

# Keynes Controls Ltd

## *NetPod 4004 Instrumentation & Software*

### *User Manual*

Version 1.02



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Warranty service will be furnished on an exchange bases. The manufacturer may repair or replace your product with a new or reconditioned one. Any replace components or parts become the property of the manufacturer

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## CE-Certificate

This equipment is in compliance with the following regulations:

EN550022 Class B



## 1. Safety Instructions

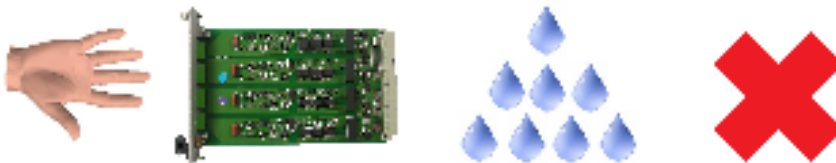
Please read and follow these important steps:

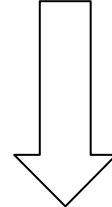
1. Follow all warnings and instructions marked on the product
2. Unplug this product before cleaning it or connecting it into sensor inputs or network
3. Use a damp cloth with mild soap to clean this product. Do not apply cleaner directly to the unit. Do not use volatile or abrasive cleaners on this product.
4. Do not place this product on an unstable surface where it may fall
5. Do not block or cover the units ventilation's openings. Also never place this product near or over a radiator or heat register, or in a build in installation unless adequate ventilation is provided
6. Operate this product in accordance with its rated power specification.

### 7. This equipment must be properly Earthed

8. Do not allow foreign matter to enter this product
9. Do not attempt to service this product yourself. Opening or removing covers may expose dangerous voltage points. Refer all repair work to qualified service personnel
10. Un-plug this product from the mains source, do not operate it, and immediately seek proper services proper servicing if:
  - The power cord or plug is damaged or frayed
  - Liquid or foreign matter has entered the product
  - Damage to the IEC main power connector
  - The product has been exposed to rain or water
  - The product has been dropped or damaged
  - The product exhibits a distinct change in performance indicating a need for a service
11. Only use UL listed/CSA certified power cords rated to 3A 250V minimum (VDE approved or equivalent)

**Important Notice - Do not handle the NetPod 4004 or any parts with wet hands**





The image shows the rear panel of a 6U x 84 HP rack system



## Important Safety Instruction

**NEVER REMOVE THIS PANEL WITH THE MAINS SUPPLY CONNECTED TO THE INSTRUMENT**

Only suitably qualified test engineers should work inside the rear of this unit when mains power is applied due to the chance of electrical shock.

If in any doubt send the instrument back to Keynes Controls Ltd for modifications and/or repair.



## Earth

This equipment must have an electrical Earth connection in order for it to be used safely.

Do not use this equipment if the Earth is not connected or seems damaged.

In case of any problems please contact a suitably qualified engineer for advice or return the unit to Keynes Controls for examination.



### 1.1 Power cable



Only use approved IEC mains cable and plugs with this instrument.

Do not use a mains cable if there are any signs of damage to the insulation. If in doubt get assistance from a suitable qualified engineer or contact Keynes Controls for a new mains cable.

### 1.2 Safety Fuse



Use a 3A quick blow fuse with this unit

The safety fuse fits directly into the fuse holder of the IEC connector.

**Table of Contents**

|     |   |           |
|-----|---|-----------|
| 1.  | <b>Safety Instructions</b>                                | <b>4</b>  |
| 2.  | <b>INSTALLATION CHECK LIST</b>                            | <b>8</b>  |
| 3.  | <b>Network Specifications</b>                             | <b>10</b> |
| 4.  | <b>Data Transmission Protocol</b>                         | <b>18</b> |
| 5.  | <b>Driver Software Operations</b>                         | <b>21</b> |
| 6.  | <b>Software Parameters</b>                                | <b>40</b> |
| 7.  | <b>Configuring the NetPod 4004 for Network Operations</b> | <b>43</b> |
| 8.  | <b>Interface Cards</b>                                    | <b>46</b> |
| 9.  | <b>Digital Interface Cards</b>                            | <b>51</b> |
| 10. | <b>Digital Output card – Relay</b>                        | <b>58</b> |
| 11. | <b>Windows Driver Instructions – Relay card</b>           | <b>61</b> |
| 12. | <b>Processor Cards &amp; Firmware</b>                     | <b>66</b> |
| 13. | <b>Power Supply</b>                                       | <b>69</b> |
| 14. | <b>Part Number Summary</b>                                | <b>73</b> |

## 2. INSTALLATION CHECK LIST

In order to install and operate a NetPod data acquisition and control system, ensure that the following operations have been undertaken:

Each instrument is supplied with a detailed configuration setup sheet. Please ensure that your system meets the instrument order.

### **Local Area Network Operations**

1. Ensure that the network card is installed into the instrument correctly. When the instrument is connected to a suitable network then the Link light on the processor card will illuminate to show network traffic is in operation.
2. Obtain and record the Network IP addresses to be assigned to the NetPod instruments.  
  
The NetPod 4004 uses broadcast network packets for timing operations. Ensure that any network to be used by the NetPod 4004 supports this type of data transmission.
3. Ensure you have a copy of the latest version of the NetPod manager software. This software can be downloaded for free from <http://www.aquabat.net> web site
4. Ensure that all network connections used to link the NetPod 4004 instruments to an Ethernet HUB are operating. The NetPod 4004 support 100BaseT operations. Most modern network hubs auto-detect the network type and adjust their speed accordingly.
5. Ensure that suitable mains power supply outlets are available for use with the NetPod 4004. Allow a supply of up to 30 W for each instrument.
6. Only use approved IEC standard mains cable and plugs with this instrument.



## 2.1 Hardware Test

1. Power on each NetPod 4004 and make sure the power supply status LED is illuminated.

On applying power to the instruments you will observe the power status light will illuminate and the Receive and Transmit LED status lights will flash on and off. If the status lights do not illuminate then check that the mains power outlet is operating correctly. If you are still having problems then please contact your supplier for advice before returning the units for repair.

1. Connect the Processor card network port to a suitable network and the network status LED will illuminate. The status LED will illuminate to show network traffic even if the network does not allow the broadcast timing packets.

## Installation Quick Guide

To install the system do the following:

1. Power on the NetPod 4004 and make sure the power supply in the instrument illuminates.

As soon as power is supplied to the NetPod 4004 the fan system in the back of the enclosure will start and run for several seconds.

Attach a network cable to the 4004 and connect directly to a laptop. Some modern PC / Laptops enable direct connection to the instrument. Use a network cross over cable if the network status light does not illuminate or if no data packets are seen to transmit.

Use the Podmng software. This software is freely available from the <http://www.aquabat.net> site.

Run PodMng software and scan the network.

The new instrument should now be identified in the main Podmng Window.

See Page 21

## **3. Network Specifications**

### **3.1 Introduction to Networks**

The following chapter summarises the technical specifications for the Ethernet networks that can be used to transmit data from the NetPod instrumentation. The Ethernet networks described below are only those that can be directly connected to the instrument. Data can be easily passed to many different families of Ethernet using standard networking products.

### **3.2 Ethernet Networks**

Subnets are used when configuring networks consisting of several different strings, for example connecting users on an office based LAN when the users are located at different sites. The routes on a network will not know the exact location of each node (NetPod or user).

Instead a router will only know about a subnet address. It will read each packet on the network, using complex addressing protocols and determine the appropriate destination for the data packets. The packets will be repackaged and transmitted to the next stage of the network.

Routers do not care what kind of hardware the LAN segments use, but they should run software conforming to the same network protocol. Routers often contain automatic identifications and transmission routines for data from DecNet, IP, IPX and XNS.

### **3.3 Internet Addresses & Classes**

The Internet address is a unique 32 bit address that is used in all communications with the host systems. The address uniquely identifies the network and the specific instruments that are to operate on it. The number of address bits that define the network and the number that define the host vary according to the class of the address. There are three main classes of IP addresses- class A, class B and class C.

### **3.4 Setting the Sub net mask**

Sub-netting is a method of dividing up large networks to comply with the hardware topology or organisational constraints. A subnet modifies the standard IP address structure by using host address bits to extend the network address. In brief, a subnet moves the dividing line between network and host address portions to create additional networks known as subnets.

For small networks subnetting is not required unless imposed by organisational or physical Ethernet constraints. The maximum length of cable for thick Ethernet is 500 metres and 300 metres for thin Ethernet.

Sub-netting is commonly used on large networks. A subnet mask is applied to the IP address to define the subnet on a network to which a particular machine is defined. Thanks to subnets, large sites can have interconnecting networks regardless of the length of cabling required. The subnet mask need only be set if you have multiple interconnected networks at your site that are using the same network address.

An Internet address is divided into a network portion and a host portion. The address class determines where the 32 bit Internet address is divided to give the network part and the local part. The local part is then divided into two parts according to the subnet mask. One extends the bits allocated to the network part and identifies the physical network. The other identifies the host. If a bit is set in the subnet mask, then its equivalent bit in the Internet address is interpreted as a network bit. Conversely, if a bit is off in the subnet mask, its equivalent in the Internet address is interpreted as belonging to the host part of the address.

### 3.5 Local Area Networks

Local area network allows several computers to share resources such as files and printers, and allows the transmission of data using TCP/IP. It is this later functionality that allows data from the NetPod to communicate with Windows programs.

Ethernet communication provides a utility call "ping" for testing.

Ping is a simple diagnostic program for testing the connection between systems on a network. The command can be run from an MS DOS prompt. The command can also be run from most other non-Microsoft operating system computers.

The use of this command is shown below:

**ping <IP address>**

**e.g. ping 12.34.56.78**

```
Reply from 12.34.56.78 bytes=32 time=2ms TTL=32
Reply from 12.34.56.78 bytes=32 time=2ms TTL=32
Reply from 12.34.5 6.78 bytes=32 time=2ms TTL=32 (Successful )
```

**e.g. ping 12.34.56.78**

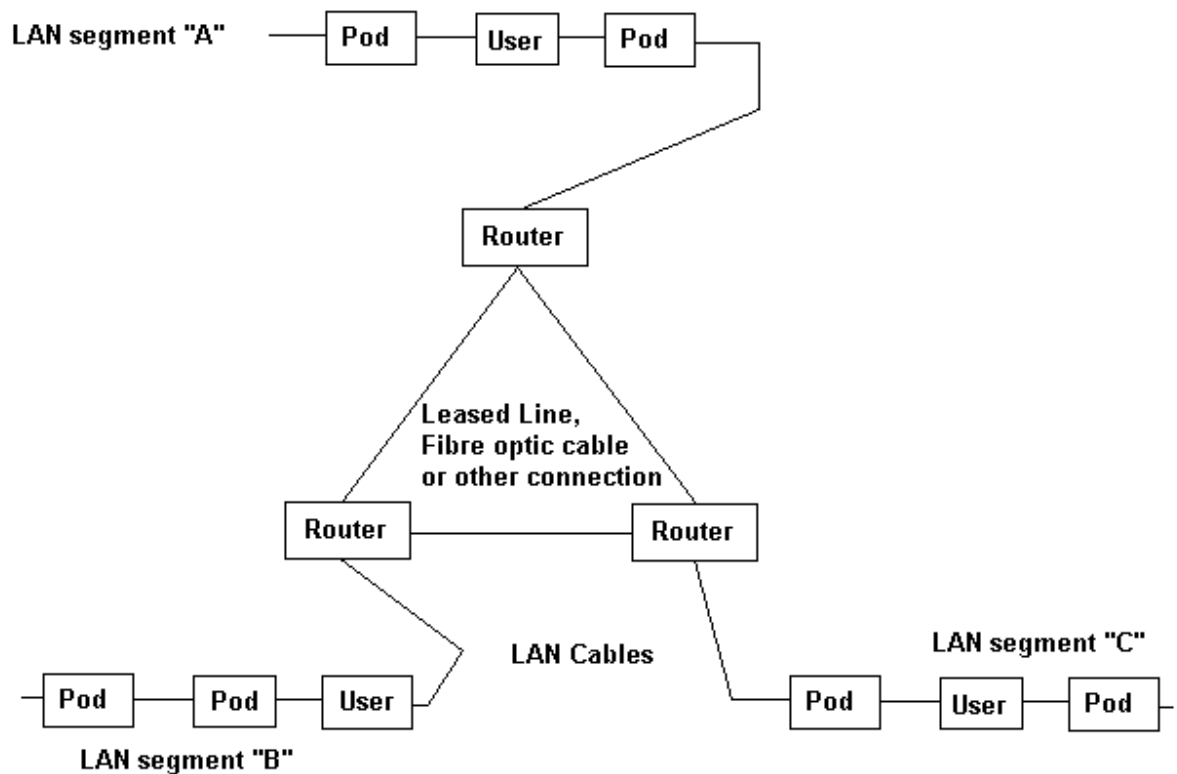
```
Requested Time-out
Requested Time-out
Requested Time-out (Comms to instrument failed. )
```

The IP address of the host should be read from the IP Address tab of the TCP/IP protocol service bound to the network card selected from Control Panel->network. On some systems that IP address is obtained automatically from a central server, in which case consult you network administer for information on your network configuration.

### 3.6 Routers

Routers work at the Network layer of the OSI model. Unlike bridges, routers don't know the exact location of each node. Instead routers only know about the subnet network addresses. The router reads the address information for each packet or frame passing through the device, and uses complex network addressing procedures to set appropriate destinations, before it repackages and transmits the data to the correct location.

Routers play an important role in connecting LANs to the Internet, intranets, and other outside networks. When a connection to the Internet is made from a LAN, you are actually connecting your LAN to the Internet service providers (ISP's) LAN. A router is the portal between your LAN and the ISP's LAN. The router only sends traffic addressed to the different nodes across the Internet connection and, in theory, it only allows desired packets onto a LAN.



Routers in a large LAN network can use the interconnecting circuits as alternative routes for data traffic. If the circuit between Segment A and B fails then traffic for B is sent via segment C.

Figure 1 Routers

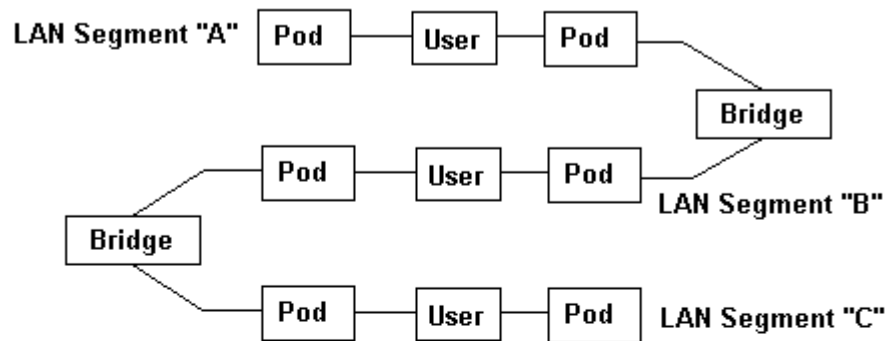
### 3.7 Bridges

Bridges are used to link local network cables together. They can link network LANs to networks consisting of leased lines to telephone exchanges etc. The two main purposes of a bridge are to extend the network and to segment traffic. Bridges can send data packets and frames between various types of media. Bridges can send packets between different types of media (Networks) but they only forward data if the node to which data is to be sent is on the adjacent network. As a result unessential data is not passed onto network traffic and the bridges can remove non essential data from network operations.

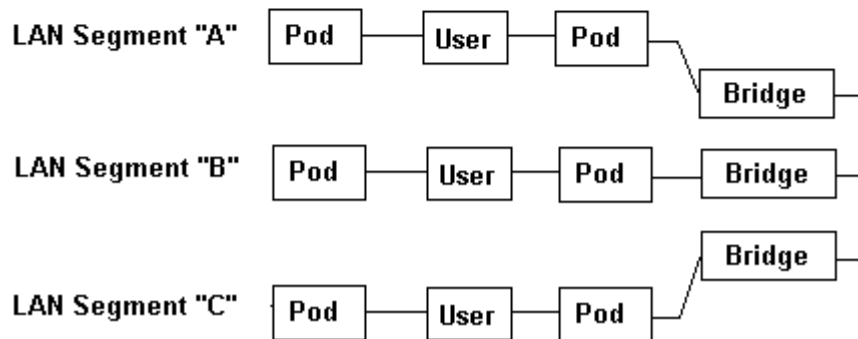
A bridge reads the designation address of the network packet and determines whether the address is on the same segment as the originating station. If the designation station is on the other side of the bridge, then the bridge sequences the data traffic onto that cable segment.

Bridges are categorised as *local* or *remote*. Local bridges link cable segments on a local network. Remote bridges link cables to leased or dedicated long distance network systems. The important point to remember is that you only require a single bridge to link two physically close cable segments, but you will require two remote bridges to link two cable segments over long interconnecting span of media.

### CASCADED BRIDGE TOPOLOGY



### BACKBONE BRIDGE TOPOLOGY



## 3.8 Instructions

1. Ensure that the NetPod manager software is installed onto the host PC.
2. Connect a mains supply to the NetPod instrument. The **power status** LED will illuminate.
3. The Transmit and Receive status lights will flash on and off slowly in sequence. The illumination of the Tx and Rx status lights are used to show that the NetPod is operating correctly and is scanning the communication interfaces for data.
4. Ensure that all of the NetPod 4004 instruments are installed and connected to a port on a hub. The link to the hub is via the RJ45 connector which is found mounted on the front panel of the instrument.

