Actisense®

NMEA Data Multiplexer

NDC-4-A
NDC-4-A-USB
NDC-4-A-ASW
NDC-4-A-AIS

Full User Manual

Issue 1.06

- 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.
- Reconfigurable to work as an NDC-4-ASW Autoswitch to allow the automatic switching between upto 4 NMEA inputs.

Contents

Important Notices

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 warranty.

The **Actisense** NMEA Data Multiplexer (NDC-4) 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 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

When using this document, keep the following in mind:

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 accidents or any other reasons during operation of the user's unit according to this document.

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** NMEA Data Multiplexer (NDC-4) product 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 **Actisense** 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**.

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. If the USB cable is not plugged in (or not powered) and OPTO IN 0 is not used to connect to a PC, OPTO IN 0 can be used as a fifth fully compliant NMEA 0183 data input.

2 ISO-Drive output ports

These outputs combine the input data into standard NMEA outputs. 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 bi-directional 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 the combined output. 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.

When the USB cable is plugged in and powered up, it disables the OPTO IN 0 on the NDC. For example this is very useful when a PC is supplying data, and you want an NMEA device to supply the same data when the PC is powered down.

Note that standard NDC-4 units can be upgraded to USB by purchasing a USB upgrade kit.

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, 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.

The NMEA 0183 inputs are floating receivers, opto-isolated to 2500 volts, protecting your system even during the most extreme fault conditions. This differential input is fully compliant with the NMEA 0183 standard specification **and** is also compatible with RS232 signal levels. Typical operating voltage is 2.0v to 15.0v. The unit can withstand +/- 35v continuously, and +/- 40v transients. The Opto-isolator can thus protect any upstream equipment (chart plotter, laptop PC, radar etc.) from up to 2500v of common mode voltage difference.

ISO-Drive output technology creates a driver, unique to Actisense, that is isolated to 1500 volts. ISO-Drive allows a completely floating output to be created, making a safe connection to a PC an easy task. The output automatically changes between differential and single ended drive depending upon the type of instrument it is connected to. The ISO-Drive output is fully compliant with the NMEA 0183 standard specification and is also compatible with RS422 & RS232 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.

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.

Very tough Polycarbonate case is certified to IP66 (splash-proof). 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 (submersible). Note that to achieve this level of water integrity all grommets must be occupied by round-section cables of between 4.5mm and 10mm diameter.

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

Software updates

The NDC-4’s built-in firmware is held in “flash” memory, allowing quick and easy upgrades using a simple Microsoft Windows (98 SE/ME/NT/2000/XP) user interface program (ActiPatch) running on a connected PC.

It is our policy to provide these updates free on our website, **www.actisense.com**. This upgrade can be performed with the unit completely in-situ, via a PC connected to the 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** for full details on these and other **Actisense** interfacing, Depth sounding and Sonar 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 "**Rx**" 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. Connect the ground line of the single-ended output device to the OPTO IN "**-/B**" input of the NDC. 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 the **Output Connections** section for example of these connection methods.

Connections

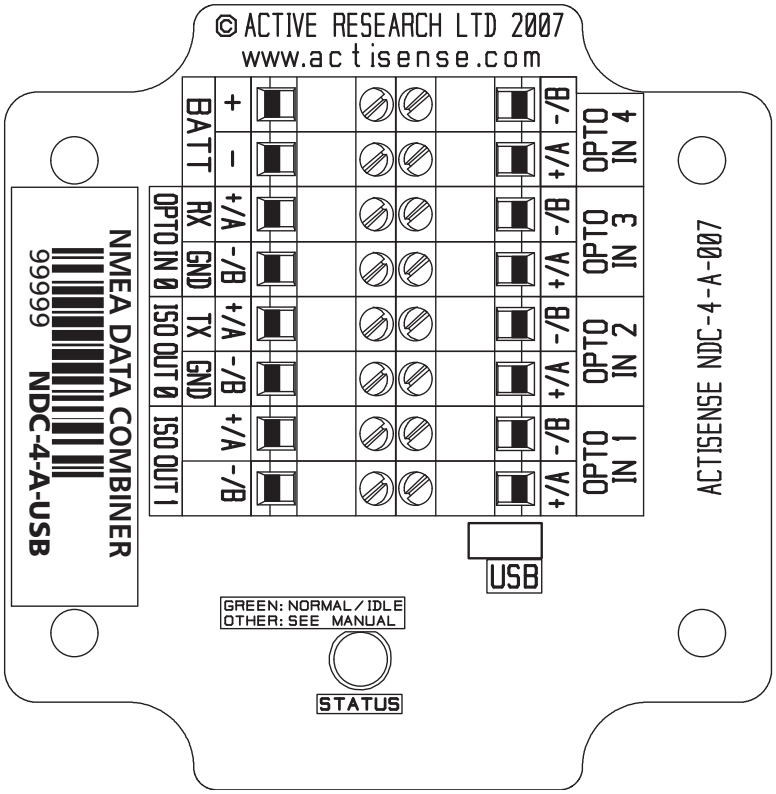


Figure 1 – All external connections

The NMEA Data Multiplexer (NDC-4) 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 bi-directional 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 (NDC-4-A-USB Only).
   The standard USB 1.1 port 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 bi-directional control of the NDC-4.

   USB 2.0 is backwardly compatible with USB 1.1.

5. Battery supply input.
   Standard battery power connections.

Note:

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 the **Specifications** section for the full details on input/output specifications.

Connecting to NMEA devices

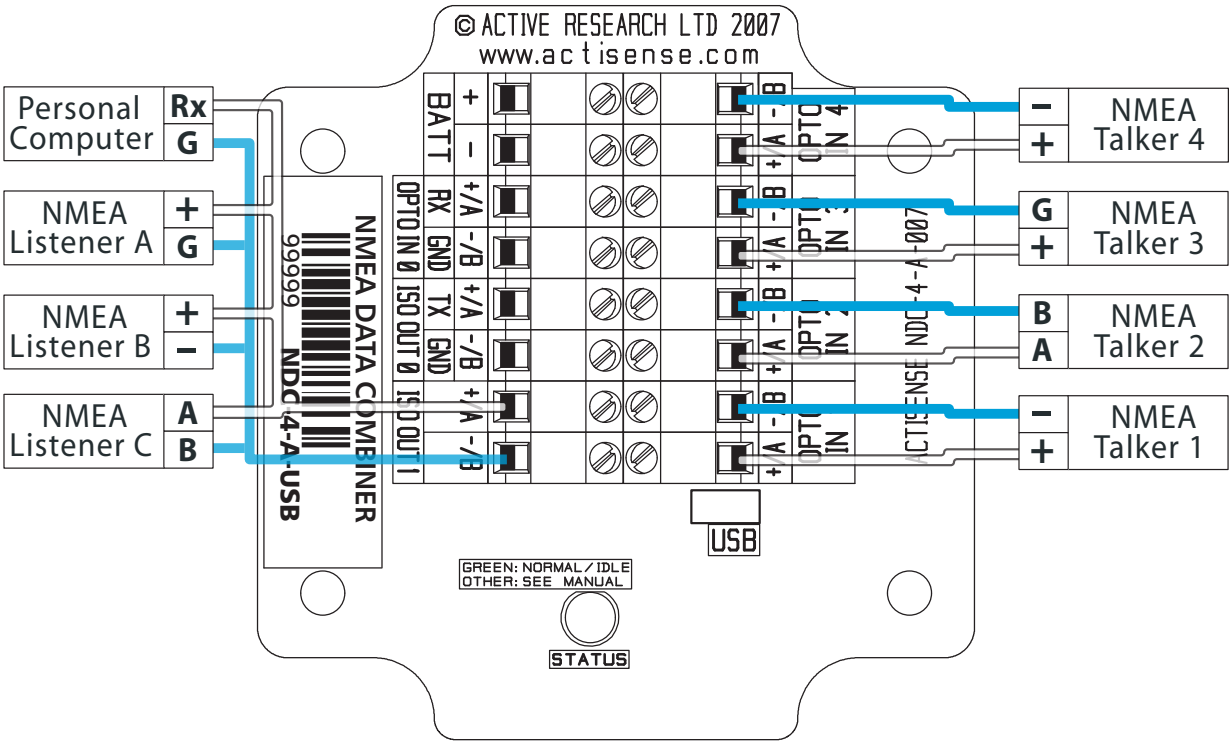


Figure 2 – NMEA 0183 connections

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 **Actisense** NDC-4 conforms in full to the NMEA 0183 network communication standard. If it does not, the flexible **Actisense** 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.

NMEA Talker devices 1, 2 and 4: These devices conform in full to the NMEA 0183 standard. Devices 1 and 4 share the same connection ID's as the **Actisense** NDC, so connection is a simple matter of matching the ID's (refer to figure 2). Device 2 uses the RS485 convention connection ID's. Simply connect '**A**' to '**+/A**' and '**B**' to ' **-/B**' (refer to figure 2).

NMEA Talker device 3: This device does not conform completely to the NMEA 0183 standard. However, by connecting '**+**' to '**+/A**' and its '**G/Ground**' to the NDC "**-/B"** the NDC 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.

Personal Computer: Whilst the OPTO IN 0 and ISO-Drive 0 provide a bi-directional 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 (probably male) connector.

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

Note:

1. Wire colours are for guidance only.

Other Connections

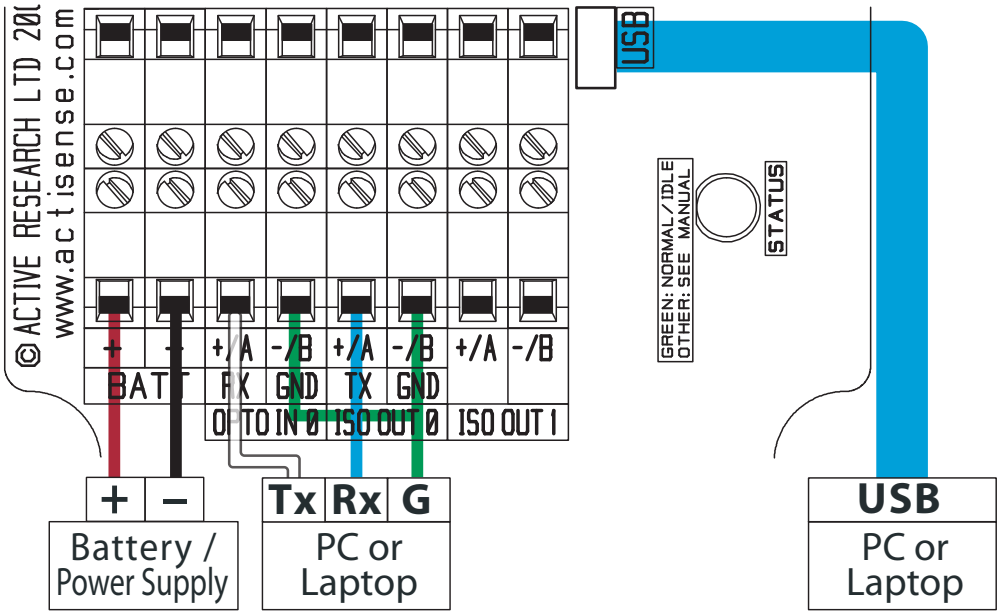


Figure 3 – RS232, USB and Battery connections

CAUTION!

The USB power and battery power are NOT isolated from each other. The USB and external battery should NOT be connected at the same time unless an isolated power supply is used.

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.

Connecting to a Personal Computer

The USB port can be used to connect a PC to the NMEA 0183 system.

The NDC-4 should be used with the 2 metre USB cable supplied as standard. If a longer cable length is required, a standard USB 1.1/2.0 extension cable should be used in conjunction with the existing USB cable. This extension cable would have **female** '**A**' and **male** '**A**' connectors.

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. Please note that both the Rx and Tx grounds on the NDC-4 must be connected to the PC's ground, as shown in figure 3 above.

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 the NDC-4 should be connected to the PC's serial port ground (pin 5).

Connecting to the battery supply

The **Actisense** NDC-4 can be powered either by the USB connection or through an external power source. If both power sources are available, the current drawn from the USB supply will be reduced to a trickle. If the external power source is removed, the USB power will seamlessly take over, without loss of data.

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 **Actisense** NDC-4 (refer to the **Specifications** sections).

Note:

1. Wire colours are for guidance only.

USB Driver Installation

(NDC-4-A-USB Only - Note standard NDC-4 units can be upgraded to USB by purchasing a USB upgrade kit).

The **Actisense** NDC-4 makes use of a virtual serial port driver (know as the Virtual COM Port Driver) to interface between the USB port on the PC and the **Actisense** product. This driver allows software running on a PC to communicate with the **Actisense** NDC-4 as if it was connected to a standard serial port on the PC, when in fact all communication is done over the USB connection.

The required driver installation comes in two separate packages. The first driver is a called the 'Serial Converter' which converts the USB data packets to a serial data stream. The second driver, called the 'Actisense NDC USB Serial Port', makes the USB connection appear as a COM port in the Windows™ Device Manager.

The NDC-4 with USB connection has been extensively tested with both Windows™ XP and Windows™ 98 SE.

For the experienced Windows™ XP user who is used to installing drivers, this section will be very familiar. To all other Windows™ users, the required steps are detailed below to help with installation.

The steps for Windows™ 98 SE are very similar to those of Windows™ XP and so are not detailed here.

The **Actisense** CD also contains the USB drivers for Windows™ 2000. These drivers have not been tested by **Actisense**, but should operate in the same manner as the Windows™ 98 SE and XP drivers.

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.

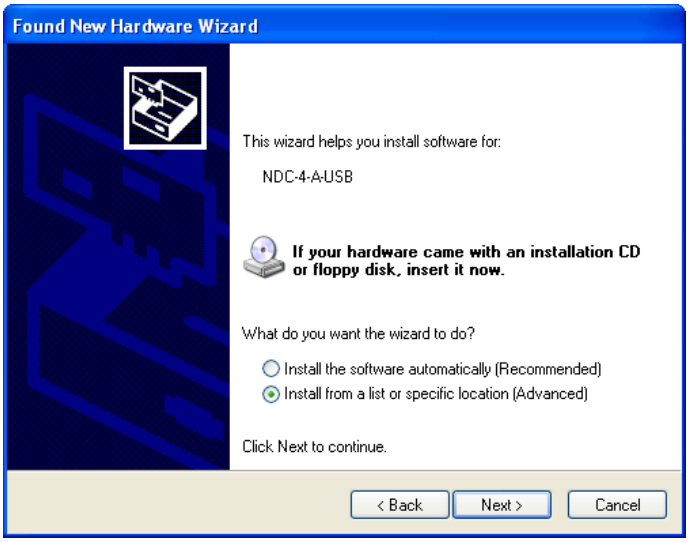
For MAC OS 8, 9, and X please contact **Actisense** for details (refer to the **Contact Information** section).

