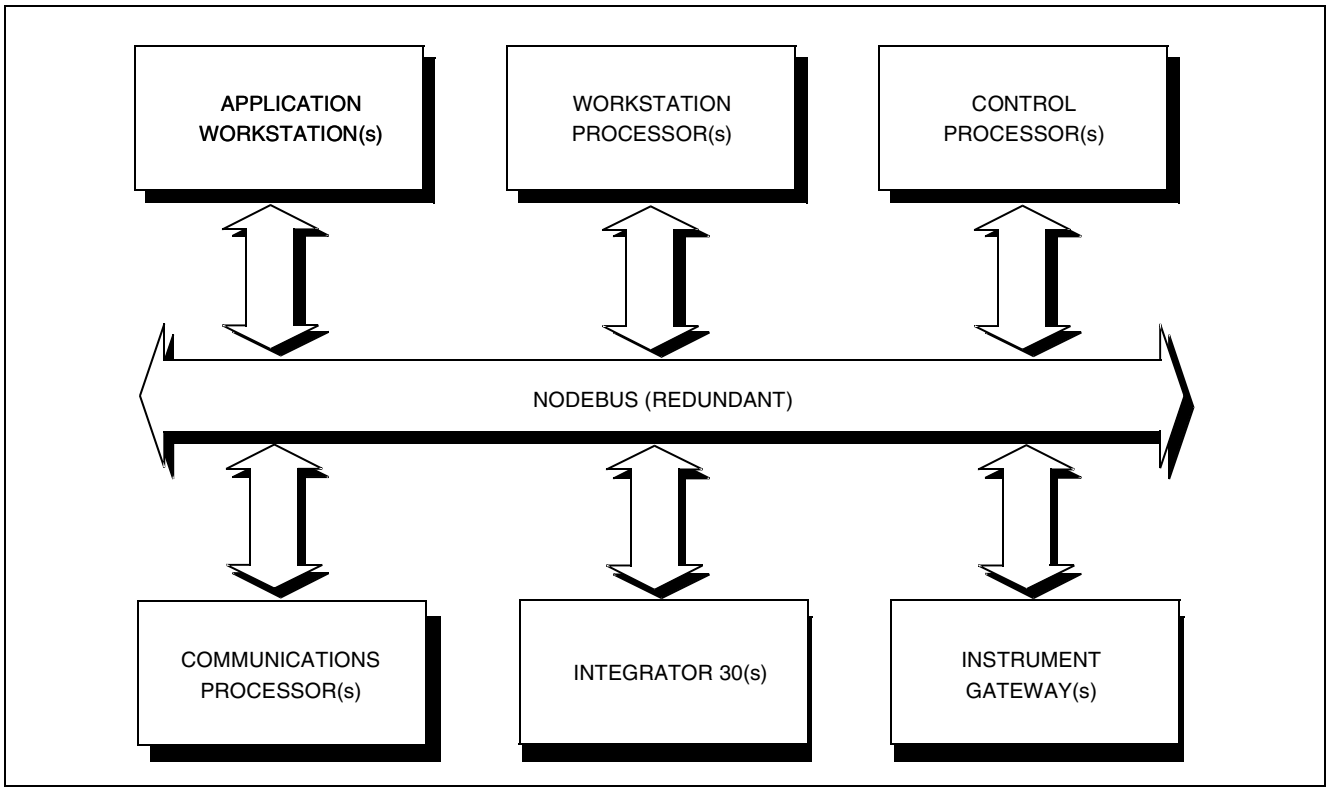
I/A Series® Hardware
Nodebus



The Nodebus interconnects stations (Control Processors, Application Processors, Application Workstations, and so forth) in the I/A Series system to form a process management and control node (UNIX® based or Windows NT® based). Depending on application requirements, the node can serve as a single, stand-alone entity, or it can be configured to be part of a more extensive communications network.

Operating in conjunction with the Nodebus interface electronics in each station, the Nodebus provides high-speed, redundant, peer-to-peer communications between the stations.

The high speed, coupled with the redundancy and peer-to-peer characteristics, provide performance and security superior to that provided by communication media used in conventional computer-based systems. Station interfaces to the Nodebus are also redundant, further ensuring secure communications between the stations. The Nodebus can be implemented in a basic, non-extended configuration (shown above) or it can be extended through the use of Nodebus Extenders and Dual Nodebus Interface Extenders (station attachment units).

