Honeywell

Network Gateway Site Planning and Installation

NG02-500

TotalPlant

Honeywell

Implementation
Network Gateway

Network Gateway Site Planning and Installation

NG02-500
Release 500
CE Compliant
12/95

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About This Publication

This publication is provided to guide the reader in planning and installing the Network Gateway Module (NG). It is not intended to be a substitute for the *LCN Planning* and *LCN System Installation* manuals. The Network Gateway is supported by *Five/Ten-Slot Module Service* or *Dual Node Module Service* manuals.

The Plant Interface Network (PIN) is provided by the customer and must conform to the IEEE (coaxial and fiber optic cable) standard 802.4. While the detailed design of the PIN is the responsibility of the customer, we describe it in this manual in general terms.

This revision incorporates the Universal Control Network (UCN) cable technology introduced when the Wideband modems were withdrawn from sale in mid 1994.

This publication supports TDC 3000X software release 500 and CE Compliant hardware.

> Any equipment designated as "CE Compliant" complies with the European Union EMC and Health and Safety Directives. All equipment shipping into European Union countries after January 1, 1996 requires this type of compliance—denoted by the "CE Mark."

Standard Symbols

Scope

The following defines standard symbols used in this publication

ATTENTION

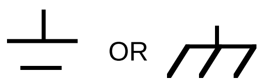
Notes inform the reader about information that is required, but not immediately evident

CAUTION

Cautions tell the user that damage may occur to equipment if proper care is not exercised

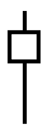
WARNING

Warnings tell the reader that potential personal harm or serious economic loss may happen if instructions are not followed



53893

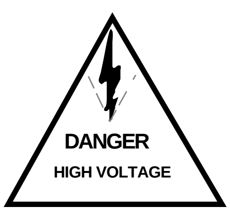
Ground connection to building safety ground


53894

Ground stake for building safety ground

53895

Electrical Shock Hazard—can be lethal



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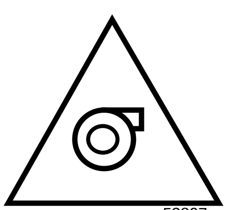
Electrical Shock Hazard—can be lethal


53897

Rotating Fan—can cause personal injury

Table of Contents

Table of Contents

Figures and Tables

Acronyms

EC ....European Community
FOM..Fiber Optic Modem
LCN CL ....LCN Control Language
NG ....Network Gateway
PIN...Plant Information Network

References

Publication Title	Publication Number	Binder Title	Binder Number
TDC 3000^X System Site Planning	SW02-550	System Site Planning - 1	3020-1
LCN Planning	SW02-501	System Site Planning - 1	3020-1
Universal Control Network (UCN) Planning	UN02-501	System Site Planning - 1	3020-1
LCN System Installation	SW20-500	LCN Installation	3025
Hardware Verification Test System	SW13-511	LCN Service-3	3060-3
Five/Ten-Slot Module Service	LC13-500	LCN Service-2	3060-2
Dual Node Module Service	LC13-510	LCN Service-2	3060-2

Section 1 – Network Gateway and Plant Information Network

1.1 Overview

Section contents

These are the topics covered in this section:

Network Gateway

The Network Gateway (NG) is a node specifically developed to provide a communications path between two or more Local Control Networks (LCN).

- The NG node adapts the communication disciplines of the LCN system to the Plant Information Network (PIN) discipline.
- It also translates parameter requests and answers from a locally understood encoding to a globally understood self-describing form.

Figure 1-1 illustrates the major components required to support communications between two Local Control Networks (systems).

Plant Information Network

A Network Gateway Plant Information Network, referred to as PIN, is any network capable of conforming to IEEE 802.4. There are two types of PIN supported by the Network Gateway.

- Carrier Band network such as the Universal Control Network (UCN) used for Network Interface Module (NIM), Process Manager, Advanced Process Manager, and Logic Manager products. **The NG PIN cannot be connected to a UCN cable system; the two networks will not function if tied together.**
- Fiber Optic network physically configured as a star network.

Continued on next page

PIN description

The PIN consists of two single-cable networks. This differs from the LCN, which is a single network with redundant cables.

- Each NG connected to the PIN has a unique PIN address.
- The PIN address is defined with jumper pins (pinning) in each connected node at the time of installation.
- Each NG node has three addresses controlled by pinning.
  - Two addresses are pinned to define the cable network A and network B addresses.
  - The third pinned address is used to define the LCN address. This LCN address is commonly referred to as the LCN node number.

The PIN cable network A and B addresses are always pinned to be the same address.

Example

An example of a basic Network Gateway (NG) and Plant Information Network link between two LCNs is shown in Figure 1-1.

Illustration

Figure 1-1 NGs (NG) Connected by a Plant Information Network (PIN)

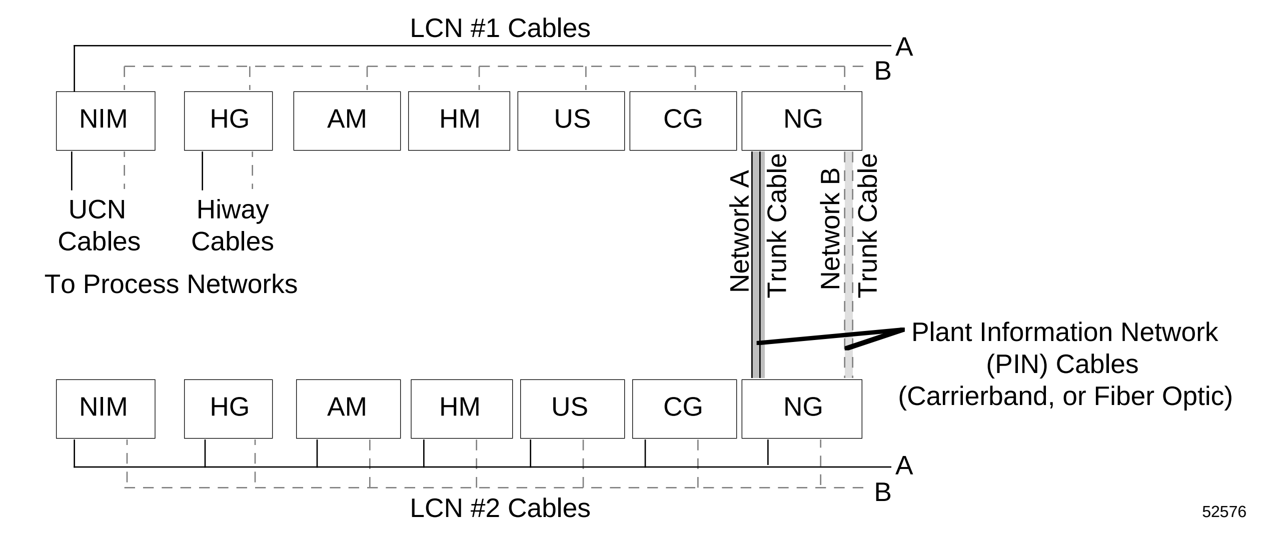


Figure 1-1 shows both an A cable network and a B cable network for the PIN. The B cable network is offered (dashed line) as an option. It is not absolutely necessary to have a B cable network for the PIN; however, most installations will have the B cable to meet their system availability requirements in the event of a cable network failure.

1.2 Network Gateway Provided Features

Example, continued

The example system shown in Figure 1-1 does have one drawback. There is only one NG on each LCN, and therefore the link would disappear if either of the NGs failed.

Notice that the cable B network can be implemented using either of two types of communication medias; Carrier band (CB) or Fiber Optic (FO). The actual hardware used to make up the PIN will vary depending on which network type is used. The type of PIN is invisible to the operating software. The throughput of the NG remains the same no matter which type of PIN is used.

The type of media used for PIN A does not need to match the type of media used for network B. This allows considerable flexibility in facilities that already have more than one type of PIN network.

Performance

The throughput of the NG is up to 1200 point parameters per second with a minimum 3-second delay, concurrent with file transfer operations up to 12000 words per second. The parameter passing and file transfer capabilities are controlled by independent channels inside the NG and changing the demand on one, does not affect the other.

The NG point parameter throughput is dependent on the available throughput of the data owners (AM and CG, NIMs and HGs). It is reasonable to assume that the 1200-point parameters per second rate is achieved when the points are spread over several data owners.

Feature description

The Network Gateway communication link between LCN systems provides powerful new capabilities. A brief summary is given below:

- Allows reading and writing of point parameters to (or from) other LCNs.
- Allows on-line file transfer between the local HM (or local cartridge/floppy drive) and remote LCN HMs, using standard Command Processor utilities. The remote cartridge/floppy drives are not accessible through the NG.
- Allows the local creation/edit of remote LCN CL source files, EB files, and Text (ASCII) files.

  This is done in conjunction with the use of the cross-network file read/write capability. The files must reside on the local HM or removable media during the actual creation/manipulation of the file. An edit of a remote file is done in the following manner:

  – Copy the remote file from the remote HM to local media. The local media can be an HM, cartridge, or floppy disk.
  – Modify/edit the file as it resides on local media.
  – Copy the modified file back to the original source file on the remote HM (only).

Continued on next page

Feature description

- Allows the creation and/or compilation of Remote LCN schematics.

  This is done in conjunction with the use of the cross-network file read/write capability. The files must reside on the local HM or local removable media during the actual creation/manipulation of the file. An edit of a remote file would be done in the following manner:

  – Copy the remote file from the remote HM to local media. The local media can be an HM, cartridge, or floppy disk.

  – Modify/edit the file as it resides on local media.

  – Copy the modified file back to the original source file on the remote HM.

- Allows advanced cross-network control, using the Application Module.

  – Allows AM points and CL control schemes to include points from multiple remote LCN systems.

  – Allows cascaded control for plant-wide optimization.

    An AM point can be in cascade connection with any remote LCN point, such as PM, APM, MC, CG, or AM points.

  – Allows AM file transfer from local media (HM/cartridge/floppy) or the AM itself to remote LCN HMs and vise versa. The remote cartridge/floppy drives are not accessible.

  – Internetwork Point Processor(IPP)

    A new Point Processor is provided in the AM. This point processor is used instead of the Foreground Point Processor (FPP) for internetwork access by the AM. The fastest IPP cycle is 5 seconds.

  – Allows the use of remote LCN points in background CL.

- Allows advanced control using the Computer Gateway (CG).

  – Allows upper-level computers to implement complex control schemes that include points from remote LCN systems.

  – Allows CG file transfer to (or from) remote LCN HMs.

ATTENTION

ATTENTION—Remote LCN points alarming is not included in alarm summary displays at the Local System. A work-around for this can be accomplished by using the Application Module to provide pseudo alarming.

1.3 Network Gateway Hardware Overview

Scope

The diagram in Figure 1-1 shows the connection between two LCN systems through a Network Gateway node on each LCN. The connection between the NGs is the Plant Information Network, which is referred to as the PIN. This PIN connection allows internetwork system operations such as parameter access, file transfer, and control on geographically separated LCNs.

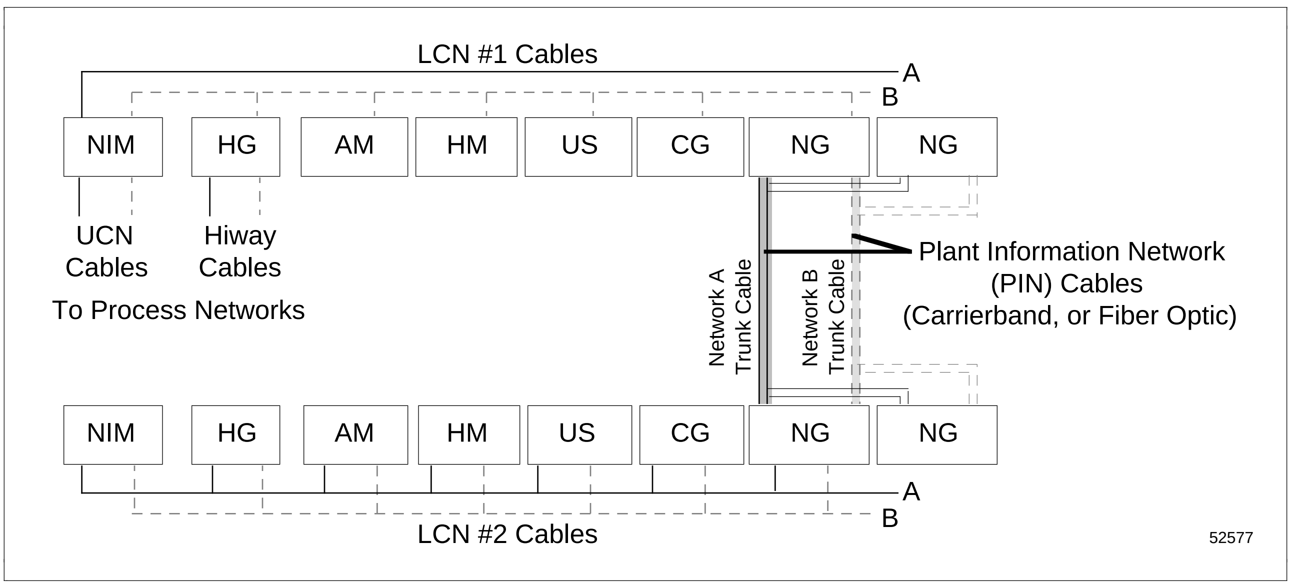
A maximum of 10 NGs for each individual LCN is supported by R4XX software.

Multiple NGs

Figure 1-2 shows two NGs on each LCN. The second NG takes over routing messages when the first NG fails or is unable to communicate with the remote LCN. Software configuration (NCF) determines which NG is responsible for routing messages to a specific remote LCN and which NG is the alternate. The alternate takes over the job of routing messages when the responsible NG fails or is unable to communicate with the remote LCN (R41X software and later only).

This allows continued system operation even if one NG should fail. This could result in a somewhat degraded performance if the alternate is already routing messages to another LCN. To ensure optimal performance, a dedicated Alternate NG can be configured as a "hot spare."

Figure 1-2 Example of Two NGs Per LCN



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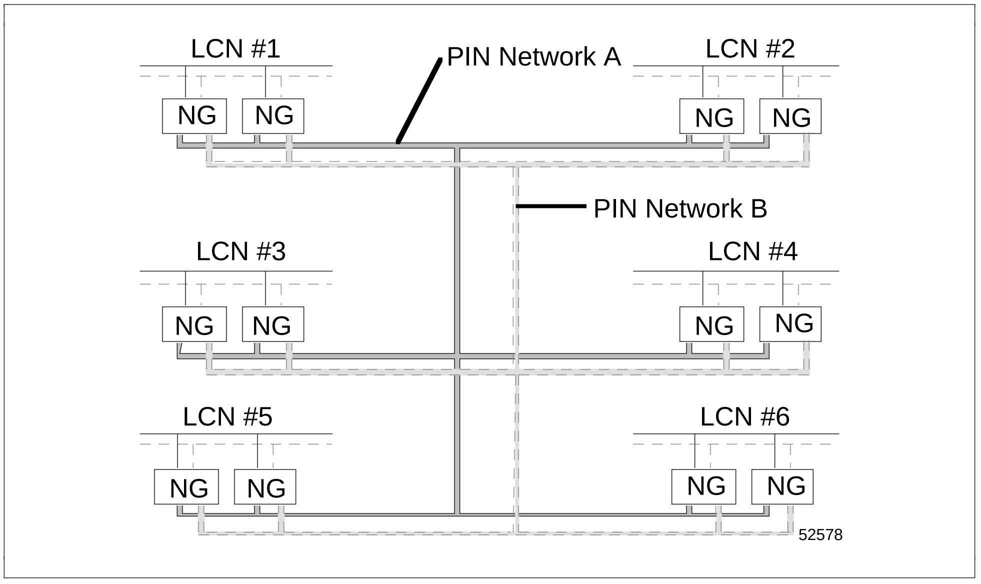
Example

Figure 1-3 shows a broader application of the PIN. This figure still shows only two NGs on each LCN. It shows that more than two LCNs can be interconnected. Figure 1-3 shows 12 NG connections. Network connection details are covered later in this publication.

A PIN network can have a maximum of 64 NGs connected.

