AM-TR-NIS-000100

Ameritech's LAN Interconnect Service - Token Ring

This service offers a dedicated bandwidth of either 4Mbps or 16Mbps between two or more customer locations within a LATA.

To:	All Audiences With an Interest in Ameritech Technical Reference Information
Effective Date:	December 1994
Issue Date:	Issue 3, December 1994
Expires On:	N/A
Related Documents:	N/A
Canceled Documents:	N/A

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1. GENERAL

This network disclosure, AM TR NIS-000100, has been reissued for the purpose adding additional optional interfaces.

Ameritech's LAN Interconnect Service - Token Ring offers a dedicated bandwidth of either 4 or 16 Mbps between two or more customer locations within a LATA. It provides a transmission repeater function for the customer's LAN at the LAN's native data rate. No other services such as bridging or routing are provided.

The Ameritech LAN Interconnect Service - Token Ring includes:

- a termination for the customer's ISO/IEC 8802-5 Token Ring LAN, medium-dependent, physical layer on network equipment;
- recovering the clock from the Manchester-encoded data;
- recovering the data and multiplexing the data over a fiber optics carrier for transmission over a wide area;
- reversing the process at the customer's terminating location.

2. NETWORK INTERFACE

The interface to the customer is defined by the ISO/IEC 8802-5 Token Ring specification. This specification is organized as two parts: the Physical Layer and the MAC sublayer of the Data Link Layer. The correspondence of these parts to the ISO model for Open System Interconnection is shown in Figure 1.

The repeater function of this Service involves implementing the MAC sublayer. Below the MAC sublayer, there are many possible Physical Layer interface options. Two examples are detailed in Figure 2.

Other options used by the customer may need to connect to the network repeater by means of customer-provided adapters.

3. NOTES

1. This document does not specify the customer's cable length nor any manufacturer for connection to the network. They are specified generically asd n ISO/IEC 8802-5. The cable type and length may have an impact on the quality of data transmission between the customer's equipment and the network equipment.

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2. The Ameritech LAN Interconnect Service - Token Ring does not provide specific lightning/hazardous voltage protection; however, the use of Ameritech's fiber optics network between buildings and the use of coaxial cable as the medium on the customer's side of the network interface minimize the potential for induced voltages.

3. The Ameritech LAN Interconnect Service - Token Ring will provide dedicated bandwidth of 4Mbps or 16Mpbs between customer locations. Their subscriber may choose one or the other data rate at the time of subscription. All communicating subscriber stations on the same Token Ring will have to subscribe to the same data rate.

4. Two adjacent customer locations can be up to 50 Kilometers (approximately 31.25 miles) apart.

5. The transmission delay between any two adjacent customer network interface reference points will vary depending on the transmission processing delays, transmission framing delays and the signal propagation delay along the transmission medium.

4. ADDITIONAL OPTIONAL INTERFACES

Subsequent to purchasing the Token Ring interface Ameritech's LAN Interface Service will offer the following five additional interfaces: RS232 and RS422 interfaces; V.35 interface; and IBM's 3270 and 5250 interfaces. The network interface details are described below.

4.1. RS232 Interface

The RS232 interface offers the following available bandwidths between two customer locations within a LATA: 1200, 2400, 4800, 9600, and 38400 bps. This service will carry asynchronous or synchronous traffic between customer sites. The Ameritech LAN Interconnect Service - RS232 includes:

- a communication link for the interchange of serial binary customer data;
- a termination for the customer's RS 232 Data Terminating Equipment (DTE) on network equipment;
- the option of an internal or external clocked network connection; and
- the capability of encoding, interleaving, transporting, and decoding data from a fiber optics carrier over a wide area.

There are two possible interfaces to the customer. The first interface is a DB-25 female connector with pin configurations fully described in the ANSI/EIA/TIA-232 specification and using RS232 line drivers and receivers. This DB-25 female connector is fully described and the Data

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Circuit-terminating Equipment (DCE) connector that is employed in Ameritech's LAN Interconnect Service is also fully described. Furthermore, this interface will not use the 26 position (Alt A) connector. The following pins are used in the DB-25 connector: 2, 3, 4, 5, 6, 7, 8, 11, 15, 17, 20, 22, 24, and 25.

The line drivers used all typically drive the line between +7 to +10.5Vdc for a logic low ("space") and between -7 to -10.5Vdc for a logic high ("mark"). The line receivers used will detect a voltage between -3.0 and -25Vdc as a logic high and +3.0 and +25Vdc as a logic low.