Step by step guide

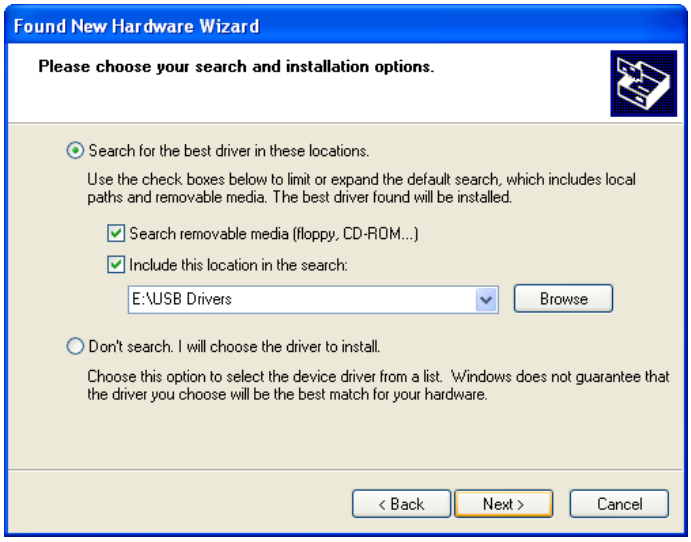
1. Connect the **Actisense** NDC-4 to an available USB port on the PC. The standard Windows™ 'Found New Hardware Wizard' window will then appear.

Select the '**No, not this time**' option, to allow driver installation from the **Actisense** CD which was supplied with your Actisense product.

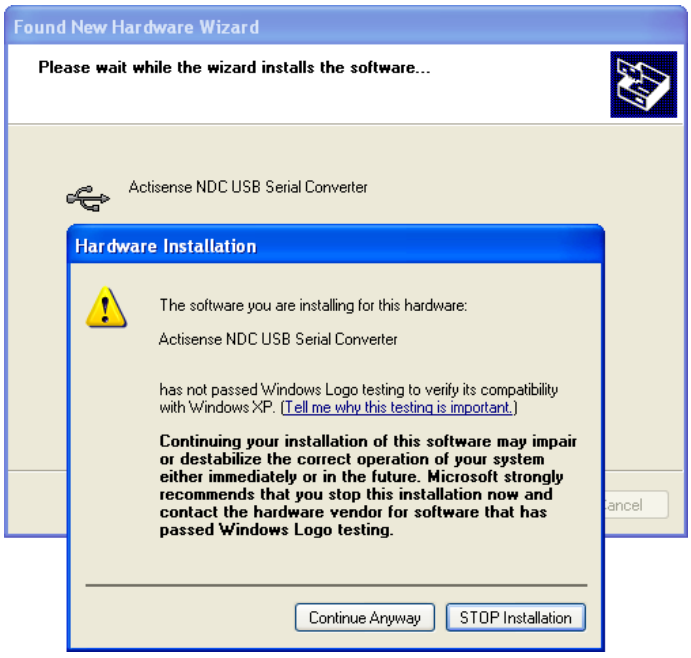
2. Insert the **Actisense** CD, choose the '**Install from a list or specific location**' option, and click '**Next**'.



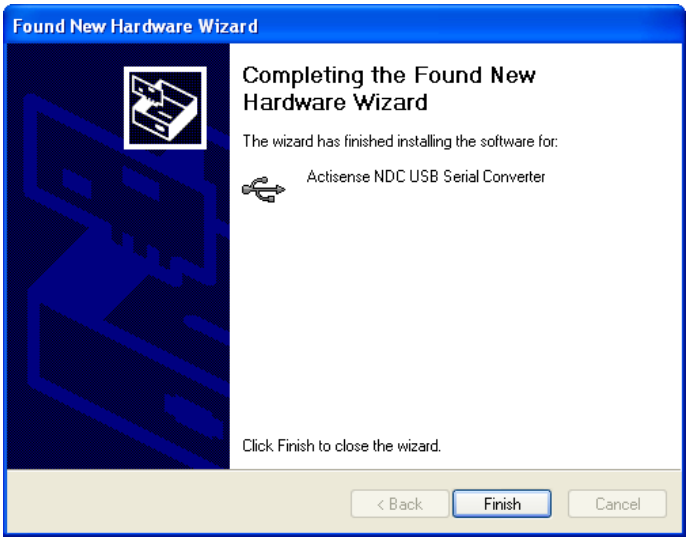
3. Make sure the '**Include this location in the search**' option is ticked, and use the '**Browse**' button to locate the '**USB Drivers**' directory on the **Actisense** CD.



4. The '**Actisense NDC USB Serial Converter**' driver is not Microsoft Windows™ certified, but it has been 'tried and tested' for stable and reliable operation with the **Actisense** NDC-4. Click '**Continue Anyway**' to carry on with the installation.



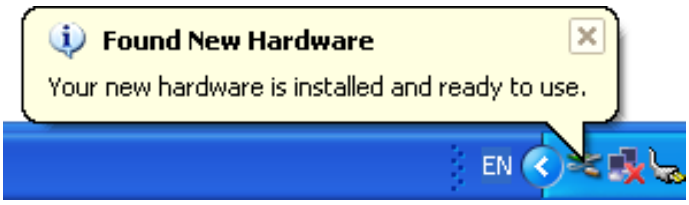
5. The '**USB Serial Converter'** driver is now installed, click '**Finish**' to complete the wizard, and wait for the '**Found New Hardware Wizard**' to appear again.



This second wizard will guide you through the '**USB Serial Port**' driver installation.

6. Follow steps **1** to **5** above for the '**USB Serial Port**' driver installation and click '**Finish**' to complete.

'**Your new hardware is installed and ready to use**' will appear in the bottom right corner of your screen when the installation is complete. See the **USB Driver Configuration section** 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 and configure the Baud rate.



USB Configuration

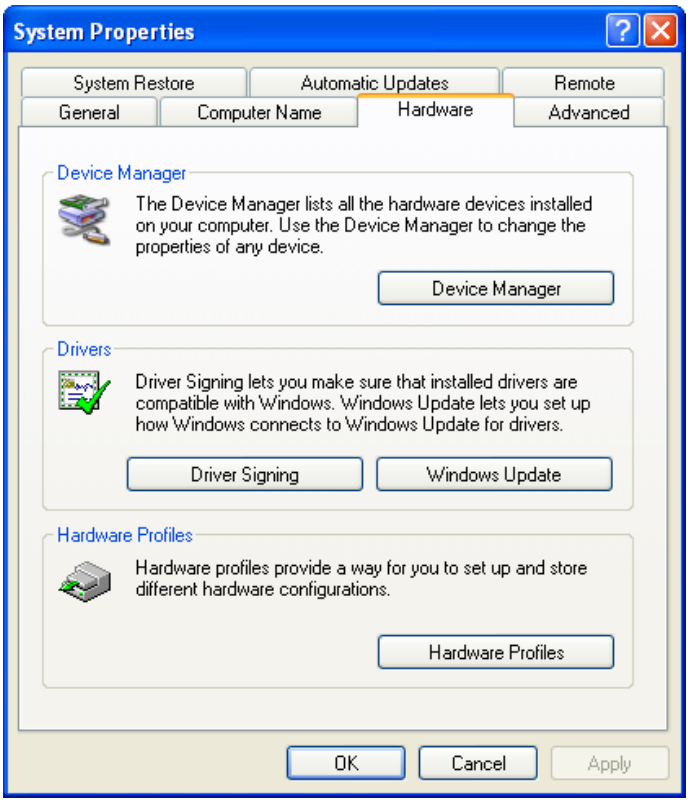
To communicate with the NDC-4, the COM port number that Windows™ has allocated to the USB port needs to be determined. The following guide will walk the user through this standard operation.

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 reselect a different COM port everytime the PC reboots, or the cable is swapped between two USB ports.

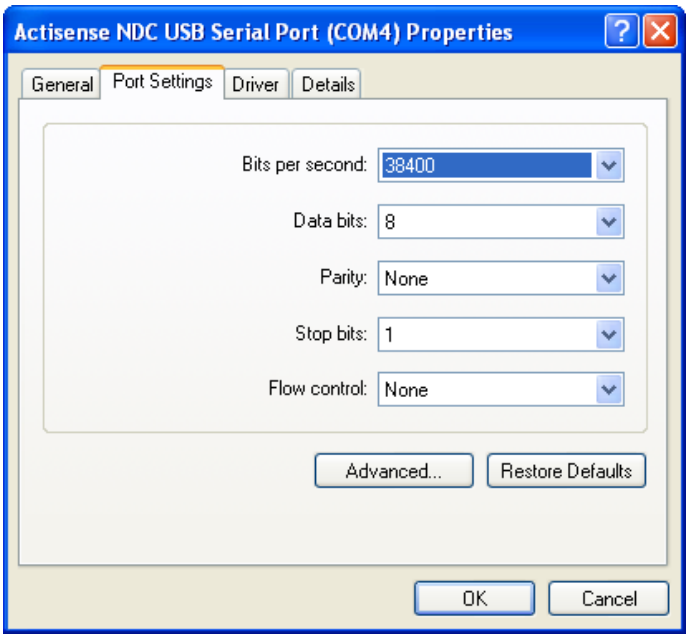
Step by step guide

1. Make sure the **Actisense** NDC-4 is powered up (indicated by a green LED) and connected to an available USB port on the PC. From the Windows™ '**Control Panel**', open the '**System Properties**' window and click on the '**Hardware**' tab.

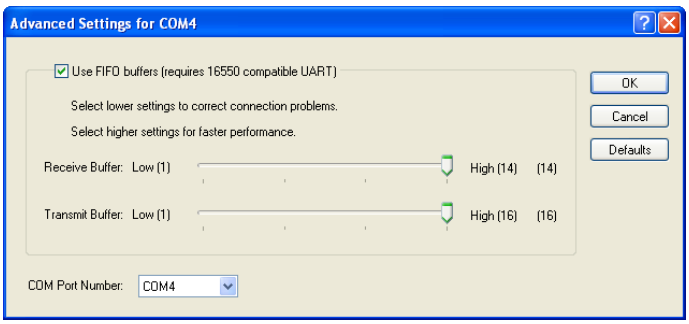


2. Click on '**Device Manager**' and expand the '**Ports (COM & LPT)**' list by clicking on the '**+**' sign next to it. You will find the '**Actisense NDC USB Serial Port**' in the list, followed by the allocated COM port number.

3. Double click on the port icon for the '**Actisense NDC USB Serial Port**' and the port properties window will appear. Click on the '**Port Settings**' tab. Select a Baud rate of 38400 for the '**Bits per second**' option. This is the fixed Baud rate for the **Actisense** NDC-4 device. Leave the other settings as they are.



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).



The other settings are already optimised for the **Actisense** NDC-4 and should be left in the default values. 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 Control Centre software suite. The **Actisense** NDC can be updated / upgraded using the latest Flash Centre 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™ platforms (98 SE/ME/NT/2000/XP), however, it has been proven possible to use the NDC Control Centre / ActiPatch on a Mac running Windows emulation software.

To install 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 and delete the program directory **before** installing the new version. Refer to the **To uninstall Actisense PC software** section for full details.

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 4 and 5).

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

5. To start / run the program, use the Windows™ 'Start' menu and navigate to the installed program's directory. There will be a program icon - double click on it (refer to figure 6 and 7).

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 a easy to access short-cut.

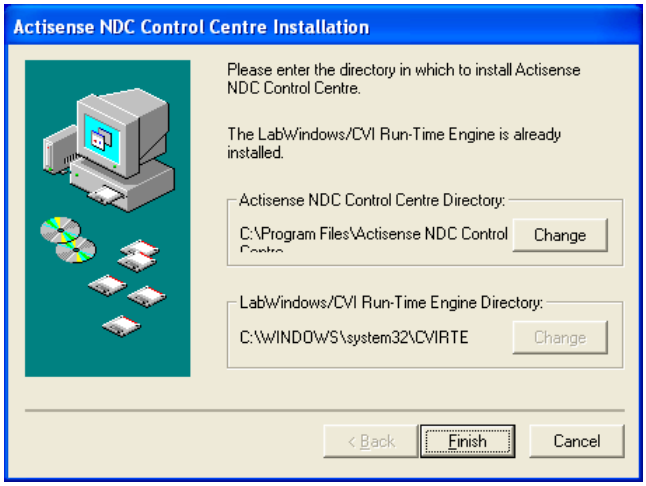


Figure 4 – Install options

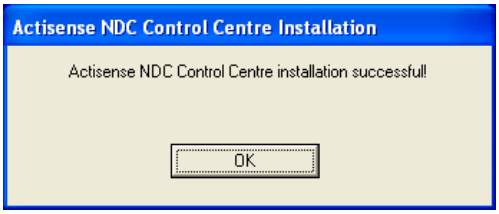


Figure 5 – Installation complete

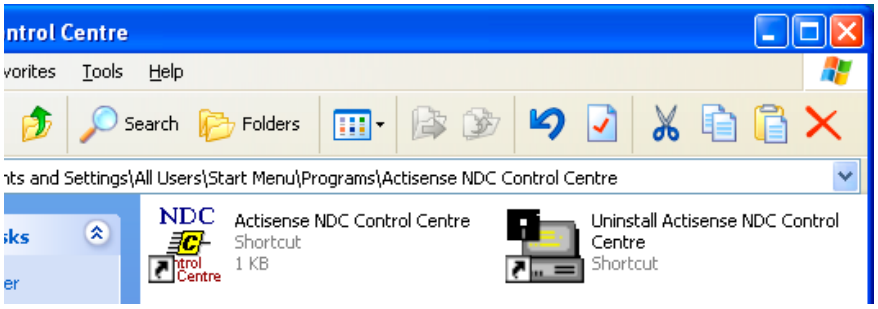
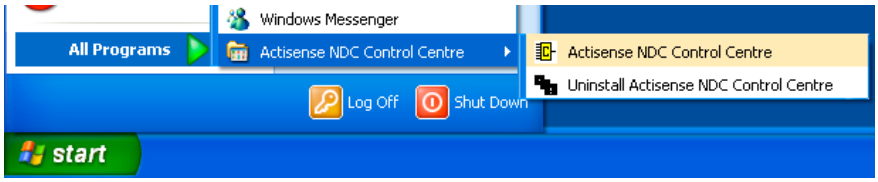


Figure 6 & 7 – 'Start' menu short-cuts



To uninstall 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. If at any time you wish to remove the installed Actisense program, simply use the standard Windows™ **'Start → All Programs → Actisense <Product Name> → Uninstall Actisense <Product Name>'** menu option to perform this operation (refer to figure 7).

