

NoLand Engineering, Inc.

MODEL RS11 c4

NMEA2000 Engine Data Converter

Installation and Getting Started



This manual covers **version 3.5**. Future versions may contain enhancements not covered

TABLE OF CONTENTS

- Introduction
- Installation
- Power/Ground and Analog Connection
- RPM or Fuel Rate Connection
- NMEA2000 Connection
- USB Interface
- Configuration & Calibration
- Example Calibrations
- Troubleshooting
- Technical Specifications

TABLES & FIGURES

- Figure 1 - Installation Example with one RS11
- Figure 2 - Twin RS11 Installation Example
- Figure 3 - Analog Connection Examples
- Figure 4 - RPM Connections
- Figure 5 - NMEA2000 Backbone Connection
- Figure 6 - COM Port Selection
- Figure 7 - Setup Utility
- Figure 8 - Setup Utility Data Window
- Figure 9 - Configuration Data Loading Options
- Figure 10- First Data Point Calibration Example
- Figure 11- Second Data Point Calibration Example
- Figure 12- Update All Configuration Command
- Figure 13 - RS11 Alarm Field

Introduction: The RS11 converts pulse signals (tach or flowmeter) and analog gauge voltages from virtually any engine into CANbus digital messages for the NMEA 2000 (N2K) protocol. It is configurable for either single or dual engine installations. The user must setup the RS11 for the desired data and enter pulse rate and analog scale factors. Configuration is performed via a USB PC interface which also serves as an output data monitor, if desired. Output messages are applied to the N2K bus, which can then be viewed by any compatible display.

The RS11 is designed for interfacing to most types of analog sensors or gauges commonly used on marine/automotive engines. It has two pulse (tach or flowmeter) inputs plus six analog (gauge) inputs and supports both 12 and 24 volt systems. The analog inputs can all be assigned to one engine or split between two engines. Multiple RS11's can be installed on the same CANbus.

The user configures the unit to suit the particular engine(s) by selecting the specific information to be converted and entering calibration factors. Although intended for direct connection to existing gauges, the RS11 can be used directly with resistive senders, where gauges have been eliminated. In such cases the A1-A4 analog inputs will provide "Sender Current" when enabled by the user. A PC-based Setup Utility is included to simplify configuration and calibration.

The RS11 is housed in a weatherproof plastic enclosure. Engine instrument connections are made to a terminal located under a removable cap. A green flashing LED (once/second) on the unit indicates normal operation.

