TCP/IP Implementation

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The Hiden Analytical Limited Website

Information on Hiden Analytical Limited and its wide range scientific instruments for research, development and production applications can be obtained from the Hiden Analytical Limited Website at http://www.HidenAnalytical.com

A copy of the Hiden Analytical Limited Website is also included on the Hiden Analytical Software Suite Compact Disk (CD); this can be accessed by double-clicking on the index.htm file in the html directory in the Windows Explorer.

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Welcome

This document describes; the implementation of the TCP/IP protocol on Hiden Analytical instruments, the TCP/IP stack as implemented on Hiden Interface Units, how IP addresses are assigned and support for NBNS / WINS name services.

Copyright notice

Acknowledgements

Warnings and Cautions

In this Manual, a **Warning** is an instruction that draws the operator's attention to the risk of injury or death; a **Caution** is an instruction that draws attention to the risk of damage to the product or process.

Warnings and Cautions are placed immediately before the text to which they refer; they are headed by **WARNING** or **CAUTION** respectively. The associated explanatory text is in **bold**. If several Warnings or Cautions apply at one point in the text, they are numbered with the most important appearing first.

Typographical conventions

For ease of identification the names of menu commands, keys, dialogue items and screen text are typographically distinct from the ordinary text of this Manual. These distinctions are as follows:

Menu commands, dialogue items, such as push-buttons and check boxes, and text that appears on the display screen are presented in bold typeface; thus **File** menu, **Enter** push-button.

Keys are presented in bold, italic text; thus ***Esc***, ***Return***, ***Space bar***.

Legend printed on the front or rear panels of equipment is printed in bold text; thus **BACKING PUMP 01**.

Terminology

Terminology that accords with basic Windows principles is included in this Manual.

Instructions

For clarity, the instructions given in this Manual are presented in two columns. The left-hand column provides imperative instructions that are numbered sequentially to provide a step-by-step guide through the functions. The right-hand column describes the system's response (where appropriate) and gives any additional information that may be of relevance.

Importance of this Manual

This Manual should be regarded as part of the product described herein.

Technical assistance

Technical assistance can be obtained from the Hiden Analytical Limited Service Department which can be contacted on:

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Option 1 U.S. Sales Office
Option 2 U.S.A. & Canada Corporate Office & Service Department
Option 3 U.K. Manufacturing Facility

Amendments

This Manual will be updated, as necessary, to cover modifications to the product. Minor amendments may take the form of Addenda, which will normally be located at the back of the Manual, on coloured paper.

Amendment history

Issue: Draft	Date: 2 July 2003. This document is applicable to HA-061-712 R5.1. (Software Modifications up to SM230). For Software Release R4.4.
Issue: A	Date 5 August 2003
Issue: B	Date: 6 June 2005. Windows Firewall. M085-294.

1 Introduction

1.1 Before starting

Before installing the Hiden Software to run on a TCP/IP network there some important steps to take.

Read the rest of this manual.

Determine the type of network being used.

Gather the information required to install on that type of network.

If necessary contact the Network Administrator. The Network Administrator may need to assign an IP address for the instrument and register the instrument with the network's name server.

Make sure that the right people are present. The System Administrator may be needed to install TCP/IP and the Hiden Software Suite.

Note

System and Network Administrators tend to be very busy and are often hard to get hold of. Please contact them well in advance of installing the software; this is particularly important if a Hiden Analytical engineer is installing the instrument. Allow enough time for the Network Administrator to make changes, there may be a delay before these become available throughout the network.

1.2 Micro board

A microcomputer controls each Interface Unit (IU); it is responsible for executing the commands issued by the PC and reporting data back to the PC. The microcomputer comprises a microprocessor, various types of memory and interface circuits mounted on a single circuit board. This micro board also contains the communications interfaces.

The HAL V is the latest evolution of Hiden Analytical's microcomputer. The first shipments of IUs fitted with the HAL V micro board were made in the fourth quarter of 2004.

Hiden Analytical Software Suite version 3.11 or later will operate with both HAL IV and HAL V micro boards. Some features are only available with one type of micro board and the user may need to determine which is fitted into the IU.

The communications interfaces on the HAL IV micro board are available through two 9 way D-type connectors and one BNC connector. These provide RS232, RS422/485 and Ethernet LAN communications interfaces.

The HAL V micro board has four communications connectors:

one 9 way D type - RS232

one 3.5mm Jack Socket - RS485

one USB connector

one RJ45 network connector.

HAL IV firmware is held in EPROM. Upgrading the firmware requires gaining access to the micro board and fitting a set of replacement EPROMs. HAL V firmware can be upgraded from the PC using the Upgrade Firmware utility.

The HAL V Micro Board is described in the Manual Addendum reference HA-085-648 or the relevant instrument manual.

1.3 Installing on Windows NT, 2000 and XP

If the installation is on Windows NT, Windows 2000 or Windows XP then, "Administrator Privileges" may be required in order to alter certain aspects of the PCs configuration or to install software.

If the user's Windows log-in does not have full administrator privileges then it may not be possible to install the TCP/IP network protocol, or alter the TCP/IP settings if it is already installed.

Even if TCP/IP is already correctly installed the Hiden Software Suite cannot be installed without Administrator Privileges. This is because the installation has to alter certain Windows files and make entries in the Registry, if the installation is not allowed to make these changes then the Hiden Analytical software will probably operate incorrectly.

For users without Administrator Privileges who wish to install Hiden Analytical software, ask the System Administrator to install this software.

1.4 Overview

1.4.1 Why is it so difficult?

Two common questions asked by users are,

"Why is this so difficult?" and,

"Why can I not just plug it in and have it work?".

In situations where one Hiden Analytical instrument's LAN is connected to a PC which is not networked to any other PCs, the chances are that everything will work if they are just connected together. The installation tries to keep things simple but it has to cope with all types of network be it a laboratory, small office, university, large company or corporation.

There are two steps required to establish communication between the PC and the Interface Unit:

1. The Interface Unit must get an IP address.
2. The PC must find out what IP address the unit is using.

If the PC is connected to the Interface Unit on the LAN and nothing else, then:

1. The Interface Unit will use APIPA (Automatic Private IP Address assignment) to get its IP address, and
2. The PC will use NBNS (NetBIOS Name Server) to find out what the IP address is.

The rest of this section may be skipped if the PC is connected to the Interface Unit and nothing else.

If the PC running the Hiden Analytical software is connected to a company or university network it may be preferable to let the Network Administrator read this document and carry out the installation.

The remainder of the section is intended to give some understanding of how the Interface Unit is assigned an IP address. It is not necessary to understand this section in detail in order to install the Hiden Software, on most networks the Installation will take care of this. The Installation is described in Sections 2 and 3 of this manual.

1.5 Getting an IP Address

Setting up a PC to use TCP/IP involves starting the PC, going to the Control Panel, selecting Network or Network Connections, and adding the TCP/IP protocol. The PC's IP address could be typed into TCP/IP's properties.

The IP Address is a set of four numbers that uniquely identifies anything connected to a Internet Protocol network. An example of an IP Address is 192.168.254.12.

Hiden Interface Units do not have a keyboard so there is no way to enter the IP address, therefore the Interface Unit has to find out what its IP address is when it switches on.

Hiden Interface Units are assigned a permanent name and an Ethernet address (not the same as an IP address) based on the instrument's "Works Reference" number. These are programmed into the instrument's memory.

Every Hiden instrument is assigned a unique four or five digit Works Reference (WR) number when it is manufactured. The Ethernet address and name are derived from the WR number. For instance if the instrument is WR12345 then its Ethernet address is 02:48:41:01:23:45 and its name is HIDEN-WR12345.

The WR number appears on the serial number label, see Section 1.12.

IP addresses, however, are not programmed into the memory because Hiden does not know what IP address the customer will want to use. For instance, at Hiden addresses that begin 192.9.201 are used but another company might use the more common 192.168. Large companies and universities will have their own sets of IP addresses, for instance the AN Other Company might use addresses beginning 137.222.10.

If the PC has automatic address assignment it is likely to use addresses beginning 192.168.0 or 169.254.

If the IP address of the Interface Unit does not match the 'subnet' address of the PC then the PC will not be able to communicate with the Interface Unit. For this reason it is not possible to choose an arbitrary fixed IP address for the Interface Unit and program it into the EPROM.

The PC and the instrument must be on the same subnet - the first two (or three) numbers of the IP address must be the same, unless somewhere on the network a 'name server' is set up with the necessary routing information.

The problem of giving an IP address to an Interface Unit is similar to the problem of giving an IP address to a network printer. Fortunately, DHCP (Dynamic Host Configuration Protocol) is an answer to the problem. Unfortunately, DHCP requires a DHCP server. A DHCP server is a program running on a computer somewhere on the network that tells the Interface Unit what IP address to use.

If the PC is connected to a company network and has a Network Administrator then a DHCP server may already be set up. This is one reason why contact with the Network Administrator is required.

If the PC uses Microsoft's Internet Connection Sharing (ICS) then a DHCP server is built into the ICS software.

Alternatively the haneWIN or other DHCP server software may be used on the PC.

Internet Connection Sharing is a standard part of Windows that the user may choose to install. It provides a way of sharing one modem between several computers on a network so that all the computers sharing the modem can connect to the internet.

Most routers are capable of acting as DHCP servers.

A router is a device for connecting two different subnet sections of a network to each other, or a network to an ISDN or broadband connection.

If the network does not have a DHCP server then the Interface Unit will use APIPA (Automatic Private IP Addressing). This is exactly what the PC will do if "Obtain an IP address automatically"is selected, first the PC tries DHCP then if that fails APIPA is used.

With DHCP the network device is told by the DHCP server what address to use, with APIPA the device chooses an address at random and checks that nothing else is using it.

The important thing is that the PC and the Interface Unit should obtain their addresses in the same way. If the PC has a fixed IP address then the Interface Unit must have a fixed IP address. If the PC obtains an IP address automatically using DHCP then the Interface Unit must use DHCP, if the PC uses APIPA the Interface Unit must use APIPA.

If the PC has a fixed address then the Hiden Software can be set up to tell the Interface Unit what address to use.

A problem with this trial and error approach to getting an IP address is that it takes quite a long time. If the PC and Interface Unit are getting IP addresses automatically, the PC should be started first and after a few minutes the Interface Unit should be switched on. Finally, wait another minute before launching MASsoft or ESPsoft.

Windows XP is better than previous versions in this respect, because the Start menu does not appear until Windows is ready – a “welcome” screen is displayed until the IP address has been assigned.

1.6 Name server

Once the Interface Unit has an IP address it is ready to communicate with the PC. Unfortunately, the PC does not know the IP address of the Interface Unit, especially if it has been assigned a random address by DHCP or APIPA.

The PC does, however, know the name of the Interface Unit, because it is based on the units Works Reference number. The name of the unit is programmed into the unit’s memory.

The standard way to find out an IP address from a name on a TCP/IP network is DNS (Domain Name Service). However, there are alternatives like NIS (Network Information Service).

If DNS or NIS is being used then the Network Administrator must make an entry in the name table to relate the IP address to the unit’s name.

See the Administrator’s section of this manual for notes on using DHCP and NIS or DNS together.

If the network does not have a DNS server, or if the DNS server does not find a match for the name then the PC will try WINS (Windows Internet Name Service) which uses NBNS (NetBIOS Name Service).

WINS/NBNS will only work if the PC and Interface Unit are on the same physical network and if the subnet of the PC and Interface Unit match.	Unless there is a Windows NT Server, Windows 2000 Server or Windows XP Server on the network running as a WINS server.
One PC connected to one Interface Unit will use NBNS.	With one PC and one Interface Unit connected together there is nothing to worry about because they are the only devices on the network so they are on the same physical network and as they both used APIPA their IP address will inevitably be on the same subnet.
Finally, if DNS and WINS both fail Windows will try the local HOSTS file.	The local HOSTS file is set up by Hiden's installation software.

1.7 What sort of network?

Knowing what sort of network is being used will make the installation easier. The distinction that needs to be made is between Peer-to-Peer self-administered networks and Administered networks with servers. If the installation is on a Peer-to-Peer network a simplified procedure with fewer questions will be followed. The installation for an Administered network allows for more variations.

A Peer-to-Peer self-administered network will typically connect just the computers in a office, laboratory, department or small company. There will be no connections to a larger "outside" network, except perhaps a shared connection to the internet. No computer is special in the network, they are all "peers" (equals). The network does not rely on one or more special computers (servers) to operate. Generally, each user is responsible for their own PC with no one in overall charge.

An Administered network will typically be found in a larger organisation. It will link an entire company, university or other institution. There may be links to other buildings and sites, perhaps in other countries. The network relies on servers, possibly at a remote location; when the server goes down the network does not operate correctly. The network and servers are controlled by a Network Administrator. Users may be restricted in the software they can install and run on their PCs, they may not be allowed access to certain features of Windows on their PC.

Networks that are basically Peer to Peer, self-administered but have some workstations or servers running Unix, Linux or Sun operating systems, perhaps with some form of file sharing between the PCs and the workstations (NFS or SAMBA), should be set up as if they are an Administered system. Such networks may well be using fixed IP addresses

and have a DNS server. In such situations the Unix, Linux or Sun expert should be treated as the Network Administrator.

1.8 Fixed or Automatic IP Address Assignment

1.8.1 Automatic IP Address

If the PC has the "Obtain an IP address automatically" option set in the TCP/IP properties DHCP or APIPA will be used to get an IP address. To the Hiden Software it does not matter whether DHCP or APIPA is used. The Hiden Software Installation detects that this option is set and sets up the software accordingly, the user will not be asked to enter an IP address for the Interface Unit.

If the installation is on a Peer to Peer self administered network, or just connecting the PC to one or more Interface Units, then there is nothing else to set up before the Hiden Software is installed.

If, however, the installation is on an Administered network and the PC has the "Obtain an IP address automatically" option set then the network probably has a DHCP server. A DHCP server may be set up to either always assign the same IP address to the same computer or it may assign an unused IP address from a block of available addresses.

If the DHCP server is set up to always assign the same IP address to the same computer then the Network Administrator should set up the DHCP server to assign an address to the Interface Unit before the Hiden Analytical software is installed. The Network Administrator will probably have to set up the DNS server to associate a name with the IP address. The name of the unit is HIDEN-WR followed by the WR number of the Interface Unit. This is programmed into memory and cannot be changed.

