Anixter Standards Reference Guide

Anixter: The Cabling System Experts

Anixter is a leading global supplier of communications and security products, electrical and electronic wire and cable, fasteners and other small components. We help our customers specify solutions and make informed purchasing decisions around technology, applications and relevant standards. Throughout the world, we provide innovative supply chain management services to reduce our customers' total cost of production and implementation.

Purpose of Industry Standards

By providing guidelines for installation, maintenance and testing to improve availability and reduce expenses associated with downtime, the telecommunications standards define cabling types, distances, connections, cable system architectures, cable termination standards, performance characteristics, installation and testing methods. The standards provide recommended best practices for the design and installation of cabling systems to support a wide variety of existing and future systems to extend the life span of the telecommunications infrastructure. A single common structured cabling system for all communications and security systems simplifies moves, adds and changes, maximizes system availability and extends the usability of a cabling system. By adhering to industry standards, industrial environments can expect to fully experience the benefits of structured cabling on overall performance.

Scope of this Guide

This document is meant as a reference that highlights the key points of the ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, ANSI/TIA-568-C.2, ANSI/TIA-568-C.3, ANSI/TIA-569-B, ANSI/TIA-606-A, J-STD-607-A, ANSI/TIA-942, ANSI/TIA-1005, ISO 11801, ISO 11801 Class E_A, IEEE 802.3af, IEEE 802.3at, IEEE 802.3an, IEEE 802.3ba and IEEE 802.11 standards.

It is not intended as a substitute for the original documents. For further information on any topic in the guide, refer to the actual standard. See the section called "Reference Documents" for instructions on how to order a copy of the standard itself.

Abbreviation References

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CSA	Canadian Standards Association
EIA	Electronic Industries Alliance
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical & Electronics Engineers
ISO	International Organization for Standardization
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
TIA	Telecommunications Industry Association

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ANSI/TIA-568-C.0 Standard

Purpose of the ANSI/TIA-568-C.0 Standard

The ANSI/TIA-568-C.0 standard enables the planning and installation of a structured cabling system for all types of customer premises. It specifies a system that will support generic telecommunications cabling in a multiproduct, multimanufacturer environment. By serving as the foundation for premises telecommunications cabling infrastructure, the ANSI/TIA-568-C.0 standard provides additional requirements for other standards specific to the type of premises (e.g., ANSI/TIA-568-C.1 contains additional requirements applicable to commercial building cable).

The standard specifies requirements for generic telecommunications cabling, including:

- Cabling system structures
- Topologies and distances
- Installation, performance and testing
- Optical fiber transmission and test requirements.

This standard replaces ANSI/TIA/EIA-568-B.1 dated April 12, 2001, and its addenda. It incorporates and refines the technical content of ANSI/TIA/EIA-568-B.1-1 Addendum 1, 568-B.1-2 Addendum 2, 568-B.1-3 Addendum 3, 568-B.1-7 Addendum 7, TSB125, TSB140 and TSB153.

Section Contents

ANSI/TIA-568-C.0

Generic Telecommunications Cabling for Customer Premises

Telecommunications Cabling System Structure

General

Figure 1 shows a representative model of the functional elements of a generic cabling system for ANSI/TIA-568-C.0. In a typical commercial building where ANSI/TIA-568-C.1 applies, Distributor C represents the main cross-connect (MC), Distributor B represents the intermediate cross-connect (IC), Distributor A represents the horizontal cross-connect (HC), and the equipment outlet (EO) represents the telecommunications outlet and connector.

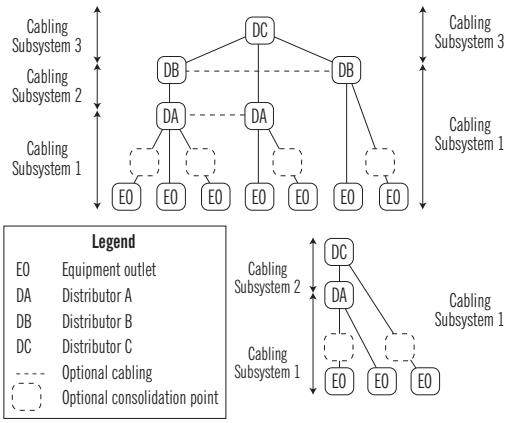


Figure 1 – Elements that comprise a generic cabling system

Topology

- Star topology
- No more than two distributors between Distributor C and an equipment outlet (EO)

Equipment Outlets (EOs)

Also called the work area (WA) in ANSI/TIA-568-C.1, equipment outlets are the outermost location to terminate the cable in a hierarchical star topology.

Distributors

Distributors provide a location for administration, reconfiguration, connection of equipment and testing. They can be either interconnections or cross-connections.

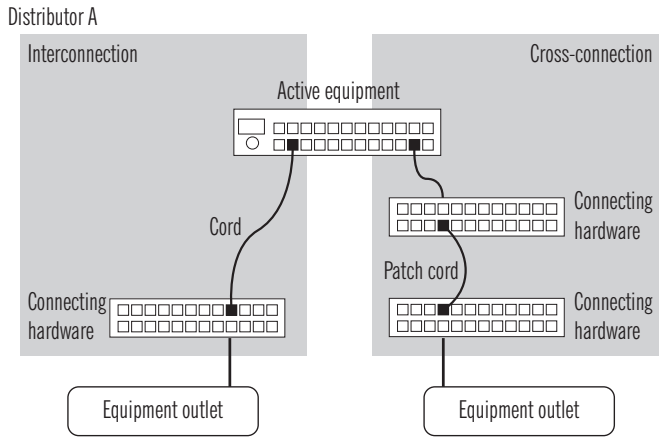


Figure 2 – Interconnections and cross-connections

ANSI/TIA-568-C.0 Standard

Cabling Subsystem 1

- Provides a signal path between Distributor A, Distributor B or Distributor C and an EO (see Figure 1)
- Contains no more than one transition point or consolidation point
- Stipulates that splices shall not be installed as part of a balanced twisted-pair cabling subsystem and that splitters shall not be installed as part of optical fiber for Cabling Subsystem 1

Cabling Subsystem 2 and Cabling Subsystem 3

Cabling Subsystem 2 and Cabling Subsystem 3 provide signal paths between distributors (see Figure 1). The use of Distributor B is optional.

Recognized Cabling

The recognized media, which shall be used individually or in combination, are:

- 100-ohm balanced twisted-pair cabling
- Multimode optical fiber cabling
- Single-mode optical fiber cabling.

Cabling media other than those recognized above may be specified by the appropriate premises cabling standards.

Cabling Lengths

Cabling lengths are dependent upon the application and upon the specific media chosen (see following tables).

Cabling Lengths			
Application	**Media**	**Distance m (ft.)**	**Comments**
Ethernet 10BASE-T	Category 3, 5e, 6, 6A	100 (328)	
Ethernet 100BASE-TX	Category 5e, 6, 6A	100 (328)	
Ethernet 1000BASE-T	Category 5e, 6, 6A	100 (328)	
Ethernet 10GBASE-T	Category 6A	100 (328)	
ASDL	Category 3, 5e, 6, 6A	5,000 (16,404)	1.5 Mbps to 9 Mbps
VDSL	Category 3, 5e, 6, 6A	5,000 (16,404)	1,500 m (4,900 ft.) for 12.9 Mbps; 300 m (1,000 ft.) for 52.8 Mbps
Analog Phone	Category 3, 5e, 6, 6A	800 (2,625)	
Fax	Category 3, 5e, 6, 6A	5,000 (16,404)	
ATM 25.6	Category 3, 5e, 6, 6A	100 (328)	
ATM 51.84	Category 3, 5e, 6, 6A	100 (328)	
ATM 155.52	Category 5e, 6, 6A	100 (328)	
ATM 1.2G	Category 6, 6A	100 (328)	
ISDN BRI	Category 3, 5e, 6, 6A	5,000 (16,404)	128 kbps
ISDN PRI	Category 3, 5e, 6, 6A	5,000 (16,404)	1.472 Mbps

Table 1 – Maximum supportable distances for balanced twisted-pair cabling by application, which includes horizontal and backbone cabling (application specific)

	Parameter	Multimode						Single-mode	
		62.5/125 μm TIA 492AAAA (OM1)		50/125 μm TIA 492AAAB (OM2)		850 nm laser-optimized 50/125 μm TIA 492AAAC (OM3)		TIA 492CAAA (OS1) TIA 492CAAB (OS2)	
Application	**Nominal Wavelength (nm)**	**850**	**1,300**	**850**	**1,300**	**850**	**1,300**	**1,310**	**1,550**
Ethernet 10/100BASE-SX	Channel attenuation (dB)	4.0	–	4.0	–	4.0	–	–	–
	Supportable distance m (ft.)	300 (984)	–	300 (984)	–	300 (984)	–	–	–
Ethernet 100BASE-FX	Channel attenuation (dB)	–	11.0	–	6.0	–	6.0	–	–
	Supportable distance m (ft.)	–	2,000 (6,850)	–	2,000 (6,850)	–	2,000 (6,850)	–	–
Ethernet 1000BASE-SX	Channel attenuation (dB)	2.6	–	3.6	–	4.5	–	–	–
	Supportable distance m (ft.)	275 (900)	–	550 (1,804)	–	800 (2,625)	–	–	–
Ethernet 1000BASE-LX	Channel attenuation (dB)	–	2.3	–	2.3	–	2.3	4.5	–
	Supportable distance m (ft.)	–	550 (1,804)	–	550 (1,804)	–	550 (1,804)	5,000 (16,405)	–
Ethernet 10GBASE-S	Channel attenuation (dB)	2.4	–	2.3	–	2.6	–	–	–
	Supportable distance m (ft.)	33 (108)	–	82 (269)	–	300 (984)	–	–	–
Ethernet 10GBASE-LX4	Channel attenuation (dB)	–	2.5	–	2.0	–	2.0	6.3	–
	Supportable distance m (ft.)	–	300 (984)	–	300 (984)	–	300 (984)	10,000 (32,810)	–
Ethernet 10GBASE-L	Channel attenuation (dB)	–	–	–	–	–	–	6.2	–
	Supportable distance m (ft.)	–	–	–	–	–	–	10,000 (32,810)	–
Ethernet 10GBASE-LRM	Channel attenuation (dB)	–	1.9	–	1.9	–	1.9	–	–
	Supportable distance m (ft.)	–	270 (720)	–	270 (720)	–	270 (720)	–	–
Fibre Channel 100-MX-SN-I (1062 Mbaud)	Channel attenuation (dB)	3.0	–	3.9	–	4.6	–	–	–
	Supportable distance m (ft.)	300 (984)	–	500 (1,640)	–	880 (2,822)	–	–	–

Table 2 – Maximum supportable distances and attenuation for optical fiber applications
(more on page 13.4)

ANSI/TIA-568-C.0 Standard

	Parameter	Multimode						Single-mode	
		62.5/125 μm TIA 492AAAA (OM1)		50/125 μm TIA 492AAAB (OM2)		850 nm laser-optimized 50/125 μm TIA 492AAAC (OM3)		TIA 492CAAA (OS1) TIA 492CAAB (OS2)	
Application	**Nominal wavelength (nm)**	**850**	**1,300**	**850**	**1,300**	**850**	**1,300**	**1,310**	**1,550**
Fibre Channel 100-SM-LC-L (1062 Mbaud)	Channel attenuation (dB)	–	–	–	–	–	–	7.8	–
	Supportable distance m (ft.)	–	–	–	–	–	–	10,000 (32,810)	–
Fibre Channel 200-MX-SN-I (2125 Mbaud)	Channel attenuation (dB)	2.1	–	2.6	–	3.3	–	–	–
	Supportable distance m (ft.)	150 (492)	–	300 (984)	–	500 (1,640)	–	–	–
Fibre Channel 200-SM-LC-L (2125 Mbaud)	Channel attenuation (dB)	–	–	–	–	–	–	7.8	–
	Supportable distance m (ft.)	–	–	–	–	–	–	10,000 (32,810)	–
Fibre Channel 400-MX-SN-I (4250 Mbaud)	Channel attenuation (dB)	1.8	–	2.1	–	2.5	–	–	–
	Supportable distance m (ft.)	70 (230)	–	150 (492)	–	270 (886)	–	–	–
Fibre Channel 400-SM-LC-L (4250 Mbaud)	Channel attenuation (dB)	–	–	–	–	–	–	7.8	–
	Supportable distance m (ft.)	–	–	–	–	–	–	10,000 (32,810)	–
Fibre Channel 1200-MX-SN-I (10512 Mbaud)	Channel attenuation (dB)	2.4	–	2.2	–	2.6	–	–	–
	Supportable distance m (ft.)	33 (108)	–	82 (269)	–	300 (984)	–	–	–
Fibre Channel 1200-SM-LL-L (10512 Mbaud)	Channel attenuation (dB)	–	–	–	–	–	–	6.0	–
	Supportable distance m (ft.)	–	–	–	–	–	–	10,000 (32,810)	–
FDDI PMD ANSI X3.166	Channel attenuation (dB)	–	11.0	–	6.0	–	6.0	–	–
	Supportable distance m (ft.)	–	2,000 (6,560)	–	2,000 (6,560)	–	2,000 (6,560)	–	–
FDDI SMF-PMD ANSI X3.184	Channel attenuation (dB)	–	–	–	–	–	–	10.0	–
	Supportable distance m (ft.)	–	–	–	–	–	–	10,000 (32,810)	–

Table 3 – Maximum supportable distances and attenuation for optical fiber applications

Cabling Installation Requirements

- Cabling installations shall comply with the authority having jurisdiction (AHJ) and applicable regulations.
- Cable stress caused by suspended cable runs and tightly cinched bundles should be minimized.
- Cable bindings, which are used to tie multiple cables together, should be irregularly spaced and should be loosely fitted (easily moveable).

Balanced Twisted-Pair Cabling

Maximum Pulling Tension

- The pulling tension for a 4-pair balanced twisted-pair cable shall not exceed 110 N (25 pound-force) during installation.
- For multipair cable, manufacturers' pulling tension guidelines shall be followed.

Minimum Bend Radius

Cable

- The minimum inside bend radius, under no-load or load, for a 4-pair balanced twisted-pair cable shall be four times the cable diameter.
- The minimum bend radius, under no-load or load, for a multipair cable shall follow the manufacturer's guidelines.

Cord Cable

- The minimum inside bend radius for a 4-pair balanced twisted-pair cord cable shall be one times the cord cable diameter.

Cable Termination

- Cables should be terminated with connecting hardware of the same performance (Category) or higher.
- The Category of the installed link should be suitably marked and noted in the administrative records.
- The cable geometry shall be maintained as close as possible to the connecting hardware and its cable termination points.
- The maximum pair untwist for the balanced twisted-pair cable termination shall be in accordance with Table 4.

Pair Untwist Lengths	
Category	**Maximum Pair Untwist mm (in.)**
3	75 (3)
5e	13 (0.5)
6	13 (0.5)
6A	13 (0.5)

Table 4 – Maximum supportable pair untwist length for Category cable termination

ANSI/TIA-568-C.0 Standard

8-Position Modular Jack Pin-Pair Assignments

Pin-pair assignments shall be as shown in Figure 3 or, optionally, per Figure 4 if it is necessary to accommodate certain 8-pin cabling systems. The colors shown are associated with 4-pair cable.

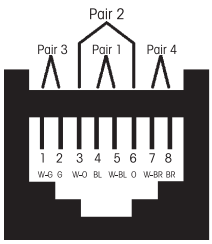


Figure 3 – Front view of 8-position jack pin-pair assignments (T568A)

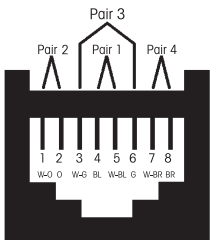


Figure 4 – Front view of optional 8-position jack pin-pair assignment (T568B)

Cords and Jumpers

Cross-connect jumpers and modular plug cords should be of the same Category or higher as the Category of the cabling to which they connect. It is recommended that modular cords be factory manufactured.

Grounding and Bonding Requirements for Screened Cabling

- The screen of screened twisted-pair (ScTP) cables shall be bonded to the telecommunications grounding busbar (TGB) or telecommunications main grounding busbar (TMGB).
- A voltage greater than 1 volt rms between the cable screen and the ground of the corresponding electrical outlet used to provide power to the equipment indicates improper grounding.

Optical Fiber Cabling

Minimum Bend Radius and Maximum Pulling Tension

Measured to the inside curvature, the bend radius is the minimum a cable can bend without any risk to kinking it, damaging it or shortening its life. The smaller the bend radius, the greater the material flexibility.

Minimum Bend Radius and Maximum Pulling Tension

Cable Type and Installation Details	Maximum Tensile Load During Installation	Minimum Bend Radii While Subjected To Maximum Tensile Load (During Installation)	No Tensile Load (After Installation)
Inside Plant Cable with 2 or 4 Fibers Installed in Cabling Subsystem 1	220 N (50 lbf)	50 mm (2 in.)	25 mm (1 in.)
Inside Plant Cable with more than 4 Fibers	Per manufacturer	20 times the cable outside diameter	10 times the cable outside diameter
Indoor/Outdoor Cable with up to 12 Fibers	1335 N (300 lbf)	20 times the cable outside diameter	10 times the cable outside diameter
Indoor/Outdoor Cable with more than 12 Fibers	2670 N (600 lbf)	20 times the cable outside diameter	10 times the cable outside diameter
Outside Plant Cable	2670 N (600 lbf)	20 times the cable outside diameter	10 times the cable outside diameter
Drop Cable Installed by Pulling	1335 N (300 lbf)	20 times the cable outside diameter	10 times the cable outside diameter
Drop Cable Installed by Directly Buried, Trenched or Blown into Ducts	440 N (100 lbf)	20 times the cable outside diameter	10 times the cable outside diameter

Table 5 – Maximum and minimum pulling tension and bend radius for different cable types

Polarity

Transmit-to-receive polarity must be maintained throughout the cabling system. (Annex B of the full standard describes methods to do this.)

ANSI/TIA-568-C.1 Standard

Purpose of the ANSI/TIA-568-C.1 Standard

The ANSI/TIA-568-C.1 standard enables the planning and installation of a structured cabling system within a commercial building and in between commercial buildings within a campus environment. By supporting a multiproduct, multimanufacturer environment, the standard supports a wide range of different commercial applications (e.g., voice, data, text, video and images) and building sites with a geographic extent from 3,000 square meters (approximately 10,000 feet) up to 1,000,000 square meters (approximately 10,000,000 square feet) of office space and with a population of up to 50,000 users.

This standard replaces ANSI/TIA/EIA-568-B.1 dated April 12, 2001, and its addenda. It incorporates and refines the technical content of ANSI/TIA-B.1-4, Addendum 4, and ANSI/TIA-B.1-5, Addendum 5.

Significant Technical Changes from the Previous Edition

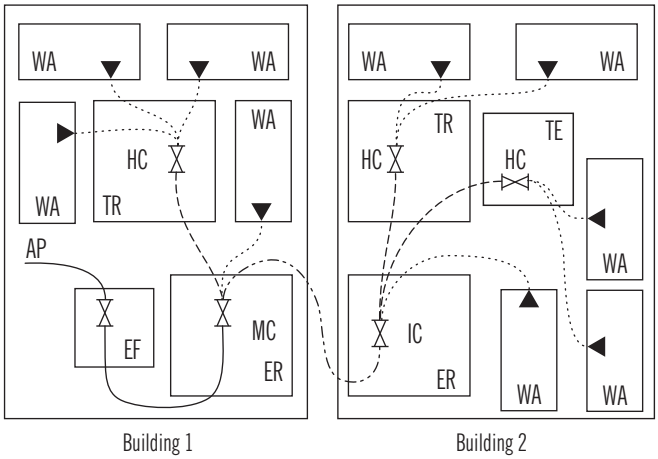
- Incorporates generic nomenclature found in ANSI/TIA-568-C.0, "Generic Telecommunications Cabling for Customer Premises"
- Includes Category 6 and Category 6A balanced 100-ohm cabling
- Includes 850-nm laser-optimized 50/125 μm multimode optical fiber cabling
- Includes telecommunications enclosures (TEs)
- Removes 150-ohm STP cabling
- Removes Category 5 cabling

Telecommunications Cabling System Structure

Establishes a structure for commercial building cabling based on the generic cabling system structure in ANSI/TIA-568-C.1

Figure 5 shows a model for a commercial building telecommunications cabling system. The elements of a commercial building telecommunications cabling system are:

a) Entrance facilities
b) Equipment rooms (space typically containing Distributor C, but may contain Distributor B)
c) Telecommunications room (space typically containing Distributor A, but may contain Distributor B and Distributor C) or, in some implementations, telecommunications enclosures (space containing Distributor A)
d) Backbone cabling (Cabling Subsystem 2 and Cabling Subsystem 3)
e) Horizontal cabling (Cabling Subsystem 1)
f) Work area (space containing the equipment outlet).



Legend	
Access provider	AP
Entrance facility	EF
Equipment room	ER
Main cross-connect (Distributor C)	MC
Intermediate cross-connect (Distributor B)	IC
Telecommunications room	TR
Telecommunications enclosure	TE
Horizontal cross-connect (Distributor A)	HC
Work area	WA
Telecommunications outlet/connector	▼
Cross-connect	⧖

Cabling Legend	
Backbone (Cabling Subsystem 3)	– – – –
Backbone (Cabling Subsystem 2)	– – – –
Horizontal (Cabling Subsystem 1)	.....

Figure 5 – Model for a commercial building telecommunications cabling system

ANSI/TIA-568-C.1 Standard

Section Contents

ANSI/TIA-568-C.1

Commercial Building Telecommunications Cabling Standard

Entrance Facilities

- Entrance facilities (EFs) contain the cables, network demarcation point(s), connecting hardware, protection devices and other equipment that connects to the access provider (AP) or private network cabling.
- Entrance facilities include connections between outside plant and inside building cabling.

Equipment Rooms

- Equipment rooms (ERs) are considered to be distinct from telecommunications rooms (TRs) and telecommunications enclosures (TEs) because of the nature or complexity of the equipment they contain. An ER may alternatively provide any or all of the functions of a TR or TE.
- The main cross-connect (MC, Distributor C) of a commercial building is located in an ER. Intermediate cross-connects (ICs, Distributor B), horizontal cross-connects (HCs, Distributor A), or both, of a commercial building may also be located in an ER.

Telecommunications Rooms (TRs) and Telecommunications Enclosures (TEs)

- Telecommunications rooms and enclosures provide a common access point for backbone and building pathways (see Figure 5) and cabling used for cross-connection.
- The horizontal cross-connect (HC, Distributor A) of a commercial building is located in a TR or TE. The main cross-connect (MC, Distributor C) and intermediate cross-connects (IC, Distributor B) of a commercial building may also be located in a TR. The TR and any TE should be located on the same floor as the work areas served.
- The telecommunications enclosure (TE) is intended to serve a smaller floor area than a TR and may be used in addition to the "minimum one TR per floor" rule.

Centralized Optical Fiber Cabling (see Figure 6)

- Centralized optical fiber cabling is designed as an alternative to the optical cross-connect located in the TR or TE in support of installing centralized electronics.
- It provides connections from work areas (WAs) to centralized cross-connects by allowing the use of pull-through cables and the use of an interconnect or splice in the TR or TE.
- The maximum allowed distance for a pull-through cable is 90 m (295 ft.).

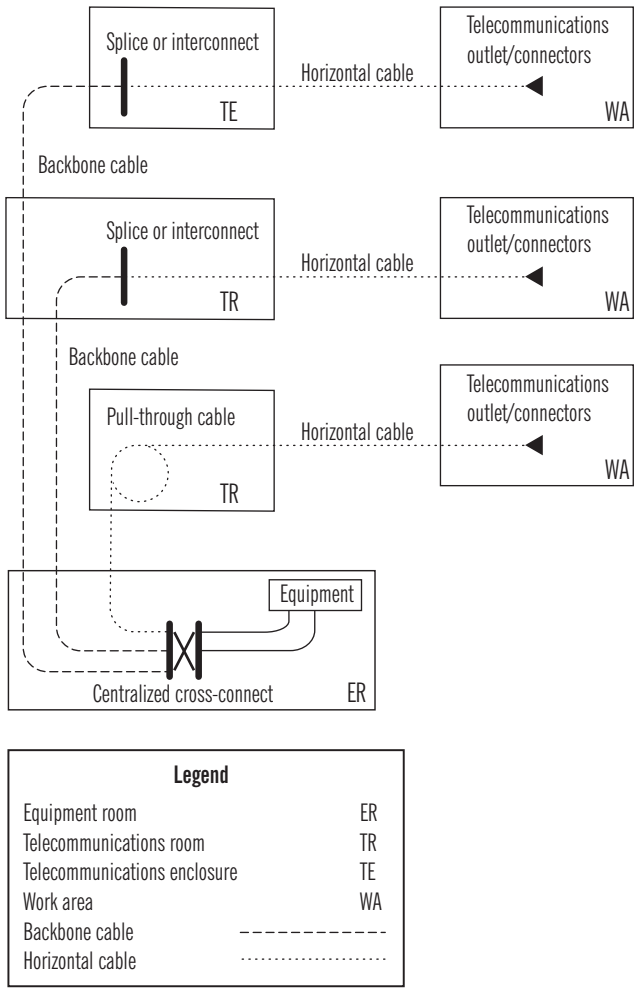


Figure 6 – Centralized optical fiber cabling

Backbone Cabling (Cabling Subsystems 2 and 3)

- Provides interconnections between entrance facilities (EFs), access provider (AP) spaces, service provider (SP) spaces, common equipment rooms (CERs), common telecommunications rooms (CTRs), equipment rooms (ERs), telecommunications rooms (TRs) and telecommunications enclosures (TEs) (see Figure 5)
- Ensures that the backbone cabling shall meet the requirements of ANSI/TIA-568-C.0 Cabling Subsystem 2 and Cabling Subsystem 3
- Uses a star topology (see Figure 7)
- Allows for no more than two hierarchical levels of cross-connects

Length and Maximum Distances

- Backbone cabling length extends from the termination of the media at the MC to an IC or HC.
- Cabling lengths are dependent on the application and the media chosen. They are found in the previous section covering ANSI/TIA-568-C.0 (see Tables 1, 2 and 3).
- The length of the cross-connect jumpers and patch cords in the MC or IC should not exceed 20 m (66 ft.).
- The length of the cord used to connect telecommunications equipment directly to the MC or IC should not exceed 30 m (98 ft.).

ANSI/TIA-568-C.1 Standard

Recognized Cabling
The recognized media, which shall be used individually or in combination, are:

- 100-ohm balanced twisted-pair cabling (Category 3, 5e, 6 or 6A)
- Multimode optical fiber cabling: 850-nm laser-optimized 50/125 μm is recommended; 62.5/125 μm and 50/125 μm are allowed
- Single-mode optical fiber cabling.

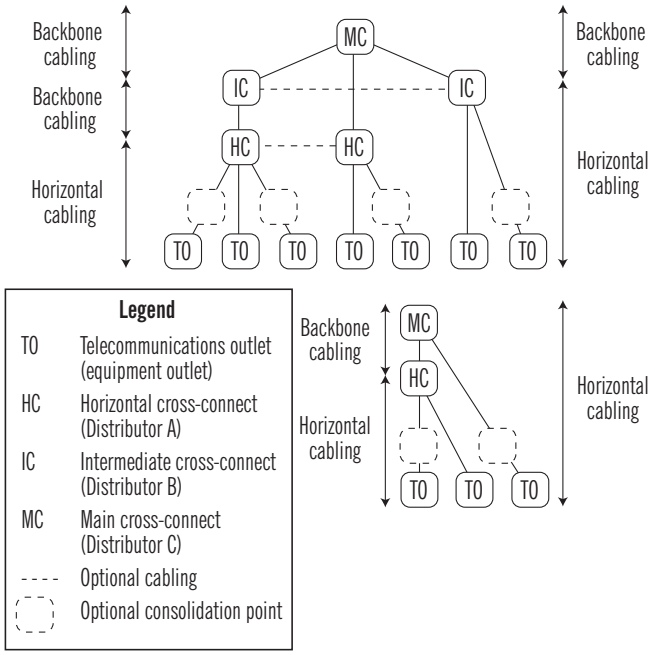


Figure 7 – Commercial building hierarchical star topology

Horizontal Cabling (Cabling Subsystem 1)

- Horizontal cabling (see Figure 8) includes horizontal cable, telecommunications outlets and connectors in the work area (WA); mechanical terminations and patch cords or jumpers located in a telecommunications room (TR) or telecommunications enclosure (TE); and may incorporate multiuser telecommunications outlet assemblies (MUTOAs) and consolidation points (CPs).
- A minimum of two permanent links shall be provided for each work area.
- Each 4-pair cable at the equipment outlet shall be terminated in an 8-position modular jack.
- Optical fibers at the equipment outlet shall be terminated to a duplex optical fiber outlet and connector.
- Horizontal cabling uses a star topology.
- The maximum horizontal cable length shall be 90 m (295 ft.), independent of media type. If a MUTOA is deployed, the maximum horizontal balanced twisted-pair copper cable length shall be reduced in accordance with Table 6 (page 13.9).
- The length of the cross-connect jumpers and patch cords that connect horizontal cabling with equipment or backbone cabling should not exceed 5 m (16 ft.).
- For each horizontal channel, the total length allowed for cords in the WA, plus patch cords or jumpers and equipment cords in the TR or TE, shall not exceed 10 m (33 ft.) unless a MUTOA is used.

Recognized Cabling
The recognized media, which shall be used individually or in combination, are:

- 4-pair 100-ohm unshielded or shielded twisted-pair cabling (Category 3, 5e, 6 or 6A)
- Multimode optical fiber cabling, 2 fiber (or higher count)
- Single-mode optical fiber cabling, 2 fiber (or higher count).

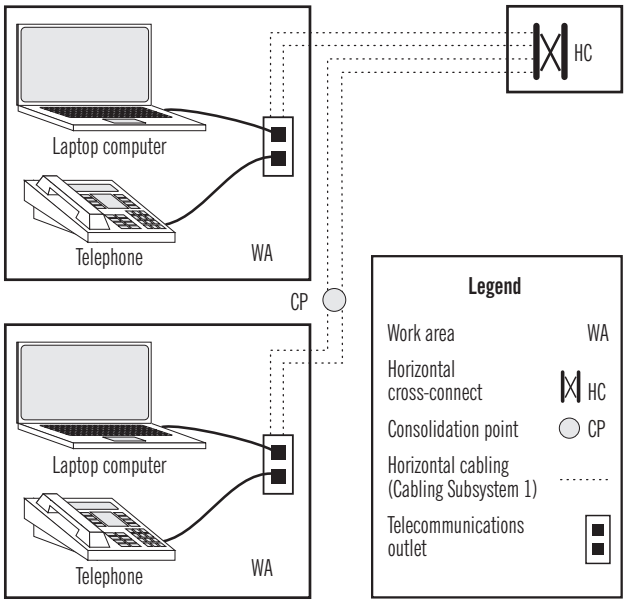


Figure 8 – Typical horizontal and work area cabling using star topology

Work Area

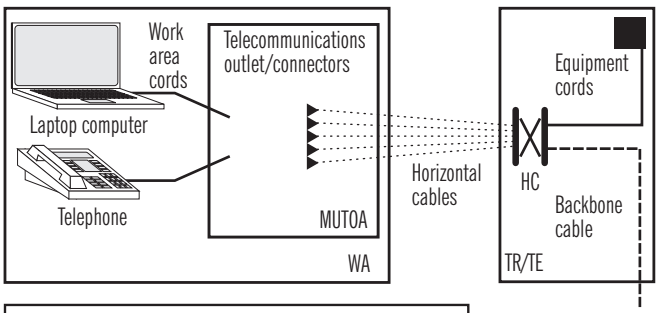
- The telecommunications outlet and connector shall meet the requirements of ANSI/TIA-568-C.0.
- The work area (WA) components extend from the telecommunications outlet/connector end of the horizontal cabling system to the WA equipment.
- When application-specific adapters are needed at the WA, they shall be external to the telecommunications outlet and connector.

ANSI/TIA-568-C.1 Standard

Open Office Cabling (MUTOA)

Open office design practices use multiuser telecommunications outlet assemblies (MUTOAs), consolidation points (CPs) or both to provide flexible layouts. MUTOAs allow horizontal cabling to remain intact when the open office plan is changed.

- WA cords originating from the MUTOA should be routed through WA pathways (e.g., furniture pathways).
- The WA cables shall be connected directly to workstation equipment without the use of any additional intermediate connections (see Figure 9).
- MUTOAs shall be located in fully accessible, permanent locations, such as building columns and permanent walls. They should not be located in ceiling spaces, obstructed areas or in furniture unless the furniture is secured to the building structure.



Legend	
Work area	WA
Telecommunications room	TR
Telecommunications enclosure	TE
Horizontal cross-connect	HC
Multiuser telecommunications outlet assembly	MUTOA

Figure 9 – Multiuser telecommunications outlet assembly (MUTOA) application

Maximum Work Area Cord Lengths

- Balanced twisted-pair WA cables: the maximum cord length used in the context of MUTOAs and open office furniture is as follows in Table 6.
- Optical fiber WA cords: the maximum horizontal cabling length is not affected by the deployment of a MUTOA.

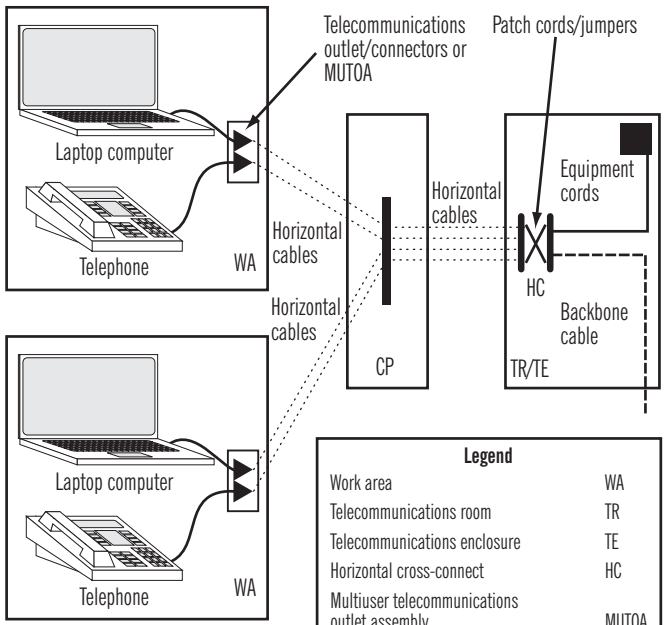
Maximum Length of Horizontal Cables and Work Area Cords				
	24 AWG Cords		26 AWG Cords	
Length of horizontal cable	Maximum length of work area cord	Maximum combined length of work area cord, patch cords and equipment cord	Maximum length of work area cord	Maximum combined length of work area cord, patch cords and equipment cord
H m (ft.)	W m (ft.)	C m (ft.)	W m (ft.)	C m (ft.)
90 (295)	5 (16)	10 (33)	4 (13)	8 (26)
85 (279)	9 (30)	14 (46)	7 (23)	11 (35)
80 (262)	13 (44)	18 (59)	11 (35)	15 (49)
75 (246)	17 (57)	22 (72)	14 (46)	18 (59)
70 (230)	22 (72)	27 (89)	17 (56)	21 (70)

Table 6 – Maximum length of work area cord in relation to horizontal cable

Consolidation Point (CP)

The CP is an interconnection point within the horizontal cabling. It differs from the MUTOA in that a CP requires an additional connection for each horizontal cable run. It may be useful when reconfiguration is frequent, but not so frequent as to require the flexibility of a MUTOA (see Figure 10).

- The CP should be located at least 15 m (49 ft.) from the TR or TE.
- Cross-connections shall not be used at a CP.
- Each horizontal cable extending to the WA outlet from the CP shall be terminated to a telecommunications outlet/connector or MUTOA.
- CPs shall be located in fully accessible, permanent locations such as building columns and permanent walls. They should not be located in obstructed areas or in furniture unless the furniture is secured to the building structure.



Legend	
Work area	WA
Telecommunications room	TR
Telecommunications enclosure	TE
Horizontal cross-connect	HC
Multiuser telecommunications outlet assembly	MUTOA
Consolidation point	CP

Figure 10 – Application of consolidation point

ANSI/TIA-568-C.2 Standard

Purpose of the ANSI/TIA-568-C.2 Standard

This standard includes component and cabling specifications as well as testing requirements for copper cabling, including Category 3, Category 5e, Category 6 and Category 6A. It recommends Category 5e to support 100 MHz applications. By using one laboratory test method to define all categories of connecting hardware, the standard introduces coupling attenuation parameters that are under study for characterizing radiated peak power generated by common-mode currents for screened cables. Balanced twisted-pair channel and permanent performance requirements were moved to this document.

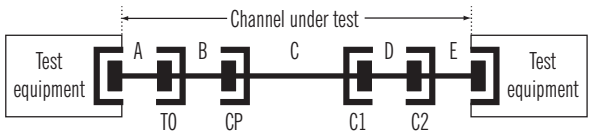
Section Contents

ANSI/TIA-568-C.2

Balanced Twisted-Pair Telecommunications Cabling and Components Standard

Channel and Permanent Link Test Configurations

For the purpose of testing twisted-pair cabling systems, the worst-case cabling channel configuration is assumed to contain a telecommunications outlet and connector, a transition point, 90 meters of twisted-pair cable, a cross-connect consisting of two blocks or panels and a total of 10 meters of patch cords. The figure below shows the relationship of these components.



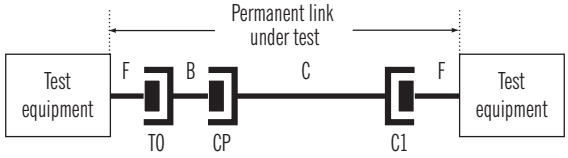
Legend

Cables and cords		Connecting hardware	
Work area cord	A	Telecommunications outlet/connector	TO
Optional consolidation point cabling	B	Optional consolidation point connector	CP
Horizontal cabling	C	Horizontal cross-connect or interconnect	C1, C2
Patch cord or jumper cable	D		
Telecommunications room equipment cord	E		

Maximum length	
B + C	90 m (295 ft.)
A + D + E	10 m (32.8 ft.)

Figure 11 – Channel test configuration

The permanent link test configuration includes the horizontal distribution cable, telecommunications outlet and connector or transition point and one horizontal cross-connect component including the mated connections. This is assumed to be the permanent part of a link. The channel is comprised of the permanent link plus cross-connect equipment, user equipment cord and cross-connect patch cable.



Legend

Cables and cords		Connecting hardware	
Test equipment cord	F	Telecommunications outlet/connector	TO
Optional consolidation point cabling	B	Optional consolidation point connector	CP
Horizontal cabling	C	Horizontal cross-connect or interconnect	C1

Maximum length	
B + C	90 m (295 ft.)

