

NBE100 Network Bus Extender



User's Manual

Revision 1.2

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<http://www.maretron.com>

Revision History

Revision	Description
1.0	Original Document
1.1	Changed Company Information to Carling
1.2	Added PGN Filtering Notes

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1 Introduction

Congratulations on your purchase of the Maretron Network Bus Extender. Maretron has designed and built your NBE100 to the highest standards for years of dependable and accurate service.

Maretron's NBE100 (Network Bus Extender) allows you to extend the maximum node count, network trunk length and cumulative drop length of any NMEA 2000® network. The NBE100 solves bus errors and other electrical issues caused by exceeding any of these limitations and makes design of large networks easier. NMEA 2000® networks have a maximum of 50 nodes allowed on a single network, a maximum network trunk length of 200m and a maximum cumulative drop length of 78m. If you have a network that exceeds any of these specifications, you can simply disconnect the network trunk in the middle and connect the ends to the NBE100, along with additional termination resistors. This will split the network into two electrical segments, each of which can have up to 50 nodes, for a total of 100 nodes on the logical network. The NBE100 will transparently route NMEA 2000® messages between the two network segments, making them work as a single logical NMEA 2000® network. Advanced priority-based message routing ensures that higher-priority messages are always prioritized over lower-priority messages, enabling predictable and reliable network operation. For exceptionally large networks, multiple NBE100's may be used. Enable NBE100's PGN Filtering Mode to pass only the PGNs you desire.

1.1 Firmware Revision

This manual corresponds to NBE100 firmware revision 2.3.1.2

1.2 NBE100 Features

The Maretron NBE100 has the following features.

- Segments a single large NMEA 2000® network into two smaller electrical segments.
- Allows you to exceed the 50 node limitation on a NMEA 2000® network.
- Allows you to exceed the 200m trunk length limitation on a NMEA 2000® network.
- Allows you to exceed the 78m cumulative drop length limitation on a NMEA 2000® networks.
- Allows all NMEA 2000® devices to operate as if they were still on a single NMEA 2000® network.
- Priority-based message routing ensures higher-priority messages get through the bus extender first.
- Optically isolates network segments, increasing signal integrity and network reliability.
- Features one user configurable PGN (Parameter Group Number) "Pass filter" per NMEA200® Interface where 32 PGNs per interface can be forwarded from one NMEA2000® Interface to the other.

1.3 NBE100 Application

The NBE100 can be applied, not only anytime a NMEA 2000® bus needs extending, but also can be used to make only specific communication messaging to be passed between NMEA2000® busses possible. Apply the PGN (Parameter Group Number) Pass Filter and the NBE100 will allow only the desired PGN messages to be passed between the connected NMEA2000® buses. Because NBE100 features a pass filter for each of the two NMEA2000® Interfaces it has, Pass Filters will obtain and forward the specific information messages you desire from one bus onto the other or vice versa. This feature is great for reducing unnecessary traffic but still share data without physically combining busses. The NBE100 allows up to 32 “Pass” PGNs per filter.

For an example of when NBE100 pass filtering is necessary, suppose there is a vessel with two separate NMEA2000® buses. One Bus is for used for “Navigation Devices” and the other bus is used for the vessel’s Distributed Power System. The Distributed Power System has a Time display feature, the Time feature is set manually however, has the ability to update it’s Time via NMEA2000® message. Because the Distributed Power System’s NMEA2000® network does not have any devices with updated Time messaging the Time display does not update automatically when the vessel crosses time zones. Separately, the Distributed Power System only sends alerts within its own NMEA2000® network and would be beneficial if these messages could be shared to the “Navigation Devices” NMEA2000® network giving the ability to acknowledge Distributed Power System alerts using the vessel’s navigation display that is attached to the “Navigation Devices” NMEA2000® network. An NBE100 is applied to this vessel to connect the Distributed Power System’s NMEA2000® network and the “Navigation Devices” NMEA2000® network. Using the NBE100 Pass Filter, the Distributed Power System can get updated Time information from the “Navigation Devices” NMEA2000® network and the “Navigation Devices” NMEA2000® network can receive Distributed Power System alerts. The vessel’s captain can now acknowledge the Distributed Power Systems alerts while underway using the vessel’s navigation display. The NBE100 provides such a solution with only necessary bus traffic messaging being passed.

Please note that the NBE100 will not filter and always pass ISO Address Claim, Request, and Acknowledgement messages, as well as Product Information allowing for “visibility” of all devices connected to the two NMEA2000® networks as if they were one.

