Actisense®

NMEA 2000 to NMEA 0183 Gateway

NGW-1-ISO

(Hardware revision A)

Installation Manual

Issue 1.00

❑ Gateway between the NMEA 2000 network and an NMEA 0183 device, or the serial port of a computer running NMEA 0183 compatible software

❑ Complete electrical isolation (of 1500 volts) between NMEA 0183 serial port and the NMEA 2000 connections

❑ Fully configurable via serial port or through the NMEA 2000 network

Contents

Important notices

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The **Actisense** NMEA 2000 to NMEA 0183 Gateway (NGW-1-ISO) is intended for use in a marine environment, primarily for below deck use. If the NGW-1-ISO is to be used in a more severe environment, such use may be considered misuse under the seller's guarantee.

The NGW-1-ISO has been certified to comply with the European directive for Electro-Magnetic Compatibility (EN60945), and is appropriately CE marked. Operation of the unit should be in conjunction with appropriate CE approved shielded connectors and cabling used in accordance with the CE directive EN60945. Any EMC related issues should be reported to Active Research immediately to allow the company to rectify or resolve EMC related problems in accordance with its obligations under EN60945.

If the unit is misconnected so that compliance failure occurs, the company shall not be held responsible for compliance failure until suitable EMC guidelines for connection are seen to have been taken.

Notices

When using this document, please note the following:

The products described in this manual and the specifications thereof may be changed without prior notice. To obtain up-to-date information and/or specifications, contact Active Research Limited or visit the **Actisense website (www.actisense.com)**.

Active Research Limited will not be liable for infringement of copyright, industrial property right, or other rights of a third party caused by the use of information or drawings described in this manual.

Active Research Limited will not be held responsible for any damage to the user that may result from an accident during operation of this unit when used in accordance with this document.

Foreword

At Active Research Limited, we recognise that instructions are often skipped, so we have aimed to write this document in an informative and direct manner that will aid the user. We have covered all the points a typical user needs to know.

Please read all sections before installing and using the NGW-1-ISO, and any referenced software programs.

Introduction

The NGW-1-ISO allows NMEA 0183 electronic equipment to be connected to a vessel's NMEA 2000 network. This can allow equipment installers to adopt the NMEA 2000 network early, whilst connecting any existing NMEA 0183 devices to the new bus standard.

The NMEA 2000 network can reduce installation costs of marine equipment and greatly reduce a boat's wiring harness complexity, leading to improved reliability and reduction in unnecessary weight. Now only a single cable is required from the bridge to the engines, sensors and all other NMEA 2000 instruments on the boat

NMEA 2000 uses the "CAN Bus" system (prevalent in most modern cars), to provide the quality and security of data transmissions that the NMEA 0183 bus can never hope to provide. This enables NMEA 2000 products to achieve better transmission reliability in the passage of data through the vessel.

The NMEA Gateway can transfer data from an NMEA 0183 source and place that data on the NMEA 2000 bus, or it can take NMEA 2000 data from the NMEA 2000 bus and make it available to the NMEA 0183 instrument.

Full information on the complete **Actisense** product range and supporting software packages can be found on the **Actisense website (www.actisense.com)**.

Technical features

High-speed 32-bit ARM processor capable of up to 40 million instructions per second.

Flash ROM technology that supports automatic programming for quick and easy updates, 10,000+ erase cycles and a 10-year Data Retention provides carefree user configuration.

On-chip memory store allows buffering of short term NMEA data, allowing the unit to smooth short-term peaks in the NMEA data flow.

Fully configurable via the serial connection or over the NMEA 2000 network allowing optimisation of the serial interface to better suit the system it is a part of.

NMEA 2000 interface offers 2500 volts of opto-isolation, protecting the system even during the most extreme fault conditions and fully compliant with the NMEA 2000 standard for interfacing with the NMEA 2000 network.

