SIEMENS

SIMATIC TIWAY I

Host Adapter

User Manual

Order Number: PPX:TIWAY–8102
Manual Assembly Number: 2587871–0002
Second Edition

⚠ DANGER

DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

DANGER is limited to the most extreme situations.

⚠ WARNING

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and/or property damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury, and/or damage to property.

CAUTION is also used for property-damage-only accidents.

MANUAL PUBLICATION HISTORY

SIMATIC TIWAY I Host Adapter User Manual
Order Manual Number: PPX:TIWAY–8102

Refer to this history in all correspondence and/or discussion about this manual.

Event	Date	Description
Original Issue	06/84	Original Issue (2704939–0001)
Second Edition	10/95	Second Edition (2704939–0002)

LIST OF EFFECTIVE PAGES

Pages	Description	Pages	Description
Cover/Copyright	Second		
History/Effective Pages	Second		
iii — vi	Second		
1-1 — 1-5	Second		
2-1 — 2-21	Second		
3-1 — 3-6	Second		
4-1 — 4-22	Second		
5-1 — 5-5	Second		
Registration	Second		

Contents

Chapter 3 Host Adapter Protocol

Chapter 4 Installation

Chapter 5 Diagnostic Tests

List of Figures

List of Tables

Chapter 1

Overview

1.1 Introduction

The SIMATIC® TIWAY™ I Host Adapter is a device which allows a Host Computer to be connected to the TIWAY I Communications Network. This manual describes the installation and operation of the Host Adapter.

This chapter contains a brief description of the TIWAY I system and the Host Adapter's role within the system. The remainder of the manual describes the Host Adapter's function (Chapter 2), protocol (Chapter 3), installation procedures (Chapter 4), and diagnostic tests (Chapter 5).

1.2 TIWAY I System Characteristics

TIWAY I is a Local Area Network (LAN) which is designed for industrial environments. The TIWAY I network connects a series of Siemens Programmable Controllers. With the network, you can obtain, modify or replace data stored in any of the following controllers:

- SIMATIC 520/530
- SIMATIC® PM550™
- SIMATIC® 5TI™, Series 102, 103

TIWAY I is designed to satisfy today's factory requirements for acquiring data and controlling manufacturing processes. It is a significant enhancement of Siemens' "Local Line," which has supported the PM550 and DS 990 computer products since 1991. The improvements to Siemens' Local Line include extended geographic coverage, increased data transmission rates for higher information throughput, and a common interface which permits communication with any of the controllers mentioned above.

TIWAY I is a "hosted" network: a primary (host) computer controls up to 254 separate Secondaries, providing a central collection point for information. With appropriate host software, a TIWAY I operator can program, monitor, and control any controller on his network from a single location.

TIWAY I System Characteristics (continued)

The importance of the new TIWAY I Host Adapter is that it provides a communications link between the TIWAY I network and any host computer. Figure 1-1 is a block diagram of a TIWAY I network with a Host Adapter.

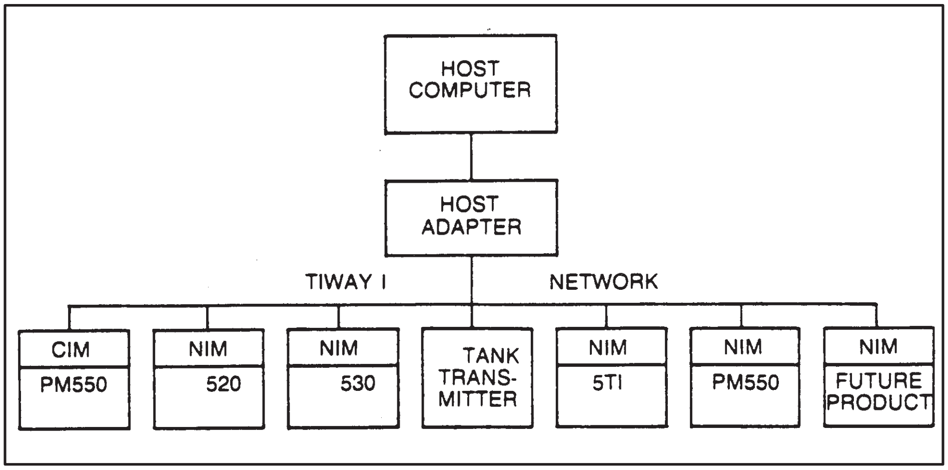


Figure 1-1 TIWAY I System Block Diagram

For detailed information on the TIWAY I system, you should refer to the *SIMATIC TIWAY I System Manual* (PPX:TIWAY–8101).

1.3 Related Publications

The following publication is available from Siemens to give you a reference for further information on the operation of TIWAY I and its compatible products.

	Manual No.
• *TIWAY I Systems Manual*	PPX:TIWAY–8101

You may also wish to refer to the following documents for more information regarding RS-232-C and RS-423 specifications.

1. EIA RS-232-C, "Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange," August 1969.
2. EIA RS-423, "Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits," April 1975.

Chapter 2

Description and Operation

2.1 Description

The Host Adapter allows communication with up to 254 Programmable Controllers or other Secondaries on a TIWAY network by connecting a host computer to the network. The Host Adapter has two interface ports, one to communicate with the host computer and one to communicate with the TIWAY I network. Both Host Adapter ports have several features and user-selectable options which allow you to modify the Host Adapter to meet your particular interface needs. The features and options are listed in the sections below for the host computer and the network ports.

There are four Host Adapter models. Table 2-1 shows the four models; you should choose the one which fits your needs.

Table 2-1 Host Adapter Models

	Type of Media Card	
	Local Line	**RS-232-C/423**
110 V	Model 7101	Model 7102
220 V	Model 7103	Model 7104

Host Computer Port Features and Options

Features:

- RS-232-C/423 port (DTE)
- 7-bit Hex-ASCII data
- 1 stop bit
- Host Computer/Host Adapter communications via Non-intelligent Terminal Protocol using command codes

Options:

- Baud rates ranging from 110 to 19.2K bps
- Synchronous/asynchronous modem use
- 7 bits of data with or without a parity bit
- Even or odd parity
- Full or half duplex communication
- Modem or direct line to the host computer

Network Port Features and Options

Features:

- 16-bit cyclical redundancy check (CRC–CCITT) error detection
- Connection to as many as 254 controllers via NIMs
- High Level Data Link Control (HDLC) protocol

Options:

- Baud rates ranging from 110 to 115.2K bps
- Full or half duplex communication
- NRZI/NRZ
- Modem or direct line connection
- Synchronous or asynchronous communication

Other Host Adapter Features and Options

Features:

- TIWAY I conformant on the network interface side
- Noise hardened
- Suitable for factory environment
- Internal user test
- Host Computer/NIM communication using Primitives (TIWAY I network instructions)

Options:

- Local Line bias if Host Adapter is located at the physical end of the Local Line cable
- Can be logically disconnected from the TIWAY I network via a dipswitch

Description (continued)

The Host Adapter protocol enables it to be used with any host computer (see Chapter 3). Both synchronous and asynchronous communications are supported for the Host Port. Baud rates on the Host Port range from 110 to 19.2K bps.

The Network Port on the Host Adapter has two communication options. The first is a direct connection to the TIWAY I network via a Local Line Interface Card. This will connect directly with the TIWAY I Local Line (twisted pair) network, which will allow a network length of up to 25,000 feet and 1500 VRMS isolation. The second option is an RS-232-C/423 synchronous/asynchronous modem attachment.

The Network Port baud rate ranges from 110 to 115.2K bps. It supports the High-Level Data Link Control (HDLC) protocol with 16 bit cyclical redundancy check (CRC-CCITT) error detection and will support up to 254 Secondaries on the TIWAY I network.

2.2 Host Adapter: Block Diagram Analysis

Figure 2-1 illustrates the basic structure of the Host Adapter.

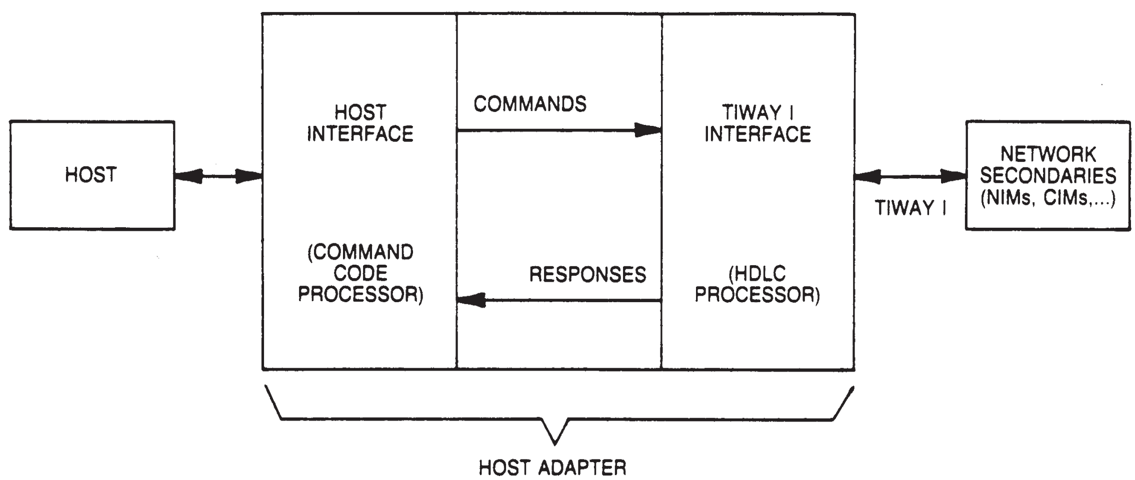


Figure 2-1 Block Diagram of TIWAY I Host Adapter

The major functional components of the Host Adapter are:

- CPU card
- RS-232-C/423 card
- Local Line card
- Power Supply

These four components will be described in the sections that follow.

CPU Card

The CPU card consists of 16K RAM, 16K ROM 2 port Serial Communications Controller, a 12 MHz (external clock) TMS–9995 microprocessor, one 8-switch and one 10-switch dipswitch bank, 6 LEDs (which indicate the status of the Host Adapter), a watchdog timer, and baud rate generation and control circuitry.

The Serial Communications Controller (SCC) implements the network control functions at the hardware level. It can generate the transmit and receive clocks and synchronize Receive operations in the HDLC operation. The SCC has two channels with separate transmitters, receivers and baud rate generators.