Once the instrument detects network packets, which indicates that the 100BaseT network has been detected, then the **Link Status** LED will illuminate.

5. Start the NetPod manager software on a machine which is connected to the same network as the instruments. Connection to the instruments may be via a gateway or directly to the hub.

6. The NetPod manager software will show on the main results screen the type of network for which traffic has been detected. For 10BaseT operations the results screen will display the network type **Ethernet**
7. From the main menu select the **Configure** option. A further list of menu options will appear under this menu item.
8. Select the **Scan Network** option. A menu will appear on the screen showing that the software is scanning the network for datagrams originating from the NetPod instruments. As each instrument is identified its name is shown on the program main screen.
9. The link status light on each of the NetPod will illuminate when communication between the PC and the NetPod unit is obtained. Data is broadcast by the instrument and detected and recovered from the network by the NetPod manager software.
10. To start data recording operations select the **File** option from the main screen. Using the mouse pointer or cursor keys select the **Run Mode** menu option. A tick mark will appear adjacent to this option and is used to indicate that data recording operations are underway.
11. The Receive and Transmit status lights will appear to flash on and off together on all instruments connected to the network. The faster the illumination the greater the sample rate. For sample rates greater than 100 Hz the Rx and Tx status lights will give the appearance of being continuously illuminated.

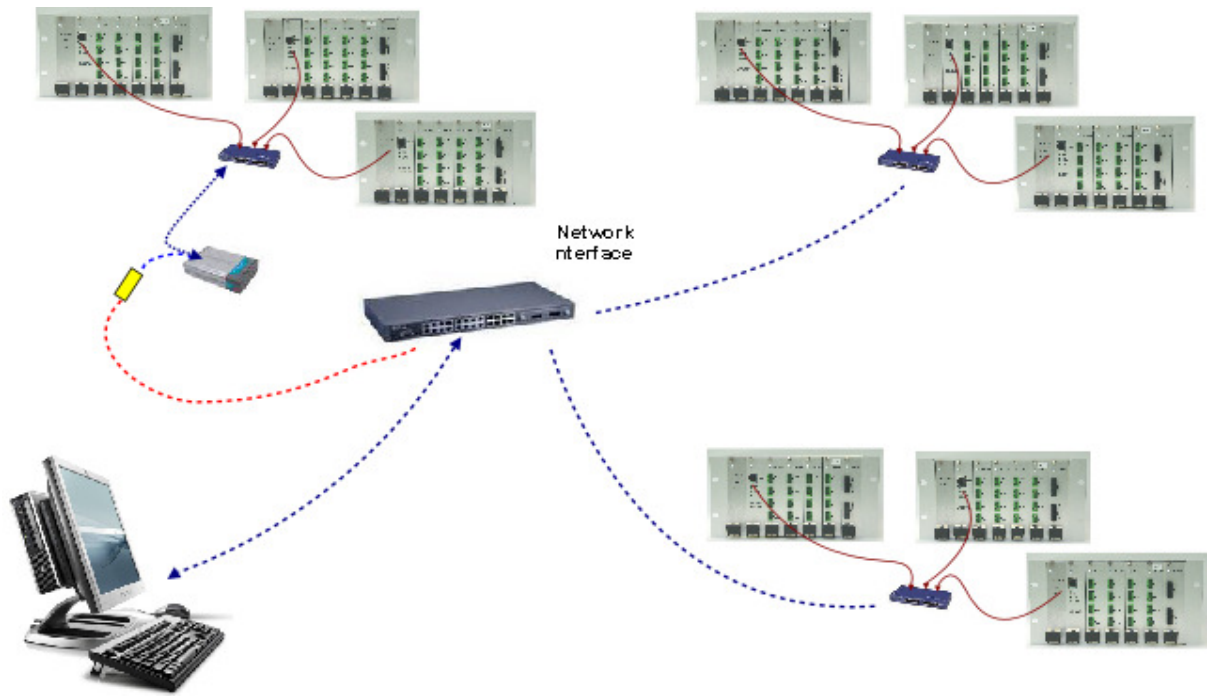


Figure 2 Typical Instrument Layout - Using LAN for Communications

### 3.9 Searching For Instruments on a network

The searching for NetPod units on a network is only relevant when using a local area network (LAN) for data transmission.

- 1) Activate the Podmng driver software.
- 2) From the default driver Window select the **Configure** menu item.
- 3) Select the '**Scan Network**' option.

The **Scanning Network Window** will appear and the software will start examining the network for data packets originating from one of the NetPod units. All operating system functions will be suspended until this action is completed.

The Window will completely fill with the small blue rectangles and then disappear. This action will take about 20 seconds.

- 4) On completing the scanning network operation all of the detected NetPod 4004 will be displayed on the default driver screen.





Figure 3 Scanning Network Indicator

### 3.10 Ethernet Hubs

Hubs are required for Ethernet local area network configurations in order to connect devices together.

The modern network hubs automatically detect the network packet type sent by the NetPod 4004. Modern devices support a range of network speeds and auto-detect the packet traffic rate sent by devices such as the NetPod 4004. A channel status LED on the HUB often changes colour to indicate the different network speeds being used.

## 4. Data Transmission Protocol

The following chapter describes the data transmission operations of the NetPod.

The pods operates using a non-pre-emptive packet sending system i.e. when a run command has been sent to an instrument it responds by sending at regular intervals the data to the host computer system. Data is sent from the instruments to the User computer systems in the form of data packets.

The data from the input channels is broken into packets call UDP **datagrams**. Note. up to 16 samples can be sent in any particular data packet.

### 4.1 Small Packet Size

**Advantages:** Data is returned to the host computer system very quickly (ideal where short response time is requires, i.e. real time operations are essential)

**Dis-advantage:** small packet size results in high network overhead

### 4.2 Large Packet Size

**Advantage:** Large packet sizes provide efficient use of network traffic. Data from each analogue channel is easily packed and sent across the network.

**Disadvantage:** Data packets are sent slowly across a network making them ideal for use in control system loops. PID etc.

### 4.3 Broadcast vs Single-Host Operations

When a single User/Operator is accessing data from the instruments, and standard PodMng application software is in **Run** mode, the instruments send data only to the single computer system. All other computers connected to the network, using a standard network interface card will ignore the data from the NetPod. The software contained within the network card filters out instrument packets from the standard user operations i.e. print servers etc. and enables normal network operations to be undertaken.

However, should more than one user be running the Pod Manager software, then the instruments sends special packets called broadcast packets instead of the normal datagrams. The broadcast packets will be received by every computer system connected to the network which results in a small overhead in processing for machines that have nothing to do with the acquisition of data from the instruments. The user of broadcast packets enables many users to access and process data from the instruments simultaneously yet independently from each other.

Ensure that the local area network on which the NetPod 4004 will operate has broadcast packets enabled. Consult your network manager for details.

For the most efficient use of the Ethernet network for data transmission operations, then only one user should be running the Pod Manager software at any one time. This is especially the case when high sample rates are required. Should data be required for more than one user, then it is recommended that the computer running the Pod Manager software re-sends information to the next PC after it has been processed.

Data re-transmission can be undertaken by third party software supporting TCP/IP functions, or by NetDDE. For user software which can send a NetDDE Poke command to a channel being sampled at 1 KHz should this channel go above a threshold level, then considerably lower processing overhead will be required than would be the case if 1000 packets data/sec were being transmitted across a network to each user. Note: Most SCADA packages have the facility to share processed data in this way.

#### **4.4 Data Synchronisation**

One of the important features of the NetPod instrumentation is the integral synchronisation operations available between instruments across an Ethernet network. These operations enable widely separated units to be combined to provide static as well as dynamic measuring systems.

The instruments are kept in synchronization by requesting, at regular intervals the current time from each pod. The time returned from each instrument is examined and compared to the master clock within the processing system. If the drift between instruments is greater than a preset amount then the clock within the instrument is reset. The resolution of the clock within the pod is considerably greater than that of the PC .i.e.10us for the instrument against 20ms for the PC.

The synchronization packets are sent every 5 seconds across the network to each instrument. so that the time skew between instrument clocks is very low (1 - 2 microseconds). The timing within the instruments surpasses that available within nearly all processor systems unless extremely accurate precautions are made to improve time keeping.

This use of the synchronisation pulses for maintaining timing between instruments across a network ensures that there is low skew between samples on the input channels. Typical skew between analogue inputs on a distributed network is  $< \pm 1\text{ms}$ .

#### **4.5 Improved Synchronisation**

It is possible to supply instruments with enhanced data synchronisation capability by using temperature compensated real-time clocks instead of the standard clock. This feature will allow skew between channels to be considerably less than the 1ms stated for standard production units.

## 4.6 Datagram Construction

The figure below shows how the datagrams used to transmit data from the NetPods to the applications software are constructed:

|                |   |
|----------------|---|
| Ethernet frame | Source address<br>Destination Address<br>Frame type                         |
| I.P. Header    | Source IP address<br>Destination IP address<br>Length<br>Flags and checksum |
| TCP Header     | Source Port<br>Destination Port<br>Length<br>Sequence/acknowledgement       |
| Netpod Data    | Pod Identifier<br>Number of samples   |
| Sample n       | Channels 0..15 + digital  |
| Sample n+1     | Channels 0..15 + digital  |
| Sample n+2     | Channels 0..15 + digital  |

Figure 4 Datagram Construction

## 5. Driver Software Operations

The Keynes Controls NetPod manager software is the package provided by Keynes Controls when you purchase any of our network products. The software operates under Microsoft Windows XP, 7 operating systems. The following operations are supported:

- Password Protected Operating Environment**
- Starting & Stopping data acquisition operations.**
- Channel Configuration.**
- Data Recording.**
- Calibration Operations.**
- Sensor Selection.**
- Multi-user operations.**
- Real Time Display**
- Multi-instrument Operations.**

All of the graphical operations of the driver are identical no matter which network is being used to gather data.

Upon installing the driver software and up on initialisation, the NetPod manager scans the local area network interfaces within the host system for Pod traffic. If any traffic identified as originating from NetPod instruments then the software auto-configures the instruments for operation. All the user need do is to assign channel names to the instruments that can be used to easily identify the source of data.

The software details shown in this manual are the same for the NetPod 4000, 4003 and 4004 version instruments.

Refer to the Unix /Linux Software Developers Kit for instructions for Unix version software commands and operations.

## 5.1 Password Protected Operating Environment

The PodMng driver software provides a password protected operating environment. There are two modes of operation **Admin** and **Operator**.

**Operator** mode enables data to be presented to third party applications software but prevents any changes of configuration and data transmission operations from the driver of third party software. You cannot change any instrument configurations or start and stop the data transmissions. **Operator** mode operations are ideal where you require terminals to display data only.

**Admin** Mode enables full configuration of the instruments. You can select and configure any instrument operation.

## 5.2 Software Mode Changes

To change the mode of operation of the driver software:

From the Default PodMng Window select **File > Access Control**

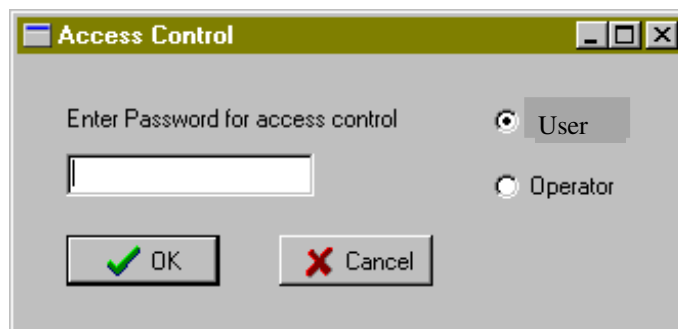


Figure 5 PodMng - Access Control Window

The Access Control Window will appear. Enter your password.

Select the Mode of Operation

Press the **OK** button to activate the mode change.

When the Access Control Window disappears you have changed operating modes.

### 5.3 Starting and Stopping Global Data Acquisition Operations

The driver software allows the user to have full control of all aspects of the data acquisition operations of the instruments. You can start and stop all data acquisition operations for all instruments simultaneously across a network or individually to a dedicated unit. The aim of this section is to describe the data acquisition operations that control all instrument operations simultaneously across a network, for the purpose of this manual called global data acquisition operations.

The status of the data acquisition operations can be clearly seen directly from the instrument status lights and from the driver by the colour of the task bar icon. The task bar icon is coloured green when data transmission operations are active and red when no data is present. See images below

Figure 6 Task bar icon - Data Transmission Active

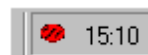


Figure 7 Task bar icon - Data Transmission Stopped



Data Acquisition  
Stopped



Data Acquisition  
Started

The images opposite demonstrate the Processor card status LED operations when data acquisition is stopped and when running.

## 5.4 Starting Global Data Transmission Operations

The following section shows the instruction to follow to start global data acquisition operations ie start all instruments up on a network to broadcast data.

1. From the main menu select the **FILE** menu item.
2. Using the mouse pointer or cursor keys select the **Run Mode** menu item.

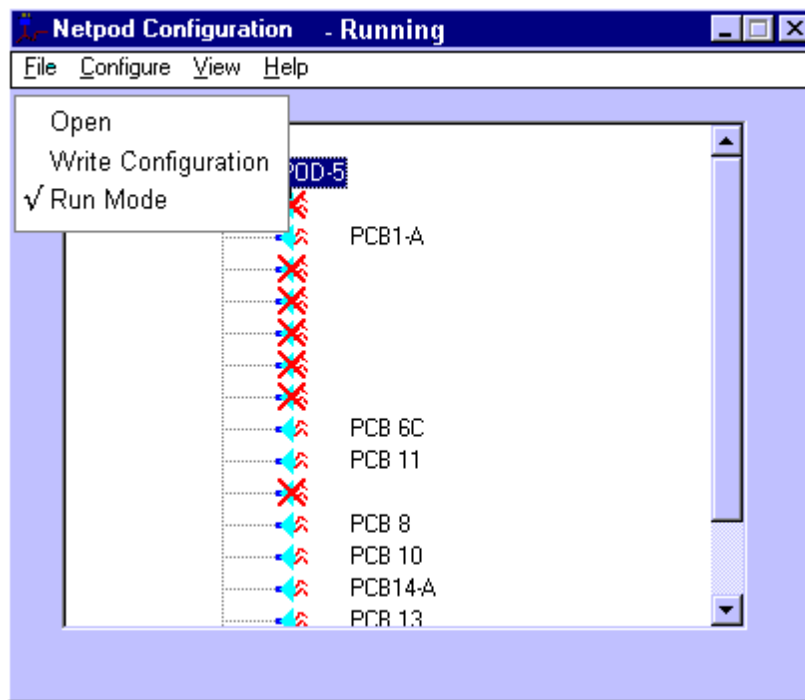


Figure 8 PodMng Software - Run Mode Active

A tick mark will appear adjacent to the **Run Mode** menu option. The tick mark is used to indicate that data recording and control operations are under way.

3. The File menu options will disappear and the main menu be displayed. You can now carry out any further operations.

Note. In order to check the status of the logging operations from the NetPod manager simply select the **FILE** menu option from the main display. You will see a series of menu items displayed on the screen, one of them being the **Run Mode** option.

If a tick mark is displayed adjacent to the **Run Mode** menu item then data acquisition operations are underway.

The task bar icon will appear to be flashing green in colour.



## Stopping Data Transmission Operations

The following section shows the instruction to follow to start global data acquisition operations ie start all instruments up on a network to broadcast data.

1. From the main menu select the **FILE** menu option.
2. Using the mouse pointer or cursor keys select the **Run Mode** menu item.

The tick mark which appears adjacent to the **Run Mode** menu item will disappear.

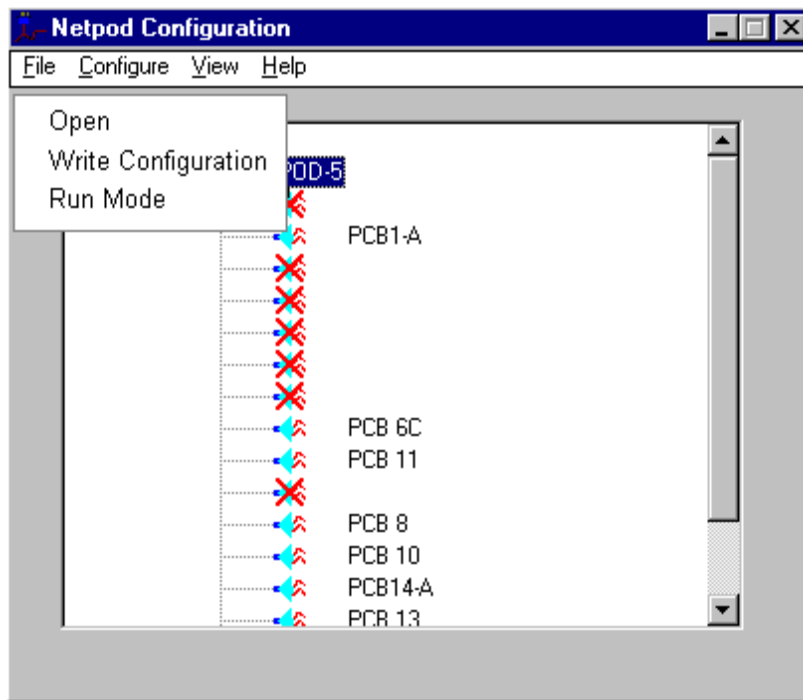


Figure 9 PodMng Software - No Data Acquisition Stopped

A tick mark is used to indicate that data recording and control operations are active and that data may be in the process of being recorded.