NODEBUS INTERFACE

The Nodebus Interface is an I/A Series module which allows direct connection of an I/A Series personal workstation (PW) on a UNIX based node, with appropriate Nodebus connector card and software, to the Nodebus (Figure 1). In this configuration, the PW functions as a station on the node.

The Nodebus Interface allows connection of a 50 Series station (AW51/WP51) or 70 Series station (AW70/WP70) hosting a Micro-I/A™ Ethernet configuration to a UNIX based or Windows NT based Nodebus, respectively. See Figure 1.

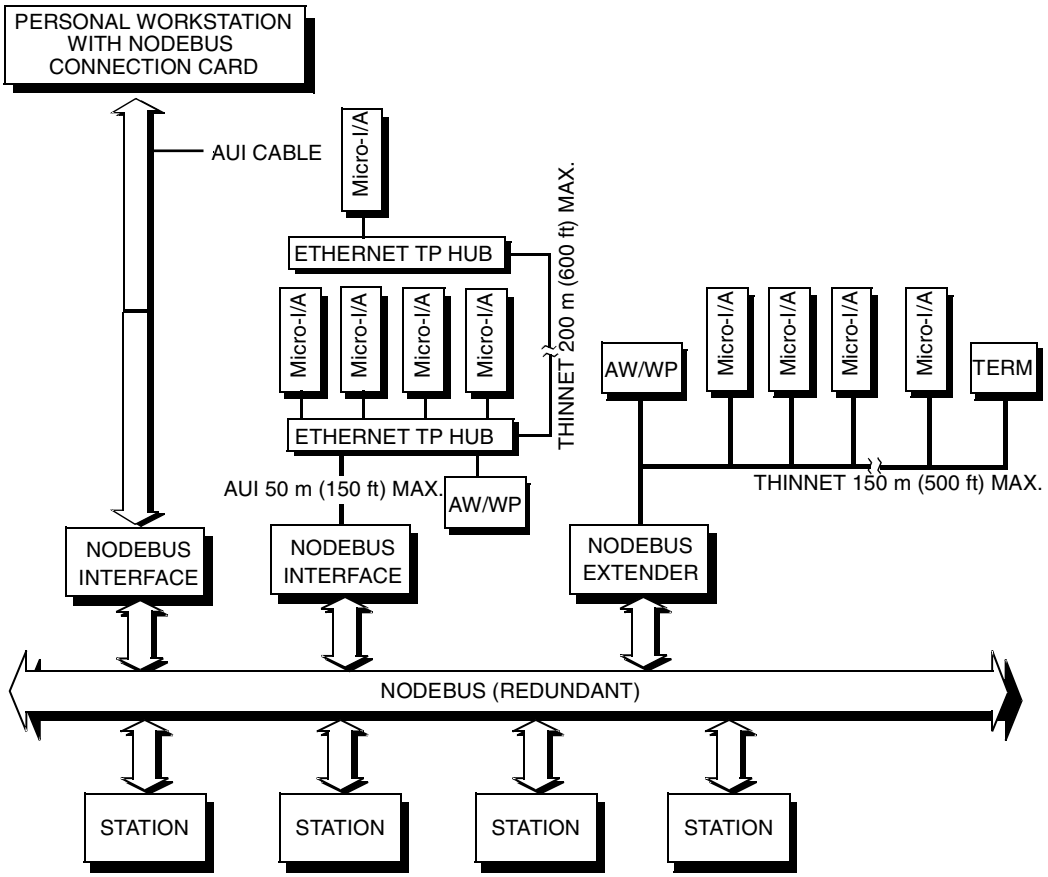


Figure 1. Nodebus Interface Implementation (Typical)

An Attachment Unit Interface (AUI) cable, having a maximum length of 50 m (150 ft), connects the PW or an Ethernet hub configuration to the Nodebus via a Nodebus Interface. A coaxial cable (ThinNet) having a maximum length of 150 m (500 ft) connects an Ethernet daisy chain configuration to the Nodebus via a Nodebus Extender. Up to four Nodebus Interfaces, with compatible workstations, can be connected to the Nodebus.

