

## MANUAL

# MODEL NM42U NMEA 0183 USB Multiplexer

This manual covers version 3.1. Future versions of this product may contain enhancements not covered here.

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### Programming Instructions

#### 1. General Description

The NM42U USB Multiplexer combines up to four NMEA 0183 instruments (talkers) into a common NMEA 0183 output. This output would normally go to another NMEA listener such as a radar, chartplotter, or repeater. The USB connector provides a computer interface. The computer will receive all of the combined data from the instruments and can also send data back to the instruments, which will appear, at the **TLK** port of the NM42U. This can be used for downloading waypoints, requesting specific types of data, sending steering commands, and more.

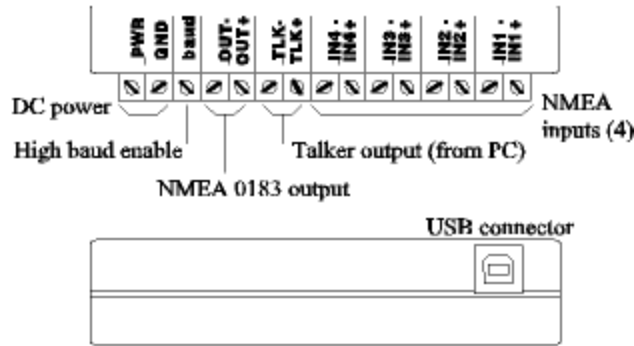
Installation and operation of the NM42U is simple. All connections to instruments are made via a terminal strip. The unit begins operating as soon as power is applied. No initialization or setup is required. The USB connector provides 2-way data communication to/from the computer. The NM42U may be operated either with or without a USB connection. Some configuration options are user programmable. (See Appendix A.)

To assist in installation and troubleshooting, a multicolor LED is located on top of the NM42U. The LED will flicker green when valid NMEA sentences are being received on any of the four inputs. The LED flickers red when valid NMEA sentences are received from the USB interface. It will show a yellow color for about ½ second if an error is detected and simultaneously send an error identification sentence to the outputs (**OUT+ / OUT-** and USB).

#### 2. Installation

Installation of the NM42U requires connection to a power source and to NMEA talkers and listeners. All connections are made via a fifteen position terminal strip. A description of the connections is given in Table 1. Any unused connections open may be left disconnected. A USB connector is provided on the rear for connection to a computer. D.C. power to operate the NM42U must be supplied to the terminal strip. It does not come from the USB connection.

**Figure 1. NM42U Connections**



**Table 1. Interface Description**

PWR, GND	Ships' power (8-28VDC), 50 mA. typical current draw.
Baud	Baud rate select terminal. Ground this terminal for HIGH baud. Leave open for 4800 baud (default).
OUT+, OUT-	Combined output (RS-422) from the 4 NMEA 0183 inputs. 4800 – 38,400 baud (selectable).
TLK+, TLK-	Talker output (RS-422) from computer to listeners such as GPS, autopilot, etc. 4800 baud only.
IN1.. 4+, IN1.. 4-	Listener inputs (opto-isolator) from instruments. IN1, 2 = 4800 or 9600 baud. IN3, 4 = 4800 baud only.
USB Conn.	USB interface to computer. A small amount of D.C. current (< 10 mA.) required from host.

**Power/Ground Connection**

The power (**PWR**) and ground (**GND**) connections are located at one end of the terminal strip. The power source can be anywhere in the 8-28 Vdc range. D.C. power must be supplied to this terminal even if USB power is present. There is no ON/OFF switch on the NM42U due to its low power consumption.

**NMEA 0183 Inputs and Output**

The four NM42U input connections are labeled **IN1** through **IN4**, and the output is labeled **OUT**. When connecting instruments to these inputs, it is important to maintain the proper polarity of the lines. Always connect the “+” terminal of each talker to the corresponding “+” or “A” terminal of each listener. Likewise, connect the “-” terminal of each talker to the corresponding “-“ or “B” terminal of each listener. Likewise, connect the “-“ terminal of each talker to the corresponding “-“ or “B” terminal of each listener. In some cases a device will not have “+/-” or “A/B” connections, but rather only a “Data in” or “Data out” which is referenced to ground. These are known as “single-ended” devices.

