User Manual for the
HE150ETN150

Ethernet TCP/IP Module for the Hitachi™ H-252 Series

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MAN0262-01

PREFACE

This manual explains how to use the Horner APG's TCP/IP Ethernet Link Module for the H-252 series of Hitachi™ programmable logic controllers.

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To obtain warranty service, return the product to your distributor with a description of the problem, proof of purchase, post paid, insured and in a suitable package.

ABOUT PROGRAMMING EXAMPLES

Any example programs and program segments in this manual or provided on accompanying diskettes are included solely for illustrative purposes. Due to the many variables and requirements associated with any particular installation, Horner APG cannot assume responsibility or liability for actual use based on the examples and diagrams. It is the sole responsibility of the system designer to appropriately design the end system, to appropriately integrate the HE150ETN150 and to make safety provisions for the end equipment as is usual and customary in industrial applications as defined in any codes or standards which apply.

Note: The programming examples shown in this manual are illustrative only. Proper machine operation is the sole responsibility of the system integrator.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

1.1 General

The HE150ETN150 is an Ethernet TCP/IP communication module for the Hitachi™ H-252 Series. It enables point-to-point communication from a Personal Computer (PC) to a single H-252 series PLC over an exiting Ethernet network (see Figure 1.1). It uses a TCP/IP protocol under a standard Hitachi Ethernet layer. The HE150ETN150 is configured using specialised Configuration Software. (See Chapter 2 for software configuration details.)

The HE150ETN150 module interacts with the PLC via the link area (WL/L registers) only. Communications from the PC are initiated by task codes sent to the HE150ETN150 requesting data or writing data to/from the link areas. Up to two PCs can "connect" to the HE150ETN150, via the Ethernet bus, at any one time.

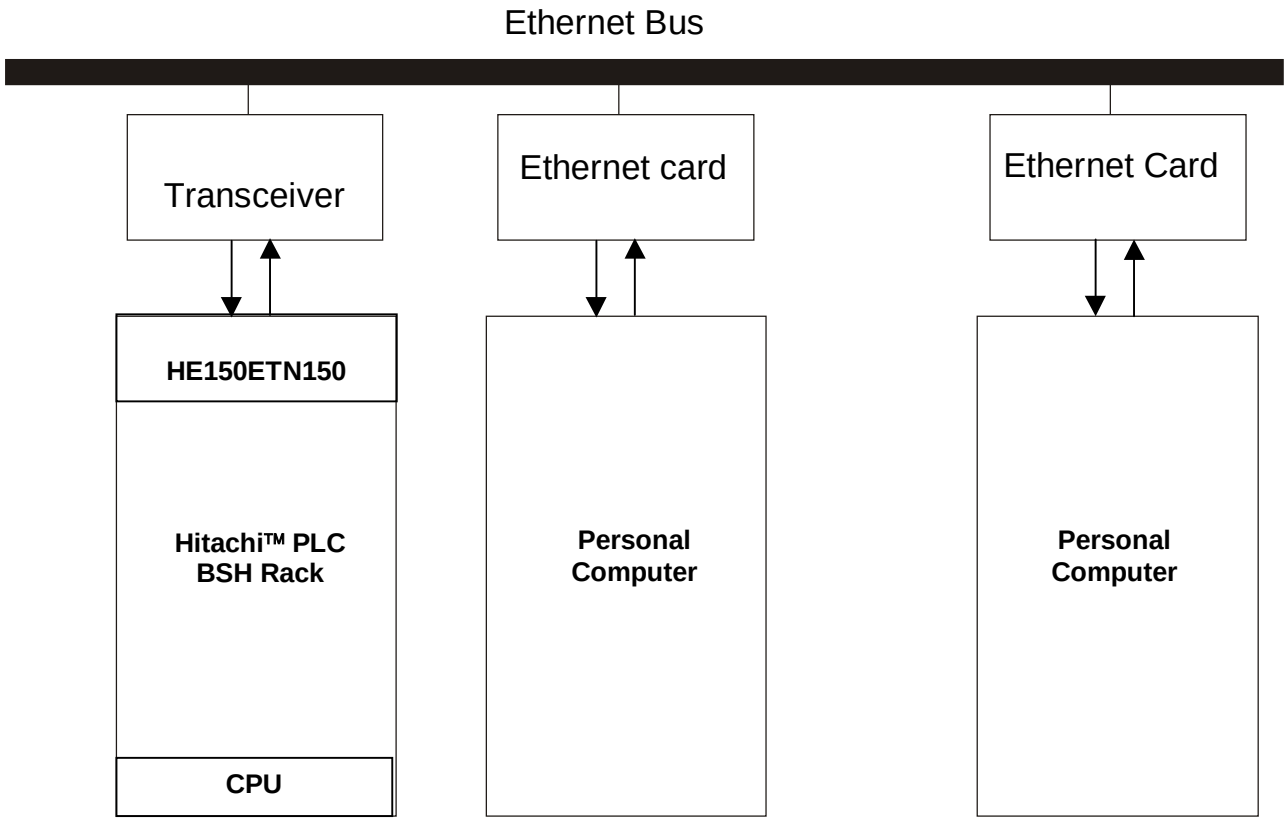


Figure 1.1 – Network Overview

Before an HE150ETN150 module sends information to the Ethernet bus, it must, first, send the information to the transceiver, which is physically plugged into the HE150ETN150 module. The transceiver plugs into the HE150ETN150 module's AUI Port. The HE150ETN150 sends the information (in the form of Ethernet packets) to the transceiver. The output of the transceiver depends upon the type of transceiver that is used. (See Table 1.1.)

Table 1.1 – Compatible Transceivers	
Standard Thick Ethernet- 10BASE5	
Maximum length of one segment:	500m / 1640ft
No more than 100 connections per segment.	
Minimum distance between transceivers	2.5m / 8ft
Maximum length of transceiver-AUI cable	50m / 164ft
Thin Ethernet, ThinNet- 10BASE2	
Maximum length of one segment:	185m / 600ft
No more than 30 connections per segment.	
Minimum distance between T-connectors	0.5m / 1.6ft
No cable between T-connector and transceiver	
Twisted-Pair Ethernet- 10BASE-T	
Maximum length of one segment	100m / 328ft
One transceiver per segment connected to hub in "star" configuration.	
Fiber Optic Ethernet- 10BASE-FL, FOIRL	
Maximum length of one segment	2.0km /1.2miles
Maximum length of FOIRL segment	1.0km / 0.6miles
One transceiver on each end of fiber optic pair.	
Point to point links to hubs and between repeaters.	
Note: The trunk and drop distances are determined by the Ethernet transceiver rather than by the HE150ETN150 module. The values below are the industry standards for four classes of transceivers compatible with the HE150ETN150. They are included for reference only. Actual values may change depending on application and environment. These values have not been tested with the HE150ETN150.	