The Nodebus Interface is non-redundant, and can be used in any of the Nodebus configurations described.

DUAL NODEBUS INTERFACE

The Dual Nodebus Interface (DNBI) is an I/A Series module which allows direct connection of 50 Series or 70 Series(1) stations to the appropriate I/A Series Nodebus. (Examples of such stations include the Application Processor 51, Application Workstation 51, Workstation Processor 51, Application Workstation 70, and Workstation Processor 70.) Connection between the DNBI and the 50 Series or 70 Series stations is made via an AUI cable having a maximum length of 50 m (150 ft).

(1) The WP70 may be used on either a UNIX based or Windows NT based node.

For data transmission security, a separate (RS-423) control cable connects between the 50 Series or 70 Series station and the DNBI to allow switching between the two redundant Nodebus cables. Switching of the Nodebus cables is controlled by the 50 Series or 70 Series station, which transmits commands to the DNBI via the control cable. Figure 2 shows connection of a 50 Series or 70 Series station to the Nodebus using a DNBI.

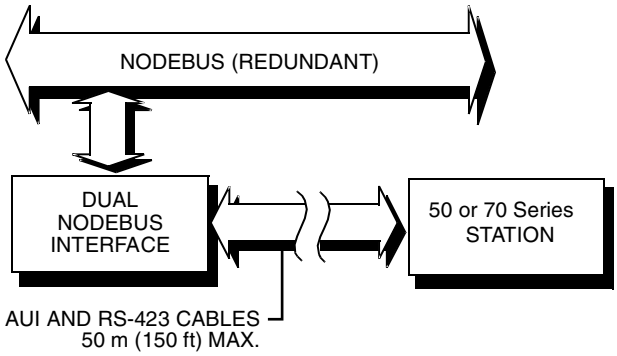


Figure 2. Local Connection of 50 Series or 70 Series Station

DUAL NODEBUS INTERFACE EXTENDER

The Dual Nodebus Interface Extender (DNBX) is functionally similar to the DNBI, but provides a greater cabling distance: 450 m (1,500 ft). The principal transmission medium used is a coaxial Ethernet cable directly connected to the 70 Series station or coupled to an AUI cable at the 50 Series station end by a standard Ethernet transceiver. Figure 3 and Figure 4 show remote connection of a 50 Series and a 70 Series station to the Nodebus using a DNBX.