For single-ended talkers, connect the “Data out” to **IN+** connection of the NM42U. The **IN-** connection must be connected to ground or “common.” For single-ended listeners, connect the

NM42 **OUT+** terminal to the “Data in.” Leave the **OUT-** terminal open. Never connect **OUT-** to ground or common.

The inputs (**IN1-IN4**) are configured to operate at 4800 baud. **IN1** and **IN2** can be reconfigured to operate at 9600 baud. See Appendix A.

### **NMEA 0183 Talker Connection**

The talker (**TLK**) port outputs data received from the PC interface (USB). It may be connected to any instrument that is a listener, such as an autopilot or GPS receiver, which requires information from the PC. The **TLK** output baud rate is fixed at 4800 regardless of the baud rate of the PC interface. This port is also differential (RS-422) and follows the same convention as with the **OUT+/OUT-** output. The **TLK-** terminal should never be connected to ground or common. It can be left disconnected where necessary. Multiple listeners may be connected to this port within the loading limitations of the device (50 mA. max.) The **TLK** output data rate is always fixed at 4800 baud even if the baud terminal is set to HIGH (grounded).

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### **Baud Terminal**

This connection is used to increase the output data rate, which increases the data throughput of the NM42U. With the terminal disconnected, the data rate is set at 4800 baud, the standard for NMEA 0183. Connecting **baud** to ground causes the output (**OUT+/OUT-**) data rate to change to the HIGH value. Normally the HIGH baud rate will be 9600 (factory preset) if the unit has not been reconfigured. To reconfigure the HIGH baud for 19,200 or 38,400 see Appendix A. The NMEA inputs and the **TLK** output will remain at 4800 baud even with **baud** grounded. The baud rate detection only takes effect at power-up. Any change to this terminal must be followed by a reset command or by power removal and restoration for the change to take effect.

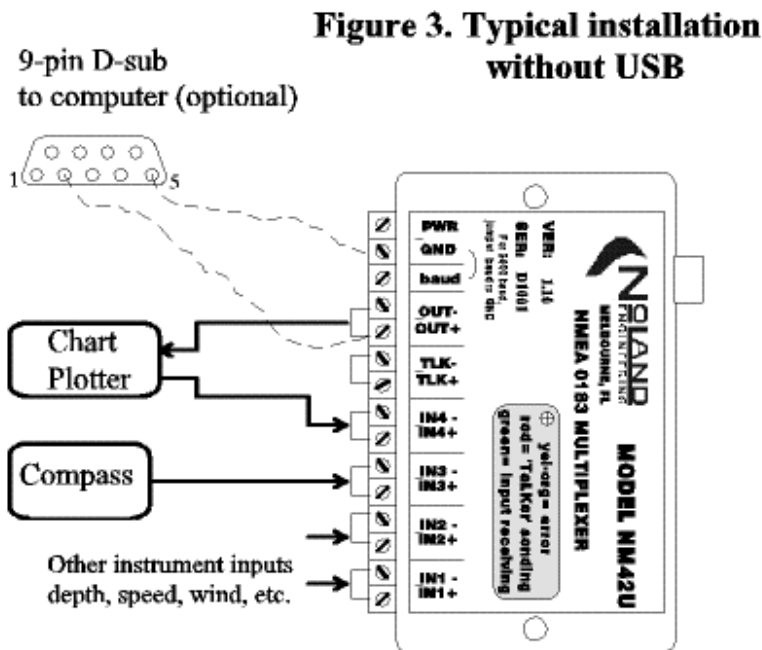
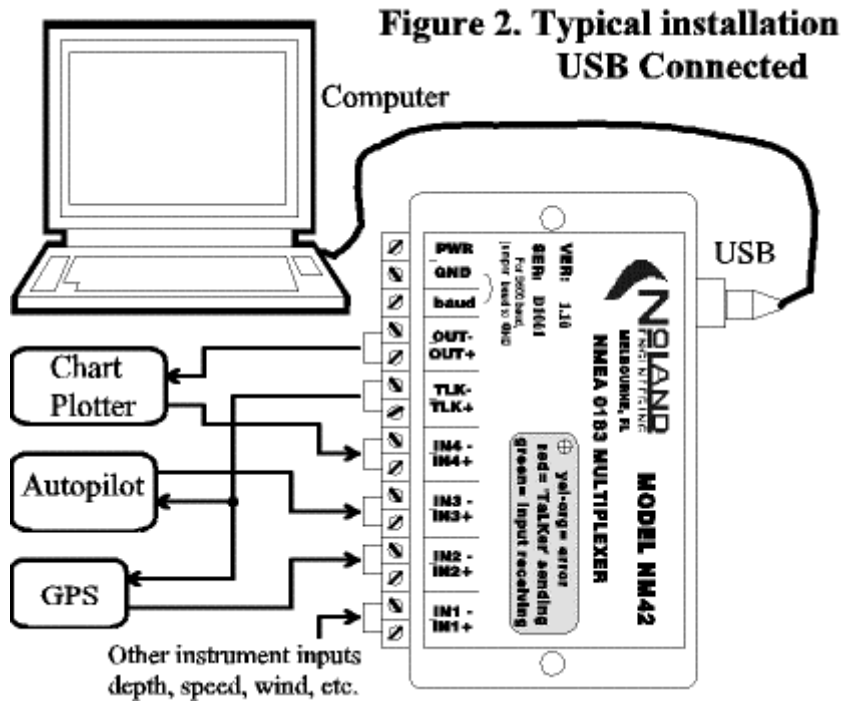
### **USB Connector**