Figure 12 – Permanent link test configuration

ANSI/TIA-568-C.2 Standard

Definitions of Electrical Parameters

Return loss: A measure of the degree of impedance mismatch between two impedances. It is the ratio, expressed in decibels, of the amplitude of a reflected wave echo to the amplitude of the main wave at the junction of a transmission line and a terminating impedance.

Insertion loss: This term has replaced the term "attenuation" (ATTN). It is a measure of the decrease of signal strength as it travels down the media.

NEXT loss (near-end crosstalk): A measure of the unwanted signal coupling from a transmitter at the near-end into a neighboring (nonenergized) pair measured at the near-end.

PSNEXT loss (powersum near-end crosstalk): A computation of the unwanted signal coupling from multiple transmitters at the near-end into a neighboring (nonenergized) pair measured at the near-end.

FEXT loss (far-end crosstalk): A measure of the unwanted signal coupling from a transmitter at the near-end into a neighboring pair measured at the far-end.

ACRF (attenuation to crosstalk ratio, far-end) or ELFEXT (equal-level far-end crosstalk): A measure of the unwanted signal coupling from a transmitter at the near-end into a neighboring pair measured at the far-end, relative to the received signal level measured on that same pair.

PSFEXT loss (powersum far-end crosstalk): A computation of the unwanted signal coupling from multiple transmitters at the near-end into a neighboring pair measured at the far-end.

PSACRF (powersum attenuation to crosstalk ratio, far-end) or PSELFEXT (powersum equal-level far-end crosstalk): A computation of the unwanted signal coupling from multiple transmitters at the near-end into a neighboring pair measured at the far-end, relative to the received signal level measured on that same pair.

Propagation delay: The time needed for the transmission of signal to travel the length of a single pair.

Propagation delay skew: The difference between the propagation delay of any two pairs within the same cable sheath. Delay skew is caused primarily because twisted-pair cable is designed to have different twists per foot (lay lengths). Delay skew could cause data transmitted over one wire pair to arrive out of sync with data over another wire pair.

ANEXT loss (alien near-end crosstalk): A measure of signal coupling from a near-end disturbing pair into a disturbed pair of a neighboring cable or connector pair or part thereof, measured at the near-end.

PSANEXT loss (powersum alien near-end crosstalk): A computation of signal coupling from multiple near-end disturbing pairs into a disturbed pair of a neighboring channel, cable or connector pair or part thereof, measured at the near-end.

AFEXT loss (alien far-end crosstalk): A measure of signal coupling from a near-end disturbing pair into a disturbed pair of a neighboring cable or connector pair or part thereof, measured at the far-end.

PSAFEXT loss (powersum alien far-end crosstalk): A computation of signal coupling from multiple near-end disturbing channel pairs into a disturbed pair of a neighboring channel or part thereof, measured at the far-end.

PSAACRF (powersum alien attenuation to crosstalk ratio, far-end) or PSAELFEXT (powersum alien equal-level far-end crosstalk): A computation of signal coupling from multiple pairs of disturbing channels to a disturbed pair in another channel measured at the far-end and relative to the received signal level in the disturbed pair at the far-end.

Recognized Categories of Balanced Twisted-Pair Cabling and Components

As data transmission rates have increased, higher performance twisted-pair cabling has become a necessity. In addition, some means of classifying horizontal twisted-pair cables and connecting hardware by performance capability had to be established. These capabilities have been broken down to a series of categories. The following categories are currently recognized.

Category 3: Cables and connecting hardware with transmission parameters characterized up to 16 MHz

Category 5e: Cables and connecting hardware with transmission parameters characterized up to 100 MHz

Category 6: Cables and connecting hardware with transmission parameters characterized up to 250 MHz

Category 6A: Cables and connecting hardware with transmission parameters characterized up to 500 MHz. Additionally, requirements for alien crosstalk are specified in order to support 10GBASE-T transmission systems.

The following tables show the performance limits for channel, permanent link and twisted-pair cable for Category 3, Category 5e, Category 6 and Category 6A.

Channel Transmission Performance

The following tables reflect the various mitigating factors that need to be taken into consideration when calculating a channel's transmission performance.

Channel Return Loss

Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	17.0	19.0	19.0
4.00	-	17.0	19.0	19.0
8.00	-	17.0	19.0	19.0
10.00	-	17.0	19.0	19.0
16.00	-	17.0	18.0	18.0
20.00	-	17.0	17.5	17.5
25.00	-	16.0	17.0	17.0
31.25	-	15.1	16.5	16.5
62.50	-	12.1	14.0	14.0
100.00	-	10.0	12.0	12.0
200.00	-	-	9.0	9.0
250.00	-	-	8.0	8.0
300.00	-	-	-	7.2
400.00	-	-	-	6.0
500.00	-	-	-	6.0

Table 7 – Minimum channel return loss

Channel Insertion Loss

Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	3.0	2.2	2.1	2.3
4.00	6.5	4.5	4.0	4.2
8.00	9.8	6.3	5.7	5.8
10.00	11.2	7.1	6.3	6.5
16.00	14.9	9.1	8.0	8.2
20.00	-	10.2	9.0	9.2
25.00	-	11.4	10.1	10.2
31.25	-	12.9	11.4	11.5
62.50	-	18.6	16.5	16.4
100.00	-	24.0	21.3	20.9
200.00	-	-	31.5	30.1
250.00	-	-	35.9	33.9
300.00	-	-	-	37.4
400.00	-	-	-	43.7
500.00	-	-	-	49.3

Table 8 – Maximum channel insertion loss

ANSI/TIA-568-C.2 Standard

Channel NEXT Loss (Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	39.1	60.0	65.0	65.0
4.00	29.3	53.5	63.0	63.0
8.00	24.3	48.6	58.2	58.2
10.00	22.7	47.0	56.6	56.6
16.00	19.3	43.6	53.2	53.2
20.00	-	42.0	51.6	51.6
25.00	-	40.3	50.0	50.0
31.25	-	38.7	48.4	48.4
62.50	-	33.6	43.4	43.4
100.00	-	30.1	39.9	39.9
200.00	-	-	34.8	34.8
250.00	-	-	33.1	33.1
300.00	-	-	-	31.7
400.00	-	-	-	28.7
500.00	-	-	-	26.1

Table 9 – Minimum channel NEXT loss

Channel PSNEXT Loss (Powersum Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	57.0	62.0	62.0
4.00	-	50.5	60.5	60.5
8.00	-	45.6	55.6	55.6
10.00	-	44.0	54.0	54.0
16.00	-	40.6	50.6	50.6
20.00	-	39.0	49.0	49.0
25.00	-	37.3	47.3	47.3
31.25	-	35.7	45.7	45.7
62.50	-	30.6	40.6	40.6
100.00	-	27.1	37.1	37.1
200.00	-	-	31.9	31.9
250.00	-	-	30.2	30.2
300.00	-	-	-	28.8
400.00	-	-	-	25.8
500.00	-	-	-	23.2

Table 10 – Minimum channel PSNEXT loss

Channel ACRF (Attenuation to Crosstalk Ratio, Far-End) or ELFEXT (Equal-Level Far-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	57.4	63.3	63.3
4.00	-	45.4	51.2	51.2
8.00	-	39.3	45.2	45.2
10.00	-	37.4	43.3	43.3
16.00	-	33.3	39.2	39.2
20.00	-	31.4	37.2	37.2
25.00	-	29.4	35.3	35.3
31.25	-	27.5	33.4	33.4
62.50	-	21.5	27.3	27.3
100.00	-	17.4	23.3	23.3
200.00	-	-	17.2	17.2
250.00	-	-	15.3	15.3
300.00	-	-	-	13.7
400.00	-	-	-	11.2
500.00	-	-	-	9.3

Table 11 – Minimum channel ACRF

Channel PSACRF (Powersum Insertion Loss to Alien Crosstalk Ratio Far-End) or PSELFEXT (Powersum Equal-Level Far-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	54.4	60.3	60.3
4.00	-	42.4	48.2	48.2
8.00	-	36.3	42.2	42.2
10.00	-	34.4	40.3	40.3
16.00	-	30.3	36.2	36.2
20.00	-	28.4	34.2	34.2
25.00	-	26.4	32.3	32.3
31.25	-	24.5	30.4	30.4
62.50	-	18.5	24.3	24.3
100.00	-	14.4	20.3	20.3
200.00	-	-	14.2	14.2
250.00	-	-	12.3	12.3
300.00	-	-	-	10.7
400.00	-	-	-	8.2
500.00	-	-	-	6.3

Table 12 – Minimum channel PSACRF

Channel Propagation Delay Skew

Channel propagation delay skew shall be less than 50 ns for all frequencies from 1 MHz to the upper frequency limit of the Category. For field-testing channels, it is sufficient to test at 10 MHz only and channel propagation delay skew at 10 MHz shall not exceed 50 ns.

Channel Propagation Delay				
Frequency (MHz)	Category 3 (ns)	Category 5e (ns)	Category 6 (ns)	Category 6A (ns)
1.00	580	580	580	580
4.00	562	562	562	562
8.00	557	557	557	557
10.00	555	555	555	555
16.00	553	553	553	553
20.00	-	552	552	552
25.00	-	551	551	551
31.25	-	550	550	550
62.50	-	549	549	549
100.00	-	548	548	548
200.00	-	-	547	547
250.00	-	-	546	546
300.00	-	-	-	546
400.00	-	-	-	546
500.00	-	-	-	546

Table 13 – Maximum channel propagation delay

ANSI/TIA-568-C.2 Standard

Channel PSANEXT Loss (Powersum Alien Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	-	-	67.0
4.00	-	-	-	67.0
8.00	-	-	-	67.0
10.00	-	-	-	67.0
16.00	-	-	-	67.0
20.00	-	-	-	67.0
25.00	-	-	-	66.0
31.25	-	-	-	65.1
62.50	-	-	-	62.0
100.00	-	-	-	60.0
200.00	-	-	-	55.5
250.00	-	-	-	54.0
300.00	-	-	-	52.8
400.00	-	-	-	51.0
500.00	-	-	-	49.5

Table 14 – Minimum channel PSANEXT loss

Channel PSAACRF (Powersum Insertion Loss to Alien Crosstalk Ratio Far-End) or PSAELFEXT (Powersum Alien Equal Level Far-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	-	-	67.0
4.00	-	-	-	65.0
8.00	-	-	-	58.9
10.00	-	-	-	57.0
16.00	-	-	-	52.9
20.00	-	-	-	51.0
25.00	-	-	-	49.0
31.25	-	-	-	47.1
62.50	-	-	-	47.1
100.00	-	-	-	37.0
200.00	-	-	-	31.0
250.00	-	-	-	29.0
300.00	-	-	-	27.5
400.00	-	-	-	25.0
500.00	-	-	-	23.0

Table 15 – Minimum channel PSAACRF loss

Augmented Category 6 Channel Requirements

Note: The requirements for ISO (the International Organization for Standardization) 11801 Class E_A are more demanding compared to the TIA Augmented Category 6 requirements. Anixter's Infrastructure Solutions Lab tests to the more stringent ISO 11801 standards.

ISO Compared to TIA		
Characteristics 500 MHz (dB)	ISO Class E_A	TIA Augumented Category 6
PSNEXT Loss	24.8 dB	23.2 dB
NEXT Loss	27.9 dB	26.1 dB
PSANEXT Loss	49.5 dB	49.5 dB
Return Loss	6.0 dB	6.0 dB
Insertion Loss	49.3 dB	49.3 dB
Referred to by IEEE	Yes	No

Table 16 – ISO versus TIA performance comparison

Note: See the IEEE 802.3an and ISO Class E_A section of this book for more information on 10 Gigabit cabling and protocol methods.

Permanent Link Transmission Performance

The tables below show the requirements intended for performance validation according to the specific cabling Category.

Permanent Link Return Loss				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	19.0	19.1	19.1
4.00	-	19.0	21.0	21.0
8.00	-	19.0	21.0	21.0
10.00	-	19.0	21.0	21.0
16.00	-	19.0	20.0	20.0
20.00	-	19.0	20.0	20.0
25.00	-	19.0	19.5	19.5
31.25	-	17.1	18.5	18.5
62.50	-	14.1	16.0	16.0
100.00	-	12.0	14.0	14.0
200.00	-	-	11.0	11.0
250.00	-	-	10.0	10.0
300.00	-	-	-	9.2
400.00	-	-	-	8.0
500.00	-	-	-	8.0

Table 17 – Minimum permanent link return loss

Permanent Link Insertion Loss				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	2.6	2.1	1.9	1.9
4.00	5.6	3.9	3.5	3.5
8.00	8.5	5.5	5.0	5.0
10.00	9.7	6.2	5.5	5.5
16.00	13.0	7.9	7.0	7.0
20.00	-	8.9	7.9	7.8
25.00	-	10.0	8.9	8.8
31.25	-	11.2	10.0	9.8
62.50	-	16.2	14.4	14.0
100.00	-	21.0	18.6	18.0
200.00	-	-	27.4	26.1
250.00	-	-	31.1	29.5
300.00	-	-	-	32.7
400.00	-	-	-	38.4
500.00	-	-	-	43.8

Table 18 – Maximum permanent link insertion loss

ANSI/TIA-568-C.2 Standard

Permanent Link NEXT Loss (Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	40.1	60.0	65.0	65.0
4.00	30.7	54.8	64.1	64.1
8.00	25.9	50.0	59.4	59.4
10.00	24.3	48.5	57.8	57.8
16.00	21.0	45.2	54.6	54.6
20.00	-	43.7	53.1	53.1
25.00	-	42.1	51.5	51.5
31.25	-	40.5	50.0	50.0
62.50	-	35.7	45.1	45.1
100.00	-	32.3	41.8	41.8
200.00	-	-	36.9	36.9
250.00	-	-	35.3	35.3
300.00	-	-	-	34.0
400.00	-	-	-	29.9
500.00	-	-	-	26.7

Table 19 – Minimum permanent link NEXT loss

Permanent Link PSNEXT Loss (Powersum Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	57.0	62.0	62.0
4.00	-	51.8	61.8	61.8
8.00	-	47.0	57.0	57.0
10.00	-	45.5	55.5	55.5
16.00	-	42.2	52.2	52.2
20.00	-	40.7	50.7	50.7
25.00	-	39.1	49.1	49.1
31.25	-	37.5	47.5	47.5
62.50	-	32.7	42.7	42.7
100.00	-	29.3	39.3	39.3
200.00	-	-	34.3	34.3
250.00	-	-	32.7	32.7
300.00	-	-	-	31.4
400.00	-	-	-	27.1
500.00	-	-	-	23.8

Table 20 – Minimum permanent link PSNEXT loss

Permanent Link ACRF (Attenuation to Crosstalk Ratio, Far-End) or ELFEXT (Equal-Level Far-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	58.6	64.2	64.2
4.00	-	46.6	52.1	52.1
8.00	-	40.6	46.1	46.1
10.00	-	38.6	44.2	44.2
16.00	-	34.5	40.1	40.1
20.00	-	32.6	38.2	38.2
25.00	-	30.7	36.2	36.2
31.25	-	28.7	34.3	34.3
62.50	-	22.7	28.3	28.3
100.00	-	18.6	24.2	24.2
200.00	-	-	18.2	18.2
250.00	-	-	16.2	16.2
300.00	-	-	-	14.6
400.00	-	-	-	12.1
500.00	-	-	-	10.2

Table 21 – Minimum permanent link ACRF

Permanent Link PSACRF (Powersum Insertion Loss to Alien Crosstalk Ratio Far-End) or PSELFEXT (Powersum Equal Level Far-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	55.6	61.2	61.2
4.00	-	43.6	49.1	49.1
8.00	-	37.5	43.1	43.1
10.00	-	35.6	41.2	41.2
16.00	-	31.5	37.1	37.1
20.00	-	29.6	35.2	35.2
25.00	-	27.7	33.2	33.2
31.25	-	25.7	31.3	31.3
62.50	-	19.7	25.3	25.3
100.00	-	15.6	21.2	21.2
200.00	-	-	15.2	15.2
250.00	-	-	13.2	13.2
300.00	-	-	-	11.6
400.00	-	-	-	9.1
500.00	-	-	-	7.2

Table 22 – Minimum permanent link PSACRF

Permanent Link Propagation Delay				
Frequency (MHz)	Category 3 (ns)	Category 5e (ns)	Category 6 (ns)	Category 6A (ns)
1.00	521	521	521	521
4.00	504	504	504	504
8.00	500	500	500	500
10.00	498	498	498	498
16.00	496	496	496	496
20.00	-	495	495	495
25.00	-	495	495	495
31.25	-	494	494	494
62.50	-	492	492	492
100.00	-	491	491	491
200.00	-	-	490	490
250.00	-	-	490	490
300.00	-	-	-	490
400.00	-	-	-	490
500.00	-	-	-	490

Table 23 – Maximum permanent link propagation delay

ANSI/TIA-568-C.2 Standard

Permanent Link Propagation Delay Skew

Permanent link propagation delay skew shall be less than 44 ns for all frequencies from 1 MHz to the upper frequency limit of the Category. For field-testing channels, it is sufficient to test at 10 MHz only and permanent link propagation delay skew at 10 MHz shall not exceed 50 ns.

Permanent Link PSANEXT Loss (Powersum Alien Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	-	-	67.0
4.00	-	-	-	67.0
8.00	-	-	-	67.0
10.00	-	-	-	67.0
16.00	-	-	-	67.0
20.00	-	-	-	67.0
25.00	-	-	-	66.0
31.25	-	-	-	65.1
62.50	-	-	-	62.0
100.00	-	-	-	60.0
200.00	-	-	-	55.5
250.00	-	-	-	54.0
300.00	-	-	-	52.8
400.00	-	-	-	51.0
500.00	-	-	-	49.5

Table 24 – Minimum permanent link PSANEXT loss

Permanent Link PSAACRF (Powersum Insertion Loss to Alien Crosstalk Ratio Far-End) or PSAELFEXT (Powersum Alien Equal-Level Far-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	-	-	67.0
4.00	-	-	-	65.7
8.00	-	-	-	59.6
10.00	-	-	-	57.7
16.00	-	-	-	53.6
20.00	-	-	-	51.7
25.00	-	-	-	49.7
31.25	-	-	-	47.8
62.50	-	-	-	41.8
100.00	-	-	-	37.7
200.00	-	-	-	31.7
250.00	-	-	-	29.7
300.00	-	-	-	28.2
400.00	-	-	-	25.7
500.00	-	-	-	23.7

Table 25 – Minimum permanent link PSAACRF loss

Horizontal Cable Transmission Performance

The following tables show the performance specifications for horizontal cable transmission performance.

Horizontal Cable Return Loss				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	20.0	20.0	20.0
4.00	-	23.0	23.0	23.0
8.00	-	24.5	24.5	24.5
10.00	-	25.0	25.0	25.0
16.00	-	25.0	25.0	25.0
20.00	-	25.0	25.0	25.0
25.00	-	24.3	24.3	24.3
31.25	-	23.6	23.6	23.6
62.50	-	21.5	21.5	21.5
100.00	-	20.1	20.1	20.1
200.00	-	-	18.0	18.0
250.00	-	-	17.3	17.3
300.00	-	-	-	16.8
400.00	-	-	-	15.9
500.00	-	-	-	15.2

Table 26 – Minimum horizontal cable return loss

Horizontal Cable Insertion Loss				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
0.772	2.2	-	-	-
1.00	2.6	2.0	2.0	2.1
4.00	5.6	4.1	3.8	3.8
8.00	8.5	5.8	5.3	5.3
10.00	9.7	6.5	6.0	5.9
16.00	13.1	8.2	7.6	7.5
20.00	-	9.3	8.5	8.4
25.00	-	10.4	9.5	9.4
31.25	-	11.7	10.7	10.5
62.50	-	17.0	15.4	15.0
100.00	-	22.0	19.8	19.1
200.00	-	-	29.0	27.6
250.00	-	-	32.8	31.1
300.00	-	-	-	34.3
400.00	-	-	-	40.1
500.00	-	-	-	45.3

Table 27 – Maximum horizontal cable insertion loss

ANSI/TIA-568-C.2 Standard

Horizontal Cable NEXT Loss (Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
0.772	43.0	-	-	-
1.00	41.3	65.3	74.3	74.3
4.00	32.3	56.3	65.3	65.3
8.00	27.8	51.8	60.8	60.8
10.00	26.3	50.3	59.3	59.3
16.00	23.2	47.2	56.2	56.2
20.00	-	45.8	54.8	54.8
25.00	-	44.3	53.3	53.3
31.25	-	42.9	51.9	51.9
62.50	-	38.4	47.4	47.4
100.00	-	35.3	44.3	44.3
200.00	-	-	39.8	39.8
250.00	-	-	39.3	38.3
300.00	-	-	-	37.1
400.00	-	-	-	35.3
500.00	-	-	-	33.8

Table 28 – Minimum horizontal cable NEXT loss

Horizontal Cable PSNEXT Loss (Powersum Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	62.3	72.3	72.3
4.00	-	53.3	63.3	63.3
8.00	-	48.8	58.8	58.8
10.00	-	47.3	57.3	57.3
16.00	-	44.2	54.2	54.2
20.00	-	42.8	52.8	52.8
25.00	-	41.3	51.3	51.3
31.25	-	39.9	49.9	49.9
62.50	-	35.4	45.4	45.4
100.00	-	32.3	42.3	42.3
200.00	-	-	37.8	37.8
250.00	-	-	36.3	36.3
300.00	-	-	-	35.1
400.00	-	-	-	33.3
500.00	-	-	-	31.8

Table 29 – Minimum horizontal cable PSNEXT loss

Horizontal Cable ACRF (Attenuation to Crosstalk Ratio, Far-End) or ELFEXT (Equal-Level Far-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	63.8	67.8	67.8
4.00	-	51.8	55.8	55.8
8.00	-	45.7	49.7	49.7
10.00	-	43.8	47.8	47.8
16.00	-	39.7	43.7	43.7
20.00	-	37.8	41.8	41.8
25.00	-	35.8	39.8	39.8
31.25	-	33.9	37.9	37.9
62.50	-	27.9	31.9	31.9
100.00	-	23.8	27.8	27.8
200.00	-	-	21.8	21.8
250.00	-	-	19.8	19.8
300.00	-	-	-	18.3
400.00	-	-	-	15.8
500.00	-	-	-	13.8

Table 30 – Minimum horizontal cable ACRF

Horizontal Cable PSACRF (Powersum Insertion Loss to Alien Crosstalk Ratio Far-End) or PSELFEXT (Powersum Equal-Level Far-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	60.8	64.8	64.8
4.00	-	48.8	52.8	52.8
8.00	-	42.7	46.7	46.7
10.00	-	40.8	44.8	44.8
16.00	-	36.7	40.7	40.7
20.00	-	34.8	38.8	38.8
25.00	-	32.8	36.8	36.8
31.25	-	30.9	34.9	34.9
62.50	-	24.9	28.9	28.9
100.00	-	20.8	24.8	24.8
200.00	-	-	18.8	18.8
250.00	-	-	16.8	16.8
300.00	-	-	-	15.3
400.00	-	-	-	12.8
500.00	-	-	-	10.8

Table 31 – Minimum horizontal cable PSACRF

Horizontal Cable Propagation Delay Skew

Horizontal cable propagation delay skew shall be less than 45 ns/100 m for all frequencies from 1 MHz to the upper frequency limit of the Category.

Horizontal Cable Propagation Delay				
Frequency (MHz)	Category 3 (ns/100 m)	Category 5e (ns/100 m)	Category 6 (ns/100 m)	Category 6A (ns/100 m)
1.00	570	570	570	570
4.00	552	552	552	552
8.00	547	547	547	547
10.00	545	545	545	545
16.00	543	543	543	543
20.00	-	542	542	542
25.00	-	541	541	541
31.25	-	540	540	540
62.50	-	539	539	539
100.00	-	538	538	538
200.00	-	-	537	537
250.00	-	-	536	536
300.00	-	-	-	536
400.00	-	-	-	536
500.00	-	-	-	536

Table 32 – Maximum horizontal cable propagation delay

ANSI/TIA-568-C.2 Standard

Horizontal Cable PSANEXT Loss (Powersum Alien Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	-	-	67.0
4.00	-	-	-	67.0
8.00	-	-	-	67.0
10.00	-	-	-	67.0
16.00	-	-	-	67.0
20.00	-	-	-	67.0
25.00	-	-	-	67.0
31.25	-	-	-	67.0
62.50	-	-	-	65.6
100.00	-	-	-	62.5
200.00	-	-	-	58.0
250.00	-	-	-	56.5
300.00	-	-	-	55.3
400.00	-	-	-	53.5
500.00	-	-	-	52.0

Table 33 – Minimum horizontal cable PSANEXT loss

Horizontal Cable PSAACRF (Powersum Insertion Loss to Alien Crosstalk Ratio Far-End) or PSAELFEXT (Powersum Alien Equal Level Far-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	-	-	67.0
4.00	-	-	-	66.2
8.00	-	-	-	60.1
10.00	-	-	-	58.2
16.00	-	-	-	54.1
20.00	-	-	-	52.2
25.00	-	-	-	50.2
31.25	-	-	-	48.3
62.50	-	-	-	42.3
100.00	-	-	-	38.2
200.00	-	-	-	32.2
250.00	-	-	-	30.2
300.00	-	-	-	28.7
400.00	-	-	-	26.2
500.00	-	-	-	24.2

Table 34 – Minimum horizontal cable PSAACRF loss

TIA Category 6 Versus Augmented Category 6				
	TIA Category 5e UTP	TIA Category 6 UTP	TIA Augmented Category 6 UTP	ISO Class E_A
Recognized by IEEE 802.3an	No	Yes	Yes	Yes
55 Meter Distance Support	No	Yes	Yes	Yes
100 Meter Distance Support	No	No	Yes	Yes
Extrapolated Test Limits for NEXT and PSNEXT to 500 MHz	No	No	No	Yes

Table 35 – IEEE 10GBASE-T application support

Note: This table compares current TIA Category 6 cabling with new TIA and ISO specifications for 10 Gigabit cabling. This table summarizes the various twisted-pair cabling options and their respective 10 Gigabit performance attributes as defined by the latest standards. Category 5e is not recognized as a viable cabling media to support 10 Gigabit transmission regardless of its installed cabling distance. Category 6 cabling will only support 10 Gigabit Ethernet at a maximum installed distance of 55 meters.

Bundled and Hybrid Cable

Bundled, wrapped or hybrid cables are allowed for use in horizontal cabling, provided that each individual cable type meets the TIA-568-C.2 transmission specifications and that the PSNEXT loss created by adjacent jacketed cables is 3 dB better than the normally allowed pair-to-pair NEXT for the cable type being tested. Color codes must follow individual cable standards to distinguish them from multipair twisted-pair backbone cabling.

Patch Cord Transmission Performance

Jumper and patch cord maximum length limitations:

- 20 m (66 ft.) in main cross-connect
- 20 m (66 ft.) in intermediate cross-connect
- 6 m (20 ft.) in telecommunications room
- 3 m (10 ft.) in the work area

Assembled patch cords: Insertion loss (attenuation): per 100 m (328 ft.) at 20° C = horizontal UTP cable insertion loss + 20 percent (due to stranded conductors) for all performance categories

Matrix of Backward Compatible Mated Component Performance					
		Category of Modular Connecting Hardware Performance			
		Category 3	Category 5e	Category 6	Category 6A
Modular Plug and Cord Performance	Category 3	Category 3	Category 3	Category 3	Category 3
	Category 5e	Category 3	Category 5e	Category 5e	Category 5e
	Category 6	Category 3	Category 5e	Category 6	Category 6
	Category 6A	Category 3	Category 5e	Category 6	Category 6A

Table 36 – The lowest rated component determines the rating of the permanent link or channel

Patch Cord Cable Construction

Stranded conductors for extended flex-life cables used for patch cords and cross-connect jumpers need to be of the same performance Category (or higher) as the horizontal cables they connect.

Patch Cord Return Loss				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	19.8	19.8	19.8
4.00	-	21.6	21.6	21.6
8.00	-	22.5	22.5	22.5
10.00	-	22.8	22.8	22.8
16.00	-	23.4	23.4	23.4
20.00	-	23.7	23.7	23.7
25.00	-	24.0	24.0	24.0
31.25	-	23.0	23.0	23.0
62.50	-	20.0	20.0	20.0
100.00	-	18.0	18.0	18.0
200.00	-	-	15.0	15.0
250.00	-	-	14.0	14.0
300.00	-	-	-	12.8
400.00	-	-	-	10.9
500.00	-	-	-	9.5

Table 37 – Minimum patch cord return loss

ANSI/TIA-568-C.2 Standard

2-Meter Patch Cord NEXT Loss (Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	65.0	65.0	65.0
4.00	-	65.0	65.0	65.0
8.00	-	60.6	65.0	65.0
10.00	-	58.7	65.0	65.0
16.00	-	54.7	62.0	62.0
20.00	-	52.8	60.1	60.1
25.00	-	50.9	58.1	58.2
31.25	-	49.0	56.2	56.3
62.50	-	43.2	50.4	50.4
100.00	-	39.3	46.4	46.4
200.00	-	-	40.6	40.7
250.00	-	-	38.8	38.9
300.00	-	-	-	36.2
400.00	-	-	-	31.9
500.00	-	-	-	28.4

Table 38 – Minimum 2-meter patch cord NEXT loss

5-Meter Patch Cord NEXT Loss (Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	65.0	65.0	65.0
4.00	-	64.5	65.0	65.0
8.00	-	58.6	65.0	65.0
10.00	-	56.7	64.5	64.5
16.00	-	52.8	60.5	60.5
20.00	-	50.9	58.6	58.7
25.00	-	49.1	56.8	56.8
31.25	-	47.2	54.9	54.9
62.50	-	41.6	49.2	49.2
100.00	-	37.8	45.3	45.4
200.00	-	-	39.8	39.9
250.00	-	-	38.1	38.1
300.00	-	-	-	35.9
400.00	-	-	-	32.1
500.00	-	-	-	29.0

Table 39 – Minimum 5-meter patch cord NEXT loss

10-Meter Patch Cord NEXT Loss (Near-End Crosstalk)				
Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1.00	-	65.0	65.0	65.0
4.00	-	62.5	65.0	65.0
8.00	-	56.7	64.8	64.8
10.00	-	54.9	62.9	63.0
16.00	-	51.0	59.0	59.1
20.00	-	49.2	57.2	57.3
25.00	-	47.4	55.4	55.4
31.25	-	45.6	53.6	53.6
62.50	-	40.2	48.1	48.1
100.00	-	36.7	44.4	44.5
200.00	-	-	39.3	39.3
250.00	-	-	37.6	37.7
300.00	-	-	-	35.8
400.00	-	-	-	32.5
500.00	-	-	-	29.8

Table 40 – Minimum 10-meter patch cord NEXT loss

ANSI/TIA-568-C.3 Standard

Purpose of the ANSI/TIA-568-C.3 Standard

The purpose of the ANSI/TIA-569-C.3 standard is to specify cable and component transmission performance requirements for premises optical fiber cabling. Although this standard is primarily intended to be used by manufacturers of optical cabling solutions, other groups such as end-users, designers and installers may also find it useful.

ANSI/TIA-568-C.3 Optical Fiber Cabling Components

Optical Fiber Cabling Systems				
Optical Fiber and Cable Type[2]	**Wavelength (nm)**	**Maximum Attenuation (dB/km)**	**Minimum Overfilled Modal Bandwidth-Length Product (MHz • km)[1]**	**Minimum Effective Modal Bandwidth-Length Product (MHz • km)[1]**
62.5/125 μm				
Multimode	850	3.5	200	Not required
TIA 492AAAA (OM1)	1300	1.5	500	Not required
50/125 μm				
Multimode	850	3.5	500	Not required
TIA 492AAAB (OM2)	1300	1.5	500	Not required
850-nm				
Laser-Optimized				
50/125 μm Multimode	850	3.5	1,500	2,000
TIA 492AAAC (OM3)	1300	1.5	500	Not required
Single-Mode				
Indoor-Outdoor				
TIA 492CAAA (OS1)	1310	0.5	-	-
TIA 492CAAB (OS2)[3]	1550	0.5	-	-
Single-Mode				
Inside Plant				
TIA 492CAAA (OS1)	1310	1.0	-	-
TIA 492CAAB (OS2)[3]	1550	1.0	-	-
Single-Mode				
Outside Plant				
TIA 492CAAA (OS1)	1310	0.5	-	-
TIA 492CAAB (OS2)[3]	1550	0.5	-	-
NOTES				
1 – The bandwidth-length product, as measured by the fiber manufacturer, can be used to demonstrate compliance with this requirement.				
2 – The fiber designation (OM1, OM2, OM3, OS1 and OS2) corresponds to the designation of ISO/IEC 11801 or ISO/IEC 24702.				
3 – OS2 is commonly referred to as "low water peak" single-mode fiber and is characterized by having a low attenuation coefficient in the vicinity of 1383 nm.				

Table 41 – Optical fiber cable transmission performance parameters

Optical Fiber Bend Radius	
Fiber Type	**Bend Radius**
Small Inside Plant Cable (2–4 fibers)	1 in. (no load)
	2 in. (with load)
All Other Inside Plant Cable	10 x diameter (no load)
	15 x diameter (with load)
Outside Plant Cable	10 x diameter (no load)
	20 x diameter (with load)

Table 42 – Optical fiber bend radius

Outside plant cable must be water-blocked and have a minimum pull strength of 600 lb. (drop cable pull strength may be 300 lb.).

Optical Fiber Connector

No specified connector: 568SC and other duplex designs may be used in addition to the MPO or MTP array connectors.

Color Identification

Unless color coding is used for some other purpose, the connector strain relief and adapter housing should be identifiable by the following colors:

a) 850-nm laser-optimized 50/125 mm fiber – aqua
b) 50/125 mm fiber – black
c) 62.5/125 mm fiber – beige
d) Single-mode fiber – blue
e) Angled contact ferrule single-mode connectors – green

In addition, unless color coding is used for some other purpose, the connector plug body should be generically identified by the following colors, where possible:

a) Multimode – beige, black or aqua
b) Single-mode – blue
c) Angled contact ferrule single-mode connectors – green

Optical Fiber Telecommunications Outlet Required Features

- Capability to terminate minimum of two fibers into 568SC couplings or other duplex connection
- Means of securing fiber and maintaining minimum bend radius of 25 mm (1 in.)

Optical Fiber Splices, Fusion or Mechanical

Maximum insertion loss 0.3 dB

- Minimum return loss:
  – Multimode: 20 dB
  – Single-mode: 26 dB
  – Single-mode: 55 dB (analog CATV)

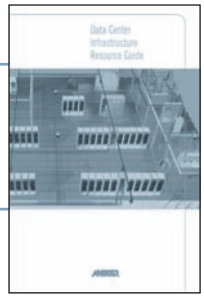
Optical Fiber Connector (mated pair)

- Maximum insertion loss 0.75 dB

Patch Cords

- Shall be dual fiber of the same type as the horizontal and backbone fiber
- Polarity shall be keyed duplex

For more information on Fibre Channel, download Anixter's Data Center Resource Guide at anixter.com/datacenterguide.



ANSI/TIA/EIA-569-B Standard

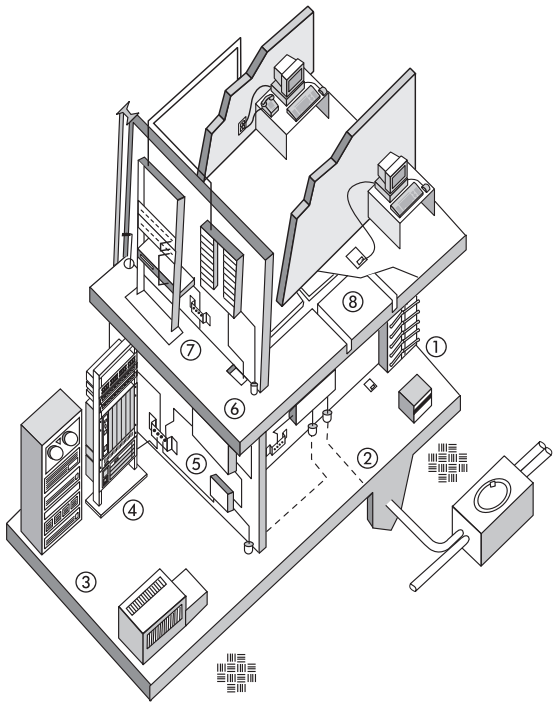
Purpose of the ANSI/TIA/EIA-569-B Standard

As the complexity of voice and data telecommunications has increased, standards have been established to ensure the operability, flexibility, manageability and longevity of these critical commercial support systems. Telecommunication systems now encompass voice, data and video transmission of business information, fire and security, audio, environmental and other intelligent building controls over media that include fiber optics, specialized copper data cabling, microwave and radio wave. This document concisely describes the architectural design elements of cabling pathways and dedicated rooms for telecommunications equipment.

A multitenant commercial building has a life expectancy of at least 50 years. Software, hardware and communications gear have a far shorter life span of one to five years. Moreover, in a multitenant environment, continuous moves, adds and changes are inevitable. Standards help to guide the design of current systems to ease future changes. By planning for the future, these standards intend to provide a generic structured cabling plant capable of running any voice or data application foreseeable in the next 10 to 15 years.

Abbreviations:

AWG	American Wire Gauge
V	Volts
A	Amps
kVA	Kilovolt ampere
V/m	Volts per meter



1. Electric entrance	5. Voice equipment
2. Telco entrance	6. Telecommunications room
3. Telecommunications equipment room	7. Grounding and bonding
4. Data equipment	8. Underfloor system

Figure 13 – Pathways and spaces

Section Contents

ANSI/TIA/EIA-569-B

Commercial Building Standard for Telecommunications Pathways and Spaces

ANSI/TIA/EIA-569-B Design Considerations

Entrance Facilities

Entrance facilities include the pathways for outside carrier services, interbuilding backbone, alternate entrance and antennae entrance. The entrance facilities consist of a termination field interfacing any outside cabling to the intrabuilding backbone cabling. The local telephone carrier is typically required to terminate cabling within 50 ft. of building penetration and to provide primary voltage protection.

In buildings larger than 20,000 usable sq. ft., a locked, dedicated, enclosed room is recommended. Beyond 70,000 sq. ft., a locked, dedicated room is required, with a plywood termination field provided on two walls.

In buildings up to 100,000 usable sq. ft., a wall-mounted termination field may serve as the entrance facility, using 3/4-in. plywood, 8 ft. high. Beyond 100,000 sq. ft., rack-mounted and free-standing frames may also be required. Minimum space requirements are given in Table 43 (page 13.21).

Service Entrance Pathways

For underground facilities, use a minimum 4-in. conduit or duct constructed of PVC type B, C or D, multiple plastic duct, galvanized steel or fiber glass with appropriate encasement. No more than two 90-degree manufactured bends are allowed (10 times the diameter). Drain slope should not be less than 12 in. per 100 ft. Recommended conduit fill varies, but should not exceed 40 percent for more than two cables. Maintenance holes (typically 3,500 lb./sq. in., concrete) must be equipped with sump, corrosion-protected pulling iron, cable racks, grounded ladder and only such power and light conductors as required for telecommunications support per NEC requirements.