If the DHCP server is set up to assign an unused IP address from a block of available addresses then there is probably a mechanism to update the DNS data automatically when the address is allocated.

1.8.2 Fixed IP Address

If the PC has been allocated a fixed IP address then the user, or the Network Administrator, must allocate an address for the Interface Unit on the same subnet.

Before the Hiden Analytical software is installed on an Administered network the DNS server should be set up to associate the Interface Unit's name with its IP address. This is because the Hiden Software installation checks to see if the Name Server resolves the name before asking the user to enter the IP address. Setting up DNS before installing the Hiden Software will make the installation easier.

The name of the unit is HIDEN-WR followed by the WR number of the Interface Unit. This is programmed into memory and cannot be changed.

If the unit's name cannot be added to DNS then the installation can create an entry in the PC's HOSTS file, or optionally, in the HIDEN.INI file.

When using a fixed IP address the unit is not assigned its correct address until the Hiden application (MASsoft or ESPsoft) is started. When the unit switches on it will try to get an address using DHCP/BOOTP and fail, it will then use APIPA to assign itself an address in the range 168.254.0.1 to 168.254.255.254.

The Interface Unit will take about 1 minute after switch on to assign itself an address by APIPA. Communication with the Interface Unit by Telnet (or Hyperterm in Telnet

mode), Ping or the Hiden test software is not possible until the unit has been assigned its correct address by a Hiden application.

An alternative to allowing the Hiden application to assign the unit an IP address is to run a DHCP server on the PC. The shareware haneWIN DHCP server is available from,

http://www.haneWIN/de or the Hiden Analytical Software Suite CD.

If the haneWIN DHCP server is installed on the PC running the Hiden Software then the Hiden Installation will set up the haneWIN DHCP server's address tables. Using a DHCP server will reduce the time that the Interface Unit takes after switch on and will enable the user to communicate with it using Telnet, Ping etc.

1.9 Information required on Administered networks

This section provides a step by step guide to the information required when installing TCP/IP on an Administered network.

1.	What is the Works Reference number of the Interface Unit?	WR_ _ _ _ _	The Works Reference number can be found on the label on the rear of the instrument. The label has 4 sections: Model, Serial No., Supply, Freq. There are two numbers in the Serial No. section, e.g. : 80739/E 11632 The lower number (11632) is the Works Reference (WR) number. See Figure 1.
2.	Who is the Network Administrator?		The Network Administrator should be contacted before installing the software.
3.	Does the user have administrator privileges on their log-in?	If Yes proceed to question 5.	Unless the user has administrator privileges the System Administrator will need to install the software.

4.	Who is the System Administrator?		The System Administrator must install the software if the user does not have administrator privileges. This is particularly important if a Hiden engineer is installing the system. Arrange for the System Administrator to be present in good time for the installation.
5.	Is TCP/IP configured to "Obtain an IP address automatically"?	 If YES proceed to question 8. This assumes that if the PC gets its address automatically so will the Interface Unit.	In the Network Section of the Control Panel or in Network Connections find the connection properties (depends on Windows version) and select TCP/IP for the network card. Click on Properties. Check if "Obtain an IP address automatically" is selected.
6.	Is the instrument going to be assigned an address by a DHCP or BOOTP server ?	 If YES proceed to question 8.	Ask the Network Administrator.
7.	What is the fixed IP address assigned to the Interface Unit?	___.___.___.___	Ask the Network Administrator.
8.	Is the Network Administrator going to create a DNS entry?	 If NO answer question 9.	Ask the Network Administrator.
9.	Can the HOSTS file on the PC be modified.		It should be possible to modify the HOSTS file unless it is distributed from a server.

1.10 Information required on Peer to Peer, self-administered networks

This section provides a step by step guide to the information required when installing TCP/IP on a Peer to Peer, self administered network.

1. What is the Works Reference number of the Interface Unit?	WR_ _ _ _ _	The Works Reference number can be found on the label on the rear of the instrument. The label has 4 sections: Model, Serial No., Supply, Freq. There are two numbers in the Serial No. section, e.g. : 80739/E 11632 The lower number (11632) is the Works Reference (WR) number. See Figure 1.
2. Is TCP/IP configured to "Obtain an IP address automatically"?	If YES skip the remaining questions. This assumes that if the PC gets its address automatically so will the Interface Unit.	In the Network section of the Control Panel or in Network Connections find the connection properties (depends on Windows version) and select TCP/IP for the network card. Click on Properties. Check if "Obtain an IP address automatically" is selected.
3. What is the IP address assigned to the PC?	___.___.___.___	This address can be found in the TCP/IP Properties dialog box, see Figure 13.
4. What is the subnet mask used by the PC?	___.___.___.___	This address can be found in the TCP/IP Properties dialog box, see Figure 13.
5. What is the subnet used by the PC?	___.___.___.___	This is worked out from the IP address and the subnet mask. Check each of the four subnet mask sections; if the mask is 255 then the subnet value for that section is the same as the IP address, otherwise the subnet value is zero.

For instance if the IP address is 192.168.5.120 and the subnet mask is 255.255.0.0 then the subnet is 192.168.0.0

6. What is the fixed IP address assigned to the Interface Unit? —·—·—·— Choose an address that is not in use by any other PC or instrument. The address must be on the same subnet as the PC – the non zero numbers of the subnet in step 5 must be the same as the corresponding numbers in step 6.

1.11 Setting up TCP/IP

There are now too many varieties of Windows (Windows 98, Windows NT, Windows Me, Windows 2000, Windows XP …) to give explicit instructions for setting up TCP/IP for all of them, please refer to Microsoft's documentation. Here, however, are some guidelines.

If TCP/IP is already installed and working on the PC do not alter any of the settings, Hiden Software can be configured to work with the existing TCP/IP settings.

If TCP/IP is not installed on the PC and the PC is going to be connected to a network that has more on it than just Hiden instruments then, set up TCP/IP in the normal way and get it working with the rest of the network before installing the Hiden software.

If TCP/IP is being set up on a PC that is only going to connect to Hiden Instruments then select "Obtain an IP address automatically" in the TCP/IP properties. Nothing else needs to be done.

1.12 Serial number label

Figure 1 shows a typical serial number label attached to the rear panel of a 2U Mass Spectrometer Interface Unit. This Serial Number label is from an instrument with the Works Reference (WR) number 11142.

Figure 1 Typical MSIU serial number label

1.13 Windows XP Firewall

Windows XP Service Pack 2 (SP2) enables the Windows firewall by default. When MASsoft is first run with the Windows Firewall enabled the dialog box shown in Figure 2 is displayed.

Figure 2 Windows Firewall dialog box

Click the **Unblock** button.

MASsoft, or a DHCP server such as HaneWin, needs access to the DHCP (Dynamic Host Configuration Protocol) well-known port, port 67. To allow programmes to open port 67 an Exception must be defined in Window's Firewall list of blocked incoming connections.

To do this:

1. Select **Windows Firewall** from the **Control Panel** or from the **Security Center**.

2. Click the **Exceptions** Tab. The dialog box shown in Figure 3 will be displayed.

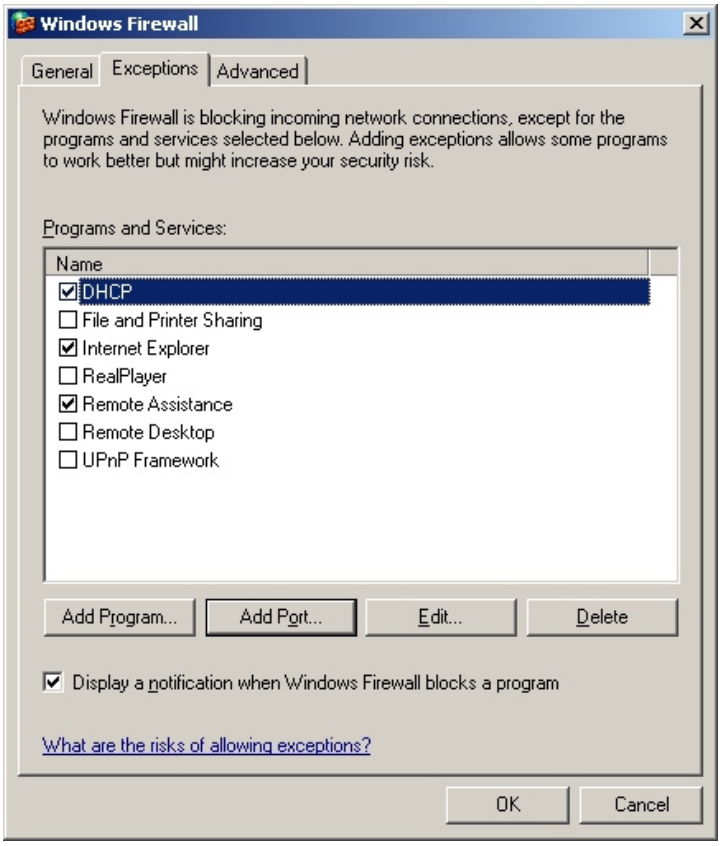

Figure 3 Windows Firewall Exceptions

3. Click the **Add Port…** button. The dialog box shown in Figure 4 will be displayed.

4. In the **Name** box type ***DHCP*** and in the **Port number** box type ***67***. Then select **UDP**.

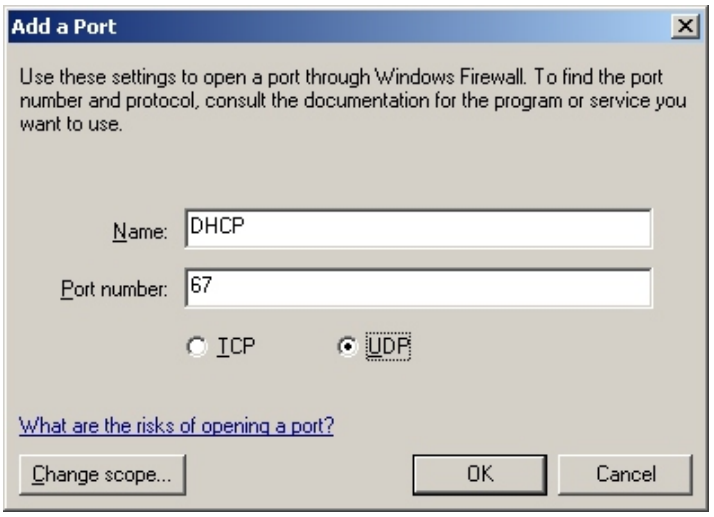

Figure 4 Windows Firewall, Edit a Port

5. Click the **Change scope...** button. The dialog box shown in Figure 5 will be displayed.

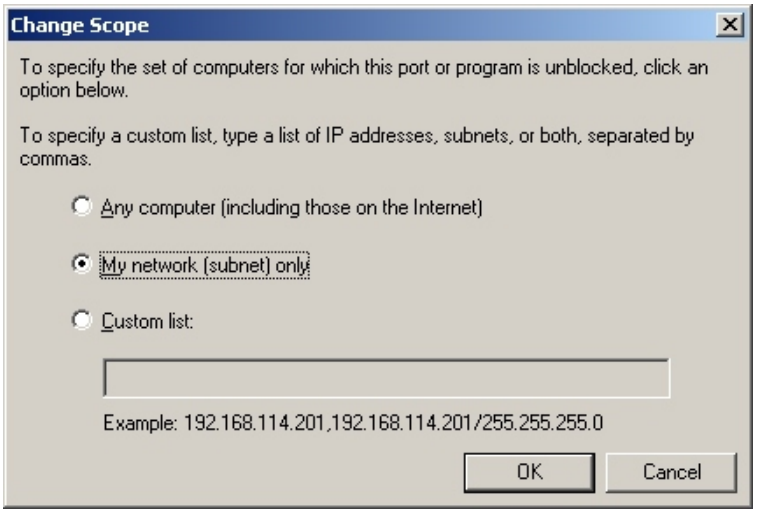

Figure 5 Change scope dialog box

6. Select **My network (subnet) only** and click **OK**. The dialog box shown in Figure 3 will be displayed again.

If haneWIN DHCP is being used as a service on Windows XP DHCP4NT.exe must be added to the firewall exceptions.

7. Click the **Add Program...** button. The dialog box shown in Figure 6 is displayed.

Figure 6 Add a Program dialog box

8. Click the **Browse...** button. The **Browse** dialog box will be displayed as shown in Figure 7.

Figure 7 Browse dialog box

8. Select the file ***dhcp4nt.exe*** from the ***DHCP*** folder then click the **Open** button.

   DO NOT select the file ***dhcpsrv.exe***.

   The **Browse** dialog box will be closed.

9. Click the **OK** button.

   The file name will appear in the **Path:** box in the **Add a Program** dialog box.

10. In the **Windows Firewall** dialog box click the **OK** button.

2 Installing TCP/IP

2.1 Windows 98

This section describes the procedure to configure a single PC running, Windows 98 and a Mass Spectrometer Interface Unit (MSIU) to use TCP/IP on a private network.

To install TCP/IP:

1. Click the **Start** button on the Windows Taskbar and select **Settings, Control Panel**. See Figure 8.

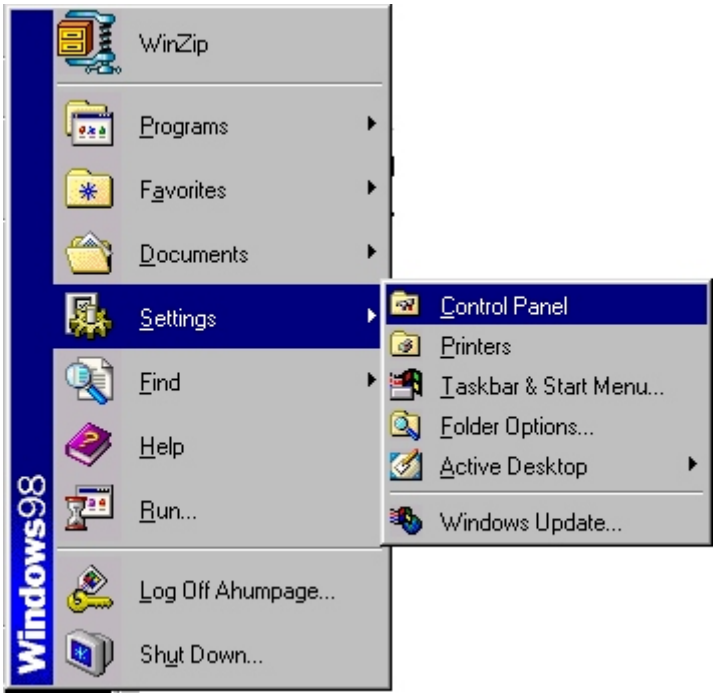

Figure 8 Opening the control panel

2. In the **Control Panel** double click the 

Network icon. The **Network** dialog box shown in Figure 9 will be opened.

