Actisense EMU-1 Toolkit Software User Guide

Actisense®
Connect without limits

EMU Configuration Manual

Contents

EMU-1 Toolkit Software

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Using the EMU-1 Configuration options in the Actisense Toolkit

Set up before using Actisense Toolkit
Before getting started, the EMU-1 needs to be powered up as per the **user manual**. Please note that if a single EMU-1 is used for more than one engine, the engines must have a common ground and there must be no chance for a ground loop to be introduced through the EMU-1 interconnections.

- The EMU-1 needs to be connected to a working NMEA 2000 network (or bus) which fulfills the minimum network requirements (refer to EMU-1 user manual for guidelines).
- Connect an **Actisense NGT-1/NGX-1** to both the NMEA 2000 network and a PC running Microsoft Windows (Windows XP, Vista, 7, 8, 8.1, 10 or 11.
- If using the USB variant of the NGT-1/NGX-1 (product code: NGT-1/NGX-1-USB) the latest Actisense USB drivers must be installed. If there is a working internet connection in the PC when the NGT-1/NGX-1-USB is

plugged in, and if the operating system settings allow automatic updates from Windows, the latest USB drivers will download automatically. If this fails, the same USB driver files are available as a pre-installer on the CD provided or from the **Actisense website**.

- Check that Actisense NMEA Reader has been installed. This powerful diagnostics software tool is freely available from the **Actisense website**. Check that the NGT-1/NGX-1 COM port is not in use by another software application (e.g. NMEA Reader).

Connecting the EMU-1 to the NGT-1/NGX-1

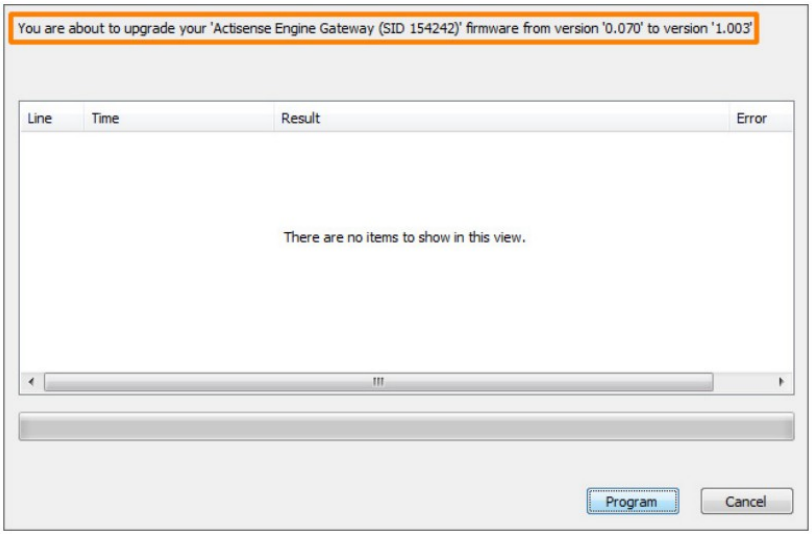
1. Launch Actisense Toolkit.
2. Select the “Actisense NGT” or NGX from the ‘COM ports’ list. The selected NGT-1/NGX-1 COM port will be remembered for all future sessions but it can be changed at any time if required.
3. Select the correct baud rate for the NGT-1/NGX-1. Default baud rate is 115200. However, on a busy NMEA 2000 bus (with load above 40%) the NGT-1/NGX-1 will need to be configured to use the maximum NGT-1/NGX1 baud rate of 230400. The NGT-1/NGX-1 baud rate can be modified using the ‘Hardware Config’ tab in NMEA Reader.
4. Select the EMU-1 to be configured/updated in the ‘Network List View’ window.

Useful Tip: Instead of closing the Actisense Toolkit (and needing to re-load configuration settings), select ‘Offline’ in the COM port’s drop down list so that the NGT-1/NGX-1 COM port is closed, allowing it to be used/opened by another program such as NMEA Reader.

Updating or Downgrading the EMU-1 Firmware Using Actisense Toolkit

The **EMU-1 firmware ‘Release Notes’** document (that details all EMU-1 firmware changes) and the **Actisense Toolkit ‘Release Notes’** document (that details all changes to Toolkit plus a complete list of the product firmware updates available) can be found on the EMU-1’s Download page.

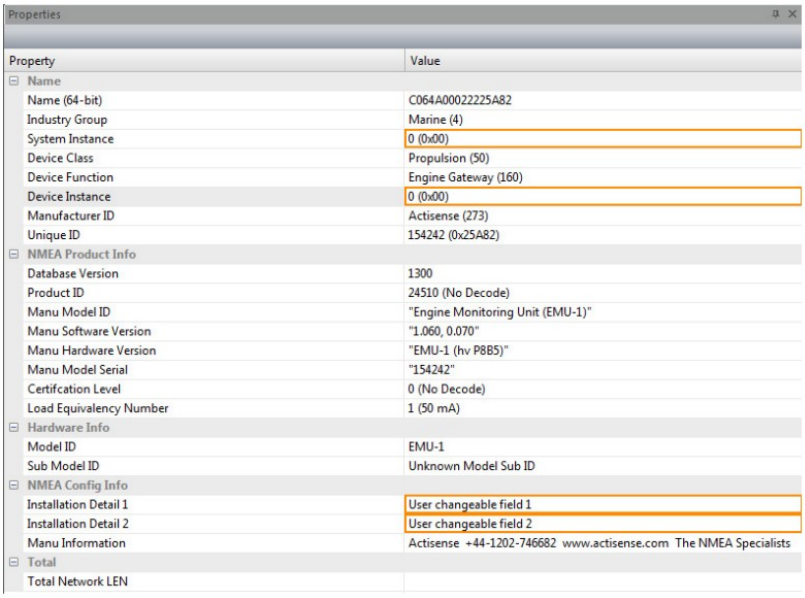
- To upgrade the EMU-1 firmware to the latest version available, click the ‘Update firmware’ button followed by ‘Program’. The firmware version being updated to can be seen at the top of the programming window visible during the upgrade process.