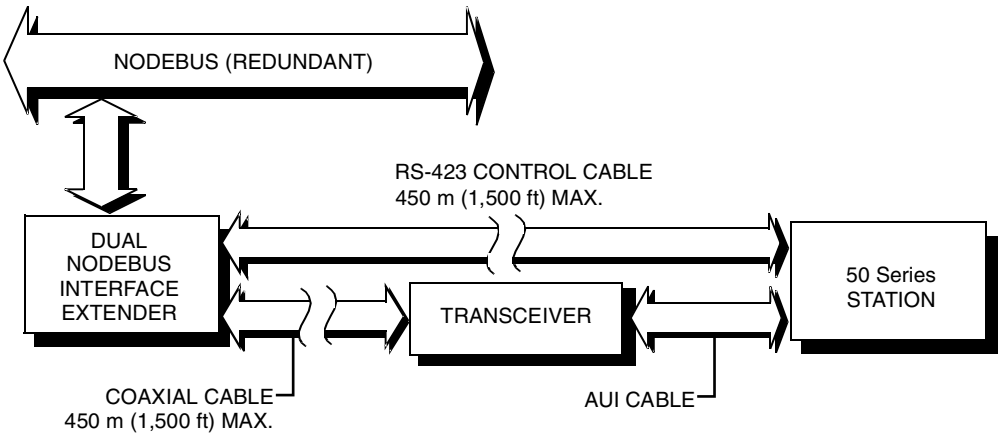


Figure 3. Remote Connection of 50 Series Station

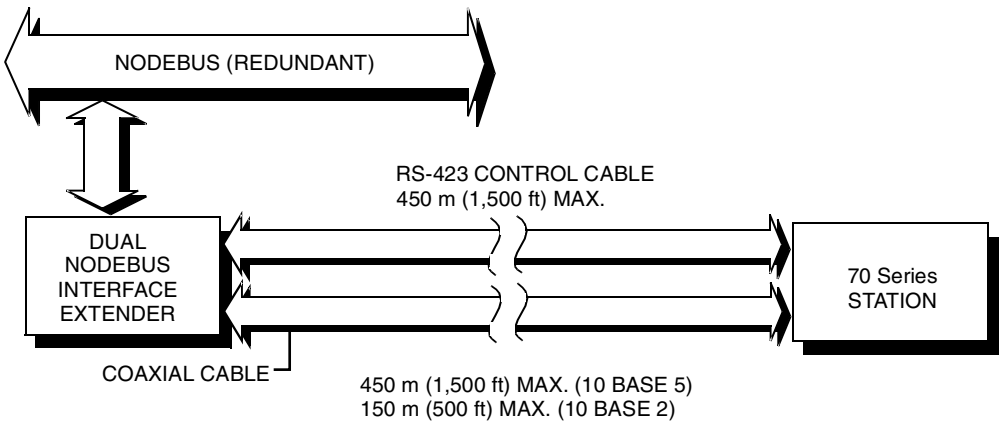


Figure 4. Remote Connection of 70 Series Station

NON-EXTENDED NODEBUS

The non-extended Nodebus (shown in the cover figure) interconnects I/A Series stations locally, to comprise a complete process management and control system. Having a maximum length of 30 m (100 ft), the non-extended Nodebus can span multiple I/A Series enclosures (up to six mounting structures(2)) and can accommodate up to 32 stations(3).

EXTENDED NODEBUS

The extended Nodebus utilizes the coaxial and fiber optic Nodebus Extenders or DNBXs to increase the length of the Nodebus.

Coaxial Nodebus Extension

The coaxial Nodebus Extenders can be used to extend the length of the Nodebus (Figure 5). This type of extender is used in pairs (one for each redundant Nodebus cable) and serves to produce a Nodebus run that is divided into “segments”.((2))

A Nodebus extended through the use of coaxial Nodebus Extenders can consist of up to three Nodebus segments, each having a maximum length of 30 m (100 ft). Each segment can span multiple I/A Series enclosures (up to six mounting structures((2))). The maximum cabling distance between segments is 300 m (1,000 ft).

The Nodebus extension (using coaxial Nodebus Extenders) can have a maximum overall cabling length of 600 m (2,000 ft) and can accommodate up to 64 stations((3)).

