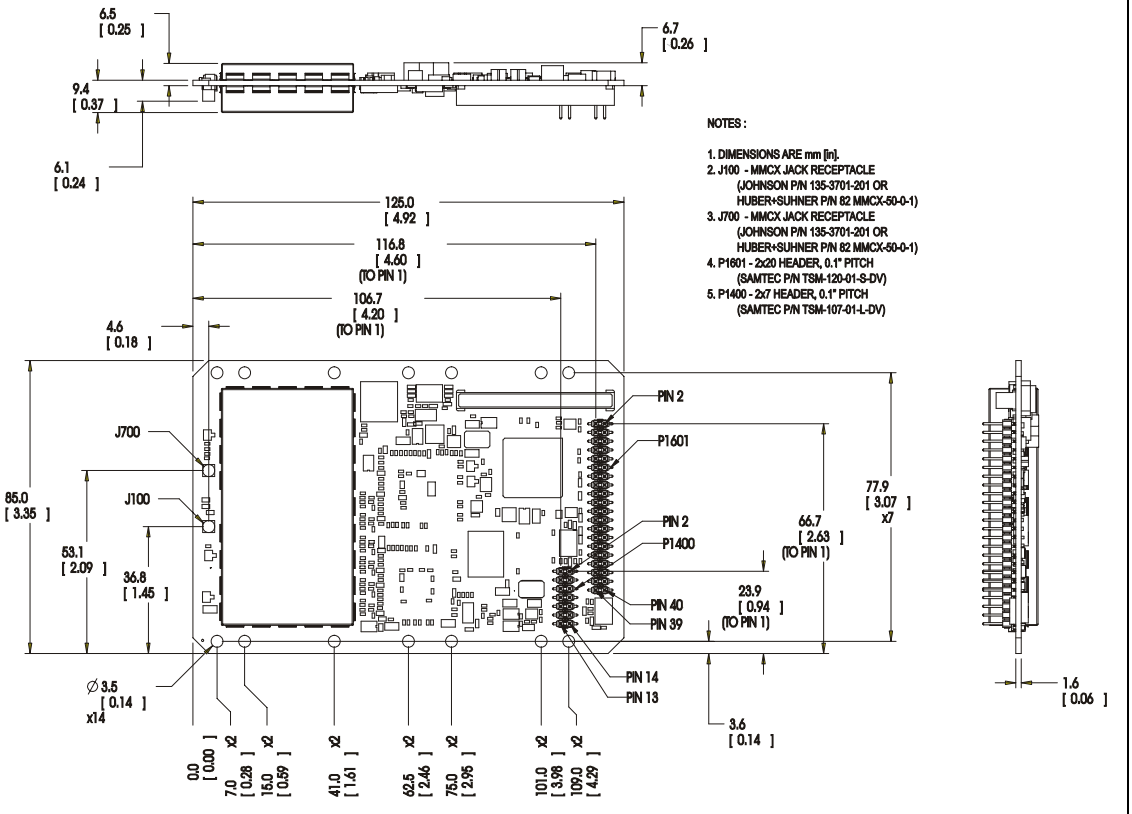


Figure 53: OEMV-3 Board Dimensions

ENVIRONMENTAL	
Operating Temperature	-40°C to +85°C
Storage Temperature	-45°C to +95°C
Humidity	Not to exceed 95% non-condensing
Random Vibe	MIL-STD 810F (7.7g)
Sine Vibe	SAEJ1211 (4g)
Bump/Shock	IEC 68-2-27 (30g)
POWER REQUIREMENTS	
Voltage	+4.5 to +18.0 V DC
Allowable Input Voltage Ripple	100 mV p-p (max.)
Power consumption	2.1 W (typical, GPS only) 2.8 W (typical, GPS and GLONASS)
RF INPUT / LNA POWER OUTPUT	
Antenna Connector	MMCX female, 50 Ω nominal impedance (See *Figure 53* on *Page 148*)
Acceptable RF Input Level	-80 dBm to -105 dBm
RF Input Frequencies (MHz)	GPS L1: 1575.42 MHz GPS L2: 1227.60 MHz GPS L5: 1176.45 MHz GLONASS L1: 1602.0 MHz for Fk=0 where k = (-7 to +13) Channel spacing 562.5 kHz GLONASS L2: 1246.0 MHz for Fk=0 where k= (-7 to +13) Channel spacing 437.5 kHz OmniSTAR or CDGPS: 1525 to 1560 MHz
LNA Power **Internal** External (Optional Input)	(See *Section 2.3.1* on *Page 32*) +4.75 to +5.10 V DC @ 0 - 100 mA **(output from card, default)** +5.5 to +18 V DC, 100 mA max. (user-supplied)
EXTERNAL OSCILLATOR INPUT	
Connector	MMCX female (See *Figure 53* on *Page 148)*
External Clock Input (Refer to the EXTERNALCLOCK command)	Frequency: 5 MHz or 10 MHz Input Impedance: 50 Ω nominal Input VSWR: 2.0:1 Signal Level: 0 dBm minimum to +13.0 dBm maximum Frequency Stability: ± 0.5 ppm maximum Wave Shape: Sinusoidal

INPUT/OUTPUT DATA INTERFACE	
COM1	
Electrical format	User-selectable. Defaults to RS-232 but can be configured for RS-422. See *Page 43* for more details or GPIO if configured by the MARKCONTROL command. (Can also be factory configured for LVTTL operation)
Bit rates[a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400, 460800, 921600 bps
Signals supported	COM1_Tx, COM1_Rx, RTS1, CTS1 for RS-232 or COM1_Tx (+), COM1_Tx (-), COM1_Rx (+), COM1_Rx (-) for RS-422
COM2	
Electrical format	RS-232 (Can be factory configured for LVTTL operation)
Bit rates[a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400 bps
Signals supported	COM2_Tx, COM2_Rx, RTS2, CTS2, DTR2, DCD2
COM3	
Electrical format	LVTTL [b]
Bit rates[a]	300, 1200, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400 bps
Signals supported	COM3_Tx, COM3_Rx, RTS3, CTS3
CAN BUS [c]	
Electrical format	CANBUS [c d]
Bit rates	500 kb/s maximum. CAN Bus throughput is determined by slowest device on the bus.
CAN1 signals supported [e]	CAN Bus 1(with transceiver), see also *Figure 55, Top-view of 14-Pin CAN Connector on the OEMV-3* on *Page 155*
CAN2 signals supported [e]	CAN BUS 2 (with transceiver), see also *Figure 55* on *Page 155*
USB	
Signals supported	USB D(+), USB D(-)

a. Baud rates higher than 115,200 bps are not supported by standard PC hardware. Special PC hardware may be required for higher rates, including 230400 bps, 460800 bps, and 921600 bps.
b. Upon power-up, EVENT2 is enabled and GPIO1 is disabled unless the default is overridden by a changed configuration, previously saved using the SAVECONFIG command. GPIO1 is configured by the MARKCONTROL command.
c. CAN Bus behavior must be asserted through the NovAtel API software. See *Section 3.3.3, CAN Bus* on *Page 46* for further details.
d. CANBUS transceivers are populated on the OEMV-3 card.
e. See also *Figure 54* on *Page 153* and its table.

Table 31: OEMV-3 Strobes

Strobes	Default Behavior	Input/ Output	Factory Default	Comment [a]
MSR (Measure Output)	Dedicated pin	Output	Active low	1 ms pulse, leading edge is synchronized with internal GNSS measurements. The MSR signal is not user-configurable. Up to 20 Hz.
Event1 (Mark 1)	Dedicated pin	Input Leading edge triggered	Active low	An input mark for which a pulse greater than 150 ns triggers certain logs to be generated. (Refer to the MARKPOS and MARKTIME logs and ONMARK trigger.) Polarity is configurable using the MARKCONTROL command. The mark inputs have 10K pull-up resistors to 3.3 V
Event2 (Mark 2)	Multiplexed pin	Input Leading edge triggered	Active low	An input mark for which a pulse greater than 150 ns triggers certain logs to be generated. (Refer to the MARK2POS and MARK2TIME logs.) Polarity is configurable using the MARKCONTROL command. The mark inputs have 10K pull-up resistors to 3.3 V.
PV (Position Valid)	Dedicated pin	Output	Active high	Indicates a valid GPS position solution is available. A high level indicates a valid solution or that the FIX POSITION command has been set (refer to the FIX POSITION command).
VARF (Variable Frequency)	Dedicated pin	Output	Active low	A programmable variable frequency output ranging from 0 - 20 MHz (refer to the FREQUENCYOUT command).
RESETOUT	Dedicated pin	Output	Active low	140 ms duration
RESETIN	Dedicated pin	Input	Active low	Reset LVTTL signal input from external system; active low, > 20 µs duration
PPS	Dedicated pin	Output	Active low	A time synchronization output. This is a pulse where the leading edge is synchronized to receiver-calculated GPS Time. The polarity, period and pulsewidth can be configured using PPSCONTROL command.
ERROR	Dedicated pin	Output	Active high	See *Chapter 7, Built-In Status Tests* starting on *Page 118*

Continued on Page 152

Strobes	Default Behavior	Input/ Output	Factory Default	Comment [a]
STATUS_RED	Dedicated pin	Output	Active high	Status output which is high, or pulses, to indicate that the OEMV-3 card is not working properly. [b]
STATUS_GREEN	Dedicated pin	Output	Active high	Status output which pulses to indicate that the OEMV-3 card is working properly. [b]

a. The commands and logs shown in capital letters (for example, MARKCONTROL) are discussed in further detail in the *OEMV Family Firmware Reference Manual.*

b. See also *Section 7.6, Status LEDs* starting on *Page 122* of this manual.

Table 32: OEMV-3 Strobe Specifications

Strobe	Sym	Min	Typ	Max	Units	Conditions
Event1 (Mark 1) Event2 (Mark2) PPS	V_{IL}			0.8	V	VDD = 3.3 V; 85°C
	V_{IH}	2.0			V	VDD = 3.3 V; 85°C
PV MSR VARF ERROR STATUS_RED STATUS_GREEN RESETOUT	V_{OL}			0.4	V	VDD = 3.3 V; 85°C
	V_{OH}	3.0			V	VDD = 3.3 V; 85°C
RESETIN	V_{IL}			0.8	V	VDD = 3.3 V; 85°C
	V_{IH}	2.3			V	VDD = 3.3 V; 85°C

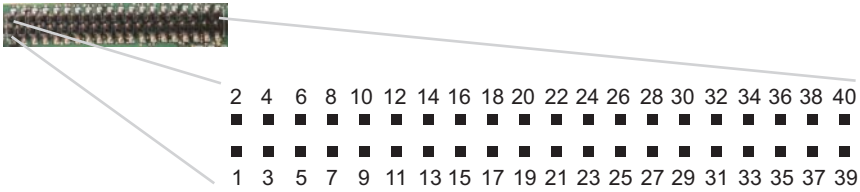


Figure 54: Top-view of 40-Pin Connector on the OEMV-3

Signal	Behavior	Descriptions	Pin
V_{IN}	Input DC	Card power	1
PV	See strobes	Output indicates a valid GPS position when high	2
USB D (+)	Bi-directional	USB interface data (+)	3
GND	Ground	Digital Ground	4
USB D	Bi-directional	USB interface data (-)	5
GND	Ground	Digital Ground	6
PPS	See strobes	Pulse output synchronized to GPS Time	7
GND	Ground	Digital Ground	8
VARF	See strobes	Variable frequency out	9
GND	Ground	Digital Ground	10
Event1	See strobes	Input trigger	11
GND	Ground	Digital Ground	12
STATUS_RED	See strobes	Indicates the OEMV-3 card is not working properly when high or pulsing.	13
CTS1/ COM1_Rx (-)	See COM Ports	COM1 input Clear to Send for RS-232 / Received Data (-) for RS-422	14
COM1_Tx/ COM1_Tx (+)	See COM Ports	COM1 output Transmitted Data for RS-232 / Transmitted Data (+) for RS-422	15
RTS1/ COM1_Tx (-)	See COM Ports	COM1 output Request to Send for RS-232 / Transmitted Data (-) for RS-422	16
COM1_Rx/ COM1_Rx(+)	See COM Ports	COM1 input Received Data for RS-232 / Received Data (+) for RS-422	17
CTS3	Input	Clear to Send for COM 3	18
COM3_Tx	Output	Transmitted Data for COM 3	19
DCD2	Input	Data Carrier Detected for COM 2	20
COM3_Rx	Input	Received Data for COM 3	21
RTS3	Output	Request to Send for COM 3	22
DTR2	Output	Data Terminal Ready for COM 2	23
CTS2	Input	Clear to Send for COM 2	24
COM2_Tx	Output	Transmitted Data for COM 2	25
RTS2	Output	Request to Send for COM 2	26

Continued on Page 154

Signal	Behavior	Descriptions	Pin
COM2_Rx	Input	Received Data for COM 2	27
STATUS_GREEN	See strobes	Indicates the OEMV-3 card is working properly when pulsing at 1 Hz.	28
GPIO_USER0	Reserved	Do not use. 10 kΩ pull-down resistor internal to OEMV-3.	29
USERIO1	Input	COM1 port configuration selector. 10 kΩ pull-down resistor internal to OEMV-3. (At startup, tie high to set COM1 to RS-422 or leave open for RS-232. See *Page 43* for more details.)	30
Event2/GPIO1	See strobes	Input trigger default: EVENT2	31
MSR	See strobes	Pulse synchronized to GNSS measurements	32
RESETIN	See strobes	Card reset	33
GPAI	Analog	General purpose analog input (refer to the RXHWLEVELS log). The voltage range is 0.0 to 2.75 V DC.	34
RESETOUT	See strobes	Reset TTL signal output to external system; active low.	35
GND	Ground	Digital Ground	36
GPIO_FR	Reserved	Do not use. 10 kΩ pull-up resistor internal to OEMV-3.	37
ERROR	See strobes	Indicates fatal error when high	38
*	Reserved	Do not use.	39
LNA_PWR	Output DC	Optional external power to antenna other than a standard NovAtel GPSAntenna (see also *Antenna LNA Power* on *Page 51*).	40

✉ To create a common ground, tie together all digital grounds (GND) with the ground of the power supply.

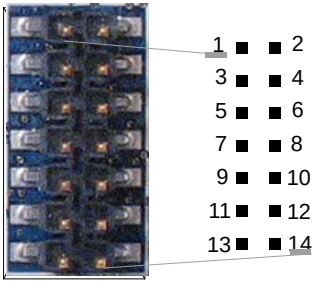


Figure 55: Top-view of 14-Pin CAN Connector on the OEMV-3

Signal	Descriptions	Pin
CAN1L	CAN1 low	1
CAN1H	CAN1 high	2
GND	Digital Ground	3
GND	Digital Ground	4
CAN2L	CAN2 low	5
CAN2H	CAN2 high	6
GND	Digital Ground	8
GND	Digital Ground	8
NC	Not Connected	9
NC	Not Connected	10
GPIO	Reserved. 10 kΩ pull-down resistor internal to OEMV-3.	11
GPIO	Reserved. 10 kΩ pull-down resistor internal to OEMV-3.	12
NC	Not Connected	13
NC	Not Connected	14

A.6 DL-V3

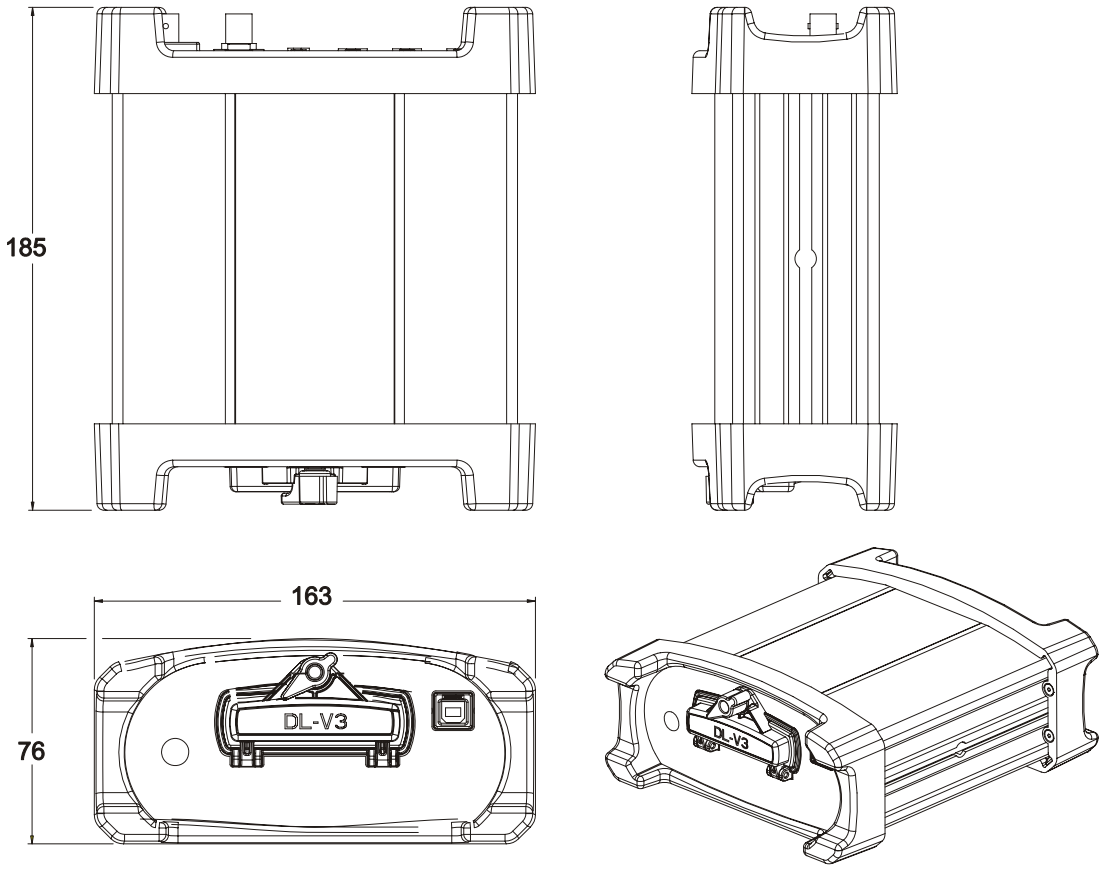
INPUT/OUTPUT CONNECTORS	
Antenna Input	TNC female jack, 50 Ω nominal impedance +4.75 to +5.10 V DC, 100 mA max (output from DL-V3 to antenna/LNA)
PWR	4-pin LEMO connector +9 to +28 V DC at 3.5 W (typical while logging) [a]
COM1 COM2 COM3 AUX I/O OSC	DB9P connector DB9P connector Bluetooth v1.1 interface or Ethernet [b] DB9P connector DB9S connector BNC connector (external oscillator)
PHYSICAL	
Size	185 x 163 x 76 mm
Weight	1.3 kg maximum (including OEMV-3 card)
ENVIRONMENTAL	
Operating Temperature	-40°C to +75°C
Storage Temperature	-45°C to +95°C
Humidity	Not to exceed 95% non-condensing

a. When tracking GPS satellites

b. The DL-V3 is Bluetooth ready by default. COM3 may be configured for Ethernet but only one communication mode at a time can be used on COM3. Ethernet usage also requires a change of cable. See also the *APPCONTROL* command in the *DL-V3 Firmware Reference Manual* and *Appendix C, Ethernet Configuration* on *Page 189* of this manual.

