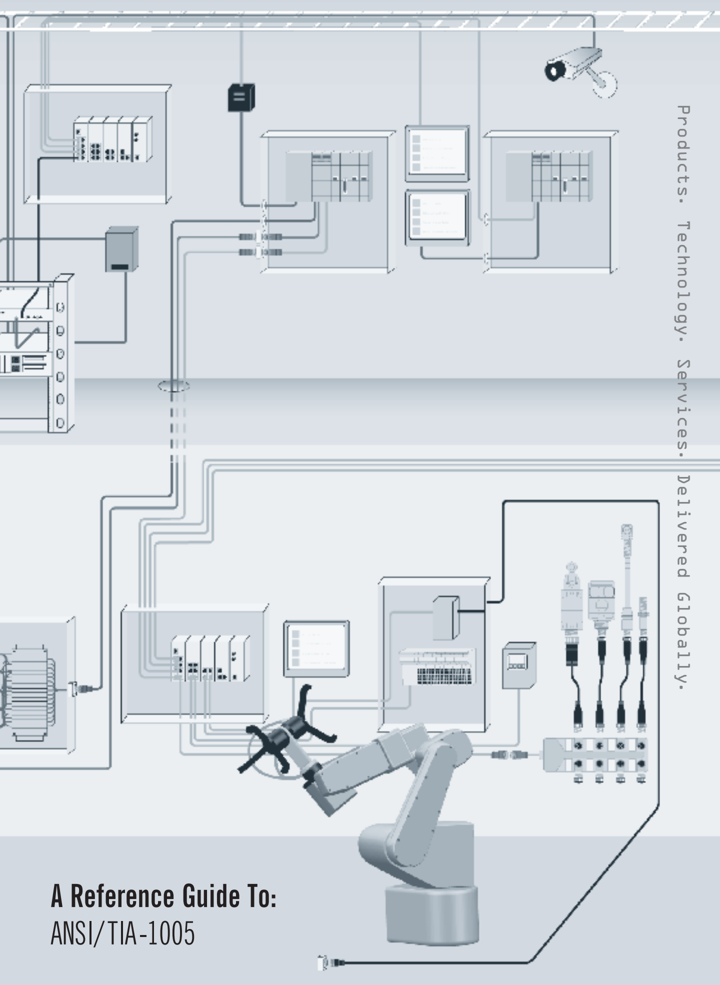

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A Reference Guide To:
ANSI/TIA-1005

Standards Reference Guide

Telecommunications Infrastructure for Industrial Premises

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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 Reference Guide

This document is meant as a reference that highlights the key points of the ANSI/TIA-1005 standard. It is not intended as a substitute for the original documents. For further information on any topic in this guide, refer to the actual standard. See the section called "Reference Documents" for instructions on how to order a copy of the standard.

The cabling described by this standard meets the environmental requirements of the specific areas into which it must be installed. It is equally important that the devices the cabling connects to also meet these environmental requirements, including any Ethernet switches or routers, gateways or other related devices exposed to the specific environment.

Abbreviation References:

ANSI	American National Standards Institute
EIA	Electronic Industry Alliance (now completely absorbed into the TIA as of March 2008)
TIA	Telecommunications Industry Association

Table of Contents

Purpose of the ANSI/TIA-1005 Standard

Telecommunications Infrastructure Standard for Industrial Premises

The Purpose:

- This standard helps to enable the planning and installation of telecommunications cabling infrastructure within and between industrial buildings.
- In contrast to the ANSI/TIA/EIA-568, 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 proposed ANSI/TIA-1005 draft standard structure
- Industrial area concepts
- Recognized cables
- Recognized connectivity
- The automation outlet
- 2-pair cabling
- Multiconnect or Ethernet channels
- MICE

Terms not part of ANSI/TIA/EIA-568-B:

- **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 **(see Figure 14 on page 24)**

Note : Telecommunications for this standard covers all Ethernet transmission cabling.

Industrial Areas

Industrial premises cabling may traverse from the front office through the factory floor. The factory floor **(see Figure 1)** 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.