1.2 Network Communications using HE150ETN150 Modules

Although the HE150ETN150 is a point-to-point communication card, network information may be obtained through the common link area. In other words, were there a communication or link module (such as Horner APG's Ethernet network module, HE150ETN100 or *DeviceNet*™ master, HE150DNT125) and a HE150ETN150 in a single BSH rack, the network information can be passed to the PC from the HE150ETN150 via the link area.

1.3 Specifications

Table 1.2 – HE150ETN150 Specifications	
Mounting Requirement	One I/O slot in BSH rack
Power Requirements	450mA @ 5VDC; 75mA @ 24VDC
Operating Environment	0 to 60°C (32 to 140°F) 0 to 95% humidity (non-condensing)
User Memory	Dual-port 1,024 words (2,048 bytes)
Communications	One RS-232 port One AUI (Attachment Unit Interface) port
Protocol	TCP/IP
Speed	10 Mb/s
Number of Connections	2

1.4 System Requirements:

The HE150ETN150 requires:

a. One free BSH slot;
b. H-252, H-252B or H-252C CPU;
c. Programming software for Hitachi™ PLCs (ActSip-H or ActWin); and
d. Configuration software (available from Horner APG, LLC.).

1.5 Physical Layout of the HE150ETN150

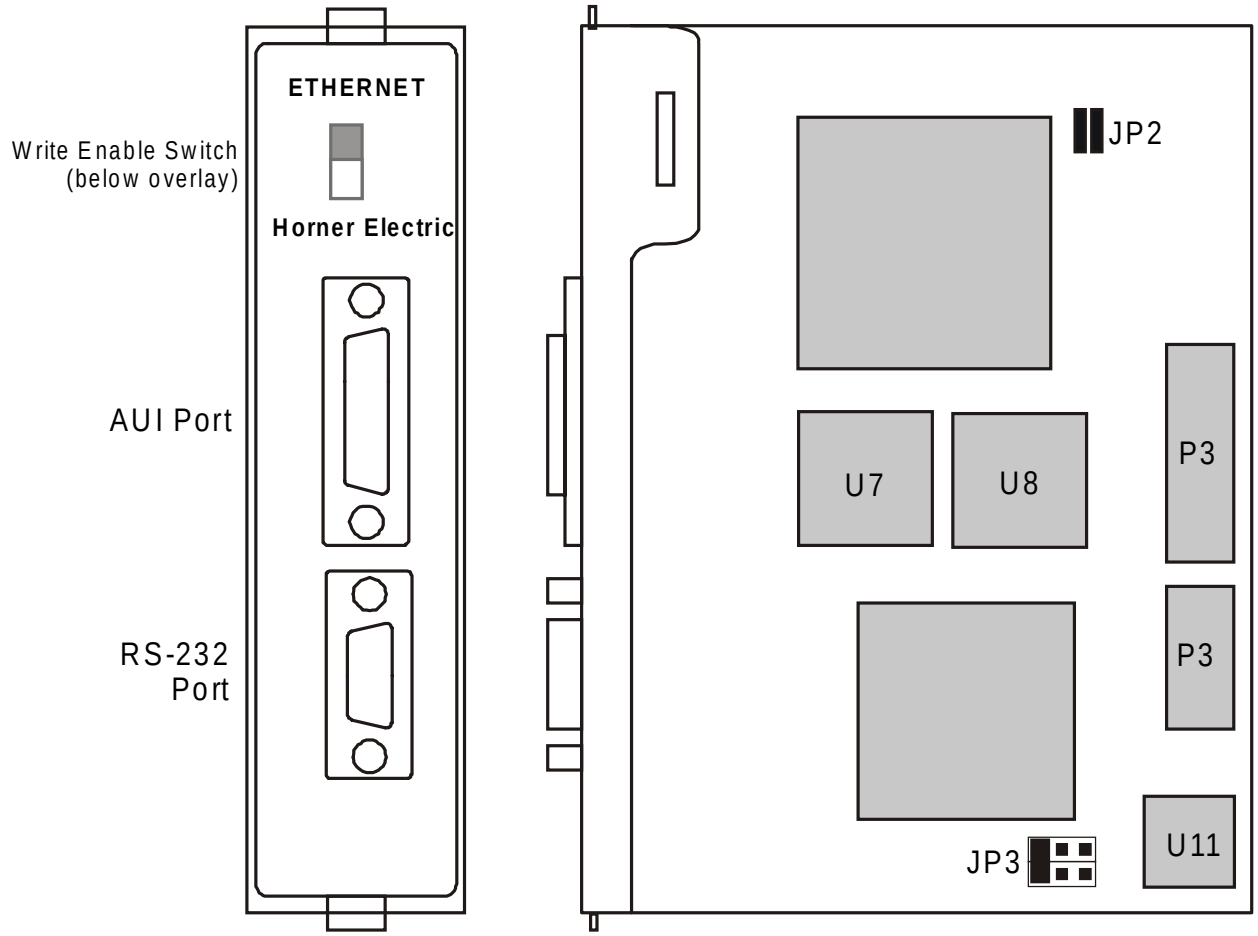


Figure 1.2 - HE150ETN150 Link Module

CHAPTER 2: INSTALLATION AND CONFIGURATION

2.1 HE150ETN150 Mounting Requirements

The HE150ETN150 Module plugs into any BSH local slot. It requires an H-252, H-252B or H-252C CPU.

Refer to the "Hitachi Programmable Controller H-Series Application Manual" for information on mounting the module.

2.2 Configuring the HE150ETN150 with HETCPIP Configuration Software

HETCPIP Configuration Software supports field configuration of the HE150ETN150 link module. The software requires a personal computer (PC) running Windows 95 or NT, and one uncommitted standard serial port assigned to COM1, 2, 3 or 4.

Step 1: Plug the HE150ETN150 into the desired slot.

Step 2: Connect the HE150ETN150 to COM1 (2, 3 or COM4) on the PC using a standard serial cable with a 9-pin male plug on the HE150ETN150 end. The HE150ETN150 appears as a DCE/MODEM to the PC.

Step 3: Power up the PLC and place it in **STOP** mode.

Step 4: Start the HETCPIP Configuration Software. The screen in Figure 2.1 appears.