3. The File menu options will disappear and the main menu be displayed. You can now carry out any further operations.

**The instrument Tx and Rx LEDs will stop flashing (LAN operations only)**

The task bar icon will appear to be flashing green in colour.

## 5.5 Starting and Stopping Data Acquisition Operations for a Specified Instrument

The following section describes the operations to follow to start and stop data acquisition operations for a single specified instrument. These operations are meant as an aid to testing the network prior to acquisition operations are overridden by the use of global acquisition commands.

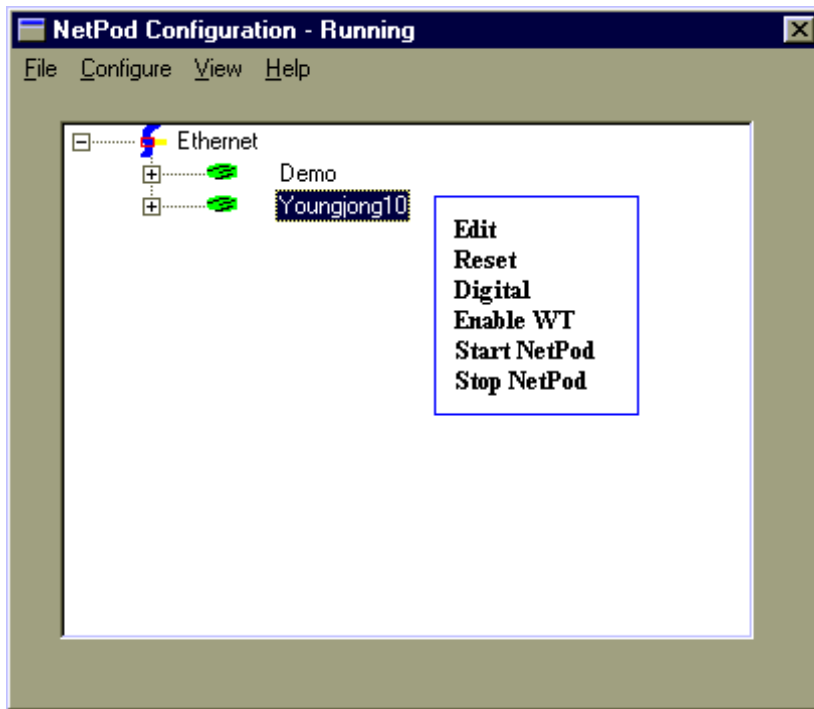


Figure 10 - Start and Stop acquisition - menu options

### Stopping Data Acquisition Operations for Specified Instrument.

1. Ensure that the driver is active and receiving data. The task bar icon should be flashing green
2. From the main driver window (as above) select the instrument whose data acquisition operation you want to suspend (stop) using left hand mouse.
3. Once you have selected the instrument whose data transmission operations you want to suspend press the right hand mouse button. You will observe a menu appear adjacent to the selected instrument with the following options: EDIT, RESET, DIGITAL, ENABLE WT, START NetPod, STOP NetPod
4. Select " Stop NetPod" option – you will observe the Tx status light on the instrument is off.
5. The Error log will report Time (00:00:00) Pod-id disabled

**Starting Data Acquisition Operations for Specified Instrument.**

1. Ensure that the driver is active and receiving data. The task bar icon should be flashing green
2. From the main driver window (as above) select the instrument whose data acquisition operation you want to activate (start) using left hand mouse.
3. Once you have selected the instrument whose data transmission operations you want to activate press the right hand mouse button. You will observe a menu appear adjacent to the selected instrument with the following options: EDIT, RESET, DIGITAL, ENABLE WT, START NetPod, STOP NetPod
4. Select “ Start NetPod” option – you will observe the Tx status light on the instrument is now active.
5. The Error log will report “Time (00:00:00) Pod-id Enabled”

**REMEMBER – activating logging from the driver for all units will over ride these actions.**

## 5.6 Configuring the Analogue Input Channels

The following instructions detail the procedures followed to assign channel configuration details for use within the Pod Manager software package:

From the main menu select a Pod whose channel you want to configure.

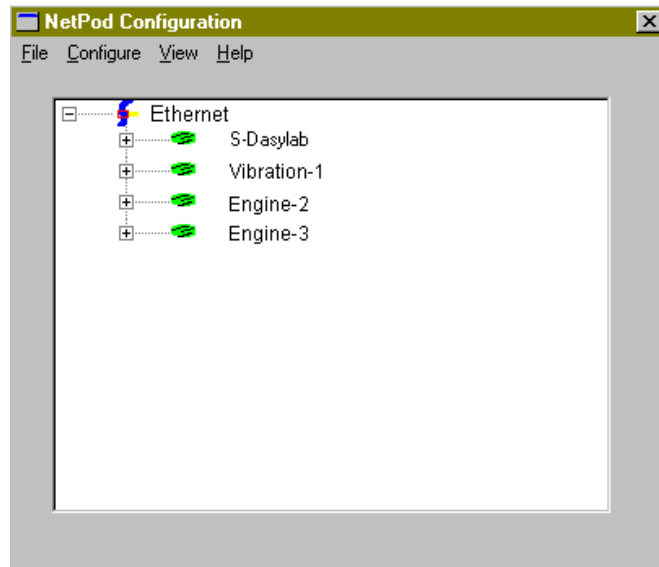


Figure 11 PodMng Software - Default Screen (Multi-user operations)

The Window shown above is the main configuration Window that appears when the PodMng software first activated and the network scanned in a multi-instrument environment. Each of the NetPod instruments for which data traffic has been identified will be shown on the main screen below the title listing the interface upon which traffic was detected.

1. Move the mouse pointer over the Pod chosen for channel configuration. Select by pressing the left hand mouse button either the + symbol; which appears adjacent to the Pod for which channel details are going to be adjusted, or directly the channel which is going to be configured.

### NOTE.

On selecting the + symbol. The channel details associated with the chosen pod will be listed. The Pod manager software will interrogate all identified units and report details of any analogue and digital interface cards installed within the instruments.

2. Move the mouse pointer until it is above the channel name which has been selected for configuration.

Double click the left hand mouse button. The **Edit Channel** window will appear. If you do not double click the left hand mouse button quickly enough then only the text on the menu will change. The text will change from black on a white background to white on a blue background.

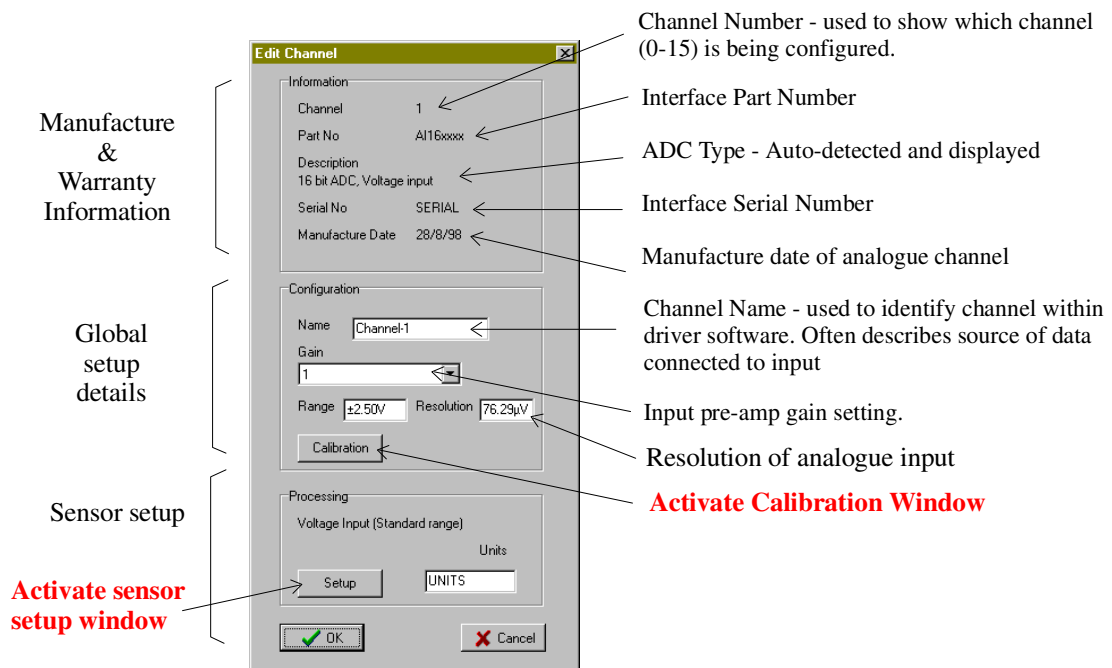


Figure 12 PodMng Software - Edit Channel Window

- 3 Using either the Tab key or mouse pointer, select the parameter that is to adjusted.
- 4 On completing the channel configuration details select the "OK" button. All of the newly configured parameters will now take effect.

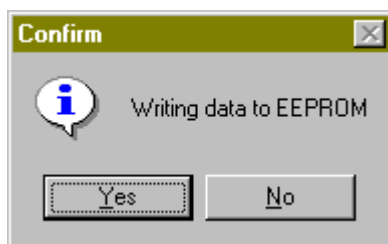


Figure 13 PodMng - Confirm Window

If at any time you want to stop the configuration process simply select the "Cancel" button on the Edit Pod menu. The Edit Pod menu will disappear and you will return to the main system configuration menu.

## 5.7 Setting the Sample Rate

The following section details the operations that are to be undertaken to set the sample rate of the NetPod. Unlike most data acquisition systems the NetPod supports multiple sample rate operations.

### 5.8 Best Practice – Sample Rate Options.

The PodMng driver enables multi-rate sampling to be undertaken across a network.

It is not possible to mix sample rates directly within a single unit but it is possible to have multiple 4004 instruments running on a network operating at different sample rates. For example, if there are three units on a network, Pod-1 can operate at 1 KHz, Pod-2 at 500 Hz, and Pod-3 at 10 Hz.

It is best practice to have all instruments running at the same sample rate as this simplifies the data analysis

The sample rates at which are unit will operate are automatically determined and are based upon the technical specifications of the input modules.

## 5.9 Data Decimation

In order that you can undertake multi-rate data processing for analogue channels contained within the same unit, you will have to develop your own processing software. A drivers developers kit has been created to enable you to design your own applications and utilise the functionality within the instruments

To set the sample rate of a chosen NetPod unit follow the instructions specified below

### 5.10 Sample Rate - Instructions.

Using Podmng software, stop the data transmission operations across the network.

For sample rate changes the data transmission operations must be stopped regardless of type of network from which data is being acquired. The Podmng software displays a green flashing icon while data is being broadcast by NetPod instruments across a network. The Podmng software displays a red icon when data transmission operations are suspended.

- 1) Display the Default driver menu.

Move the mouse pointer until it is above the Podmng icon. Press the Right hand mouse button.

Select the **Config** menu option.

- 2) The Default driver screen will appear. Select the NetPod unit whose sample rate you want to adjust.

Move the mouse pointer until it is directly above the NetPod icon whose sample rate you want to adjust.

Double click the left hand mouse button.

- 3) The **Edit Pod** window will appear. Note. It is using the **Edit Pod** Window that the sample rate can be adjusted.

- 4) Using the mouse pointer or **Tab** key select the Sample Rate pull down menu list.

Once you have selected the Sample Rate pull down menu, you can select the new sample rate by using the Up and Down cursor keys to adjust the highlight bar or by simply selecting the new rate directly by the mouse pointer.

- 5) Once you have selected the new sample rate press the **OK** button. The *Confirm* screen will appear.
- 6) Select the OK button on the Confirm screen to store new sample in the specified pod.

Once you re-start the data transmission operations the new sample rate will take effect.

### 5.11 Multi-user Operations

The standard driver supports multi-user operations. Simply load the driver software on to the additional PCs using the CD supplied with the instrument. The software for multi-user operations is generally supplied in two parts. The standard driver i.e. PodMng is provided for general purpose operations, diagnostics and instrument configuration. Third party drivers are supplied to integrate data from the instruments directly into applications packages.

When operating in a multi-user environment the PodMng software will appear in just the same way as described for single user operations. The software automatically determines the state of the data emissions from the instruments on a network. If data transmissions from the instruments is detected the task bar icon colour changes from red to green.

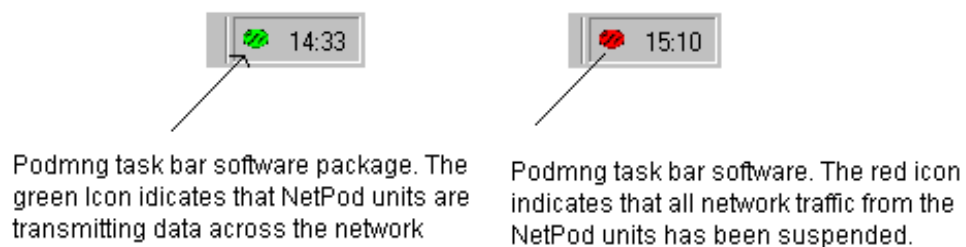


Figure 14 - Taskbar Operations Indication

Depending upon which mode of operation you are using, i.e. **Admin** mode or **User**. It is possible to can configure the instruments, start and stop data transmissions and record data directly from each User's terminal. Most third party drivers call the NetPod.dll to transmit and receive configuration details to and from the instruments.

The control of the instruments is a global operation i.e. effects all users and instruments. Starting and stopping data transmissions and configuration changes are reflected directly to each user connected to the network. The driver software automatically detects any changes and updates each user automatically. There are no configuration files to maintain. The automatic updating of the Keynes Controls software is not necessarily a feature of third party packages.

## 5.12 Real Time Data Display

To observe real time data from any of the instruments on the network follow the instruction below. You must ensure that the network data transmission operations are active.

- 1) At the PodMng Window select **View** window option  
The **Display** window will appear
- 2) The Display window has the following Tab options. Graph, Raw, Processed Errors
- 3) Select the Graph Tab The Chart Recorder display will appear.

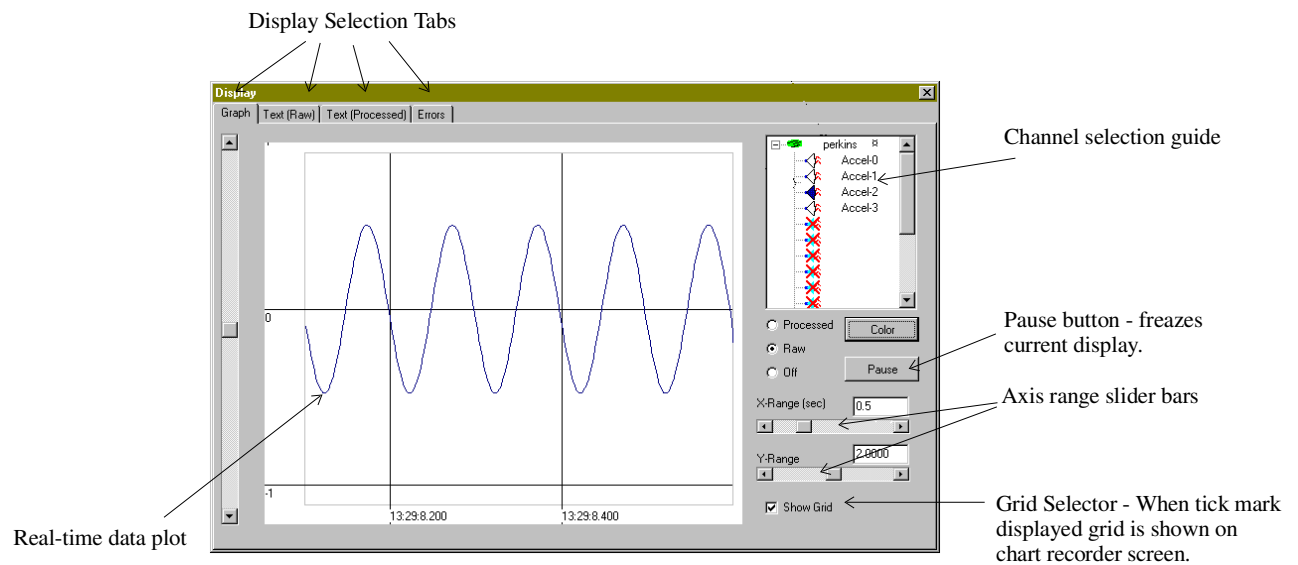


Figure 15 PodMng Software - Chart Recorder Display

- 4) You can observe data from any instrument on the network. Using the Channel selection guide select the instrument and channel whose data you require to plot.
- 5) For each channel you are using select either Raw or Processed data type options. You can mix raw and processed data on the screen.



### 5.13 Text Display - Raw and Process Data

To observe the raw and processed data in a text format follow the instructions below:

- 1) At the Display Window (See Figure 20) select the **Text (Raw)** or **Text (Processed)** tab.