Host Adapter: Block Diagram Analysis (continued)

RS-232-C/423 Card

The RS-232-C/423 card provides a standard format of communication that is compatible with most user I/O equipment. An output driver and input receiver for the RS-232-C/423 card transfer data to and from the communication cable. They are disabled during a hardware reset to prevent spurious line signals during power-on/reset. Jabberstop circuitry is used on this card to prevent the communications media from being tied up for an excessive amount of time, such as when a software failure leaves the CPU in the active transmission state continuously transmitting data over the communications channel. The jabberstop will halt this condition after an excessive number of data bits are detected in the outgoing data stream.

Local Line Interface Card

The LLIF (Local Line Interface) card uses opto-isolated line driver/receivers to send or receive data to or from the CPU card. A jabberstop circuit serves to disable communications from the CPU card to the LLIF card when the transmission length of data frames becomes excessive. The LLIF card receives its power from the CPU card interface along with the necessary bias voltages from the card's isolated power supply.

Power Supply Card

The power supply is a forward converter switching type, which provides both +5 volts DC and –5 volts DC for operation. The power supply protects against excess current and voltage, and has an internal fuse to protect against abnormal component short circuits.

2.3 Communications

To make communications with a controller more user-friendly, there are different levels of communications between each of the network components as shown in Figure 2-2. Each level has its own format for communicating. In effect, each level “builds” upon the next lower level.

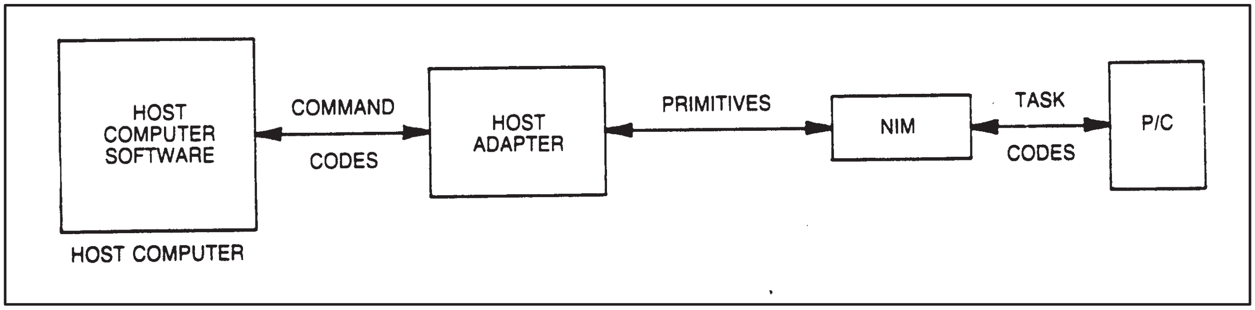


Figure 2-2 Network Communication Levels

First, at the most basic level, there is Task Code Communication between the NIM and the controller. Each model of controller uses a different group of Task Codes. The next level of communication is that between the NIM and the Host Adapter. At this level Primitives are used. Only one set of Primitives is used by all NIMs, as described in Section 2.4. The third level of communication is between the Host Adapter and the host computer. Communication at this level is accomplished through the use of Command Codes. Finally, at the highest level, there is the communication between an operator and the host computer. This level involves the software of the host computer, which is used to generate the Command Codes.

The following is an example of the series of events that would occur when a specific instruction is sent to a controller.

Highest Level

1. User runs a program written to do a specific job. The program asks for the required data (i.e., which controller is to be talked to, etc.).

   The user's program generates the instruction and puts it into the correct format (Non-intelligent Terminal Protocol). Here, the instruction is probably a Primitive, embedded in a command code instruction.

2. This instruction is then embedded in a high-level language (for example, PRINT ":000E....;").

3. The high-level language command (PRINT) is processed when it goes to the next lowest level, which is the Host Adapter.

4. The Host Adapter strips away the command code section of the instruction and uses it for routing the remainder of the instruction (the Primitive) to the network.

Lowest Level

5. The NIM takes the instruction, isolates the part it needs, and translates the remainder into a code understandable to the controller. Figure 2-3 shows the Host Adapter Message Structure.

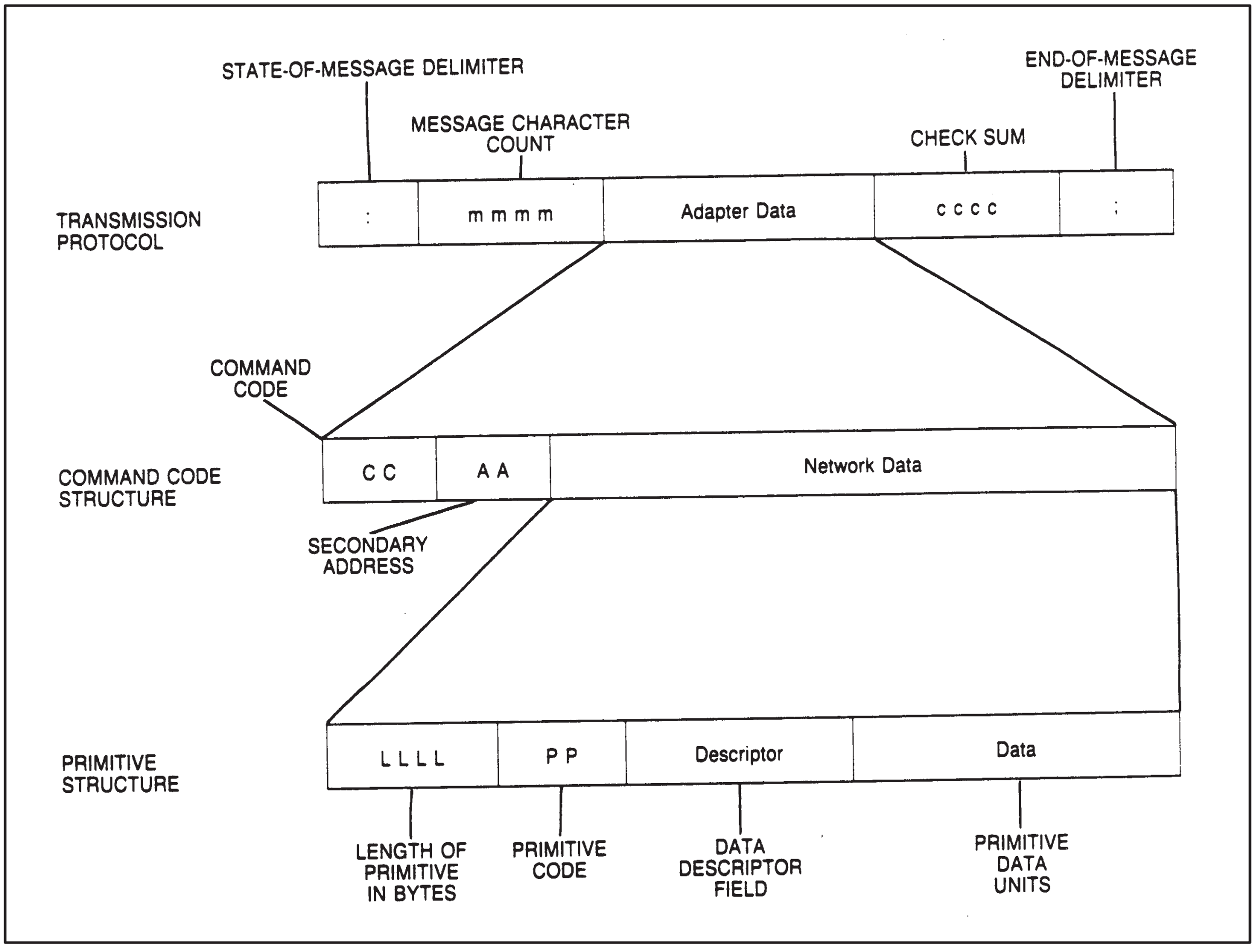


Figure 2-3 Host Adapter Message Structure

2.4 TIWAY I Primitives

Primitives are high-level commands used by the network control interface which allow a user to communicate with different Secondaries in the same manner. A Primary can access, for example, Image Register memory in a NIM-equipped 520, 530, 5TI, and PM550 controller with exactly the same command, without regard to the specific Task Codes used by that controller. The purpose of the Primitives is to remove the differences between the controllers. This allows all TIWAY controllers to be treated equally for application programs. The Primitives also allow data to be accessed more efficiently by adding powerful options to the data transfer. The data types. lengths of data types, and data addresses supported by the Primitives provide greater flexibility than the Task Codes supported in a standard programming peripheral such as a Video Programming Unit (VPU). Some of the benefits of the Primitives are:

- A reduction in the amount of host computer software needed to acquire data from the Secondaries.
- The elimination of the different types of software required to uniquely handle different types of Secondaries.
- More efficient use of the available network bandwidth by increasing the amount of data that is available in a single message. For example, with a single programming peripheral Task Code, you might be able to access no more than 15 words of data. With some Primitives, up to 134 words can be accessed.
- A reduction in total system loading. This is possible because the Network Interface Modules can memorize data locations that are repeatedly accessed. Certain Primitives enable a user to access a block of data previously defined and stored in the controller.

Table 2-2 provides a list of TIWAY I Primitives.

Table 2-2 TIWAY I Primitives

Primitive	Description
00	Exception reporting
01	Native task codes
02	Machine status
03	Machine type configuration
04	Primitive format configuration
10	Change state
11	Self Diagnostics
20	Read block (single continuous block)
21	Read random block
30	Write block (single continuous block)
31	Write random block
32	Fill block
33	Buffered write
40	Locate (instruction execution memory)
41	Remove (instruction execution memory)
42	Insert data elements
50	Define block (up to 32 separate blocks)
51	Gather blocks (as defined)
52	Write and gather defined blocks
53	Program condition
54	Poll condition

The Host Adapter will allow all TIWAY I Primitives. Refer to the NIM User Manuals for Primitives supported in each NIM. For a more detailed description of Primitive structure and functions, refer to the *SIMATIC TIWAY I Systems Manual* (TIWAY–8101).

The CIM does not support any TIWAY I Primitives.

2.5 Host Adapter Command Codes

The devices on either side of the Host Adapter – the host computer and the TIWAY I network – are entirely different in protocol. The adapter is therefore not only an interface translator, but a network controller as well. The host computer interface supports a set of Communication Adapter Command Codes which provides network control by way of high-level command code operations. The following sections describe each command code, which are briefly summarized below:

00	Error Response	05	Disconnect Secondary
01	Send Network Data	06	Read Secondary Log
02	Broadcast Network Data	07	Read Secondary Diagnostics
03	Poll Secondary	08	Read Adapter Diagnostics
04	Connect Secondary	FF	Reset Adapter

Error Response Command Code – 00

The Error Response command code is used primarily to notify the host of an exception from normal operation within the Host Adapter. There are three possible areas where an error can occur. Each of these areas has a subset of error codes based on the area where they occurred. The following chart shows the three areas and the error codes for each:

NOTE: Upper-case characters represent Hexadecimal digits; lower-case characters represent binary digits.