The USB connector located on the rear of the NM42U provides a computer interface. The use of the USB interface requires software drivers be installed on the computer to which it is connected. These drivers convert the USB connection into a “Virtual Com Power” so that software expecting a serial COM\_ port can send and receive data. A small of D.C. current (< 10 mA.) is drawn from the USB connection when connected.

### **Typical Installation**

A typical NM42U installation with a computer connected to the USB interface would resemble Figure 2. A computer is present to collect all the data from onboard instruments and also to send steering commands to an autopilot and send waypoints to the GPS. The GPS provides position information while the autopilot provides heading. Any other instruments, such as a chartplotter, may obtain the combined instrument data from the **OUT+ / OUT-** terminals.

The NM42U can also be used without the USB connection. In this case, D.C. power must be applied to the +12V terminal on the front of the unit. An optional computer with a COM Port can be connected to the **OUT+** terminal as shown to receive the combined NMEA 0183 data. Figure 3 shows the connection.



### Software Installation

This section describes how to install the USB Serial Port drivers and Virtual COM Port drivers. Updates to these procedures may be found on the NoLand Engineering NM42U Drivers Disk.

#### Windows 98,ME,NT,2000,XP

- 1) Plug NM42U into USB port of computer
- 2) Insert NoLand Engineering NM42U Drivers Disk into disk drive of computer

- 3) When the “New Hardware Wizard” window appears, select the “Windows recommended option”
- 4) Click ”Next”
- 5) Click ”Finish”

If your computer does not automatically install the “USB Port Drivers,” a “New Hardware Wizard” will appear. In this case:

- 1) When the “New Hardware Wizard” window appears, select the “Windows recommended option“
- 2) Click “Next“
- 3) Click “Finish“

Software driver installation is complete. To determine which COM port number was assigned to the USB serial port, look under Windows “Device Manager, “double click ports (COM and LPT), and look for USB Serial (COM #).

If any problems occur, please reference the Readme.txt file on the installation disk.

### 3. Operation

**NOTE: The NM42U can be operated with or without the USB connection. See “Installation” for more details.**

Once the NM42U is installed and a computer is connected to the USB interface, the unit begins acquiring data automatically. The combined data rate will be 4800 baud (~480 characters/second). To change this to the HIGH baud rate, ground the “baud“ terminal, remove D.C. power (or USB connection) and reapply power to reset the NM42U. The **baud** terminal is only checked at initialization, so any change will not take affect until a “reset” is issued or the D.C. power is removed and restored.