Each instrument will be listed horizontally across the screen

Listed below each instrument will be the data from the analogue input channels. A blank space in the channel list shows that no channel is installed in the instrument.

The display should match directly the configuration of your channels in the instruments.

When the display is no longer required Close the Display Window. Closing the window does not stop the driver from operating. No data is lost if your are streaming results to disk.

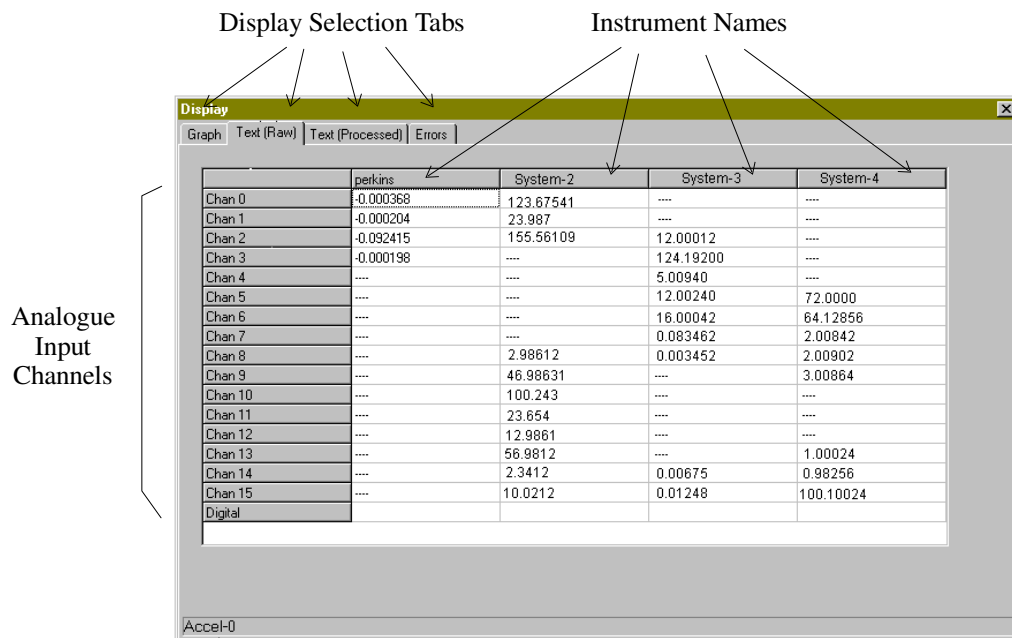


Figure 16 PodMng Software - Real Time Text Display

### 5.14 Channel Configuration - Edit Channel Menu

The following instructions detail the procedures to be followed to assign channel configuration details for use within the Pod Manager software package:

1. From the main menu select a Pod whose channel you want to configure.

**NOTE.**

The main configuration menu is the menu that appears when you first activate the NetPod manager software. Each of the NetPod instruments for which data traffic has been identified will be shown on the main screen below the title listing the interface upon which traffic was detected.. For data identified as originating from the 100BaseT network port then it will be titled **Ethernet**.

2. Move the mouse pointer over the Pod chosen for channel configuration. Select by pressing the left hand mouse button or the + symbol; which appears adjacent to the Pod for which channel details are going to be adjusted, or directly the channel which is going to be configured. Figure 15 shows the **Edit Channel** Window

**NOTE.**

On selecting the + symbol. The channel details associated with the chosen pod will be listed. The Pod manager software will interrogate all identified units and report details of any analogue and digital interface cards installed within the instruments.

3. Move the mouse pointer until it is above the channel name which has been selected for configuration.  
  
Double click the left hand mouse button. The **Edit Channel** window will appear. If you do not double click the left hand mouse button quickly enough then only the text on the menu will change. The text will change from black on a white background to white on a blue background.
4. Using either the Tab key or mouse pointer, select the parameter that is to adjusted.
5. On completing the channel configuration details select the "OK" button. All of the newly configured parameters will now take effect.

**NOTE.**

If at any time you want to stop the configuration process simply select the "Cancel" button on the Edit Pod window. The Edit Pod Window will disappear and you will return to the main system configuration menu.

### **5.15 Multi-instrument Operations**

The NetPod driver supports multi-instrument operations on 100BaseT network. The PodMng driver and NetPod 4004 has been designed for operation on an Ethernet network.

To install additional 4004 instruments on to a 100BaseT network simply power on the new instrument and connect the network cable from the processor card to the hub. Instantly the instrument detects network data you will see the **link** status light illuminate.

The Link status light is one of the LEDs mounted on the front panel of the unit. You must ensure that each instrument has its own unique IP address before connecting onto a network.

### 5.16 Data Recording Operations

The following page details the instructions that should be followed to store data to disk. Each user can record data using the PodMng software or third party application packages.

- 1) From the main menu select the **Configure** menu option
- 2) Select the **Logging** menu item to access the data recording operations setup screen.

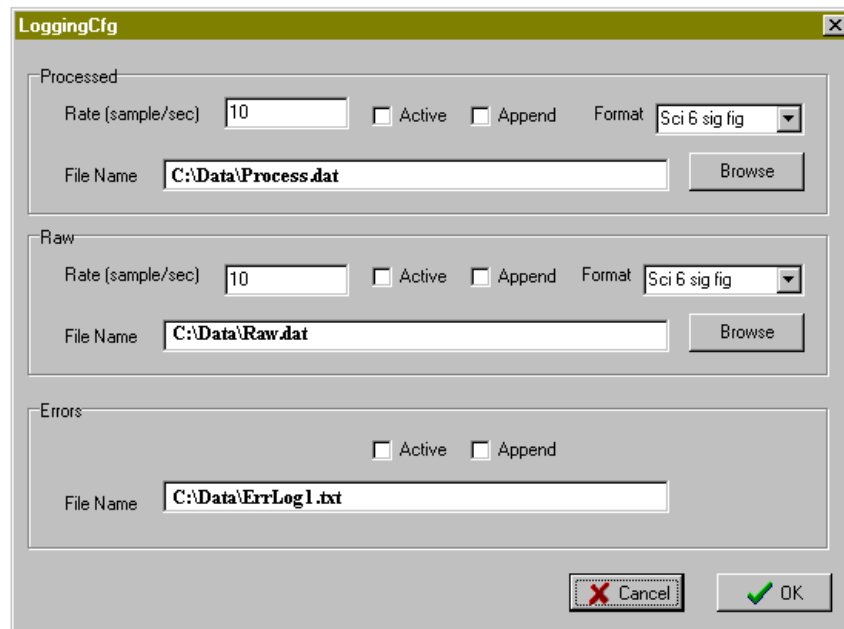


Figure 17 PodMng Software - LoggingCfg Window

Using the LoggingCfg setup dialog box simply enter the file names and directory locations where you want to store processed and raw data.

**Processed Data:** This is data converted into engineering units by a mathematical process.

**Raw data:** This is the data gathered by the NetPod instruments prior to any data processing

- 3) Enter in the “Rate (Sample/sec)” boxes the desired sample rate.

Only enter sample rates up to the maximum rate set for the NetPod instrumentation. The recording of data does not include any multi-rate filtering to eliminate aliasing effects.

- 4) Using the mouse pointer select the desired type of recording operations.

**Active:** Data is recorded to a new file each time storage operations are activated. Old files are overwritten.

**Append:** Data is appended to the end of the specified file at the resumption of data recording operations.

Move the mouse pointer over the data recording function tick boxes. Use the left mouse button to select the desired option. You can only select one option at any one time for either of the raw and processed data file.

- 5) Once you have completed the setup operations select the OK button. The **LoggingCfg** Window will disappear and you will return to the default screen.

### 5.17 Error Recording

Error recording is useful to show the status of the instruments and network operations for a series of instruments widely separated on an Ethernet network. It is possible to locate and in many cases identify the source of any system error without need of manually inspecting the instruments.

The following page details the instructions that should be followed to record the instrument and network error messages to disk. Each user can record an error log using the PodMng software or third party application packages.

- 1) From the main menu select the **Configure** menu option
- 2) Select the **Logging** menu item to access the data recording operations setup screen.
- 3) Using the LoggingCfg setup dialog box (See Figure 22) simply enter the file name and directory location where you want to store the error log. Enter the error log file name in the space provided for this information.
- 4) Using the mouse pointer select the desired type of recording operations.

**Active:** Data is recorded to a new file each time storage operations are activated. Old files are over written.

**Append:** Data is appended to the end of the specified file at the resumption of data recording operations.

Move the mouse pointer over the data recording function tick boxes. Use the left mouse button to select the desired option. You can only select one option at any one time for either of the raw and processed data file.

- 5) Once you have completed the setup operations select the OK button. The **LoggingCfg** Window will disappear and you will return to the default screen.

### 5.18 Network Error Report

In order to provide a clear indication as to the operating characteristics for each instrument connected to a LAN a network reporting system has been created.

To view the Error Report Window you should.

1. Select the **View** menu option from the PodMng default screen.
2. Select **Error** Tab on the Display Window. On selecting the Error tab the Error Display Window will appear.

The **Error Display Window** is split into two parts. The top screen shows the instantaneous messages that are directed to the PodMng from the instruments. The bottom of the screen shows each instrument connected to the network and a real time summary of the network statistics.

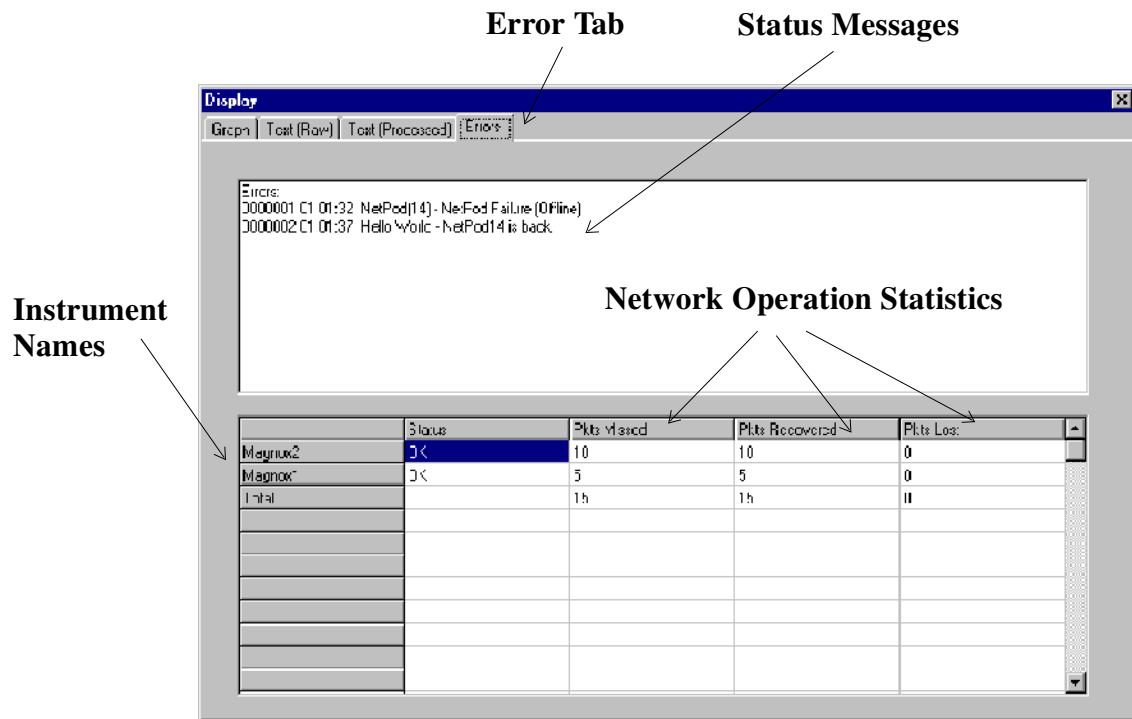
For each instrument connected to the LAN the following network statistics are reported:

**Packets Missed**

**Packets Resent**

**Packets Lost**

**Status:** OK (Normal Operations) Failed (Network time out, power failure)



The Status message indicates the instantaneous action of the instruments. **OK** for successful operations and **Failed** for any instrument that have timed out or become disconnected.

### **5.19 Hiding Error Screen from the User**

It is not possible to have a perfect network where no packets will be lost. In order to prevent confusion with a user, a facility has been included with the driver software to remove the error log from a users screen. The error log is removed by a simple command included in the operating system registry.

Remove error log from screen insert following command into Registry

Command1= nopackerr

## 6. Software Parameters

The following chapter details the names and functions of the parameters used by the software for the NetPod instrumentation. The system parameters are described in two parts, global and channel. Global parameters are those that are stored within the main processor board. They contain manufacture, warranty and parameters that describe instrument operations. Channel parameters, are those that describe the setup and operation of a particular analogue input module. Just like the global parameters they are retained even if the channel is removed, stored or moved to another instrument.

### 6.1 Global Configuration Parameters

The following page details the global User Defined parameters that can be assigned by an operator to assist in the control and configuration of the control units for project specific tasks. Some of the parameters you can adjust when you configure the instrument. Others are set on manufacture and are used to assist us to provide technical support.

The following details are assigned via the EDIT POD menu. See *Assigning Pod System Information* for further instructions on how to apply parameters.



**FACTORY SPECIFIED MANUFACTURE DETAILS**

|                         |  |
|-------------------------|--|
| <b>I.D</b>              | Pod Instrument Identification number.  |
| <b>Part No</b>          | DSP mother board part number. Used to indicate PCB version and firmware level. |
| <b>Serial No</b>        | Pod serial number. Used to identify the client details.                        |
| <b>Manufacture Date</b> | Date on which instrument was shipped for operations.                           |
| <b>ADC Type</b>         | Details the resolution of the ADC system installed in the instrument.          |
| <b>Ethernet Address</b> | Default Ethernet network address assigned at manufacture time.                 |

**CONFIGURATION DETAILS**

|                        |  |
|------------------------|--|
| <b>Name.</b>           | User specified instrument identifier. Used to identify instrument location or source of data.  |
| <b>IP Address</b>      | User specified IP address. Used to identify instruments on a local area network.   |
| <b>Sample Rate</b>     | Global instrument sampling rate. Sets sample rate for acquisition.   |
| <b>Packet Size</b>     | Data block packet size. Used to adjust packet rates sent down the network. Used to optimize data transmission rates for local area network operations. |
| <b>Comments. (Box)</b> | Area for user defined comments and reports. Maximum length 1024 characters.  |
| <b>Digital Button</b>  | Used to define status of the digital I/O interface for a specified POD.  |
| <b>Default Button.</b> | Used to set the default status of the digital I/O interface.   |
| <b>OK Button.</b>      | Used to assigns new configuration parameters or control operations.  |
| <b>Cancel Button.</b>  | Used to reset all recent configuration details. Prevents new user parameters from being assigned to an instrument.                                     |

**6.2 Analogue Channel Parameters**

Each of the configuration settings shown below are stored directly within each channel using the onboard EEPROM.

The following details are configured at the time of manufacture. No parameter contained within the "Factory Configured Details" list can be adjusted by the operator. Information is used to confirm warranty information.

**FACTORY CONFIGURED DETAILS**

|                          |  |
|--------------------------|--|
| <b>Channel.</b>          | Is the position within the instrument where the interface is installed. See layout for more details. |
| <b>Part No.</b>          | Part number associated with the analogue interface.  |
| <b>Description.</b>      | Details the operations of the specified analogue interface.  |
| <b>Serial Number.</b>    | System management information. Reference for client - distributor application.                       |
| <b>Manufacture date.</b> | Record of manufacture date.  |

The following section details the user configurable channel parameters.

**CONFIGURATION**

|                     |   |
|---------------------|---|
| <b>Name.</b>        | User definable channel name. Use this parameters to identify source of input data.      |
| <b>Gain.</b>        | Gain setting for channel pre-amp. Range is sample rate limited.                         |
| <b>Range.</b>       | Shows the direct analogue input signal range.   |
| <b>Noise.</b>       | Shows the expected noise level for a set sample rate and pre-amp gain configuration.    |
| <b>Calibration.</b> | Insert linear calibration details for specified channel. Offset and gain settings only. |

The processing section provides the user with a simple pull down menu system which is used to assign the type of sensor attached to a specified analogue input channel.

## **Processing**

- Setup.** Assign sensor type and operating characteristics.  
**OK Button.** Select this button to confirm the selection of the new configuration details.  
**Cancel Button.** Select this button to cancel any modifications made to the configuration details.

## **Confirm Menu**

- Yes** Select this button to store new configuration details to EEPROM.  
**No** Select this button to reject any changes to the config details stored within the channel

## 7. Configuring the NetPod 4004 for Network Operations

The following chapter details the operations that have to be followed to alter the instrument configurations to suit your organisations operating requirements. Every care is undertaken to ensure that the instruments will operate directly upon arrival but for some users it may be advisable to change network addresses of multiple network string and bridging equipment should this be in operation.

The instructions shown below are identical for the NetPod 4000, 4003, and 4004 series instruments.

The NetPod 4004 supports 100BaseT network operations. On initialisation the instrument monitors the network port for traffic and switches on the status LED when traffic is detected..

