



NMEA Protocol Converter 2 Plus 3 Users Guide

Constellation Data Systems, Inc.
10296 Springfield Pike
Cincinnati, OH 45215
Phone: (513) 984-4491
Fax: (513) 984-4896
Web: www.ConstellationData.com

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Limitations

The information contained herein is not to be used in conjunction with a system or component, which can through action or inaction cause damage to life, limb, property or the environment.

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1.2 Feature Summary

The NPC 2+3 has the following high level features:

- **Intelligent** firmware control over 2 bi-directional serial ports
- **Flexible** COMM Port Configurations: RS-232 / RS-485 / RS-422 / TTL
- **Powerful** 3 port data splitter derived from COMM 1 TX
- **Convenient** power distribution bus with filtering and fusing
- **Solid** data signal optical isolation / floating grounds / transient suppression
- **Tough** industrial and maritime enclosure options
- **Easy** field configuration or custom programming
- **Efficient** on board switching power generation

1.3 Why Should You Select the NPC 2 + 3?

Selecting the NPC 2+3 as your data integration solution affords you with the piece of mind know that:

- present and future protocol integration issues can be easily resolved
- have reduced reliance on your GPS, and NAV equipment manufacturers to provide expensive custom solutions to simple problems
- greater protection against electrical transients damaging expensive equipment
- increased reliability and fewer data errors
- for fleet operators, the NPC 2+3 *Design Package* may be licensed, which contains the full hardware and firmware design reference reducing your risk, enabling you to build your own NPC 2+3 or design variants (Constellation Data Systems *Sales and Marketing* for more information)

Further, Constellation Data Systems has a staff of professional support engineers who can easily support off the shelf NPC solutions, or when needed provide custom and tailored **Rapid Response Engineering** solutions. Contact Constellation Data Systems *Sales and Marketing* for more information.

1.4 Standard Configuration Options

The NPC 2+3 may be ordered in any of the following standard configurations.

Product Name Part Number	COMM 0-1 Port Type (TX/ RX)	COMM 2-4 Port Type (TX only)	COMM's TVS + Optical Isolation	Power Source for Port Isolation
NPC 2+3 2893797-0	All RS: 232/485/TTL	All RS: 232/485/TTL	TVS + Optical Isolation	Independent Port to Port (GND Isolation)
NPC 2(232)+3(232) 2893797-1	RS-232	RS-232	TVS + Optical Isolation	Independent Port to Port (GND Isolation)
NPC 2(4XX)+3(4XX) 2893797-2	RS-422 RS-485 TTL	RS-422 RS-485 TTL	TVS + Optical Isolation	Independent Port to Port (GND Isolation)
NPC 2(232)+3(4XX) 2893797-3	RS-232	RS-422 RS-485 TTL	TVS + Optical Isolation	Independent Port to Port (GND Isolation)
NPC 2(4XX)+3(232) 2893797-4	RS-422 RS-485 TTL	RS-232	TVS + Optical Isolation	Independent Port to Port (GND Isolation)
NPC 2(232)+3(232)-Econ 2893797-5	RS-232	RS-232	TVS + Optical Isolation	Shared (Common GND)
NPC 2(4XX)+3(4XX)-Econ 2893797-6	RS-422 RS-485 TTL	RS-422 RS-485 TTL	TVS + Optical Isolation	Shared (Common GND)
NPC 2(232)+3(4XX)-Econ 2893797-7	RS-232	RS-422 RS-485 TTL	TVS + Optical Isolation	Shared (Common GND)
NPC 2(4XX)+3(232)-Econ 2893797-8	RS-422 RS-485 TTL	RS-232	TVS + Optical Isolation	Shared (Common GND)

Note:	The maximum flexibility in port options, and maximum electrical isolation is afforded in the base NPC 2+3 product, (part number 2873797-0).
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1.5 Custom Configuration Options

The NPC 2+3 may also be ordered with any variety of supported port configuration and isolation options. Please contact Constellation Data Sales for a custom quotation.

1.6 Enclosure Options

The NPC 2+3 is available in the following enclosure / mounting options:

- Weather tight NMEA 4X
- Transparent Lids
- Medium Duty ABS Case
- Nylon Standoffs
- Custom Configurations

Contact Constellation Data *Sales and Marketing* for information.