The network clocking mode can be internal synchronous, external synchronous, slave or asynchronous. The line rat and jitter tolerances are: 1200, 2400, and 4800 bps with a maximum jitter tolerance of 1%; 9600 bps with a maximum jitter tolerance of 1.5%; 19200 bps with a max. jitter tolerance of 2.7%; and 38400bps with a max. jitter tolerance of 5.4%.

The second customer interfaces is two ports, where each port is a 50 pin connector that supports 16 devices for asynchronous network access. The current 2 port configuration can communicate with up to 32 asynchronous devices. The interface is referenced in the previously mentioned ANSI/EIA/TIA-232 specification as well as EIA/TIA-561. Port 1 handles interfaces 1-16 and port 2 handles interfaces 17-32. The pin-outs shown in Table 1 and Table 2 are used in the 50 pin connector:

Table 1.

Pin	Signal Description	Pin	Signal Description
1	Input	26	Output
2	Ground	27	Ground
3	Input 2	28	Output 2
4	Input 3	29	Output 13
5	Ground	30	Ground
6	Input 4	31	Output 4
7	Input 5	32	Output 5
8	Ground	33	Ground
9	Input 6	34	Output 6
10	Input 7	35	Output 7
11	Ground	36	Ground
12	Input 8	37	Output 8
13	Input 9	38	Output 9

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14	Ground	39	Ground
15	Input 10	40	Output 10
16	Input 11	41	Output 11
17	Ground	42	Ground
18	Input 12	43	Output 12
19	Input 13	44	Output 13
20	Ground	45	Ground
21	Input 14	46	Output 14
22	Input 15	47	Output 15
23	Ground	48	Ground
24	Input 16	49	Output 16
25	TSETOUT1	50	TSETIN

Table 2.

Pin	Signal Description	Pin	Signal Description
1	Input 17	26	Output 17
2	Ground	27	Ground
3	Input 18	28	Output 18
4	Input 19	29	Output 19
5	Ground	30	Ground
6	Input 20	31	Output 20
7	Input 21	32	Output 21
8	Ground	33	Ground
9	Input 22	34	Output 22
10	Input 23	35	Output 23
11	Ground	36	Ground
12	Input 24	37	Output 24
13	Input 25	38	Output 25
14	Ground	39	Ground
15	Input 26	40	Output 26

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16	Input 27	41	Output 27
17	Ground	42	Ground
18	Input 28	43	Output 28
19	Input 29	44	Output 29
20	Ground	45	Ground
21	Input 30	46	Output 30
22	Input 31	47	Output 31
23	Ground	48	Ground
24	Input 32	49	Output 32
25	TSETOUT2	50	RSETOUT

Pin are paired together in the following sequence (refer to Table 1 and Table 2):

Interface	Pins	Port
1	1, 2, 26	1
2	27, 28, 3	1
3	4, 5, 29	1
4	30, 31, 6	1
5	7, 8, 32	1
6	33, 34, 9	1
7	10, 11, 35	1
8	36, 37, 12	1
9	13, 14, 38	1
10	39, 40, 15	1
11	16, 17, 41	1
12	42, 43, 18	1
13	19, 29, 44	1
14	45, 46, 21	1
15	22, 23, 47	1
16	48, 49, 24	1
17	1, 2, 26	2

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18	27, 28, 3	2
19	4, 5, 29	2
20	30, 31, 6	2
21	7, 8, 32	2
22	33, 34, 9	2
23	10, 11, 35	2
24	36, 37, 12	2
25	13, 14, 38	2
26	39, 40, 15	2
27	16, 17, 41	2
28	42, 43, 18	2
29	19, 20, 44	2
30	45, 46, 21	2
31	22, 23, 47	2
32	48, 49, 24	2

The RS232 interface complies with the EIA-232C specification by using standard RS232 line drivers and line receivers. These line drivers and line receivers take on the same characteristics as shown above with the DB-25 connectors. The maximum available data rate is 3840 bps. This interface can be expected to maintain the following jitter characteristics:

Data Rate	Jitter
1200 bps	< - 0.5%
2400 bps	< - 1.0%
4800 bps	< - 1.8%
9600 bps	< - 3.7%
19200 bps	< - 7.4%
38400 bps	< - 14.9%

A pictorial representation of this interface is shown in Figure 3.

4.2. RS422 Interface

Ameritech's LAN Interconnect Service - RS422 offers the following available bandwidths between two customer locations within a LATA: 56, 64, 112, 128, 256, 384, 512, 768, 1536, and 1544 Kpbs. The preceding rates are available when using internal synchronous clock modes.

