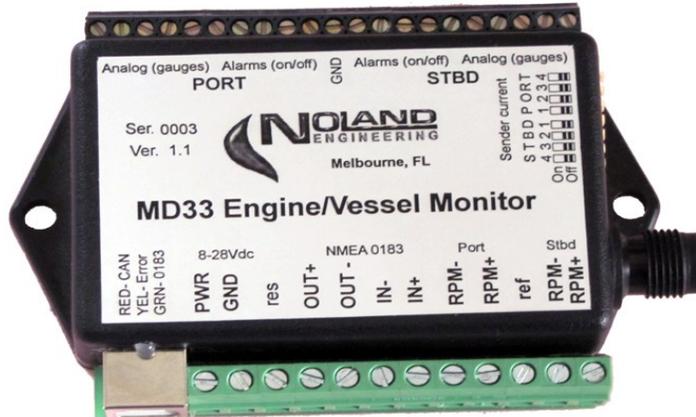


# NoLand Engineering, Inc.



## MODEL MD33 DUAL-ENGINE VESSEL MONITOR

This manual covers version 1.0. Future versions of this product may contain enhancements not covered here.

### TABLE OF CONTENTS

1. Introduction
2. General Description
3. MD33 Installation
5. Operation
6. Troubleshooting
7. Technical Specifications
8. Warranty

### TABLES & FIGURES

- Table 1 –Dual-Engine Vessel Monitor Capabilities
- Table 2 - Interface Description
- Table 3 - Status LED Meanings
- Table 4 - Single Error Codes
- Table 5 - Multiple Error Codes

- Figure 1 - MD33 Components
- Figure 2 - Dual-Engine Vessel Monitor Typical Installation
- Figure 3 – MD33 Connections
- Figure 6 – Example Installation with Vessel Gauges
- Figure 7 – AD20 Differential Amplifier Hookup
- ?? Figure 8 – Contact closure example
- Figure 9 – Hookup of Alarms with Auto Bilge Pumps
- Figure 10 – Outline Drawings

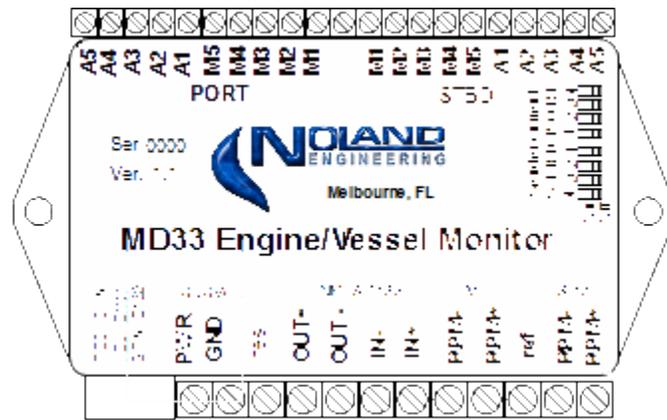
**APPENDIX A** Programming Instructions

**APPENDIX B** MD33 Sentence Definitions

1. **INTRODUCTION:** The MD33 is a versatile data interface system intended for marine vessel and dual-engine monitoring. A variety of analog, rpm, and alarm signals can be monitored by the MD33 along with Navigation/Vessel data from NMEA 0183 and NMEA 2000(N2K) instruments. The data collected is sent to a PC (user supplied) for display and logging by our C-Port II software.

The complete MD33 system consists of the following components (ref. Figure 1):

- MD33 Processor Unit
- PC Interface Cable (USB)
- CANbus (N2K) 'Tee' connector
- 2 ea., AD50 Differential Amplifiers
- C-Port II Installation CD (for MS Windows®)
- Mounting hardware



**Figure 1 MD33 Components**

This dual engine and vessel monitor system is intended to operate with sensors currently onboard the vessel or any added aftermarket sensors. It also accepts NMEA 0183 Navigation data (GPS, depth, etc.) and N2K engine data (fuel flow, alarms, etc.) and combines these into a single PC data interface. When combined with the C-Port II PC software, a complete data acquisition, display, and logging system is provided. The MD33 can also be programmed to send N2K CANbus engine messages for display by compatible instruments on the bus..

