



# NMEA Data Multiplexer

## NDC-4

For all variants:

NDC-4, NDC-4-USB, NDC-4-ASW  
NDC-4-AIS, NDC-4-AIS-USB

# Install User Manual

Issue 1.08

- Multiple talker interface for use with the NMEA 0183 standard. Serial data networking of marine electronic devices / instruments.
- RS232 & USB 1.1 & 2.0 PC interfaces to the NMEA 0183 standard.
- Actisense ISO-Drive technology for a fully isolated serial data system.
- Intelligent NMEA filtering on all inputs allows smart removal of NMEA data.
- Re-configurable to work as an NDC-4-ASW Autoswitch to allow the automatic switching between up to 4 NMEA inputs.



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## Important Notices

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The **Actisense** NMEA Data Multiplexer / Combiner / Autoswitch (NDC-4) is intended for use in a marine environment, primarily for below deck use. If the unit is to be used in a more severe environment, such use may be considered misuse under the seller's guarantee.

The **Actisense** NDC-4 has been certified to comply with the European directive for Electromagnetic 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 Limited** immediately to allow the company to rectify or resolve EMC related problems in accordance with its obligations under EN60945.

If the unit is connected such that compliance failure occurs beyond the company's control, the company shall not be held responsible for compliance failure until suitable EMC guidelines for connection are seen to have been taken.

## Notices

The products and specifications described in this guide may be changed without prior notice. To obtain the latest information visit [www.actisense.com](http://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.

The NDC-4 must be used in accordance with the manufacturers instructions. **Active Research Limited** will not be held responsible for any damage or injury, direct or otherwise, as a result of failure to adhere to these instructions.

The NDC-4 does not validate the NMEA data it receives in any way. Neither the NMEA sentence checksum, nor the data contained within the NMEA sentence is validated. Therefore, the electronic device(s) supplying the NDC-4 with NMEA data retain(s) the sole responsibility for the NMEA data's validity.

## Foreword

**Actisense** recognises that instructions are often skipped, so we have aimed to write this document in an informative, yet direct manner that will aid the user. We have tried to cover all the points a typical user may need to know. Please read all sections before installing and using the **Actisense** NMEA Data Multiplexer product and any related software programs.

## Introduction

The **Actisense** NDC product range developed out of the requirement to solve two fundamental problems with the existing marine industry NMEA 0183 communications standard.

In theory, the NMEA 0183 standard allows any suitably designed marine electronic device to share its gathered information with any other device on a vessel. Unfortunately, there is one very large drawback with this standard - only one device on a connected network can actually send data (a single talker), with multiple devices (determined by the current limit of the sending unit) listening to that data (multiple listeners).

If the vessel owner has an instrument that ideally requires the data output of two or more devices, for example a chart-plotter, then the owner has no alternative but to settle on connecting only the most important device (that which supplies the most used information), normally that is the GPS unit. All other devices cannot be used.

What happens if the owner prefers the vessels gyro compass heading output to that of the GPS, or requires that the current depth be displayed on the plotted chart to help avoid the possible case of running the vessel aground on a shifting sand bank? The NMEA 0183 standard cannot supply an answer to those questions as it can handle only one transmitting device.

These two elementary problems can be solved simply and easily with the **Actisense** NMEA Data Multiplexer's very flexible design approach.

Alternately, if the vessel has two or more identical NMEA devices (e.g. GPS's or depth sounders) the system solution could be to use the NDC-4 as an NMEA Autoswitch to select the highest priority source.

Full information on the complete **Actisense** product range can be found on the [Actisense website \(www.actisense.com\)](http://www.actisense.com).

## General Features

### 4/5 Opto-isolated Input Ports

Each Opto-isolated input port has a priority level. This defaults to the logical order matching the port numbers, i.e. port 1 has the highest priority and port 4 has the lowest. When the USB cable is not plugged in (or not powered), OPTO IN 0 can be used as a fifth fully compliant NMEA 0183 data input, appearing last in the priority list.

### 2 ISO-Drive Output Ports

These outputs combine the input data into standard NMEA outputs with independent Baud rate selection options, defaulting to 4800 (OUT 1) and 38400 (OUT 0). If the combined Baud rate of all NMEA inputs exceed the output Baud rate, it is possible that the combined data could exceed the data carrying capacity of the NMEA output channel. The multiplexer contains special software to ensure that when the output channel is overloaded, new data of the same type as older data, still in the buffer, will overwrite the older sentence.

### A PC RS232 or USB Bidirectional Port

The RS232 compatible Port 0 (OPTO IN 0 plus ISO OUT 0) and the USB interface ensures that any device (or PC), that has an RS232 or USB port, receives all the input NMEA data, and can add its own NMEA data to ISO OUT 1. This allows for the possibility of a “virtual cockpit” of instruments displaying all available data in any manner the user requires (available from a number of manufacturers).

These connections also allow the unit to be updated via the freely available ActiPatch flash upgrade software that will be made available on the **Actisense** website when the NDC-4 firmware has been enhanced.

#### Notes:

1. When the USB cable is plugged in and powered up, it disables OPTO IN 0 on the NDC-4.
2. NDC-4 variants that don't come with a USB cable can be upgraded by purchasing a USB Upgrade Kit.

## Technical Features

**Flash ROM technology** that supports automatic programming for quick and easy updates, 100,000+ 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.

**A diagnostic LED** indicates the operation mode of the NDC-4, if any faults have been detected, or the peak load currently on any one of the NMEA inputs.

**High-speed 32-bit ARM processor** capable of up to 40

million instructions per second.

**The NMEA 0183 inputs** are galvanically opto-isolated differential inputs, protecting against common mode voltage differences of up to 2500v. Fully compliant with the NMEA 0183 standard specification and compatible with RS232, RS422 and RS485 signal levels. The typical operating voltage is 2.0v to 15.0v and can withstand +/- 35v continuously and +/- 40v transients. Compatible with both differential and single ended inputs.

**ISO-Drive output technology** unique to **Actisense**, protects against common mode voltage differences of up to 1500v. The output automatically changes between differential and single ended drive depending upon the type of instrument it is connected to. Fully compliant with the NMEA 0183 standard specification and compatible with RS232, RS422 and RS485 signal levels.

**Wide battery input voltage range** to offer maximum compatibility, the NMEA 0183 NDC-4 can operate from a battery supply anywhere between 8 and 35 volts.

**USB powered** option is available when the battery source is not present. When the main battery is present, the USB power drain is minimal. **WARNING:** The USB and battery grounds are not isolated, see **“USB Warning” on page 9**.

**Very tough Polycarbonate case** is certified to IP66 (Protection against heavy seas, or powerful jets of water), the addition of non-acid based marine sealant to the gasket can increase this to IP67 (Protection against immersion). Being Polycarbonate, it is also incredibly strong, offering a wide temperature range and superior protection to the electronics inside.

**Robust Nylon grommets** are certified to IP68 (Protection against complete, continuous submersion in water).

**Note:** To achieve this level of water integrity all glands must be occupied by round-section cables of between 4.5mm and 10 mm or be replaced by blanking plugs.

**Large range of possible cable diameters** of between 4.5 mm and 10 mm, single or multi-pair wire types can be easily accepted.

**An NMEA 0183 Checksum** will be added to any sentence received without one to ensure that they can be accepted by an NMEA 0183 Listener that expects a checksum. This feature makes the NDC-4 essential even when interfacing a single v.1.5 NMEA 0183 Talker to a v.2.0 (and above) NMEA 0183 Listener.

## Software Updates

The NDC's built-in firmware is held in 'flash' memory, allowing quick and easy upgrades using a simple Microsoft Windows™ NT/2000/XP/Vista/7 user interface program (ActiPatch) running on a connected PC.

It is our policy to provide these updates free on the [Actisense website \(www.actisense.com\)](http://www.actisense.com). This upgrade can be performed with the unit completely in-situ, via a PC connected to either Port 0 (OPTO IN 0 and ISO OUT 0) or the USB port.

## Connecting devices together

### The Basics

NMEA data is transmitted from an information source such as GPS, depth sounder, gyro compass etc. These data sending devices are called "Talkers".

