User Manual for the
HE150ETN100

Hitachi™ Ethernet Link Module for the Hitachi™ H-Series

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PREFACE

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

For user manual updates, contact Horner APG, LLC. Technical Support Division, at (317) 916-4274 or visit our web-site at www.heapg.com.

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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 utilizing the Hitachi™ Ethernet Link Module for the Hitachi™ H-Series to appropriately design the end system, to appropriately integrate the Hitachi™ Ethernet Link Module for the Hitachi™ H-Series 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.

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CHAPTER 1: INTRODUCTION

1.1 General

1.1.1 Horner APG Hitachi™ Ethernet Link Modules for the Hitachi™ H-Series (HE150ETN100) allow communications over an Ethernet network. The HE150ETN100 modules provide a means to make the same data available to CPUs (and other modules) located in up to sixty-four (64) H-Series PLCs. The way in which the information is made available is accomplished through an updating process where HE150ETN100 modules (one master and up to 63 slaves) exchange information over the Ethernet bus. A proprietary Ethernet protocol is used which sends standardized Ethernet packets. The HE150ETN100 can be configured as a master or a slave using Horner APG Hitachi Ethernet Link Configuration Software. (See Chapter 2 for software configuration details.)

1.1.2 Each HE150ETN100 module is responsible for sending its designated link area to all other HE150ETN100 modules in the network via the Ethernet bus. Likewise, each HE150ETN100 module is also receiving updates from all other modules in the network about the data located in their respective designated link areas via the Ethernet bus. As a result, a common list of data (or "map") is made available (via the HE150ETN100 modules) to the CPUs (and other modules). . The CPUs (and other modules) in the H-Series PLCs respond accordingly depending upon how the user has configured them.

1.1.3 **Because each H-Series PLC can support up to two HE150ETN100 modules, it is possible to setup two different networks. The two networks, however, must split the amount of memory available to "link" the HE150ETN100 modules together (link area).** Whether one or two networks are used, the total link area can be no greater than 1,024 words (2,048 bytes). (In other words, when two networks are setup, it must not be assumed that each network has an allotted link area of 1,024 words. The link area (with a total of 1,024 words) must be split between them.)

1.2 Ethernet Network Communications using HE150ETN100 Modules

1.2.1 The Horner APG's Hitachi™ Ethernet Link Modules for the Hitachi™ H-Series (HE150ETN100) provide the necessary links to make the same data (or "map") available to CPUs (and other modules) in up to sixty-four H-Series PLCs. The CPUs (and other modules) respond accordingly depending upon how the user has configured them. The following explanation describes how various equipment functions together using an Ethernet network. (**See Figure 1.1 and Table 1.1.)**

IMPORTANT: All master *and* slave modules must be properly configured prior to network communications.

IMPORTANT: To ensure proper initialization and transmission, all slave modules must be powered-up before the master module is powered-up.

1. Power Up: The HE150ETN100 master and up to sixty –three HE150ETN100 slaves are assigned a base address. The master also allocates the amount of data that each HE150ETN100 transfers from its designated link area. The base address represents the designated link area for a particular HE150ETN100 module.

Example: HE150ETN100 Slave 1 (located in Rack #2) is assigned a specific base address for a designated link area that contains data relative to the temperature of the plant. HE150ETN100 Slave n (located in Rack #n) is assigned a different base address for a designated link area that indicates whether a fan is turned on or off. Through link data, the information is provided to all CPUs in the network.