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When using an external synchronous clock source, 24.4 Kbps is an additional available rate. The following rates are available when using asynchronous communication: 2.4, 4.8, 9.6, 14.4, 19.2, 28.8, 38.4, 56, 64, 112, 128, and 256 Kbps. Finally, this service also operates in a slave clock mode. The Ameritech LAN interconnect Service - RS422 includes:

- a termination for the customer's RS422 Data Terminating Equipment (DTE) or Data Circuit-terminating Equipment (DCE) on network equipment;
- the option of an internal or external clocked network connection; and
- the capability of encoding, interleaving, transporting, and recovering data from a fiber optics carrier over a wide area

The customer interface is a DB25 female connector and has a mechanical and functional description shown in the ANSI/EIA/TIA-530 standard. This interface does not use the 26 position, Alt A connector.

The interface will comply with the TIA/EIA-422 specification by using standard RS422 line drivers and line receivers. The jitter rate does not exceed 6% for synchronous rates ad for asynchronous rates up to 38.4 Kbps. the control line delay is typically less than 6 milliseconds.

A pictorial representation of this interface is shown as Figure 4.

4.3. V.35 Interface

Ameritech's LAN Interconnect Service - V3.5 offers the following available bandwidths between two customer locations within a LATA: 56, 64, 112, 128, 256, 384, 512, 768, 1536, and 1544 Kbps. The preceding rates are available when using internal synchronous clock modes. When using an external synchronous clock, 24.4 Kbps is an additional available rate. The following rates are available when using asynchronous communication: 2.4, 4.8, 9.6, 14.4, 19.2, 28.8, 38.4, 56, 64, 112, 128, and 256 Kbps. Finally, this service also operates in a slave clock mode. The Ameritech LAN Interconnect Service -V.35 includes:

- a termination for the customer's V.35 Data Terminating Equipment (DTE) or Data Circuit-terminating Equipment (DCE) on network equipment;
- the option for an internal, external, or slave clocked network connection; and
- the capability of encoding, interleaving, transporting, and recovering data from a fiber optics carrier over a wide area.

The customer interface is a Winchester (M34) female connector with pin configurations and dimensions as shown in document ISO 2593. The line drivers and receivers comply with the data

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communications standards for the V.35 interface given in CCITT recommendation V.35 CCITT red book volume V111 - Fascicle V111.1 and recmmendations V.36, and V.37 CCITT blue book volumne V111 - Fascicle V111.1. The network clocking mode can be internal synchronous, external synchronous, slave or asynchronous. The maximum timing jitter transmitted to the customer is approximately 6% at 64 Kbps with asynchronous clocking and less than 6% with cynchronous clocking.

A pictorial representation of this interface is shown as Figure 5.

4.4. 3270 Interface

Ameritech's LAN Interconnect Service - 3270 offers the capability of extending the connection of 3270 type devices between two customer locations within a LATA. 3270 type devices refers to devices such as the 3278-series user terminals and 3274 communications controllers. All of these devices communicate via the IBM 3X7X-series physical and electrical interface protocols. The Ameritech LAN Interconnect Service - 3270 includes:

- a termination for the customer's 3270 type device on network equipment via a BNC connector with a 93 ohm impedence;
- direct transport of up to 8-, 16-, or 32- ports of non-multiplexed data to/from the controller and peripheral devices.
- a termination for the customer's 3270 type device on network equipment via an RJ-11 or RJ-45 patch panel;
- transport of 4-ports of pre-multiplexed data to a terminal multiplex adapter (TMA) to a remote node where either a TMA is resident, or
- the capability to transport user data to and from a controller, and
- the capability for encoding, interleaving, transporting, and recovering data from a fiber optics carrier over a wide area.

This service has two possible interfaces to the customer. A BNC connector (93 ohm) may be used to support increments of 8 customers or a standard DB25 telco female connector with 50 pins may be used to support 16 customer ports. Two DB25 telco female connectors using 50 pins each may be used to support 32 customer ports under a single configuration. The pinouts are described in Table 3. This interface complies with IBM specifications as described in the following documents:

- IBM 3174/3274 Controller To Distributed Function Device Product Attachment Information

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- IBM 3174/3274 Control Unit to Device Product Attachment Information
- GA27-2787 - 3270 Display Installation Physical Planning Guide
- GA23-0206 - 3270 Cabling System Supplement
- GA23-0279 - Coax to Twisted Pair Adapter Reference
- GA27-3722 - ROLM 3270 Coax-to-Twisted Pair Adapter
- GA27-3714 - Telephone Twisted-Pair Media Guide

A pictorial representation of this interface is shown in Figure 6.

