

Overpack Sheet

HPS Downloadable Cluster Controller Installation Guide

(014-001814-02)

This document contains important information about installing VMEbus-distributed (VDC/8P, VDC/16) cluster controllers. These controllers are manufactured by Systech Corporation for Data General. Accordingly, we have packaged the attached manufacturer's documentation for your use. This Overpack Sheet contains supplementary information that you will need to successfully install and operate this equipment.

NOTE: Successful operation of Model 030 cluster controllers requires downloadable software resident in DG/UX™ revision 4.32 or above. VDA/255 host adapters also depend on this software. *You cannot operate a Model 030 controller or VDA/255 host adapter in systems running DG/UX™ revision 4.31 or lower.*

Getting Help from Data General

Please disregard any problem reporting procedures described in the manufacturer's documentation. For help with hardware or software problems, contact the Data General Help Line at 1-800-DG-HELPS (U.S. customers only), or contact your Data General representative at the nearest Data General office.

Warranty Information

The warranties specified in your Data General sales and field engineering contracts supersede any and all warranties referred to in the manufacturer's documentation.

WARNING: Data General Corporation does not recommend or support customer installation or maintenance of some AViiON® systems. Refer to your Data General sales and field engineering contracts for information regarding Data General warranties *before* attempting to configure, install, or remove any system components.

Installation and Maintenance

The following manuals contain basic information on configuring, installing, removing, and connecting cluster controllers in AViiON® systems.

- *Setting Up and Installing VMEbus Options in AViiON® Systems* (014-001867)
(for deskside systems including two VMEbus option slots)
- *Setting Up and Starting AViiON® 5000 Series Systems* (014-001806)
(for office model systems including six or more VMEbus option slots)

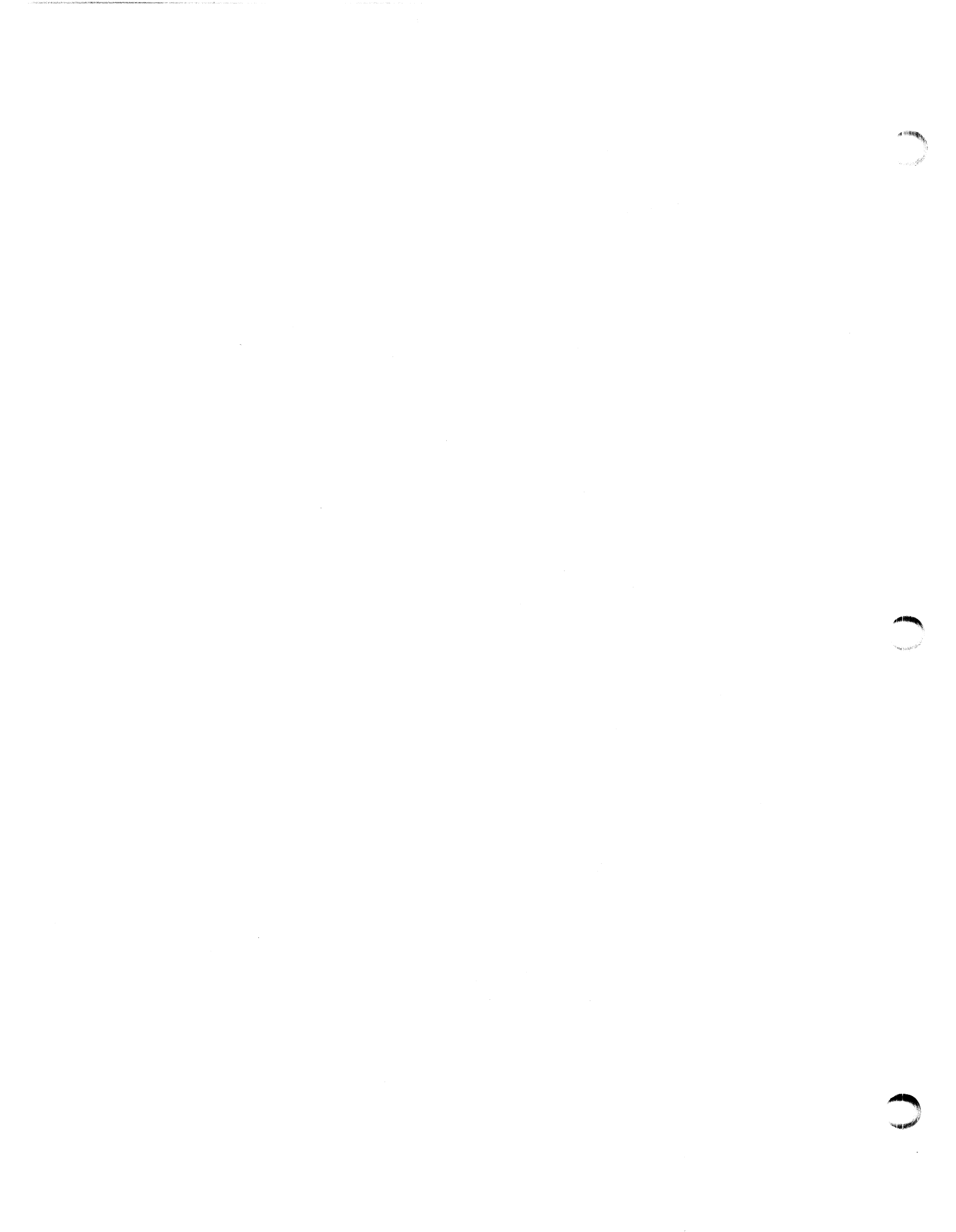
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HPS Downloadable Cluster Controller Installation Guide

(80-000422-6-00 Revision D)



HPS Downloadable Cluster Controller Installation Guide

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Change Record Page

Manual Part No. 80-000422-6-00

Date	Rev	By	Description	Pages Affected
5/10/88	A	ELB	Initial production release.	All
9/6/88	erratum	ELB	Deleted references to specific downloadable cluster controller models; removed listed price of loaner board from warranty information.	iii, 1-1, 1-6, 2-18, 4-3
12/13/88	B	ELB	Incorporated 9/6/88 erratum; added cable information to the FCC notice; clarified coaxial installation specifications; removed "DCE" from table 2-3 column heading; clarified LED "heartbeat" description in table 2-5.	iii, v, 1-1, 1-4, 1-6, 2-6 - 2-21, 4-3
2/9/89	erratum	ELB	Added Canadian DOC notice.	iii, 1-4
12/13/89	C	ELB	Incorporated 2/9/89 erratum; added new regulatory agencies section; corrected power supply statements; added note about autoranging power supply; changed current (ampere) rating; revised warranty and repair information.	iii - v, 1-2, 1-4 - 1-8, 2-21, 4-1 - 4-5
6/6/90	erratum	ELB	Clarified section 1.2.2 and the power requirements (table 1-1); changed length limitation for RS-232 serial cables from 150 to 50 feet; revised the warranty and repair chapter.	iv, 1-4, 1-7, 3-7, 4-1 - 4-4
12/12/90	D	ELB	Incorporated 6/6/90 erratum; added parallel printer timing and electrical interface specifications.	iii - v, 1-4, 1-7, 1-8, 2-19 - 2-24, 3-7, 4-1 - 4-4

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Chapter 1

Introduction

This installation guide explains how to set up HPS downloadable cluster controller(s) in conjunction with the HPS host adapter board installed in your host computer. Among issues covered are: cluster controller cabling and setup requirements, installation troubleshooting information, and discussions on both the use and handling of coaxial cable and the RS-232 signals that are supported (installation of the HPS host adapter board into the host computer is not covered; refer to the appropriate host adapter technical manual for board installation instructions). Three configurations of downloadable cluster controllers are available. Depending on your needs, you can select cluster controllers equipped with:

- eight RS-232C serial ports
- eight RS-232C serial ports plus a Centronics¹-compatible parallel printer port
- sixteen RS-232C serial ports

All the information you'll need to install HPS downloadable cluster controllers is included in this manual. Additional information about the cluster controllers, which is not essential to installation, is provided in the appropriate technical manual for your model cluster controller. For information on the HPS host adapter board, refer to the appropriate technical manual for the model of HPS host adapter you have.

¹ Centronics is a trademark of Data Computer Corporation.