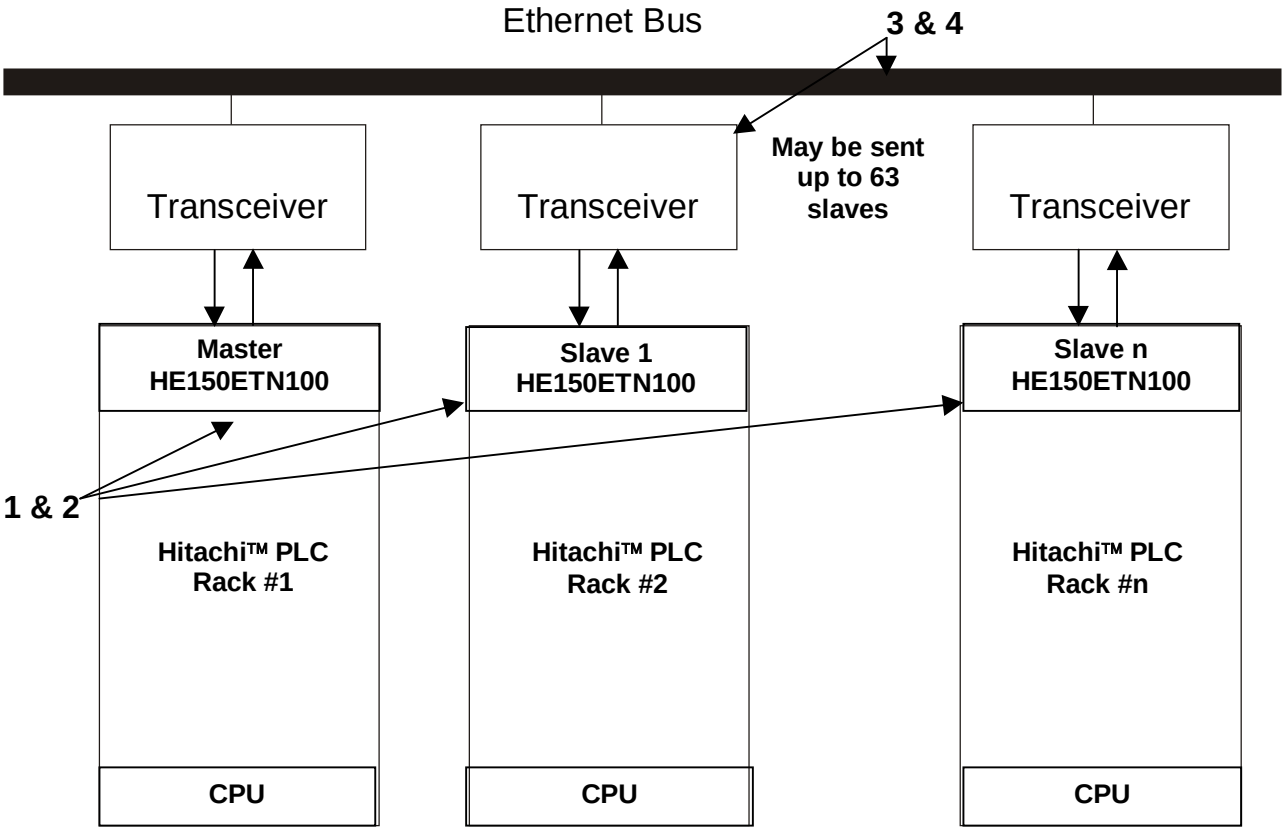

Figure 1.1 – Network Overview

2. After Power-Up: Each HE150ETN100 module (one master and up to sixty-three slaves) sends updates of its particular designated link area to all other HE150ETN100 modules in the network via the Ethernet bus. In addition, each HE150ETN100 module also receives updates from all other modules in the network about the data located in their respective designated link areas via the Ethernet bus. A common list of data (or a "map") is made available (via the HE150ETN100 modules) to the CPUs (and other modules). The CPUs (and other modules) in the H-Series PLCs respond accordingly depending upon how the user has configured them.

Note: All HE150ETN100 modules provide updates to all other HE150ETN100 modules whether or not there is a change in the status of their respective designated link areas.

3. The HE150ETN100 modules send and receive updates over the Ethernet bus via transceivers that are physically plugged into each individual HE150ETN100 module. The transceivers used with the HE150ETN100 modules are purchased separately. Table 1.1 provides a list of the four classes of transceivers that are compatible with HE150ETN100 modules as well as other pertinent information. The trunk and drop distances of the Ethernet Bus are determined by the Ethernet transceiver rather than by the HE150ETN100 module.

4. Before an HE150ETN100 module sends information to the Ethernet bus, it must, first, send the information to the transceiver which is physically plugged into the HE150ETN100 module. The transceiver plugs into the HE150ETN100 module's AUI Port. The HE150ETN100 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 HE150ETN100 module. The values below are the industry standards for four classes of transceivers compatible with the HE150ETN100. They are included for reference only. Actual values may change depending on application and environment. These values have not been tested with the HE150ETN100.