Figure 1-3 Plant Information Network Coupling More Than Two LCNs



1.4 Carrier Band PIN

Scope

Carrier band PIN is implemented using the Universal Control Network (UCN) hardware:

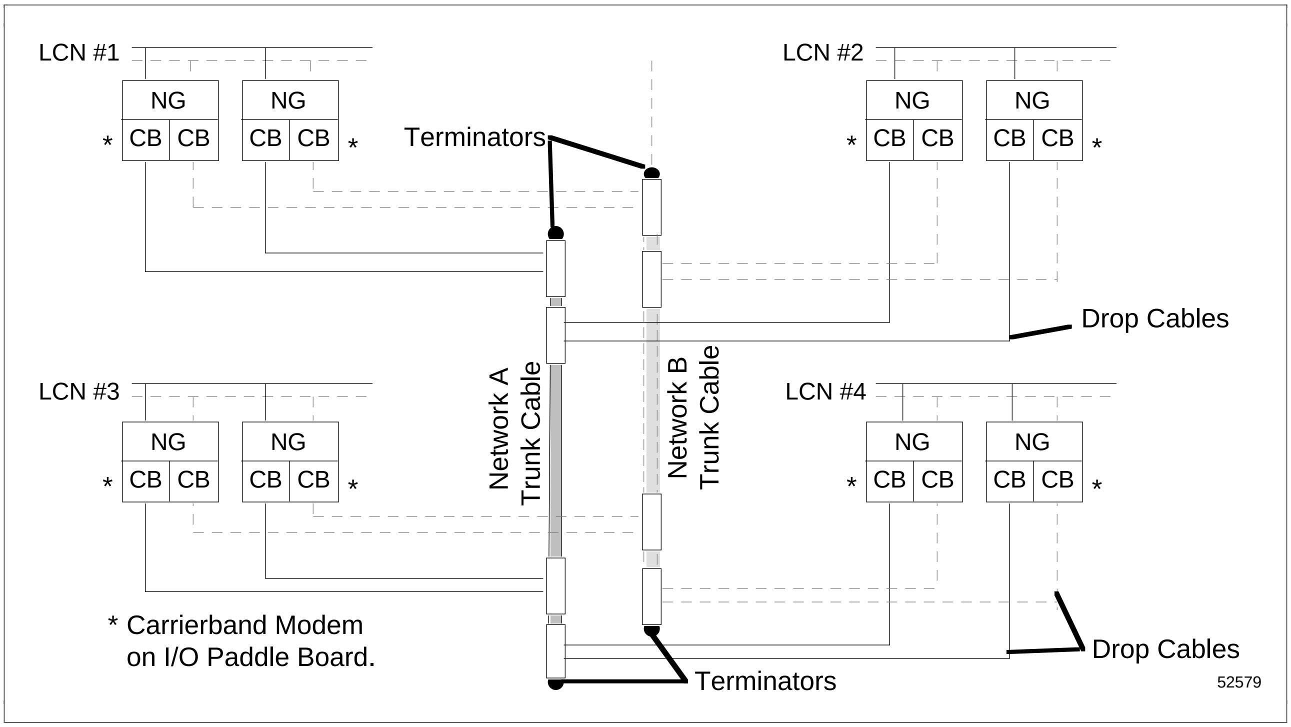
- NIM modem boards are installed in the I/O card file of each NG.
- UCN Trunk cable, taps, and drop cable are combined to form the PIN.

Refer to *UCN Planning*, UN02-401 or UN02-400, in the *System Site Planning* binder, TDC 2020.

Example

Figure 1-4 provides an overview of how four LCNs can be networked using a carrier band PIN.

Figure 1-4 Carrier Band PIN Coupling More Than Two LCNs



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Description

The carrier band (CB) modems are called NIM Modem (boards). These are I/O paddle boards that plug into the I/O slots of the NG node itself. Each modem has two outputs, but only the B output is used; one modem per cable. It is recommended that A output be terminated on the CB modem.

The data transfer rate is 5 Mbps. The system software does not know or care about which type of PIN is implemented. The NG throughput remains the same.

The carrier band cable network is limited to a maximum trunk length is 650 meters. Notice that there are two types of cable illustrated in Figure 1-4. The trunk cables and drop cables. All of these cable connections must be tightened with a torque wrench to a value of 25 inch/pounds.

The carrier band cable network has limitations. These limitations relate to cable types, lengths, and number of taps. They are outlined in detail in the *UCN Planning* publication. This is mandatory reading for anyone planning to implement a carrier band PIN.

1.5 Fiber Optic PIN

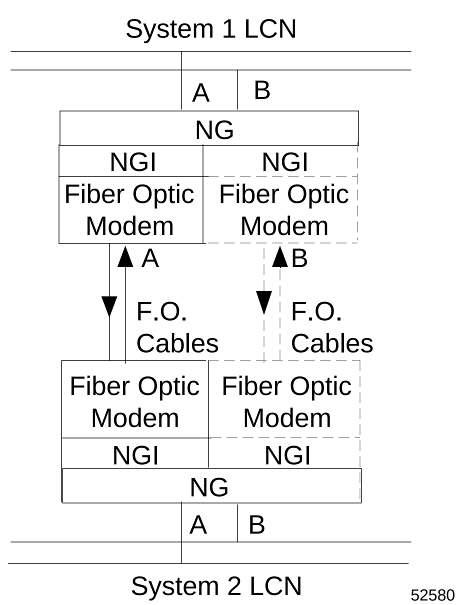
Scope

Fiber optic PIN is implemented using:

- Fiber optic modem boards are installed in the I/O card file of each NG.
- Each fiber optic link segment has a cable containing two fibers enabling transmit and receive in both directions.
- If more than two nodes are on the fiber optic PIN, one or more star couplers are used to complete the network.
- Complex networks can use splitter/combiners (amplifying or non-amplifying).
- Fiber optic PINs have a transfer rate of 10 Mbps. The system software does not know or care about which type of PIN is implemented. The throughput remains the same.

Illustration

Figure 1-5 Simple Fiber Optic PIN



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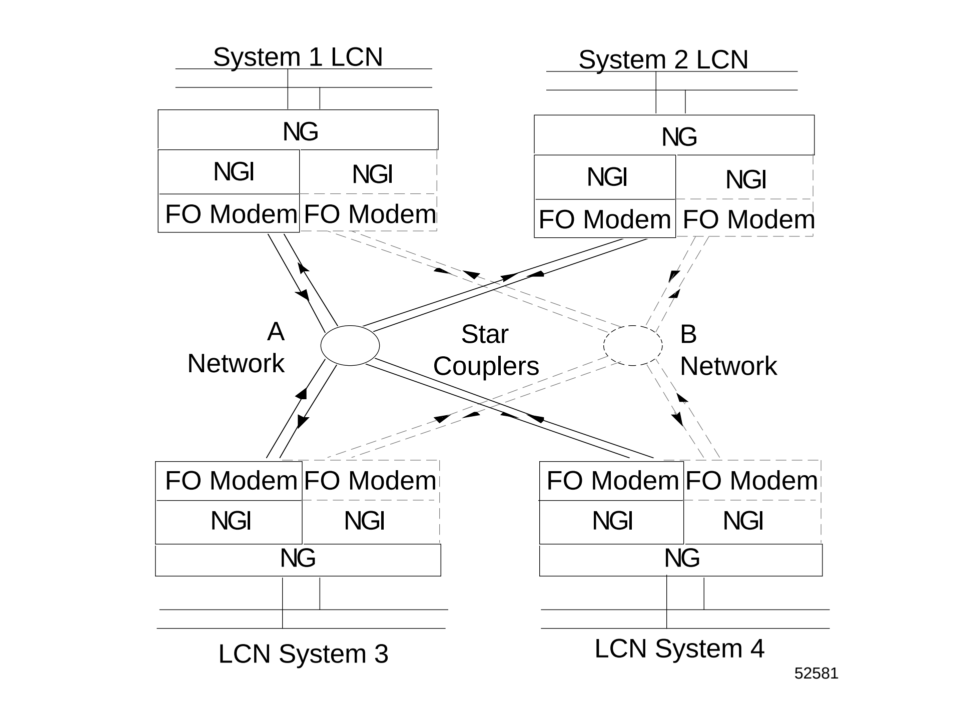
Moderately complex F.O. PIN

A more complex Fiber Optic PIN is illustrated in Figure 1-6. Star couplers or combiners are needed to split the signal when more than two LCNs are connected.

Passive (non-amplifying) and active star coupler mechanisms are available. Passive devices achieve signal distribution by splitting the optical signal. Therefore, splitting the signal to multiple destinations also splits the signal strength and reduces the distance possible. Passive star couplers can be used for short distance connections if they fit within the loss budget requirement. See subsection 3.4.

Figure 1-6 Fiber Optic PIN Using Star Couplers



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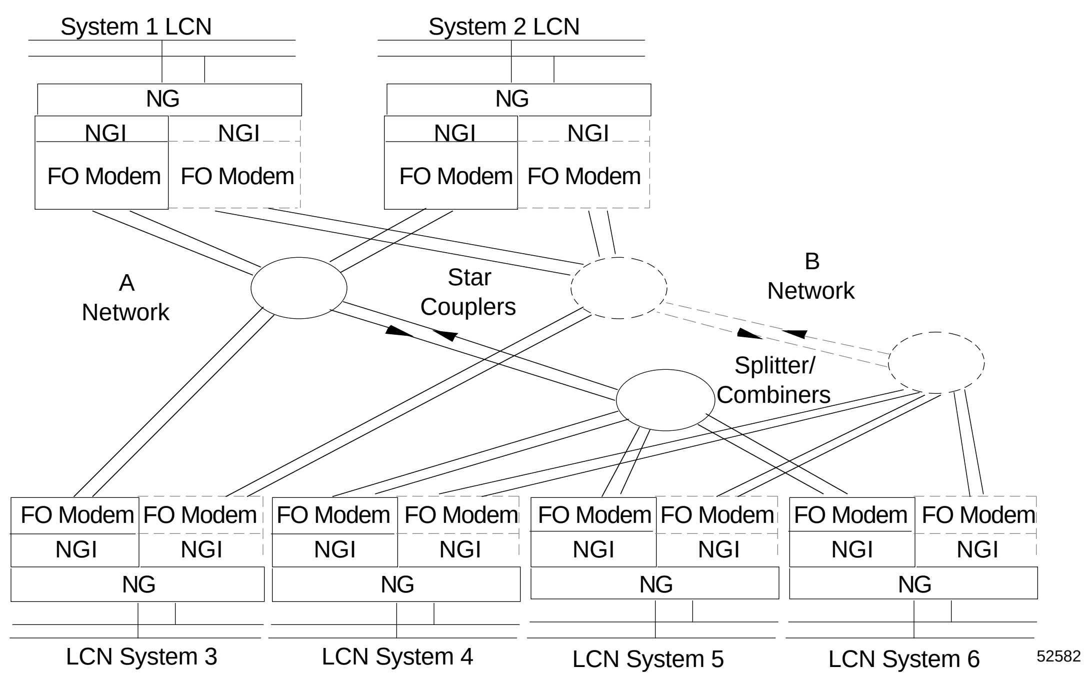
Complex F.O. PIN

Figure 1-7 illustrates a more complex fiber optic PIN. Here you see the addition of splitter/combiner elements. These splitter/combiner connection devices are also available as active (amplifying) and passive (non-amplifying) devices.

Figure 1-7 Fiber Optic PIN Using Star Couplers and Splitter/Combiners



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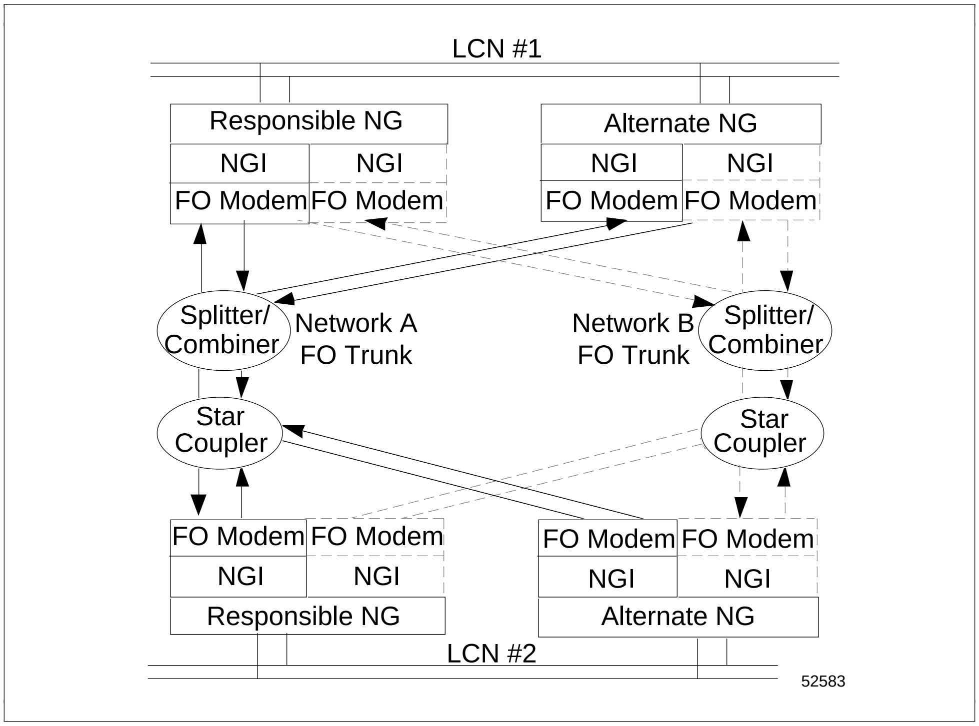
Responsible/Alternate NGs on one LCN

Figures 1-5, 1-6, and 1-7 all have shown only one NG on each LCN. Figure 1-8 illustrates one possible method of connecting two LCNs with both Responsible and Alternate NGs configured. The example shown uses the least number of trunk cables possible.

Figure 1-8 FO PIN for Two LCNs with Responsible and Alternate NGs



Specifications

A simple point-to-point PIN can reach to approximately 6 km. The use of active Star couplers along the way can increase this distance. The distance achievable using a Fiber Optic PIN depends on the signal power available at the source, combined with amplification and all of the losses along the way. Careful signal power calculations must be made, including the consideration of the following attenuation factors:

- Fiber Optic cable attenuation per running foot. (Different Fiber Optic cable efficiencies are available.)
- Number of Fiber Optic cable splices.
- Fiber Optic cable connector loss.
- Any passive Star or Splitter/Combiner losses.
- Safety margin

Section 2 – Carrier Band PIN

2.1 Overview

Section contents

These are the topics covered in this section:

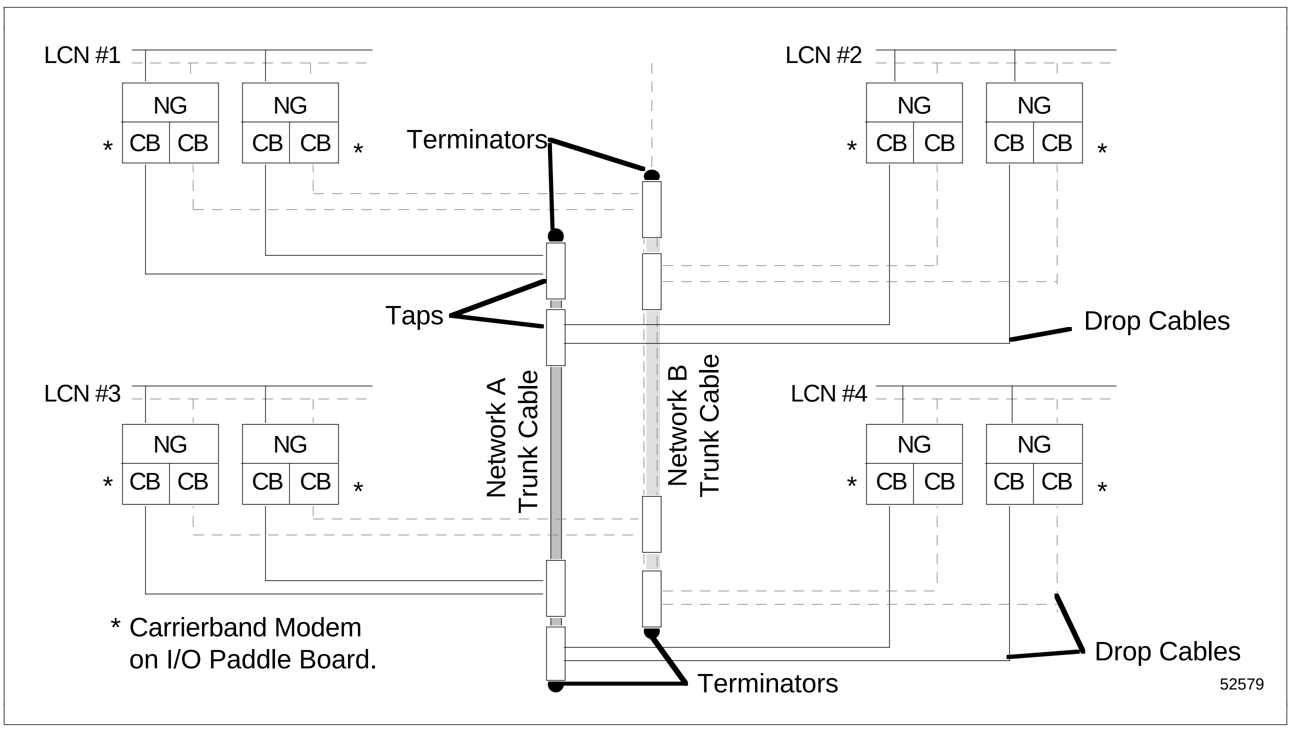
Scope

The carrier band Plant Information Network (PIN) is implemented using the Universal Control Network (UCN) carrier band technology. The UCN cable network is adapted to serve the Network Gateway (NG) carrier band requirements. **An active UCN cable network that is used for a Network Gateway PIN cannot be connected to or use the same cable that is used for a UCN network which is connected to UCN devices (PM, APM, LM, NIM).**

While the UCN has a redundant cable (Cable A and Cable B) system, the NG carrier band has a single cable (Cable B) for each Network Gateway Interface (NGI) board installed in the NG module. A second NGI and second trunk cable is optional and is shown in illustrations as a dashed line.