Code < 00 >	<0 0 0xxx xxxx > – Network Exception Area
Code <00 >	<0 0 1xxx xxxx > – Host Exception Area
Code < 00 >	<1 0 0xxx xxxx > – Adapter Internal Exception Area

The command and response for the Error Response Code is shown below:

Command: None

Response: <00> <dddd> (<aa>)*

where:

<aa> = the Secondary address field. Present only when a network error has occurred.

<dddd> = the diagnostic code (see Table 2-3).

*() denotes optional element

Table 2-3 Error Diagnostic Codes

Code	Meaning	Code	Meaning
0000	Undefined network problem	0082	Lost CTS on Host Port transaction
0001	Secondary timed out	0083	Timed-out waiting on Host transaction
0002	Miscellaneous Secondary protocol errors	0084	Unrecognized command code
0003	Wrong Secondary (aa) responded	0085	Invalid field received with command code
0004	Secondary frame too short	0086	Host frame of excessive length
0005	Secondary frame too long	0087	Host frame too short
0006	Bad (Null) address	0088	Secondary not connected to network
0007	No data returned from Secondary	0089	Missed start of message delimiter
0008	Receive buffer overflow	008A	Missed end of message delimiter
0009	FCS errors on frame received	008B	Message length count error
000A	Frames aborted by Secondary	008C	Message check-sum bad
000B	Secondary timeouts	008D	Invalid Hex-ASCII character received
000C	Transmitter underruns	1000	Undefined Adapter problem
000D	Receiver overruns	1001	Memory management error
000E	Frame did not end on byte boundary	1002	No media card installed on Host Port
0010	Lost DCD (Data Carrier Detect) on RS-232 receive	1003	System stack management error
0011	Lost CTS (Clear to Send) on RS-232 receive	1004	System queue management error
0012	Received an invalid frame	1005	Illegal interrupt received by processor
0013	Illegal communications interrupt	1006	Invalid op-code encountered by processor
0014	Timed-out waiting on DCD (half-duplex RS-232)	1007	Buffer management error
0015	Timed-out waiting on CTS (RS-232)	1008	No buffer available at present
0080	Problem undefined on host	1009	No network media card installed
0081	Lost DCD on Host Port transaction	100A	All memory is allocated
		100B	Adapter ONLINE switch in OFFLINE position

Send Network Data Command Code – 01

The Send Network Data command code transfers an information frame over the network. All protocol control information is handled by the HDLC layers in the Host Adapter. Normally, a network response will be passed back up to the Host Port by the command code processors in the Host Adapter. If an exception occurs, then the exception command code will be returned.

The following shows the command and response for this code:

Command: <01> <aa> <pppp...>

Response: <01> <aa> <pppp...>

where:

< aa> = the Secondary address field to which the data is sent
<pppp> = the network Primitive

NOTE: When using a CIM on the network, a Poll Secondary command may be necessary after a Send Network Data command. This occurs because some CIM commands may take longer to complete than the Host Adapter’s poll cycle time.

Broadcast Network Data Transfer Command Code – 02

The Broadcast Network Data command code is used to send network Primitive elements to all Secondaries simultaneously. The Host Adapter passes the information to the command code processor, which builds Unnumbered Information HDLC Frames which are sent over the network. The HDLC layer returns either an indication of successful transmission, or an error code. The response can be retrieved by the Poll Secondary command code.

NOTE: A Poll Secondary command code (03) must be sent immediately after each Broadcast Network Data Transfer command. This will ensure that all latent information is cleared from the Secondary.

The command and response for this code are shown below:

Command: <02> <pppp...>

Response: <02>

where:

<pppp> = the Primitive data element

Poll Secondary Command Code – 03

The Poll Secondary command code is used to request a response from a Secondary. This command is used either in conjunction with the Broadcast Network Data Transfer command or to retrieve any latent information from a Secondary.

The following shows the command and response for this code:

Command: <03> <aa>

Response: <03> <aa> <pppp...>

where:

<aa> = the Secondary address field to which the data is sent

<pppp> = the Primitive data element

Connect Secondaries Command Code – 04

The Connect Secondaries command code is used in conjunction with an address list to connect Secondaries to the network. If no address list is found, then the Adapter enters an error state and an error processor is invoked. If the Broadcast Address (FF hex) is sent, the Host Adapter will poll all Secondaries at the end of the Transmit state. It will also transmit a list of on-line Secondaries back to the Host. If no Secondaries connect to the network, an address field of 00 Hex is returned.

> **⚠ CAUTION**
>
> **If the Broadcast Address (FF Hex) is sent, a lengthy delay is possible (4 seconds for each Secondary address that is not physically connected to the network).**
>
> **The Broadcast Address is only recommended when a large number of Secondaries is connected to the network.**

The command and response for this code is shown below:

Command: <04> (<aa> <aa> <...>)*

Response: <04> (<aa> <aa> <...>)*

where:

<aa> = the Secondary address which is to be connected

NOTES: If a Broadcast Address is sent (FF Hex), then no other address field should be sent in conjunction with it.

The CIM does not discard old network information frames when it is connected or disconnected. Therefore, when connecting a CIM, you should send a Poll Secondary command from the Host to the CIM until a “No Data Returned from Network Secondary (00 0007)” error response is returned. This will ensure that any latent information in the CIM is removed.

* () denotes optional element

Disconnect Secondaries Command Code – 05

The Disconnect Secondaries command code is used in conjunction with an address list to disconnect Secondaries from the network. If no address list is found, then the Host Adapter generates an error condition and invokes the error processor. If the broadcast address is found. then the Adapter will re-poll all Secondaries at the conclusion of the TRANSMIT cycle and build a table of off-line Secondary addresses to transmit to the Host Port. If no Secondaries disconnect, an address field of 00 Hex is returned.

NOTE: If a Broadcast Address is sent (FF Hex), then no other address field should be sent with it.

The following shows the command and response for this code:

Command: <05> (<aa> <aa> <...>)*

Response: <05> (<aa> <aa> <...>)*

where:

<aa> = the Secondary address which is to be disconnected

*() denotes optional element

NOTE: If no Secondary address is found, an address field of 00 is returned.

Read Secondary Log Command Code – 06

The Read Secondary Log command code reads the list of Secondaries currently connected to the network.

The command and response for this code are shown below:

Command: <06>

Response: <06> <aa> <aa> <...)

where:

<aa> = the Secondary addresses of the network log

Read Secondary Diagnostics – 07

The Read Secondary Diagnostics command code is used to read the diagnostic cell for a network Secondary. It consists primarily of status information related to the network functions performed in the Host Adapter. If no Secondary is connected, the Adapter generates an error condition and invokes the error processor.

The following shows the command and response for this code:

Command: <07> <aa>

Response: <07> <aa> <pppp> <xxxx> <tttt> <qqqq> <cccc> <ffff> <uuuu> <gggg>

where:

<aa> = Secondary address

<pppp> = number of times polled*

<xxxx> = number of I–frames transmitted*

<tttt> = number of timeouts

<qqqq> = number of I–frames received*

<cccc> = number of I–frames re–transmitted*

<ffff> = number of received errors from Secondary *

<uuuu> = number of transmitted errors to Secondary*

<gggg> = number of times Secondary initialized*

* since last Host Adapter reset

Read Adapter Diagnostics Command Code – 08

The Read Adapter Diagnostics command code retrieves the data for the internal status of the Host Adapter. This data contains the entire network status and is defined similarly to the Read Secondary Diagnostics <07> command code. The command and response for this code are shown below:

Command: <08>

Response: <08> <aaaa> <bbbb> <cccc> <dddd> <eeee> <ffff> <gggg> <hhhh> <iiii> <jjjj> <kkkk> <llll> <mmmm> <nnnn> <oooo> <pppp> <qqqq> <rrrr> <ssssssss>

where:

<aaaa> = number of invalid commands from Host

<bbbb> = number of Send Information commands processed

<cccc> = number of Broadcast commands processed

<dddd> = number of Poll Secondary commands

<eeee> = number of Connect Secondary commands processed

<ffff> = number of Disconnect Secondary commands processed

<gggg> = number of Read Secondary Log commands processed

<hhhh> = number of Read Secondary Diagnostic commands processed

<iiii> = number of Read Adapter Diagnostic commands processed

<jjjj> = number of Reset Adapter Commands processed

<kkkk> = total number of poll cycles

<llll> = total number of I–frames transmitted

<mmmm> = total number of timeouts Total number of timeouts

<nnnn> = total number of I–frames received

<oooo> = total number of I–frames re–transmitted

<pppp> = total number of receive errors

<qqqq> = total number of transmit errors

<rrrr> = total number of Secondary initializations

<ssssssss> = current system clock value in 256 microsecond intervals

Reset Adapter Command Code – FF

The Reset Adapter command code forces a software jump to the system initialization routine. This routine will run the power-up diagnostics and will re-initialize the operating system.

The following is the command and response for this code:

Command: <FF>

Response: <FF>

2.6 Specifications

Descriptor	TIWAY I Conformant
Theory of Operation	Open system interconnection (OSI) model developed by International Standards Organization (ISO)
Network Communication	1 channel per unit
Host Port Interface	RS-232-C/423
Max. Cable Length	50 feet (RS-232-C/423)
Network Port Interface	RS-232-C/423 or Siemens Local Line
Data Link Protocol	HDLC with 16-bit cyclic redundancy error checking (CRC-CCITT)
Host Port Protocol	Siemens Non-intelligent Terminal Protocol with improvements
Network Data Rates	110 – 115.2K bps
Host Port Data Rates	110 – 19.2K bps
Modem Type Supported	Asynchronous, synchronous; half/full duplex
Network Undetected Bit Error Rate	6 x 10E–13 (calculated) with premium cables
Unit Size	9.5″ high by 4.0″ wide by 7.5″ deep
Unit Power Consumption	20 VA maximum
Operating Temperature	0° to 60° C (32° to 140° F)
Storage Temperature	–40° to 85° C (–40° to 185° F)
Operating Humidity Range	0 – 95% relative humidity, noncondensing
Agency Approvals	UL Listed

Chapter 3

Host Adapter Protocol

3.1 General

This chapter describes the protocol which allows communication with the Host Adapter.

Physical Interface

The mechanical and electrical characteristics of the Host Adapter interface are described in the following sections.

Mechanical Characteristics. The Host Adapter functions as a data terminal (DTE) according to the EIA RS-232-C specification. Therefore, it requires a male (plug) 25-pin D-type connection on the communications cable. Table 3-1 lists the pin assignments used; all other pins remain vacant in order to prevent damage to the host computer or the Host Adapter which might be caused by non-standard pin usage.