#### Status LED

A multicolor LED is situated in a recess on top of the NM42U. The colors and their meaning are summarized in Table 2. The LED will only show one color at a time as determined by its priority. The yellow color has highest priority to indicate an error has occurred. The red color has next highest priority and will be seen if no error is currently present and data is being sent to the **TLK** output. The green LED will only be lit if either of the other colors is not displayed. The green and red LED colors flicker as data is being sent. The yellow color is for error notification and remains lit for approximately ½ second. This makes it easier to discriminate from the red color.

**Table 2. LED Status Meanings**

Color/State	Priority	Meaning
Yellow Steady ~ 1/2 sec	highest	An error has occurred, and an error identification sentence is being sent.
Red Flickering	middle	A valid sentence from the USB interface is being sent to the <b>TLK</b> output.
Green Flickering	lowest	A valid sentence from one of the four inputs is being sent to the outputs.

Whenever the yellow LED is displayed, an error message is sent to both the NMEA output

(**OUT+/OUT-**) and the USB interface. Refer to Troubleshooting (Section 4) for more information about the error messages.

#### **Data Acquisition**

Acquiring data from marine navigational instruments is the primary function of the NM42U. Under the NMEA 0183 Standard, all data is transmitted as ASCII characters assembled into specific sentences. The format of every sentence is defined in the Standard.

Every sentence begins with a dollar sign (\$) and ends with a carriage return and linefeed, (<CR><LF>). Immediately following the "\$" is a five character identifier which defines the type of instrument and the specific sentence being sent. Following the identifier are data fields separated by commas.

The easiest way to view the data is with a terminal program such as "Hyperterminal" available on most PC's. The following settings are used to view NMEA 0183 data:

Baud Rate	4800
Data Bits	8
Parity	none
Stop Bits	1
Flow Control	none

NMEA 0183 devices may be either talkers or listeners or both. Data is typically sent once each second.

#### **4. Troubleshooting**

A useful feature of the NM42U is the detection and reporting of errors. There are five types of errors, which can be detected, in any of the five internal channels (4 inputs + talker). An error message identifies both the channels and types of errors that have occurred. It is available at both the USB interface and the **OUT+/OUT-** terminals. The error message is sent simultaneously with the error LED (yellow) being displayed.

The error message identifies the error channels and types with an alphanumeric code. The format is as follows:

**\$PNOLE, c, t**

where *c* represents an alphanumeric code identifying the error channel(s), and *t* represents an alphanumeric code identifying the error type(s).

The codes for a single error and their meaning are presented in Table 3. The error message is sent only once each half second when errors are present. The message will contain a summary of all error channels and types which occurred during the previous interval (~ ½ sec).

**Table 3. Single Error Codes**

<b>CODE</b>	<b>ERROR CHANNEL</b>	<b>ERROR TYPE</b>
1	IN1	sync
2	IN2	char
4	IN3	dolr
8	IN4	lnfd
G(16)	TLK	ovfl

The meaning of the error types is as follows:

**sync** This is a synchronization, or framing, error caused by an invalid START bit or STOP bit, usually from corrupted data.

**char** This is a character error which occurs when an 8-bit ASCII character is detected.

**dolr** This is an error generated when a “\$” (start of sentence) character is not received when expected.

**lnfd** This is an error generated by a missing linefeed character or a sentence containing too many characters.

**ovfl** This is a buffer overflow error which occurs when more data is coming into the NM42 than it can send out.

In most instances only a single channel will have an error, but there may be several errors occurring during the reporting interval. For example, synchronization errors will usually occur simultaneously with character errors and possibly dollar and/or linefeed errors. If an input is connected or disconnected “on-the-fly” while it is sending data, an error will most likely occur. If an input is reverse polarized, it will generate continuous error messages about twice per second.