2 Installation

2.1 Unpacking the Box

When unpacking the box containing the Maretron NBE100, you should find the following items:

- 1 – NBE100 – Network Bus Extender
- 1 – Parts Bag containing 4 Stainless Steel Mounting Screws
- 1 – NBE100 User’s Manual
- 1 – Warranty Registration Card

If any of these items are missing or damaged, please contact Maretron.

2.2 Choosing a Mounting Location

Please consider the following when choosing a mounting location.

1. The NBE100 is waterproof, so it can be mounted in a damp or dry location.
2. The orientation is not important, so the NBE100 can be mounted on a horizontal deck, vertical bulkhead, or upside down if desired.
3. The NBE100 is temperature-rated to 55°C (130°F), so it should be mounted away from engines or engine rooms where the operating temperature exceeds the specified limit.

2.3 Mounting the NBE100

Attach the NBE100 securely to the vessel using the included stainless steel mounting screws or other fasteners as shown in Figure 1 below. Do not use thread locking compounds containing methacrylate ester, such as Loctite Red (271), as they will cause stress cracking of the plastic enclosure.

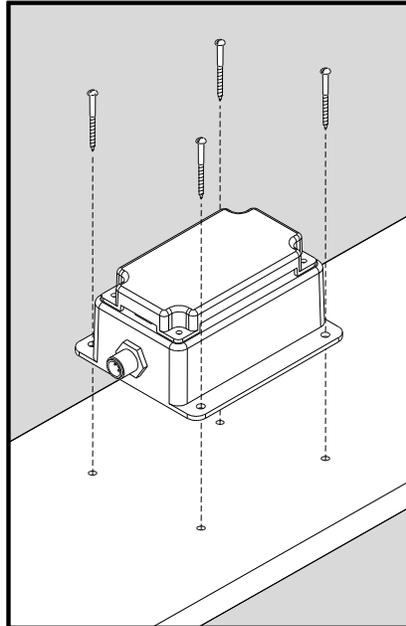


Figure 1 – Mounting the NBE100

2.4 Connecting the NBE100

The NBE100 requires one type of electrical connection: the NMEA 2000® connections (refer to Section 2.4.1).

2.4.1 NMEA 2000® Connection

The NBE100 has two NMEA 2000® connectors. The NMEA 2000® connectors can be found on either end of the enclosure.

The NMEA 2000® connectors are round five pin male connector (see Figure 2). You connect the NBE100 to an NMEA 2000® network using a Maretron NMEA 2000® cable (or compatible cable) by connecting the female end of the cable to the NBE100 (note the key on the male connector

and keyway on the female connector). Be sure the cable is connected securely and that the collar on the cable connector is tightened firmly. Connect the other end of the cable (male) to the NMEA 2000® network in the same manner. The NBE100 is designed such that you can plug or unplug it from an NMEA 2000® network while the power to the network is connected or disconnected. Please follow recommended practices for installing NMEA 2000® network products.