1.1 OPERATIONAL THEORY

HPS downloadable cluster controllers allow you to connect groups of either eight or sixteen terminals (depending on the cluster controller model used) to a single HPS host adapter by means of a single RG-62A/U coaxial cable. And because each cluster controller is assigned an exclusive address (as described later in this manual), as many as fifteen cluster controllers can be "daisy chained" to the host adapter. And depending on how many cluster controllers are connected to the host adapter, the last cluster controller in the daisy chain can be up to 1000 feet from the host adapter. This configuration is illustrated in figure 1-1.

The coaxial cable connects to each cluster controller via a "T" fitting; the cable passes through the "T" fitting on its way to the termination point. The cluster controller is transformer coupled to the cable. This ensures that a failing cluster controller, or one that is accidentally disconnected from power, will not prevent the remainder of the system from operating properly. The use of a "T" fitting for interconnecting the coaxial cable and the cluster controller allows a cluster controller to be physically disconnected from the "T" fitting while the system is on-line, without breaking the coaxial connection to other cluster controllers. This feature allows you to replace or add cluster controllers--as long as a "T" fitting already exists at the desired location--without disturbing other users of the system.

Each downloadable cluster controller provides either eight or sixteen lines of RS-232C data communication equipment (DCE) data ports via DB-25S connectors. Software utilities resident on the host computer can program the lines individually for communication at baud rates of from 50 bps to 38.4K bps.

HPS downloadable cluster controllers operate on universal input AC power delivered by a detachable power cord. This input power capability enables the cluster controllers to be used interchangeably as either 120 VAC or 220 VAC units with no changes required. The power cord attaches to an International Electrotechnical Commission (IEC) connector on the cluster controller's connector panel. A tri-color indicator light, visible on the cover, provides information regarding the operating status of the cluster controller.

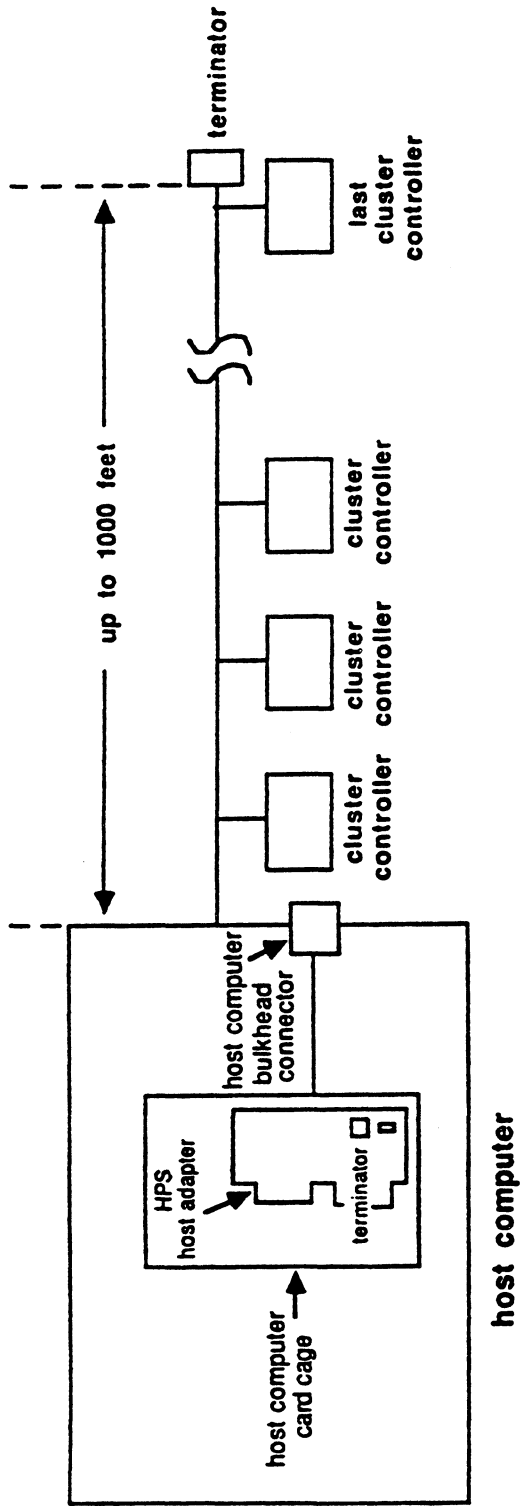


Figure 1-1. Interconnection Diagram

1.2 REGULATORY AGENCY INFORMATION

1.2.1 SAFETY REGULATIONS

HPS downloadable cluster controllers have obtained the following safety agency approvals:

- Underwriter's Laboratories Information Processing and Business Equipment Standard UL 478, Fifth Edition.
- Canadian Standards Association (CSA) C22.2 number 220-M1986.
- TÜV International Electrotechnical Commission (IEC) 380.

1.2.2 EMISSIONS REGULATIONS

HPS downloadable cluster controllers have obtained VDE 0871 emissions agency approval.

In addition, the cluster controllers comply with the following regulations:

- United States Federal Communications Commission (FCC) Part 15, Subpart J, Class A.
- Canadian Department of Communications (DOC) (FCC standards apply).

FCC WARNING

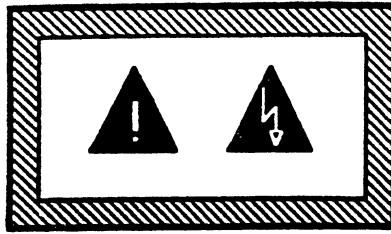
This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested with shielded I/O cabling, and nickel-plated metal shell connectors, and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Only peripherals (computer input/output devices, i.e., terminals, printers, etc.) that comply with either Class A or B FCC limits may be attached to this unit. Operation with noncompliant cables or peripherals is likely to result in interference to radio and television reception.

DOC Notice

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe A prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.



1.3 SERVICE PRECAUTIONS

Refer all servicing to qualified service personnel.

CAUTION

Electrical shock hazards inside. Do not remove cover. No user-serviceable parts inside.

VORSICHT

Um elektrischen schlag zu vermeiden metallplatte nicht abnehmen. Zugang zur bedienung nicht erforderlich. Wartung nur durch qualifiziertes personal.

PRECAUCION

Esta cubierta no debe abrirse. Solo personal de servicio calificado. No hay partes que puedan recibir mantenimiento por el usuario.

ATTENTION

Ne pas enlever ce couvercle. Réserve au personnel autorisé. Il n'y a pas de composant à l'intérieur qui puisse être remplacé par l'utilisateur.

ATTENZIONE

Non rimuovere questo coperchio. Scopritura: Solo per personale addestrato e autorizzato Nell'interno non vi sono componenti che possono essere sottoposti a servizio dall'utente o fuori fabbrica.

1.4 SPECIFICATIONS

Table 1-1 lists the specifications for the HPS downloadable cluster controller.

NOTE

HPS downloadable cluster controllers are equipped with auto-ranging input circuitry suitable for 120 VAC and 220 VAC operation. No adjustments are necessary. Be sure to use the proper power cord for the AC voltage applied.

Table 1-1. Specifications

Parameter	Specification
Dimensions	<p>Eight-Channel Cluster Controllers: 2-7/8 in. high by 10-1/8 in. wide by 10 in. deep</p> <p>Sixteen-Channel Cluster Controllers: 20-5/8 in. wide by 10 in. deep</p>
Weight	<p>Eight-Channel Cluster Controllers: 4.5 lbs (2.04 kg)</p> <p>Sixteen-Channel Cluster Controllers: 7 lbs (3.17 kg)</p>
Power requirements	120V/240V (92 – 249 VAC, 0.5A – 0.4A, 47 – 63 Hz)
Environment	<p>operating temperature: 0°C to 40°C ambient (32°F to 104°F ambient)</p> <p>operating humidity: 10% to 90% noncondensing</p> <p>storage temperature: 0°C to 55°C (32°F to 131°F)</p>

Table 1-1. Specifications (Continued)

Parameter	Specification
Processor	10 MHz 68000
Serial I/O interface	RS-232C
Signals supported	TXD, RXD, RTS, CTS, DTR, DSR, DCD, and Ground
Transport medium	RG-62A/U, 93 ohm coaxial cable terminated at each end with 93 ohm passive terminators
Maximum transport length	1000 foot maximum network length, without the use of HPS SYSTECH Pluriaxial Unplug Repeater (SPUR) units
Indicators	Tri-color status light-emitting diode (LED)
Printer port	HPS-7082-xxx only: Centronics-type parallel printer port

Chapter 2 Installation

This chapter defines the requirements for installing the HPS downloadable cluster controller system, and provides instructions for the actual installation.