NMEA 2000 network powered to offer easy installation with no need for a direct connection to the vessels main battery supply. The NGW-1-ISO takes all its power from the NMEA 2000 network connection and contains a clever built-in power isolator to power its serial circuitry without the need of an extra battery source. This creates total isolation between the serial and NMEA 2000 circuitry to completely eliminate the risk of ground loop faults occurring and the resulting damage.

Software updates

The NGW-1-ISO's built-in firmware is held in "flash" memory, allowing quick and easy upgrades using either the latest **NGW-1-ISO ActiPatch**, or alternatively the **NMEA 2000 Gateway Configuration Tool** running on a PC connected to the NGW-1-ISO.

It is our policy to provide these updates free on the **Actisense website (www.actisense.com)**, so that the NMEA 2000 to NMEA 0183 Gateway (NGW-1-ISO) can be further developed over time, and should there be any bugs reported in the firmware, they can be promptly fixed without the unit requiring to come out of commission.

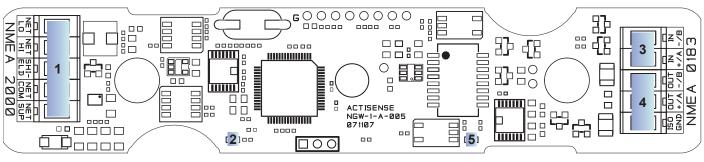# Connecting devices together

The NMEA 2000 standard

The NMEA 2000 system is a low-cost data network operating at 250 kbits/sec utilizing the Controller Area Network (CAN). Multiple devices can be connected together on a single trunk cable to simply and easily share information between themselves.

NMEA 2000 uses a shielded cable and a "differential" signalling scheme, whereby two wires are used to transmit the NMEA data named CAN High and CAN Low. These connections will be labelled as "NET HI" and "NET LO" respectively. Power is also supplied through the NMEA 2000 cable named NET Supply and NET Common. These connections will be labelled "NET SUP" and "NET COM" respectively on the PCB.

Please refer to the **Connecting to the NMEA 2000 Network** section for an example of these connection methods.

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Connections

Figure 1 – All external connections

Figure 1 shows an internal view of the NGW-1-ISO Printed Circuit Board (PCB).

1. **NMEA 2000 Interface**
   A five way screw terminal block is supplied for connecting the NMEA 2000 cable. The CAN interface is fully compatible with the NMEA 2000 standard.

   Actisense supplies a pre-fitted four-core screened cable for the NMEA 2000 connection, fitted with a male micro-fit connector. The colour codes used for this cable are:

Wire colour	NMEA 2000
Shield / Screen	SHIELD
Blue	NET LO
White	NET HI
Black	NET COM
Red	NET SUP

   If you need to use your own NMEA 2000 cable, the five way screw terminal block is provided within the NGW-1 to allow easy connection, along with a spare cable gland that should be fitted on to the new cable to help maintain the water protection level.

   Any such cable is required to conform in full to the NMEA 2000 specification and be no longer than 6 metres (maximum drop length).

2. **NMEA 2000 indicator LED**
   This LED flashes when NMEA 2000 data set to be transferred is **received** by the NGW-1-ISO. It can be clearly seen through the NGW-1-ISO's translucent lid when the case is closed.

3. **Serial opto-isolated input.**
   Two screw terminals are provided to connect the serial input. The serial input is of the differential opto-isolated type and uses the unique **Actisense** low current drain circuitry (2 mA @ 2.0 V).

4. **Serial ISO-Drive output.**
   Three screw terminals are provided to connect to the serial ISO-Drive output. The serial output comprises of three connections: '**+**', '**-**' and '**Ground (GND)**'. The colour codes used for this cable are:

Wire colour	NMEA 0183
Shield / Screen	SHIELD
Blue	ISO Out B / -
White	ISO Out A / +
Black	Opto In B / -
Red	Opto In A / +

   In most installations, this ground (GND) can be left disconnected. It is useful where an "RS485" or "IEC61162-2" 3 terminal type connection is required, or where ground continuity is needed between source and target connections. No damage will be caused by connecting to this GND in error. Always follow the connection diagrams shown in this manual to ensure correct operation.