- To downgrade the EMU-1 firmware (to an older version that is still compatible), click the arrow under the ‘Downgrade firmware’ button and select the version required. Follow the on screen instructions and if acceptable, click the ‘Program’ button.

Instances

When ‘Instances’ are discussed in this manual, this is referring to the PGN ‘Instance’ data field inside the PGN that is used to differentiate between multiple engines sending the same data values. The ‘Instance’ number that should be used is determined by NMEA definitions and the device used to display the data.
The primary and standard NMEA 2000 method for distinguishing between two (or more) engines is by configuring the Engine Instance value for each Engine. However, some older NMEA 2000 display devices use a secondary and more basic method of the Device Instance to distinguish each Engine. If it becomes necessary to set the EMU-1 Device Instance, Toolkit can perform this operation quickly and simply: click on the box with the orange border next to the ‘Device Instance’ column. Type the new instance value and hit enter to finish.
As the EMU-1 has a single NMEA Name, it can only be configured with a single Device Instance.
In order to correctly generate NMEA 2000 PGNs, all configuration options for a single engine must share the same ‘Instance’ value.



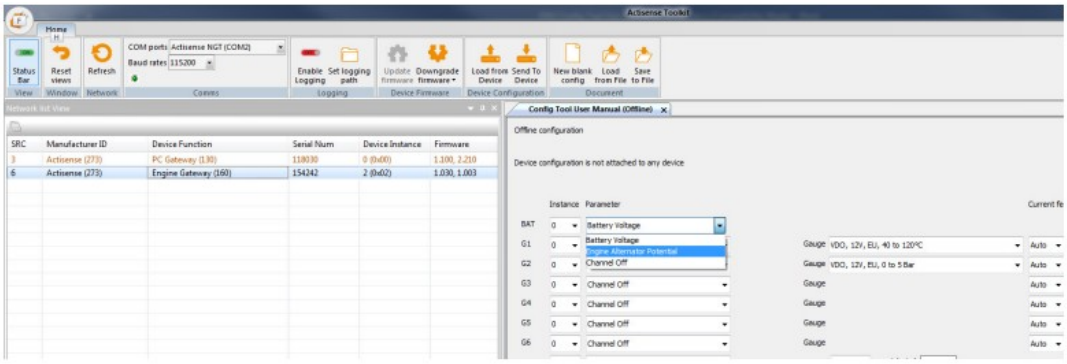
Configuring the EMU-1 using Actisense Toolkit

There are 3 options to start the configuration process:

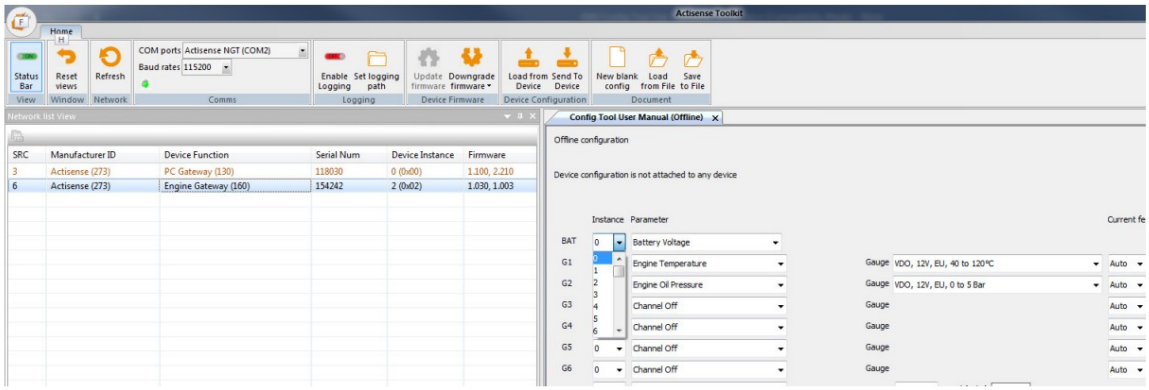
- To view or make changes to the configuration currently inside the EMU-1, click the ‘Load from Device’ button. If the configuration in the EMU-1 has not been named previously, a configuration name will need to be given.
- To start a new configuration from the default settings, select ‘New blank config’ and name the configuration as required.
- To install a configuration that is saved on file, select ‘Load from File’. If no further changes are required to be made to a previously saved configuration, simply select the device you wish to send to in the ‘Network List View’ and then ‘Send to Device’.

Configuring the Battery Power monitoring

The voltage measured on the EMU-1’s PWR connectors can be shared as either a Battery Voltage PGN (127508) instance or an Engine Alternator Potential PGN (127489) instance. If it is not required to share this information as an NMEA 2000 PGN select Channel Off:

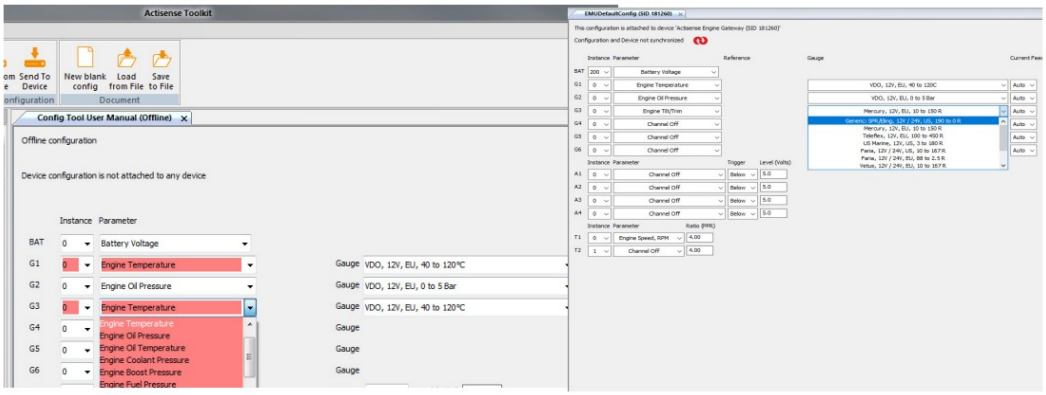


The BAT Instance selection becomes the Battery Instance in the Battery Voltage PGN (127508) or the Engine Instance in the Engine Alternator Potential PGN (127489). When Engine Alternator Potential is chosen, use Engine Instance 0 for the Port engine and 1 for the next engine (e.g. Starboard):