2.Operation

2.1 General

The NPC listens for NMEA-0183 sentence data on both of the bi-directional ports (COMM0 or COMM1). Once a valid NMEA-0183 sentence is received, it is parsed, manipulated, and filtered, if necessary, before it is transmitted out the opposite port it was received on.

2.2 Bi Directional Input Ports (COMM 0 / COMM1)

Ports COMM0 and COMM1 can transmit or receive NMEA-0183 sentence data. These ports can be connected to any type of marine instrument that can transmit NMEA-0183 signals.

2.3 Split Output Ports (COMM 2 – COMM4)

Ports Comm0, Comm1, Comm2, Comm3, and Comm4 transmit NMEA-0183 sentence data. Ports Comm2, Comm3, and Comm4 are all dedicated outputs, connected to the transmit data (O) side of Comm1. NMEA sentence data received on Comm0 will be transmitted out Comm1, Comm2, Comm3, and Comm4. Conversely, NMEA sentence data received on Comm1 will only be transmitted out Comm0.

COMM2 – COMM4 default to a baud rate of 4800bps (NMEA 0183 standard). However, each port is configurable through the diagnostic port. The NPC supports independent port operation at selectable baud rates of 4800bps, 9600bps, 19200bps, and 38400bps (NMEA 0183 HS).

2.4 Diagnostic Port

The diagnostic port is carried in RS-232 signal levels, and is set to a baud rate of 19200bps. This port can be connected to any PC, capable of running a terminal emulation program such as HyperTerminal, for debugging purposes. During normal operating mode, received NMEA-0183 sentence data is echoed on the diagnostic port.

Running a terminal emulator at 19200bps, 8 bit data, no parity, and 1 stop bit, type the following:

```
debug
```

This will cause the command prompt '>' to be displayed. The NPC is now operating in diagnostic mode, and will continue to do so in a 10 second window. If no command is received for the duration of that window, diagnostic mode is disabled, and the NPC resumes normal operating mode.

When the NPC operates in diagnostic mode, the following commands are acceptable:

2.4.1 Version

Syntax : "version"

Displays the version number of the loaded firmware.

2.4.2 Model

Syntax : "model"

Displays the model number of the NPC unit.

2.4.3 Test Uart

Syntax : "uart [id]"

[id] – Uart to send test data out ('0' / '1').

NMEA-0183 test packet is sent out the desired RS-422 port.

2.4.4 Set Baud Rate

Syntax : "baud [id] [rate]"

[id] – Uart to set baud rate for ('0' / '1').

[rate] – Baud rate to set port to ("4800" / "9600" / "19200" / "38400").

Sets the desired RS-422 port to the desired baud rate.

2.4.5 Debug

Syntax : "debug"

Commands the device to enter debug mode. Once enabled, the device has a ten second window before it resumes normal operating mode. Received NMEA-0183 sentence data is not echoed on the diagnostic port when debug mode is enabled.

2.4.6 Led Test

Syntax : "led [id] [state]"

[id] – Status LED to set state of ('0' / '1').

[state] – State to set status LED to ('0' – OFF / '1' – ON)

Sets the desired status LED port to the desired state.

2.4.7 Port Status

Syntax : "status"

Displays current baud rate, receive frequency, total packets received, and total packets transmitted.

2.4.8 Default Output Speed

Syntax : "low"

Sets all ports to the default baud rate of 4800bps. NMEA sentences are only transmitted as they are received.

2.4.9 High Speed Output

Syntax : "high [id]"

[id] – Uart to put into high speed operating mode ('0', '1').

Modulates the output of the desired port by five (5). Basically, for every NMEA sentence received, five of the same NMEA sentences will be transmitted on the desired port.

Example:

The command 'high 1' is entered into the device during a debug session.

A device that transmits at a baud rate of 4800bps, and a frequency of 10Hz is connected to COMM0.

COMM1, COMM2, COMM3, and COMM4 will output the received NMEA sentence at a baud rate of 38400bps, and a frequency of 50Hz.

2.4.10 Reset Device

Syntax : "reset"

Resets the device.

2.5 Power Supply

The NPC operates from a DC voltage supply from 10 to 24VDC nominal input voltage (Max 28VDC). It features reverse polarity protection on power input, over-current protection via self-resetting fuses, and transient voltage protection on power and data inputs.

2.6 Auxiliary Power Interface

The NPC features a set of 4 auxiliary power interface outputs. These incorporates four 24V output channels, which are each hard fused at 3.5A. An LED under each fuse indicates that the fuse is not blown.