### 7.1 IP Address

In order to identify data originating from an instrument on an Ethernet network each instrument is assigned it's own unique IP address. This address is appended to each data packet originating from the chosen instrument prior to its broadcast across a network. The IP address can be user assigned in order to enable the instrument to meet network management requirements.

### 7.2 Setting The IP Address of the instrument

The following page details the operations you are to carry out to modify the IP address of a NetPod instrument.

#### Operations

- 1) Stop network data transmission operations.
- 2) From the default driver screen select the NetPod instrument whose IP address you want to change.  
  
To select the NetPod unit for configuration, simply move the mouse pointer until it is above NetPod unit you want to configure then double click with the left mouse button the unit whose IP address you require to set.
- 3) The **Edit Pod** window will appear.  
  
The **Edit Pod** window that the chosen IP address for the chosen NetPod unit is displayed. The IP address shown on the menu is the current setting for the instrument.
- 4) Using the Mouse pointer or Tab key select the IP address on the menu system.  
  
Edit the current I.P. address and insert the new address values.  
  
**Ensure that you do not insert a repeat address i.e. one already assigned to an earlier unit.**
- 5) Once you assigned the new address select the OK button.  
  
Up on selecting the OK button the **Confirm** Window will appear. Pressing the OK button on the Confirm menu will cause the new IP address to be sent to the chosen NetPod unit and stored for use.  
  
You will observe the status lights on each of the NetPod units flash on and off quickly to show that configuration parameters have been sent across the network.
- 6) You can now start the data transmission operations again. The new IP address will take effect as soon as data transmission operations are activated.

**Manufacture & Warranty Information**

- Instrument ID Number (I.D.)
- Product Part Number (Part No)
- Instrument Serial Number (Serial No)
- Manufacture Date - DSP Board (Manufacture Date)
- Analogue Cards only - ADC Type (ADC Type)
- Ethernet Address - 10Base2/10BaseT only (Ethernet Address)

**Global setup details**

- Name - Used to identify instrument on network within the driver software. (Name)
- IP Address - ensure this address is unique for each instrument you use on a network (IP Address)
- Sample rate of instrument (Sample Rate)
- Data block packet size (1-16) (Packet Size)

**Digital interface setup**

- Assign digital I/O port operations (Digital button)

Figure 18 PodMng Software - Edit Pod Window

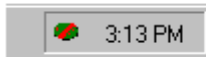
### 7.3 Automatic Restart

The instrument will restart data transmission operations automatically should a network link fail or be reset. This action may occur during network maintenance. Data is restarted for both 10Base2 and 10BaseT networks.

The Error Display Window will indicate the operating status of each instrument. If an instrument has timed out or been disconnected then the status message will indicate a failed status message. The status message will revert back to OK up on the PodMng software detecting new data packets.

The default Timeout period used to indicate an instrument failure is 20 seconds.

The figure below shows how the task bar icon indicates that an instrument has failed or timed out. The task bar icon will automatically change status to indicate correct operations or stopped data transmission operations. (Timeout task bar icon)



**Task bar icon**

The red bar through the icon indicates that an instrument has failed/timed out somewhere on the LAN

*Figure 19 Task bar icon - Instrument Failure or Timeout*

Should the instrument not restart automatically after a timeout operation then please ensure that the watchdog timer has been energized.

## 8. Interface Cards

### 8.1 Analogue Output Card

**Part Number - NPAO16-1030**

**Analogue Output  $\pm 10$  V Output  $\pm 30$  mA Software Selectable**

#### Introduction

The **NPAO16-1030** card is a 4 channel high speed analogue output card for the NetPod 4004 series dc acquisition instrument. The NPAO16-1030 supports 4 independently configurable analogue output channels each individually set for voltage or current operations by the driver software. Preset output levels, for each channel at boot up time can be defined in the driver software.

**Important Note:** When using this card make sure the mounting screws are correctly terminated in order guarantee an electrical earth connection to the main instrument chassis. This is essential for safety when operating with high voltages. Do not use this card if the mounting screws are not fitted

#### 4 x Independent Output Channels

$\pm 10$  V /  $\pm 30$  mA User Software Selectable Output Type

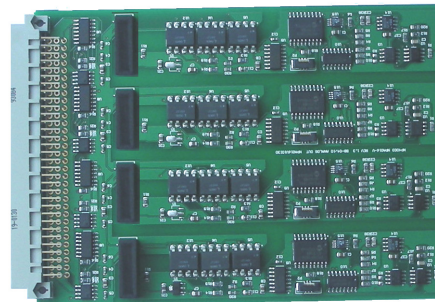
Maximum Isolation 2000V DC/Channel

Maximum Cable Size 1.5 mm<sup>2</sup>

Power Consumption < 1 W / Channel

User Defined Initialisation Levels

Output Signal Type Identification



#### Output Signal Type Selection

Only a suitably qualified engineer should make any changes unsure about this procedure return the product to Keynes Controls for any adjustments.

**The following instructions should be followed in order to change the output signal type.**

Stop data acquisition operations before trying make and configuration changes. The NetPod 4004 does not allow configuration changes while making measurements.

1. Using the Podmng driver software select the output type. See user manual for additional details
2. Re-scan the network to ensure instrument configuration changes are updated in to the driver software.
3. Re-start data acquisition operations. Enter 'Run-mode' in the Podmng driver software.

#### Pre-set Initialisation / Startup levels

Each output channel can be independently configured using the driver software to give a pre-set output level on initialisation. The output levels of a complete instrument must be known at start-up.

See Page XX for details on setting the default start-up conditions.



Installation

The **NPAO16-1030** card fits into slots 3-6 in the main instrument chassis as shown below.

- 1. Power off the NetPod 4004 before installing any new interface card.  
Fasten the mounting screws to the chassis.
- 2. Power on the instrument and scan the network for the updated Netpod 4004.

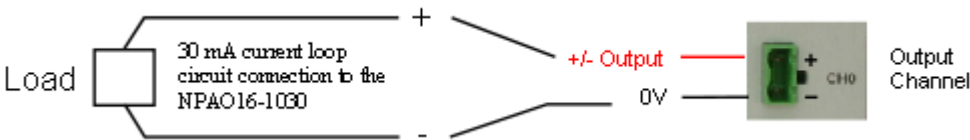
Output Signal Type Identification

The output signal type for each channel can be identified by the driver software. Signal operational details can be accessed and processed by third party applications.

See Page XXX for details on identifying and setting the output type and levels.

Connecting a Current Load to the NPAO16-1030

The following example demonstrates connecting a current load to an output channel. T

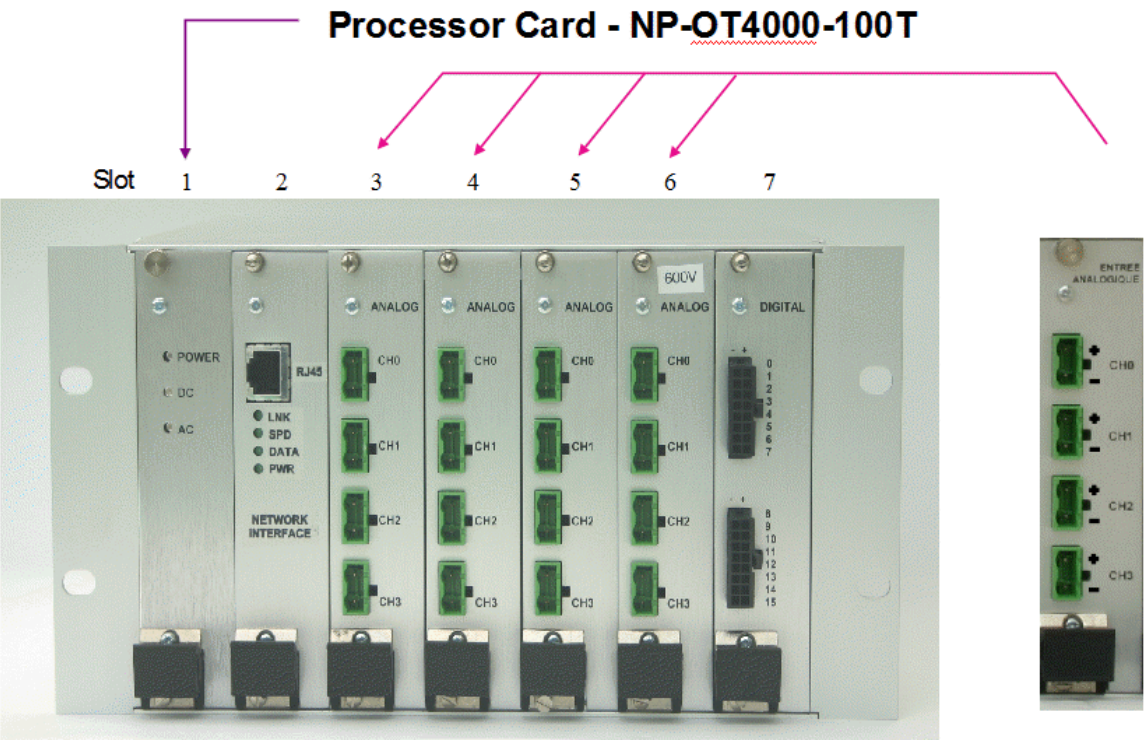


Technical Specifications

|                        |           |                   |                                |
|------------------------|-----------|-------------------|--------------------------------|
| <b>Number Channels</b> | 4/Card    | <b>Isolation</b>  | 2 KV DC                        |
| <b>Range</b>           | +/- 30 mA | <b>Protection</b> | Short circuit protected < 1 mi |
|                        | +/- 10V   |                   |                                |
| <b>Resolution</b>      | 16 Bit    |                   |                                |
| <b>Power</b>           | < 1W      |                   |                                |

The NPAO16-1030 card installs only into slots 3, 4, 5 and 6 as shown below.

Note. It is not possible to mix analogue input and output cards in the same instrument.



Analogue Output Card



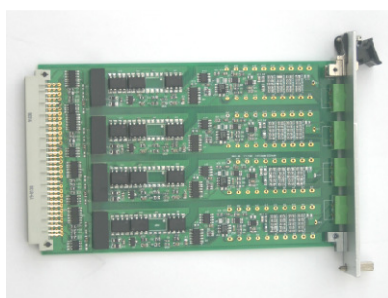
## 8.2 Analogue Input cards

The **NPA16-VXH1-4** card is a 4 channel high speed analogue input card for the NetPod 4004 series data acquisition instrument. The NPA16-VXH1-4 supports 4 simultaneously sampling channels each with its own ADC input enabling the cards to be used for both static and dynamic measurements. The cards are suitable for DC as well as AC inputs.

A range of different boards are available enabling signals from +/- 50 mV to 600V to be measured within the one instrument.

Keynes Controls design and manufacture all parts in-house and are able to configure these cards for additional input ranges on request.

**Important Note:** When using these cards make sure the mounting screws are correctly terminated to guarantee an electrical earth connection to the main instrument chassis. This is essential for safety when operating with high voltages. Do not use this card if the mounting screws are not fitted



### 4 x Independent Input Channels

User set +/- 50 mV / 5V / 50V / 600V Input Range

Maximum Isolation 2000V DC/Channel

Maximum Cable Size 2.5 mm<sup>2</sup>

5000 Input readings/Sec/Chan

Power Consumption < 2W

Automatic Card Type Identification System

| Specifications                           | High Speed 16 Bit C                              |
|--|--|
| SNR                                      | See Note 1                                       |
| Sample Rate                              | 0.1 - 5 KHz / channel                            |
| Isolation                                | 2000 V <sub>RMS</sub>                            |
| Over Load (Max)                          | 20% above FS range                               |
| Signal/Noise                             | See Note 1                                       |
| Gain Accuracy<br>(Accuracy as % reading) | 0.05 % or better                                 |
| Settling Time                            | 100 nS   |
| Input Range: V1                          | ± 10 V   |
| V2                                       | ± 50 V   |
| V3                                       | ± 500 V  |
| V4                                       |  |
| Resolution: V1                           | 0.3 mV   |
| V2                                       | 1.5 mV   |
| V3                                       | 20.0 mV  |
| Input Offset: V1                         | ± 1 μV/°C  |
| V2                                       | ± 10 μV/°C                                       |
| V3                                       | ± 100 μV/°C                                      |
| Stability: Over -25 to 50 Deg C          | 2.5 LSB  |
| Input Impedance: V1                      | 20 MΩ typically                                  |
| V2                                       | 20 MΩ typically                                  |
| V3                                       | 20 MΩ typically                                  |
| Current Input                            | 0-20 mA 0-60 mA, 4-20<br>Other ranges on request |
| Overload                                 | 250 V <sub>RMS</sub>                             |

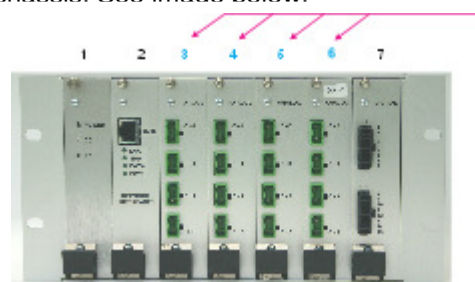
### Signal Connection

All signal cables are terminated using standard plastic 2 way plugs as shown below. A lock tag secures the plug to the socket and ensure that the connections automatically align and are simple to replace.

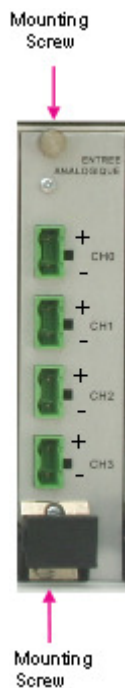


### Installation

No matter which analogue input card type are used they fit into slots 3 - 6 in the instrument chassis. See image below.



## Pin-out / Connections



All of the analogue input cards use the same pin-out for signal connection as shown opposite.

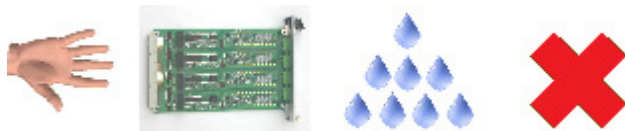
Make sure that mounting screws are securely fastened to the instrument frame when using these cards. The mounting screws are used to ensure a good electrical Earth is maintained to the card. This is essential when high voltages are being used.

### Card Installation

The NPAI16 range of analogue cards are fitted into the instrument using slots 3 – 6 as shown above. The analogue inputs can be used with any digital I/O card.

It is not possible to mix analogue input and analogue output cards into the same instrument. Currently any analogue output cards have to be fitted in to a separate instrument.

## SAFETY INSTRUCTIONS



**Important Note. Do not handle this card with wet**

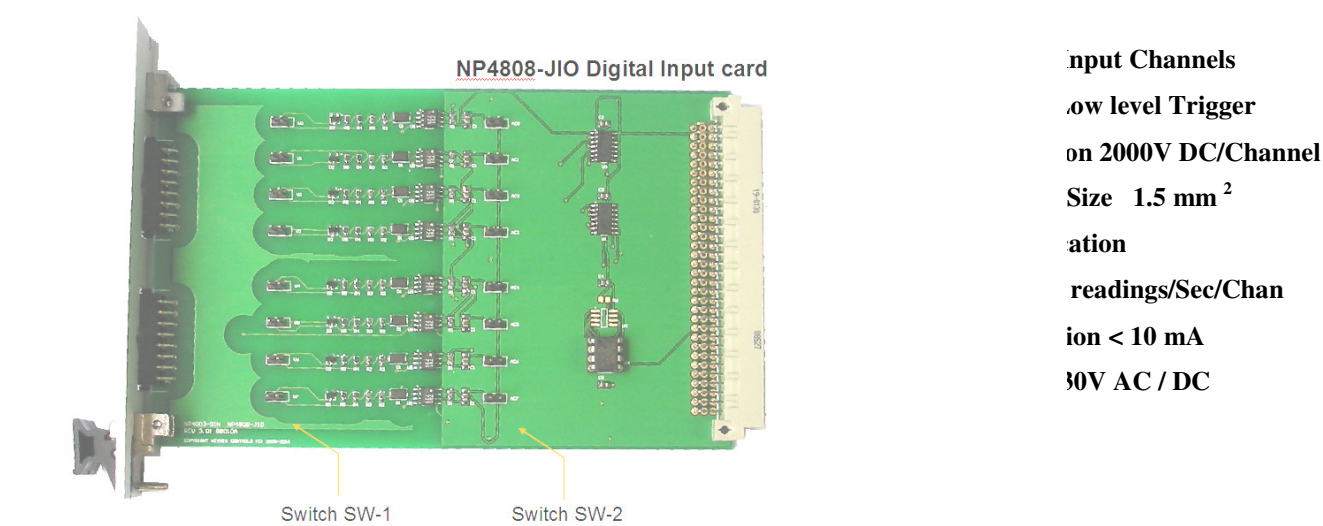
## 9. Digital Interface Cards

Part Number - NP4808-JIO-X                      8 Channel Digital Input Card

### 9.1 Introduction

The NP4810-JIO is an 8 channel high speed digital input card supporting both high and low level inputs in a single user defined card for the NetPod 4003/4004 series data acquisition instrument.

**Important Note:** When using this card make sure that the mounting screws are correctly terminated to guarantee an electrical earth connection to the main instrument chassis. This is essential for safety when operating with high voltages. Do not use this card if the mounting screws are not fitted.



The images below show the switch settings for the input range selection and input signal type.