- Cable A is connected to the lower NIM Modem board.
- Cable B is connected to the upper NIM Modem board.

Figure 2-1 Carrier Band PIN Coupling More Than Two LCNs



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Reference

The UCN cable technology is supported by two publications in the TDC 3000X bookset:

- Universal Control Network (UCN) Planning UN02-401 2020-1
- UCN Installation UN20-400 2041

These publications must be referenced with the understanding they support the UCN connected to Process Manager, Advanced Process Manager, and Logic Manager products with a redundant cable system, not a single cable with an optional second cable.

The trunk cable rules and specification apply just the same as on the UCN.

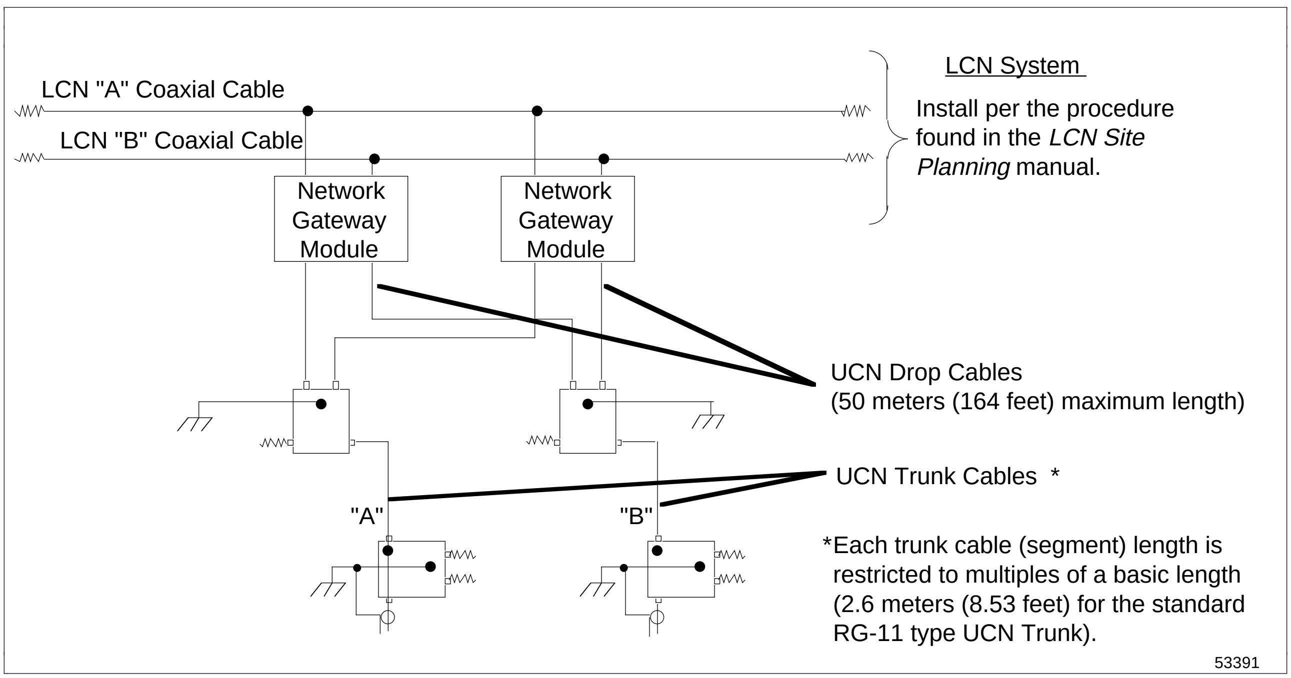
Example of Carrier Band PIN using UCN Cables

Notice that the NG has only one cable connected to each NIM MODEM board (shown as CB in figures) where the NIMs would have two cables connected to each NIM MODEM board.

Only the Cable B connector is used when the NIM MODEM board is used in a Network Gateway.

What is shown in Figure 2-2 is the part of the cable network connected to the NGs. Later figures show other parts of the cable network.

Figure 2-2 Network Gateways Adapted to UCN



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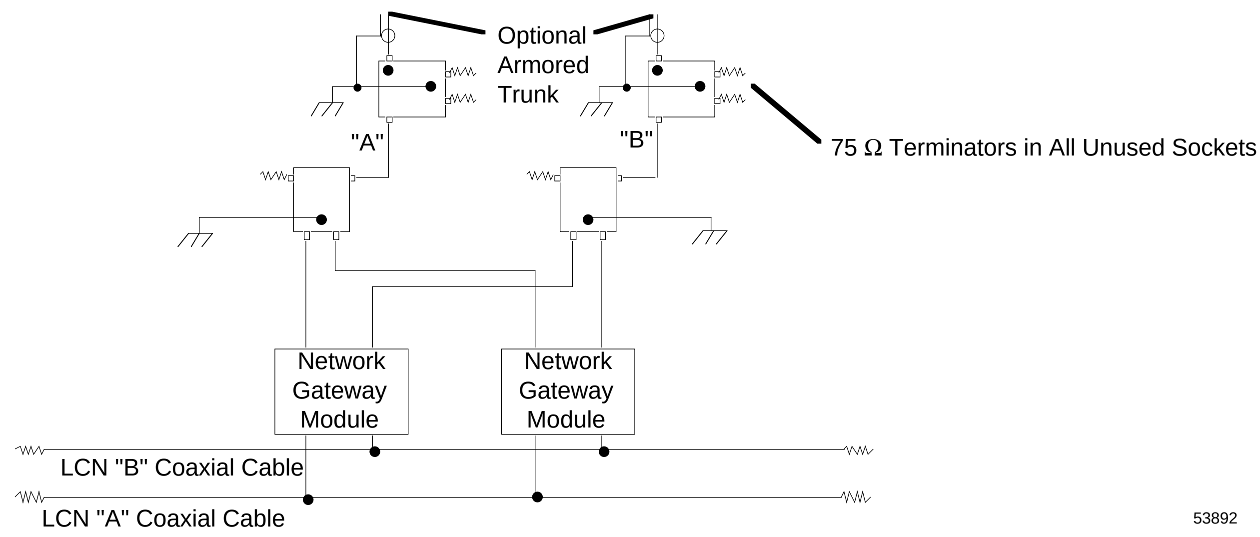
Example of Carrier Band PIN using UCN Cables, continued

Figure 2-3 shows how armored cable can be implemented in two segments of the cable network. This is generally done on segments of the network that are outdoors between buildings.

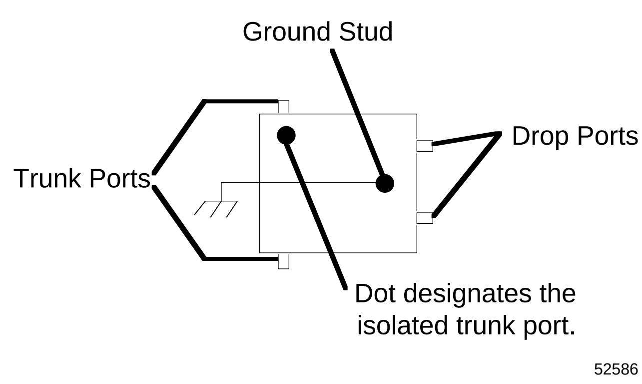
Figure 2-3 PIN with Armored Cable Implemented in Two Segments



Trunk taps

Trunk taps are available in 2-drop, 4-drop, and 8-drop models. All unused ports on taps must be terminated with the termination covers that are connected to each port when received.

Figure 2-4 Trunk Cable Taps



Section 3 – Fiber Optic PIN

3.1 Overview

Section contents

These are the topics covered in this section:

Description

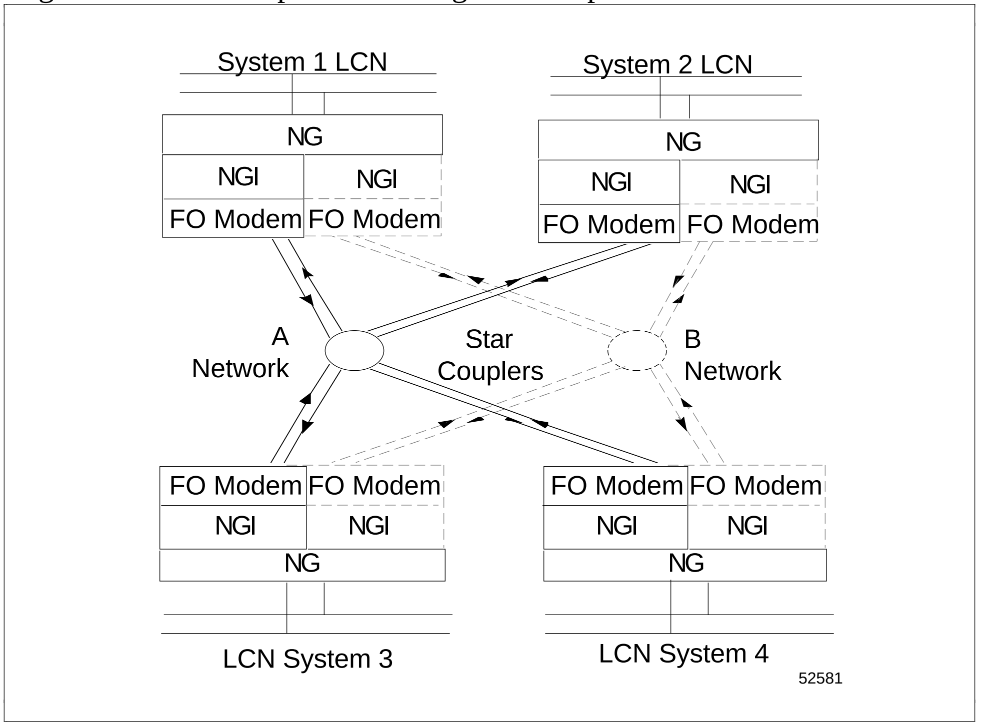
The fiber optic Plant Information Network (PIN) consists of:

- Fiber optic modems
- Fiber optic cable
- Star couplers
- Splitter combiners

Continued on next page

Illustration

Figure 3-1 Fiber Optic PIN Using Star Couplers



Notes:

- Each fiber connection has two fibers; one fiber is connected to the fiber optic transmitter at the first end and a fiber optic receiver at the other end, the other fiber has a fiber optic receiver at the first end and a fiber optic transmitter at the other end.
- Fiber optic cables are available for indoor applications and outdoor applications (aerial or underground.)
  – When installing cable, it is a good idea to install cable with spare fiber pairs to avoid having to replace a complete cable because one fiber fails or is damaged.

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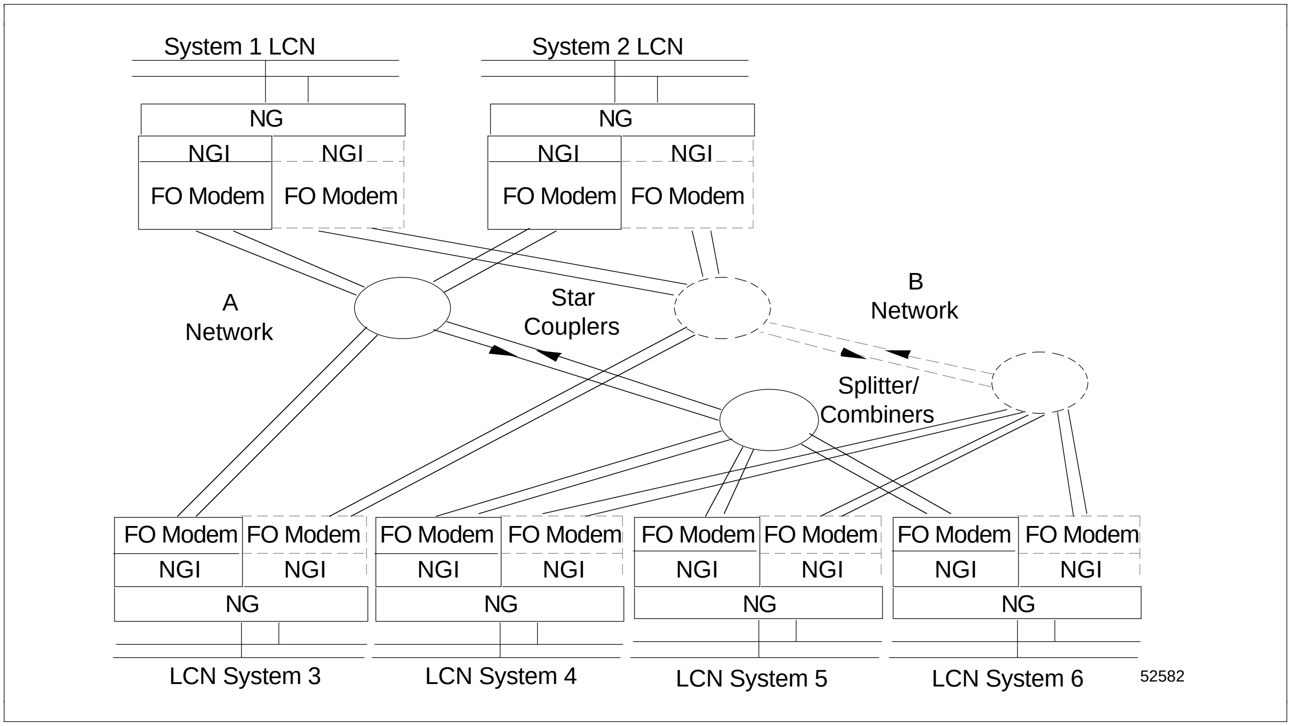
Illustration

A more extensive network may require splitter/combiners.

- Passive splitter/combiners split and combine several fiber connections into one fiber where there is already plenty of signal strength.
- Active (amplifying) splitter/combiners drive greater distances and more loads, combining several fibers into one fiber output and splitting one fiber into several outputs with increased power.

Figure 3-2 Fiber Optic PIN Using Star Couplers and Splitter/Combiners



3.2 Source of Fiber Optic Equipment

Scope

This section describes Honeywell certified fiber optic modems and gives a generic description of implementations, only as a guide, to give the user an understanding of the principles. It also contains information concerning the CE Compliant products.

ATTENTION

ATTENTION—Honeywell does not sell the hardware mentioned in this section and, consequently, cannot be responsible for its performance. The Honeywell customer obtains the hardware directly from the vendor. Therefore, Honeywell cannot be responsible for the operation and maintenance of any implementation of the fiber optic PIN. This document merely serves as a guide to how the fiber optic PIN may be implemented.

With the exception of fiber optic cable, the following equipment is available from CD Networks for implementing fiber optics in the Honeywell Plant Information Network (PIN). The parts list number is 38002188-100.

CD Networks, Inc.
16 Harvest Hill Drive
Stockton, New Jersey,08559
609-397-3794

Consult the applicable CD Networks' user's manual for specific configuration and setup information regarding this equipment.

3.2.1 Fiber Optic Modem

Description

The fiber optic modem replaces the NGIO card in an NG module to provide a direct connection to the fiber optic PIN. The modem takes as input from the NGI, signals as described in ANSI/IEEE standard 802.4, Section 10, "Exposed DTE-DCE Interface."

The ANSI/IEEE standard also establishes standards for the fiber optic side of the modem. However, to achieve the long distances required of the PIN, 802.4 compatibility in fiber optics must be abandoned. The standard calls for nominal 850 nm optics which are capable of, at best, a repeaterless distance of 2.5 km.

The fiber optic modem for the PIN uses 1300 nm optics and ST style fiber optic connectors. The modem provides signal encoding, signal decoding, clock recovery, and station management functions. The modem has LED indicators for Transmit, Receive, and Bad Signal/Jabber.

The optical power guaranteed to be transmitted into the 62.5 μm fiber is a minimum of -13 dBm. The minimum power guaranteed to be properly received with a Bit-Error-Rate (BER) greater than 10^{-12} is -33 dBm. Subsection 3.2.2 discusses the calculation of fiber optic power budgets.

3.2.1.1 Fiber Optic Modem (NGFOM)

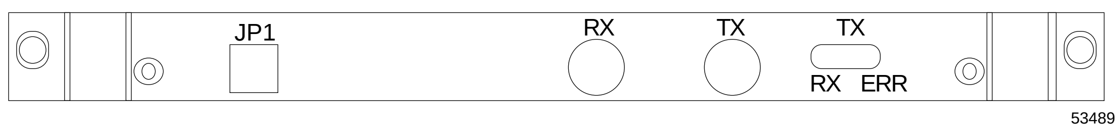
Description

The fiber optic modem that is CE Compliant is the Network Gateway Fiber Optic Modem (NGFOM). This board interfaces another NGFOM to provide a direct connection to the fiber optic PIN. This connection uses either a single link or star configuration.

Figure 3-3 shows the CE Compliant faceplate used for interface connections. This faceplate is mounted to the NGFOM board shown in Figure 3-4.