ANSI/TIA/EIA-569-B Standard

Entrance Room, Wall and Floor Space		
Gross Building Floor Space Served (ft.²/m²)	Minimum Termination Wall Size Plywood Wall Field in. (mm)	Minimum Termination Floor Space Dimensions Free-Standing Floor Mounted Frame (ft.) mm
10,000/1000	8 ft. high (2.4 m) x 39 in. (990 mm)	
20,000/2,000	8 ft. high (2.4 m) x 42 in. (1,060 mm)	
40,000/4,000	8 ft. high (2.4 m) x 68 in. (1,725 mm)	
50,000/5,000	8 ft. high (2.4 m) x 90 in. (2,295 mm)	
60,000/6,000	8 ft. high (2.4 m) x 96 in. (2,400 mm)	
80,000/8,000	8 ft. high (2.4 m) x 120 in. (3,015 mm)	
100,000/10,000	8 ft. high (2.4 m) x 144 in. (3,630 mm)	(12 x 6.5) 3,660 x 1,930
200,000/20,000		(12 x 9.0) 3,660 x 2,750
400,000/40,000		(12 x 13.0) 3,660 x 3,970
500,000/50,000		(12 x 15.5) 3,660 x 4,775
600,000/60,000		(12 x 18.5) 3,660 x 5,630
800,000/80,000		(12 x 22.5) 3,660 x 6,810
1,000,000/100,000		(12 x 27.5) 3,660 x 8,440

Table 43 – Recommended entrance room termination wall and floor space dimensions

Allow 1 sq. ft. (929 cm²) of plywood wall mount for each 200 sq. ft. (19 m²) area of floor space.

Equipment Room

An equipment room may house the main distribution frame, PBXs, secondary voltage protection, etc. The equipment room is often appended to the entrance facilities or a computer room to allow shared air conditioning, security, fire control, lighting and limited access.

Workstation Floor Space	
Number of Workstations	Equipment Room Floor Space ft.² (m²)
1–100	150 (14)
101–400	400 (38)
401–800	800 (74)
801–1,200	1,200 (111)

Table 44 – The floor space needed to accomodate workstations

Provide 0.75 ft.² (697 cm²) of equipment room floor space for every 100 ft.² (9 m²) of user workstation area.

Location

Typically, rooms should be located away from sources of electromagnetic interference (transformers, motors, X-ray, induction heaters, arc welders, radio and radar).

Perimeters

Typically, no false ceiling; all surfaces treated to reduce dust; walls and ceiling painted white or pastel to improve visibility.

Limited Access

Typically, single or double 36-in. x 80-in. lockable doors with no doorsills.

Other

Typically, no piping, ductwork, mechanical equipment or power cabling should be allowed to pass through the equipment room. No unrelated storage.

Ceiling Height

Minimum clear height in room shall be 8 ft. (2.4 m); the height between the finished floor and the lowest point should be 10 ft. (3 m) to accommodate tall racks and overhead raceways. False ceilings should not be installed.

HVAC

24 hours a day, 365 days a year, 64° F to 75° F, 30 to 55 percent humidity, positive pressure, with independent power from telecommunications equipment.

Lighting

Typically, 8.5 ft. high, providing 50 foot-candle at 3 ft. above floor.

Electrical

Typically, a minimum of two dedicated 15 A, 110 V AC duplex outlets on separate circuits is required. Convenience duplex outlets shall be placed at 6-ft. intervals around the perimeter. Emergency power should be considered and supplied if available.

Bonding and Grounding

Access shall be available to the bonding and grounding as specified in J-STD-607-A (see page 1209 of the office standards document or refer to page 13.27 of this guide).

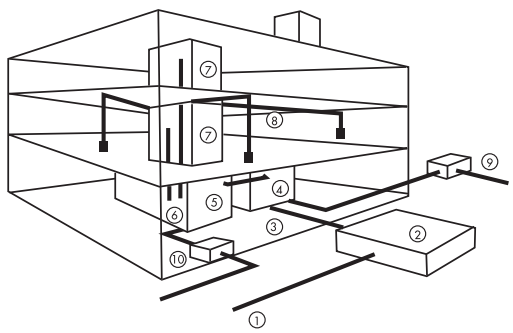
Dust

Less than 100 micrograms/cubic meter per 24 hour period.

Note: The term "typically" is applied here to indicate, where applicable, that these requirements also apply to other elements of the cabling system spaces. Lighting requirements, for instance, are largely identical for entrance facilities, equipment rooms and telecommunications rooms.

Intrabuilding Backbone Pathways

Within a building, the intrabuilding backbone pathways extend between the entrance facilities, equipment room and telecommunications rooms. Telecommunications rooms should be stacked vertically above each other on each floor and be provided with a minimum of three 4-in. sleeves (a stub of conduit through the floor) for less than 50,000 sq. ft. served. An equivalent 4-in. x 12-in. slot may be used in lieu of three sleeves. Firestopping is required. If rooms are not vertically aligned, then 4-in. horizontal conduit runs are required. Include no more than two 90 degree bends between pull points. Pulling iron or eyes embedded in the concrete for cable pulling is recommended. Fill should not exceed 40 percent for any run greater than two cables.



1. Telco conduit	6. Vertical backbone
2. Telco manhole	7. Telecommunications room
3. Entrance conduit	8. Horizontal cabling
4. Telco entrance facility	9. Interbuilding backbone
5. Telecommunications equipment room	10. Electrical entrance facility

Figure 14 – Backbone and horizontal pathways

ANSI/TIA/EIA-569-B Standard

Telecommunications Room

The telecommunications room on each floor is the junction between the backbone and horizontal pathways. It contains active voice and data telecommunications equipment, termination fields and cross-connect wiring. More than one telecommunications room per floor is required if distance to a work area exceeds 300 ft., or if floor area served exceeds 10,000 sq. ft. Recommended room sizing is 10 ft. x 11 ft. for each 10,000 sq. ft. area served. Power, lighting, air conditioning and limited access are typical. See requirements for equipment room. There are a minimum of three 4-in. firestopped backbone sleeves in the floor at the left side of a plywood termination field, which are ideally located near the door. A fire extinguisher is recommended.

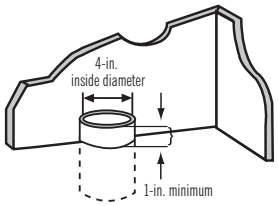


Figure 15 – Riser sleeve

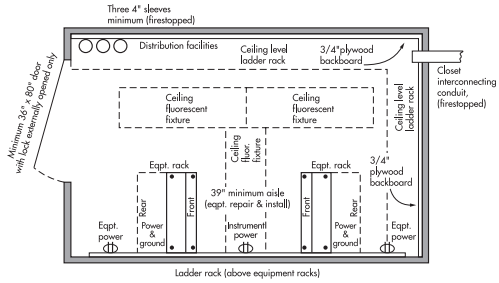


Figure 16 – Telecommunications room

Horizontal Pathways

Horizontal pathways extend between the telecommunications room and the work area. A variety of generic pathway options are described. Choice of pathway(s) is left to the discretion of the designer. The most commonly employed pathway consists of cable bundles run from the telecommunications room along J-hooks suspended above a plenum ceiling, which fan out once a work zone is reached. They then drop through interior walls or support columns or raceways, and terminate at an information outlet (I/O). Other options include the following.

Underfloor Duct

Single- or dual-level rectangular ducts embedded in greater than 2.5-in. (7 cm) concrete flooring.

Flushduct

Single-level rectangular duct embedded flush in greater than 1-in. (3 cm) concrete flooring.

Multichannel Raceway

Cellular raceway ducts capable of routing telecommunications and power cabling separately in greater than 3-in. (8 cm) reinforced concrete.

Cellular Floor

Preformed hollows or steel-lined cells are provided in concrete with header ducts from the telecommunications room arranged at right angles to the cells.

Trenchduct

A wide, solid tray, sometimes containing compartments and fitted with a flattop (with gaskets) along its entire length. It is embedded flush with the concrete finish.

Access Floor

Modular floor panels supported by pedestals, used in computer rooms and equipment rooms.

Plenum and Ceiling

Bundled cables, suspended above a false ceiling, fan out to drop through walls, power poles or along support columns to baseboard level.

Conduit

To be considered only when outlet locations are permanent, device density low and flexibility (future changes) are not required.

Cable Trays

Options include channel tray, ladder tray, solid bottom, ventilated and wireway.

Perimeter Pathways

Options include surface raceway, recessed, molding and multichannel (to carry separate power and lighting circuits).

Typically, size horizontal pathways by providing 1 sq. in. of cross-section area for every 100 sq. ft. of workspace area being served.

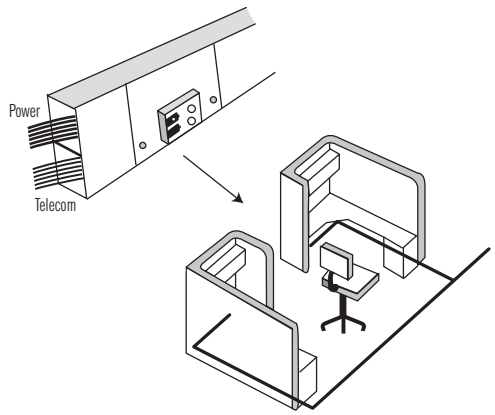


Figure 17 – Perimeter pathway and modular office path

Note: Typically, a pull box, splice box or pulling point is required for any constrained pathway where there are more than two 90 degree bends, a 180 degree reverse bend or length more than 100 ft.

A Variety of Horizontal Pathways

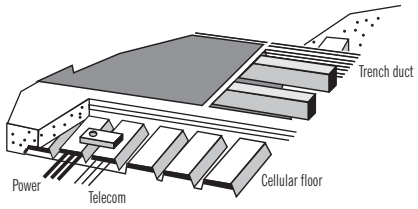


Figure 18 – Access floor

ANSI/TIA/EIA-569-B Standard

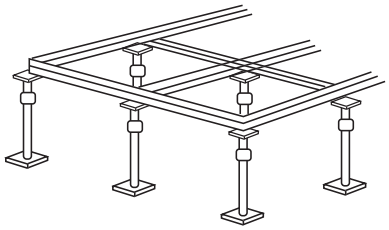


Figure 19 – Access floor

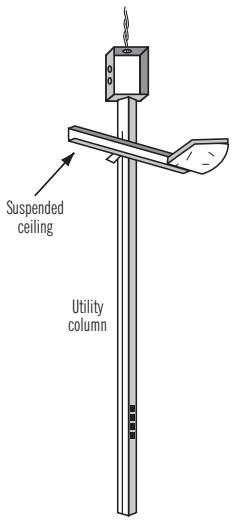


Figure 20 – Ceiling utility pole

Consolidation Points and MUTOAs

Consolidation points provide limited area connection access. Typically, a permanent flush wall, ceiling or support column-mounted panel serves modular furniture work areas. The panels must be unobstructed and fully accessible without moving fixtures, equipment or heavy furniture.

A multiuser telecommunication outlet assembly (MUTOA) is another methodology to reduce cabling moves, adds and changes in modular furniture settings. The user cord is directly connected to the MUTOA. A MUTOA location must be accessible and permanent and may not be mounted in ceiling spaces or under access flooring. Similarly, it cannot be mounted in furniture unless that furniture is permanently secured to the building structure.

For more descriptive information on distance limitations and purposes of consolidation points and MUTOAs, see ANSI/TIA-568-C.1.

Electromagnetic Interference

Voice and data telecommunications cabling should not be run adjacent and parallel to power cabling – even along short distances – unless one or both cable types are shielded and grounded. For low-voltage communication cables, a minimum 5-in. distance is required from any fluorescent lighting fixture or power line over 2 kVA and up to 24 in. from any power line over 5 kVA*. In general, telecommunications cabling is routed separately several feet away from power cabling. Similarly, telecommunications cabling is routed away from large motors, generators, induction heaters, arc welders, X-ray equipment and radio frequency, microwave or radar sources.

***Note:** Distance recommendations from (1990) ANSI/TIA/EIA-569 are reproduced here by popular request. For current recommendations, refer to NEC/NFPA 70, Article 800-52.

Firestops

Annex A of the standard discusses various types of packing used to re-establish the integrity of fire-rated structures when these barriers have been penetrated by cable. This section of the standard briefly discusses passive mechanical systems and nonmechanical systems such as putty, caulk, cements, intumescent sheets and strips, silicone foams and premanufactured pillows. The most common method is stuffing all apertures with ceramic or mineral wool and caulking both sides with fire-resistant putty. The information refers the designer to check manufacturer specifications and UL ratings against NFPA, ASTM and NEC codes.

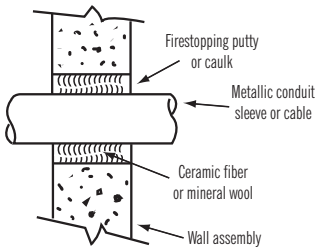


Figure 21 – Cross-section of typical firestop

ANSI/TIA/EIA-606-A Standard

Purpose of the ANSI/TIA/EIA-606-A Standard

Modern buildings require an effective telecommunications infrastructure to support the wide variety of services that rely on the electronic transport of information. Administration includes basic documentation and timely updating of drawings, labels and records. Administration should be synergistic with voice, data and video telecommunications, as well as with other building signal systems, including security, audio, alarms and energy management.

Administration can be accomplished with paper records, but in today's increasingly complex telecommunications environment, effective administration is enhanced by the use of computer-based systems.

A multitenant commercial building has a life expectancy of at least 50 years. Moreover, in a multitenant environment, continuous moves, adds and changes are inevitable.

Administrative record keeping plays an increasingly necessary role in the flexibility and management of frequent moves, adds and changes. This standard concisely describes the administrative record keeping elements of a modern structured cabling system.

Section Contents

ANSI/TIA/EIA-606-A

Administration Standard for Commercial Telecommunications Infrastructure

Elements of an Administration System

- Horizontal pathways and cabling
- Backbone pathways and cabling
- Telecommunications grounding and bonding
- Spaces (e.g., entrance facility, telecommunications room, equipment room)
- Firestopping

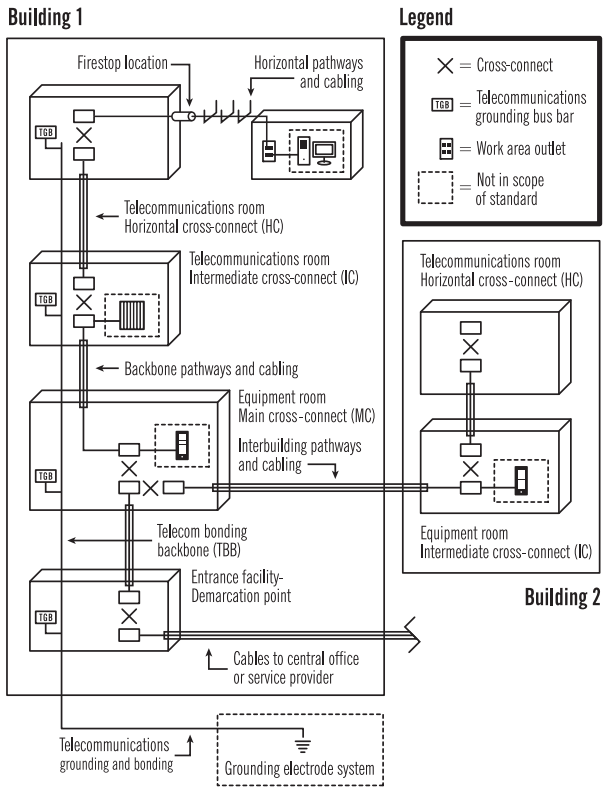


Figure 22 – A typical model for the infrastructure elements used in an administration system

Classes of Administration

Four classes of administration are specified in this standard to accommodate diverse degrees of complexity present in telecommunications infrastructure. Each class defines the administration requirements for identifiers, records and labeling. An administration system can be managed using a paper-based system, general-purpose spreadsheet software or special-purpose cable management software.

Classes of Administration

Identifier	Description of identifier	Class of administration 1	2	3	4
fs	Telecommunications space (TS)	R	R	R	R
fs-an	Horizontal link	R	R	R	R
fs-TGMB	Telecommunications main grounding busbar (TMGB)	R	R	R	R
fs-TGB	Telecommunications grounding busbar (TGB)	R	R	R	R
fs_1 /fs_2-n	Building backbone cabling		R	R	R
fs_1 /fs_2-n.d	Building backbone pair or optical fiber		R	R	R
f-FSLn(h)	Firestop location		R	R	R
[b_1-fs_1]/[b_2-fs_2]-n	Campus backbone cable			R	R
[b_1-fs_1]/[b_2-fs_2]-n/d	Campus backbone or optical fiber			R	R
b	Building			R	R
c	Campus or site				R

Table 45 – Identifier descriptions and classes of administration

ANSI/TIA/EIA-606-A Standard

Class 1 Administration

Class 1 addresses the administration requirements for a building or premise that is served by a single equipment room (ER).

The following infrastructure identifiers shall be required in Class 1 Administration when the corresponding elements are present:

- Telecommunications space (TS) identifier
- Horizontal link identifier
- Telecommunications main grounding busbar (TMGB)
- Telecommunications grounding busbar (TGB)

Class 1 Identifiers	
Identifier	**Description of identifier**
f	Numeric character(s) identifying the floor of the building occupied by the TS
s	Alpha character(s) uniquely identifying the TS on floor f or the building area in which the space is located
fs	The TS identifier
a	One or two alpha characters uniquely identifying a single patch panel, a group of patch panels with sequentially numbered ports, or an IDC connector (punch-down block), or a group of IDC connectors, serving as part of the horizontal cross-connect
n	Two to four numeric characters designating the port on a patch panel, or the section of an IDC connector on which a four-pair horizontal cable is terminated in the TS
TMGB	Portion of an identifier designating a telecommunications main grounding busbar
TGB	Portion of an identifier designating a telecommunications grounding busbar

Table 46 – Class 1 identifiers

Class 2 Administration

Class 2 addresses the administration of infrastructure with one or more telecommunications spaces (TS) in a single building.

The following infrastructure identifiers shall be required in Class 2 Administration when the corresponding elements are present:

- Identifiers required in Class 1 Administration
- Building backbone cable identifier
- Building backbone pair or optical fiber identifier
- Firestopping location identifier

Class 2 Administration may also include pathway identifiers.

Class 2 Identifiers	
Identifier	**Description of identifier**
fs_1	TS identifier for the space containing the termination of one end of the backbone cable
fs_2	TS identifier for the space containing the termination of the other end of the backbone cable
n	One or two alphanumeric characters identifying a single cable with one end terminated in the TS designated fs_1 and the other end terminated in the TS designated FS_2
fs_1/fs_2-n	A building backbone cable identifier
d	Two to four numeric characters identifying a single copper pair or a single optical fiber
FSL	An identifier referring to a firestopping location
h	One numeric character specifying the hour rating of a firestopping system

Table 47 – Class 2 identifiers

Class 3 Administration

Class 3 Administration addresses infrastructure with multiple buildings at a single site.

The following infrastructure identifiers shall be required in Class 3 Administration:

- Identifiers required in Class 2 Administration
- Building identifier
- Campus backbone cable identifier
- Campus backbone pair or optical fiber identifier

The following infrastructure identifiers are optional in Class 3 Administration:

- Identifiers optional in Class 2 Administration
- Outside plant pathway element identifier
- Campus pathway or element identifier

Additional identifiers may be added if desired.

Class 3 Identifiers	
Identifier	**Description of identifier**
[b_1-fs_1]/[b_2-fs_2]-n	Campus backbone identifier
d	Two to four numeric characters identifying a single copper pair or a single optical fiber
b	One or more alphanumeric characters identifying a single building

Table 48 – Class 3 identifiers

Class 4 Administration

Class 4 Administration addresses infrastructure with multiple sites or campuses.

The following infrastructure identifiers shall be required in Class 4 Administration:

- Identifiers required in Class 3 Administration
- Campus or site identifier

The following infrastructure identifiers are optional in Class 4 Administration:

- Identifiers optional in Class 3 Administration
- Intercampus element identifier

Additional identifiers may be added if desired.

Class 4 Identifiers	
Identifier	**Description of identifier**
c	One or more alphanumeric characters identifying a campus or a site

Table 49 – Class 4 identifiers

Identification Formats

A unique alphanumeric identification code is created for every location, pathway, cable and termination point. The standard includes these suggestions:

Alphanumeric Identification Code			
Code	**Description**	**Code**	**Description**
BCxxx	Bonding conductor	HHxxx	Handhole
BCDxxx	Backbone conduit	ICxxx	Intermediate cross-connect
Cxxx	Cable	Jxxx	Jack
CBxxx	Backbone cable	MCxxx	Main cross-connect
CDxxx	Conduit	MHxxx	Manhole or maintenance hole
CTxxx	Cable tray	PBxxx	Pull box
ECxxx	Equipment (bonding) conductor	Sxxx	Splice
EFxxx	Entrance facility	SExxx	Service entrance
ERxxx	Equipment room	SLxxx	Sleeve
Fxxx	Fiber	TCxxx	Telecommunications closet
GBxxx	Grounding busbar	TGBxxx	Telecommunications grounding busbar
GCxxx	Grounding conductor	TMGB	Telecommunications main grounding busbar
		WAxxx	Work area

Table 50 – Alphanumeric identification codes

ANSI/TIA/EIA-606-A Standard

Identification Format Example

The actual format in the preceding chart is not mandated by the standard. However, the chosen format must be consistent and provide a unique identifier number for each system element. This method lends itself to organizing and updating multiple records by the use of powerful relational database (three-dimensional spreadsheet) programs.

Identification Example

J0001 Label for an information outlet jack

D306 Designation for a work area

3A-C17-005 Termination in closet 3A, column C, row 17, block position 005

Examples like those above (taken from the ANSI/TIA/EIA-606-A text and administrative labeling map) indicate the flexibility of conventions that can be established for purposes of naming. Logical naming conventions can also convey considerable additional information about other linkages. Further examples are included in the complete standard.

Summary of Record Elements

This table outlines the minimum required information and required linkages. Further information is optional. A multidimensional database or spreadsheet is helpful.

Documentation Requirements

	Record	Required Information	Required Linkages
Pathways and Spaces	Pathway	Pathway identification #	Cable records
		Pathway type	Space records
		Pathway fill	Pathway records
		Pathway load	Grounding records
	Space	Space identification #	Pathway records
		Space type	Cable records
		Grounding records	
Wiring	Cable	Cable identification #	Termination records
		Cable type	Splice records
		Unterminated pair #s	Pathway records
		Damaged pair #s	Grounding records
		Available pair #s	
	Termination Hardware	Termination hardware #s	Termination position records
		Termination hardware type	Space records
		Damaged position #s	Grounding records
	Termination Position	Termination position #	Cable records
		Termination position type	Other termination records
		User code	Termination hardware records
		Cable pair/condition #s	Space records
	Splice	Splice identification #	Cable records
		Splice type	Space records
Grounding	TMGB	TMGB identification #	Bonding conductor records
		Busbar type	Space records
		Grounding conductor #s	
		Resistance to earth	
		Date of measurement	
	Bonding Conductor	Bonding conductor ID#	Grounding busbar records
		Conductor type	Pathway records
		Busbar identification #	
	TGB	Busbar identification #	Bonding conductor records
		Busbar type	Space records

Table 51 – Documentation requirements

Grounding and Bonding Administration

Telecommunications systems require a reliable electrical ground reference potential, provided by a dedicated grounding and bonding conductor network.

WARNING

IF THIS CLAMP OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER.

Figure 23 – Sample label

Bonding conductor cabling shall be colored green or labeled appropriately with an alphanumeric identifier and warning label. Grounding records are similar to cable record format.

Grounding and Bonding Terms (with abbreviation):

TMGB Telecommunications main grounding busbar

TBB Telecommunications bonding backbone

TGB Telecommunications grounding busbar

TBBIBC Telecommunications bonding backbone interconnecting bonding conductor

Label Color Coding

Shown here are the color codes used for termination field labels.

Field Label Color Codes

Termination Type	Color	Comments
Demarcation Point	Orange	CO terminations
Network Connections	Green	Also aux. circuit terms.
Common Equipment	Purple	PBX, host, LANs, Mux
First-Level Backbone	White	MC-IC terminations
Second-Level Backbone	Gray	IC-TC terminations
Station	Blue	Horizontal cable terms.
Interbuilding Backbone	Brown	Campus cable terms.
Miscellaneous	Yellow	Aux., maint., security
Key Telephone Systems	Red	

Table 52 – Field label color codes

The abbreviation "terms." is used in this example (for space considerations) to mean "terminations."

J-STD-607-A Standard

Purpose of the J-STD-607-A Standard

This standard specifies a uniform telecommunications grounding and bonding infrastructure that shall be followed within commercial buildings. Following the AT&T divestiture of 1984, the end-user became responsible for all premises cabling for voice and data. Advancements in voice communications and the convergence of voice and data communications led to increasingly complex interactive systems owned and maintained by the end-user. These systems require a reliable electrical ground-reference potential. Grounding by attachment to the nearest piece of iron pipe is no longer satisfactory to provide ground-reference for sophisticated active electronics systems.

Section Contents

J-STD-607-A

Commercial Building Grounding and Bonding Requirements for Telecommunications

Design Considerations

Solid copper grounding busbars (1/4 in. thick x 4 in. high x variable length) are installed with insulated standoffs in entrance facilities and the equipment room, as well as each telecommunications room (1/4 in. thick x 2 in. high x variable length is sufficient here). Each busbar is drilled with rows of holes according to NEMA standards, for attachment of bolted compression fittings.

Telecommunications equipment, frames, cabinets and voltage protectors are typically grounded to these busbars. Busbars are connected by a backbone of insulated, solid copper cable between all closets and rooms (minimum 6 AWG, 3/0 AWG recommended). This backbone is connected to a main grounding busbar in the telecommunications entrance facility, to an earth ground in the electrical entrance facility and to structural steel on each floor. Bonding conductor cabling must be colored green or labeled appropriately.

Abbreviations

- Telecommunications main grounding busbar (TMGB)
- Telecommunications bonding backbone (TBB)
- Telecommunications grounding busbar (TGB)
- Telecommunications bonding backbone interconnecting bonding conductor (TBBIBC)

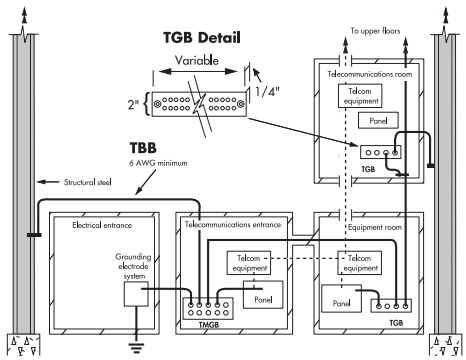


Figure 24 – Schematic of grounding/bonding network

ANSI/TIA/EIA-942 Standard

Purpose of the ANSI/TIA/EIA-942 Standard

Telecommunications Infrastructure Standard for Data Centers

The purpose of this standard is to provide requirements and guidelines for the design and installation of a data center or computer room. It is intended for designers who need a comprehensive understanding of the data center design including the facility planning, the cabling system and the network design. It facilitates the planning for data centers to occur earlier in the building development process (architectural, facilities and IT).

Data centers support a wide range of transmission protocols. Some of these protocols impose distance restrictions that are shorter than those imposed by this standard. When applying specific transmission protocols, consult standards, regulations, equipment manufacturers and system service suppliers for applicability, limitations and ancillary requirements. Consider consolidating standardized and proprietary cabling into a single structured cabling system.

The Standard specifies:

- Cabling design
- Network design
- Facilities design
- Informative annexes containing best practices and availability requirements
- Spaces
- Pathways
- Racks and cabinets.

Section Contents

ANSI/TIA/EIA-942

Telecommunications Infrastructure Standard for Data Centers

Data Center Cabling Infrastructure

The basic elements of a data center cabling system include the following:

- Horizontal cabling
- Backbone cabling
- Cross-connect in the entrance room or main distribution area
- Main cross-connect (MC) in the main distribution area
- Horizontal cross-connect (HC) in the telecommunications room, horizontal distribution area or main distribution area
- Zone outlet or consolidation point in the zone distribution area
- Outlet in the equipment distribution area

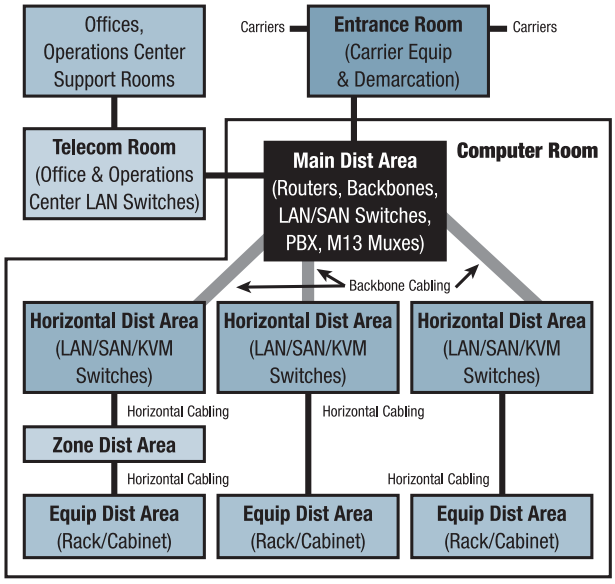


Figure 25 – Example of basic data center topology

Hot and Cold Aisles

Cabinets and racks shall be arranged in an alternating pattern, with the fronts of cabinets and racks facing each other in a row to create hot and cold aisles.

Cold aisles are in front of racks and cabinets. If there is an access floor, power distribution cables should be installed here under the access floor on the slab. Hot aisles are behind racks and cabinets. If there is an access floor, cable trays for telecommunications cabling should be located under the access floor in the hot aisles.

A minimum of 1 m (3 ft.) of front clearance shall be provided for installation of equipment. A front clearance of 1.2 m (4 ft.) is preferable to accommodate deeper equipment. A minimum of 0.6 m (2 ft.) of rear clearance shall be provided for service access at the rear of racks and cabinets. A rear clearance of 1 m (3 ft.) is preferable. Some equipment may require service clearances of greater than 1 m (3 ft.).

ANSI/TIA/EIA-942 Standard

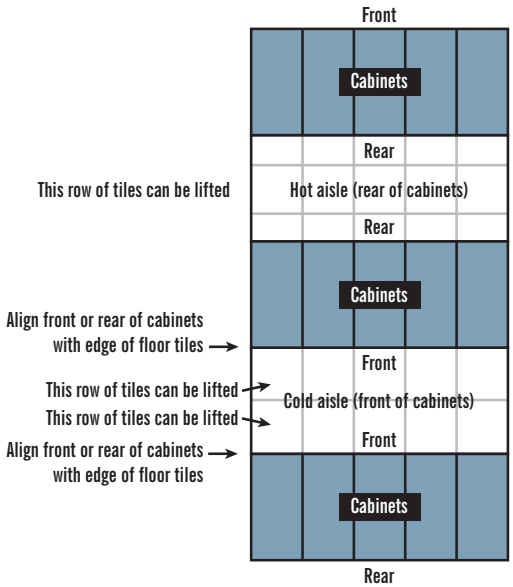


Figure 26 – Hot and cold aisles

Horizontal Cabling

The horizontal cabling is the portion of the telecommunications cabling system that extends from the mechanical termination in the equipment distribution area to either the horizontal cross-connect in the horizontal distribution area or the main cross-connect in the main distribution area. The horizontal cabling includes horizontal cables, mechanical terminations, and patch cords or jumpers. It may also include a zone outlet or a consolidation point in the zone distribution area.

The following partial listing of common services and systems should be considered when designing the horizontal cabling:

- Voice, modem and facsimile telecommunications service
- Premises switching equipment
- Computer and telecommunications management connections
- Keyboard/video/mouse (KVM) connections
- Data communications
- Wide area networks (WAN)
- Local area networks (LAN)
- Storage area networks (SAN)
- Other building signaling systems (building automation systems such as fire, security, power, HVAC, etc.)

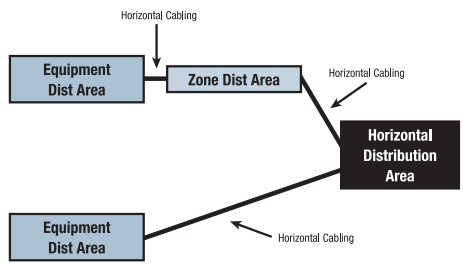


Figure 27 – Horizontal cabling using star topology

Maximum Equipment Area Cord Length				
	24 AWG UTP/24 ScTP Patch Cords		26 AWG ScTP Patch Cords	
Length of Horizontal Cable (H) m (ft.)	Maximum Length of Zone Area Cable (Z) m (ft.)	Maximum Combined Length of Zone Area Cables, Patch Cords and Equipment (C) m (ft.)	Maximum Length of Zone Area Cable (Z) m (ft.)	Maximum Combined Length of Zone Area Cables, Patch Cords and Equipment Cable (C) m (ft.)
90 (295)	5 (16)	10 (33)	4 (13)	8 (26)
85 (279)	9 (30)	14 (46)	7 (23)	11 (35)
80 (262)	13 (44)	18 (59)	11 (35)	15 (49)
75 (246)	17 (57)	22 (72)	14 (46)	18 (59)
70 (230)	22 (72)	27 (89)	17 (56)	21 (70)

Table 53 – Maximum length horizontal and equipment area cables

Backbone Cabling

The function of the backbone cabling is to provide connections between the main distribution area, the horizontal distribution area and entrance facilities in the data center cabling system. Backbone cabling consists of the backbone cables, main cross-connects, horizontal cross-connects, mechanical terminations and patch cord or jumpers used for backbone-to-backbone cross-connections.

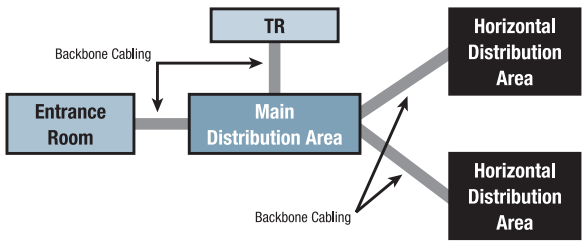


Figure 28 – Backbone cabling using star topology

ANSI/TIA/EIA-942 Standard

Recognized Cabling Media for Horizontal and Backbone Applications

Recognized cables, associated connecting hardware, jumpers, patch cords, equipment cords and zone area cords shall meet all applicable requirements specified in ANSI/TIA-568-C.2 and ANSI/TIA-568-C.3. *

- 100-ohm twisted-pair cable **
- Multimode optical fiber cable, either 62.5/125 μ or 50/125 μ, 50/125 μ 850-nm laser-optimized multimode fiber is recommended
- Single-mode optical fiber cable
- Recognized coaxial media: 75-ohm (734 and 735 type) coaxial cable (Telcordia Technologies GR-139-CORE) and coaxial connector (ANSI T1.404)

* Since publication of the ANSI/TIA/EIA-942 standard, the ANSI/TIA-568-C.2 and ANSI/TIA-568-C.3 standards supersede the referenced ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.3 standards.

** Although not part of the currrent ANSI/TIA/EIA-942 Standard, best practices for data centers would include recommending Cat 6A twisted-pair cabling ANSI/TIA-568-C.1 and ANSI/TIA-568-C.2.

Redundancy

Data centers that are equipped with diverse telecommunications facilities may be able to continue their function under catastrophic conditions that would otherwise interrupt the data center's telecommunications service. This standard includes four tiers relating to various levels of availability of the data center facility infrastructure. The tiers are related to research conducted by the Uptime Institute, which defines four tiers of performance as shown in the following table.

Providing redundant cross-connect areas and pathways that are physically separated can increase the reliability of the communications infrastructure. It is common for data centers to have multiple access providers that supply services, redundant routers, redundant core distribution and edge switches. Although this network topology provides a certain level of redundancy, the duplication in services and hardware alone does not ensure that single points of failure have been eliminated.

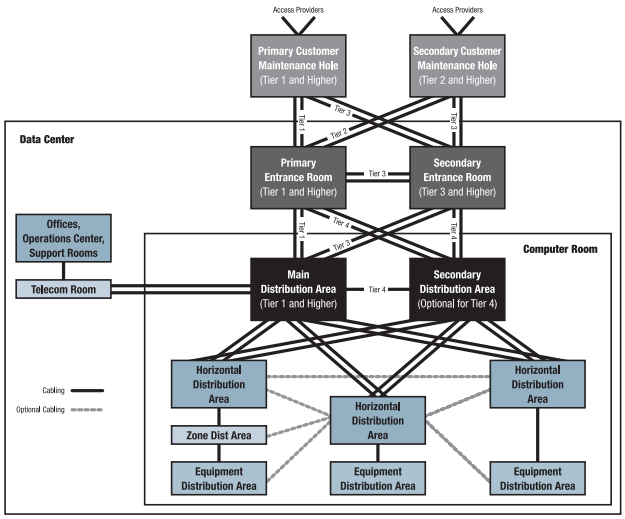


Figure 29 – Telecommunications infrastructure redundancy

Tier Clarification				
	Tier I: Basic	Tier II: Redundant Components	Tier III: Concurrently Maintainable	Tier IV: Fault Tolerant
Number of Delivery paths	Only 1	Only 1	1 Active, 1 Passive	2 Active
Redundant Components	N	N+1	N+1	2 (N+1) S+S
Support Space to Raised Floor Ratio	20%	30%	80-90%	100%
Initial Watts/ft.	20-30	40-50	40-60	50-80
Ultimate Watts/ft.	20-30	40-50	100-150	150+
Raised Floor Height	12 in.	18 in.	30-36 in.	30-36 in.
Floor Loading Pounds/ft.	85	100	150	150+
Utility Voltage	208, 480	208, 480	12-15 kV	12-15 kV
Months to Implement	3	3-6	15-20	15-20
Year First Deployed	1965	1970	1985	1995
Construction $/ft. Raised Floor	$450	$600	$900	$1,100+
Annual IT Downtime Due to Site	28.8 hrs.	22.0 hrs.	1.6 hrs.	0.4 hrs.
Site Availability	99.671%	99.749%	99.982%	99.995%

Table 54 – Uptime Institute tier references

ANSI/TIA-1005 Standard

Purpose of the ANSI/TIA-1005 Standard

This standard helps to enable the planning and installation of telecommunications cabling infrastructure within and between industrial buildings. In contrast to the ANSI/TIA-568-C series of wiring standards, which addresses commercial buildings, the central concept of this standard is the potential exposure to hostile environments in the industrial space. A prime design principle of this document is the special cabling system requirements for industrial operations.