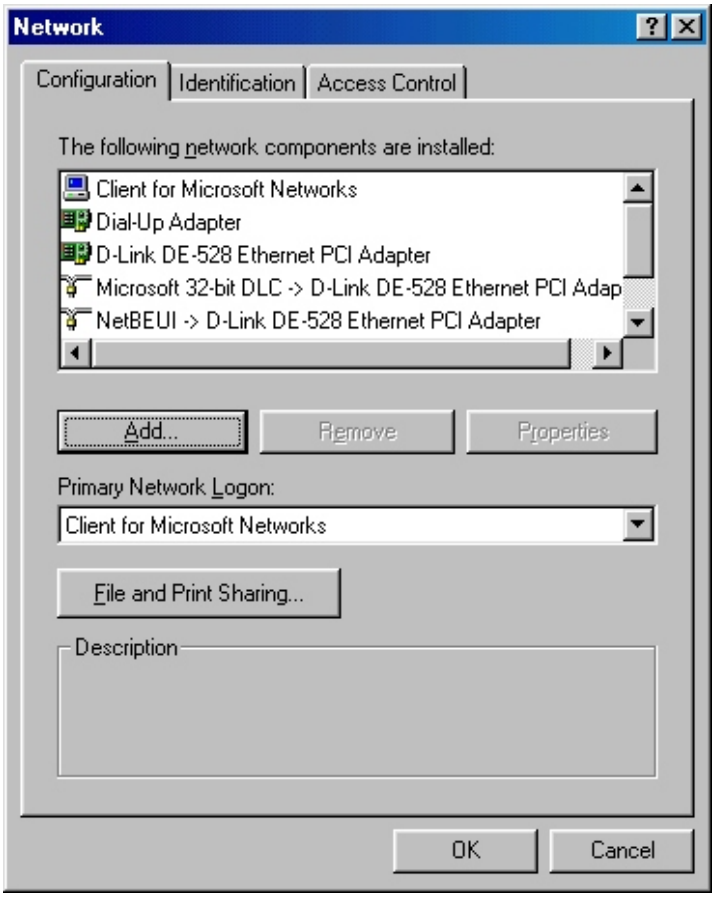

Figure 9 Network dialog box

3. In the **Network** dialog box **Configuration** page click the **Add** button.

The **Select Network Component Type** dialog box shown in Figure 10 will be displayed.

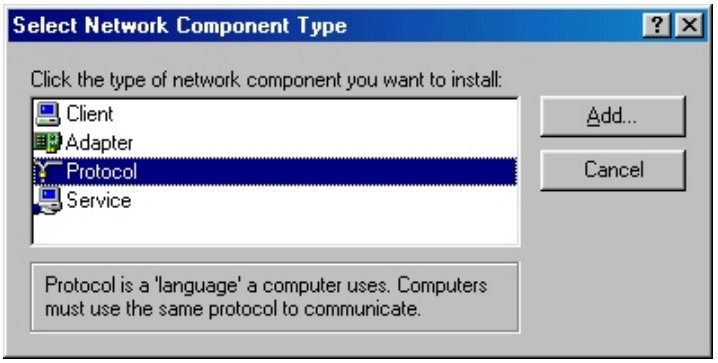

Figure 10 Select Network Component Type dialog box

4. In the **Select Network Component Type** dialog box select **Protocol** from the list box and click the **Add** button.

   The **Select Network Protocol** dialog box will be opened, as shown in Figure 11.

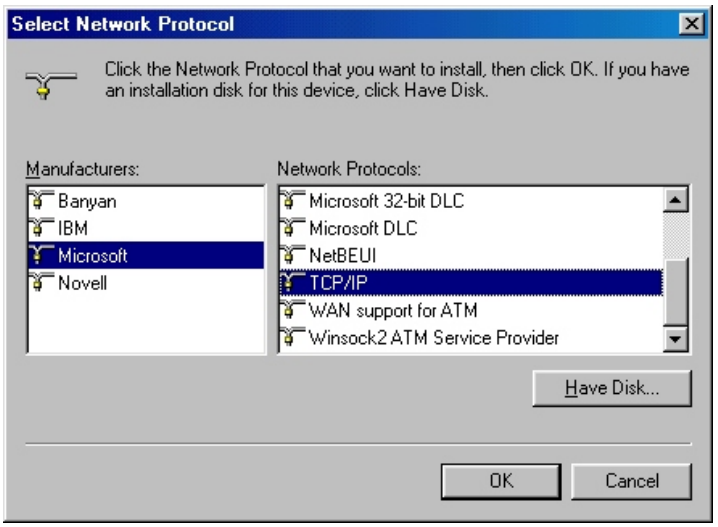

Figure 11 Select Network Protocol dialog box

5. Select **Microsoft** from the **Manufacturers:** list and **TCP/IP** from the **Network Protocols:** list.

   See Figure 11.

6. Click the **OK** button.

   The **Network** dialog box will be displayed as shown in Figure 12.

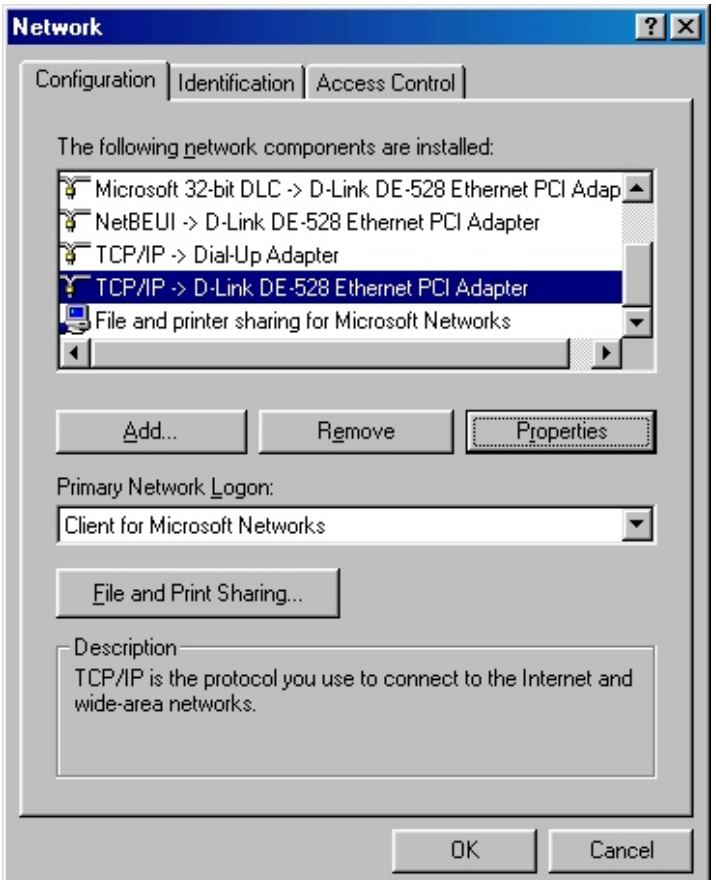

Figure 12 Network, Configuration dialog box

7.	Select the TCP/IP protocol for the Ethernet adapter from the list box on the **Configuration** page of the **Network** dialog box.	Refer to Figure 12.
8.	Click the **Properties** button.	The **TCP/IP Properties** dialog box will be displayed as shown in Figure 13.

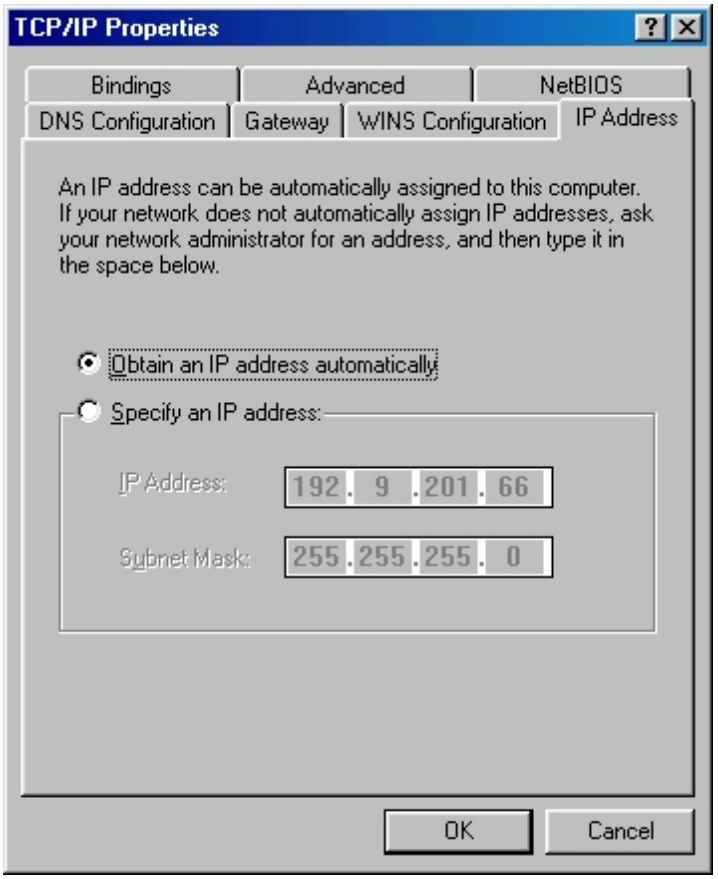

Figure 13 TCP/IP Properties, IP Address dialog box

9.	In the **TCP/IP Properties** dialog box select the **IP Address** page and click on the **Obtain an IP address automatically** radio button.	See Figure 13.
10.	Click on the **DNS Configuration** tab.	The **DNS Configuration** page will be displayed as shown in Figure 14.

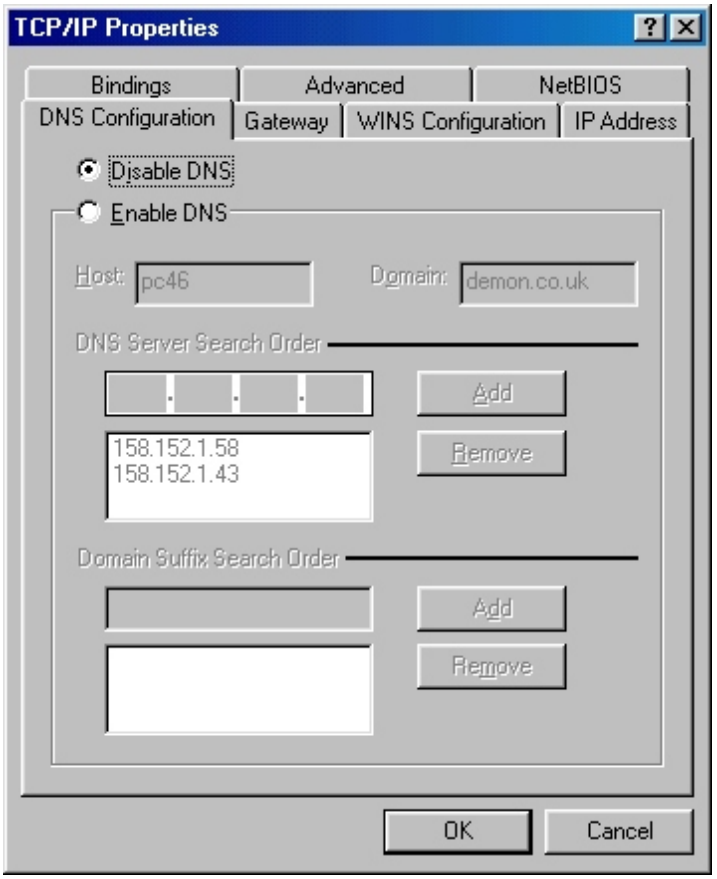

Figure 14 TCP/IP Properties, DNS Configuration dialog box

11.	In the **DNS Configuration** page of the **TCP/IP Properties** dialog box click on the **Disable DNS** radio button.	See Figure 14.
12.	Click the **OK** button.	The **System Settings Change** message box will be displayed as shown in Figure 15.

Figure 15 System Settings Change message box

13. The **System Settings Change** message box will be displayed, click on the **Yes** button to re-boot the PC. The PC must be re-booted before proceeding with the rest of the TCP/IP Implementation.

3 Configuring TCP/IP

To configure the PC to use TCP/IP to communicate with the MSIU:

1. Click the **Start** button on the Windows Taskbar.

2. Select **Programs, Hiden Applications, Comms configuration utility**.

   The **MASsoft and ESPsoft communications configuration utility** dialog box is displayed as shown in Figure 16.

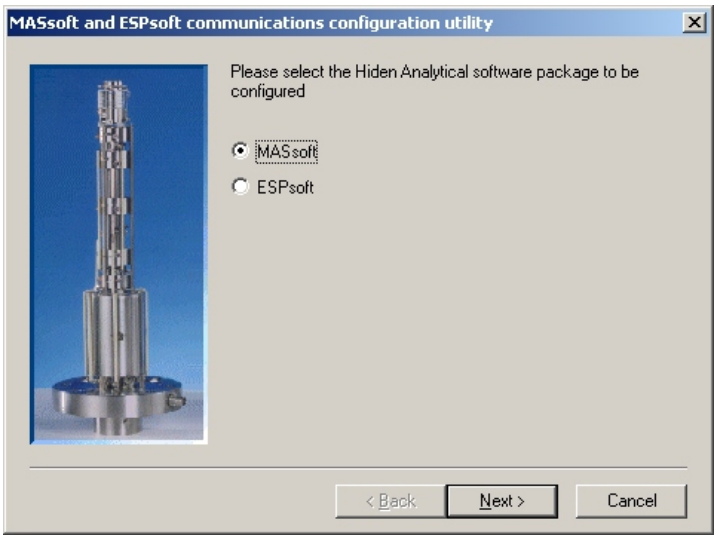

Figure 16 MASsoft and ESPsoft comms. configuration utility dialog box

3. Select **MASsoft** and click the **Next>** button.

   Installing TCP/IP for ESPsoft is not covered in this version of the manual.