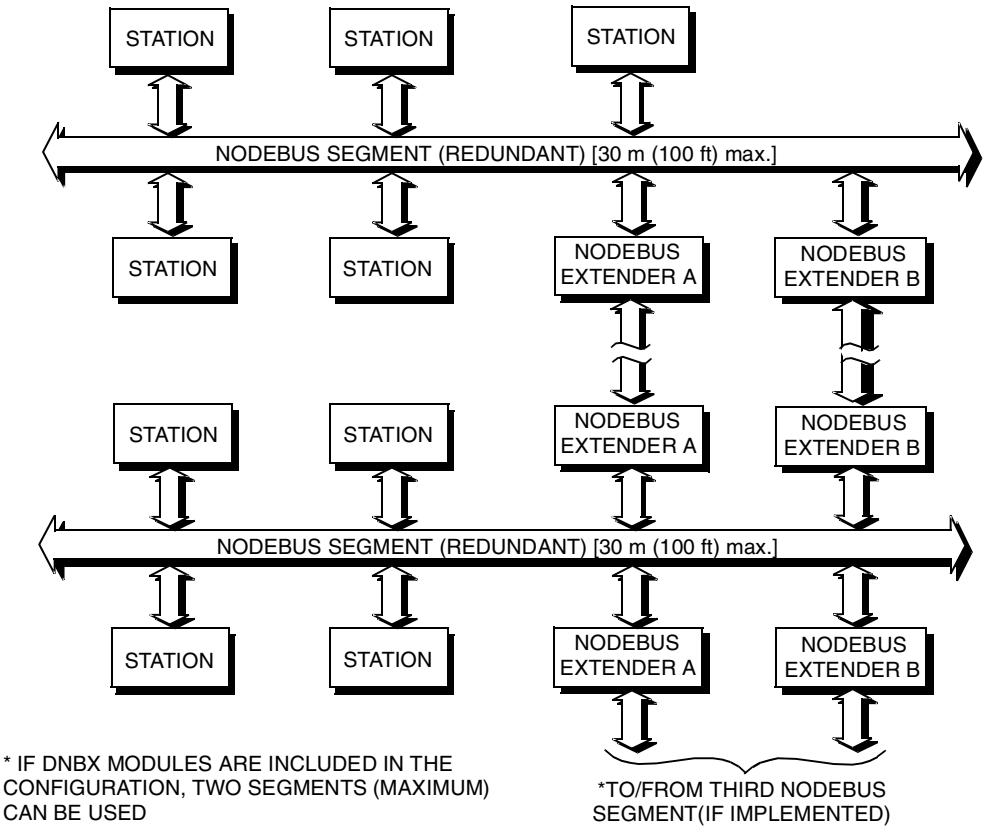


Figure 5. Extended Nodebus Configuration (Typical)

(2) For example, an Industrial Enclosure 32 has two mounting structures; therefore, no more than three industrial Enclosure 32s can be included in a segment.

(3) Fault-tolerant stations count as two stations; Nodebus Extender pairs count as two stations.

Fiber Optic Nodebus Extension

Fiber optic extenders should be used when the Nodebus needs to be extended more than 600 m (2,000 ft) or when the environment may create ground loops. There are two supported configurations:

- Point-to-point link (see Figure 6)
- Cascaded point-to-point link (see Figure 7).

Point-to-Point link

The point-to-point link allows a two (2) segment Nodebus (Figure 6). Each of the redundant Nodebuses (A and B) requires a pair of Fiber Optic Nodebus Extenders (FONBE) modules to connect the two (2) segments (four (4) modules).

A duplex fiber cable (fiber pair) connects each FONBE pair.

The maximum fiber cable extension distance for the fiber link is 2000 m (6560 ft). When Control Processor 10s (CP10s) are used in the node, the maximum extension distance must be reduced to 600 m (2000 ft).

Cascaded Point-to-Point Link

The Cascaded point-to-point link allows a three (3) segment Nodebus (Figure 7). Two (2) pairs of FONBE modules are required for each Nodebus (A and B) in this configuration (eight (8) modules).

The maximum distance of 2000 m (6560 ft) is the sum of the fiber cables distances (length x + length y).

When Control Processor 10s (CP10s) are used in the node, the maximum extension distance sum (length x + length y) must be reduced to 600 m (2000 ft).