CAUTION

To prevent electrical shock, do not remove the cluster controller cover. No user-serviceable parts are inside. Refer servicing to qualified service personnel.

CAUTION

The RG-62A/U coaxial cables required for use with HPS cluster controllers are not designed for outdoor installation. To protect equipment and personnel from possible damage or injury due to lightning, use the coaxial cable only for indoor installations.

If your installation needs include a requirement for outdoor cabling (e.g., between facilities), it is preferable to use an HPS SPUR to increase your cabling flexibility and distance. The SPUR can make use of fiber optic cables which offer protection from hazards such as lightning strikes.

2.1 INSTALLATION REQUIREMENTS

There are certain facts about the HPS system that you should be familiar with before you begin the installation. Understanding the capabilities and limitations will allow you to install the cluster controllers in the most efficient manner, thus ensuring that the system works as described and provides you the optimum operational performance.

2.1.1 CABLES/CONNECTORS

- Use 93 ohm, RG-62A/U coaxial cable between the host bulkhead connector and the first cluster controller on the line, and between each subsequent cluster controller. The cable must be equipped with a standard BNC connector for attaching to the bulkhead connector, and another BNC connector for attaching to the cluster controller. Figure 2-1 illustrates the cable and attached BNC connector.

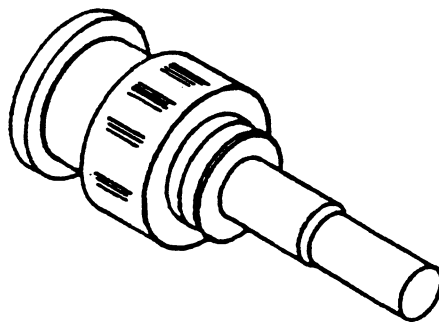


Figure 2-1. BNC Connector

- BNC "barrel" connectors can be used as necessary to splice cable lengths together or to connect sections of the line where an individual cluster controller has been removed from the system.

CAUTION

Because each barrel connector cable splice contributes to signal attenuation, keep the use of barrel connectors to a minimum.

Figure 2-2 illustrates a barrel connector. Check your installation carefully to ensure that exposed metal on coaxial connectors is not touching any metallic surfaces (i.e., conduit pipe, water pipe, etc.). Contact with metallic objects may cause interference to the network. If this occurs, you'll have to insulate the metal portions of connectors with electrical tape, heat shrink tubing, etc.

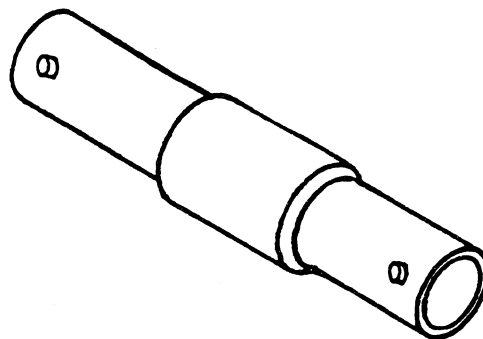


Figure 2-2. Barrel Connector

- Install a "T" fitting on each cluster controller. The RG-62A/U coaxial cable leading from the previous cluster controller (or, in the case of the first cluster controller on the line, from the host computer bulkhead) attaches to one side of the "T" connector, and the cable leading to the next cluster controller attaches to the other side of the "T." Figure 2-3 illustrates a "T" fitting.

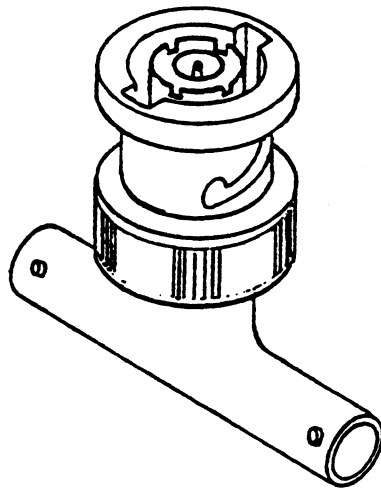


Figure 2-3. BNC "T" Fitting

- Terminate the coaxial line (at the end) by connecting a 93 ohm BNC terminator cap to the open end of the "T" fitting installed on the last cluster controller on the line. Figure 2-4 illustrates a terminator.

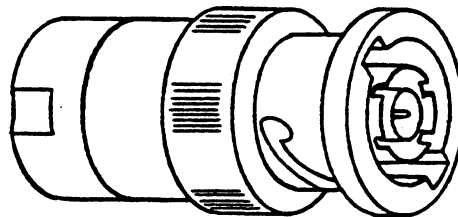


Figure 2-4. BNC Terminator Cap

2.1.2 LOCATION/CONFIGURATION

The downloadable cluster controllers can be placed on a desktop or any flat surface, or they can be mounted in a convenient location on the wall (an optional wall-mount bracket is available). Where you locate the cluster controllers depends on availability of AC power, environmental conditions, and coaxial cable length from the host computer.

Because each cluster controller requires connection to an AC power source (standard wall outlet), you'll have to locate the controllers so that the AC connection is readily accessible. For reliable operation, the operating temperature specification listed in chapter 1 must be taken into account when selecting a location and, additionally, you must leave 6 inches of free space around the air vents for proper ventilation.

For the HPS system to operate properly, the signals transmitted by each node¹ on the coaxial cable must reach all of the other nodes with sufficient strength for proper reception. The coaxial cable itself, the receivers at each node, and the intervening "barrel" connectors all attenuate the signal as it propagates through the network. HPS equipment allows a maximum of 9.6 dB attenuation between any two nodes on the network.

Table 2-1 provides "rule-of-thumb" estimates for cable length versus number of nodes. The table is based on the following assumptions:

- Attenuation introduced by each node is 0.5 dB.
- Attenuation introduced by the cable (Belden RG-62A/U, #9268) is 5.6 dB/1000 feet at 5 MHz.

In addition, each barrel connector inserted in the coaxial cable attenuates the signal 0.2 dB. Note that the attenuation characteristics of cable from different manufacturers can vary considerably. If you are designing an installation that operates near the attenuation limits (either due to cable length or number of nodes), check your cable specifications carefully. The appropriate attenuation specification gives attenuation at a signal frequency of 5 MHz.

If the number of nodes in an HPS network is N , the total length of cable between the most distant pair of nodes is L , the cable loss (in dB/1000 feet) is a , and the number of barrel connectors is B , then the total attenuation in the system is:

$$0.5 \times (N - 1) + a \times \frac{L}{1000} + 0.2 \times B$$

This total must not exceed 9.6 dB.

1 A node is defined as any active device (host adapter or cluster controller) connected to the coaxial line. For example, a system configuration consisting of one host adapter and nine cluster controllers is considered to be ten nodes. As shown in table 2-1, the maximum coaxial cable length for ten nodes is 700 feet.

Table 2-1. HPS Coaxial Cable Length Specifications

Number of Nodes	Maximum Cable Length
8	1000
9	800
10	700
11	650
12	600
13	550
14	500
15	400
16	350

2.1.3 INSTALLATION TIPS

The installation tips listed below provide information that will help ensure reliable operation of the cluster controllers. Become familiar with this information before beginning the actual installation.

- The coaxial line running from the host computer bulkhead must connect directly to the "T" fitting on each cluster controller. Attaching a cable between the "T" and the cluster controller (this is called a "stub"), is not allowed. In other words, you can't set up the system so that there is a main coaxial line from which short lengths of cable lead off to each of the cluster controllers. Figure 2-5, view A, illustrates an incorrect installation--one that makes use of this type of stubs. Figure 2-6 illustrates a correct installation.

