

# EMS100 Engine Monitoring System

## User's Manual

Revision 1.0

**Copyright © 2007 Maretron, LLP All Rights Reserved**

**Maretron, LLP  
9014 N. 23<sup>rd</sup> Ave #10  
Phoenix, AZ 85021  
<http://www.maretron.com>**

**Maretron Manual Part #: M001601**

## **Revision History**

<b>Revision</b>	<b>Description</b>
1.0	Original document

## Table of Contents

1	General .....	1
1.1	Introduction.....	1
1.2	Firmware Revision.....	1
1.3	Features .....	1
1.4	Quick Install.....	2
2	Installation.....	2
2.1	Unpacking the Box .....	2
2.2	Choosing a Mounting Location .....	2
2.3	Mounting the EMS100.....	3
2.4	Connecting the EMS100.....	3
	2.4.1 Connecting to NMEA 2000® Interface .....	4
	2.4.2 Checking Connections.....	4
2.5	Configuration .....	4
	2.5.1 Engine Instance.....	4
	2.5.2 Drive Trim Gauge Type .....	5
	2.5.3 Drive Trim Sender Type .....	5
	2.5.4 Drive Trim Sender Offset.....	5
	2.5.5 Boost Pressure Gauge Type .....	5
	2.5.6 Boost Pressure Sender Type .....	5
	2.5.7 Boost Pressure Sender Offset.....	5
	2.5.8 Oil Pressure Gauge Type .....	6
	2.5.9 Oil Pressure Sender Type .....	6
	2.5.10 Oil Pressure Sender Offset .....	6
	2.5.11 Water Temperature Gauge Type .....	6
	2.5.12 Water Temperature Sender Type .....	6
	2.5.13 Water Temperature Sender Offset.....	6
	2.5.14 Engine Hours .....	7
	2.5.15 Flywheel Teeth .....	7
	2.5.16 NMEA 2000® PGN Enable/Disable .....	7
	2.5.17 Restore Factory Defaults .....	7
3	Maintenance .....	7
4	Troubleshooting .....	8
5	Technical Specifications.....	9
5.1	Specifications .....	9
5.2	Certifications.....	9
5.3	NMEA 2000® Parameter Group Numbers (PGNs) .....	9
	Technical Support.....	10
	Installation Template .....	11
	Maretron (2 Year) Limited Warranty .....	12

## **Table of Figures**

Figure 1 – Mounting the EMS100 .....	3
Figure 2 – NMEA 2000® Connector Face Views .....	4
Figure 3 – Mounting Surface Template .....	11

## **Table of Appendices**

Appendix A – NMEA 2000® Interfacing.....	A1
--	----

## 1 General

### 1.1 Introduction

Congratulations on your purchase of the Maretron EMS100 Engine Monitoring System. Maretron has designed and built your engine monitoring system to the highest standards for years of reliable, dependable, and accurate service.

The EMS100 plugs directly into engine wiring harnesses (through the use of a Maretron wiring harness, purchased separately) and converts analog signals such as water temperature and oil pressure to the NMEA 2000® digital interface. Critical engine data is then distributed throughout the vessel over a single cable where it can be monitored by any NMEA 2000® compatible display. The EMS100 is compatible with existing instrument panels and key switches so you don't need to remove them while upgrading to newer digital technology. For new installations, the EMS100 and a compatible NMEA 2000® display can replace the traditional analog instrument panel.

The Maretron EMS100 is designed to operate within the harsh demands of the marine environment. However, no piece of marine electronic equipment can function properly unless installed, configured, and maintained in the correct manner. Please read carefully and follow these instructions for installation, configuration, and usage of the Maretron EMS100 in order to ensure optimal performance.

### 1.2 Firmware Revision

This manual corresponds to EMS100 firmware revision 1.1.1.

### 1.3 Features

The Maretron EMS100 Engine Monitoring System provides the following information on the NMEA 2000® bus.