   The **MASsoft communications configuration utility** dialog box will be displayed as show in Figure 17.

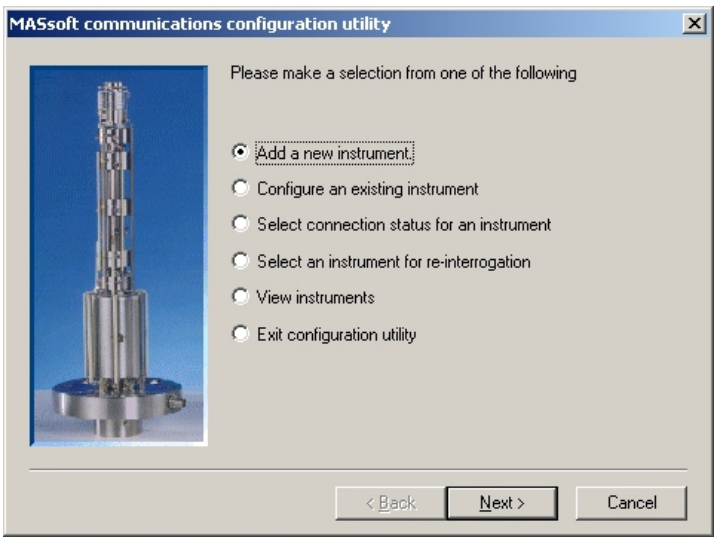

Figure 17 MASsoft communications configuration utility dialog box

4. Select **Add a new instrument** and click the **Next>** button.

The **Current list of instruments** dialog box will be displayed, as shown in Figure 18.

This dialog box provides information only, there is nothing to change.

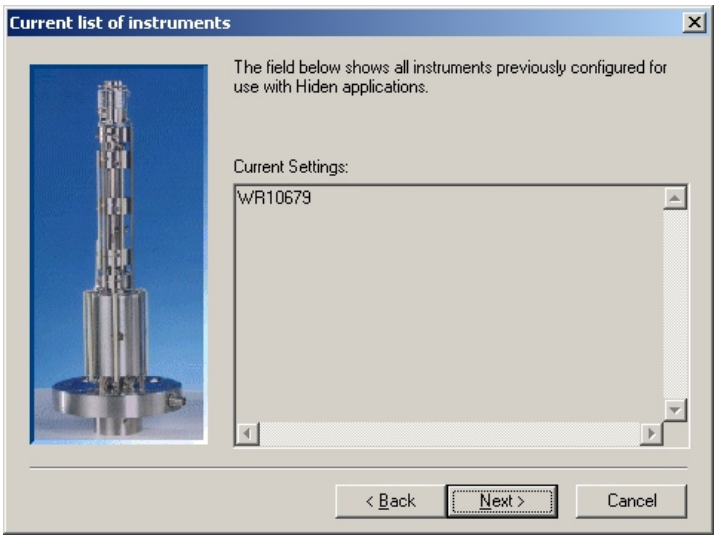

Figure 18 The Current list of instruments dialog box

5. Click on the **Next>** button to display the **Works reference identification number** dialog box, shown in Figure 19.

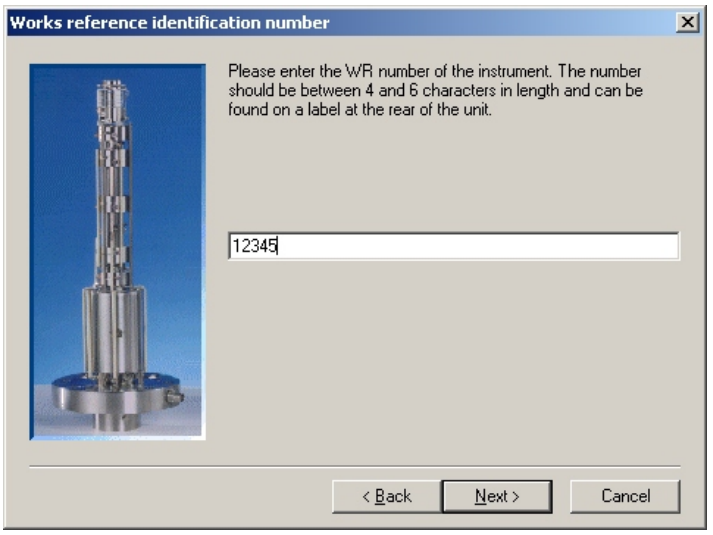

Figure 19 Works reference identification number dialog box

6. Enter the WR (Works Reference) number for the instrument.

   The Works Reference number can be found on the label on the rear of the instrument. The label has 4 sections: Model, Serial No., Supply, Freq.

   There are two numbers in the Serial No. section, e.g. :

   80739/E
   11632

   The lower number (11632) is the Works Reference (WR) number.

   Figure 1 shows a typical serial number label.

7. Click the **Next>** button.

   The **Interface** dialog box is opened, as shown in Figure 20.

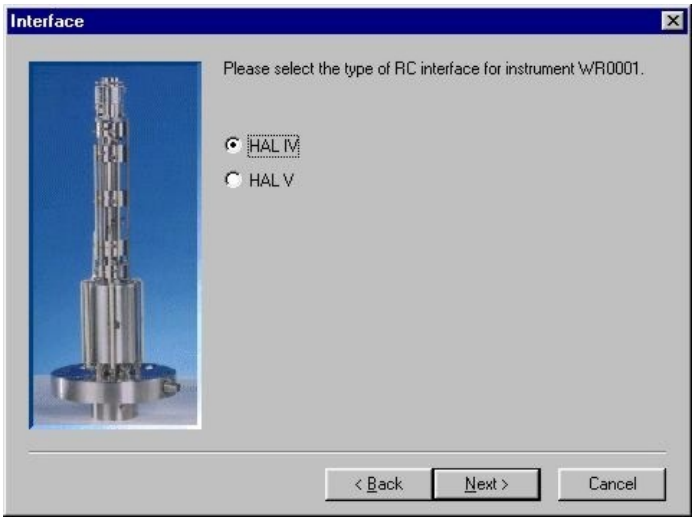

Figure 20 Interface dialog box

8. Select either **HAL IV** or **HAL V** depending on the tpye of micro board fitted in the Interface Unit.

   Click the **Next>** button.

   Refer to Section 1.2 to determine the tyoe of Micro board. The **MASsoft communications configuration utility** dialog box is opened, as shown in Figure 21.

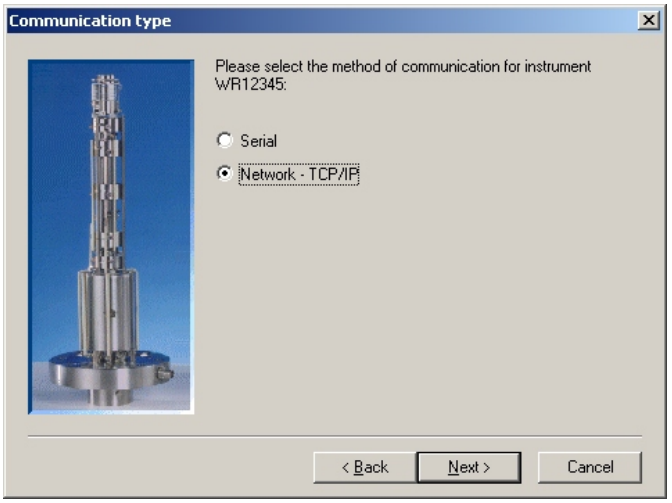

Figure 21 MASsoft communications configuration utility (2) dialog box

9. Select **Network - TCP/IP** and click the **Next>** button

   The dialog box shown in Figure 22 is displayed.

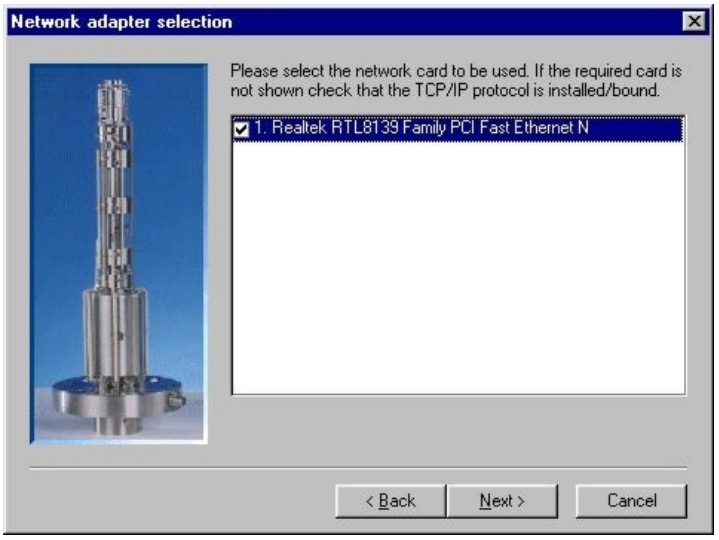

Figure 22 Select network card dialog box

10. Select network card to be used and click the **Next>** button

The dialog box shown in Figure 23 is displayed.

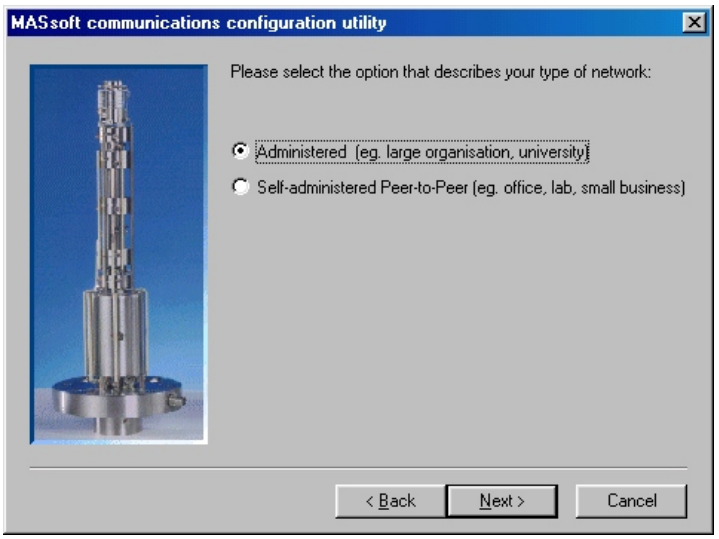

Figure 23 Select type of network dialog box

11. Select the option that describes the type of network being used and click the **Next>** button.

Selecting Peer to Peer will cause some of the install steps to be omitted.

If the Administered option was selected in the dialog box shown in Figure 23 follow the instructions in Section 3.1.

If the Self-administered Peer-to-Peer option was selected in the dialog box shown in Figure 23 follow the instructions in Section 3.2.

3.1 Administered networks

Follow the instructions in this section if Administered was selected in the type of network selection dialog box shown in Figure 23.

1. The installation program searches for haneWIN DHCP, if it is found the dialog box shown in Figure 24 is displayed.

   If haneWIN is not found the dialog box shown in Figure 26 is displayed.

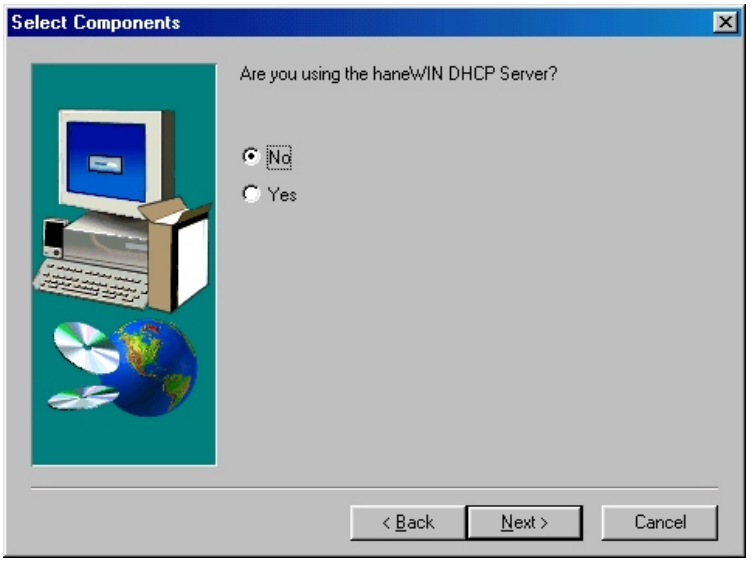

Figure 24 Select Components dialog box, administered networks

2. The dialog box shown in Figure 24 is displayed as a result of the installation program detecting haneWIN. Make the selection appropriate for the PC's configuration and click the N**ext>** button.

   If **No** is selected the dialog box shown in Figure 26 will be displayed.

   If **Yes** is selected the dialog box shown in Figure 25 will be displayed.

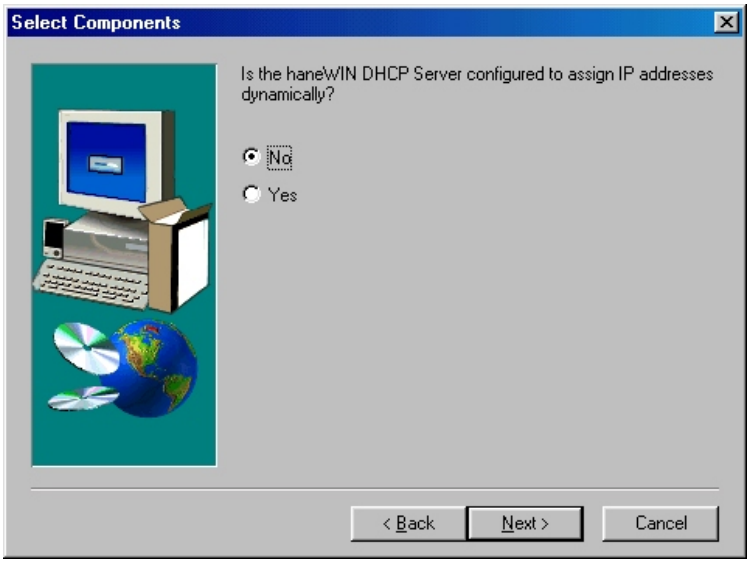

Figure 25 Select Components dialog (2), administered networks

3. If haneWIN is installed on the PC and is being used the dialog box shown in Figure 25 will be displayed.

   Make the required selection and click the **Next>** button.