Table 3-1 Standard Connector Pin Assignments

Pin	ISO #	RS-232-C Name/Function
1	101	AA – Protective Ground
2	103	BA – Transmitted Data
3	104	BB – Received Data
4	105	CA – Request to Send (RTS)
5	106	CB – Clear to Send (CTS)
6	107	CC – Data Set Ready (DSR)
7	102	AB – Signal Ground
8	109	CF – Received Line Signal Detector/Data Carrier Detect (RLSD/DCD)
15	114	DB – Transmitter Signal Element Timing
17	115	DD – Receiver Signal Element Timing
20	108/2	CD – Data Terminal Ready (DTR)

Electrical Characteristics. Line drivers and receivers which are compatible with RS-232-C and RS-423 specifications may be used with the Host Adapter.

Data Link Interface

The data link layer services provide secure message transfer over a physical link which may be error-prone. These services include link establishment and disconnection, character and message framing and sequence control, and error checking.

Data Link States

If the Host Adapter is connected directly to the Host Computer without modems, the Host Adapter functions as data terminal equipment (DTE) and the Host Computer functions as data communications equipment (DCE). If modems are used, both the Host Adapter and the Host Computer are DTE; the modem is DCE on both input and output. The Host Adapter can control the modem circuitry to provide two-way alternate transmission on half or full duplex modems.

The following are descriptions of data link states and transitions.

Receive Wait State. At initialization, or when the Data Set Ready circuit is off, the Host Adapter waits for the Data Set Ready circuit to come on. No data transmission and reception is attempted, and the Request to Send circuit is turned off. The Host Adapter remains in this state until Data Set Ready and Received Line Signal Detector circuits are turned on. When they are turned on, the Host Adapter enters the Receive State and will accept data on the Received Data circuit.

Receive State. The Request to Send circuit remains off while the Host Adapter is in the Receive state. It remains in this state until either a message-terminating character has been received from the host computer, until an error condition has been detected, or until it enters the Receive Wait state again. Characters received during the Receive state are accumulated in a “Received Data” buffer area.

When the message-terminating character has been received, and if no error conditions exist, the Data Link layer enters the Frame Processing state while waiting for a message transmission request from the higher level software within the Host Adapter.

When an error condition is detected, the Data Link layer places an appropriately framed error message in the “Transmit Data” buffer, and enters the Transmit Wait state.

Frame Processing State. While the Data Link layer is in the Idle state, the Request to Send circuit is off. Any data coming in on the Received Data circuit is ignored. When a request for message transmission is received from the higher-level Host Adapter software, the Data Link appends the appropriate message framing characters to data contained in the Transmit Data buffer and enters the Transmit Wait state.

Transmit Wait State. In the Transmit Wait state, the Data Link layer places the Transmit Data pointer to the first character of the Transmit Data buffer, and turns on the Request to Send circuit. The Data Link layer then enters the Transmit state when the Clear to Send circuit is turned on.

Transmit State. When in the Transmit state, the Data Link layer serially transmits the data in the Transmit buffer via the Transmitted Data circuit. When the transmission of the message is finished, the Data Link layer turns off the Request to Send circuit and enters the Receive Wait state. If the Clear to Send circuit is turned off during data transmission, the Data Link layer stops transmitting and goes into an idle state.

Data Interchange

Data transmission is synchronous or asynchronous as well as serial by bit with the standard ASCII 7-bit code. Single start and stop bits are used, and parity/no parity and even/odd parity may be chosen. Data transmission rates may be one of the following: 110, 150, 300, 600, 1.2K, 9.6K, or 19.2K bps.

Message Structure

The following sections describe the structure of the messages used by the Host Adapter.

Character Set. The only ASCII characters which may be used to form valid messages are those used in hexadecimal numbers (the digits 0–9 and the letters A–F) and the two characters which delimit the beginning and end of a message.

Message Delimiters. A colon (:) marks the beginning of a message. A semicolon (:) marks the end of a message. Any characters between a colon and the next semicolon are interpreted as a valid message, while any characters between a semicolon and the next colon are ignored. This allows the host to use any parameters required by its software between lines of output. Any character other than 0–9 or A–F which is received between a colon and the next semicolon is interpreted as being in error. When transmitting data to the host, the Host Adapter sends carriage return and line feed characters after the terminating colon.

Character Count. To aid in error control, the colon at the beginning of the message is followed by a four-digit character count in Hex-ASCII notation. This represents the total number of printable characters in the message, including the colon, character count, message body, error-checking code, and terminating semicolon. This number is limited to a maximum value of 570 (decimal) or 023A (Hex).

Error-checking Code. An ASCII four-character error-checking code (ECC) in the form of a 16-bit hexadecimal number is included at the end of the message just before the semicolon terminator. The ECC is a checksum computed as follows:

1. Divide the character count and the message body into blocks of four characters, left-justified and zero-filled.
2. Interpret each block as a four-digit hexadecimal number.
3. Add the resulting numbers.
4. Take the two's complement of the sum to get the ECC.

As an example, consider a message whose body is the ASCII string "1234ABC". The total character count is found by adding together the number of characters in the message, the 4 characters for the ECC, the 4 characters for the character count, and the 2 characters used to delimit the message. Thus, the total character count for a message containing "1234ABC" is 7+4+4+2 = 17 (11 Hex). Appending this to the body results in "00111234ABC". The ECC is given by:

Two's complement of (0011 + 1234 + ABC0) = 41FB
(Error Code)

so that the entire message is:

:00111234ABC41FB;

3.2 Summary

Table 3-2 summarizes the message structure described above.

Table 3-2 Message Structure for Host Adapter Protocol

Field	Contents	Number of Characters
Beginning Delimiter	Colon (:)	1
Character Count	Hexadecimal	4
Body of Message	Hexadecimal	560 (max)
Error-checking Code	Hexadecimal	4
Terminator	Semicolon (;)	1
	Total	570

Chapter 4

Installation

4.1 Requirements for Installation

The following items are necessary to install the TIWAY I Host Adapter and to connect it to the TIWAY I network.

- Host Adapter
- L-shaped mounting brackets and bracket screws
- Customer-provided mounting screws
- Belden® 9271 cable or equivalent (customer-supplied)*
- Tap housing*
- AC power cable (customer-supplied)
- TIWAY I network

* For Local Line installation

4.2 Network Media Installation

TIWAY I is a multidrop communications network, consisting of a main line and dropline cables, which connect a host computer to as many as 254 Secondaries.

The selection of the media interface depends primarily upon two criteria: the distance to be spanned and the cost of installation. The main trunk can be up to 25,000 feet long, and each dropline can be up to 100 feet long (with Local Line). For distances exceeding 25,000 feet, the use of RS-232-C media interfaces and modems is required.

If cable redundancy is desired, two cables and two Host Adapters must be installed. The following sections describe cable installation for Local Line and RS-232-C media interfaces.

Local Line Cable

The Local Line is designed to operate with shielded twisted pair cable which has a characteristic impedance of 124 ohms. The interface is a male, 9 pin D-type receptacle with pin assignments as shown in Table 4-1.

Table 4-1 Local Line Connector Pin Assignments

Pin	Name	Description
1		No Connection
2		No Connection
3	SHIELD	Cable shield and signal common
4		No Connection
5		No Connection
6	LLM+	Positive biased signal line
7		No Connection
8		No Connection
9	LLM–	Negative biased signal line

Up to 254 Secondaries and one host can be interconnected via the Local Line interface. The interconnecting cable usually consists of a main cable (or spine) with droplines (or taps) to each Secondary. The maximum main line cable length cable type, tap length, tap spacing, number of Secondaries and maximum baud rates are interrelated network variables and have a direct influence upon network performance.

Network Media Installation (continued)

Figure 4-1 illustrates the relationship of cable distance to number of Secondaries for different baud rates for two types of twisted pair cable. Note that the cable distance (in thousands of feet) is shown vertically; the maximum number of units that may be attached is shown horizontally.

For example, Figure 4-1 indicates that when using Belden 9860 cable (or its equivalent) up to 75 stations can be attached to a network operating at 38K bps and having a spine length of 20,000 feet. At 115.2K bps, the maximum length of a Local Line network having 254 stations would be 10,000 feet.

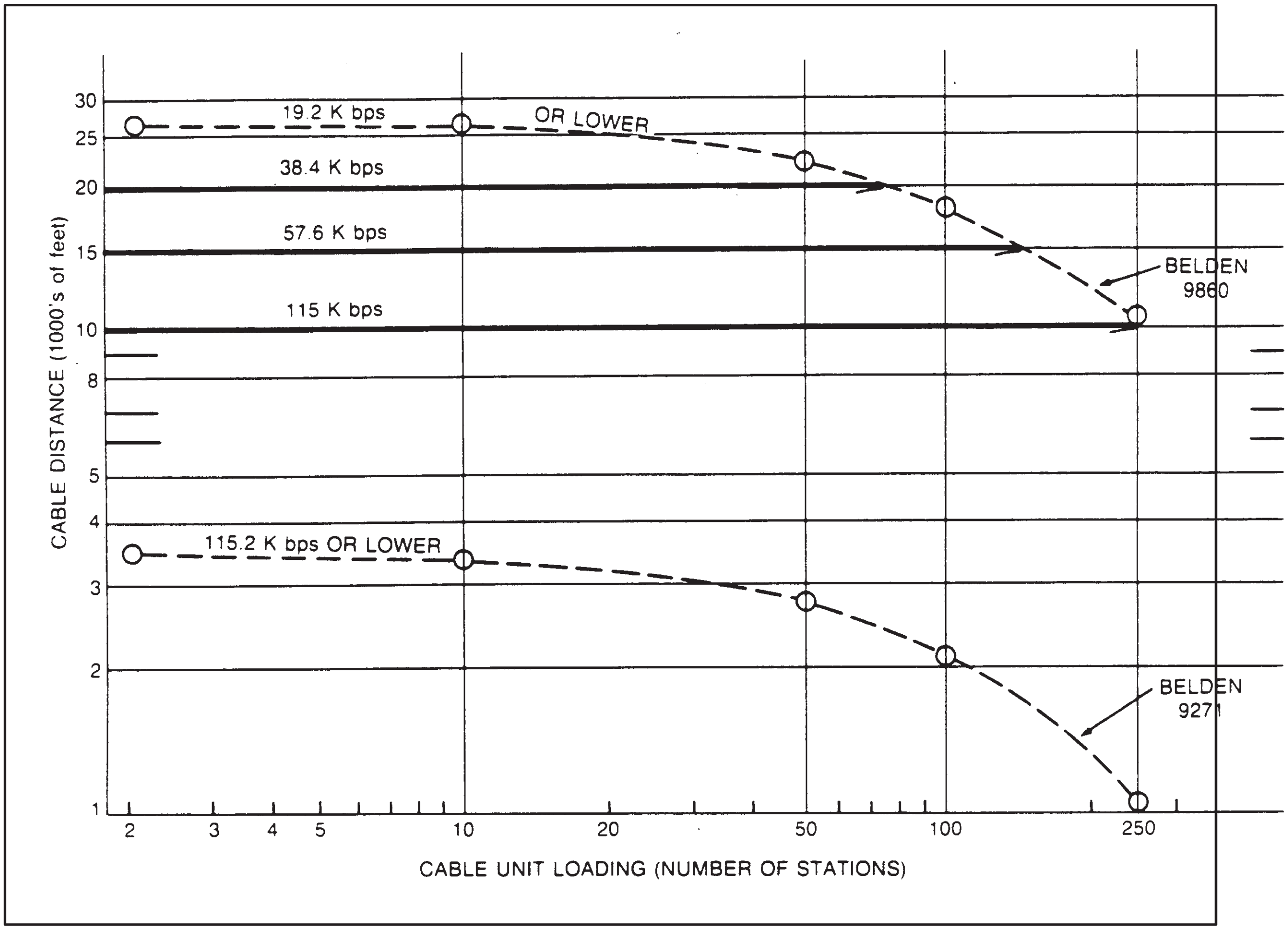


Figure 4-1 Number of Local Line Secondaries versus Cable Distance

Local Line Hardware Components

The hardware components of a Local Line network are explained in the sections below and consist of the following:

- Siemens Tap Housing (PPX:500–5606)
- Customer-supplied twisted pair cabling

NOTE: When the Host Adapter is located at either end of the network, the Local Line bias switch must be placed in the ON position.

Tap Housing. The tap housing, shown in Figure 4-2, is manufactured by Siemens specifically for the Local Line network. The tap housing can be mounted rigidly to a NEMA panel or other enclosure. It could also be used to splice cables in a cable tray without being rigidly mounted. The tap housing not only allows tapping into a twisted pair cable, but also contains termination resistors, resists moisture, relieves strain, and provides noise isolation for attached cabling. One tap housing is provided with Host Adapter Model 7101 or 7103. Additional tap housings may be ordered from your Siemens distributor under part number PPX:500–5606.

The termination resistors mentioned in the previous paragraph are very important. They must be used to ensure that the main line cable is properly terminated and biased. This in turn ensures that the Local Line will operate reliably. Each tap housing is supplied with termination resistors to connect to the ends of the main line cable. At each end a termination resistor must be connected between LLM + and the cable shield and also between LLM – and the cable shield inside the tap housing.

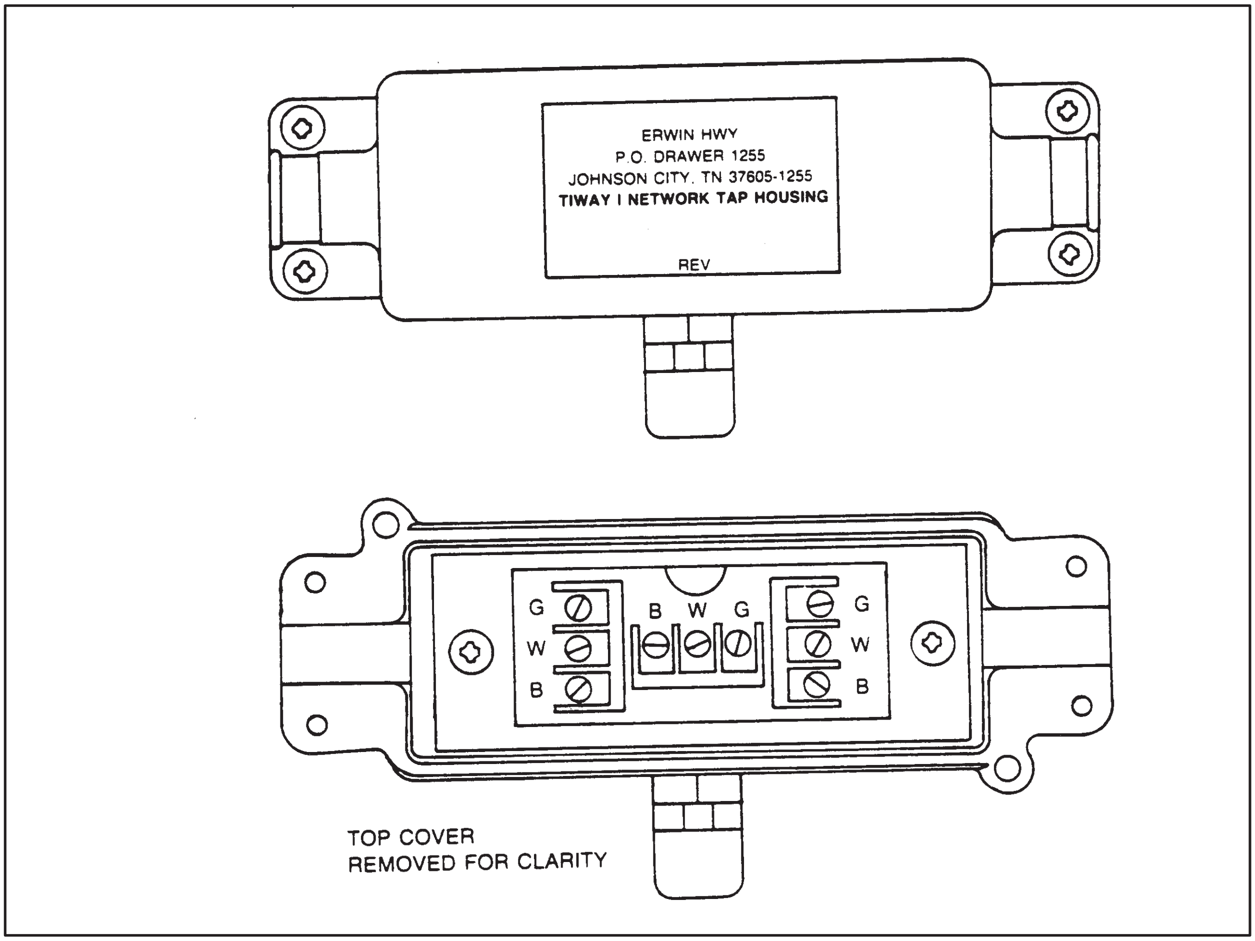


Figure 4-2 Tap Housing

Twisted Pair Cabling. Siemens recommends Belden 9860 twisted pair cabling or its equivalent for use as the Local Line network spine. Belden 9271 or its equivalent should be used for the dropline. Brands other than those listed here will be specified by Siemens upon request.

Important Planning Considerations. Some major points to consider during the planning phase of a Local Line network are:

- From the start, allow for system growth. This means making provisions for the attachment of additional computing devices by routing cables through all probable areas of future plant expansion.
- Always make the network flexible enough to allow for rearrangement of plant equipment.
- Since network system noise is usually picked up by its interconnecting wiring, steps should be taken at the outset to bypass or eliminate noise sources.
- If cable redundancy is desired, the two cables should never be routed along the same path, since the environmental factors which disable one cable will very likely disable the second cable.

Local Line Tap Spacing. Local Line signal characteristics require that the distance between droplines on the network be calculated using the length of the droplines at the last drop point. The minimum distance between droplines must be equal to or greater than one-half the length of the dropline at the last drop point. Two drop lines with the last one closer than one-half the drop line length of the previous one are considered a double drop point from the closest tap. The sum of both of their lengths is used to calculate the spacing between them and the next dropline. A dropline fifty feet long, for example, precludes the installation of the next station tap closer than 25 feet along the spine. No limit is placed on the number of NIMs that can be daisy-chained to form a drop line off of the main trunk as long as the resulting tap length is no greater than 100 feet. Figure 4-3 illustrates three typical examples of tap spacing.

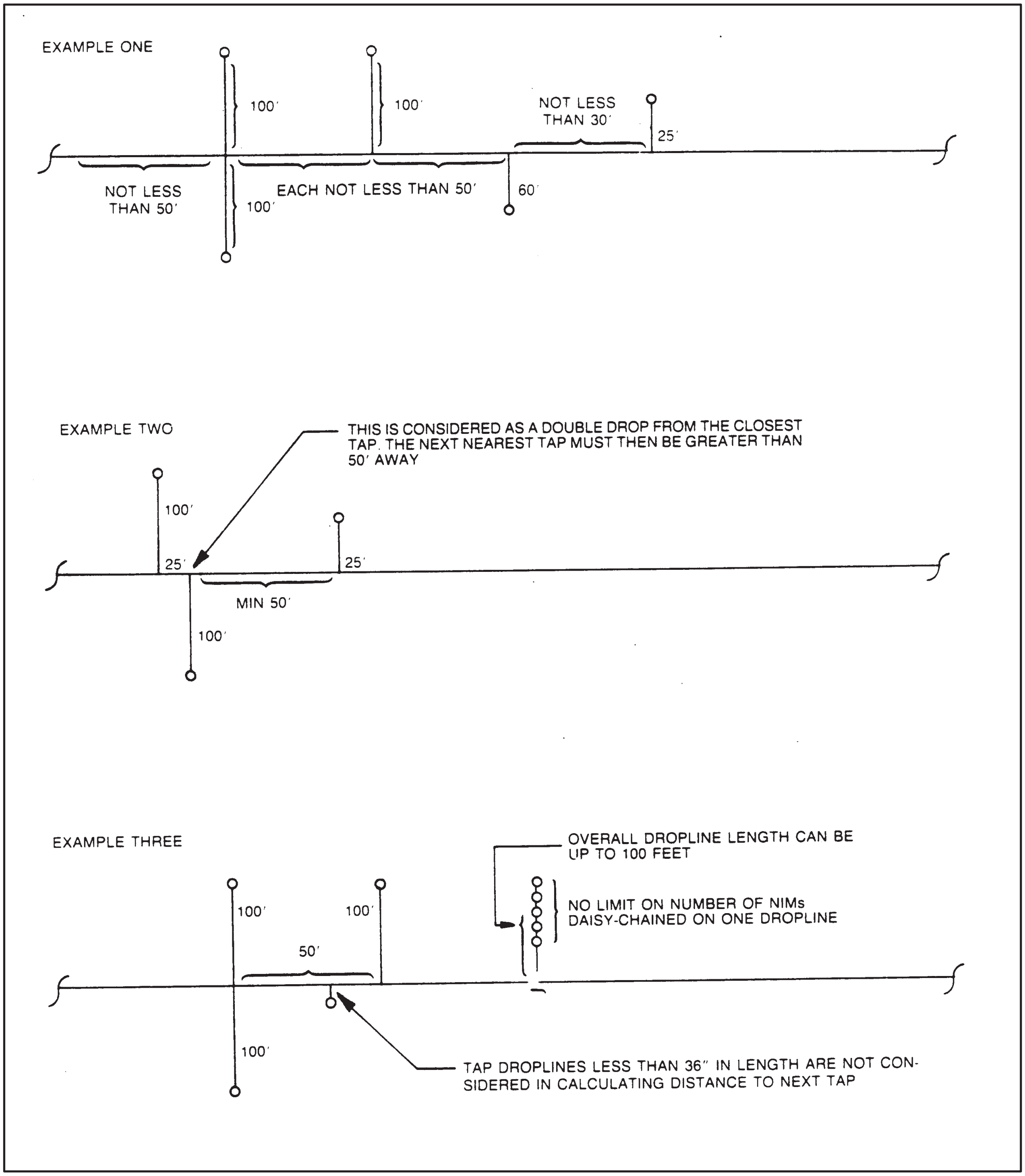


Figure 4-3 Tap Spacing Examples

Cable Routing. Cable routing should be planned as if the path between all stations on the network were free of obstructions. The next step is to modify the first routing to account for obstructions, then calculate the amount of cable needed.