Equipment receiving this information such as a chart-plotter, radar or NMEA display is called a "Listener".

Unfortunately, only one Talker can be connected on to a single NMEA 0183 system at any one time. Two or more Talkers are simply not possible because they are not synchronised to each other, and will attempt to 'talk' at the same time (over each other), resulting in corruption of the NMEA data, and potentially in disaster if valuable data such as navigation information is lost or corrupted so that it is incorrect and/or misleading.

**Actisense** produces a full range of products to solve all NMEA interfacing requirements.

Please visit the [Actisense website \(www.actisense.com\)](http://www.actisense.com) for full details on these and other **Actisense** interfacing, Depth sounding and NMEA 2000 products.

### The NMEA Signals

The NMEA 0183 system v2.0 and later uses a "differential" signalling scheme, whereby two wires are used to transmit the NMEA data. These connections will be labelled as either NMEA 'A' and 'B' or NMEA '+ ' and ' - ' respectively, depending on the instrument and manufacturer.

When connecting between different manufacturers, there can be some confusion, but it is simple and easy to remember: NMEA 'A' connects to NMEA '+ ' and NMEA 'B' connects to NMEA ' - '.

## The Different NMEA Standards

The NMEA 0183 specification has slowly evolved over the years, so connecting one device to another is not always a straightforward matter. The earlier versions of NMEA 0183 (before v2.0, as detailed above), used slightly different connection methods and signal levels: the instruments had just one "NMEA" data line ('Tx' or 'Out'), and used the ground as the other line - similar to the way a computer serial port works. This connection method is referred to as "single ended" instead of the "differential" method used by NMEA 0183 v2.0 devices.

The data format is largely the same between both systems, with v2.0 adding some extra sentence strings, and removing older (redundant) sentence strings from the specification. The situation is further complicated, as many manufacturers still use the old ("single ended") method of connection because it is cheaper to implement.

So how can an older type NMEA device be connected to a newer type device?

Care is needed – it is possible to damage or overload the output of a newer differential device if it is incorrectly connected to an older device. This is because the older devices used ground as the return, whereas the newer devices actually drive the NMEA ' - /B ' line between 5v and 0v. Thus, connecting this output to ground will result in high currents being drawn by the driver instrument, resulting in potential overheating and damage to the driver circuits.

However, the new **Actisense** ISO-Drive technology allows the user not to worry about this potentially damaging incompatibility. Instead, an ISO-Drive output can be connected to an old type single-ended system, by connecting the NMEA '+ /A ' output from the ISO-Drive to the single-ended NMEA 'R<sub>x</sub>' or "In" input of the device. Connect the NMEA ' - /B ' output of the ISO-Drive to the ground of the single-ended device. This provides the required data signal return current path.

To connect an old type single-ended device to an OPTO IN input, connect the NMEA 'Tx' or 'Out' output from the single-ended driver to the OPTO IN '+ /A ' input of the NDC-4. Connect the ground line of the single-ended output device to the OPTO IN ' - /B ' input of the NDC-4. This provides the data signal return current path. If the NMEA ' - /B ' input is left floating, then data corruption / errors may occur.

Please refer to "[Connecting to NMEA devices](#)" on page 8 for examples of these connection methods.

## Connections

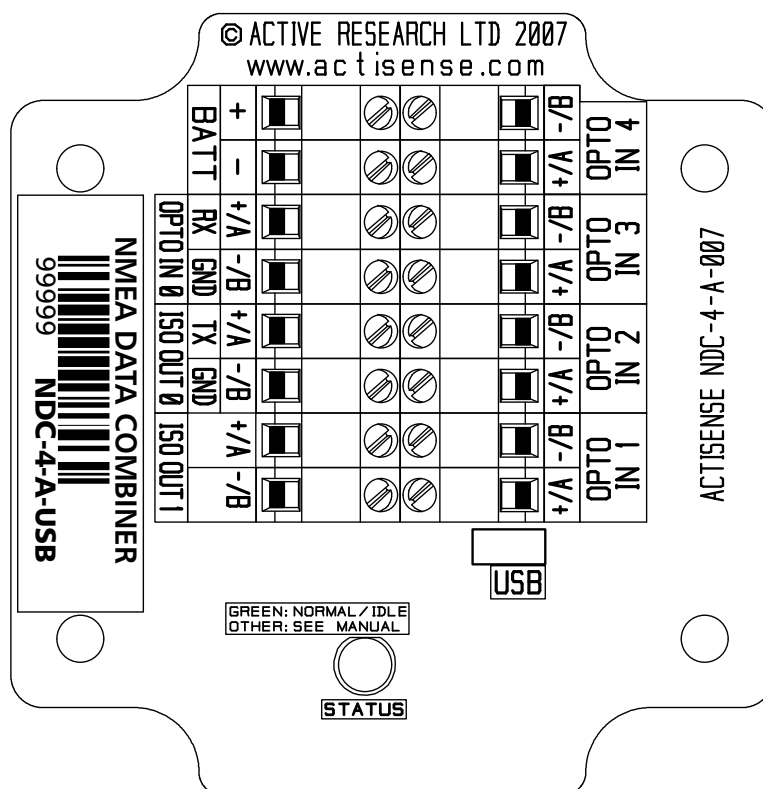


Figure 1 – All external connections

The NMEA Data Multiplexer (NDC) has screw-terminal “Phoenix” type external connections for: -

### 1. Five Opto-isolated Inputs.

All inputs are of the differential opto-isolated type and use the unique **Actisense** low current drain circuitry (2mA @ 2.0v) to conform in full with the NMEA 0183 marine electronic device network communication standard, and are flexible enough to interface to most fully and partially compliant devices.

### 2. Two ISO-Drive Outputs.

The ISO-Drive outputs comprise of two connections: ‘+/A’ and ‘-/B’ and conform in full to the NMEA 0183 standard.

### 3. RS232 Compatible Input/Output Option.

The ISO OUT 0 and OPTO IN 0 connections can be used as a bidirectional RS232 compatible port and is designed for direct connection to a Personal Computer (PC) or other marine device capable of interfacing to a standard RS232 port.

When a USB cable is powered and plugged into the NDC-4, this port switches to output only - i.e. the RS232 input (OPTO IN 0) no longer operates.

### 4. A USB Input/Output (USB Variants Only).

The USB connector is designed for direct connection to a PC's USB port. Once the USB cable is powered and plugged into the NDC-4, Port 0 switches to an output only mode - this allows the USB port to take over bidirectional control of the NDC-4.

### 5. Battery Supply Input.

Standard battery power connections (8 to 35v).

#### Notes:

1. To complete the NMEA 0183 standard all device interconnection NMEA cables used should meet the two-conductor, shielded, twisted pair configuration specification. The shield connection of these wires should be connected at the instrument end only to prevent ground loops.