2. Alternatively, there is a very convenient uninstall icon included in the program's folder (see figure 6).

3. Once the uninstall operation has been requested, the confirmation box (figure 8) 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 (refer to figure 9).

3. 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.

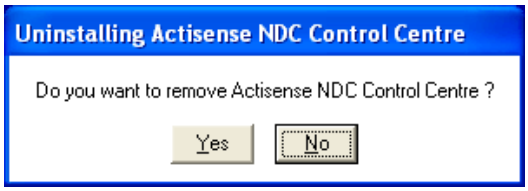


Figure 8 – Uninstall confirmation

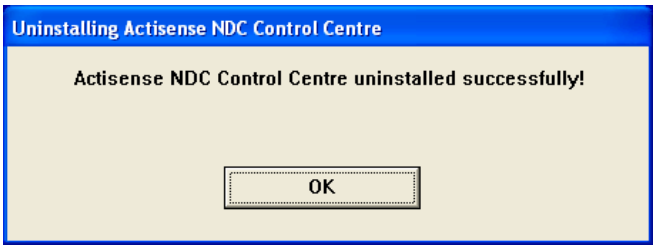


Figure 9 – Uninstall complete

Using the Control Centre

The **Actisense** NMEA Data Combiner hardware can be configured and monitored using its own dedicated Control Centre suite. This section provides a complete users guide to all the Control Centre's features.

This program is currently only available for Windows platforms (98/ME/NT/2000/XP), however, it has been proven possible to use the Control Centre on a Mac running Windows emulation software.

Main window

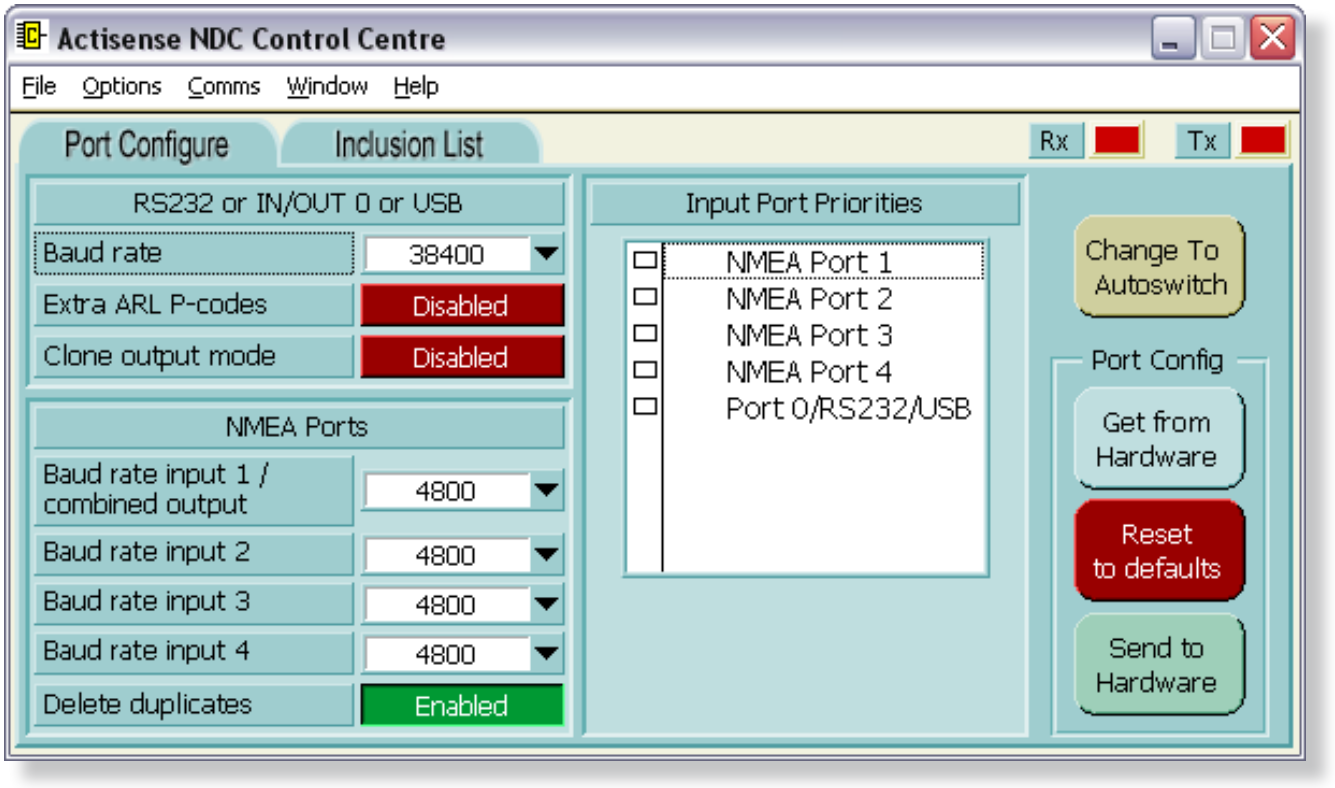


Figure 10 – Control Centre main window (after hardware detected)

The Control Centre main window allows the user access to all the NDC hardware configuration and monitor features, and adjustment of the Control Centre's actual appearance on screen.

The Control Centre is capable of displaying a large array of data and information, and not all will be of interest to every user. Therefore, the user can easily select which information / status windows are of interest and are visible, and which are not (hidden).

To meet the users specific requirements, any visible window can be repositioned on the screen by dragging it with the mouse. If a window is dropped (the left mouse button is released after the drag operation) close enough to an adjacent windows edge, it will snap to that windows edge. This allows for quick, easy and neat arrangement of the Control Centre's windows.

From the main window the user can select what Baud rates the various inputs and outputs of the NDC need to be, and even change the input port priorities. Selection of these options is possible by using the standard Windows menu system ('Options' menu) or via a tab system (behaving just like tabs in a filing cabinet). Full explanation of these features is detailed in the following sections.

Any changes the user makes to the Control Centre's appearance will be remembered for subsequent sessions, allowing the user to keep their favourite settings. Any new configuration settings must be downloaded to the NDC hardware before they can be remembered - this helps keep the Control Centre and NDC hardware in sync.

The main window has an '**Exit'** control button to close the Control Centre program. Refer to the menu **File** → **Exit** for full details on the operation of the exit request.

Initial hardware and software set-up

Important information - please read.

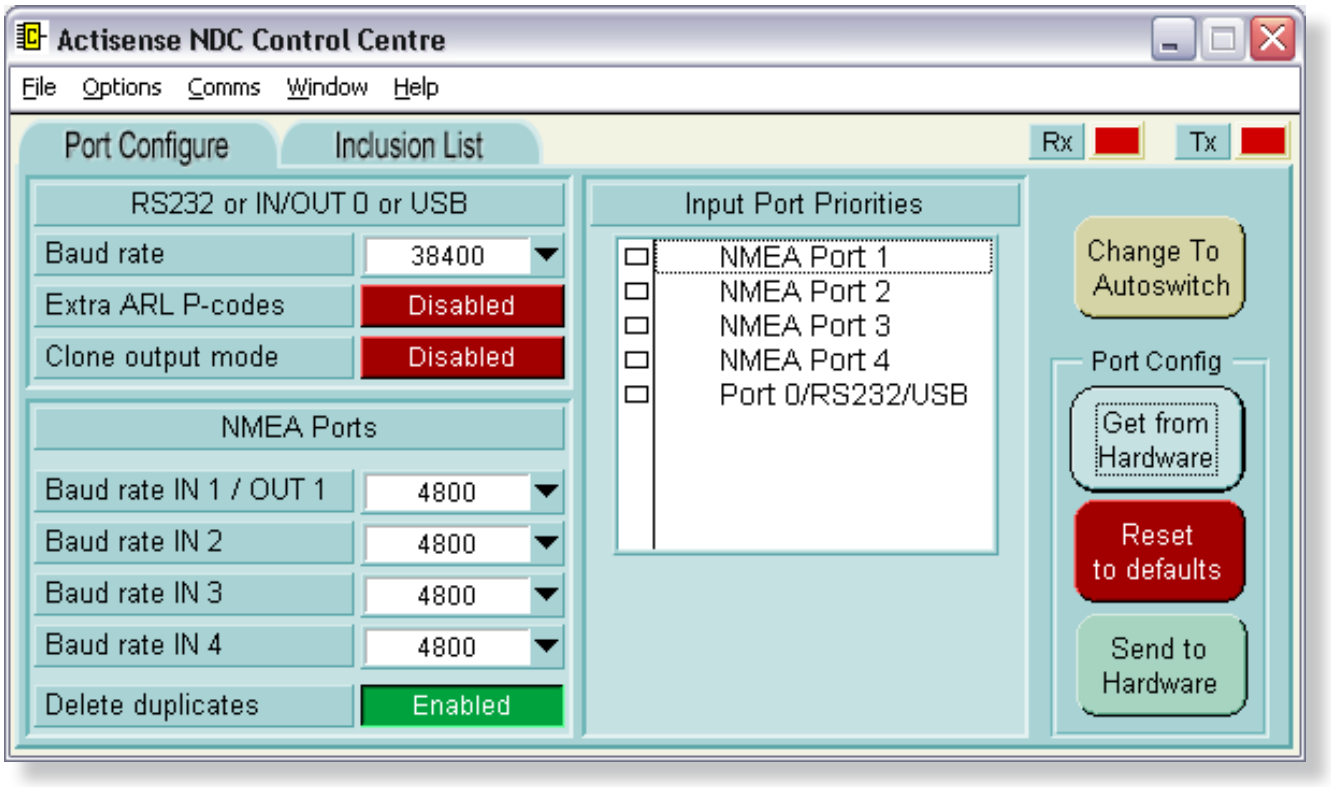


Figure 11 – Control Centre main window (before hardware detected)

To access all the NDC Control Centre configuration features, the Control Centre must first detect what type of NDC is connected. This allows the same Control Centre to be used for the NDC-1, NDC-2, NDC-3 and NDC-4 (as they all have different configuration and test options).

Before the NDC-4 hardware is detected by Control Centre, the main window will look like that in **Figure 11** - with the sections ghosted out.

Once detected, any disabled options that are available for the detected NDC type will become active and the main window will look like that in **Figure 10**.

To allow detection of the NDC hardware, perform the initial setup procedure:

1. Connect battery power (10 - 35v) to the NDC-4 and switch on the battery. The NDC-4's LED will cycle through its standard start-up colours ('red', 'amber' and finally 'green'). Refer to the **Connecting to the battery supply** section for more details.

2. If using an NDC-4: connect an RS232 cable from the PC to the NDC-4, as shown earlier in the manual. Alternatively, if using an NDC-4-USB: connect the provided USB cable to an available USB port. Refer to the **Connecting to a Personal Computer** section.

3. Select the PC Comm port number that the RS232 cable was plugged into (or the USB port was issued by WIndows) from the options in the main windows 'Comms' menu. The Baud rate will default to 38400 Baud (the factory default), but will auto-Baud to the actual Baud rate if it has been changed.

4. The Rx and Tx 'LED's on the main window will flash to indicate that communication is in progress (between the Control Centre and the NDC-4 hardware). Once the hardware information has been received (and displayed), all the NDC-4 configuration and test options will be enabled.

If for any reason the hardware detection operation does not happen as described, check all connections are made as required and are secure.

Pull-down menus

The main window has five standard pull-down menus.

File → Load / Save Configuration File:
The Control Centre will automatically save its appearance and all other settings to file "`ControlCentre.ini`" so that the same settings can be used in subsequent sessions.

If the user requires more than one configuration set up with unique Port Configurations, then each set up can be saved and loaded back from this menu. This is very useful for standardising vessel installations.

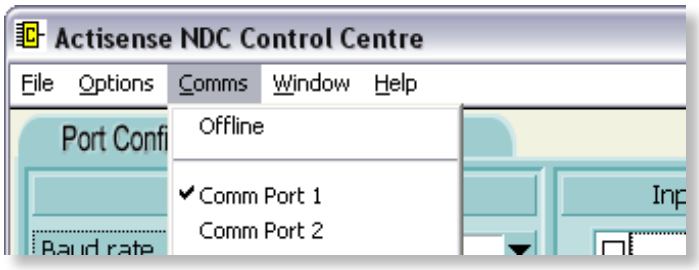
Note: Do not attempt to edit the "`ControlCentre.ini`" file by hand, as this can result in all the configuration settings being lost.

File → Exit:
Closes the Control Centre program. If any changes to the Port Configurations have been made, but not yet transferred to the NDC hardware, the user will be asked to confirm the exit request (as all alterations will otherwise be lost when the program closes).

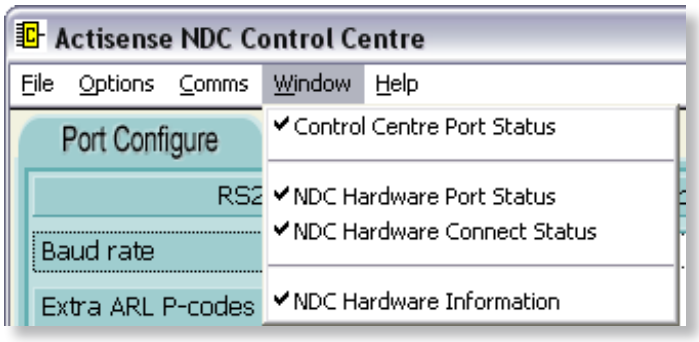
Options → Configure Ports:
Displays the Port configuration tab of the main window. Refer to the **Port configuration** sub-section for full details on this feature.

Options → Configure Inclusion Lists:
Inclusion List configuration options are not currently available for the NDC-4. This functionality will be released as a free firmware upgrade on the Actisense website when finalised. Please monitor the **Actisense website** and / or sign up for the **Actiscope** newsletter.

Options → Test Hardware:
The Test hardware tab is not required / selectable for the NDC-4 (only required for the NDC-2 Multiplexer).



Comms → Comm Port 1-8:
Selects the PC communications port the NDC hardware is attached to. The Baud rate will default to 38400 (the NDC hardware default). If the NDC is not using the default Baud rate, the Control Centre will try all possible Baud rates until the correct one is found (this will take up to 12 seconds). The offline option closes the communication port.



Window → Control Centre Port Status:
Displays the Control Centre's port status window. Refer to **Control Centre Port status** window for full details.

Window → NDC Hardware Port Status:
Displays the NDC hardware's port status window. Refer to the **Hardware's Port status** window for full details.