1.3 Specifications

Table 1.2 – HEC-ENET100 Specifications

Mounting Requirement	One I/O slot
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)
Network	1 Master and up to 63 slaves
Communications	One RS-232 port One AUI (Attachment Unit Interface) port

1.4 System Requirements:

The HE150ETN100 requires:

a. One free I/O slot
b. H-252, H-252B or H-252C CPU;
c. ACTSIP-H programming software for Hitachi™ PLCs, version 2.32A or higher (from Actron).
d. HEC_ENET configuration software (available from Horner APG, LLC.).

1.5 Physical Layout of the HE150ETN100

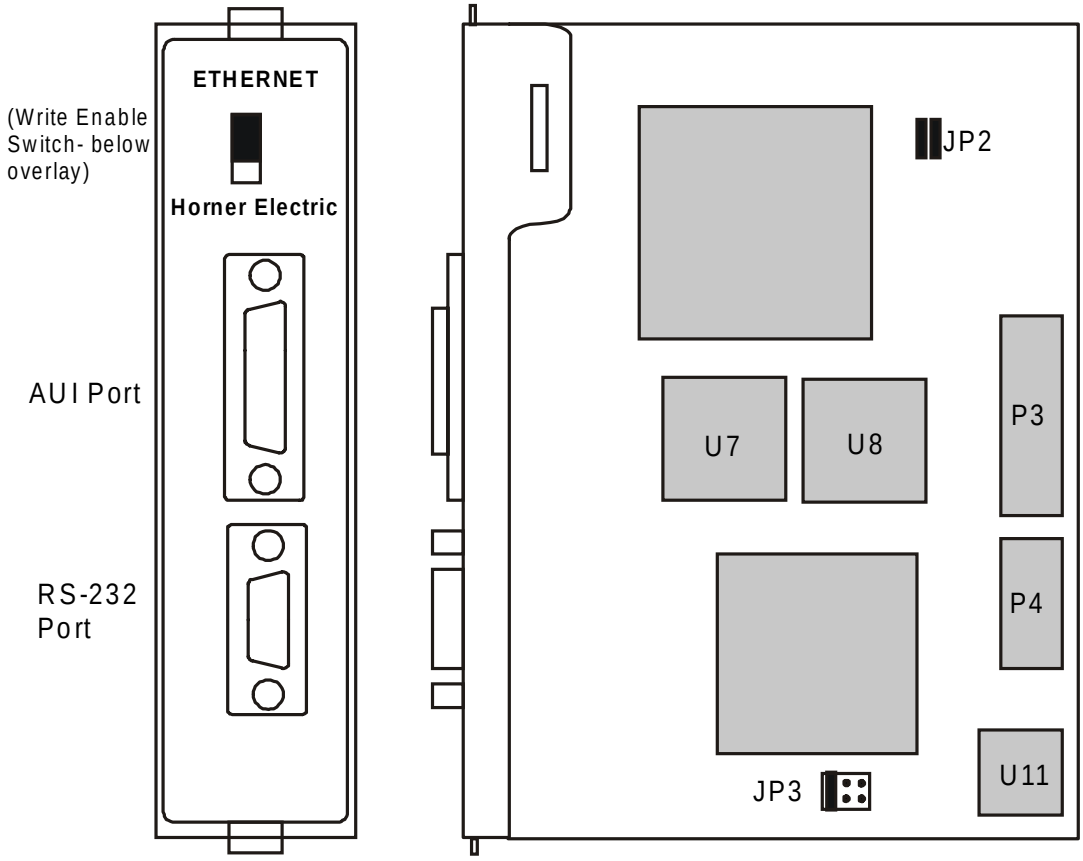

Figure 1.2 - HE150ETN100 Link Module

CHAPTER 2: INSTALLATION AND CONFIGURATION

2.1 HE150ETN100 Mounting Requirements

2.1.1 The HE150ETN100 Module plugs into any H-200 local slot. It requires an H-252, H-252B or H-252C CPU.

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

2.2 Configuring the HE150ETN100 with HEC_ENET Configuration Software

2.2.1 General

2.2.1.1 HEC_ENET supports field and factory configuration of the HE150ETN100 link module. The software requires an IBM PC or compatible personal computer (PC) using DOS version 5.0 or higher, and one uncommitted standard serial port assigned to COM1 or COM2. (COM1 is the default.)

Step 1: Plug the HE150ETN100 into the desired slot. DO NOT connect it to the Ethernet cable yet.