Expected Usefulness:

- This standard is useful for those responsible for designing a telecommunications infrastructure to meet the requirements of an industrial environment.
- A working knowledge of this standard may prove beneficial in understanding problems associated with the unique aspects of industrial environments and applications.

The Standard's Specifics:

- Definition of structured cabling for commercial networks
- Definition of structured cabling for industrial networks
- The ANSI/TIA-1005 standard structure
- Industrial area concepts
- Recognized cables
- Recognized connectivity
- The automation outlet
- 2-pair cabling
- Multiconnect or Ethernet channels
- MICE

Terminology:

- **Automation island:** Area in proximity to the industrial machines
- **Automation outlet:** Where the generic telecommunications cabling ends and the automation-specific cabling begins
- **Device area:** Where system I/O interacts with control equipment
- **Industrial segment:** A point-to-point connection between two active industrial communications devices
- **MICE:** Mechanical, ingress, climate/chemical, electromechanical conditions

Increasing severity

	Classes		
Mechanical	M_1	M_2	M_3
Ingress rating	I_1	I_2	I_3
Climatic	C_1	C_2	C_3
Electromagnetic	E_1	E_2	E_3

The MICE matrix defines environmental classes in three levels and four parameters.

Legend

$M_1I_1C_1E_1$ describes a worst-case environment according to ISO/IEC 11801

$M_2I_2C_2E_2$ describes a worst-case light industrial environment

$M_3I_3C_3E_3$ describes a worst-case industrial environment

Industrial Areas

Industrial premises cabling may traverse from the front office through the factory floor. The factory floor (see Figure 31) may include work areas and automation islands. Typically, industrial premises encompass environments that are much harsher when compared to commercial office environments. As such, additional performance requirements for industrial-premises telecommunications components must be considered.

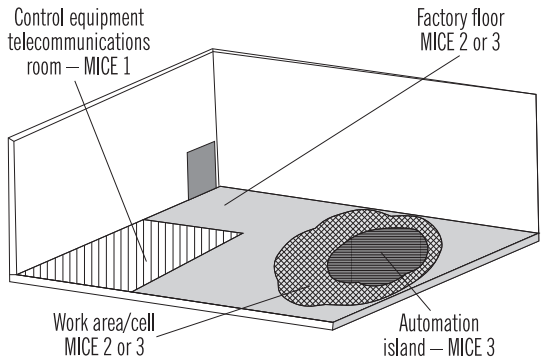


Figure 31 — Typical industrial environment

Control Equipment/Telecommunications Room

This area is equivalent to the MDC or IDC as defined in the ANSI/TIA-568-C.1. It is usually enclosed and protected from the factory environment and is located where the primary network interface equipment for the factory is housed.

Factory Floor Area

The factory floor is the space beyond the office in the manufacturing facility where the machines and work areas exist. These are typically high-traffic areas that require special consideration for the protection and placement of communications equipment. The factory floor environment is generally classified MICE 1 or higher.

Work Area

On a factory floor, the work area is where personnel interact with the telecommunications devices and industrial machines. Work areas often have more severe environments than the factory floor. It is important that the work area be properly designed for both occupants and control devices. The environment of the work area is generally classified MICE 1 or higher.

Automation Island Area

The automation island is the space on the factory floor in immediate proximity to or on the industrial machines and usually accompanies a work area. It is usually the most environmentally harsh area within the industrial premise. Accordingly, the automation island can often be identified as an area where humans are generally not present during machine cycling. In some cases, the automation island may extend into the work area. Components selected to be installed need to be compatible with the environment local to the components. The industrial machines require connectivity to machine control devices such as machine sensors, vision and general telecommunications devices. The environment of the automation island is generally classified MICE 3.

ISO, European and IEEE Standards

Purpose of the ISO/IEC 11801 Standard

The international standard provides users with an application-independent generic cabling system capable of supporting a wide range of applications. It provides users with a flexible cabling scheme, so modifications are both easy and economical. Building professionals (architects, for example) are given guidance on the accommodation of cabling at the initial stages of development.

The International Standard specifies a multimanufacturer cabling system that may be implemented with material from single and multiple sources and is related to:

- International standards for cabling components developed by committees in the IEC
- Standards for the installation and operation of information technology cabling as well as for testing of installed cabling
- Applications developed by technical committees of the IEC
- Planning and installation guides that take into account the needs of specific applications.

Generic cabling defined within this International Standard:

- Specifies a cabling structure supporting a wide variety of applications
- Specifies channel and link classes A, B, C, D and E, meeting the requirements of standardized applications
- Specifies channel and link classes E and F based on higher performance components to support future applications
- Specifies optical channel and link classes OF-300, OF-500 and OF-2000
- Involves component requirements and specifies cabling implementations that ensure performance of permanent links and channels that meet or exceed the requirements for cabling classes

The International Standard specifies a generic cabling system that is anticipated to have a usable life in excess of 10 years.

ISO 11801 Class E_A Standard

The requirements for ISO (the International Organization for Standardization) Class E_A are more demanding compared to the TIA/EIA Augmented Category 6 requirements. Anixter's Infrastructure Solutions Lab tests to the more stringent ISO standards.

ISO Compared to TIA		
Characteristics 500 MHz (dB)	**ISO Class E_A**	**TIA Augmented Category 6**
PSNEXT Loss	24.8 dB	23.2 dB
NEXT Loss	27.9 dB	26.1 dB
PSANEXT Loss	49.5 dB	49.5 dB
Return Loss	6.0 dB	6.0 dB
Insertion Loss	49.3 dB	49.3 dB
Referred to by IEEE	Yes	No

Table 55 – ISO Class E_A and TIA Category 6 performance comparison

TIA Category 6 versus Augmented Category 6 versus ISO Class E_A				
	TIA Category	**TIA Category**	**TIA Augmented**	**ISO Class E_A**
Recognized by IEEE 802.3an	No	Yes	Yes	Yes
55 Meter Distance Support	No	Yes	Yes	Yes
100 Meter Distance Support	No	No	Yes	Yes
Extrapolated Test Limits for NEXT and PSNEXT to 500 MHz	No	No	No	Yes

Table 56 – ISO and TIA 10GBASE-T media types

Table 56 summarizes the various UTP cabling options and their respective 10 Gigabit performance attributes as defined by the latest draft standards. Category 5e is not recognized as a viable cabling media to support 10 Gigabit transmission regardless of its installed cabling distance. Category 6 cabling will only support 10 Gigabit at a maximum installed distance of 55 meters.

Today, the only options for operating 10 Gigabit at 100 meters using RJ45 connectivity are the TIA Augmented Category 6 and ISO Class E_A standards. ISO's Class E_A system has superior NEXT and PSNEXT performance values when compared with the current TIA Augmented Category 6 standard.

IEEE 802.3af Power over Ethernet (PoE) Standard

The IEEE 802.3af specification calls for power source equipment (PSE) that operates at 48 volts of direct current. This guarantees 12.95 watts of power over unshielded twisted-pair cable to data terminal equipment (DTE) 100 meters away (the maximum distance supported by Ethernet). That's enough power to support IP phones, WLAN access points and many other DTE devices. Two PSE types are supported including Ethernet switches equipped with power supply modules called endspan devices and a special patch panel called a midspan device that sits between a legacy switch and powered equipment, injecting power to each connection.

IEEE 802.3at Power Over Ethernet+ (Plus) Standard

The IEEE 802.3at Power over Ethernet Plus amendment to the IEEE 802.3af standard offers improved power-management features and increases the amount of power to end devices. The new amendment will usher in new possibilities of powering devices through standard Category 5e, 6 and 6A cabling. It will allow many more devices, such as access control and video surveillance, to receive power over a twisted-pair cabling infrastructure.

The standard defines the technology for powering a wide range of devices up to 25 watts over existing Category 5e and above cables. The 802.3at standard states that 30 watts at a minimum are allocated at the port, so 24.6 watts are ensured at the end-device connector 100 meters away. It also allows for gigabit pass-through. PoE Plus represents a considerable upgrade over the existing PoE standard.

ISO, European and IEEE Standards

IEEE 802.3an, Physical Layer and Management Parameters for 10 Gbps Operation Type 10GBASE-T

Describes the physical layer (PHY) for 10 Gigabit Ethernet transmission over twisted-pair copper cable.

IEEE 802.3an Standard		
Standard	**Media**	**Distance**
ISO Class F (Individual Shields)	S/FTP	100 m
ISO Class E_A	UTP	100 m
TIA Augmented Category 6	UTP	100 m
Shielded Category 6 (Overall Shield)	F/UTP, ScTP, STP	100 m
TIA Standard Category 6/ISO Class E	UTP	<55 m

Table 57 – Maximum 10GBASE-T cabling distances

ANSI/TIA-568-C.2 (Augmented Category 6) and ISO 11801 (Class E_A) cable specifications are based on IEEE cabling models. 100 meters over UTP is only guaranteed when using Augmented Category 6 or ISO Class E_A compliant cabling systems.

TIA-568-B.2-ad10 Augmented Category 6 or ISO 11801 Class E_A Cables

10 Gigabit Ethernet Channel Applications			
Application	**10GBASE Fiber (802.3ae)**	**10GBASE-T**	**10GBASE-CX4 (802.3ak)**
Data Center (Server Clustering)	Yes	Yes	Yes (<15 m)
Horizontal (In Building)	No	Yes	No
Vertical (Risers)	Yes	No	No
Campus/Metro	Yes	No	No

Table 58 – 10 Gigabit Ethernet applications and recommended protocols

In Table 58, the recommended application roadmaps for 10 Gigabit Ethernet cabling and protocol types have been provided. The choice of which media to use will revolve around three variables:

- Circuit distances
- Cost
- Active equipment interfaces (connectors)

10GBASE fiber will maintain traditional applications in backbones and risers and also in the data center for server clustering.

10GBASE-T copper will remain in the traditional areas of application (in horizontal building cabling but also in the data center between servers and clusters).

10GBASE-CX4 defines a multiconductor copper solution primarily designed to connect servers and switches over short distances.

IEEE 802.3ba Media Access Control Parameters, Physical Layers and Management Parameters for 40 Gbps and 100 Gbps Operation

The 802.3ba amendment to the IEEE 802.3-2008 standard defines Media Access Control (MAC) parameters, physical layer specifications and management parameters for the transfer of 802.3 frames at 40 Gbps and 100 Gbps. The updated amendment will facilitate the migration of 10 Gigabit Ethernet from the network core to the network edge by providing 40 Gbps and 100 Gbps data rates for backbone and backhaul applications to effectively remove the bandwidth bottleneck that exists in many corporate networks today. The following media types and distances are approved as part of the 802.3ba amendment:

40 Gigabit Ethernet		
Protocol	**Media**	**Distance**
40GBASE-CR4	Twinax	10 m
40GBASE-SR4	OM3 MMF	100 m
40GBASE-SR4	OM4 MMF	150 m
40GBASE-LR4	SMF	10 km

100 Gigabit Ethernet		
Protocol	**Media**	**Distance**
100GBASE-CR10	Twinax	10 m
100GBASE-SR10	OM3 MMF	100 m
100GBASE-SR10	OM4 MMF	150 m
100GBASE-LR4	SMF	10 km
100GBASE-ER4	SMF	40 km

Table 59 – 40 Gbps and 100 Gbps approved media types and distances

ISO, European and IEEE Standards

IEEE 802.11 Wireless Standard

IEEE 802.11, the Wi-Fi standard, denotes a set of wireless LAN/WLAN standards developed by working group 11 of the IEEE LAN/MAN standards committee (IEEE 802). The term 802.11x is also used to denote this set of standards and is not to be mistaken for any one of its elements. There is no single 802.11x standard.

802.11 details a wireless interface between devices to manage packet traffic (to avoid collisions, etc.). Some common specifications and their distinctive attributes include the following:

802.11a – Operates in the 5 GHz frequency range (5.125 to 5.85 GHz) with a maximum 54 Mbps signaling rate. The 5 GHz frequency band isn't as crowded as the 2.4 GHz frequency because it offers significantly more radio channels than the 802.11b and is used by fewer applications. It has a shorter range than 802.11g, is actually newer than 802.11b and is not compatible with 802.11b.

802.11b – Operates in the 2.4 GHz Industrial, Scientific and Medical (ISM) band (2.4 to 2.4835 GHz) and provides signaling rates of up to 11 Mbps. This is a commonly used frequency. Microwave ovens, cordless phones, medical and scientific equipment, as well as Bluetooth® devices, all work within the 2.4 GHz ISM band.

802.11e – Ratified by the IEEE in late September 2005, the 802.11e quality-of-service specification is designed to guarantee the quality of voice and video traffic. It will be particularly important for companies interested in using Wi-Fi phones.

802.11g – Similar to 802.11b, this standard supports signaling rates of up to 54 Mbps. It also operates in the heavily used 2.4 GHz ISM band but uses a different radio technology to boost overall throughput. Compatible with older 802.11b.

802.11i – Also sometimes called Wi-Fi Protected Access 2 (WPA 2), 802.11i was ratified in June 2004. WPA 2 supports the 128-bit-and-above Advanced Encryption Standard, along with 802.1x authentication and key management features.

802.11k – Passed in June 2008, the 802.11k Radio Resource Management Standard will provide measurement information for access points and switches to make wireless LANs run more efficiently. It may, for example, better distribute traffic loads across access points or allow dynamic adjustments of transmission power to minimize interference.

802.11n – Ratified in September 2009, 802.11n is a set of standards for wireless local area network (WLAN) communications, developed by the IEEE LAN/MAN Standards Committee (IEEE 802) in the 5 GHz and 2.4 GHz public spectrum bands. The proposed amendment improves upon the previous 802.11 standards by adding multiple-input multiple-output (MIMO) and many other newer features.

Anixter Infrastructure Solutions Lab

The Anixter Infrastructure Solutions Lab

Anixter's Infrastructure Solutions Lab actively demonstrates the best practical technology solutions from best-in-class manufacturers in the area of enterprise cabling, video security and access control for our customers. Our mission for The Lab is simple—educate, demonstrate and evaluate.

- **Educate** customers on the latest industry standards and technologies
- **Demonstrate** the latest infrastructure product solutions available from our manufacturer partners
- **Evaluate** our network infrastructure and security solutions to ensure that our customers are selecting the right products for their specific needs

We are continually testing products in The Lab to ensure:

- Quality products are recommended and delivered to our customers
- Consistency of performance across product lines and within systems
- Interoperability of products and systems to ensure customers can integrate systems and follow the trend toward convergence.

Networking and security product testing at The Lab includes:

- Random performance testing of Anixter inventory to ensure quality of standards compliance
- Network throughput and interoperability testing
- Copper and fiber cabling compliance verification (TIA/EIA, ISO/IEC, IEEE)
- Customer proof of concept
- Power over Ethernet (PoE)
- Application testing
- 10 Gig Ethernet cabling testing
- Video over IP, video quality and bandwidth utilization
- Power over Ethernet capability and verification
- Digital compression image quality vs. analog technology testing
- Evaluation of analog and IP cameras, video management software evaluation, DVR, NDVR and NVR products.

THE LAB
ANIXTER'S INFRASTRUCTURE SOLUTIONS LAB

Anixter's Infrastructure Solutions Lab In Action

Challenge: Leading Pennsylvania University Explores Campuswide Rewiring Project

Anixter Infrastructure Solutions Lab Resolution: The Anixter Infrastructure Solutions Lab was called upon to help this university determine which copper cabling system would best meet its current and future information technology needs. The university had a variety of different copper cabling products installed in its network infrastructure: Category 3, Category 5 and some Category 5e. The Anixter Infrastructure Solutions Lab deployed computer applications that the university typically carried over its cabling infrastructure, including Lotus Notes, SAP and streaming video. Testing found that its current infrastructure was consistently dropping information, causing the network to operate slowly and inefficiently. This same traffic was sent over a Category 6 infrastructure with no degradation to the data. Armed with testing from the Anixter Infrastructure Solutions Lab, university IT professionals wrote cabling infrastructure specifications around a higher performing Category 6 system that better met the university's network performance needs.

Challenge: Major Railway Company Needs Video Surveillance to Monitor Switchyard

Anixter Infrastructure Solutions Lab Resolution: A railroad company wanted to use video surveillance to monitor yards as it assembled unit trains, but it had a big cabling challenge. Installing traditional cabling in the switchyard would have entailed major disruptions and expense for the customer. Instead, Anixter's Infrastructure Solutions Lab recommended a sophisticated wireless Internet video surveillance system that did not require cabling. Anixter was able to simulate the wireless Internet video surveillance solution in the Infrastructure Solutions Lab for the customer. The Infrastructure Solutions Lab also provided this customer with test results illustrating how much bandwidth the video solution would absorb on the customer's network as well as the video quality the customer could expect from the recommended system.

Challenge: National Insurance Company with Data Center Cabling Choice

Anixter Infrastructure Solutions Lab Resolution: The Anixter Infrastructure Solutions Lab assessed backbone cabling requirements based on the current and future bandwidth needs for this insurance provider. The Anixter Infrastructure Solutions Lab ran representative network traffic over 62.5-micron, 50-micron and laser-optimized 50-micron fiber (OM3) to ascertain which would best meet the company's needs. These tests were key in determining that the OM3 was the customer's best choice.

Anixter's 10 Gigabit Ethernet Cabling Testing

Anixter Infrastructure Solutions Lab is the only UL Certified lab to conduct rigorous, independent third-party testing of emerging 10 Gigabit cabling solutions. Anixter's 10 Gigabit cabling testing examines electrical characteristics such as insertion loss, return loss and crosstalk, but also looks at alien crosstalk (which is part of the Augmented Category 6 spec). To ensure the 10 Gigabit cabling solutions we sell meet the highest levels of performance and reliability, the Anixter Infrastructure Solutions Lab tests the toughest performance parameter, alien crosstalk, in the "worst case" scenario. Customers can rest assured that the cabling solutions Anixter sells will provide the network performance they require.

Reference Documents

Reference Documents for Further Information on Cabling Standards

IEEE 802.3ba (2010)
Media Access Control Parameters, Physical Layers and Management Parameters for 40 Gbps and 100 Gbps Operation

ANSI/TIA-568-C.0 (2009)
Generic Telecommunications Cabling for Customer Premises

ANSI/TIA-568-C.1 (2009)
Commercial Building Telecommunications Standard

ANSI/TIA-568-C.2 (2009)
Balanced Twisted-Pair Telecommunications Cabling and Component Standard

ANSI/TIA-568-C.3 (2009)
Optical Fiber Cabling Components

ANSI/TIA-1005 (2009)
Telecommunications Infrastructure for Industrial Premises

IEEE 802.3at (2009)
Power over Ethernet Plus

IEEE 802.3an (2006)
Physical Layer and Management Parameters for 10 Gbps Operation, Type 10GBASE-T

TIA/EIA-942 (2005)
Telecommunications Infrastructure Standard for Data Centers

ANSI/TIA/EIA-569-B (2004) ..... (CSA T530)*
Commercial Building Standard for Telecommunications Pathways and Spaces

IEEE 802.3af (2003)
Power over Ethernet (PoE) Standard

ISO/IEC 11801 (2002)
Generic Cabling for Customer Premises

J-STD-607-A (2002) ..... (CSA T527)*
Commercial Building Grounding/Bonding Requirements for Telecommunications

TIA/EIA-606-A (2002) ..... (CSA T528)*
Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

TIA/EIA-570-A (1999) ..... (CSA T525)*
Residential and Light Commercial Telecommunication Wiring Standard

TIA/EIA-758 (1999)
Customer-Owned Outside Plant Telecommunications Cabling Standard

IEEE 802.3-1998 (1998)
Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specification (also known as ANSI/IEEE Std 802.3-1998 or ISO 8802-3: 1990 (E))

IEEE 802.11
Wireless Standard

802.11n (2009)

802.11k (2008)

802.11e (2005)

802.11i (2004)

802.11a (2003)

802.11b (2003)

802.11g (2003)

*Canadian Standards Association equivalent document

Obtaining Standards Documents

TIA/EIA documents may be purchased through Global Engineering Documents at 800.854.7179 or www.global.ihs.com. IEEE documents may be purchased through IEEE, P.O. Box 1331, Piscataway, NJ 08855 or www.ieee.org. CSA documents may be purchased through the Canadian Standards Association at www.csa.ca or by calling 416.747.4000.

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Glossary

A

A—Ampere.

abrasion resistance—Ability to resist surface wear.

AB switch—A cable switch capable of switching one cable to one of two branch cables, A or B.

AC—Alternating current.

accelerated aging—A test that duplicates long time environmental conditions in a relatively short time.

acceptance test—Made to demonstrate the degree of compliance with specified requirements.

access group—In LAN technology, all stations have identical rights to make use of computer, network or data PABX resources.

access line—The connection between a subscriber's facility and a public network—either a PDN, public switched network or public telephone network. Also, see LOCAL LINE.

access method—1. In IBM environments, a host program that manages the movement of data between the main storage and an input/output device of a computer system; BUAM, TCAM, VTAM are common data communications access methods. 2. In LAN technology, a means to allow stations to gain access to—to make use of—the network's transmission medium; classified as shared access, which is further divided into explicit access or contended access on discrete access method.

access unit—In the IBM token-ring network, a wiring concentrator.

ACR (attenuation to crosstalk ratio)—The relationship between a signal's attenuation and near-end crosstalk (NEXT) levels expressed in decibels. ACR = usable bandwidth.

active converter—A device that converts one communication signaling standard to another (e.g., 10BASE-T to RS-232). Active converters require separate AC power sources.

active device—Any electronic device that is supplied activating power, normally from an external source. An amplifier is a typical active device.

A/D (analog/digital)—An integrated circuit device that converts analog signals to digital signals initiating them.

adapter—A device that enables different sizes or types of plugs to mate with one another, provides for the rearrangement of leads, allows large cables with numerous wires to fan out into smaller groups of wires, or makes interconnections between cables. In fiber optics, it joins two connectors of the same (or different) types.

adaptive equalizer—An equalizer that adjusts to meet varying line conditions; most operate automatically.

address—The location of a terminal, a peripheral device, a node or any other unit or component in a network.

administration subsystem—The part of a premises distribution system that includes the distribution hardware and components for adding or rearranging circuits. These components include cross-connects, interconnects and their associated patch cords and plugs.

ADP—Automatic data processing.

ADPCM (adaptive differential pulse code modulation)—An encoding technique standardized by the CCITT that allows an analog voice conversation to be carried within a 32 kbps digital channel. Three or four bits are used to describe each sample, which represents the difference between two adjacent samples. Sampling is done 8,000 times per second.

ADU—Asynchronous data unit.

AES (advanced encryption standard)—A type of cryptographic algorithm used to protect sensitive (unclassified) information. Usually seen in conjunction with wireless applications.

AF—Audio frequency.

aging—The irreversible change of material properties after exposure to an environment for an interval of time.

AIT (advanced intelligent tape)—A type (format) of recording tape.

AL—Aluminum.

alarming—The ability of CCTV equipment to respond to an input signal, normally a simple contact closure. The response varies depending on equipment type.

alloy—A substance having metallic properties and being composed of an elemental metal and one or more chemical elements.

ALPETH—Telecommunications cable employing a corrugated aluminum shield and an outer polyethylene jacket.

alternating current—Electric current that periodically reverses direction. Alternating current is generally abbreviated AC.

AM (amplitude modulation)—A method of adding information to an electronic signal where the height (amplitude) of the wave is changed to convey the added information.

ambient—Conditions existing at a test operation location prior to energizing of equipment (e.g., ambient temperature).

ambient temperature—The temperature of a cable group when there is no load on any cable of the group or on the duct bank containing the group.

AMI (alternate mark inversion)—A T-1 line code.

ampacity—The current a device can carry within specified temperature limitations in a specified environment dependent upon a) temperature rating; b) power loss; and c) heat dissipation.

ampere—A standard unit of current. Designated as the amount of current that occurs when one volt of EMF is applied across one ohm of resistance. An ampere of current is produced by one coulomb of charge passing a point in one second.

ampere-turn—The product of amperes times the number of turns in a coil.

amplifier—A device used to boost the strength of an electronic signal.

amplitude—The maximum value of a varying wave form.

amplitude distortion—An unwanted change in signal amplitude, usually caused by nonlinear elements in the communications path.

analog—Not digital. A continuously varying waveform.

analog loopback—Technique for testing transmission equipment and devices. It isolates faults to the analog signal receiving or transmitting circuitry, where a device, such as a modem, echoes back a received (test) signal that is then compared with the original signal.

angle of view—The angular range that can be focused within the image size. Small focal lengths give a wide angle of view, and large focal lengths give a narrow field of view.

ANI (automatic number identification)—Provides the telephone number of an incoming call for various purposes.

anneal—To soften and relieve strains in any solid material, such as metal or glass, by heating to just below its melting point and then slowly cooling it. This also generally lowers the tensile strength of the material while improving its flex life.

annular ring—An 8 mm (5/16 in.) wide black band printed at 2.5 m (8.2 ft.) intervals on standard Ethernet coaxial cable to identify locations at which transceivers may be connected.

ANSI—American National Standards Institute.

API (application programming interface)—Defines the methods by which other software applications can access and/or control a given system.

APPN (advanced peer-to-peer networking)—A System/46 feature that provides distributed processing through a set of services based on Node Type 2.1 network node and Logical Unit 6.2. These services include connectivity, directory, route selection, session activation and data transport and provide for distributed, dynamic node resource updates and intermediate, pass-through node capabilities.

Glossary

aperture—The opening of a lens that controls the amount of light reaching the surface of the pickup device. The size of the aperture is controlled by the iris adjustment. By increasing the f-stop number (f1.4, f1.8, f2.8, etc.) less light is permitted to pass to the pickup device.

approved—1. Acceptable to the authority having legal enforcement. 2. Per OSHA: a product that has been tested to standards and found suitable for general application, subject to limitations outlined in the nationally recognized testing lab's listing.

architecture—The manner in which a system (such as a network or a computer) or program is structured. See also CLOSED ARCHITECTURE, DISTRIBUTED ARCHITECTURE and OPEN ARCHITECTURE.

ARCNET (Attached Resource Computer NETwork)—The Datapoint 2.5 Mbps local area network that was one of the first local area networks.

armor—Mechanical protector for cables; usually a helical winding of metal tape, formed so that each convolution locks mechanically upon the previous one (interlocked armor); may be a formed metal tube or a helical wrap of wires.

array connector—A connector that aligns and protects the 12 fibers from a ribbon fiber cable. A fanout array design can be used to connect ribbon fiber cables to non-ribbon cables.

AS/400—Application Systems, IBM's midrange computer system that was originally designed to operate on twinax cable, may now also be implemented on unshielded twisted pair with the use of twinax baluns.

ASCII (American National Standard Code for Information Interchange)—A seven bit plus parity code established by the American National Standards Institute to achieve compatibility among data services and consisting of 96 displayed upper and lower case characters and 32 nondisplayed control codes.

ASCII Terminal—A terminal that uses ASCII; usually synonymous with asynchronous terminal and with dumb terminal.

ASIC—An IC designed for specific applications, typically a gate array or a full custom chip.

ASIS (American Society of Industrial Security)—A professional organization for the security industry.

ASP—Telecommunications cable employing a corrugated aluminum shield (A), corrugated steel shield (S) and an outer polyethylene (P) jacket. Considered rodent-resistant and used primarily in underground applications.

aspect ratio—The ratio of the picture frame width to the picture frame height in standard TV systems. It is four units horizontal and over three units vertical.

aspherical lens—A lens designed with a nonspherical shape that refracts the light passing through it to either lower the lens aperture, so it passes more light or decrease barrel distortion on wide angle lenses.

ASTM (American Society for Testing and Materials)—A group writing standards for testing materials and specifications for materials.

ASU (automatic switch unit)—Provides automatic switching from one coaxial cable or network component to a redundant cable or network component in response to loss of signal on the primary cable or component.

ASYNC—Asynchronous.

asynchronous—Transmission in which each information character is individually synchronized, usually by means of start and stop elements. Also called start-stop transmission.

asynchronous terminal—A terminal that uses asynchronous transmission, usually synonymous with ASCII terminal and with dumb terminal.

ATDM (asynchronous time-division multiplexing)—A TDM that multiplexes asynchronous signals by over-sampling; also infrequently used to mean a concentrator.

ATA (analog terminal adapter)—A device that converts an analog terminal, like a phone, to one that works on an ISDN line or Ethernet. (Analog to IP phone device is one example.)

ATM (asynchronous transfer mode)—A connection-type transmission mode carrying information organized into blocks (header plus information field); it is asynchronous in the sense that recurrence of blocks depends on the required or instantaneous bit rate. Statistical and deterministic values have been proposed that correspond respectively to the packet and circuit values defined for information transfer mode.

attenuation—The decrease in magnitude of a wave as it travels through any transmitting medium, such as a cable or circuitry. Attenuation is measured as a ratio or as the logarithm of a ratio (decibel).

attenuation constant—A rating for a cable or other transmitting medium, which is the relative rate of amplitude decrease of voltage or current in the direction of travel. It is measured in decibels per unit length of cable.

audio—A term used to describe sounds within the range of human hearing. Also used to describe devices that are designed to operate within this range.

audio frequency—That range of frequencies lying within the range of human hearing: approximately 20 to 20,000 Hz.

AUI (Attachment Unit Interface)—The interface between the Ethernet/IEEE 802.3 controller and the baseband transceiver or broadband modem.

automatic frequency control (AFC)—An electronic circuit used whereby the frequency of an oscillator is automatically maintained within specified limits.

automatic gain control (AGC)—An electronic circuit where the gain of a signal is automatically adjusted as a function of its input or other specified parameter.

automatic iris lens—A lens in which the aperture automatically opens or closes to maintain proper light levels on the faceplate of the camera pickup device.

automatic level control (ALC)—A feature on auto iris lenses (also known as the peak/average control). Adjusting this control allows the auto iris circuitry to either take bright spots more into consideration (peak), bringing out detail in bright areas, or less into consideration (average) bringing out detail in shadows.

auto-terminating—A feature where the equipment (e.g., monitor) automatically selects the correct termination depending on whether the video output BNC is connected.

auto white balance—A feature on color camera that constantly monitors the light and adjusts its color to maintain white areas.

AVD (alternate voice data)—Telephone lines that have been electronically treated to handle both voice and data signals. Typically used on leased overseas circuits to save money.

AWG (American Wire Gauge)—A standard measurement in the determination of the physical size (diameter) of a conductor determined by its circular mil area. The gauge varies inversely with the actual wire diameter. The larger the gauge number, the smaller the wire.

B

B8ZS (Binary Eight Zero Suppression)—A method of converting eight consecutive zero bits into a recognizable, intentionally bipolar violation. The violation is converted back into eight zero bits at the receiving end. Equipment at both ends of the span must be compatible with B8ZS for proper operation. Also called Binary Eight Zero Substitution.

backbone—1. In packet switched networks, the major transmission path for a PDN. 2. The trunk media of a multimedia LAN separated into sections by bridges, gateways or routers. 3. PDS terminology for that part of the distribution system, including both wire and fiber cables, which is often called riser or house distribution. The backbone does not include the interconnection cables that connect ISN equipment, such as packet controllers and concentrators, to cross-connects or interconnects.

backbone drop—A network drop that is connected directly to the backbone segment.

Glossary

backbone network—In an extended LAN, the network whose primary function is to forward network datagrams between the other networks in the extended LAN.

backbone segment—In a single Ethernet LAN, the Ethernet segment whose primary function is to forward datagrams between the other segments in the Ethernet. See BRANCH SEGMENT.

backbone subsystem—The part of a premises distribution system that includes the main cable route and the facilities for supporting the cable. The riser subsystem usually extends from an equipment room (often in a building's basement) to the upper floors in a multistory building or along the same floor in a single-story building. It is terminated on a cross-connect in a riser closet, at the network interface or on the distribution components of the campus subsystem.

backfill—The materials placed to fill an excavation, such as sand backfill in a trench.

back focal distance—The distance from the rear most portion of the lens to the image plane.

back light compensation (BLC)—A feature on newer CCD cameras that electronically compensates for high-background lighting to give detail that would normally be silhouetted.

balanced line—A cable having two identical conductors with the same electromagnetic characteristics in relation to other conductors and to ground.

ballast—A device designed to stabilize current flow.

BALUN (BALanced/UNbalanced)—A device that converts the impedance of one interface to the impedance of a second interface (usually coax to UTP).

bandwidth—The width of a communications channel, measured as frequency (in cycles per second or hertz). A channel's bandwidth is a major factor in determining how much information it can carry.

bare conductor—A conductor having no insulation or jacket.

barrel connector—A female connector for connecting two sections of coaxial cable.

BAS—Building automation systems.

baseband—A signaling technique in which the signal is transmitted in its original form and not changed by modulation (e.g., CCTV video X).

baseband LAN—A local area network employing baseband signaling.

baseband modem—A modem that does not modulate the signal before transmission, thereby transmitting the signal in its native form. Baseband signaling is the transmission of either digital or analog signals at their original frequencies.

baseband network—A type of network that carries a single channel of communications signals.

baseband system—A data transmission system in which information is encoded, multiplexed and transmitted without modulation of a carrier.

baseband transmission—Transmission method used for short distances (less than 10 miles). Uses a bandwidth whose lowest frequency is zero (DC level) for transmission of raw (carrierless) binary data. The transmission medium carries only one signal at a time.

battery backup—A battery that provides power when the main AC power fails.

battery backup unit—An optional unit within an ISN packet controller that consists of three batteries connected in series. When AC power fails, the battery backup unit delivers 144 volts DC to the power supplies on each shelf of the packet controller.

baud—The number of signal (or state) changes in a carrier per second; also referred to as baud rate. The maximum baud rate of a modem is limited by the bandwidth of the phone line.

BCD (binary coded decimal)—Group of binary digits representing decimal numbers, with each number allocated four binary digits. This system is widely used in telecommunications computer projects.

Beldfoil—Belden trademark for highly effective electrostatic shield using reinforced metallic foil.

bend radius—1. In fiber cable, the radius of curvature that a fiber can bend without breaking or causing excessive loss. 2. In copper cable, the minimum radius that a cable can be bent without the possibility of causing structural or electrical damage to the cable.

BEP—Building entrance protection.

BER (bit error rate)—The ratio of received bits that are in error, relative to a specific amount of bits received; usually expressed as a number referenced to a power of 10.

BERT (bit error rate tester)—A network diagnostic instrument used to troubleshoot LANs.

BICSI—Building Industry Consulting Service International.

binary—1. A half-duplex, character-oriented synchronous data communications protocol originated by IBM in 1964. 2. Digital system with two states: 1 and 0.

binary encoded—A signal consisting of two states such as on or off, high or low level, one or zero, or presence or absence of a signal.

binder—A tape or thread used for holding assembled cable components in place.

bipolar transmission—Method of sending binary data in which negative and positive states alternate; used in digital transmission facilities such as DDS and T1. Sometimes known as polar transmission.

bipolar violation—Two or more successive pulses having the same polarity in a bit stream.

birdcage—The undesired unwinding of a stranded cable.

BISDN (broadband ISDN)—A form of the integrated services digital network (ISDN) that will carry digital transmission at rates equal to or greater than the T1 rate (1.544 megabits per second). BISDN standards packetize information (e.g., voice, data and video) into fixed-length cells for transmission over synchronous optical networks.

bit—Contraction of binary digit; fundamental unit of information expressed in digital form as the choice between only two states, for example, 0 or 1, or high or low, or on or off.

bits per second (bps)—The number of bits of data transmitted by a modem through a phone line in one second. To get the bps rate of a modem, multiply the number of signal changes per second (baud rate) by the number of bits of information carried by each change.

bit stream—A digital signal or series of pulses.

black level—The level of the video signal that corresponds to the maximum limits of the black areas of the picture.

blanking—The process of cutting off the electron beam in a camera pickup device or picture tube during the retrace period. It is a signal that is composed of recurrent pulses at line and field frequencies. It is intended primarily to make the retrace on a pickup device or picture tube invisible.

blooming—The halation and defocusing effect that occurs around the bright areas of the picture (highlight) whenever there is an increase in the brightness intensity.

BNC—Common connector for coax. BNC is said to be short for Bayonet-Neill-Concelman.

bonding—The connecting together of all building and equipment electrical grounds to eliminate differences in electrical ground potential.

BPS or BIS (bits per second)—The number of bits passing a point per second. A measure of the speed of transmission of digital information; used to describe the information transfer rate on a circuit.

braid—Textile or metallic filaments interwoven to form a tubular structure which may be applied over one or more wires or flattened to form a strap (see shield).

branch—An intermediate cable distribution line in a broadband coaxial network that either deeds or is fed from a main trunk. Same as a feeder.

branch network—In an extended LAN, any network that is linked by a bridge to the backbone network or to another branch network. Every network except the backbone network is a branch network.

branch segment—In a single Ethernet LAN, any segment that is linked by a repeater to the backbone segment. Branch segments carry datagrams to and from stations on the branch segment to the backbone segment.

breaking strength—The maximum load that a conductor attains when tested in tension to rupture.

Glossary

BRI (basic rate interface)—The ISDN term that refers to the basic ISDN interface of 2B + D. Operating at 144 kbps, BRI provides two B (bearer) channels at 64 Kbps and a D (data) channel at 16 kbps.

bridge—A circuit that measures by balancing four impedances through which the same current flows:

Wheatstone—Resistance.

Kelvin—Low resistance.

Schering—Capacitance, dissipation factor, dielectric constant.

Wien—Capacitance, dissipation factor.

bridged tap—The multiple appearances of the same cable pair at several distribution points.

bridging—A term indicating that a high-impedance video line is paralleled, usually through a switch, to a source of video.

broadband LAN—A LAN that uses FDM (frequency division multiplexing) to divide a single physical channel into a number of smaller independent frequency channels. The different channels created by FDM can be used to transfer different forms of information: voice, data, and video.

broadcast—The act of sending a signal from one station on a LAN to all other stations, all of which are capable of receiving that signal.

B&S—Brown and Sharpe wire gauge; same as AWG.

BSC (binary synchronous communications)—A byte- or character-oriented IBM communications protocol that has become an industry standard. It uses a defined set of control characters and sequences for synchronized transmission of binary-coded data between stations in a data communications system.

buffer—A protective coating in intimate contact with an optical fiber.

building entrance area—The area inside a building where cables enter and are connected to riser cables and where electrical protection is provided. The network interface, as well as the protectors and other distribution components for the campus subsystem, may be located here.

bus—A network topology that functions like a signal line that is shared by a number of nodes.

bus and tag (serpentine) cable assembly (IBM)—This assembly used as an interface from IBM 360/370/380 mainframe computers.

bus network—A one-cable LAN, in which all workstations are connected to a single cable. On a bus network, all workstations hear all transmission on the cable. Each workstation then selects those transmissions addressed to it.

byte—A collection of bits operated upon as a unit. Most bytes are eight bits long, and most character sets use one byte per character. The capacity of storage devices is frequently given in bytes or in K bytes (K meaning 1,024 bytes).

C

C—Symbol designation for capacitance, bias supply and centigrade.