Table 3

Port	Pin (Ring)	Pin (Tip)
0	1	26
1	2	27
2	3	28
3	4	29
4	5	30
5	6	31
6	7	32
7	8	33
8	9	34
9	10	35
10	11	36
11	12	37
12	13	38
13	14	39
14	15	40
15	16	41
No connection	17	42
No connection	18	43

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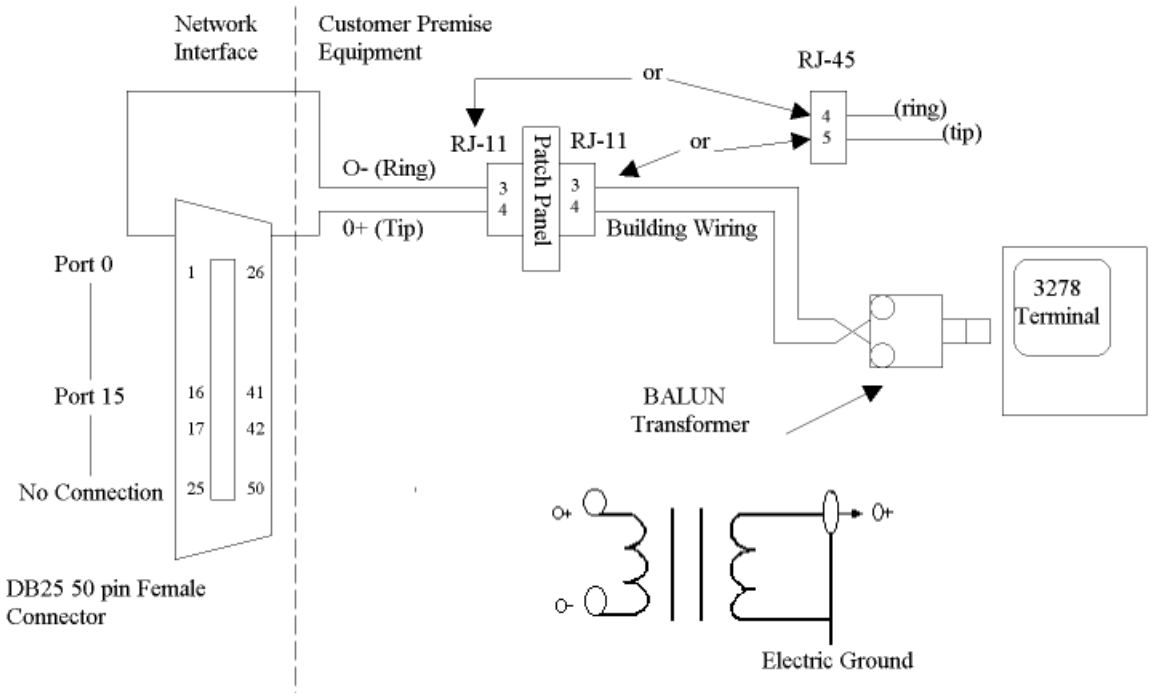
No connection	19	44
No connection	20	45
No connection	21	46
No connection	22	47
No connection	23	48
No connection	24	49
No connection	25	50

The pins from the DB-25 connector must be wired to an RJ-11 or RJ-45 patch panel using the following diagram:



The network interface may be configured to operate in four separate modes. The operational mode is determined by the devices it will interface with. Its modes are:

Terminal mode, when it will interface with 3270 user terminal type devices; Controller mode - 3174/3274 Multiplexed Terminal Adapter Port (TAP) no 3299, when it will accept multiplexed traffic only and will not perform 3299 multiplexing functions (extension controller only);Controller

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mode-3174/3274 Multiplexed (TAP) with 3299 Function, when the interface will accept input from 3270 user type devices and generate multiplexed traffic streams; and Controller mode-3174/ 3274 Direct Connect, when the interface will be directly connected to a 3174 or 3274 controller.