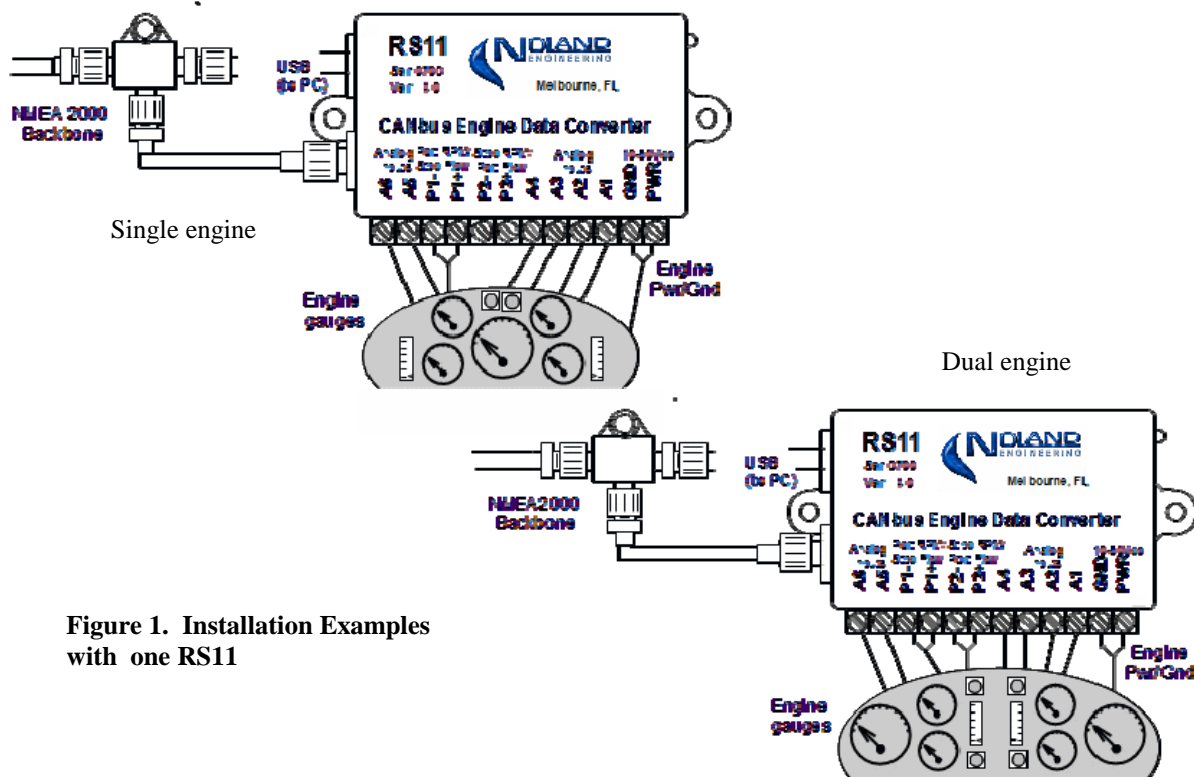


Figure 1. Installation Examples with one RS11

Installation: Example installations are shown in Figure 1 for a single and a dual engine RS11. For the single engine case, only the 'Port' RPM input is used, and all analog inputs are available for that engine. In the dual engine case with only one RS11, the analog inputs must be divided between the two engines. This usually means each engine only gets three analog inputs.

To get six analog inputs from each of two engines, you need two RS11's, one for "Port" instance and another for "Stbd" instance (see Figure 2). The RPM inputs are specifically assigned to Port and Starboard, whereas the analog inputs can be independently assigned to Port or Starboard, as desired. Note that the unused RPM inputs on each RS11 are available for 'Fuel flow' measurement from a flowmeter.

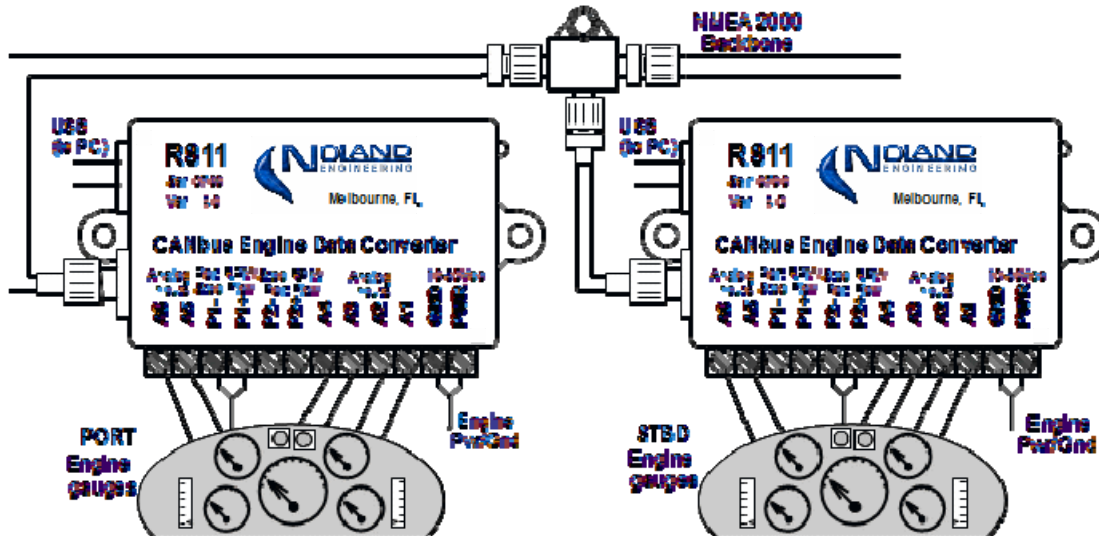


Figure 2. Twin RS11 Installation (dual engines)

Power/Ground connection: The "PWR" and "GND" terminals of the RS11 should generally be connected directly to engine Power and Ground. The Power can be switched 10-28 Vdc so that the RS11 shuts down whenever the engine is shut off. Otherwise, bothersome alarms on your MFD may result. The engine ground connection must be good to ensure stable RPM and analog readings.

Analog (Gauge/Sender) connection: The RS11 A1-A4 inputs accept voltages from 0-20V while A5,A6 accept 0-30V. Normally these connect directly to existing gauges or voltage-based sensors, but A1-A4, can also measure resistive senders directly when no gauges are present. The user must enable internal current sources (Sender Current) for this function. Inputs A5 and A6 do not have current sources but can be used for direct voltage measurement up to 30V.

Figure 3 shows typical analog connections. For existing gauges, the 'S' terminal on the back of each gauge is where the connection should be made. For bare senders (no gauge), the connection is made directly to the senders. The RS11 will provide 'Sender Current' for this case when enabled by the user.