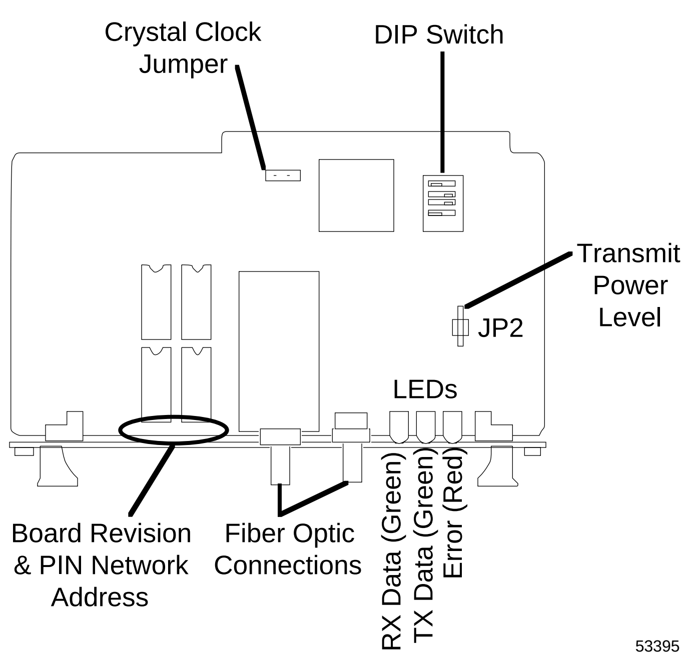
Illustration

Figure 3-3 NGFOM Faceplate



Illustration

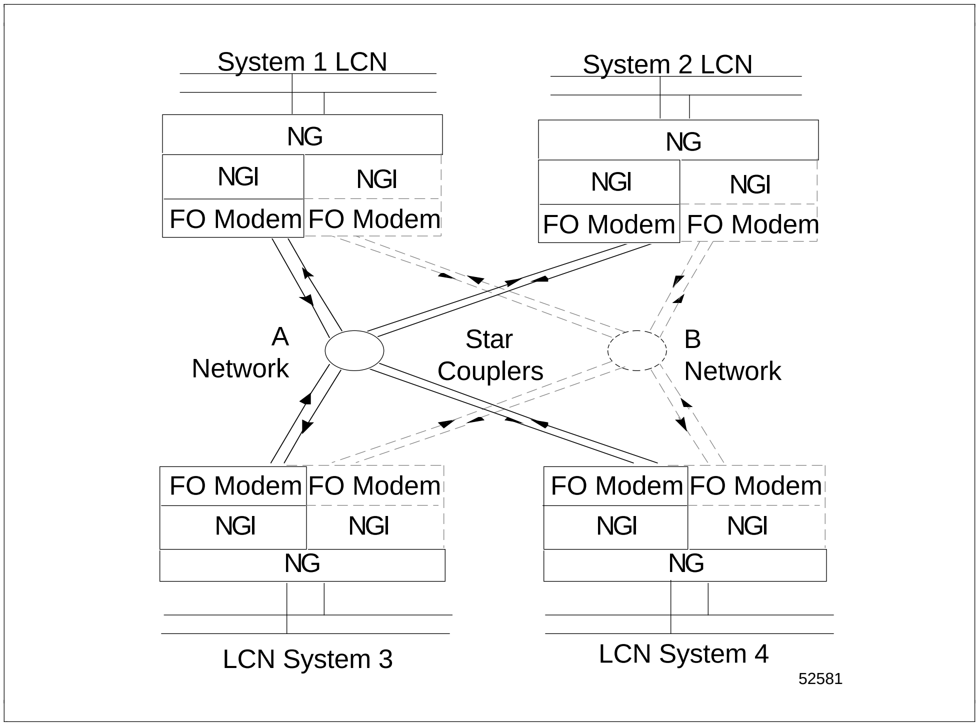
Figure 3-4 NGFOM Board



3.2.1.2 Fiber Optic Modem (NGFOM) Used in PIN

NG fiber optic PIN

Figure 3-5 NGFOM Used in Fiber Optic PIN



3.2.2 Passive Fiber Optic Star

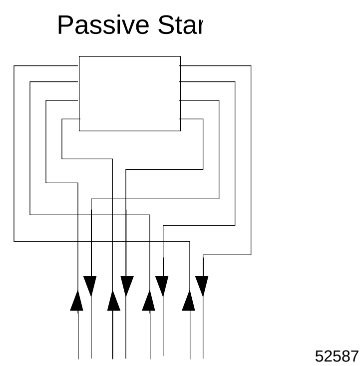
Description

A passive fiber optic star is a device that is used to distribute optical signals to and from some number of fiber optic modems. Containing no electronics, it is very reliable.

It achieves signal distribution by splitting the optical power applied to one of its input ports equally among its output ports. Passive optical stars are typically available in 4, 8, and 16 port options.

Because the incoming light is split, a heavy power penalty is taken between an input and any one of the output ports. See subsection 3.4.2 about calculating fiber optic power budgets for networks that use passive fiber optic couplers.

Figure 3-6 Passive Star Coupler

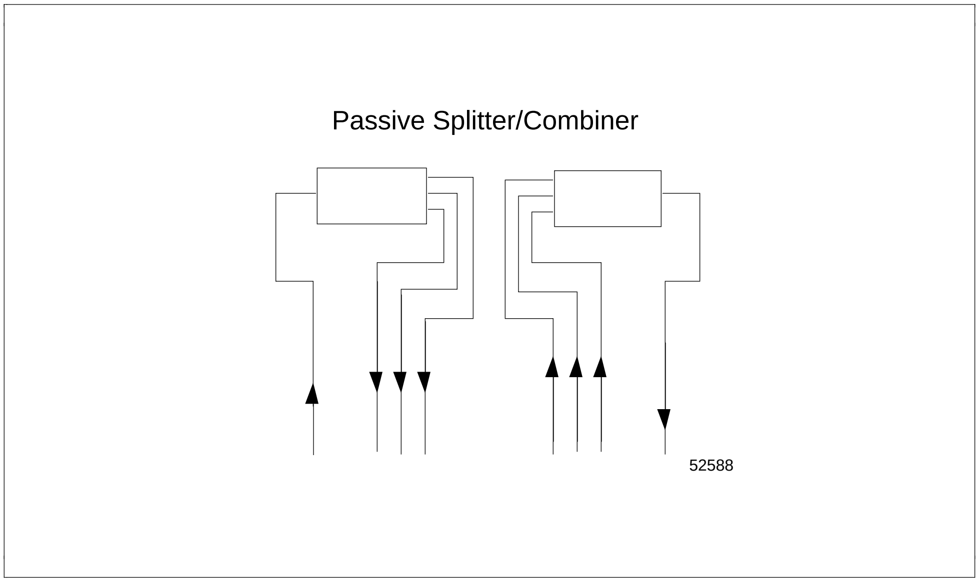


In the star coupler, an input is redistributed to all output ports, including the path back to the modem which originated the signal. For this reason, a star cannot be used at the intermediate branch points in a tree network topology. A star can only be used in a single level star topology or at the root of a tree topology.

3.2.3 Passive Splitter/Combiner

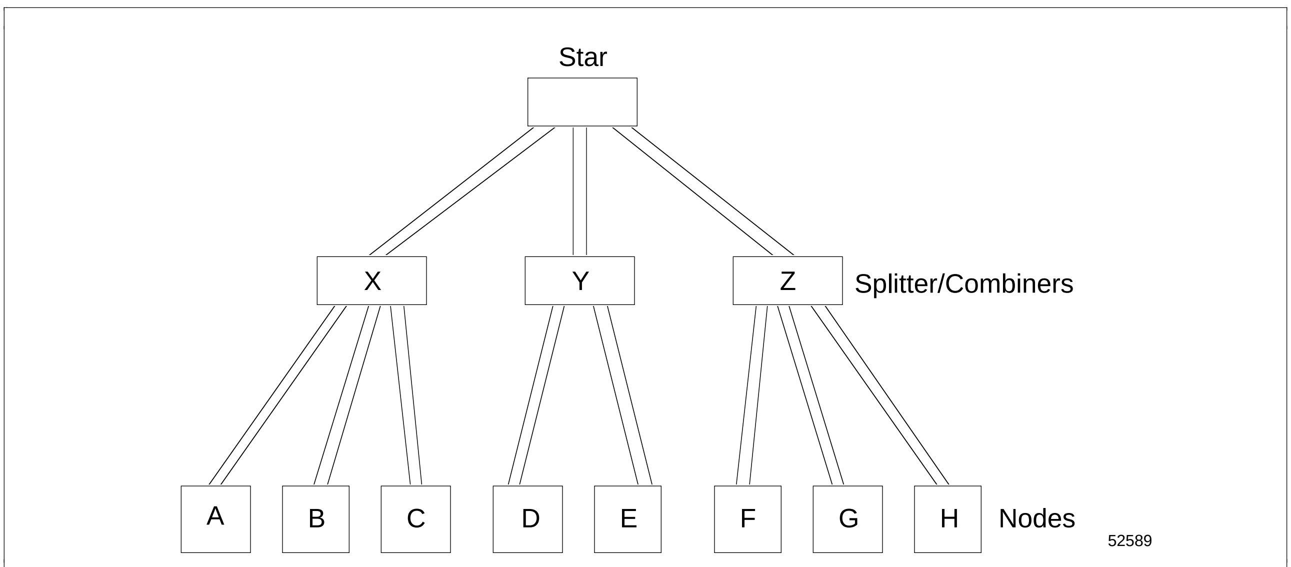
Description, continued

Figure 3-7 Passive Splitter/Combiner



Use of splitter/combiner The splitter/combiner, instead of a star coupler is used at the intermediate branch points of a multi-branched tree topology. Figure 3-8 shows a tree topology fiber optic PIN network.

Figure 3-8 Tree Topology Fiber Optic Network



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As an example, in Figure 3-8, consider a message originating at node A. It is transmitted up to splitter/combiner X. At this time, splitter/combiner X does not distribute the message to nodes B and C. It is forwarded only up to the star at the root of the tree. The star then distributes the message back down to splitter/combiners Y and Z and to its origin X; then each splitter/combiner distributes the message to each of its nodes.

The reason stars cannot be used at points X, Y, and Z in the tree, is that the original message and the echoed message from the root of the tree would collide at the intermediate branch point. Remember that a star immediately distributes an input to every one of its outputs, including the path back to that input's origin.

In Figure 3-8, the star at the root of the tree and the splitter/combiners at the intermediate branch point can either be active or passive devices. However, both levels of the tree cannot be passive because there is not enough optical power to be split twice. The valid combinations would be:

- Active star concentrator at the root, with passive splitter/combiners at the intermediate branch points, or
- Passive star coupler at the root, with active star concentrators (configured as an active splitter/combiner) at the intermediate branch points, or
- Active star concentrator at the root, with active star concentrators (configured as an active splitter/combiner) at the intermediate branch points.

Subsection 3.4.1 and 3.4.2 discusses how link distances can be determined in point-to-point links and in links that employ a passive optical splitting device. The distance that is required to be covered by the network is of paramount importance in deciding on a topology.

3.2.4 Active Fiber Optic Concentrator

Description

The active fiber optic concentrator is an electrically powered device that can operate in both modes: as an active star coupler or as an active splitter/combiner. As a star coupler or as a splitter/combiner, it is used in the same manner as its passive counterpart.

In either mode, the active star is not subject to the optical power splitting losses that are exhibited by the passive fiber optic couplers. This is because the distribution of signals is handled not in the optical domain, but in the electrical domain by receiving a signal, electronically recovering and reclocking the signal, then retransmitting the signal. Therefore, each fiber optic path is handled as a point-to-point link when calculating the link power budget (see subsection 3.5.1). Each "point" of the star can extend to at least 6 km. Of course, if a point of the star is linked to a passive splitter, the power budget for passive splitting devices will apply (see subsection 3.4.2).

3.2.5 Fiber Optic Cable

Description

The fiber optic cables to be used in the fiber optic PIN shall comply with Honeywell specification 51190919 for 62.5 µm outdoor grade cable, and with specification 51190918 for 62.5 µm indoor grade cable. Duplex indoor cable assemblies with factory installed connectors are available from Honeywell:

Table 3-1 Fiber Optic Cable Model Numbers

Cable Length	Model Number
1 Meter	P-KFB01
2 Meter	P-KFB02
5 Meter	P-KFB05
10 Meter	P-KFB10
20 Meter	P-KFB20
50 Meter	P-KFB50

3.2.5.1 Fiber Optic Cable Procurement

Contractor

In general, Honeywell does not wish to supply or install outdoor fiber optic cables. Honeywell relies on the cable installation expertise of cable vendors and fiber optic cable installation contractors to perform the cable installation.

Honeywell does not wish to restrict the purchase of outdoor fiber optic cable to a particular vendor. Honeywell recognizes that vendors may be able to supply better service in some parts of the world than in others, thus making it desirable to have a choice worldwide. Also, the installation conditions at various project sites may call for widely differing types of cable construction. For these reasons, the outdoor cable specifications were written rather loosely with respect to physical construction details and mechanical parameters. The actual glass fiber itself is completely specified to ensure proper operation of the fiber link.

Honeywell assistance

If the customer requires, Honeywell will contract with cable vendors and installation contractors, for the customer, to purchase cable and oversee and guarantee a proper installation. However, if the customer procures his fiber optic cable directly from the supplier and arranges his own installation, the cable supplier and/or installing contractor must certify to the customer that his cable fully meets or exceeds the applicable Honeywell cable specification. Honeywell will freely supply our outdoor cable specification to our customers for this purpose. The Honeywell specification number for outdoor cable to be used in fiber optic PIN implementations is 51190919.

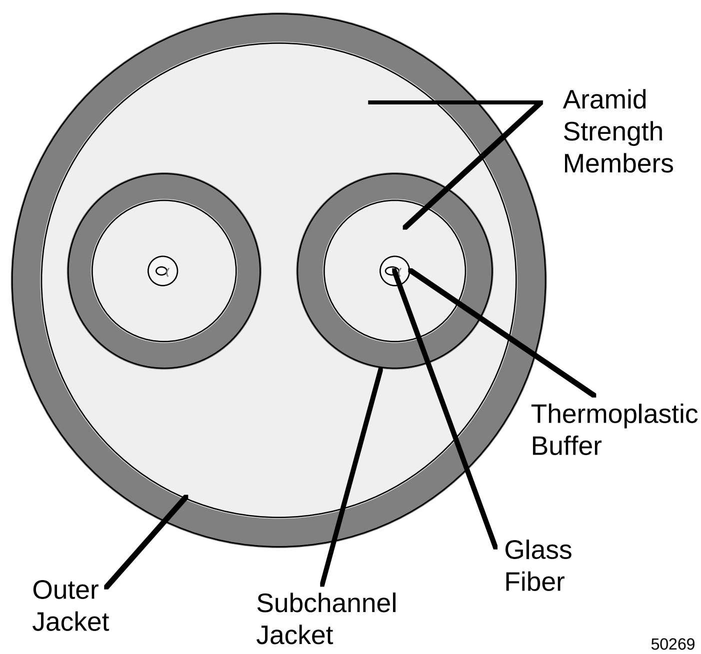
In contrast, the indoor cable specifications completely specify both the mechanical construction details of the cable and the important parameters of the glass fiber. The preferred method of procurement for indoor cable is direct purchase from Honeywell as a finished cable assembly with preinstalled connectors under the Honeywell model number. See subsection 3.2.5 for a description of the cable assemblies used in the fiber optic PIN and the corresponding Honeywell model numbers.

3.2.5.2 Indoor Grade Cable

Description

Figure 3-9 illustrates the construction of indoor fiber optic cable as specified by Honeywell. This type of cable is known as "tight-buffered" cable because the optical fibers are tightly held by the cable fillers. Unmatched coefficients of expansion between the cable materials and the glass fiber can subject the fibers to significant micro-bending losses if the cable is exposed to temperature extremes. For this reason, tight-buffered cable is limited to indoor use.

Figure 3-9 Indoor Tight-Buffer Cable



Advantage

The advantage tight-buffered cable holds for indoor use is good physical protection for the fiber while maintaining the cable flexibility required for routing the cable inside electronic cabinets, under floors, etc.

Description

The cable contains two, four, or six subunits. Each subunit protects a single fiber and can have independent cable connectors installed. The standard indoor cable assemblies are duplex (two fibers). Finished cable assemblies with four or six fibers are available on special order.

Continued on next page

3.2.5.2 Indoor Grade Cable, Continued

Cable jacket option

There are two cable jacket options available for the indoor cable. The National Fire Protection Association (NFPA) publishes the National Electrical Code (NEC) to establish fire safety standards for premises wiring. Honeywell specifies jacketing material conforming to either

- NEC optical cable rating OFNR (Optical Fiber, Nonconducting, for Riser applications), or
- OFNP (Optical Fiber, Nonconducting, for Plenum applications)

The standard cable assemblies that can be purchased from the Honeywell price book by model number are OFNR rated cables. Should OFNP rated cables be required, they can be special ordered through Honeywell Purchasing. OFNP rated cables are required only when routing indoor fiber runs through air handling chambers.