5. **Serial data indicator LED**
   This LED flashes when serial data set to be transferred is **received** by the NGW-1-ISO. It can be clearly seen through the NGW-1-ISO's translucent lid when the case is closed.

To open the NGW-1-ISO, remove the two screws in the base of the unit, then slide off the top of the case. The cable glands need to be slid out from the top of the case in order to access the internal connections. The NGW-1-ISO circuitry will be left attached to the base of the unit and the two supplied cables attached to their connectors.

Note: When opening the NGW-1-ISO case, be aware that the circuitry inside is not 100% protected against static electricity. Please ensure that, when opening the case, you use precautions against static damage by only touching the connector block and by holding the unit by its plastic base. In this way, the risks of static damage will be minimised.
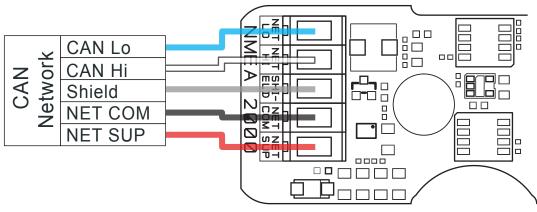
Connecting to the NMEA 2000 network

Figure 2 – NMEA 2000 connections

NMEA 2000 connections

The **Actisense** NGW-1-ISO is designed to be connected to the vessel's NMEA 2000 network using the supplied, pre-fitted Actisense cable.

If a different length cable is required, an NMEA 2000 certified cable of the required length (maximum 6 metres) should be connected to the vessel's NMEA 2000 network using a standard NMEA 2000 connector.

The standard wiring connection can be seen in Figure 2.

Note:
1. Wire colours are for guidance only. The colours given relate to the supplied Actisense cable and the NMEA 2000 standard cable definition.
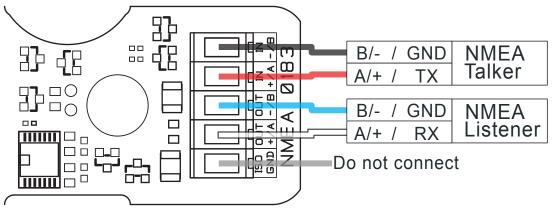
Connecting to an NMEA 0183 device

Figure 3 – NMEA 0183 connections

NMEA 0183 connections

The **Actisense** NGW-1-ISO is designed to be connected to an NMEA 0183 device using the supplied, pre-fitted Actisense cable.

If a different cable is required, the cable specification (quality) and length should be considered. The maximum length of such a cable is dependent on the input & output specifications of the NMEA 0183 device and cable quality.

The NGW-1-ISO has a very sensitive input and powerful output to help maximise the working cable length.

The standard wiring connection can be seen in Figure 3.

1. Wire colours are for guidance only. The colours given relate to the supplied Actisense cable.
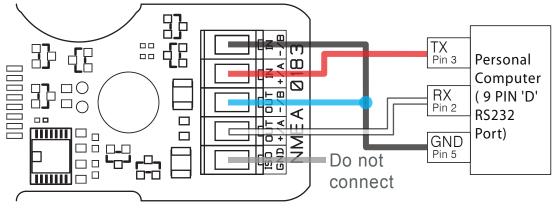
Connecting to an RS232 (PC) port

Figure 4 – Personal Computer / RS232 port connections

RS232 Connections

The NGW-1-ISO can be connected to a PC communications (RS232) port using the supplied cable and a connector with the following specification:

1. A minimum of 3-cores are required in a shielded cable. Higher quality cable will naturally yield higher performance / higher Signal-to-Noise Ratio (SNR). Most typical cables have two twisted pairs inside. In this case, use one pair for the **TX** line and one for the **RX** line. Use the spare wire in each pair as ground, and connect the cable shield to ground only at the computer end.