C mount/CS mount—CCTV lenses are available in two different lens mounts. C mount lenses have a flange back distance of 17.5 mm vs. 12.5 mm for CS mount lenses. Many of today's cameras can accept either type of lens, but it is important to make sure the camera and lens are compatible and set up properly. C mount lenses can be used on CS mount cameras by utilizing a 5 mm adapter or adjusting the camera for C mount lenses. Because of the short back focal distance, CS mount lenses can only be used on CS mount cameras. Your picture will be out of focus if you use a CS mount lens on a C mount camera.

CCD (charged coupled device)—A CCD chip that is the pickup device on a camera, performing a similar function as a camera tube.

cabinet—A physical enclosure for rack-mount equipment; standard cabinets have 1 3/4 in. vertical spacing between mounting holes and 19 in. wide horizontal spacing between mounting rails.

cable assembly—See PATCH CORD.

cable-based LAN—A shared-medium LAN that uses a cable for its transmission medium.

cable concentrator—A device that converts several individual cables to a larger single cable without loss of signal information.

cable loss—The amount of RF (radio frequency) signal attenuated by coaxial cable transmission. The cable attenuation is a function of frequency, media type and cable distance. For coaxial cable, higher frequencies have greater loss than lower frequencies and follow a logarithmic function. Cable losses are usually calculated for the highest frequency carried on the cable.

cable, pressurized—A cable having a pressurized fluid (gas or oil) as part of the insulation; nitrogen and oil are the most common fluids.

cable, spacer—An aerial distribution cable made of covered conductors held in place by insulated spacers; designed for wooded areas.

cable system, cabling system—In LAN technology, the medium used to interconnect stations; often called the premises network.

cable tilt—The increase in cable attenuation as the frequency increases.

cable, tray—A multiconductor cable having a nonmetallic jacket designed for use in cable trays per the National Electrical Code.

cabling—The method by which a group of insulated conductors is mechanically assembled (or twisted together).

CAD—Computer aided design.

campus subsystem—The part of a premises distribution system that includes the cable, interbuilding distribution facilities, protectors and connectors that enable communications among multiple buildings on a premises.

candlepower—The unit measure of an incident light.

capacitance—The ability of a dielectric material between conductors to store electricity when a difference of potential exists between the conductors. The unit of measurement is the farad, which is the capacitance value that will store a charge of one coulomb when a 1-volt potential difference exists between the conductors. One farad is the capacitance value that will permit one ampere of current, when the voltage across the capacitor changes at the rate of one volt, per second.

capacitive reactance—The opposition to alternating current due to the capacitance of a capacitor, cable or circuit. It is measured in ohms and is equal to 1/6.28 fC where f is the frequency in Hz and C is the capacitance in farads.

capacitor—Two conducting surfaces separated by a dielectric material. The capacitance is determined by the area of the surface, types of dielectric and spacing between the conducting surfaces.

carbon block—A device for protecting cable from being hit by lightning strikes in electrical storms. The carbon block consists of two electrodes spaced, so any voltage above the design level is arced from line to ground. Carbon block protectors are used commonly in both local customer offices and central offices. They are effective, but can be destroyed if high voltage is directly applied—as in a direct strike by lightning. See also GAS DISCHARGE TUBE.

carrier—An AC electrical signal that is used to carry information.

carrier band—A band of continuous frequencies that can be modulated with a signal.

cascade—The number of amplifiers connected in series on a broadband trunk cable.

cathode—1. The negative electrode through that current leaves a nonmetallic conductor, such as an electrolytic cell. 2. The positive pole of a storage battery. 3. In vacuum tubes, the electrode that emits electrons.

cathode-ray tube—The electronic tube that has a screen upon which a beam of electrons from the cathode can be made to create images; for example, the television picture tube.

Glossary

cathodic protection—Reduction or prevention of corrosion by making the metal to be protected the cathode in a direct current circuit.

CATV (community antenna television)—Refers to the use of a coaxial cable to transmit television or other signals to subscribers from a single headend location.

CATV cable—General term for all cables used for community antenna TV service and feeders, distribution and house drops.

CAU (controlled access unit)—IBM's 8230 is a wiring concentrator that supports up to 80 devices on a ring. The base unit, when used alone or in conjunction with up to four lobe attachment modules (LAMs), functions as a copper repeater or optical fiber converter at either four or sixteen megabits per second.

CB (Citizens band)—One type of two-way radio communication.

CBN (common bonding network)—A grounding term used in TIA standards.

CCIA—Computer and Communications Industry Association.

CCITT—A United Nations-sponsored organization, in Geneva, Switzerland, devoted to establishing worldwide communications standards. In English, it is known as the International Consultative Committee for Telephone and Telegraph.

C-Connector—A bayonet-locking connector for coax; the C refers to Carl Concelman.

CCS (copper clad steel)—Used in CATV, RG-59, 11 and 6 cables.

CCTV (closed-circuit television)—Video security cameras.

CCU (communications control unit)—In IBM 3270 systems, a communications computer, often a minicomputer, associated with a host mainframe computer. It may perform communications protocol, control message handling, code conversion, error control and applications functions.

CD (collision detection)—The ability of a transmitting node to detect simultaneous transmission attempts on a shared medium.

CD (carrier detect)—An RS-232 control signal (on pin 8) that indicates the local modem is receiving a signal from the remote modem. Also called received line signal detector (RSLD) and data carrier detect (DCD).

CDMA (code division multiple access)—A wireless (cellular) telephony.

CDR—Call detail recording.

cellular polyethylene—Expanded or "foam" polyethylene, consisting of individual closed cells of inert gas suspended in a polyethylene medium, resulting in a desirable reduction of dielectric constant.

CENELEC—Comite European de Normalization Electrique. European Electrical Standards Institute.

CFM (cubic feet per minute)—Usually associated with air flow and cooling systems.

CFR (Code of Federal Regulations)—The general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government.

channel—1. A path for electrical transmission. Also called a circuit facility, line, link or path. 2. A specific and discrete bandwidth allocation in the radio frequency spectrum (for example, in a broadband LAN) utilized to transmit one information signal at a time.

characteristic impedance—A frequency dependent resistance that quantifies the complex opposition to current flow offered by a transmission line.

charge—The cause of material bodies exerting forces on each other of repulsion or attraction. The unit of measure is the coulomb, which corresponds to a charge of 6.24 x 1,018 electrons.

charging current—See CURRENT, CHARGING.

CIF (common intermediate format)—A video resolution format sometimes called compressed image format. The resolution ratings of all digital or IP cameras are given in multiples or divisions of CIF. In an image, it is true grid resolution based upon the number of pixels in horizontal rows and vertical columns. (See chart)

RESOLUTION		
Format	NTSC	PAL
D1	720 x 480	720 x 576
4-CIF	704 x 480	704 x 576
CIF	352 x 240	352 x 288
Q-CIF	160 x 120	160 x 144
VCA	640 x 480	

circuit—A system of conducting media designed to pass an electric current.

circuit switching—A switching technique in which an information path (i.e., circuit) between calling and called stations is established on demand for exclusive use by the connected parties until the connection is released.

cladding—The low refractive index material that surrounds the core of an optical fiber.

clad wire—Different from coated wire, it is any metal covered with a relatively heavy coating of different metal, such as copperweld (copper over steel) or alum-o-weld (aluminum over steel). See COATED WIRE.

CLC—IBM's abbreviation for cluster controller. The central node in a star-shaped cluster network, which governs all message traffic to and from the other nodes.

closed architecture—An architecture that is compatible only with hardware and software from a single manufacturer. Contrast with OPEN ARCHITECTURE.

closet, telecommunications—An enclosed space for housing telecommunications equipment, cable terminations and cross-connects. The closet is the recognized cross-connect between the backbone and horizontal cabling.

cluster—A collection of terminals or other devices in a single location.

CMIP (common management information protocol)—The network management standard by OSI.

CMIS (common management information services)—An OSI network management standard. CMIS services are provided by CMIP.

CMOS (complimentary-symmetry metal oxide semiconductor)—An imaging device used in some low-end cameras.

CNR—Carrier to noise ratio.

CO—Central office.

coated wire—Any metal covered by a relatively thin coating of a different metal such as tin, zinc or other alloy by a dip bath and wipe process, often at high speeds in line with insulating equipment.

coatings—Light is lost by reflection from optical surfaces that are intended to be refractors only. This loss is effectively reduced by very thin coatings on the lens surfaces. This can be seen as a blue or violet hue on the lens surface.

coaxial cable—A cylindrical transmission line comprised of a conductor centered inside a metallic tube or shield, separated by a dielectric material and usually covered by an insulating jacket.

codec—An assembly comprising an encoder and a decoder in the same equipment.

coil effect—The inductive effect exhibited by a spiral wrapped shield, especially above audio frequencies.

cold-drawing—Reducing the cross section by pulling through a die or dies at a temperature lower than recrystallization.

Glossary

CO lines—These are the lines connecting your office to your local telephone company's central office, which in turn connects you to the nationwide telephone system.

collision—Overlapping transmissions that occur when two or more nodes attempt to transmit at or about the same instant. Their interference is a collision.

collision detection (CD)—The ability of a transmitting node to detect simultaneous transmission attempt: a shared medium.

color burst—The portion of a composite video signal that comprises a few cycles of a sine wave of chrominance subcarrier frequency used to establish a reference for demodulating the chrominance signal.

common carrier—A data communications utility company or a government organization that furnishes communications services to the general public and is usually regulated by local, state or federal agencies. Often PTTs provide these services outside, and the USA Telcos inside.

communications controller—A device within a host computer that allows communication with the LAN.

communications protocol—The means used to control the orderly exchange of information between stations on a data link or on a communications network or system. Also called line discipline or protocol, for short.

communications server—An intelligent service providing communications functions. Usually, an intelligent, specially configured node on a LAN designed to enable remote communications access to, and egress from, LAN users.

composite—The line side of a concentrator or multiplexer that includes all the multiplexed data.

composite video—The combined video signal that includes the picture signal, the vertical and horizontal blanking and synchronizing pulses.

compound filled splice—Joints in which the joint housing is filled with an insulating compound that is nonfluid at normal operating temperatures.

compression—Two types are available: data compression, which reduces the number of bits required to represent data (accomplished in many ways, including using special coding to represent strings of repeat characters or using fewer bits to represent the more frequently used characters); analog compression that reduces the bandwidth needed to transmit analog signal. Also called compaction.

compromised balanced network—Circuitry in a D4 channel unit card that provides a matching interface to the customer loop to facilitate proper transmission characteristics.

computer room—Any room or area where several multiuser computers are located.

concentration—Collection of data at an intermediate point from several low- and medium-speed lines for transmission across one high-speed line.

concentrator—One of the basic components of an ISN system. The concentrator accepts as many as 40 data streams from terminals and hosts, and multiplexes them for transmission through an optical fiber cable connected to the packet controller. In turn, it accepts a multiplexed data stream from the Packet Controller, divides it into multiple signals (de-multiplexes) and forwards messages to the proper devices.

concentric stranding—A group of uninsulated wires twisted together and containing a center core with subsequent layers spirally wrapped around the core to form a single conductor.

conditioning—The "tuning" or addition of equipment to improve the transmission characteristics or quality of a leased voice-grade line, so it meets specifications for data transmission.

conductance—The real part of admittances. It is the reciprocal of resistance and is measured in mhos.

conductivity—The ability of a material to allow electrons to flow, measured by the current per unit of voltage applied. Also, it is the reciprocal of resistivity. It has units of mhos/meter.

conductor—A material suitable for carrying an electric current.

conduit—A pipe, usually metal, that runs either from floor to floor, or along a floor or ceiling, to protect cables. In the riser subsystem, when riser closets are not aligned, conduit is used to protect cable and provide the means for pulling cable from floor to floor. In a horizontal subsystem, conduit may be used between a riser closet and an information outlet in an office or other room. Conduit is also used for in-conduit campus distribution, where it is run underground between buildings and intermediate manholes and encased in concrete.

connecting block—A flame-retardant plastic block containing metal wiring terminals (insulation displacement contacts) that establish an electrically tight connection between the cable and the cross-connect wire.

connecting hardware—A device providing mechanical cable terminations.

connection—1. An established data communications path. 2. The process of establishing that path. 3. A point of attachment for that path.

connection diagram—Indicates the location and describes the types of connectors to be used at every junction in the distribution system.

connector—A metallic device of suitable electric conductance and mechanical strength, used to splice the ends of two or more cable conductors, or as a terminal connector on a single conductor. Conductors are sometimes spliced without connectors by soldering, brazing or welding. Connectors usually fall into one of the following types:

- Solder
- Welded
- Mechanical
- Compression or indent

contention—A "dispute" between two or more devices over the use of a common channel at the same time.

copolymer—A polymer consisting of a "mixture" of two or more polymers.

cord—A very flexible insulated cable.

core—The light transmitting portion of an optical fiber that has a higher index of refraction than the cladding. The core is typically 50 or 62.5 microns in diameter for multimode and 8 to 9 microns for single-mode.

COS (Committee for Open Systems)—A group of major computer manufacturers whose intent it was to form standards of interconnection for computer systems. One result of their efforts was the 150/051 network model.

coulomb—The derived 51 unit for quantity of electricity or electrical charge: One coulomb equals one ampere-second.

counter emf—The voltage opposing the applied voltage and the current in a coil; caused by a flow of current in the coil; also known as back emf.

coupling—The transfer of energy between two or more cables or components of a circuit.

CPC—Customer premises communication.

CPC (calling party control)—A signal from most electronic COs to indicate that the calling party has hung up. Sometimes called an open loop disconnect. The timing on this signal ranges from 250 to 500 ms.

CPE—Dow Chemical trademark for chlorinated polyethylene. A jacketing compound.

CPE (customer premises equipment)—A telecommunications term for voice or data equipment that resides at a customer's premises.

CPP (cable patch panel)—A panel, half of which is used to terminate cables coming from faceplates, and half of which is used to terminate cables coming from network or host connections. The connections are joined using patch cables.

CPS (cycles per second)—This is an obsolete designation and is now called hertz (Hz). The SI unit is the hertz: one cycle per second.

Glossary

CPS (characters per second)—When referring to printers, a measure of the average number of characters that the printer can print in one second.

CPU (central processing unit)—Actually the heart of a computer, but often used as a synonym for computer.

CRAC—Computer room air conditioner (data center term).

CRM—Customer relationship management.

cross-bar switch—In older PABX technology, a switch having multiple vertical paths, multiple horizontal paths and electromagnetically operated mechanical means for connecting any vertical path with any horizontal path. Modern PABXs often use an electronic version of the cross-bar switch.

cross-connect—The apparatus in a distribution system providing for the termination of twisted pairs or optical fibers and the rearrangement and testing of circuits. In a wire cross-connect, incoming and outgoing twisted pairs terminate on separate connecting blocks, and patch cords complete the circuits. In a light wave cross-connect, incoming and outgoing fibers terminate in connectors that fit into fiber couplings and single fiber jumpers complete the circuits.

cross-connect field—A color-coded strip identifying the type of service carried on the cables terminated on a wire cross-connect terminal block. The color code is:

- Green: central office trunks
- Blue: station cables
- Purple: ISN equipment, multiplexing devices, PBX ports
- White: house cables
- Yellow: auxiliary equipment (such as an application processor)
- Orange: multiplexer ports (premises light wave system only)
- Gray: tie cables (between riser and apparatus and satellite closets)

cross-connect, horizontal—See HORIZONTAL CROSS-CONNECT.

crosstalk—A type of interference caused by audio frequencies from one line being coupled into adjacent lines. The term is loosely used also to include coupling at higher frequencies.

CRT (cathode-ray tube)—A television-like picture tube used in terminals; CRT is commonly used as a synonym for the CRT terminal.

CRT wire—High-voltage lead wire for energizing cathode ray tubes.

CSA (Canadian Standards Association)—The Canadian Standards Association is a not-for-profit membership-based association serving business, industry, government and consumers in Canada and the global marketplace. Similar to UL in the United States.

CSMA (carrier sense multiple access)—A contention technique that allows multiple stations to gain access to a single channel. A contended access method in which stations listen before transmission, send a packet and then free the line for other stations. With CSMA, although stations do not transmit until the medium is clear, collisions still occur; two alternative versions (CSMA/CA and CSMA/ CD) attempt to reduce both the number of collisions and the severity of their impact.

CSMA/CD/CA (carrier sense multiple access with collision detection)—A contention technique that allows multiple stations to successfully share a broadcast channel by avoiding contention via carrier sense and deference and managing collisions via collision detection and packet retransmission. See CSMA and COLLISION DETECTION.

CSO (composite second order)—A type of signal distortion in CATV transmission.

CSU (channel service unit)—A digital DCE unit for DDS lines; interfaces with DSU on customer's premises.

CT (cable tray)—NEC Article 318. A cable marking indicating a single conductor cable suitable for use in a cable tray.

CTB (composite triple beat)—A type of signal distortion in CATV transmission.

CTI—Computer telephony integration. Usually provides a screen-pop and other interaction.

cure—To change the properties of a polymeric system into a more stable, usable condition by the use of heat, radiation or reaction with chemical additives.

current—The rate of transfer of electricity. The unit of current is the ampere, a rate of one coulomb a second.

current, charging—The current needed to bring the cable up to voltage; determined by the capacitance of the cable. The charging current will be 90° out of phase with the voltage.

current density—The current per cross sectional area in units of amperes/meters2.

customer premises—Building(s) with grounds and appurtenances (belongings).

cut-through resistance—The ability of a material to withstand mechanical pressure without damage.

CWDM—Coarse wavelength division multiplexing.

CXR—Carrier. A continuous light wave or radio frequency that is transmitted over a cable and is modulated with a signal. The receiving terminal interprets any change in signal as information. Changes to the signal made by outside influences (noise) can cause the receiving terminal to misinterpret the information transmitted.

D

D/A—Digital to analog.

DAC (digital to analog converter)—A device that converts a digital input to an analog output signal carrying equivalent information.

DACS—Digital access and cross-connect system.

daisy chaining—The connection of multiple devices in a serial fashion. An advantage of daisy chaining is a savings in transmission facilities. A disadvantage is that if a device malfunctions all of the devices daisy chained behind it are disabled.

DASD—Direct attached storage device.

database—A large, ordered collection of information.

data center—A building or a portion of a building whose primary function is to house a computer room and its support areas.

data compression—Packing data into a reduced format. Compressed data are in "short-hand" form and must be decompressed before it can be used by the receiving computer.

datagram—A packet that includes a complete destination address specification (provided by the user, not the network) along with whatever data it carries.

data integrity—A measure of data communications performance, indicating a sparsity (or, ideally, the absence) of undetected errors.

data rate—A measure of the signaling rate of a data link.

dB—Decibel. The standard unit used to express the relative strength of two signals. When referring to a single signal measured at two places in a transmission system, it expresses either a gain or loss in power between the input and output devices. The reference level must always be indicated, such as one milliwatt for power ratio.

DBC—A measure of spurious signal level. The level is measured relative to the nominal unmodulated carrier level.

dBm—Absolute measure of signal power where 0 dBm is equal to one milliwatt. Contrast with dB.

dB mV (decibel millivolt)—The level at any point in a system expressed in dBs above or below a one millivolt/75 ohm standard is said to be the level in decibel-millivolts or dBmV. Zero dBmV is equal to one millivolt across 75 ohms.

DB-9 (RS-449)—A 9-conductor EIA cable assembly used for interfacing VF lines to printers, PCs and all data compatible operations.

Glossary

DB-15 (RS-422/RS-423)—A 15-conductor EIA cable assembly used as drop cable for Ethernet local area networks and for interfacing all freestanding async peripheral equipment, such as PCs, controllers, etc.

DB-25 (RS-232)—A 25-conductor round or flat EIA cable assembly used to interface most IBM DEC, local area networks and all async compatible systems, such as connects mainframes, controllers, PCs, modems, etc.

DB-37 (RS-449)—A 37-conductor EIA cable assembly that connects data terminal equipment (DTE) and data circuit terminating equipment (DCE) employing binary serial data interchange.

DB-50 (RS-422/RS-423)—A 50-conductor EIA cable assembly meets interface needs of all high-volume circuit systems. Same standards as RS-232 connect controllers, PCs, modems, etc.

DC (direct current)—Electrical current whose electrons flow in one direction only. It may be constant or pulsating as long as their movement is in the same direction.

DC type lens—An auto iris lens with internal circuit that receives voltage and a video signal from the camera to adjust the iris.

DCE (data communications equipment)—In common usage, synonymous with modem; the equipment that provides the functions required to establish, maintain, and terminate a connection as well as the signal conversion required for communications between the DTE and the telephone line or data circuit.

DC resistance—See RESISTANCE.

DCL—Data carrier level.

DDA (direct digital access)—A 56 kbps digital data access through a 4 ESS switch.

DDNS (dynamic DNS)—A service that allows you to automatically (dynamically) upload your current IP info that has been assigned via DHCP.

DDS (digital data system)—A network that transmits data signals point-to-point.

decibel (dB)—One-tenth of a bel. It is equal to 10 times the logarithm of the power ratio, 20 times the log of the voltage ratio or 20 times the log of the current ratio. One decibel is the amount by which the pressure of a pure sine wave of sound must be varied in order for the change to be detected by the average human ear. The decibel can express an actual level only when comparing with some definite reference level that is assumed to be zero dB.

delay skew—The difference in propagation delay between the fastest and slowest pair within the same cable sheath. Usually expressed in nanoseconds.

demand—1. The measure of the maximum load of a utility's customer over a short period of time. 2. The load integrated over a specified time interval.

demarcation point—A point where the operational control or ownership changes.

demarcation strip—The terminal strip or block (typically a 66-block) that is the physical interface between the phone company's lines and the lines going directly to your own phone system.

demodulation—The process of separating a data (digital) signal from an analog carrier signal. Opposite of MODULATION.

demultiplexing—The process of breaking a composite signal into its component channels; the reverse of multiplexing.

DEMUX—Demultiplexer.

depth of field—The front to back zone in a field of view that is in focus in the televised scene. With a greater depth of field, more of the scene, near to far, is in focus. Increasing the f-stop number increases the depth of field of the lens. Therefore, the lens aperture should be set at the highest f-stop number usable with the available lighting. The better the lighting, the greater the depth of field possible. In other words, the depth of field is the area in front of the camera that remains in focus. The larger the f-number the greater is the depth of field.

DES (data encryption standard)—An encryption method originally developed by IBM in the 1970s.

destination—Receiver of data; data sink.

device, as related to a workstation—An item such as a telephone, personal computer, or graphic or video terminal.

device, as related to protection—A protector, a protector mount, a protector unit or a protector module.

dew point—The temperature at which vapor starts to condense (liquefy) from a gas-vapor mixture at constant pressure.

diagnostics—Programs or procedures used to test a piece of equipment, a communications link or network, or any similar system.

dial-up line—Your average everyday home or business phone line. See also LEASED LINE.

DHCP (Dynamic Host Configuration Protocol)—A protocol that automatically assigns an IP address to a device requesting an IP address. A DHCP server automatically issues network devices with IP addresses when they connect to the network.

dielectric—An insulating (nonconducting) medium.

dielectric constant—The property of an insulation that determines the electrostatic energy stored per unit volume for unit potential gradient. It is expressed as a ratio. K for air is 1.0, while that for polyethylene is 2.2. Therefore, the capacitance of polyethylene is 2.2 times that of air. It is also referred to as specific inductive capacity or permittivity.

differential amplifier—One that has two input signal connections in addition to the zero signal reference lead. The output is the algebraic sum of the instantaneous voltages appearing between the two input signal connections.

digital—Discretely variable as opposed to continuously variable. Data characters are coded in discrete, separate pulses or signal levels. Contrast with ANALOG.

digital line—The facility that carries the digital bit stream from one location to another.

digital loopback—A diagnostic test that forms the loop at the modem's DTE interface. See LOOPBACK.

digital PBX—A PBX that switches voice and data traffic as digital signals.

digital signal—An electrical signal consisting of two discrete voltage levels, encoding information as a series of ones and zeros.

digroup—A group of 24 customer channels.

DIN (Deutsches Institut fur Normung)—The German standard for many products.

DIN connected cable assembly 5 and 8 conductors—Used for interfacing the IBM keyboards and other compatible systems.

DIP (dual in-line pins)—Term used to describe the pin arrangement on an integrated circuit (IC) or a multiple (electric) switch.

diplex filter—A passive filter that combines and separates the inbound and outbound passbands in a broadband system.

direct connection—A connection between a terminal and a host computer that does not use terminal servers and Ethernet. Direct connections use the RS-232 or DEC423 interface.

directional coupler—A passive device used in a cable system to divide or combine unidirectional RF power sources.

discrete access—In LAN technology, an access method used in star LANs; each station has a separate (discrete) connection through which it makes use of the LAN's switching capability. Contrast with SHARED ACCESS.

display station, display terminal—A device consisting of a keyboard and video or CRT display. In the IBM 3270 Information Display System, a 3278 is an example of a display station; in an ASCII CRT terminal, it is an example of a display terminal.

dissipation factor—Energy lost when voltage is applied across an insulation. The cotangent of the phase angle between voltage and current in a reactive component. Dissipation factor is quite sensitive to contamination and deterioration of insulation. Also known as power factor (of dielectrics).

Glossary

distortion factor—An undesired change in waveform as the signal passes through a device.

distortion level—1. The ratio, measured in dB, of unwanted distortion to desired carrier. 2. Any unwanted electromagnetic component present on the desired RF modulated carrier. 3. The unwanted changes in signal or signal shape that occur during transmission between two points.

distributed architecture—In LAN technology, a LAN that uses a shared communications medium; used on bus or ring LANs; uses shared access methods.

distributed computing—The name of the trend to move computing resources such as minicomputers, microcomputers or personal computers closer to individual workstations. See also DISTRIBUTED PROCESSING.

distributed processing—An arrangement that allows separate computers to share work in the same application program. Often erroneously used to mean distributed computing.

distribution amplifier—A device that accepts a (video) signal and sends it out to a number of independent outputs.

distribution cable—In a CATV system, the transmission cable from the distribution amplifier to the drop cable. In an electric power system, provides low-voltage service to the customer.

distribution frame—A structure with terminations for connecting the permanent wiring of a facility in such a manner that interconnection by cross-connections may be readily made.

distribution panel—A wiring board that provides a patch panel function and mounts in a rack.

DIW (D-Inside Wire)—Also called unshielded twisted pair (UTP). The standard wire originally designated for voice communications. Typically, DIW consists of four pairs of copper wire in the same sheath. Each pair is twisted around one another.

DLC—Digital loop carrier.

DNIS—Dialed number identification service.

DNS (Domain Name System [or Server/Service])—A service that assigns and translates registered friendly names (registered domain names) into IP addresses. In large networks a domain name server is literally a "name" server. It associates and remembers given names to corresponding IP addresses. (i.e., a more easily remembered name such as "MDF camera" rather than by using a long IP address number like 192.36.253.80).

DOCSIS (Data Over Cable Service Interface Specification)—A standard for cable modem products drafted in 1996. It was developed to ensure that cable modem equipment built by a variety of manufacturers is compatible, as dial-up modems are.

DoD (Department of Defense)—Part of the U.S. government executive branch that handles military matters, including data communications; responsible for some LAN associated protocols and standards such as TCP/IP.

dose, integrated (nuclear power)—Cumulative radiation dosage over a given period of time.

download—The process of loading software into the nodes of a network from one node or device over the network media.

downstream—1. On a ring network, the direction of data flow. 2. The direction on the cable from the headend to the modems.

drain wire—An uninsulated wire in contact with a shield throughout its length, used for terminating the shield.

drawing, wiring diagram—Shows how the devices are interconnected.

drop—1. The physical location of the end of an Ethernet transceiver cable. 2. A cable that leads from a faceplate to the distribution panel in a wiring closet. When the IBM Cable System is used with the IBM token-ring network, a drop may form part of a lobe. See LOBE. 3. Individual connections (sometimes called nodes) on a multipoint (also called multidrop) circuit. 4. The coaxial cables which connect the taps to the devices on the plant floor.

drop cable—1. In a CATV system, the transmission cable from the distribution cable to a dwelling. 2. The smaller diameter flexible coaxial cable used for drops (RG-59, RG-6, RG-11).

DSF—Dispersion shifted fiber.

DSLAM (digital subscriber line access multiplexer)—On a DSL service it separates voice and data traffic at the central office.

DSS/BLF—Direct station selector/busy lamp field.

DSU (data service unit)—Device designed to transmit digital data on transmission facilities. Typically a device that interfaces DTE (data terminal equipment) to a line contacting a dataport channel to allow digital communications without a modem. It is used with a CSU when the DTE lacks complete digital line interface capability or alone (i.e., without a CSU) when the DTE includes digital line interface capability.

DS-0 (Digital Service, level 0)—It is 64,000 bps, the worldwide standard speed for digitizing one voice conversation.

DS-1 (Digital Service, level 1)—It is 1.544 Mbps in North America and 2.048 Mbps elsewhere. 1.544 Mbps is the old Bell System standard and 2.048 is the CCITT standard.

DS-1C (Digital Service, level 1C)—It is 3.152 Mbps in North America.

DS-2 (Digital Service, level 2)—It is 6.312 Mbps in North America.

DS-3 (Digital Service, level 3)—Term referring to the signaling rate of a T3 network: 44.736 Mbps.

DTE (data terminal equipment)—User equipment. The end-user machine (terminal, computer, controller, etc.) that plugs into a unit which is the termination point of the communications circuit (DCE).

dual cable—A two-cable system in broadband LANs in which the coaxial cable provides two physical paths for transmission, one for transmit and one for receive, instead of dividing the capacity of a single cable.

duct—A pipe, tube or conduit through which cables or wires can be passed. Duct space is always at a premium. If you ever install a duct, make sure it is twice the diameter you ever think you need. If you're lucky, it will last a couple of years. The cost of putting in thicker or extra ducts is peanuts compared to the cost of having to install additional ones later.

dumb terminal—The dumb terminal is an asynchronous terminal that may operate at speeds as high as 9,600 bps or higher. The dumb terminal is an ASCII terminal that, although it may be "intelligent" in many of the functions it provides, it uses no communications protocol.

Duofoil—Belden trademark for a shield in which metallic foil is applied to both sides of a supporting plastic film.

duplex (multiplexer)—A multiplexer that allows the user to look at multiscreen images while performing time multiplex recording.

DUT—Device under test.

DVI (digital visual interface or digital video interface)—Video standard and connector for digital and analog monitor connections. DVI-A: analog monitor only; DVI-D: digital video only. Works up to 16.5 feet (5 m).

DWDM—Dense wavelength division multiplexing.

dwell time—The length of time a switcher holds on a camera before moving on to the next in sequence.

DVR (digital video recorder)—A device that records video in a digital format on an internal (or external) hard disk drive. This is in contrast to a traditional VCR (videocassette recorder) that records video in an analog format on tape media. Some DVRs are combined with a multiplexer in the same unit, which allows multiple cameras to be simultaneously recorded, played back or viewed. Some common features of DVRs are fast picture retrieval, date and time search, maintenance free, no tapes to change or heads to clean, time lapse and event alarm recording, adjustable recording rates per video input, programmable timer, audio recording, alarm event logs and water-marking of images to prevent tampering. (Not all DVRs have the same features.)

DX (duplex signaling)—Signaling system that occupies that same cable pair as the voice path, yet does not require filters.

Glossary

E

E—Voltage (electromotive force).

E—A UL cable type elevator lighting and control cable.

EAC—Electronic access control.

EAP—Extensible authentication protocol.

earth—British terminology for zero-reference ground.

earthing conductor—A conductor that goes from a known earth ground to a device to be grounded.

echo—1. A faint return of the transmitted signal to the originating modem when a signal is related by a communications satellite. 2. The interference caused when a modem receives its own signal, experienced when two 9,600-bps modems communicate, each using most of the available bandwidth.

echo canceller—A device that digitally compensates for echo signals that appear on telecommunications circuits.

echo suppressor—A device used by telcos or PTTs that blocks the receive side of the line during the time that the transmit side is in use.

echoplex—A method of checking data integrity by returning characters to the sending station for verification of data integrity.

Ecma International (European association for standardizing information and communications systems)—Before 1994, Ecma was known as the European Computer Manufacturers Association (ECMA). After 1994, Ecma was implemented as a trademark to represent the historical aspect of the organization. Ecma is an industry association dedicated to the standardization of information and communications technology and consumer electronics.

ECTFE—(Halar) An Ausimont Co. trademark for ethylene chlorotrifluoro ethylene. Used as an insulation or jacketing material.

ED (ending delimiter)—In the FDDI frame and token-format blocks, this contains non-data symbols to indicate the end of the frame. The delimiter is eight bits long for a token (two consecutive T symbols) and four bits long (a single T symbol) for all other frames.

eddy current—An electric current induced in a conductor by a varying magnetic field.

EDFA—Erbium doped fiber amplifier (fiber amplifier).

EFM (Ethernet in the First Mile)—There is a standard IEEE 802.3ah.

EEPROM (electrically erasable programmable read only memory)—An EPROM that can be cleared with electrical signals rather than the traditional ultraviolet light.

EFS (end of frame sequence)—In the FDDI frame and token-format blocks, this consists of ED (encoding delimiter) and FS 9 (frame status) fields, which ensure a clear function occurs close to each frame.

EI—The European standard for high-speed data transmission at 2.048 Mbps. Thirty-two 64 kbps channels are provided.

EI (electronic iris)—Automatically changes a CCD camera's shutter to mimic auto iris control, allowing fixed or manual iris lenses to be used in a range of areas that used to require an auto iris lens.

EIA (Electronic Industries Association)—Formerly RMA or RETMA. The U.S. national organization of electronic manufacturers. It is responsible for the development and maintenance of industry standards for the interface between data processing machines and data communications equipment.

E.I.A. (electronic industry association)—A U.S. TV standard 525 lines 60 fields.

EIA crossover cable—A seven-wire cable used to change a DCE to DTE. It is terminated on both ends with a male connector and serves both the AIM8 and AIM4 circuits.

EIA RS-232-C—A standard, defined by the Electronics Industries Association, describing the electrical, mechanical and functional characteristics of the connections between devices exchanging data in serial binary form.

EIA RS-232-C port—A 25-pin male or female connector compatible with RS-232-C signals and cable.

EIA signal—A digital signal having a number of characteristics (in time duration, voltage and current) defined by the Electronics Industries Association as standards for data communication.

elastomer—Any material that will return to its original dimensions after being stretched or distorted.

electromagnet—A device consisting of a ferromagnetic core and a coil that produces appreciable magnetic effects only when an electric current exists in the coil.

electromagnetic—Referring to the combined electric and magnetic fields caused by electron motion through conductors.

electromagnetic coupling—The transfer of energy by means of a varying magnetic field. Inductive coupling.

electromechanical cables—Dual purpose composite cables made up of support strands capable of supporting predetermined loads together with communication, coaxial or power as integral members of a finished cable.

electron—An elementary particle containing the smallest negative electric charge; Mass = 9.1 x 1,031; Charge = 0.16 attocoulom; Diameter = 1 femtometer.

electron volt—A measure of the energy gained by an electron passing through an electric field produced by one volt.

electrostatic—Pertaining to static electricity or electricity at rest. For example, an electric charge.

electrostatic coupling—The transfer of energy by means of a varying electrostatic field. Capacitive coupling.

electronic shuttering—Electronic shuttering is the ability of the camera to compensate for moderate light changes in indoor applications without the use of auto iris lenses.

electrostatic discharge (ESD)—An instantaneous flow of an electrical charge on a nonconductor through a conductor to ground.

ELFEXT (equal level far-end crosstalk)—A measure of the unwanted signal coupling from a transmitter at the near-end into a neighboring pair measured at the far-end relative to the received signal measured on that same pair. ELFEXT is FEXT-adjusted to discount attenuation.

EMA (electrical moisture absorption)—A water tank test during which the sample cables are subjected to voltage while the water is maintained at rated temperature; the immersion time is long, with the object being to accelerate failure due to moisture in the insulation; simulates buried cable.

EMB—Effective modal bandwidth.

EMF (electromotive force)—See VOLTAGE.

EMI (electromagnetic interference)—External signals that disrupt the data being transmitted on the local area network or electronic device being operated. Typically, these external signals emanate from universal motors with brushes, fluorescent lights, personal computers, printers or other devices including copy machines, etc. The Federal Communications Commission (FCC) regulates this emission area.

EMI/RFI filter—Circuit or device containing series inductive (load-bearing) and parallel capacitive (non-load-bearing) components that provide a low-impedance path around the protected circuit for high-frequency noise. Filters and surge suppressors when used together act synergistically.

entrance facility, telecommunications—An entrance to a building for both public and private network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

environment—1. The universe within which a system must operate 2. All the elements over which the designer has no control and that affect a system or its puts and outputs.

EOT (end of transmission character)—A transmission control character used to indicate the end of transmission, which may include one or more texts and any associated message headings.

Glossary

EP, EPR, EPM, EPFM—Designations for synthetic rubber based upon ethylene-propylene hydrocarbon.

EPA (Environmental Protection Agency)—The federal regulatory agency responsible for keeping and improving the quality of our living environment – mainly air and water.

EPDM (ethylene propylene diene monomer)—A rubber thermoset material with good insulating properties.

EPON—Ethernet passive optical network.

EPROM (erasable programmable read-only memory)—A nonvolatile semiconductor PROM that can have three current contents cleared (usually through exposure ultraviolet light) and then accept new contents for storage.

equalization—Equalization is achieved by circuitry that compensates for the differences in attenuation at different frequencies.

equalizer—A device used by modems to compensate for distortions caused by telephone line conditions.

equipment grounding conductor—A conductor used to connect noncurrent-carrying metal enclosures of electrical equipment to the system ground.

equipment room—The room in which voice and data common equipment are housed, protected and maintained, and where circuit administration is performed using the trunk and distribution cross-connects.

equipment wiring subsystem—The part of a premises distribution system that includes the cable and distribution in an equipment room and that interconnects system-common equipment, other associated equipment and cross-connects.

error detection—A hardware or software protocol determining when a group of incoming data have an error. If one is detected, the receiving modem orders the transmitting modem to resend the data group that contains the error.

error rate—A measure of data integrity, given as the fraction of bits which are flawed. Often expressed as a negative power of 10, as in 10-6 (a rate of one error in every one million bits).

ESF—Extended super frame format.

ESCON—IBM Enterprise Systems Connection. A highly flexible channel interconnection environment with extended distance range, it combines technology and architecture including optical fiber cabling, dynamic connectivity, interconnectivity with other networks and input/output (I/O) architecture that exploits optical fiber.

ETFE—(Tefzel) DuPont trademark for ethylene tetrafluoroethylene.

Ethernet—Ethernet is a network standard of communication using either coaxial or twisted-pair cable. The most widely used in LAN communications, Ethernet typically runs at 10 megabytes per second, though newer systems use 100 Mbps or 10 Gbps.

ETL—Electrical testing laboratory.