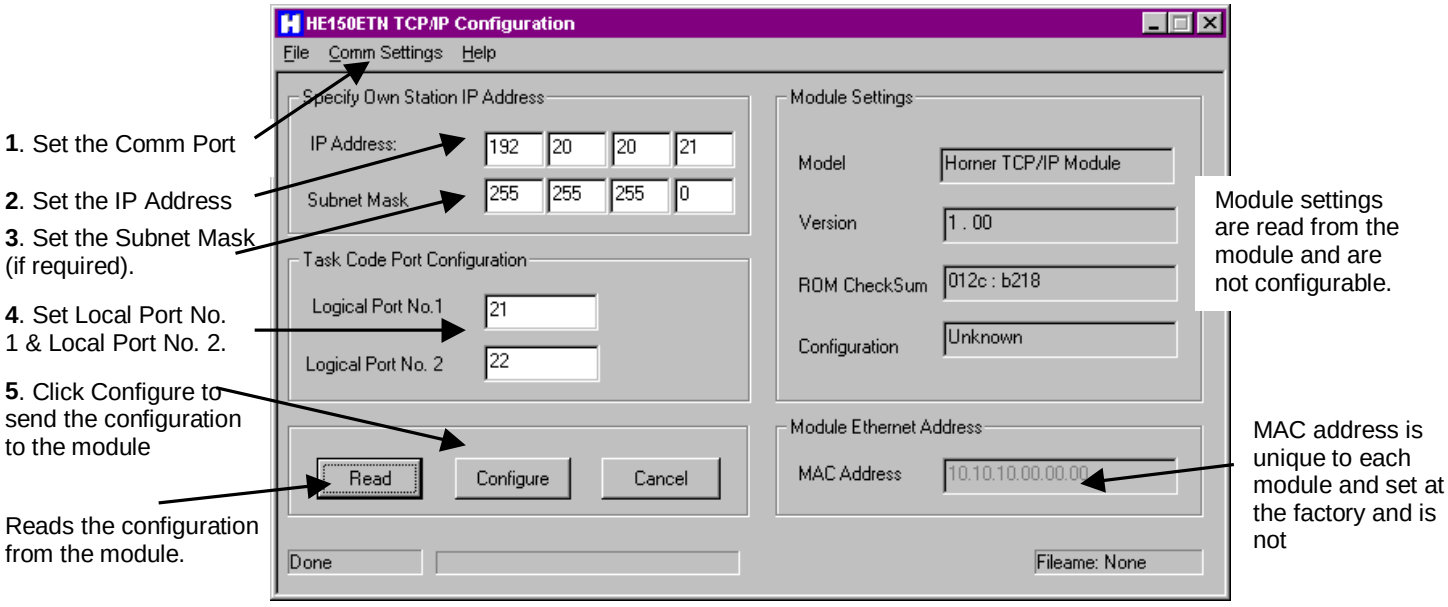


Figure 2.1 – HETCPIP Configuration Software Screen

Step 5. Set the **IP Address** (must be of the format for example 192.20.20.20). Set the **Subnet Mask**. If the network plant that the HE150ETN150 is connecting to uses subnetting, the subnet mask is used to mask out part of the IP Address; contact your network administrator for further instructions. Set **Logical Port No. 1** and **Logical Port No. 2**. Choose the desired **COM** port. Click **Configure**.

Step 6. Power cycle the module. This is required for the settings to take effect.

2.2.1 Summary of Configuration Fields

Table 2.1 – Summary of Configuration Fields	
Field	**Description**
IP Address	This is the network address used by a host PC to "find" the HE150ETN150.
Subnet Mask	This field enables the user to mask off or set limits to the IP Address. Subnet masking is only required if the module is used on a network which employs subnetting. Otherwise set the subnet mask to 0.0.0.0.
Logical Port No. 1	Specifies the TCP/IP logical port number for connection between the PC and HE150ETN150. The user defines the actual port number. (1 to 65535)
Logical Port No. 2	
MAC Address	READ ONLY. This unique number is assigned to each module in the factory.
Module Settings	READ ONLY. Shows information about the module. Important when requesting Technical Support.
Comm Port Selection	Must match the Comm port being used on the PC. Choose COM 1 or COM 2

2.2.2 Subnetting

Given the limited number of IP Addresses, many Companies and/or Organizations using TCP/IP break their networks into many logical sub-networks. To do this, the last portion of the IP address is reassigned to a sub-network address. This is possible using a method know as *subnet masking*. Subnet masking occurs on a bit level using an AND operator.

192.20.20.**XXX** - **XXX** is the portion reassigned to the subnet

Example:

We wish to mask the forth byte of the IP address for subnetting. The network address is 192.20.20.22

Address (192.20.20.22) 11000000.00010100.00010100.00010110
Subnet Mask (255.255.255.0) 11111111.11111111.11111111.00000000
True Network (192.20.20.0) 11000000.00010100.00010100.00000000

NOTE Subnet masking is only required if the module is used on a network which employs subnetting. Otherwise set the subnet mask to 0.0.0.0.

Implementation of subnetting and subnet masking are beyond the scope presented here. For further information, contact your network administrator or consult text on networking or network protocols.

2.3 Set-up to the PLC

Each HE150ETN150 must be set up to operate with its PLC. The link module fits in any I/O slot of a BSH base, not in an expansion base. The set-up with ACTSIP-H and ActWin is shown here.

Note: If two link or communication modules are in the same rack, the HE150ETN150 must use link area 1, WL0000 ~ 03FF (i.e., be the module closest the CPU).

2.3.1 Set-up with ActSip-H

Step1: Start ACTSIP-H configuration software (refer to the ACTSIP user manual for details).

Step2: From the Relay window, Press **<Esc>**, go to **Setup** and **PLC**. In **PLC setup** window (see Figure 3), the **I/O assignment and Link parameter(s)** must be set.