Step 2: Connect the HE150ETN100 to COM1 (or COM2) on the PC using a standard serial cable with a 9-pin male plug on the HE150ETN100 end. The HE150ETN100 appears as a DCE/MODEM to the PC.

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

Step 4: Start HEC_ENET. Type ***path*\HEC ETN** at the DOS prompt and press **<Enter>.**

If **COM2** is to be used: Type **HEC_ENET =C2 <Enter>.**

Three text windows are opened as in Figure 2.1. The upper is the **[Module Status]**; the middle is the **[Network Configuration]**; and the lower displays the function key's commands. The upper windows are updated when the program starts.

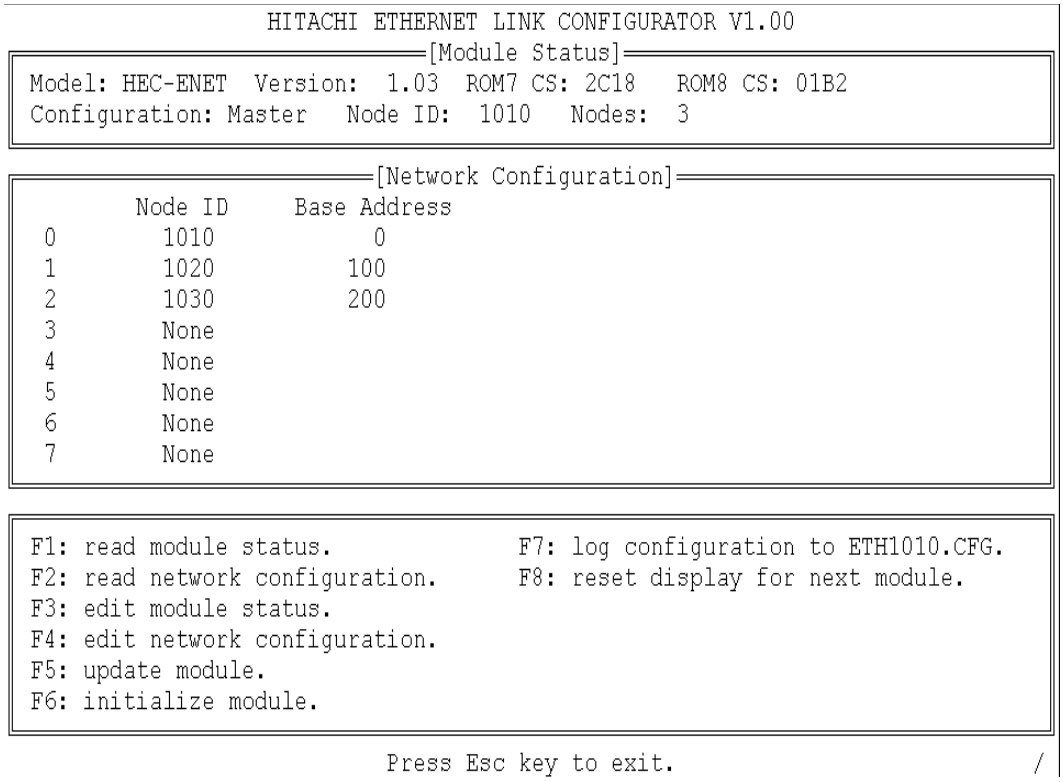

Figure 2.1 – HEC-ENET Screen

IMPORTANT: Figure 2.1 indicates the Base Address of one master module and one slave module. It also indicates the use of a "dummy" ID. The designated link area is indicated by the upper and lower Base Address. For example: The designated link area for the master (Node ID 1010) is from Base Address 0-100 and the slave's designated link area (Node ID 1020) is from 100 – 200. Node ID 1030 is a "dummy" ID that is used to set the lower base address for Node ID 1020 (slave). The use of the dummy ID shortens the block (in cases when the user is not intending to use the maximum of 1,024 words) and thus reduces unnecessary traffic on the network.

Step 5: Press **<F3>** to set the **Configuration** of the HEC_ENET, **Node I***D*, and **number of Nodes**.