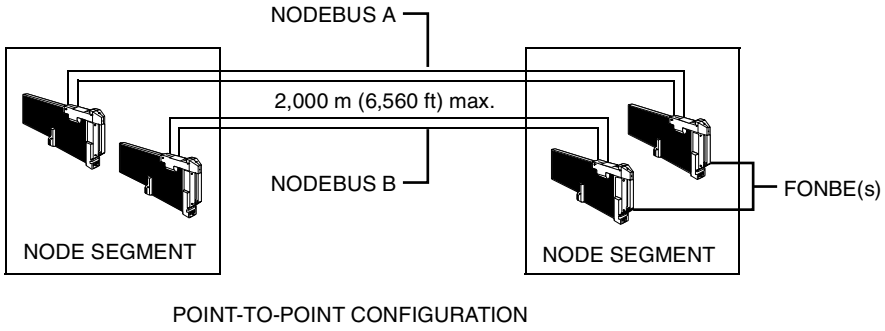


Figure 6. Point-to-Point Extended Fiber Optic Nodebus Configuration

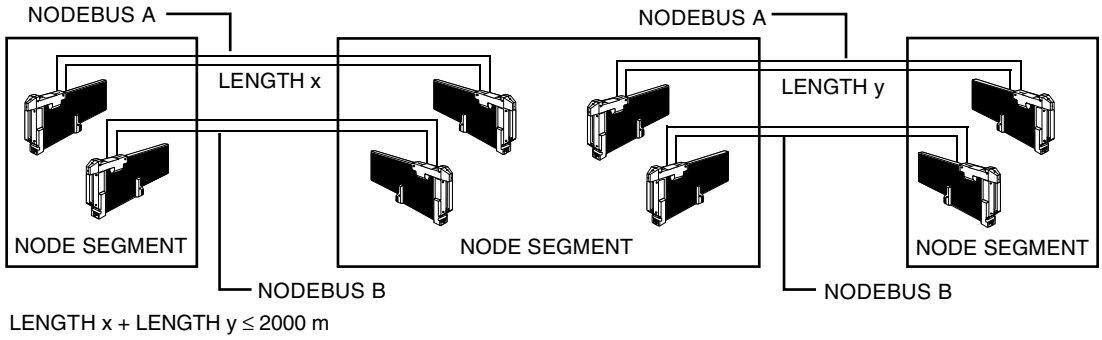


Figure 7. Cascaded Point-to-Point Extended Fiber Optic Nodebus Configuration

Nodebus Extension using DNBXs

Dual Nodebus Interface Extenders (DNBXs) can be used with the basic (non-extended) Nodebus or with a Nodebus that has been extended using Nodebus Extenders. When a DNBX and associated 50 Series or 70 Series station are added to basic (non-extended) Nodebus, the Nodebus becomes extended by virtue of its link with the remote 50 Series or 70 Series station.

One or more DNBXs (with associated 50 Series or 70 Series stations) can be connected to the basic Nodebus, as shown in Figure 8. Figure 9 shows DNBXs used with a Nodebus that has been extended through the use of Nodebus Extenders. Note that, in this configuration, certain restrictions must be observed:

- No more than two Nodebus segments can be implemented.
- The DNBXs (with associated stations) can be connected to either Nodebus segment, but not both.