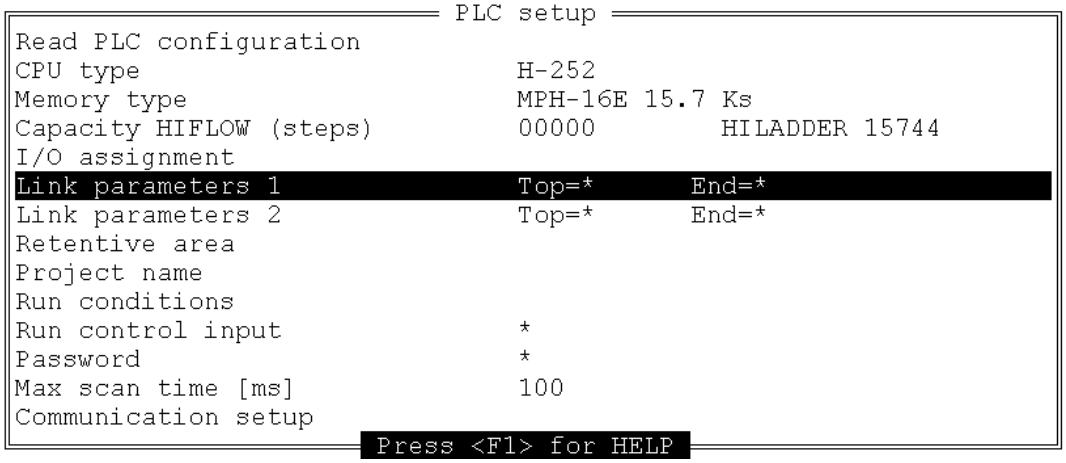


Figure 2.2 - ACTSIP-H PLC Setup Window

Step 3: Scroll down to the **I/O assignment** and press **<Enter>.** The **I/O assignment** window appears (shown in Figure 4). Choose the slot occupied by the HE150ETN150, using the right/left arrow keys. Press **<PgDn> <3>** to choose **CPU Link** from the list to the right. LINK is placed in the slot.

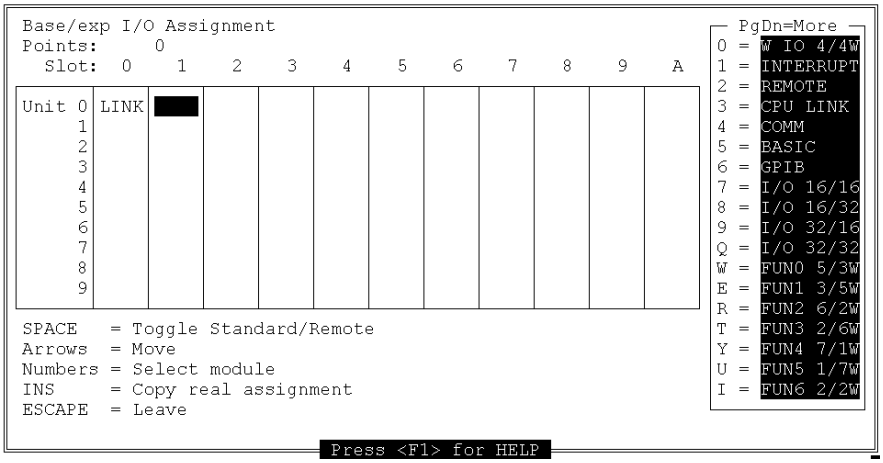


Figure 2.3 - I/O Assignment Screen

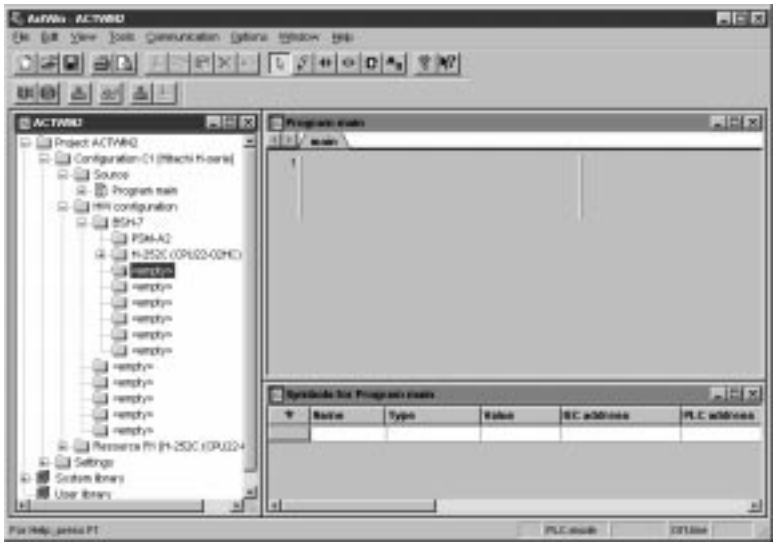
Step 4: Scroll down to **Link parameters 1** and press **<Enter>** (Link 1 is the module nearest to the CPU; Link 2 is farthest from the CPU, if used). Enter the **Top** value and press **<Enter>**; enter the **End** value and press **<Enter>.** The **Top** and **End** values are depend on the application. The WL registers between Top and End are read/write for the PLC. The WL registers outside TOP and End are read/write to the HE150ETN150 and by extension to the user on a connected PC.

Step 5: The WL0000 **Allocation Pointers** from the **Allocation** pull-down should be left at 0.

Step 6: The set-up may be sent to the PLC now by choosing **To PLC** from the **Communication** pull-down menu *or* by choosing to send it with the rest of the ladder code later.

2.3.2 Set-up with ActWin

Step1: Start ActWin programming software (refer to the ActWin user's manual for details).



Step2: Right click on the appropriate <empty> slot under HW Configuration in the project tree. Select the "add module" command from the pop-up menu to create a hardware configuration with a CPU and an input module and output module.

Step 3: In the **Select Module** screen, under **Groups,** select **Special**. Under M**odules**, select **LINK-02H**. Click **OK**.

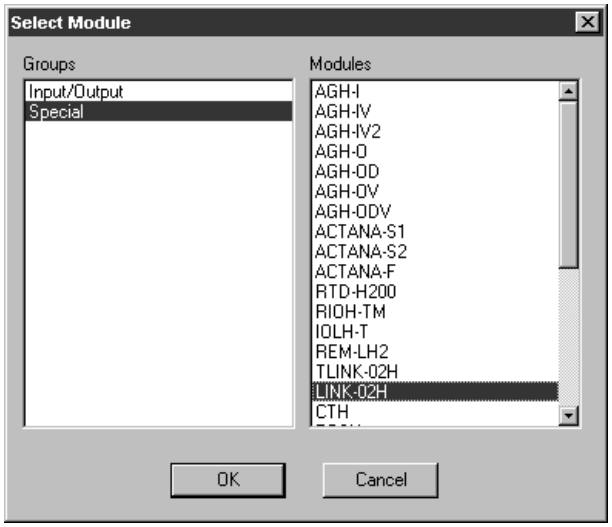


Figure 2.5 – ActWin Select Module Screen

Step 4: Right click on the CPU module under the HW Configuration in the project tree. Choose **Properties**. Click on the **CPU memory settings**. Under **Link area**, click on **Enable** (WL1 is the module nearest to the CPU; WL2 is the module farthest, if used). Enter the **Top** the **End** value and press. The **Top** and **End** values are depend on the application. The WL registers between Top and End are read/write for the PLC. The WL registers outside TOP and End are read/write to the HE150ETN150 and by extension to the user on a connected PC. Press **OK** when completed.