**General Description.** The MD33 collects data from multiple sources and sends it as standard and/or proprietary NMEA 0183 sentences to the PC for display and logging. The “C-Port II” program included with this system employs a simulated “dash panel” where the various inputs are assigned to gauges and dials per the users preference. Navigation data, such as position, speed, etc., can also be displayed on the panel and logged along with all the vessel/engine data. To collect all this data the MD33 Processing Unit has 3 main interface points as follows:

- 1) Engine interface terminal strips (Port and Stbd). Provides a connection point for engine gauges /sensors.
- 2) NMEA 0183 Interfaces - Data In, Data Out, for sending/receiving data to/from instruments and PC's.
- 3) CANbus – Allows for connection to vessel NMEA 2000 bus for sending/receiving messages.

The engine inputs (Port & Stbd) are intended to connect directly to the existing gauges at the vessels' dashboard. The analog inputs (A1-A5) usually connect to a gauge or sensor, such as an engine sending unit or current shunt. In the case of battery volts, however, a direct connection is made; no sensor is required. The other inputs, RPM and alarms (M1-M5), can often be directly connected to existing sensors or switches. In most installations, the sensor connections will be made at the existing gauges on the vessel (see Section 4). Where resistive senders exist, without gauges, the MD33 can provide sender current.

The Dual-Engine Vessel Monitor can measure three different types of inputs as follows:

Analog. The 5 analog voltage inputs (A1-A5) will normally connect to existing sensors or gauges on the vessel. The voltages can be anywhere from 0-20V for A1-A4 or 0-40V for A5 and must be steady D.C. voltages. Pulsed or rapidly varying signals cannot be measured by these inputs.

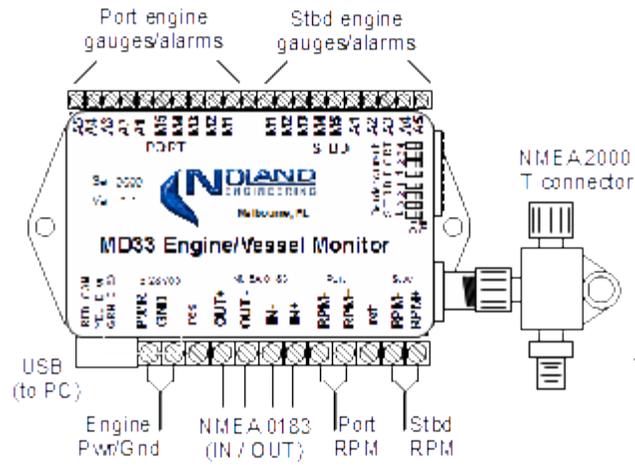
RPM This input is intended specifically to determine RPM by measuring the frequency (pulses/sec) from a tachometer signal or RPM sensor. The pulses need to switch from near 0V (ground) to at least 2V to be detected. To obtain RPM from frequency, we must know the pulses-per-revolution (ppr) of the engine.

Alarm. Alarm inputs, M1 – M5, are for “on/off” type of indicators, such as bilge pumps, hi-water alarms, hatch open indicators, etc. Any voltage near 0V (Ground) is detected as either an “on” or “off” state (user defined), while a voltage over 2V is detected as the opposite state. Voltages up to 30V will not damage the alarm inputs.

**Table 1. Engine Monitor Capabilities**

TYPE	QTY	RANGE	RESOLUTION	PRIMARY USAGE
Analog (Gauge)	10	0-20 v (A1-A4) 0-40 v (A5)	0.01v	volts, amps, temp, press., ...
RPM	2	0-7000 Hz		RPM
Alarm (On/Off)	10	on/off	n/a	Bilge, temp., press.alarms, hatch open, ...
NMEA 0183	1	n/a	n/a	Navigation data
NMEA 2000	1	n/a	n/a	Additional engine/vessel sensors

The MD33 measurement capability is summarized in Table 1. All engine inputs are connected to the front/rear terminal strips. The raw engine data is converted into digital messages for display and logging by a PC and other instruments. NMEA 0183 navigation data from instruments such as GPS, depthsounders, compasses, and others, is displayed in data panes of the “C-Port II” simulated dash panel and logged along with engine data. The NMEA 2000(N2K) interface allows C-Port to accept additional data from sensors such as flowmeters. A typical installation is shown in Figure 3(a).



**Figure 2 Typical Installation**

The PC connector (USB) provides a computer interface. The MD33 collects data from the inputs and sends it as standard and/or proprietary NMEA 0183 sentences to the PC for display and logging. The computer will receive all of the combined data from the instruments and can also send configuration/calibration data back to the MD33. All the data sent by USB is duplicated at the NMEA OUT+/- terminals for use by other PC's or NMEA devices.