DIMENSIONS

a b



a. All dimension are in millimeters, please use the *Unit Conversion* section of the *GPS+ Reference Manual* for conversion to imperial measurements.

b. See also the ProPak-V3 *Dimensions* section, on *Page 164*, for the dimensions of the mounting bracket. The mounting bracket also has a set of instructions with it.

A.6.1 Port Pin-Outs

Table 33: DL-V3 Serial Port Pin-Out Descriptions

Connector Pin No.	COM1 RS-232	COM2 RS-232	AUX RS-232
1	N/C	N/C	N/C
2	COM1_Rx	COM2_Rx	COM3_Rx
3	COM1_Tx	COM2_Tx	COM3_Tx
4	N/C	POUT	POUT
5	GND	GND	GND
6	D (+)	N/C	N/C
7	RTS1	RTS2	RTS3
8	CTS1	CTS2	CTS3
9	D (-)	N/C	N/C

Table 34: DL-V3 I/O Port Pin-Out Descriptions

Connector Pin No.	Signal Name	Signal Descriptions
1	VARF	Variable frequency out
2	PPS	Pulse per second
3	MSR	Mark 1 output
4	EVENT1	Mark 1 input
5	PV	Valid position available
6	EVENT2	Mark 2 input, which requires a pulse longer than 150 ns. 10K ohm pull down resistor internal to the DL-V3. Refer also to the MARKCONTROL command in the *OEMV Firmware Reference Manual*.
7	_RESETOUT	Reset TTL signal output to an external system. Active low.
8	ERROR	Indicates a fatal error when high.
9	GND	Digital ground

✉ For strobe signal descriptions, please see *Section 3.3.1, Strobes* on *Page 44*.

A.6.2 Cables

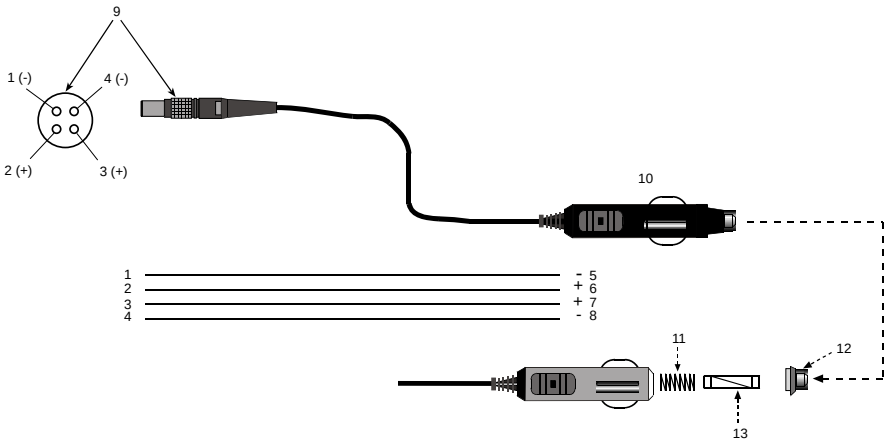
A.6.2.1 12V Power Adapter Cable (NovAtel part number 01017663)

The power adapter cable supplied with the DL-V3, see *Figure 60*, provides a convenient means for supplying +12 V DC while operating in the field.

Input is provided through the standard 12V power outlet. The output from the power adapter utilizes a 4-pin LEMO connector (LEMO part number FGG.0B.304.CLAD52Z) and plugs directly into the *PWR* input located on the back panel of the DL-V3.

This cable is RoHS compliant.

For alternate power sources please see *Section 3.1.3* on *Page 34*.



Reference	Description	Reference	Description
1	Black	5	Ground
2	Red	6	+6 to +18 V DC
3	Orange	7	+6 to +18 V DC
4	Brown	8	Ground
9	Connector key marking	12	Universal tip
10	12V adapter	13	6 Amp slow-blow fuse
11	Spring		

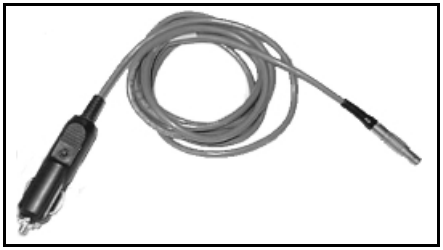
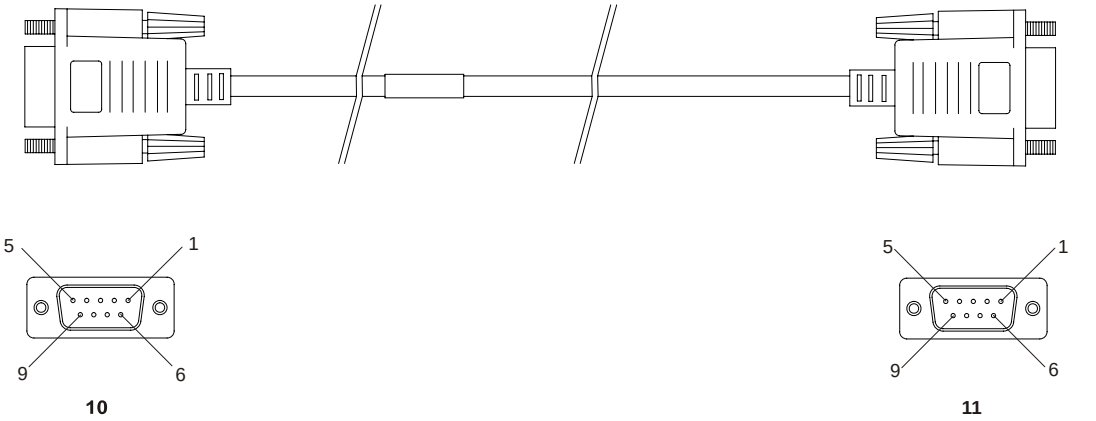


Figure 56: DL-V3 Power Cable

A.6.2.2 Null Modem Cable (NovAtel part number 01017658)

This cable supplied with the DL-V3, see *Figure 61*, provides an easy means of communications with a PC. The cable is equipped with a 9-pin connector at the receiver end which can be plugged into the *COM1*, *COM2*, or *AUX* port. At the PC end, a 9-pin connector is provided to accommodate a PC serial (RS-232) communication port.

This cable is RoHS compliant.



Wiring Table:

Connector	Pin Number						
To DB9S (10)	2	3	8	7	4	5	1 & 6
To DB9S (11)	3	2	7	8	1 & 6	5	4

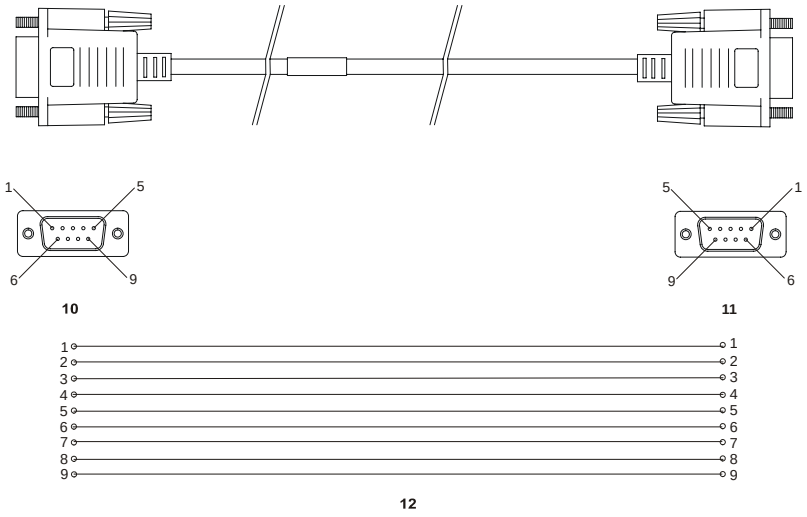
Reference	Description
10	DB9S (Female)
11	DB9S (Female)

Figure 57: DL-V3 Null Modem Cable

A.6.2.3 Straight Through Serial Cable (NovAtel part number 01017659)

This cable can be used to connect the DL-V3 to a modem or radio transmitter to propagate differential corrections. The cable is equipped with a female DB9 connector at the receiver end. The male DB9 connector at the other end is provided to plug into your user-supplied equipment (please refer to your modem or radio transmitter user guide for more information on its connectors). The cable is approximately 2 m in length. See *Figure 62*.

This cable is RoHS compliant.



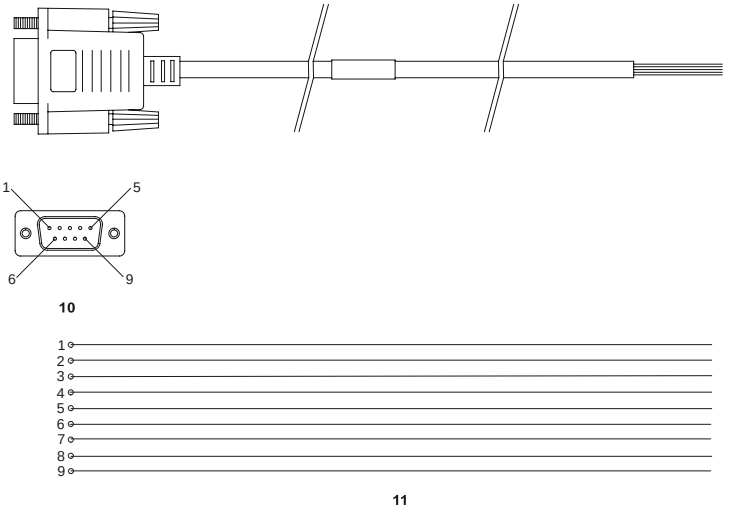
Reference	Description	Reference	Description
10	DB9P (male) connector	12	9-conductor cable
11	DB9S (female) connector		

Figure 58: DL-V3 Straight Through Serial Cable

A.6.2.4 I/O Strobe Port Cable (NovAtel part number 01017660)

The strobe lines on the DL-V3 can be accessed by inserting the male DB9 connector of the I/O strobe port cable into the *I/O* port. The other end of this cable is provided without a connector to provide flexibility. The jacket insulation is cut away slightly from the end but the insulation on each wire is intact. The cable is approximately 2 m in length. See *Figure 63*.

This cable is RoHS compliant.



Wiring Table:

I/O Port Pin	I/O Port Signal	I/O Port Cable Wire Color	I/O Port Pin	I/O Port Signal	I/O Port Cable Wire Color
1	VARF	Black	6	Event2	Green
2	PPS	Brown	7	_RESETOUT	Blue
3	MSR	Red	8	ERROR	Violet
4	Event1	Orange	9	GND	White/Grey
5	PV	Yellow			

Reference	Description	Reference	Description
10	DB9P (male) connector	11	9-conductor cable

Figure 59: DL-V3 I/O Strobe Port Cable

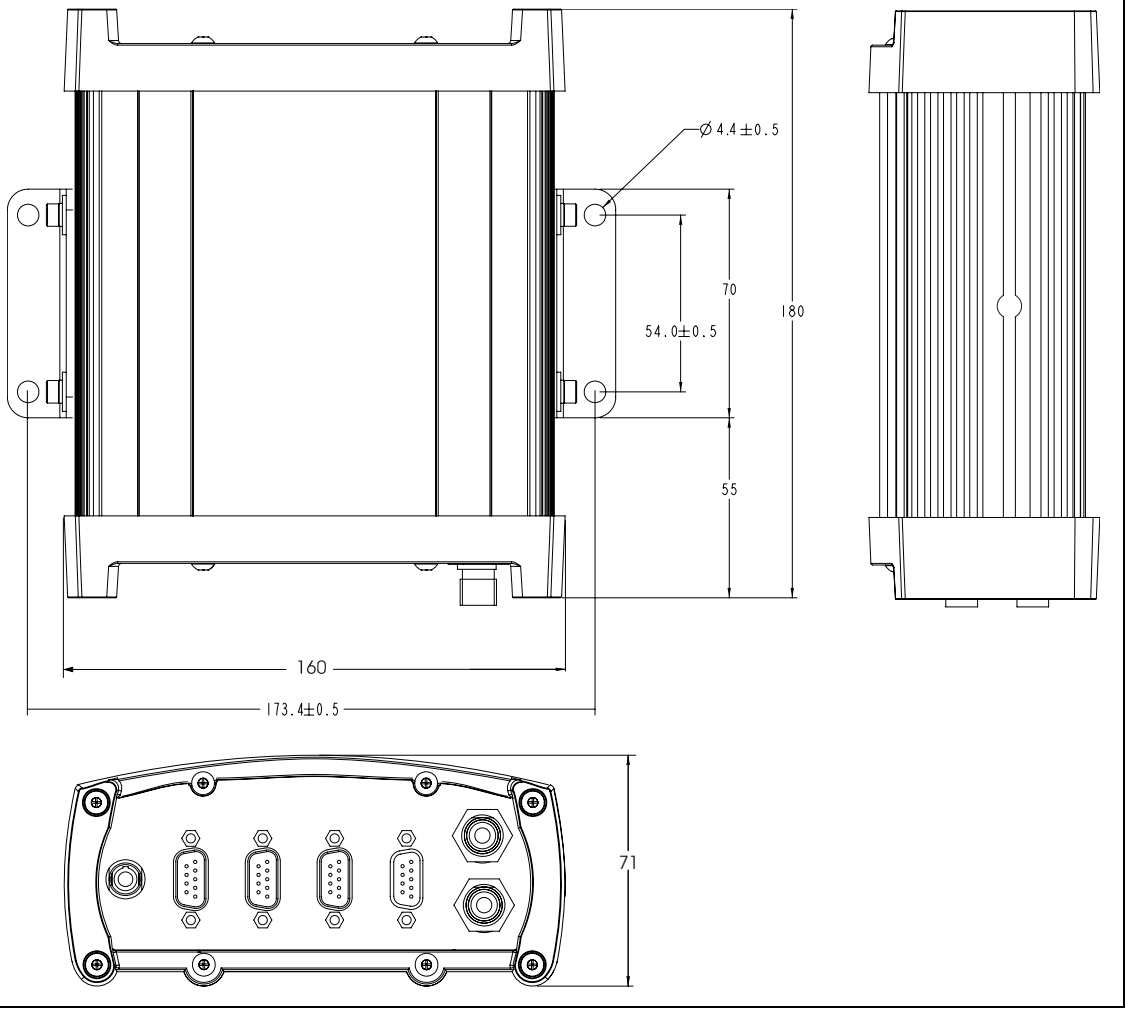
A.7 ProPak-V3

INPUT/OUTPUT CONNECTORS	
Antenna Input	TNC female jack, 50 Ω nominal impedance +4.75 to +5.10 V DC, 100 mA max (output from ProPak-V3 to antenna/LNA)
PWR	4-pin LEMO connector +6 to +18 V DC at 2.8 W (typical) [a] [b]
COM1 COM2 AUX I/O OSC	DB9P connector DB9P connector DB9P connector [c] DB9S connector BNC connector (external oscillator)
PHYSICAL	
Size	185 x 160 x 71 mm
Weight	1.0 kg maximum (including OEMV-3 card)
ENVIRONMENTAL	
Operating Temperature	-40°C to +75°C
Storage Temperature	-45°C to +95°C
Humidity	Not to exceed 95% non-condensing
Tested to these standards:	MIL-STD-810F 512.4 Procedure 1 Waterproof Immersion IEC 60529 IPX7 Waterproof MIL-STD-810F 509.4 Salt Spray MIL-STD-810F 510.4 Sand and Dust IEC 68-2-27Ea Shock (non-operating) MIL-STD-202G 214A Vibration (random) SAE J/211 4.7 Vibration (sinusoidal) FCC Part 15/ EN55022 Class B Emissions EN 61000-6-2 Immunity EN60950 Safety

a. For SPAN applications, this becomes +9 to +18 V DC
b. When tracking GPS satellites
c. The AUX port on the ProPak-V3 supports input from an IMU. If applicable, refer also to your *SPAN User Manual*. This port, although labelled AUX, is COM3.