ETPR (expanded thermal plastic rubber)—ETPR is often used as a filling compound in OSP cable.

exchange—A unit established by a common carrier for the administration of communications services in a specified geographical area such as a city. It consists of one or more central offices together with the equipment used in providing the communications services. Frequently used as a synonym for central office.

excitation losses—Losses in a transformer or electrical device because of voltage.

explicit access—In LAN technology, a shared access method that allows stations to use the transmission medium individually for a specific time period; every station is guaranteed a turn, but every station must also wait for its turn. Contrast with CONTENDED ACCESS.

extension tube—Kit consisting of various size spacers that are used between the lens and the camera to reduce the lens MOD. Generally used for very close-up applications. Not recommended for zoom lenses due to loss of tracking.

external timing—Use of a timing source that is external to the transmission system. This timing source synchronizes the transit and receives circuits with a given facility.

F

f-number—The f-number indicates the brightness of the image formed by the lens, controlled by the iris. A smaller f-number means a brighter image.

f-stop—A term used to indicate the speed of a lens. The smaller the f-number, the greater is the amount of light passing through the lens.

F/UTP—Foil applied over unshielded twisted pairs.

facility—1. In general, a feature or capability offered by a system, item of hardware or software. 2. In Telco environments, line and equipment used to furnish a completed circuit. See NETWORK FACILITIES.

facility equipment room—A room or wiring closet used to store extended networking components that link one building with another building. These products include remote bridges and remote repeaters as well as X.25 gateways and DECnet wide-area network routers.

facsimile—The remote reproduction of graphic material: an exact copy.

farad—A unit of capacitance when a difference of potential of one volt produces a displacement of one coulomb in a capacitor. The farad is a very large unit and a much smaller unit, the microfarad (μf), is more commonly used.

FAT (file allocation table)—A record, generated by DOS, that keeps track of where each file is on a disk, which sectors of the disk are in use and which sectors are available for new data to be written to them.

fault—An unintentional, low-resistance connection between two or more conductors, or an open or broken conductor.

fault, ground—A fault to ground.

FCC (Federal Communications Commission)—Has the authority to regulate all interstate communications originating in the United States. It is run by seven board members appointed by the President. It sets prices for interstate phone, data and video service; determines who can or cannot get into the business of providing telecommunications service or equipment in the U.S.; and determines the electrical and physical standards for telecommunications equipment.

F Connector—A standard 75-ohm connector used on drop-cable.

FDDI (fiber distributed data interface)—An ANSI defined token-passing ring using optical fiber media to attain a 100 Mbps transmission rate.

FDM (frequency division multiplexing)—Method by which the available transmission frequency range is divided into narrower bands, each used for a separate channel. As used by broadband technology, the frequency spectrum is divided up among discrete channels to allow one user or a set of users access to single channels.

FDMA—Frequency division multiple access.

FEXT (far-end crosstalk)—Unwanted signal coupling from a transmitter at the near end into a neighboring pair measured at the far end.

FDX (full-duplex)—Transmission in two directions simultaneously or, more technically, bi-directional, simultaneous two-way communications.

feeder cable—An intermediate cable distribution line in a broadband coaxial network that branches off a main trunk cable.

femto—A prefix meaning 0.000000000000001 (10^{-15}).

FEP—(Teflon) DuPont trademark for Fluorinated Ethylene Propylene.

Glossary

FEP—Front-end processor.

FEXT—Far-end crosstalk.

FDDI—Fiber distributed data interface.

FDM—Frequency division multiplexing.

FDX—Full duplex.

fiber backbone—See BACKBONE.

fiber optic cable—See OPTICAL FIBER.

fiber optics—Transmission of energy by light through glass fibers. A technology that uses light as an information carrier. Optical fiber cables (light guides) are a direct replacement for conventional coaxial cable and wire pairs. The glass-based transmission cable occupies far less physical volume for an equivalent transmission capacity; the fibers are immune to electrical interference.

field—One half of a frame, consisting of either the odd or the even numbered lines, 60 fields are transmitted every second.

file—A collection of related data records.

file server—A station dedicated to providing file and mass data storage to the other stations on the local network.

filling compound—A dielectric material poured or otherwise injected into a splice housing to prevent the entry of water. Filling compounds may require heating or mixing prior to filling. Some filling compounds may also serve as the insulation.

filter—An arrangement of electronic components designed to pass signals in one or several frequency bands and to attenuate signals in other frequency bands.

flange back—The distance from the flange of the lens (beginning of the lens mount) to the focal plane. C mount lenses have a flange back distance of 17.526 mm vs. 12.5 mm for CS mount.

flat loss—Equal signal loss across the system's entire bandwidth.

flooded cable—A special coaxial cable that contains a corrosion resistant gel between the outer aluminum sheath and the outer jacket. The gel flows into imperfections in the jacket to prevent corrosion in high-moisture areas.

flow control—The capability of network nodes to manage buffering schemes in order to allow devices of differing data transmission speeds to communicate with each other.

FM (frequency modulation)—A modulation technique in which the carrier frequency is shifted by an amount proportional to the value of the modulating signal. The amplitude of the carrier signals remains constant. The deviation of the carrier frequencies determines the signal content of the message.

focal length—The distance from the center of the lens to a plane at which point a sharp image of an object viewed at an infinite distance from the camera is produced. The focal length determines the size of the image and the angle of the field of view seen by the camera through the lens. That is the distance from the center of the lens to the pickup device.

FOCIS—Fiber Optic Connector Intermateability Standard.

FOIRL (Fiber Optic Inter-Repeater Link)—An optical fiber signaling methodology based in the proposed IEEE 802.3 standard governing optical fiber and the FDDI standard.

footcandle—It is the light intensity (illumination) of a surface one foot distant from a source of one candela. It is equal to one lumen per square foot. (1FC = 1 lm ft.2). The footcandle is the unit used to measure incident light.

forward direction—The direction on the cable from the headend to the modems.

four-wire circuit, four-wire line—A circuit using two pairs of conductors, one pair for the transmit channel and the other pair for the receive channel. All long distance circuits are four wire. Almost all local phone lines are two wires. All analog phones are two wires. Four-wire circuits offer much higher quality.

frame—1. The total area of the picture that is scanned while the picture signal is not blanked. 2. Same as transmission block. 3. The sequence of bits and bytes in a transmission block. 4. The overhead bits and bytes that surround the information bits in a transmission block. 5. The unit of transmission in some local area networks, including the IBM token-ring network. It includes delimiters, control characters, information and checking characters. A frame is created from a token when the token has data appended to it.

framing—Process of inserting control bits to identify channels; used in TDM signals.

frequency—The number of cycles per second at which an analog signal occurs, expressed in hertz (Hz). One hertz is one cycle per second.

frequency analyzer—An instrument to measure the intensity of various component frequencies from a transmitting source.

frequency deviation—A swing away from the nominal frequency.

frequency division multiplexing—The splitting of a communications line into separate frequency bands, each capable of carrying information signals. This allows several messages to be sent at the same time over the same transmission medium.

frequency range—The frequency spectrum allocated for use by any frequency selective device or component.

frequency response—The variation of gain or attenuation with frequency.

front porch—The portion of the composite video signal that lies between the leading edge of the horizontal blanking pulse and the leading edge of the corresponding synchronizing pulse.

FSMA (fiber subminiature assembly)—It is a threaded connector for multimode optical fiber cables.

FSO (free space optics)—Refers to the transmission of modulated visible or infrared (IR) beams through the atmosphere to obtain optical communications. Like fiber, free space optics (FSO) uses lasers to transmit data, but instead of enclosing the data stream in a glass fiber, it is transmitted through the air.

FTTD®—Anixter registered trademark meaning fiber to the desk.

FTTH—Fiber to the home.

FTTP—Fiber to the premises.

"F" type connector—A low cost connector used by the TV industry to connect coaxial cable to equipment.

full duplex—Two-way communications in which each modem simultaneously sends and receives data at the same rate.

G

gain—The increase in signaling power caused by an amplifier and measured in decibels (dB).

galvanized steel wire—Steel wire coated with zinc.

gas discharge tube—1. A calibrated spark gap in a gas-filled chamber. These devices are relatively slow, activating in microseconds, but can handle very large surges. They work by shunting the surge or spike impulse around the protected circuit. 2. A method of protecting phone lines and phone equipment from high voltage caused by lightning strikes.

gateway—Provides a convenient way to create a local network. It works as a combined router, switch and a NAT (network address translator) and is available from various manufacturers.

gauss—A unit of magnetic induction (flux density) equal to 1 Maxwell per cm^2 or 10-4 weber per $meter^2$.

general purpose instrumentation bus (GPIB)—A protocol standard defined by the IEEE.

gen-lock—A method used to synchronize one or more cameras by external means such as composite video, composite sync, horizontal or vertical sync.

Glossary

GFI (ground fault interrupter)—A protective device that detects abnormal current flowing to ground and then interrupts the circuit.

ghost—A shadowy or weak image in the received picture, offset either to the right or to the left of the primary image. It is the result of transmission conditions where secondary signals are created and received earlier or later than the primary signal.

GHz (gigahertz)—1,000,000,000 cycles per second.

GPRS (general packet radio service)—Wireless (cellular) telephony.

graded index fiber—An optical fiber with a refractive index that gets progressively lower away from the axis. This causes the light rays to be continually refused by refraction in the core. It bends the rays inward and allows them to travel faster in the lower index of refraction region. This type of fiber provides high bandwidth capabilities.

ground—A voltage reference point that is the same as earth or chassis ground.

ground fault—See FAULT, GROUND.

ground loop—Caused by different earth potentials in a system. Affects video pictures in the form of a black shadow bar across the screen or as a tearing in the top corner of a picture.

guard band—1. The unused bandwidth separating channels to prevent crosswalk in an FDM system. 2. In a broadband system, the frequency spectrum between the inbound and outbound passbands.

GSM (global system for mobile communications)—A type of wireless (cellular) telephony.

GUI (graphical user interface)—Computer "human interface" that is based on icons rather than text. Pioneered by Xerox, implemented first by Apple, then by Microsoft Windows, Hewlett Packard and Unix-X-Windows.

guy—A tension wire connected to a tall structure and another fixed object to add strength to the structure.

H

Halar (ECTFE)—Ausimont Co. trademark for Ethylene ChloroTriFluoro Ethylene

half-duplex—Two-way communications in which data are sent in only one direction at a time.

hard-drawn wire—As applied to aluminum and copper, wire that has been cold drawn to final size so as to approach the maximum strength attainable.

hardware handshaking—The ability of a modem to signal when to start or stop transmitting data. Handshaking is accomplished by sending a control signal over the modem cable rather than by issuing a software command.

harmonic—Sinusoidal component of an AC voltage that is multiple of the fundamental waveform frequency.

harmonic distortion—A form of interference involving the generation of unwanted signals.

hazardous location—Ignitable vapors, dust, or fibers that may cause fire or explosion as defined by the NEC.

HC—Horizontal cross-connect.

HDCP (high-definition content protection)—A type of digital encryption that protects content from being copied. A subsystem of HDMI.

HDPE—High-density polyethylene.

HDMI (high-definition multimedia interface)—The newest digital video connection on the market. HDMI supports the same high-quality video as DVI; however, it also incorporates digital audio support at many rates including surround sound, copyright protection and consumer control, all packaged into a cable with a connector about half the physical size of the original DVI connector. Utilizes a 19 pin plug for single link DVI or a 29 pin plug for dual link DVI. Works up to 75 ft. (23 m).

HDTV—High-definition television.

HDX (half-duplex transmission)—Transmission in either direction but not in both directions simultaneously. Compare with FULL DUPLEX.

headend—A central point in broadband networks that receives signals on one set of frequency bands and retransmits them on another set of frequencies.

headend unit—In LAN technology, an item of hardware on a single or dual cable broadband network using split frequency bands to provide multiple services.

henry—A unit of inductance equal to the inductance of a current changing at the rate of one ampere per second inducing a counter electromotive force of one volt.

hertz (Hz)—Cycles per second. A cycle that occurs once every second has a frequency of one hertz. The bandwidth of the average phone line is between 300 and 3,000 cycles per second.

HF—High frequency.

HIPAA (Health Insurance Portability and Accountability Act [1996])—HIPAA provides rights and protections for participants and beneficiaries in group health plans. This can include protections for electronic transmission of health information.

HI-Z (unterminated)—Video input of a piece of CCTV equipment, wired so as to allow the video signal to be fed to further equipment. Does not necessarily include extra sockets for the extra coaxial cables.

HMWPE—High-molecular weight polyethylene.

horizontal blanking—The blanking signal that is produced at the end of each scanning line.

horizontal (HUM) bars—Horizontal bars, alternately black and white, which extend over the entire picture. They are known as venetian-blinds. They may be stationary or move up or down. They are often caused by approximately 60 hertz interfering frequency or its harmonic frequencies.

horizontal cross-connect—A cross-connect of horizontal cabling to other cabling, e.g., horizontal, backbone, equipment.

horizontal resolution—The maximum number of individual picture elements that can be distinguished in a single scanning line.

horizontal subsystem—The part of a premises distribution system installed on one floor that includes the cables and distribution components connecting the riser subsystem and equipment wiring subsystem to the information outlet via cross-connects.

housing—A metallic or other enclosure for an insulated splice.

HSPD (Homeland Security Presidential Directive)—Various directives related to security.

HSPD-12—Requires a common ID credential for all federal employees and contractors to be used for both physical access to facilities and logical access to information systems. The PIV (personal identity verification) standard requires contact and contactless smart card technologies and biometrics.

HSRP—Hot standby router protocol.

HRC (harmonically related carrier)—In CATV, an offset band of channel frequencies.

HTCP—Home theater personal computer, separates the computer and its keyboard.

HTML (Hypertext Markup Language)—HTML is the major language of the Internet's World Wide Web. Web sites and Web pages are written in HTML. With HTML and the World Wide Web, you have the ability to bring together text, pictures, sounds and links. HTML files are plain text files, so they can be composed and edited on any type of computer.

HTTP (Hypertext Transfer Protocol)—It's the network protocol used to deliver virtually all files and other data (collectively called resources) on the World Wide Web, whether they're HTML files, image files, query results or anything else. Usually, HTTP takes place through TCP/IP sockets. A browser is an HTTP client because it sends requests to an HTTP server (Web server), which then sends responses back to the client. The standard (and default) port for HTTP servers to listen on is 80, though they can use any port.

Glossary

hub—In LAN technology, it is 1. The center of a star topology network or cabling system; and 2. Same as a headend for bi-directional networks except that it is more centrally located within the network.

HV—High voltage.

HVAC—Heating, ventilation and air conditioning.

hybrid network—A LAN with a mixture of topologies and access methods. For example, a network that includes both a token ring and a CSMA/CD bus.

hybrid cable—An assembly of two or more cables of different types or categories, covered by one overall sheath.

hybrid topology—A network interconnection scheme consisting of a mixture of elements of daisy chain, fully connected, hierarchical, ring and star topologies.

hydroscopic—Readily absorbing and retaining moisture.

Hypalon—(CSP) DuPont trademark for chlorosulphonated polyethylene.

Hz (hertz)—A measure of frequency or bandwidth equal to one cycle per second. Named after experimenter Heinrich Hertz.

I

I—Current.

IAD—Integrated access device.

IC—Intermediate cross connect.

ICEA (Insulated Cable Engineers Association)—The association of cable manufacturing engineers who make nationally recognized specifications and tests for cables. Formerly IPCEA.

IDC—Insulation displacement connector.

IDE—Integrated drive electronics also known as ATA (advanced technology attachment).

IDF—Intermediate distribution frame.

IDMS (identity management system)—A system that manages the identities and privileges of computer systems and people. Can be used in conjunction with both physical and IT access control.

IDS (intrusion detection system)—A system that monitors network traffic and responds with an alarm when it detects port scanning, an unauthorized access attempt, a denial-of-service attack or other forms of attack on the network.

IEC—International Electrotechnical Commission.

IEEE (Institute of Electrical and Electronic Engineers)—An international professional society that issues its own standards and is a member of ANSI and ISQ.

IEEE 10BASE2 Network—A network conforming to the IEEE 802.3 local area network standard. The network is capable of carrying information at rates up to 10 Mbps over distances up to 185 meters; also called thinnet.

IEEE 10BASE5—A network conforming to the 8023 local area network standard. The network is capable of carrying 10 Mbps of data over coax cable for distances up to 500 meters.

IEEE 10BROAD36—10 million bits per second over broadband coaxial cable with node-to-node coverage of 3,600 meters. The IEEE 802.3 specification for running Ethernet on broadband.

IEEE 488 (Institute of Electrical And Electronic Engineers-488)—An IEEE standard parallel interface bus consisting of eight bi-directional data lines, eight control lines and eight signal grounds, which provide connections to an IEEE-488 device.

IEEE 488 241C gen. interface bus cable assembly—Meets the requirements of IEEE 488 standard for cable interface of up to 15 programmable instruments in a BUS-connected system. Dual-sided connector can terminate into a star or daisy chain.

IEEE 802—Standards for the interconnection of local networking computers equipment. The IEEE-802 standard deals with the physical link layers of the ISO Reference Model for OSI.

IEEE 802.1—The standard that defines the network layer of the OSI Model for LANs. IEEE 802.1d defines the spanning tree protocol (STP) used by bridges to detect and break any loops found in an Ethernet network.

IEEE 802.2—A subcommittee responsible for defining the upper half of the data link layer, known as the LLC or logical link control.

IEEE 802.3—An IEEE standard describing the physical and data link layers of a local area network based on bus topology and CSMA/CD. (Ethernet)

IEEE 802.3af—Data terminal equipment (DTE) power delivery standard. Commonly referred to as Power over Ethernet (PoE).

IEEE 802.4—A physical layer standard specifying a LAN with a token-passing access method on a bus topology. Used with manufacturing automation protocol LANs.

IEEE 802.5—A physical layer standard specifying a LAN with a token-passing access method on a ring topology. Used by IBM's token ring hardware.

IEEE 802.6—The IEEE project 802 LAN Standards for Empty Slot Ring. A ring LAN in which a free packet circulates past, or more precisely, through every station; a bit in the packet's header indicates whether it contains any messages (if it contains messages, it also contains source and destination addresses).

IEEE 802.7—A proposed physical layer standard specifying a LAN using both 802.3 and 802.4 standards.

IEEE 802.8—The IEEE Project 802 committee responsible for defining standards for optical fiber LANs.

IEEE 802.g—A committee looking into aspects of ISDN type voice and data integration across IEEE 802.3 and 802.4 LANs. As yet, the IEEE 802.9 committee has made "proposals," but has not published any "standards."

IEEE 802.11—Wireless LAN standard.

IETF—Internet Engineering Task Force.

IF—Intermediate frequency.

IGMP (Internet Gateway Multicast Protocol)—A standard IP protocol. When used in MAPs it is the signaling mechanism used with multicasting of video. The set-top box uses IGMP to insert or remove a subscriber from a video stream (IGMP multicast filtering).

IMAP—Internet Message Access Protocol.

impact tests—Tests designed to reveal the behavior of material of a finished part if it were subjected to impact or shock loading.

image size—Reference to the size of an image formed by the lens onto the camera pickup device. The current standards are 1 in., 2/3 in., 1/2 in. and 1/3 in. measured diagonally.

impairment—The generic term for a flaw in phone line quality, usually caused by echo, noise or a reduction in signal strength.

impedance—The total opposition a circuit, cable or component offers to alternating current. It includes both resistance and reactance and is generally expressed in ohms.

impedance, characteristic—In a transmission cable of infinite length, the ratio of the applied voltage to the resultant current at the point the voltage is applied. When connected across the cable's output terminals, the impedance that makes a transmission cable seems infinitely long. For a waveguide, when the waveguide is match-terminated, it is the ratio of rms voltage to total rms longitudinal current at certain points on a diameter.

impedance match—A condition whereby the impedance of a particular cable or component is the same as the impedance of the circuit, cable, or device to which it is connected.

impedance matching stub—A section of transmission line or a pair of conductors cut to match the impedance of a load. Also called matching stub.

impedance matching transformer—A transformer designed to match the impedance of one circuit to that of another.

impulse—See PULSE.

Glossary

incident light—The light that is falling directly over an object.

indoor termination—A cable termination intended for use where it is protected from direct exposure to both solar radiation and precipitation.

inductance—A property of a conductor or circuit that resists a change in current. It causes current changes to lag behind voltage changes and is measured in henrys.

induction—The phenomenon of a voltage, magnetic field or electrostatic charge being produced in an object by lines of force from the source of such fields.

infrastructure, telecommunications—A collection of those telecommunications components, excluding equipment, that together provide the basic support for the distribution of all information within a building or campus.

input—A signal (or power) that is applied to a piece of electric apparatus, or the terminals on the apparatus to which a signal or power is applied.

insertion loss—The signal strength loss that occurs when a piece of equipment is inserted into a line.

inside plant—Everything inside a telephone company central office. See INSIDE WIRING.

inside wiring—The telephone wiring located inside your premises or building. Inside wiring starts at the telephone company's demarcation point and extends to the individual phone extensions. Traditionally, inside wiring was installed and owned by the telephone company. Now you can install your own wiring. Most companies installing new phone systems are installing their own new wiring because of potential problems with reusing old telephone company cable.

insulated splice—A splice with a dielectric medium applied over the connected conductors and adjacent cable insulation.

insulating (isolating) joint—A cable joint that mechanically couples and electrically separates the sheath, shield and armor on contiguous lengths of cable.

insulation—A material having good dielectric properties that is used to separate close electrical components, such as cable conductors and circuit components.

insulation, rating—A maximum temperature assigned to insulations based on laboratory tests.

Intel—A semiconductor (chip) manufacturer; one of the sponsors of Ethernet.

intelligence, intelligent—A term for equipment (or a system or network) that has a built-in processing power (often furnished by a microprocessor) that allows it to perform sophisticated tasks in accordance with its firmware.

interconnect—A connection scheme that provides for the direct connection of individual cables to another cable or to an equipment cable.

interface—1. A shared boundary defined by common physical interconnection characteristics, signal characteristics and meanings of interchanged signals. 2. The equipment that provides this shared boundary.

interlace—A scanning process where every other horizontal line is scanned in one field while the alternate lines are scanned in the next field to produce a complete picture frame.

interleaving—A method used in alarms or activity detection that allows extra frames of video from alarmed cameras to be added to a time multiplexed sequence whilst a state of alarm exists.

intermediate cross-connect—A cross-connect between first level and second level backbone cabling.

internetwork router—In LAN technology, a device used for communications between subnetworks; only messages for the corrected subnetwork are transmitted by this device.

intranet—Within one network.

intrinsically safe—Incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most ignitable concentration.

I/O (input/output)—The process of transmitting data to and from the processor and its peripherals.

IP (Internet Protocol)—A procedure used to forward Internet traffic to neighbor gateway nodes. IP is also used in ADS gateway nodes to forward traffic between networks. IP's primary function is Internet routing and packet fragmentation and assembly.

ipAssured℠—An infrastructure assurance program that matches the cabling infrastructure to the security equipment based on the technical, application and life-cycle requirements of the user.

IP-Class 1+℠—An Anixter ipAssured infrastructure cabling assurance that will meet life-cycle requirements of 1 to 5 years.

IP-Class 5+℠—An Anixter ipAssured infrastructure cabling assurance that will meet life-cycle requirements of 5 to 10 years.

IP-Class 10+℠—An Anixter ipAssured infrastructure cabling assurance that will meet life-cycle requirements of 10 or more.

ips—In video, it stands for images per second. It is also sometimes called pictures per second (pps).

ISDN (Integrated Services Digital Network)—A CCITT standard that covers a wide range of data communication issues but primarily the total integration of voice and data. Digital phone lines that allow transmission of video signals via fastscan at speeds of 128 kbps; used with terminal adapters.

ISO (International Organization for Standardization)—Reference model for open systems interconnection; a standard approach to network design that introduces modularity by dividing the complex set of communications protocols into more manageable, functional slices.

isochronous—A form of data transmission in which individual characters are only separated by a whole number of bit-length intervals. Contrast with ASYNCHRONOUS in which the characters may be separated by random-length intervals. A form that will not tolerate delay. (e.g., RealTime V.V.)

isolation—The ability of a circuit or component to reject interference, usually expressed in dB.

isolation loss—The amount of signal attenuation of a passive device from output port to tap outlet port.

ISO Reference Model for OSI (International Organization for Standardization Reference Model for Open Systems Interconnection)—A standard approach to network design which introduces modularity by dividing the complex set of functions into more manageable, self-contained, functional slices. These layers, from the innermost layers, are as follows:

1. Physical Layer: Concerned with the mechanical and electrical means by which devices are physically connected and data are transmitted.
2. Link Layer: Concerned with how to move data reliably across the physical data link.
3. Network Layer: Provides the means to establish, maintain, and terminate connections between systems; concerned with switching and routing of information.
4. Transport Layer: Concerned with end-to-end data integrity and quality of service.
5. Session Layer: Standardizes the talk of setting up a session and terminating it; coordination of interaction between end-application processes.
6. Presentation Layer: Relates to the character set and data code which is used, and to the way data is displayed on a screen or printer.
7. Application Layer: Concerned with the higher level functions which provide support to the application of system activities.

I^2R—Formula for power in watts, where I = current in amperes, R = resistance in ohms.

interface device—A device which meets a standard electrical interface on one side and meets some other nonstandard interface on the other. The purpose of the device is to allow a device with a nonstandard interface to connect to a device with a standard interface.

interference—Disturbances of an electrical or electromagnetic nature that introduce undesirable responses into other electronic equipment.

Glossary

intermediate frequency—A frequency to which a signal is connected for ease of handling. Receives its name from the fact that it is an intermediate step between the initial and final conversion or detection stages.

internetwork—Between two distinct networks.

IRC (incrementally related carrier)—In CATV, an offset band of channel frequencies.

IRE—Institute of Radio Engineers.

ISI (intersymbol interference)—In multimode fiber it is caused by DMD (differential mode delay).

ISM (industrial, scientific and medical)—Usually used to define the unlicensed RF bands used for wireless transceivers as defined by FCC regulations (47CFR parts 15 and 18). These are 5.8 GHz, 2.4 GHz and 900 MHz.

IW—Inside wire.

IWCA—Inside wiring cable.

J

jabber (watchdog timer)—Built into controller units and transceiver units.

jabber, jabbering—In LAN technology, continuously sending random data (garbage); normally used to describe the action of a station (whose circuitry or logic has failed) that locks up the network with its incessant transmission.

jacket—Pertaining to wire and cable, the outer sheath that protects against the environment and may also provide additional insulation.

jam—A short encoded sequence emitted by a node to ensure that all other nodes have detected a collision.

JBOD (just a bunch of disks)—Used to refer to hard disks that aren't configured according to RAID; a subsystem of disk drives that improves performance and fault tolerance.

jitter—The slight movement of a transmission signal in time or phase that can introduce errors and loss of synchronization in high speed synchronous communications.

joule—A unit of energy defined as the work done when the point of application of one Newton is displaced one meter in the direction of the force.

jumper—1. A wire used to connect equipment and cable on a distributing frame. 2. When errors are found on printed circuit boards, a jumper cable is sometimes soldered in to correct the problem.

jumper wire—A short length of wire to route a circuit by linking two cross-connect termination points.

junction box—Metal box inside which cables are connected together.

K

Kapton—DuPont trademark for polyimide.

kB (kilobyte)—1,024 bytes. Usually describes bits or bytes, as in transmission speeds measured in KBsec or kilobits per second.

kbps—Kilobits per second.

kevlar—A high-strength DuPont polymer used as a cable messenger or strength member.

keying—The mechanical feature of a connector system that guarantees correct orientation of a connection or prevents the connection to a jack or to an optical fiber adapter of the same type intended for another purpose.

kHz—Kilohertz (1,000 hertz).

kilo—Prefix meaning thousand.

KPSI—A unit of tensile strength expressed in thousands of pounds per square inch.

KS—Connecting a CATV trunks hard line.

kV (kilovolt)—1,000 volts.

kVA—Kilovolt ampere.

Kynar—Atochem trademark for polyvinylidene fluoride (PVDF).

kW (kilowatt)—1,000 watts.

L

L—Inductance.

lag—The image retention of an object after the object has been scanned. Sometimes, it causes smearing effect.

LAMBDA—Individual wavelengths as a result of DWDM.

LAN (local area network)—A user-owned, user-operated, high-volume data transmission facility connecting a number of communicating devices within a single building or campus of buildings.

LASER (light amplification by stimulated emission of radiation)—A device that produces coherent light with a narrow range of wavelengths

laser-optimized multimode fiber (LOMMF)—Laser-optimized 50-micron multimode fiber. Uses an enhanced bandwidth capable of supporting 10 Gigabit Ethernet at 850 nm using VCSEL technology. This is also a restricted mode launch, so it avoids the pulse spreading due to DMD. Also referred to as OM3-grade fiber.

LATA (local access and transport area)—One of 161 USA geographical subdivisions used to define local as opposed to long distance telephone service.

lay—Pertaining to wire and cable, the axial distance required for one cabled conductor or conductor strand to complete one revolution about the axis around which it is cabled.

lay direction—The twist in the cable as indicated by the top strands while looking along the axis of the cable away from the observer. Described as right hand or left hand.

L Band—The band of frequencies between 390 and 1,550 megahertz.

lbf—Pound force.

LCL (longitudinal conversion loss)—A measurement of balance in a cable. Measured by applying a common-mode signal to the cable and measuring the differential at the near end.

LCTL (longitudinal conversion transfer loss)—Measured by applying a common-mode signal to a cable and measuring it at the far end of the cable. (Same as LCL but measures at far end.)

LDAP (Lightweight Directory Access Protocol)—An Internet protocol that e-mail programs use to look up contact information from a server.

lead-in—The conductor that provides the path for rf energy between the antenna and the radio and television receiver.

leakage current—An undesirable flow of current through or over the surface of an insulating material.

leakage distance—The shortest distance along an insulation surface between conductors.

LEAP—Cisco proprietary wireless security protocol.

leased line—A line intended for data communications that is leased from a telephone company. Leased lines are conditioned to a variety of specifications to keep impairments at a minimum. See also DIAL-UP.

LED (light-emitting diode)—Semiconductor device, much more reliable than an incandescent lamp, used for status display purposes in electronics equipment.

length of lay—The axial length of one turn of the helix of a wire or member.

level—A measure of the difference between a quantity or value and an established reference.

Glossary

level control—Main iris control. Used to set the auto iris circuit to a video level desired by the user. After setup, the circuit will adjust the iris to maintain this video level in changing lighting conditions. Turning the control toward high will open the iris, toward low will close the iris.

LF (low frequency)—A band of frequencies extending from 30 to 300 kHz in the radio spectrum, designated by the Federal Communications Commission.

lightning ground cable—A specially stranded single conductor cable connecting lightning rods (air terminals) protecting buildings to adequate ground, such as grounding rods.

light wave—The term used to describe the signal providing communication over optical fiber.

limpness—The ability of a cable to lay flat or conform to a surface as with portable or microphone cables.

line driver—A signal converter which conditions the digital signal transmitted by an RS-232 interface to ensure reliable transmission beyond the 50 ft. RS-232 limit and often up to several miles; it is a baseband transmission device.

line equalizer—A reactance (inductance and/or capacitance) connected in series with a transmission line to alter the frequency-response characteristics of the line.

line hit—An electrical surge, dip or transient that causes spurious signals in a circuit.

line level—The level of a signal at a certain point on a transmission line. Usually expressed in decibels.

line lock—To synchronize the field sync pulses, of an AC powered camera, to the frequency of the voltage input (line voltage).

line noise—Sustained high-frequency voltage excursions due to static electricity or RF interference from various sources.

line turnaround—The reversal of transmission on a half-duplex circuit.

line unbalance—Unequal loads on the phase lines of a multi-phase feeder.

linearity—The property of a transmission medium or of an item of equipment that allows it to carry signals without introducing distortion.

line voltage—The value of the potential existing on a supply or power line.

link—Communications circuit or transmission path connecting two points.

LLC (logical link control)—Defined by IEEE 802.2, it is the upper half of the second layer of the OSI model. It interfaces with the MAC and the network layer.

LLDPE (linear low-density polyethylene)—Usually used as cable jacketing.

load—A device that consumes or converts the power delivered by another device.

loaded line—A transmission line that has lumped elements (inductance or capacitance) added at uniformly spaced intervals. Loading is used to provide a given set of characteristics to a transmission line.

loading—See LOADED LINE.

lobe—In the multiuse communication loop, one of two separately driven sections of a loop. In the local area network, the section of cable that attaches a device to a wiring concentrator (access unit).

local area network (LAN)—A network that is located in a localized geographical area (e.g., an office, building, complex of buildings or campus) and whose communications technology provides a high-bandwidth, low-cost medium to which many nodes can be connected.

local exchange, local central office—The exchange or central office in which the subscriber's lines terminate.

local line, local loop—A channel connecting the subscriber's equipment to the line terminating equipment in the central office; usually a metallic circuit (either 2-wire or 4-wire).

LOMMF (laser-optimized multimode fiber)—Laser-optimized 50-micron multimode fiber, some times referred to as next-generation fiber, has enhanced bandwidth capable of supporting 10 Gigabit Ethernet at 850 nm using VCSEL technology. This is also a restricted mode launch so it avoids the pulse spreading due to DMD. Also called OM3.

long-haul network—A network most frequently used to transfer data over distances from several thousand feet to several thousand miles. These networks can use the international telephone network to transmit messages over most or part of these distances.

LCL (longitudinal conversion loss)—A measurement of balance in a cable. Measured by applying a common- mode signal to the cable and measuring the differential at the near end.

LCTL (longitudinal conversion transfer loss)—Measured by applying a common-mode signal to a cable and measuring it at the far end of the cable. (Same as LCL but measures at far end.)

loop—A closed circuit unidirectional signal path connecting input-output devices to the system.

looping—A term indicating that a high-impedance device has been permanently connected in a parallel to a video source.

loopback, loopback test—Type of diagnostic test in which the transmitted signal is returned to the sending device, after passing through all of or a portion of a data communications link or network; this allows a technician (or built-in diagnostic circuit) to compare the returned signal with the transmitted signal. This comparison provides the basis for evaluating the operational status of the equipment and the transmission paths through which the signal traveled.

loop test—A long line test where a good line is connected to a faulty line to form a loop in which measurements will locate the fault.

loss—1. The portion of energy applied to a system that is dissipated and performs no useful work. 2. Reduction in signal strength, expressed in decibels; also attenuation; opposite of GAIN.

loss factor—The power factor times the dielectric constant.

low frequency—A band of frequencies extending from 30 to 300 kHz in the radio spectrum, designated by the Federal Communications Commission.

low voltage—1. In the National Electrical Code, an electromotive force rated nominal 24 volts, nominal or less, supplied from a transformer, converter or battery. 2. In power system voltage ratings, a class of nominal system voltages 1,000 or less.

lumen—A unit of measurement for light output.

lux—A unit of measuring the intensity of light (1 FC = 10 lux).

LV—Low voltage.

LWAPP—Light Weight Access Point Protocol.

M

M-50 50/C high-speed modem cable—The 50/C cable assembly has the same function as the V.35 but allows for more circuit capability.

mA (milliampere)—One-thousandth of an ampere.

MAC (media access control)—The method by which network stations gain access to the network media and transmit information as part of the second layer of the OSI model.

magnetic field—The field created when current flows through a conductor; especially a coiled conductor.

main cross-connect—A cross-connect for first level backbone cables, entrance cables and equipment cables.

main distribution Ethernet—See STANDARD ETHERNET.

main ring path—The party of the ring made up of access units and the cables connecting them.

main trunk—The major link(s) from the headend or hub to downstream branches.

MAN (metropolitan area network)—A data network linking together terminals, memories and other resources at many sites within a city area. Each site may have its own local area network (LAN). Links between sites are usually on digital circuits rented from the local telephone company using a bit-rate appropriate to traffic requirements.

Glossary

Manchester code—A means of coding a single bit of data with two signaling pulses in the same time slot (0, 11, 1, 00), so there is a signal event for every bit of data, whether a 1 or a 0. This simplifies the clocking needed to interpret the bit stream at the receiving end.

manual iris lens—A lens with a manual adjustment to set the iris opening (f-stop) in a fixed position. Generally used for fixed lighting applications.

MAP (multiservice access platform)—Like a DSLAM they can provide service over copper wire using DSL technology but MAPs carry additional capabilities by also supporting FTTH and other types on interfaces out of the same platform. It has QoS capabilities also.

MAP (Manufacturing Automation Protocol)—The OSI profile championed by General Motors Corporation to provide interconnectivity between plant hosts, area managers and cell controllers over a broadband token-passing bus network.

MAP/TOP (Manufacturing Automation Protocol/Technical Office Protocol)—MAP originally developed by General Motors, defines OSI protocols and application utilities for use in the manufacturing environment. TOP, originally developed by Boeing, performs the same function for the office.

mark—1. In single-current telegraph communications, represents the closed, current-flowing condition. 2. In data communications, represents a binary 1; the steady state, no-traffic state for asynchronous transmission. 3. The idle condition.

MAT—Metropolitan area trunks.

matrix switcher—A switcher able to route any of its (camera) inputs to any of its (monitor) outputs, they often include telemetry control.

MATV (master antenna television system)—A small, less expensive cable system usually restricted to one or two buildings such as hospitals, apartments, libraries, hotels, office buildings, etc.

MAU (media access unit)—Circuitry used in LANs to enable data terminal equipment to access the transmission medium.

Mbps (megabits per second)—A unit of data transmission speed.

MC—Main cross connect.

MDF—Main distribution frame.

MDPE (medium-density polyethylene)—Usually used as cable jacketing.

mechanical focus (back-focus)—The mechanical aligning of the imaging device with the focal point of the lens; it is most important on zoom lenses to be sure the image stays in focus throughout the zoom range.

MDU (multiple dwelling units)—Apartment buildings and condominiums.

medium frequency—The band of frequencies between 300 and 3,000 kilohertz.

medium- and hard-drawn wire—As applied to copper wire, having tensile strength less than the minimum for hard drawn wire, but greater than the maximum for soft wire.

mega—Prefix meaning million.

megger—A special ohmmeter for measuring very high resistance. Primarily used for checking the insulation resistance of cables; however, it is also useful for leakage tests.

melinex—ICI trademark for polyester. See MYLAR.

messenger wire—A metallic supporting member either solid or stranded which may also perform the function of a conductor.

MHz (megahertz)—One million cycles per second.

MIB (management information base)—A set of descriptions of manageable features, used with SNMP devices. MIBS are unique per manufacturer and assigned by the IANA (Internet Assigned Numbers Authority).

MIC—1. Media interface connector. A FDDI fiber connector or an IBM Type 1 connector. 2. Multifiber indoor cable. A Corning term.