Fuse Name	Description
F2	Auxiliary Power Out 1 (see LED D50)
F3	Auxiliary Power Out 2 (see LED D49)
F4	Auxiliary Power Out 3 (see LED D48)
F5	Auxiliary Power Out 4 (see LED D47)

2.7 Status LEDs

There are many status LEDs on the NPC, which can be used to determine it's current state.

Name	Description
+24VDC	Indicates that the 24V power source is active.
+5VDC	Indicates that the 5V power source is active.
+3.3VDC	Indicates that the 3.3V power source is active.
DIAG0	Indicates that the processor has detected an error.
DIAG1	Indicates that the processor is busy.

There are various other LEDs located around each of the COMM channels. These LEDs are used to indicate whether or not a COMM channel is enabled or disabled, and if data is being transmitted or received on that channel.

Name	Description
D22	Indicates that COMM1 is enabled.
D23	Indicates that COMM2 is enabled.
D24	Indicates that COMM3 is enabled.
D25	Indicates that COMM4 is enabled.
D26	Indicates that COMM0 is enabled.
D27	Indicates COMM0 transmit - differential signal is active.
D28	Indicates COMM0 transmit + differential signal is active.
D29	Indicates COMM1 transmit - differential signal is active.
D30	Indicates COMM1 transmit + differential signal is active.
D31	Indicates COMM4 transmit - differential signal is active.
D32	Indicates COMM4 transmit + differential signal is active.
D33	Indicates COMM3 transmit - differential signal is active.
D34	Indicates COMM3 transmit + differential signal is active.
D35	Indicates COMM2 transmit - differential signal is active.
D36	Indicates COMM2 transmit + differential signal is active.
D41	Indicates COMM1 receive - differential signal is active.
D42	Indicates COMM1 receive + differential signal is active.
D45	Indicates COMM0 receive - differential signal is active.
D46	Indicates COMM0 receive + differential signal is active.

There is also one LED located under each fuse. Each LED indicates the status of its respective fuse. If the fuse is in normal working condition, the LED will be on. If the fuse has been blown, the LED will be off.

Name	Description
D50	Indicates that fuse 2 is not blown.
D49	Indicates that fuse 3 is not blown.
D48	Indicates that fuse 4 is not blown.
D47	Indicates that fuse 5 is not blown.

3. TTL Serial Port Connections

3.1 General

Single ended TTL style serial port connections may be implemented from RS-422 / RS-485 connections of the NPC 2+3. On the desired port, simply connected the negative (-) signal to the corresponding port's signal ground, and connect the positive (+) to the connected port's TTL.

Inverted TTL data (zeros when one's are expected and visa/versa) may be corrected by connecting the TTL's data signal to the negative (-) signal on the NPC, and connecting the positive (+) signal on the NPC to ground.

Important :	TTL serial port implementations cannot use an NPC RS-232 port.
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3.2 Wiring Connections

The following will describe how to connect one or more serial level converters to a Nmea Protocol Converter.