DIMENSIONS

a



a. All dimension are in millimeters, please use the *Unit Conversion* section of the *GPS+ Reference Manual* for conversion to imperial measurements.

A.7.1 Port Pin-Outs

Table 35: ProPak-V3 Serial Port Pin-Out Descriptions

Connector Pin No.	COM1		COM2	AUX	
	RS-232	RS-422	RS-232 Only	RS-232	RS-422
1	Reserved	Reserved	N/C	N/C	N/C
2	COM1_Rx	COM1_Rx (+)	COM2_Rx	COM3_Rx	COM3_Rx (+)
3	COM1_Tx	COM1_Tx (+)	COM2_Tx	COM3_Tx	COM3_Tx (+)
4	N/C	N/C	POUT	POUT	POUT
5	GND	GND	GND	GND	GND
6	D (+)	D (+)	N/C	N/C	N/C
7	RTS1	COM1_Tx (-)	RTS2	RTS3	COM3_Tx (-)
8	CTS1	COM1_Rx (-)	CTS2	CTS3	COM3_Rx (-)
9	D (-)	D (-)	N/C	N/C	N/C

Table 36: ProPak-V3 I/O Port Pin-Out Descriptions

Connector Pin No.	Signal Name	Signal Descriptions
1	VARF	Variable frequency out
2	PPS	Pulse per second
3	MSR	Mark 1 output
4	EVENT1	Mark 1 input
5	PV	Valid position available
6	EVENT2	Mark 2 input, which requires a pulse longer than 150 ns. 10K ohm pull down resistor internal to the ProPak-V3. Refer also to the MARKCONTROL command in the *OEMV Firmware Reference Manual*.
7	_RESETOUT	Reset TTL signal output to an external system. Active low.
8	ERROR	Indicates a fatal error when high.
9	GND	Digital ground

✉ For strobe signal descriptions, please see *Section 3.3.1, Strobes* on *Page 44*.

A.7.2 Cables

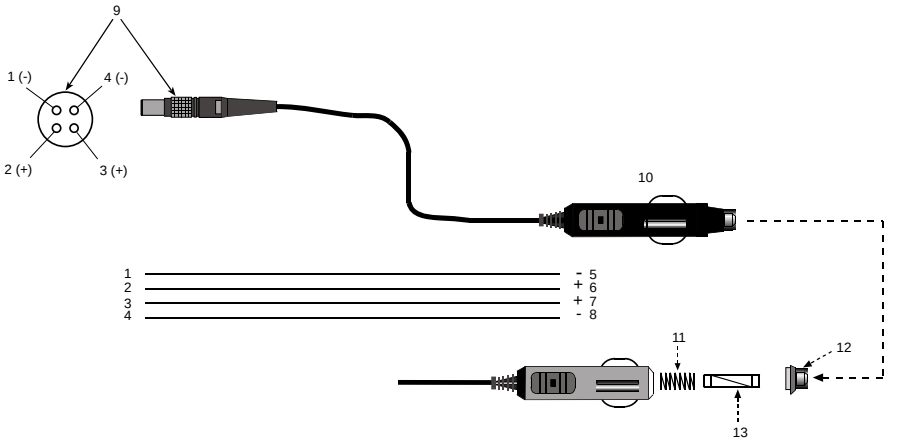
A.7.2.1 12V Power Adapter Cable (NovAtel part number 01017663)

The power adapter cable supplied with the ProPak-V3, see *Figure 60*, provides a convenient means for supplying +12 V DC while operating in the field.

Input is provided through the standard 12V power outlet. The output from the power adapter utilizes a 4-pin LEMO connector (LEMO part number FGG.0B.304.CLAD52Z) and plugs directly into the *PWR* input located on the back panel of the ProPak-V3.

This cable is RoHS compliant.

For alternate power sources please see *Section 3.1.3* on *Page 34*.



Reference	Description	Reference	Description
1	Black	5	Ground
2	Red	6	+6 to +18 V DC [1]
3	Orange	7	+6 to +18 V DC [1]
4	Brown	8	Ground
9	Connector key marking	12	Universal tip
10	12V adapter	13	6 Amp slow-blow fuse
11	Spring		

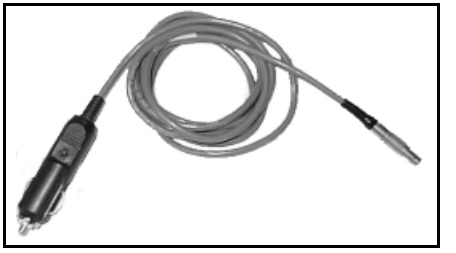


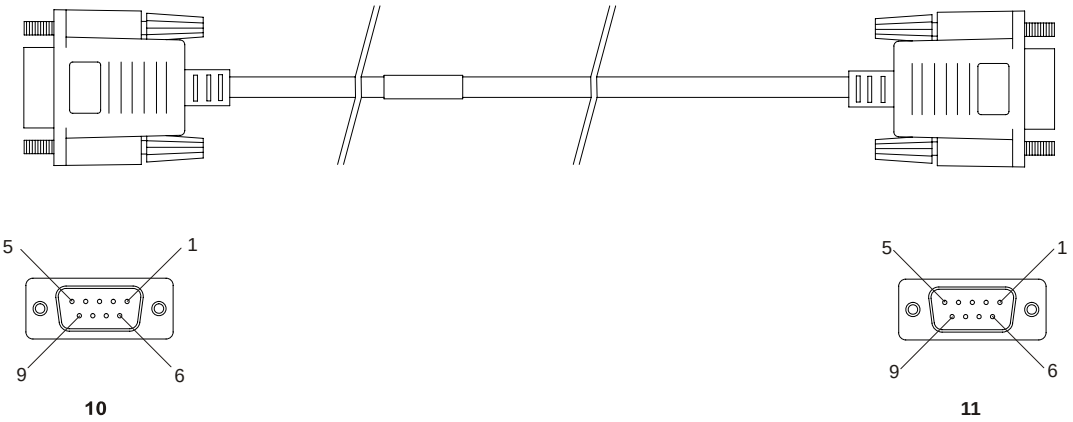
Figure 60: ProPak-V3 Power Cable

1. For SPAN applications this becomes +9 to +18 V DC

A.7.2.2 Null Modem Cable (NovAtel part number 01017658)

This cable supplied with the ProPak-V3, see *Figure 61*, provides an easy means of communications with a PC. The cable is equipped with a 9-pin connector at the receiver end which can be plugged into the *COM1*, *COM2*, or *AUX* port. At the PC end, a 9-pin connector is provided to accommodate a PC serial (RS-232) communication port.

This cable is RoHS compliant.



Wiring Table:

Connector	Pin Number						
To DB9S (10)	2	3	8	7	4	5	1 & 6
To DB9S (11)	3	2	7	8	1 & 6	5	4

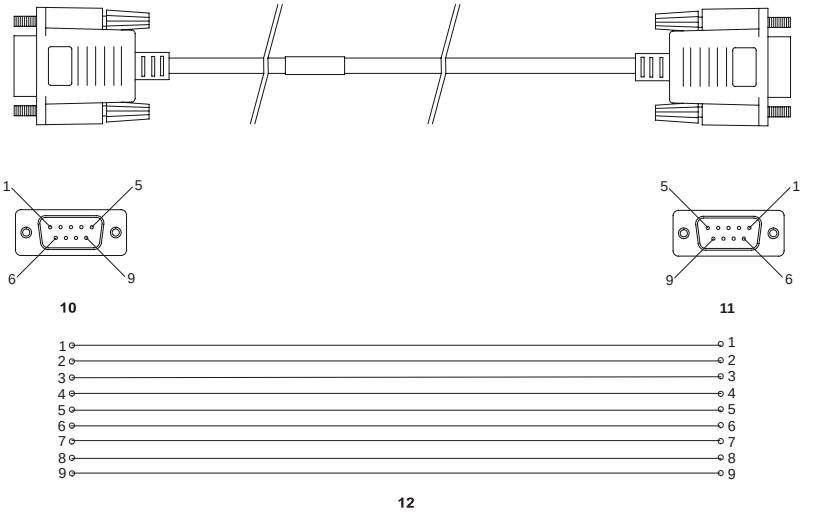
Reference	Description
10	DB9S (Female)
11	DB9S (Female)

Figure 61: ProPak-V3 Null Modem Cable

A.7.2.3 Straight Through Serial Cable (NovAtel part number 01017659)

This cable can be used to connect the ProPak-V3 to a modem or radio transmitter to propagate differential corrections. The cable is equipped with a female DB9 connector at the receiver end. The male DB9 connector at the other end is provided to plug into your user-supplied equipment (please refer to your modem or radio transmitter user guide for more information on its connectors). The cable is approximately 2 m in length. See *Figure 62*.

This cable is RoHS compliant.



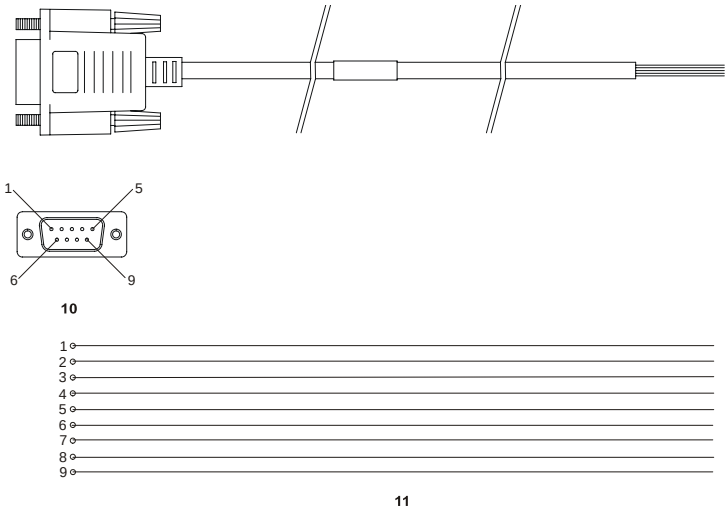
Reference	Description	Reference	Description
10	DB9P (male) connector	12	9-conductor cable
11	DB9S (female) connector		

Figure 62: ProPak-V3 Straight Through Serial Cable

A.7.2.4 I/O Strobe Port Cable (NovAtel part number 01017660)

The strobe lines on the ProPak-V3 can be accessed by inserting the male DB9 connector of the I/O strobe port cable into the *I/O* port. The other end of this cable is provided without a connector to provide flexibility. The jacket insulation is cut away slightly from the end but the insulation on each wire is intact. The cable is approximately 2 m in length. See *Figure 63*.

This cable is RoHS compliant.



Wiring Table:

I/O Port Pin	I/O Port Signal	I/O Port Cable Wire Color	I/O Port Pin	I/O Port Signal	I/O Port Cable Wire Color
1	VARF	Black	6	Event2	Green
2	PPS	Brown	7	_RESETOUT	Blue
3	MSR	Red	8	ERROR	Violet
4	Event1	Orange	9	GND	White/Grey
5	PV	Yellow			

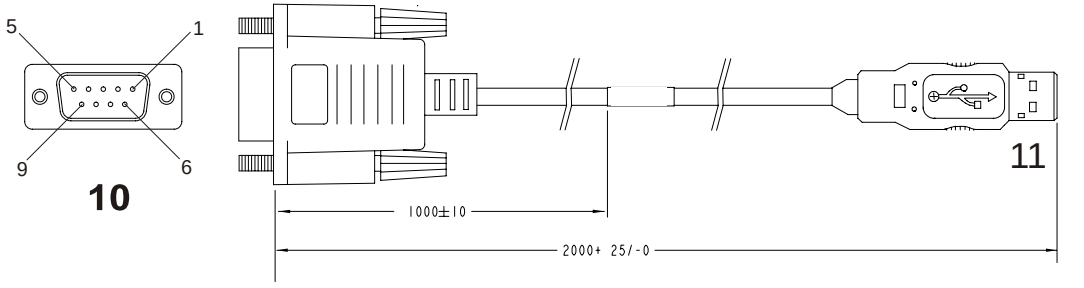
Reference	Description	Reference	Description
10	DB9P (male) connector	11	9-conductor cable

Figure 63: ProPak-V3 I/O Strobe Port Cable

A.7.2.5 USB Serial Cable (NovAtel part number 01017664)

The USB cable shown below provides a means of interfacing between the COM1 port on the ProPak-V3 and another serial communications device, such as a PC. At the ProPak-V3 end, the cable is equipped with a DB9 connector, which plugs directly into a COM port. At the other end, a USB connector is provided.

This cable is RoHS compliant.



WIRING			
DB9 CONNECTION ON RECEIVER	SIGNAL	SERIES "A" USB PLUG	WIRE COLOR
PIN 5	GND	PIN 4	BLACK
PIN 6	USB D+	PIN 3	GREEN
PIN 9	USB D-	PIN 2	WHITE
INSULATE TO PREVENT SHORT			RED

Reference	Description
10	Female DB9 connector
11	USB connector

Figure 64: USB Serial Cable

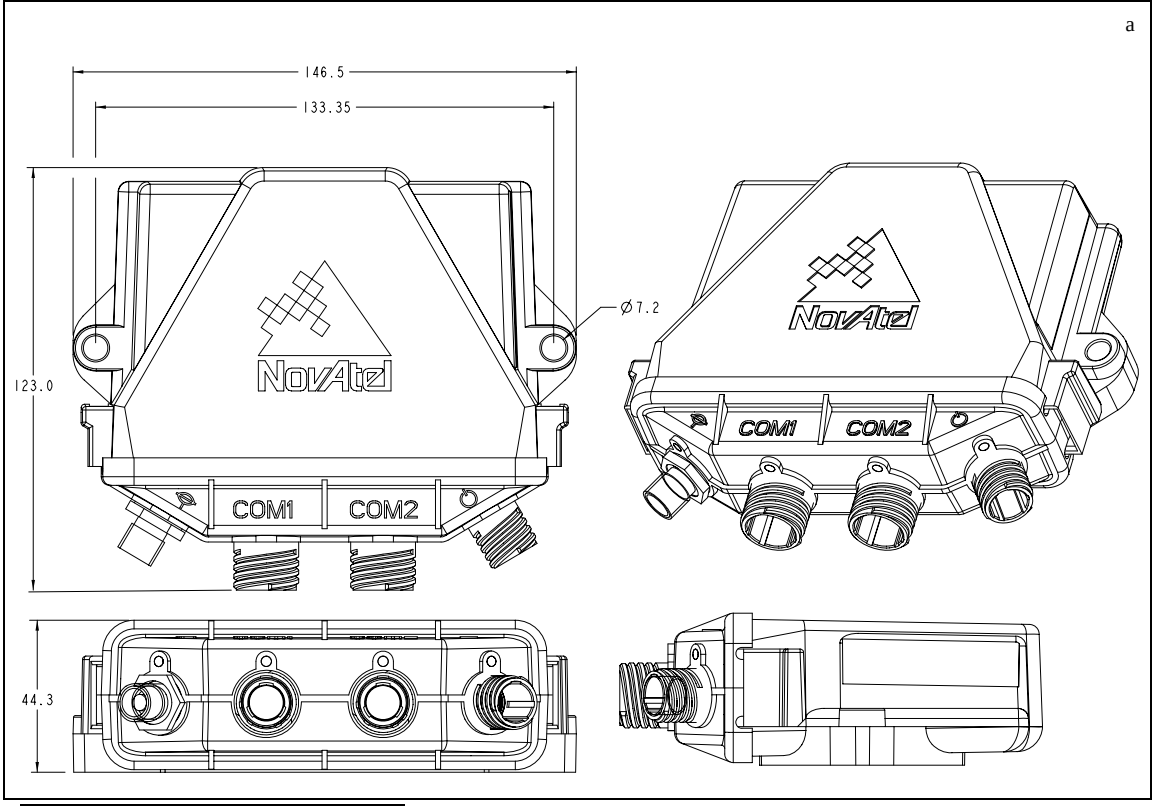
A.8 FlexPak-V1, FlexPak-V1G and FlexPak-V2

INPUT/OUTPUT CONNECTORS	
ANT	Waterproof TNC female jack, 50 Ω nominal impedance +4.75 to +5.10 V DC, 100 mA max (output from FlexPak to antenna/LNA)
PWR	3-pin waterproof Deutsch connector +6 to +18 V DC (Deutsch PN 59065-09-98PN)
COM1	13-pin waterproof Deutsch connector (Deutsch P/N 59065-11-35PF)
COM2	13-pin waterproof Deutsch connector [a] (Deutsch P/N 59065-11-35PF)
PHYSICAL	
Size	45 x 147 x 123 mm
Weight	350 g maximum
Mounting System	Integral flange with two 7 mm (9/32 inch) diameter mounting holes 133 mm (5.25 inches) apart
ENVIRONMENTAL	
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Humidity	Not to exceed 95% non-condensing
Waterproof	To IEC 60529 IP X7

a. Normally RS-232 but can be dynamically changed to RS-422 by grounding Pin# 1 on the COM2 Deutsch connector. You can switch between RS-232 and RS-422 by changing the state of this pin. You do not have to cycle power on the FlexPak for this change to take effect.