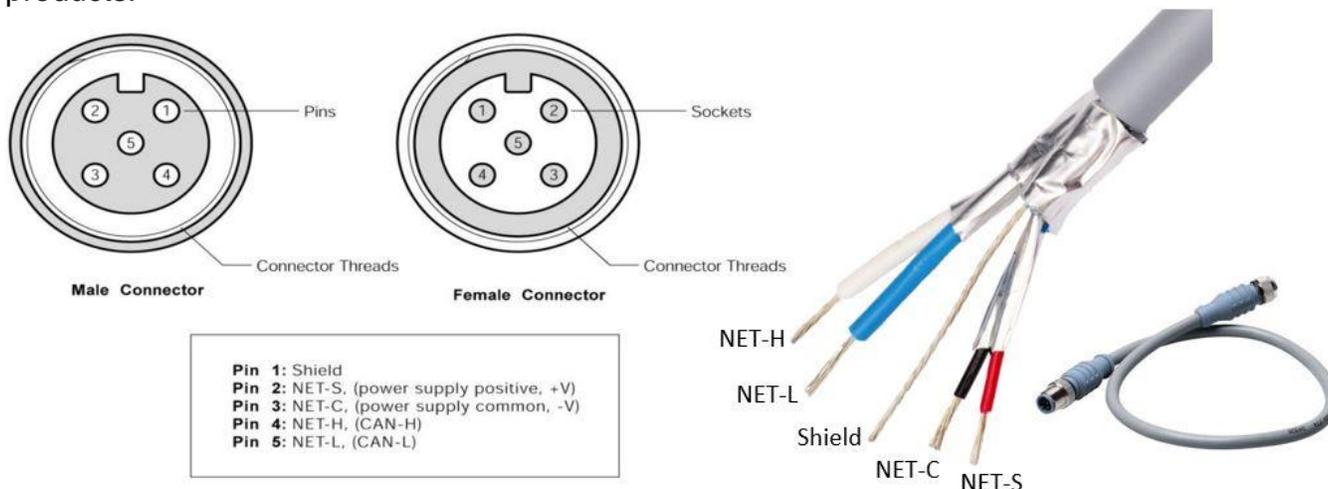


Figure 2 – NMEA 2000® Connector Face Views

The NBE100 is installed on an NMEA 2000® network between the two sections that you wish to physically isolate. Because the port on the NBE100 are optically isolated, there is no electrical connection through the NBE100, so you must ensure that each of the two NMEA 2000® networks connected to the NBE100 have separate power sources and two termination resistors. This means that if you use an NBE100 to split an existing network into two separate networks, you must provide one additional power connection and two additional termination resistors (one for each side of the NBE100).

The two NMEA 2000® connectors are labeled “N2K PORT A(PWR)” and “N2K PORT B”. Logically, these connectors are identical; that is, you can connect the NBE100 between two networks in either way and it will function identically. However, the NBE100 sources power only from the connector marked “N2K PORT A(PWR)”. It uses no power from the connector labeled “N2K PORT B”.

Figure 3 below shows the installation of an NBE100 into a simple NMEA 2000® network.

For exceptionally large networks, multiple NBE100’s may be used to segment the network into more than two segments. Each segment must have its power connection and two termination resistors.

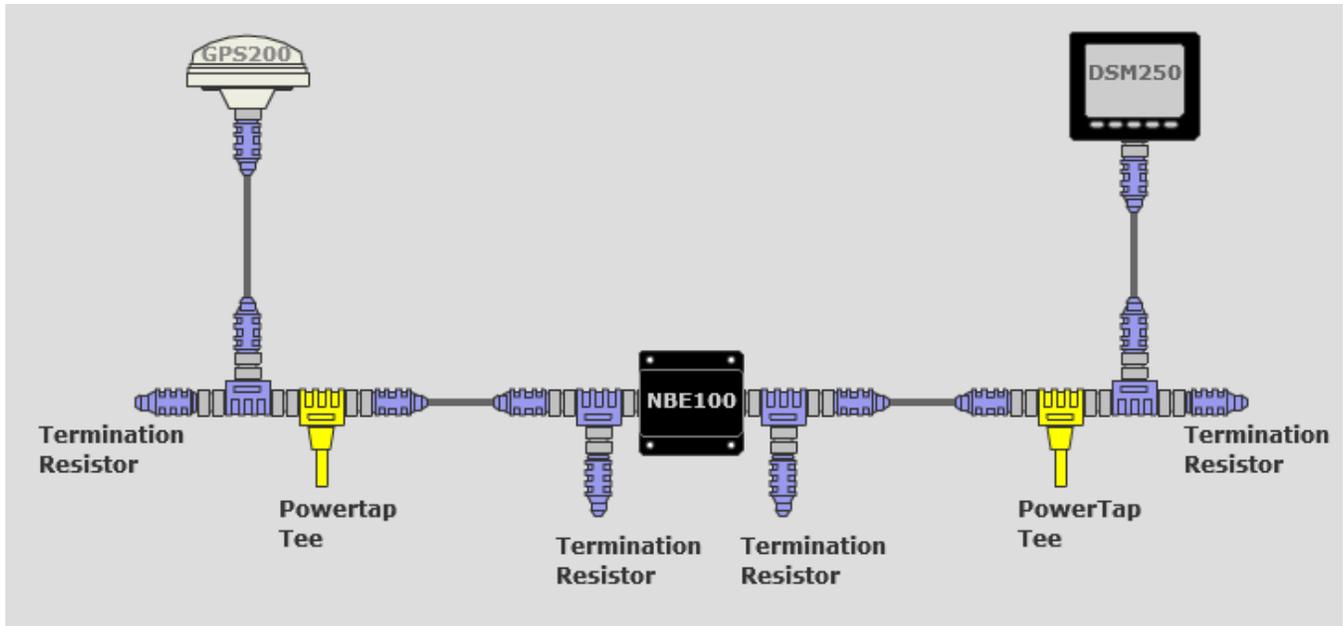


Figure 3 – NBE100 Connection Diagram

2.4.2 Checking Connections

Once the NMEA 2000® connections to the NBE100 have been completed, check to see that information is being properly transmitted by using an appropriate NMEA 2000® display to observe a sensor on the opposite side of the NBE100. If you don't see data from that sensor, refer to Section 4, "Troubleshooting".