Within the **[Module Status]** window, the first line displays HE150ETN100 information; this is not configurable by the user. The second line displays the following alterable items:

Table 2.1 - Summary		
Configuration	**Node ID**	**Nodes**
Use the **up** and **down** arrow keys to scroll through the options below:	Enter the desired number:	Enter the desired number:
Blank Not configured module. **Slave** Module configured as a slave node. **Peer** Reserved for future link firmware. **Master** Module configured as a master node. **Faulted** Incorrect configuration	0 to 65534 – each module must have a unique number	Master: 1 to 64 – set for master modules only
Use the left and right arrow keys to move between fields. Press <Esc> to exit the Module Status window		

Step 6: **For HE150ETN100 configured as a master ONLY**.

Press **<F4>** to set **the Network Configuration**. Each table line sets up one node. The table consists of a table entry number (column of numbers furthest to the left), a decimal **Node ID**, and a hexadecimal **Base Address**.

Note: The table is sorted by **Base Address**. Therefore, the table entry number corresponding to a particular **Base Address** may change when the window is exited, and the table is sorted.

Step 7: Press **<F5>** to write the configuration to the HE150ETN100 module. Press **<Esc>** to quit.

2.2.2 Summary of Function Keys

Esc The **<Esc>** key exits any part of the program. If at the main menu (or if the program is waiting for communication with the module), pressing **<Esc>** exits back to the DOS prompt.

F1 Reads the **Module Status**.

F2 Reads the **Network Configuration**. (Only applicable for modules configured as master devices.)

F3 Moves to the **Status** window and displays editing instructions in the operator window. Select slave or master. Set Node ID between 0 and 65534 (must be unique to node). If master is selected, the number of nodes is set between 1 and 64.

F4 Used for master nodes only; moves to the **Network Configuration** window and displays editing instructions in the lower window. The scrollable window displays 8 of the possible 64 node entries. Each node is given a unique **Node ID** equal to the **Node ID** given the slave during its configuration. Also, each node is assigned a **Base Address** between 0 and 3FFH. Unused table entries are marked as "None."

Upon exit (pressing **<Esc>**), the number of nodes is automatically adjusted and *Network Configuration* table is sorted by **Base A***ddress*. Also upon exit, the table is checked for duplicate **Node IDs** or **Base Addresses**. Any duplicates are reported in an error window. Any duplication must be corrected.

The **Base Address** represents the start of that node's data block. The **Base Address** for the next node indicates the end of the first node's data block. The last node's data block extends from its base address up to the end of the 3FFH word link area. If it is not necessary to exchange all 3FFH words of global data, a dummy **Node ID** and **Base Address** is entered to shorten the last block and thus reduce Ethernet traffic.
Note: 'receive-only' slave modules are not entered into the network configuration table.

F5 Writes configuration to the module. The configuration is stored in nonvolatile memory

F6 Reserved for future use. At present does nothing.

F7 Saves the configuration to a file in the current directory called ETHxxxxx.CFG (xxxxx is the node ID). This creates a permanent record of the module configuration.

F8 Resets the display to a null condition. This enables the **Module Status <F1>** or **Network Configuration <F2>** to be cleanly read. This null condition may be programmed into a module.

2.3 ACTSIP-H Setup

2.3.1 Each HE150ETN100 (slave or master) on the link must be set up to operate with its PLC. The link module fits in any I/O slot in a basic or standard base, not in an expansion base. To set up the module using the ACTSIP-H programming software:

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.