Configuring the Gauge Inputs

Select the required Parameter type and Instance for each of the G1 to G6 Gauge inputs. Set the Parameter type of any unused Gauge input to Channel Off. If a conflict is created by selecting a duplicate Parameter type and Instance setting for two or more Gauge inputs, they will be highlighted to the user in red until the selection is changed and the conflict removed. For example, two inputs cannot both be set to measure Engine Temperature with the same Engine Instance because a display device will not know how to differentiate between the two:
To remove the red highlighting, the second Engine Temperature input in the example shown is set to Engine Instance 1 (for Starboard):



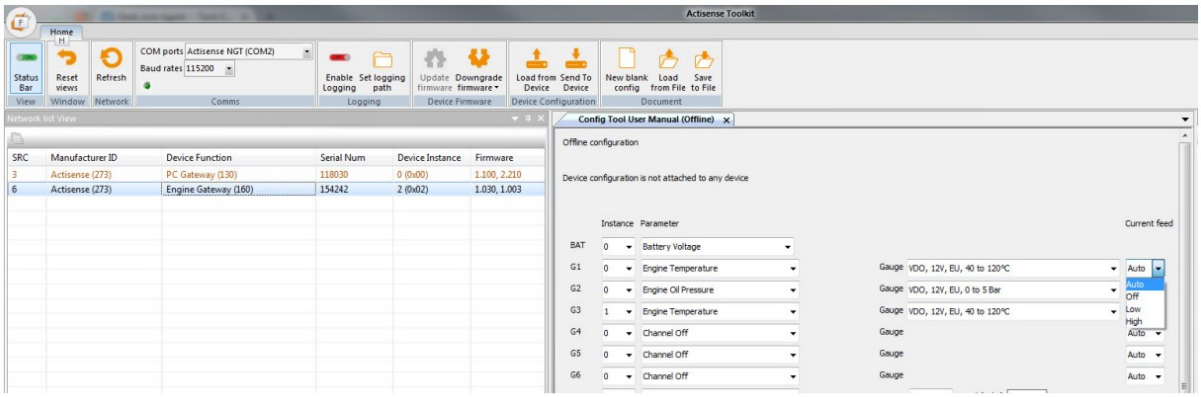
Note: Selecting a particular gauge assumes that the correct corresponding sender is connected to that gauge, hence selecting a gauge is essentially selecting the gauge / sender combination.
If there is no gauge present then it is important to still select any gauge which has the corresponding correct sender range (e.g. 40 to 120deg. C for a temperature sender, e.g. 3 to 180 R for a fluid level sender etc.) and the EMU-1 will automatically detect if there is a gauge present and use the corresponding parameter curve for that sender.
If it is known that there is definitely a gauge present or only a sender present then it is better practice to configure the current feed manually however it may be left on Auto for most installations. See Current Feed below….
If no suitable gauge is present in the drop down list then a custom gauge can be create and added to this list using the Custom Gauge Manager. See pg 12 for details.

Current Feed

The Current feed setting should be left on the default ‘Auto’ option for almost all installations. The Auto setting means that the EMU-1 automatically detects if there is a gauge present and only provides a current feed to the sender if a gauge is not detected.
In certain installations (e.g. when low resistance senders are used and/or the voltage across the sender is very low i.e. < 0.3V) a more reliable and accurate result may be obtained by overriding this automatic detection mechanism to force the Current Feed sent to the sender to High, Low or Off.
The following general rules can be applied:
If there is definitely a gauge present then set current feed to Off.
If there is definitely only a resistive sender present and the range of this sender is known then set current feed either to Low or High depending on the particular resistance range of the sender.
If the senders maximum resistance is <= 330R then set the current feed to High, else set it to Low.
The following table summarises the use of the Current Feed setting:

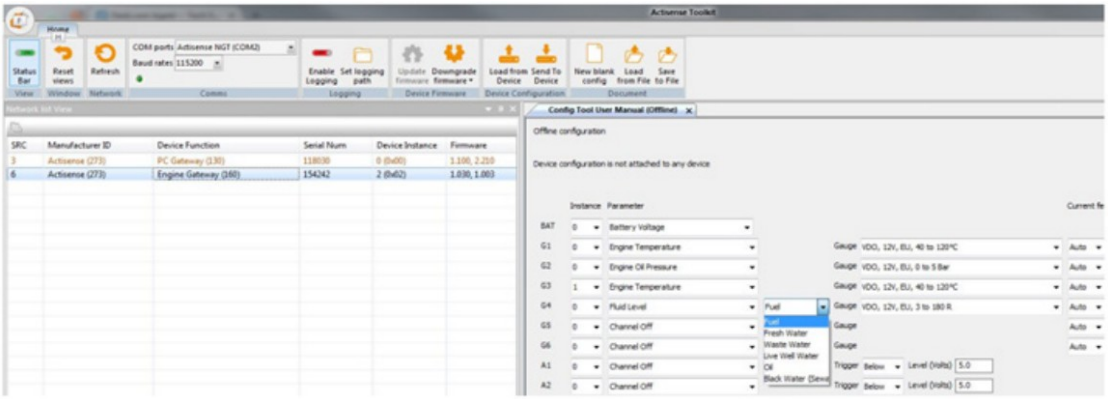
Gauge / Sender	**Current Feed**
Automatic detection of Gauge	Auto
Gauge / resistive sender combo	Off
Voltage output sender	Off
Resistive Sender only (Max resistance <= 330 R)	High
Resistive Sender only (Max resistance > 330 R)	Low

Note: If you experience a “pulsing” of the Gauge needle when the Current Feed is set to Auto, then this indicates that the Current Feed should be set to Off.