- Tachometer
- Engine Hours
- Coolant Water Temperature
- Engine Oil Pressure
- Boost Pressure
- Charging Voltage
- Drive Trim
- Fuel Filter Alarm
- Boost Alarm
- Coolant Water Level Alarm
- Engine Oil Pressure Alarm
- Exhaust (Salt Water Flow) Alarm
- Coolant Water Temperature Alarm

The EMS100 is compatible with these Yanmar engines:

- GM Series
- YM Series
- JH Series
- LH Series
- LP Series
- LY Series

The EMS100 has the following additional features:

- Waterproof Enclosure and Cable System
- Connects to Analog or Digital tachometers
- Can Work With or Without Existing Analog Gauges

## **1.4 Quick Install**

Installing the Maretron EMS100 Engine Monitoring System involves the following five steps. Please refer to the individual sections for additional details.

1. Unpack the Box (Section 2.1)
2. Choose a Mounting Location (Section 2.2)
3. Mount the EMS100 Engine Monitoring System (Section 2.3)
4. Connect the EMS100 Engine Monitoring System (Section 2.4)
5. Configure the EMS100 Engine Monitoring System (Section 2.5)

## **2 Installation**

### **2.1 Unpacking the Box**

When unpacking the box containing the Maretron EMS100, you should find the following items.

- 1 – EMS100 Engine Monitoring System
- 1 – EMS100 User's Manual
- 1 – Warranty Registration Card

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

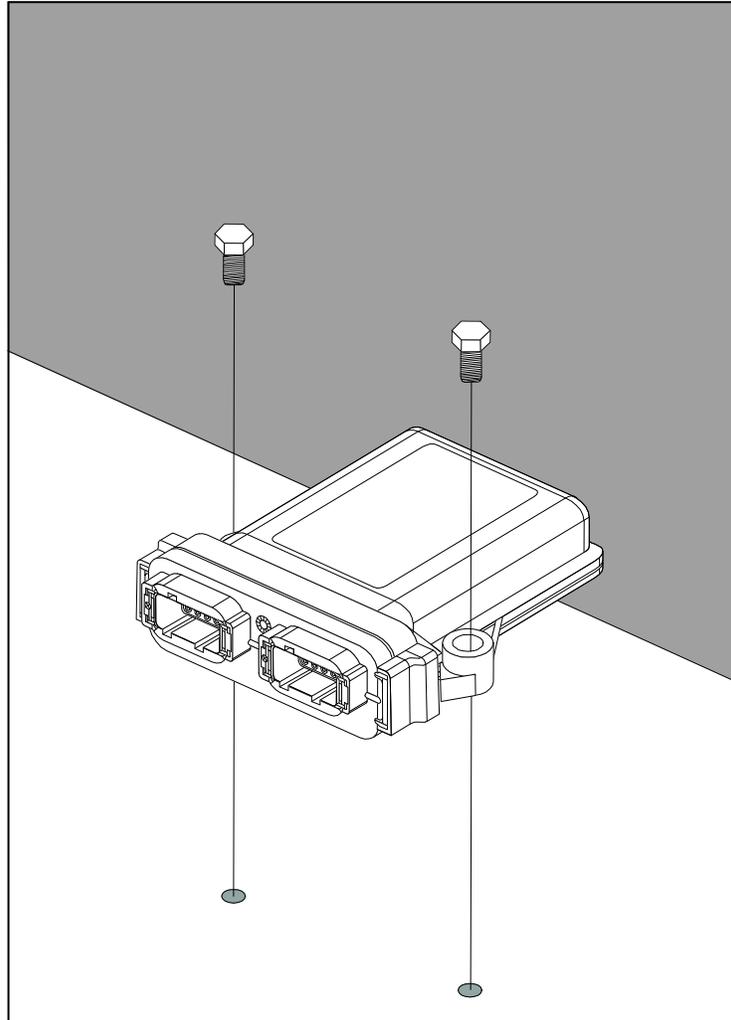
### **2.2 Choosing a Mounting Location**

The EMS100 is mounted between the engine and the NMEA 2000<sup>®</sup> network. Please consider the following when choosing a mounting location.