2. Refer to “**Specifications**” on page 19 for the full details on input/output specifications.



# Connecting to NMEA Devices

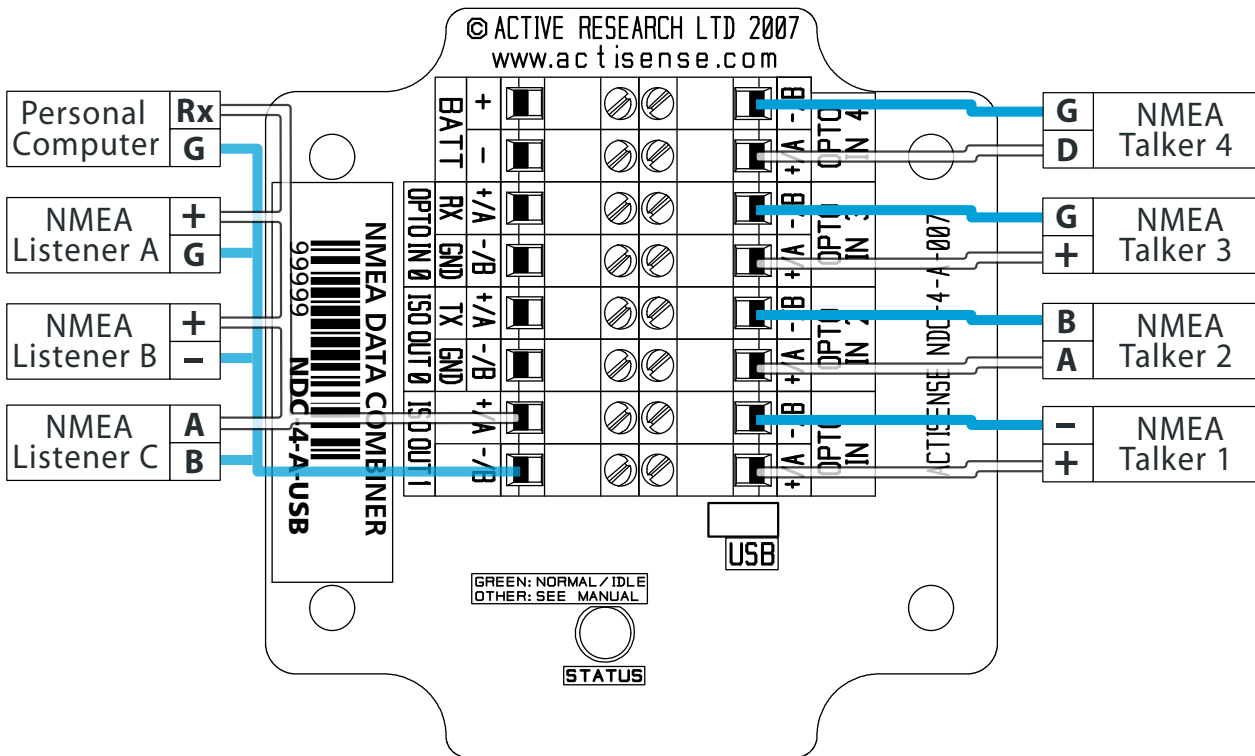


Figure 2 – NMEA 0183 connections

## OPTO Inputs

The differential opto-isolated inputs are designed to handle a variety of NMEA 0183 device output specifications. Please determine (from device manufacturer’s information) if the device(s) required to be connected to the NDC-4 conforms in full to the NMEA 0183 network communication standard. If it does not, the flexible NDC-4 inputs should still be capable of interfacing with the device, though this is not guaranteed.

The diagram above shows a typical installation with both fully compliant NMEA devices with differential inputs/outputs, and non-differential output devices.

**Note:** All NDC-4 inputs are identical and the connections shown are examples that can be used on every input port.

**NMEA Talker Devices 1 and 2:** These devices conform in full to the NMEA 0183 standard. Talker 1 shares the same connection ID’s as the NDC-4, so connection is a simple matter of matching the ID’s. Connect ‘+’ to ‘+/A’ and ‘-’ to ‘-/B’ or ‘A’ to ‘+/A’ and ‘B’ to ‘-/B’ (refer to figure 2).

**NMEA Talker Devices 3 and 4:** These devices do not conform completely to the NMEA 0183 standard. However, by connecting ‘+’ to ‘+/A’ or ‘Data/Signal’ to ‘+/A’ and ‘G/Ground’ to ‘-/B’ the NDC-4 should receive the NMEA data correctly.

## ISO-Drive Outputs

The ISO-Drive outputs are capable of driving up to 10 NMEA 0183 fully compliant listening devices, or a mixture of NMEA 0183 devices and a Personal Computer (PC) communication port. However, if you wish to maintain isolation between all devices, then only **one** listening device should be connected to an ISO-Drive output.

**NMEA Listener Device’s B and C:** These devices conform in full to the NMEA 0183 standard and their connection ID’s match that of the NDC-4.

**Personal Computer:** Whilst the OPTO IN 0 and ISO-Drive 0 provide a bidirectional RS232 compatible port for connection to a PC, the ISO-Drive 1 output is also capable of being read by a PC’s RS232 port. Simply connect ‘+/A’ to ‘Rx’ and ‘-/B’ to ‘G/Ground’ on a standard D-type connector. See “Figure 26 - DB9 Connection” on page 8 of the “Full user manual” available on the CD and from [www.actisense.com](http://www.actisense.com) for a diagram of this wiring connection.

**NMEA Listener Device A:** This device does not conform in full to the NMEA 0183 standard. However, by connecting ‘+/A’ to ‘+’ or ‘Data/Signal’ and ‘-/B’ to ‘G/Ground’ the device should be able to receive the NMEA data correctly, though this is not guaranteed.

**Note:** Wire colours are for guidance only.



## Other Connections

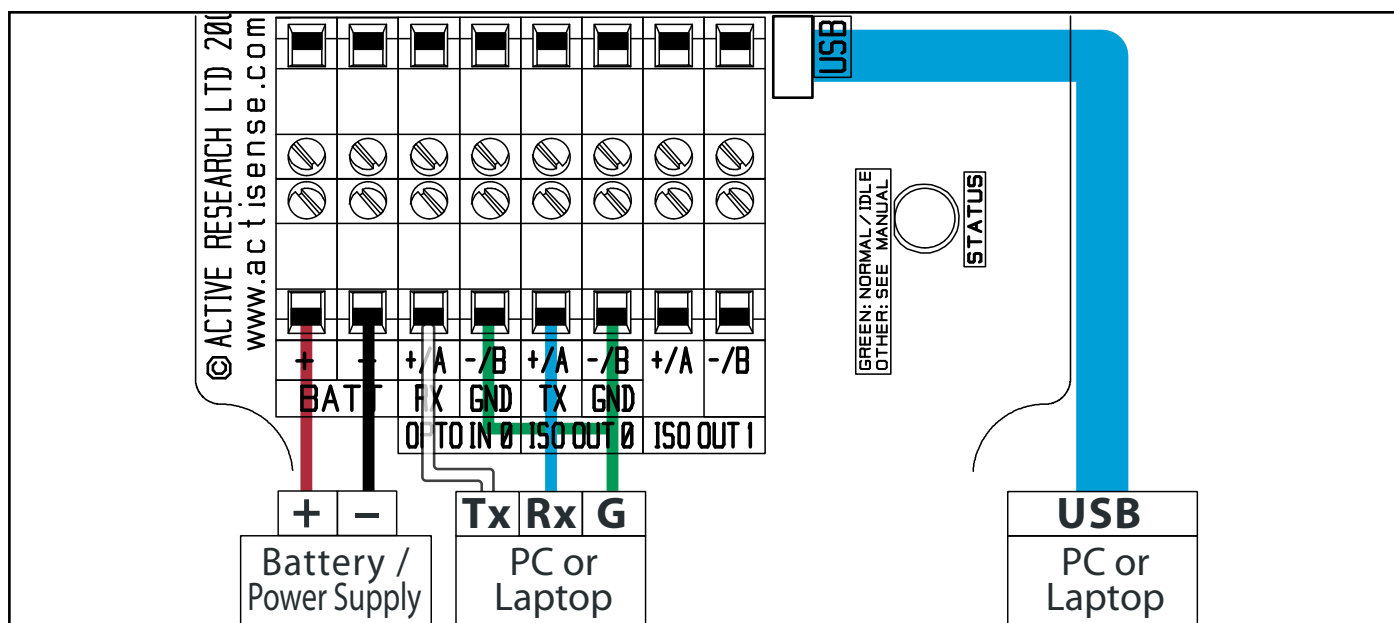


Figure 3 – RS232, USB and Battery connections



### USB Warning!

USB power and battery power are NOT isolated from each other. Consult a qualified installer to ensure there is no ground loop hazard when connecting both. Disconnecting a single battery lead or turning off the supply does NOT prevent this ground loop hazard. Ground loop damage is NOT covered by the guarantee.

For installs where the NDC-4 must still operate when the PC is switched off, full PC isolation can be maintained by using Port 0 ('OPTO IN 0' and 'ISO OUT 0') as the PC connection.

Only when using a laptop running on its internal battery (with NO charging supply), can the NDC-4 USB cable be used at the same time as powering the NDC-4 from the ships battery on the "BATT" terminals.

### Connecting to the Battery Supply

The NDC-4 can be powered either by the USB connection or through an external power source. If both power sources are available, the precautions in the USB warning section above must be adhered to.