Pre-assembled cables

Cable assemblies with factory installed ST style connectors are available from Honeywell in 1, 2, 5, 10, 20, and 50 meter lengths under model number P-KFBxx, where the "xx" is replaced by two numeric digits specifying a standard length. For example, if a 5 meter long cable assembly was desired, the correct model number would be P-KFB05. See subsection 3.2.5.

3.2.5.3 Outdoor Grade Cable

Description

Honeywell specifies a cable construction known in the industry as “loose tube” for its outdoor grade fiber optic cable. An illustration of this construction is shown in Figure 3-10. This construction is characterized by loose fitting, gel-filled tubes into which the fibers are placed. The fibers are actually longer than the tubes, so that when thermal expansion lengthens the buffer tubes, the glass fibers (which have a lower coefficient of expansion) are never subject to tensile stress.

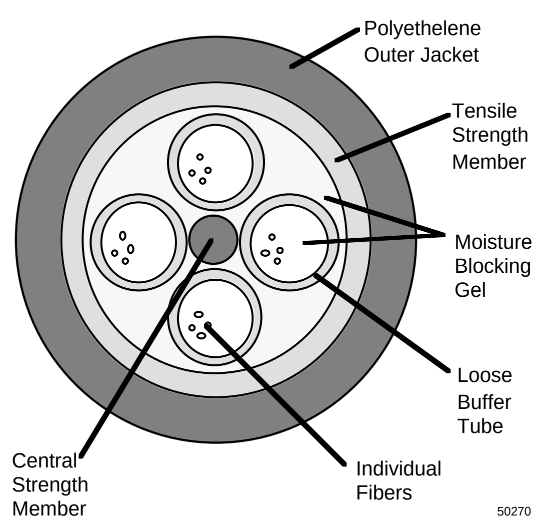
The cable is given buckle resistance typically by a glass reinforced plastic (GRP) rod through the center of the cable. An aramid wrap around the buffer tubes provides tensile strength. This type of cable is significantly stiffer than tight-buffered cable and the jacketing material does not meet NEC requirements. These factors make it unsuitable for indoor use. The loose buffer design's advantage is being able to take environmental extremes without suffering any significant optical performance degradation.

Figure 3-10 shows a typical construction for an aerial/duct loose tube cable. A direct burial cable is similar, except that it would probably have two additional layers: a steel armor tape layer for rodent protection, covered by an additional polyethylene jacket. Vendors may also have double-armoring options available. Again, exact construction details will vary from vendor to vendor, but the basic loose tube concept remains the same.

The National Electrical Code ratings do not apply to outdoor cable because it does not fall into the category of premises wiring. The NEC does mention that the maximum length of unrated outdoor cable that is permitted inside a building is 50 feet. This allows enough length to bring the cable to a splice enclosure or interconnect panel where the transition to indoor cable can be made. See subsection 3.5.1 about managing the transition from indoor-to-outdoor cable.

Illustration

Figure 3-10 Outdoor Loose Tube Cable



3.3 Network Configuration Topology

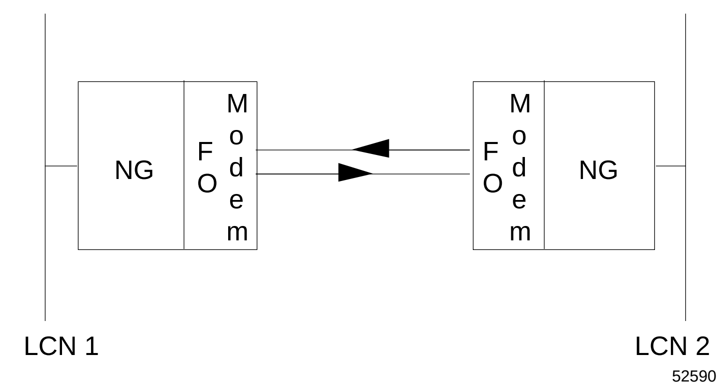
Scope

For simplicity, the topologies presented in the following sections are shown in nonredundant PIN cable configurations (each NG node contains a single NGI PWA and modem). For redundant configurations, each element in the fiber optic PIN would have to be duplicated for the B trunk.

Modem-to-modem

This is the simplest network topology. A modem-to-modem topology is used when it is necessary to link together two LCNs only over some distance. The only equipment required for this connection is the fiber optic modems and the fiber optic cable. Refer to subsection 3.4.1 for a discussion of achievable distance in point-to-point links.

Figure 3-11 Modem-to-Modem Connection of Two LCNs



Small network

In the following discussion, the terms "small network" and "large network" refer to the number of nodes on the PIN rather than to geographical distance covered. A small network is defined as the number of nodes that can be served by a single star (passive or active). The choice of passive star versus active star depends on the distances that must be covered. A passive star achieves signal distribution by optical power splitting, so distance is substantially limited. See subsection 3.4.2 for a detailed power budget for passive stars.

An active star solution for a small node-count network is limited by the point-to-point distance allowed by the grade of fiber employed. If fiber with 2 db/km attenuation is used, then the maximum distance from a node to the active star is about 6 km. See subsection 3.4.1 for a detailed power budget for point-to-point links.

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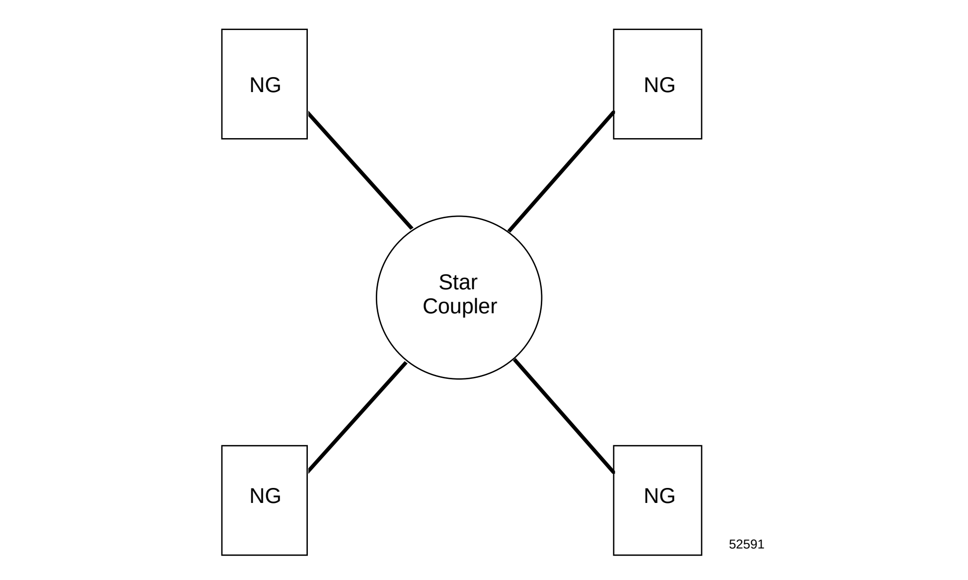
Illustration

Figure 3-12 Small Fiber Optic PIN Network

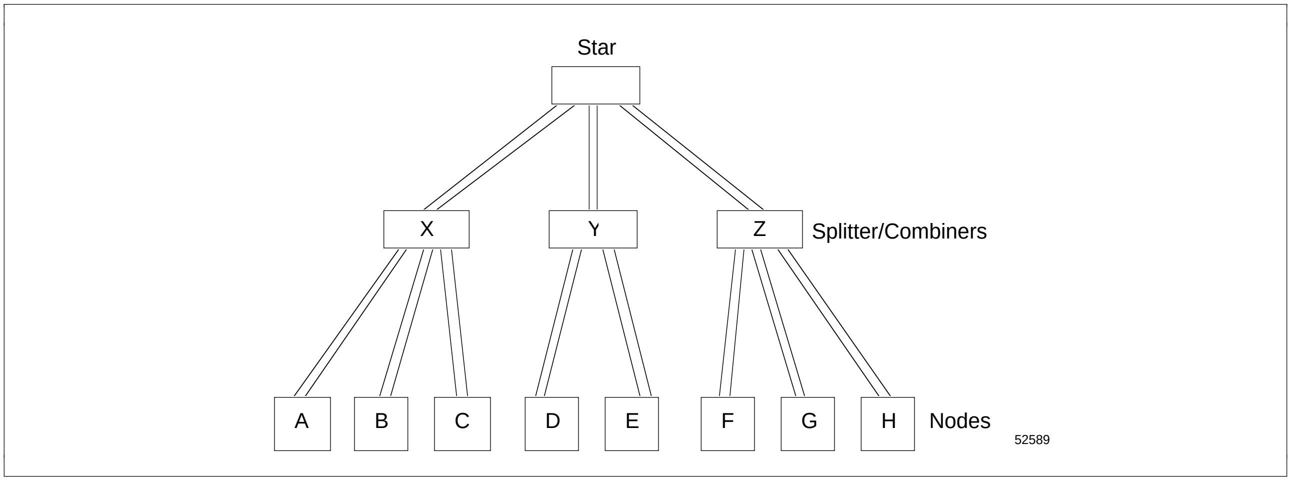


Large network

A large network is defined as one in which a multilevel tree topology must be employed to accommodate the number of nodes required, regardless of the geographical distance covered by the network. A large network cannot use two consecutive levels of passive stars/splitters/combiners to implement the network. Active concentrators must be used at least in every other level of the tree because the power loss experienced in two consecutive layers of passive devices cannot be accommodated by the optical power budget.

One possible approach would be to use the active concentrator as a star at the "root" of the tree structure, with passive splitter/combiners at the intermediate branch points, distance requirements permitting. If distance requirements demanded, the entire tree structure could be implemented using only active concentrators.

Figure 3-13 Large PIN Network



3.4 Calculating Power Loss Budgets

Method description

In planning the installation of any fiber optic link, one of the most important tasks is the calculation of the power budget. The power budget determines the link distance achievable and indicates how much power margin exists. It depends on a number of factors, such as fiber attenuation, number of connector joints, and the number and type of splices in the link.

Table 3-2 Fiber Optic Transmitter/Receiver Characteristics

Function	Parameter	Characteristic
Transmitter	Wave length	1300 nm
	Minimum Transmitted power into 62.5 µm fiber	-13 dBm
Receiver	Minimum receive power to achieve >10^{-12} BER	-33 dBm

There are two basic link configurations for which the calculation of power budgets must be understood.

- The first is the simple point-to-point link. This is the case where a fiber optic transmitter is connected to a fiber optic receiver with no passive optical splitting device (star coupler or splitter/combiner) interposed in the link. This applies where there is a direct link between any two active network components. Some examples: between two fiber optic modems; between a fiber optic modem and a broadband-to-fiber repeater; between an active star concentrator and a fiber modem or a broadband-to-fiber repeater.
- The second link configuration involves the use of some type of optical power splitting device in the link between two active network components. An additional power loss factor must be included in the budget to account for optical power splitting losses.

3.4.1 Power Budget Calculation for Point-to-Point Network

Example

Table 33-3 details the calculation of a power budget for a point-to-point link using 62.5 µm fiber:

Table 3-3 Example of Point-to-Point Power Budget

Minimum power coupled into fiber Minimum power receiver needs Total Power Budget	-13.0 dB -33.0 dB 20.0 dB
Losses LED degradation over lifetime Connector loss (2 x 1.0 dB) Splice loss (2 x 0.25 dB) Safety margin Budget remaining for loss in cable	 3.0 dB 2.0 dB 0.5 dB 2.0 dB 12.5 dB
Divide by specified attenuation per kilometer Achievable link distance	2.0 dB 6.25 km

Explanation of calculation

Starting with the minimum power guaranteed to be coupled into the fiber, -13 dBm, and subtracting from that figure, the minimum power level guaranteed to be properly decoded by the receiver, -33 dBm, a total power budget of 20 dB is arrived at.

To this 20 dB, certain losses must be applied. The first shown is 3 dB of power output degradation over the lifetime of the LED. Next, the loss of two connector-to-connector butt splices is taken from the budget. Typically, two such connections are made in the link at interconnect boxes at the interface between the outdoor and the indoor cable - one at each end of the link.

Similarly, each indoor-to-outdoor cable interface may require a fiber-to-fiber splice, so two splice losses are applied to the budget.

Lastly, a 2 dB safety factor is applied, which is minimal. It is strongly recommended that if a larger safety factor can be arranged (either by shortening the required link distance or by using fiber with a better attenuation figure), by all means do so. The fatter the safety margin, the more reliable the link will be.

After all the above loss factors have been applied, the 12.5 dB that remains is the power left to be expended in cable loss. It is this number, when divided by the attenuation figure of the fiber, that determines the achievable link distance. As can be seen above, using the maximum attenuation allowed by Honeywell specification 51190919, a typical link distance of slightly more than 6 km can be achieved. Fiber optic cable vendors may be able to supply cables with attenuation as low as 1 dB per kilometer at the 1300 nm wavelength. If such a cable were used, the achievable link distance would double to better than 12 km.

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3.4.1 Power Budget Calculation for Point-to-Point Network,

Continued

ATTENTION

ATTENTION—A possible problem exists for point-to-point links less than about 2.5 km. The possibility exists for optical reflections to interfere with the signal seen by the receiver. A jumper on the modem allows optical power to be reduced by about 6 dB. At distances less than 2.5 km, reducing the transmitted power by 6 dB still allows enough forward power to reach the receiver for normal operation. The advantage is that the power level of reflected signals will be reduced far enough that optical reflections will cease to be a problem. Therefore, it is recommended that for point-to-point links less than 2.5 km, the transmitter power jumper should be placed for reduced power.

In links employing a passive power splitting device, power to the receiver is attenuated enough that reflections are not a problem. In links where passive power splitting devices are used, the transmitters should always be pinned for full power.

3.4.2 Passive Stars and Splitter/Combiners

Splitter/combiner losses

A passive star (or the splitter half of a splitter/combiner) splits the power of an incoming signal among its outputs. The manufacturer of the device will usually specify a maximum insertion loss from input to output.

While the combiner half of the splitter/combiner is not subject to splitting loss, the splitter half is usually the limiting factor in link distance, because the transmit and receive fibers are usually jacketed together. In the duplex fiber channel, the half of the link that goes through the combiner (where very little loss is taken) can physically be no longer than the fiber that goes through the splitter (where significant losses are taken). So it is just as well to budget the link as if the splitter loss were taken both coming and going.

Table 3-4 details a power budget where a four-legged passive star (or, equivalently, a four-legged passive splitter/combiner) is located between two fiber optic modems.

Table 3-4 Power Budget for a Four-Point Star Coupled Network

Minimum power coupled into fiber	-13.0 dB
Minimum power receiver needs	-33.0 dB
Total Power Budget	20.0 dB
Losses	
Maximum passive star insertion loss	9.0 dB
LED degradation over lifetime	3.0 dB
Connector loss (2 x 1.0 dB)	2.0 dB
Splice loss (2 x 0.25 dB)	0.5 dB
Safety margin	2.0 dB
Budget remaining for loss in cable	3.5 dB
Divide specified attenuation per kilometer	2.0 dB
Achievable link distance	1.75 km

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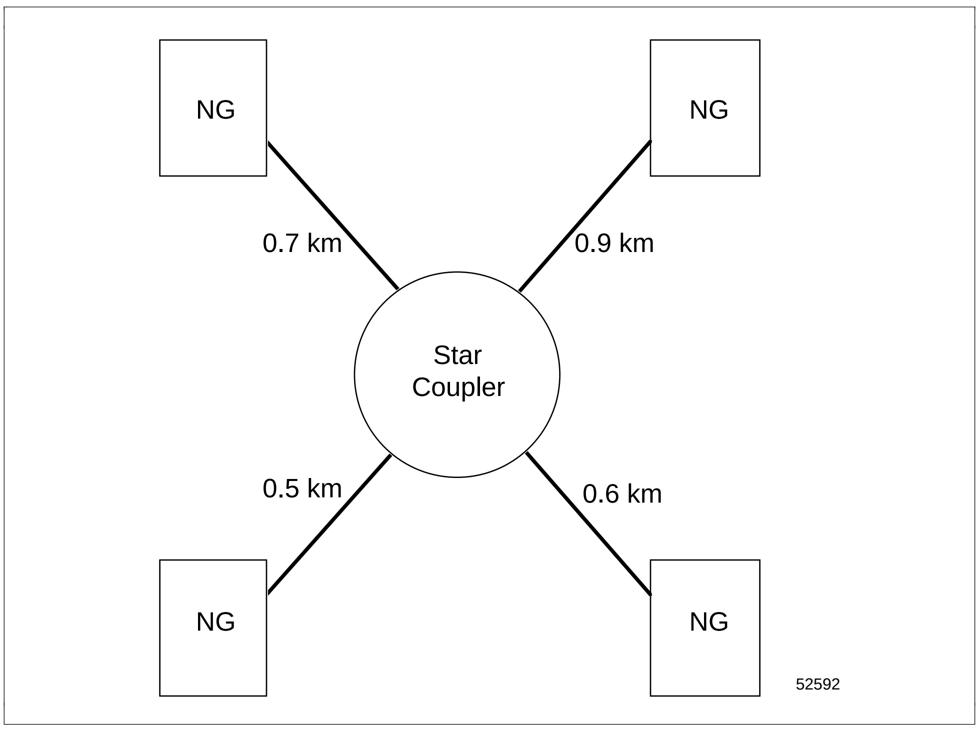
Implementation

It is very similar to the power budget developed for a point-to-point link with the exception of the additional insertion loss that must be taken for the passive fiber optic coupler. Note once again, that the achievable node-to-node distance can be up to doubled if a fiber cable which exceeds Honeywell's specification is employed.