1. The EMS100 is waterproof, so it can be mounted in a damp or dry location.
2. The orientation is not important, so the EMS100 can be mounted on a horizontal deck, vertical bulkhead, or even upside down if desired.
3. The EMS100 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 EMS100

Attach the Maretron EMS100 securely to the vessel using bolts or screws (not included) as shown in Figure 1 below.



*Figure 1 – Mounting the EMS100*

## 2.4 Connecting the EMS100

You connect the EMS100 using a Maretron wiring harness (available separately) which is designed for a particular type of engine. One end of the Maretron wiring harness has two 12-pin Deutsch connectors which plug into the two connectors on the end of the EMS100 product enclosure. These connectors are keyed differently, so there is no danger of plugging these in incorrectly.

## 2.4.1 Connecting to NMEA 2000® Interface

The Maretron EMS100 provides a connection to an NMEA 2000® interface through a five pin male connector located on the Maretron wiring harness, which is purchased separately (see Figure 4). You connect the EMS100 to an NMEA 2000® network by plugging the male connector into a female receptacle of the NMEA 2000® network (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. The EMS100 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.

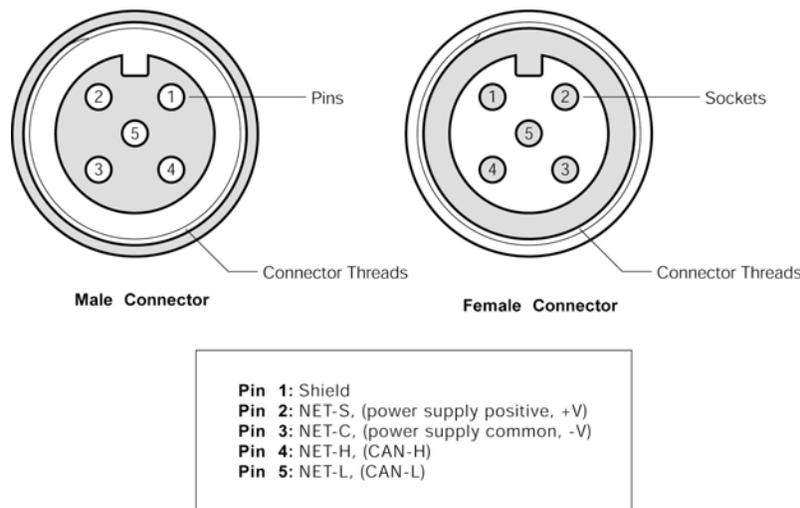


Figure 2 – NMEA 2000® Connector Face Views

## 2.4.2 Checking Connections

Once the engine harness connections to the Maretron EMS100 have been completed and the engine harness has been connected to the NMEA 2000® bus, supply power to the engine and check to see that engine information is being properly transmitted by observing an appropriate display. Refer to Section 7, “Troubleshooting”, if no engine information appears, otherwise proceed to Section 2.5 entitled “Configuration”.

## 2.5 Configuration

There are several configurable items within the EMS100. You configure the EMS100 using a Maretron DSM250 display or other NMEA 2000® display unit that is capable of configuring the EMS100. Please refer to the Maretron *DSM250 User's Manual* for details. Descriptions of the various configurable items appear in the following sections.

### 2.5.1 Engine Instance

In order to allow display equipment to distinguish between data coming from different engines, the NMEA 2000® network requires that each engine be assigned a unique instance number in the range of 0-252. The EMS100 comes from the factory programmed with an instance

number of 0. Conventions for instance numbers for common engine configurations are as follows:

- Single Engine = 0
- Dual Engines: Port Engine = 0, Starboard Engine = 1
- Triple Engines: Port Engine = 0, Starboard Engine = 1, Center Engine = 2

## 2.5.2 Drive Trim Gauge Type

The EMS100 comes from the factory preprogrammed with the characteristics of drive trim gauge types for supported engines. If the EMS100 is used with an analog drive trim gauge, you must select the correct type of gauge for this setting in order for the data to be displayed correctly. If you have no drive trim gauge present, select the “No Gauge” option for this setting.