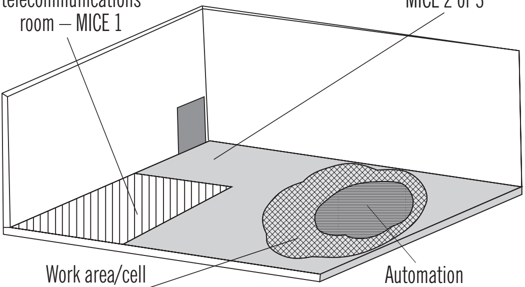


Figure 1 – Typical Industrial Environment

Control Equipment/Telecommunications Room

This area is equivalent to the MDC or IDC as defined in the ANSI/TIA/EIA-568-B. 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.

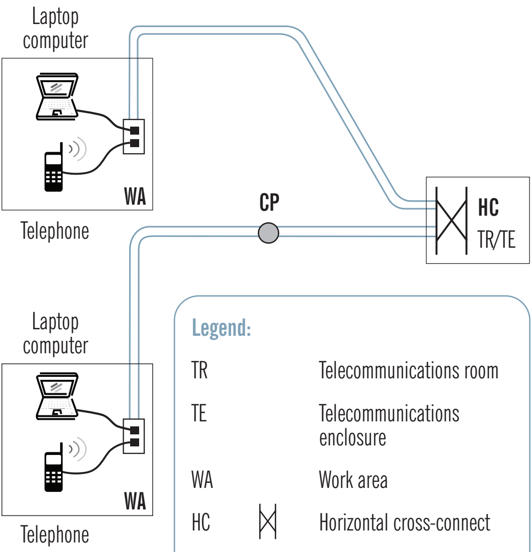
Automation Island Area

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.

For more detailed information on networking standards for commercial buildings, order Anixter's Standards Reference Guide at anixter.com/literature (North American or European version).

Horizontal Cabling

The horizontal cabling topology of ANSI/TIA/EIA-568-B is followed in this standard.



Legend:

TR		Telecommunications room
TE		Telecommunications enclosure
WA		Work area
HC		Horizontal cross-connect
CP		Consolidation point
		Horizontal cabling (Level III cabling)
		Telecommunications outlet

Figure 2 – Horizontal Cabling Topologies

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Recognized Horizontal Cables

- Twisted-pair copper
  - 4-pair, 100-ohm balanced (unshielded or shielded)
  - 2-pair, 100-ohm balanced (unshielded or shielded)
- Optical fiber
  - Optical (glass) fiber, single-mode and multimode cable (ANSI/TIA/EIA-568-C.3)
- Plastic optical fiber (removed from the standard and referred to a working group for later addition as a draft addendum)
  - Plastic polymer optical fiber (ISO/IEC 24702)
  - Plastic polymer clad silica optical fiber (ISO/IEC 24702)

Horizontal Cabling Allowable Distances for Copper Links

- In many cases, industrial cabling can be made almost entirely of work area cabling, which must be accounted for when combined with equipment and patch cabling in the limited 100 m (328 ft.) channel.
- The following formula must be used to calculate the maximum cord and link lengths:

Equation 1: $H + (1+D)C \leq 102$ m

Equation 2: $W = C - T$

C = the maximum combined length of the work area cable, equipment cable and patch cord (m).

W = the maximum length of the work area cable (m).

H ≤ 90 m is the length of the horizontal cable (m).

D = 0.2 for 24 AWG patch cables and 0.5 for 26 AWG patch cables.

T = the assumed maximum length of patch and equipment cords in the telecommunications room.

Cords shall comply with the requirements of ANSI/TIA/EIA-568-B.2 unless exceptions are stated in this standard. For patch cords that meet these requirements, the maximum cord and horizontal link lengths shall be determined by equations 1 and 2.

Table 1 **(see pages 10-11)** illustrates the application of these formulas. The length of the work area cord shall not exceed 82 m (269 ft.). Where a multiuser telecommunications outlet assembly (MUTOA) is deployed, the outlet assembly shall be marked with the maximum allowable work-area cord length. Telecommunications outlets with cabling segments designed for longer cords shall be marked with the maximum cord length. One method to determine this length is to evaluate cable length markings.