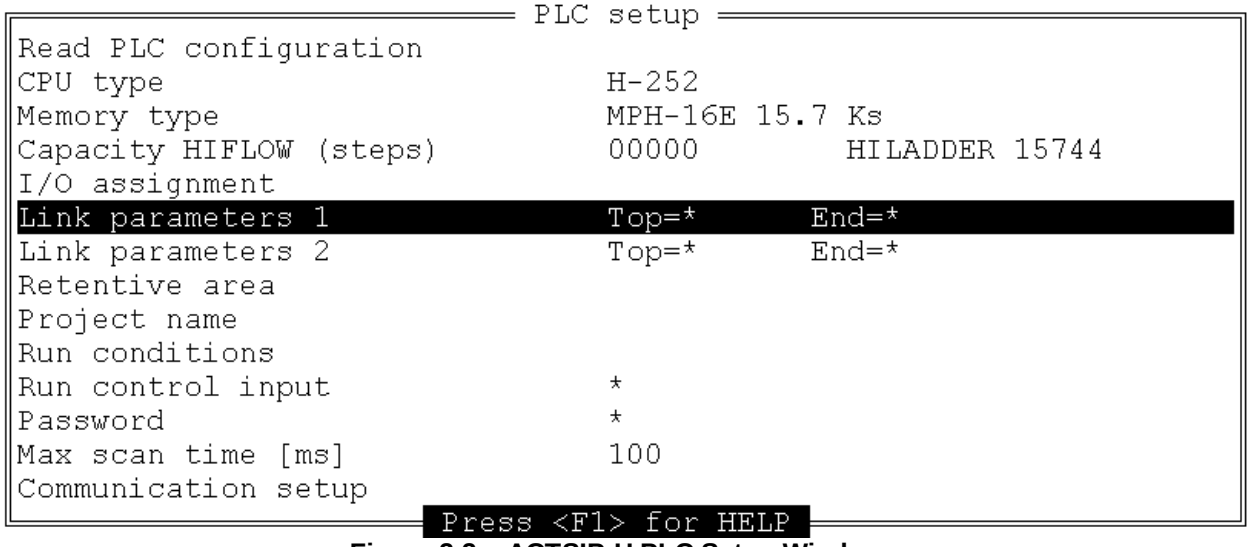

Figure 2.2 - ACTSIP-H PLC Setup Window

Step 3: Scroll down to the **I/O assignment** and press **<Enter>.** The **I/O assignment** window appears as shown in Figure 4. Choose the slot occupied by the HE150ETN100, using the right/left arrow keys. Press **<PgDn>** and **<3>** to choose **CPU Link** from the list to the right. LINK is placed in the slot.
If there are two modules in this rack, do the same for the second module. Press **<Esc>** when complete.

Step 4: Scroll down to **Link parameters 1** and press **<Enter>** (Link 1 is the module nearest to the CPU; Link 2 is the module 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 any WL register as long as the size (i.e., ***End-Top***) equals that specified in **Network Configuration** of HE150ETN100 for that node. Press **<Esc>** when completed.
Do the same for **Link parameter 2** when applicable.

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

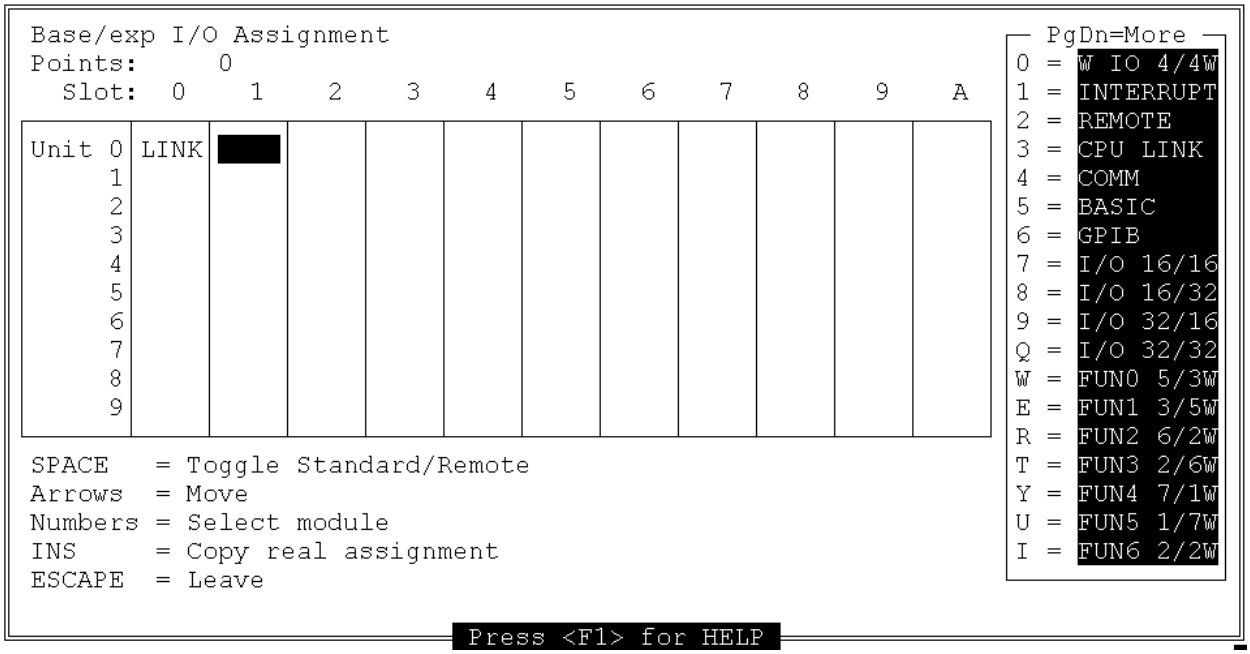

Figure 2.3 - I/O Assignment Screen

Step 6: The setup 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.