   If **Yes** is selected haneWIN will assign the IP address and the **Configuration updated** dialog box (Figure 34) will be displayed, refer to Step 12.

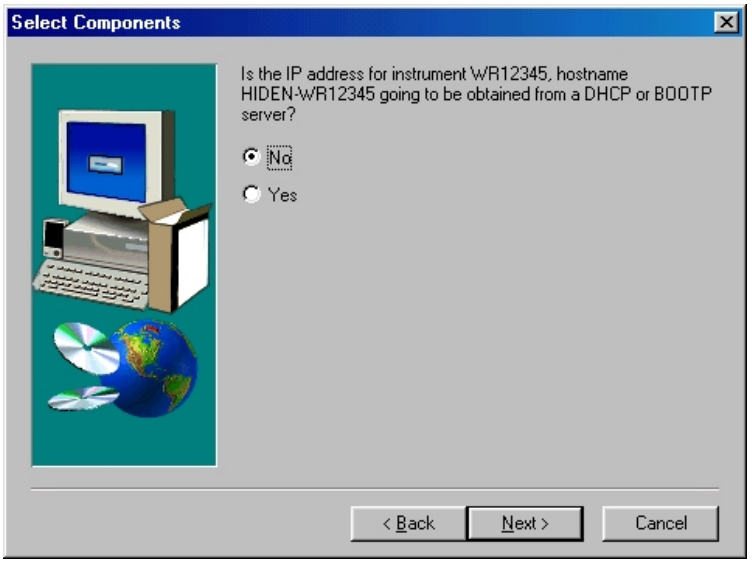

Figure 26 DHCP server dialog box

4. The dialog box shown in Figure 26 will be displayed if haneWIN is not being used or is not installed.

   If the IP address is to be obtained from a BOOTP or DHCP server select **Yes** otherwise select **No**. Click the **Next>** button.

   If the **Yes** option is selected the dialog box shown in Figure 27 is displayed.

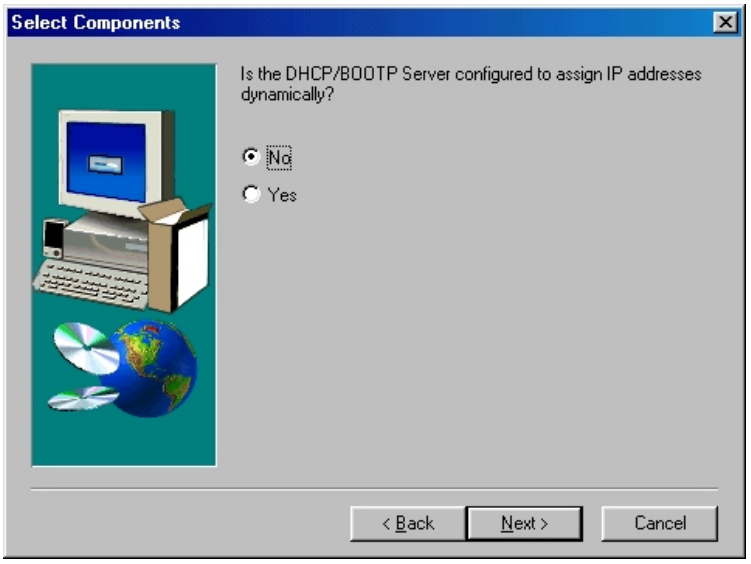

Figure 27 Select Components (3) dialog, administered networks

5. In the dialog box shown in Figure 27 select **Yes** if the DCHP/BOOTP server assigns addresses dynamically. Otherwise, select **No**.

   Click the **Next>** button.

   If **Yes** is selected the **Configuration Updated** dialog box is displayed, see Figure 34 and DCHP or BOOTP will automatically assign the IP address.

In the first part of the procedure (Steps 1. to 5.) the installation program tries to determine if the IP address will be set by haneWIN, DHCP or BOOTP.

The installation program calls GetHostByName if the PC is not set up to assign IP addresses dynamically (by haneWIN or DHCP/BOOTP).

If GetHostByName fails to retrieve the IP address and haneWIN is being used the haneWIN ethers file is checked before displaying the dialog box shown in Figure 29.

If GetHostByName fails and haneWIN is not being used the dialog box shown in Figure 28 is displayed.

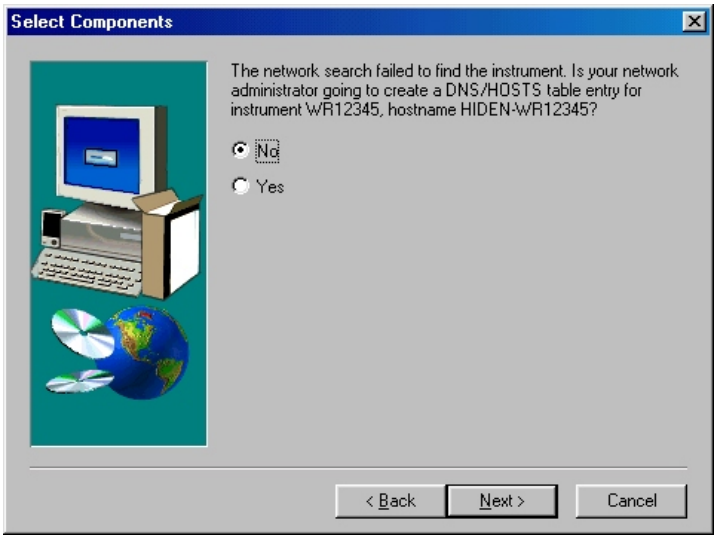

Figure 28 DNS/HOSTS dialog box

6. If the dialog box shown in Figure 28 is displayed and the network administrator is going to create a DNS/HOSTS table entry select **Yes** otherwise select **No**. Click the **Next>** button.

   Selecting the **Yes** option will result in the **Configuration updated** dialog box will be displayed, see Figure 34.

   Selecting the **No** option will result in the dialog box shown in Figure 29 being displayed.

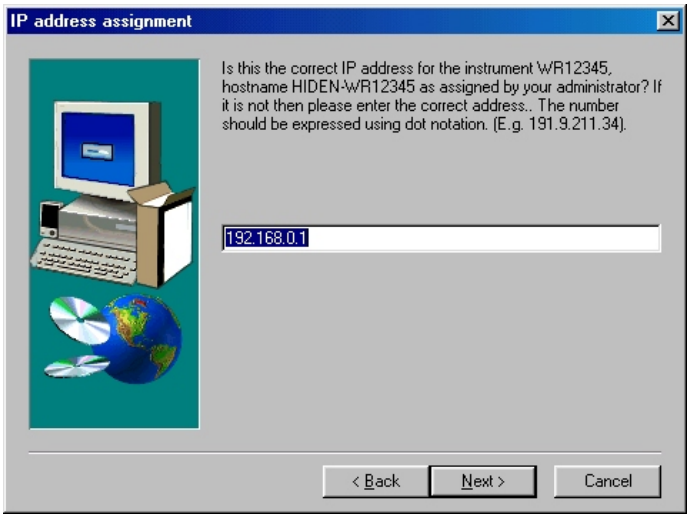

Figure 29 IP address assignment dialog box

7. The **IP address assignment** dialog box is shown in Figure 29. Accept the IP address or enter the required IP address and click the **Next>** button.

   The IP address displayed will have been retrieved by GetHostByName from the haneWIN ethers file haneWIN or created from the sub-net mask and IP address.

   If the IP address has been retrieved by GetHostByName and has not been changed the installation program will proceed to generate an ethernet address, see Step 10.

   If the IP address has been changed by the user the installation program checks to see if the HOSTS file is pristine. A check is then made to see if the IP address is already assigned. See Step 9.

   If the HOSTS file is not pristine the dialog box shown in Figure 31 will be displayed.

   If the IP address is in use the dialog box shown in Figure 30 will be displayed.

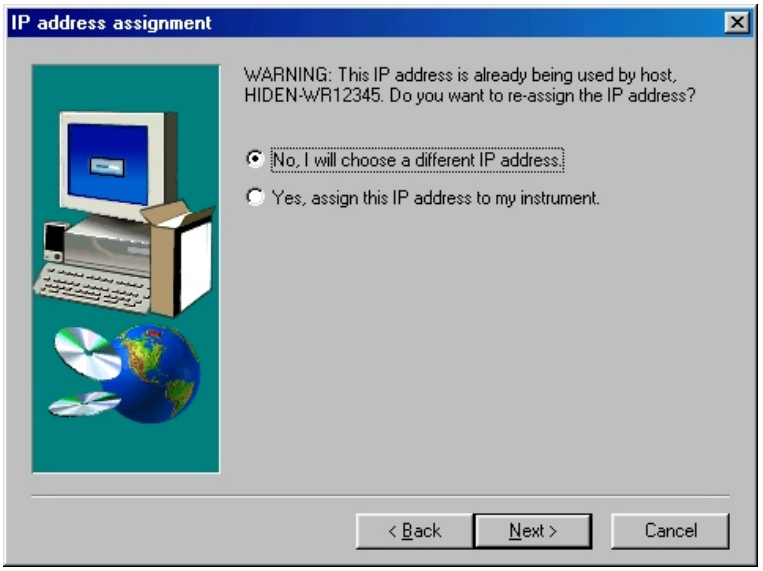

Figure 30 Re-assign IP address dialog box

8. The **IP address assignment** dialog box shown in Figure 30 is displayed if an IP address is chosen that is already being used. Select **Yes** to re-assign the IP address to the instrument being installed. Click the **Next>** button to continue with the installation.

   Selecting the **No** option will cause the dialog box shown in Figure 29 to be displayed where the IP address can be changed.

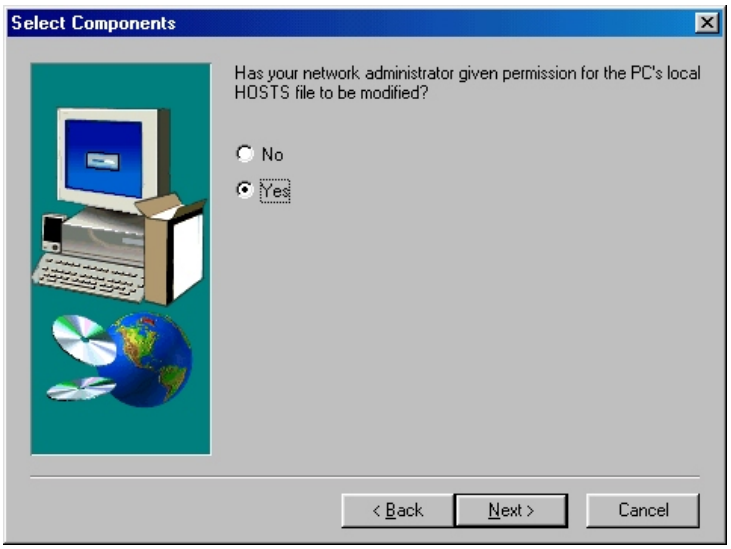

Figure 31 Permission to modify Hosts file dialog box

9. In the dialog box shown in Figure 31 make the appropriate selection and click the **Next>** button.

   If **No** is selected the installation program checks the Hiden.ini file to see if the IP address is already assigned. If it is not the the IP address is added to the Hiden.ini file

   If **Yes** is selected GetHostByAddress is used to check if the IP address is already assigned. If it is not assigned the address is written to the HOSTS file otherwise Figure 30 is displayed.

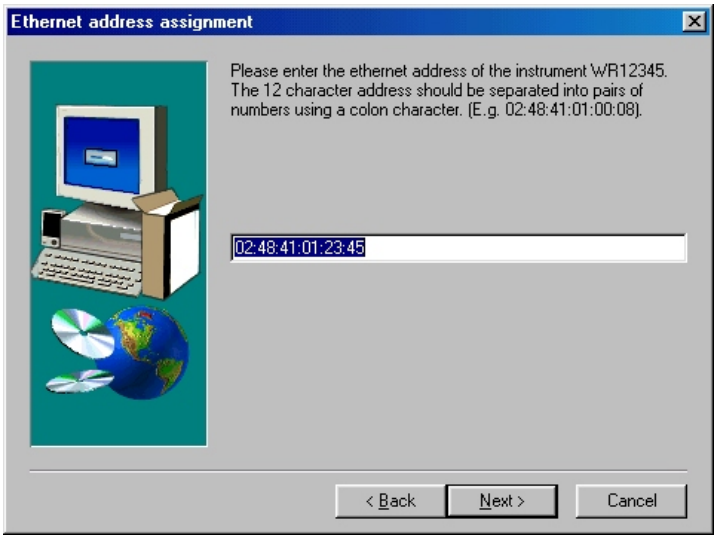

Figure 32 Ethernet address assignment dialog box

10. When the IP address has been accepted the **Ethernet address assignment** dialog box will be displayed, as shown in Figure 32.

    Accept or enter the correct twelve character ethernet address for the particular instrument. Use the colon character to separate pairs of digits.

    Click the **Next>** button.

    If haneWIN is installed on the system the ethernet address is added to the haneWIN Ethers file.
    If haneWIN is not installed the ethernet address is added to the Hiden.ini file.

    If the ethernet address differs from the default the dialog box shown in Figure 33 will be displayed.

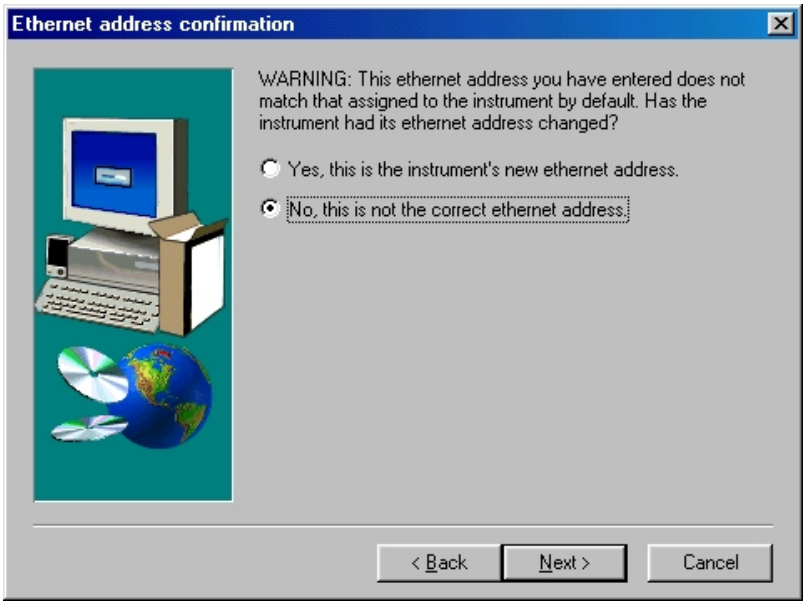

Figure 33 Ethernet address change dialog box

11. Selecting **Yes** in the dialog box shown in Figure 33 will add the ethernet address to either the Hiden.ini file or the haneWIN Ethers file.