SW-1    High / Low Trigger Level Setting

SW-2 Input Signal Type Selection

Input

### Card Configuration

The NP4808-JIO-X card operations are configured using the Link/Switch positions defined by SW-1 and SW-2. SW-1 defines the low level trigger setting. SW-2 defines the input signal type.

By default the NP4808-JIO is configured for 18 V trigger with a DC input signal

Default Switch Positions – new card

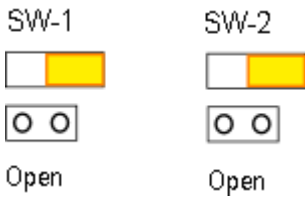


Table 1 - Switch Settings

|      | Open               | Closed              |
|------|--------------------|---------------------|
| SW-1 | High level Trigger | Low Voltage Trigger |
| SW-2 | DC Input           | AC Input            |

Default Link / Switch Settings  
18V Trigger DC Input Signal

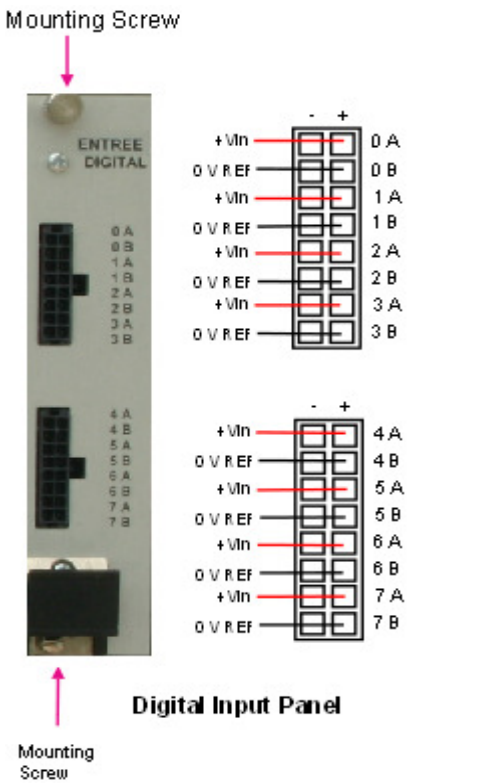
Signal Connection



When connecting signals to the NP4808-JIO card make sure that both adjacent pins in the 16 way header are used. See image above.

Card Installation

The NP4808-JIO card like all other digital interfaces only fits into slot 7 of a NetPod 4004 instrument, see image opposite.



Connector

2 Row 16 Way  
3 mm Pitch

## 9.2 Fitting the NP4810-JIO into the Instrument

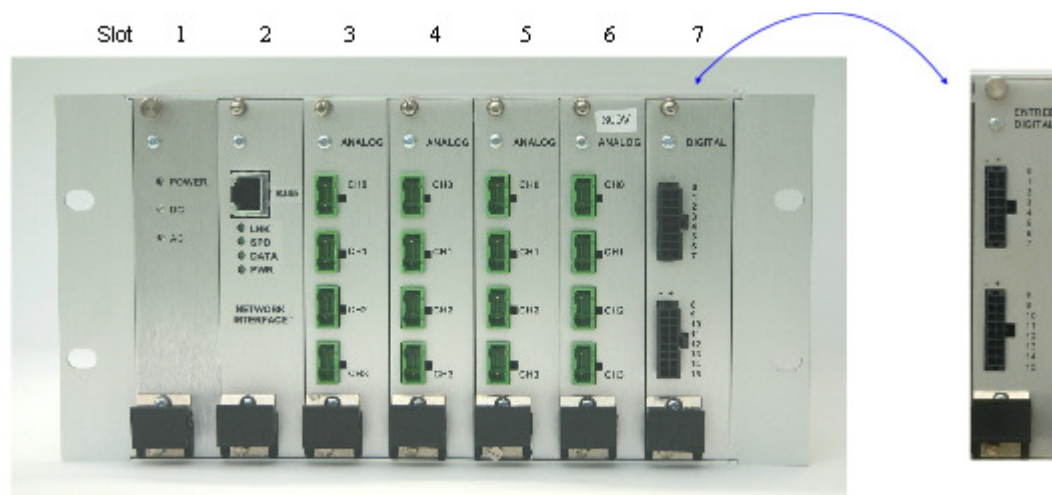
The NP4810-JIO card is fitted into slot 7 of the instrument only as shown below.

- 1) Slide the NP4810-JIO card into slot 7 and fasten into the chassis using the top and bottom mounting screws

### Important Note - Earth Connection

The top and bottom mounting screws fitted to the front panel of the NP4810-JIO card must be securely fastened to the instrument chassis to provide the earth connection for electrical safety. This is essential when operating the card with high 300V input signals.

Location of the Card in the frame.



Fully Populated Instrument

### Digital Port Connector



Max Cable Diameter:1.52mm  
Max Wire Area Size:0.12m<sup>2</sup>  
Max Wire Size AWG:30AWG  
Min Cable Diameter:1.52mm  
Min Wire Area Size:0.05m<sup>2</sup>  
Min Wire Size AWG:26AWG

### Trigger Levels

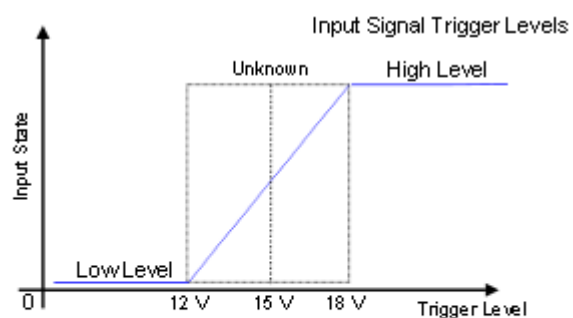
The **NP4810-JIO** card offers both high and low signal operations in a single card. The example below shows the trigger values for the popular 18V card.

#### High Level - 300V Operation

Low signal  $< 12\text{V}$       High  $> 18 \leq 300\text{ V}$

#### Low Level Operation

Low signal  $< 3\text{V}$       High  $> 3 \leq 50\text{ V}$



The diagram above shows the trigger levels for 18V input signals.

### 9.3 Windows Driver Software

The following instructions demonstrate using the NP4810-JIO card from within the standard podmng Windows driver.

#### Instructions

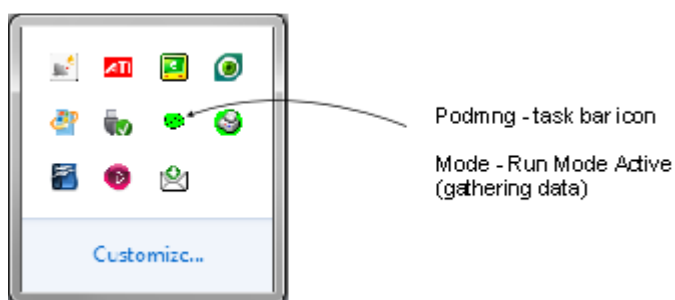
The following instructions are based on the **NP4810-JIO** card already being installed into the Net Pod 4004

1. Start the PodMng.exe software

Make sure the network has been scanned and the instrument to be used has been recognised by the driver.

Refer to the User Guide for details of using the driver software.

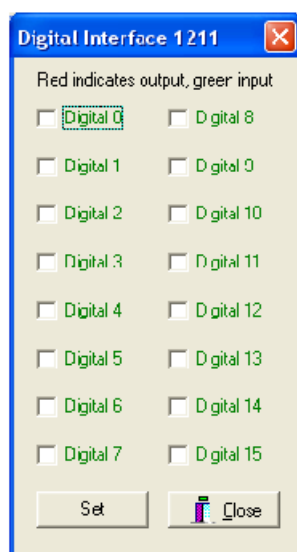
The Podmng.exe task bar icon should be green and flashing as shown below:



- 2) Select the instrument under investigation from within the main Podmng Window
- 3) Move the mouse pointer over the instrument name and select the right mouse button.

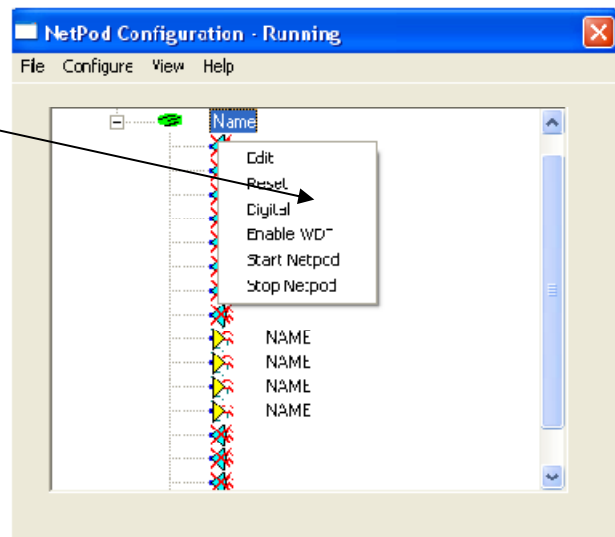
The menu system shown in the '**NetPod Configuration**' Window will appear.

From the menu system select the '**Digital**' menu item.



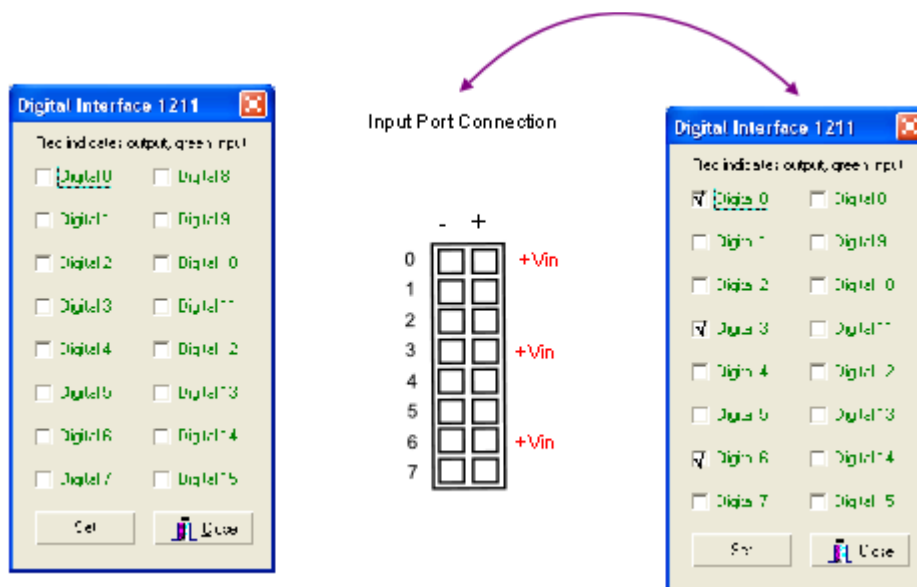
The '**Digital Interface**' Window will appear and the tick boxes show the input port levels.

Select the '**Digital**' menu option  
To see the real-time input port levels.



## 9.4 Viewing Digital Input Port Levels

The input signal levels to the NP4810-JIO card are only shown when the NetPod 4004 is in 'Run Mode' and acquiring data

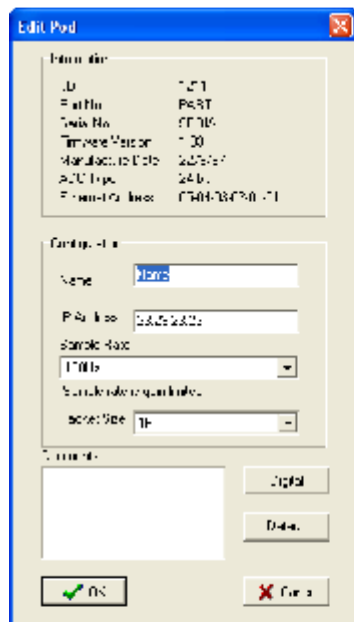


The example opposite shows the levels on the digital ports when suitable digital signals are connected to channels 0, 3 and 6.



## 9.5 Default Port Setting

The following instructions show how to set the NP4810-JIO output port initialisation default switch positions for the card at the time of powering on of the instrument.

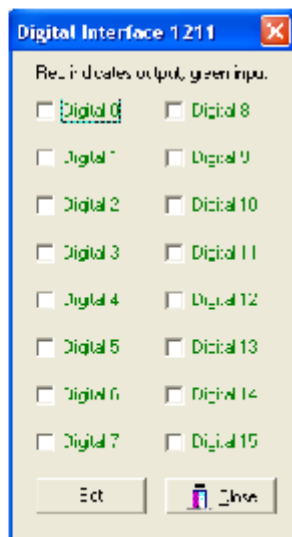


Edit Pod Window

- 1) Using the 'Edit Pod' Window select the 'Digital' button.

The 'Digital Interface' Window showed below will appear.

In the case of the NP4810-JIO card the 'default Digital Interface' Window only shows all channels as digital inputs. There is no way a change in the channel type with this card.



### Digital Interface Information

The 'Digital Interface' Window show those channels that are defined for outputs and those set for input operations.

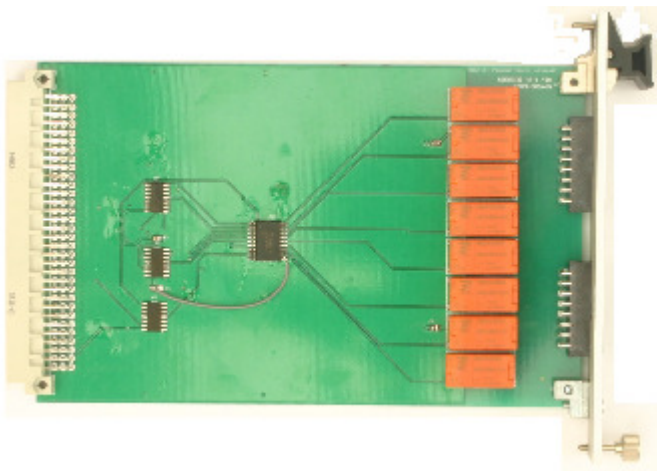
## 10. Digital Output card – Relay

### Part Number - NP4004-RLY

The NP4004-RLY is a high speed digital relay card for the NetPod 4004 series data acquisition instrument. The NP4004-RLY relay card supports up to eight independent digital output signals. Each output can be individually controlled from the driver software.

**Important Note:** When using this card make sure the mounting screws are correctly terminated to guarantee an electrical earth connection to the main instrument chassis. This is essential for safety when operating with high voltages. Do not use this card if the mounting screws are not fitted.

### NP4004-RLY Card



**8 x Independent Output Channels**

**230V AC/DC - 3 Amp Switch Capability**

**Boot-time Pre-set Conditions**

**Maximum Isolation 2000V DC/Channel**

**Maximum Cable Size 1.5 mm**

**Microsoft Windows / Linux / Unix driver support**

**Part Number ID**

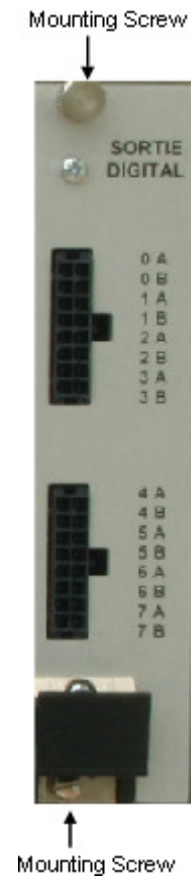
### Power Off Status

A time delay of 1 second on initialisation of the NetPod 4004 ensures the digital output ports return to a preset condition before data acquisition operations recommence. The relay switch positions can go open after a system power off. This is a standard feature of a relay switch system.

### Level switching

The relay switching action is controlled under software. Setting the digital port output to a high level '1' will cause the relay to close. This action enables the input level on one side of the relay to pass through to other side.

### 10.1 Connection to Digital Output Port



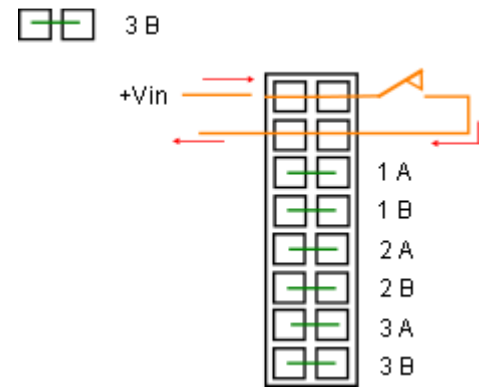
Signal Level Connection

Adjacent pins on the digital output card are connected together. This is to ensure reliable operation and to guarantee the current switching capacity is maintained.

There is no limit on the to the signal levels that can be used among adjacent channels so long the chosen signal to be used is within the defined range of the card.

The example below shows how to switch a signal using **channel 0 relay**. The input signal is shown connected to pins 0-A and the output taken from 0-B contacts.

The switching is undertaken by relay and so it does not technically matter which way round the signals and output are used. The output is only active when the relay closes.



the image shows how contacts 3 -B connected together

The image opposite demonstrates how the relay output is used to switch an applied signal. The signal to be switched can be either an AC or DC level.

The signal to be switched is connected to pins B as shown.