A passive star coupler can be placed anywhere in the network as long as the maximum modem-to-modem distance between any two NGs in the system is not violated. For example, in Figure 5-8, the maximum modem-to-modem distance exists between NGs 1 and 2 at .7 km + .9 km = 1.6 km. This is within the distance established by the power budget example and is, therefore, a valid configuration.

Passive fiber optic couplers are made in a variety of fiber sizes. When specifying a passive fiber optic star coupler, be sure to verify that it uses 62.5 µm fiber; the same size used in the cables in the system.

Figure 3-14 Four-Point Passive Star Coupled Network



3.5 Outdoor Cable Network Implementation

Scope

The design of the cable network implementation is dependent upon the physical requirement and restrictions of the job site. The following material describes what can be done with each type of cable, cabinet, and termination panel.

Major classes of outdoor cable installation

There are four most common methods of outdoor cable implementation:

- Aerial
- Underground Duct
- Direct Burial
- Preassembled Cable

The method chosen depends on site-specific factors. Each method has advantages and disadvantages.

Aerial

Aerial cable installations are subject to the greatest environmental stresses of the major classes of outdoor cable installation. An aerial cable is subject to wind loading, ice loading, and extremes of temperature variation.

Aerial cable installations include hanging the cable from poles, but also, as is common at industrial sites, laying the cable in outdoor exposed cable trays.

There are two basic kinds of aerial cable available.

- Nonself-Supported—Not designed to support itself when hung on poles. It must be lashed to a messenger wire. As self-support is not required for outdoor exposed cable trays, this cable type would generally be chosen for exposed cable trays.
- Self-supported—Of the self-supporting aerial cables, there are two main subclasses:
  - self-contained tensile stress bearing member within the normal fiber cable sheath
  - “figure eight” type of cable, where the cable contains its own built-in messenger wire, from which, hangs the fiber-carrying capsule.

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Underground duct

This type of installation buries a plastic tube, or tubes, into which a cable or several cables can be pulled. A recommended fill ratio is 50% by cross sectional area. The cable is usually of the same construction as nonself-supporting aerial cable. Under the ground it is well protected from environmental stress. It is recommended that the duct be buried as deeply as possible—definitely below the frost line. Frost heaving can crack the duct. The relatively large diameter of the duct provides rodent protection. Rodents can't chew on it if they can't get their mouths around it. If empty inner-ducts were provided within a larger duct, then new cables could be pulled in the future without too much trouble. Pulling new cable through an already occupied inner-duct is not recommended.

Direct burial

This type of installation buries the cable directly into the earth. As with the underground duct, this cable should be buried as deeply as possible. Make sure to document and mark where the cable is buried for future reference. An armor sheath is required on this cable for rodent protection. Keep in mind, though, that the metal content of the cable may subject the cable to lightning strikes. Also, the armor must be grounded at each end where it enters the building. It is particularly important to provide extra fiber capacity in this type of cable installation. When compared with the other cable installation methods, it is more difficult to install a second cable on the same route if more capacity is required in the future.

Preassembled

In certain situations, it may be desirable to deliver a cable with factory installed connectors to the site. This may be the case where the skilled labor required to splice cables and install connectors will not be available at the installation site. Preinstalled connectors make pulling the cable through duct or conduit very difficult; so in duct situations, it may not be feasible. If handled carefully, it should not be as much of a problem in aerial or direct burial situations. Still, the risk of damaging the terminations during installation is substantial. Therefore, the general preference is to splice or install connectors to the cable in the field once the cable is installed.

3.5.1 Transition from Outdoor-to-Indoor Cable

Scope

It is necessary to use both indoor and outdoor fiber optic cable types when implementing a fiber link between two buildings. The indoor cable has the flexibility to allow routing under floors and into equipment cabinets, while the outdoor grade has superior performance over temperature and environmental extremes.

There are two methods of transition in use today:

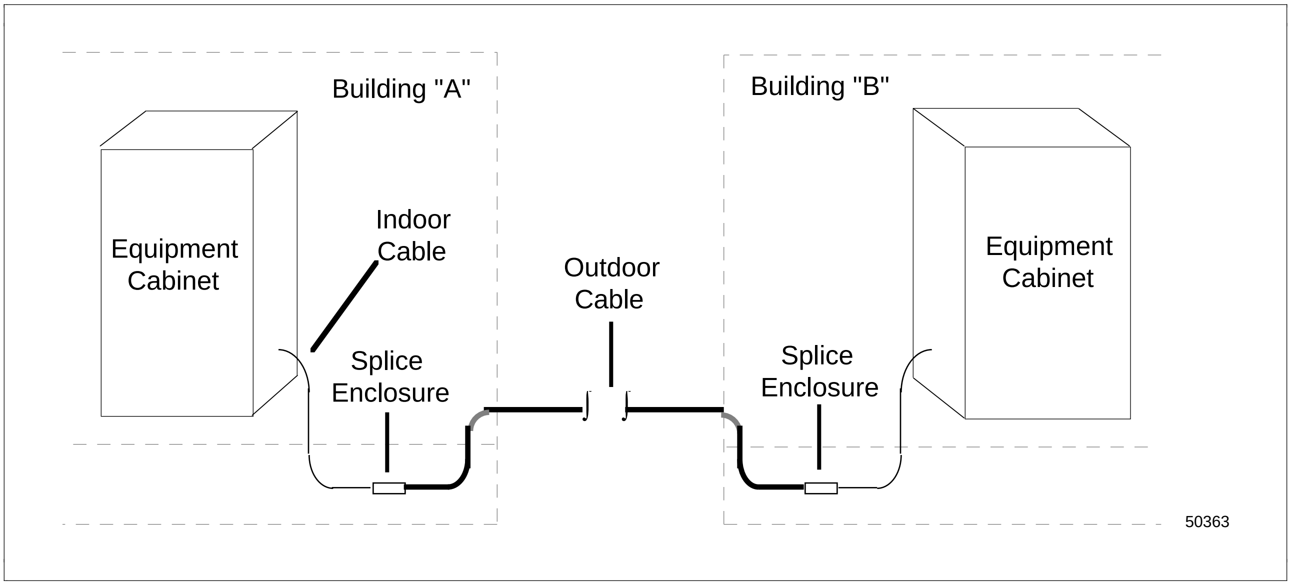
- Splicing—direct splicing of indoor-to-outdoor cable
- Interconnect Panels—these panel terminate the outdoor cable and couple to the indoor cable. Allows for replacement of damaged segment with out replacing the compete cable link.

3.5.1.1 Splicing

Description

Perhaps the most straight-forward method of transitioning from outdoor-to-indoor cable types is to use a splice housed in an in-line splice enclosure. Because this method does not involve any connector-to-connector couplings, it suffers the least power budget penalty.

Figure 3-15 Indoor-to-Outdoor Cable Transition Using In-line Splice



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ATTENTION

ATTENTION—The drawback, though, is lack of flexibility. The in-line splice enclosures have provision for only one cable in and one cable out. If extra dark fibers were supplied in the outdoor cable, and it becomes necessary to use them in the future, the in-line splice enclosure will have to be replaced with a wall-mounted interconnect panel. Multiple indoor cable runs cannot be fanned out from the simple in-line splice enclosure. Of course, if it is considered highly unlikely that future expansion needs to be accommodated, this is a very cost-effective method of transitioning.

Splice enclosure

The splice enclosure protects the actual fiber splice. As for the fiber splice itself, there are two basic methods used to join the fibers: fusion splicing and mechanical splicing.

Fusion splicing

Fusion splicing is accomplished by bringing the two fiber ends together in a precision micro-positioning fixture, then hitting the joint with a precisely timed electric arc to melt the fiber ends together. Fusion splicing is the most reliable method, and when done properly, results in less than .2 dB of power loss in the link. The biggest drawback to fusion splicing is expense. The machine is quite expensive, as is the technical talent. The cost to get a trained individual with a fusion splicer to a project site can be significant.

Mechanical splicing

In recent years, fiber optics vendors have begun to produce mechanical splices with excellent insertion loss performance. The low insertion loss of fusion splicing can even be approached. The newest mechanical splices can be mated and remated if the first try is not optimum. The mechanical splice aligns the two fibers to be joined in a V-groove or a precision capillary. The joint between the two fibers is filled with an index-matching gel to minimize back reflection and maximize forward coupling. Mechanical splices typically exhibit insertion losses less than .5 dB, or better, if tuning is employed. Since these splices can be made with a minimum of training, and the alignment jig is relatively inexpensive, the mechanical splice is quite cost-effective in most cases.

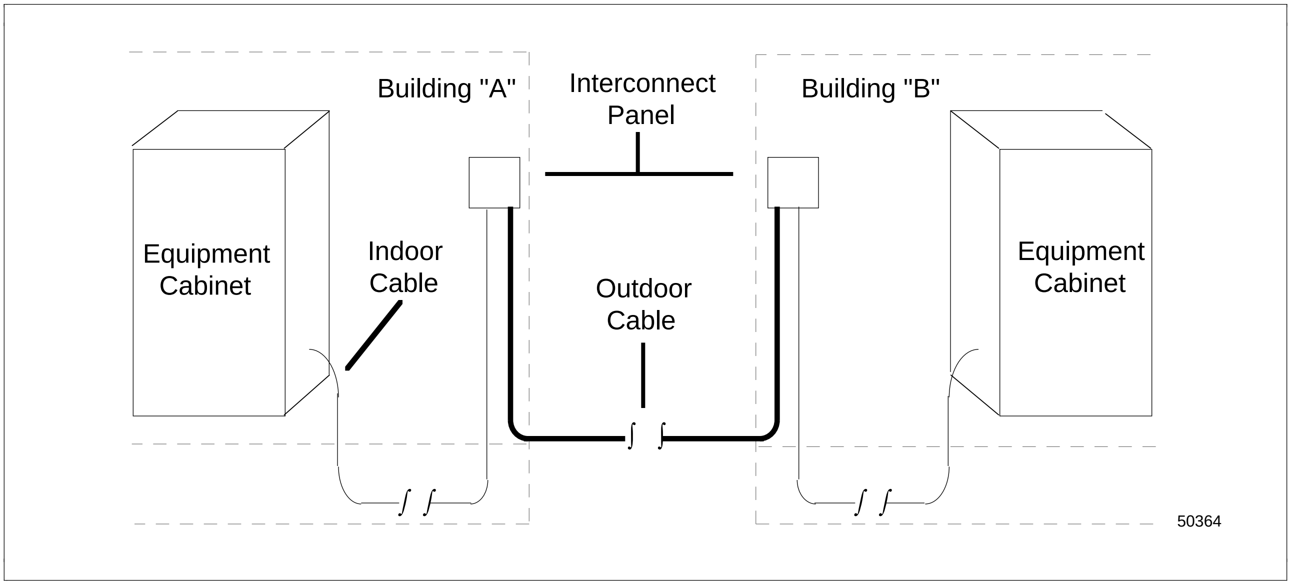
3.5.1.2 Interconnect Panels

Scope

The use of interconnect (or patch) panels in the fiber optic cable plant is strongly encouraged. Their use allows the quick and easy future use of extra dark fibers. Also, cables from several remote buildings may be brought to a single interconnect box to provide a central point of fiber channel management for plant-wide data communications.

Illustration

Figure 3-16 Indoor/Outdoor Cable Transition Using Interconnect Panels



Method

This method can make use of fan-out tubing to avoid the need to perform any splicing. Fan-out tubing is a tight buffer subunit without any fiber. A fan-out tube is slipped over each of the individual fibers in the loose tube cable after the sheath and buffer tubes have been stripped off. Cable vendors supply "break out" or "fan-out" kits which consist of fan-out tubing and a strain relieving boot. These kits allow the individual fibers to have connectors installed.

This technique can jacket only about 1 to 5 meters (3 to 15 feet) of bare fiber, so it is really limited to use inside an interconnect panel.

Each fiber in the outdoor cable (now jacketed by the breakout kit), including any spares, is installed with connectors and plugged into the back of an ST-type bulkhead-mount barrel connector. On the other side, the connection to an NG is made by means of the duplex cable assembly discussed in subsection 3.2.5.2. Unused receptacles should be capped off to prevent the ingress of contaminants.

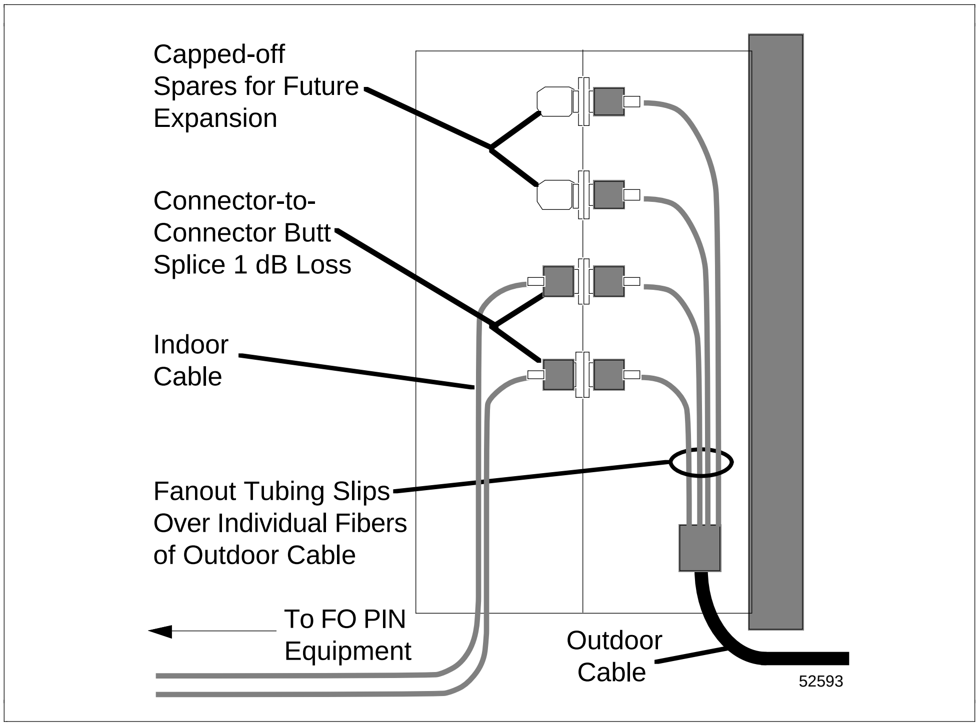
Continued on next page

Example of interconnect panel

The outdoor cable should have spare fibers for expansion or repair. The spare pairs must be capped off to protect the contact points from corrosion.

This panel does cause greater losses in light power, but gives much better trade-off in flexibility.

Figure 3-17 Interconnect Panel Construction



3.6 Qualifying the Link

Optical checkout (OTDR Test)

Once a fiber link is installed, a final optical check should be made. For multimode fiber installations (such as the fiber optic PIN), an optical time domain reflectometer (OTDR) is normally not necessary. An end-to-end attenuation check is sufficient. A 1300 nm optical power source, an optical power meter (calibrated for 1300 nm operation), and a short length of 62.5 µm patch cable are the equipment items required for this test.

When the fiber link was planned, the link power budget should have been calculated (refer to subsection 3.4) in order to get an idea of where the optical losses would be taken and how much safety margin would remain. The end-to-end attenuation check verifies the planned link attenuation against the actual installation.

The fiber optic network does not transmit light when not in actual token passing communication, so one cannot simply connect a meter and verify proper photonic power.

Tools required: 1300 nanometer optical power source
Optical power meter calibrated to 1300 nanometer

Table 3-5 Link Confidence Test

Step	Action
1	Verify that the optical power meter has been recently calibrated for 1300 nanometers during a regular calibration cycle.
2	Make a baseline measurement of the optical power source by connecting the it to the power meter. Record the results.
3	Connect the power source to one end of the fiber link under test.
4	Connect the power meter to the other end of the fiber link under test. Record the measurement. The difference between the baseline reading and the this value should not be greater than the loss budget originally calculated for this link.
5	If excess loss is encountered, check all connections and inspect the cable for kinks and other damage.

If this check returns satisfactory results, the link can be commissioned with confidence. If this check is not satisfactory, check all accessible connections for security. If problems persist, an Optical Time Domain Reflectometer (OTDR) may be required for troubleshooting. The OTDR can pinpoint exactly where any anomalies in the continuity of the light path lie.

Section 4 – Hardware Installation

4.1 Overview

Section contents

These are the topics covered in this section:

Installation tasks

The following tasks must be completed or verified to install a Network Gateway (NG) and Plant Information Network (PIN.)

- Mount the NG module in the cabinet, Universal Station, or Universal Station^X.
- Connect power and ground to the module.
- Ensure pinning on circuit boards.
- Ensure connection of PIN cable to NIM MODEM/Fiber Optic MODEM.