Window → NDC Hardware Connect Status:
Displays the NDC hardware's connection status window. Refer to the **Hardware's Connect Status** window for full details.

Window → NDC Hardware Information:
Displays the NDC hardware's information window. Refer to the **Hardware's Information** window for full details.

Help → Control Centre Help:
Currently unavailable (not selectable).

Help → About Control Centre:
Displays the Control Centre's software version number and the **Actisense contact information**.

Port Configuration tab

The Port configuration tab of the main window allows the user to select the priority and Baud rates of the NMEA and USB / RS232 input ports of the NDC-4 hardware, plus other useful features.

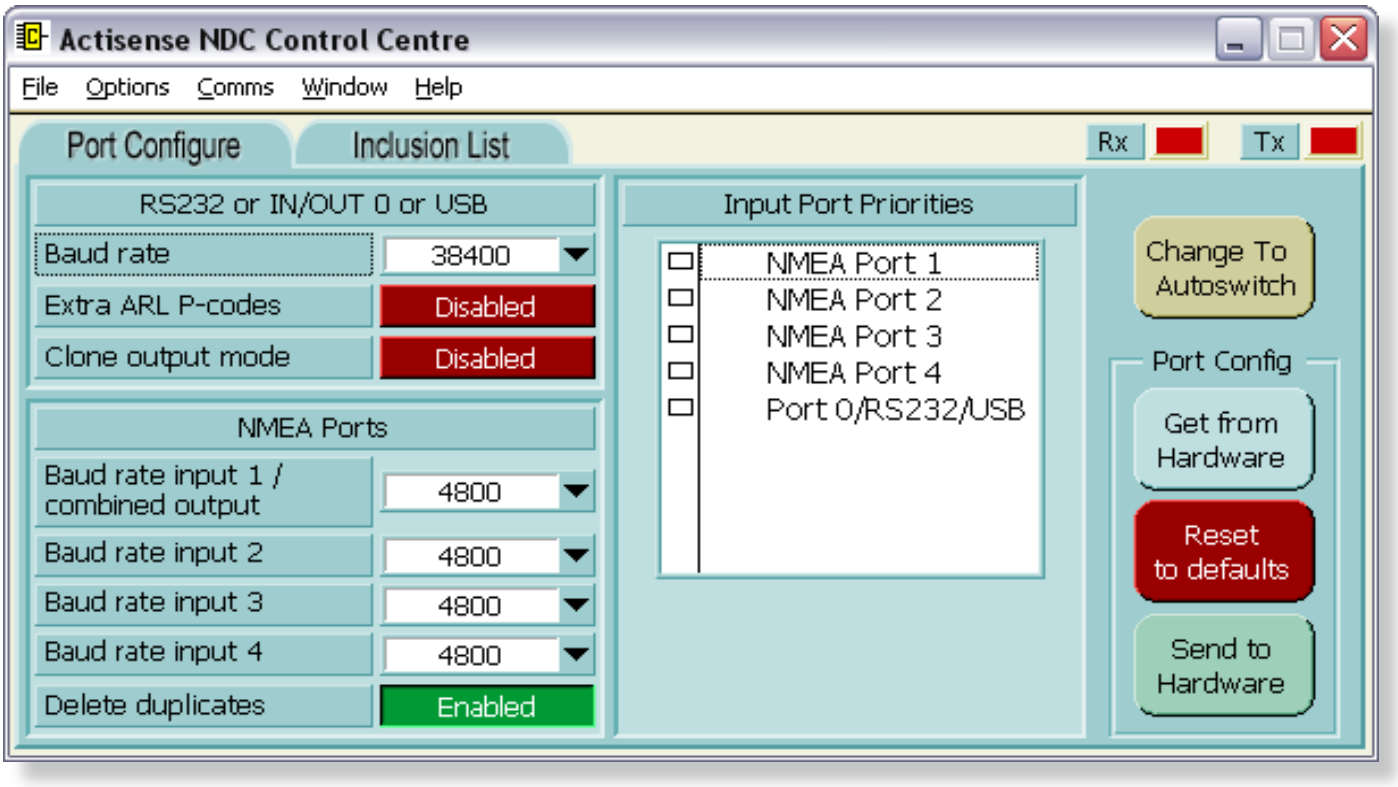


Figure 12 – Port Configuration tab

Why is there a need for Port Priorities?

Each of the five NMEA input ports can transfer anything up to 480 bytes of data per second, making a total of 1920 bytes/second. The data combined output of the NDC is also forced (by the NMEA 0183 standard) to send a maximum of 480 bytes/second. Therefore, there exists the distinct possibility that there could be more data to send out than is possible to achieve. If this situation occurs the port priority system comes into operation.

This system stipulates that the highest priority input port will have the highest number of time slots in the combined output. The next lowest priority port has less time slots, down to the lowest priority input port that has only a few time slots. Each time slot allows one NMEA 0183 sentence to be sent until either no data remains (the usual case), or the transmit capacity has reached its maximum of 480 bytes/second.

If the rate of data in to the NDC hardware continues at this very high level, then eventually some sentences (from the lowest priority channel first) will have to be dropped. If however, the rate drops below the maximum, then the sentence data will be sent at the next opportunity.

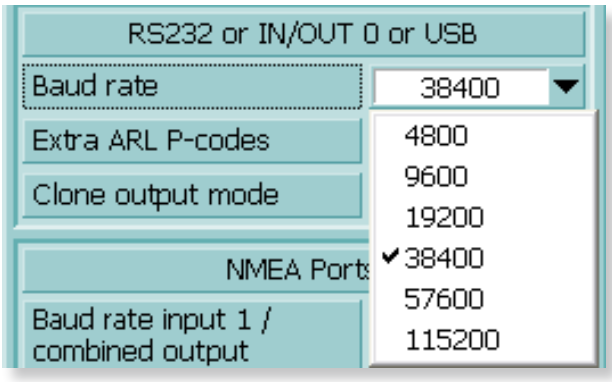
How to change port priorities and Baud rates

The port configuration tab consists of a vertical port priority list, a Baud rate pull-down list for each NMEA / USB / RS232 port, the P-code enable toggle control, and **Get from Hardware**, **Reset to defaults** and **Send to Hardware** buttons (refer to **Figure 12**).

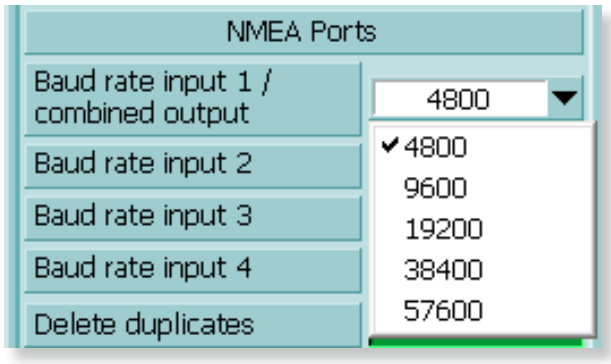
Input Port Priority list:
Click on two inputs in turn to change their positions in the priority list. The topmost item has the highest priority and the item at the bottom, the lowest.

RS232 or IN/OUT 0 or USB Baud rate lists:
Select the required Baud rate for the appropriate port(s).

Please note that the NMEA 0183 specification restricts the Baud rate for NMEA data to 4800 Baud. Therefore, any input port that has an NMEA device attached to it that cannot modify its Baud rate **must** remain at 4800 Baud (otherwise no data will be received). However, some NMEA devices (e.g. GPS units) do allow for the Baud rate to be increased to 9600 Baud, or even 38400 Baud (Hi-Speed NMEA). **Only** in these cases should the Baud rate of the appropriate port be changed from 4800 Baud to match that of the attached device.



The **USB or IN/OUT 0** Baud rate options are 4800, 9600, 19200, 38400, 57600 or 115200 Baud. It is important to note that setting the USB / RS232 Baud rate to anything under 19200 Baud may reduce the bandwidth of this output below that of the total input bandwidth. This could result in random loss of NMEA sentences. Therefore, for normal operation, 38400 Baud is ideal, however, for exceptional requirements were the total input bandwidth is below 100%, any of the available Baud rates can be used.



NMEA input 1 and the Combined NMEA output are two sides of the same port, and therefore share the same Baud rate (with options between 4800 and 57600 Baud).

NMEA inputs 2 and 3 also have the same Baud rate options of 4800 to 57600 Baud. Inputs 1, 2 and 3 can be used as hi-speed inputs (ideal for AIS transponders). Currently, setting the Baud rate to 57600 will restrict all other NMEA inputs to 4800 Baud - to help keep the total bandwidth to a manageable level.

NMEA input 4 is fixed to the standard 4800 Baud rate.

It is worth noting, that the NDC-4 **receives and buffers** all the NMEA 0183 sentences from all 5 inputs (4 NMEA 0183, and 1 USB / RS232), and then as a **totally independent** operation, it **re-sends** the required NMEA 0183 sentences out its 2 ISO-Drive outputs.

As these two operations are independent, the Baud rates of all the inputs and outputs can also be independent, that is to say, different - **the inputs and outputs can all have different Baud rates (with the except of Input 1)**.

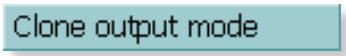
Extra ARL P-codes:

Toggles the enable/disable state of the extra ARL P-code sentences on the RS232 port. These P-codes are used by Control Centre to determine which NDC input supplied which piece of NMEA data. In this way, Control Centre can show what data came from channel 1, channel 2, etc. This ability is also open to any other PC program. For example, an NDC with 4 digital NMEA depth sounders connected to it could have the 4 individual depth values shown on a PC screen in representative positions (bow starboard, bow port, stern starboard and stern port).

If in the unlikely event however, the USB / OUT 0 port is connected to an electronic device (e.g. chart plotter) that cannot ignore the P-codes (as it should by default), then these P-codes can be disabled to aid compatibility.

Note: As the Control Centre requires the extra Actisense P-code sentences to operate correctly, it will temporarily turn them on when it first connects to the NDC-4. When the Control Centre software is closed, the NDC-4 will revert back to the user-stored configuration settings, and the P-code sentences will stop being transmitted (if configured as such by the user as disabled).

Clone output mode:



Toggles the enable/disable state of the data **Clone output mode** on the USB/OUT 0 port. When output port is in **Clone output mode**, the data output will be a clone, or copy, of the data output from the NMEA Combined output (OUT 1). That is to say, the data output will have been filtered just like the NMEA Combined output data is.

This is useful if you need to supply an NMEA device with filtered NMEA data that will only accept RS232 signal levels on its input, or requires a higher Baud rate.

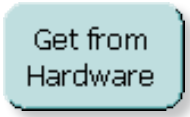
When **Clone output mode** is disabled, the USB/OUT 0 output will contain all data received on all 5/4 of the NMEA inputs (no filtering applied).

Delete duplicates:

Toggles the enable/disable state of the useful **Delete duplicates** option. When enabled, any duplicate NMEA sentences found in the receive buffer that are deemed safe to delete older versions (duplicates) will be deleted. This intelligently reduces the output data when too much data is coming through the input channels. For example, if two depth sentences are in the buffer ready to be transmitted, there is normally no point in transmitting the older depth value, as the newer one has replaced all previous ones.

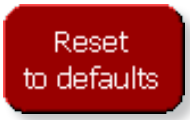
However, for special systems that do not want this feature (and can guarantee that there will not be more than 100% total loading), this feature can be disabled.

Get from hardware:



Reads the current Port Configuration information, for all channels, from the connected NDC hardware. This will overwrite any current settings held by the Control Centre's Port Configuration; if the current settings must be remembered, the **File** → **Save Configuration file** main window menu option should be used before requesting this operation.

Reset:



Returns all Port Configurations to the factory defaults – port priorities match channel numbers (port 1 has highest priority and port 4 has the lowest), NMEA Baud rates are set to 4800 Baud, USB/RS232 Baud rate set to 38400 Baud and the extra ARL P-codes are enabled.

Send to Hardware:

Finalises the Port Configuration editing operation. If any alterations to the port configuration settings have occurred the Control Centre will now attempt to download the new settings to the attached **Actisense** NDC hardware. The **Flash Hardware Control** window will appear for the brief duration of the download (normally one to two seconds).

Note: Pressing any of the threes buttons above **will only affect the Port Configuration settings**.

Set-up Procedure

1. The USB / RS232 communication port defaults to 38400 Baud - normally more than capable of transferring the received data of all four NMEA input ports. When connected to a Personal Computer there should not be any reason to change this Baud rate. However, if it is required to connect the NDC hardware to an RS232 compatible device that does not support the Baud rate of 38400, then the rate can be changed. Left click on the USB / **RS232 Port Baud rate** control's down arrow to display the list and then select the required Baud rate value.

2. The proprietary **Extra ARL P-code** sentences sent by the NDC hardware are completely benign and should be ignored by all other manufacturer devices. The **Actisense** software programs (Control Centre and ActiPatch) use these sentences to perform certain operations that enhance their control over the NDC hardware and are therefore important. There should not be any reason for requiring that these sentences be disabled. However, as **Actisense** believes in offering complete control over its products, it is possible to enable/disable these sentences by clicking on the **Extra ARL P-codes** control.

3. The OUT 0 / RS232 output defaults to normal output mode - that is, with the **Clone output mode** option disabled. If however, it is required to apply the NMEA filter settings to the OUT 0 data, enable this option.

4. As detailed above, the NMEA 0183 standard determines the Baud rate of 4800. If however, to make the NMEA input compatible with special devices that offer a different Baud rate, the rate can be changed by left clicking on the **NMEA Port 1-3** pull-down lists.

   NMEA Port 4 does not have a pull-down list as it is fixed at 4800 Baud.

5. To aid memory, it is normal to keep the port priorities in the same order as the port numbers - port 1 has highest priority and port 4 the lowest. However, if for some reason the port priorities require changing and it is inconvenient to alter the hardware connections, the port priorities can be changed using the **Input Port priorities** list.

6. If the NDC hardware has not been detected yet, the Control Centre will not allow the configuration transfer. If this happens check all cable connections, Control Centre communication settings (port number and Baud rate) and battery power to the NDC hardware (the diagnostic LED should be lit and either a 'Green' or 'Amber' colour).

7. When the Control Centre has detected the NDC hardware (the hardware information will be displayed in the **NDC Hardware Information** window), clicking the **Send to Hardware** control button will start a transfer of the new Port Configuration data to the hardware. This process can be monitored on the **Flash Hardware Control** and **NDC Hardware Connection Status** windows (normally for advanced users only).

8. The **Flash Hardware Control** window will display the success status of the transfer and then disappear.

9. If at any time you would like to return the Port Configuration settings back to their defaults, press the **Reset to defaults** control button followed by the **Send to Hardware** control button.