4.5. 5250 Interface

The 5250 interface with Ameritech's LAN Interconnect Service offers a dedicated bandwidth of 1 Mpbs and the capability of supporting 5250 or ASCII workstation controller access to IBM's AS/400. All of these devices and controllers communicate via a Poll/Response type protocol. The Ameritech LAN Interconnect Service - 5250 includes:

- a termination for the customer's 5250 type workstation controller on network equipment via a twinax interface;
- a termination for the customer's 5250 type workstation controller or workstation on an RJ-45 type interface;
- the capability to transport user data to and from an AS/400 within the time sensitive Poll/Response protocol requirements; and
- the capability of having a point to point connection e.g. between a workstation and controller, or a point to multipoint connection e.g. connecting controller traffic to multiple locations.

This service has two possible interfaces to the customer. A Twinax interface may be used which supports up to seven devices or an RJ-45 connector may be used to support ASCII workstation controllers. These interfaces comply with IBM specifications as described in the following documents:

- 5250 Information Display System to System/36, System/38, and Application System/400 System Units Product Attachment Information
- GA21-9337 - IBM 5250 Information Display System Planning and Site Preparation Guide
- GA27-3361 - IBM Cabling System Planning and Installation Guide

The following physical interface pin configuration is used in the RJ-45 connector:

Pin	Signal
1	NC
2	NC

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3	NC
4	IN/OUT
5	IN/OUT
6	NC
7	NC
8	NC

The following physical interface pin configuration is used in the Twinax connector:

Pin	Signal
1	IN/OUT
2	IN/OUT

The RJ-45 ports may be used to connect directly to devices (i.e. terminals or printers) or may connect to an existing twinax installation by using a twinax to RJ-45 balun (balance unbalance transformer). Twinax baluns which support pins 4 &5 on the RJ-45 adapter must be used.

The distance specifications for the RJ-45 twisted-pair connection is 1000 ft. When interfacing with a Twinax cable a Twinax-RJ-45 balun is required and has a distance limit of 3000 ft. Connections using Twinax only have a limit of 5000 ft.

Data frames that are standard with the 5250 controller are used on this interface and are documented in publication GA21-9337. The standard frames include the start of frame bit synchronization pattern which consists of **1010101010** and the frame synchronization pattern, **11100**.

The interface can be configured to be in controller, peripheral, or multiplexer mode. There can be one configured controller consisting of a maximum 8 ports for each virtual circuit. When the 5250 module is configured in controller mode, each interface is connected to the same workstation controller (if the interface is used) with a point-to-point connection to another module and interface that is in peripheral mode or multiplexer mode. A module configured in peripheral mode is connected to terminal and printer devices with each corresponding interface connected to a 5250 module in controller mode. The connecting peripheral device can be the head of a daisy chain of up to 7 devices per 5250 module interface. When the 5250 module is in multiplexer mode, each port can be connected to a peripheral device while a point-to-point connection is made when a single module port is connected to its corresponding remote port on the controller module.

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It is possible for the controller to have multipoint connections. Using multipoint connections the controller ports are dropped to different locations.

A Pictorial Representation of this interface is shown as Figure 7.

5. DOCUMENTATION

The ISO/IEC 8802-5 Token Ring specification defines the interface to the customer, and is available from IEEE at the address below.

IEEE Customer Service

1-800-678-4333

445 Hoes Lane

PO Box 1331

Piscataway, NJ 08855-331

The following interface specifications are detailed in the named documents. All of these documents are available from the Electronics Industries Association.

Interface	Document
RS232	EIA/TIA-232-E EIA/TIA-561
RS422	ANSI/TIA/EIA-530 TIA/EIA-422
V.35	CCITT Blue Book Volume VIII-Fasicicle VIII.I, Recommendations V.36 and V.37

Electronics Industries Association

Engineering Department

2001 Pennsylvania Avenue, N.W.

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or by phoning the EIA Standards Sales Department at (202) 457-4966

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The following IBM interface specifications are defined in these IBM Publications:

Interface	Document	Title
3270	GA27-2787	"3270 Display Installation and Physical Planning Guide"
	GA23-0206	"3270 Cabling System Supplement"
	GA23-0279	"Rolm 3270 Coax to Twisted-Pair Adapter Supplement to 3270 Installation Physical Planning"
	GA27-3722	Rolm 3270 Coax-to-Twisted-Pair Adapter
	GA27-3714	Telephone Twisted-Pair Media Guide
5250	GA21-9337	"IBM 5250 Information Display System Planning and Site Preparation Guide"
	GA27-3361	"IBM Cabling System Planning and Installation Guide"

IBM Corporation

Attention Publications

P.O. Box 9046

Boulder, CO 80301

Phone: 1-800-879-2755

The 3174/3274 and 5250 Product Attachment Information documents may be obtained by contacting IBM's Commercial Relations department.