2.5 Configuring the NBE100

The NBE100 will function on the NMEA 2000 network as it is shipped from the factory; no user configuration is required. The NBE100 features PGN filtering if enabled. Configure the NBE100 using Maretron's N2KAnalyzer®. See details below for information on how to configure your NBE100.

2.5.1 General Tab

The "General Tab" for the NBE100 features a blank field for entering a Label. Enter any Label desired in the field such as the NBE100's location on the vessel or an NBE100 reference number such as "Box 2". See example below of the "General Tab".

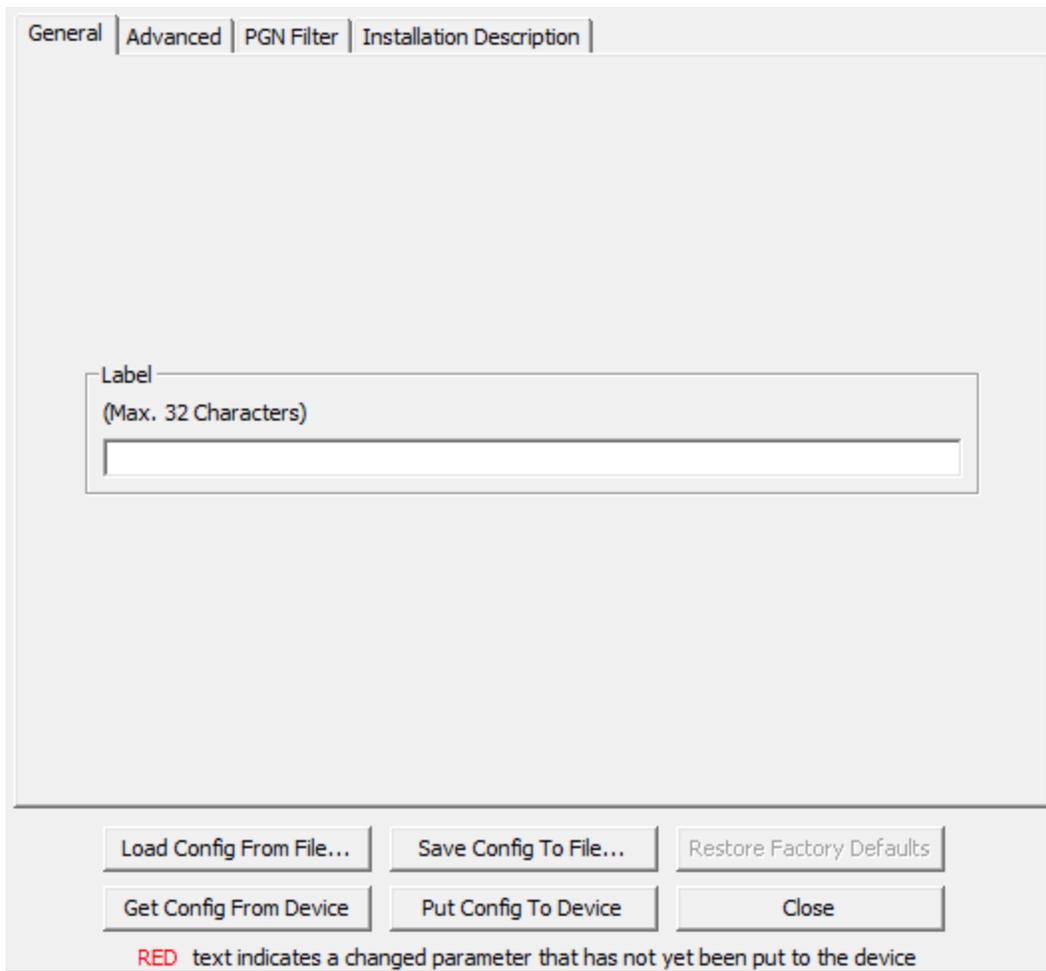


Figure 4 - NBE100 General Tab

2.5.2 Advanced Tab

In the “Advanced Tab” there is a field for Device Instance. NMEA 2000® provides a unique device instance for each device on a vessel. This value should be programmed in each NBE100 so that each NBE100 is associated with a unique device instance number. The default instance number is 0, which is used to indicate the first NBE100 that is hooked to the network. Subsequent NBE100’s connected to the network would be numbered 1, 2, and so on. See preceding figure of the NBE100 Advanced Tab containing this field.