If the NDC-4 is powered from an external power source, like a battery, it should be wired to the vessel's battery supply in the most direct manner possible, to minimize interference from other electronic devices. The cable used should be of sufficient gauge to handle the power requirements of the NDC-4 (refer to "[Specifications](#)" on [page 19](#)).

### Connecting to a Personal Computer

The USB port can be used to connect a PC to the NMEA 0183 system. A USB cable is available in the form of an upgrade kit for variants that do not come with a cable. The part number will include "USB" if a cable is provided with that variant (e.g. NDC-4-USB).

Alternatively, Port 0 (OPTO IN 0 and ISO OUT 0) can be used to connect a PC into the NMEA 0183 system by using a serial port cable conforming to the following specification:

1. A D-type female (socket) connector for the PC end of the cable.
2. A minimum of 3 cores are required in a shielded cable. Higher quality cable will yield higher performance (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.
3. The **TX** of the NDC-4 should be connected to the **RX** of the computer (standard D-type, **pin 2**) and the NDC-4 **RX** should be connected to the **TX** of the computer (**pin 3**). The **GND** of both IN 0 and OUT 0 on the NDC-4 should be connected to the PC's serial port ground (**pin 5**). See "Figure 26 - DB9 Connection" on page 9 of the "Full user manual" available on the CD and from [www.actisense.com](http://www.actisense.com) for a diagram of this wiring connection.

**Note:** Wire colours are for guidance only.

## USB Driver Installation

When using an NDC-4 with a USB cable it is necessary to install the USB drivers. Any NDC-4 variant without a USB cable can be 'upgraded' by purchasing a **USB Upgrade Kit** from your dealer.

The USB cable is not vital to the configuring or updating of an NDC-4; Port 0 (OPTO IN 0 and ISO OUT 0) connected to an RS232 port can perform exactly the same operations if a USB cable is not available see **"Other Connections" on page 9**.

The **Actisense** USB driver has been extensively tested with Windows versions from Windows 98SE to Windows 7 and is proven to work with the NDC-4. The driver comes in two parts and both are required for correct operation. The first is the **'USB serial converter'** driver and the second is the **'Virtual serial port'** driver.

The required Linux drivers are already included in the Linux kernels from v2.4.20 and onwards. However, **Actisense** has not been able to test the compatibility of the NDC-4 with USB and this driver. Install instructions are available on the CD and the **Actisense website (www.actisense.com)**.

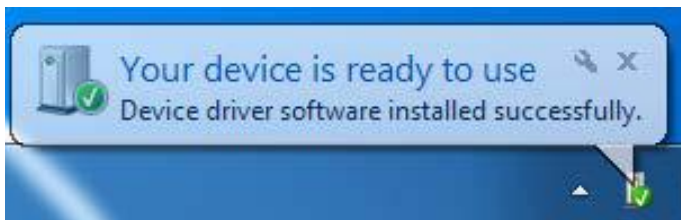
Drivers for MAC OS X are provided 'as is' and **Actisense** is unable to offer support for MAC related issues. To download the drivers visit the **Actisense website (www.actisense.com)**.

## Installation Guide

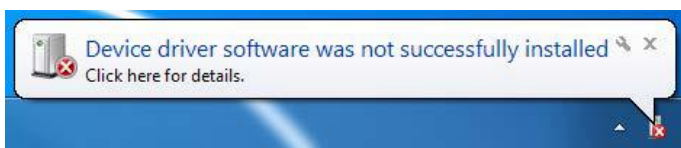
### Windows 7 and Windows Vista

The following instructions are for Windows 7. Although not the same, Windows Vista users will be able to use this information to install the drivers as well.

With an active Internet connection the process is very simple. Connect the USB cable and Windows will automatically download and install the latest driver from Windows update. Both drivers are now installed and no further steps are required.

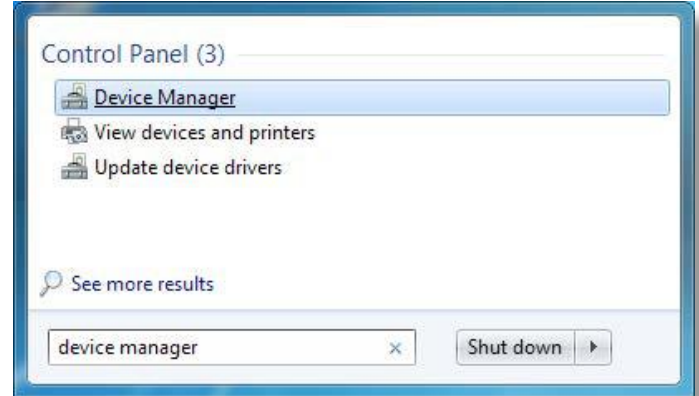


When there is no Internet connection Windows will fail to install the driver.

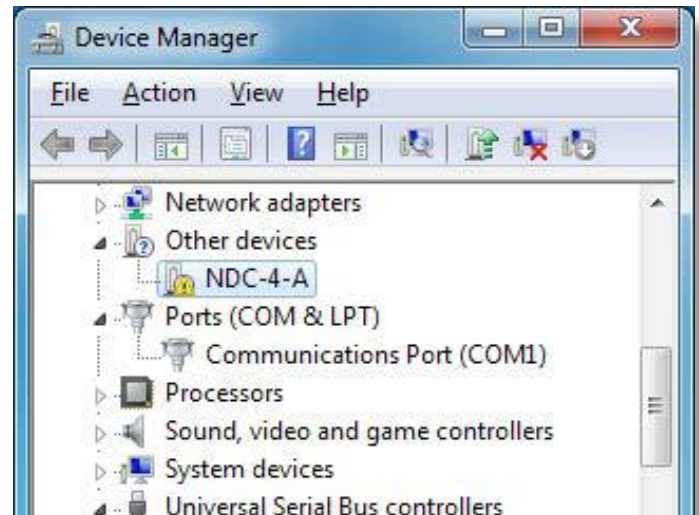


Follow these steps to manually install the drivers from the **Actisense** CD or a copy downloaded from the **Actisense website**.

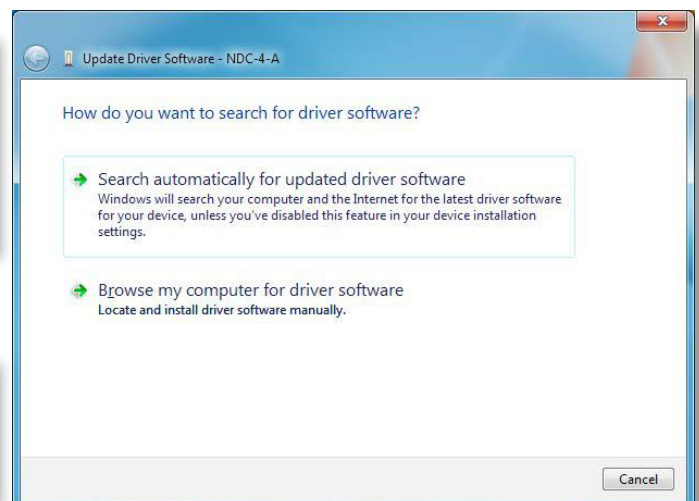
1. Open **'Device Manager'** (from the start menu type **'device manager'** in the search box, open it from the list).



2. Find the NDC-4 under **'Other devices'** and right click, then select **'Update Driver Software'**.



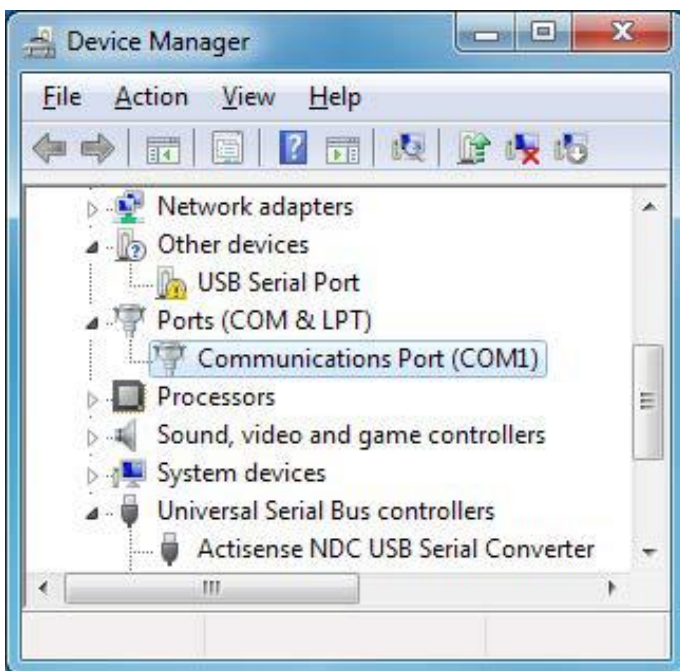
3. If the CD is inserted select **'Search automatically for updated driver software'** and jump to step 4. Without the CD select **'Browse my computer for driver software'**.