**INSTALLATION.** A typical installation is shown in Figure 2. A computer is present to display/log all the data from engines and other instruments. 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+/-**” terminals. All connections to Engines and NMEA instruments are made via front/rear terminal strips. The PC connector (USB) provides 2-way data communication to/from the computer. Configuration options are user programmable (see Appendix A).

To assist in installation and troubleshooting, a multicolor LED is located on top of the MD33 USB Connector. The LED will flicker green when valid NMEA 0183 sentences are being received or red when valid NMEA 2000 messages are received. It will briefly flash yellow if an error is detected and simultaneously send an error identification sentence to the PC.

The MD33 is essentially a data collection, conversion, and combining unit. It collects engine data, converts it into digital (text) data for display by a PC running appropriate software. The MD33 also accepts NMEA 0183 and N2K data from vessel instruments and combines them into a common output for use by a PC or other Multifunction Displays (MFD's).

The MD33 must be connected to a Windows PC to run the C-Port II display software as well as to perform configuration and calibration. A USB cable is provided for this purpose. The data sent via USB conforms to the NMEA 0183 standard and can be viewed by any terminal program such as “HyperTerminal”. The C-Port II program can also display the incoming data sentences in its “Data Window.”

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 10-30 Vdc range. There is no ON/OFF switch on the MD33 due to its low power consumption. By connecting the MD33 to Engine Power, it will come on when the engines are on and turn off when the engines shut off.

NMEA 0183 Input and Output: The four MD33 NMEA 0183 connections are labeled **IN+/IN-** and **OUT+/OUT-**. When connecting NMEA instruments 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 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 their “Data out” to an **IN+** connection of the MD33. The **IN-** connection must be connected to ground or “common.” For single-ended listeners, however, connect the MD33 **OUT+** or **TLK+** terminal to the “Data in” of the listener. Leave the **OUT-** terminal open. Never connect **OUT-** to any Ground or Common terminal.

The input and output are configured to operate at 4800 baud. They can, however, be reconfigured for higher baud rates. (See Appendix A.) The In/Out baud rates are independently set.

CANbus connection: The NMEA 2000 connector is for optional N2K bus interfacing, where desired. It allows the MD33 to receive data from special N2K sensors and also send engine data to N2K displays

USB Connector: The USB connector on the MD33 provides a computer interface. The USB port creates a “Virtual COM Port” within the PC so that it mimics an RS232 port. It may be necessary to install drivers when first connecting the MD33 to your PC.

***The Virtual COM Port driver is installed as follows:***

- 1) Plug MD33 into USB port of computer
- 2) Insert NoLand Engineering **C-PortII** CD into disk drive of computer
- 3) When “New Hardware Wizard” appears, select “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” appears, select “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 #).

**Analog and Alarm Connection:** These connections accept the analog and alarm sensor data. Connections are designated for Port side and Starboard side engines. Analog gauge connections to the MD33 can be made at the "sense" or 'S' terminals of existing gauges. Alarm connections can generally be made directly at the switch (sensor) or indicator (lamp).

To measure very small voltages, such as a 50mV current shunt, the AD50 differential amplifier is provided which multiplies the shunt voltage by 50. Thus, a 50mV (0.050V) signal would be boosted to 2.5 volts full-scale by the AD50 amplifier.

The Dual-Engine Vessel Monitor has several setup (programming) options. These include defining the ON/OFF alarm characters, and setup of the RPM pulses-per-revolution (ppr). These options are described in detail in Appendix A.

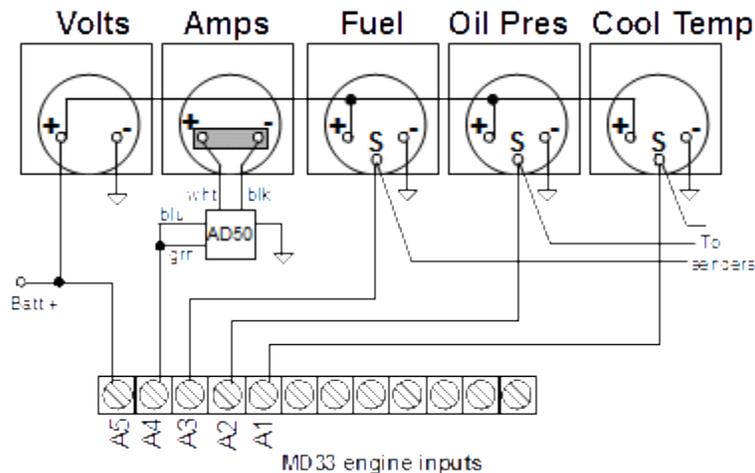


Figure 6. Example Installation with Vessel Gauges

#### Engine sensor connection examples:

**Battery volts:** Battery voltage can be sensed directly by the MD33. Analog input A5 should normally be used for this since it can handle inputs up to 40 volts.