> **CAUTION**
>
> **Improper wiring can present fire hazards and cause damage to equipment.**
>
> **Observe all local and national electrical/fire codes when installing all electrical wiring.**

In general, there are three routes network cabling may take:

- Under-flooring
- In-ceiling
- Inside surface ducting

Any combination of these three routes may be used on a single network. The choice is often determined by whether the building (or buildings) in which the network is being installed is new construction, or is an existing building. The following paragraphs describe some of the advantages and disadvantages of each type of cable routing.

Under-floor. For under-floor routing, the cable can be enclosed within ducts or, with raised flooring, in the “open air.” Under-floor systems enclosed in ducts are usually expensive, and while they are better protected against unauthorized taps than are “open air” systems, they often make future expansion of the network more difficult and expensive.

“Open air” underfloor cabling systems usually provide good access, and allow maximum network expansion and flexibility.

In-ceiling. For in-ceiling routing, network cables are usually supported in troughs or with hooks and clamps every 10 or 15 feet. Some advantages of in-ceiling installation are that:

- It provides flexibility;
- Installation can be made at low cost; and
- It ensures accessibility to cabling.

Some disadvantages are that:

- It is impractical for buildings without drop ceilings;
- It may present difficulties due to its inaccessibility: and
- Ceilings often collect dust and other debris.

Surface Ducting. Surface ducting for network cabling is usually installed along the baseboards or is attached to walls at desktop height. While surface ducting ordinarily protects cables from both physical and EMI effects, it may also require that network computing devices be positioned near a wall.

Obstructions. You should avoid both physical obstructions such as posts, walls, partitions and the like, and also electrical interference. Some sources of such interference are:

- Power distribution mains
- Arcing motors
- Fluorescent lighting
- Teletypes
- Undesired signal transfer (cross-talk) between adjacent circuits
- Poor cable-to-equipment impedance matching

Noise: Minimum Distances. In general, network cabling should never come into direct contact with any electrical conductor, and if cabling is installed inside a conduit, the conduit should be grounded in accordance with applicable electrical codes. A minimum of three feet should be kept between all network cabling and the following:

- Power lines up to 440 volts
- Generators
- Electric motors
- Electric welders
- Transformers
- Induction furnaces and heaters
- Rectifiers
- All sources of microwave radiation

RS-232-C Cable Installation

The physical layer in TIWAY I provides a modem interface for synchronous or asynchronous modems at data transmission rates up to 115.2 K baud. The modem interface provides standard signals for control of two-way alternate data transmission using both half and full duplex modems. The modem interface is a standard “Type E” DTE configuration as defined in Section 5 of EIA RS-232-C. This interface uses a male (plug) 25-pin D-type receptacle for connection to the communication cable. The circuits and pin assignments shown earlier in Table 3–1 are used here as well. All other pins should be left vacant to prevent damage which may be caused by non-standard pin usage. The use of the interchange circuits should conform to the functional descriptions given in Section 5 of EIA RS-232-C.

4.3 Installation Procedures

⚠ WARNING

If power is supplied to the Host Adapter before installation is completed, unpredictable operation can result.

Unpredictable operation can cause death or serious injury to personnel, and/or damage to equipment.

Do not supply power to the Host Adapter until all other installation procedures have been completed.

1. There are three possible places on the Host Adapter where the two L-shaped mounting brackets can be located. Depending on how you want the Adapter to be mounted, attach the mounting brackets to the adapter in any of these three places. (Refer to Figure 4-4 for the possible bracket mounting locations.)

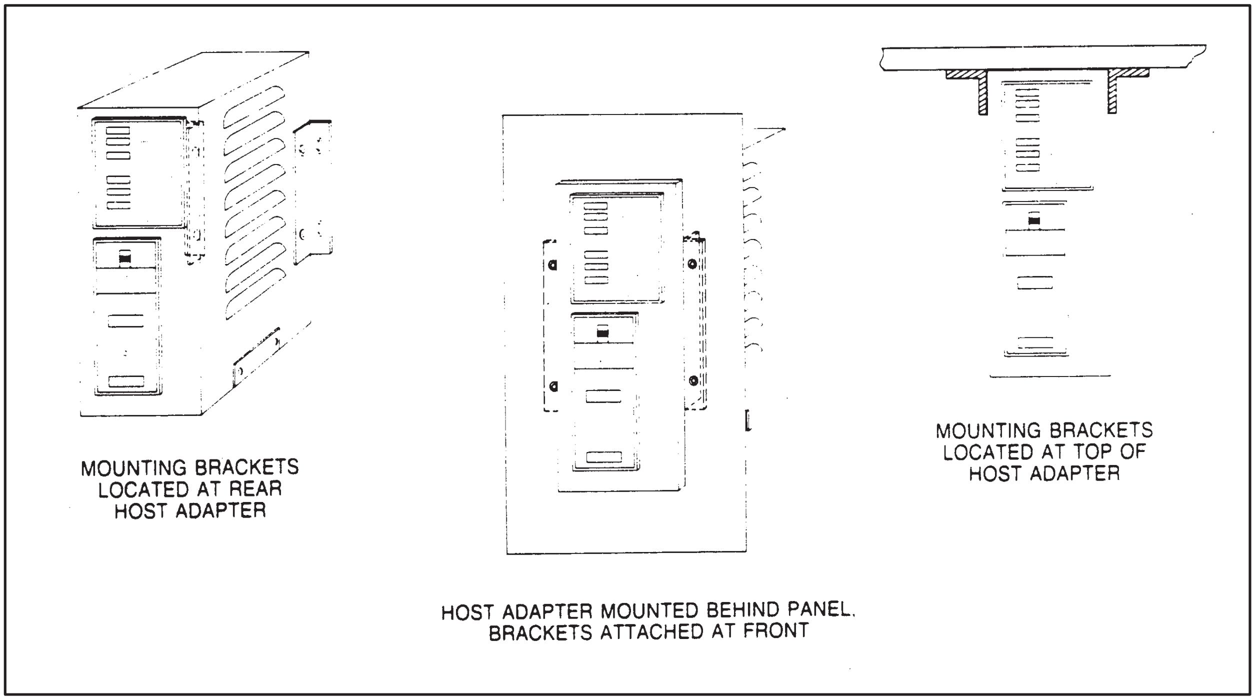


Figure 4-4 Possible Bracket Locations on Host Adapter

2. You should mount the Host Adapter in a suitable enclosure (such as a NEMA panel) to protect against adverse environmental conditions and the possibility of electrical shock. The Adapter should not be near moisture sprays, or where the temperature is above 60° C or below 0° C.

⚠ CAUTION

Installing the adapter so that air flow vents are covered can cause restricted air flow over the air vents, leading to overheating.

Overheating can cause damage to the equipment.

Do not install the adapter so that the air vents are covered.

3. Once the Host Adapter has been mounted, remove the shield covering the three AC terminals (ground/neutral/line). With power off, attach the AC power cable, and then replace the shield. (See Figure 4-5.)

4. Connect the Local Line or modem interface cable to the TIWAY I port.

5. Connect the Host interface cable to the Host port.

6. Power-up the unit.

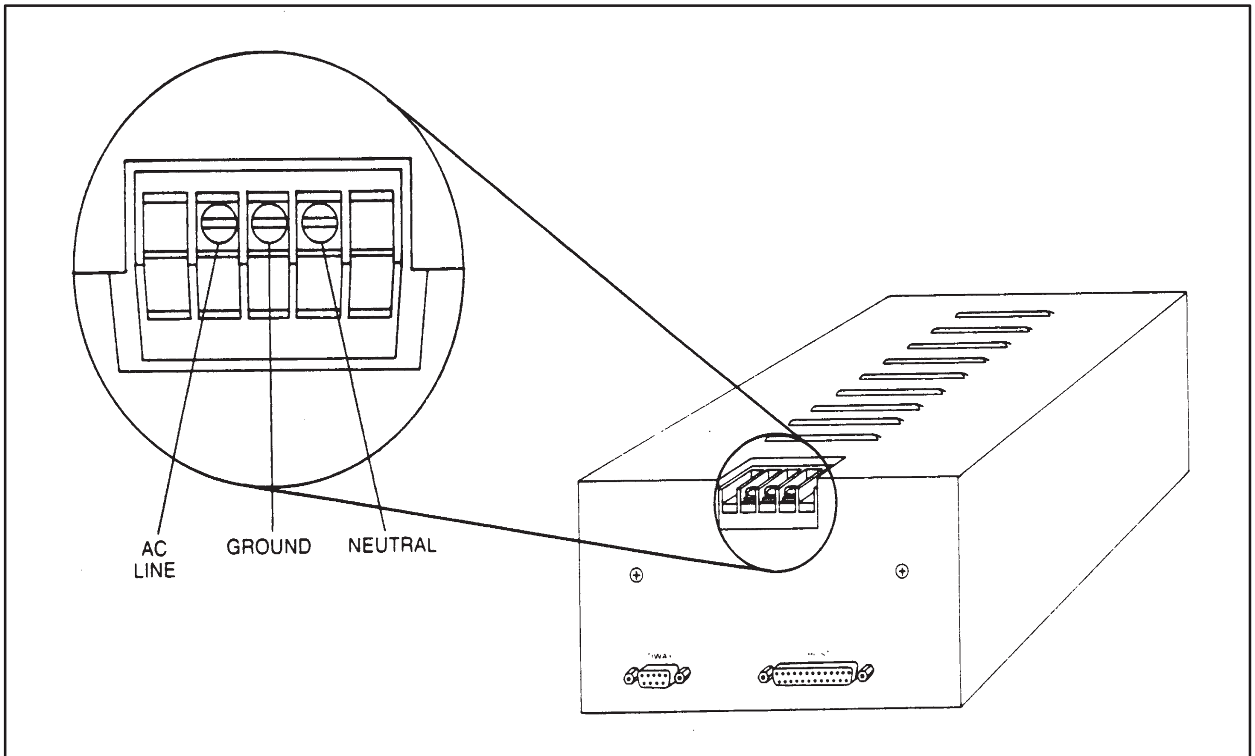


Figure 4-5 AC Power Terminals

4.4 Dipswitch Configuration and Function

There are two banks of dipswitches for the Host Adapter: one for the Host port and one for the Network port. All switches are located behind the access cover on the front of the Host Adapter. The following sections define the switches and describe the effect they have upon the Host Adapter's operation. Figure 4-6 illustrates the switch assignments for the Host Adapter.