Pin# 1 is a No Connect (N/C) at the DB9F end of the FlexPak communication cable, see *Page 177*. There are not enough pins on the DB9F connector to accommodate this extra pin. However, if you cut the COM cable you can access wires for all the pins on the Deutsch side of the cable, including the Deutsch Pin# 1.

DIMENSIONS



a. All dimension are in millimeters, please use the *Unit Conversion* section of the *GPS+ Reference Manual* for conversion to imperial measurements.

A.8.1 Port Pin-Outs

The pin numbering for each of the ports, is described in the tables that follow.

Table 37: FlexPak COM1 Port Pin-Out Descriptions

Deutsch RS-232 Only	
Connector Pin No.	**Signal Name**
1	GPIO
2	COM1_Rx
3	CTS1
4	EVENT1
5	GND
6	EVENT2
7	RTS1
8	COM1_Tx
9	POUT [a]
10	PPS
11	USB D (+)
12	USB D (-)
13	ERROR

a. The current is limited to 1.5 A

✉ For strobe signal descriptions, please see . See also *Section 3.3.1, Strobes* on *Page 44*.

Table 38: FlexPak COM2 Port Pin-Out Descriptions

Deutsch RS-232		Deutsch RS-422	
Pin	**Function**	**Pin**	**Function**
1	Select 232/ 422 Mode	1	Select 232/ 422 Mode
2	COM2_Rx	2	COM2_Rx (+)
3	CTS	3	COM2_Rx (-)
4	Event 1	4	Event 1
5	GND	5	GND
6	Event 2	6	Event 2
7	RTS2	7	COM2_Tx (+)
8	COM2_Tx	8	COM2_Tx (-)
9	POUT [a]	9	POUT [a]
10	PPS	10	PPS
11	USB D (+)	11	USB D (+)
12	USB D (-)	12	USB D (-)
13	ERROR	13	ERROR

a. The current is limited to 1.5 A

✉ The cable supplied needs to be modified to work in RS-422 mode, see *Section A.8.2.2, 13-Pin Deutsch to DB9 Null Modem Cable (NovAtel part number 01017822)* on *Page 176*.

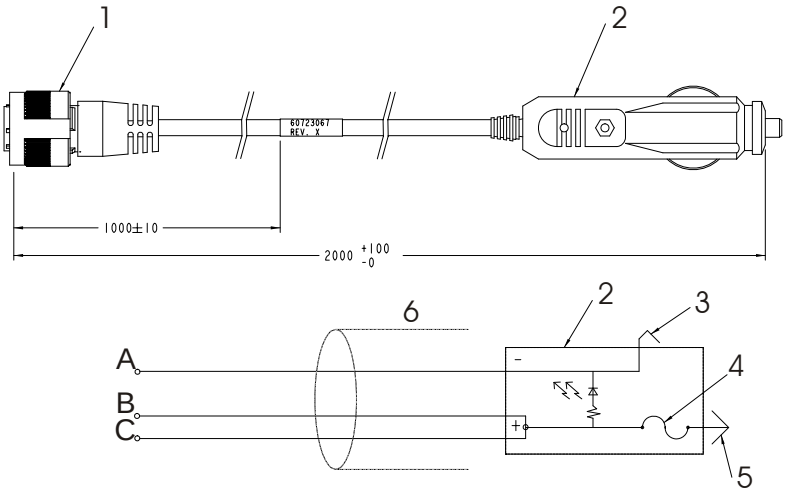
A.8.2 Cables

✉ Deutsch cable connector pin numbers are labelled on the connectors.

A.8.2.1 12V Power Adapter Cable (NovAtel part number 01017821)

The power adapter cable supplied with the FlexPak provides a convenient means for supplying +12 V DC while operating from a 12V source (the actual voltage range for the receiver is +6 to +18 V DC). The figure below shows the cable and a wiring diagram of the 12V adapter.

The output of the power adapter uses a 3-pin Deutsch socket (Deutsch part number: 59064-09-98SN). This cable plugs directly into the PWR port on the front of the FlexPak.

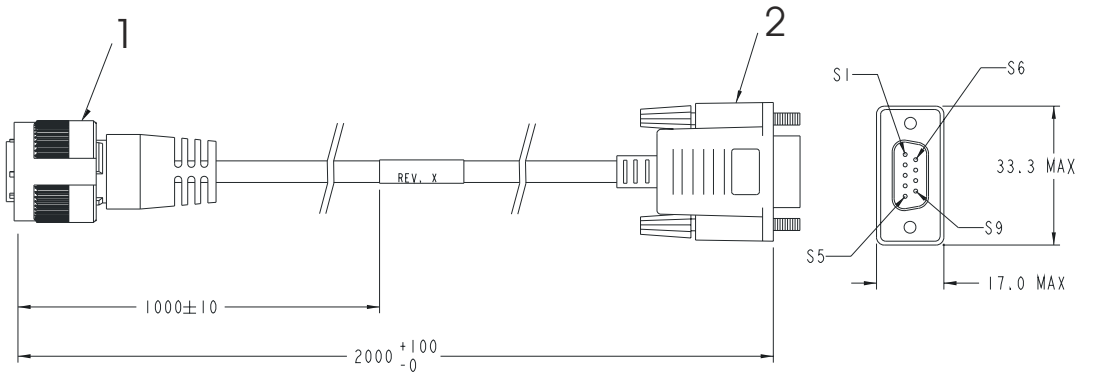


Reference	Description	Reference	Description
1	3-pin Deutsch connector	A	Black
2	12V adapter	B	Red
3	Outer contact	C	White/Natural
4	3 amp slow-blow fuse		
5	Center contact		
6	Foil shield		

Figure 65: FlexPak Power Cable

A.8.2.2 13-Pin Deutsch to DB9 Null Modem Cable (NovAtel part number 01017822)

The null modem serial cable shown below provides a means of interfacing between the COM1 or COM2 port on the FlexPak and another serial communications device, such as a PC. At the FlexPak end, the cable is equipped with a 13-pin Deutsch connector (Deutsch part number: 59064-11-35SF), which plugs directly into a COM port. At the other end, a RS-232 DB9S connector is provided. To use this cable in RS-422 mode, you must cut the DB-9 connector off and make a cable to match the COM2 port for RS-422, see *Section 38, FlexPak COM2 Port Pin-Out Descriptions* on *Page 174*. This cable looks identical to the straight through serial cable, see *Page 177*, but its use and part number differs. It is 2 meters in length.



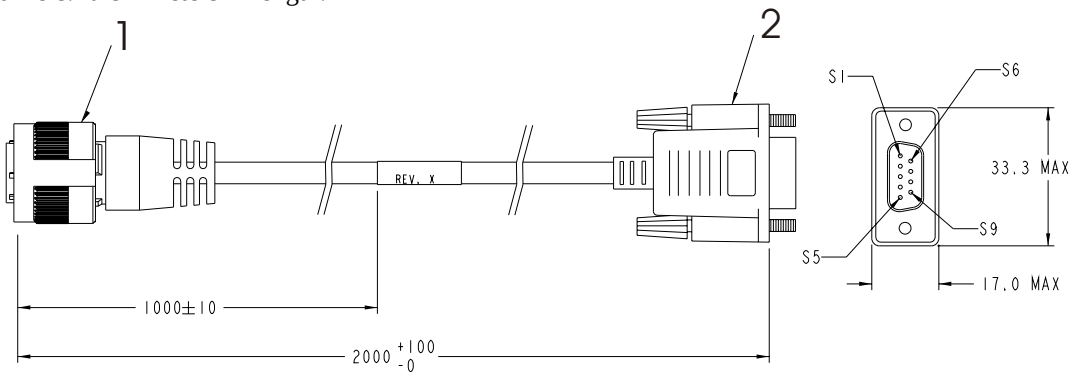
TO RECEIVER	COLOR	SIGNAL	DB-9 FEMALE TO PC
S1	BLUE/WHITE	GPIO	N/C
S2	BROWN	RXDI	S3
S3	BROWN/WHITE	CTSI	S7
S4	GREEN	EVENTI	N/C
S5	BLUE	GND	S5
S6	GREEN/BLACK	EVENT2	N/C
S7	RED	RTSI	S8
S8	RED/BLACK	TXDI	S2
S9	YELLOW/BLACK	POUT	S1, S6
S10	ORANGE	PPS	N/C
S11	WHITE	USB D+	N/C
S12	WHITE/BLACK	USB D-	N/C
S13	ORANGE/BLACK	ERROR	N/C

Reference	Description
1	13-pin Deutsch connector
2	DB9S connector

Figure 66: FlexPak 13-Pin Serial Cable

A.8.2.3 13-Pin Deutsch to DB9 Straight Cable (NovAtel part number 01017823)

The straight through serial cable shown below is used to connect the FlexPak to a modem or radio transmitter to propagate differential corrections. At the FlexPak end, the cable is equipped with a 13-pin Deutsch connector (Deutsch part number: 59064-11-35SF), which plugs directly into a COM port. The female DB9 connector at the other end is provided to plug into your user-supplied equipment (please refer to your modem or radio transmitter user guide for more information on its connectors). This cable looks identical to the null modem serial cable, see *Page 176*, but its use and part number differs. It is 2 meters in length.



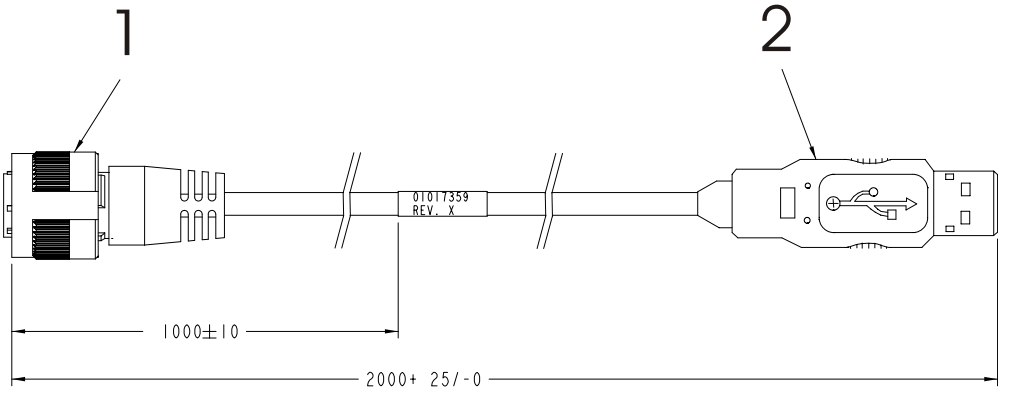
PINOUT ON RECEIVER END CONNECTOR		SIGNAL	DB-9 FEMALE
S1		GPIO	N/C
S2	PAIRED	RXD1	S2
S3		CTS1	S8
S4		EVENT1	N/C
S5		GND	S5
S6		EVENT2	N/C
S7	PAIRED	RTS1	S7
S8		TXD1	S3
S9	2 WIRES	POUT	S1
S9			S6
S10		PPS	N/C
S11	PAIRED	USB D+	N/C
S12		USB D-	N/C
S13		ERROR	N/C

Reference	Description
1	13-pin Deutsch connector
2	DB9S connector

Figure 67: FlexPak 13-Pin Serial Cable

A.8.2.4 USB Serial Cable (NovAtel part number 01017820)

The USB cable shown below provides a means of interfacing between the COM1 or COM2 port on the FlexPak and another serial communications device, such as a PC. At the FlexPak end, the cable is equipped with a 13-pin Deutsch connector (Deutsch part number: 59064-11-35SF), which plugs directly into the COM2 port. See also *Section A.8.2.3, 13-Pin Deutsch to DB9 Straight Cable (NovAtel part number 01017823)* on *Page 177*. At the other end, a USB connector is provided.



WIRING			
DEUTSCH CONN. ON RECEIVER	SIGNAL	SERIES "A" USB PLUG	WIRE COLOR
PIN 5	GND	PIN 4	BLACK
PIN 11	USB D+	PIN 3	GREEN
PIN 12	USB D-	PIN 2	WHITE
INSULATE TO PREVENT SHORT			RED

Reference	Description
1	Deutsch connector
2	USB connector

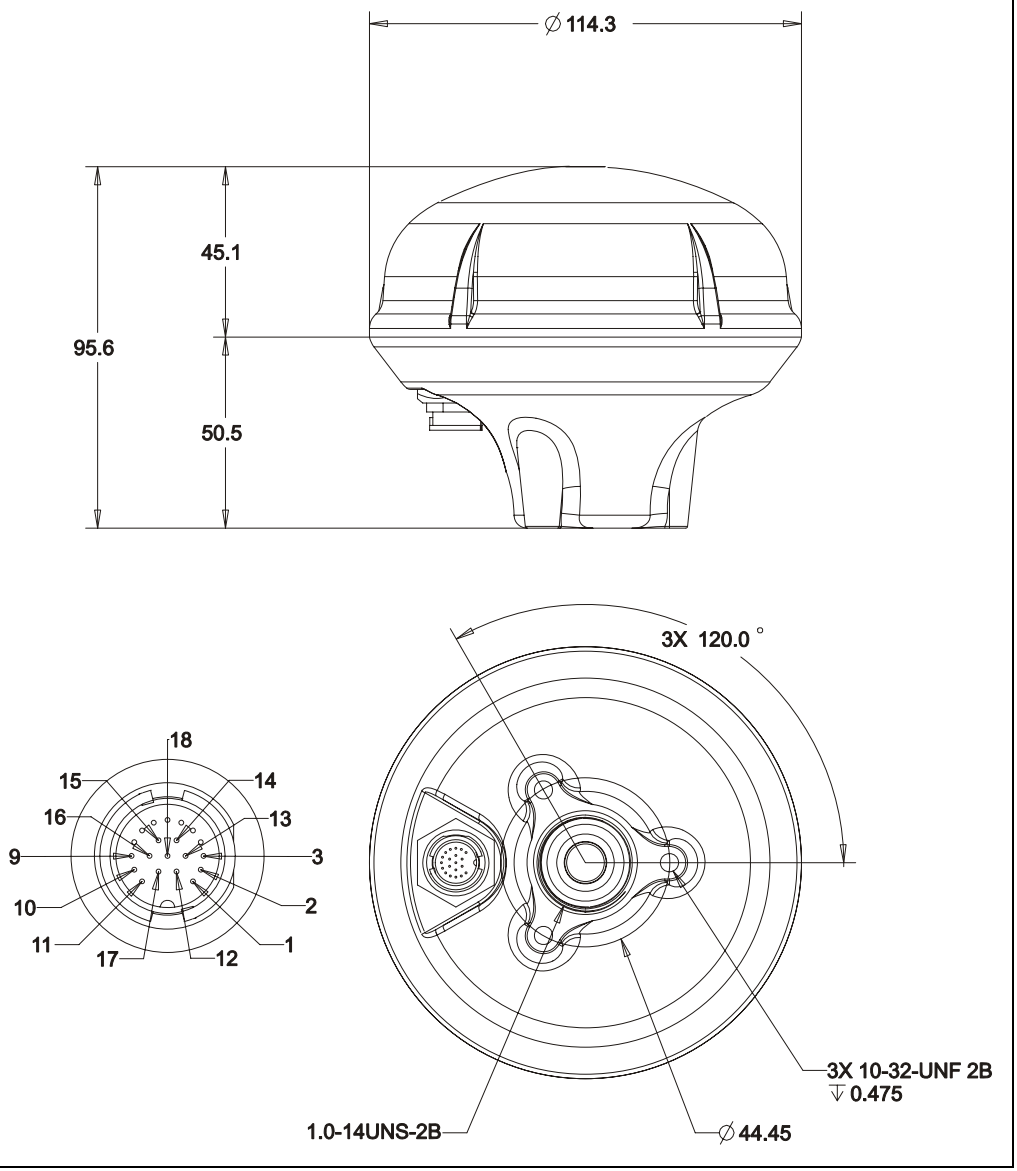
Figure 68: FlexPak USB Cable

A.9 SMART-V1

INPUT/OUTPUT CONNECTORS		
WARNING!:	It is important that you read the ***SMART-V1 Power Warning*** on ***Page 11*** of the *Notice* section.	
USB model port	18-pin Switchcraft RS-232 +9 to +28 V DC 2.5 W (typical) power consumption	
CAN model port	18-pin Switchcraft RS-232 +9 to +28 V DC 2.5 W (typical) power consumption	
PHYSICAL		
Size	114.3 mm Diameter x 95.6 mm Height (4.5" Diameter x 3.76" Height)	
Weight	525 g maximum excluding cable (1.16 lb.)	
Mounting System	1-14 UNS threads x 1” deep and/or 3 x 10-32 UNF screws	
ENVIRONMENTAL		
Operating Temperature	-40°C to +75°C (-40°F to +167°F)	
Storage Temperature	-55°C to +90°C (-67°F to +194°F)	
Humidity	Not to exceed 95% non-condensing	
Tested to all these standards	Waterproof/Immersion Salt Spray Sand and Dust UV Light Protection Shock Vibration (Random) Vibration (Sine)	MIL-STD-810F 512.4 Procedure I MIL-STD-810F 509.4 MIL-STD-810F 510.4 ASTM G-151 MIL-STD-810F 516.5 MIL-STD-801F 514.5 C17 SAE EP455

DIMENSIONS

a b



a. All dimension are in millimeters, please use the *Unit Conversion* section of the *GPS+ Reference Manual* for conversion to imperial measurements.

b. ∅ indicates a diameter and ↧ indicates a depth.