## 2.5.3 Drive Trim Sender Type

The EMS100 comes from the factory preprogrammed with the characteristics of drive trim senders for supported engines. If the engine to which you are connecting the EMS100 has a drive trim sender, you must select the correct type of drive trim sender for this setting in order for the data to be displayed correctly. If you have no drive trim sender present, select the “Disabled” option for this setting.

## 2.5.4 Drive Trim Sender Offset

Often, the characteristics of individual drive trim senders vary from their specified values. This setting allows you to apply an offset to the resistance value of the drive trim sender in order to allow you to bring the digital value reported by the EMS100 into agreement with that displayed by the analog gauge.

## 2.5.5 Boost Pressure Gauge Type

The EMS100 comes from the factory preprogrammed with the characteristics of boost pressure gauge types for supported engines. If the EMS100 is used with an analog boost pressure gauge, you must select the correct type of gauge for this setting in order for the data to be displayed correctly. If you have no boost pressure gauge present, select the “No Gauge” option for this setting.

## 2.5.6 Boost Pressure Sender Type

The EMS100 comes from the factory preprogrammed with the characteristics of boost pressure senders for supported engines. If the engine to which you are connecting the EMS100 has a boost pressure sender, you must select the correct type of boost pressure sender for this setting in order for the data to be displayed correctly. If you have no boost pressure sender present, select the “Disabled” option for this setting.

## 2.5.7 Boost Pressure Sender Offset

Often, the characteristics of individual boost pressure senders vary from their specified values. This setting allows you to apply an offset to the resistance value of the boost pressure sender

in order to allow you to bring the digital value reported by the EMS100 into agreement with that displayed by the analog gauge.

### **2.5.8 Oil Pressure Gauge Type**

The EMS100 comes from the factory preprogrammed with the characteristics of oil pressure gauge types for supported engines. If the EMS100 is used with an analog oil pressure gauge, you must select the correct type of gauge for this setting in order for the data to be displayed correctly. If you have no oil pressure gauge present, select the “No Gauge” option for this setting.

### **2.5.9 Oil Pressure Sender Type**

The EMS100 comes from the factory preprogrammed with the characteristics of oil pressure senders for supported engines. If the engine to which you are connecting the EMS100 has a oil pressure sender, you must select the correct type of oil pressure sender for this setting in order for the data to be displayed correctly. If you have no oil pressure sender present, select the “Disabled” option for this setting.

### **2.5.10 Oil Pressure Sender Offset**

Often, the characteristics of individual oil pressure senders vary from their specified values. This setting allows you to apply an offset to the resistance value of the oil pressure sender in order to allow you to bring the digital value reported by the EMS100 into agreement with that displayed by the analog gauge.

### **2.5.11 Water Temperature Gauge Type**

The EMS100 comes from the factory preprogrammed with the characteristics of water temperature gauge types for supported engines. If the EMS100 is used with an analog water temperature gauge, you must select the correct type of gauge for this setting in order for the data to be displayed correctly. If you have no water temperature gauge present, select the “No Gauge” option for this setting.

### **2.5.12 Water Temperature Sender Type**

The EMS100 comes from the factory preprogrammed with the characteristics of water temperature senders for supported engines. If the engine to which you are connecting the EMS100 has a water temperature sender, you must select the correct type of water temperature sender for this setting in order for the data to be displayed correctly. If you have no water temperature sender present, select the “Disabled” option for this setting.

### **2.5.13 Water Temperature Sender Offset**

Often, the characteristics of individual water temperature senders vary from their specified values. This setting allows you to apply an offset to the resistance value of the water temperature sender in order to allow you to bring the digital value reported by the EMS100 into agreement with that displayed by the analog gauge.