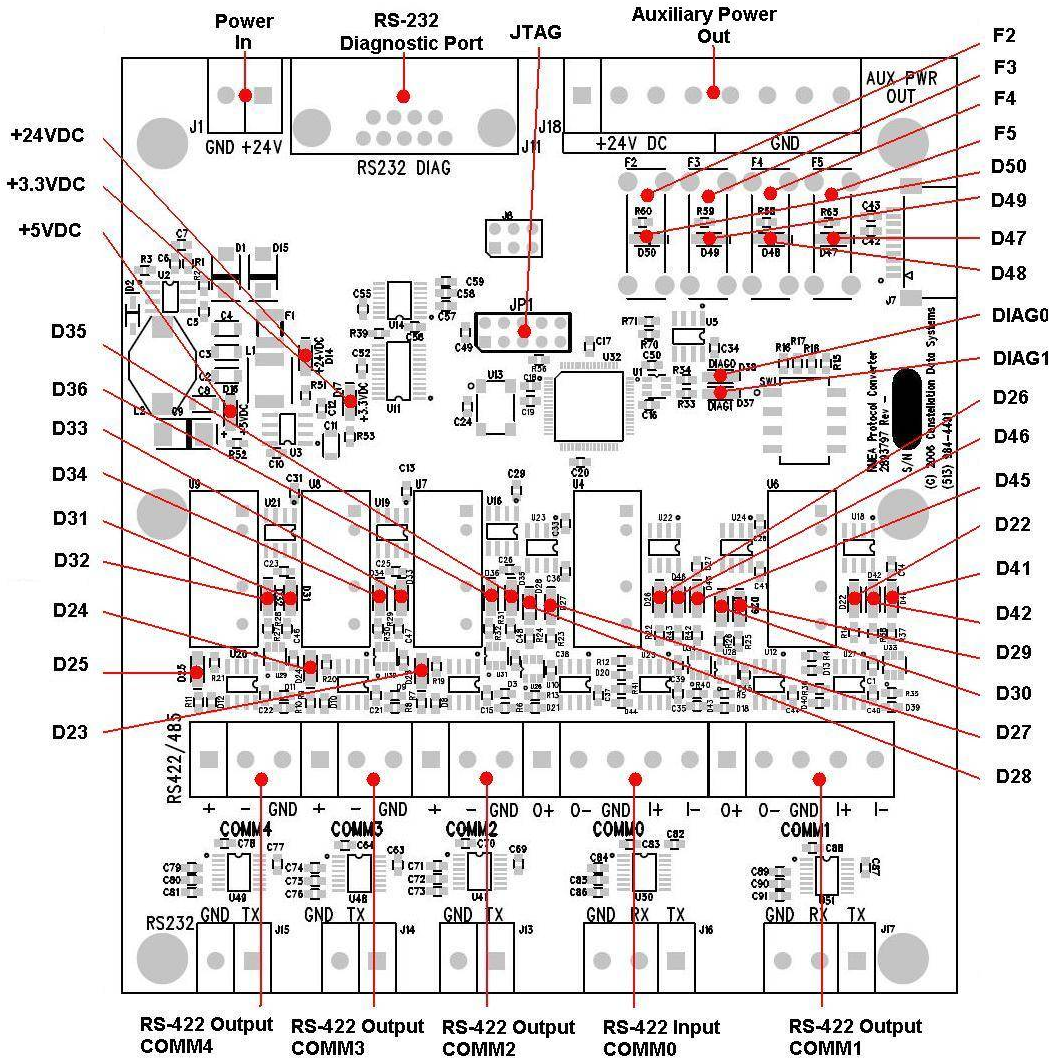
The most common configuration of the Nmea Protocol Converter is RS-422 input/output. In this configuration, the data is carried on a pair of differential lines, +/- . The NPC is labeled accordingly; 'I' stands for input and 'O' stands for output. Each input and output consists of a pair of differential connection points.

If connecting the NPC to a PC, for instance, to debug, a RS-422 to RS-232 serial level converter will be needed for each channel being used. A typical serial level converter is labeled: Power, Ground, Shield, Tx+, Tx-, Rx+, Rx-. Power and Ground may vary by manufacturer, and cannot always be connected to the NPC's power points. Receive and transmit (Rx/Tx) are labeled with regards to the remote device, in this case, the PC. Tx is transit data from the PC and Rx is receive data to the PC.

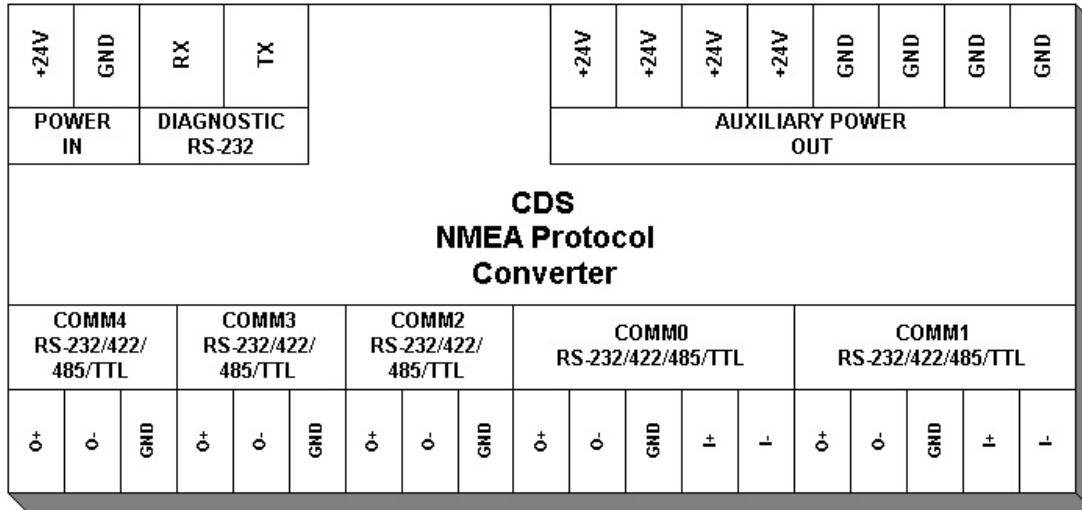
Therefore, when connecting a serial level converter to the NPC, the connect points should be as follows:

