MANUAL

MODEL NM42
NMEA 0183 Multiplexer

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

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GENERAL DESCRIPTION: The NM42 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. An added feature of the NM42 is the 9-pin serial (RS-232) connector for direct connection to a computer. The computer will receive all of the combined data from the instruments and can also send data back to the instruments via the **TLK** port of the NM42. This can be used for downloading waypoints, requesting specific types of data, sending steering commands, and more.

Installation and operation of the NM42 is simple. All connections to ships' power and instruments are made via a terminal strip. The unit begins operating as soon as power is applied. No initialization or setup is required. For connection to a computer, a separate 9-pin connector is provided. Some configuration options are programmable by the user. See Appendix A for details.

To assist in installation and troubleshooting, a multicolor LED is located on top of the NM42. 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 9-pin connector (typically from a PC). 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.

INSTALLATION: Installation of the NM42 requires connection to a power source (8-28 VDC) and to NMEA talkers and listeners. All connections are made via a fifteen position terminal strip as shown in Figure 1. A description of the connections is given in Table 1. Any unused connections open, may be left disconnected.

Figure 1. NM42 Connections

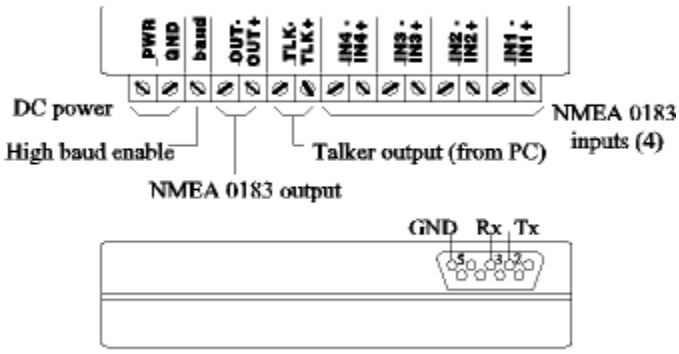


Table 1. Interface Description

PWR, GND	Ships' power (8-28 VDC), approximately 50 mA. 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 PC interface. 4800 baud only. Connect to listeners such as GPS, autopilot, etc. 4800

	baud only.
IN1.. 4+, IN1.. 4-	Listener inputs (opto-isolated) from instruments. IN1, IN2=4800 or 9600 baud. IN3, IN4=4800 baud.
9 pin D_sub	Computer (RS-232) interface. 4800 – 38,400 baud (selectable).

Power/Ground Connection**:** The power (**PWR**) and ground (**GND**) connections are located at one end of the terminal strip. It is recommended that these be connected to the same power source (e.g., circuit breaker) as the ships instruments and/or computer, since it is normally used only when both the instruments and computer are also in use. There is no ON/OFF switch on the NM42 due to its low power consumption.

NMEA 0183 Inputs and Output: The four NM42 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. In some cases a device will only have a single wire input and/or single wire output, which is referenced, to ground. These are known as "single-ended devices.

In the case of single-ended talkers, connect the talker "Data out" to the **IN+** connection of the NM42. The **IN-** connection of the NM42 must be connected to "ground" or "common." For single-ended listeners, connect the NM42 **OUT+** terminal to the listener "Data in." Leave the **OUT-** terminal open. Never connect **OUT-** to "ground" or "common" as this may damage internal circuitry.

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

NMEA 0183 Talker Connection: The talker (**TLK**) port 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** terminals output data received from the PC interface (9 pin D-sub). It 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 **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 (50mA max.).

Baud Terminal: This connection is used to change the data rate of the RS-232 interface to either 9600, 19200, or 38400 baud. With the pin disconnected, the data rate is fixed at 4800 baud, the standard for NMEA 0183. Connecting this pin to ground causes the data rate to change to the HIGH baud. This only affects the RS-232 connection (on rear of unit) and the NMEA output (**OUT+/OUT-**). The NMEA inputs and the **TLK** output will still operate at 4800 baud even with the **baud** pin grounded.

Normally, the HIGH baud rate is 9600 (factory preset) if the unit has not been reconfigured. To reconfigure for 19,200 or 38,400, see Appendix A. The baud rate detection only takes effect at

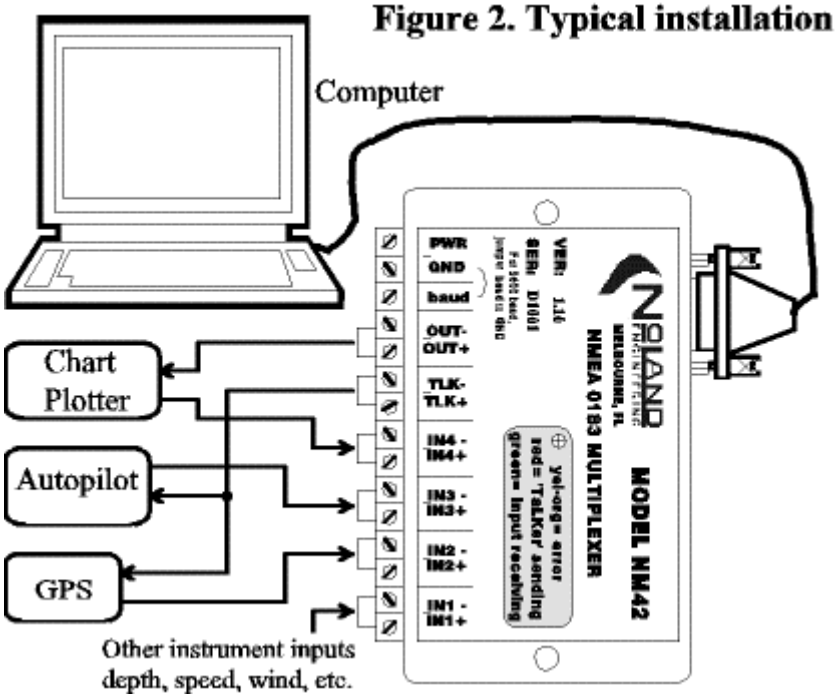
power-up. Any change to this pin must be followed by power removal and restoration or a reset command for the change to take effect.