A.9.1 Port Pin-Outs

The pin numbering for the SMART-V1 port, USB followed by CAN models, is described in the tables that follow.

Table 39: SMART-V1 USB Model Port Pin-Out Descriptions

Switchcraft RS-232	
Pin	**Function**
1	PWR
2	GND
3	TX2
4	RX2
5	TX1 (+)
6	RX1 (+)
7	TX1 (-)
8	RX1 (-)
9	Reserved
10	USB D (-)
11	Digital GND
12	TIMEMARK
13	TX3 (+)
14	RX3 (+)
15	TX3 (-)
16	USB D (+)
17	PWR2
18	GND2

✉ For strobe signal descriptions, please see . See also *Section 3.3.1, Strobes* on *Page 44*.

Table 40: SMART-V1 CAN Model Port Pin-Out Descriptions

Switchcraft RS-232	
Pin	**Function**
1	PWR
2	GND
3	CAN H
4	CAN L
5	TX1 (+)
6	RX1 (+)
7	TX1 (-)
8	RX1 (-)
9	CAN PWR
10	CAN GND
11	Digital GND
12	TIMEMARK
13	TX3 (+)
14	RX3 (+)
15	TX3 (-)
16	RX3 (-)
17	PWR2
18	GND2

A.9.2 Optional Cables

Each SMART-V1 comes with its own multi-cable in either a USB (NovAtel part number 01017893) or CAN format (NovAtel part number 01017894). These cables are also available with no connectors at the USB or CAN end (NovAtel part numbers 01017923 and 01017922 respectively) but with tin-terminated ends. All 4 cables have an 18-pin Switchcraft connector at one end and are 3 m in length.

Section A.9.2.1 below contains pin-out information for a SMART-V1 USB multi-cable while *Section A.9.2.2* on *Page 184* contains pin-out information for a SMART-V1 CAN multi-cable. *Figures 69* and *70* on *Page 185* show examples of the cables with their DB-9 and/or USB ends.

✉ Switchcraft cable connector pin numbers are labelled on the connectors.

A.9.2.1 18-Pin Switchcraft to USB Multi-Cable (NovAtel part number 01017893)

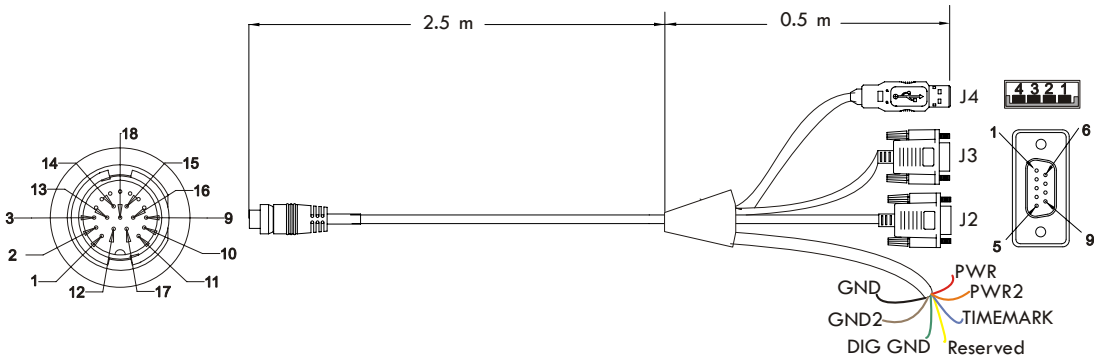


Table 41: USB Multi-Cable Connector Pin-Outs

J1 Switchcraft		J2 DB-9 socket		J3 DB-9 socket		J4 USB A	
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	PWR	1	N/A	1	N/A	1	N/A
2	GND	2	TX1 (+)	2	TX2	2	USB D (-)
3	TX2	3	RX1 (+)	3	RX2	3	USB D (+)
4	RX2	4	N/A	4	N/A	4	Digital GND
5	TX1 (+)	5	Digital GND	5	Digital GND		
6	RX1 (+)	6	N/A	6	N/A		
7	TX1 (-)	7	N/A	7	N/A		
8	RX1 (-)	8	N/A	8	N/A		
9	Reserved	9	N/A	9	N/A		
10	USB D (-)						
11	Digital GND						
12	TIMEMARK						
13	TX3 (+)						
14	RX3 (+)						
15	TX3 (-)						
16	USB D (+)						
17	PWR2						
18	GND2						

✉ See also *Table 43* on *Page 184* for the optional USB cable's bare tagged wire colors.

WARNING!: It is important that you read the ***SMART-V1 Power Warning*** on ***Page 11*** of the *Notice* section.

A.9.2.2 18-Pin Switchcraft to CAN Multi-Cable (NovAtel part number 01017894)

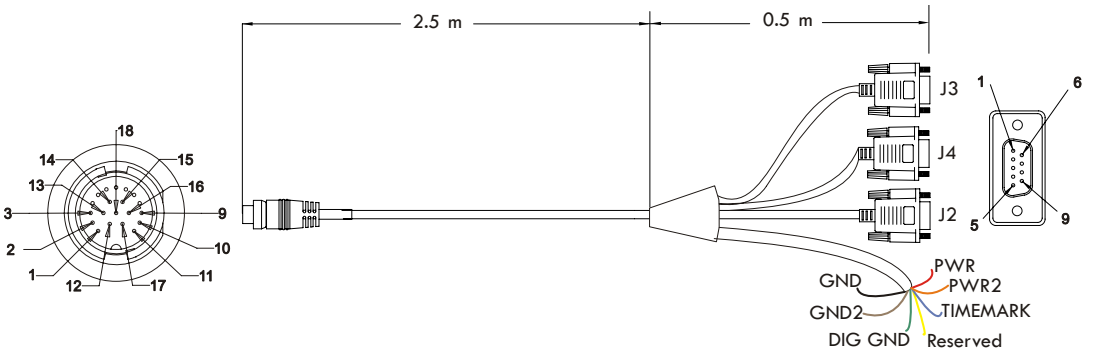


Table 42: CAN Multi-Cable Connector Pin-Outs

J1 Switchcraft		J2 DB-9 plug		J3 DB-9 socket		J4 DB-9 socket	
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	PWR	1	N/A	1	N/A	1	N/A
2	GND	2	TX1 (+)	2	CANH	2	TX3 (+)
3	CANH	3	RX1 (+)	3	CANL	3	RX3 (+)
4	CANL	4	N/A	4	N/A	4	N/A
5	TX1 (+)	5	Digital GND	5	N/A	5	Digital GND
6	RX1 (+)	6	N/A	6	N/A	6	N/A
7	TX1 (-)	7	TX1 (-)	7	N/A	7	TX3 (-)
8	RX1 (-)	8	RX1 (-)	8	N/A	8	RX3 (-)
9	CAN PWR	9	N/A	9	N/A	9	N/A
10	CAN GND						
11	Digital GND						
12	TIMEMARK						
13	TX3 (+)						
14	RX3 (+)						
15	TX3 (-)						
16	RX3 (-)						
17	PWR2						
18	GND2						

✉ See also *Table 43* below for the optional CAN cable's bare tagged wire colors.

WARNING!: It is important that you read the ***SMART-V1 Power Warning*** on ***Page 11*** of the *Notice* section.

Table 43: USB or CAN Multi-Cables Bare Tagged Wire Colors

Color	Function
Red	PWR
Orange	PWR2
Blue	TIMEMARK
Yellow	Reserved
Green	Digital GND
Brown	GND2
Black	GND

Figure 69: SMART-V1 Optional USB Multi-Cable

Figure 70: SMART-V1 Optional CAN Multi-Cable

Appendix B Electrostatic Discharge Control (ESD) Practices

B.1 Overview

Static electricity is electrical charge stored in an electromagnetic field or on an insulating body. This charge can flow as soon as a low-impedance path to ground is established. Static-sensitive units can be permanently damaged by static discharge potentials of as little as 40 volts. Charges carried by the human body, which can be thousands of times higher than this 40 V threshold, can accumulate through as simple a mechanism as walking across non-conducting floor coverings such as carpet or tile. These charges may be stored on clothing, especially when the ambient air is dry, through friction between the body and/or various clothing layers. Synthetic materials accumulate higher charges than natural fibers. Electrostatic voltage levels on insulators may be very high, in the order of thousands of volts.

Various electrical and electronic components are vulnerable to electrostatic discharge (ESD). These include discrete components, hybrid devices, integrated circuits (ICs), and printed circuit boards (PCBs) assembled with these devices.

B.2 Handling ESD-Sensitive Devices

ESD-sensitive devices must only be handled in static-controlled locations. Some recommendations for such handling practices follow:

- Handling areas must be equipped with a grounded table, floor mats, and wrist strap.
- A relative humidity level must be maintained between 20% and 80% non-condensing.
- No ESD-sensitive board or component should be removed from its protective package, except in a static-controlled location.
- A static-controlled environment and correct static-control procedures are required at both repair stations and maintenance areas.
- ESD-sensitive devices must be handled only after personnel have grounded themselves via wrist straps and mats.
- Boards or components should never come in contact with clothing, because normal grounding cannot dissipate static charges on fabrics.
- A circuit board must be placed into a static shielding bag or clamshell before being removed from the work location and must remain in the clamshell until it arrives at a static-controlled repair/test center.
- Circuit boards must not be changed or moved needlessly. Handles may be provided on circuit boards for use in their removal and replacement; care should be taken to avoid contact with the connectors and components.
- On-site repair of ESD-sensitive equipment should not be undertaken except to restore service in an emergency where spare boards are not available. Under these circumstances repair station techniques must be observed. Under normal circumstances a faulty or suspect circuit board must be sent to a repair center having complete facilities, or to the manufacturer for exchange or repair.

- Where protective measures have not been installed, a suitable alternative would be the use of a Portable Field Service Grounding Kit (for example, 3M Kit #8501 or #8507). This consists of a portable mat and wrist strap which must be attached to a suitable ground.
- A circuit board in a static-shielding bag or clamshell may be shipped or stored in a cardboard carton, but the carton must not enter a static-controlled area such as a grounded or dissipative bench top or repair zone. Do not place anything else inside the bag (for example, repair tags).
- Treat all PCBs and components as ESD sensitive. Assume that you will damage the PCB or component if you are not ESD conscious.
- Do not use torn or punctured static-shielding bags. A wire tag protruding through the bag could act as a "lightning rod", funneling the entire charge into the components inside the bag.
- Do not allow chargeable plastics, such as binders, within 0.6 m of unshielded PCBs.
- Do not allow a PCB to come within 0.3 m of a computer monitor.

B.3 Prime Static Accumulators

Table 44 provides some background information on static-accumulating materials.

Table 44: Static-Accumulating Materials

Work Surfaces	• formica (waxed or highly resistive) • finished wood • synthetic mats • writing materials, note pads, and so on
Floors	• wax-finished • vinyl
Clothes	• common cleanroom smocks • personal garments (all textiles) • non-conductive shoes
Chairs	• finished wood • vinyl • fiberglass
Packing and handling	• common polyethylene bags, wraps, envelopes, and bubble pack • pack foam • common plastic trays and tote boxes
Assembly, cleaning, and repair areas	• spray cleaners • common solder sucker • common soldering irons • common solvent brushes (synthetic bristles) • cleaning, drying and temperature chambers

B.4 Handling Printed Circuit Boards

ESD damage to unprotected sensitive devices may occur at any time. ESD events can occur far below the threshold of human sensitivity. Follow this sequence when it becomes necessary to install or remove a circuit board:

1. After you are connected to the grounded wrist strap, remove the circuit board from the frame and place it on a static-controlled surface (grounded floor or table mat).
2. Remove the replacement circuit board from the static-shielding bag or clamshell and insert it into the equipment.
3. Place the original board into the shielding bag or clamshell and seal it with a label.
4. Do not put repair tags inside the shielding bag or clamshell.
5. Disconnect the wrist strap.

Appendix C Ethernet Configuration

At power-up, the DL-V3 configures the COM3 multiplexer to switch to the Bluetooth device by default. In order to use the Ethernet device, the multiplexer must be switched to use Ethernet. To do this, follow one of the two methods outlined in this appendix.

C.1 Physical Set-Up

Below are the configuration methods described in this appendix and the hardware you require to set them up:

- Configuration Via Network Cable
  - DL-V3 with power cable and serial communications cable
  - User-supplied laptop with an available Ethernet port, serial port (or USB port with NovAtel serial to USB drivers) and the Lantronix software, described below, installed
  - CAT5 Ethernet cross-over cable (or use a switch with a straight through Ethernet cable)
- Configuration Via Serial and Network Parameters
  - DL-V3 with power cable
  - User-supplied laptop with the Lantronix software, described below, installed
  - Serial null-modem cable to connect from the laptop and switch between COM1 and COM2 on the DL-V3. You can avoid switching if you have two serial connections on your laptop and two null-modem cables. Also, if your laptop has only USB connectors, you need a USB to serial adaptor between the null-modem cable and the laptop's USB connector.
  - CAT5 Ethernet cross-over cable (or use a switch with a straight through Ethernet cable)

In both cases, first install the **DeviceInstaller** and **Com Port Redirector** utilities programs onto the laptop you intend to use with your DL-V3 from the Lantronix website at: http://www.lantronix.com/device-networking/utilities-tools/.

Figure 71, CAT5 Ethernet Cable Connection on *Page 190* shows the two methods of physically providing an Ethernet connection between your laptop and DL-V3. The top shows a direct connection using a CAT5 Ethernet cross-over cable and the bottom shows two straight-through CAT5 Ethernet cables with a DSS-5+ port switch in between them.

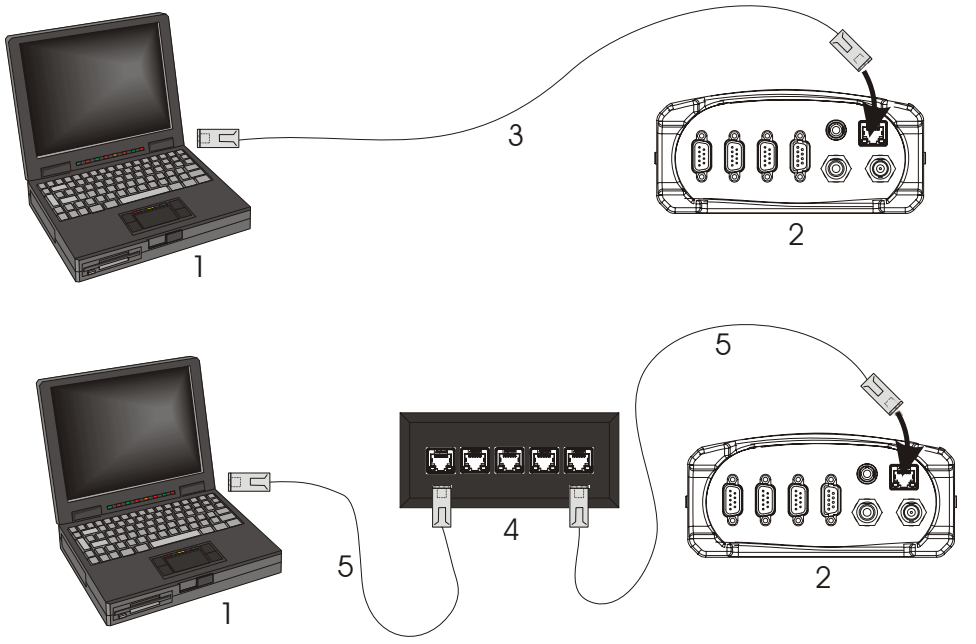


Figure 71: CAT5 Ethernet Cable Connection

Reference	Description
1	User-supplied laptop computer with Ethernet connector
2	DL-V3 (powered)
3	User-supplied CAT5 Ethernet cross-over cable
4	User-supplied DSS-5+ Port Switch
5	User-supplied CAT5 Ethernet straight-through cables

C.2 Configuration Overview

Both configuration methods are used to provide the DL-V3 with a static Internet Protocol (IP) address to be used in your personal network. To do this, your Network Administrator must assign a static IP address to you so that every time there is a receiver start-up, it has the same IP address. Otherwise, the Ethernet module in the DL-V3 is DHCP-enabled by default where DHCP is an acronym for Dynamic Host Configuration Protocol. This means that normally the Ethernet device issues a new IP address every time the receiver is started up. A static IP aids with remote work especially.