    Click the **Next>** button to complete the installation.

    Selecting **No** will cause the dialog box shown in Figure 32 to be displayed where the ethernet address can be changed.

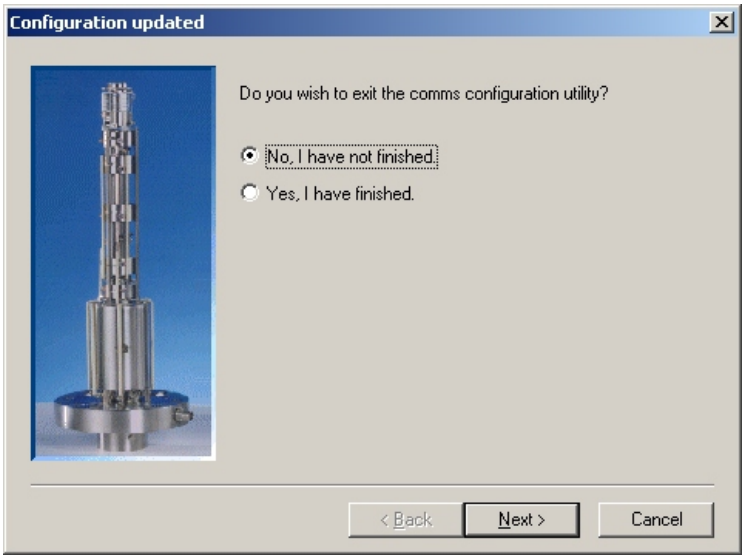

Figure 34 Configuration updated dialog box

12. In the dialog box shown in Figure 34 select either **No, I have not finished** or **Yes, I have finished** and click **Next>.**

    Selecting **Yes** will open the **Hiden Analytical configuration utility** dialog box shown in Figure 35. Selecting **No** will re-open the **MASsoft communications configuration utility** dialog box (shown in Figure 17) from where other configuration tasks can be undertaken.

Figure 35 Configuration completed dialog box

13. In the **Hiden Analytical configuration utility** dialog box shown in Figure 35 click the **Finish** button to complete the configuration and close the configuration utility.

3.2 Self-administered Peer to Peer networks

Follow the instructions in this section if **Self-administered Peer-to-Peer** was selected in the type of network selection dialog box shown in Figure 23.

1. If the PC is configured to automatically assign IP addresses the IP address will be assigned and the **Configuration updated** dialog box will be displayed, see Figure 43.

   If automatic IP address assignment is not enabled and the haneWIN DHCP Server is installed then the dialog box shown in Figure 36 will be displayed. Make the selection appropriate for the PC's configuration and click the **Next>** button.

   If **No** is selected the **IP address assignment** dialog box will be displayed as shown in Figure 39.

   If **Yes** is selected the **Select Components** dialog box as shown in Figure 37 will be displayed.

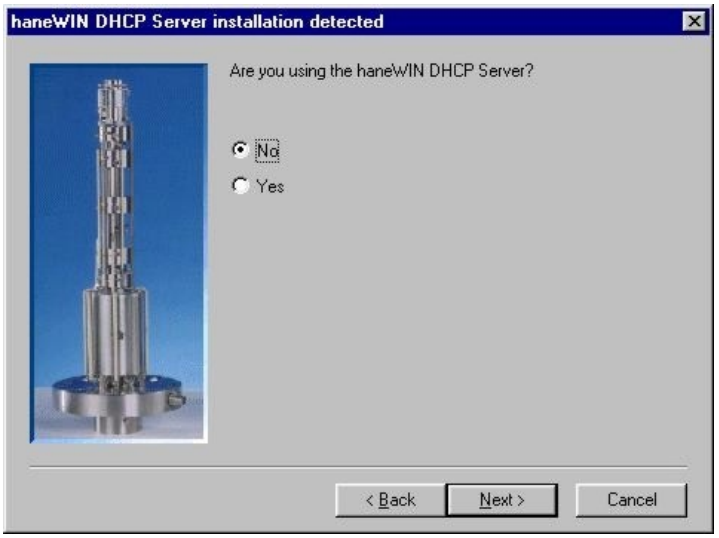

Figure 36 haneWIN DHCP detected dialog box

2. If haneWIN is installed on the PC and is being used the **Select Components** dialog box shown in Figure 37 will be displayed.

   Make the required selection and click the **Next>** button.

   If **No** is selected the **IP address assignment** dialog box will be displayed as shown in Figure 39.

   If **Yes** is selected haneWIN will assign the IP address and the **Configuration updated** dialog box will be displayed, see Figure 43.

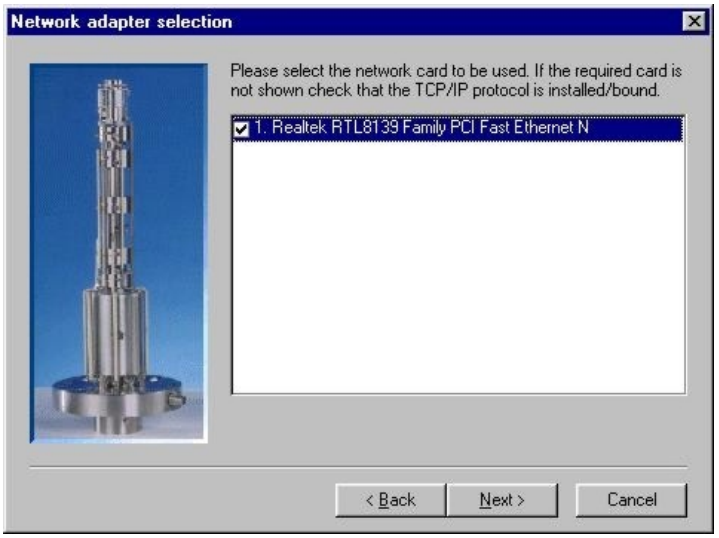

Figure 37 haneWIN DHCP Server configuration dialog box

3. The Searching for an IP address message box will be displayed, as shown in Figure 38.

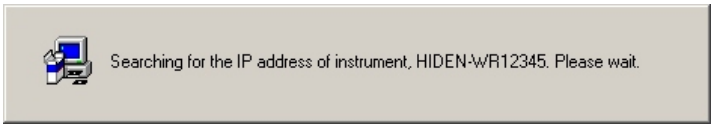

Figure 38 IP address search message box

4. The **IP address assignment** dialog box, shown in Figure 39 will be displayed where the assigned IP address can be accepted or modified.

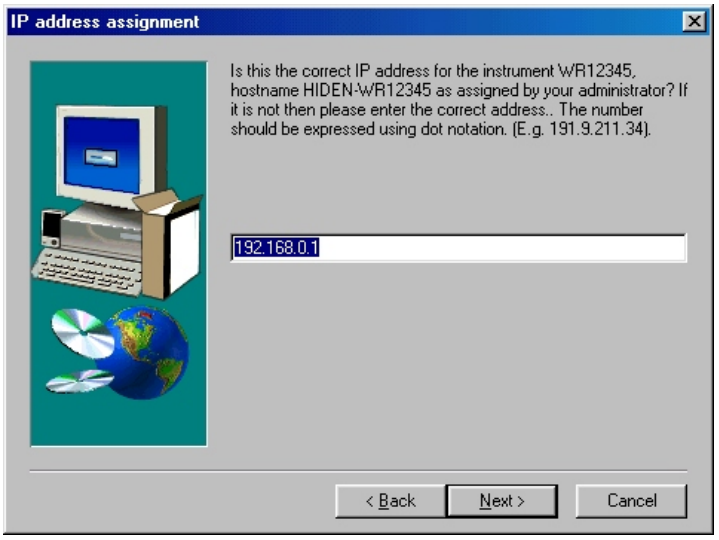

Figure 39 IP address assignment dialog box

5. Accept the IP address or enter the required IP address and click the **Next>** button.

If an IP address that is already in use is entered the **IP address assignment** dialog box will be displayed as shown is Figure 40. Otherwise, the **Ethernet address assignment** dialog box will be displayed as shown in Figure 41.

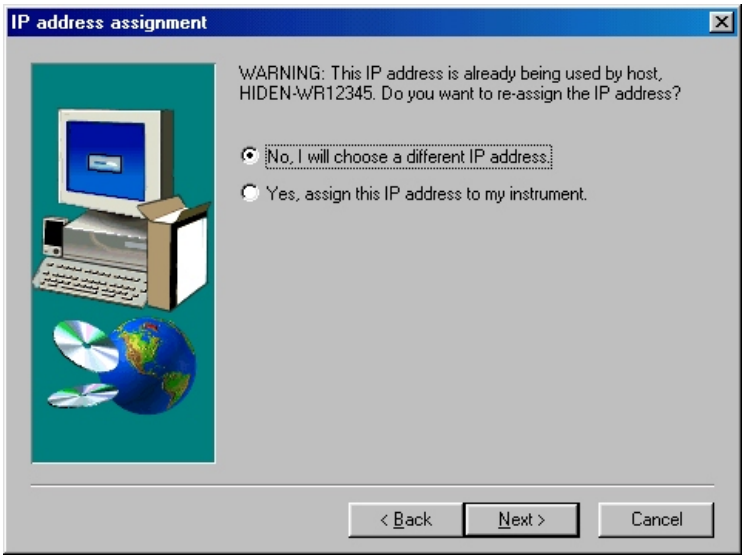

Figure 40 IP address re-assignment dialog

6. The **IP address assignment** dialog box shown is Figure 40 is displayed if an IP address that is already in use is selected. Make the required selection and click the **Next>** button.

   Selecting **No** will result in the **IP address assignment** dialog box, shown in Figure 39 being displayed again so the address can be changed.

   Selecting **Yes** will delete the existing association and assign the IP address to this instrument.

7. When the IP address has been sucessfully assigned the **Ethernet address assignment** dialog box will be displayed as shown in Figure 41.

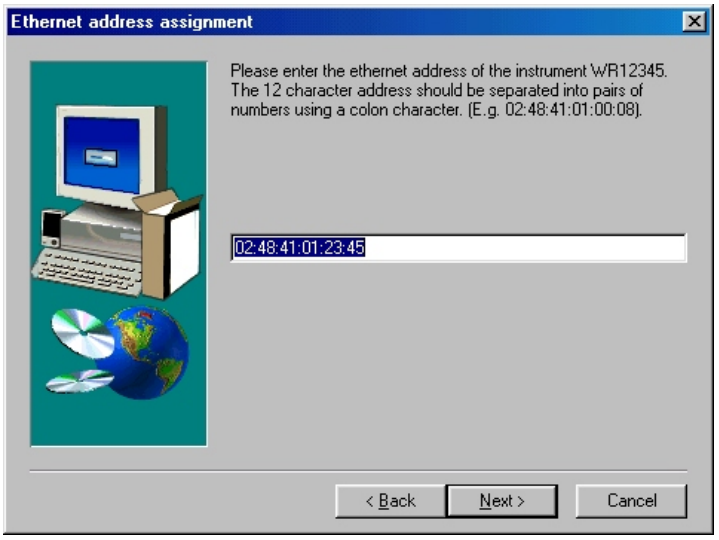

Figure 41 Ethernet address assignment

8. Accept or correct the Ethernet address displayed in the **Ethernet address assignment** dialog box.

   Click the **Next>** button.

   If an Ethernet address that is already in use is entered a warning dialog box, as shown in Figure 42, will be displayed.

   Otherwise, the **Configuration updated** dialog box will be displayed as shown in Figure 43.

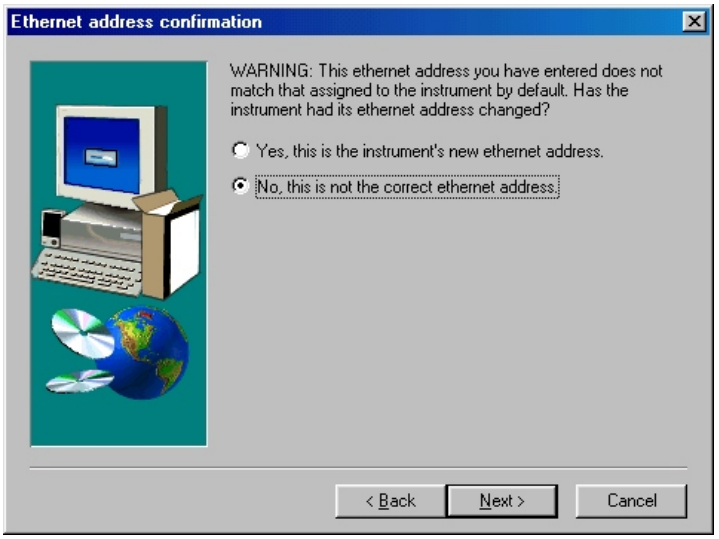

Figure 42 Ethernet address confirmation dialog box

9. Make the required selection in **Ethernet address confirmation** dialog box and click the **Next>** button.

Selecting **No** will result in the **Ethernet address assignment** dialog box, shown in Figure 41 being displayed again so the address can be changed.