Note:

1. The USB / RS232 output is unaffected by the NMEA Port Priorities, and typically retains all received data – as this port has a high enough transmit bandwidth/ capacity to handle all NMEA data received.

2. Pressing any of the three control buttons on the Port Configuration Tab will only change / download / retrieve the port configuration values.

Inclusion List configuration tab

The Inclusion List configuration tab of the main window allows the user to select which NMEA sentences are to be **included** in the onward data transmission from the NMEA Data Combiner. Each of the four NMEA input ports and the USB input port have their own Inclusion List, so that each can be tuned separately to match its connected device.

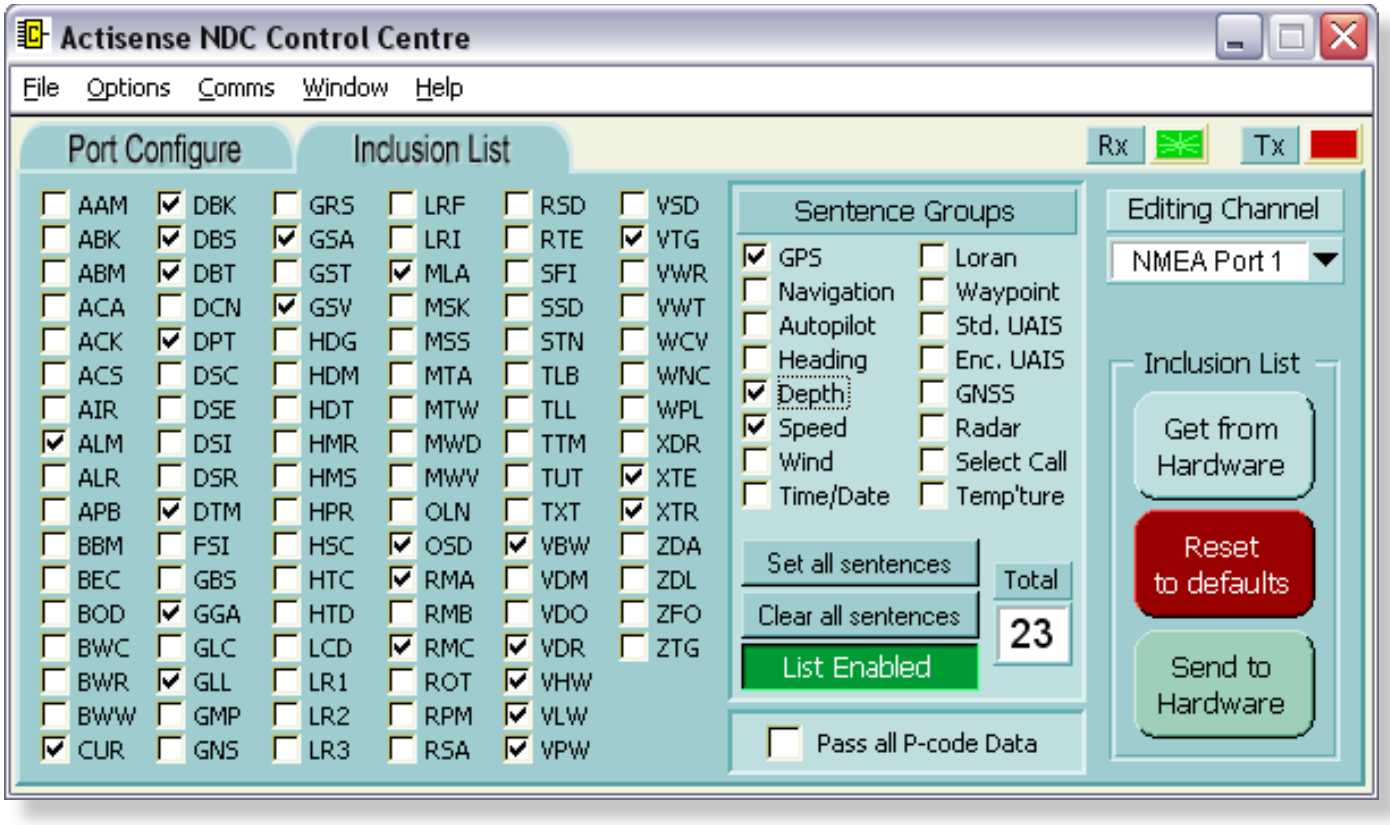


Figure 13 – Inclusion List configuration tab

Why is there a need for Inclusion Lists?

Each of the 5 input ports can transfer anything up to 480 bytes of data per second, making a total of 1920 bytes/second. The data combined output of the NDC is also forced (by the NMEA 0183 standard) to send a maximum of 480 bytes/second. Therefore, there exists the distinct possibility that there could be more data to send out than is possible to achieve - thus, some data may require removal to balance this equation. The **Actisense™** NDC-4 achieves this reduction in an intelligent manner with Inclusion Lists and Port Priorities.

Is some NMEA data really unnecessary?

Many NMEA instruments output a large number of sentences every period (usually 1-3 seconds), some of this data is of absolutely no use to the average boat owner, and just clogs up the NMEA network. Most GPS units are especially guilty of this and not all allow the user to reduce the number of unwanted sentences that are transmitted. Of those that do, the procedure can often be tricky and time consuming.

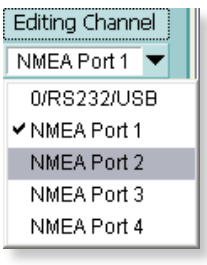
The **Actisense™** NDC-4 can filter the incoming NMEA data to remove any sentences deemed unnecessary.

For example, most GPS units automatically output the 'GSV' sentences (normally 2 but could be as many as 4), which give details of all the satellites that are currently in view. All of this information is of no use to 99% of users, but this alone can use up to 5% of the available NMEA bandwidth/capacity.

The **Actisense™** NDC 'Inclusion List' default is to allow all sentences through. The user can modify these lists using a simple 'tick-box' panel from within the Control Centre.

How to change the Inclusion Lists

The Inclusion List configuration tab consists of two groups of sentence tick boxes, a box indicating the total number of selected sentences, an NMEA channel selection pull-down list, and **Get from hardware, Reset to defaults** and **Send to Hardware** control buttons (refer to **Figure 13**).



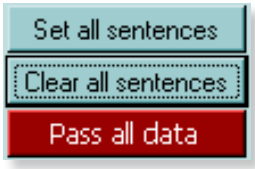
Channel selection list:
Determines which input channel (port) has its Inclusion List displayed for editing with the tick-box controls in the main section to the left.

Main (left) tick-box area:
Each NMEA 0183 sentence has its own individual tick-box, and is intended for the advanced user to fine tune the selection to exactly what is required (as this requires detailed knowledge of NMEA 0183 sentences).

Sentence Groups (right) tick-box area:
To make selection of NMEA 0183 sentence's easier, all sentences of a particular type have been collected together, and is primarily intended for the novice user who does not know which sentences contain what information.

The NMEA sentence collections are designed for quick list configuration; each collection influences all the NMEA sentence tick-boxes in the main (left) area that contain the selected information.

The tick-box operation is straightforward: if the box is ticked, the corresponding NMEA sentence will appear on the combined NMEA output. Conversely, if the box is not ticked, that NMEA sentence will be blocked and not appear on the combined output.



To completely disable the Inclusion List for a particular channel, click on the **Clear all sentences** button. The list status indicator will then change from the green **List Enabled** to red **Pass all data**.

The **Sentence Total** box will also show that '0' sentences are selected.

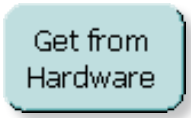
Once disabled (and **Pass all data** displayed), all NMEA sentences will be passed to the NMEA combined output - no filtering will occur on this channel. This is only useful when trying to pass an NMEA sentence that is not available for selection in the Inclusion List and is not normally used.

The buttons **Clear all sentences** and **Set all sentences** are useful to quickly reset or set all tick marks. This allows for quick configuration of the Inclusion List without having to click on every tick box. For example, if only a couple of sentences are required to be set, press the **Clear all sentences** button followed by selecting the couple of required sentence IDs.

Sentence Total:

The total number of NMEA sentences currently selected / enabled for the current channel / port is displayed in the bottom right corner. This is purely for user information and interest.

Get from Hardware:



Reads/retrieves the current Inclusion List information, for all channels, from the connected NDC hardware. This will overwrite any current settings held by the Control Centre Inclusion Lists; if the current settings must be remembered, the **File** → **Save Configuration file** main window menu option should be used before requesting this operation.

Reset to defaults:

Returns all channel Inclusion Lists to the factory default – all Inclusions Lists are disabled on all channels, which allows all sentences to be passed by default.

Send to Hardware:

Finalises the Inclusion List editing operation. If any alterations to the list have occurred, the Control Centre will now attempt to download the new settings to the attached **Actisense™** NDC hardware. The **Flash Hardware Control** window will appear for the duration of the download and the details of the conversation can be viewed in the **NDC Hardware Connection Status** window (advanced users only).

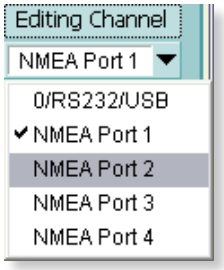
Note: Pressing any of the threes buttons above will only affect the Inclusion List settings - all Port Configuration settings will remain unaffected as they are controlled by their own independent set of buttons.

Set-up procedure

1. Remembering that the channel's have a priority level (that only has a effect during very high loads), choose which device to connect to which channel. Place the most important device on channel 1 and so on. If the 'Inclusion Lists' are tuned to allow only the required data of each device through, then the port priorities will normally not come into operation (as the maximum output rate will usually not be exceeded).

2. Starting with channel 1, place a tick next to all required NMEA sentences (using the individual tick boxes, the grouped tick boxes or a combination of both), by left clicking on the text or box with the mouse pointer.

3. Perform the same operation for any other channels that you intend to use. Use the **Editing Channel** selection list to change which channel is active - left click on the controls down arrow to display the list and then select the required channel number. Any combination of channels can be used – for example, in a two-device set-up channel's 1 and 3, or 2 and 3 etc. could be used.



4. If the NDC hardware has not been detected yet, the Control Centre will not allow the configuration transfer. If this happens check all cable connections, Control Centre communication settings (port number and Baud rate) and battery power to the NDC hardware (the diagnostic LED should be lit and either a 'Green' or 'Amber' colour).

5. When the Control Centre has detected the NDC hardware (the hardware information will be displayed in the **NDC Hardware Information** window), clicking the **Send to Hardware** button will start a transfer of the new Inclusion List data to the hardware. This process can be monitored on the **Flash Hardware Control** and **NDC Hardware Connection Status** windows (for advanced users only).

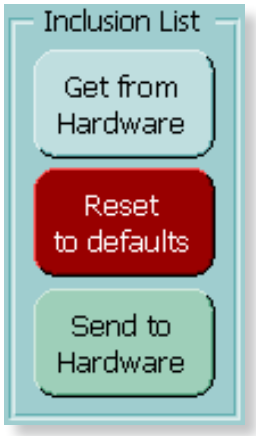
6. The **Flash Hardware Control** window will display the success status of the transfer and then disappear.

7. If at any time you would like to return the Inclusion List settings back to their defaults, press the **Reset to defaults** control button followed by the **Send to Hardware** control button.

Note:

1. The OUT 0 / RS232 / USB output is unaffected by the NMEA Inclusion Lists and typically (when **Clone output mode** is disabled) retains all received NMEA data – as this port's high transmit bandwidth/capacity can handle all the NMEA data received.

2. Pressing any of the three control buttons on the Inclusion List Tab will **only** change / download / retrieve the inclusion list configuration values. The Port configurations will remain unchanged.



Flash Hardware window

The Flash Hardware window is displayed for the duration of the Port Configuration update operation.

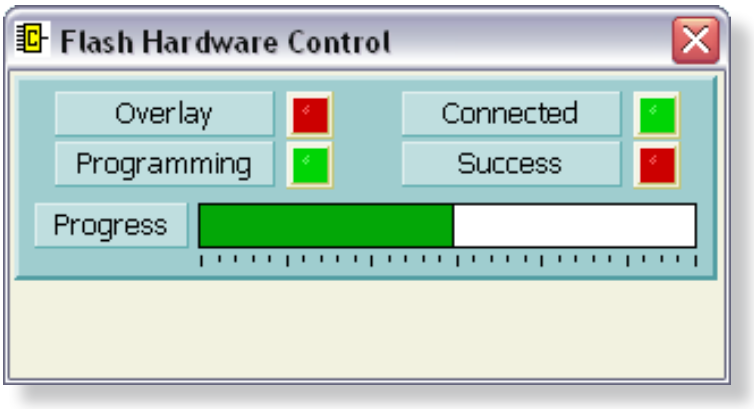


Figure 14 – Flash Hardware Control window

Please note that during this updating process, it is vital that the Control Centre and NDC hardware are not interrupted. Therefore, the following precautions are suggested:–

1. Ensure there are no programs active/running on the PC other than the Control Centre.

2. Check that the USB / RS232 cable between the PC and the NDC hardware is secure.

3. Confirm that the battery supply to the NDC hardware is secure.

If the Flash hardware operation is interrupted, the Port Configurations could become corrupted. The user should identify and remove the reason for the previous interruption before re-attempting to flash the hardware again (by pressing the **Send to Hardware** control button on the appropriate tab).

The Flash Hardware window consists of four LED's that indicate the flash operations current status, a progress bar indicating percentage completed of the current stage, and a flash program counter that indicates how many times the NDC hardware's Inclusion List has been re-programmed.

The **Success LED** indicates the final outcome of the data transfer. If it does not light up green, the **NDC Hardware Connection Status** will indicate a more detailed cause and the process should be performed again.

Advanced Features

The following windows and/or tabs will only be of interest to the advanced user, as they are not vital for the configuration of the NDC hardware. They do however, explain the useful diagnostic and monitoring features available.

These advanced windows are hidden by default, and all novice users should advance past this section to the **Using the NDC ActiPatch** section that follows.

Control Centre Port Status window

The Control Centre status window displays all information relating to the communications port open between the Control Centre and the NDC-4 hardware.