Serial Level Converter		Nmea Protocol Converter
Tx+	to	I+
Tx-	to	I-
Rx+	to	O+
Rx-	to	O-

4.PCB Layout



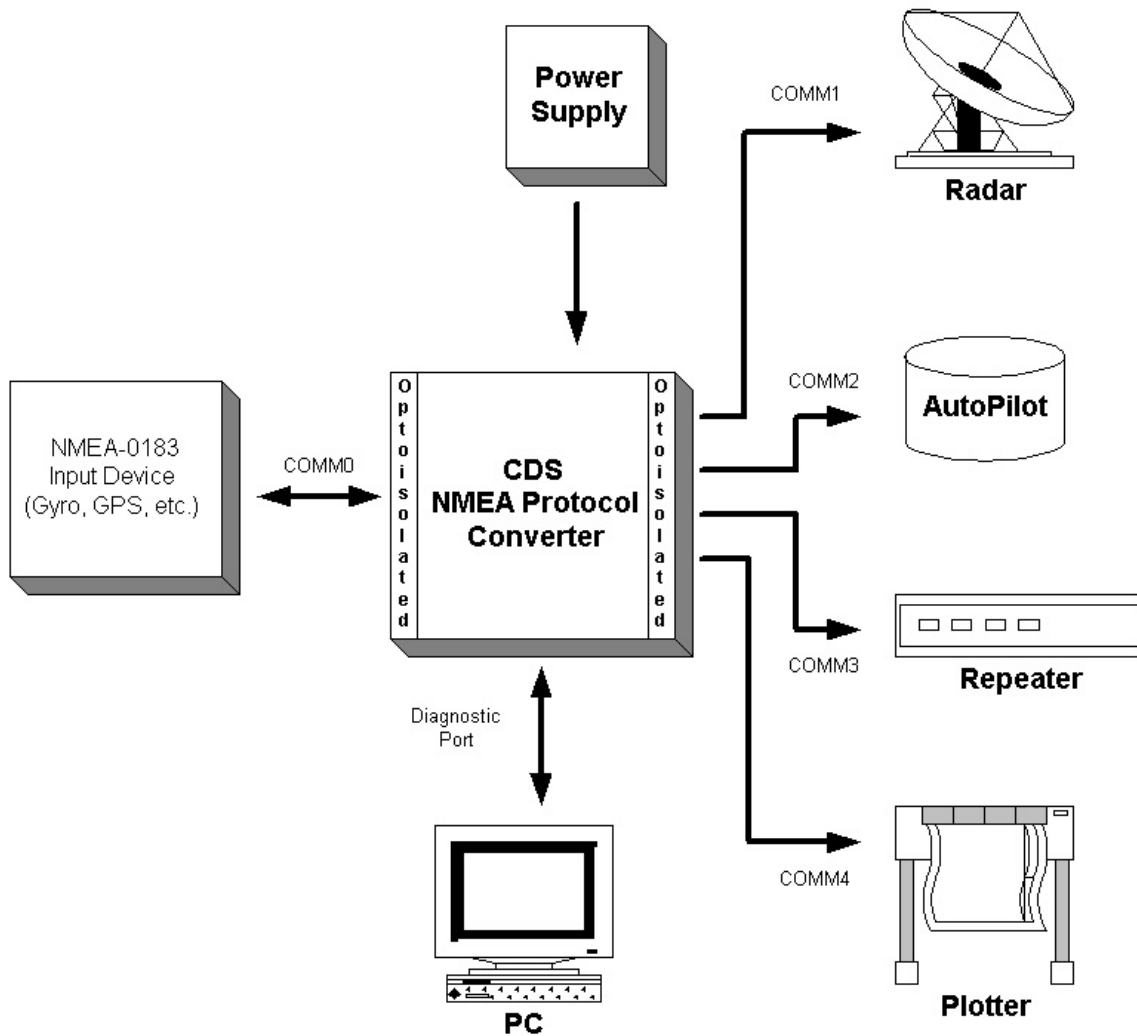
5. Block Diagram



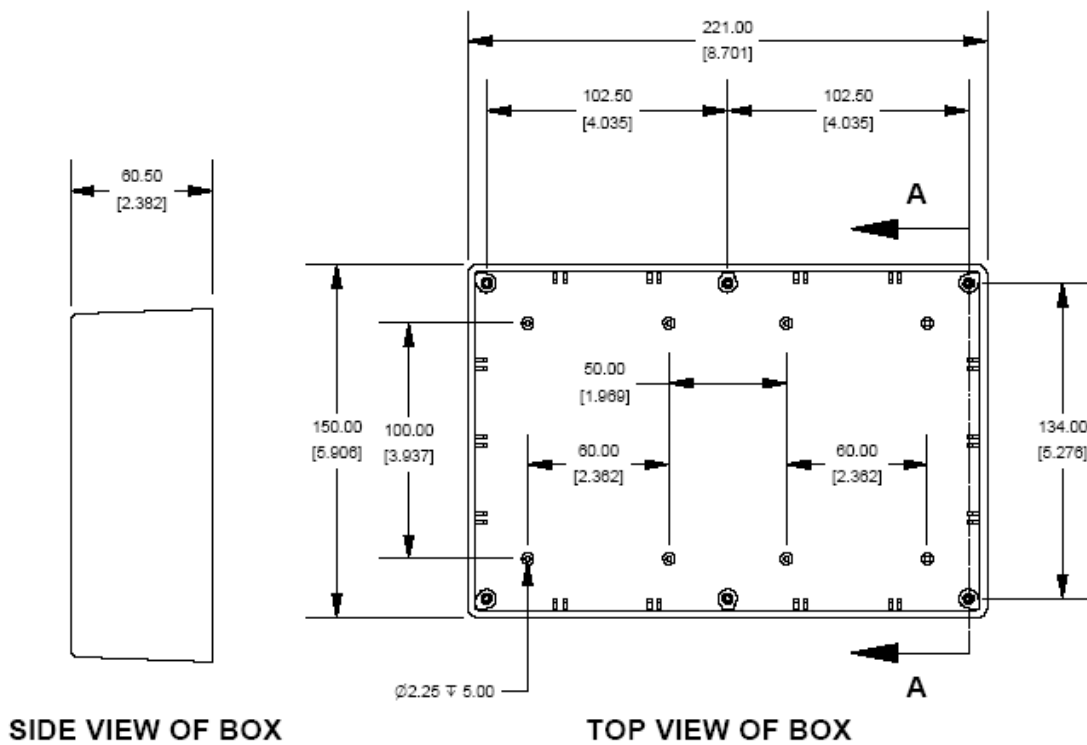
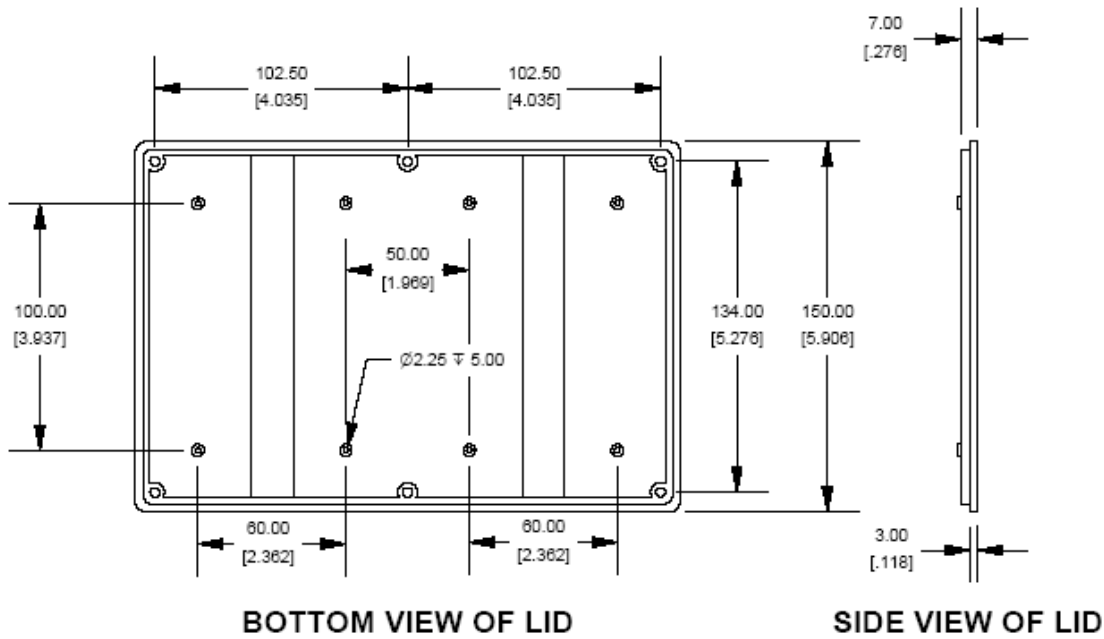
Power	
+24V	24 Volt Power Supply
GND	Ground Connection
Aux. Power Out	
+24V	24 Volt Power Out
GND	Ground Connection
Diagnostic Port	
Pin 2 (TX)	RS-232 Transmit Data
Pin 3 (RX)	RS-232 Receive Data
Pin 5 (GND)	RS-232 Ground
COMM0	
O+	Transmit Differential Output + Signal (connects to RX+ if applicable)
O-	Transmit Differential Output – Signal (connects to RX- if applicable)
GND	Instrument Ground
I+	Receive Differential Input + Signal (connects to TX+ if applicable)
I-	Receive Differential Input – Signal (connects to TX- if applicable)
COMM1	
O+	Transmit Differential Output + Signal (connects to RX+ if applicable)
O-	Transmit Differential Output – Signal (connects to RX- if applicable)
GND	Instrument Ground
I+	Receive Differential Input + Signal (connects to TX+ if applicable)
I-	Receive Differential Input – Signal (connects to TX- if applicable)
COMM2	
+	Transmit Differential Output + Signal
-	Transmit Differential Output – Signal
GND	Instrument Ground
COMM3	
+	Transmit Differential Output + Signal
-	Transmit Differential Output – Signal
GND	Instrument Ground
COMM4	
+	Transmit Differential Output + Signal
-	Transmit Differential Output – Signal
GND	Instrument Ground