## Fitting the NP4004-RLY into the Instrument

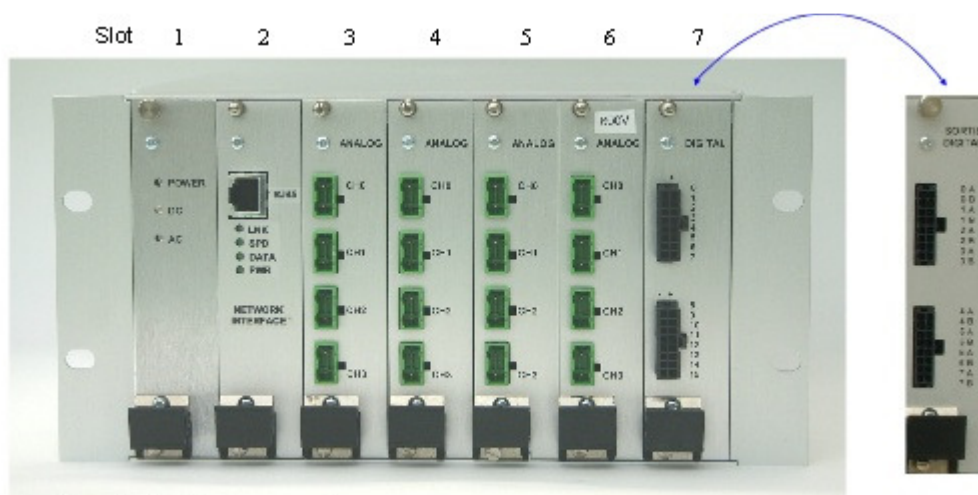
The NP4004-FLY card is fitted into slot 7 of the instrument only as shown below.

1. Fit the NP4004-RLY card into slot 7 of the instrument chassis.

Push the card firmly into place and secure to the chassis using the top and bottom mounting screws.

### Important Note - Earth Connection

The top and bottom mounting screws fitted to the front panel of the NP4004-RLY card must be securely fastened to the instrument chassis to provide the earth connection for electrical safety. This is essential when operating the card with high 230V AC or similar amplitude output signals.



Fully Populated Instrument

### Digital Port Connector



Max Cable Diameter:1.52mm  
Max Wire Area Size:0.12m<sup>2</sup>  
Max Wire Size AWG:30AWG  
Min Cable Diameter:1.52mm  
Min Wire Area Size:0.05m<sup>2</sup>  
Min Wire Size 26AWG

## 11. Windows Driver Instructions – Relay card

The following instructions demonstrate using the NP4004-RLY card from within the standard podmng Windows driver.

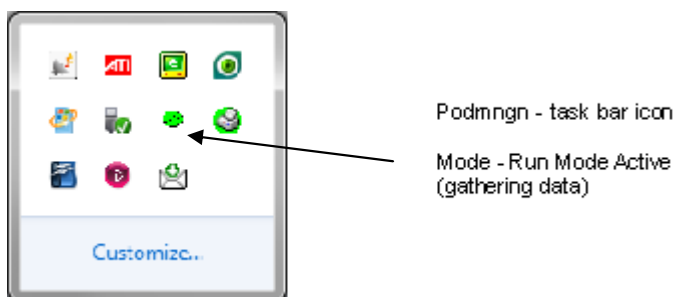
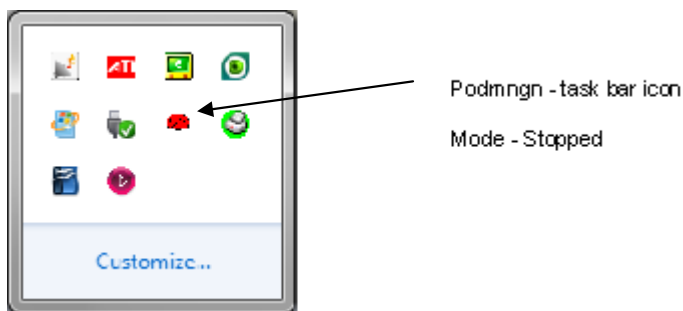
### Instructions.

The following instructions are based on the **NP4004-RLY** card already being installed into the NetPod 4004

1. Start the PodMng.exe software.

Make sure the network has been scanned and the instrument to be used has been recognised by the driver. Refer to the User Guide for details of using the driver software.

The Podmng.exe task bar icon should look like:



**Edit Pod**

Information

I.D. 1211  
Part No PART  
Serial No SERIAL  
Firmware Version 1.03  
Manufacture Date 22/3/97  
ADC Type 24 bit  
Ethernet Address 05-04-03-02-01-01

Configuration

Name   
IP Address   
Sample Rate   
Sample rate is gain limited  
Packet Size

Comments

### Further Information

The '**Digital Interface**' Window opposite shows that the 'NP4004-RLY' card being used has relays closed.

for channels 1,3,4 and 7

When the relay is closed the input signal is switched through to the output

**Digital Interface 1211**

Red indicates output, green input

|   |                                     |
|---|-------------------------------------|
| <input type="checkbox"/> Digital 0            | <input type="checkbox"/> Digital 8  |
| <input checked="" type="checkbox"/> Digital 1 | <input type="checkbox"/> Digital 9  |
| <input type="checkbox"/> Digital 2            | <input type="checkbox"/> Digital 10 |
| <input checked="" type="checkbox"/> Digital 3 | <input type="checkbox"/> Digital 11 |
| <input checked="" type="checkbox"/> Digital 4 | <input type="checkbox"/> Digital 12 |
| <input type="checkbox"/> Digital 5            | <input type="checkbox"/> Digital 13 |
| <input type="checkbox"/> Digital 6            | <input type="checkbox"/> Digital 14 |
| <input checked="" type="checkbox"/> Digital 7 | <input type="checkbox"/> Digital 15 |

The '**Set**' button activates the changes to the state of the relay on the selected channel

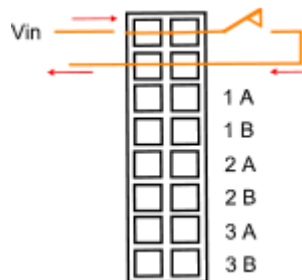
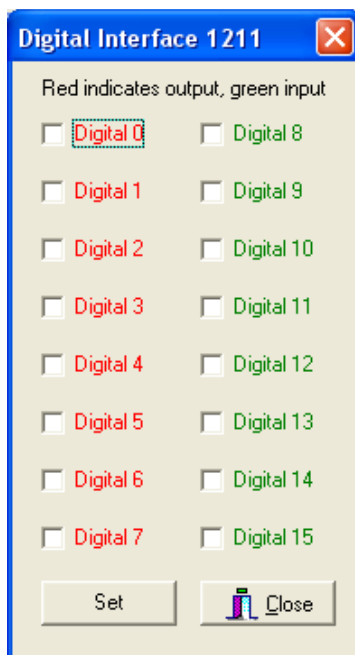
The '**Close**' button removes the 'Digital Interface' Window from the screen

## Switching A Channel

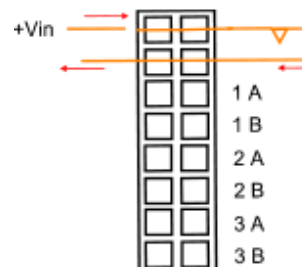
Activate the 'Digital' button on the at the bottom of the 'Edit Pod' Window and the 'Digital Interface' Window will appear.

Select the 'Tick' box for the channel to switch and the relay will change state. The relay will change state regardless to the operating mode of the driver software. The relay will switch as soon as the 'Set' button is selected and new levels are written to the card.

## Open Relay Contac



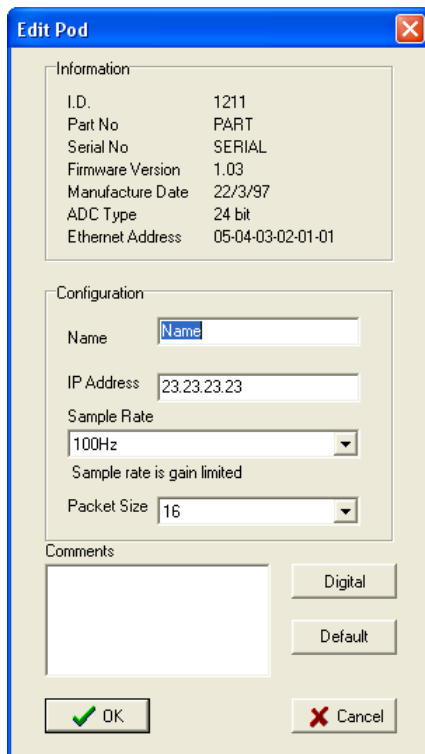
## Closed Relay Contact



The example above shows how to wire an input signal into Channel 0 and how that relay is switched to the output on demand.

## Default Port Setting

The following instructions show how to set the NP4004-RLY output port initialisation default switch positions for the card at the time of powering on of the instrument.



The 'Edit Pod' window is divided into three sections. The 'Information' section at the top lists device details: I.D. 1211, Part No PART, Serial No SERIAL, Firmware Version 1.03, Manufacture Date 22/3/97, ADC Type 24 bit, and Ethernet Address 05-04-03-02-01-01. The 'Configuration' section in the middle contains fields for Name (with a placeholder 'Name'), IP Address (23.23.23.23), Sample Rate (100Hz), a checkbox for 'Sample rate is gain limited', and Packet Size (16). The 'Comments' section at the bottom has a text area and a 'Digital' button. At the very bottom are 'OK' and 'Cancel' buttons.

- 1) Using the '**Edit Pod**' Window select the '**Default**' button.

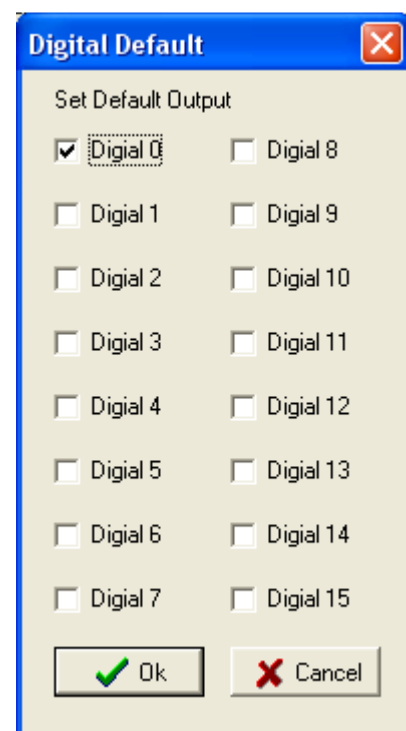
The '**Digital Default**' Window showed below will appear.

### Selecting Output Channel Relay Closures

- 2) Using the '**Digital Default**' Window  
Select the '**Tick Box**' for the desired channel

When all the tick boxes are selected press the '**OK**' button to confirm the to the instrument

The '**Digital Default**' Window opposite shows that only Channel 0 relay is closed at initialization / boot-time.

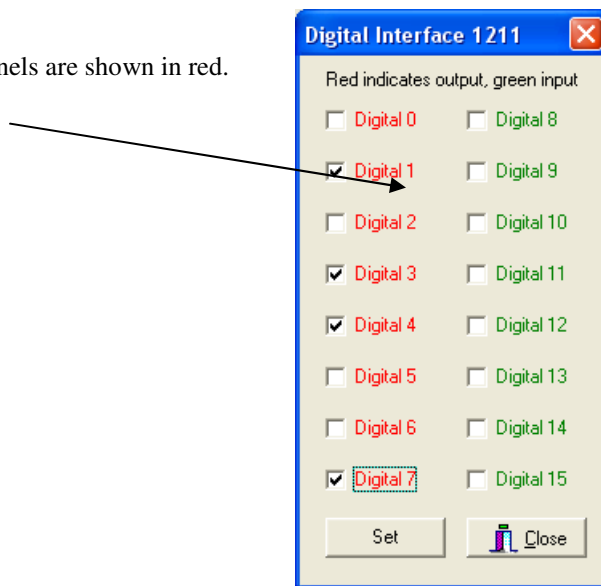


The 'Digital Default' window is titled 'Set Default Output'. It contains a grid of 16 checkboxes labeled 'Digial 0' through 'Digial 15'. Only 'Digial 0' is checked. At the bottom are 'Ok' and 'Cancel' buttons.

| Channel   | State     |
|-----------|-----------|
| Digial 0  | Checked   |
| Digial 1  | Unchecked |
| Digial 2  | Unchecked |
| Digial 3  | Unchecked |
| Digial 4  | Unchecked |
| Digial 5  | Unchecked |
| Digial 6  | Unchecked |
| Digial 7  | Unchecked |
| Digial 8  | Unchecked |
| Digial 9  | Unchecked |
| Digial 10 | Unchecked |
| Digial 11 | Unchecked |
| Digial 12 | Unchecked |
| Digial 13 | Unchecked |
| Digial 14 | Unchecked |
| Digial 15 | Unchecked |



Digital output channels are shown in red.



### Digital Interface Information

The 'Digital Interface' Window show which channels are defined for outputs and those for input operations.

The NP4004-RLY card only uses channels 0 to 7 on this Window.

Any channel shown in 'red' is an output channel.

Example see Window opposite.

**Digital 0 to Digital 7** shown in red are output channels

### Part Number Identification

Each NP4004-RLY card has in built card recognition via the driver software. All interfaces contain a built in EEPROM that stores the card type and can be accessed via the driver software. A scan of the driver software can ensure the correct card type is being used and output level options are set.

## 12. Processor Cards & Firmware

The NetPod 4004 uses the new high speed NP-SF4000-100T software defined processor card. This processor card offers high speed network operations and connects to an external network using its on-board Ethernet port.

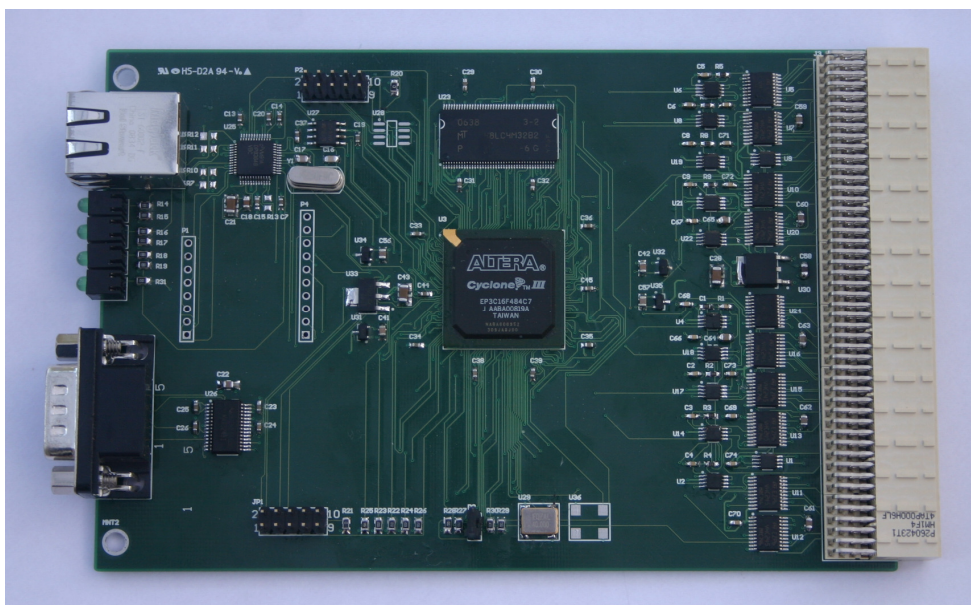
The NP-SF4000-100T does not contain a dedicated microprocessor as would be expected on any similar product but creates the processor in software at the time of initialisation. The core of the processor is stored in memory and copied into the programmable logic unit where in all purposes it acts just like the dedicated hardware device.

Currently the NP-SF4000-100T uses a 32 bit processor core optimised for Ethernet packet handling. The NP-SF4000-100T now undertakes in hardware the data handling and synchronisation operations as if it is dedicated device and operates faster, with improved error correct and recovery with lower power than previous devices.

Options.

The NetPod 4004 has to separate the analogue input and output functions in order to optimize data handling operations.

It is not possible to mix analogue input and output cards in within the same instrument. Individual instruments are supplied for input and output data acquisition operations.



### 12.1 Part Numbers

There are 2 different processor card used in the NetPod 4004 instruments. Technically the same hardware just supplied with different firmware.

|                  |              |                |                                  |
|------------------|--------------|----------------|----------------------------------|
| Analogue Input:  | Use part no. | NP-SF4000-100T | for analogue input measurements. |
| Analogue Output: | Use part no. | NP-OT4000-100T | for analogue output operations   |

## Network Support

The NP-SF4000-100T processor card supports 100BaseT network operations.