## 2.5.14 Engine Hours

The EMS100 reports engine hours based on how long the EMS100 has been powered from the engine. The EMS100 comes from the factory preprogrammed with an engine hours reading of 0 hours. If you are installing the EMS100 on an engine that has been in service, or if you have overhauled an engine, you can use this setting to preset the engine hours reading to the desired value.

## 2.5.15 Flywheel Teeth

The EMS100 needs to know the number of flywheel teeth on the engine (or the number of alternator pulses per revolution) in order to correctly calculate engine RPM. Use this setting to program the EMS100 with the number of flywheel teeth or alternator pulses per revolution for the engine the EMS100 is connected to.

## 2.5.16 NMEA 2000® PGN Enable/Disable

The EMS100 is capable of transmitting several different kinds of NMEA 2000® messages (or PGNs) associated with engines. You can use this setting to enable or disable transmission of each of these message types.

## 2.5.17 Restore Factory Defaults

This setting will cause all user-programmable settings on the EMS100 to be restored to the values that were in the EMS100 when it was shipped from the factory.

## 3 Maintenance

Regular maintenance is important to ensure continued proper operation of the Maretron EMS100. 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 EMS100 enclosure or seals.
- 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 connections to the engine wiring harness and re-seat or tighten if necessary.

## 4 Troubleshooting

If you notice unexpected operation of the Maretron EMS100, 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 engine data visible on NMEA 2000 <sup>®</sup> network.	<p>Ensure that the NMEA 2000<sup>®</sup> network is operational by observing displays. You should see information from components besides the ones attached to the EMS100 which verifies an operational NMEA 2000<sup>®</sup> network. If you don't see data, try disconnecting the NMEA 2000 connection you made to the EMS100 as something may have been connected incorrectly.</p> <p>Ensure that the Maretron wiring harness is securely connected both to the EMS100 and to the existing engine wiring harness as directed in the instructions supplied with the Maretron wiring harness.</p> <p>Once you are sure that the NMEA 2000 network is operational with a connected EMS100, ensure that the NMEA 2000<sup>®</sup> connector on the Maretron wiring harness is securely connected to the NMEA 2000<sup>®</sup> network.</p> <p>Ensure that the ignition switch for engine is turned on. The EMS100 draws the majority of its power from the engine power connection.</p> <p>Ensure that the EMS100 is programmed with an appropriate engine NMEA 2000 instance as described in Section 2.5.1.</p> <p>Ensure that all NMEA 2000<sup>®</sup> messages are enabled (see Section 2.5.16 for details).</p>
Incorrect Engine Data	<p>Ensure that the settings for gauge type, sender type, and number of flywheel teeth are programmed appropriately.</p> <p>Check the values of sender offset programmed into the EMS100.</p>

**Warning: There are no user-serviceable components inside the Maretron EMS100. Opening the EMS100 will expose the sensitive electronic components to adverse environmental conditions that may render the unit inoperative. Please do not open the EMS100, as this will automatically void the warranty. If service is required, please return the unit to an authorized Maretron service location.**

## 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.

### 5.1 Specifications

Parameter	Type	Comment
Tachometer	Analog/Digital Input	Configurable by # of Teeth
Engine Hours	Logged with Key On	Stored Indefinitely in Non-Volatile Memory
Oil Pressure	Analog Input	Sensor Voltage Monitor/Sensitize
Coolant Water Temperature	Analog Input	Sensor Voltage Monitor/Sensitize
Boost Pressure	Analog Input	Sensor Voltage Monitor/Sensitize
Drive Trim Angle	Analog Input	Sensor Voltage Monitor/Sensitize
Charging Voltage	Alarm/Switch Input	
Lube Oil Filter Alarm	Alarm/Switch Input	
Boost Pressure Alarm	Alarm/Switch Input	
Coolant Water Temperature Alarm	Alarm/Switch Input	
Oil Pressure Alarm	Alarm/Switch Input	
Exhaust (Salt Water Flow) Alarm	Alarm/Switch Input	
Clutch Oil Pressure Alarm	Alarm/Switch Input	
Diesel Preheat Alarm	Alarm/Switch Input	