Figure 2.6 – ActWin CPU Properties Screen

Step 5: The set-up may be sent to the PLC now by choosing **PC to PLC** from the **Communication** pull-down menu, *or* by choosing to send it with the rest of the ladder code later.

2.3 Testing Communications- Ping

Ping is an application that is standard with Windows 95 and NT. It enables the locating or "pinging" of an IP address to see if it exists and is on-line.

Note: Before running Ping a 10Mb/s Ethernet card must be installed in the PC and properly configured under Windows 95 or NT

To Ping the HE150ETN150:

1. Open a DOS window. At the DOS prompt type **Ping <*IP Address of the HE150ETN150*>.**
2. The response should be similar to that in Figure 2.7

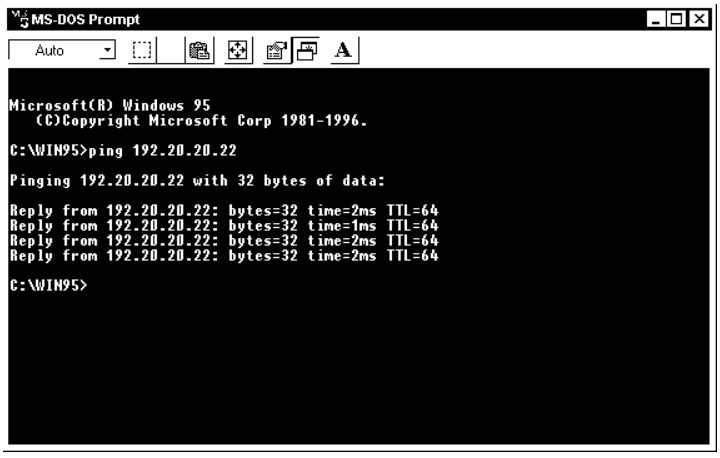


Figure 2.7 – Testing Communications with Ping

CHAPTER 3: WIRING

3.1 Jumper Connections

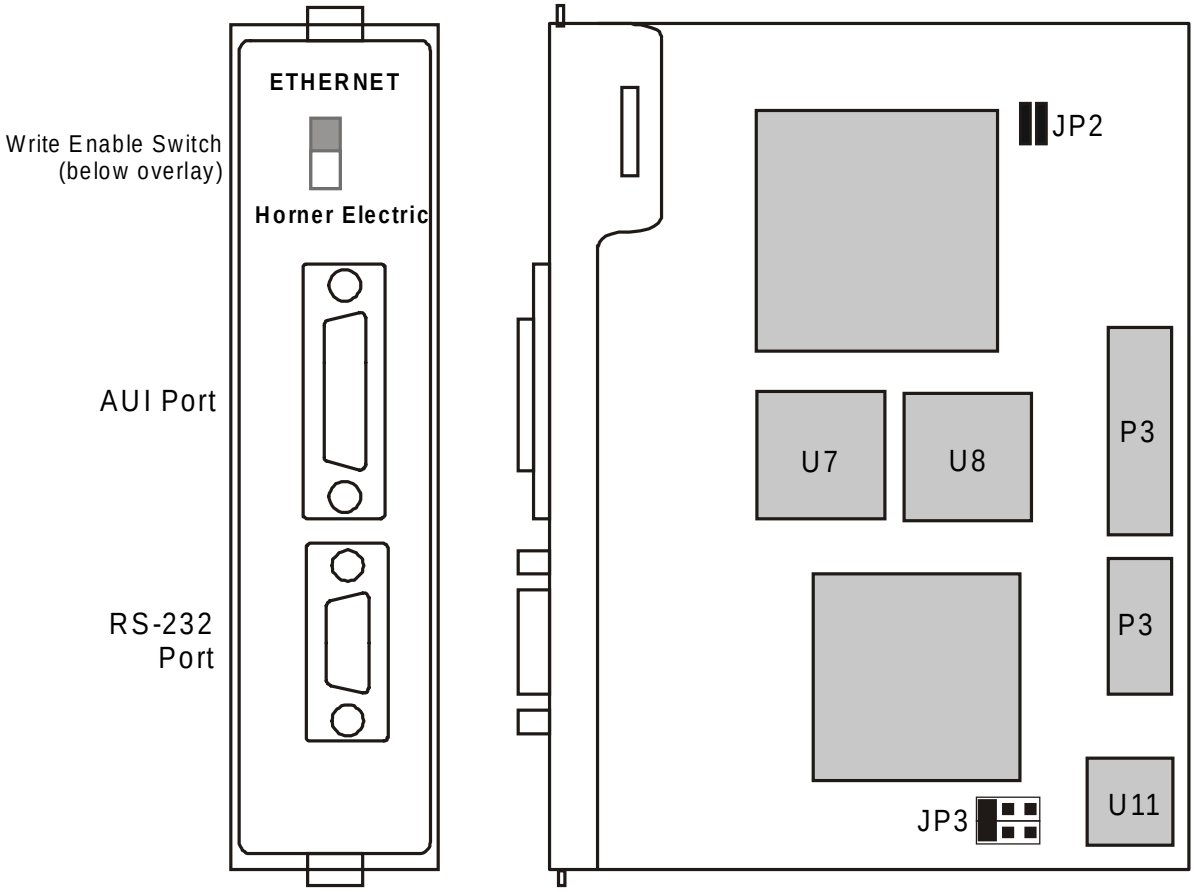


Figure 3.1 – Jumpers/Plugs

Table 3.1 – Jumper Configurations (See Figure 3.1)	
S1	Up position- enables configuration Down position- disables configuration
JP1	Used for debugging only
JP2	Always closed vertically
JP3	Pins 3 and 4 closed

3.2 Port Connections (See Figure 3.1.)

The RS-232 port is compatible with a standard PC serial port and appears to the PC as a DCE/MODEM. This port is used to configure the module only.

The AUI port connects the module to the Ethernet bus via a transceiver. The four types of compatibly transceivers are: Standard thick Ethernet- 10BASE5, thin Ethernet- 10BASE2, twisted-pair Ethernet- 10BASE-T, or fibre-optic Ethernet- 10BASE-FL, FOIRL.

3.3 Wiring Diagram and Pin-outs

The pin-outs of the ports are shown in Tables 3.2 and 3.3.