**Battery amps :** Sensing of battery amps is usually done with a 'current shunt'. This is a very small resistor, which develops a small voltage in exact proportion to the current flowing through it. The shunt is usually a short bar of steel or copper attached directly to the rear panel of the Ammeter for lower current applications. For higher current applications, the shunts are too large to mount behind or inside the meter, so they are mounted elsewhere near the meter or battery. Since all the battery current must pass through the shunt for the measurement, the shunt is only allowed to develop a small voltage drop (typically 50mV or 100mV) at full rated current.

For increased resolution, the small voltage across the shunt must be amplified before measurement by the MD33. The model AD50 amplifier, with a gain of 50, is provided for this task. This amplifier is connected directly across the shunt terminals with the output going to one of the analog inputs of the Interface Adapter.

**Sending units (temperature, pressure, level, etc.)** There are a variety of sensors, called 'sending units', commonly used on boats and automobiles to sense pressure, temperature, level, etc. The majority of these sensors are resistive, which means their internal resistance changes with the property being sensed. The gauge to which each sending unit is attached provides a current that changes the voltage across the sending unit as its resistance changes. Thus, most

sending units need to be attached to an appropriate gauge to operate correctly.

In most cases, sending units can be directly connected to an analog input of the MD33. This is most conveniently done at the “S”(sense) terminal of the gauge itself rather than at the sending unit. Once connected, the appropriate scaling of each analog input must be set.

Incompatible analog sensors: There are some types of sensors or transducers used on vessels, which will not interface directly to the MD33. An example is rudder position sensors. Some smaller pleasure craft do use simple resistive rudder position sensors, which will connect directly to an analog input of the MD33. Larger vessels, however, use a more sophisticated “synchro” sensor, which requires a special display unit and will not connect directly to the MD33.

RPM measurement: Gasoline engines generally measure RPM by sensing ignition pulses either directly or via a “TACH” signal in electronic ignitions. Diesel engines, however, must use a special sensor, since they have no ignition system. Most diesels use a flywheel sensor, which sends a pulse for every tooth on the flywheel. Other diesels, and some gasoline engines, sense rpm from an alternator frequency output. Determining the RPM value is simply a matter of measuring the sensed frequency and knowing the number of pulses-per-revolution (ppr) the engine produces.

The RPM is calculated by:

$$\text{RPM} = 60 \times (\text{F} / \text{ppr}),$$

Where **F** = frequency (pulses/sec) and **ppr** = pulses/rev. For example, a gasoline engine with ppr =12 and measured F =500 pulses/sec would result in 2500 rpm.

As with the analog inputs, the frequency input, F, can usually be obtained directly from the “S” terminal on the ships’ tachometer. Some diesel engine tachometers do not have a sense terminal. Instead they have two wires coming from a flywheel sensor. To connect to these sensors, use the supplied AD50 Differential Amplifier unit directly across the sensor terminals. The AD50 amplifies the weak signal from the flywheel sensor so that it can be sensed by the MD33. Connecting the AD50 to your sensor will not affect the operation of your vessel tachometer.

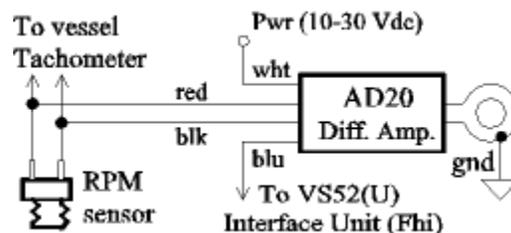


Figure 7. AD20 Differential Amplifier Hookup

Contact closure alarms: The most common type of alarm indicator is a passive contact closure (switch or relay). This type of alarm can either be NO (normally open) or NC (normally closed). These passive alarms usually have a one of their terminals connected either to “ground” or a supply voltage. In electronic terms, this is referred to either as “pulled up” or “pulled down” The MD33 alarm inputs are weakly pulled up so that they can readily detect a simple switch closure to Ground.

Bilge pump: An important use of an alarm input is to detect when a bilge pump is running. There are a variety of ways to do this depending upon the type of pump and switch involved. Where a float or trip switch is involved, it is usually desirable to connect the alarm input directly to the switch. Some examples of this are presented in Figure 8.