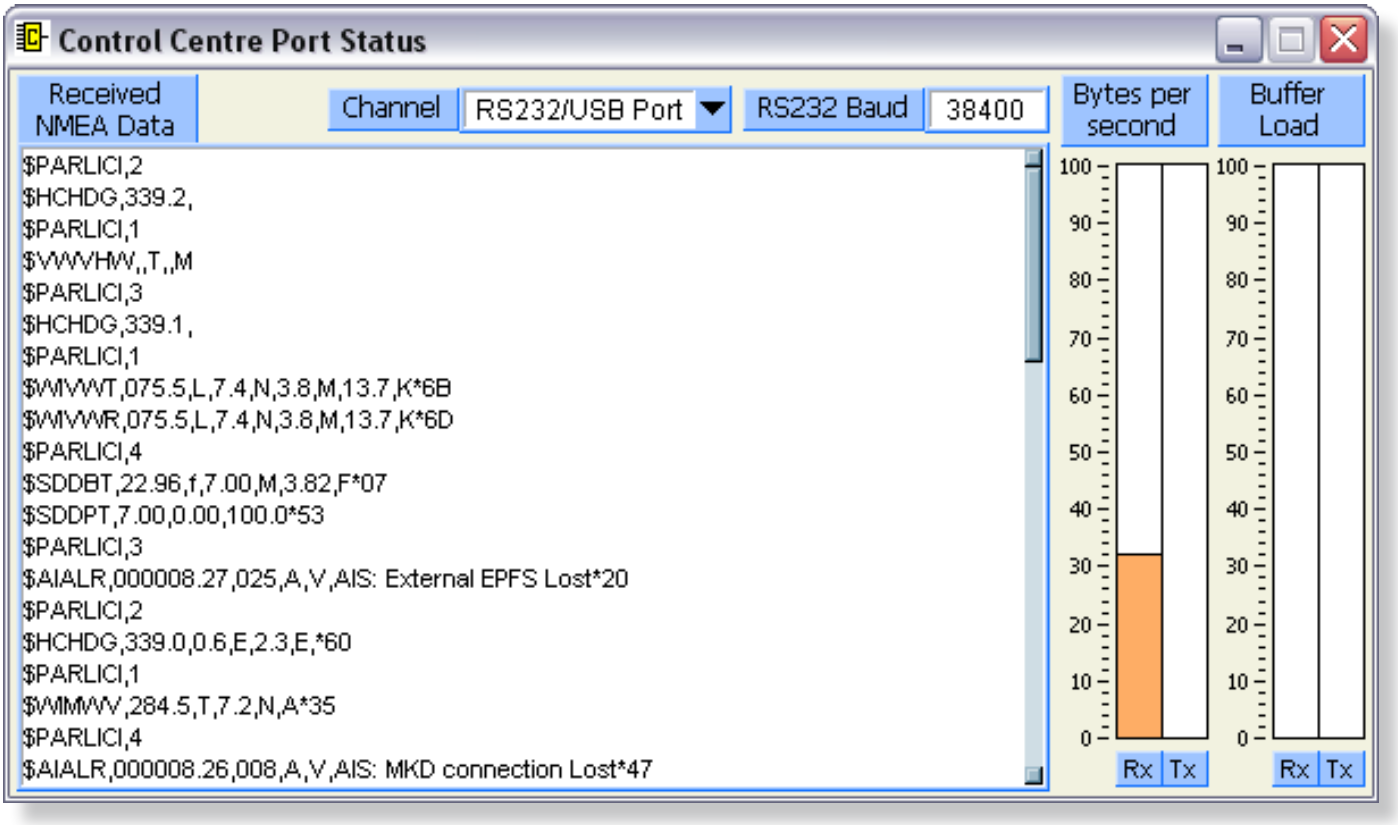
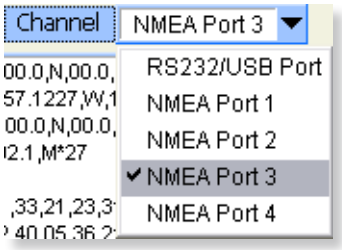


Figure 16 – Control Centre Port Status window

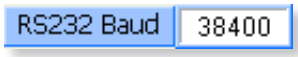
This includes data received (from the NDC hardware) and data sent (to the NDC hardware), and the bytes-per-second transfer rate / buffer loading rate for both directions of the communications port.



The **Channel** selection list allows the user to choose which channel's NMEA data is displayed in the **Received NMEA Data** window.

This enables each NDC input to be analysed and the NMEA data checked. For example, this is very useful in allowing the user to view an NMEA channel's data and prove that the NMEA device connected to that NDC input is functioning correctly.

This window should be the first port-of-call when trying to diagnose a problem with the NMEA system connected to the NDC-4. Contact a qualified marine electronic installer if you require hands-on help with understanding the NMEA 0183 data seen in this window. In addition, there is a very good source of NMEA information contained within the **NMEA 0183 information sheet** document available on the **Actisense website**.



The current USB / RS232 Baud rate being used for communication between the Control Centre and NDC hardware is displayed here for the user's information.

The **Received NMEA Data** window is valuable in monitoring the performance of the NDC hardware, and as a diagnostic tool for pinpointing:

- A port overload condition - this is when the maximum data transfer rate of a port is exceeded, and data is being dropped/deleted randomly as a result.
- A data corruption condition - this is either when the signal level of NMEA 0183 data being received is marginal and/or suffering from interference, or when interference is occurring between the NDC-4 and the computer running Control Centre.
- When all data is being processed as required.

Hardware Port Status window

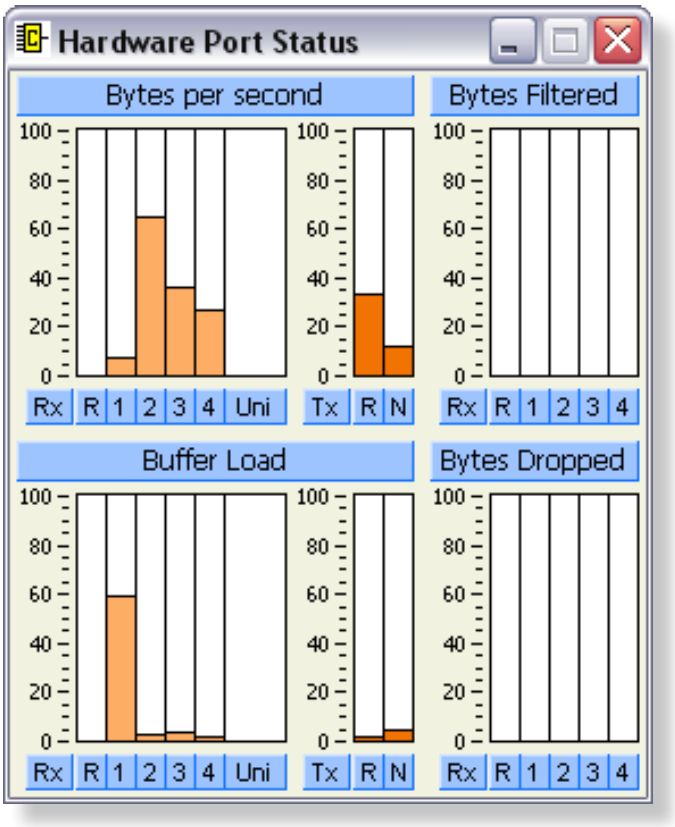


Figure 17 – Hardware Port Status window

The NDC hardware status window, like the **Control Centre Port Status** window, displays bytes-per-second transfer rates and buffer loading rates for a number of ports. (expressed as a percentage of the maximum) However, these values relate to the ports on the NDC hardware – the four NMEA input ports, NMEA combined output port and the USB / RS232 input/output port.

This data is also valuable in monitoring the performance of the NDC hardware, and as a diagnostic tool for pinpointing an overload condition (refer to **Control Centre Port Status window** for more details).

Hardware Connection Status window

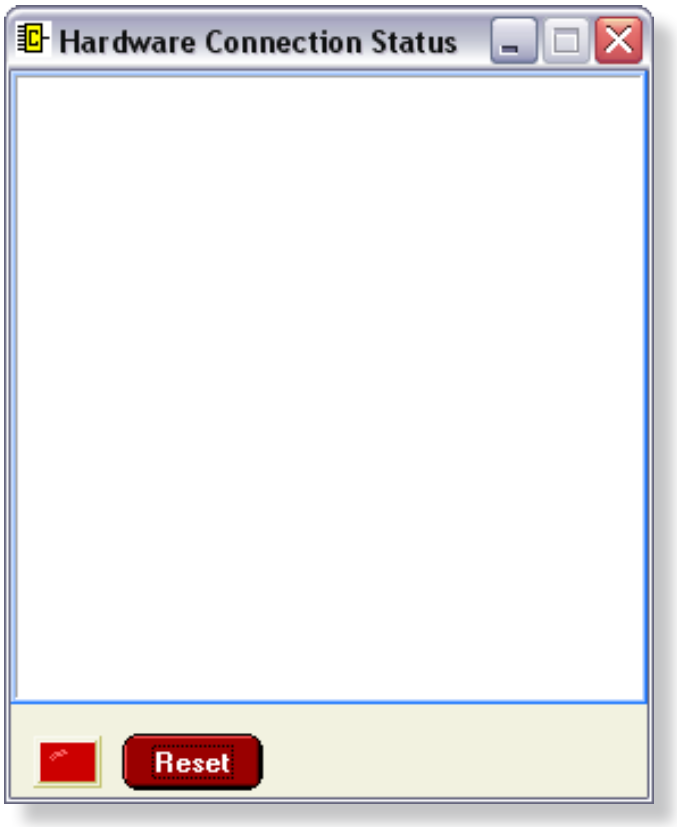


Figure 18 – Hardware Connection Status window

The NDC hardware connection status window displays all information related to the connection status between the Control Centre and the NDC hardware. This includes all handshaking and data transfer information required for flash programming the NDC hardware during the Port configuration data updates.

This information is normally only useful when speaking with Actisense technical support engineer and can be ignored at all other times.

Reset:

Resets the connection status messages currently displayed, clearing the window.

Hardware Information window

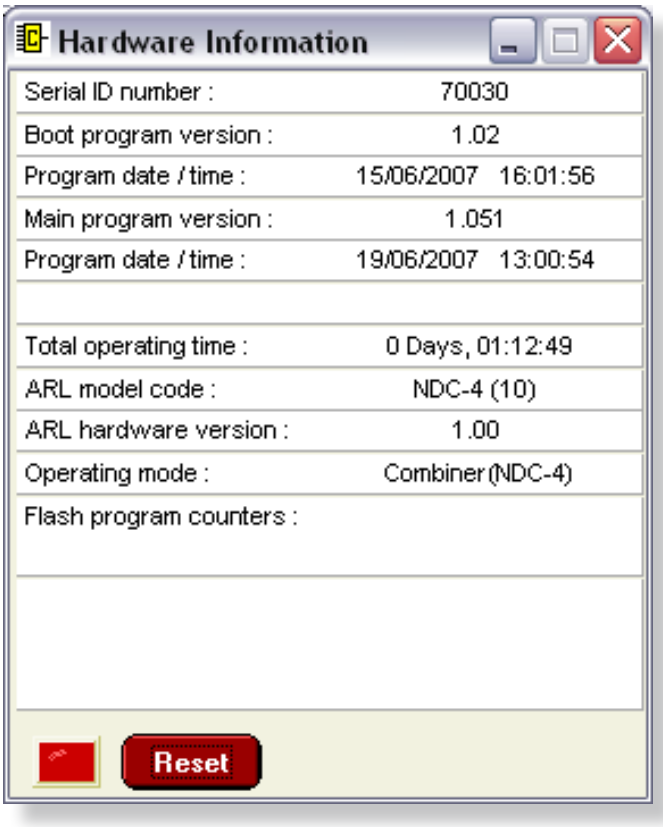


Figure 19 – Hardware Info window (NDC-4)

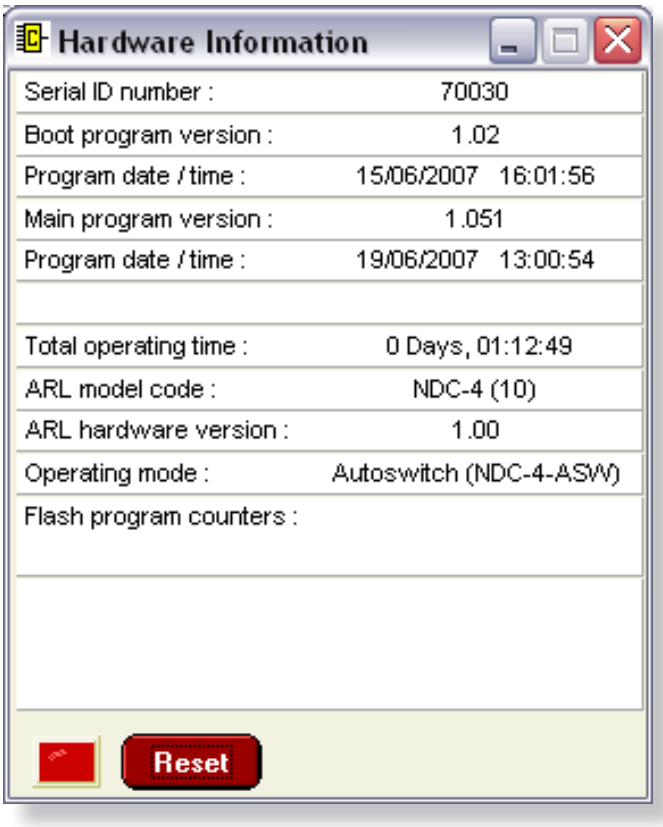


Figure 20 – Hardware Info window (NDC-4-ASW)

The NDC hardware information window displays the information received from the NDC hardware.

This information Includes:-

1. **Hardware Serial ID number:**
   The unique serial identification number given to each Actisense product. This number is used to identify each NDC-4 unit in our records.

2. **Bootloader & Main (software) program version:**
   Version numbers of the bootloader and Main application software programs. If the Main program's version number is older (less than) that of the currently available **NDC ActiPatch**, the latest **NDC ActiPatch** should be downloaded from the **Actisense** website and the NDC unit updated.

3. **Bootloader & Main program date and time:**
   Dates and times that the bootloader and Main Application programs where updated / 'flashed' into the hardware's memory.

4. **Total operating time:**
   The total time that the NDC hardware has been operating since new.

5. **ARL model code:**
   The Manufacturer's Model ID. Model "10" determines the hardware as an NDC-4 module.

6. **ARL hardware version:**
   The Manufacturer's hardware revision number. Version "1.00", in combination with the Model ID "10" determines that this NDC is actually an NDC-4-A product variant.

7. **Operating mode:**
   Current NDC-4 operating mode - either 'Combiner' or 'Autoswitch'. Confirms how the NDC-4 is currently processing any received NMEA data.

8. **Flash program counters:**
   Not used for NDC-4's and will remain blank.

Reset:

Resets the hardware information displayed and requests the current information from the NDC hardware (thus refreshing the displayed information).