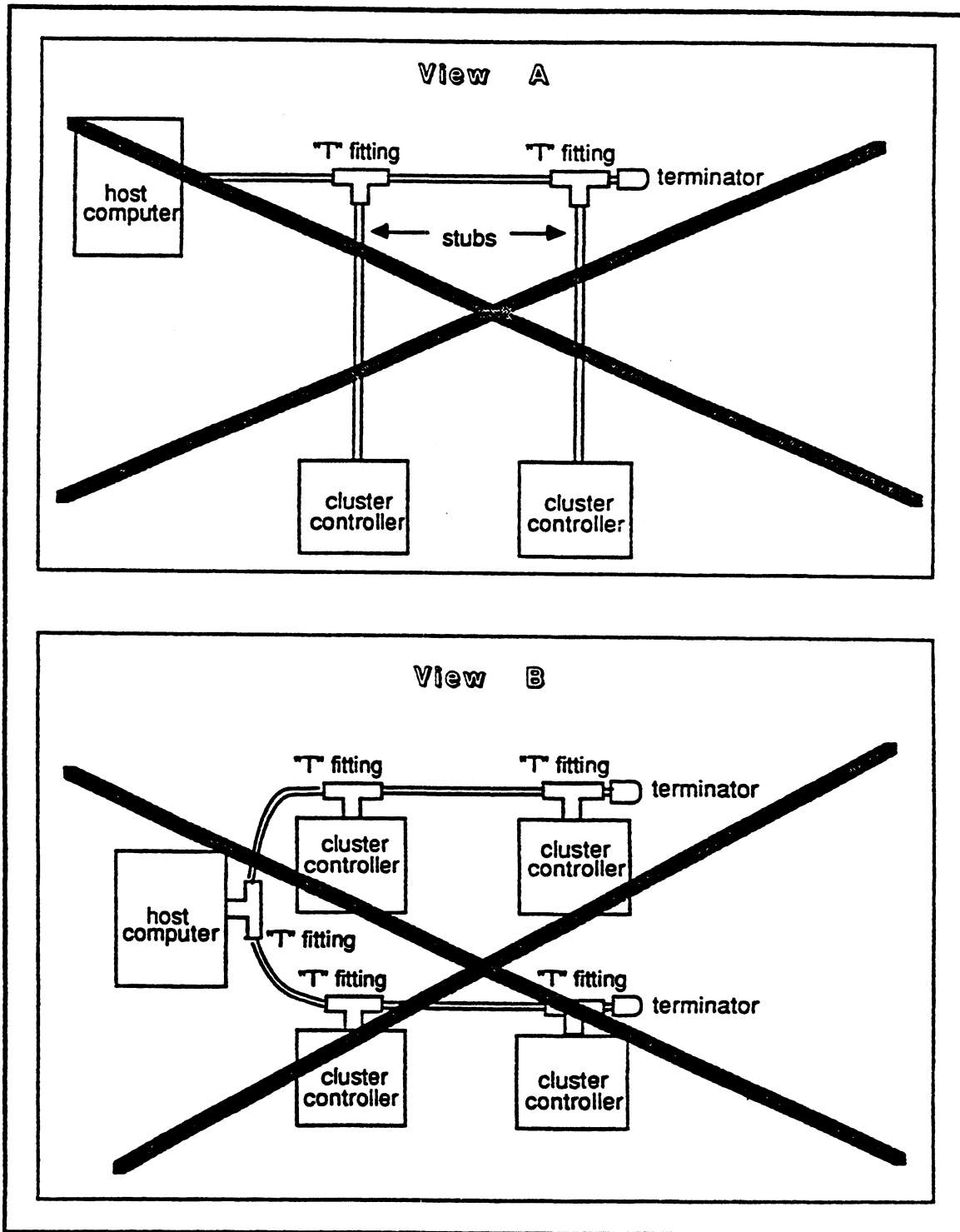


Figure 2-5. Incorrect Installation (Using Stubs)

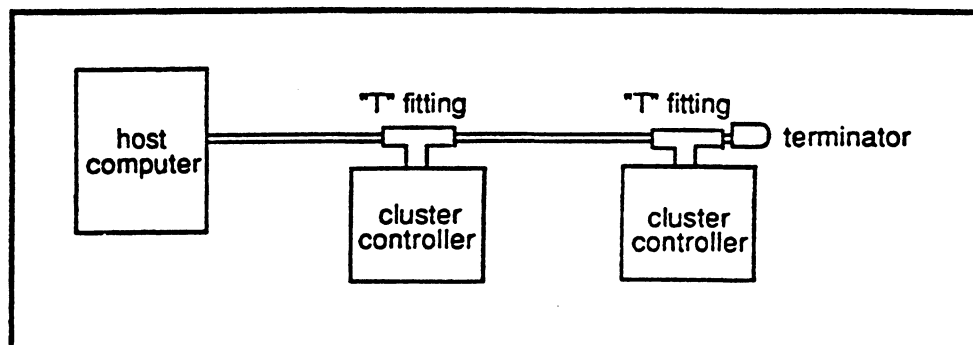


Figure 2-6. Correct Installation (No Stubs Permitted)

- In keeping with the restriction against using stubs, you are not permitted to use a "T" fitting on the host computer bulkhead connector. Because the cable between the host adapter board and the bulkhead connector is part of the main coaxial line, a "T" fitting on the bulkhead results in making this cable a stub of the main line. Figure 2-5, view B, illustrates an incorrect installation that makes use of this type of stub. Figure 2-6 illustrates the correct installation.

On the host bulkhead, since you are prohibited from using a "T" fitting, connect an RG-62A/U coaxial cable (equipped with a BNC connector) directly to the host bulkhead connector. This single cable will lead to the first cluster controller in the daisy chain.

- Take care that none of the metal coaxial connections are touching other pieces of metal, such as conduit or water pipes. If there is any chance of this happening, put an insulating sleeve (of electrical tape or shrink tubing) around the potential trouble spots. Contact with other pieces of metal may cause interference to the network.
- The coaxial line must be terminated at both its beginning and end. To terminate the end of the line, connect a 93 ohm terminator to the open end of the "T" fitting attached to the last cluster controller on the line.

The beginning of the line is terminated by a jumper installed on the host adapter board. This jumper connects a 91 ohm terminating resistor from the center conductor to the shield.

The jumper required for line termination is factory installed on all host adapters. Refer to the technical manual for your particular host adapter board to determine the jumper number.

2.2 INSTALLATION PROCEDURES

2.2.1 LOCATION

First determine where you want to locate each of the cluster controllers that you are initially going to install on the coaxial line (you can add or delete cluster controllers later, but remember that you're limited to a total of fifteen cluster controllers). Whether you decide to place an individual cluster controller on a flat surface or mount it on the wall, verify that you have an available AC power connection near each proposed cluster controller location, and that the temperature in the area is acceptable for operating a cluster controller. Also keep in mind the maximum coaxial line length restrictions discussed in section 2.1.2 as you determine the placement of cluster controllers.

If you're going to mount any of the cluster controllers on the wall, use proper hardware (molly bolts, toggle bolts, or screws) to securely attach the wall bracket (figure 2-7) to the selected location on the wall. Then slide the cluster controller onto the mounting bracket, hooking the raised slots on the bottom of the cluster controller onto the bracket tabs (figure 2-8). Ensure that the cluster controller is firmly positioned.