There are some bilge pumps with self-contained float switches. There is no easy way to connect these types to the Dual-Engine Vessel Monitor.

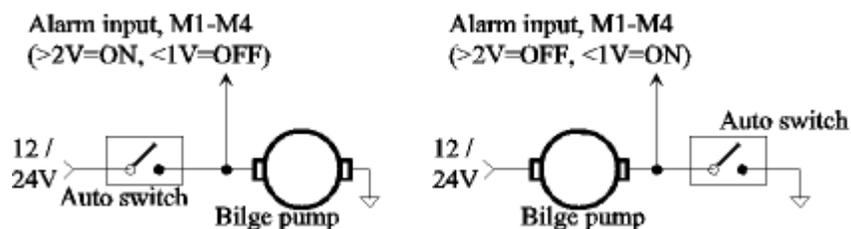


Figure 9. Example hookups of Alarms with Auto Bilge Pumps

**5. OPERATION:** Once the MD33 is installed and power is applied, the unit begins acquiring data automatically. No user intervention is needed unless default settings must be changed. (See Appendix A.) The MD33 will also operate without the PC or N2K connections.

**Status LED:** A multicolor LED is situated in a recess on top of the MD33. The colors and their meaning are summarized in Table 3. 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 when data from the PC is received. The green LED will only be lit if either of the other colors is not displayed and input or engine data is detected. The green and red LED colors flicker as data is being sent. The yellow color is for error notification and remains lit for approximately 1/2 sec. 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 (**OUT+/OUT-**) and the PC interface. Refer to “Troubleshooting” (Section 6) for more information about deciphering the error messages.

**Data Acquisition:** Acquiring data from marine navigational instruments is the primary function of the MD33. 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.

Table 3. Status LED Meanings

Color/State	Priority	Meaning
Yellow Steady ~ 1/2 sec	highest	An error has occurred, and an error id sentence is being sent.
Red Flickering	middle	A valid sentence from PC interface is being sent to the <b>TLK</b> output.
Green Flickering	lowest	A valid NMEA 0183 sentence is being sent to the output.

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.

**6. TROUBLESHOOTING:** A useful feature of the MD33 is the detection and reporting of errors. There are several types of errors which can be detected. An error message identifies both the channel and type of errors that have occurred. It is available at both the PC 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 shown in Table 4. 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 (~1/2 sec).

**Table 4. Single Error Codes**

CODE	ERROR CHANNEL	ERROR TYPE
1	internal	interrupt
2	NMEA IN	synchronization
4	CAN	protocol
8	---	overflow

The meaning of the error types is as follows:

- 1** This is an **internal (processor)** error caused by invalid operations or internal resets.
- 2** This is a **synchronization**, or framing error, caused by timing or data rate errors.
- 4** This is a **protocol** error caused by incorrect characters or other violations.
- 8** This is an **overflow** error generated by too much data.

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,2,6**

indicates that **IN** had **synchronization** and protocol errors. We know this because 6 is the sum of 2(synchronization) + 4(protocol). Each type of errors is assigned a binary power (1, 2, 4, 8). 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.

Testing with Status LED: The LED provides a convenient means to test the MD33 in place. This is because the MD33 will always produce an output whenever any data input (IN or CANbus) 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 5. Multiple Error Codes**

CODE	ERROR CHANNEL(S)	ERROR TYPE(S)
3		
5		
6		
7		

**Table 6. Multiple Error Codes including TLK & ovfl**

CODE	ERROR CHANNEL(S)	ERROR TYPE(S)

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 MD33, 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 MD33.

**7. MD33 TECHNICAL SPECIFICATIONS**

Supply Voltage/Current	10-30 VDC/50 mA. (typ)
NMEA Input Drive Voltage (IN+/IN-)	2-14 V (Active State)
NMEA Input Impedance (IN+/IN-)	2K Ohms (typ)
NMEA Out level (TLK, OUT)	4V Differential (RS-422)
NMEA Out current (OUT, TLK)	50 mA. (max)
Serial Output Baud Rate	4800-38,400 (programmable)
CANbus data rate	250 Kbps
Analog input range	0-20v(A1-A4), 0-40v(A5)
Analog resolution	0.01v
RPM pulse rate	0-25 kHz
Alarm input level, M1-M45	0-30 V or contact closure
Size	3.75x3.0x1.0” + 3.5x2.4x0.9 (x2)
Weight	14 oz.