### 5.2 Certifications

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

### 5.3 NMEA 2000® Parameter Group Numbers (PGNs)

Description	PGN #	PGN Name	Default Rate
Periodic Data PGNs	127488	Engine Parameters, Rapid Update	10 times/second
	127489	Engine Parameters, Dynamic	1 time/second
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
	060416	ISO Transport Protocol, Connection Management	N/A
	060160	ISO Transport Protocol, Data Transfer	
	060928	ISO Address Claim	N/A
	065240	ISO Address Command	N/A
	126208	NMEA	N/A
Maretron Proprietary PGNs	128720	Configuration	N/A

# EMS100 User's Manual

---

## Electrical

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

## Mechanical

Parameter	Value	Comment
Size	5" x 4.5" x 1.25"	Excluding Wiring Harness
Weight	12 oz.	Excluding Wiring Harness

## Environmental

Parameter	Value
IEC 60954 Classification	Exposed
Degree of Protection	IP68
Operating Temperature	-25°C to 55°C
Storage Temperature	-40°C to 70°C
Relative Humidity	93%RH @40° per IEC60945-8.2
Vibration	2-13.2Hz @ ±1mm, 13.2-100Hz @ 7m/s <sup>2</sup> 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 7days @ 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

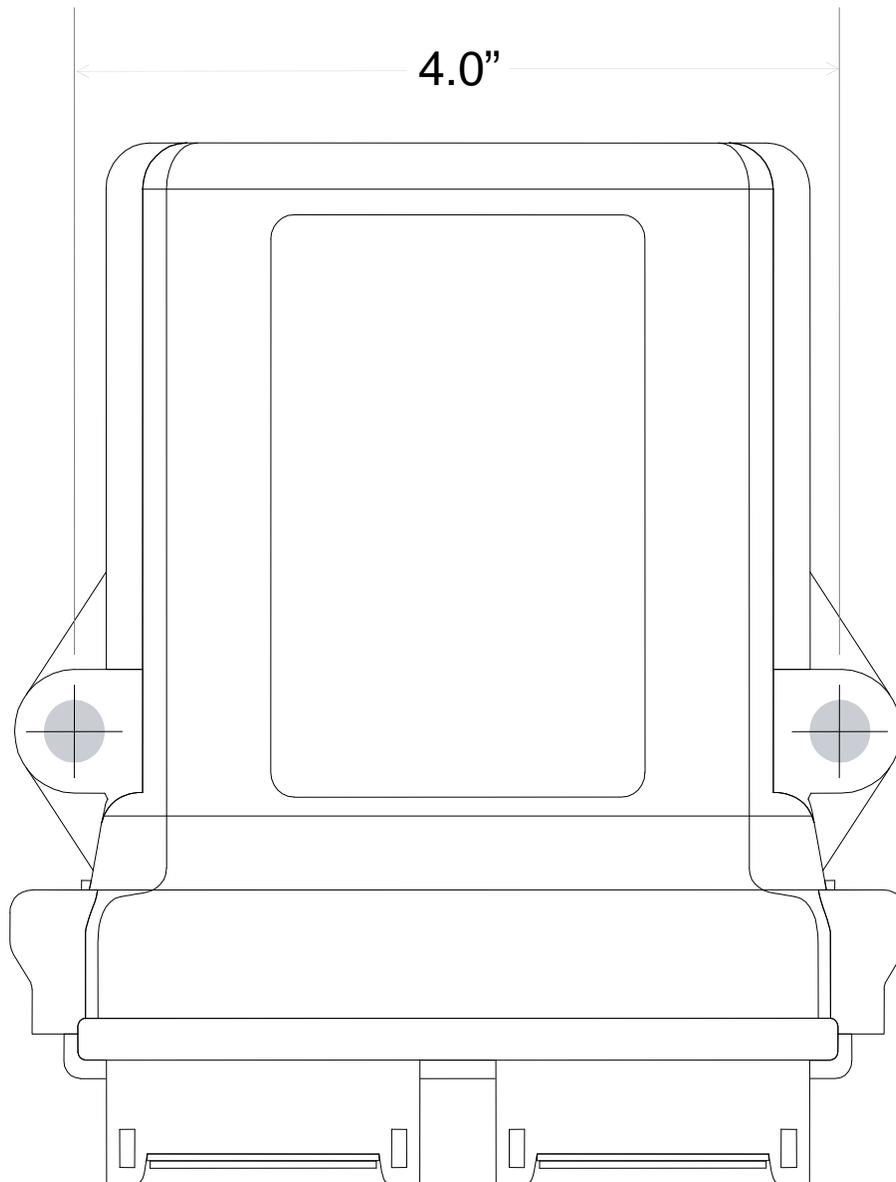
## Technical Support

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](mailto:support@maretron.com)  
World Wide Web: <http://www.maretron.com>  
Mail: Maretron, LLP  
Attn: Technical Support  
9014 N. 23<sup>rd</sup> Ave Suite 10  
Phoenix, AZ 85021 USA

## 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 3 – Mounting Surface Template**

### **Maretron (2 Year) Limited Warranty**

Maretron warrants the EMS100 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 Maretron's satisfaction to fail to meet the above limited warranty, such products shall be repaired or replaced at Maretron's option. Purchaser's exclusive remedy and Maretron's sole obligation hereunder, provided product is returned pursuant to the return requirements below, shall be limited to the repair or replacement, at Maretron's option, of any product not meeting the above limited warranty and which is returned to Maretron; or if Maretron is unable to deliver a replacement that is free from defects in materials or