Table 3.2 – 9-pin RS-232 Port		
Pin #	**Signal Name**	**Direction**
1	[CD] Carrier Detect	N/A
2	[RXD] Receive Data	Output
3	[TXD] Transmit Data	Input
4	Connected to pin 6	N/A
5	[GND] Signal Ground	N/A
6	Connected to pin 4	N/A
7	[RTS] Request to Send	Input
8	[CTS] Clear to Send	Output
9	No Connection	N/A

Table 3.3 – 15-pin AUI Port		
Pin #	**Signal Name**	**Direction**
1	[GND] Signal Ground	N/A
2	[COL+] Collision	
3	[TXD+] Transmit Data	Output
4	[GND] Signal Ground	N/A
5	[RXD+] Receive Data	Input
6	[GND] Signal Ground	N/A
7	No Connection	N/A
8	[GND] Signal Ground	N/A
9	[COL-] Collision	
10	[TXD-] Transmit Data	Output
11	[GND] Signal Ground	N/A
12	[RXD-] Receive Data	Input
13	[PWR] +12VDC	N/A
14	[GND] Signal Ground	N/A
15	No Connection	N/A

The wiring diagram of an HE150ETN150 link module network is shown in Figure 3.2:

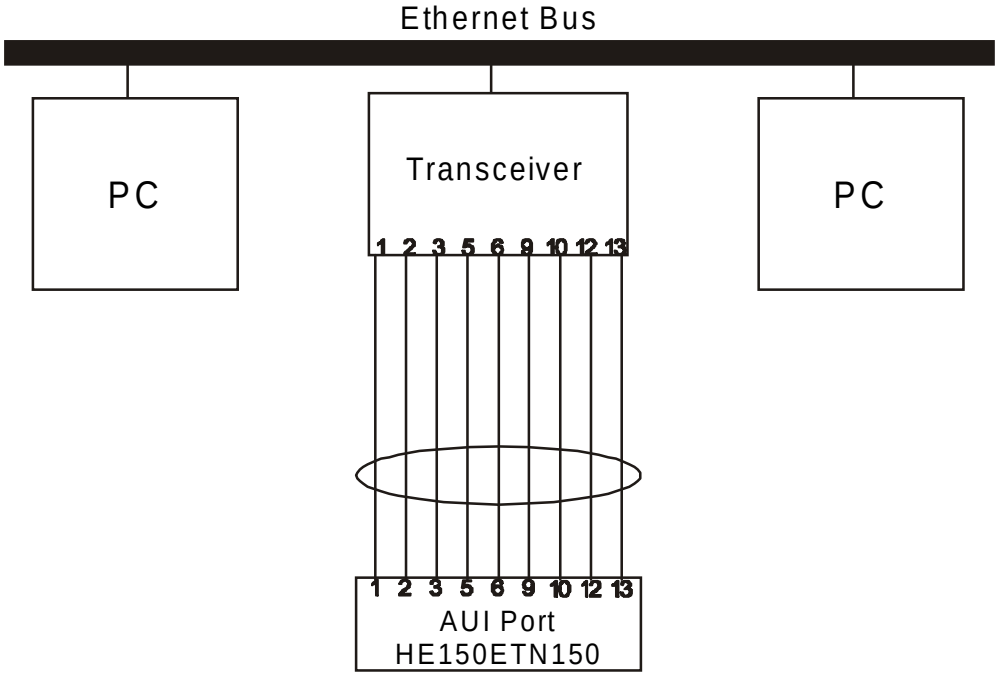


Figure 3.2 - Wiring Diagram

CHAPTER 4: TASK CODES

4.1 General

For a PC to communicate with theHE150ETN150, standard Hitachi task codes are used. The requesting (sent from the PC to module) task code structure is (always in hexadecimal):

00	12	FF	FF	00	00	task code	task code parameters

The response (sent by the module to the PC) task code structure is (always in hexadecimal):

00	12	FF	FF	00	00	task code	data from module

The currently supported task codes are:

a. 40H – Continuous Monitor
b. 42H – Continuous Force
c. 44H – Random Monitor
d. 45H – Random Force

Included here is a summary of these task codes. For more details, refer to the “Intelligent Ethernet Interface Module: Instruction Manual.”

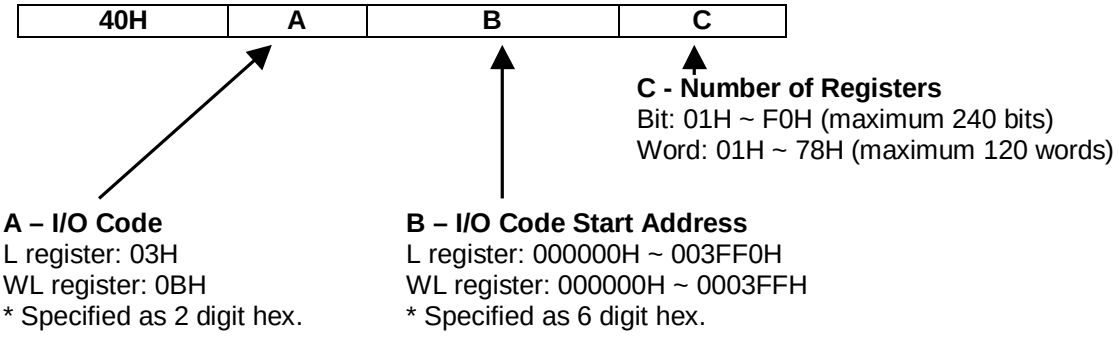
4.2 40H – Continuous Monitor

This task code monitors (reads) data stored in N continuous points (bits) or words starting at the specified I/O number. This task code is executed even when unoccupied; however, the response will be “02H.”

03 Where the I/O code and number specified in bits, the module searches the top of the monitor data from the data memory and gathers 8 bits as 1 byte then returns the monitor data as a response. If the number of bits requested is less than 8, a “0” is returned for the unrequested bits.

0B Where the I/O code and number specified in words, the module searches the top of the monitor data from the data memory and then returns the monitor data as a response.

4.2.1 Request



4.2.2 Response

B – Data

A	**40H**	**B**	. . . .	**B**

A - Normal Execution code is 00H (see section 4.6 for error codes)

B- Word Data	
H	**L**

B – Bit Data							
bit7							bit0
1st Point	2nd Point	3rd Point	4th Point	5th Point	6th Point	7th Point	8th Point

4.3 42H – Continuous Force

This task code is used to force set/reset on N continuous points (bits) or words starting at the specified I/O number.

4.3.1 Request

42H	**A**	**B**	**C**	**D**	. . .	**D**

C - Number of Registers
Bit: 01H ~ C8H (maximum 220 bits)
Word: 01H ~ 64H (maximum 100 words)

A – I/O Code
L register: 03H
WL register: 0BH
* Specified as 2 digit hex.