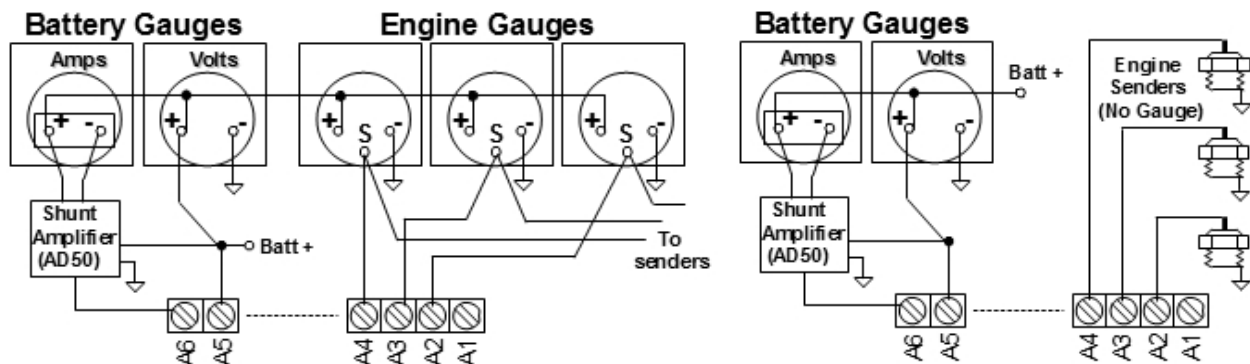


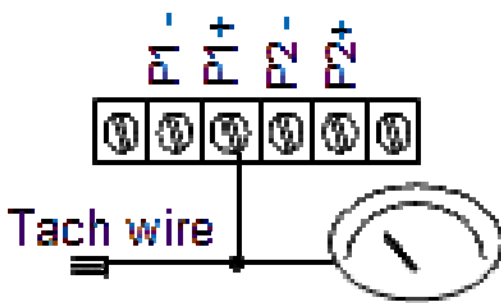
Figure 3. Analog Connection Examples

RPM or Fuel Rate Connection: The pulse inputs, (P1+/P1-, P2+/P2-) can measure either RPM or fuel rate, as desired. RPM signals come from different sources depending on the engine. They may come from an alternator output, the ignition coil, an ECU (engine control unit), or some type of AC or pulse sender (diesel engines). The RS11 will interface to all of these, but the details vary by type. The RS11 also sends 'Engine Hours' whenever RPM is > 100.

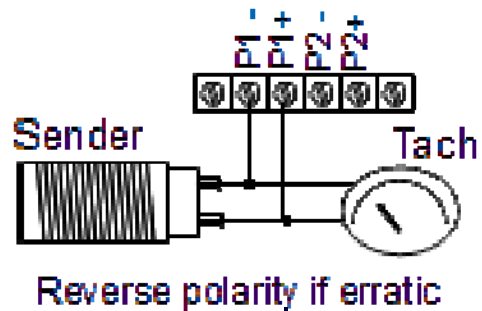
Figure 4(a) shows how to connect the RS11 to an ignition coil or alternator output signal or a single wire flowmeter. Since there is only one signal wire, it must connect to the P+ terminal. The P- terminal should usually be left disconnected (open). In some cases, however, the connection of Figure 4(c) gives more stable readings.

Figure 4(b) shows how to connect to a sender or generator used on many diesel engines and flowmeters. These senders have 2 signal wires, which should be connected to the P+/P- terminals of the RS11. If the RPM reading is not stable, the polarity may need to be reversed.

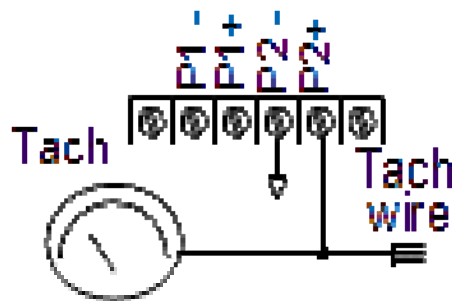
Figure 4(c) shows an alternative connection, which works better with some one-wire senders and also 2-wire senders with one side grounded. The signal (ungrounded) wire of the sender should go to P+ while the P- terminal is grounded. This connection increases the input sensitivity, but is only used when necessary. .



4(a) Most single-wire Tachs



4(b) Most two- wire Tachs



4(c) Some Tachs, incl. 2-wire senders with one wire grounded.

NMEA2000 Connection: The N2K bus is used to send the acquired engine data to appropriate Multi-function Displays. Connection to the bus is via a ‘Micro C’ connector on the side of the RS11. The connection is normally made to an N2K backbone as shown in Figure 5.

A NMEA2000 backbone typically consists of cables, a power injector, one (or two) terminations, and drop Tee’s for connecting each device. Cables and Tee’s form the main backbone while devices are connected with short drop cables to each Tee. The backbone provides both a DC Power(8-16V) and data(250 Kbps) interface for all devices on the bus. Short buses can be terminated with a single 120 ohm termination, but very long buses should have a termination at both ends.