**8. 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 10. Outline Drawing**

## APPENDIX A Programming Instructions

**Introduction** : The MD33 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 MD33, 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.

**TABLE A-1 MD33 Commands  
Factory presets are shown in bold.**

Command	Action	Options	Comments
<	Stop device	(n/a)	Stop data for programming
>	Reset (restart) device	(n/a)	Same as power disconnect-reconnect
?	Query configuration	(n/a)	Shows current device configuration
%	Show Help		Shows help (Commands list)
B	Set OUTput baud rate	<b>0</b> , 1 ,2, 3	<b>0=4800</b> , 1=9600, 2=19200, or 3=38,400 baud
I	Input baud rate select	<b>0</b> , 1 ,2, 3	<b>0=4800</b> , 1=9600, 2=19200, or 3=38,400 baud
E	Error report on/off	+/-	<b>+ =on</b> , - =off
P	Port RPM ppr	xxx, +/-	xxx=ppr (000-250), '+' = on, '-' = off
S	Stbd RPM ppr	xxx, +/-	xxx=ppr (000-250), '+' = on, '-' = off

**Programming Example** : An example will demonstrate how to program the MD33. With the device connected to a computer and a terminal window open your terminal settings should match those shown in Section 5. When 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. Assume we now want to reconfigure the output baud rate for 38400. By typing “@B3” the **OUT** 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, we can again type “@?” which will show the new 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 works identical to the “@B\_” command for changing **IN** baud rate

The “@E” command turns error reporting on or off . Turning error reporting off does not affect operation of the error (yellow) LED.

To enable and configure the RPM sentence, the user must know the pulses-per-revolution (ppr) value of the engine (see Section 4, "RPM Measurement). With a ppr value of 24, then the user would type

**@P024**

to set Port ppr value. The new ppr value will not be accepted until all 3 digits have been typed and the value is within the specified range. If rejected, the "**Invalid Command**" message will be displayed. To confirm the ppr value just entered, type the "@?" command and the current configuration settings will appear.

The user can enter separate ppr values for both Port RPM and Stbd RPM, and both will be kept in memory. For most vessels, however, the ppr will be the same for both engines.

Typing the command

**@P000**

w turn on (or off) the RPM sentence, but will not change the stored Port ppr value. The Starboard ppr commands are identical.

## **APPENDIX B Dual-Engine Vessel Monitor Sentence Definitions**

The MD33 Dual-Engine Vessel Monitor System is capable of supplying both standard and proprietary data sentences for use by application software. The proprietary sentences are necessary for two reasons. One, the raw data in the proprietary sentences is useful for setup, calibration and troubleshooting of both the hardware installation and the application software. Second, the NMEA 0183 standard has almost no "standard sentences" for the type of data supplied by this system; so proprietary sentences are the most efficient way to send it. The sentences sent by the MD33 are described next.

**Proprietary Sentence:** A separate proprietary is sentence is sent for each engine data input. 'PNOLS,...' is for starboard, and 'PNOLP, ...' is for port. The format of this sentence is shown below

**\$PNOLP(S) , c , c , c , c , c , xx.x, xx.x, xx.x, xx.x, xx.x <CR><LF>**  
(alarms 1-5, A1 , A2 , A3 , A4 , A5 )

As per the NMEA 0183 standard, the above sentence starts with a '\$', then the letter 'P', which indicates a proprietary sentence, and then the 3 letters 'N-O-L' indicating the sentence belongs to NoLand Engineering. The next character, 'S' (or 'P'), indicates the sentence is for 'Stbd' (or 'Port') data. The actual data is contained in the next several fields, separated by commas. The data is given as single characters for alarms ('A' or 'V' by default) and volts for analog inputs. The sentence is sent once per second.

### **RPM sentence**

An RPM sentence can also be sent, if configured by the user. This sentence conforms to that specified by the NMEA 0183 Standard as follows:

**\$ERRPM, c , , xxxx , , <CR><LF>**  
side, RPM

The character (c) will be either '1' for STBD RPM or '0' for PORT RPM. The RPM sentence is only sent when configured by the user, who must also enter the pulses-per-revolution (ppr) of the engine. The advantage of the RPM sentence is that it is direct reading and is sent twice per second. Configuring the RPM sentence is covered in Appendix A.

**Tel: (321) 951 –7329 Fax: (321) 951-8773**  
**<http://www.nolandengineering.com>**  
**email: *info@nolandengineering.com***