C.3 Configuration Via Network Cable

To physically connect the DL-V3 to Ethernet, follow these steps:

1. Connect a CAT5 cross-over cable to a laptop with a free Ethernet port
2. Connect the other end of the CAT5 crossover cable to the DL-V3's Ethernet port

3. Connect the power cable to the DL-V3 and power-up the unit

C.3.1 Enable Ethernet on DL-V3 Receiver

From the laptop, connect the DL-V3 to a serial, or USB, cable. Open communication with the receiver using HyperTerminal or **CDU**. Issue the following command:

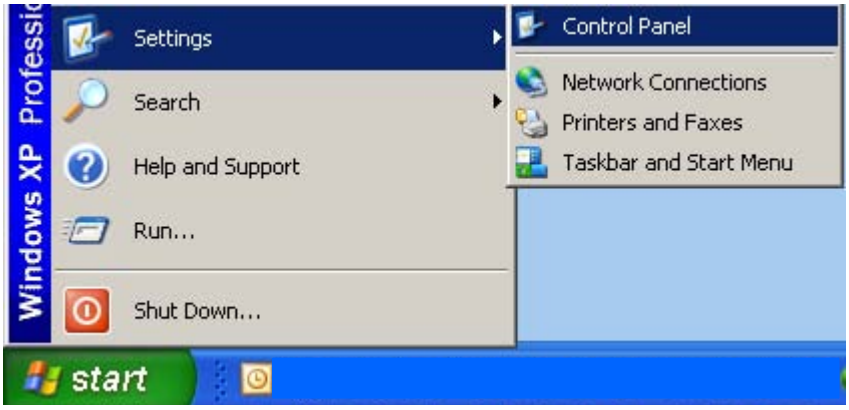
```
APPCONTROL BLUETOOTH 1
```

Restart your laptop. COM3 switches from the Bluetooth to the Ethernet device in the DL-V3. You can see this because the Ethernet LED, labelled , on the DL-V3 now glows orange.

C.3.2 Windows XP Network Settings

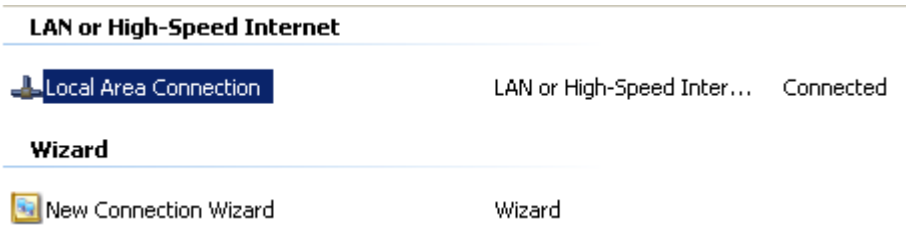
If using TCP/IP networking on a Windows XP-based PC or laptop, Windows may be configured to obtain an IP address automatically. However, an alternate IP must be configured manually rather than having an automatically generated private IP address. To do this, follow these steps:

1. Click on the *Start* button in Windows and select *Settings* | *Control Panel*.

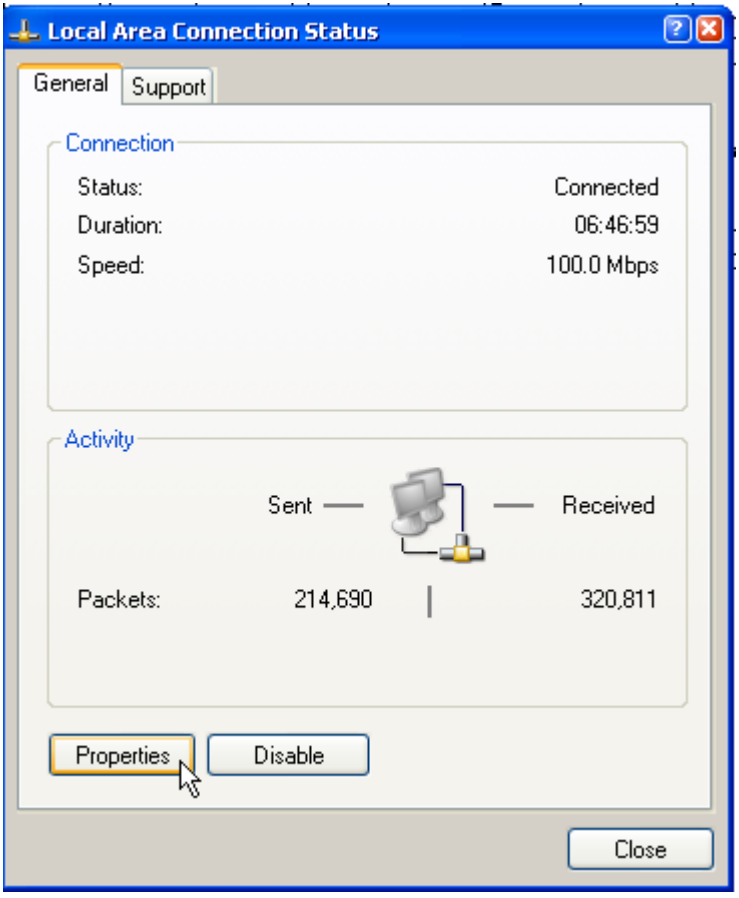


2. Select *Network Connections* in *Control Panel*, and double-click on it.

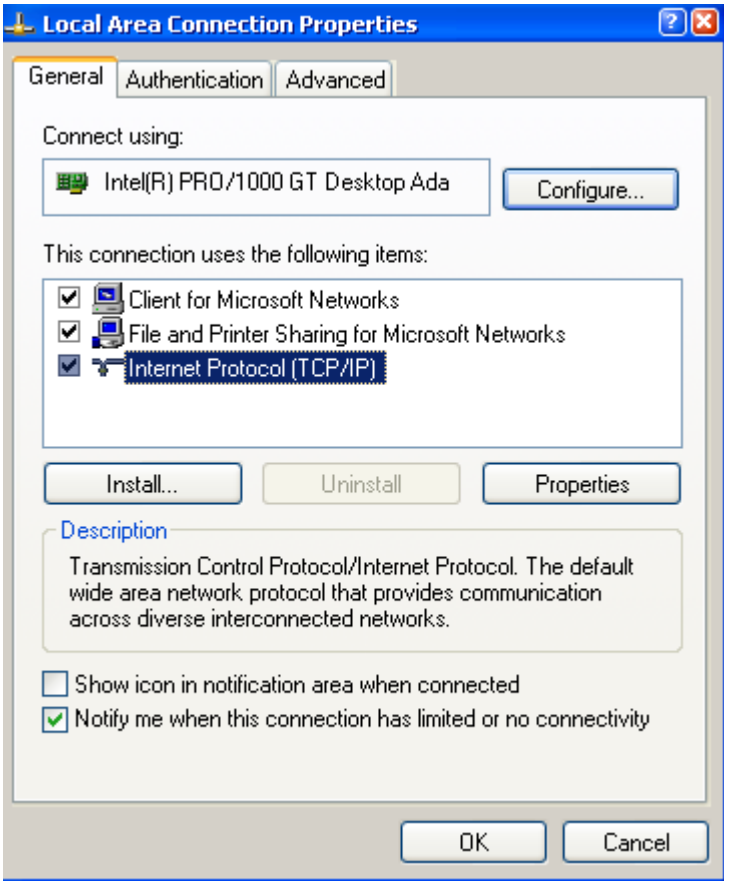
3. Highlight *Local Area Connection* and double-click on it.



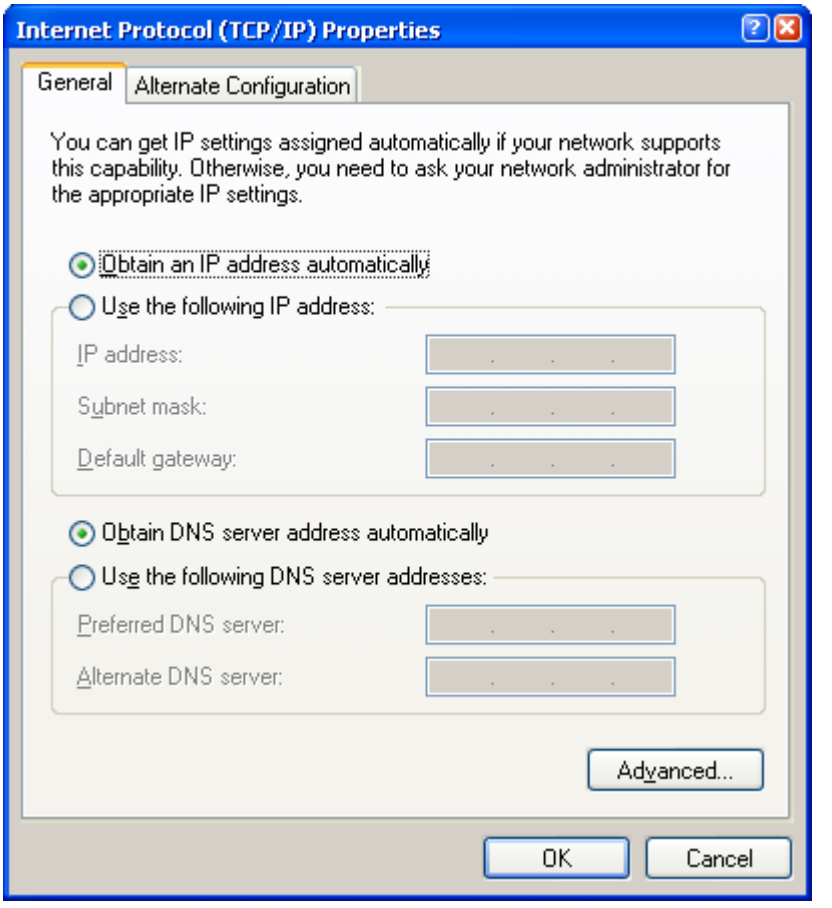
4. Click on *Properties* in the *General* tab in the *Local Area Connection* dialog that appears. The *Local Area Connection Properties* dialog appears.



5. Select *Internet Protocol (TCP/IP)* and click on the *Properties* button. The *Internet Protocol TCP/IP Properties* dialog appears.

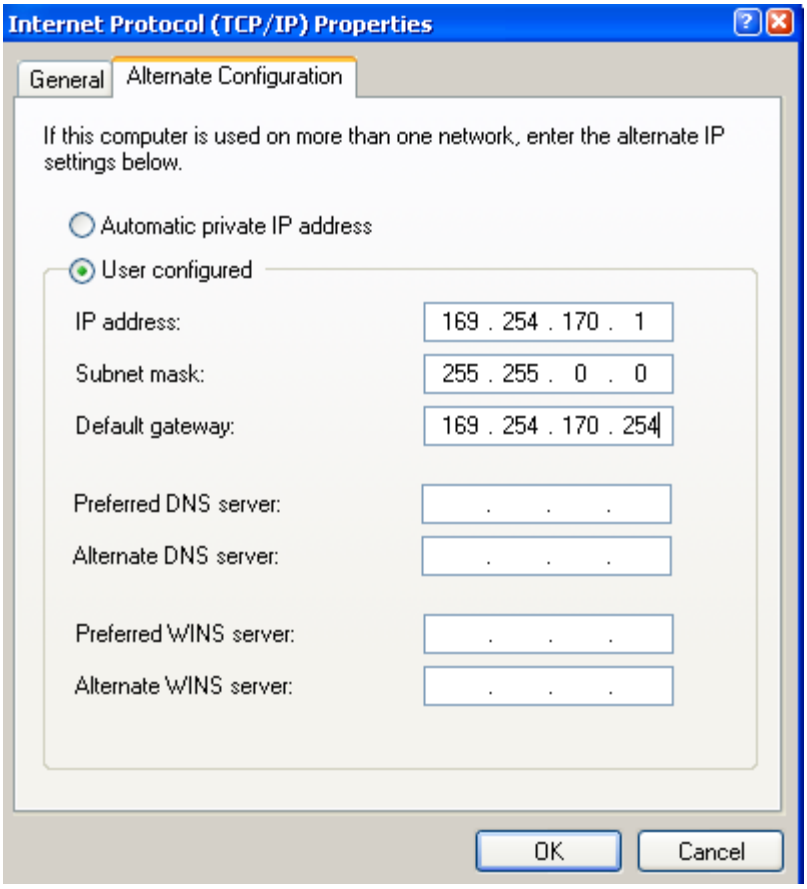


6. Ensure the *Obtain an IP address automatically* and *Obtain DNS server address automatically* radio buttons are selected in the *General* tab.



7. Select the *Alternate Configuration* tab in the *Internet Protocol (TCP/IP) Properties* dialog.

✉ *Step 7*, above, is very important. If the *Alternate Configuration* tab is not selected, this procedure will not work.



8. Ensure that the *User Configured* radio button is selected. Change the settings to something similar to the fictional examples shown on this page (check with your Network Administrator for details) and click *OK*.

✉ 1. The described IP address, and its respective submask and gateway, are for a private Auto IP, class B, designated IP address and you should obtain yours from your Network Administrator.

2. **Record your IP Address, Network Mask and Gateway numbers for future use.**

9. Click *OK* when you are returned to the *Local Area Connection Properties* dialog.
10. Click *Close* to complete the network configuration.

11. Restart the laptop for the settings to take effect.
12. Power-off and then power-on the DL-V3. The Bluetooth mode is on again by default.
13. Issue the following commands, using Hyperterminal, to switch COM3 back to Ethernet and reset the Ethernet device in the DL-V3:

    APPCONTROL BLUETOOTH 1
    APPCONTROL OPTION 12 1

14. Restart your laptop for the settings to take effect.

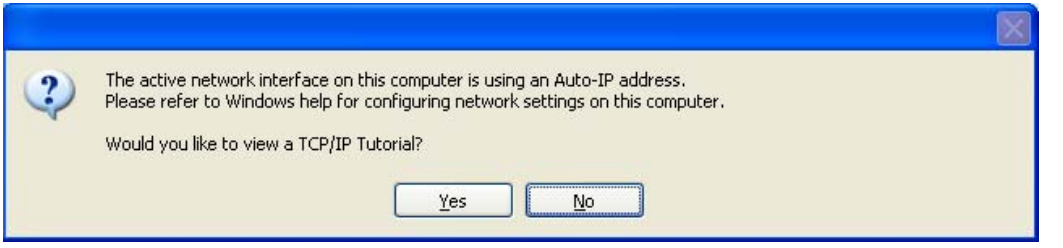
C.3.3 Configuring Ethernet Serial and Network Parameters

The DL-V3's Ethernet module is DHCP-enabled by default, see *Section C.2, Configuration Overview* starting on *Page 190*.

The default serial settings are 9600 baud, 8 data bits, no stop bits, 1 parity bit, and no flow control. In order to change these settings, use the *DeviceInstaller* utility. Select and click on *DeviceInstaller* from the Start | All Programs | Lantronix | DeviceInstaller menu in Windows.

Follow these steps to use DeviceInstaller:

1. Click *No* if you see an information message asking if you would like to see a tutorial on TCP/IP.



   If you click *No*, the *Lantronix DeviceInstaller* program window is visible.

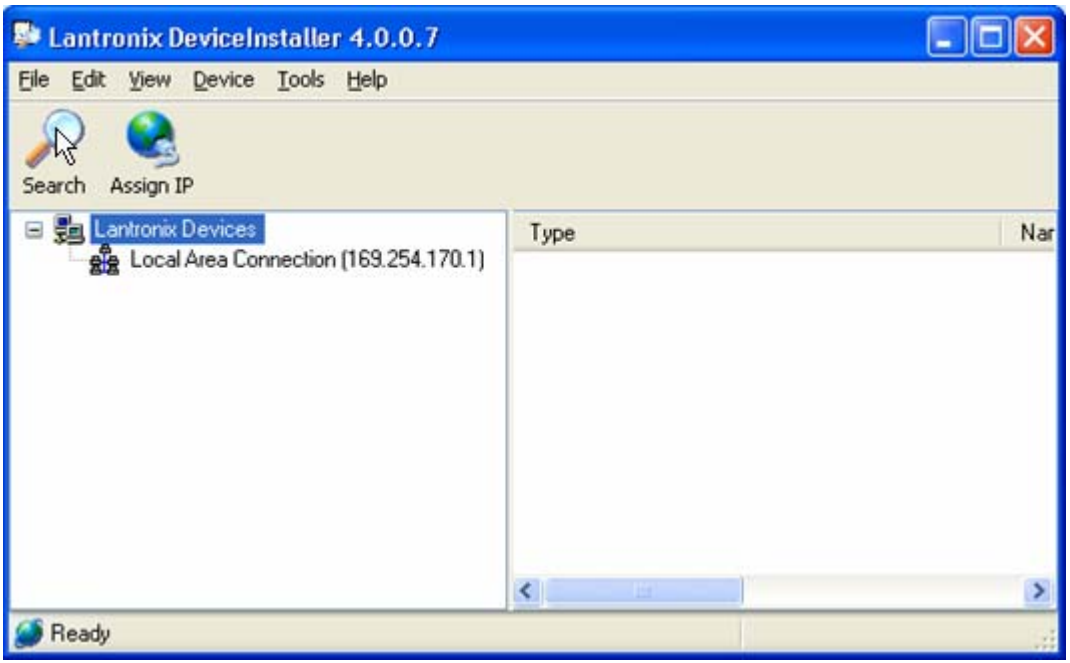
✉ 1. We previously went through the TCP/IP settings in *Section C.3.2, Windows XP Network Settings* starting on *Page 191*.