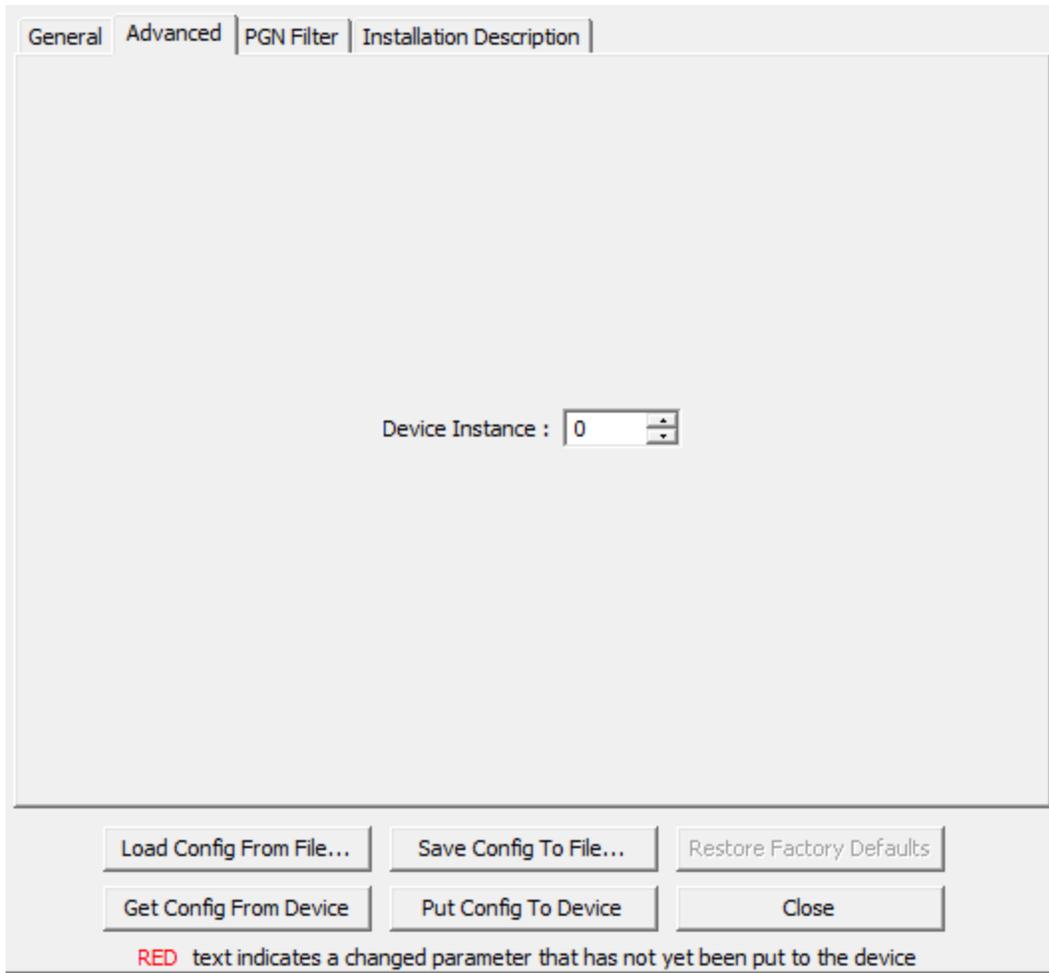


Figure 5 - NBE100 Advanced Tab

2.5.3 PGN Filter Tab

The NBE100 has a feature with which only certain messages will be passed from one port to the other, as opposed to the default state, in which all messages are passed between both ports. Messages to be passed are selected on the basis of the Parameter Group Numbers (PGN's) of the messages. This is useful for passing only certain information from the NMEA 2000 network on one port of the NBE100 to the NMEA 2000 network on the other port.