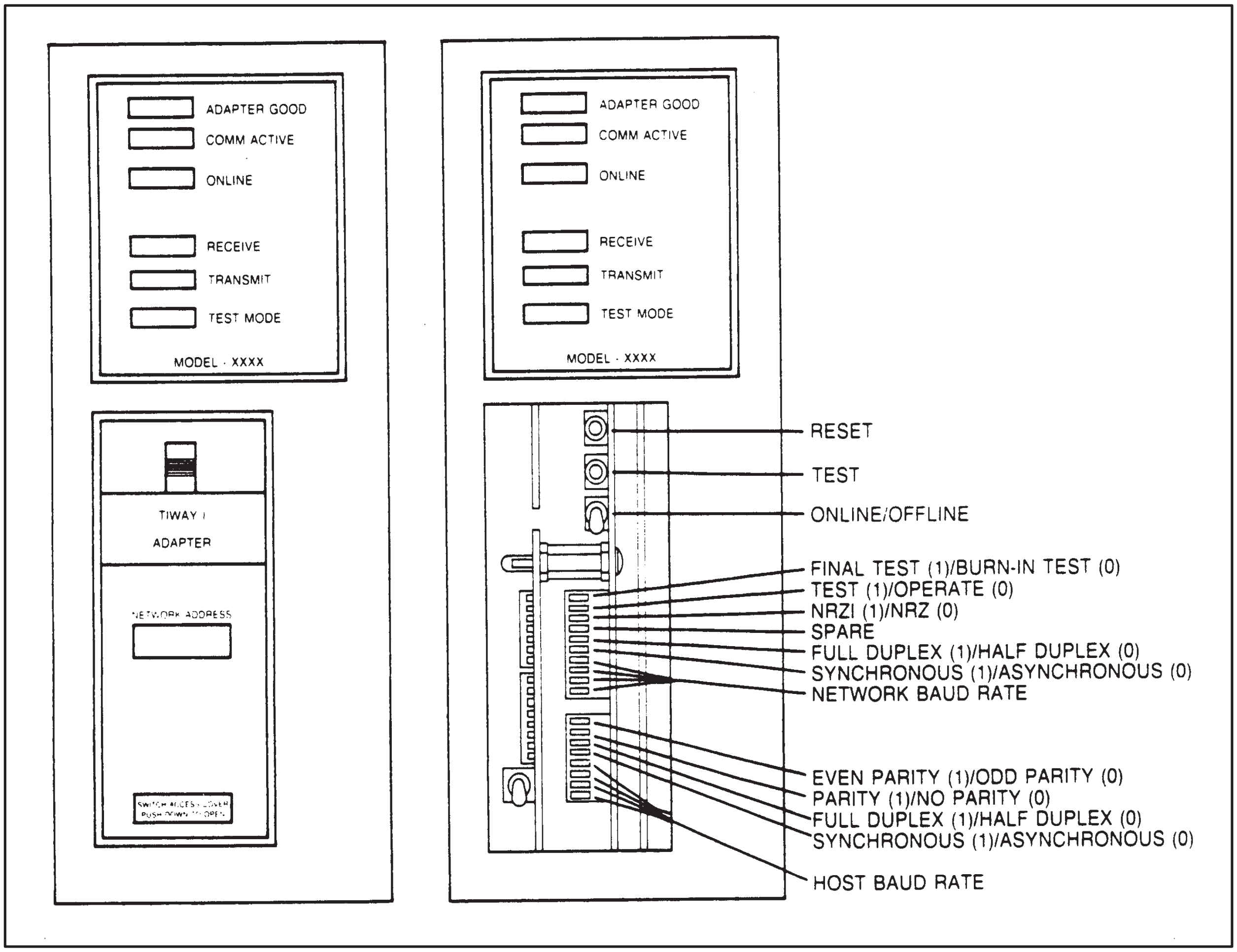


Figure 4-6 Host Adapter Switches

There are eight configuration dipswitches for the Host port, and ten for the Network port, of which nine are used (Switch 7 is currently unassigned). The switch settings are binary coded so that Switch 1 represents the most significant bit (MSB) and Switch 8 represents the least significant bit (LSB).

When you are configuring the dipswitches for the Host Adapter, you should check to make sure that both the NIM and the host computer dipswitches match the Host Adapter configuration. The host configuration should be 7 bits with parity and 1 stop bit.

The dipswitches are read by the Host Adapter only after a reset. Therefore, any changes to the dipswitches must be followed by a reset.

Host/Network Data Rate Selection

The first four dipswitches (1–4) for both the Host and Network ports are used to select the baud rate at which the Host or Network ports will communicate. Table 4-2 illustrates the configurations of these four dipswitches for various baud rates.

Table 4-2 Host/Network Ports Data Rate Selection

Dipswitches				Data Rate
S1	S2	S3	S4	
0	1	0	0	110 bps
0	1	0	1	150 bps
0	1	1	0	300 bps
0	1	1	1	600 bps
1	0	0	0	1200 bps
1	0	0	1	2400 bps
1	0	1	0	4800 bps
1	0	1	1	9600 bps
1	1	0	0	19.2K bps
1	1	0	1	38.4K bps*
1	1	1	0	57.6K bps*
1	1	1	1	115.2K bps*
* Note: 38.4K bps, 57.6K bps, and 115.2K bps are not used on the Host Port.				

Synchronous/ Asynchronous Operation

The SYNC/ASYNC switch is used for modem operation. In the synchronous position, the Host Adapter uses the receiver signal element timing to sample the “receive” data and the transmitter signal element timing to send “transmit” data. Both the receiver and transmitter signal timing elements are supplied by the modem. In the asynchronous position the modem does not supply receiver or transmitter timing elements and the Host Adapter uses internal clocks to determine “receive” data sample points and to send “transmit” data.

Dipswitch Configuration and Function (continued)

Full/Half Duplex

The full/half duplex switch selects operation compatible with full or half duplex modems even though communication with the Host Adapter is half duplex only. When half duplex operation is selected the Adapter does not activate the Request to Send circuit before Data Carrier Detect becomes inactive. Timing relationships between Data Carrier Detect and Request to Send are ignored when full duplex is selected.

Parity Enable/ Inhibit

On the Host Port dipswitches, switch 7 either enables or inhibits parity.

Even/Odd Parity

If switch 7 on the Host port is set to enable parity, switch 8 on the Host Port selects either odd (0) or even (1) parity.

NRZI/NRZ

The NRZI/NRZ (non-return to zero inverted/non-return to zero) switch selects the type of encoding to be used during network communication. The NRZI encoding option is required for asynchronous operation. Either NRZI or NRZ may be used with synchronous operation, but NRZ encoding is preferred.

Test/Operate Modes

Switch 9 on the Network port dipswitches selects either “test” (1) or “operate” (0) mode.

Final/Burn-in Tests

If switch 9 is configured for “test,” switch 10 chooses either final test or burn-in test. These are used primarily for factory testing; normally switch 9 should be set for “operate,” which allows the setting for switch 10 to be either 1 or 0.

4.5 Other User Switches

Other switches are available to allow user access to Host Adapter features. They are: reset, on/off-line mode setting, built-in test functions, and Local Line biasing. These switches are accessible from the same access panel as the dipswitches.

On/Off-line Switch

The On/Off-line switch, when placed in the on-line position, allows the Host Adapter to communicate with the network and the host computer. In the off-line position the Host Adapter is logically disconnected from the network.

The position of this switch is read before each communication cycle, so a reset of the Host Adapter is not necessary each time the On/Off-line switch position is changed.

Self-test Switch

The Self-test switch is a push-button which initiates a set of diagnostics, including a communications loopback test. This test requires a special hardware setup, using the loopback connector supplied with the Host Adapter. This setup is described more fully in Chapter 5, Diagnostic Tests. The Host Adapter must have the Online switch in the off-line position to initiate the self-test.

Reset Switch

The Reset switch is a push-button switch which causes a reset and invokes the power-on test. The power-on test is explained in detail in Chapter 5, Diagnostic Tests.

Local Line Bias

For the Host Adapters and NIMs supplied with Local Line media interfaces, a switch is provided which allows selection of bias or no bias for the Local Line. This switch provides a network system function of placing a 100 millivolt potential between each of the two conductors in the cable and the signal common. The Local Line must be biased to prevent unwanted oscillations at the receivers connected to the line. Bias should be applied by only two units (one at each end of the cable) in the network.

4.6 LED Displays

There are 6 LEDs on the CPU card to indicate the current machine state, as shown in Figure 4-7.

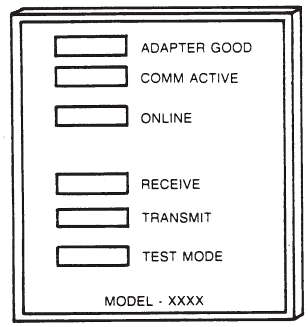


Figure 4-7 Host Adapter LED Panel

Adapter Good. The Adapter Good LED signifies that all power-on/reset diagnostics passed successfully and that the run-time diagnostics have been completed successfully thus far. The power-on diagnostics check all major elements of the Adapter. A failure of any component of the normal operation mode diagnostics causes the Adapter Good LED to blink.

Comm Active. The Comm Active LED is off when the Host Adapter is awaiting a host information frame. The Adapter cannot receive a frame while the Comm Active light is on. The LED is on if communication to the Host Port is in progress.

On–line. The On-line LED indicates that the Adapter is communicating with the network. The LED lights at the onset of the on-line network data transfer condition and goes out when the network data transmission is complete.

Receive. The Receive LED lights when any receive operation on either port is in progress. It goes out when the receive operation ends.

Transmit. The Transmit LED lights when a data transmission cycle is initiated on either port. It goes out when the data transmission ends.