As an example, the sentence

**\$PNOLE,4,7**

indicates that **IN3** had **sync**, **char**, and **dolr** errors. We know this because 7 is the sum of 1(sync) + 2(char) + 4(dolr). Each of the five types of errors is assigned a binary power (1, 2, 4, 8, F). The sum of any of these binary powers equals a unique number, which can be decomposed into the simple error types. To accommodate quantities over 9, letters are used to represent the quantities 10(A), 11(B), 12(C), 13(D) ... and so on.

The encoding of the error channel follows this same scheme used for error type. Table 4 provides codes, which represent multiple error types and multiple error channels.

The “TLK” error code and the “ovfl” error code are not shown in Table 4, because they rarely occur in practice. If a “TLK” or “ovfl” error occurs with other errors, Table 5 can be used to decipher the codes.

#### Testing with Status LED

The LED provides a convenient means to test the NM42U in place. This is because the NM42U will always produce an output whenever any of the five input channels (4 + talker) is stimulated. If valid data is detected, the LED will flash red or green as appropriate and the data will be sent to the output.

**Table 4. Multiple Error Codes**

CODE	ERROR CHANNEL(S)	ERROR TYPE(S)
3	IN2 + IN1	char + sync
5	IN3 + IN1	dolr + sync



6	IN3 + IN2	dolr + char
7	IN3 + IN2 + IN1	dolr + char + sync
9	IN4 + IN1	lnfd + sync
A(10)	IN4 + IN2	lnfd + char
B(11)	IN4 + IN2 + IN1	lnfd + char + sync
C(12)	IN4 + IN3	lnfd + dolr
D(13)	IN4 + IN3 + IN1	lnfd + dolr + sync
E(14)	IN4 + IN3 + IN2	lnfd + dolr + char
F(15)	IN4 + IN3 + IN2 + IN1	lnfd + dolr + char + sync

**Table 5. Multiple Error Codes including TLK & ovfl**

CODE	ERROR CHANNEL(S)	ERROR TYPE(S)
H(17)	TLK+IN1	ovfl+sync
I(18)	TLK+IN2	ovfl+char
J(19)	TLK+IN2+IN1	ovfl+char+sync
K(20)	TLK+IN3	ovfl+dolr
L(21)	TLK+IN3+IN1	ovfl+dolr+sync
M(22)	TLK+IN3+IN2	ovfl+dolr+char
N(23)	TLK+IN3+IN2+IN1	ovfl+dolr+char+sync
O(24)	TLK+IN4	ovfl+lnfd
P(25)	TLK+IN4+IN1	ovfl+lnfd+sync
Q(26)	TLK +IN4+IN2	ovfl+lnfd+char
R(27)	TLK+IN4+IN2+IN1	ovfl+lnfd+sync
S(28)	TLK+IN4+IN3	ovfl+lnfd+dolr
T(29)	TLK+IN4+IN3+IN1	ovfl+lnfd+dolr+sync
U(30)	TLK+IN4+IN3+IN2	ovfl+lnfd+dolr+char
V(31)	TLK+IN4+IN3+IN2+IN1	ovfl+lnfd+dolr+char+sync

If an input has invalid data, the error LED will light and an error sentence will be transmitted identifying the problem. If a computer is connected to the NM42U, the error message can be observed with a terminal program such as “Hyperterminal.”

These tests are simple, requiring no special equipment. Voltmeter testing of differential signals (RS-422) can produce very confusing results and should not be relied upon to determine proper operation of the NM42U.