If the PGN Filter is enabled the NBE100 will filter all PGNs except for the PGNs entered into the "Exception Field". Where "CAN1" refers to the NBE100's "N2K Port A" and "CAN2" refers to the NBE100's "N2K Port B", the PGN Filter can filter PGNs traveling from CAN1 to CAN2, CAN2 to CAN1 or PGNs traveling both directions. To enable PGN Filtering, select "Enable" in the drop-down box located under the desired PGN traveling direction to be filtered. To enable PGN filtering exceptions, enter the PGN number into the "PGN" field located under the "Filter Enabled" dialog. See example of the NBE100 PGN Filter Tab in the preceding figure for example of this feature.

The screenshot shows a software window with four tabs: 'General', 'Advanced', 'PGN Filter', and 'Installation Description'. The 'Installation Description' tab is active. It contains three main sections:

- Installation Description #1:** A section with two radio buttons. The first is selected and labeled 'ASCII (English language only, Max. 70 characters)'. The second is labeled 'Unicode (Max. 35 characters)'. Below the radio buttons is a large empty text input field.
- Installation Description #2:** A section with two radio buttons. The first is selected and labeled 'ASCII (English language only, Max. 70 characters)'. The second is labeled 'Unicode (Max. 35 characters)'. Below the radio buttons is a large empty text input field.
- Manufacturer Information:** A section with a text input field containing the text 'Maretron 1-866-550-9100 www.maretron.com'.

At the bottom of the window, there are six buttons arranged in two rows:

- Row 1: 'Load Config From File...', 'Save Config To File...', 'Restore Factory Defaults'
- Row 2: 'Get Config From Device', 'Put Config To Device', 'Close'

Below the buttons, there is a red text label: 'RED text indicates a changed parameter that has not yet been put to the device'.

Figure 7 - NBE100 Installation Description Tab

3 Maintenance

Regular maintenance is important to ensure continued proper operation of the Maretron NBE100. Perform the following tasks periodically:

- Clean the unit with a soft cloth. Do not use chemical cleaners as they may remove paint or markings or may corrode the NBE100 enclosure or seals. Do not use any cleaners containing acetone, as they will deteriorate the plastic enclosure.
- Ensure that the unit is mounted securely and cannot be moved relative to the mounting surface. If the unit is loose, tighten the mounting screws.
- Check the security of the cables connected to the NMEA 2000® connector and tighten if necessary.

4 Troubleshooting

If you notice unexpected operation of the Maretron NBE100, follow the troubleshooting procedures in this section to remedy simple problems. If these steps do not solve your problem, please contact Maretron Technical Support (refer to Section 6 for contact information).

Symptom	Troubleshooting Procedure
No devices on one side of the NBE100 are visible from a display connected to the other side.	<ul style="list-style-type: none">• Ensure that the NBE100 is properly connected to the NMEA 2000® network segments.• Ensure that both NMEA 2000 network segments have power.• Ensure that both NMEA 2000 network segments have two termination resistors fitted.
PGNs do not pass the NBE100	<ul style="list-style-type: none">• Ensure desired configuration of the PGN Filter feature

5 Technical Specifications

As Maretron is constantly improving its products, all specifications are subject to change without notice. Maretron products are designed to be accurate and reliable; however, they should be used only as aids to navigation and not as a replacement for traditional navigation aids and techniques.

Certifications

Parameter	Comment
NMEA 2000® Standard	Level A+
Maritime Navigation and Radiocommunication Equipment & Systems	IEC 61162-3
Maritime Navigation and Radiocommunication Equipment & Systems	IEC 60945
FCC and CE Mark	Electromagnetic Compatibility

NMEA 2000® Parameter Group Numbers (PGNs)

Description	PGN #	PGN Name	Default Rate
Response to Requested PGNs	126464	PGN List (Transmit and Receive)	N/A
	126996	Product Information	N/A
	126998	Configuration Information	N/A
Protocol PGNs	059392	ISO Acknowledge	N/A
	059904	ISO Request	N/A
	060928	ISO Address Claim	N/A
	065240	ISO Address Command	N/A
	126208	NMEA Request/Command/Acknowledge	N/A
Maretron Proprietary PGN's	126720	Configuration	N/A

Electrical

Parameter	Value	Comment
Operating Voltage	9 to 16 Volts	DC Voltage
Power Consumption	<150mA	Average Current Drain
Load Equivalence Number (LEN)	3	NMEA 2000® Spec. (1LEN = 50 mA)
Reverse Battery Protection	Yes	Indefinitely
Load Dump Protection	Yes	Energy Rated per SAE J1113