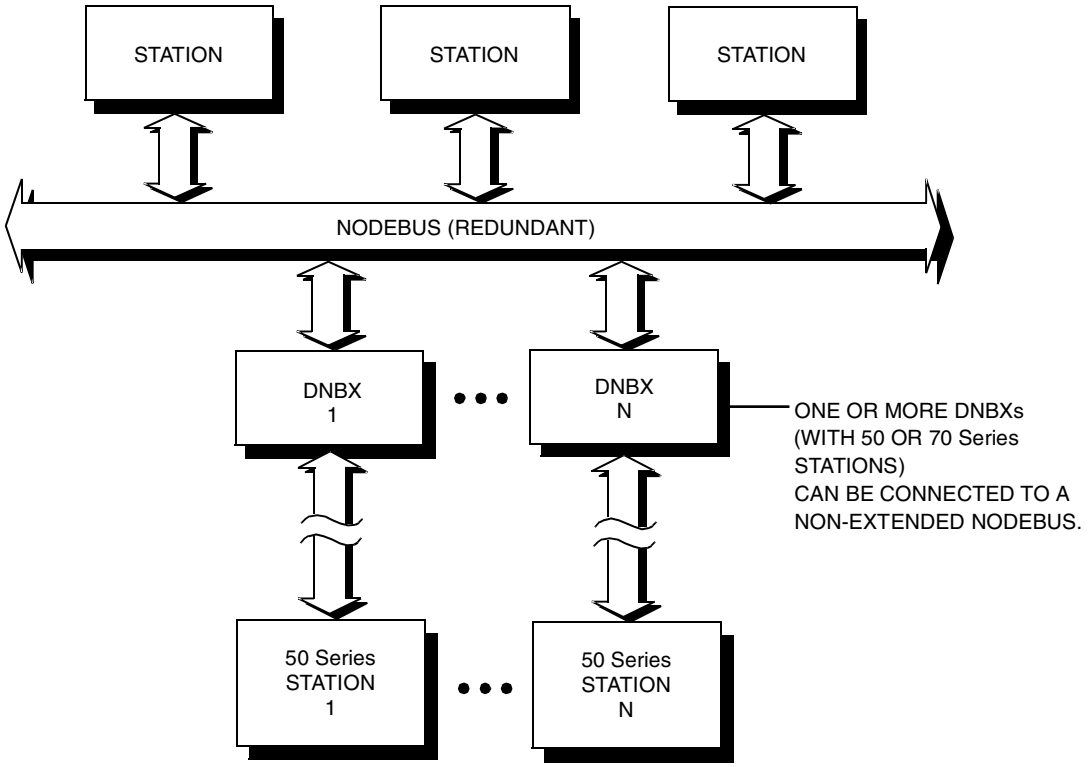
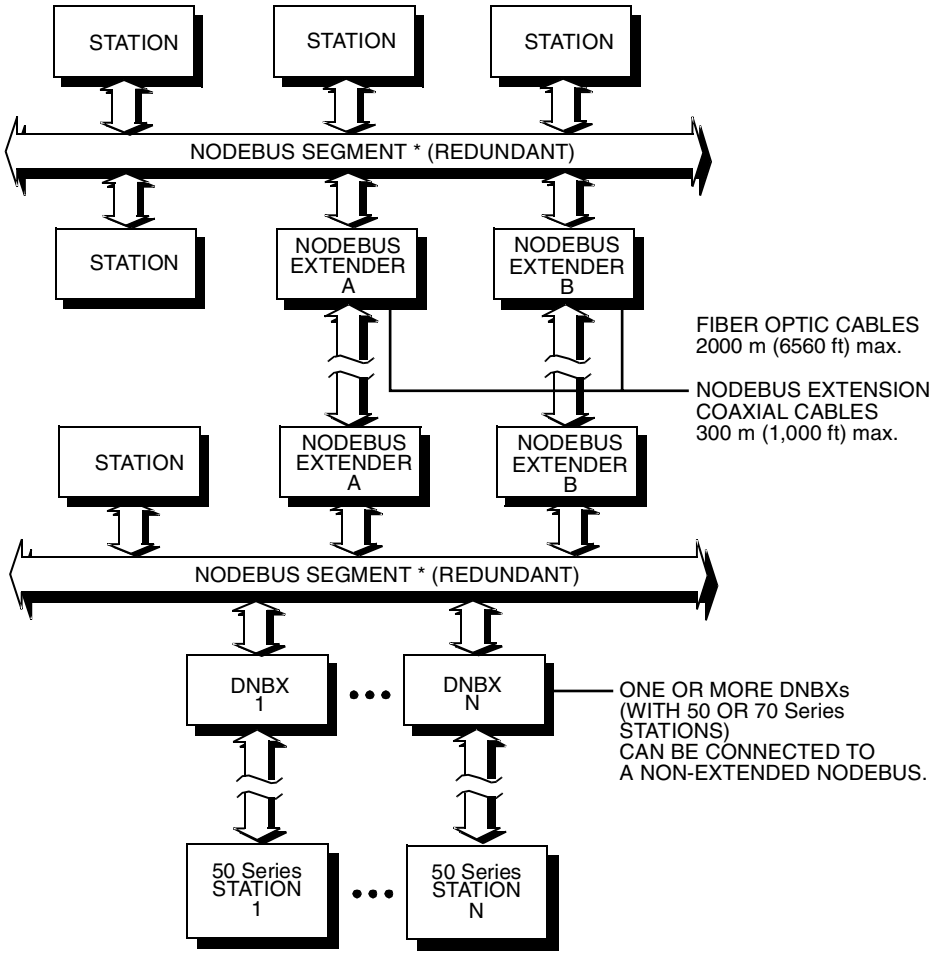


Figure 8. DNBXs used with Basic (Non-Extended) Nodebus



* UP TO TWO NODEBUS SEGMENTS (MAXIMUM) CAN BE IMPLEMENTED WHEN DNBXs ARE USED.