Test. The Test LED indicates that the User-Test button has been pressed (and the Adapter is in off-line mode). This LED remains illuminated until all the specified sub-tests have been executed. Once the sub-tests have been completed, the LED blinks with the remaining LEDs indicating the source of the failure.

4.7 Host Adapter Power-up Sequence

After the Host Adapter is powered-up, all six LEDs will flash briefly, then all but the Test LED will go out. The Test LED will stay lit for approximately 6 seconds while the Host Adapter runs through a series of diagnostics, including RAM and ROM tests and a serial communications port internal loopback check. If the diagnostics are successful, the Adapter Good LED will illuminate and will stay on. If a failure on any test occurs, the Adapter Good LED will flash.

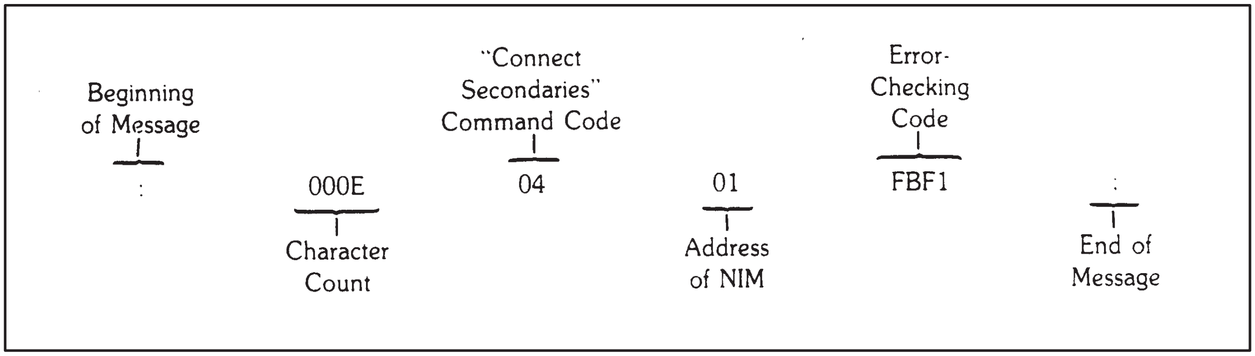
4.8 Using the Host Adapter

This section gives examples of how the Host Adapter may be used once it is installed and the dipswitches are configured for both Host and Network ports. For a detailed explanation of the TIWAY I Primitives and Command Codes used in these examples, please see the *SIMATIC TIWAY I Systems Manual* and the manuals accompanying the NIMs used with the TIWAY I system. Once the Host Adapter has been installed and powered-up, you may use any non-intelligent terminal to type in commands, such as the Command Code to connect a Secondary:

EXAMPLE: (Connect Secondaries)

Type: :000E0401FBF1;

Using the principles discussed in Chapter 3 of this manual, an analysis of the message structure would look like this:



If a successful connection to NIM address 01 is made, the response will show that the connection has been made:

:000E0401FBF1;

At this time, the Online indicator on the NIM and the Comm Active indicator on the Host Adapter will light.

If the connection to NIM address 01 is not successful (for example, if there were no NIM at address 01), Comm Active and Online would light, and Receive would flash ten times. This means that the Host Adapter is polling the Secondary and is attempting to make a connection. After Receive has flashed ten times, all LEDs except Adapter Good will go out. To indicate that the connection was not successful, the message returned on the screen will not be the same as the message sent. For example, if the following message appeared on the screen:

:000E0400FBF0;

then the “00” instead of “01” would indicate that the Host Adapter was unable to find any NIM connected at address 01.

Since this may mean that there is a problem with the network connection, you should check the network cable connections on both the NIM and the Host Adapter. You should also check to be sure that the configuration dipswitches agree on both the NIM and the Host Adapter.

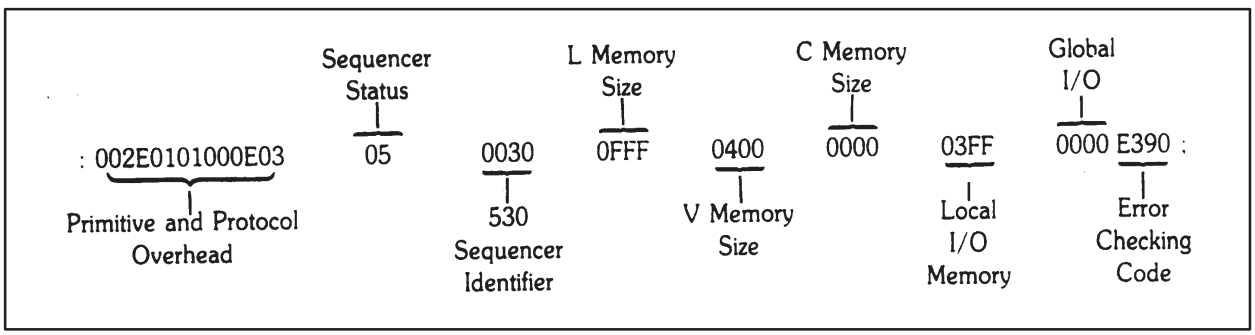
Once the Connect Secondaries command is successful, you may wish to know the status of the sequencer connected to the Secondary. To do this, you would type a transaction request which looks like this:

:00140101000103FBEA;

This will transmit TIWAY I Primitive 03, requesting Machine Status and Configuration. The response, for example, might look like this:

:002E0101000E030500300FFF0400000003FF0000E390;

Analysis of this code would yield the following information:



Another command you might use could be Disconnect Secondaries. To do this, type:

:000E0501FAF1:

The screen will display the response, indicating that all Secondaries have been disconnected:

:000E0501FAF1;

At this point, all six LEDs on the NIM will light briefly and then go out, leaving only the Test mode LED illuminated. Adapter Good will remain lit on the Host Adapter.

For a more complete description of the Command Codes and Primitives supported by each NIM, you should refer to the appropriate NIM manuals and to the *SIMATIC TIWAY I Systems Manual*.

Chapter 5

Diagnostic Tests

5.1 General

There are five levels of built-in tests in the Host Adapter:

- power-on test
- operational test
- self-test
- burn-in test
- final test

Power-on Test

This test executes the initialization routine following a master reset. All LED indicators light for approximately 1 second prior to executing any sub-tests. All LEDs except for the Test LED will be out while the tests are running. If the tests all pass, the Adapter Good LED will light.

The sub-tests include a RAM data and address integrity test, a ROM CRC integrity test, and a communications controller internal loopback test.

Upon failure of any of the Power-on tests, the adapter will keep the watchdog timer alive, go to the IDLE state, and wait for the reset switch to be pressed.

Operational Diagnostic Test

This test executes during all normal modes of the Host Adapter's operation, off-line or on-line. The sub-tests do not disturb normal operation of the network. They are performed at least once per minute under all conditions.

An operational diagnostics failure is treated in the same way as a power on test failure. Test status is indicated on the Adapter Good LED which will blink after a failure.

User-initiated Self Test

This diagnostic test may be performed by the user only when the adapter is in the Off-line mode (as determined by the On/Off-line switch) and when the Test switch is pressed. Normal adapter operation is suspended during this test mode.

> **⚠ CAUTION**
>
> **The adapter self-test will not start if the Host Adapter is on-line.**
>
> **Failure to place the adapter off-line during the test may cause a temporary communication error on the network.**
>
> **Be sure to place the On/Off-line switch in the off-line position and to disconnect the adapter from the network during the adapter self-test.**

This test will perform both internal and external loopback, jabberstop, and data rate sub-tests to each channel. If a media card is missing or is bad the test will fail.

A loopback connector is required for the RS-232-C/423 port. If no loopback connector exists on an RS-232-C/423 channel, that channel will fail the external loopback sub-test. The remaining channel will still be tested to see if it is functioning correctly. Table 5-1 shows the signal line connections made by the loopback connector.

No loopback connector is necessary on the Local Line port.

Table 5-1 RS-232-C/423 Loopback Connections

Pin # To	Pin #	Signal To	Signal
2	3	Data Out	Data In
4	5	Request to Send (RTS)	Clear to Send (CTS)
20	6.8	Data Terminal Ready (DTR)	Data Set Ready (DSR) Data Carrier Detect (DCD)

The sub-tests for the user-initiated self-test include:

- RAM data and address line verification (internal and external RAM)
- ROM integrity using CRC and checksum
- Serial Communications Chip (SCC) using internal loopback and baud rate
- Transmitter/Receiver via external loopback and jabberstop
- Verification of watchdog timer
- Indicator operation

General (continued)

Table 5-2 illustrates the LED indicator status for the user-initiated self-test.

Table 5-2 Indicator Status for Self-test

LED	Pass	Fail/Not Installed	Sub-tests Included
Adapter Good	On	Off	ROM, RAM, Watchdog
Transmit	On	Off	Network Interface: Loopback, Jabberstop, Network Data Rate
Receive	On	Off	Host Port (same tests as above)
Test	Flashing	Flashing	Test completed
Note: During the test, the Comm Active and Online LEDs are off.			

Burn-in and Final Tests

The burn-in and final tests are primarily factory tests and are normally not used in any applications.

5.2 Technical Assistance

If you encounter problems in the installation or operation of the TIWAY I Host Adapter, you may call Siemens Technical Services for assistance at (423) 461–2522. If you need additional help, or information that is not included in this manual, contact your Siemens distributor or sales office. If you need assistance in contacting your distributor or sales office in the United States, call 800–964–4114.

Customer Response

We would like to know what you think about our user manuals so that we can serve you better. How would you rate the quality of our manuals?

	Excellent	Good	Fair	Poor
Accuracy	____	____	____	____
Organization	____	____	____	____
Clarity	____	____	____	____
Completeness	____	____	____	____
Graphics	____	____	____	____
Examples	____	____	____	____
Overall design	____	____	____	____
Size	____	____	____	____
Index	____	____	____	____

Would you be interested in giving us more detailed comments about our manuals?

☐ **Yes!** Please send me a questionnaire.

☐ **No.** Thanks anyway.

Your Name: ______________________________

Title: ______________________________

Telephone Number: (____) ______________________________

Company Name: ______________________________

Company Address: ______________________________

____

____

Manual Name: SIMATIC TIWAY I Host Adapter User Manual **Edition:** Second

Manual Assembly Number: 2587871–0002 **Date:** 10/95

Order Number: PPX:TIWAY–8102

FOLD

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO.3 JOHNSON CITY, TN

POSTAGE WILL BE PAID BY ADDRESSEE

ATTN: Technical Communications M/S 519
SIEMENS ENERGY & AUTOMATION INC.
3000 BILL GARLAND RD
P O BOX 1255
JOHNSON CITY TN 37605–1255

FOLD