2. A D-type female (socket) connector for the PC end of the cable.

3. The **OUT +/A** of the NGW-1-ISO should be connected to the **RX** of the computer (standard D-type, pin 2) and the NGT-1-ISO **IN +/A** should be connected to the **TX** of the computer (pin 3).

4. **Connect the IN -/B and OUT -/B together** and connect to the PC's serial port ground (pin 5).
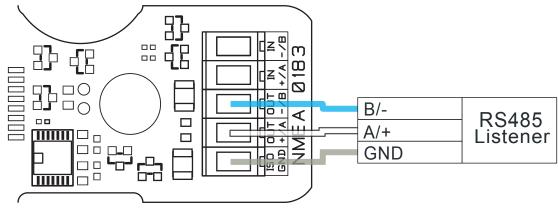
Connecting to an RS485 (IEC 61162-2) listening device

Figure 5 – RS485 / IEC 61162-2 port connections

RS485 Connections

The ISO-Drive output of the NGW-1-ISO can be connected to an RS485 Listener that requires differential drive plus a ground connection as shown in figure 5.

The standard wiring connection can be seen in Figure 5.

1. Wire colours are for guidance only. The colours given relate to the supplied Actisense cable.

Specifications

Parameter	Conditions	Min.	Max.	Unit
Supply				
Supply voltage		8	35	V
Supply current (see note 1)	Supply voltage = 12v	26	30	mA
	Supply voltage = 24v	16	18	mA
NMEA 2000 CAN Bus line (CAN-H; CAN-L) Transmitter				
Recessive bus voltage	VTXD = VDD; no load.	2.0	3.0	V
Dominant bus voltage CAN-H	VTXD = 0.8V	2.75	4.5	V
Dominant bus voltage CAN-L	VTXD = 0.8V	0.5	2.25	V
Recessive differential output voltage	VTXD = 2V; no load	-500	50	mV
Dominant differential output voltage	40Ω < RL < 60Ω	1.5	3.0	V
Short circuit output current CAN-H	VCAN-H = -5V	-	-200	mA
Short circuit output current CAN-L	VCAN-H = -40V, +40V. (see note 2)	-	200	mA
NMEA 2000 CAN Bus line (CAN-H; CAN-L) Receiver				
CAN-H, CAN-L common-mode input resistance		5	50	KΩ
Differential input resistance		20	100	KΩ
Opto-isolated Input				
Input voltage tolerance	Continuous operation	-15	+15	V
	Short term operation (< 1 sec)	-35	+35	V
Differential input voltage	Required level for data to be detected	1.8	-	V
Input current		-	2	mA
Input to Ground				
Baud rate	Configurable Baud rate	4800	230400	bps
ISO-Drive Output				
Output current	RS485 / RS422 / RS232 compatible	-	20	mA
Differential output voltage	100 ohm load	2.1	-	V
Output to Ground	Full Galvanic isolation protection	-	1500	V
Baud rate	Configurable Baud rate	4800	230400	bps
General				
Ambient operating temperature		-20	+70	°C

Table 2 – NGW-1-ISO specifications

All specifications are taken with reference to an ambient temperature (T_A) of +25°C.

Note:
1. Current consumption measured under no-load conditions

Troubleshooting guide

This guide will concentrate on all relevant troubleshooting issues above simple cable connection faults. Therefore, the cables between the NGW-1-ISO hardware and any other devices should be checked as a matter of course, before continuing with this guide.

Status LEDs

The NGW-1-ISO hardware has two bright LEDs that can be seen through the case to indicate when data is **received** from either the NMEA 0183 device or NMEA 2000 network connection. It is an important point to note that these two LEDs can only show when their respective data is RECEIVED; it is not possible to show both transmit and receive simultaneously on a single colour LED.