2. You can view the Window's TCP/IP tutorials at any time by selecting *Help and Support* from Window's *Start* menu and then using its Search engine to find TCP/IP.

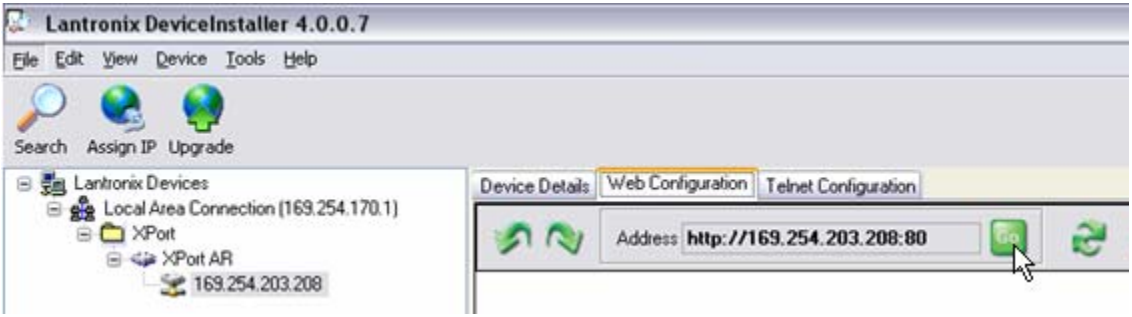
---

2. Click the *Search* button (with a magnifying glass icon) in the *Lantronix DeviceInstaller* program window to commence a search for any available Ethernet devices. If a device is found, its IP

address appears in a hierarchical tree found under Lantronix Devices.



3. Restart the laptop, select *DeviceInstaller* from the *Start* menu again and re-follow Steps *1* to *2* above. This time the *Lantronix DeviceInstaller* window should have a more detailed hierarchal tree on the left and tabs to the right.



4. Select the *Web Configuration* tab and then click on the *GO* button found beside the *Address* field.
5. Enter the *User Name* as **admin** and the *Password* as ***PASS*** in the pop-up screen that appears.
6. Click *OK* to return you to the *Lantronix DeviceInstaller* window with a new Status menu to the left of the right-side panel.

C.3.3.1 Network Settings Configuration

Select *Network*| *Configuration* from the *Status* menu to change to the desired network settings. Typically, the Ethernet device requires a static IP address, thus the DHCP Client is disabled. Also IP Address, Network Mask, Gateway, Hostname, Domain, and Ethernet types are changed according to the correct network values. Refer to an IT Network Administrator for further information, see also *Step 8* on *Page 195*. For instance, *Figure 72* is an example of a private IP configuration:

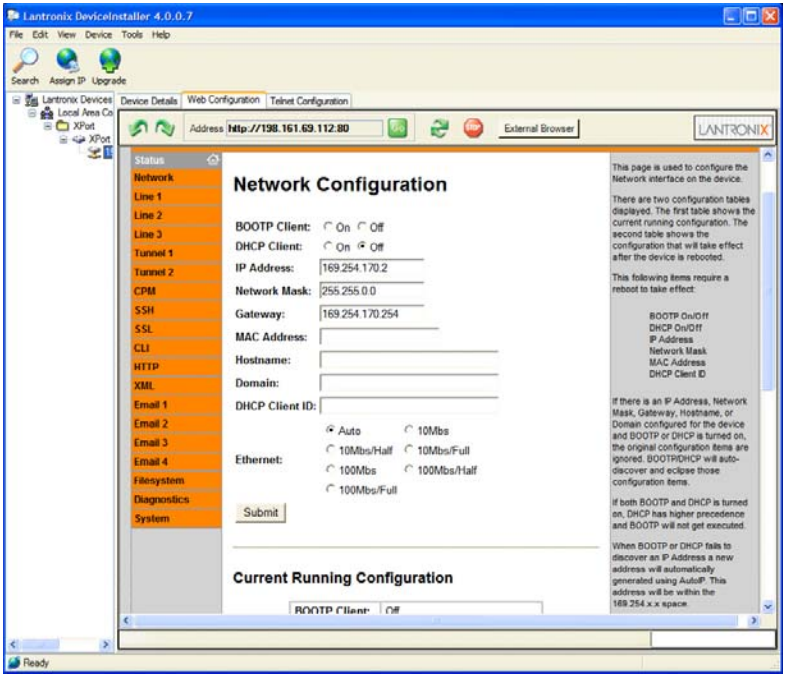


Figure 72: Lantronix Device Installer: Network Configuration

Click on the *Submit* button for the network settings to be saved to the Ethernet device's NVM.

C.3.3.2 Line 1 Configuration

Select *Line 1 | Configuration* from the *Status* menu. Line 1 refers to COM1 of the Ethernet device. This is the port that is connected to COM3 of the DL-V3. Change the settings to match COM3 of the DL-V3. The screen shown in *Figure 73* displays the new settings:

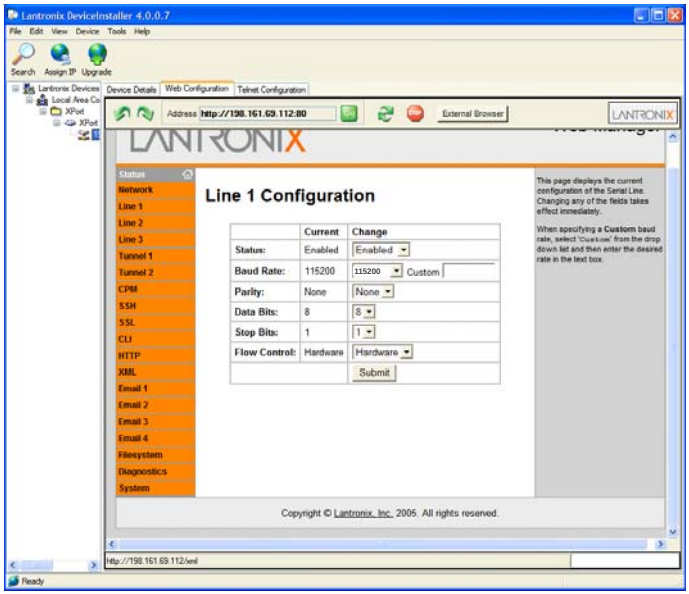


Figure 73: Lantronix Device Installer: Line 1 Configuration

Click the *Submit* button for the Line 1 configuration to be saved to the Ethernet device's NVM.

C.3.3.3 Tunnel 1 Serial Settings

Select *Tunnel 1| Serial Settings* from the *Status* menu. Tunnel 1 is associated with Line 1 and must be enabled. The screen in *Figure 74* displays the current configuration:

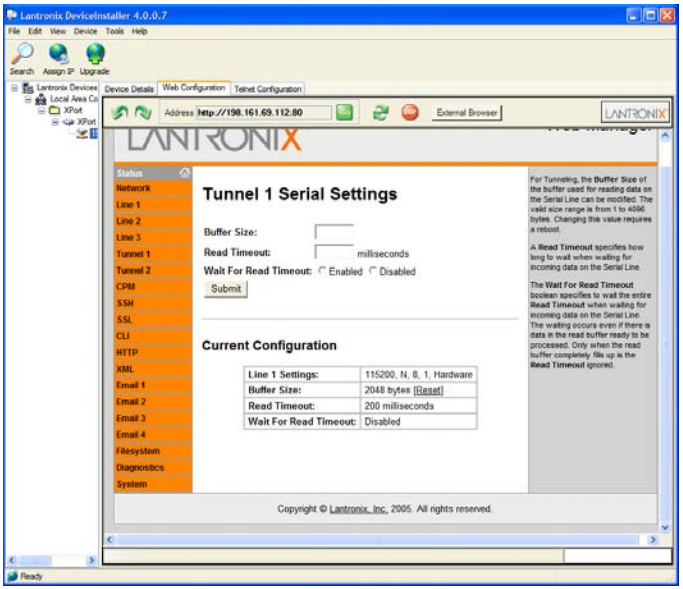


Figure 74: Lantronix Device Installer: Tunnel 1 Serial Settings

C.3.3.4 Tunnel 1 Accept Mode

Select *Tunnel 1 | Accept Mode* from the *Status* menu. In order for the Ethernet device to transfer serial data, Accept Mode must be enabled. That is, any data arriving at the Ethernet device's serial port automatically enables a TCP/IP connection. Refer to the *Lantronix XPORT-AR User Guide*, available from their website, for further information. The screen in *Figure 75* displays the Accept Mode configuration:

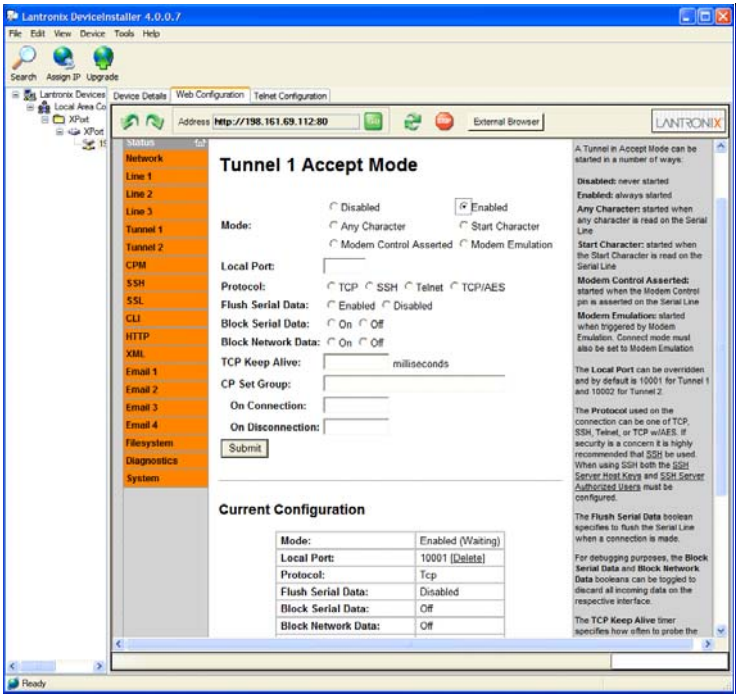


Figure 75: Lantronix Device Installer: Tunnel 1 Accept Mode

Ensure that the *Enabled* radio button is selected and click on the *Submit* button to save the Accept Mode to Ethernet device's flash memory.

A pop-up warning may appear regarding the enabling of Accept Mode. Click *OK*.

C.3.3.5 Reboot the XPORT-AR device

Select *System* from the *Status* menu. Click on the *Reboot* button to reboot the Ethernet device, and for the network and serial settings to take effect. The screen in *Figure 76* displays the system screen:

Figure 76: Lantronix Device Installer: System Screen

The Ethernet device is now ready to communicate with the DL-V3. In order for a client to communicate with the Ethernet device using existing communications tools such as HyperTerminal, the Ethernet device's IP address must be mapped to a virtual serial port within the Lantronix Port Redirector utility. *Section C.3.4, Lantronix Port Redirector Software*, starting below, describes the configuration process.

C.3.4 Lantronix Port Redirector Software

Run the Lantronix Port Redirector software from the *Start* | *All Programs* | *Lantronix* | *Redirector* menu.

The main *Lantronix Redirector Configuration* screen appears, see *Figure 77* on *Page 203*.

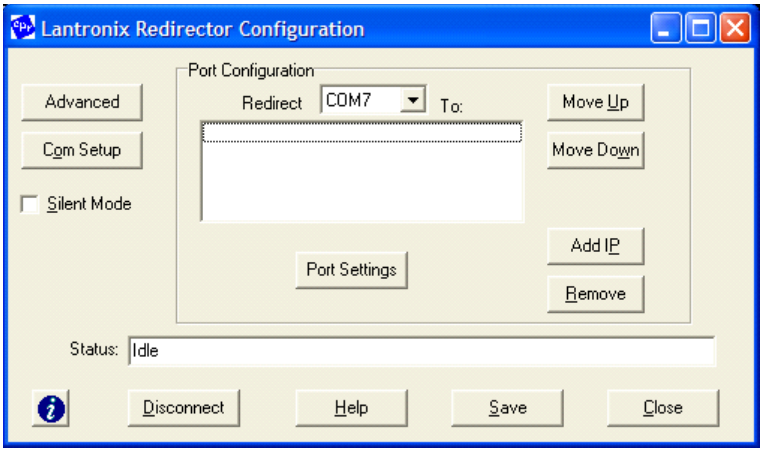


Figure 77: Lantronix Redirector Configuration Dialog

C.3.4.1 Add the DL-V3 Ethernet Device's IP Address and Port

Click on the *Add IP* button. The *IP Service Setup* screen appears. *Figure 78* is an example using the same IP address as configured in the Lantronix *DeviceInstaller* utility.

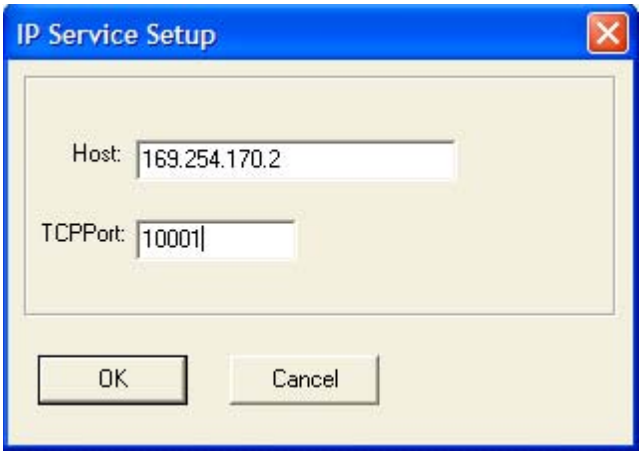


Figure 78: Lantronix Port Redirector: IP Service Setup

In the *Host* field, key in the DL-V3 Ethernet device's IP address. Since the IP address is unique for each installation, it is left up to the user to configure a valid IP address, typically static. For the port setting, in the *TCPPort* field use 10001. Click *OK* to return you to the main *Lantronix Redirector Configuration* dialog shown in *Figure 77*.

See also *Section C.3.3.1, Network Settings Configuration* on *Page 198* and *Section C.2, Configuration Overview* on *Page 190*.

C.3.4.2 Configure Port Settings

In the *Lantronix Redirector Configuration* dialog, click on the *Port Settings* button. The Port Setting dialog appears as shown in *Figure 79*. Check the *Raw Mode* check box. Click *OK* to return you to the main *Lantronix Redirector Configuration* dialog shown in *Figure 77* on *Page 203*.

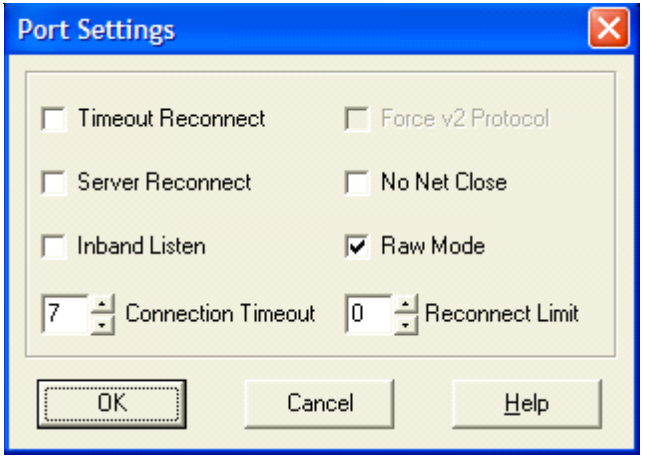


Figure 79: Lantronix Port Redirector: Port Settings Screen

C.3.4.3 Configure Virtual Serial Port

In the *Lantronix Redirector Configuration* dialog, click on the *Com Setup* button.