Mechanical

Parameter	Value	Comment
Size	3.11" x 3.46" x 1.38" (79mm x 88mm x 35mm)	Including Flanges for Mounting
Weight	8 oz. (227 g)	

Environmental

Parameter	Value
IEC 60945 Classification	Exposed
Degree of Protection	IP67
Operating Temperature	-25°C to 55°C
Storage Temperature	-40°C to 70°C
Relative Humidity	93%RH @40°C per IEC60945-8.2
Vibration	2-13.2Hz @ ±1mm, 13.2-100Hz @ 7m/s ² per IEC 60945-8.7
Rain and Spray	12.5mm Nozzle @ 100liters/min from 3m for 30min per IEC 60945-8.8
Solar Radiation	Ultraviolet B, A, Visible, and Infrared per IEC 60945-8.10
Corrosion (Salt Mist)	4 times 7 days @ 40°C, 95%RH after 2 hour Salt Spray Per IEC 60945-8.12
Electromagnetic Emission	Conducted and Radiated Emission per IEC 60945-9
Electromagnetic Immunity	Conducted, Radiated, Supply, and ESD per IEC 60945-10
Safety Precautions	Dangerous Voltage, Electromagnetic Radio Frequency per IEC 60945-12

6 Technical Support

If you require technical support for Maretron products, you can reach us in any of the following ways:

Telephone: 1-866-550-9100
Fax: 1-602-861-1777
E-mail: support@maretron.com
World Wide Web: <http://www.maretron.com>
Mail: Carling Technologies, Inc.
Attn: Maretron Technical Support
120 Intracoastal Pointe Dr. Suite 100
Jupiter, FL 33477 USA

7 Installation Template

Please check the dimensions before using the following diagram as a template for drilling the mounting holes because the printing process may have distorted the dimensions.