These LEDs can be used to debug potential problems. If both an NMEA 0183 'talker' and a 'listener' are connected, it is possible to analyse which is working by disconnecting one of them or by stopping the computer from sending data.

Sequence	Description
NMEA 2000 LED does not flash when the data is received from the NMEA 2000 network	Check that the NGW-1-ISO is connected to the NMEA 2000 network, that the NMEA 2000 network is operational, and that the required PGN messages are selected for transfer by using the **NGW Configuration Tool**.
Serial LED does not flash when Serial data is being received	Check that the NGW-1-ISO is connected correctly to the NMEA 0183 device, that the same Baud rate has been set on both devices, and that the required messages are selected to be transferred by using the **NGW Configuration Tool**.
Both LEDs flash together, once every 10 seconds	Indicates that the NGW-1-ISO is powered but no data is received from either connection. If data should be being transferred through then check that the required PGN messages are selected by using the **NGW Configuration Tool**.
	If the error persists, **please contact Actisense support to help trace the issue before considering the return of the product.** If Actisense support concludes that the NGW-1-ISO unit should be returned to **Actisense** (refer to the **Company Information** section), a **Returns Number will be issued by the support engineer.** **The Returns Number must be clearly visible on both the external packaging and any documentation returned with the product. Any returns sent without a Returns Number will incur a delay in being processed.**

Table 3 – Diagnostic LED

Product order codes

NGW-1-ISO	**NMEA 2000 ↔ Serial Interface with ISO-Drive** Standard version required to connect the **NMEA 2000** network to an **NMEA 0183** device or computer serial port
NGW-1-USB	**NMEA 2000 ↔ USB Interface** Special version required to connect the **NMEA 2000** network to the USB port of a computer running **NMEA 0183** compatible software

Company Information

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The Actisense NGW-1-ISO allows an NMEA 0183 device to talk and listen to NMEA 2000 devices on an NMEA 2000 network.
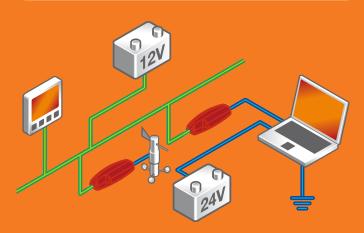
By translating NMEA 2000 data into the NMEA 0183 equivalent (and vice-versa), the NGW-1-ISO enables information to be shared between NMEA 0183 devices and any instrument on the NMEA 2000 network.

The isolating ISO-Drive connection of the NGW-1-ISO makes it one of the best and safest ways to connect your NMEA 0183 device to an NMEA 2000 network.

Just connect and relax, knowing that Actisense has it secured.

Benefits

- All NMEA 2000 instruments on the network can see translated NMEA 0183 data sent from NMEA 0183 device
- PC software can receive translated data from any NMEA 2000 instrument
- Electrical isolation separates the two networks, protecting against ground loop faults. This creates a protected computer and a safe installation
- The NGW-1 device is compatible with all NMEA 0183 devices (both single-ended and standard differential types)

Specifications

NMEA 2000 Connection

- NMEA 2000 network is opto-isolated from the serial connection to offer 1500 volts of protection
- NMEA 2000 current draw 30 mA typical
- Terminal block available for user cable connection
- Cable length 1.5 metres

Opto & ISO-Drive Connection

- Exceeds all NMEA 0183 input/output specifications
- Compatible with RS422 (NMEA), RS232 & RS485
- Baud rates 4800 to 230400
- Cable length 1.5 metres

System Requirements

- Supported OS's: Windows (2000, XP and Vista). Check website for other versions
- No drivers required

Environmental

- Recommended operating temperature: -20°C to +70°C
- Splash proof plastic casing provided with sealing cable glands certified to IP54
- Stainless steel case screws
- Humidity: 0-80% RH

Guarantee

- 3 years return to base

Certifications

- CE (EN60945)
- Tested and certified NMEA 2000 compliant