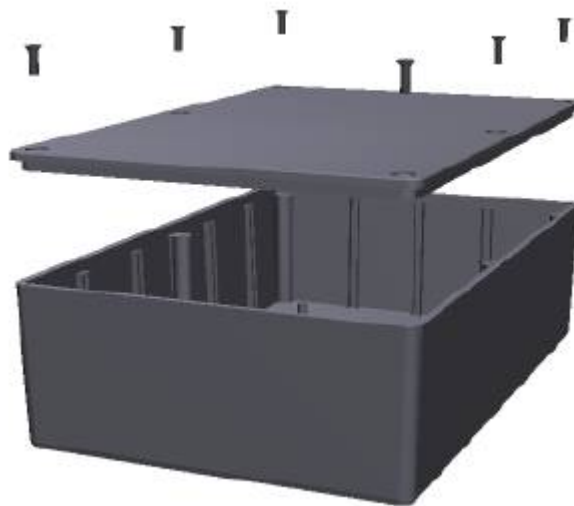
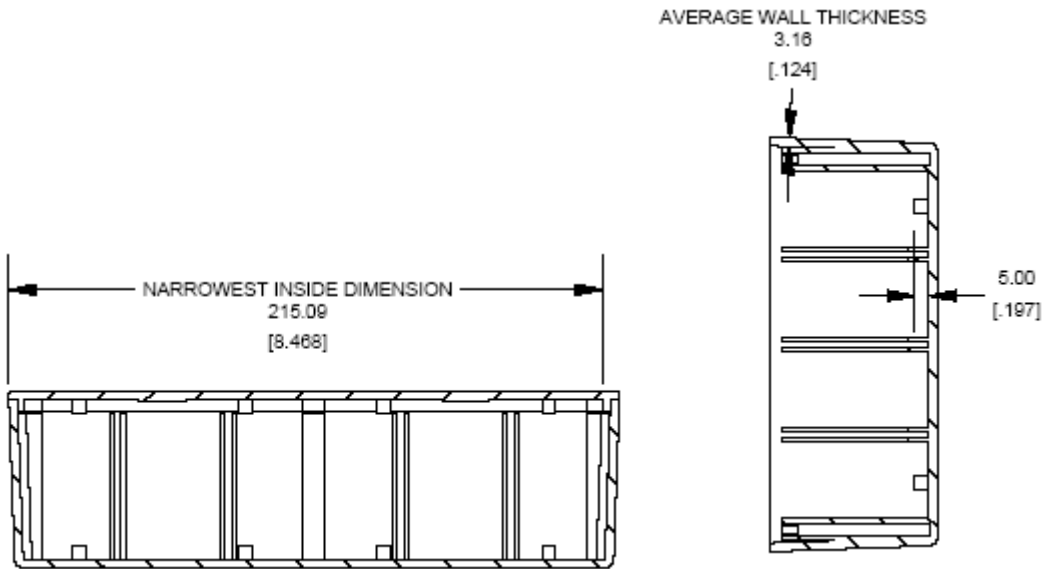
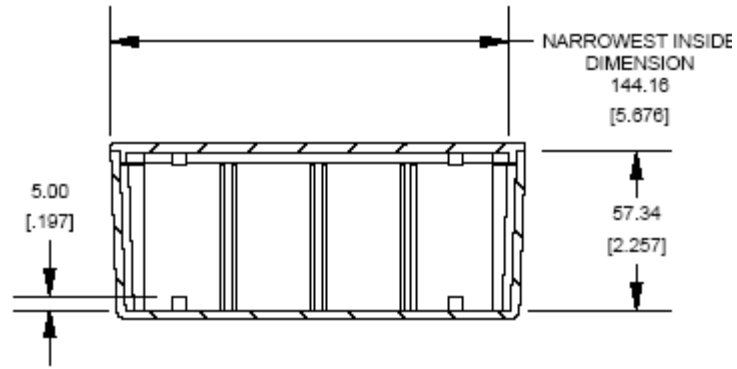
6. Hypothetical System Diagram