B – I/O Code Start Address
L register: 000000H ~ 003FF0H
WL register: 000000H ~ 0003FFH
* Specified as 6 digit hex.

D – Bit Data							
bit 7							bit 0
1st	2nd	3rd	4th	5th	6th	7th	8th
Every 8 points of Bit Data are gathered into 1 byte of image data. If bit data is less than 8 points, it is described as “0”.							

D – Word Data	
High	**Low**
Data is 0000H ~ FFFFH; byte x 2= word	

4.3.2 Response

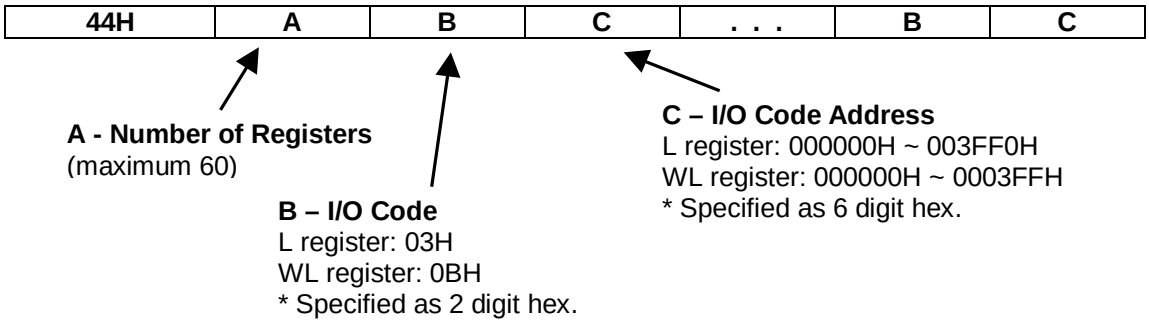
A	**42H**

A - Normal Execution code is 00H
(See section 4.6 for error codes)

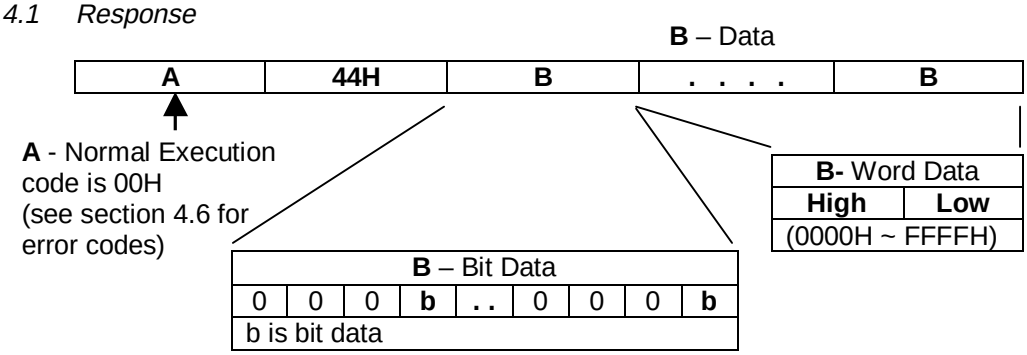
4.4 44H – Random Monitor

This task code monitors (reads) data stored in N random points (bits) or words starting at the specified I/O number. This task code is executed even when unoccupied; however, the response will be "02H."

Request



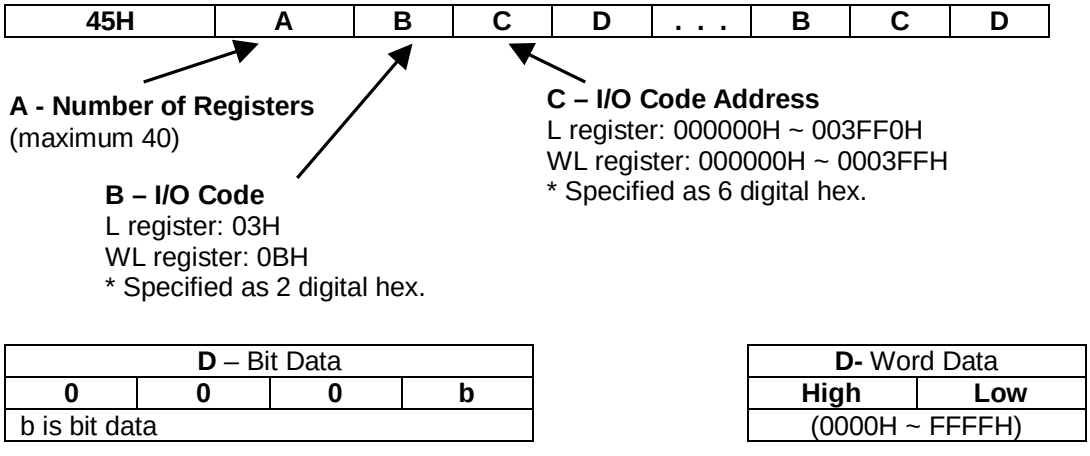
4.4.1 Response



4.5 45H – Random Force

This task code is used to force set/reset on N random points (bits) or words at specified I/O numbers.

4.5.1 Request



4.5.2 Response

4.6 Error Codes

Error codes corresponding to certain error factors are shown in Table 4.2.

Table 4.2 – Error Codes

Task Code	Response Task Code		Return Code		Error Factor
40H	Normal Execution	00H			
	Task Code Error	01H	Number of steps, number of words error	05H	Number of points requested exceeds prescribed range.
			I/O code error	06H	Undefined I/O type code is requested or requested I/O type cannot be monitored.
			I/O number error	07H	I/O number requested is out of the prescribed range.
	Warning	02H			Not occupied
42H	Normal Execution	00H			
	Task Code Error	01H	Number of steps, number of words error	05H	Number of points requested exceeds prescribed range.
			I/O code error	06H	Undefined I/O type code is requested or requested I/O type cannot be monitored.
			I/O number error	07H	I/O number requested is out of the prescribed range.
44H	Normal Execution	00H			
	Task Code Error	01H	Number of steps, number of words error	05H	Number of points requested exceeds prescribed range.
			I/O code error	06H	Undefined I/O type code is requested or requested I/O type cannot be monitored.
			I/O number error	07H	I/O number requested is out of the prescribed range.
	Warning	02H			Not occupied
45H	Normal Execution	00H			
	Task Code Error	01H	Number of steps, number of words error	05H	Number of points requested exceeds prescribed range.
			I/O code error	06H	Undefined I/O type code is requested or requested I/O type cannot be monitored.
			I/O number error	07H	I/O number requested is out of the prescribed range.