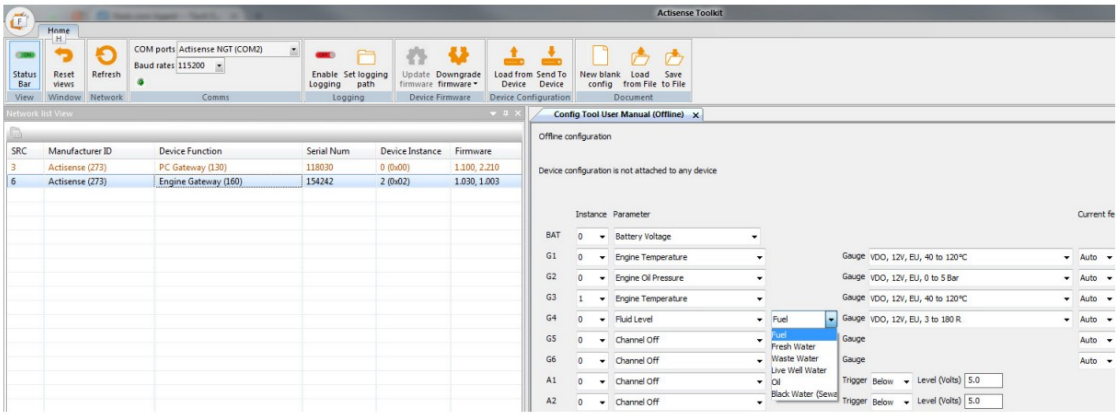
Fluid Level Gauges

If Fluid level is selected as a Gauge Input, a secondary Fluid Type selection list appears to allow the user to choose one of the six Fluid Types. Any combination of Fluid Types and Fluid Instances can be configured (as long as each Gauge Input configuration is unique):
For fluid level gauges it is important to select the Gauge / sender combo according to the resistance of the sender.
All Level gauges represent 0 to 100% in the corresponding parameter curve. (0% being empty, 100% being full)



Configuring the Alarm Inputs

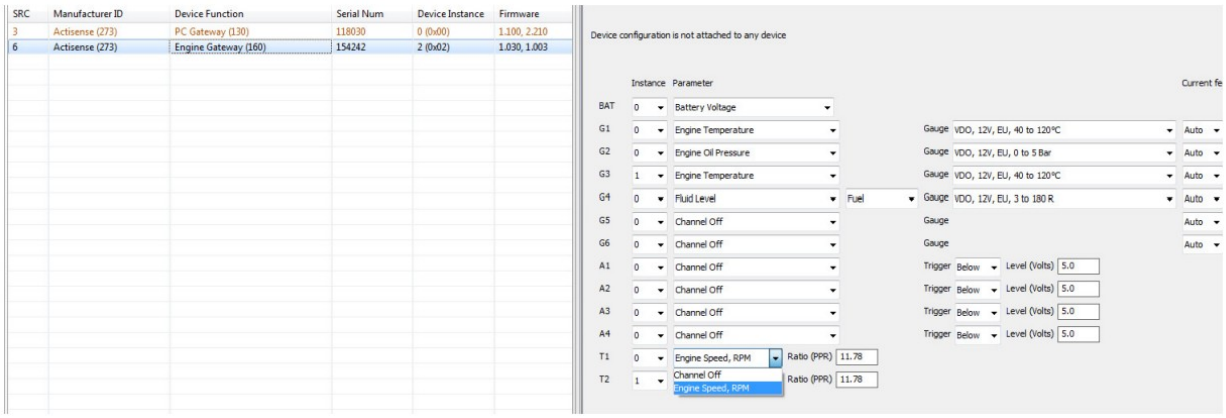
Select the required Parameter type and Instance for each of the A1 to A4 Alarm inputs. Set the Parameter type of any unused Alarm input to Channel Off. If a conflict is created by selecting duplicate Parameter type and Instance setting for two or more Alarm inputs, they will be highlighted to the user in red until the selection is changed and the conflict removed. For example, two inputs cannot be set to Alarm on Over Temperature with the same Engine Instance because a display device will not know how to differentiate between the two.
The point that an alarm will be indicated in the Engine Discrete Status fields of the Engine Parameters, Dynamic PGN (127489) can be configured as Above or Below a user defined voltage trigger level:



The default trigger level is 5 volts but that can be configured to any value which falls within the Alarm input range (of 0.1 – 40.0 volts).