workmanship, Purchaser's payment for such product will be refunded. Maretron 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's products or parts shall be used. With respect to products not manufactured by Maretron, Maretron's warranty obligation shall in all respects conform to and be limited to the warranty actually extended to Maretron by its supplier. The foregoing warranties shall not apply with respect to products subjected to negligence, misuse, misapplication, accident, damages by circumstances beyond Maretron'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 Maretron, which are inconsistent or in conflict with the terms of this Limited Warranty, shall not be binding upon Maretron unless reduced to writing and approved by an officer of Maretron.

IN NO CASE WILL MARETRON 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 MARETRON'S AGGREGATE LIABILITY EXCEED THE PURCHASE PRICE OF THE PRODUCT(S) INVOLVED. MARETRON 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 MARETRON, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO.

Maretron 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 Maretron 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 Maretron's limited warranty.

#### **Warranty Return Procedure:**

To apply for warranty claims, contact Maretron or one of its 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 send to an Authorized Maretron Service Location. You are responsible for all shipping and insurance charges. Maretron 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.

Maretron 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, please go to the following web page:

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

## Appendix A – NMEA 2000® Interfacing

Note: For integer values, the most positive three values are reserved; e.g., for 8-bit unsigned integers, the values 0xFD, 0xFE, 0xFF are reserved, and for 8-bit signed integers, the values 0x7D, 0x7E, 0x7F are reserved. The most positive value (0xFF and 0x7F, respectively, for the 8-bit examples) represents Data Not Available.

### **EMS100 NMEA 2000® Periodic Data Transmitted PGNs**

#### ***PGN 127488 – Engine Parameters, Rapid Update***

The EMS100 uses this PGN to transmit rapidly changing engine data.