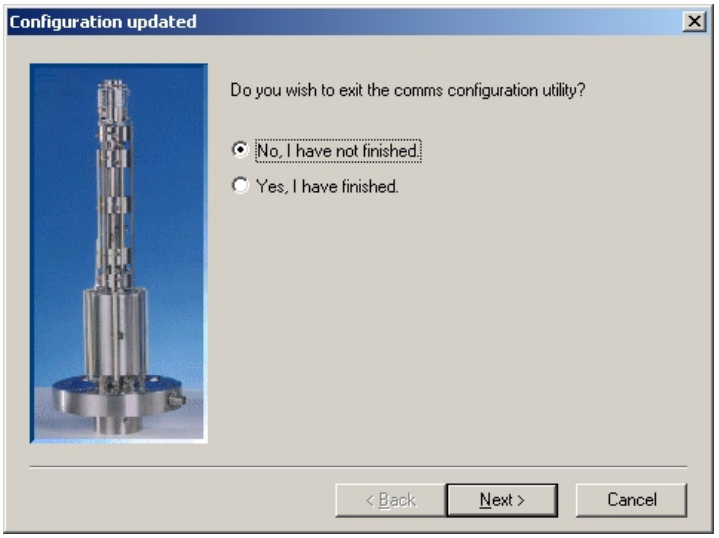

Figure 43 Configuration updated dialog box

10. The **Configuration updated** dialog box is displayed at the end of the configuration procedure.
Select **No, I have not finished** to return to the **MASsoft communications configuration utility** dialog box otherwise, select **Yes, I have finished**.

Refer to Figure 43.

4 For system Administrators

This document is intended for System Administrators who need to know the details of the implementation of the TCP/IP protocol stack on Hiden Analytical instruments.

Only IP version 4 is implemented. IP V6 frames are not supported. The TCP / IP stack is intended to be basically RFC 1122 compliant, but data in SYN frames is not received.

From a System Administration point of view the biggest problem is assigning IP addresses to Interface Units that have no user interface until an IP address has been assigned to them; the problem is similar to administering network printers.

To enable an IP address to be assigned remotely the Interface Units support DHCP, BOOTP, RARP and APIPA (Automatic Private IP Address assignment) .

Once an IP address has been assigned to an Interface Unit this address must be made known to the system. To facilitate this the Interface Units make NBNS / WINS name announcements at boot up and respond to queries thereafter.

The rest of this document describes the support for DHCP, BOOTP, RARP, APIPA and NBNS in more detail and discusses various options.

5 Implementation

5.1 Assigned IP Addresses

On boot up the Interface Unit normally has no IP address assigned. A fixed IP address can be assigned by setting the “assigned-IP” parameter. This can be done by using the pset command from a terminal connected to the Interface Unit’s serial port. Use HyperTerm or any other terminal program set to 115.2K baud (19.2K baud for HAL 4 micros), no parity, 8 data bits, 1 stop bit – Terminal in the Hiden Applications group is configured to these settings. For instance to set the IP address 192.168.10.3 use the command:

pset assigned-IP 192 168 10 3

Note:

The IP address is separated by spaces not by dots and the parameter name assigned-IP is case sensitive.

This value will be stored in battery-backed RAM. However if the Interface Unit should crash during boot-up the RAM is cleared prior to re-booting in case the crash is caused by corrupt values in RAM; this means that if, on switch on, power is removed before boot up is complete then the RAM will be cleared; this can be caused by a mains “brown-out” or by the on/off switch arcing.

If a fixed IP address is assigned the Interface Unit sends 5 gratuitous ARP frames at 200ms intervals to check that the address is not in use, if there is no reply to these ARPs the address is not in use and the sequence proceeds to make the NBNS / WINS name announcements

If there is a reply to the ARP frames the sequence proceeds through the normal DHCP, BOOTP, APIPA sequence.

5.2 DHCP

If the **assigned-IP** parameter is 0.0.0.0 (the default) then the Interface Unit attempts to obtain an address by broadcasting a DHCPDISCOVER DHCP packet. It responds to the first DHCP server to answer with a DHCPOFFER by sending a DHCPREQUEST. If any other DHCP servers respond with offers these are ignored. On receipt of a DHCPACK from the server that sent the offer the Interface Unit sends 5 gratuitous ARP frames at 200ms intervals to check that the address is not in use, if there is no reply to these ARP frames the address is not in use and the sequence proceeds to make the NBNS / WINS name announcements

If there is a reply to the ARP frames then the XID is incremented and DHCPDISCOVER is re-sent as a result of the error. This also occurs if a DHCPNAK is received in response to a DHCPREQUEST.

If there is no response to the DHCPREQUEST within 5s then the DHCPREQUEST is resent. If after 3 DHCPREQUESTs there is still no response then another DHCPDISCOVER is re-sent as a result of the error.

If a DHCPDISCOVER does not elicit a response within 5s then it will be re-sent, until 3 consecutive DHCPDISCOVERs have been sent.

If DHCPDISCOVER is resent due to error up to 4 times, or if there are 3 DHCPDISCOVERS sent without a response within 5s then the Interface Unit will try sending plain BOOTP packets.

The initial DHCPDISCOVER is sent with its options aligned. If the DHCPOFFER comes from a server identifying itself as “ICS ” (note the trailing space) then subsequent options are no longer aligned.

DHCPREQUEST packets are broadcast if source address in IP header does not match the siaddr in the DHCP packet and the Server Identifier option (54). In other words if there is any doubt about who to reply to, the request is broadcast.

The Interface Unit accepts the following DHCP (vendor) options:

- 1 - Subnet Mask
- 3 - Router
- 6 - Domain Server
- 23 - IP TTL
- 26 - MTY
- 28 - Broadcast Address
- 37 - TCP TTL
- 54 - Server ID
- 51 - Lease
- 58 - T1
- 59 - T2

The Broadcast address is derived from the subnet mask if not set explicitly. Currently the Broadcast address is only used to broadcast NBNS / WINS announcements.

Initially the Interface Unit requests an infinite lease on the IP address. If an infinite lease is not granted the Interface Unit attempts to renew its lease on an IP address by sending a DHCPREQUEST to the DHCP server when T1 or ½ the lease has expired, whichever is sooner. T2 is not currently used.

The IP TTL, TCP TTL and MTU are not yet used by the TCP/IP stack.

The Domain Server and IP Router are not yet used either.

The maximum time that DHCP is likely to take is either 3 unacknowledged requests taking 10s or 4 failures taking about 15s.

5.3 BOOTP

If DHCP fails the Interface Unit tries sending plain BOOTP packets. The Interface Unit sends a BOOTREQUEST and waits 5s for a BOOTREPLY. If no reply is received the BOOTREQUEST is re-sent. After 3 BOOTREQUESTS without response the Interface Unit tries RARP.

If the Interface Unit receives a response it sends 5 gratuitous ARP frames at 200ms intervals to check that the address is not in use, if there is no reply to these frames the address is not in use and the sequence proceeds to make the NBNS / WINS name announcements

If there is a reply to the ARP frames then the XID is incremented and BOOTPREQUEST is re-sent. After four attempts resulting in failure to get a unique address the Interface Unit tries RARP.

Because BOOTP and DHCP packets are handled by the same code, BOOTP accepts the same Vendor Options as DHCP if the BOOTP server transmits them.

The maximum time that BOOTP is likely to take is either 3 unacknowledged requests taking 10s or 4 failures taking about 15s.

5.4 RARP

If BOOTP fails the Interface Unit tries sending Reverse ARP (RARP) packets. Because RARP is not routable the RARP server must be on the local network, therefore it only waits 500ms for a reply. Because RARP is not commonly used it only tries twice.

If the Interface Unit receives a RARP response it sends 5 gratuitous ARP frames at 200ms intervals to check that the address is not in use, if there is no reply to these frames the address is not in use and the sequence proceeds to make the NBNS / WINS name announcements.

If RARP fails the Interface Unit falls back to using APIPA.

The maximum time RARP can take is 1s.

5.5 APIPA

Automatic Private IP Address assignment is described in Microsoft Knowledge Base article Q220874, “Automatic Windows 98/Me TCP/IP Addressing Without a DHCP Server”. The Interface Unit tries addresses in the Class B address range 168.254.x.x. In the first address it tries x.x corresponding to the last 2 bytes of the Ethernet address of the unit; thereafter x.x is incremented, modulo 65536, by 13 until all the addresses have been tried.

Each address is tested by sending out a gratuitous ARP, and confirmed by a further 5 ARPs at 200ms intervals. If no reply is received for any of these ARPs then the address is used as the unit's IP address.

If an address is assigned by APIPA the Broadcast Address used by NBNS / WINS is set to 168.254.255.255. so the name of the Interface Unit can only be resolved to an IP address by PCs using APIPA to obtain their own IP address.

Unlike Window's implementation of APIPA the Interface Unit does not continue to try to contact a DHCP server once it has assigned itself an IP address. However the unit will accept an unsolicited BOOTP BOOTREPLY packet; this allows Hiden applications to act in lieu of a BOOTP server for Interface Units on systems without a DHCP/BOOTP server.

The maximum total time to obtain an address will be approximately 31s for the DHCP/BOOTP/RARP attempts + 200ms per APIPA address tried + 1s for 5 ARPs.

5.6 NBNS / WINS

When the Interface Unit has been assigned an IP address it announces this using NetBios Name Service packets as used by WINS. Microsoft NetBIOS names are 15 characters long with the last byte encoding a "resource type" – see "Windows Internet Naming Service (WINS) :Architecture and Capacity Planning: Appendix A". The Interface Unit announces itself using a name consisting of the prefix HIDEN-WR followed by a 4, 5 or 6 digit ASCII works reference number. This is padded with trailing spaces to 15 characters. The last byte is either NUL (0x0) , the WorkStation Name resource type, or a space (0x20), the Server Name resource type.

The Works Reference number is obtained from the last 3 bytes of the Ethernet address. Leading zeroes from the first byte are omitted. For instance the unit with WR12345 would have an Ethernet address of 02:48:41:01:23:45 and a NetBIOS name of "HIDEN-WR12345 \0".

5.6.1 Accessms's view of TCP/IP

Accessms is a utility program that provides the communication elements of any other software (MASsoft/ESPsoft) that employs it, these communication elements consist of RS232, DLC and TCP/IP. When attempting to connect via TCP/IP, Accessms needs to be informed of either the Hostname or the IP address of the Interface Unit (IU). If a hostname has been specified then Accessms will resolve it by checking the hiden.ini file to see if there is a corresponding entry in the [HOSTS] section. If there is an entry then it will use the IP address indicated otherwise it will make a system call which will check the naming service(DNS/WINS/NBNS/Local host file) to determine if there is an IP address assigned to this hostname. If this fails then Accessms will not be able to connect to the IU.

Note

It is important not to have any entries in the [HOSTS] section if a DNS is being employed as these will take precedence.

Example

[HOSTS]

HIDEN-WR093A=192.9.201.233

This ensures Accessms attempts to connect to an IU using the IP address 192.9.201.233 regardless of any other naming service.

Accessms can be used to assign an IP address to an IU by adding the appropriate information to the [ETHERS] section in the hiden.ini file. Having resolved the hostname to an IP address, Accessms will examine the [ETHERS] section to see if there is a corresponding entry present, if there is then a BOOTP packet is generated with the net result of this IP address being assigned to the IU.

Example

[ETHERS]

192.9.201.233=02:48:41:00:09:3A

or

192.9.201.233=02484100093A

Note

Either format is correct but only one statement is required.

6 Scenarios

6.1 Introduction

For a TCP/IP connection to an Interface Unit to work two things must happen:

1. The Interface Unit must be assigned an IP address.
2. The IP Address of the Interface Unit must be obtainable by the Hiden application calling GetHostByName. The host name of the Interface Unit must be resolved to obtain the assigned IP address.

This requires two separate systems in the operating system environment to work together:

1. The IP assignment mechanism – DHCP, BOOTP, RARP or APIPA.
2. The Name Service – DNS, NIS, NDS, WINS or Active Directory.

Unfortunately, these two systems are often poorly integrated, indeed it is likely that the Name Service will not reside on the PC that runs the Hiden application and may well not run the same operating system – hence the use of the phrase “operating system environment” instead of just “operating system” (OS) to describe the combination of Application PC’s OS, the Name Service provider’s OS and IP Address provider’s OS.

6.1.1 Description

When a Hiden application opens a TCP/IP connection to an Interface Unit it first calls GetHostByName. The operating system calls the Name Server (which may be on another system) to look up the IP address corresponding to the host name of the Interface Unit.

The correct operation of this step can be determined by using the ping command from the command prompt (DOS box):

ping <hostname>

If ping returns “Unknown host <hostname>” then the name is not being properly resolved.

It should be possible to ping the interface unit using its IP address. To determine its IP address connect to the Interface Unit using Terminal in the Hiden Applications group. Type the command:

pget IP-address

it should return something similar to:

169,254,227,1

If it returns 0,0,0,0 wait and try again.

Now type

ping <ip-address>

In <ip-address> substitute dots for the commas in the address returned by the pget command. If ping times out then the Interface Unit’s IP address is probably on a different sub-net than the PC.

Once the IP address has been obtained the Ethernet address of the interface unit must be found. The OS will do this either by sending an ARP frame or by looking up the Ethernet address in the ARP cache.

To see the contents of the ARP cache use the command:

arp –a

For this to work the IP address assigned to the Interface Unit must correspond to the IP address associated with the hostname of the Interface Unit. In systems where the IP addresses are statically allocated, historically the association between IP-address and Ethernet address was held in a table called ETHERS; since each Interface Unit has a unique Ethernet address this associates an IP address with each unit. Similarly relationship between IP address and host name was held in a table called HOSTS.

Conceptually the problem is one of keeping IP addresses in the ETHERS table, or whatever is used by the IP address allocation service, associated with the IP addresses in the HOSTS table, or whatever is used by the Name service.

If the IP address is dynamically allocated by DHCP the Interface Unit’s host name is sent as an option to the DHCP server in the DISCOVER and REQUEST packets. This may (or more likely may not) be used by the DHCP server to update the Name service’s HOSTS table.

Once an Interface Unit has been assigned an IP address it sends WINS / NBNS announcements. These *may* be received by the name server and used to update its HOSTS table; they *should* be received by a NT / Windows 2000 WINS server; they appear to be ignored by workstation PCs.

Workstation PCs fall back to NBNS queries when they can not resolve a host name. Provided the Interface Unit is on the same sub-net as the PC it will respond to these queries and the name will be resolved. This mechanism will probably only work if the PC and the Interface Unit are on the same LAN and not through a router.

6.2 Simple Peer to Peer networks

6.2.1 One PC and one or more IUs

The PC must not have a fixed IP address assigned.