Configuring the Tach Inputs

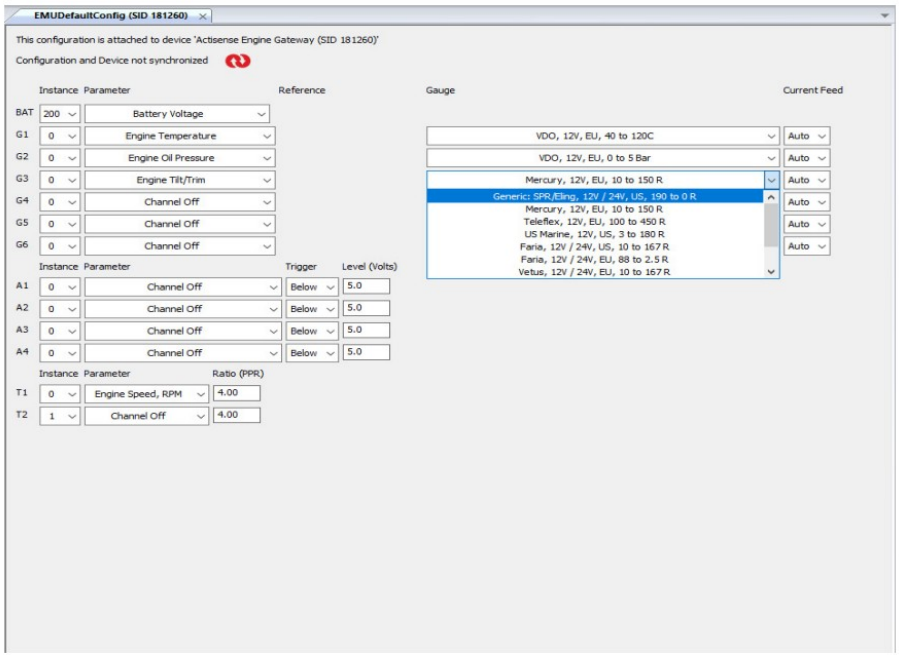
Select the required Parameter type and Instance for each of the T1 and T2 Tach inputs. Set the Parameter type of any unused Tach input to Channel Off. If a conflict is created by setting a duplicate Instance for the two Tach inputs, they will be highlighted to the user in red until the selection is changed and the conflict removed. Both Tach inputs cannot be set to the same Engine Instance because a display device will not know how to differentiate between the two.
The Engine Instance, can in theory be set to any value between 0 and 251, however to be compatible with the majority of NMEA 2000 devices the first engine (typically Port) needs to have Instance 0 and the next engine (typically Starboard) needs to be Instance 1.
The Tach input (and its defined Engine Instance) is used by the EMU-1 to increment the Total Engine Hours field in the corresponding instance of Engine Parameters, Dynamic PGN (127489).
The Pulses Per Revolution (PPR) ratio is either defined by the engine manufacturer in their documentation or by using the calculation methods detailed in the EMU-1 User Manual. Enter the required ratio value (with a maximum of two decimal places) in to the Ratio (PPR) text box:



Tilt / Trim gauges

Same as for Level gauges it is important to select the Gauge / sender combo according to the resistance of the sender when selecting Tilt / Trim gauges. There is no standard for Tilt / Trim and different engine manufacturers use senders with different resistance ranges.
Some gauge manufacturers allocate ranges which can be used to cover senders from different engine manufacturers. Tilt / Trim senders and gauges are not absolute and need to be calibrated on the particular vessel for accuracy.
Tilt / Trim gauges usually represent 0 to 100% in the corresponding parameter curve. (0% being fully down, 50% being mid position and 100% being fully up)
Note: Some VDO gauges allow the indicated range to go beyond the fully up (100%) position, in this case the max. value of 124% will be output.
Note: If a Gauge / Sender Combo is being used (i.e. not just sender only) then it is highly recommended to set the Current Feed setting to “Off” to prevent inaccurate readings.
Below is a table (information sourced from Faria) which can be used as a rouge guide to engine / sender resistance range compatibility:
Note: It may be more accurate and easier to create a custom gauge using the Custom Gauge Manager (see pg 12). This could also allow a custom trim gauge to be created with no need for calibration of the sender.

Engine Manufacturer / Trim Gauge / Common Sender Compatibility		**Resistance (Ohms)**		
Type		Down (0%)	Mid (50%)	Up (100%)
Mercury / Force	A	10	38.7	160
Volvo SX Cobra, SX (HU Mod), SX (NC Mod), Volvo DP-S (NC Mod)	A	11	–	146
Volvo DP	A	10	–	180
Yamaha 2001 and newer	A	10	150	280
Johnson / Evenrude Outboard	B	88	44	10
Suzuki 1999 and newer	B	88	44	2.5
OMC Cobra Stern	C	11	29.5	70
OMC Sea Stern Drive	C	10	44	88
Volvo SX (MD Mod)	C	3	–	70
Yamaha 1996	Y	100	240	450
Yamaha 1997 – 2000	Y	100	330	550



Custom Gauge Manager

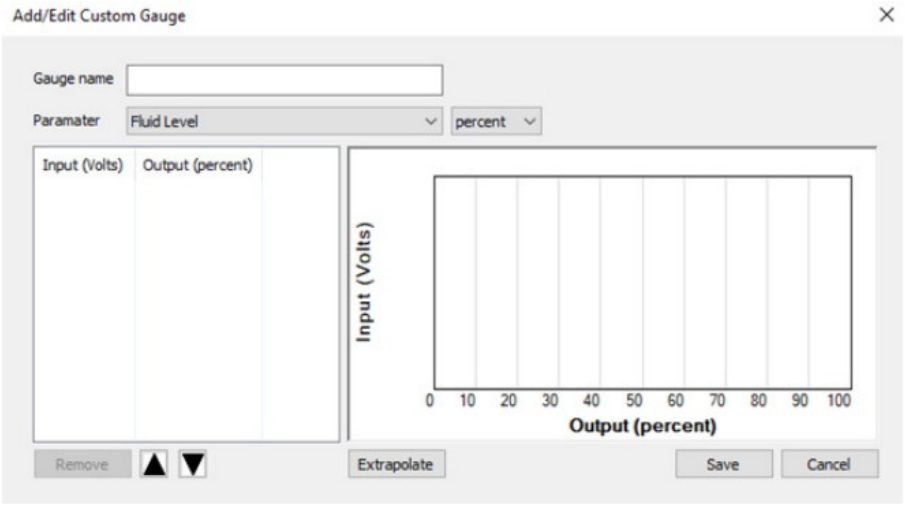
The Custom Gauge Manager (CGM) within Actisense Toolkit is a utility designed for users to create their own gauges by creating a graph consisting of Voltage against the output of the connected sender/gauge pairing.
A physical analogue gauge must be present for the gauge created in the CGM to operate correctly. If there is no analogue gauge present, the EMU-1 will inject current as it is expecting to be operating from a resistive sender alone.