4.2 Mount the Network Gateway Module

Scope

In new systems, the NG is already mounted in the cabinet. Therefore, this section may skipped.

If the NG is an expansion installation, then this is the first task to be completed.

Locations

Network Gateways can be located in one of the following available locations.

- LCN equipment cabinet
- Universal Station cabinet
- Universal Station^X cabinet

If the node is just a set of two or three boards and power supply without a module, they can be installed in an available Dual Node Module upper or lower node location (lower slots 1, 2, 3 for cable A and B or upper slots 1, 2 for cable A only).

Continued on next page

Ergonomic (new) furniture

To add a second node to new furniture (Universal Station or Universal Station^X), an additional module pod will have to be added to the station. The hardware required for this and the procedures for doing so are found in Section 2 of *Universal Station (Ergonomic) Service* or *Universal Station^X (Ergonomic) Service*. Module grounding instructions are also found there.

Classic furniture

The Network Gateway can be mounted as the second module in the upper module location. See *LCN System Installation* for grounding instructions.

LCN equipment cabinet

The Network Gateway can be mounted in any open module location within the cabinet. See *LCN System Installation* for grounding instructions.

If installing multiple modules for duplicate PIN connections, alternate modules should be split between the two ac power bus strips. This provides backup ac power to one of the modules in case of a power outage.

4.3 Node Address Pinning

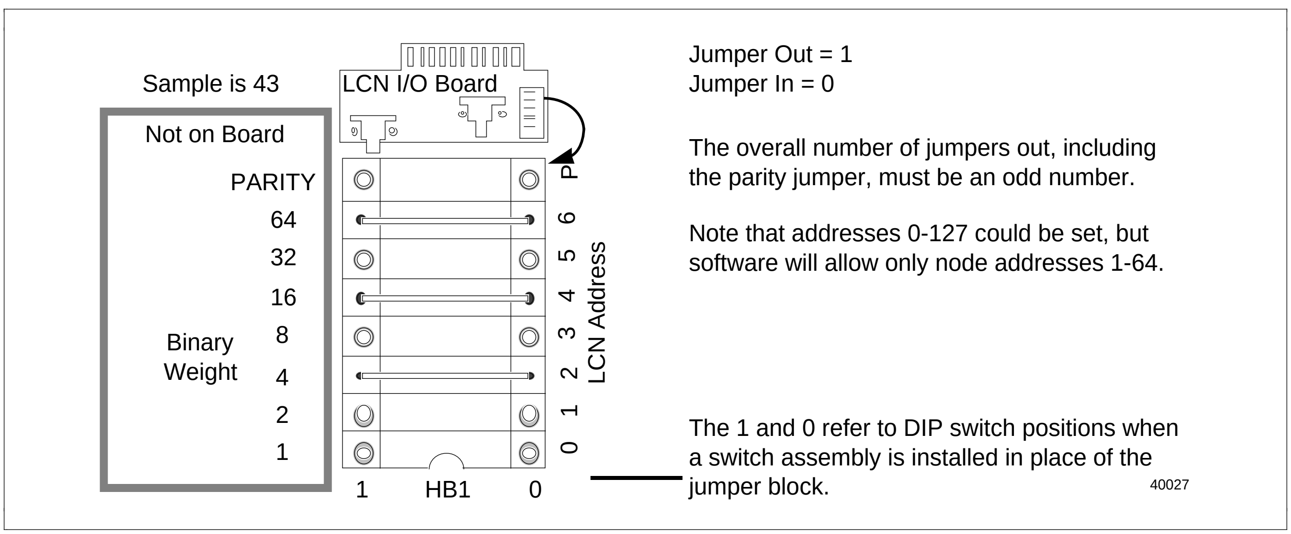
LCN I/O board

If the node is in a Five-Slot Module with a LCN I/O board and no K2LCN board, the node address is configured on the LCN I/O board. **If the node is in a Five-Slot Module with a K2LCN board installed, the node's address pinning must be done on the LCN I/O.**

ATTENTION

ATTENTION—When the node has both boards installed all pinning jumpers on the K2LCN must be removed .

Figure 4-1 Node Address Pinning on LCN I/O Board



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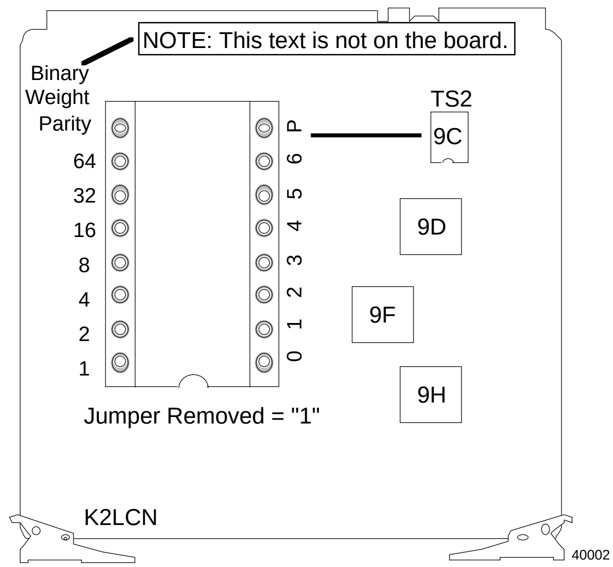
4.3 Node Address Pinning, Continued

K2LCN board dual node

In a dual node, the pinning of the address on a K2LCN board, shown in Figure 4-2, is done exactly as on an LCN I/O board as shown in Figure 4-1.

Figure 4-2 Dual Node Address Pinning on K2LCN Board



4.4 Fiber Optic PIN Installation

Contractor installed

It is recommended that the fiber optic Plant Information Network (PIN) be designed, provided and installed by a contractor who is an expert in this field.

4.5 Carrier Band PIN Installation

Reference

The carrier band Plant Information Network (PIN) must be installed according to the methods found in *Universal Control Network Installation* and *Universal Control Network Guidelines*. A step-by-step procedure for Process Manager installation is found in Appendix A of *Universal Control Network Guidelines.* Adapt this procedure to install NG nodes on a new PIN connecting only Network Gateways.

Continued on next page

Carrier Band modem

Each NIM MODEM board in a node has one cable connected to the UCN-B connector (J3) of each NIM modem board located in the I/O card file on the rear of the node.

- Tighten **each cable connection** with the calibrated wrench provided with the carrier band taps. This wrench is designed to "click" at the correct tightening pressure of 25 in/lb. **DO NOT OVER TIGHTEN**.

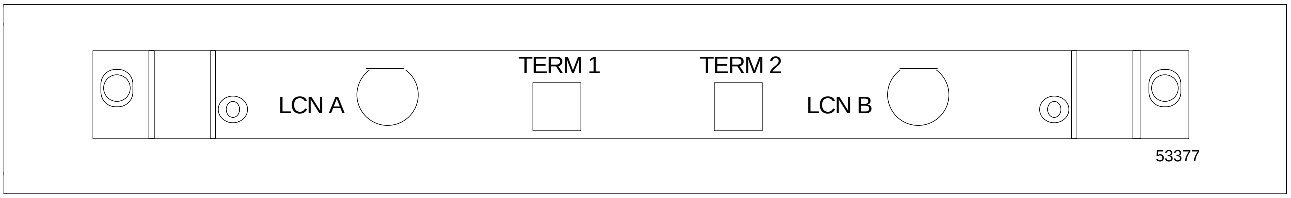
4.6 CE Compliant Hardware Installation

European Compliance hardware installation

The I/O board interfaces both LCN cable A and cable B to the KxLCN board or LLCN in a Five-Slot Module and Ten-Slot Module. New I/O boards and interface cabling are developed to support the CE Compliant standards. The following illustrations show the new hardware.

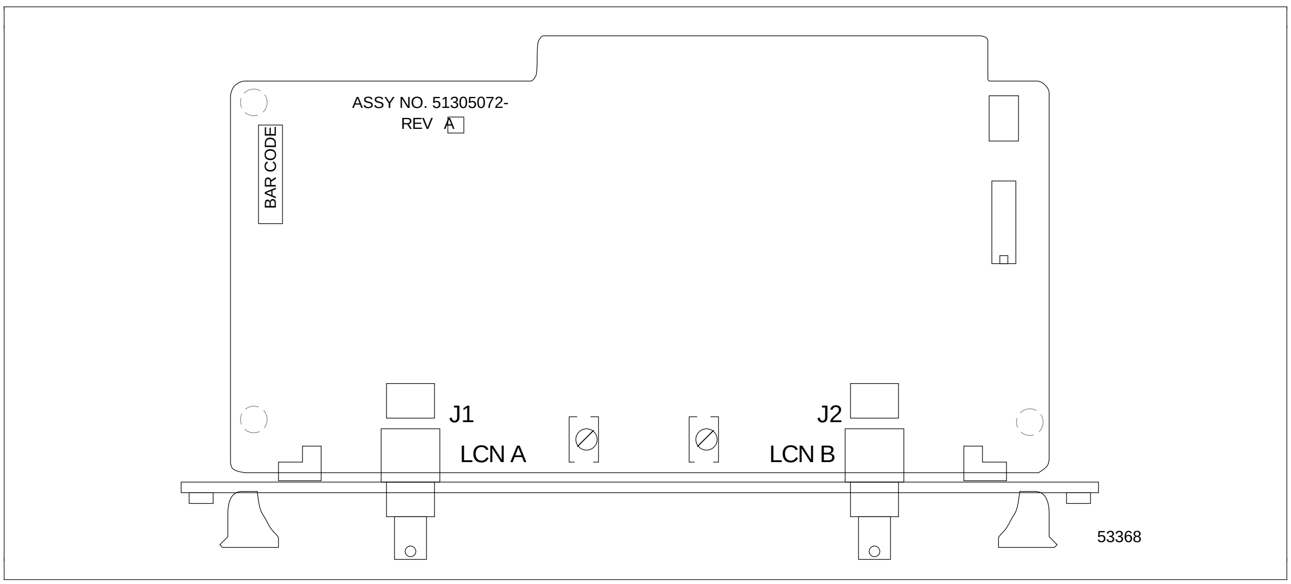
Illustration

Figure 4-3 CLCNA/B Faceplate



Illustration

Figure 4-4 CLCNA/B I/O Board



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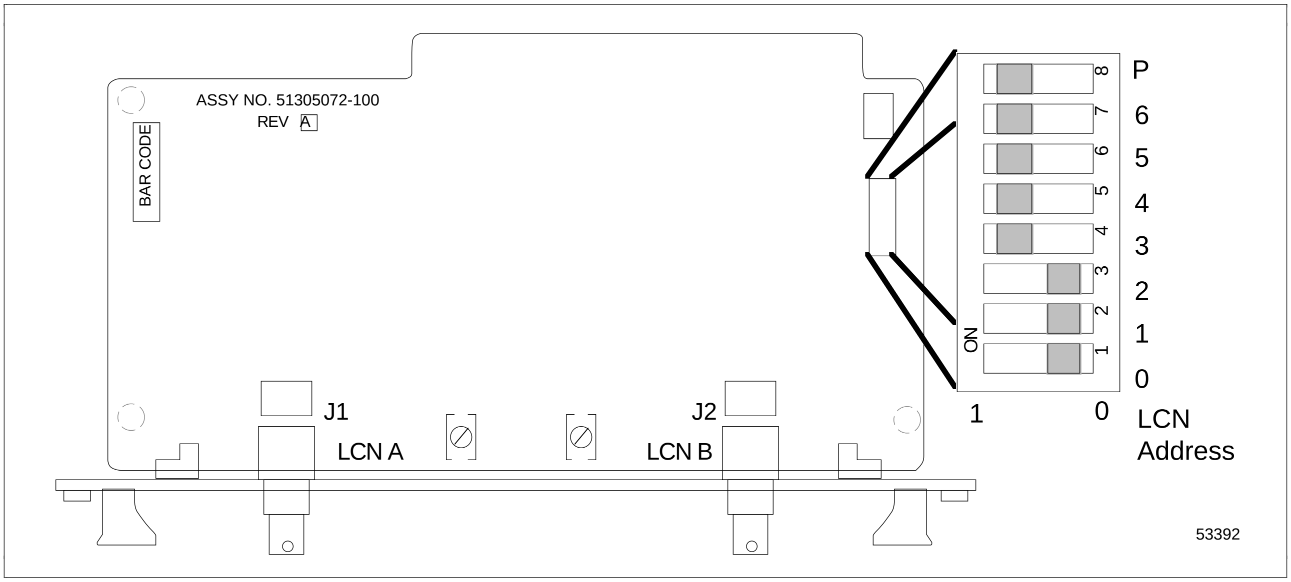
Pinning Illustration

Figure 4-5 CLCNA/B I/O Address Pinning



Section 5 – Network Gateway Module Checkout

5.1 Overview

Section contents

These are the topics covered in this section:

Scope

This section provides the installer with a checkout procedure that ensures that both a Dual Node Module or a Five-Slot Module with the Network Gateway Interface and Network Interface circuit boards installed are capable of on-line operation.

Firmware tests

The module is tested with firmware (in the hardware) and software (from the system). Firmware tests, resident in the node, provide two similar means of functionally testing the unit, whether or not the node is connected to the Local Control Network (LCN). The first firmware self-tests begin when power is applied to the equipment. Pressing the node's RESET button initiates a second, but slightly different, set of firmware self-tests on the K2LCN or HPK2 circuit boards. The NGI circuit board does not alter its firmware self-tests.

Software tests

Software tests are optionally initiated at the System Console if the node is connected to the system. Loading the node personality, for example, initiates a software Quality Logic Test (QLT).

Refer to *Five/Ten-Slot Mode Service* or *Dual Node Module Service* for a flow chart that explains the relationship of these different tests.

5.2 Power-On Testing

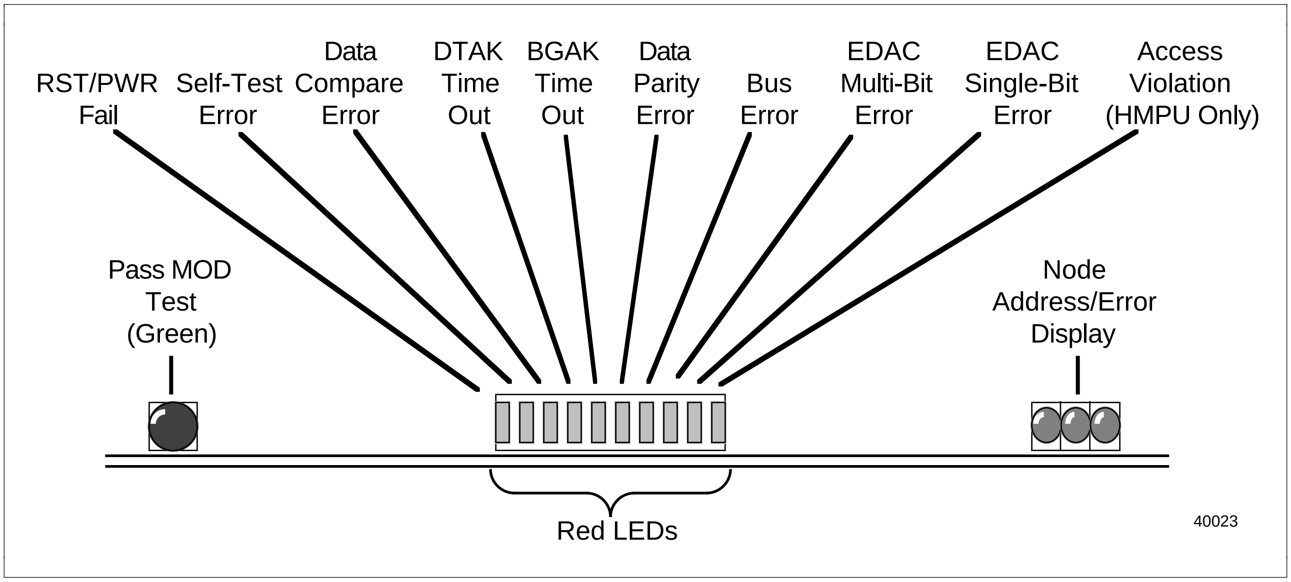
Turning on power

Initiate the power on testing by placing the node's power rocker switch in the On position by pressing the "1" side of the Power Supply switch. Each node has its own Power Supply Assembly, and therefore its own power switch. Test each one separately. Note that the red LEDs on the circuit boards illuminate for a short period (less than 40 seconds). They must then extinguish and all the circuit boards' green LEDs illuminate after a short period of time (30 seconds).

LED Indicators

The NGI's red LED will extinguish when the NGI is ready to accept commands from the K2LCN circuit board. See Figures 5-1, 5-2, and 5-3 for a view of the display's location.