Figure 9. DNBXs used with Extended Nodebus

NODEBUS AS PART OF A CARRIERBAND LAN NETWORK

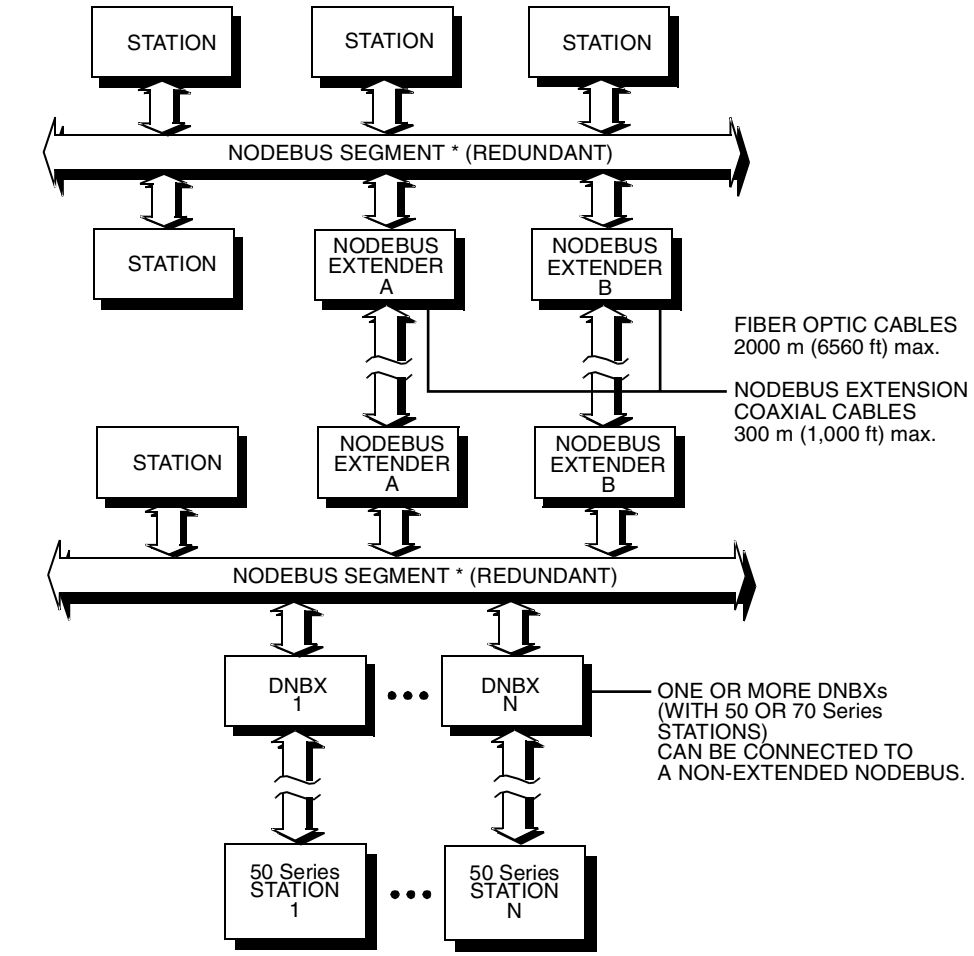
The Nodebus, with its associated I/A Series stations, can be a part of a LAN based communications network consisting of a coaxial system, a fiber optic system, or a combination of both. A Nodebus connected to a coaxial Carrierband LAN is represented in Figure 10. In this configuration, a Carrierband LAN Interface module (optionally fault-tolerant) provides an interface between the Nodebus and the Carrierband LAN trunk cable. Within the node, the same configuration rules (cabling distance, maximum number of stations, and so forth) apply as for the extended and non-extended Nodebus configurations described above.

A fiber optic LAN (not shown) is also available, providing the same level of performance as the coaxial Carrierband LAN, but with added distance, application versatility, and security benefits. Refer to PSS 21H-7F1 B3, Local Area Network for additional information.

DATA TRANSMISSION SECURITY

The Nodebus is designed to operate despite any single point of failure. Should a bus failure occur, the failure is detected by the station management software, and all succeeding messages are transmitted over the operational bus until the failed bus is repaired.

In addition to redundancy, the Nodebus electronics within each station utilize comprehensive transmission error detection techniques. Unlike parallel buses which typically use a single parity bit to check each transfer and do not have provisions for retransmission of data after fault detection, the Nodebus interface employs a 32-bit error check code, appended to each transmission, for comprehensive checking of all messages. The Nodebus thus provides for retries on error detection, further enhancing system security and availability.



* UP TO TWO NODEBUS SEGMENTS (MAXIMUM) CAN BE IMPLEMENTED WHEN DNBXs ARE USED.

Figure 10. Nodebus (Extended) used with Carrierband LAN (Typical)

33 Commercial Street
Foxboro, Massachusetts 02035-2099
United States of America
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