Table 1 – Maximum Length of Horizontal and Work Area Cables

Length of Horizontal Cable H m (ft.)	24 AWG Patch Cords (D=0.2, T= 0 m)	
	Maximun Length of Work Area Cable W m (ft.)	Maximum Combined Length of Work Area Cables, Patch Cords and Equipment Cable C m (ft.)
90 (295)	5 (16)	10 (33)
85 (279)	9 (30)	14 (46)
80 (262)	13 (44)	18 (60)
75 (246)	18 (57)	23 (74)
70 (229)	22 (71)	27 (87)
67 (220)	24 (79)	29 (96)
58 (190)	32 (104)	37 (120)
50 (164)	38 (126)	43 (142)
43 (141)	44 (145)	49 (161)
37 (121)	49 (161)	54 (178)
32 (105)	53 (175)	58 (191)
25 (82)	59 (194)	64 (211)
20 (66)	63 (208)	68 (224)
15 (49)	68 (221)	73 (238)
10 (33)	72 (235)	77 (252)
5 (16)	76 (249)	81 (265)
0	N/A	85 (279)

26 AWG Patch Cords (D=0.5, T= 0 m)	
Maximum Length of Work Area Cable W m (ft.)	Maximum Combined Length of Work Area Cables, Patch Cords and Equipment Cable C m (ft.)
4 (13)	8 (26)
7 (24)	11 (37)
11 (35)	15 (48)
14 (46)	18 (59)
17 (57)	21 (70)
19 (63)	23 (77)
25 (83)	29 (96)
31 (101)	35 (114)
35 (116)	39 (129)
39 (129)	43 (142)
43 (140)	47 (153)
47 (155)	51 (168)
51 (166)	55 (179)
54 (177)	58 (190)
57 (188)	61 (201)
61 (199)	65 (212)
N/A	68 (223)

Backbone Cabling

Recognized Backbone Cables

- Copper
  – 4-pair, 100-ohm balanced (unshielded or shielded)

- Fiber Optic
  – Optical (glass) fiber, single-mode and multimode cable (ANSI/TIA/EIA-568-C.3)

- Plastic optical fiber (removed from the standard and referred to a working group for later addition as a draft addendum)
  – Plastic polymer optical fiber (ISO/IEC 24702)
  – Plastic polymer clad silica optical fiber (ISO/IEC 24702)

Connecting Hardware: Copper

Telecommunications Outlet and Connector

- 8-position modular: A 100-ohm balanced twisted pair per ANSI/TIA/EIA-568-B.1 must use the T568-A or -B wiring method.

- Non-sealed: Each 4-pair terminated must meet the performance requirements of ANSI/TIA/EIA-568-B.2.

- Sealed: These may be housed (encapsulated) within a protective housing and must meet the performance requirements of ANSI/TIA/EIA-568-B.2 when subjected to the applicable environmental conditions as defined by the MICE table.

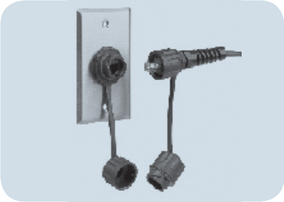


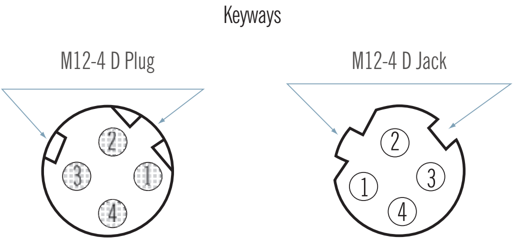
Figure 3 – Encapsulated Copper Connector

Automation Outlet Connector

- This serves as the interface between generic cabling and the automation island.
- 8-position modular: Each 100-ohm balanced twisted pair, per ANSI/TIA/EIA-568-B.2, is required to meet Category 6 or better.
- Non-sealed: Each 100-ohm, 4-pair cable shall terminate on an 8-position connector.
- Sealed: These shall use connector encapsulation variant 1 from IEC 61076-3-106.

Alternate Automation Outlet and Connector

- A 2-pair sealed connector. Where a full set of applications is not required (100BASE-T max), the M12-4 D-coding connector as defined in IEC 61076-2-100 may be used. It should be a minimum of Category 5e for four connections or less, and Category 6 for more than four connections.



Pin Number with Wiring Color Code

Pin Number	Signal	Color Code
1	TX+	White - Orange
2	RX+	White - Green
3	TX –	Orange
4	RX –	Green

Figure 4 – 2-Pair Data Connection

Adapters

- Balanced twisted pair
  - A back-to-back jack is recommended for use on enclosures for bulkhead quick connections.
  - Mated adapters shall conform to the transmission requirements of the appropriate media type and category.
  - When two connections are used in very close proximity, they should be of the next higher performance category. If the space is less than 10 cm, it can count as a single connection.