- Field 1: Engine Instance – (8-bit unsigned integer) This field indicates the particular engine for which this data applies. A single engine will have an instance of 0. Engines in multi-engine boats will be numbered starting at 0 at the bow of the boat incrementing to  $n$  going in towards the stern of the boat. For engines at the same distance from the bow are stern, the engines are numbered starting from the port side and proceeding towards the starboard side.
- 2: Engine Speed – (16-bit unsigned integer) This field indicates the rotational speed of the engine in units of  $\frac{1}{4}$  RPM.
- 3: Engine Boost Pressure – (16-bit unsigned integer) This field indicates the turbocharger boost pressure in units of 100 Pa.
- 4: Engine tilt/trim – (8-bit signed integer) This field indicates the tilt or trim (positive or negative) of the engine in units of 1 percent.
- 5: Reserved – (16 bits) This field is reserved by NMEA; therefore, the EMS100 sets all bits to a logic 1.

#### ***PGN 127489 – Engine Parameters, Dynamic***

The EMS100 uses this PGN to transmit more slowly changing engine data.

- Field 1: Engine Instance – (8-bit unsigned integer) This field indicates the particular engine for which this data applies. A single engine will have an instance of 0. Engines in multi-engine boats will be numbered starting at 0 at the bow of the boat incrementing to  $n$  going in towards the stern of the boat. For engines at the same distance from the bow are stern, the engines are numbered starting from the port side and proceeding towards the starboard side.
- 2: Engine Oil Pressure – (16-bit unsigned integer) This field indicates the oil pressure of the engine in units of 100 Pa.
- 3: Engine Oil Temperature – (16-bit unsigned integer) This field indicates the oil temperature of the engine in units of 0.1°K.
- 4: Engine Temperature – (16-bit unsigned integer) This field indicates the temperature of the engine coolant in units of 0.1°K.
- 5: Alternator Potential – (16-bit signed integer) This field indicates the alternator voltage in units of 0.01V.

- 6: Fuel Rate – (16-bit signed integer) This field indicates the fuel consumption rate of the engine in units of 0.0001 cubic meters / hour.
- 7: Total Engine Hours – (32-bit unsigned integer) This field indicates the cumulative runtime of the engine in units of 1 second.
- 8: Engine Coolant Pressure – (16-bit unsigned integer) This field indicates the pressure of the engine coolant in units of 100 Pa.
- 9: Fuel Pressure – (16-bit unsigned integer) This field indicates the pressure of the engine fuel in units of 1000 Pa.
- 10: Reserved – (8 bits) This field is reserved by NMEA; therefore, the EMS100 sets all bits to a logic 1.
- 11: Engine Discrete Status 1 – (16 bits) This field indicates warning conditions of the engine with the following bit assignments (value of 1 indicates warning present):
  - Bit 0: Check Engine
  - Bit 1: Over Temperature
  - Bit 2: Low Oil Pressure
  - Bit 3: Low Oil Level
  - Bit 4: Low Fuel Pressure
  - Bit 5: Low System Voltage
  - Bit 6: Low Coolant Level
  - Bit 7: Water Flow
  - Bit 8: Water in Fuel
  - Bit 9: Charge Indicator
  - Bit 10: Preheat Indicator
  - Bit 11: High Boost Pressure
  - Bit 12: Rev Limit Exceeded
  - Bit 13: EGR System
  - Bit 14: Throttle Position Sensor
  - Bit 15: Emergency Stop Mode
- 12: Engine Discrete Status 2 – (16 bits) This field indicates warning conditions of the engine with the following bit assignments (value of 1 indicates warning present):
  - Bit 0: Warning Level 1
  - Bit 1: Warning Level 2
  - Bit 2: Power Reduction
  - Bit 3: Maintenance Needed
  - Bit 4: Engine Comm Error
  - Bit 5: Sub or Secondary Throttle
  - Bit 6: Neutral Start Protect
  - Bit 7: Engine Shutting Down
  - Bit 8-15: These bits are reserved and should be masked when read
- 13: Percent Engine Load – (8-bit signed integer) This field indicates the percent load of the engine in units of 1 percent.
- 14: Percent Engine Torque – (8-bit signed integer) This field indicates the percent torque of the engine in units of 1 percent.