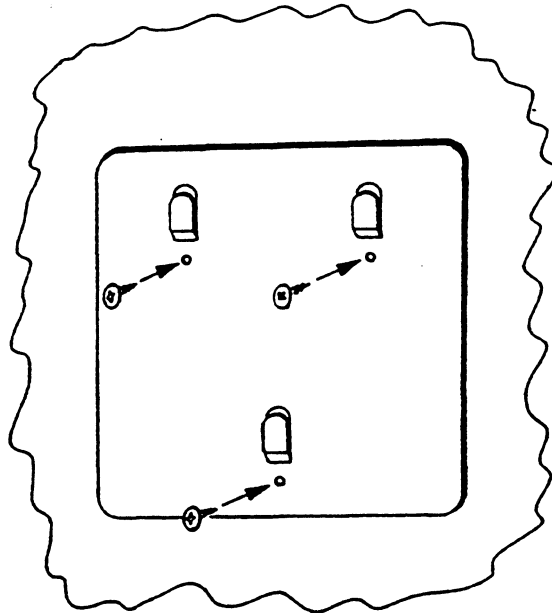


Figure 2-7. Securing Mounting Bracket to Wall

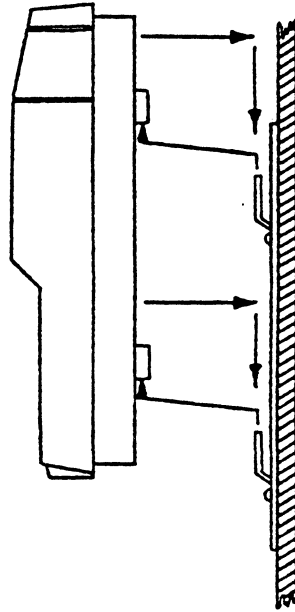


Figure 2-8. Attaching Cluster Controller to Mounting Bracket

2.2.2 COAXIAL INSTALLATION

Establishing the daisy chain:

- 1. Using an RG-62A/U coaxial cable terminated with BNC connectors, firmly push one of the connectors onto the host computer bulkhead connector (figure 2-9). Ensure that the pins on the outside of the bulkhead connector slide all the way into the slots on the cable connector.**

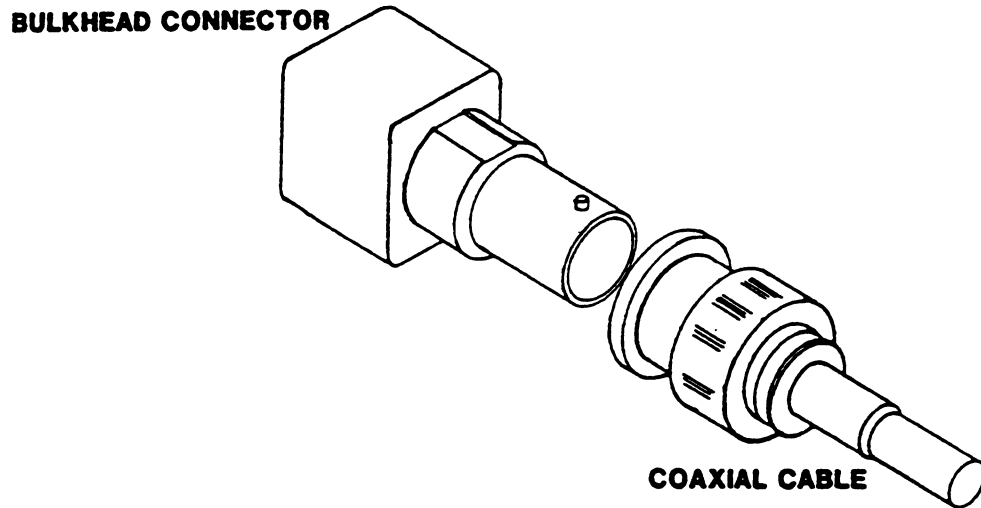


Figure 2-9. Connecting Coaxial Cable to Bulkhead

WARNING

Do not connect a "T" fitting to the host computer bulkhead. (Only one BNC coaxial connection is allowed at the host computer.)

2. Turn the knurled ring on the cable connector clockwise until the pins on the outside of the bulkhead connector snap into place.

3. All BNC connections are handled as described in steps 1 and 2. Using this same procedure, connect a "T" fitting to the serial bus connector on the first cluster controller to be installed on the line (figure 2-10).

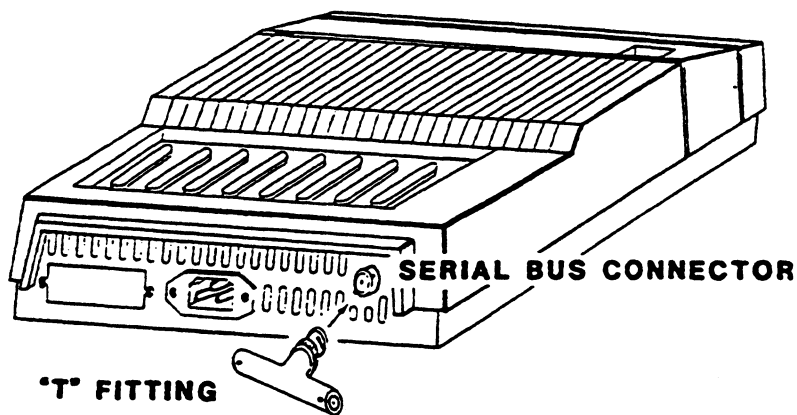


Figure 2-10. Connecting "T" Fitting to Cluster Controller

4. To establish the daisy chain, you must connect the HPS host adapter to the cluster controller. Do this by connecting the free end of the cable leading from the bulkhead connector to one side of the "T" fitting installed on the first cluster controller.

Adding additional controllers to the daisy chain:

5. Connect a "T" fitting to the next cluster controller to be installed on the line.
6. Connect one end of another RG-62A/U cable to the open side of the "T" fitting on the previously installed cluster controller.
7. Connect the free end of the cable to one side of the "T" fitting on the cluster controller you are currently installing.
8. Repeat steps 5 through 8 until all cluster controllers that are to be initially installed have been daisy chained together.

Terminating the daisy chain:

9. Connect a 93 ohm terminator to the free end of the last cluster controller's "T" fitting.

2.2.3 SETTING THE EXTERNAL ADDRESS SWITCHES

Setting the external address switches (figure 2-11) determines the node address of each HPS downloadable cluster controller. You determine the address assignment for each cluster controller in the daisy chain. Although any address between 01 hexadecimal and FF hexadecimal may be selected, follow the rules listed on the next page when selecting addresses for the cluster controllers.

- Select a unique address for each cluster controller on the coaxial line.
- Because address 00 is reserved for general broadcasts to all stations, do not use it as an individual cluster controller address.
- Do not set any of the cluster controllers to the same address as the HPS host adapter. **SYSTECH** recommends that the HPS host adapter address be configured as 0FFH (255), and that the cluster controllers start at address 01H (1) and increase sequentially to 0FH (15). To convert decimal addresses (1 through 15) to hexadecimal as required for installation, refer to the decimal-to-hexadecimal conversions in table 2-2.

Use a small-blade screwdriver to set the addresses. Insert the blade through the opening on the cover and into the "arrow" on one of the switches. Then turn the arrow to the desired setting.

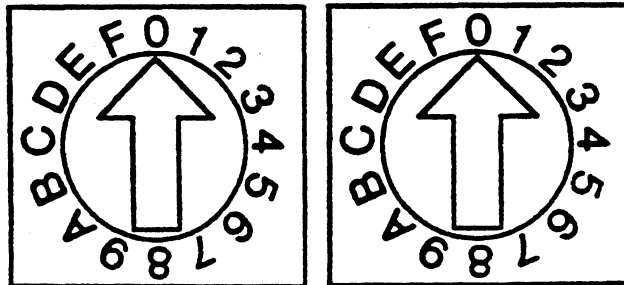


Figure 2-11. External Address Switches

Table 2-2. Decimal-to-Hexadecimal Conversion Chart

Decimal Address	Hexadecimal Switch Settings
0	00
1	01
2	02
3	03
4	04
5	05
6	06
7	07
8	08
9	09
10	0A
11	0B
12	0C
13	0D
14	0E
15	0F
16	10

NOTE

Refer to appendix A for information on connecting a three-wire cable to the cluster controller.

2.2.4 RS-232C CONNECTION

Connect each terminal or serial printer to a DB-25S connector on the cluster controller. On the eight-port cluster controller, the ports are labeled 0 through 7. On the sixteen-port cluster controller, the ports are labeled 0 through 15.

The serial interface on all eight (or sixteen) ports is configured for EIA RS-232C (data communication equipment--DCE) standards. Table 2-3 shows the relationship between the signals and DB-25S connector pin numbers for ports 0 through 7 (or 0 through 15). As a convenient reference, the signal direction for each signal is also shown. The "<" symbol indicates that the signal is being received by the cluster controller, and the ">" symbol indicates that the signal is being transmitted from the cluster controller.