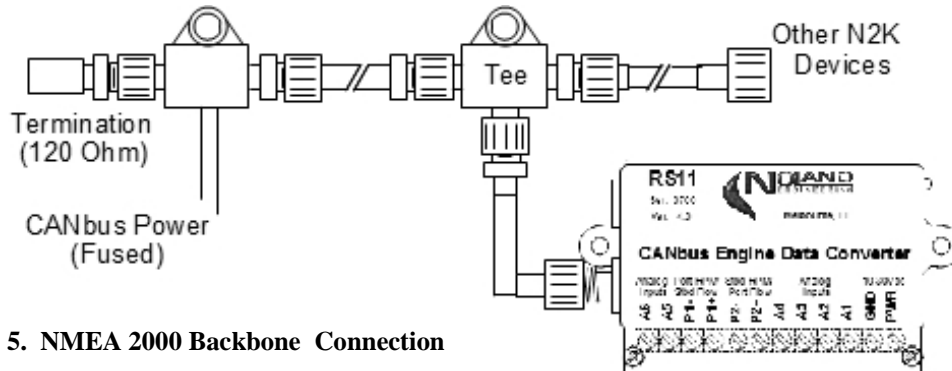


Figure 5. NMEA 2000 Backbone Connection

USB Interface: The USB interface is used for setup and calibration of the RS11. It also allows monitoring of the RS11 and updating firmware, when necessary. When the USB interface is first connected the PC creates a ‘Virtual COM Port’ to communicate with the RS11. This happens even if the RS11 has no DC power. The first time the RS11 is plugged into your PC, driver installation may be automatic. If not, you may get a message that “no driver could be found”. You will then need to install the drivers as below. USB Drivers are on the supplied CD or website (www.nolandeng.com).

To install the RS11 USB drivers, do the following:

- 1) Plug RS11 into USB port of computer
- 2) Insert RS11 Installation CD into disk drive of computer
- 3) When New Hardware Wizard appears, select ‘Windows recommended option’.
- 4) Click “Next”.
- 5) Click “Finish”.

A “New Hardware Wizard” may then appear. If so, do the following:

- 1) When New Hardware Wizard appears, select ‘Windows recommended option’.
- 2) Click “Next”.
- 3) Click “Finish”.

To repair, reinstall, or update drivers, do the following:

- 1) Open “Device Manager” in PC with RS11 USB cable unplugged.
- 2) Plug in RS11 USB cable and locate new device which appears
(It may appear under “Ports, COM & LPT” or “Other Devices”)
- 3) Right click the device and select “Update Driver”.
- 4) Browse to the “USB Drivers” file location (CD or downloaded).

NOTE: Before “Connecting” to the RS11, it must have power applied with the green LED flashing.

Once the USB Drivers are installed you must then select the proper COMx port. Under the ‘Config’ menu item of the Setup Utility, select ‘Set COM port.’ This will open the window shown in Figure 6, which contains a pull-down list of all available COM ports. If you know the correct COM port for the RS11, select it and click ‘OK’. To determine the correct COM port, unplug the RS11 USB cable, click ‘Rescan’ and note which COM port disappears from the list. Then plug the USB cable back in, click ‘Rescan’ and select the newly created COM port. If no new COM port appears, see “Troubleshooting”.

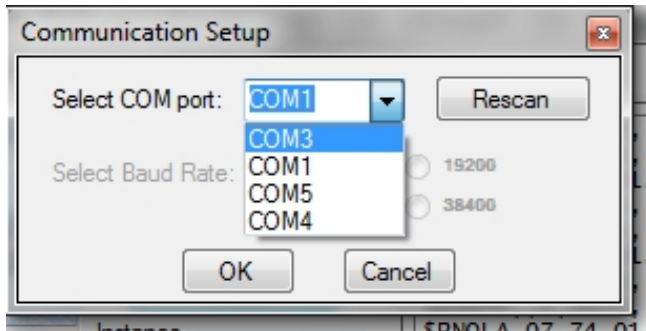


Figure 6. COMx Port Selection

Configuration/Calibration: The RS11 Setup Utility (Figure 7) configures and calibrates the RS11 to send NMEA 2000 messages based on the incoming analog engine data. The Utility allows you to select the data type for each input and enter calibration values, where needed. All configuration/calibration data is stored within the RS11 and can also be stored as “.cfg” files on your PC.