4. Click the **'Browse'** button and locate the folder that the USB driver is saved (containing "ftdibus.inf"). Once the folder is selected click **'Next'**.



5. When the **'USB Serial Converter'** driver has completed the **'Virtual Serial Port'** driver will need to be installed in the same way. This time in **'Device Manager'** right click **'USB Serial Port'** and select **'Update Driver Software'**.



6. Repeat steps 3 and 4 to install the **'Virtual Serial Port'** driver.

Now both drivers are installed see **"USB Configuration"** on page 12 for details on how to find out which COM port number has been allocated to your **Actisense** device as well as how to change to a different COM port.

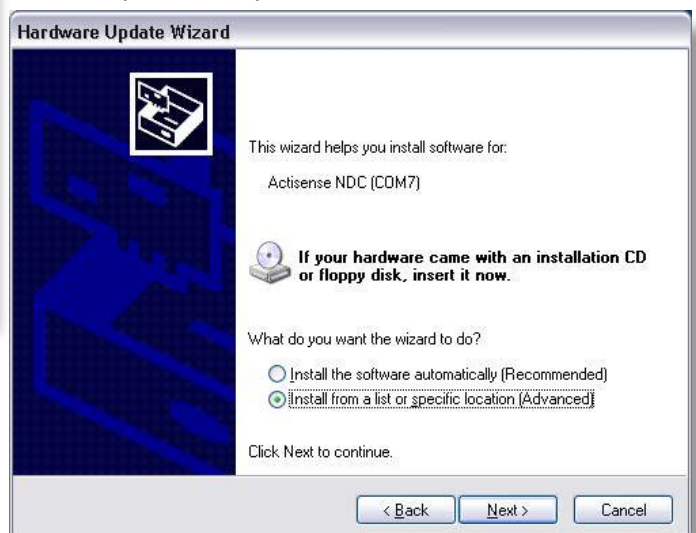
## Windows XP and Windows NT/2000

The following instructions are for Windows XP. Although not the same, Windows NT/2000 users will be able to use this information as well.

1. Connect the USB cable and Windows will automatically open the **'Found New Hardware Wizard'**. If an active Internet connection is available select **'Yes, this time only'**, click **'Next'** and go to step 4. Without an active Internet connection select **'No, not at this time'** and click **'next'**.



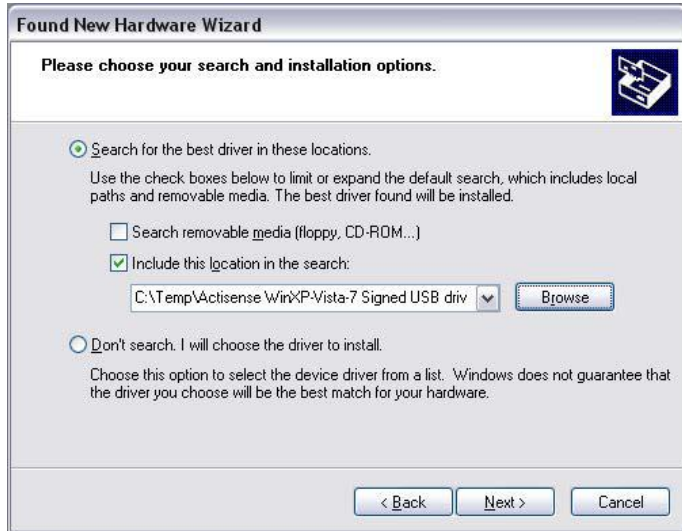
2. If using drivers from the CD, choose **'Install the software automatically (Recommended)'** and click **'next'**. Windows will search the CD and install the drivers, go to step 4. If using drivers downloaded from the **Actisense** website, choose **'Install from a list or specific location (Advanced)'** and click **'Next'**.





3. When using the drivers downloaded from the **Actisense** website, it is important to unzip them to an easy to find location. Make sure the **'Include this location in the search'** option is ticked, and use the **'Browse'** button and

Now both drivers are installed see **"USB Configuration"** on page 12 for details on how to find out which COM port number has been allocated to your **Actisense** device as well as how to change to a different COM port.



select the folder where the drivers have been extracted and click **'Next'**.



- 4. The **'USB serial converter'** driver is now installed, click **'Finish'** to complete the wizard.
- 5. Once complete **'Your new hardware is installed and ready to use'** will appear in the bottom right corner of your screen.



Wait for the **'Found New Hardware Wizard'** to appear again. Repeat steps 1 to 4 to install the **'Virtual Serial Port'** driver.

## USB Configuration

To communicate with the NDC-4, the COM port number that Windows has allocated to the USB port needs to be determined. The following guide will walk the user through this standard operation.

The **Actisense** NMEA Data Multiplexer, NDC-4 is completely USB port independent: It can be easily unplugged from one USB port and connected to another available USB port on the same PC without the COM Port number changing.

This is very useful when the NDC-4 is working in unison with a software program that is set up to use a particular COM port, as the user does not need to re-select a different COM port every time the PC reboots, or the cable is swapped between two USB ports.

## Locate and Change the Port Number

1. Connect the NDC-4 USB cable to a USB port on the PC.

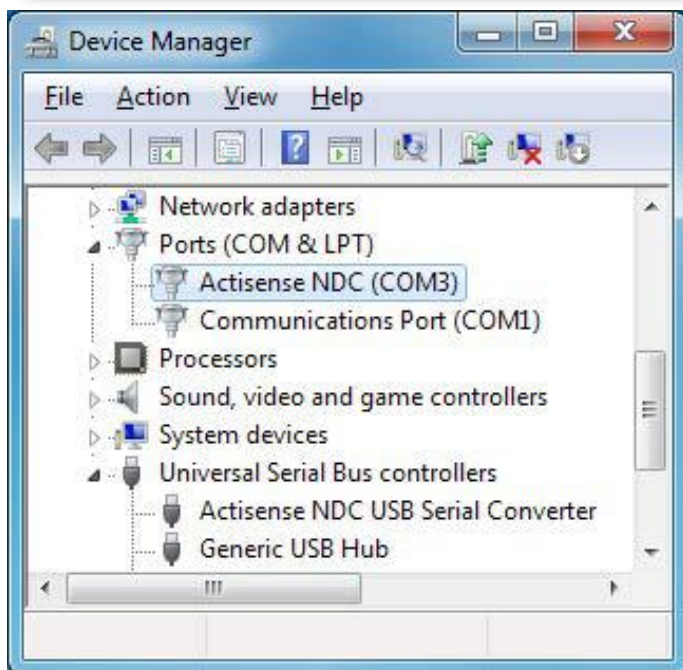
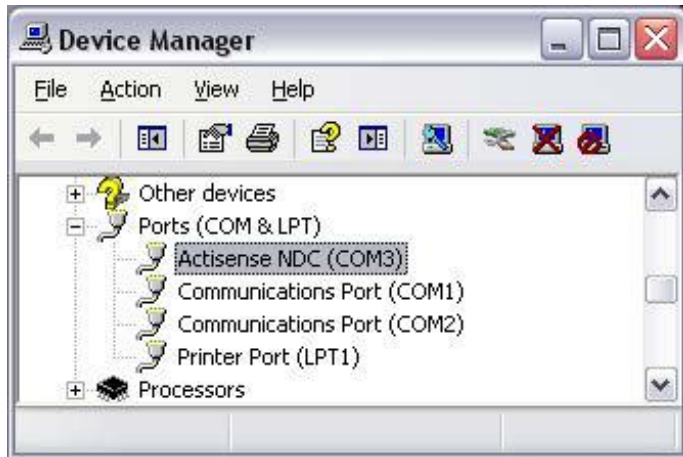
In Windows 7 and Vista; from the start menu type **'Device Manager'** in the search box, open it from the list.