Accessing the CGM

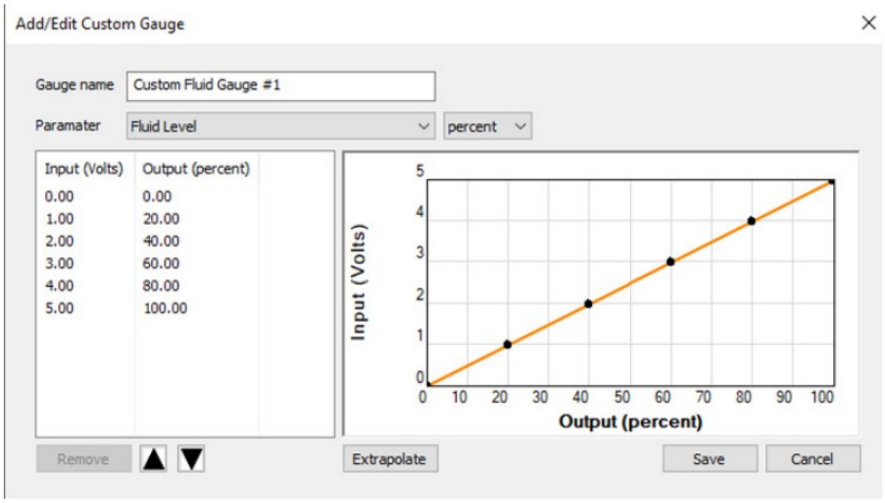
To access the CGM, load Toolkit and select the CGM from the Ribbon Menu, pictured here:

This guide is a simplified step by step for creating a new gauge, however some of the processes still apply if editing an existing one that has already been created.
Once the CGM has opened, the following screen will be presented, which allows you to create a new gauge, edit a previously defined one, or delete old ones which are not required anymore.
Clicking ‘Create New’, will start a new gauge. From here an option box will pop up indicating if you want to use a blank configuration to start from fresh, or a previously configured gauge can be selected from this list and act as a template for the new gauge being created.

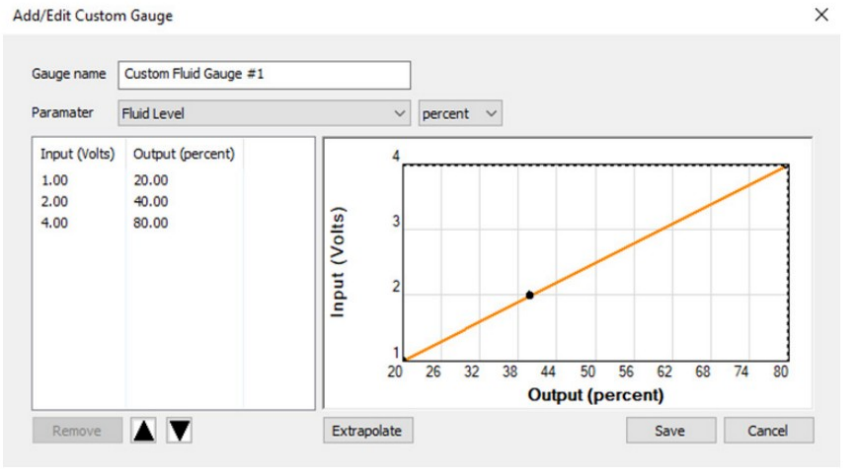
Building the custom gauge is done from this window:



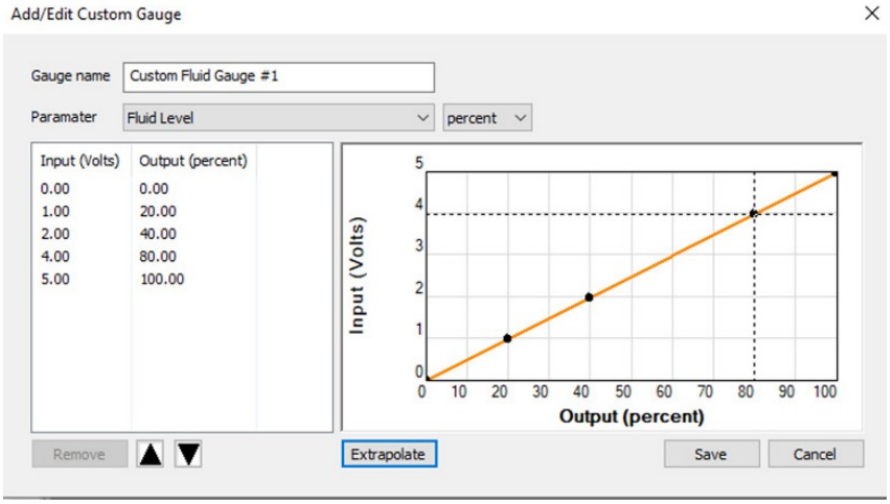
In this Window, the values are entered into the table on the left to start building the graph.
The first step is to name the gauge. It is important to name the gauges, as they will show in the config gauge list when configuring the EMU-1. If the name is relevant, e.g. 'Custom Fluid Gauge #1', then it is obvious that the gauge is custom, which can save headaches later on for installers / technicians who may need to investigate issues should they arise with the engine system etc…
Once the gauge has been named, then the defining parameter for the gauge needs to be set. In this example it is Fluid Level, but others are available.
The left-hand side of the CGM gauge screen is where the values are entered to build the graph on the right side. As the voltages are entered in the Input (Voltage) column, the y-axis of the graph will populate accordingly.
The voltage readings are taken from the gauge input connection on the EMU-1 by using a voltmeter / DMM across the connection terminals.
The Output (percent) column is what fluid level % is present, relative to the voltage value seen on the gauge input. This reading is taken by looking at the physical analogue gauge on the vessel, and then entering this value into the CGM tool.
When building a custom gauge, the more readings entered, the more accurate the output value and graph is going to be. It is always suggested to take a minimum of 3 readings to get a reasonable level of accuracy, containing one low, one middle and one higher value.
Once the values have been entered, the graph is configured, giving the EMU-1 reference values for each voltage reading on the input. Here is an example of a completed custom gauge: (Please note, this is not an actual value range, and has been configured purely to give a graphical representation of how it looks.)