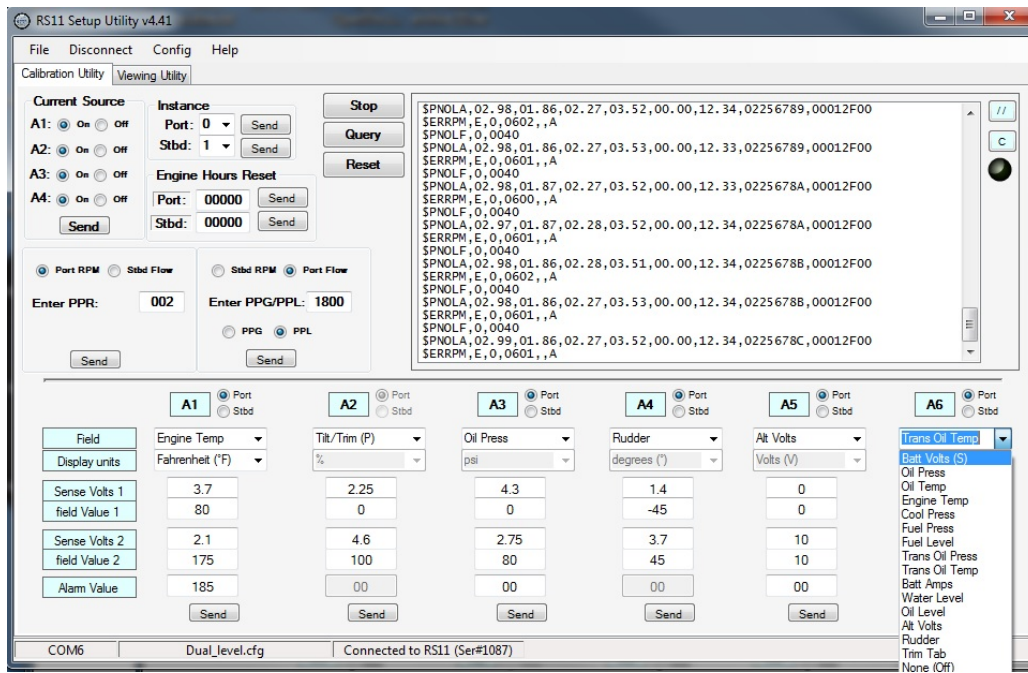
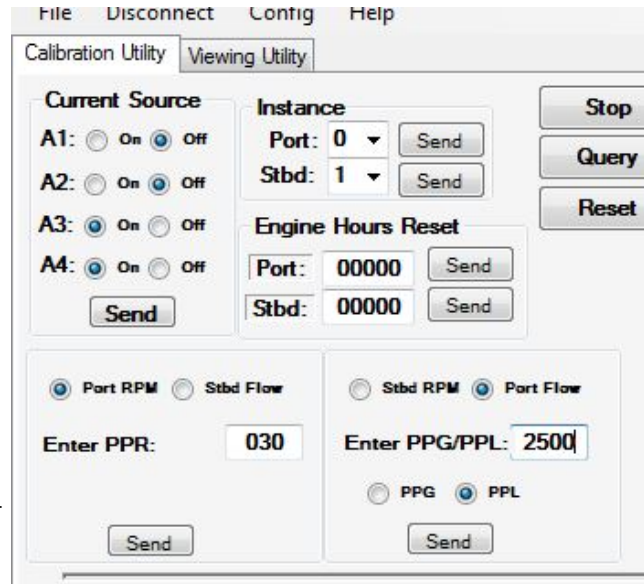


Figure 7. Setup Utility

The RS11 connects to this utility through a USB Virtual COM Port. The Utility both writes to and reads from the RS11, so that configuration can be verified. It consists of selection boxes and entry fields for calibration data. Additional details of the Setup Utility are contained within the Utility's "Help" section.

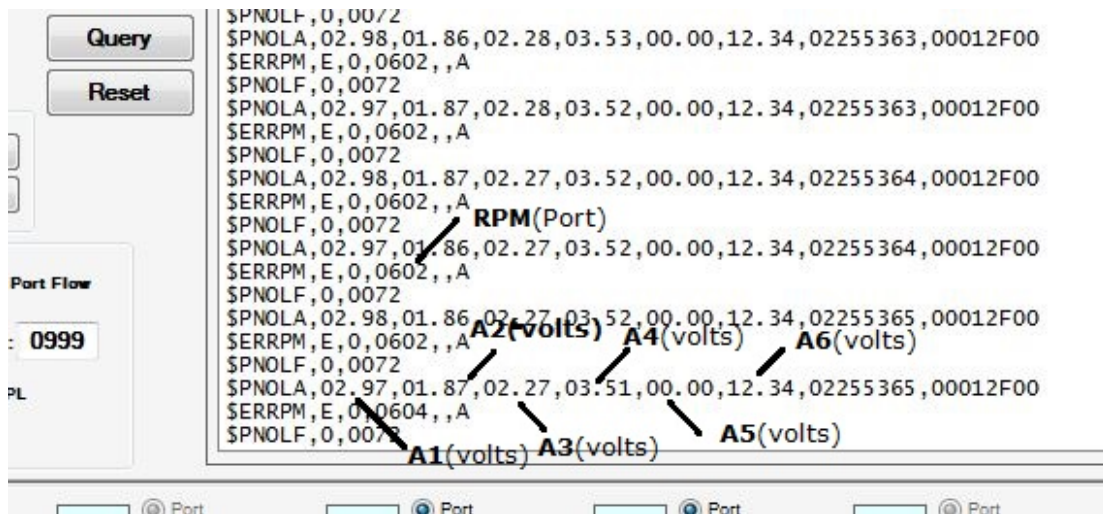
The upper left section of the Setup Utility (right) contains several selections. You can enable the RS11 internal current sources for any resistive senders on A1-A4 inputs lacking a gauge. RPM or flow rate calibration is done by entering the pulses-per-revolution (ppr) of each engine or the pulses-per-liter (ppl) of the flowmeter. If unknown, it can be done by trial-and-error. You can also reset the Engine ID's (instance) and "Engine Hours if necessary. The "Connect/Disconnect" button (top) makes/breaks the communication between RS11 and the Setup Utility. Each "Send" button sends the proper command to make the change in the RS11.