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6. ACRONYMS

ALIS Ameritech LAN Interconnect Service

CSMA/CD Carrier Sense Multiple Access with Collision Detection

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IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
LAN	Local Area Network
LATA	Local Access and Transport Area
MAC	Media Access Control
Mpbs	Million Bits Per Second
OSI	Open Systems Interconnection

Summary

Figure 1. 8802-5 Layer Relationship to OSI Model

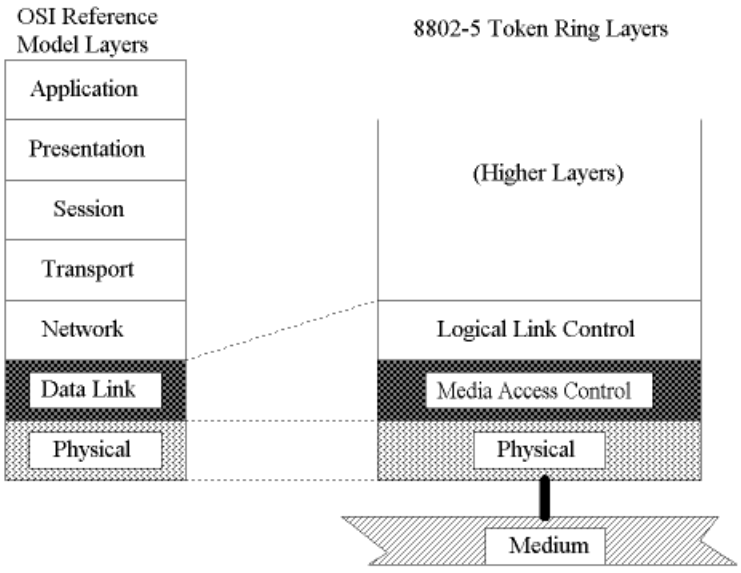

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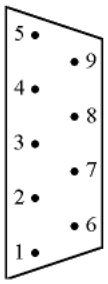
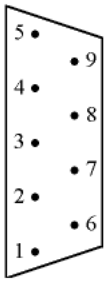
Figure 2. 8802-5 Token Ring Network Interface Examples

Example 1 (Two female DB9 connectors)

Pin Number	Signal	Direction with respect to network
1	Receive	In A
2	Ground	
3		
4	Ground	
5		
6	Receive	In B
7	Ground	
8		
9		

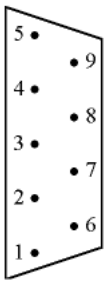


Pin Number	Signal	Direction with respect to network
1	Transmit	Out A
2	Ground	
3		
4	Ground	
5		
6	Transmit	Out B
7	Ground	
8		
9		



Example 2 (One female DB9 connector)

Pin Number	Signal	Direction with respect to network
1	Transmit	Out A
2	Ground	
3		
4		
5	Receive	In A
6	Transmit	In B
7		
8		
9	Receive	In B



NOTE:
Signal designations with letters A and B refer to differential pair, e.g., Out A and Out B form a differential voltage pair for transmission toward the customer's Token Ring network.

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Figure 3. RS232 Device Connection