This gauge can then be saved to store it in the gauge library. It can also be saved as an .actj file, which can then be loaded back into Toolkit later.
If a minimum or maximum value cannot be taken, the CGM tool can extrapolate the graph, by using the values already entered. For example, if readings were only entered for 20%, 40% and 80% on the fluid level, the extrapolate function can be used to extend the graph to a defined min / max range (usually 0 to 100 on fluid level).
The extrapolate function, allows a graph which has 2 or more readings (3 readings in this example):



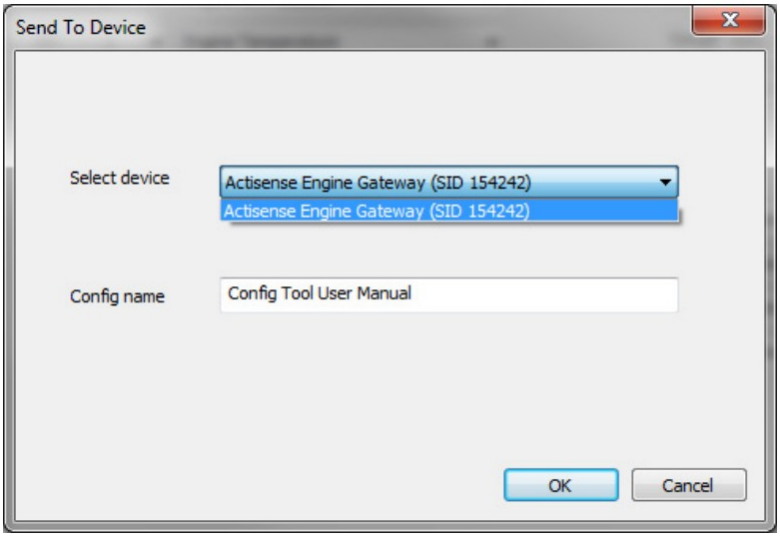
To be turned into a graph with a value for 0% to 100% output, where the EMU-1 then has a reference for voltages from 0-5V in this example:



It is important to remember that the more readings that are added, the more accurate the custom gauge is going to be.
Alongside this, extrapolation with fewer values can result in some values being way off, especially when the graph should be curved but it has extrapolated in a straight line due to lack of data being input.

Completing the Configuration

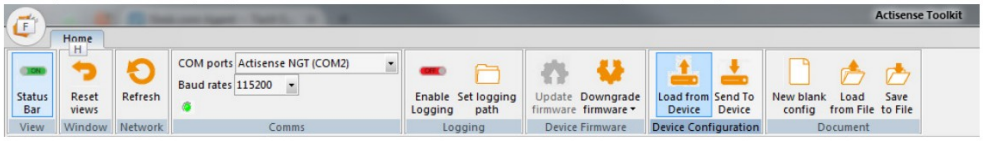
Click on the Send to Device button to send the whole configuration to the selected EMU-1. Ensure the correct EMU-1 is selected in the drop down menu and that the configuration is named as required.



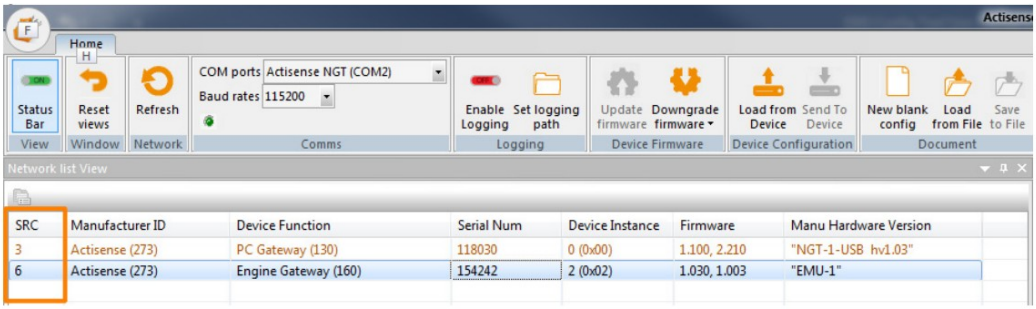
The green progress bar will fill from left to right, followed by a notification to signify that the EMU-1 has been configured successfully.

Viewing EMU-1 Configuration using Actisense Toolkit

Ensure the correct EMU-1 is selected in the Toolkit 'Network List View' tab and click the 'Load from Device' button at the top of the window (or right click on the device in the 'Network List View'). The configuration will need to be named before the settings can load if a name has not been allocated previously.

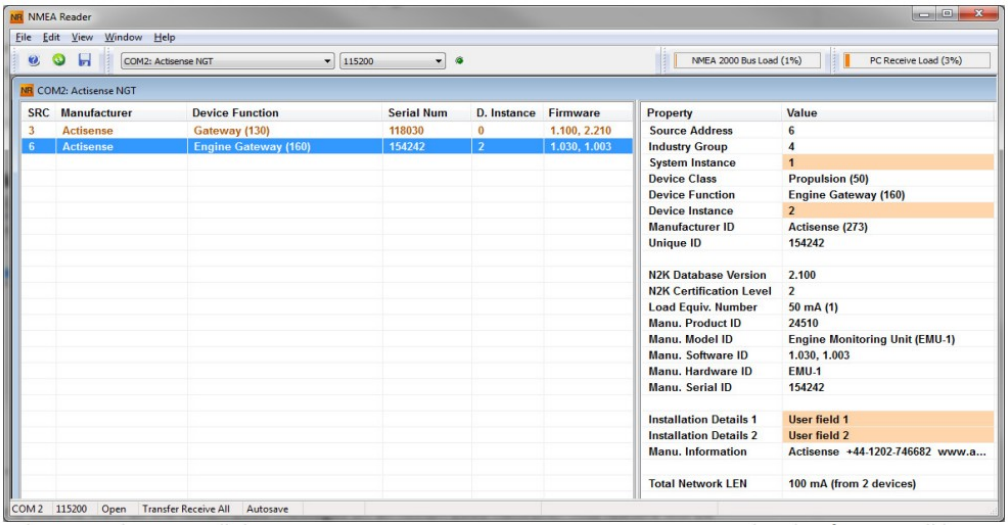


In the left hand pane, the column SRC shows the Source Address of each Device. As discussed in the Instances section above, the Device Instance column is different from the Engine Instance numbers configured in the EMU configuration tab/panel. The Serial Number is a manufacturer unique device identifier and is required when contacting Actisense Tech