The Terminal Window within the Setup Utility displays the data received and calculated by the RS11. The data scrolls continuously through the Window, but can be stopped via the "Stop" button. The data displayed includes RPM, flow rate, analog voltage values, and Engine Hours. A detailed breakdown of the sentences is found in the Setup Utility "Help" section. More about this will be found in the "Example Calibrations" section.

A "Query" button is included in the Setup Utility to print the current configuration of the RS11 in the Terminal Window. It is helpful when verifying the configuration settings.

Figure 8. Setup Utility Data Window



The Setup Utility automatically saves calibration/configuration data inside the RS11 during any updates. The user can also choose to save all setup information to files on the PC. The Setup Utility can load the data either from the PC “.cfg” file or directly from the RS11 as shown in Figure 9. This is very useful when you need to recover the configuration from an existing RS11 or transfer a configuration from the PC to another RS11.

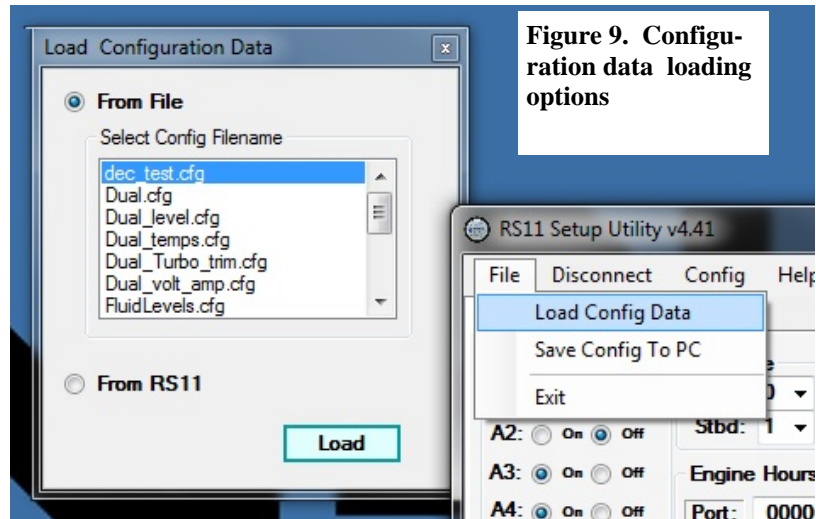


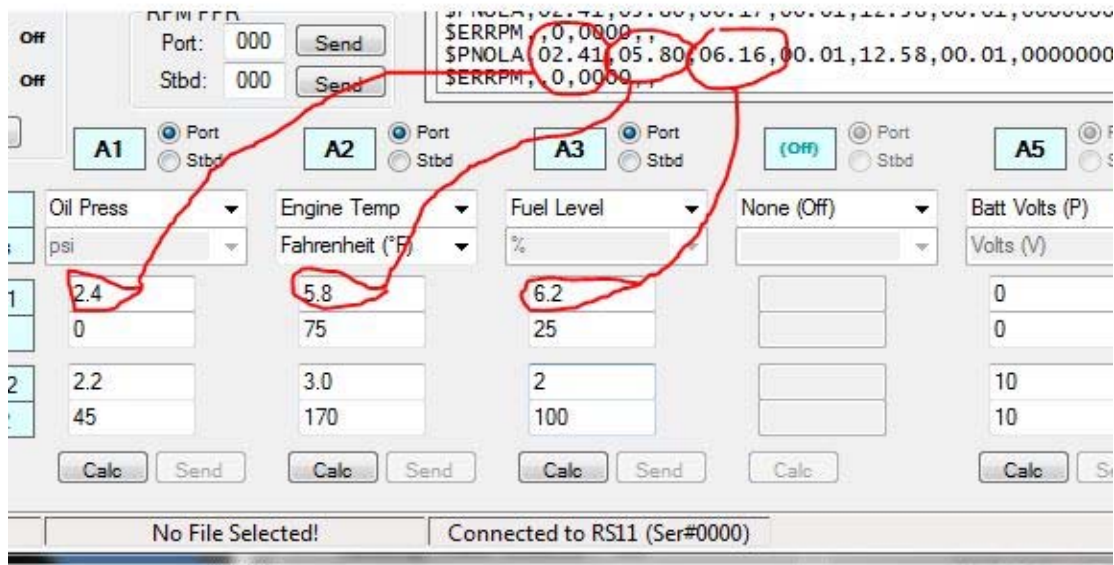
Figure 9. Configuration data loading options

Example Calibration: An example calibration is shown here. Assuming this is a single (or Port) RS11, we have selected all analogs as ‘Port’ instance. The example assumes A1, A2, and A3 are being used for Oil Pres., Engine Temp., and Fuel Level respectively. "Batt. Volts" is on A5 and its calibration is very simple, where '0v' measured is '0v' displayed and '10v' measured is '10v' displayed, (see Fig 10.).