Configuration of AIS

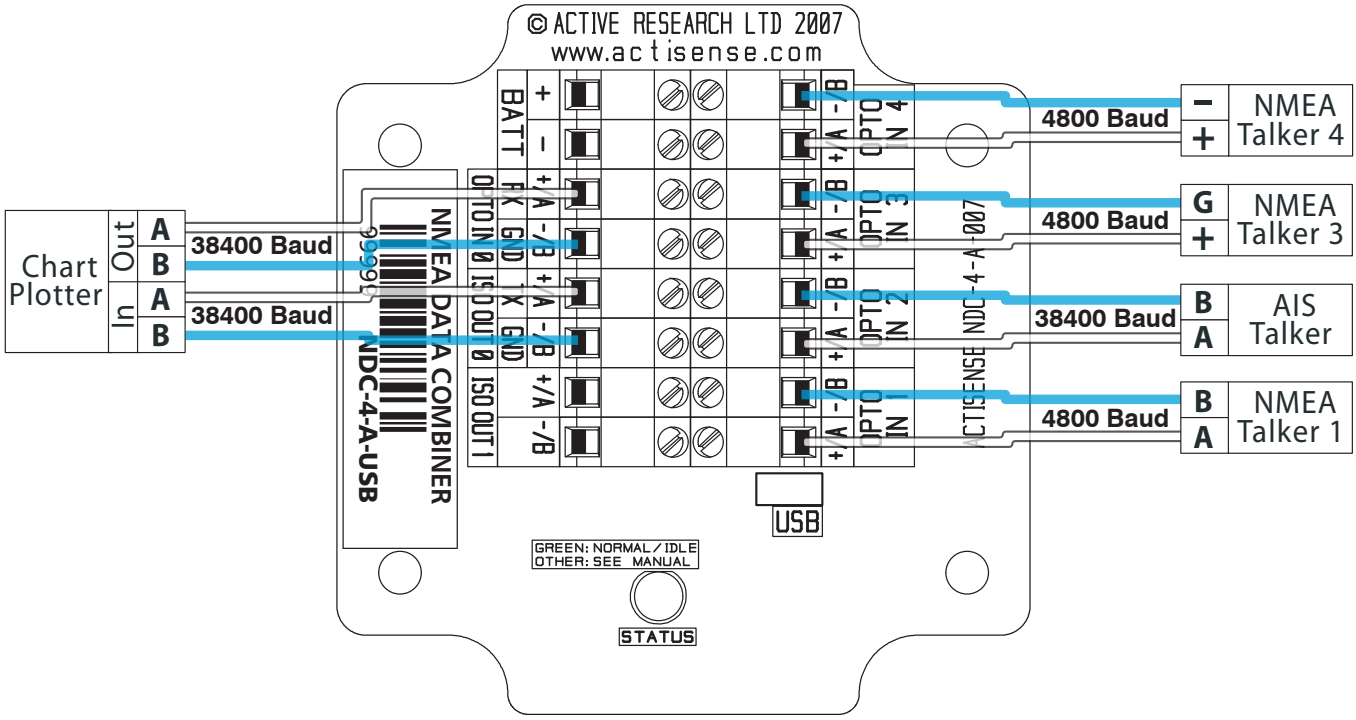
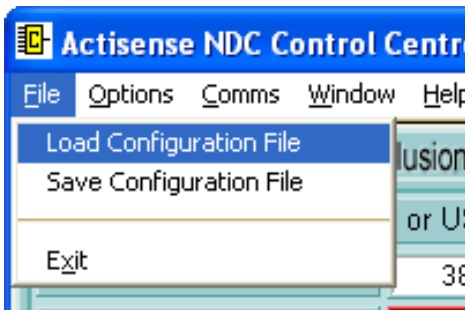


Figure 21 – AIS Configuration with 38400 Baud Rate

Setting up the Hardware for AIS

NDC Control Centre, supplied on the CD (or available for download from Actisense website) 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. This will set input port 2 to the AIS required Baud rate of 38400, and configure OPTO IN 2's Inclusion List to filter out all AIS data from being sent to ISO OUT 1 which is typically kept at 4800 Baud.

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 Config' and 'Inclusion List' tabs.

The AIS device should then be connected to the NDC-4'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 NDC Control Centre. Refer to the '**Using NDC Control Centre**' section for full detailed information on how to use the NDC Control Centre.

The NDC-4-ASW Autoswitch

The **Actisense** NMEA Data Multiplexer / Combiner / Autoswitch (NDC-4) 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:

1. A complete failure to send any NMEA data
2. An invalid NMEA sentence checksum
3. 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.

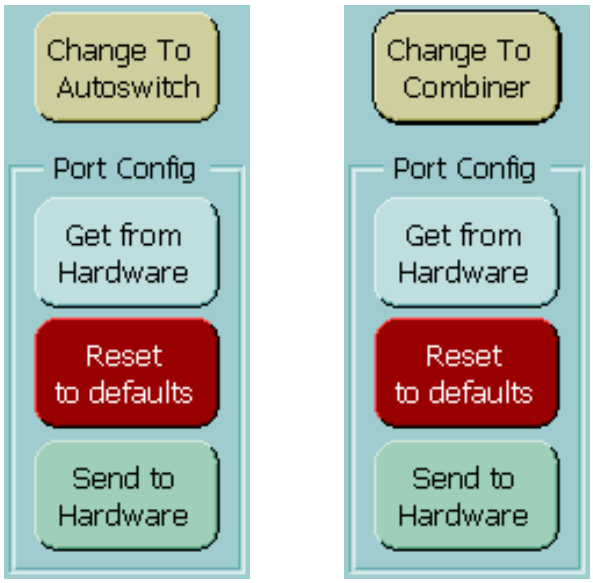
With the addition of two fully Baud rate configurable outputs protected by **ISO-Drive technology**, that can also incorporate NMEA filtering to remove any unwanted sentences before the switching process, the Actisense NDC-4 Autoswitch mode is the most flexible available.

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 the NDC 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 NDC Control Centre.



In the 'Port Configure' tab click on the button labelled "Change To Autoswitch" to change the NDC-4's operation mode to Autoswitch.

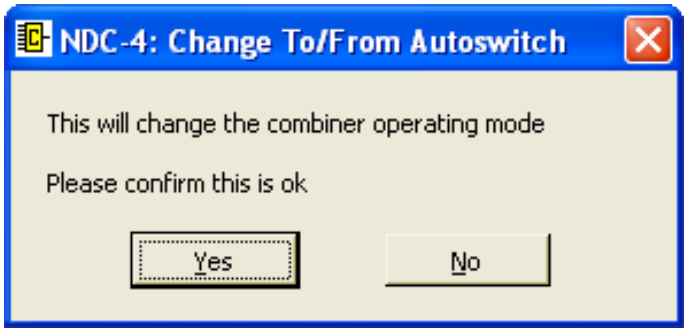


Figure 22 – "Change To/From Autoswitch" message

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.

Using the NDC ActiPatch

The **Actisense** NDC-4 firmware can be easily and quickly updated using the **Actisense** NDC ActiPatch. The program has a simple look, as the flash update process has been completely automated for a trouble-free operation.

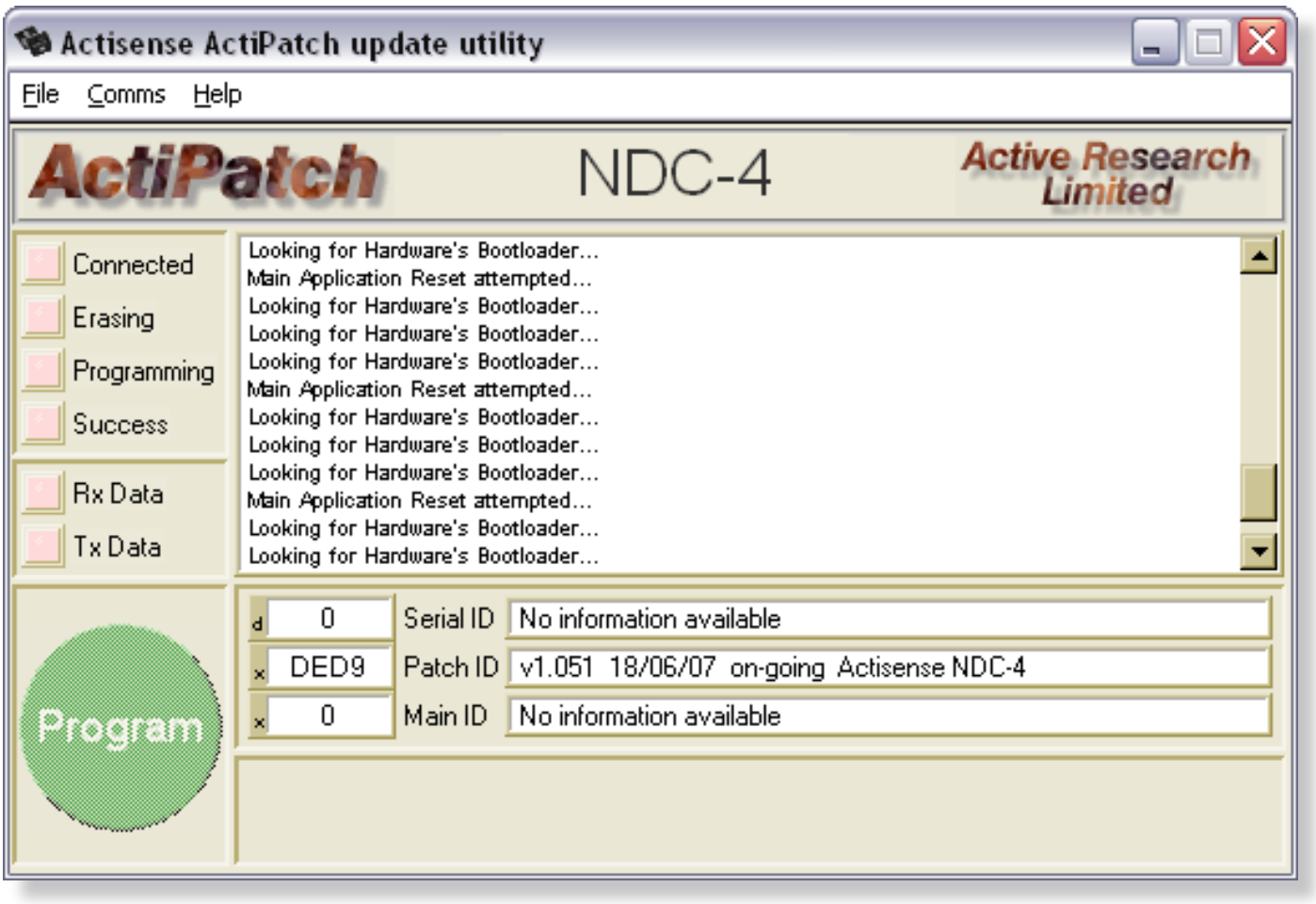


Figure 23 – NDC ActiPatch window (searching for NDC)

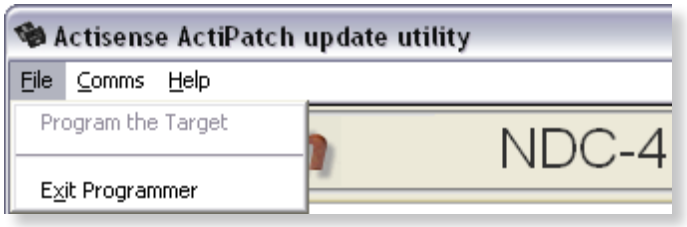
This program is currently only available for Windows platforms (98/ME/NT/2000/XP), however, it has been proven possible to use NDC ActiPatch on a Mac running Windows emulation software.

The NDC ActiPatch window consists of a **Hardware Connection Status** text box, **Hardware status LEDs**, **Current Version (Main ID)** and **New Version (Patch ID)** text boxes, and the **Program (Flash)** control button.

The NDC hardware should be connected to the PC communications port (RS232 or USB) and if not using a USB connection, a battery supply is also required, as per the instructions in the **Connecting to a Personal Computer** section and **Figure 3** (RS232, USB and Battery connections diagram).

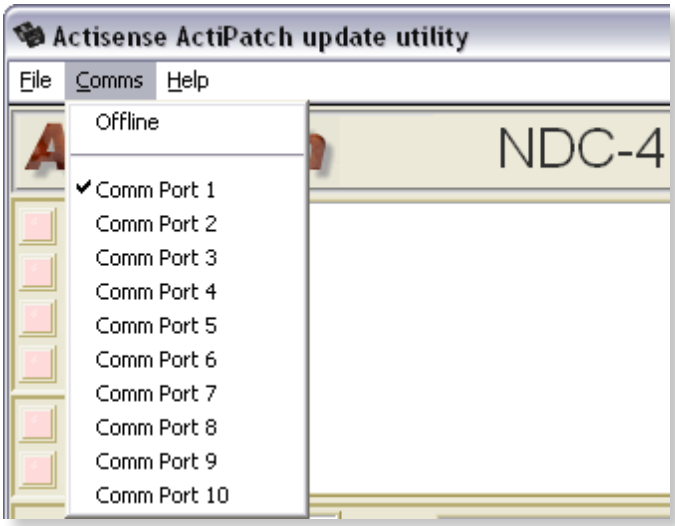
Pull-down menus

The main window has three standard pull-down menus:-



File → Program the Target:
This option will become active / selectable when a successful connection has been made to the 'target' (NDC-4). The **Program** button is normally used to start the reprogram operation, but this menu option can be used instead and is included for completeness.

File → Exit:
Closes the NDC ActiPatch program.



Comms → Comm Port 1-10:
Selects the PC communications port that the NDC hardware is attached to (via the RS232 or USB cable).

ActiPatch will automatically match the NDC hardware's Baud rate if it has changed from the 38400 Baud default. This auto-baud matching process could take up to 20 seconds to achieve. The result of this automatic feature is that the user does not need to select the Baud rate.

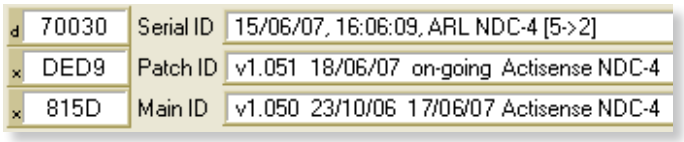
Once a Comms port has been selected (or remembered from a previous session), ActiPatch will immediately attempt to connect to the attached NDC hardware - no further user action is required until the successful connection has been made.

Help → Help with reprogramming:
Displays a window with useful information about how to perform the reprogramming operation if the user cannot reference this more complete support document.

Help → About:
Displays the NDC ActiPatch's software version number and the **Actisense** contact information.