5.0 CHAPTER 5: AN EXAMPLE

5.1 General

In this example, the HE150ETN150 is to have an IP Address of 192.20.20.22, and logical ports of 21 and 3004. All but the last 3 fields of the IP Address are to be masked. The PC is using COM 2. On the PLC, registers WL0000 to WL00FF are to be read and WL0100 to WL01FF are to be editable. The PC's Ethernet card is set to 192.20.20.23.

5.2 HETCPIP Configuration

1. Connect the communications cable from COM2 on the PC to RS-232 port on the HE150ETN150.
2. Start the HETCPIP configuration software.
3. From **Comm Settings**, select **Comm2**.
4. Set the **IP Address** to 192.20.20.22, **Subnet Mask** to 255.255.255.0, **Logical Port 1** to 21 and **Logical Port 2** to 3004.
5. Click **Configure**.
6. Power cycle the module.

5.3 Set-up in ACTSIP-H or ActWin

Configure the HE150ETN150 module as a **CPU Link (LINK-02H)** in the **I/O Assignment** window. The **Link parameters 1** is as follows:

Link parameters 1 Top=0000 End=00FF

5.4 Chatter

Connections to the module can be made at IP address 192.20.20.22. Up to two concurrent connections to the module are possible through ports 21 and/or 3004. WL0000 to WL00FF are read only while WL0100 to WL03FF are read and write. To read and write to the module is accomplished using task codes (detailed in section 4). The implementation of these task codes is through TCP/IP software prepared by the user. An example of this type of software, Chatter.exe, has been included here for demonstration purposes only.

Note: Before running Chatter a 10Mb/s Ethernet card must be installed in the PC and properly configured under Windows 95 or NT

How to communicate to the HE150ETN150 with Chatter:

1. A file, HOSTS. (with no extension), must be created (or edited) within the windows sub-directory (e.g. c:\windows). This file assigns *Server Names* to IP Addresses. In this case, the IP address 192.20.20.22 is assigned a server name ETN150. The file is as follows:

Table 5.1 – File "HOSTS."

```
192.20.20.22    ETN150  # assigns name ETN150 to 192.20.20.22
```

2. Ensure the module and PLC are configured as detailed above in 5.2 and 5.3.

3. Start **Chatter.exe**. Set **Server Name** to ETN150 and **TCP/IP Port** to 21 (or 3004). Click **OK**. The screen in Figure 5.1 appears. If it does not, check your connections, configuration of the Ethernet card in the PC and HOSTS file.

Codes are entered in the bottom white area and responses from the HE150ETN150 module are displayed in the upper gray area.

Table 5.1 – Task Code Examples

Command	Task Code	Response
Monitor WL0000 to WL0004	00,12,ff,ff,00,00,40,0b,00,00,00,04	0 12 ff ff 0 0 2 40 X X X X X X X*****
Force ABCDH to WL0100 and 1234H to WL0101	00,12,ff,ff,00,00,42,0b,00,01,00,02,ab,cd,12,34	0 12 ff ff 0 0 0 42
Monitor WL00AE and L0008	00,12,ff,ff,00,00,44,02,0b,00,00,ae,03,00,00,08	0 12 ff ff 0 0 2 44 X X X X*****
Force FFFFH to WL01F0 and TRUE to L31FF	00,12,ff,ff,00,00,45,02,0b,00,01,f0,ff,ff,03,00,31,ff,00,01	0 12 ff ff 0 0 0 45
***** The value of X depends on the value in the particular register.		

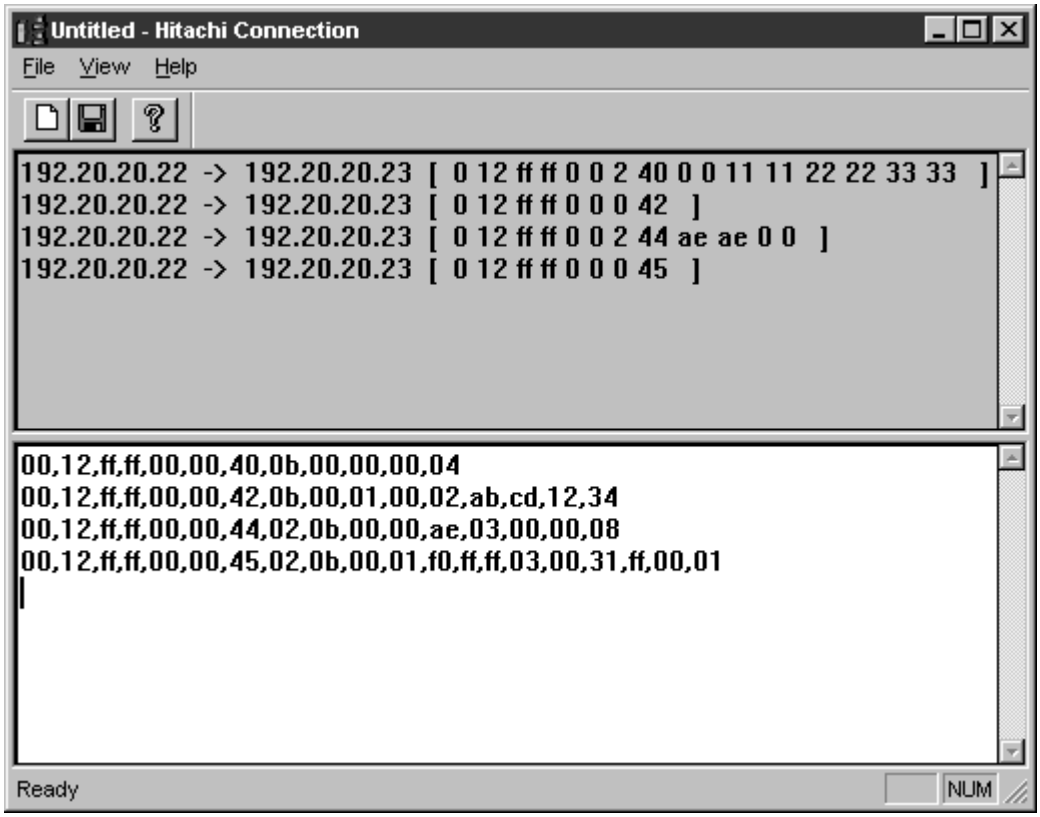


Figure 5.1 – Chatter Screen and Example

Note: In this example, WL0=0000H, WL1=1111H, WL2=2222H, WL3=3333H, WLAE=AEAEH and L8=FALSE, which gives the returned values (responses) as shown in Figure 5.1.