Figure 5-1 HPK2 LED Indicators



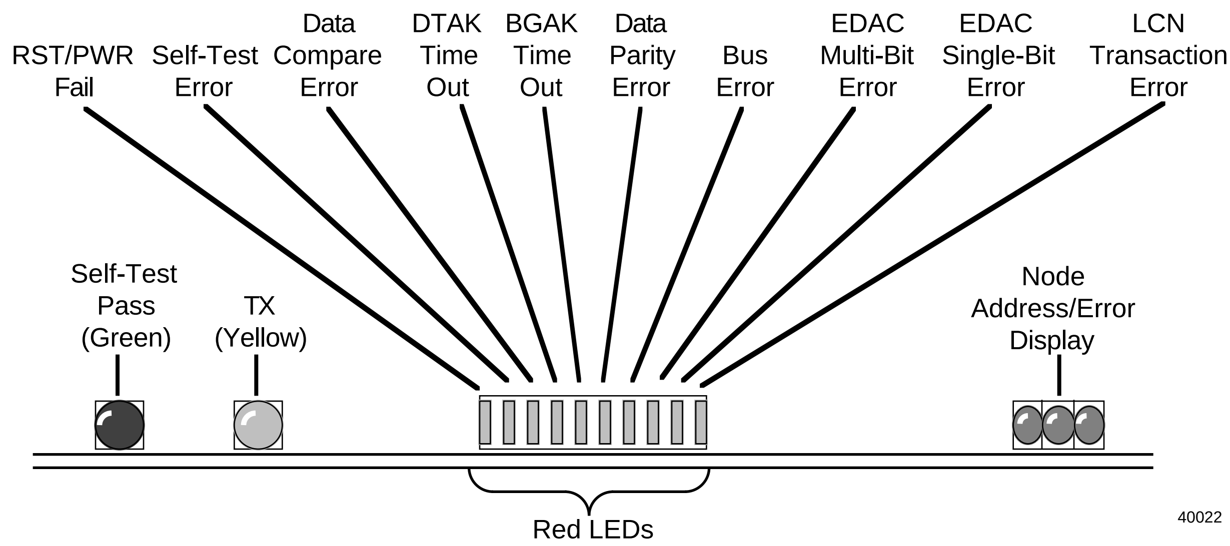
Ready NGI for software loading

Another test can be performed to verify if the NG is ready to run software. Prior to power-up, set the jumper at TS3 to the TEST position and verify a modem is connected on each NGI board installed (see Figure 5-3). Apply power and verify the DS4 LED (TX) is illuminated on all installed NGIs. This test checks out all the connections on the NGIs and assures the NG is ready for loading of software. Power the unit off and move the jumper at TS3 on each installed NGI back to the NORMAL position.

Continued on next page

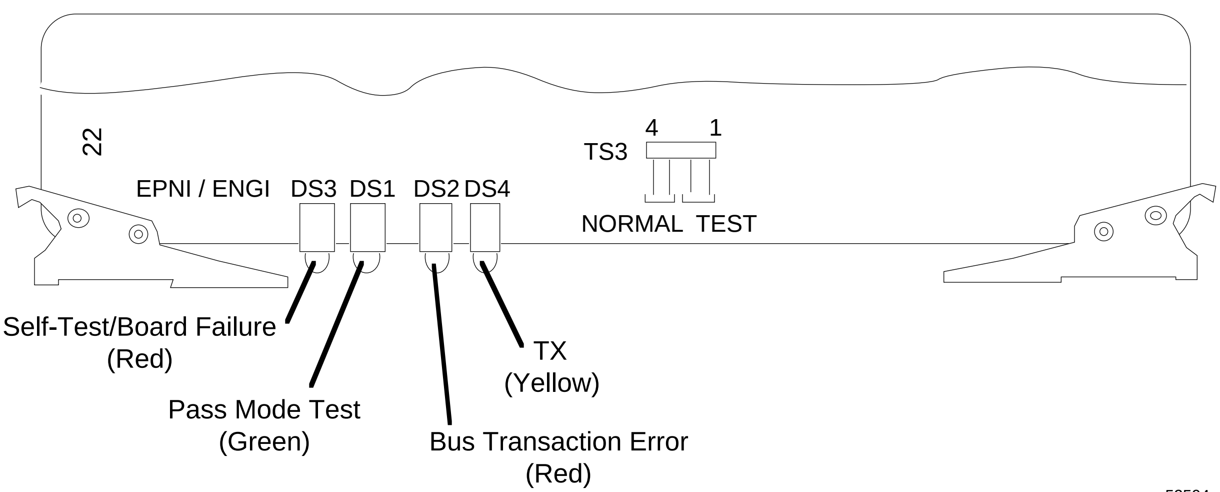
K2LCN LED Indicators

Figure 5-2 K2LCN LED Indicators



NGI LED Indicators

Figure 5-3 Network Gateway Interface (NGI) LED Indicators



Section 6 – Network Gateway Module Service

6.1 Overview

Section contents

These are the topics covered in this section:

Scope

Network Gateway service is supported by:

- *Five/Ten-Slot Module Service*, found in the LCN Service binder
- *Dual Node Module Service*, found in the LCN Service binder
- Service for the fiber optic PIN must be provided by the fiber optic network contractor.
- Service for the carrier band PIN

6.2 Network Gateway PIN Troubleshooting

Scope

Troubleshooting is supported as follows:

- Offline testing—Install NGIO board in place of the modem card (fiber optic or carrier band); this allows the execution of the NGIF test from the Hardware Verification Test System (HVTS). This will test the connections from the NGI board to the I/O card (NIM MODEM board or Fiber Optic MODEM board).
- NG node—Five/Ten-Slot Module Service or Dual Node Module Service
- Fiber optic PIN
  - —Check the error LED on each fiber optic modem board for flickering or steady indications. Refer to Figure A-1.
  - —See subsection 3.6, Table 3-5, repeat link confidence test measuring fiber optic modem output levels and power levels at the end of the fiber optic cable.
- The operating system has online test which sends messages from one NG to another and back. See *Network Operation* in Section 4 of *Network Gateway Implementation and Operation.*

6.3 Network Gateway Spare Parts

Circuit boards

See *Five/Ten-Slot Module Service* or *Dual Node Module Service*.

Section 7 – MODEM Data

7.1 Overview

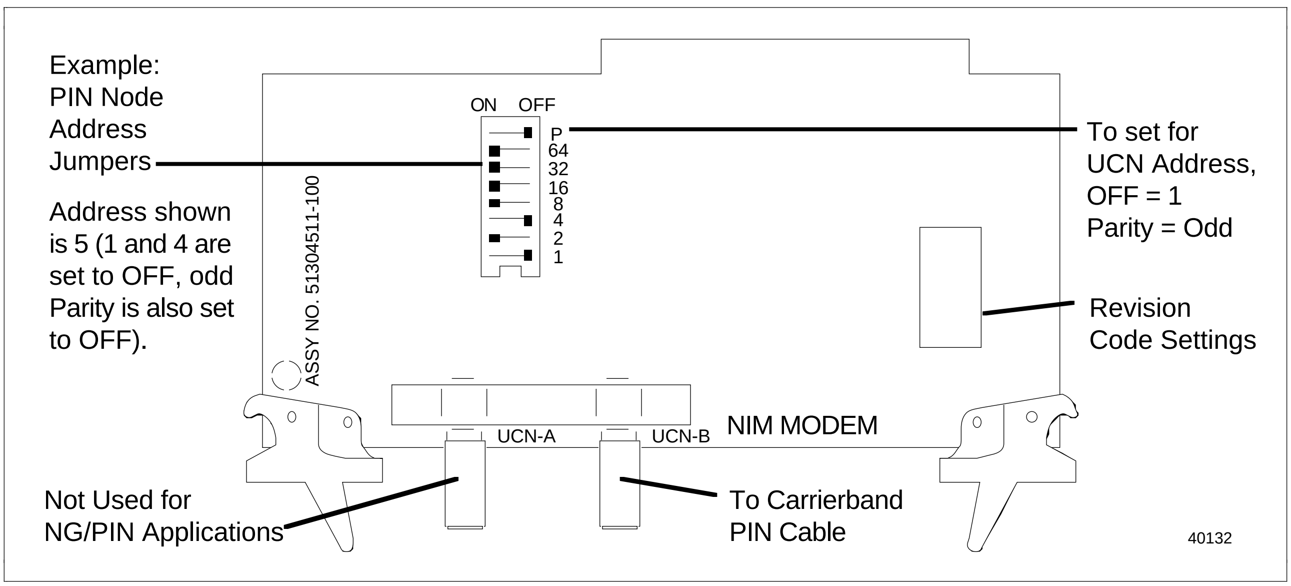
Section contents These are the topics covered in this section:

Scope This section identifies those modems that have been tested to work with the Network Gateway interface to a Plant Information Network (PIN).

7.2 Carrier Band MODEM

Description The MODEM used for a carrier band PIN is the same NIM MODEM board, 51304511-100, used in Network Interface Module (NIM) on the LCN.

Figure 7-1 NIM MODEM Board, 51304511-100



7.3 Fiber Optic Modem

Description

The fiber optic modem is a direct connect modem board that plugs into the I/O card file in place of the NGIO board and directly interfaces the fiber optic cable. One modem board is required for each end of the cable.

The NGIO board is required to execute the test programs that run on the NGI board.

Table 7-1 Fiber Optic MODEM Specifications

CD Networks	
Model	2005A (Honeywell Special)
Operating Range	0 to 70°C
Storage Range	-40 to 100°C
Ac Power Consumption	None
Dc Power Consumption	+5Vdc only, 1.25 watts maximum
Dimensions	Fits in I/O card file of a Five-Slot Module or a Dual Node Module

Fiber optic modem pinning

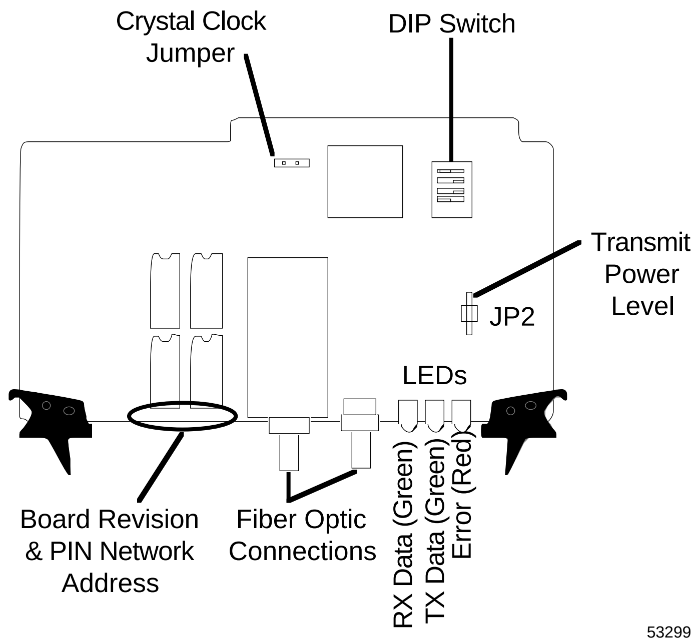
Table 7-2 CD Networks Modem Pinning

Pinning Function	Functional Description	Pinning
Switch position #1	Controls the timing recovery circuitry	OFF for 5 MB/s ON for 10 MB/s **Use the ON position**
Switch position #2	Controls the timing recovery circuitry	ON for 5 MB/s OFF for 10 MB/s **Use the OFF position**
Switch position #3	Controls bit rate	ON for 5 MB/s OFF for 10 MB/s **Use the OFF position**
Switch position #4	Used for factory testing	**Leave in ON position**
Shorted jumper next to the gate array	This jumper enables the on-board crystal clock	Must be left shorted
Factory Test Jumper	Factory Test Only	Must be left open
Transmit Power Level Jumper	JP2 is used to reduce transmit power	For links greater than 3 km or links using Passive Stars or Passive Splitter/ Combiners, use jumper. For point-to-point links (a modem connecting directly to an Active Concentrator port, Repeater or other modem) of less than 3 km, **leave this jumper open**.

Continued on next page

Illustration

Figure 7-2 CD 2005A Fiber Optic MODEM Board



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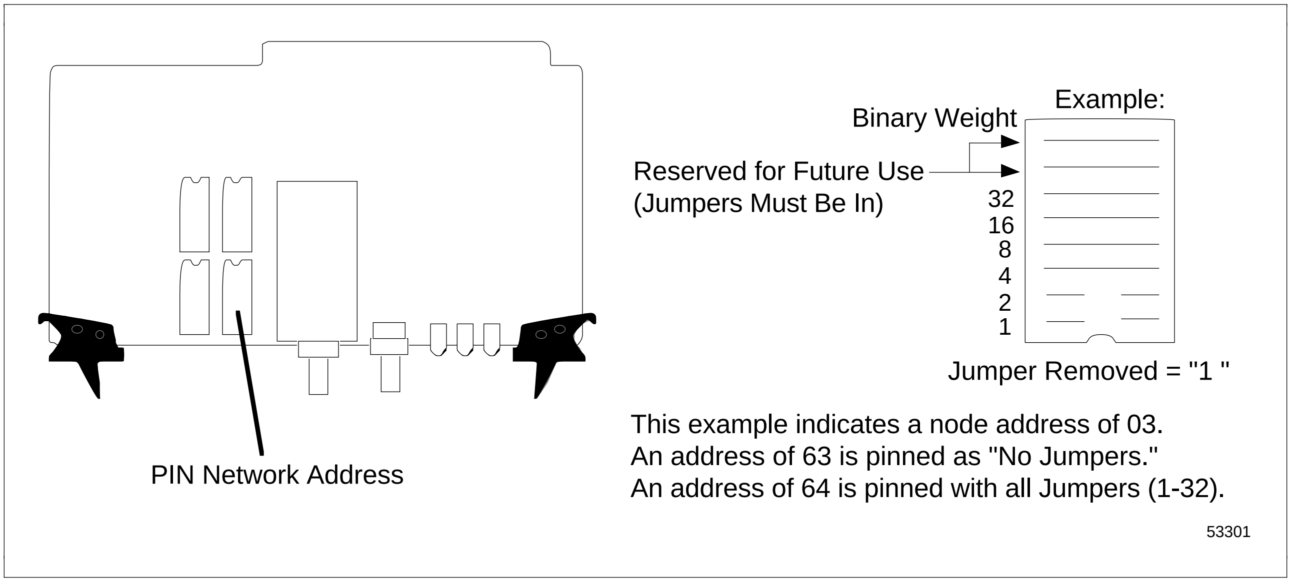
Pinning the Plant Information Network (PIN) address

The PIN address must be pinned on the fiber optic MODEM board.

Figure 7-3 CD 2005A Fiber Optic MODEM Address Pinning



7.4 CE Compliant NIM Modem

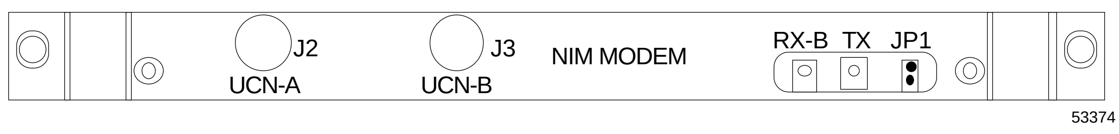
Description

The CE Compliant Network Interface Module Modem (NIM MODEM) board interfaces the cable through a faceplate. The other end of the cable is tapped into the UCN Trunk cable.

It also is used to interface a Network Gateway Plant Information Network (PIN) through a trunk cable tap.

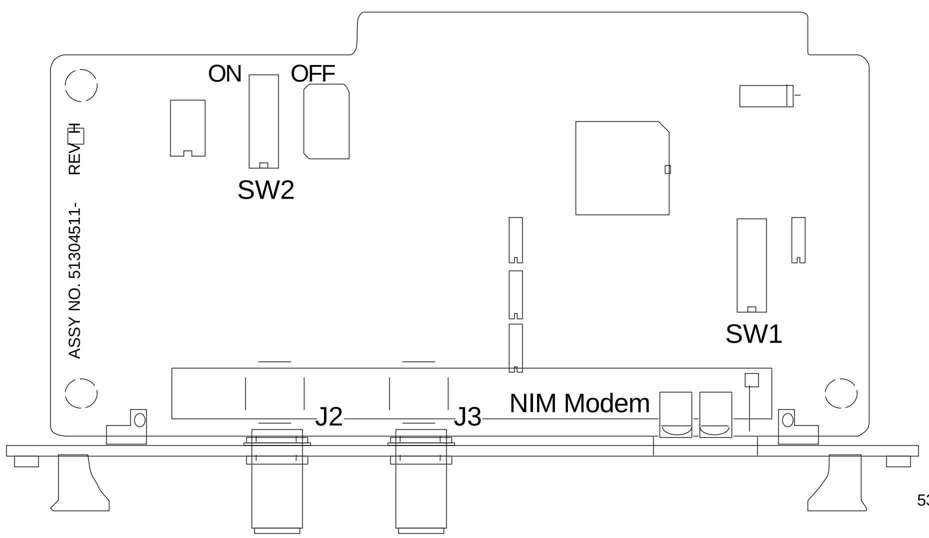
Illustration

Figure 7-4 NIM Modem Faceplate



Illustration

Figure 7-5 NIM Modem Board



Index

A, B

C, D, E

F, G, H

I, J, K

L

M

N

Index

O

P, Q

R

S

T, U, V, W, X, Y, Z

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