The Firmware column details the relevant device firmware versions which should be known before contacting Actisense Tech Support for any help. All Actisense devices have two firmware numbers e.g. 1.030, 1.003 – the first is the Bootloader firmware version and the second is the Main Application version that can be upgraded or downgraded using Toolkit.

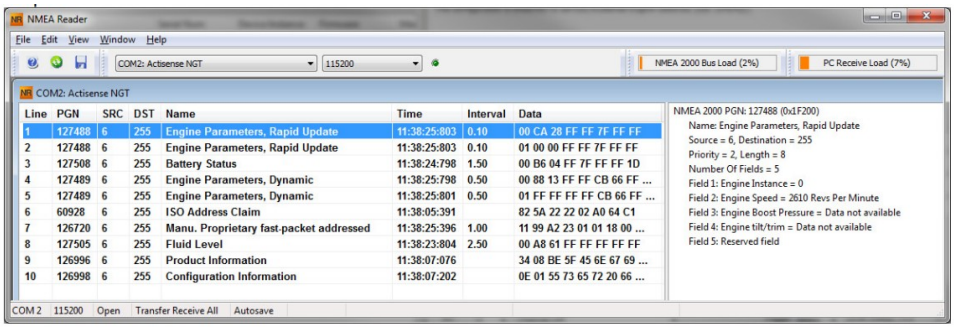
Viewing NMEA 2000 data



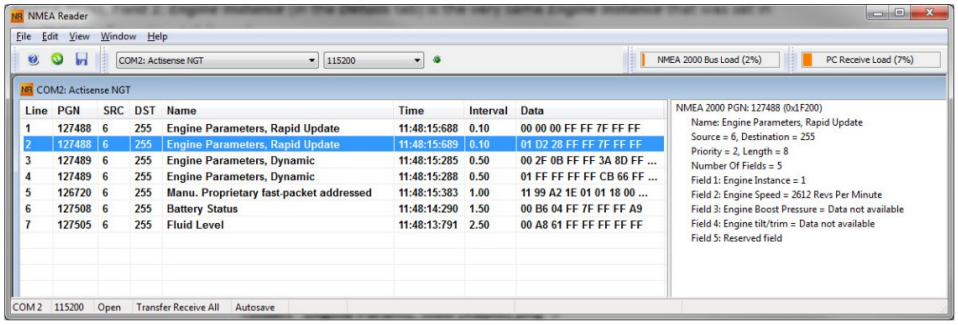
NMEA Reader is used to view all the NMEA 2000 messages on an NMEA 2000 network. This feature will be integrated in to Toolkit in a future update. If the same NGT-1/NGX-1 is to be used for viewing data in NMEA Reader as well as using Toolkit, the COM port in Toolkit will need to be closed (set to 'Offline') before it can be opened in NMEA Reader.

Once the NGT-1/NGX-1 COM port is opened successfully, select the Data View and Details tabs. The decoded details of the selected message in the Data View tab are shown field by field in the Details tab. For all Engine PGNs, Field 1: Engine Instance (in the Details tab) is the very same Engine instance that was set in the EMU configuration tab/panel.

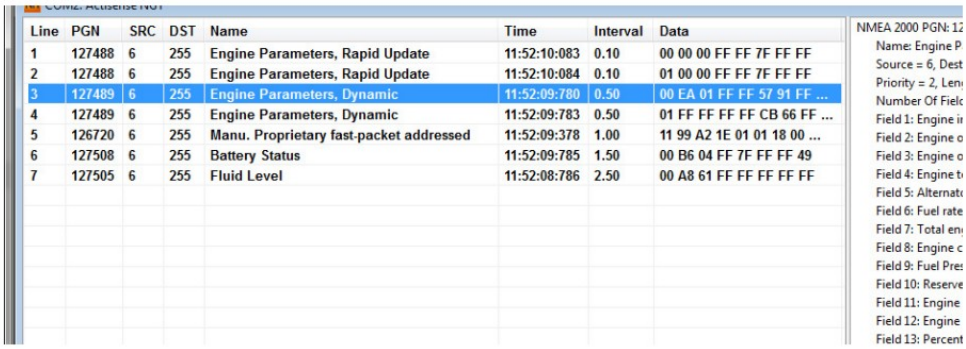
In the example shown, an EMU-1 is on Source Address (SRC) 6 and is sending an Engine Parameters, Rapid Update PGN 127488 for the Port Engine (Engine Instance = 0) that indicates its Tach input 1 is measuring the Port Engine running at a speed of 2610 RPM:



The EMU-1 on Source Address (SRC) 6 is also sending an Engine Parameters, Rapid Update PGN 127488 for the Starboard Engine (Engine instance = 1) that indicates its Tach input 2 is measuring the Starboard Engine running at a speed of 2612 RPM:



The EMU-1 on Source Address (SRC) 6 is also outputting Engine Parameters, Dynamic PGN 127489 and Fluid Level PGN 127505 as shown below:



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Documents / Resources

	Actisense EMU-1 Toolkit Software [pdf] User Guide EMU-1 Toolkit Software, EMU-1, Toolkit Software, Software

References

- Actisense | Marine Network Technology & Vessel Monitoring
- Actisense | Marine Network Technology & Vessel Monitoring
- User Manual