RS-232 Computer Connection: In most applications the NM42 will be connected to a computer via the 9-pin "D" connector. As shown in Figure 1, only three pins of this connector are used. A standard 9-pin "thru" cable is used to connect the NM42 to a PC. A "Null Modem" cable will not work.

If a custom cable is to be built, only three pins are used. The **Tx** of the NM42 must connect to the **Rx** pin of the computer. Likewise, the **Rx** pin of the NM42 connects to the **Tx** pin of the computer.

Typical Installation: A typical NM42 installation in a vessel might resemble Figure 2. A PC is present to collect all the data from onboard instruments and also to send steering commands to an autopilot. The PC can also download 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.

Figure 2. Typical installation



OPERATION: Once the NM42 is installed and power is applied, the unit begins acquiring data automatically. A computer is not necessary, but one may be connected, if desired. The data rate for the computer connection (RS-232) will be 4800 baud per the NMEA 0183 Standard. To change this to HIGH baud rate, disconnect power, ground the **baud** terminal, and reapply power. The **baud** terminal is only checked at power-up, so any change will not take affect until power is removed and reapplied or a "reset" (@>) command is issued. (See Appendix A.)

Status LED: A multicolor LED is situated in a recess on top of the NM42. 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 has lowest priority and will only be lit if either of the other colors is not displayed and valid data is received on any of the 4 inputs.

The duration of the red or green LED gives an approximate indication of the amount of data being sent. For example, if the green LED remains lit all of the time, then the NM42 is passing the maximum amount of data possible and might even be losing data if too much data is present.

The green and red LED colors flicker as data is being sent, but the yellow color is for error notification and remains lit for approximately ½ second. This makes it easier to discriminate from the red color. Whenever the yellow LED is displayed, an error message is sent to both the NMEA output and the RS-232 (9-pin) interface. To maximize data throughput, the error message can be turned off (see Appendix A), but the yellow error LED will still function.

Refer to the "Troubleshooting" section for more information about the error messages.

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 Intermittent	middle	A valid sentence from the RS-232 input is being sent to the **TLK** output.
Green Intermittent	lowest	A valid sentence from one of the four inputs is being sent to the outputs.

Data Acquisition**:** Combined data from marine navigational instruments is the primary function of the NM42. 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.

TROUBLESHOOTING: A useful feature of the NM42 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 RS-232 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 half-second interval

Table 3. Single Error Codes

CODE	ERROR CHANNEL	ERROR TYPE
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 the msb(d7) of a character is a 'ONE'.

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 error sentence

$PNOLE,4,7

indicates that **IN3** had **sync**, **char**, and **dolr** errors. (Refer to Table 3.) You 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.

Error reporting consumes valuable processing time and output bandwidth. The elimination of all errors maximizes data throughput in high bandwidth installations. (See Appendix for turning off reporting.)

Testing with Status LED: The LED provides a convenient means to test the NM42 in place. This is because the NM42 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. If bad data is being detected a yellow LED will flash. If the green LED remains lit all of the time, then it is possible that too much data is being sent into the NM42.

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 LED will light yellow and an error sentence will be transmitted identifying the problem. If a computer is connected to the NM42, the error message can be

observed with a terminal program such as "Hyperterminal."

NM42 TECHNICAL SPECIFICATIONS

Supply Voltage	8-28 VDC
Supply Current	50 mA (typical)
Input Drive Voltage	2-14 V (Active State)
Input Impedance	1K Ohms (Min.) opto-isolated
Talker Output	4 Differential (RS-422)
Output drive (OUT, TLK)	50 mA. (max)
Serial Output Baud Rate	4800 – 38,400 (selectable)
Serial Output Formats	RS-232 and RS-422
Size	3.75" x 3.0" x 1.0"
Weight	4 oz.

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.

APPENDIX A
Programming Instructions

Introduction: The NM42 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 (RS-232) 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 NM42, 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 1.

Programming Example: An example will demonstrate how to program the NM42. With the device connected to a computer and a terminal window open and configured for the correct COM port, you are ready to send a command. If the device is currently receiving data, you can stop the data flow by typing

@<

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

@?

You will get a list of the current configuration settings as well as a list of commands/options.

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

Command	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	**1**,2,3	**9600**, 19200, or 38400 baud available
I or i	Input baud rate select	**1**,2, **3**,4	IN1 = **4800**, 9600 IN2 = **4800**, 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.

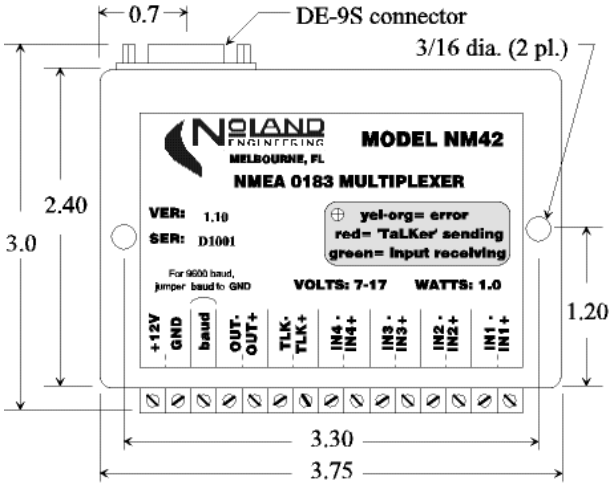


Figure 3. Outline Drawing

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