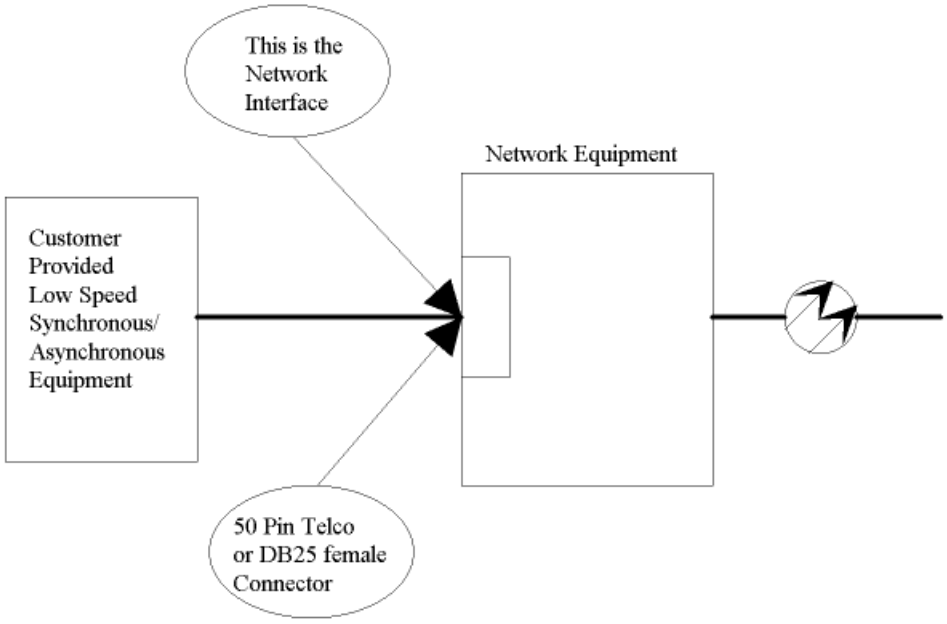

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Figure 4. RS422 Device Connection

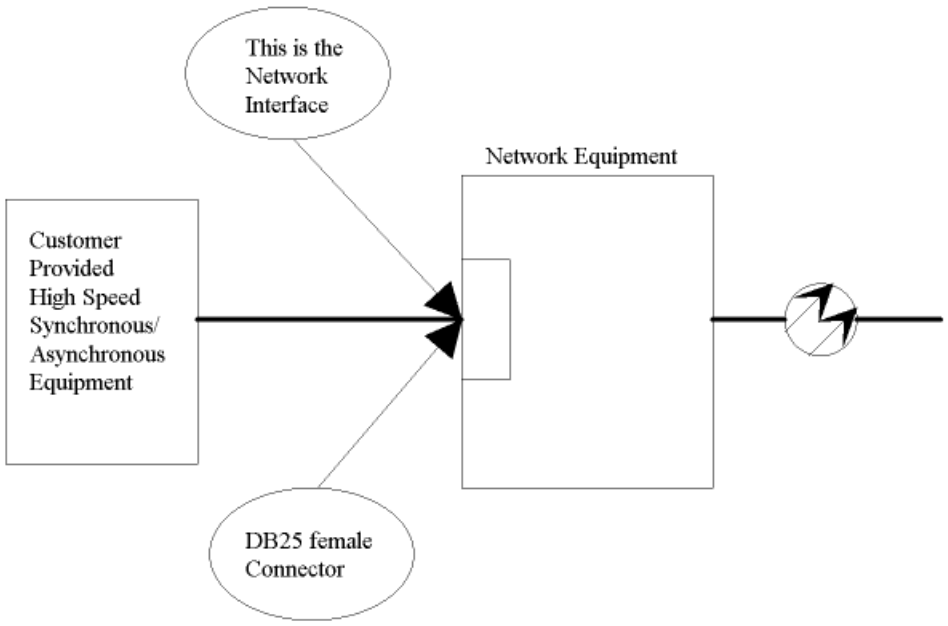

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Figure 5. V.35 Device Connection

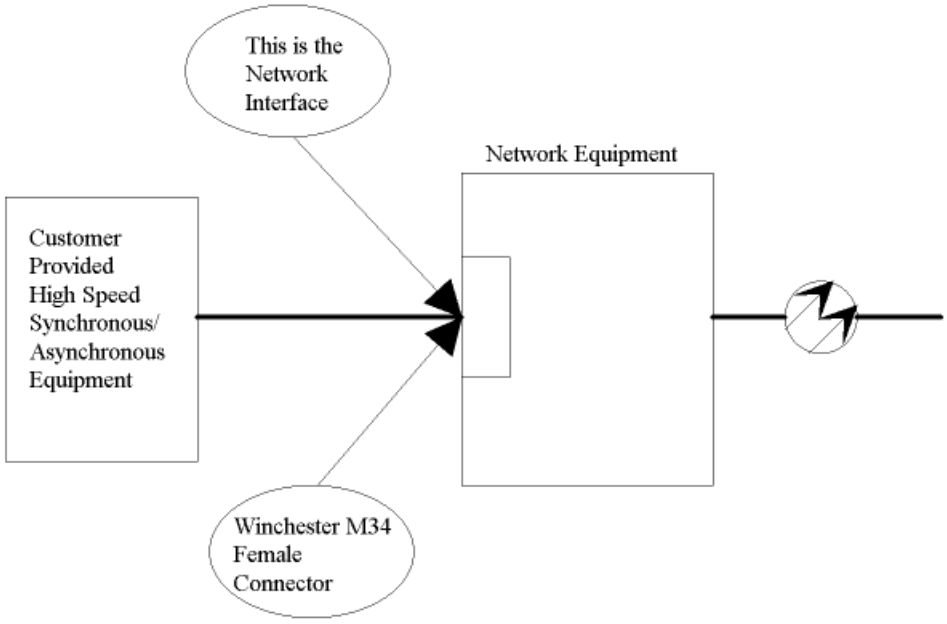

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Figure 6. 3270 Device Connection