Table 2-3. Signal/DB-25S Pin Number Cross Reference

DB-25S Pin Number	RS-232C Signal Name
1	Protective (chassis) ground
2	TXD <
3	RXD >
4	RTS <
5	CTS >
6	DSR >
7	Signal ground
8	DCD* >
20	DTR <
<p>* The DCD signal is pulled actively high (+12V) through a 5.6 kΩ resistor.</p>	

2.2.5 CENTRONICS INTERFACE CONNECTION

2.2.5.1 Printer Interface Signals

A Centronics-compatible parallel line printer may be connected to those eight-channel downloadable cluster controllers equipped with the Centronics-compatible port (many printers are available with a Centronics parallel interface). The parallel printer connector used is the industry-standard 36-pin connector for Centronics interfaces. The connector type for a mating cable should be the Amphenol 57 series, 36-pin cable-to-panel connector (Amphenol P/N 57-30360 or a compatible equivalent).

The Centronics-compatible interface supports the signals shown in table 2-4. As a convenient reference, the signal direction for each signal is also shown. The "<" symbol indicates that the signal is being received by the cluster controller, and the ">" symbol indicates that the signal is being transmitted from the cluster controller.

Table 2-4. Signal/36-Pin Connector Cross Reference

Signal Pin Number	Return Pin Number	Signal	Description
1	19	DATA STROBE/ >	STROBE/ pulse for printer to read data in.
2	20	DATA 1 >	These signals represent information of the first-to-eighth bits of parallel data, respectively. Each signal is at "HIGH" level when data is logical "1," and at "LOW" level when logical "0."
3	22	DATA 2 >	
4	22	DATA 3 >	
5	23	DATA 4 >	
6	24	DATA 5 >	
7	25	DATA 6 >	
8	26	DATA 7 >	
9	27	DATA 8 >	
10	28	ACKNLG/ <	"LOW" indicates that data has been received and that the printer is ready to accept other data.
12	30	PE <	A "HIGH" signal indicates that the printer is out of paper or has an error.
13	-	SLCT <	A "HIGH" signal indicates that the printer is selected, on line, and connected.

2.2.5.2 Timing Interface

The HPS-7082-xxx supports a Centronics-type printer interface. The printer data setup time is 600 ns, followed by a printer data strobe of 800 ns. The data hold after strobe is longer than 1 μ s because the data is held until the next printer data write cycle. This time is dependent on the microprocessor print data inter-character processing, microprocessor speed, and other processing functions handled by the microprocessor between print characters. The printer interface timing diagram appears as figure 2-12.

In general terms, the cluster controller addresses the printer interface option as it would a UART. When it writes to the command register, the address for UART 0 is used. When data is written to the printer data register, the address for UART 1 is used.

2.2.5.3 Electrical Interface

The Centronics electrical interface design is described below and illustrated in figure 2-13. A parallel printer with the same type of interface will operate properly at a distance of 25 feet from the cluster controller. To determine the maximum distance that a particular printer may be located from a cluster controller, use the interface specifications provided to calculate an acceptable distance.

- Input characteristics: Each input pin from the printer connector is terminated with a 220 ohm pull-up and a 330 ohm pull-down circuit, followed by a 10k-ohm series resistor. This provides a noise-free low-impedance input.
 - V_{il} = 0.8V at I_{il} of -16.7 mA or more negative
 - V_{ih} = 2.4V at I_{ih} of -4.5 mA or more positive
- Output characteristics: Each output to the printer connector is driven with 1k-ohm pull-up open collector driver. This provides high drive capability plus protection against short circuits.
 - V_{ol} = 0.4V at I_{ol} of 40 mA or less