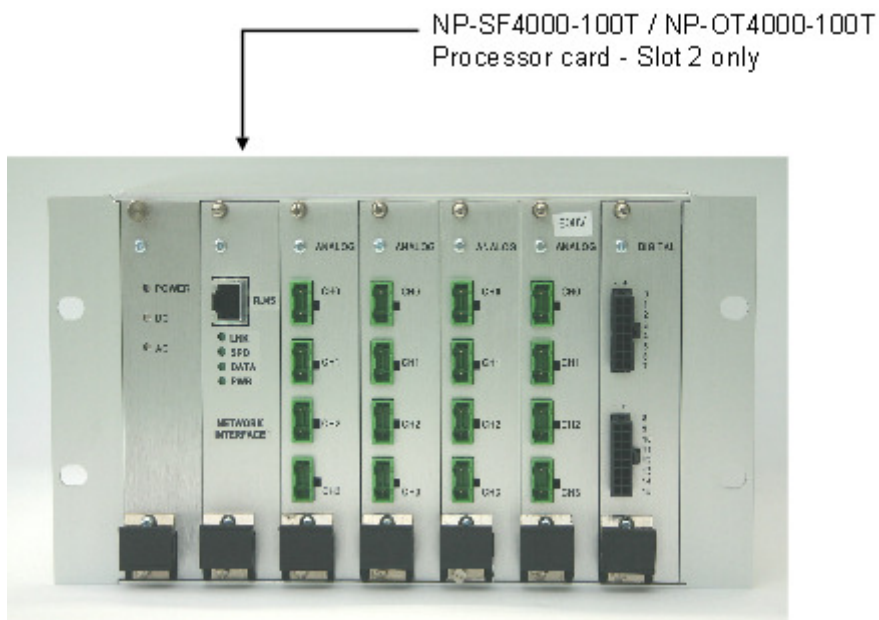
## Data Buffer

The NP-SF4000-100T contains 32 MB of data buffer memory.

The instrument sends data continually to the data logger computer running the driver software. Any lost packets are recovered automatically.

## 12.2 Installation

The processor card fits into slot 2 of the instrument only. See image below.



## 12.3 Instructions

1. Switch the power off. No status LED illuminated. See image above
2. Undo the locking screws
3. Make sure the network cable is disconnected from the instrument.
4. Push the ejector handle downwards and the NP-SF4000-100T card will come free of the chassis
5. Remove the card.
6. Re-insert the processor card or replace with a new model .
7. Power on the instrument
8. Reconnect the network cable.

## **12.4 Driver Operations**

On restarting the NetPod 4004 the driver software will automatically detect the instrument and re-synchronise the measurements with any other device on the network.

### **New Processor card – Starting Data Acquisition**

When a new processor card has been fitted into a 4004 instrument and has a different setup to the original card it is replacing, or if this is for a new instrument all together then:

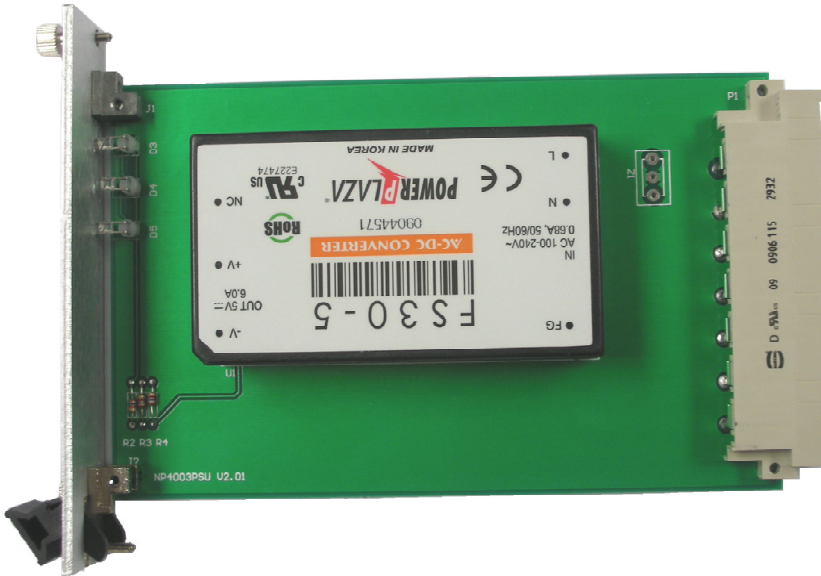
1. Stop data acquisition operations.
2. Scan network -- identify all the instruments on a network
3. Re-start data acquisition readings

See page 21 for additional details

### 13. Power Supply

There are 2 x power supply modules available for use with the NetPod 4004

Figure 21 Power Supply Module NPGPSU-02



The **NPGPSU-02** power supply module, shown above, is rated a 30W rated module for applications requiring additional excitation.

Figure 22 Power Supply Module NPGPSU-01



The **NPGPSU-01** module operates with 230/240 V 50/60 HZ AC mains supply or 9 – 30 V DC supply and provides a regulated supply for the 4004 series of instruments. 25 W rated

A mains transient filter is fitted to the IEC connector of the instrument to remove spikes on the mains supply.

Additional power supply options available upon request.

### 13.1 Installing the Power Supply

The power supply module fits into slot 1 of the instrument. See image below

#### Power Supply Module



Slot 1

2

3

4

5

6

7

#### Fully Populated Instrument



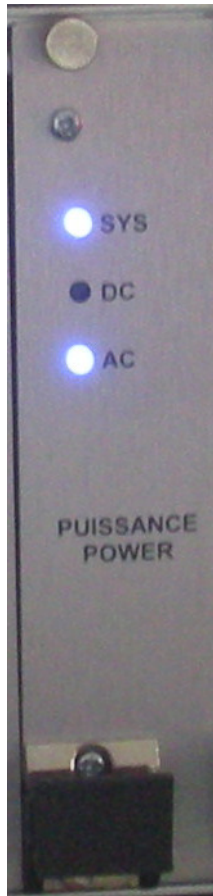
Never touch the power supply cards with wet hands

The NetPod 4004 must be earthed at all times to ensure safe operation.

1. Switch off the NetPod 4004
2. Remove the mounting screws from the power supply card
3. Remove the power supply by pressing down on the black ejection handle.  
Only a small amount of force is required to remove the card.
4. Insert the new power supply module.
5. Ensure the mounting screws are securely fastened
6. Restart the instrument. The status LED will illuminate when the instrument is powered on.

### 13.2 Auto-restart Data Acquisition Operations

If the power supply has been fitted into an instrument already in use and configured for network operations then as soon as it is powered on then the driver software will re-start data acquisition operations immediately.



The image above shows the power supply card powered on.



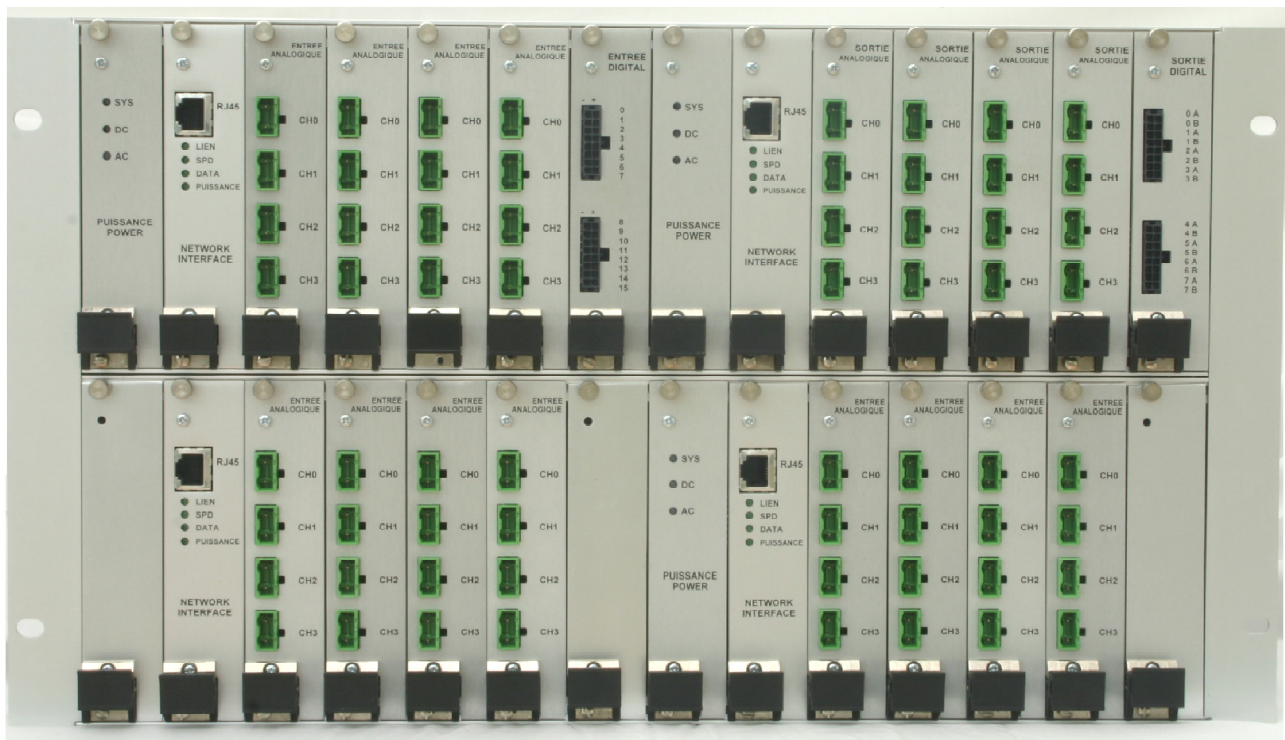
### Combined Data Acquisition & Control Solutions

The image below demonstrates a complete data acquisition & control system

The NetPod 4004 systems can be supplied in a variety of enclosures that can be customised to suit many different applications.

The rack system below supports 48 analogue input channels, 16 analogue output channels and a variety of digital interfaces in a single 6U x 84HP rack.

Figure 23 Complete NP-RACK-04-4004 System





## 14. Part Number Summary

| Part Number          | Description  |
|----------------------|--|
| <b>HPAI16-V1H1-4</b> | 4 Channel $\pm 12V$ . 16 bit ADC board                                       |
| <b>HPAI16-V2H1-4</b> | 4 Channel $\pm 50V$ . 16 bit ADC board                                       |
| <b>HPAI16-V3H1-4</b> | 4 Channel $\pm 600V$ . 16 bit ADC board                                      |
| <b>HPAI16-V4H1-4</b> | 4 Channel $\pm 50 mV$ . 16 bit ADC board                                     |
| <b>HPAI16-SC1-4</b>  | 4 Channel of 16 bit Current loop . 4-20mA, 0-60 mA                           |
| <b>HPAI16-SC5A-4</b> | 4 Channel of 16 bit Current Input 5A   |
| <b>HPAI16-SG1-4</b>  | 4 Channel of 16 bit $\frac{1}{4}$ and $\frac{1}{2}$ bridge strain gauge card |
| <b>HPAI16-SG2-4</b>  | 4 Channel of 16 bit full bridge strain gauge card                            |
| <b>HPAI16-SG3-4</b>  | 4 Channel of 16 bit full bridge strain gauge - No Excitation                 |
| <b>HPAI16-TC-B-4</b> | 4 Channel of 16 bit thermocouple type B                                      |
| <b>HPAI16-TC-C-4</b> | 4 Channel of 16 bit thermocouple type C                                      |
| <b>HPAI16-TC-E-4</b> | 4 Channel of 16 bit thermocouple type E                                      |
| <b>HPAI16-TC-K-4</b> | 4 Channel of 16 bit thermocouple type K                                      |
| <b>HPAI16-TC-N-4</b> | 4 Channel of 16 bit thermocouple type N                                      |
| <b>HPAI16-TC-R-4</b> | 4 Channel of 16 bit thermocouple type R                                      |
| <b>HPAI16-TC-S-4</b> | 4 Channel of 16 bit thermocouple type S                                      |
| <b>HPAI16-TC-T-4</b> | 4 Channel of 16 bit thermocouple type T                                      |
| <b>HPAI16-RT1-4</b>  | 4 Channel of 16 bit RTD - Type A & B   |
| <b>HPAI16-PUL-4</b>  | 16 Bit Pulse Counter Card - High Speed Pulse Counter                         |
| <b>HPAO16-10/30</b>  | 4 Channel Analogue Output $\pm 10V$ / $\pm 30 mA$ switched                   |

| Part Number         | Description   |
|---------------------|---|
| <b>HP4808-JIO</b>   | 8 Channel digital input - 2 KV Isolation                |
| <b>HP4809-JIO</b>   | 16 input TTL Input channel                              |
| <b>HP4810-JIO</b>   | 16 input, Jumper Select TTL/300v isolated digital Input |
| <b>HP4004-RLY-8</b> | 8 channel relay switch card 3A @ 240V A/C               |

### Enclosures

|                        |                                |
|------------------------|--------------------------------|
| <b>HP-RACK-04-4004</b> | 4 instrument rack system       |
| <b>HP-CAB-4004</b>     | <b>6U x 42 HP mini-case</b>    |
| <b>HP-PRCK-013</b>     | <b>Standard 6U x 84HP rack</b> |
| <b>HP-CASE-4004</b>    | Desk top case                  |

### **HP-SF4001-100T** DSP & Fan Controller

100 BaseT network connection  
32 MB data buffer (standard)  
Analogue Input operation card

### **HP-OT4001-100T** DSP & Fan Controller

100 BaseT network connection  
32 MB data buffer (standard)  
Analogue Output Control

- ADC Type, 41**
- auto-configure, 21
- Automatic Restart, 45
- bridge, 12, 13
- Bridges, 13
- broadcast packets, 18
- Broadcast vs Single-Host Operations, 18
- Calibration, 41**
- Calibration Operations**
  - Driver Software, 21
- Cancel Button, 42**
- Cancel. Button., 41**
- CE-Certificate, 3**
- Channel, 40, 41
- Channel Configuration.**
  - Driver Software, 21
- Comments. (Box), 41**
- Config, 15, 16, 21, 28, 30, 34, 36, 37, 41**
- Configure, 15, 16**
- Configuring the Analogue Input Channels
  - Driver Software, 28
- Confirm, 31, 42, 43**
- Data Decimation, 30
- data packets, 18
- Data Recording.**
  - Driver Software, 21
- data transmission operations, 43
- Data Transmission Protocol, 18
- Default. Button., 41**
- Digital, 41**
- Digital Button, 41**
- Display window**
  - Driver Software, 32
- distributed network, 19
- Driver Software Operations, 21
- dynamic, 19
- Edit Channel**
  - Driver Software, 28, 29, 34
- Edit Pod, 43, 44**
- Edit Pod Window, 30, 34, 44**
- Error Display Window, 38**
  - Driver Software, 38
- Ethernet, 10, 11, 15
- Ethernet Address, 41**
- Ethernet Hubs, 17
- Ethernet Networks, 10
- Failed**
  - Error Display Window, 38
- File, 15**
- FILE, 24, 25**
- Gain, 41**
- Global Configuration Parameters, 40
- Hardware Test, 9**
- I.D, 41**
- INSTALLATION CHECK LIST, 8
- Installation Quick Guide, 9
- internal communication ports, 43
- Internet, 11, 12
- Internet Addresses & Classes, 11
- IP Address, 12, 41, 43
- IP addresses, 8, 11
- ISP, 12
- LAN, 10, 11, 12, 13, 16
- Large Packet Size, 18
- leased lines, 13
- Manufacture Date, 41**
- Microsoft Networks, 12
- Multi-instrument Operations**
  - Driver Software, 21
- multiple sample rate operations, 30
- Multi-Rate Data Acquisition
  - Driver Software, 30
- Multi-user Operations, 31
- Multi-user operations., 21**
- Name, 41**
- NetPod.dll, 31
- Network Error Report, 38
- network interface, 18
- Network Specifications, 10
- No**
  - Confirm, 42
- Noise, 41**
- OK**
  - Error Display Window, 38
- OK Button., 41**
- OK button, 43**
- Operations**
  - IP Address Configuration, 43
- Operator, 22**
- packet sending system, 18
- Packet Size, 41**
- packets, 10, 12, 13, 14, 16
- Packets Lost, 38**
- Packets Missed, 38**
- Packets Resent, 38**
- Part No., 41**
- Password Protected Operating Environment, 21**
- ping, 12
- PodMng, 44**
- Ports., 34**
- power status, 9, 14
- Range, 41**
- Real Time Data Display
  - Driver Software, 32
- Receive, 9, 14, 15
- Requested Time-out, 12**
- Routers, 11, 12
- Run Mode, 15, 24, 25**
- Safety Instructions, 4**
- Sample Rate, 41**
- Sample Rate - Instructions., 30
- Scan Network, 15, 16**
- Scanning Network Window, 16**
- Searching For Instruments on a network, 16
- Sensor Selection**
  - Driver Software, 21
- Serial No, 41**
- Setting the Sample Rate
  - Driver Software, 30
- Setting the Sub net mask, 11
- Setup, 42**
- skew, 19
- Small Packet Size, 18
- Software Mode Changes - Password
  - Driver Software, 22
- Software Parameters, 40
- Specified Instrument
  - Starting & stopping data acquisition ops, 26, 27
  - Starting and stopping data acquisition operations, 23
  - Starting Data Transmission Operations, 24
- Status**
  - Driver Software, 38**
  - status lights, 15
  - Stopping Data Transmission Operations**
    - Driver Software, 25**
  - strain, 11
  - Subnetting, 11
  - synchronization, 19
  - task bar icon, 23, 31
  - TCP/IP, 12, 19
  - Text (Processed), 33**
  - Text (Raw), 33**
  - Text Display - Raw and Process Data
    - Driver Software, 33
  - Timeout period, 45
  - Timeout task bar icon, 45

timing, **19**  
Transmit, 9, **14**, **15**  
UDP **datagrams**, **18**  
User, **18**, **22**, **31**, **40**, **41**

Warranty, 3  
Yes  
Confirm, **42**