In Windows XP; from **'Control Panel'**, select **'System'**, on the **'Hardware'** tab click **'Device Manager'**.



# NMEA Data Multiplexer - NDC-4

2. Expand the 'Ports (COM & LPT)' list by clicking on the '+' sign (Windows XP and Vista) or the white arrow (Windows 7). You will find the 'Actisense NDC' in the list, followed by the allocated COM port number.



3. Double click on the icon for the 'Actisense NDC' and the properties window will appear. Click on the 'Port Settings' tab. There is no need to change any of the settings here, the software package that opens the port will specify the required values.



4. Click on the 'Advanced' button and choose a different COM Port number if required (to make it compatible with the software requiring the NDC-4 NMEA data).

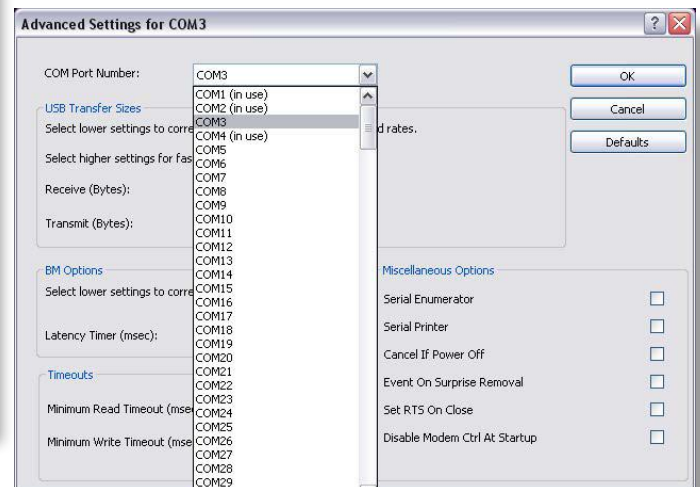
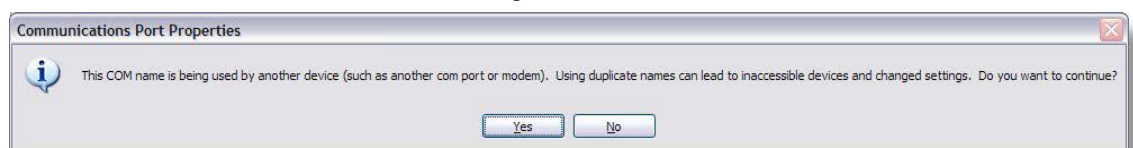


Figure 4 - COM Port Numbers List

Windows remembers all previously connected USB ports and lists all these as 'in use' even when they are not connected. On the PC the screen-shot "Figure 4 - COM Port Numbers List" the only ports that are actually 'in use' are ports 1, 2 and 3 so all the other com port numbers are available. Click on 'OK' button to save the new settings.



## Actisense PC Software suites

The **Actisense** NMEA Data Combiner hardware can be configured, monitored and tested using its own dedicated software suite, 'NDC Control Centre'. The NDC-4 can be updated / upgraded using the latest ActiPatch software suite. This section provides a complete users guide to installing and uninstalling these two software suites.

These programs are currently only available for Windows NT/2000/XP/Vista/7, however, it has been proven possible to use Control Centre and ActiPatch on a Mac running 'VMware Fusion' Windows emulation software.

### Installing Actisense PC software

Replace the generic "<Product Name>" text below with the name of the actual software you are installing: "NDC Control Centre", or "ActiPatch".

1. Download the latest version of the software from the [Actisense website](#), or locate the files on the **Actisense** CD included with the NDC-4.

2. If a previous version of the software has already been installed, uninstall the previous version **before** installing the new version. Refer to "[Uninstalling Actisense PC software](#)" on page 15 for full details.

**Note:** For a complete fresh install, delete the install directory. This will remove all previous settings. To keep these settings, do not delete the directory.

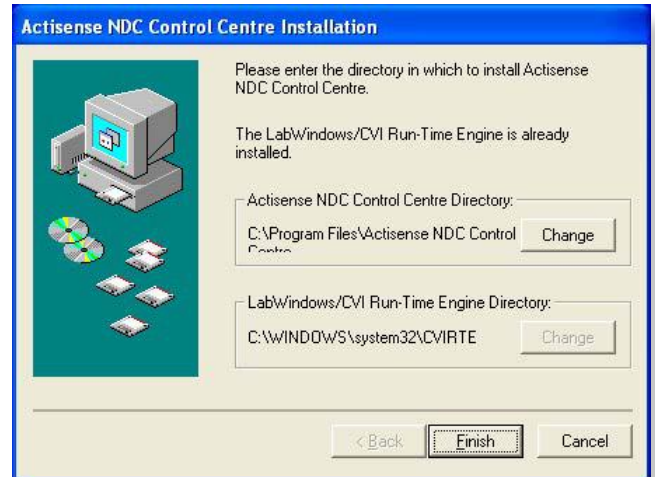
3. If the program is contained within a zip file, extract the three files ("<Product Name>.001", "<Product Name>.002" and "setup.exe") that are contained within the zip file using any available unzip program to a temporary directory (e.g. "C:\Temp").

4. Double click on the "setup.exe" program file and follow the on-screen instructions of the standard Windows install program. The install location can be change at this point, however, the default location is normally acceptable (refer to "[Figure 5 – Install Options](#)" and "[Figure 6 – Installation Complete](#)").

Once the install operation is complete, the temporary files and/or directory can be deleted. Keep the original zip file safe.

5. From the 'Start Menu' navigate to the 'Actisense' directory and double click on the 'Program' icon (refer to "[Figure 7 - 'Start Menu' Short-cuts](#)" and "[Figure 8 – 'Start Menu' Short-cuts](#)").

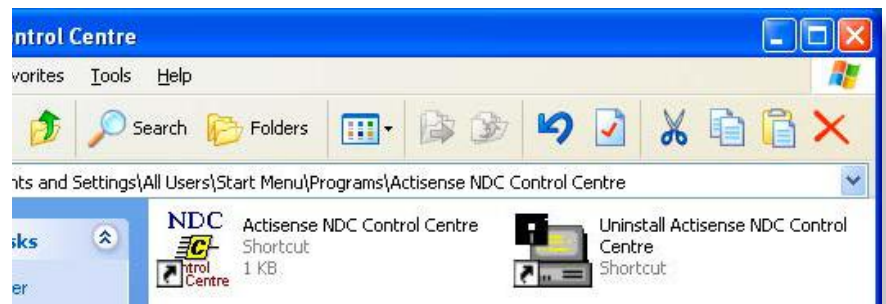
**Useful Tip:** If you access the program regularly you can 'copy and paste' the program icon from the Windows 'Start Menu' on to the desktop or the 'Quick Launch' short-cut bar to create an easy to access short-cut.



**Figure 5 – Install Options**



**Figure 6 – Installation Complete**



**Figure 7 - 'Start Menu' Short-cuts**



**Figure 8 – 'Start Menu' Short-cuts**



## Uninstalling Actisense PC software

Replace the generic "<Product Name>" text below with the name of the actual software you are installing: "NDC Control Centre", or "ActiPatch".

1. To uninstall the program, from the 'Start Menu' navigate to the 'Actisense' directory and double click on the 'Uninstall' icon (refer to "Figure 7 - 'Start Menu' Shortcuts" on page 14 and "Figure 8 - 'Start Menu' Shortcuts" on page 14).

3. Once the uninstall operation has been requested, the confirmation box ("Figure 9 - Uninstall Confirmation") will be displayed. Answer 'Yes' and the uninstall operation will be performed automatically. After successfully uninstalling the Actisense PC software, the uninstall completion box will appear ("Figure 10 - Uninstall Complete").

4. In addition, the program directory can also be deleted to completely remove the program. In this way all the program files will be uninstalled in a clean and complete manner.