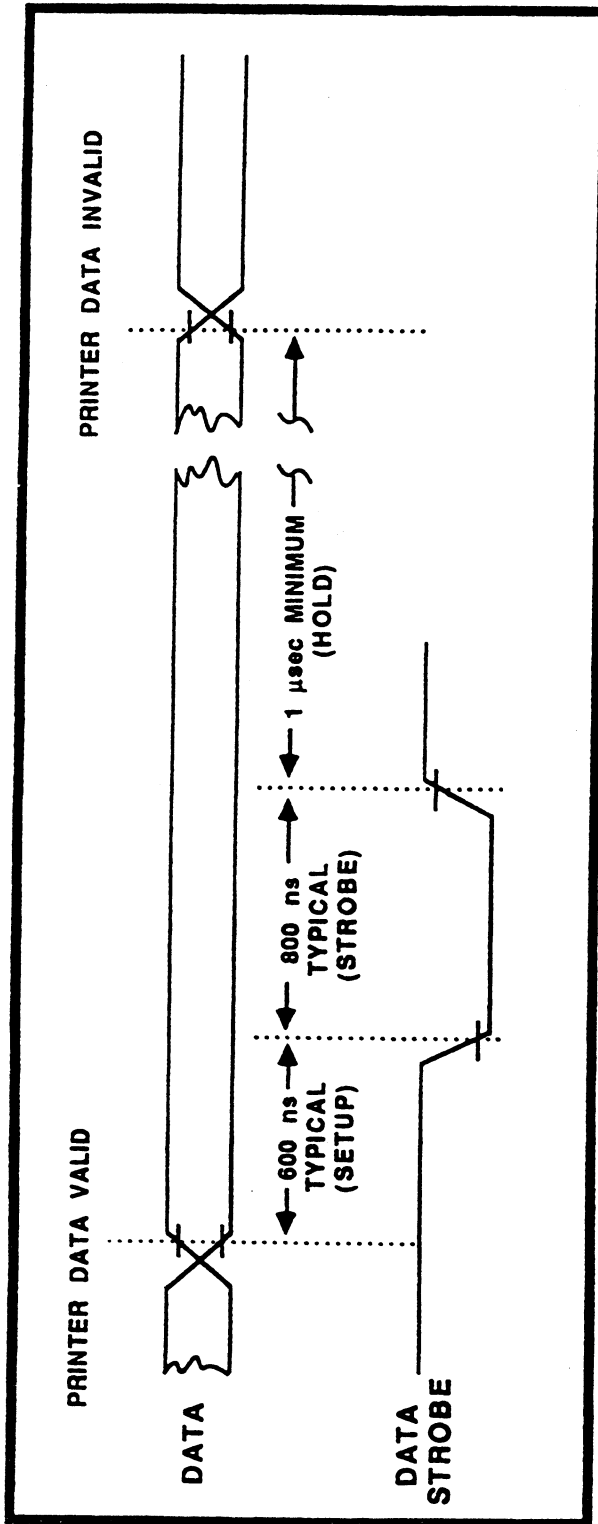


Figure 2-12. Parallel Printer Interface Timing Diagram

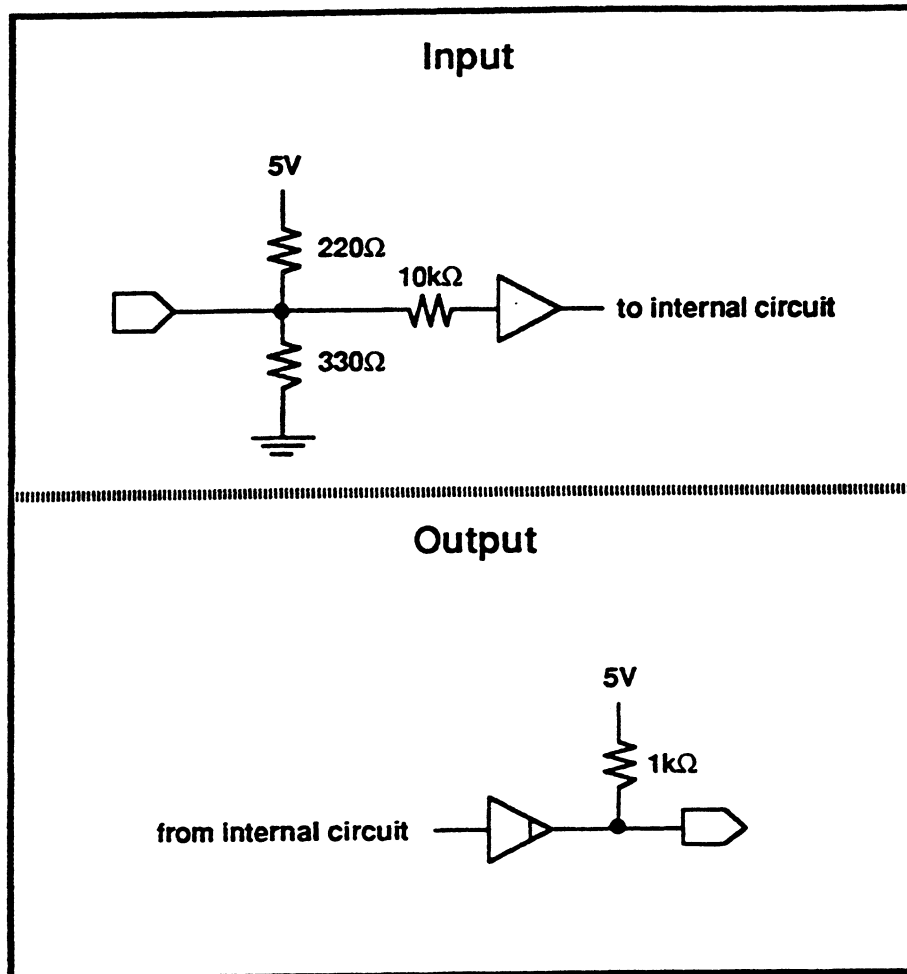


Figure 2-13. Parallel Printer Electrical Interface

2.2.6 POWER CONNECTION

The last step in the cluster controller installation is to connect each cluster controller to an AC power source (wall outlet). Do this by connecting the three-pronged female plug to the IEC connector on the cluster controller, then connect the standard three-pronged male plug to a properly grounded standard 120 VAC or 220 VAC power source (the cluster controller accepts universal input power so that it can be used interchangeably with either 120 VAC or 220 VAC power). After performing its power-up diagnostic self-test and initialization, the cluster controller is fully functional. The tri-color LED indicates operating status, as defined in table 2-5.

Table 2-5. LED Status Information

Color	Pattern	Status
yellow	flickering	self-test and network reconfiguration
green	blinking ("heartbeat")	self-test passed; waiting to be downloaded
green/red	blinking ("heartbeat")	self-test passed, but one or more ports failed self-test; waiting to be downloaded
green/red	alternating	downloaded, but one or more ports failed self-test
green	steady	normal operation
red	flashing	malfunction detected*

* If the red light appears on the tri-color LED, then the cluster controller is defective and should be replaced.

Chapter 3 Troubleshooting

This chapter provides a means of identifying the source of problems you may encounter after you've completed the installation and are attempting to operate the system.

The troubleshooting procedures have been organized according to the type of problem you may be experiencing. Locate the appropriate symptom from the list below, then refer to the section indicated for hints about how to isolate the problem.

- If one or more of the cluster controllers are not operating, see section 3.1
- If data is not being sent to and received from the cluster controllers reliably, see section 3.2
- If a terminal or serial printer attached to a cluster controller is not operating properly, see section 3.3

3.1 NONOPERATIONAL CLUSTER CONTROLLER

To determine why one or more of the cluster controllers are failing, perform the following checks.

1. Verify that the cluster controller node address switches (the two external switches visible through the opening in the plastic cover) are set to both a valid address, and to one that the host computer system is expecting to be present.
2. Verify that no two cluster controllers have been set to the same node address.
3. Verify that none of the cluster controllers have been set to the same node address as the HPS host adapter which is installed in the host computer.
4. Verify that all coaxial connections--the "T" fittings on each cluster controller, the barrel connections, and the cable connections--are secure.
5. Disconnect the AC power cord from the nonoperational cluster controller. After waiting a few seconds, reconnect the power cord while watching the tri-color LED.

The cluster controller is functional if the LED flashes yellow for a few seconds (indicating that the self-test is being performed), and then blinks green in a "heartbeat" pattern (two blinks, then a pause before the sequence is repeated). At this point, the cluster controller has passed self-test and is waiting to be downloaded.

Upon completion of the download the LED will turn steady green.

If one or more ports on the cluster controller do not pass self-test, after the download is complete the LED will blink red and green alternately. At this point, the cluster controller will function, but will return errors when attempting to access a failed port or ports. Refer to the cluster controller log table in the *HPS Diagnostic Application User Manual* (SYSTECH part number 80-000274-1-00) for an indication of which port(s) failed.

If the LED turns red or fails to complete the sequence described above, the cluster controller is defective and should be replaced.

6. Verify that the end of the coaxial line is terminated with a 93 ohm BNC terminator cap (the terminator cap should be connected to one side of the last cluster controller's "T" fitting).
7. On the HPS host adapter board, verify that the jumper which connects the terminating resistor is installed (this terminates the beginning of the coaxial line). Section 2.1.3 defines the specific jumper number for each host adapter board model.
8. If everything checks out correctly and one or more cluster controllers still are not working while others are operating properly, replace the failing cluster controller(s).

3.2 UNRELIABLE DATA TRANSMISSION

To solve why data may not be sent to and received from the cluster controllers reliably, perform the following checks.

1. Verify that all coaxial connections--the "T" fittings on each cluster controller, the barrel connections, and the cable connections--are secure.
2. Verify that the end of the coaxial line is terminated with a 93 ohm BNC terminator cap (the terminator cap should be connected to one side of the last cluster controller's "T" fitting).
3. Verify that there are no coaxial stubs anywhere along the line (refer to section 2.1.3 for the definition of a stub).
4. Verify that a "T" fitting has not been installed on the host computer bulkhead connector. Only a single BNC connection is allowed to the bulkhead connector.
5. On the HPS host adapter board, verify that the jumper which connects the terminating resistor is installed (this terminates the beginning of the coaxial line). Section 2.1.3 defines the specific jumper number for each host adapter board model.
6. Verify that the total coaxial cable length and the number of cluster controllers installed do not exceed the recommendations defined in section 2.1.2.

7. Verify that none of the exposed metal on the coaxial connectors is touching any metallic surfaces. Contact with exposed pieces of metal such as electrical conduit, water pipes, and other metallic items may cause interference to the network.

8. If you are still having difficulty, have a qualified service technician perform the following electrical ohmmeter test to determine if there is a problem (either an open or a short) with the coaxial cable:
 - a. Turn the host computer system OFF, so that its power is removed.
 - b. Remove power from all the cluster controllers by disconnecting their power cords from the AC outlets.
 - c. Disconnect the coaxial cable from the back of the host computer.
 - d. Using the cable you just disconnected, measure the DC resistance from the BNC connector's center conductor to the coaxial cable's shield. Depending on the length of the coaxial line, the resistance should be within the range of 86 to 163 ohms (cables that are close to 1000 feet in length normally have resistance readings of up to approximately 163 ohms).

If the resistance is less than 86 ohms, check the cable for shorts.

If the resistance is much higher than 163 ohms, verify that a 93 ohm terminator cap has been installed at the end of the coaxial line. If the terminator is installed properly (and is known to be good), and the resistance is still too high, test the cable for opens in either the shield or the center conductor.

3.3 NONOPERATIONAL TERMINAL OR SERIAL DEVICE

To determine why a terminal, serial printer, or other serial device connected to a cluster controller is not operating, perform the following checks.

1. Verify that the serial cable is properly connected to both the cluster controller and the terminal or serial device.
2. Verify that the host computer system is setting the baud rate for each of the cluster controller's serial ports to match the baud rate of the particular terminal or serial device that the port controls.
3. Verify that the serial cable's RS-232C signal lines have been terminated to satisfy the connection requirements of the serial device you are connecting. The cluster controller has been designed as an RS-232C data communication device (DCE). The RS-232C signals supported, along with their signal directions, are defined in section 2.2.4 of this manual. You should be able to connect a data terminating equipment (DTE) device (such as a terminal) directly to a cluster controller port with a "straight through" cable. Other types of serial devices may require a "crossover" cable or other custom connections for proper operation. Refer to the literature for the device being connected for information on the specific RS-232C signal connections it may require.

If you are still having difficulty after verifying that the serial cable has been properly terminated for the type of serial device you are using, try another serial cable. This will determine if the cable itself is defective.

4. Verify that the terminal or serial device is functional by replacing it with a known working device having the same serial configuration.
5. Verify that the cluster controller is functional by first trying another serial port on the same controller. If the controller still doesn't work, replace it with a known working controller.
6. Since excessive RS-232 serial cable lengths may lead to data transmission errors, verify that the manufacturer's specification for the length of cable used meets the EIA RS-232C specification for interface cabling.