MICE (mechanical, ingress, climatic and electromagnetic)—A TIA rating system for the survivability of cabling components in varying degrees of environmental challenges.

micro—Prefix meaning one-millionth.

microfarad—One-millionth of a farad (μf, μfd, mf, and mfd are common abbreviations).

micromicrofarad—One millionth of a microfarad (μμf, μμfd, mmf, mmfd are common abbreviations). Also, a picofarad (pf or pfd).

micron (μm)—One-millionth of a meter.

microphone cable—A very flexible, usually shielded cable used for audio signals.

microprocessor—A computer-on-a-chip.

mil—A unit of length equal to one thousandth of an inch.

MIL—Military specification.

milli—Prefix meaning one-thousandth.

minimum object distance (MOD)—The closest distance a given lens will be able to focus upon an object. This is measured from the vertex (front) of the lens to the object. Wide angle lenses generally have a smaller MOD than large focal length lenses.

MIPS (millions of instructions per second)—One measure of processing power.

MMDS (multichannel multipoint distribution service)—Fixed wireless/wireless broadband.

mj (modular jack)—A jack used for connecting voice cables to a faceplate.

MMJ (modified modular jack)—A jack used for connecting data cables to a faceplate.

modem—A contraction of modulate and demodulate; a conversion device installed in pairs at each end of an analog communications line. The modem at the transmitting end modulates digital signals received locally from a computer or terminal; the modem at the receiving end demodulates the incoming analog signal, converts it back to its original (i.e., digital) format and passes it to the destination device.

modem eliminator, modem emulator—A device used to connect a local terminal and a computer port in lieu of the pair of modems that they would expect to connect to; allows DTE-to-DTE data and control signal connections otherwise not easily achieved by standard cables or connectors. Modified cables (crossover cables) or connectors (adapters) can also perform this function.

modular—Equipment is said to be modular when it is made of plug-in-units that can be added together to make the system larger and improve its capabilities or expand its size. There are very few phone systems that are truly modular.

modular plug—A series of connecting devices adopted by the FCC as the standard interface for telephone and data equipment to the public network. The most common is the RJ11, used to connect a single line phone and RJ45 for data.

modulate—To change or vary some parameter such as varying the amplitude of a signal for amplitude modulation or the frequency of a signal for frequency modulation. The circuit that modulates the signal is called a modulator.

modulation—1. The act of modifying the amplitude, phase or frequency of a carrier to allow the transmission of information. 2. The process by which a carrier is varied to represent an information-carrying signal. See AM, FM and PHASE MODULATION.

module—1. In hardware, short for card module. 2. In software, a program unit or subdivision that performs one or more functions.

MOF—Metal-clad optical fiber.

monochrome—Having only one color. In television it is black and white.

monochrome signal—In monochrome television, a signal for controlling the brightness values in the picture. In color television, the signal that controls the brightness of the picture, whether the picture is displayed in color or in monochrome.

MPEG—Motion Picture Experts Group.

Glossary

MPLS (Multiprotocol Label Switching)—A connection-oriented switching, not routing, technology, used as a mechanism for assuring QOS on IP networks.

MSDS—Material safety data sheets.

MTU—Multiple tenant units (office buildings).

multidrop—See MULTIPOINT CIRCUIT.

multimode—Optical fiber that allows more than one mode of light to propagate. A step-index fiber has a core of uniform refractive index while in a graded-index fiber the refractive index of the core smoothly varies with the radius.

multiplex—The use of a common physical channel in order to make two or more logical channels, either by splitting of the frequency band (frequency-division multiplex) or by utilizing this common channel at different points in time (time-division multiplex).

multiplexing/multiplexers—1. Equipment that permits simultaneous transmission of multiple signals over one physical circuit. 2. The division of a composite signal among several channels; concentrators, FDMs and TDMs are different kinds of multiplexers.

multipoint circuit—A single line connecting three or more stations.

multiport repeater—A repeater that is used to connect more than two cable segments.

multiport transceiver—Multiple transceiver connection packaged in a common rack. Provides one transceiver attachment to the trunk cable and the ability to serve up to eight stations.

multisegment LAN—A LAN that is composed of more than one coaxial cable segment.

multistation access unit—In the IBM Token-Ring Network, a wiring concentrator that can connect up to eight lobes to a ring network, the 8228. Also the four-lobe unit from General Instrument that uses Type 3 Media Cable.

mutual capacitance—Capacitance between two conductors in a cable.

MUX (multiplex)—To transmit two or more signals over a single channel.

muxer—Multiplexer. Electronic equipment which allows two or more signals to pass over one telephone line.

mV (millivolt)—One-thousandth of a volt.

MV (medium voltage)—Cables usually rated 5 to 35 kV.

mW (milliwatt)—One-thousandth of a watt.

Mylar—DuPont trademark of polyethylene terephtalate (polyester) film. See MELINEX.

N

NAM—Network access method.

NAS (network attached storage)—A data storage device that is attached directly to the main data network. (Lower cost than a SAN but shares bandwidth with the data network.)

NAT (network address translation/translator)—A device, or just software on a computer, that can separate a LAN network from the Internet. Routers are often NAT routers. It translates an internal IP address to an outside public IP address.

NBS (National Bureau of Standards)—A U.S. government agency that produces Federal Information Processing Standards (FIPS) for all U.S. government agencies and network users. Now called NIST (National Institute of Standards and Technology).

N Connector—A threaded connector to coax; N is named after Paul Neill.

n/d (neutral density) filter—A filter that attenuates light equally over the whole visible spectrum.

NEBS (network equipment building systems)—Standards defined test levels created by Telcordia Technologies (formerly Bellcore) in 1985 for the telecommunications industry. NEBS testing is required in the U.S. for equipment operated in the carrier networks of Regional Bell Operating Companies (RBOCs) and competitive local exchange carriers (CLECs).

NEC—National Electrical Code.

NEMA—National Electrical Manufacturers Association.

NEXT (near-end crosstalk)—The coupling of leakage of signal from the transmit pair to the receive pair measured at the near (transmitting) end. (Expressed in dB.)

Neoprene—A synthetic rubber with good resistance to oil, chemical and flame. Also called polychloroprene.

NETVIEW—IBM's network management product for its SNA networks. It can collect information from non-SMA environments via NetView/PC.

NETWARE—A popular proprietary network operating system from Novell, Inc.

network—A series of nodes connected by communications channels.

network channel terminating equipment—Equipment used at the customer premises to provide facility termination and signaling compatibility. Also called channel service unit (CSU).

network facilities—In a packet-switched network, standard facilities are divided into essential facilities (found on all networks) and additional facilities (selected for a given network but which may or may not be selected for other networks).

networking—The connection of one ISN system to other compatible local area networks or PBXs.

network interface controller—A communications device that allows interconnection of information processing devices to a network.

network management—Administrative services performed in managing a network, such as network topology and software configuration, downloading of software, monitoring network performance, maintaining network operations and diagnosing and troubleshooting problems.

network protection device—A device which provides isolation between PBX circuits and CO trunks or tie lines.

network topology—The physical and logical relationship of nodes in a network. Networks are typically of a star, ring, tree or bus topology or some hybrid combination thereof.

Newton—The derived SI unit for force; the force that will give one kilogram mass an acceleration of one meter per second: $1N = 1 \bullet (kg \bullet m) / s^2$.

NEXT—Near-end crosstalk.

NFPA—National Fire Protection Association.

NIC (network interface card)—Also called controller card, PC expansion card, controller board, network interface controller, adapter card, adapter board, network adapter module or network interface module. Its function is to allow the workstation to be physically and electronically connected to some specific network at the physical and data link layer.

NIU—Network interface unit.

node—A station.

noise—In a cable or circuit, any extraneous sounds or signal which tends to interfere with the sound or signal normally present in or passing through the system.

Nomex—DuPont trademark for a temperature-resistant, flame-retardant nylon.

nominal—Name or identifying value of a measurable property by which a conductor or component or property of a conductor is identified and to which tolerances are applied.

NOS (network operating system)—A generic term that applies to local area network operating system software.

NRZ (non-return to zero)—The common encoding of a binary stream into two voltage levels.

NRZI (non-return to zero inverted)—In SDLC0, a binary encoding technique in which a change in state represents a binary 0 and no change in state represents a binary 1.

N-series connector—A coaxial connector (RG-8/U) used in standard Ethernet networks.

NT—Network termination.

NTP (network time protocol)—A protocol designed to synchronize the clocks of computers over a network.

Glossary

NTSC (National Television System Committee)—The television standard for North America and parts of South America having 525 lines/60 Hz (60 Hz refresh), two fields per frame and 30 frames per second (60 fields per second).

null modem—Same as modem eliminator.

null modem cable assemblies—The null modem cable assembly utilized the RS-232 cable system and replaces short distance modems.

numerical aperture—The acceptance angle of an optical fiber which determines the angle at which light can enter the fiber; expressed as a number that is equivalent to the sine of the angle.

NVP (nominal velocity of propagation)—This is a measure of how fast a signal travels along a line.

NVR (network video recorder)—A storage device on a network for storing IP video.

nylon—An abrasion-resistant thermoplastic with good chemical resistance.

NZDSF—Non-zero dispersion shifted fiber.

O

octet—In packet-switched networks, a grouping of eight bits; similar but not identical by byte.

OD—Outside diameter.

ODBC (open database connectivity)—ODBC is a widely accepted application programming interface (API) for databases using structured query language (SQL).

ODI (open data link interface)—Novell's media-and-protocol-independent communications specification providing a standard interface that allows transport protocols to share a network interface card without conflict.

OFDM—Orthogonal frequency division multiplexing.

OEM—Original equipment manufacturer.

OFDM—Orthogonal frequency division multiplexing.

OFHC—Oxygen-free high-conductivity copper.

OFL (overfilled launch)—Standard for MMF when used with LEDs (uses 100 percent of core).

OID—Object ID.

ohm—(Ω) The electrical unit of resistance. The value of resistance through which a potential difference of one volt will maintain a current of one ampere.

Ohm's law—Stated E=IR, I=E/R, or R=E/I where E is voltage, I is current and R is resistance.

1BASE-5—Starlan.

100BASE-T—100 Mbps over twisted pair.

110-type connecting block—The part of 110-type cross-connect that terminates twisted-pair wiring and can be used with either jumper wires or patch cords to establish circuit connections.

110-type wiring—The distribution system hardware developed for Dimension System 85 and other current AT&T information systems. Originally known as 88-type wiring, it was refined over a ten-year period so that customers could participate in circuit rearrangement. The number 110 is part of a Western Electric product code.

1000BASE-T—1,000 Mbps over twisted pair.

online computer—A computer used for online processing.

open architecture—An architecture that is compatible with hardware and software from any of many vendors. Contrast with CLOSED ARCHITECTURE.

open circuit—A break in an electrical circuit so that there can be no current flow.

OLT (optical line terminator)—In EFM applications, an aggregation device, usually located at the CO, that uses passive optical splitting from one fiber from a CO Ethernet switch to individual fibers feeding homes.

OM3—ISO/IEC 11801 specification for laser optimized multimode fiber type for 10 Gbps applications.

ONT (optical network terminal)—Fiber terminal outside a residence in FTTH application. Conversion point from fiber to copper.

ONU (optical network unit)—In an EPON system the ONU provides the functionality to connect the fiber owned by the service provider to the media in the residence.

optical connector—Connector designed to connect and disconnect either single or multiple optical fibers repeatedly. Optical connectors are used to connect fiber cable to equipment and interconnect cables. (Examples are: ST, SC, SMA, etc.)

optical cross-connect—A cross-connect unit used for circuit administration and built from modular cabinets. It provides for the connection of individual optical fibers with optical fiber patch cords.

optical encoder—A device whose position is determined by a photoelectric device and converted to an electrical data output.

optical fiber connector—See OPTICAL CONNECTOR.

optical fiber duplex adapter—A mechanical media termination device designed to align and join two duplex connectors.

optical fiber duplex connector—A mechanical media termination device designed to transfer optical power between two pairs of optical fibers.

optical fiber duplex connection—A mated assembly of two duplex connectors and a duplex adapter.

optical fiber—A very thin, flexible glass or plastic fiber carrying high-bandwidth digital or analog signals in the form of pulses of light. Fiber can carry a thousand times more information than conventional copper wire. Lasers or light-emitting diodes (LEDs) emit pulses of light, which are propagated through the fiber by a process of internal reflection. A fiber consists of two layers of glass or plastic enclosed in a protective buffer.

optical interconnect—An interconnection unit used for circuit administration and built from modular cabinets. It provides interconnection for individual optical fibers, but unlike the optical cross-connect panel, it does not use patch cords. The optical interconnect provides some capability for routing and rerouting circuits, but is usually used where circuit rearrangements are infrequent.

optical splice—A fiber optic splice provides the means by which two or 24 fiber optic cable ends are permanently joined together. Two types of optical splices are fusion and mechanical.

optical transceiver—An optical device which both transmits and receives data over optical fiber.

optimization—The procedure used in the design of a system to maximize or minimize some performance index.

ORL—Optical return loss.

OSHA (Occupational Safety and Health Act)—Federal Law #91-596 or 1970 charging all employers engaged in business affecting interstate commerce to be responsible for providing a safe working place. It is administered by the Department of Labor. OSHA regulations are published in Title 29, Chapter XVIII, Part 1910 of the CFR and the Federal Register.

OSI (open systems interconnection)—The OSI reference model for a logical structure for network operations standardized with the ISO; a 7-layer network architecture being used for the definition of network protocol standards to enable any OSI-compliant computer or device to communicate with any other OSI-compliant computer or device for an exchange of information.

OS/2—An operating system developed by IBM, largely relegated to niche uses and virtualization applications.

OTDR (Optical Time Domain Reflectometer)—An instrument that locates faults in optical fibers or infers attenuation from backscattered light measurements.

outlet box, telecommunications—A metallic or nonmetallic box mounted within a wall, floor or ceiling and used to hold telecommunications outlets, connectors or transition devices.

Glossary

outlet/connector, telecommunications—A connecting device in the work area on which horizontal cable terminates.

out-of-band signaling—A method of signaling which uses a frequency that is within the passband of the transmission facility, but outside of a carrier channel normally used for information transmission.

output—The useful power to signal delivered by a circuit or device.

oxygen index—A test to rate flammability of materials in a mixture of oxygen and nitrogen. More formally referred to as limiting oxygen index (LOI).

P

PABX (private automatic branch exchange)—Equipment originally used as a means of switching telephone calls within a business site and from the site to outside lines. Can also be used for low speed transmission of data, in addition to voice.

packet—A collection of bits that contain both control information and data. The basic unit of transmission in a packet-switched network, control information is carried in the packet, along with the data, to provide for such functions as addressing, sequencing, flow control and error control at each of several protocol levels. A packet can be of fixed or variable length, but generally has a specified maximum length.

packet format—The exact order and size of the various control and information fields of a packet, including header, address and data fields.

packet overhead—A measure of the ratio of the total packet bits occupied by control information to the number of bits of data, usually expressed as a percent.

packet switching—A data communications technique in which data is transmitted by means of addressed packets and a transmission channel is occupied for the duration of transmission of the packet only. The channel is then available for use by packets being transferred between different data terminal equipment.

PACS—Physical access control system.

pad—A passive attenuation device used to reduce a signal's amplitude.

PAD (packet assembler/disasssembler)—In a X.25 packet-switched network, a device used to interface non- X.25 devices to an X.25 network; it may be synchronous or asynchronous, single or multiple channel.

PAL (phase alternating line)—A non-NTSC video format used mainly in Europe, Australia, China, India and many countries in Africa and the Middle East. It has 625 lines of resolution with 50 fields per second or 25 frames per second.

PAM—Pulse amplitude modulation.

parallel circuit—A circuit in which identical voltage is presented to all components, and the current divides among the components according to the resistances or the impedances of the components.

parallel transmission—A technique that sends bits simultaneously over a separate lines; normally used to send data a byte (eight bits over eight lines) at a time to a high-speed printer or other locally attached peripheral. Contrast with SERIAL TRANSMISSION.

parity, parity check—Addition of overhead bits to ensure that the total number of 1s in a grouping of bits is either always even for even parity or always odd for odd parity. This permits detection of single errors. It may be applied to characters, transmission blocks or any convenient bit grouping.

passive—A nonpowered element of a system.

patch cable—In the IBM cabling system, a length of Type 6 cable with data connectors on both ends.

patch cord—A flexible piece of electrical cord terminated at both ends with plugs, used for interconnecting circuits on a patch board.

patch panel—A terminating enclosure for connecting cables. See DISTRIBUTION PANEL.

path loss—Actual signal attenuation from point of transmission to point of reception.

pathway—A facility for the placement of telecommunications cable.

PBX (private branch exchange)—A manual, user-owned telephone exchange. Sometimes used in a general sense to include both PBXs and PABXs.

PC—Personal computer.

PCM (pulse code modulation)—A modulation technique used to convert analog voice signals into digital form. Used for voice multiplexing on T1 circuits.

PCMCIA—Personal Computer Memory Card International Association.

PCP—(Neoprene) Polychloroprene.

PDN (public data network)—A packet switched or circuit switched network available for use by many customers. PDNs may offer value-added services at a reduced cost because of communications resource sharing, and usually provide increased reliability due to built-in redundancy.

PDS—See PREMISES DISTRIBUTION SYSTEM.

PDU—Power distribution unit.

PE—Polyethylene.

peak—The maximum instantaneous value of a varying current or voltage. Also called crest.

peak-to-peak—The amplitude difference between the most positive and the most negative excursions of a signal.

peripheral—Any device used to process data for entry into or extraction from a computer.

personal computer—A microcomputer with an end-user-oriented application program (used by data processing professionals and non-professionals alike) for an assortment of functions.

PFA—Teflon is the DuPont trademark for perfluoroalkoxy.

phase—The location of a position on a waveform of an alternating current, in relation to the start of a cycle. Measured in degrees with 360 corresponding to one complete cycle.

phase modulation—One of three basic ways to add information to a sine wave signal; the phase of the sine wave, or carrier, is modified in accordance with the information to be transmitted. With only discrete changes in phase, this technique is known as phase shift keying (PSK).

phase sequence—The order in which successive members of a periodic wave set reach their positive maximum values: a) zero phase sequence, no phase shift; b) plus/minus phase sequence, normal phase shift.

phase shift—A change in the phase relationship between two alternating quantities. The phase angle between the input and output signals of a system.

pickup—Any device which is capable of transforming a measurable quantity of intelligence (such as sound) into relative electrical signals, e.g., a microphone.

PHY—The physical layer device, a circuit block that includes a PMD (physical media dependent), a PMA (physical media attachment), and a PCS (physical coding sublayer).

PIC—Polyethylene insulated cable.

pico—Prefix meaning one-millionth of one-millionth (10^{-12}).

picofarad—One-millionth of one-millionth of a farad. A micromicrofarad, or picofarad (abbreviation pf).

PILC cable—Paper insulation, lead covered.

PIMF—Pairs in metal foil. Also referred to as S/FTP cable.

pinhole lens—Lens used for applications where the camera or lens must be hidden. Front of lens has a small opening to allow the lens to view an entire room through a small hole in a wall.

PIR—Passive infrared.

PIV—Personal identity verification.

plastic—High-polymeric substances, including both natural and synthetic products, but excluding the rubbers that are capable of flowing under head and pressure.

plasticizer—A chemical added to plastics to make them softer and more flexible.

Glossary

plenum cable—1. A cable that is UL Listed as having adequate fire resistance and low smoke producing characteristics for installation without conduit in ducts, plenums and other spaces used for environmental air, as permitted by NEC Articles 725-2(b) and 800-3(b). 2. Cable specifically designed for use in a plenum, the space above a suspended ceiling used to circulate air back to the heating or cooling system in a building. Plenum cable has insulated conductors often jacketed with Teflon or Halar to give them low flame—and low smoke—producing properties.

PLP—Packet layer protocol.

PLTC (power limited tray cable)—Rated 300 volts.

PMD—1. Physical medium dependant. The portion of the physical layer (PHY) responsible for interfacing to the transmission medium, the physical media dependent sub layer is responsible for transmission. 2. Polarization mode dispersion.

PoE (Power over Ethernet)—A system to transfer electrical power, along with data, to remote devices over standard twisted-pair cable in an Ethernet network. Defined by the IEEE 802.3af standard.

POF (polymer optical fiber)—One of the media projected to become the heart of an automotive LAN. Current experimentation and technological agreements between key companies may result in technological advancements to ultimately herald the introduction of LANs in transportation vehicles. The POF media would become the communications backbone of the vehicle.

point-to-point connection—See LINK.

polar transmission—See BIPOLAR TRANSMISSION.

polyethylene—A thermoplastic material having excellent electrical properties.

polymer—A substance made of many repeating chemical units or molecules. The term polymer is often used in place of plastic, rubber or elastomer.

polymer optical fiber—One of the media projected to become the heart of an automotive LAN. Current experimentation and technological agreements between key companies may result in technological advancements to ultimately herald the introduction of LANs in transportation vehicles. The POF media would become the communications backbone of the vehicle.

polypropylene—A thermoplastic similar to polyethylene but stiffer and having higher softening point (temperature).

polyurethane—Broad class of polymers noted for good abrasion and solvent resistance. Can be solid or cellular form.

polyvinyl chloride (PVC)—A general purpose thermoplastic used for wire and cable insulations and jackets.

port—1. An entrance to or exit from a network; an access point for data entry or exit. 2. A computer interface capable of attaching to a modem for communicating with a remote terminal.

port concentrator, port concentration—A device that allows several terminals to use a single computer port; a concentrator link in which the port concentrator simplifies the software demultiplexing used in lieu of the demultiplexing normally performed by the computer-site concentrator.

post equalization—A method of equalizing the signal that comes from the customer equipment to the D4 channel bank. Equalization provides a near-linear level for all frequencies in the voice-frequency band.

POTS—Acronym for plain old telephone service.

potting—Sealing by filling with a substance to exclude moisture.

power—The amount of work per unit of time. Usually expressed in watts and equal to I^2R.

power factor—The cosine of the phase difference between current and applied voltage.

power loss—The difference between the total power delivered to a circuit, cable or device, and power delivered by that device to a load.

power ratio—The ratio of the power appearing at the load, to the input power. Expressed in dB, it is equal to 10 $\log_{10}$ (P_x/P_1) where P_1 is input power and P_2 is the power at the load.

PPE—Polypropylene ethylene.

PPP (point-to-point protocol)—PPP is the Internet standard for transmission of IP packets over serial lines. PPP supports async and sync lines.

pps—Pictures per second. Sometimes referred to as ips (images per second).

PPTP—Point to point tunneling protocol.

PSAACRF—Powersum insertion loss to alien crosstalk ratio far-end.

PSAFEXT—Powersum alien far-end crosstalk. A computation of signal coupling from multiple near-end disturbing channel pairs into a disturbed pair of a neighboring channel or part thereof, measured at the far-end.

PSANEXT—Powersum alien near-end crosstalk. A computation of signal coupling from multiple near-end disturbing channel pairs into a disturbed pair of a neighboring channel or part thereof, measured at the near-end.

PSELFEXT—Powersum equal level far-end crosstalk.

PSNEXT (power sum near-end crosstalk)—The calculated total NEXT caused by the coupling of signals from all transmitting pairs in a cable to one other non-energized pair at the same cable end.

PSTN—Public switched telephone network.

PTC (positive temperature coefficient)—A type of resistor that acts like a fuse. It is more slow acting and does not have the accurate trip threshold as a fuse and does not protect as reliably as fuses. Their advantages are they will reset when they cool unlike a fuse which will blow and must be replaced.

preamble—An alternating sequence (1, 0, 1, 0. . .) signaling the beginning of a packet.

premises distribution system—The transmission network inside a building or group of buildings that connects various types of voice and data communications devices, switching equipment and other information management systems together, as well as to outside communications networks. The system consists of all the transmission media and electronics, administration points, connectors, adapters, plugs and supports hardware between the building's side of the network and the terminal equipment required to make the system operational.

premises network—See CABLE SYSTEM.

preposition lenses—Zoom lenses that utilize a variable-resistor (potentiometer) to indicate zoom or focus position to the lens controller. After initial setup, this allows the operator to view different preset areas quickly without having to readjust the zoom and focus each time.

private line—See LEASED LINE.

private network, private line—Telecommunications network owned by the customer or reserved for exclusive use by the customer. Same as leased line.

production (routine) tests—Tests made on components or subassemblies during production for the purpose of quality control.

PROM (programmable read-only memory)—Permanently stored data in a nonvolatile semiconductor device.

propagation delay—The transmit time through a link, network, system or piece of equipment.

propagation delay skew—The difference in delay between the fastest and slowest pairs within the same cable sheath.

proprietary LAN—A LAN that runs the equipment of only one manufacturer.

protective covering—A field-applied material to provide environmental protection over the splice or housing, or both.

protocol—A set of procedures for establishing and controlling communications.

protocol analyzer—A test unit that provides compatibility with leading integrated network management systems to optimize troubleshooting and centralized performance analysis of enterprise networks.

Glossary

protocol converters—Devices that transform one protocol to another in order to provide compatibility between systems using different protocols. In ISN, the Model 4271 Protocol Converter translates ASCII data to bisynchronous data and, in reverse, converts bisynchronous data to ASCII data. The model 4276 performs a similar translation between ASCII data and SNA/SDLC protocol.

PSN (packet switching network)—A network that enables external computers and terminals to communicate with other computers linked to the network. PSN uses packet switching to transmit data. Connections to PSN are governed by a series of recommendations known collectively as X.25.

PTFE (TFE Teflon)—Polytetrafluoroethylene.

PTSS—Passive transmission subsystem.

PTT (post telephone and telegraph authority)—The government agency that functions as the communications common carrier and administrator in many areas of the world.

pulse—A current or voltage which changes abruptly from one value to another and back to the original value in a finite length of time.

pulse width modulation—Modulating a pulse train by varying the pulse width in proportion to the modulating signal's significant characteristic.

punch-down block—A 2-foot piece of metal and plastic that allows you to connect telephone wiring coming from two remote points. Also called a 66-block or quick-connect block.

PUR—Polyur ethane.

PVC (permanent virtual circuit)—In a packet-switched network, a fixed virtual circuit between two users; no-call setup or clearing procedures are necessary; the PDN equivalent of a leased line; contrast with switched virtual circuit.

PVC (polyvinyl chloride)—A common insulating and jacketing material used on cables.

PVDF—Kynar, Atochem trademark for polyvinylidene fluoride.

Q

Q band—The band of frequencies between 36 and 46 gigahertz.

QoS—Quality of service.

QPSK (quadrature phase shift keying)—It is a digital frequency modulation technique used for sending data over coaxial cable networks.

R

R—Resistance or resistor.

raceway—A channel for holding electric wires or cables.

rack—1. Same as cabinet. 2. The vertical or horizontal open support usually made of aluminum or steel that is attached to a ceiling or wall. Cables are laid in and fastened to the rack.

rack mount—Designed to be installed in a cabinet.

radio frequency—The frequencies in the electromagnetic spectrum that are used for radio communications. A band of frequencies between 10 kilohertz and 100 gigahertz.

RADIUS (remote authentication dial-in user service)—A service to authenticate dial-in users on a LAN (RADIUS server).

RAID (redundant array of inexpensive disks)—A term used to describe a storage systems' resilience to disk failure through the use of multiple disks and by the use of data distribution and correction techniques.

RAM (random access memory)—Volatile memory.

random interlace—A scanning technique commonly used in CCTV systems in which there is no external control over the scanning process. There is no fixed relationship between adjacent lines and successive fields.

range finder—Used to determine the focal length needed and what the picture will look like on the monitor. The user looks through the device and adjusts the range finder to the desired picture. Numbers on the outside of the range finder indicate the focal length needed.

raster—The rectangular pattern of scanning lines upon which the picture is produced. The illuminated face of the TV monitor without the video information present.

REA (Rural Electrification Agency)—A federally supported program to provide electrical service to rural area. Now referred to as Rural Utilities Services (RUS).

RBOC—Regional Bell Operating Company.

reactance—The opposition offered an alternating electron flow by a capacitance or inductance. The amount of such opposition varies with the frequency of the current. The reactance of a capacitor decreases with an increase in frequency; the opposite occurs with an inductance. The imaginary part of impedance.

real-time system—An online computer that generates output nearly simultaneously with the corresponding inputs. Often, a computer system whose outputs follow by only very short delay its inputs. Also called transaction processing.

redundancy—The inclusion of extra assemblies of circuits within the UPS, with provision for automatic switchover from a failing assembly or circuit to its operational counterpart.

reflected light—The scene brightness or the light being reflected from a scene. Usually it represents 5 to 95 percent of the incident light, and it is expressed in foot-lamberts.

reflection—The change in direction (or return) of waves striking a surface. For example, electromagnetic energy reflections can occur at an impedance mismatch in a transmission line, causing standing waves.

reliability—The probability that a device will function without failure over a specified time period of amount of usage.

remote alarms—Alarm indications or status displayed at the distant end of a foreign location to the transmission line.

repeater—1. A device used to extend the length, topology or interconnectivity of the physical network medium beyond the limits imposed by a single segment. Repeaters perform the basic actions of restoring signal amplitude, waveform and timing applied to normal data and collision signals. 2. In an ISN system, a module in every information interface carrier that synchronizes bus transmissions throughout the packet controller by repeating on each IIC the timing and transmission signals generated by the clock module in the control and interface unit.

resistance—In DC circuits, the opposition a material offers to current, measured in ohms. In AC circuits, resistance is the real component of impedance, and may be higher than the value measured at DC.

resistivity—A material characteristic opposing the flow of energy through the material—expressed as a constant for each material—is affected by temper, temperature, contamination, alloying, coating, etc. The ability to resist the flow of electrical current either through the bulk of the material or on its surface. The unit of volume resistivity is the ohm-cm. The unit of surface resistivity is ohms/m^2.

resolution—A measure of the ability of a camera or television system to reproduce detail. That is the number of picture elements that can be reproduced with good definition. It is a factor of the pickup device or the TV CRT characteristics and the video signal bandwidth.

resonance—An AC circuit condition in which inductive and capacitive reactances interact to cause a minimum or maximum circuit impedance.

retained image (image burn)—A change produced in or on the target of the pickup device that remains for a large number of frames after the removal of a previously stationary light image and that yields a spurious electrical signal that corresponds to that light image.

Glossary

retractile cord—A cord having specially treated insulation or jacket, so it will retract like a spring. Retractability may be added to all or part of cord's length.

return—Inbound direction; toward the headend.

return loss—A measure of the degree of impedance mismatch between two impedances. It is the ratio, expressed in dB, of the amplitude of a reflected wave to the amplitude of the main wave at the junction of a transmission line and a terminating impedance.

reverse direction—The direction on the cable from the modem to the headend.

REX (request to exit)—Sometime referred to as RQE.

RF (radio frequency)—Uses electromagnetic waveforms used for transmission, usually in the megahertz (MHz) range. Electromagnetic waves are usually transmitted between 500 kHz and 300 GHz.

RFI (radio frequency interference)—The disruption of radio signal reception caused by any source that generates radio waves at the same frequency and along the same path as the desired wave.

RFID (radio frequency identification)—A type of wireless access control technology between a proximity card and a reader. The most common is the 125 kHz frequency used with proximity cards. There is also a 13.56 MHz version that is a contactless smart card credential.

RG (residential gateway)—A network interface device that provides a means to access a service delivered to the home.

RF modem (radio frequency modem)—Device used to convert digital data signals to analog signals (and from analog to digital) then modulate/demodulate them to/from their assigned frequencies.

RG-U—RG is the military designation for coaxial cable, and U stands for general utility.

RG-58U 50-ohm coaxial cable assembly—Used as Ethernet thinnet trunk cable and many other 50-ohm compatible systems. True Ethernet has a standard center conductor.

RG-59U 75-ohm coaxial cable assembly—Used as interconnect data equipment for the Wang system CATV, and all other compatible data, voice, baseband and broadband video systems.

RG-62U 93-ohm coaxial cable assembly—Used extensively on the IBM cabling system and all other compatible systems.

ribbon fiber cable—A cable that accommodates 1 to 12 ribbons, each ribbon having 12 fibers for a cable size range of 12 to 144 fibers. Ribbon cables are designed for use in large distribution systems where small cable size and high pulling strength are important.

RI—Ring in.

ring—1. In LAN technology, a closed loop network topology; contrast with bus and star. 2. One of the two wires in a telephone circuit. The ring wire usually has a negative battery potential relative to the tip wire. 3. A network topology in which stations are connected to one another in a closed logical circle. Typically, access to the media passes sequentially from one station to the next by means of polling from a master station, or by passing an access token from one station to another.

ring-down circuit—A tie line connecting phones in which picking up one phone automatically rings the other phone.

ring in—On an access unit, the transmit or output receptacle.

RISC (reduced instruction set computer)—The IBM RISC System/6000 system units are a second generation of computers using the RISC architecture. They offer a full range of multiuser, multitasking, open-architecture workstations and servers.

riser—Main distribution cable segments that run between floors or sections of a building.

riser cable—Cable that is UL Listed as having adequate fire resistance for installation without conduit in building riser applications such as elevator shafts. (Examples: CMR and OFNR rated.)

RJ11—A six-contact modular phone-type plug. It may have straight-through or crossover pinning depending on the application.

RJ45—An eight contact modular AT&T phone-type plug that has 4-pair unshielded twisted-pair wire (eight wires twisted in pairs).

RMS—Root-mean square.

RML (restricted mode launch)—It simulates the launch conditions of a vertical cavity surface-emitting laser (VCSEL) into a multimode fiber. Measuring RML bandwidth gives a better indicator of multimode fibers performance when used with a VCSEL.

RO—Ring out.

RO (read only)—A teleprinter receiver without a transmitter.

ROHS (Restriction of Hazardous Substances)—The RoHS is a European directive that restricts the use of certain hazardous substances in electrical and electronic equipment.

roll—A loss of vertical sync which causes the picture to move up or down on the TV screen.

ROM (read-only memory)—Nonvolatile semiconductor storage device manufactured with predefined contents. Compare with EPROM, PROM, and RAM.

romex—A type of nonmetallic sheathed cable.

root-mean-square (rms)—In a periodic quantity, this is the square root of the average or mean of the squares of the quantity taken over a complete period.

router—A station that uses upper level protocols to control network communication between other stations. A dedicated router, such as a DECnet router, offloads the host computer of the routing function.

route table—A database entered in the packet controller's memory by the system manager, containing addressing information on all nodes in the network. The packet controller refers to the router table when establishing virtual circuits between endpoints.

RS-232—An EIA recommended standard (RS); most common standard for connecting data processing devices, RS- 232 defines the electrical characteristics of the signals in the cable that connect DTE with DCE; it specifies a 25-pin connector (the DB-25 connector is almost universally used in RS-232 applications) and it is functionally identical to CCITT V.24/V.28.

RS-232C—A technical specification published by the EIA that specifies the mechanical and electrical characteristics of the interface for connecting DTE and DCE. It defines interface circuit functions and their corresponding connector pin assignments. The standard applies to both asynchronous and synchronous serial, binary data transmission at speeds up to 20 kbps, in full- or half-duplex mode. RS- 232-C defines 20 specific functions. The physical connection between DTE and DCE is made through plug-in, 25-pin connectors. RS-232-C is functionally compatible with the CCIT Recommendation V.24.

RS-232-C serial I/O port—A standard connection interface for computer peripheral equipment.

RS-422—A standard operating in conjunction with RS-449 that specifies electrical characteristics for balanced circuits. An EIA recommended standard for cable lengths that extended the RS-232 50-foot limit. Although introduced as a companion standard with RS-449, RS-422 is most frequently implemented on unused pins of DB-25 (RS-232) connectors. Electrically compatible with CCITT recommendation V.11.

RS-423—A standard operating in conjunction with RS-449 that specifies electrical characteristics for unbalanced circuits. An EIA recommended standard for cable lengths that extended the RSD-232 50-foot limit. Although introduced as a companion standard with RS-422, RS-423 is not widely used. Electrically compatible with CCITT recommendation V.10.

RS-449—Another EIA standard for DTE/DCE connection which specifies interface requirements for expanded transmission speeds (up to 2 Mbps), longer cable lengths and 10 additional functions. RS-449 applies to binary, serial, synchronous or asynchronous communications. Half- and full-duplex modes are accommodated and transmission can be over 2- or 4-wire facilities such as point-to-point multipoint lines. The physical connection between DTE and DCE is made through a 37-contact connector; a separate 9-connector is specified to service secondary channel interchange circuits, when used.

Glossary

RS-485—An EIA recommended standard which specifies electrical characteristics of generators and receivers for use in balanced digital multiport systems. It allows for multiple generators and receivers to be attached to a common interconnecting cable. Overall shielded twisted-pair cable is the primary transmission medium.

RTSP—Real-time streaming protocol.

RTP (real-time transport protocol)—An IP protocol that supports real time transmission of voice and video. Real-time control protocol is a companion protocol that is used to maintain QoS.

RTU—Remote terminal unit.

S

SAA—IBM's system application architecture. IBM's suite of protocols intended to foster interoperability and standard interfaces for applications in an IBM environment across all hardware architectures and operating environments.

SAN (storage area network)—A self-contained data storage network separate from the regular data network.

satellite equipment room—A room or wiring closet used as the central wiring hub.

saturation (color)—The vividness of a color. It is directly related to the amplitude of the chrominance signal.

S band—A band of frequencies between 1,550 and 5,200 megahertz.

SC connector—A plastic connector with a precision ceramic or polymer ferrule designed for optical fiber subscriber channel (SC) networks. Manufactured under NIT license by various companies, it offers a non-optically disconnecting design with push-pull latching.

scanning—The rapid movement of the election beam in a pickup device of a camera or in the CRT of a television receiver. It is formatted in a line-for-line manner across the photo sensitive surface that produces or reproduces the video picture. When referred to a video surveillance field, it is the panning or the horizontal camera motion.

scrambling—A method of encoding data to make it look more random, resulting in lower spurious levels and easier timing recovery.

screened twisted pair (ScTP)—100-ohm twisted-pair cable with an overall foil shield and a drain wire typically used in Category 5 cable.

SCSI (small computer system interface)—Typically used for mass storage, i.e., hard disks.

SDI (serial data interface)—SDI cables are a type of coax used for HDTV. Comes in RG-59, RG-6 and bundled versions.