If however, you are going to install a new version after this uninstall, you can keep the program directory and the configuration file stored within it. In this way, all the user settings you had for the previous version will be immediately available with the new version.



Figure 9 – Uninstall Confirmation

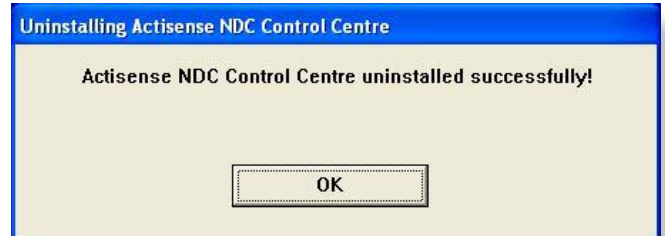


Figure 10 – Uninstall Complete

# Configuration of AIS

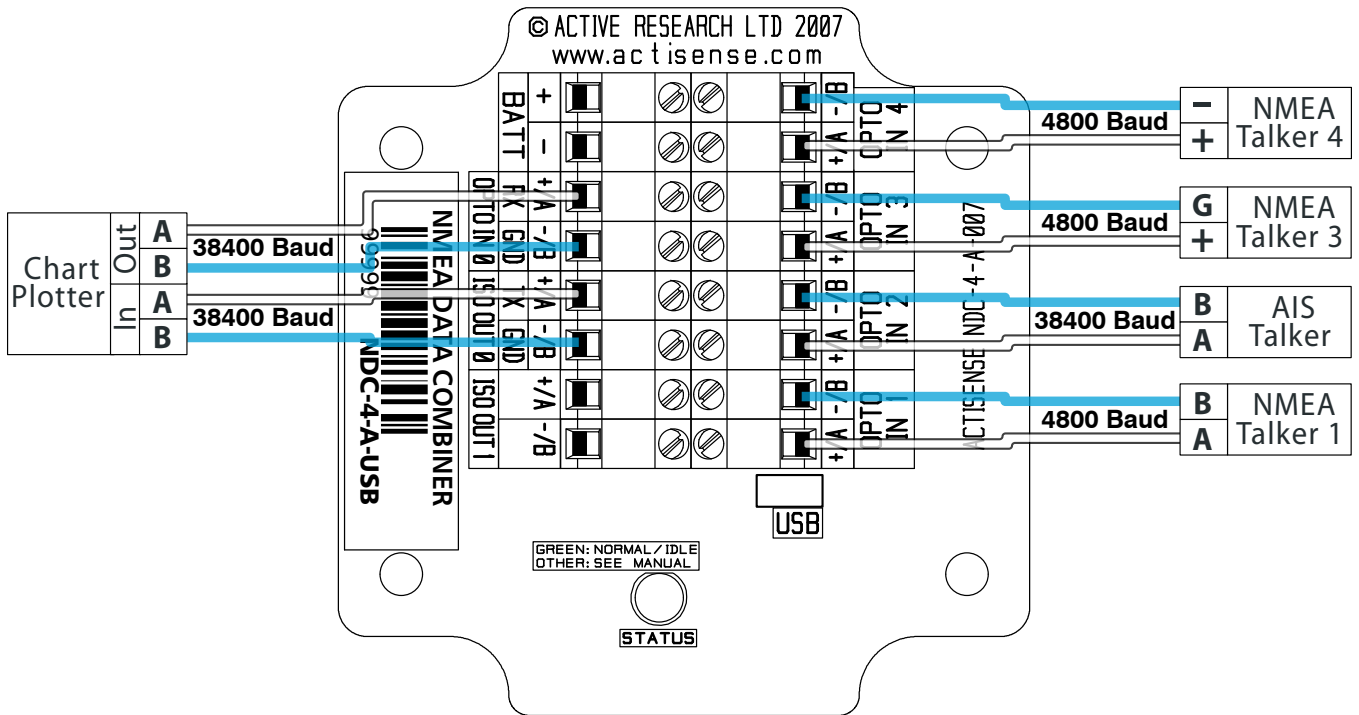
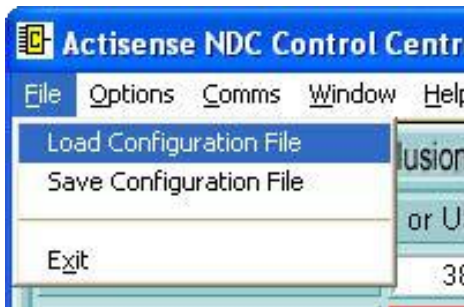


Figure 11 – AIS Configuration with 38400 Baud Rate

## Setting up the Hardware for AIS

Control Centre, supplied on the CD (or available for download from [Actisense website](http://www.actisense.com)), allows a quick set-up for AIS using the configuration file included.



From the menu select **'File → Load Configuration File'** and select "NDC-4 config for AIS.ini" file from the install directory. Read the pop up and click **'OK'**.

This will change the settings for OPTO IN 2. The configuration tab will set 38400 Baud (AIS requires NMEA 0183 HS). The Inclusion List is set to block all AIS data from being sent to ISO OUT 1 which is typically kept at 4800 Baud. Filtering does not affect the USB/RS232 port, all the AIS sentences will still be outputted on this port.

**Note:** The use of AIS at Baud rates lower than 38400 cannot be recommended as this could cause random AIS target data to be lost in areas of high target density.

To enable these settings on the NDC-4 click on the **'Send to Hardware'** button on **BOTH** the **'Port Configuration'** and **'Inclusion List'** tabs.



The AIS device should then be connected to the NDC's **'OPTO IN 2'** as shown in **'Figure 21'**, with any other talkers connected as required. The device for receiving the AIS data (chart-plotter or PC) should be connected to **'ISO OUT 0'**, or the USB port.

The remaining ports can be re-configured by the user as needed using Control Centre. Refer to "Using NDC Control Centre" on page 16 of the "Full user manual" available on the CD and from [www.actisense.com](http://www.actisense.com) for full detailed information on how to use Control Centre.

## The NDC-4-ASW Autoswitch

The **Actisense** NMEA Data Multiplexer / Combiner / Autoswitch (NDC) has been designed with the ability to operate as a Multiplexer / Combiner OR an Autoswitch.

For systems that have multiple NMEA devices of an identical type (e.g. two GPS's or two depth sounders), automatic selection of the highest priority device is normally a vital requirement. However, the NMEA 0183 standard has no method of automatically switching between different devices, so this requirement is usually fulfilled with a manual changeover switch: not a very good solution, but the only one available until now.

If the NMEA data from two (or more) devices are simply combined together, the NMEA listener(s) will not be able to differentiate between the various sources and will get very confused, often jumping between them. If this creates a 'jumping' position fix, vessel safety is seriously affected.

The NDC-4 Autoswitch mode is the perfect solution to this problem - automatically selecting a single device from the multiple 'same data type' devices available.

Autoswitch mode will automatically select the highest priority device from up to 4 connected input devices, with NMEA port 1 as the highest priority through to NMEA port 4 as the lowest. This creates a system capable of automatically selecting the next priority device if the higher priority device fails for one of three reasons:

- A complete failure to send any NMEA data.
- An invalid NMEA sentence checksum.
- If the validity flag(s) contained within the received NMEA sentence indicate that this data is not valid and should only be used with caution.

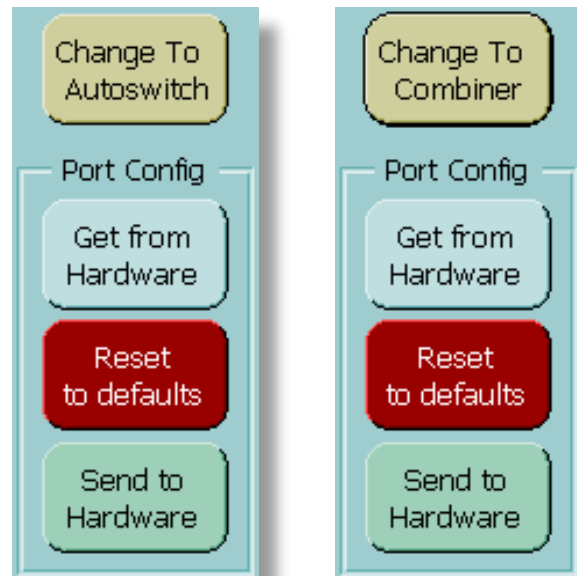
With the addition of two fully Baud rate configurable outputs protected by ISO-Drive technology, that can also incorporate NMEA filtering to remove any unwanted sentences before the switching process, the NDC-4 Autoswitch mode is the most flexible available.