Once the Setup Utility is “Connected” to a powered up RS11, data will begin scrolling in the Terminal Window. We use this data to assist in calibration. To get the first pair of calibration points per Figure 10 , we have assumed the engine is "cold" (75 degF coolant temp), in "key ON" condition to energize the gauges/senders, the Fuel Level is at 25% (1/4 full), and Oil Pressure is 0 psi since the engine is not running. The calibration voltages can be read directly from the Setup Utility “PNOLA, ... “ sentence and entered into their respective “Sense Volts” boxes as shown in the figure. The corresponding temperature(degF), pressure(psi), and level(%) values are entered into the “field value” boxes below the sense voltages.

To get the second set of calibration readings we now start the engine. In our example, we assume a gauge Oil Pressure reading of '45 psi' occurs at a new A1 voltage of "4.1" volts (see Figure 11). We enter these values into the lower boxes of A1. Oil pressure calibration is now done and we can select “Send” to send the calibration parameters to the RS11.

Figure 10. First Data Point Calibration



To get the second Engine Temperature calibration, we have to wait for the engine to warm up. In our example, we see that when the engine reaches 170 degF the A2 voltage has decreased to 4.3V. These values go into the lower boxes for A2. Select "Send" to upload the calibration parameters to the RS11.

To get a second Fuel Level calibration point, assume the fuel tank has been filled up (100%) and a new A3 voltage of "2.6" results. These values are then entered into the lower boxes for A3. The "Send" button updates these to the RS11.

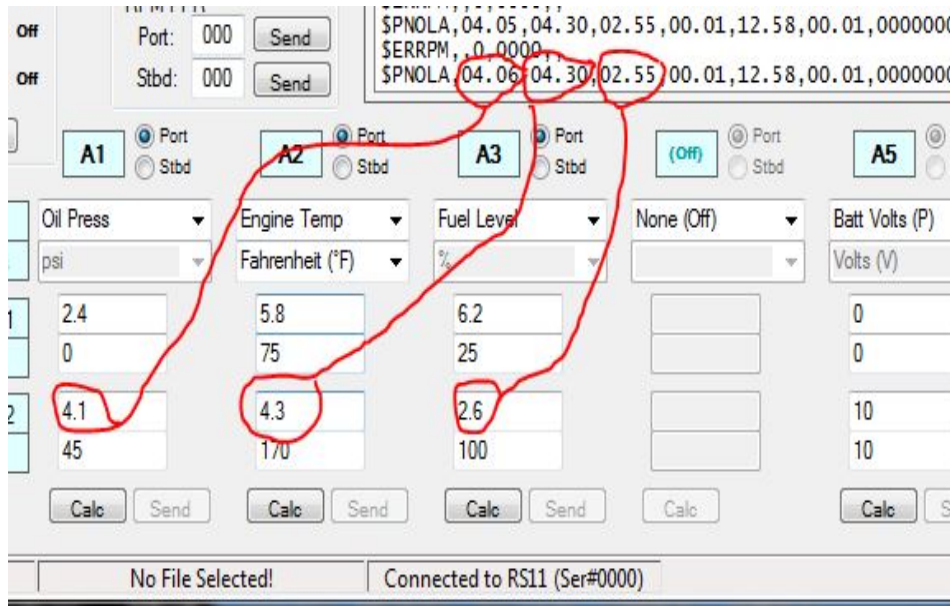


Figure 11. Second Data Point Calibration Example

As each set of calibration values are obtained, select the "Send" button to send these to the RS11. Some calibration values, such as Oil Pressure, can be obtained quickly while others, such as Engine Temperature, require a time lapse before the second set of values can be obtained. In the case of Fuel Level, it may be days before a second set of values are obtainable.

If you want to update everything to the RS11 all at once, there is simpler way than pushing every "Send" button in the Utility. Under the "Config" menu item, select "Update All" to send the entire current configuration to the RS11 (see Figure 12). This will first erase the entire configuration inside the RS11 and replace it with the current settings of the "Setup Utility". By using the individual "Send" buttons or the "Update All" command,

you can change individual configuration items or clear and update the entire configuration, as desired.

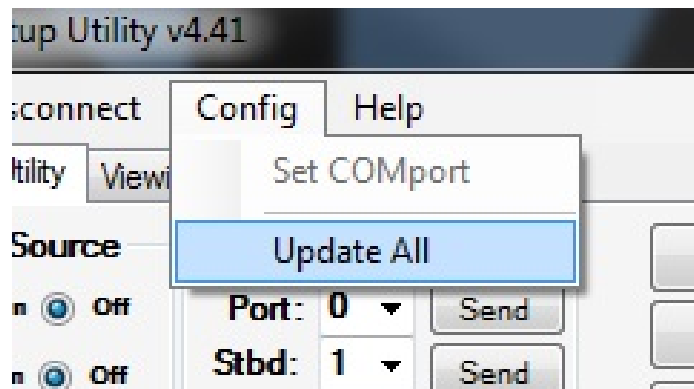


Figure 12. Update All Command

Finally, there is the option of setting “Alarm” values for certain fields, such as Oil Pressure and Engine Temperature. When the entered alarm limit is reached for any analog field, the RS11 will send the corresponding NMEA 2000 alarm message. Alarms are automatically enabled if a non-zero “Alarm” value is entered. Entering an “Alarm” value of “0” disables the alarm. Figure 13 shows an alarm value of “185” entered for the “Engine Temp” field.