2.4 Configuration and Setup Example

2.4.1 General

2.4.1.1 In the example, the network consists of three physical nodes, one master and two slaves. The master transmits 256 words of data: The first slave sends 100 words of data, and the second slave sends 64 words of data.

2.4.2 Configuration with HEC_ENET

2.4.2.1 Configure each module using the HEC_ENET software. Two modules are configured as slaves and are arbitrarily assigned **Node IDs** 1020 and 1030. One module is configured as a master and is arbitrarily assigned **Node ID** 1010. Additionally, the **Master's Network Configuration** is as follows:

Table Entry Number	Node ID	Base Address
0	1010	0
1	1020	100
2	1030	164
3	1040	204
4	None	

2.4.2.2 In this configuration, a dummy node is added at the end (table entry number 3) to shorten the total data transferred, and thus, reduce the overall Ethernet traffic.

2.4.3 Setup in ACTSIP-H

2.4.3.1 Configure each HE150ETN100 module as a **CPU Link** in the **I/O Assignment** window. The **Link parameters 1** for each module is as follows:

Master (Node 1010)	Top=0000	End=00FF
Slave 1 (Node 1020)	Top=0100	End=0163
Slave 2 (Node 1030)	Top=0164	End=01A4

2.4.3.2 In this example, the master transmits 256 words (100 HEX words) of data stored in the WL000 to WI00FF link registers of all the dual port memories. Slave 1 transmits 100 words stored in WL0100 to WL0163, and slave 2 transmits 64 words stored in WL0164 to WL01A4.

2.4.4 Example Summary

Module	Number of Words	HE150ETN100 Configuration		ACTSIP-H Setup	
		Node ID	Base Address	Top	End
Master	256 (100H)	1010	0	WL0000	WL00FF
Slave 1	100 (64H)	1020	100	WL0100	WL0163
Slave 2	64 (40H)	1030	164	WL0164	WL01A4
Dummy	remainder	1040	1A5	N/A	N/A

CHAPTER 3: WIRING

3.1 Jumper Connections

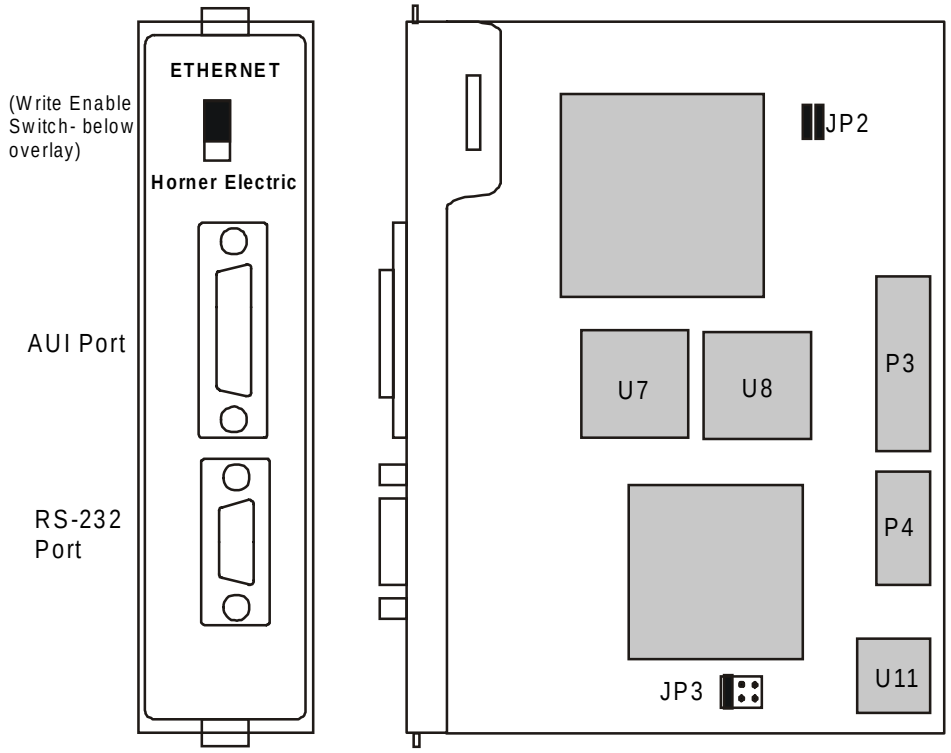

Figure 3.1 – Jumpers/Plugs

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.)