There is no DHCP server so the Interface Unit will assign an address using APIPA. The address will be in the range 169.254.0.0 to 169.254.255.254

The subnet mask will be 255.255.0.0 and NBNS/WINS will use a broadcast address of 169.254.255.255

Names will be resolved by WINS / NBNS queries so there is no need to run a DNS server or maintain HOSTS files.

6.2.2 Small network with Internet Connection Sharing

If one of the PCs on the network has a modem or broadband connection and Internet Connection Sharing (available with Windows 98 SE and later) is installed then the PC with ICS will act as a DHCP server.

All the other PCs on the network should be set up to “obtain IP address automatically” so that they use dynamic IP addresses allocated by the ICS PC.

The ICS sharing PC will have an address of 192.168.0.1.

The allocated addresses will be in the range 192.168.0.2 to 192.168.0.254

The subnet mask will be 255.255.255.0 and NBNS/WINS will use a broadcast address of 192.168.0.255

Even if a modem is not connected and ICS is not required to share an internet connection it is worth considering using ICS to provide a DHCP server. To do this a “standard” modem driver is installed and pretends that a modem is connected to COM1.

It is possible to use ICS with fixed IP addresses but only in the range 192.168.0.2 to 192.168.0.254. – see Microsoft Knowledge Base article Q30151, “How to Configure ICS to Use a Static IP Address” for Windows 98, or Q306126, “HOW TO: Configure Internet Connection Sharing in Windows XP” and others.

Names will be resolved by WINS / NBNS queries so there is no need to run a DNS server or maintain HOSTS files.

6.2.3 Small office network with Static IP addresses

If the office network uses static addresses and the Interface Unit is to be connected to the same network then the Interface Units must be on the same sub-net. For instance if the office were on the Class C network 192.9.201.x with a subnet mask of 255.255.255.0 then WINS / NBNS name queries would be broadcast on 192.9.201.255.

Although it is possible to assign a static address to an Interface Unit by connecting via the serial port and using the *pset assigned-IP <ip-address>* command, this is not

recommended because of the possibility of the battery backed parameters being reset by a failure during boot-up; therefore a DHCP server should be installed.

Shareware DHCP servers can be down-loaded from the web, e.g. the haneWIN DHCP server from http://www.haneWIN.de/ (also it is on the Hiden Analytical software suite CD).

Alternatively install ICS with a dummy modem as described in section 6.2.2, this will provide a DHCP server, but addresses will be restricted to the range 192.168.0.2 to 192.168.0.254.

Names will be resolved by WINS / NBNS queries so there is no need to run a DNS server or maintain HOSTS files.

6.2.4 Networks with routers

Many routers have built in DHCP servers. Provided that the PC and the Interface Unit are on the same side of the router – i.e. on the same sub-net – then the router may be used to provide dynamic IP addresses; names will be resolved by WINS / NBNS queries.

If the PC and Interface Unit are on opposite sides of the router then the router's DHCP server should be configured to provide a static IP address. The static IP address may then be added to the HOSTS file in the PC.

6.3 TCP/IP network with Unix / Linux Servers

6.3.1 TCP/IP with DNS Name Server

It will be necessary to run a DHCP server either on a PC, usually the one running MASsoft, or on a server. If there is already a DHCP server running on the network do not run another DHCP server on a workstation PC. BOOTP or RARP may be used in place of DHCP. RARP may not be used through a router unless the router is capable of operating as a proxy.

Provided that the Interface Unit is on the same sub-net as the PC names will be resolved by WINS / NBNS queries so it is not essential to maintain the DNS name table, but it is probably desirable.

If the Interface Unit is on another sub-net, accessed via a router, then it will be essential to maintain the DNS name table. If the DHCP server is allocating static IP addresses to the Interface Units then this can be done manually by synchronising the DHCP address (ETHERS , dhcp.conf) table with the DNS name (HOSTS, resolv.conf) table.

There are perl scripts for synchronising dynamic DHCP addresses with DNS for Linux systems.

The Princeton CMU DHCP server with the –a command line option outputs a line every time an address is allocated, this could be piped to a script to update the DNS name table.

What is required is a RFC 2136/2137 compliant DNS and a DHCP server that can make dynamic DNS update. Solaris DNS BIND supports RFC2136. Use nsupdate to change DNS records.

Cisco Network Registrar (CNR) integrates DNS and DHCP see :

http://www.cisco.com/warp/public/cc/pd/nemnsw/nerr/index.shtml

If the DNS name table can not be modified then static IP addresses can be added to the PC's local HOSTS file.

Windows 98/ME HOSTS file is in \<WINDIR> (i.e. C:\WINDOWS)

Windows NT / 2000 / XP HOSTS file is in \<WINDIR> \system32\drivers\etc

Changes take immediate affect - there is no need to re-boot.

If the PCs local HOSTS file is remotely administered (i.e. copied from a server at start up) then the equivalent entry may be made in the [HOSTS] section of HIDEN.INI; if this is done it will not be possible to ping or telnet to an Interface Unit by name.

6.3.2 TCP/IP with NIS Name Server (Sun Solaris etc)

If the DHCP server is being run on the server then the problems with TCP/IP systems using NIS are similar to those using DNS but there is an additional table to keep up to date.

A standard Windows TCP/IP system can not use NIS or NIS+ as its name service, it can only use DNS. If there is an NFS, such as PC-NFS, Solstice, or Hummingbird NFS Maestro, then there may well be a NIS client for the PC. In this case only synchronise DHCP with NIS.

If there is not a NIS client on the PC and dynamic IP addresses are allocated on a server with the PC on a separate sub-net from the Interface Unit then DNS server will have to be run on the server.

nispopulate builds a NIS+ table from the hosts file. To populate the hosts table in domain xyz.sun.com. from the hosts file in the /var/nis/files directory and using "somepasswd" as the etwork password for key encryption:

/usr/lib/nis/nispopulate -F -p /var/nis/files -l somepasswd hosts.

6.3.3 TCP/IP with SAMBA and HOSTs file

If SAMBA and DHCP are being run on a server static IP addresses can be administered by distributing a HOSTS file. A batch file in the Startup folder on the PC can copy the HOSTS file from a network drive, mapped to the location of the HOSTS file on the server, to either \
\<WINDIR> (i.e. C:\WINDOWS) on Windows 98 or

\<WINDIR>\system32\drivers\etc on NT 4, 200 and XP.

6.4 Networks with Windows NT Servers

6.4.1 TCP/IP with dynamic IP addresses

See " Windows 2000 (General) Technical Articles - Dynamic Host Configuration Protocol for Microsoft Windows 2000", Microsoft, March 1999.

A DHCP server is provided with Windows NT Server. From Windows 2000 onwards this has been integrated with DNS.

The current version of the Interface Unit does not currently send its Fully Qualified Domain Name using DHCP Option 81 so it is not clear that will register with DNS.

As the Interface Unit responds to WINS queries it will work with WINS, as long as Microsoft continue to support WINS….

6.4.2 TCP/IP with static IP addresses

The Windows NT / 2000 / XP server can be configured to assign static IP addresses. In NT 4 this is done using the "DHCP Manager" program. In Windows 2000 it is done in **DHCP Options Properties** dialog box on the DHCP server.

6.5 Novell Netware Network

6.5.1 TCP/IP with NDS

We have no experience of Novell networks and can offer no specific advice for users of these systems.

7 HIDEN.INI File Entries

The **[MASsoft.exe]** and **[ESP**] sections will have

WR=

lines with a comma separated list of <WR#> numbers following it. Each <WR#> will have a corresponding **[WR<#>]** section.

The **[<WR#>]** sections will have the following entries

connection=none

connection=serial

connection=DLC

or

connection=TCPIP

If the connection is serial there will be a

port=COM1:

line in the **[<WR#>**] section. The colon on the port name should be optional, it should accept either COM1 or COM1:

If the connection is DLC there will be a

address=0148410<WR#> or **address = 01:48:10: (WR#)**

line in the **[<WR#>]** section. There will only be 1 address on this line

If the connection is TCP/IP there will be a

host=HIDEN-WR<WR#>

socket=5025

line in the **[<WR#>]** section.

The

state=

entry supports at least the following states:

uninterrogated - The instrument will be interrogated

connected - The instrument is connected and is displayed in the list of instruments

disconnected - The instrument is not connected, but still displayed in the list of instruments

removed - Not connected and not displayed. Equivalent to being in ex address list.

Starting MASsoft with an instrument in the uninterrogated state causes that instrument only to be re-interrogated, its state will then be changed by MASsoft to connected.

The HIDEN.INI file may have an optional **[HOSTS**] section. It will contain entries of the format:

<host-name>=<ip.address>

The function of this section will be to take the place of the normal domain name search.

This may be necessary if the HOSTS file on the PC is remotely administered (perhaps copied from a central location by a batch file) or if standard DNS search hits a conflicting name; for instance the PC's at Hiden are set up to search the Demon DNS servers so that they resolve web site addresses - if a web site happened to have the same name as an MSIU then DNS would return the IP address of the web site.

The disadvantage of using **[HOSTS]** entries in the INI file is it prevents the use of Telnet to connect to a MSIU/EPIU by name.

The HIDEN.INI file may also have an **[ETHERS]** section with the format:

<ip-address>=<ethernet-address>

This will be used if the PC has a fixed IP address to assign a fixed IP address to the MSIU.

This will require setting up when MASsoft / ESPsoft is installed. The installation should detect if the PC has a fixed IP address. If the user has a fixed IP address it should ask the user to obtain an IP address for the MSIU from the System Administrator.

The installation checks if this has already been done by calling GetHostByName and asking if this is the correct IP address for the instrument. If this is the wrong IP address then an entry will be made in **[HOSTS]** section of the HIDEN.INI file. This is an important point because the HOSTs entry in HIDEN.INI over-rides the address returned by GetHostByName. If DNS is being used there must not be a HOSTS entry in the HIDEN.INI file.

If GetHostByName does not return an IP address the installation will ask if the System Administrator is going to set up a DNS entry or an entry in the HOSTs table. If the answer to this is "No" then the installation inspects the PC's local HOSTS file. If this is pristine / nonexistant or only has HIDEN-WR entries then it adds the name/ip-address to it. Otherwise it checks if it is OK to modify this file (Please ask the System Administrator ...). If OK adds entry to HOSTs file, otherwise add entry to [HOSTS] section of HIDEN.INI

Next the installation checks if the haneWIN DHCP server is installed. If the haneWINDHCP server is installed the ip-address / ethernet pair is added to its ETHERS file.

Otherwise the installation asks the user to ask the System Administrator if the system has a RARP / BOOTP / DHCP server.

If the system has, then ask the user to ask the System Administrator to add the ip-address / ethernet address pair for the system to the ETHERS file.

If there is no RARP / BOOTP / DHCP server then it makes an entry in the **[ETHERS]** section of HIDEN.INI.

If the PC has a dynamic address then making either HOSTS or ETHERS entries should not be required. There must NOT be an ETHERS entry unless a fixed address is to be assigned to the MSIU. If a fixed address is assigned the wrong subnet will be used by the MSIU and it will not respond to WINS / NBNS name queries.

8 Points

The Interface unit will accept unsolicited BOOTP BOOTREPLY packets (including those with DHCP messages types DHCPOFFER and DHCPACK) if there are no open sockets. All listening sockets are closed.

Keep-alives are sent.

The Interface Unit listens on port 5025.

The Interface Unit should receive IP over IEEE 802 frames (RFC 1042) but always transmits using DIX Ethernet (RFC 894).

Useful links:

http://www.dhcp-handbook.com/dhcp_faq.html

http://www.cisco.com/networkers/nw99_pres/806.pdf

ftp://ftp.ietf.cnri.reston.va.us/internet-draft/draft-ietf-dhc -dhcp-dns-04.txt

Title: Interaction between DHCP and DNS

Author(s) : Y. Rekhter

Glossary

Abbreviations

APIPA	Automatic Private IP Address Assignment
ARP	Address Resolution Protocol
BOOTP	Bootstrap Protocol
CNR	Cisco Network Registrar
DHCP	Dynamic Host Configuration Program
DNS	Domain Name Server
EPIU	ESPion Probe Interface Unit
ICS	Internet Connection Sharing
IP	Internet Protocol
IU	Interface Unit (Hiden Analytical Control Unit)
LAN	Local Area Network
MSIU	Mass Spectrometer Interface Unit
MTU	Maximum Transmission Unit
NBNS	NetBIOS Name Server
NDS	Netware Directory Services
NIS	Network Information Service
OS	Operating System
RARP	Reverse Address Resolution Protocol
RAM	Random Access Memory
RFC	Request For Comment
SYN	Sychronisation
TCP	Transmission Control Protocol
TTL	Time To Live
WAN	Wide Area Network
WINS	Windows Internet Naming Service
XID	Exchange Identifier

TCP/IP Terms

IP Address	A set of four numbers that uniquely identifies anything connected to a Internet Protocol network e.g. 192.168.254.12. The equivalent on telephone system would be the telephone number.
Domain	A name for the network that connects a group of computers together. A domain will usually correspond to a subnet – a subnet being a group of computers sharing the same first three or two (or rarely just one) groups of digits in their IP addresses e.g. 192.168.254. The equivalent of this on a telephone system would be the area code. Domains are hierarchical, domains can contain groups of domains : like district codes, area codes, country codes.
Subnet	A subnet is a group of computers sharing the same first three or two (or rarely just one) groups of digits in their IP address e.g. 192.168.0.254 All the devices in the same subnet can communicate directly with each other, but if they want to communicate with a device on another subnet then the message has to be "routed". PCs communicating with Hiden Analytical instruments must either be on the same subnet or must know the "route" to reach the instrument.
Subnet mask	A set of numbers used to separate an IP address into the numbers identifying the subnet and those unique to the device. Usually, the subnet mask takes the form 255.255.255.0 (for a class C address) or 255.255.0.0 (for a class B address). If the subnet mask of 255.255.0.0 were applied to the IP address 192.168.254.12 then the subnet would be 192.168.
Ethernet Address	A set of numbers that uniquely identifies the PCs network card. The Ethernet address of Hiden Interface units are based on the address 02:48:41:00:00:00, with the last 4 or 5 digits replaced with the instrument's Works Reference number. The unit's Ethernet address is programmed into its memory.
Works Reference	The Works Reference number is a number assigned to each Hiden instrument during manufacture. The Works Reference number can be found below the serial number itself on the serial number label on the instruments rear panel.