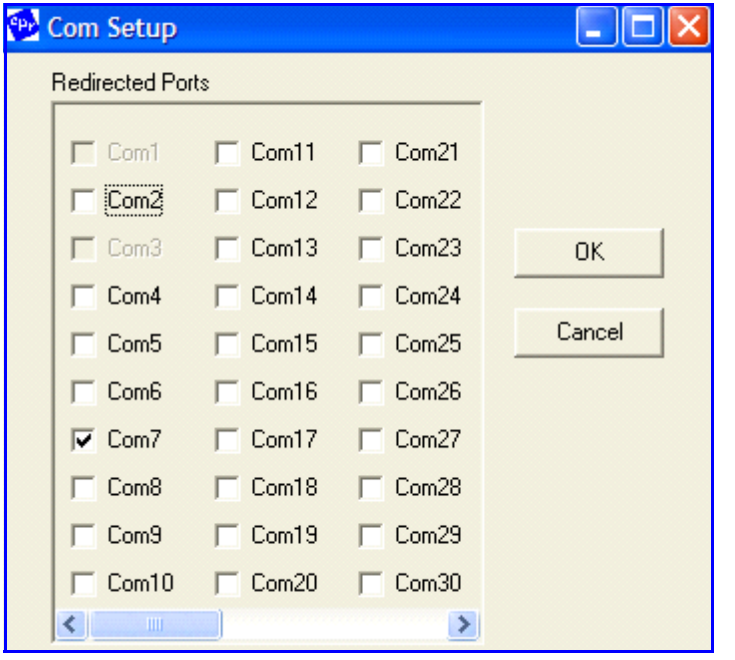


Figure 80: Lantronix Port Redirector: Com Setup Screen

The Com Setup dialog appears, see *Figure 80* on *Page 204*. Select a COM port to use as the virtual serial port for the Ethernet device. Notice that you are unable to select previously assigned ports. Click *OK* to return you to the main *Lantronix Redirector Configuration* dialog.

C.3.4.4 Redirector Configuration Completion

After completing the steps in the three sections from *Section C.3.4.1* on *Page 203* through to *Section C.3.4.3* above, click the *Save* button in the *Lantronix Redirector Configuration* dialog, shown in *Figure 77* on *Page 203*, and follow the prompts. Click the Close button to close the Redirector program. The Windows system may require a reboot when a new COM port is selected.

The system is now ready to be used with HyperTerminal, **CDU**, or other serial communications software. Ensure that the serial settings are identical to those configured for the Ethernet device, that is 115200 baud, 8 data bits, no stop bits, 1 parity bit, no flow control and the same PC COM port as selected in *Section C.3.4.3, Configure Virtual Serial Port* on *Page 204*.

C.4 Alternative Serial and Network Parameters Configuration

The DL-V3's Ethernet port is Dynamic Host Configuration Protocol DHCP-enabled by default, see *Section C.2, Configuration Overview* on *Page 190*. Also, the default serial settings are 9600 baud, 8 data bits, no stop bits, 1 parity bit, and no flow control.

Serial Command Mode is an alternative method to configure the Ethernet network and serial settings. This method is complicated by the fact that there is no direct access to the Ethernet device because it is an embedded part connected internally to COM3. The following paragraphs describe the detailed process of configuring the Ethernet via the Serial Command Mode.

C.4.1 Physical Connections

To physically connect the Ethernet to the DL-V3, follow these steps:

1. Connect a serial **null-modem** cable from your Laptop to the DL-V3 COM1 port
2. Connect a serial **null-modem** cable from your Laptop to the DL-V3 COM2 port

---

✉ 1 serial null-modem cable may be connected from the laptop and switch between COM1 and COM2 on the DL-V3. You can avoid switching if you have two serial connections on your laptop and two null-modem cables. Also, if your laptop has only USB connectors, you need a USB to serial adaptor between the null-modem cable and the laptop's USB connector.

---

3. Connect the power cable to DL-V3 power port, power and switch on the unit with the  button on its front.

C.4.2 PC Software

HyperTerminal communications software is recommended for COM1 communications to the DL-V3. From Window's *Start* menu, select *Programs* | *Accessories* | *Communications* | *Hyperterminal*. The

default communications parameters should be set to those listed in the following table in Hyperterminal:

Parameter	Setting
BAUD	9600
DATA BITS	8
PARITY	N
STOP BITS	1
FLOW CONTROL	NONE
ASCII SETTINGS	Disable echo typed characters locally

COM1 is used to tunnel to COM3 to gain direct access to the Ethernet.

COM2 is used to issue NovAtel commands to the DL-V3 using HyperTerminal communications software. The communications parameters should be set to the defaults for DL-V3 COM2. Typically, 9600, 8, N, 1, no parity and local echo on.

C.4.3 DL-V3 Commands

C.4.3.1 Switch to Ethernet Device

Once communication has been established between your laptop serial port (or USB port with a USB-to-serial port adaptor) and COM2 on the DL-V3, enter the following commands:

- LOG VERSION

✉ Record the OEMV-3 part serial number (PSN) for future use (associated with the Ethernet Media Access Control (MAC) address).

- APPCONTROL BLUETOOTH 1

✉ Switch COM3 peripheral to Ethernet. On the front of the DL-V3, the Bluetooth LED no longer glows blue but instead the Ethernet LED glows orange.

- LOG COMCONFIG

✉ COMCONFIG shows you the current port settings (the default baud setting for COM3 is 115200). The COM commands below ensure both COM1 and COM3 are set to 9600 baud.

- COM COM1 9600 N 8 1

- COM COM3 9600 N 8 1
- LOG COMCONFIG

✉ The COMCONFIG command should verify that COM3 is now set to 9600 baud.

C.4.3.2 Establish a Communications Tunnel

Still on COM2, enter the following commands:

- INTERFACEMODE COM3 TCOM1 NONE OFF
- INTERFACEMODE COM1 TCOM3 NONE OFF

C.4.3.3 Reset Ethernet

Still on COM2, enter the following command:

- APPCONTROL OPTION 12 1

This command forces the Ethernet to reset. Wait only a second for the Ethernet to power up again.

C.4.3.4 Establish Serial Command Mode in Ethernet

Switch the null-modem cable connection on the DL-V3 from the COM2 port to the COM1 port. Follow this procedure very carefully.

1. Select *File | Properties* in the HyperTerminal menu. The *Connections Properties* dialog appears.
2. Click on the *Settings* tab in the *Connections Properties* dialog.
3. Click on the *ASCII Setup* button in the *Settings* tab. The *ASCII Setup* dialog appears.
4. Ensure that the *Echo typed characters locally* check box is unchecked. Normally it is useful to see what you are typing but for the following step we are only interested in what the Ethernet device returns to the screen.
5. Click on the *OK* buttons until you return to the main HyperTerminal window.
6. Type the character '!' and wait for a returned '!' character to appear. If it does not, repeat entering the ! and continue until a ! is returned to the screen. Immediately after observing the ! character returned, type:

   • xyz

✉ 1. Do not hit the Enter key after typing the z, simply wait for the prompt to appear

2. If the ! character never appears, go back to step *C.4.3.3*.

7. Follow steps 1 through 3 above again and then go on to step 8 now that we are typing commands again, and want to see characters as we type them.

8. Ensure that the *Echo typed characters locally* check box **is** checked this time.
9. Click on the *OK* buttons until you return to the main HyperTerminal window.
10. Enter the following command in the main window (that is in Command Mode)

    • enable

    Figure 81 shows an example of the Ethernet communication in command mode. The xyz and enable commands can be seen near the top. The other commands that follow are shown in the next section. Refer back to *Figure 81*, as you follow the next section's instructions, to see if you get the expected results. If not return to step *C.4.3.3* and try again.

```
char *acCmds[] =
  {                              // expect:
     "xyz",                      // >
     "enable\r",                 // (enable)#
     "configure\r",              // (config)#
     "if 1\r",                   // (if-1)#
     "ip address   ",            // (if-1)#
     "no dhcp\r",                // (if-1)#
     "speed auto\r",             // (if-1)#
     "write\r",                  // (if-1)#
     "exit\r",                   // (config)#
     "exit\r",                   // (enable)#
     "line 1\r",                 // (line-1)#
     "databits 8\r",             // (line-1)#
     "flowcontrol hardware\r",   // (line-1)#
     "speed 115200\r",           // (line-1)#
     "write\r",                  // (line-1)#
     "exit\r",                   // (enable)#
     "reload\r",                 // Are you sure (yes/no)‘
     "yes\r",                    // Rebooting...
     0
  };
```

Figure 81: Command Mode Example

C.4.4 Network Configuration in Command Mode

✉ 1. Text within brackets < > denote optional parameters.

2. An IP address must be formatted in dotted quad IP address notation and be valid for the network. An example of dotted quad notation is: 192.168.0.254

3. Refer to the *Lantronix XPORT-AR User Guide* for a full command set. Lantronix website details are on *Section C.1, Physical Set-Up* on *Page 189*.

11. *(continued from Page 208)* Enter the following Ethernet command-mode commands on COM1, to configure the network settings:

    • show

✉ 1. Record the MAC address. It should appear as a set of six hexadecimal value pairs separated by colons. For example:

   00:20:4A:44:55:66

2. The show command is not shown in *Figure 81* on *Page 208*.

    • configure

    • if 1

    • ip address <IP> <network mask>

    • ip default-gateway <gateway IP address>

    • no dhcp

    • speed auto

    • exit

    • exit

    • write

    • line 1

    • databits 8

    • flowcontrol hardware

    • speed 115200

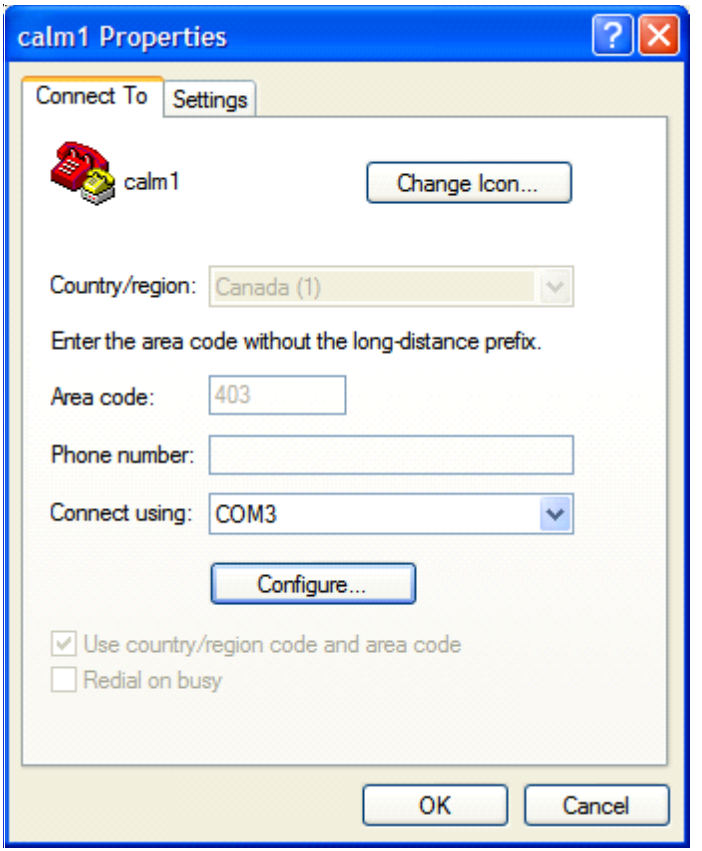
12. Change the baud rates to re-establish communications with the Ethernet device now that the Ethernet is set to 115200, but the tunneled serial ports on the DL-V3 are still at 9600 baud. In addition, HyperTerminal's baud rate is also still set to 9600.

13. Switch the null-modem cable connection on the DL-V3 from the COM1 port to the COM2 port.
14. Enter the following commands on COM2:

- COM COM1 115200
- COM COM3 115200
- LOG COMCONFIG

✉ The COMCONFIG command verifies that the baud rate on COM1 and COM3 are now 115200.

15. Select *Call* | *Disconnect* from the main menu to disconnect the communications so that a new baud rate can be configured.
16. Choose *File* | *Properties* from the main menu.



17. Click on the *Configure...* button in the *Properties* dialog.

18. Choose 115200 in the *Bits per second:* field.
19. Click *OK*.
20. Switch the null-modem cable connection on the DL-V3 from the COM2 port to the COM1 port.
21. Re-connect HyperTerminal and type the following commands to COM1:

    • exit

✉ Type YES when asked to reboot or reload the system. For example, after you see:
`reload\r`

    • yes

22. Switch the null-modem cable connection on the DL-V3 from the COM1 port to the COM2 port
23. Type RESET on COM2, or push and hold the power button on the DL-V3 and wait for the LEDs to indicate that the unit is powering off before releasing the power button, or physically remove power from the DL-V3. This step restores COM1 and COM3 by resetting the unit.

This concludes the Ethernet configuration via Serial Command Mode. Next, see the *Lantronix Port Redirector Software* section starting on *Page 202* to configure Lantronix Port-Redirector software to configure a Lantronix virtual serial port in Windows XP.

Appendix D Replacement Parts

The following are a list of the replacement parts available for your NovAtel GPS receiver. Should you require assistance or need to order additional components, please contact your local NovAtel dealer or Customer Service representative.

D.1 DL-V3 and ProPak-V3

Part Description	NovAtel Part
I/O strobe cable (*Figure 63* on *Page 169*)	01017660
Straight through serial data cable (*Figure 62* on *Page 168*)	01017659
Null modem serial data cable (*Figure 61* on *Page 167*)	01017658
Power cable: LEMO 4-pin socket to 12V power outlet plug (*Figure 60* on *Page 166*)	01017663

D.2 ProPak-V3

Part Description	NovAtel Part
USB serial cable (*Figure 64* on *Page 170*)	01017664

D.3 FlexPak-V2, FlexPak-V1G and FlexPak-V1

Part Description	NovAtel Part
12V power adapter cable (*Figure 65* on *Page 175*)	01017821
13-pin Deutsch to DB9 null modem serial cable (*Figure 66* on *Page 176*)	01017822
13-pin Deutsch to DB9 straight through cable (*Figure 67* on *Page 177*)	01017823
13-pin Deutsch to USB connector cable (*Figure 68* on *Page 178*)	01017820

D.4 Accessories

Part Description		NovAtel Part
OEMV Family Compact Disc with PC utilities		01017716-VER1
OEMV Family Installation and Operation User Manual		OM-20000093
OEMV Family Firmware Reference Manual		OM-20000094
SMART-V1 multi-cable USB (2 DB-9, 1 USB and 7 bare tagged wire ends)		01017983
SMART-V1 multi-cable CAN (3 DB-9, and 7 bare tagged wire ends)		01017984
SMART-V1 multi-cable USB variant (all bare tagged-wire ends)		01017923
SMART-V1 multi-cable CAN variant (all bare tagged-wire ends)		01017922
Optional NovAtel Antennas:	Model 702 (L1/L2)	GPS-702
	Model 701 (L1-only)	GPS-701
	Model 702L (L1/L2/L-Band)	GPS-702L
	Model 702GG (L1/L2/GLONASS)	GPS-702GG
	Model 701GG (L1/GLONASS)	GPS-701GG
	Model 702GGL (L1/L2/GLONASS/L-Band)	GPS-702GGL
	Model 701GGL (L1/GLONASS/L-Band)	GPS-701GGL
	Model 538 (L1/GLONASS/L-Band)	ANT-538

Continued on Page 213

Part Description		NovAtel Part
	Model 534 (L1/L2/L-Band)	ANT-534
	Model 533 (L1/L2)	ANT-533
	Model 532 (L1/L2)	ANT-532
Optional RF Antenna Cable:	5 meters	C006
	15 meters	C016
	30 meters	C032
	22 cm interconnect adapter cable	GPS-C002
AC Adapter 120/240VAC	15 Watts, 12 V DC adapter with USA electrical chord	40023098

D.5 Manufacturers' Part Numbers

The following original manufacturer's part numbers are provided for information only and are not available from NovAtel as separate parts:

Product	Part Description	Company	Part Number
ProPak-V3/DL-V3 Power Cable (*Figure 60* on *Page 166*)	4-pin socket connector	LEMO	FGG.0B.304.CLAD52Z
FlexPak-V1/V1G/V2 Cables (*Figures 65 -68* starting on *Page 175*)	3-pin plug connector on 12V power adapter cable	DEUTSCH	59064 - 09 - 98SN
	13-pin plug connector on serial cables	DEUTSCH	59064 - 11 - 35SF
SMART-V1, USB or CAN Model Cables	18-pin plug connector on multi-cable	Switchcraft	EN3C18F26
OEMV-1 Card/OEMV-1G Card (*Figure 47* on *Page 130*)	J100 - MCX JACK RECEPTACLE RF signal input and LNA power output	JOHNSON	133-3701-211
	J700 - 2x10 HEADER, 2mm PITCH Power, data, and signal connector	SAMTEC	TMM-110-03-TM-D
OEMV-2 Card (*Figure 51* on *Page 142*)	J100 - MMCX JACK RECEPTACLE RF signal input and LNA power output	JOHNSON	135-3701-201
	J501 - MMCX JACK RECEPTACLE External oscillator input	JOHNSON	135-3701-201
	P1101 - 2x12 HEADER, 2mm PITCH Power, data, and signal connector	SAMTEC	TMM-112-03-L-D
OEMV-3 Card (*Figure 53* on *Page 148*) Note the alternates for J100 and J700.	J100 - MMCX JACK RECEPTACLE RF signal input and LNA power output	JOHNSON	135-3701-201
		HUBER+SUHNER	82 MMCX-50-0-1
	J700 - MMCX JACK RECEPTACLE External oscillator input	JOHNSON	135-3701-201
		HUBER+SUHNER	82 MMCX-50-0-1
	P1601 - 2x20 HEADER, 0.1" PITCH Power, data, and signal connector	SAMTEC	TSM-120-01-S-DV
	P1400 - 2x7 HEADER, 0.1" PITCH CAN Bus with transceiver	SAMTEC	TSM-107-01-L-DV

Index

D

E

F

G

T

U

V

W