3.2.1 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.

3.2.2 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 fiber-optic Ethernet- 10BASE-FL, FOIRL.

3.3 Wiring Diagram and Pin-outs

3.3.1 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

3.3.2 The wiring diagram of an HE150ETN100 link module network is shown in Figure 3.2:

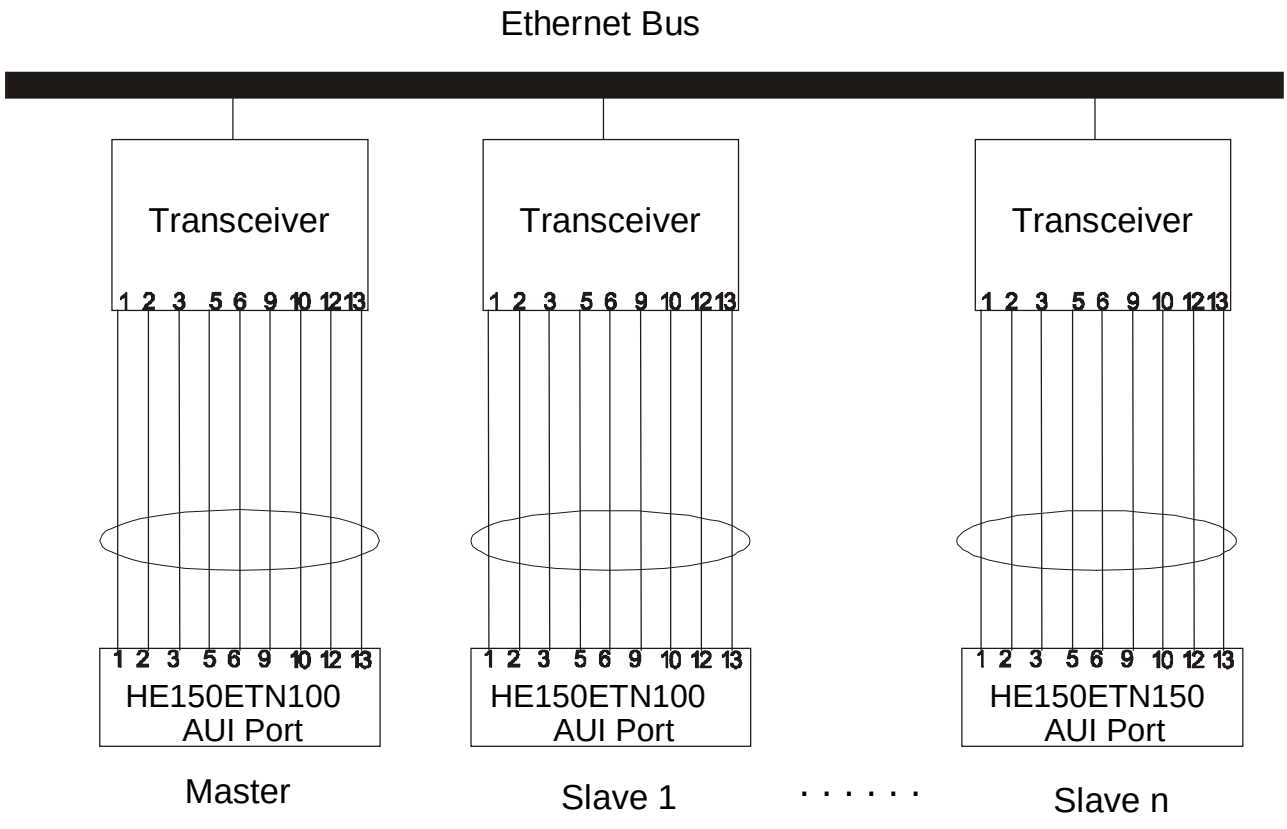

Figure 3.2 - Wiring Diagram