The following data flow diagram illustrates a hypothetical implementation using the NPC 2+3 to convert NMEA-0183 with datastream issue, from an input device (such as a Gyro or GPS), to an output corrected stream acceptable to a variety of devices (Radar / Autopilot / Repeater hypothetically shown).



7. Physical Dimensions of Medium Duty ABS Case





8. Technical Specifications

TBD: Power Protection (Fuses / TVS, etc).

Electrical

Parameter	Value	Comment
Operating Voltage	10 - 28 VDC	DC Voltage
Power Consumption	< 200 mW	
Reverse Polarity Protection	YES	
Over-current Protection	YES	
Transient Voltage Protection	YES	

Mechanical

Parameter	Value	Comment
Size	8.7" x 5.9" x 2.4"	Mounting holes in back of case
Weight	6	Ounces

Environmental

Parameter	Value	Comment
Operating Temperature	-40 to +85	Degrees Celsius
Relative Humidity	0% – 99%	Non-condensing Note: Conformal Coating on board.

9.Support

If you require support for a CDS device, we can be reached in one of the following ways:

Web : www.ConstellationData.com
Telephone: 513-984-4491
Fax : 513-984-4697
Mail : Constellation Data Systems, Inc.
10296 Springfield Pike, Suite 200
Cincinnati, OH 45215 USA

10. Index of Acronyms and Abbreviations

CDS	Constellation Data Systems (TLA)
COMM	Communications Port (FLAA)
DCE	Data Circuit-terminating Equipment (or Data Communications Equipment), example: a serial port modem.
DTE	Data Terminal Equipment (or Data Terminating Equipment), example: a serial video display terminal.
FLAA	Four Letter Alphanumeric Acronym
ISO	Isolate / Isolation
LCD	Liquid Crystal Display
LED	Light Emitting Diode
NMEA	National Maritime Electronics Association
NPC	NMEA Protocol Converter
RS-232	Standard for serial binary data interconnection between DTE and DCE, implemented using negative and positive voltages such that zero bits commonly correspond to voltage levels: -12 to -3 VDC, and one bits commonly correspond to voltage levels $+3$ to $+12$ VDC.
RS-422	Also known as EIA-422 or TIA-422, is a recommended standard for physical layer data communications implemented using two balanced differential signal pairs. RS-422 allows a single dedicated TX device, but multiple RX devices on the same channel.
RS-485	Also known as EIA-485 is a recommended standard for physical layer data communications implemented using a single balanced differential signal pair. Devices on an RS-485 network can generally be switched in a rapid fashion between TX and RX, thus allowing multiple transmitters and receivers on the same channel.
TLA	Three Letter Acronym
TTL	Transistor to Transistor Logic
TVS	Transient Voltage Suppression