Having the ability to filter out NMEA data before the autoswitch process can be particularly useful to avoid unwanted sentences from causing the Autoswitch to change input channels due to invalid data, leaving only the required sentences to switch on.

If ordered as an Autoswitch, the NDC-4 will be pre-configured as an NDC-4-ASW and be ready to work out of the box. Alternatively, any NDC-4 can be configured using Control Centre to operate in Autoswitch mode.

## Setting the NDC-4 as an Autoswitch

The NDC-4 can easily be changed between being a NMEA Data Multiplexer / Combiner and an NMEA Autoswitch using Control Centre.



In the 'Port Configure' tab click on the button labelled "Change To Autoswitch" to change the NDC's operation mode to Autoswitch.



Figure 12 – "Change To/From Autoswitch" message

A warning message will be displayed, requesting that the user confirm the request to change to Autoswitch mode. Selecting 'Yes' will automatically send the new configuration to the unit, and the NDC-4 will now Autoswitch its inputs instead of Combining them.

To revert back to Combiner mode, click on the (same) button (now labelled '**Change To Combiner**'). Again, the user must confirm the operating mode change is required and the NDC-4 will now Combine its inputs instead of Autoswitching them. There is no need to click the '**Send to Hardware**' button, this configuration change is automatic.

## Troubleshooting Guide

This guide will concentrate on all relevant troubleshooting issues above simple cable connection faults. Therefore, the cables between the NDC-4 hardware and any other devices should be checked as a matter of course, before continuing with this guide.

### Diagnostic LED

The NDC-4 hardware supports a tricolour diagnostic LED that indicates the current operating mode of the hardware, or if an error has been detected during the self-test initiation process. 'Table 1' details what each LED colour represents and if any user interaction is required.

LED Colour / Flash Count	Mode / Error condition	Required User Response
	Start up operation modes	The sequence below indicates a successful power-up of the NDC-4 with no data on any of the input channels.
LED is off	Power down mode	The NDC-4 has no power, confirm the battery is connected correctly. For USB powered units, ensure the cable is connected and the USB drivers are installed.
Red, No flashing	Start-up mode, No error	No response required. A normal operation mode that should last for no more than 1.5 seconds. Any longer indicates an error with the main program.
Amber, No flashing	Initialise and self-test mode, No error	No response required. A normal operation mode that follows after the Start-up mode and should last for approximately 1 second.
Green, No flashing	Normal and no data mode, No error	No response required. A normal operation mode that follows the Initialise and self-test mode. Indicates that no error was detected during the self-test operation.  Also indicates that no data is currently being received by the NDC-4 hardware.
	Running modes	Below are the other correct operating modes possible with the NDC-4.
Green, Flashing (1-10 per second)	Normal and data Rx mode, No error	No response required. A normal operation mode that indicates that data is currently being received (on at least one channel) by the NDC-4 hardware. Flash rate proportional to Rx rate.
Red, No flashing	Flash updating mode, No error	No response required. LED will stay red for the duration of the flash update operation (using Actipatch). Once operation complete, NDC-4 hardware will be automatically reset.
	Error mode	Below is a possible error mode for the NDC-4. If the error persists see <b>"Returns Procedure" on page 20</b> .
Amber, Flashing (Once every 4 seconds)	Error trap mode, EEPROM memory error	An error with the EEPROM memory has been detected during the self-test mode.  Reset the NDC-4 hardware.

**Table 1 – Diagnostic LED Colours**

## Specifications

The NDC-4 ISO-Drive output is a very flexible output that is RS485, RS232, RS422 and NMEA 0183 compatible.

Parameter	Conditions	Min.	Max.	Unit
<b>Supply</b>				
Supply voltage	External power supply	8	35	V
Supply current from external source (see note 1)	Supply voltage = 12v	30	40	mA
	Supply voltage = 24v	15	20	mA
Supply voltage	USB powered	4.75	5.25	V
Supply current from USB (see note 1)	Supply voltage = 5v	67	75	mA
<b>Opto-isolated Flexible Input</b>				
Input voltage between +/-	Logical '1'/stop bit	-15.0	0.5	V
	Logical '0'/start bit	4.0	15.0	V
Input current	Maximum is under +35v overload condition, Min @ 2.0v input level	1.6	9.0	mA
Differential input voltage	Required level for NMEA to be detected	1.8	2.0	V
Galvanic isolation	Between input & output		2500	V
Overdrive protection			40	V
Input Baud rate (ports 0 & 1 + USB)	Configurable Baud rate	4800	115200	bps
Input Baud rate (ports 2 & 3)	Configurable Baud rate	4800	57600	bps
Input Baud rate (port 4)	Fixed Baud rate	4800	4800	bps
<b>ISO-Drive Flexible Output</b>				
Output voltage between ISO Out +/A and ISO Out -/B (under no load)	Logical '1'	-4.6	-5.0	V
	Logical '0'	4.6	5.0	V
Output current at max load of 100 ohm	At maximum load, differential drive voltage reduces to 2.1v	-	21	mA
Output short circuit current (note 2)	Due to short circuit protection	50	55	mA
Galvanic isolation	From Opto input and (USB) ground		1500	V
Output Baud rate (ports 0 & 1 + USB)	Configurable Baud rate	4800	115200	bps
Data propagation delay	Under no-overload conditions	1.0	100	ms
<b>General</b>				
Ambient temperature		-20	+70	°C
Guarantee	Extended <b>Actisense</b> guarantee	-	3	Year
Gland clamping range	Cable diameters accommodated	4.5	10	mm
IP Rating			IP66	

**Table 2 – NDC-4 Specifications**

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

**Notes:**

1. Current consumption measured under no-load conditions.
2. Short circuit may be applied indefinitely. The ISO-Drive output may be short-circuited directly to a 30 volt battery supply without damage. A maximum current of 50mA will flow due to “polyfuse” auto-resetting fuse technology being used in each output.

## Order Codes

NDC-4	5 isolated inputs (4 NMEA HS), 2 ISO-Drive outputs
NDC-4-USB	4 isolated inputs (3 NMEA HS), USB In & Out and 2 ISO-Drive outputs
NDC-4-AIS	NDC-4 base unit pre-configured for AIS
NDC-4-AIS-USB	NDC-4-USB unit pre-configured for AIS
NDC-4-ASW	NDC-4 base unit pre-configured as an Autoswitch

## Returns Procedure

**Actisense** prides itself on having a very low product return rate. In the unlikely event that you need to return a unit for repair, it is important to follow these steps.

1. Download and install the latest Firmware version and Control Centre software from [www.actisense.com](http://www.actisense.com).
2. Read through the "Troubleshooting Guide" on page 20 of the "Full user manual" available on the CD and from [www.actisense.com](http://www.actisense.com) to see if your problem has a simple solution.
3. Contact **Actisense Tech Support** at the email address below for further support and an **RMA number**.

To qualify for an **RMA number** you will need to provide the serial number, date of purchase and where you purchased the unit from. You will be asked to confirm the above steps have been attempted and the nature of the fault.

Any units returned without an **RMA number** will incur a delay in processing and may result in a charge dependant on the guarantee status of the unit.

## Company Information



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**Website:** [www.actisense.com](http://www.actisense.com)

**Twitter:** [www.twitter.com/ActisenseNews](http://www.twitter.com/ActisenseNews) (Actisense News and Product Updates)  
[www.twitter.com/ActisenseTech](http://www.twitter.com/ActisenseTech) (Actisense Product Updates)  
**Facebook:** [bit.ly/actibook](http://bit.ly/actibook) (Actisense News and Product Updates)  
**LinkedIn:** [linkd.in/actisense](http://linkd.in/actisense) (Actisense News and Product Updates)

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