SDLC (synchronous data link control)—An IBM communications line protocol associated with SNA. SDLC provides for control of a single communications link or line, accommodates a number of network arrangements and operates in half- or full-duplex over private or switched facilities.

segment—1. A length of coaxial cable made up of one or more cable sections connected together with barrel connectors or T-connectors. 2. In a LAN, a segment of coaxial trunk cable with a maximum of 1,640 feet (500 meters) of regular Ethernet and 600 feet (187 meters) of RG-58A/U Thinnet.

semiconductor—In wire industry terminology, a material possessing electrical conduction properties that fall somewhere between conductors and insulators. Usually made by adding carbon particles to an insulator. Not the same as semiconductor materials such as silicon, germanium, etc., used for making transistors and diodes.

sensitivity (pickup device)—The amount of current developed per unit of incident light. It can be measured in watts with the projection of an unfiltered incandescent source of light at 2,870 K degrees to the pickup device surface area. It can be then expressed in foot candles.

serial interface—An interface that requires serial transmission, or the transfer of information in which the bits composing a character are sent sequentially. Implies only a single transmission channel.

serial transmission—A technique in which each bit of information is sent sequentially on a single channel, rather than simultaneously as in parallel transmission. Serial transmission is the normal mode for data communications. Parallel transmission is often used between computers and local peripheral devices.

series circuit—A circuit in which the components are arranged end-to-end to form a single path for current.

server—A processor that provides a specific service to the network. Examples of servers are as follows: routing servers connect nodes and networks of like architectures; gateway servers connect nodes and networks of different architectures by performing protocol conversions; and terminal servers, printer servers and file servers provide an interface between compatible peripheral devices on a LAN.

shared access—In LAN technology, an access method that allows many stations to use the same (shared) transmission medium. Contended access and explicit access are two kinds of shared access methods. Contrast with DISCRETE ACCESS.

sheath—A covering over the conductor assembly that may include one or more metallic members, strength members or jackets.

shield—A sheet, screen or braid of metal, usually copper, aluminum or other conducting material placed around or between electric circuits, cables or their components to contain any unwanted radiation or to keep out any unwanted interferences.

shield coverage—See SHIELD PERCENTAGE.

shield effectiveness—The relative ability of a shield to screen out undesirable radiation. Frequently confused with the term shield percentage, which it is not.

shield percentage—The physical area of a circuit or cable actually covered by shielding material, expressed in percent.

short—A low resistance path that results in excessive current flow and often in damage.

short-haul modem—See LINE DRIVER.

shunt—A very low-resistance component used to divert a proportion of the current.

SI—An international system of standardized units of measurement.

SIA (Security Industry Association)—Professional organization involved in CCTV, access control, computer security, and fire and burglar alarm systems.

signal—Any visible or audio indication which can convey information. Also, the information conveyed through a communications system.

signal-to-noise ratio (S/N or SNR)—A ratio of the amplitude in a desired signal to the amplitude of the noise, usually expressed in decibels (dB).

silicon avalanche zener diodes—A solid-state junction device. These devices are very fast acting but have low energy-handling capability. Switching speed is in picoseconds. They work by shunting the surge of spike impulse around the protected circuits.

silicone—A material made from silicon and oxygen. Can be in thermosetting elastomer or liquid form. The thermosetting elastomer form is noted for high-heat resistance.

simplex (multiplexer)—A multiplexer that allows the user to look at multiscreen images or perform time multiplex recording. It cannot record multiplexer pictures while showing multiscreen pictures.

simplex transmission—Transmission is only one direction.

single-cable—A one-cable system in broadband LANs in which a portion of the bandwidth is allocated for send signals and a portion for receive signals with a guard band in between to provide isolation from interference.

single-mode—Optical fiber in which only one mode of light can propagate.

single-segment LAN—A LAN composed of only one coaxial cable segment.

SIO—Serial input/output.

SIP—Session initiation protocol.

Glossary

66 type wiring—A type of distribution system cross-connect and termination hardware developed by AT&T in the mid-1950s. The 66 is part of a Western Electric product code assigned sequentially to new products.

skin effect—The tendency of alternating current, as its frequency increases, to travel only on the surface of a conductor.

slope—The difference between attenuation at the highest frequency and at the lowest frequency in a cable system. Also called spectrum tilt.

slope compensation—The action of an equalizer or an automatic slope-compensated amplifier.

SMDS (switched multimegabit data service)—A public, connectionless, packet-switched data service that provides LAN-like performance and features over a metropolitan or wide area.

S meter—An instrument to measure signal strength.

SMF—Single-mode fiber.

SMS (short message service)—Text service used with wireless networks.

s/n (signal-to-noise) ratio—Measure of noise levels of a video signal: the higher the number the better.

SNA (systems network architecture)—The network architecture developed by IBM.

SN238—The system 85 interface; a 4-port circuit pack.

SNA/SDLC—See SNA and SDLC.

SNMP (simple network management protocol software)—A computer program or set of computer programs held in some kind of storage medium and loaded into read/write memory (RAM) for execution. Compare with firmware and hardware.

SOHO—Small office/home office.

solid conductor—A conductor consisting of one wire.

SONET (Synchronous Optical NETwork)—An emerging broadband fiber network formed by a family of network elements that conform to the SONET interface requirements. SONET is a transport network of synchronously multiplexed tributary signals. The basic electrical signal of SONET runs at a rate of 51,840 Mbps. SONET grows in multiples of the basic signal into the multigigabit range.

span line—The T1 line facility between two locations.

SPID (service profile identifier)—A unique identifier that is programmed into ISDN devices in order for them to operate properly.

SPL (sound pressure level)—The acoustic pressure reference for the dB. The minimum threshold of undamaged human hearing is 0 dB SPL. The threshold of pain for undamaged human hearing is 120 dB SPL.

splice—The physical connection of two or more conductors to provide electrical continuity.

splitter—A passive device used in a cable system to divide the power of a single input into two or more outputs of lesser power. Can also be used as a combiner when two or more inputs are combined into a single output.

spot filter—A small insert used in a lens to increase the f-stop range of the lens.

SRL (structural return loss)—A measure of the variation of impedance down a length of cable. Impedance variations cause a return reflection of a portion of a signal's energy back to the transmitter, which looks like noise.

SSH (secure shell)—A type of secure network access software used on a gateway computer. Provides a safe way to access a private network over the Internet.

SSID (service set identifier)—An identifier used in wireless LAN (WLAN) applications.

SSL (secure socket layer)—A cryptographic protocol for securing data on the Internet.

standard—A set of rules or protocols that describe how a device should be manufactured, so it will maintain interoperability (compatibility) with others of the same type from different manufacturers.

standard Ethernet—An IEEE 802.3 compliant Ethernet network composed of standard Ethernet cable as opposed to thin Ethernet cable.

standby UPS—A UPS system that normally connects your equipment to the normal AC power line with the batteries and inverter in standby mode. When the power line is weak or fails, it transfers the load to the batteries and inverter without any load malfunction and without any user action. When the power line returns to normal, the load is automatically retransferred back to the AC power line.

standing wave—The stationary pattern of waves produced by two waves of the same frequency traveling in opposite directions on the same transmission line. The existence of voltage and current maxima and minima along a transmission line is a result of reflected energy from an impedance mismatch.

standing wave ratio (swr)—A ratio of the maximum amplitude of a standing wave stated in current or voltage amplitudes.

star—A network topology consisting of one central node with point-to-point links to several other nodes. Control of the network is usually located in the central node or switch, with all routing of network message traffic performed by the central node.

start bit—In asynchronous transmission, the first bit used to indicate the beginning of a character, normally, a space condition which serves to prepare the receiving equipment for the reception and registration of the character.

static charge—An electrical charge that is bound to an object. An unmoving electrical charge.

station—1. A network node. 2. The customer location or customer equipment.

station adapter—An active device used to connect PC/ workstations that have transceiver connectors to thin-wire Ethernet cable.

station cable—The part of the distribution system that begins at a cross-connect in either an equipment room or serving closet and terminates at the user room.

station protector—A gas discharge, carbon block or other device that short circuits harmful voltages to ground in the event of lightning strikes on the phone line.

ST connector—A plastic or metal connector with a precision ceramic, polymer, or stainless steel straight tip (ST) ferrule and bayonet-style latching.

stop bit—In asynchronous transmission, the last bit used to indicate the end of a character; normally a mark condition which serves to return the line to its idle or rest state.

stop bits—One or two bits in an asynchronous communication to indicate the end of the transmission. In ISN, one of the endpoint options which can be specified for an AIM port. The option can be set to either one or two stop bits.

stop joint—A splice that is designed to prevent any transfer of dielectric fluid between the cables being joined.

S/FTP—Foil and braided overall shield applied over individually foil shielded twisted pairs. Also referred to as PIMF cable.

STP (spanning tree protocol)—A fault tolerance protocol. Allows multiple paths to be created between a pair of LAN segments but keeps only a primary path open. When a primary path fails an alternate path will be activated to maintain the connection.

straight joint—A cable splice used for connecting two lengths of cable, each of which consists of one or more conductors.

strain gauge—A device for determining the amount of strain (change in dimension) when a stress is applied.

strand—One of the wires of any stranded conductor.

stranded conductor—A conductor composed of a group of wires, usually twisted, or of any combination of such groups of wires.

SRL (structural return loss)—A measure of the variation of impedance down a length of cable. Impedance variations cause a return reflection of a portion of a signal's energy back to the transmitter that looks like noise.

Glossary

subchannel—A frequency subdivision created from the capacity of one physical channel by broadband LAN technology. Bands of frequencies of the same or different sizes are assigned to transmission of voice, data, or video signals. Actual transmission paths are created when each assigned band is divided, using FDM, into a number of subchannels.

subrate—A customer channel transmission rate less than 64 kbps. Examples: 2.4, 4.8, 9.6, 19.2 kbps.

subscriber—A customer.

suppressor—A device used to reduce or eliminate unwanted voltages in electric or electronic circuits. For example, a resistance conductor in, or a resistor in series with, a sparkplug cable, to suppress interference that would otherwise affect radio reception in and near the vehicle.

surge—A temporary and relatively large increase in the voltage or current in an electric circuit or cable. Also called transient.

surge protector—A device that plugs between the phone system and the commercial AC power outlet. It is designed to protect the phone system from high-voltage spikes (surges) that might damage the phone system. When a surge occurs on the power line, the surge protector sends the overload to ground.

SYNC—Synchronous.

sync—Electronic pulses that are inserted in the video signal for the purpose of assembling the picture information in the correct position.

synchronization—Maintaining a constant phase relationship between AC signals.

synchronous transmission—Transmission in which there is a constant time between successive bits, characters or events. The timing is achieved by sharing of clocking.

SYS—System.

System 75—An AT&T digital PBX that provides voice and data transport for small- to medium-sized offices.

System 85—An AT&T digital PBX that provides voice and data transport for medium- to large-sized offices.

T

T—Thermoplastic vinyl, building wire, 60°C

T1—The basic 24-channel 1.544 Mbps pulse code modulation system used in the United States (2.048 Mbps elsewhere). 1.544 Mbps is the old Bell System standard and 2.048 is the CCITT standard.

T1 carrier—The AT&T digital transmission system that sends data at 1.544 Mbps. With it you can simultaneously transmit 24 voice conversations, each encoded at 64,000 bits per second. More voice signals can be transmitted if you encode each conversation with fewer bits.

T3—A digital transmission link with the capacity of 45 Mbps. Connection to the Telco is via a 4-wire or 2-wire hook-up, depending on the LEC. The equivalent of twenty-eight T1 lines or 672 56 kbps lines.

tandem connection—A back-to-back connection of channel units to provide a communication path or link.

tap—1. Baseband: The component of a connector that attaches a transceiver to a cable. 2. Broadband (also called a directional tap or multitap): A passive device used to remove a portion of the signal power from the distribution line and deliver it onto the drop line.

taped splice—A joint with hand-applied tape insulation.

TBB—Telecommunications bonding backbone.

TBBIBC—Telecommunications bonding backbone interconnecting bonding conductor.

T Connector—A cable adapter that attaches a PC with a thinnet network interface module to the network.

TC—Telecommunications closet.

TCP/IP (Transmission Control Protocol/Internet Protocol)—A protocol specification that conforms to the latest DoD ARPANET standard. The TCP/IP module corresponds to layers three and four of the ISO protocol model.

TDM (time division multiplexing)—A method utilizing channel capacity efficiently in which each node is allotted a small time interval, in turns, during which it may transmit a message or a portion of a message (for instance, a data packet). Nodes are given unique time slots during which they have exclusive command of the channel. The messages of many nodes are interleaved for transmission and then demultiplexed into their proper order at the receiving end.

TDMA (time-division multiple access)—A high-speed, burst mode of operation that can be used to interconnect LANs; first used as a multiplexing technique on shared communications.

TDR—Time domain reflectometer.

tearing—A picture condition in which horizontal lines are displaced in an irregular manner.

Telco—Short for telephone company.

telco 25- and 50-pair cable assembly—The Telco 25- and 50-pair are terminated with Amphenol 157 Series or AMP Champ series connectors or other manufacturers. They are used to interconnect PABXs, controllers, modems, hubs, etc.

Telco modular cable assemblies—The twisted-pair telephone cable allows the interface of voice, video and data operation.

telecommunications—Any transmission emission, or reception of signs, signals, writings, images and sounds, that is information of any nature by cable, radio, optical or other electromagnetic systems.

telecommunications closet—The closet where riser cable is terminated and cross-connected to the horizontal distribution cable or other riser cable. The riser closet houses cross-connect facilities, and may contain electronics such as hubs and auxiliary power supplies for terminal equipment located at the user work location.

telemetry—Transmission of coded analog data, often real-time parameters, from a remote site.

10BASE2—A network conforming to the IEE 802.3 local area network standard. Also known as thinnet, 10BASE2 networks are a continuous bus configuration and are capable of carrying information at rates up to 10 Mbps. Devices are connected to the coaxial cable with BNC T connectors over distances up to 606.80 feet (185 m).

10BASE5—A network conforming to the IEEE 802.3 local area network standard. Also known as standard Ethernet, 10BASE5 networks are a continuous bus configuration and are capable of carrying information at rates up to 10 Mbps. Devices are connected to the coaxial cable with transceivers over distances up to 1,640 feet (500 m).

10BASE-F—Operates over fiber on a star topology with a physical central hub acting as the network distribution point. Each node or workstation on the network is connected to the hub. Emerging standard under the IEEE 802.3 committee will use synchronous signaling theme, similar to Chipcom. Will also accommodate several ports of FOIRL compatible signaling.

10BASE-T—The implementation of the IEEE 802.2 standard designed to operate over a star topology with a central hub acting as the network distribution point. Each node or workstation on the network is connected to the hub by a link segment of unshielded twisted-pair cabling. The 10BASE-T standard limits unshielded twisted-pair segments to 100 meters.

10BROAD36—10 million bits per second over broadband coaxial cable with node-to-node coverage of 3600 meters. The IEEE 802.3 specification for running Ethernet on broadband.

100BASE-T—Also called "Fast Ethernet," it is a 100 Mbps version of Ethernet (IEEE 802.3u standard). 100BASE-T transmits at 100 Mbps rather than 10 Mbps. Like regular Ethernet, Fast Ethernet is a shared media LAN. All nodes share the 100 Mbps bandwidth. 100BASE-T uses the same CSMA/CD access method as regular Ethernet with some modification. Three cabling variations are provided. 100BASE-TX uses two pairs of Category 5 UTP, 100BASE-T4 uses four pairs of Category 3 and 100BASE-FX uses multimode optical fibers and is primarily intended for backbone use.

Glossary

1000BASE-T—A form of Gigabit Ethernet (1 gigabit is 1,000 megabits per second) on copper cables, using four pairs of Category 5 unshielded twisted pair to achieve the gigabit data rate. 1000BASE-T can be used in data centers for server switching, for uplinks from desktop computer switches, or directly to the desktop for broadband applications. A big advantage of 1000BASE-T is that existing copper cabling can be used instead of having to rewire with optical fiber.

1000BASE-SX—A short laser wavelength on multimode fiber optic cable for a maximum length of 550 meters.

1000BASE-LX/LH—A long wavelength for a "long haul" fiber optic cable for a maximum length of 10 kilometers.

1000BASE-ZX—An extended wavelength single-mode optical fiber for up to 100 kilometers.

1000BASE-CX—Two pairs of 150-ohm shielded twisted pair cable for a maximum length of 25 meters.

1000BASE-T—Four pairs of Category 5 unshielded twisted-pair cable for a maximum length of 100 meters.

10BROAD36—10 million bits per second over broadband coaxial cable with node-to-node coverage of 3,600 meters. The IEEE 802.3 specification for running Ethernet on broadband.

10GBASE-T—A standard by the IEEE 802 committee to provide 10 Gigabit/second connections over conventional unshielded twisted-pair cables. The committee currently working on the standard is IEEE 802.3an, a subgroup of IEEE 802.3.

Teflon—Tetrafluoroethylene.

tensile strength—The maximum load per unit of original cross-sectional area that a conductor attains when tested in tension to rupture.

terminal—Any device capable of sending or receiving data over a data communications channel.

terminal alarms—Alarm indications at the transmission terminals such as a D4 channel bank.

terminal block—A protected or unprotected unit of wiring blocks and troughs that serves as a transition point between cable conductors.

terminal server—1. A device which controls communication between terminals and hosts, thus off-loading hosts of this function. 2. In LAN technology, a device that allows one or more terminals or other devices to connect to an Ethernet LAN.

termination—A generic term meaning the point at the end of a cable run where the cable's conductors are attached to a termination connection such as a connector, plug, block or patch panel. Also a noninductive resistor that has the same resistance as the characteristic of the cable being used.

termination point—The ending point of a circuit.

terminator—A resistive device used to terminate the end of a cable or an unused tap into its characteristic impedance. The terminator prevents interference-causing signal reflections.

TEW—Canadian Standards Association type appliance wires. Solid or stranded single conductor, plastic-insulated, 105°C, 600 V TFE.

TGB—Telecommunications grounding busbar.

thermal shock—Taking an electronic device from an elevated ambient temperature where it has stabilized and immersing it in a severely cold environment, so cooling of the device is extremely rapid.

thermoplastic—A plastic material that softens and flows when heated and becomes firm when cooled. This process can be repeated.

thermoset—A plastic material that is cross linked by a heating process known as curing. Once cured, thermosets cannot be reshaped.

thick Ethernet (Thicknet)—In LAN technology, an Ethernet LAN or IEEE 802.3 LAN that uses a bus topology. Also known as 10BASE5.

thin Ethernet—In LAN technology, an Ethernet LAN or IEEE 802.3 LAN that uses smaller-than-normal diameter coax often used to link IBM personal computers together. Operates at same frequency as Ethernet but at smaller distances. Also known informally as cheapernet.

Thinwire— A variant of 10 Mbps Ethernet that uses thin coaxial cable (RG-58 or similar, as opposed to the thicker RG-8 cable used in 10BASE5 networks) terminated with BNC connectors.

3270, 3270 information display system—A very popular IBM data entry and display system that consists of control units, display station, printers and other equipment.

THHN (thermoplastic high-heat resistant nylon coated)—THHN conductors are primarily used for power and control circuits in commercial and industrial applications. THHN meets or exceeds UL Standard 83; conductors rated for 600 V, 90°C operation in dry locations. Product is oil, gasoline and abrasion resistant. It is the common electrical wire that electricians pull in conduit.

THWN (thermoplastic heat- and water-resistant nylon coated)—THWN conductors are primarily used for power and control circuits in commercial and industrial applications. THWN meets or exceeds UL Standard 83; conductors rated for 600 V; 90°C operation in dry locations and 75°C in wet locations. Product is oil, gasoline and abrasion resistant.

throughput—The total useful information processed or communicated during a specified time period. Expressed in bits per second or packets per second.

TIA—Telecommunications Industry Association.

TIA/EIA-568 Commercial Building Telecommunications Cabling Standard—The U.S. standard that specifies:

1. Minimum requirements for telecommunications cabling within an office environment
2. Recommended topology and distances
3. Media by parameters that determine performance
4. Connectors and pin assignments to ensure interconnectivity
5. The useful life of telecommunications cabling systems to be in excess of ten years

timebase corrector (TBC)—An electronic circuit that aligns unsynchronized video signals before signal processing. Used in multiplexers and quad splatters.

timing pulses—Pulses used for synchronizing the transceiver circuits of a transmission facility. They can be generated from a local, loop or external source.

tinned wire—See COATED WIRE.

tip—One of the two wires in a telephone circuit. The tip wire usually has a positive battery potential relative to the ring wire.

TMGB—Telecommunications main grounding busbar.

TNC—A threaded connector for miniature coax; TNC is said to be an abbreviation for threaded-Neill Concelman. Contrast with BNC.

token bus—A LAN access mechanism and topology in which all stations actively attached to the bus listen for a broadcast token or supervisory frame; stations wishing to transmit must receive the token before doing so. However, the next logical station to receive the token is not necessarily the next physical station on the bus. Bus access is controlled by preassigned priority algorithms.

token passing—A mechanism whereby each device receives and passes the right to use the channel. Tokens are special bit patterns or packets usually several bits in length that circulate from node to node when there is no message traffic. Possession of the token gives a node exclusive access to the network for transmitting its message.

token ring—The token access procedure used on a network with sequential or ring topology; passes tokens from adapter to adapter.

TOP (technical office protocol)—An OSI profile designed for the technical and office LAN environment.

Glossary

topology—1. Physical topology; the configuration of network nodes and links. Description of the physical geometric arrangement of the links and nodes that make up a network, as determined by their physical connections. 2. Logical topology; description of the possible logical connections between network nodes, indicating which pairs of nodes are able to communicate, whether or not they have a direct physical connection. Examples of network topologies are as follows:

- Bus
- Ring
- Star
- Tree

TP-MAU (twisted-pair medium access unit)—DSI's MAU that provides conversion from an AUI connector to a 10BASE-T RJ45 connector.

TP-PMD—Twisted-pair physical layer medium dependent.

TPE—Thermoplastic elastomer.

tracking—A zoom lens's ability to remain in focus during the entire zoom range from wide angle to telephoto position.

transceiver—A device required in baseband networks that takes the digital signal from a computer or terminal and imposes it on the baseband medium.

transceiver cable—Cable connecting the transceiver to the network interface controller allowing nodes to be placed away from the baseband medium.

transceiver drop cable—A cable used to attach a drop device to a standard Ethernet segment.

transceiver tap—The transceiver mounting mechanism that allows transceivers to be installed on a network without interrupting network operation.

transducer—Any device that senses one form of energy and converts it to another, as sound, force, temperature or humidity to electrical energy, or vice versa.

transfer impedance—The ratio of the source voltage of the wires inside the cable to the shield current of a cable or connectorized cable assembly.

translation frequency—The difference between the receive and transmit frequencies.

translator—An active device located at the headend that received inbound RF signals from devices connected to the network, converts them to signals at outbound frequencies and sends them back to the network in the outbound direction.

transmission line—The conductors used to carry electrical energy from one location to another.

transmission media—The various types of wire and optical fiber cable used for transmitting voice, data or video signals.

transmission medium—A physical carrier of electrical energy or electromagnetic radiation.

transmitter—In a telephone it is the device in the handset that converts speech into electrical impulses for transmission.

trunk—1. A carrier facility (e.g., a telephone line) between two switches. 2. A telephone communications path, or channel, between two points, one of them usually being a telephone company central office or switching center. 3. The main coaxial cable which connects the headend to major segments of cable system distribution networks. Typically, a trunk cable will be used to interconnect building networks in a multibuilding network.

trunk, analog—A trunk cable that carries voice and data traffic as analog signals.

trunk cable—A main cable used for distribution of signals over long distances throughout a cable system.

trunk, digital—A trunk that carries voice and data traffic as digital signals.

trunk processing—To disconnect channel units from service, so customer access is denied. This is done automatically by D4 equipment when a facility failure occurs.

TSB (Telecommunications System Bulletin)—Additional information about an existing TIA/EIA spec. These are sometimes incorporated into later versions of the spec. A TSB is not a standard, but rather contains technical material that may be valuable to industry and users.

turnkey system—Any system that is completely assembled and tested and that will be completely operational by turning it on.

TV camera cable—Multiconductor (often composite) to carry power for camera, lights, maneuvering motors, intercom signals to operators, coaxials, etc. Usually heavy-duty jacketed.

twinaxial cable—A shielded cable with two conductors that are insulated from one another and are within (and insulated from) a conductor of larger size.

twinaxial cable assemblies (IBM)—Utilizes two coaxial systems into one connector. It is used by IBM to interface mainframes, controllers, PCs and all other compatible material.

twin-lead—A transmission line having two parallel conductors separated by insulating material. Line impedance is determined by the diameter and spacing of the conductors and the insulating material and is usually 300 ohms for television receiving antennas. Also called balanced transmission line and twin-line.

twisted pair—1. Multiple-conductor cable whose component cables are paired together twisted and enclosed within a single jacket. 2. Two insulated copper wires twisted together. The twists, or lays, are varied in length to reduce the potential for signal interference between pairs. In cables greater than 25 pairs, the twisted pairs are grouped and bound together in a common sheath. Twisted-pair cable is the most common type of transmission media.

U

UART (universal asynchronous receiver-transmitter)—A device that converts outgoing parallel data from your computer to serial transmission and converts incoming serial data to parallel for reception.

UDP—Universal datagram protocol.

UF—Thermoplastic underground feeder or branch circuit cable.

UHF (ultrahigh frequency)—The band extending from 300 to 3,000 MHz as designated by the Federal Communications Commission. Also, television channels 14 through 83.

UL—Underwriters Laboratories, Inc.

UL Approved—Tested and approved by the Underwriters Laboratories, which was established by the National Board of Fire Underwriters to test equipment that may affect insurance risks of fire and safety. Most phone systems are tested and approved. Most of the testing focuses on the power supply feeding the phone system. The power supply plugs into the AC wall outlet, takes 120 volt AC and converts it to low-voltage DC power that the phone system typically runs on. If the power supply tests OK, then that is usually sufficient UL testing. It is the power supply—and what happens to the commercial AC power that feeds into the power supply—that determines the potential fire hazard a phone system poses. In addition to the UL approval, the other major fire concern is the use of proper wire in new building construction, with special emphasis on Teflon-covered cable in plenum ceilings.

UL Certified (Verified or Classified)—A product that has been tested to a manufacturer or industry standard (i.e., electrical performance).

UL Listed—A product that is tested to an Underwriters Laboratory safety standard (UL).

UL Recognized—A product that contains components that are UL Listed.

ultraviolet—Radiant energy within the wavelength range 10 to 380 nanometers: invisible, filtered by glass, causes suntan.

unbalanced line—A transmission line in which voltages on the two conductors are unequal with respect to ground, e.g., coaxial cable.

unconnectorized—A term used to describe bare-ended cable, i.e., cable without factory-attached connectors. See also CONNECTORIZED.

Glossary

unilay—More than one layer of helically laid wires with the direction of lay and length of lay the same for all layers.

UPS (uninterruptible power system)—An online power system that generates load voltage.

upstream—On a ring network, the direction opposite to that of data flow. Also, the direction on the cable from the modem to the headend.

USOC (universal service order code)—An old Bell System term to identify a particular service or equipment offered under tariff.

UTP (unshielded twisted pair)—Two wires, usually twisted around each other to help cancel out any induced noise in balanced circuits. An unshielded twisted-pair cable usually contains four pairs of wire in a single cable jacket.

V

V.10—A CCITT interface recommendation; electrical characteristics for unbalanced double-current interchange circuits for use with integrated circuit equipment in the field of data communications. Electrically similar to RS-423.

V.11—A CCITT interface recommendation; electrical characteristics for balanced double-current interchange circuits for use with integrated circuit equipment in the field of data communications. Electrically similar to RS-422.

V.20—Parallel data transmission modems standardized for universal use in the general switched telephone network.

V.21—A CCITT 300 bps dial modem recommendation for use in the general switched telephone network; similar to Bell 103.

V.22 bis—The worldwide standard for full-duplex 2-wire 2,400 bps modems (1,200 bps fall back), proposed by the CCITT and adopted by the telecommunications industry in 1984.

V.22—A CCITT 1,200 bps full-duplex 2-wire modem standardized for use in the general switched telephone network; similar to Bell 212.

V.23—A CCITT 5001 1,200 bps dial modem recommendation; similar to Bell 202.

V.24—A CCITT interface recommendation that defines interchange circuits between data-terminal equipment and data circuit-terminating equipment; similar to and operationally compatible with RS-232.

V.25 bis—A CCITT dial serial interface recommendation.

V.25—A CCITT dial parallel interface recommendation.

V.26 bis—A CCITT 2,400/1,200 bps dial line modem recommendation; similar to Bell 201 C.

V.26—A CCITT 2,400/1,200 bps leased line modem recommendation; similar to Bell 201 B.

V.25 ter—A CCITT 2,400 bps dial or 2-wire leased line modem recommendation.

V.27 bis—A CCITT 4,800/400 bps leased line modem recommendation with automatic equalizer.

V.27—A CCITT 4,800 bps leased line modem recommendation with manual equalizer; similar to Bell 208 A.

V.27 ter—A CCITT 4,800 bps dial modem recommendation; similar to Bell 208 B.

V.28—A CCITT interface recommendation that defines electrical characteristics for the interchange circuits defined by V.24; similar to and operationally compatible with RS- 232.

V.29—A CCITT 9,600 bps leased line modem recommendation; similar to Bell 209.

V.32—The worldwide standard for full-duplex 2-wire 9,600 bps modems (4,800 bps fall back), adopted in 1984. A V.32 modem must modulate signals at 9,600 by using QAM, it must transmit in full-duplex mode by using echo cancellation and it must be able to adjust its speed to match that of the answering modem.

V.35—Data transmission at 48 kbps using 60 to 108 kHz group band circuits.

V.35 CCITT high-speed modem cable assembly, 34/C—Terminated with an M series 34-pin connector. Used to interconnect controllers, PCs, etc. to high speed modems.

V.42—A worldwide standard for error detection in modems, adopted in 1984. Enables error-free data transfer at speeds up to 19,200 bps without the need for leased lines.

V.42 bis—A worldwide standard for data compression in modems, adopted in 1989.

V (volts)—The SI unit of electrical potential difference. It is the difference in potential between two points of a conducting wire carrying a constant current of one ampere when the power dissipated between these two points is equal to one watt.

VA (volt-ampere)—A designation of power in terms of volts and amperes.

var—A unit of reactive power that means volt-amperes, reactive.

VAR (value-added reseller)—VARs resell products to end users. They usually provide software, services and other equipment in conjunction with the sale of one particular product.

varmeter—An instrument used by power companies to measure the kvar consumption.

V band—A band of frequencies between 46 and 56 gigahertz.

VBR (variable bit rate)—One of the bit-rate modes available with MPEG compression. Will keep the image quality high even with increased motion but the bit rate will increase requiring more bandwidth. Because of this, there is a need to insure that there is available bandwidth in the network to accommodate it.

VDE—Association of German Electrical Engineers.

velocity of propagation—The transmission speed of an electrical signal down a length of cable compared to speed in free space. Usually expressed as a percentage.

vertical interval—The time of vertical retrace.

vertical retrace—The return of the electron beam to the top of a television picture tube screen or a camera pickup device target at the completion of the field scan.

VGA (video graphics array)—An evolving video graphics standard that increases the video display, resolution from the current 640-by-350 pixel resolution to up to 640-by-480 pixel resolution. For many applications the VGA improvement in resolution isn't required, but for CAD/CAM applications, this represents a significant improvement in resolution.

VHF (very-high frequency)—The band extending from 30 to 300 MHz (television channels 2 to 13 and most FM radio) as designated by the Federal Communications Commission.

video motion detection—A system that uses the video signal from a camera to determine if there is any movement in the picture and set of an alarm.

video type lens—An auto iris lens without an internal circuit to control the iris. All iris control voltages come from a circuit located within the camera.

virtual circuit—1. Provision of a circuit-like service by the software protocols of a network, enabling two end points to communicate as though via a physical circuit. 2. A circuit, generally established on demand that permits communication between two points without a direct, dedicated link between them.

VISCA (video system control architecture)—A machine-control protocol designed by Sony to allow synchronized control of up to seven Visa devices on a daisy chain.

VLAN (virtual LAN or logical LAN)—A network of computers that behave as if they are connected to the same wire even though they may actually be physically located on different segments of a LAN. VLANs are configured through software rather than hardware, which make them extremely flexible. One of the biggest advantages of VLANs is that when a computer is physically moved to another location, it can stay on the same VLAN without any hardware reconfiguration.

VLF (very-low frequencies)—The band extending from 10 to 30 kHz, as designated by the Federal Communications Commission.

VMD (video motion detection)—A way of defining activity in a scene by analyzing image data and differences in a series of images. The functionality can either be built-in into a camera and network video product or made available with video management software.

VOD—Video on demand.

Glossary

voice/data PABX—A device that combines the functions of a voice PABX and a data PABX, often with emphasis on the voice facilities.

voice frequency—The frequency range of normal speech, approximately 300 to 3,000 Hz.

voice-grade channel, voice-grade line—A channel or line that offers the minimum bandwidth suitable for voice frequencies, usually 300 to 3,400 bps.

voice PABX, voice-only PABX—A PABX for voice circuits; a telephone exchange.

volt—A unit of electrical pressure. One volt is the amount of pressure that will cause one ampere of current in one ohm of resistance.

voltage—Electrical potential or electromotive force expressed in volts.

voltage drop—The voltage developed across a conductor by the current and the resistance or impedance of the conductor.

voltage, induced—A voltage produced in a conductor by a change in magnetic flux linking that path.

voltage to ground—The voltage between an energized conductor and earth.

VPN (virtual private network)—VPNs enable a customer to securely connect their offices using a protected "tunnel" through a public infrastructure like the internet. They provide a more economical means to extend a corporate infrastructure and are an alternative to typical leased lines.

VSWR (voltage standing wave ratio)—Basically return loss on coax. Lower is better.

VTL—Virtual tie line.

VW-1—Vertical wire flame test, formerly designated as FR1. A UL fire rating given single conductor cables. Test is described in UL standard 1581.

W

W—Watt or wattage.

WAN (wide area network)—A network that uses common carrier-provided lines; contrast with LAN.

WATS (wide area telephone service watt)—A unit of electrical power. One watt is equivalent to the power represented by one ampere of current under a pressure of one volt in a DC circuit.

waveform—A graphical representation of a varying quantity. Usually, time is represented on the horizontal axis, and the current or voltage value is represented on the vertical axis.

wave front—1. That portion of an impulse (in time or distance) between the 10 percent point and the point at which the impulse reaches 90 percent of crest value. 2. The rising part of an impulse wave.

wavelength—The distance between the nodes of a wave. The ratio of the velocity of the wave to the frequency of the wave.

waveshape representation—The designation of current or voltage by a combination of two numbers: For other than rectangular impulses: 1. Virtual duration of the wave front in microseconds; 2. Time in microseconds from virtual zero to the instant at which one-half of the crest value is reached on the tail. For rectangular impulses: 1. Minimum value of current or voltage; 2. Duration in microseconds.

WEP (wired equivalent privacy)—A 128 bit wireless encryption scheme.

Wheatstone bridge—A device used to measure DC resistance. See BRIDGE.

Wi-Fi (wireless fidelity)—Meant to be used generically when referring of any type of 802.11 network whether 802.11b, 802.11a, dual-band, etc. The term is promulgated by the Wi-Fi Alliance. Wi-Fi Alliance is a nonprofit international association formed in 1999 to certify interoperability of wireless Local Area Network products based on IEEE 802.11 specification.

wideband—A communications channel offering a transmission bandwidth greater than a voice-grade channel. Synonymous with broadband.

wire—A rod or filament of drawn or rolled metal whose length is great in comparison with the major axis of its cross section.

wire cross-connect—The apparatus at which twisted pairs are terminated, to permit circuit rearrangement and testing. Cross-connects, usually located in equipment rooms and service closets, terminate house cables and station cables. Wire cross-connects in an ISN system employ either the traditional 66-type wiring or the newer 110-type wiring. The 66-type cross-connects use many single jumper wires for circuit administration and require a trained person with special tools to make connections. The 110-type cross-connect uses patch cords with molded, snap-on connectors allowing one-step administration of multiple wires and easy movement of connections; thus it permits customer participation, making it the preferred method in an ISN system.

wiring block—A molded plastic block that is designed in various configurations to terminate cable pairs and establish pair location on a 110-type cross-connect.

wiring closet—A room that contains one or more distribution racks and panels that are used to connect various cables together (via patch cables) to form physical networks. Termination point for customer premises wiring, offering access to service personnel; generally serves a specific area, with multiple wiring closets that are cross-connected.

wiring concentrator—A lobe concentrator that allows multiple attaching devices access to the ring at a central point such as a wiring closet or in an open work area.

withstand test voltage—The voltage that the device must withstand without flashover, disruptive discharge, puncture or other electric failure when voltage is applied under specified conditions.

workstation—An input/output device that allows either the transmission of data or the reception of data (or both) from a host system, as needed to perform a job; for example, a display station or printer.

WORM—Write once read many.

WPA (Wi-Fi Protected Access)—A wireless security level higher than WEP.

X

X—Reactance.

X.21 bis—Use on public data networks of data terminal equipment that is designed for interacting to synchronous V-series modems; it is equivalent to RS-232 and V.24.

X.21—(In PDNs) A CCITT recommendation that defines a digital interface, using the 15-pin connector described in V.11.

X.25—A CCITT standard that defines the interface between a RDN and a packet-node user device (DTE); also defines the services that these user devices can expect from the X.25 PDN including the ability to establish virtual circuits through a PDN to another user device, to move data from one user device to another, and to destroy the virtual circuit when through.

X.28—Defines the interface between PADs and non-packet mode DTEs.

X.29—Defines the interface between PADs and packet-mode DTEs or other PADs.

X.3—Describes the functions of the PAD and the various parameters which can be used to specify its mode of operation.

X.121—In packet-switched networks, a CCITT recommendation that defines the international packet-switched networks numbering scheme.

X band—A band of frequencies between 5,200 and 10,000 megahertz.

Xerox—The originator of Ethernet.

XHHW—Cross-linked high-temp wire.

XLP—Cross-linked polyethylene. Also written XLPE.

XNS/ITP (Xerox Network System's Internet Transport Protocol)—In LAN technology, a special communications protocol used between networks. XNS/ITP functions at the 3rd and 4th layer of the OSI model. Similar to TCP/IP.

Glossary

XNS (Xerox Network System)—A set of protocols that defines the network and transport layers of a network.

XON/XOFF—1. A form of software flow control in a DTE. A control character is transmitted over the primary data channel indicating that transmission should be suspended or reinstituted, depending upon the state of the DTE's buffers. 2. Control characters used for flow control.

XPM—Cross-phase modulation (interchannel nonlinear effect).

X-ray—Penetrating short wavelength electromagnetic radiation created by electron bombardment in high-voltage apparatus; produce ionization when they strike certain materials.

Z

Z—Impedance.

zero-signal reference—A connecting point, bus or conductor used as one side of a signal circuit. May or may not be designated as a ground. Sometimes referred to as circuit common.

zoom lens—A lens system that may be effectively used as a wide angle, standard or telephoto lens by varying the focal length of the lens.

zoom ratio—The ratio of the starting focal length (wide position) to the ending focal length (telephoto position) of a zoom lens. A lens with a 10x zoom ratio will magnify the image at the wide angle end by 10 times.

ZWPF (zero water peak fiber)—A type of single-mode fiber for long-haul transmission systems that is designed to eliminate the water peak that causes the 1350-1450 nm wavelength range, within the fiber, to be unusable. ZWPF provides more usable wavelengths for DWDM and CWDM systems.