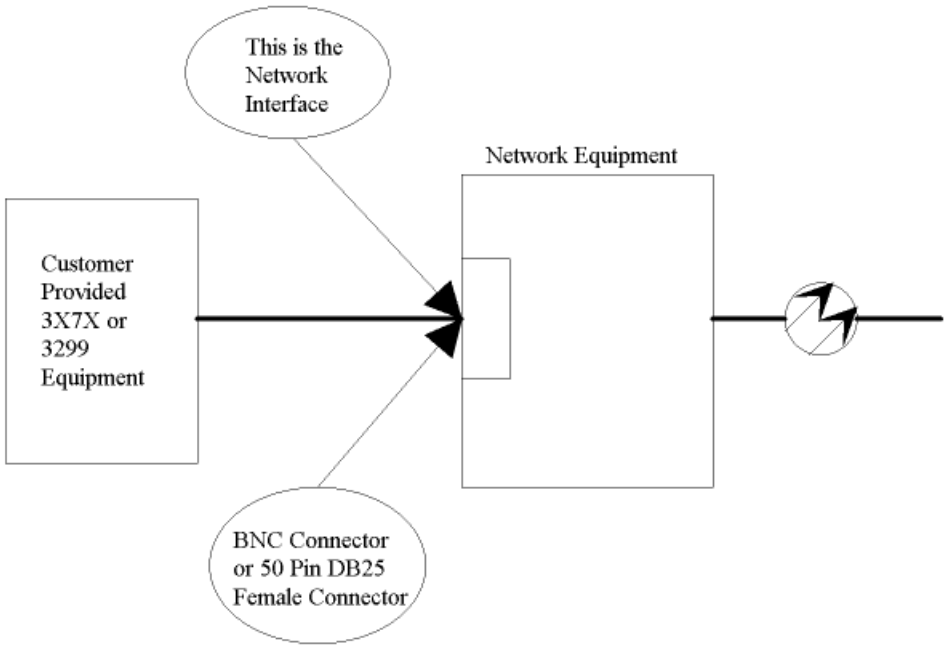

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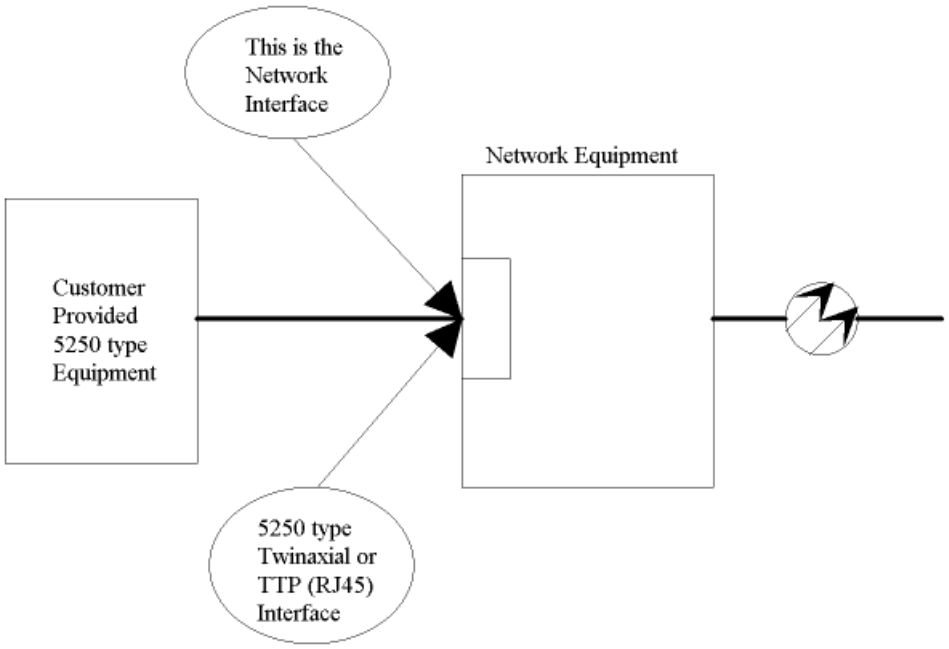
Figure 7. 5250 Device Connection



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