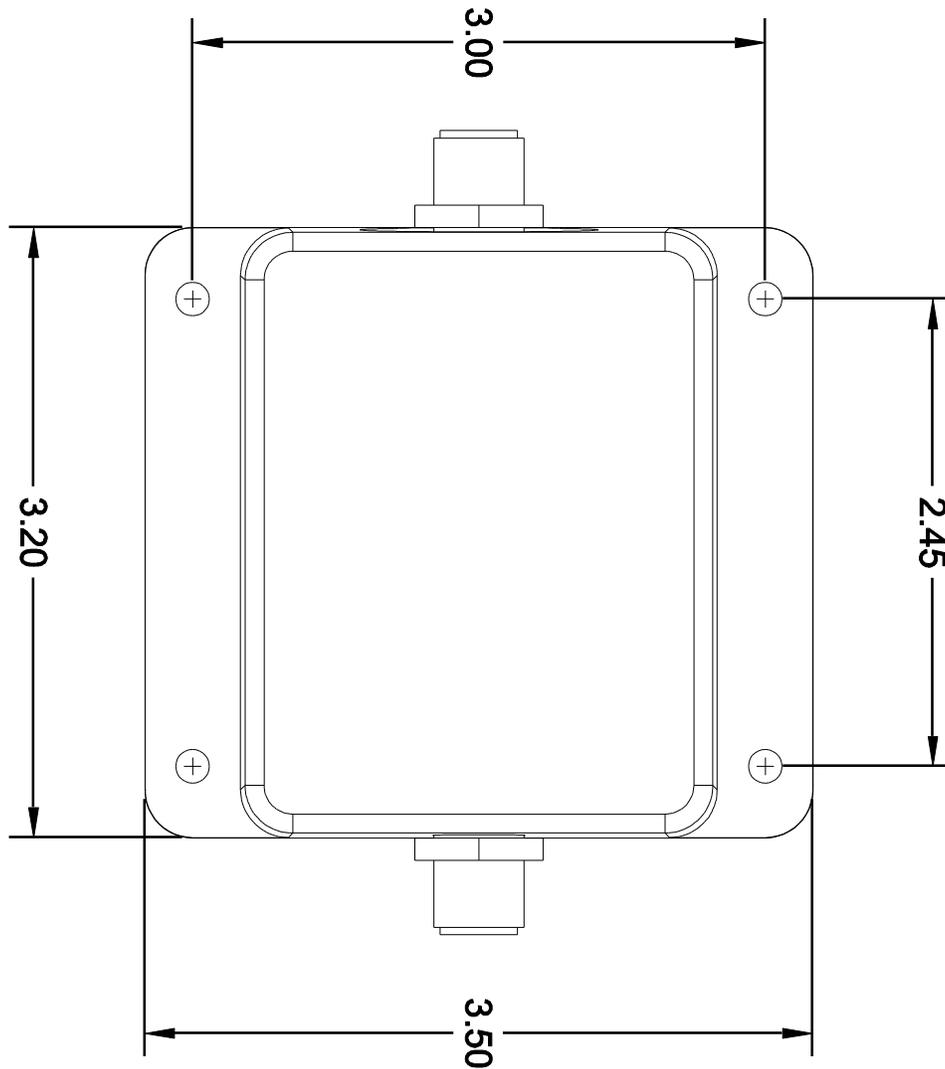


Figure 8 – Mounting Surface Template

8 Maretron (2 Year) Limited Warranty

Carling Technologies warrants the Maretron® NBE100 to be free from defects in materials and workmanship for **two (2) years** from the date of original purchase. If within the applicable period any such products shall be proved to Carling's satisfaction to fail to meet the above limited warranty, such products shall be repaired or replaced at Carling's option. Purchaser's exclusive remedy and Carling's sole obligation hereunder, provided product is returned pursuant to the return requirements below, shall be limited to the repair or replacement, at Carling's option, of any product not meeting the above limited warranty and which is returned to Carling; or if Carling is unable to deliver a replacement that is free from defects in materials or workmanship, Purchaser's payment for such product will be refunded. Carling assumes no liability whatsoever for expenses of removing any defective product or part or for installing the repaired product or part or a replacement therefore or for any loss or damage to equipment in connection with which Maretron® products or parts shall be used. With respect to products not manufactured by Carling, Carling's warranty obligation shall in all respects conform to and be limited to the warranty actually extended to Carling by its supplier. The foregoing warranties shall not apply with respect to products subjected to negligence, misuse, misapplication, accident, damages by circumstances beyond Carling's control, to improper installation, operation, maintenance, or storage, or to other than normal use or service.

THE FOREGOING WARRANTIES ARE EXPRESSLY IN LIEU OF AND EXCLUDES ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE.

Statements made by any person, including representatives of Carling, which are inconsistent or in conflict with the terms of this Limited Warranty, shall not be binding upon Carling unless reduced to writing and approved by an officer of Carling.

IN NO CASE WILL CARLING BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, DAMAGES FOR LOSS OF USE, LOSS OF ANTICIPATED PROFITS OR SAVINGS, OR ANY OTHER LOSS INCURRED BECAUSE OF INTERRUPTION OF SERVICE. IN NO EVENT SHALL CARLING'S AGGREGATE LIABILITY EXCEED THE PURCHASE PRICE OF THE PRODUCT(S) INVOLVED. CARLING SHALL NOT BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES, WHETHER ARISING OUT OF BREACH OF CONTRACT OR WARRANTY, TORT (INCLUDING NEGLIGENCE), OR OTHER THEORIES OF LAW WITH RESPECT TO PRODUCTS SOLD OR SERVICES RENDERED BY CARLING, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO.

Carling does not warrant that the functions contained in any software programs or products will meet purchaser's requirements or that the operation of the software programs or products will be uninterrupted or error free. Purchaser assumes responsibility for the selection of the software programs or products to achieve the intended results, and for the installation, use and results obtained from said programs or products. No specifications, samples, descriptions, or illustrations provided Carling to Purchaser, whether directly, in trade literature, brochures or other documentation shall be construed as warranties of any kind, and any failure to conform with such specifications, samples, descriptions, or illustrations shall not constitute any breach of Carling's limited warranty.

Warranty Return Procedure:

To apply for warranty claims, contact Carling Technologies or one of its Maretron dealers to describe the problem and determine the appropriate course of action. If a return is necessary, place the product in its original packaging together with proof of purchase and complete a Return Merchandise Authorization (RMA) on the following web page:

https://www.maretron.com/rma_request.php

You will be contacted by email with instructions on where to send the unit for repair / evaluation. You are responsible for all shipping and insurance charges. Carling will return the replaced or repaired product with all shipping and handling prepaid except for requests requiring expedited shipping (i.e. overnight shipments). Failure to follow this warranty return procedure could result in the product's warranty becoming null and void.

Carling reserves the right to modify or replace, at its sole discretion, without prior notification, the warranty listed above. To obtain a copy of the then current warranty policy for Maretron® products, please go to the following web page:

<http://www.maretron.com/company/warranty.php>