Buttons, LEDs and Displays

Connection Status text display:
Displays all handshaking and data transfer information required for flash programming the NDC hardware during the firmware update process. For most users this information can be ignored, and will only be useful if there are problems in reflashing the attached NDC.



Serial ID (Unique identification number):
Displays the Serial ID of the NDC that is attached and successfully connected to. Every Actisense product has its own unique serial identification number.

Main ID (Current Version):
Displays the version of firmware currently resident in the NDC hardware's Flash memory. This information is received from the NDC hardware when ActiPatch detects the NDC hardware's presence.

Patch ID (New Version):
Displays the version of firmware that ActiPatch can upgrade the NDC hardware to. This number must normally be greater than the **Main ID (Current Version)** for an update to be required.

If the **Patch ID (New Version)** is older or equal to the **Current Version**, then ActiPatch will display a warning message that must be acknowledged before the reflash operation can begin.

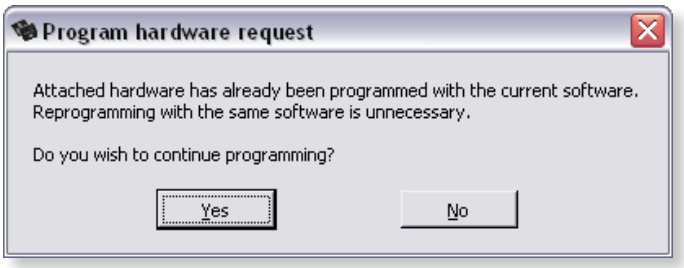
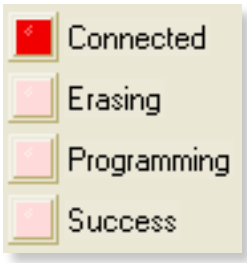


Figure 24 – "Hardware already up to date" message

There is normally nothing to be gained, and perhaps functionality and performance of the NDC to be lost, if an older firmware version is used to reprogram the NDC. However, for rare occasions when instructed by an Actisense support engineer, this 'stepping back' of the firmware can be achieved.

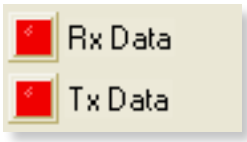
Connection Status LED's:



The four status LED's inform the user what stage the reprogramming operation is currently at.

Initially no LED's will be lit. Once a successful connection is made to an NDC-4 unit, the **Connected** LED will light. During the reprogramming operation, both the **Erasing** and **Programming** LED's will become lit, and finally, once the operation is complete, the **Success** LED with light. It is normal for the success LED to only stay lit for a second or two, after which it will turn off.

Data Communication LED's:



These LED's indicate if any data communication to the NDC (Tx) and from the NDC (Rx) is happening. They are very useful in helping to diagnose simple connection issues.

Program command button:

Becomes available/selectable once connection to an NDC-4 unit is achieved. This button Initiates the flash update of the NDC hardware.

At this point the diagnostic LED on the NDC-4 will be solid red.

The reprogramming operation

Once the program button has been pressed, the reprogramming operation cannot (and must not) be stopped and must complete successfully - otherwise the NDC hardware will become unusable.

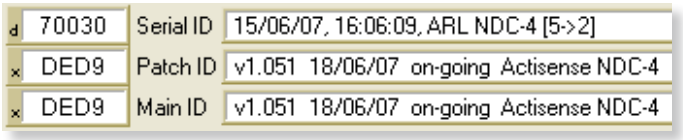
To this end the user must take all precautions to prevent loss of battery power to the NDC, or communications with the NDC hardware. If there is a failure with either of these, the reprogramming operation must be restarted - once the original issue has been removed.

Progress Bar:

During the reprogramming operation the progress bar will be visible. This indicates how much of the two stages has been completed and how much is left to do.

During the **Erasing** operation, the bar is red showing the Flash memory being erased (cleared).

During the **Programming** operation, the bar is green (with a red background), showing the new firmware being written to the flash memory. Once the green progress bar reaches the far right hand side, the operation will be complete and the **Success** LED will light for a second or two.



The successful completion of the firmware update process can be further checked by looking at the **ID display** area. The **Main ID (Current Version)** and the **Patch ID (New Version)** will now be identical - proving that the new firmware is now safely inside the NDC-4.

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 tri-colour 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
	Normal operation modes	The sequence below indicates a successful power-up of the NDC-4 and the commencement of data combining.
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.
Red, No flashing	Flash updating mode, No error	No response required. LED will stay red for the duration of the flash update operation (using Flash Centre). Once operation complete, NDC hardware will be automatically reset.
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.
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.
	Error conditions	If the error persists, the NDC-4 unit should be returned to **Actisense** (refer to the **Company Information** section). **Please contact Actisense before returning the unit in order to obtain a Returns form. Any returns sent without a Returns form will incur a delay in being processed.**
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

Control Centre Error Status window

The Control Centre will display any error information received from the NDC-4 hardware in a window like that in **Figure 22**. If this window is displayed, follow the message instructions carefully and then if the fault persists, contact **Actisense** (refer to the **Contact Information** section).

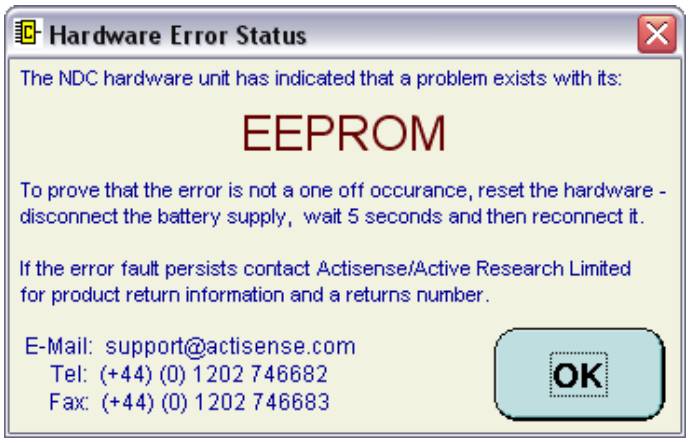


Figure 25 – Control Centre Error Status window

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
Supply				
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
Opto-isolated Flexible Input				
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		4800	57600	bps
ISO-Drive Flexible Output				
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			115200	bps
Data propagation delay	Under no-overload conditions	1.0	100	ms

General				
Ambient temperature		-20	+70	°C

Table 2 – NDC-4 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.
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.

System block diagrams

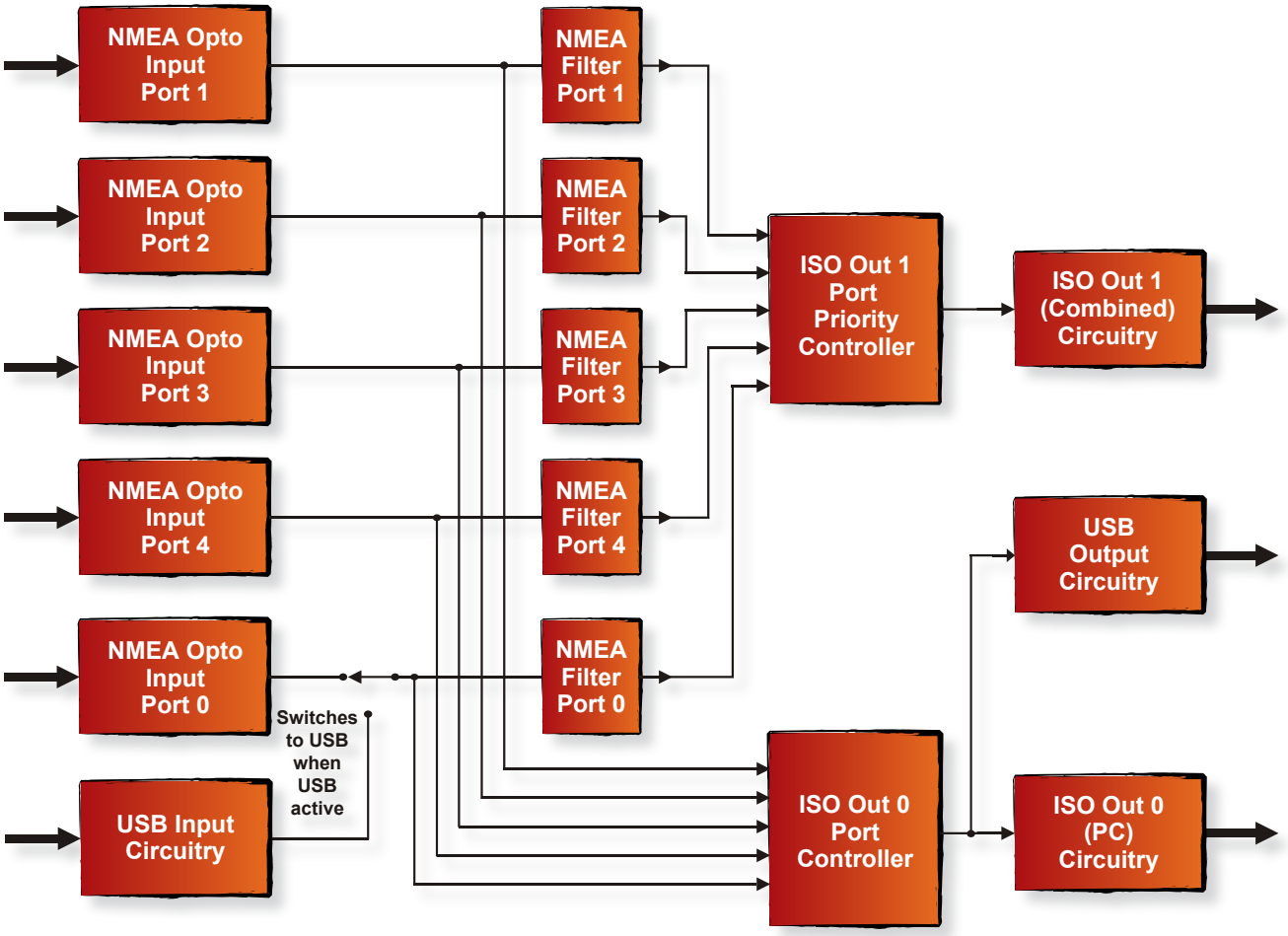


Figure 26 – NDC-4 in 'Combiner' mode signal flow block diagram

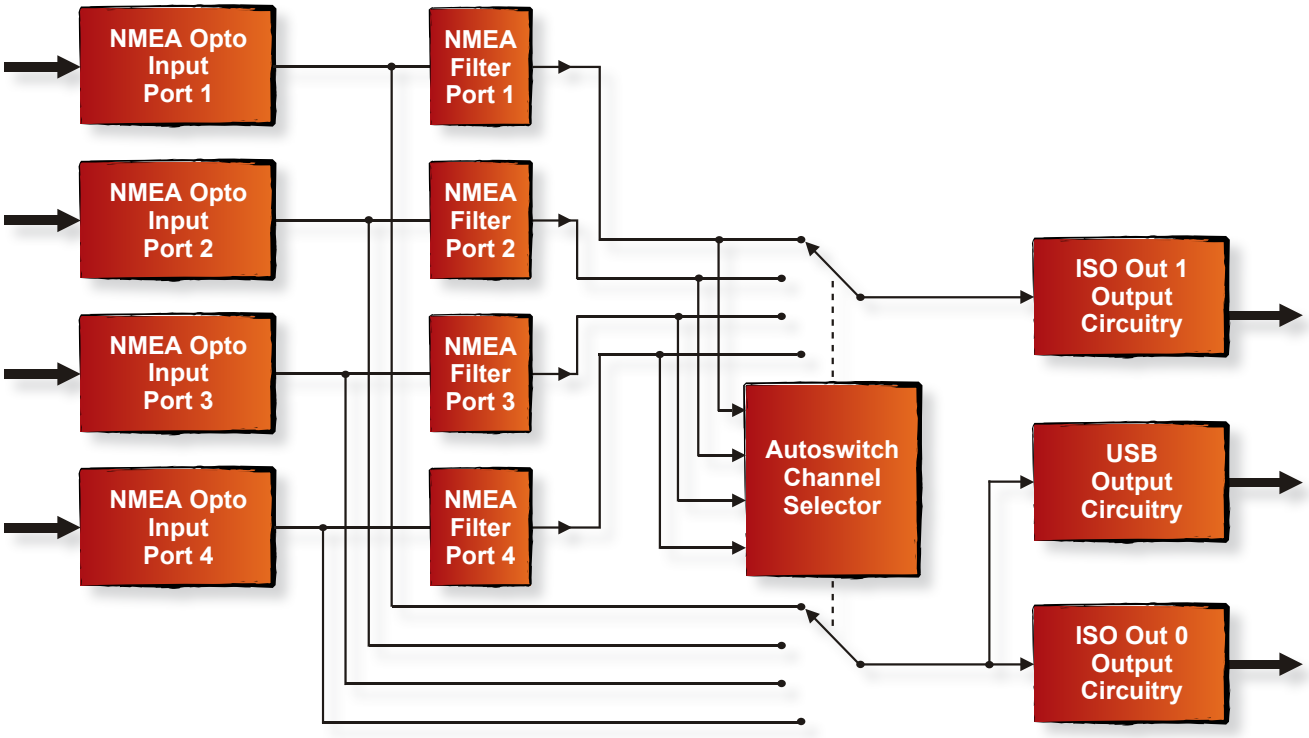


Figure 27 – NDC-4 in 'Autoswitch' mode signal flow block diagram

Save your NDC configuration options here

NMEA Input (1-4)	NMEA Device connected	Baud rate
USB / RS232 Input & Output	**NMEA Device connected**	**Baud rate**
NMEA Combined Output	**NMEA Device connected**	**Baud rate**

Order codes:

NDC-4	Standard NDC-4 (5 isolated inputs, 2 ISO-Drive outputs)
NDC-4-USB	USB capable NDC-4 (4 isolated inputs, 2 ISO-Drive outputs & USB bi-directional PC data port)
NDC-4-AIS	Standard NDC-4 preconfigured for AIS use (Input 2 set to 38400 Baud and Input 2's NMEA Filter list set to block AIS data going out standard Baud rate Output 1)
NDC-4-ASW	Standard NDC-4 preconfigured for Autoswitch use (Operating mode set to "Autoswitch" instead of standard "Combiner" mode)

Company Information

Active Research Limited
5, Wessex Trade Centre
Ringwood Road
Poole
Dorset
UK
BH12 3PF

Telephone: 01202 746682 (International : +44 1202 746682)
Fax: 01202 746683 (International : +44 1202 746683)

Actisense on the Web: For advice, support and product details

E-mail: support@actisense.com
Website: www.actisense.com