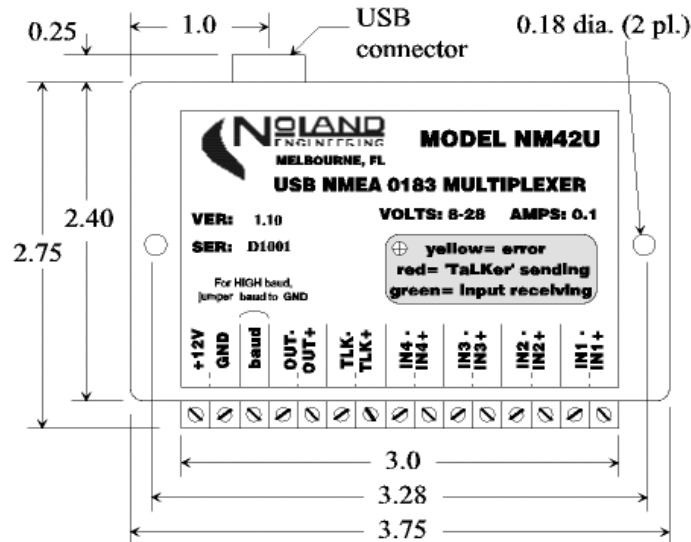
#### 5. NM42U Technical Specifications

Supply Voltage	8-28 VDC
Supply Current	50 mA. max
Input Drive Voltage	2-14 V (Active State)
Input Impedance	1K Ohms (Min.)
Talker Output	4V Differential (RS-422)
Output drive (OUT, TLK)	50 mA. (max)

Serial Output Baud Rate	4800 – 38,400 (selectable)
Serial Output Formats	USB2.0 and RS-422
Size	3.75" x 3.0" x 1.0"
Weight	3 oz.

## 6. Warranty

NoLand Engineering, Inc., provides a two-year replacement warranty against manufacturing defects and component faults. Inquiry for warranty replacement may be made directly to NoLand Engineering via phone, fax, or e-mail. Include the model number and serial number of your unit with any inquiry.



**Figure 4. Outline Drawing**

### APPENDIX A

### Programming Instructions

#### Introduction

The NM42U is capable of accepting certain commands and taking appropriate action such as a device reset. The commands are also used to configure various options, such as baud rate selection. All programming is done through the PC (USB) interface.

Although programming can be done while the unit is operating, it is much easier to stop data flow while programming is being done. This can be done with the “stop device” command, or all inputs can simply be disconnected or turned off. With the device connected to a computer, a terminal window (e.g., Hyperterminal) can be used for programming.

Commands typed into the terminal window are sent to the NM42U, which will check their validity and take appropriate action. All commands begin with an “@” character followed by another character which defines the action to take. Some actions will need additional characters (options) to more specifically define the action. A list of command characters and options is given in Table A-1.

#### Programming Example

An example will demonstrate how to program the NM42U. With the device connected to a computer and a terminal window open and configured for the correct COM port, we are ready to send a command. If the device is currently receiving data, we can stop the data flow by typing

@<

This causes the data flow to stop. If we now type

@?

We will get a list of the current configuration options.

**TABLE A-1 NM42 Command** (Factory presets are shown in **bold**.)

<b>Command</b>	Action	Options	Comments
<	Stop device	(n/a)	Stop data flow (i.e., for programming)
>	Reset (restart) device	(n/a)	Same as power disconnect-reconnect
?	Help / Query configuration	(n/a)	Shows help / shows current device configuration
B or b	Set HIGH baud rate	<b>1,2,3</b>	<b>9600</b> , 19200, or 38400 baud available
I or i	Input baud rate select	<b>1,2,3,4</b>	IN1 = <b>4800</b> , 9600 IN2 = <b>4800</b> , 9600
e or E	Error reporting on/off	1,2 3,4	1 Error report on 2 Error report off 3 Max sentence length = 82 4 Max sentence length = 127

Assume you now want to reconfigure the HIGH baud rate for 38400. By typing **@B3** the HIGH baud rate will be reconfigured to 38400. It will remain configured this way unless it is reconfigured sometime in the future. To verify the configuration change was accepted, you can again type **@?** which will show the current configuration. In this particular case, the actual baud rate change does not take effect unless power is removed and reapplied (forced reset) or the 'reset' command (**@>**) is sent.

The "**@I**" command is rarely used but is available for certain specialized users. It is used to increase IN1/IN2 baud rates to 9600.

The "**@E**" command performs two different actions. It turns error reporting on or off and also sets the maximum sentence length. Turning error reporting off does not affect operation of the error (yellow) LED. The normal sentence length limit is 82 characters per the NMEA standards but can be increased to 127 chars when needed by issuing the "**@E4**" command.

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