Chapter 4

OEM Warranty and Repair Procedure

This information applies to **SYSTECH's** authorized distributors (OEMs). An "end user's" point of contact for support or repair is the authorized distributor from which the product was purchased.

For reference, the **SYSTECH** Corporation warranty appears at the end of this chapter.

4.1 CALLING CUSTOMER SERVICE

Before calling the customer service number regarding a product support issue, have the following information available:

- A detailed description of the problem.
- System type.
- Operating software and version level.
- **SYSTECH** product, model, part number, and revision level.

The **SYSTECH** customer service number is: **(619) 453-8976**

4.2 RETURNING PRODUCT FOR REPAIR

Should the product need to be returned for repair, you will need a Return of Material Authorization (RMA) number from SYSTECH. The RMA number is valid for 30 days. All returns to the factory (warranty, nonwarranty, loaners, evaluation, beta, and exchanges) require an RMA number. The RMA number must appear on the outside packaging of all returned products.

A valid purchase order is required for all repaired products, both warranty and nonwarranty. Products under warranty will be returned prepaid; products not covered under warranty will be returned prepaid and billed.

NOTES

Any parcel received without an RMA number noted on the outside of the package will be refused by the SYSTECH receiving department, and will be returned freight collect to the sender.

For international shipments, we do not recommend the use of Air Parcel Post.

To return product for repair:

- Obtain an RMA number by calling the SYSTECH order entry department at (619) 453-8970.
- To enable us to verify warranty repairs, provide to our order entry representative the date you received the product.
- Provide a valid purchase order number for the product being returned.

- Provide the part number and serial number of the SYSTECH product. For most board assemblies, the serial number is located on the component side while the part number is printed on a small white label on the solder side (the part number takes the form 65-xxxxxx-x-xx). For cluster controllers and SPURs, the serial number is on a large silver label and the part number (65-xxxxxx-x-xx) is on a small white label; both are affixed to the bottom of the unit.
- Verify with the order entry representative your shipping and billing address.
- Describe the problem and include the name and phone number of a technical contact who can provide further information about the failure.
- Package the product for shipment, indicating on the outside of the parcel the RMA number. Then ship the product freight and insurance prepaid to:

SYSTECH Corporation
6465 Nancy Ridge Drive
San Diego, CA 92121

- The product will be returned, repaired or exchanged within 30 working days. A valid hardcopy purchase order must be received by SYSTECH before the product will be returned to the customer. Products under warranty are returned prepaid. Products not covered under warranty are returned prepaid and billed.

4.3 SYSTECH CORPORATION WARRANTY

1. **WARRANTY:** SYSTECH Corporation ("Company") warrants that hardware products manufactured by it are free from defects in materials and workmanship under normal conditions of usage and service for a period of one year from the date the product is shipped from Company's factory. This warranty shall not apply to any product which was repaired or altered outside of Company's factory or authorized service stations, nor which has been subject to misuse, negligence or accident, or use not in accord with instructions furnished by Company.
2. **RETURN OF DEFECTIVE PRODUCT:** Purported defective products shall be properly packaged by Buyer and shipped, insured, at Buyer's cost to one of Company's authorized service stations for verification of defects.
3. **REPAIR OR REPLACEMENT:** If after examination, Company determines that a product is defective, Company shall, at its option, replace or repair the product at no cost to the Buyer. Return of the repaired or replaced defective product to Buyer shall be at Company's expense. Company warrants any repair or replacement for 30 days or remainder of original warranty, whichever period is longer.
4. **PRODUCTS NOT SUBJECT TO WARRANTY:** Buyer shall pay all transportation charges plus Company's established price for replacement or repair of products sent to Company by Buyer for replacement or repair outside the scope of the warranty.
5. **DISCLAIMER AND LIABILITY RESTRICTION:** THERE ARE NO WARRANTIES EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, EXCEPT THOSE SET FORTH HEREIN, AND THE LIMITATION OF OBLIGATION HEREIN DESCRIBES THE SOLE AND EXCLUSIVE DUTIES, OBLIGATIONS AND RIGHTS OF COMPANY, BUYER, AND THEIR SUCCESSORS.

IN NO EVENT, BE IT DUE TO A BREACH OF ANY WARRANTY HEREUNDER OR ANY OTHER CAUSE WHATSOEVER, SHALL COMPANY BE LIABLE FOR OR OBLIGED IN ANY MANNER TO PAY CONSEQUENTIAL OR INDIRECT DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, PLANT DOWNTIME, PROPERTY DAMAGE, OR PERSONAL INJURY DAMAGE ASSERTEDLY SUFFERED BY BUYER OR THIRD PARTIES WHETHER SUCH CLAIM IS BASED ON CONTRACT OR TORT.

The warranty contained herein, including the Disclaimer and Liability Restriction, constitutes the entire agreement of Company and Buyer with respect to such matters, supersedes and is a merger of all prior negotiations and shall be controlling over any conflicting terms and conditions of any contracts, purchase orders, invoices, or the like, which are or may be executed in connection with the attached contract. If this warranty is voided by any breach of Condition, the Disclaimer and Liability Restriction shall remain fully effective.

No agent, employee or representative of Company has any authority to bind Company to any affirmation, representation or warranty concerning any goods, services or processes other than set forth herein.

6. **ASSIGNMENT:** This warranty may not be assigned or otherwise transferred by Buyer without the prior written consent of Company; provided, if Buyer advises Company in writing at the time of purchase that the product has been bought for resale, Buyer may assign this warranty to its customer.
7. **LIABILITY LIMITATIONS:** If at any time there shall be any liability asserted against Company for goods, services or processes furnished under this Agreement, notwithstanding the foregoing limitations and waivers, Buyer agrees to indemnify Company, hold it harmless and defend it against all liabilities from loss, damage or injury to persons or property by reason of the use of any goods, services or processes provided under this Agreement, regardless of cause or responsibility for negligence.
8. **LIMITATIONS OF DAMAGES OR REMEDIES:** In the event the provisions disclaiming warranties relieving Company from liability for its negligence should, for any reason, be held ineffective, it is expressly agreed that replacement and repair shall be the sole remedy of Buyer with respect to any other remedy available by applicable law.

Appendix A Using the HPS as a Three-Wire System

To use the HPS as a three-wire system, you must modify the DB-25 connector on any cables being used for this purpose. Specifically, you must jumper the RTS and CTS signal lines (pins 4 and 5) together, and the DTR and DSR signal lines (pins 6 and 20) together. Install jumpers to connect these signal lines together as shown in figure A-1.

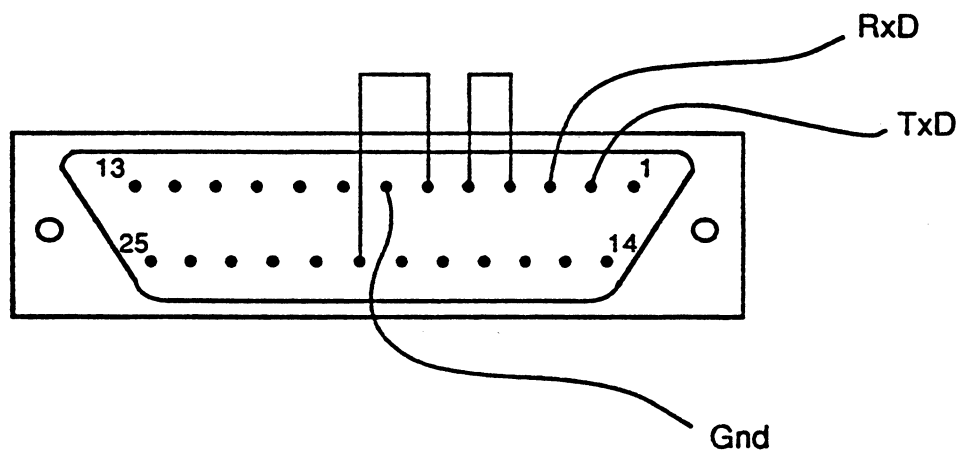


Figure A-1. DB-25 Connector, Wire Side