Figure 13. RS11 Alarm field

Field	Value
Engine Temp	Engine Temp
Display units	Fahrenheit (°F)
Sense Volts 1	3.6
field Value 1	80
Sense Volts 2	2.1
field Value 2	170
Alarm Value	185

Troubleshooting: The most commonly encountered difficulties are covered below.

I don't get data from the RS11 when I “Connect” the Setup Utility.

The most common reason for this is either the wrong COMx Port is selected or the RS11 is not operating (Green LED flashing). See “Figure 6”.

I don't see a new COMx Port when I connect the USB cable.

This is usually due to missing driver file(s). See “USB Interface” for help.

I get the error “Unable to connect ...” when I try to “Connect” the Setup Utility.

The most common reason for this is either the wrong COMx Port is selected or the RS11 is not powered on (Green LED flashing).

I don't see any data from the RS11 on my MFD.

Make sure your CANbus is powered (12V) and the bus is terminated (120 ohm). Some MFD's also require you to enable each data source for display.

I don't get “Battery Volts” displayed on my MFD.

You may need to select “Alt Volts” instead of “Batt Volts”. These fields are in different NMEA 2000 messages. Some MFDs only display “Alt Volts” while others display both Alternator and/or Battery Volts.

The RPM on my MFD jumps between “0” and its true value.

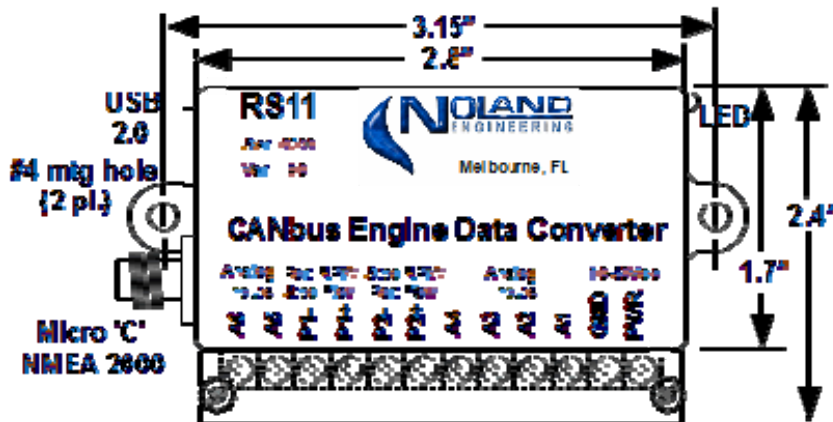
This can occur if the RPM inputs of a second RS11 are not turned off by setting their ppr to “000”.

Technical Specifications:

RPM resolution (@ 2000 rpm)	+/-1(ppr=200), +/-8(ppr=20), +/-16(ppr=2)
Analog accuracy	+/- 2%
Tach input impedance	> 100 Kohm
Analog input impedance	> 12 Kohm
Power	10-30 Vdc, 50ma. Max
Temperature, Humidity	0-50 degC, 0-100% (non-condensing)
Size, weight	2.4" x 3.4" x 0.9", 3 oz.
LEN (per NMEA 2000)	1
Certification	NMEA 2000 (Level A)

PGN's:

127245	Rudder Angle
127488	Engine Parameters, Rapid Update
127489	Engine Parameters, Dynamic
127493	Transmission Parameters, Dynamic
127503	Fluid Level (Fuel, Oil, Water)
127508	Battery Status
130576	Small Craft Status (Trimtab)



WARRANTY:

Subject to the terms, conditions and limitations herein, NoLand Engineering warrants this product against manufacturing and material defects for a period of 24 months from the date of purchase. NoLand Engineering, at its discretion, will repair or replace the defective unit with new or refurbished parts. There is no other express warranty or representation of any kind that we make concerning this product. Such repair or replacement is the sole remedy to the customer, consistent with local and provincial laws. Any repaired or replaced unit will be warranted for the balance of the original product's warranty period.

It is customer's responsibility to return products safely to NoLand Engineering. Unless other arrangements are made, the customer must properly pack, ship, and insure the unit for return. If proof of purchase is not provided by the customer, NoLand Engineering will use its own records to determine the date of purchase.

This Limited Warranty does not cover the following:

- products with alterations to the serial number, mutilated labels, or missing labels
- failure from abuse, misuse, accident, over-voltage, unauthorized repair or modification, or improper installation.
- costs incurred from re-installation and testing.

This warranty gives you specific legal rights, and other rights, which vary from state to state.