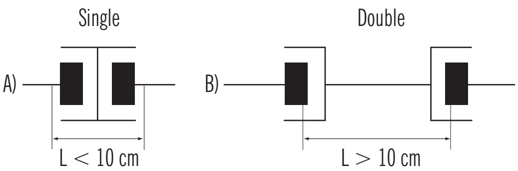


Figure 5 – Bulkhead Connection

Grounding and Bonding Considerations

- Use ANSI-J-STD-607-A for grounding requirements
  - Single-point grounds must be used.
  - Grounding and bonding should be configured to provide an equal potential grounding system to prevent ground loops.
  - The use of star grounding in communications coverage areas can be used to mitigate ground loops.

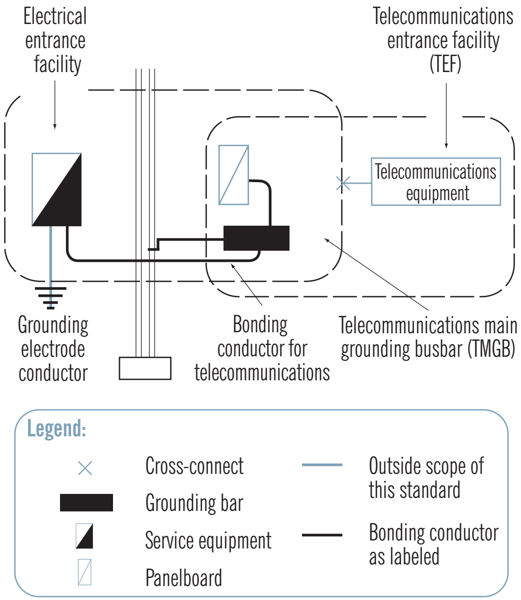


Figure 6 – Grounding and Bonding Diagram

Connecting Hardware: Fiber Optic

Telecommunications Outlet Connector

- LC connector family, as specified in ANSI/TIA/EIA-604-10A, shall perform to ANSI/TIA/EIA-568-C.3.
- Sealed fiber optic connectors may be protected by encapsulation, isolation or separation. Variant 1 of IEC 61076-3-106 methods should be used, but any suitable encapsulation may be used, as long as a single method is used throughout the facility.

Optical Fiber Automation Outlet and Connector

- Non-sealed: The LC connector family, as specified in ANSI/TIA/EIA-604-10A, shall perform to ANSI/TIA/EIA-568-C.3.
- Sealed: The sealed outlet connector housing shall be Variant 1 of IEC 61076-3-106, incorporating the duplex LC connector of ANSI/TIA/EIA-604-10A.

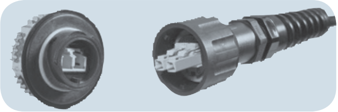


Figure 7 – Industrial Fiber Connector

Industrial Cabling Performance Requirements

Copper

Industrial cabling requires a combination of environmental and enhanced transmission performance to support the intended applications.

The standard states that for channels with more than four connections, Category 6 or better cabling should be used.

- Twisted-pair copper
  - The installed channels and permanent links shall meet the requirements for cabling as specified for:
    - Category 5e per ANSI/TIA/EIA-568-B.1, clause 11.2
    - Category 6 per ANSI/TIA/EIA-568-B.2, clause 7.
- Industrial cabling shall meet the requirements of tables in this standard concerning TCL (transverse conversion loss) and ELTCTL (equal level transverse conversion transfer loss) for unshielded pairs and coupling attenuation for shielded pairs.
  - This is a measurement of the cable's susceptibility to EMI/RF noise.

Table 2 – TCL Limits for Unshielded Twisted-Pair Cabling

Category	Frequency (MHz)	Minimum TCL (dB)		
		E_1	E_2	E_3
5e	$1 \leq f \leq 30$ $30 < f \leq 100$	53-15 log(f) 60.4-20 log(f)	63-15 log(f) 70.4-20 log(f)	73-15 log(f) 80.4-20 log(f)
6	$1 \leq f \leq 30$ $30 < f \leq 250$	53-15 log(f) 60.4-20 log(f)	63-15 log(f) 70.4-0 log(f)	73-15 log(f) 80.4-20 log(f)
TCL values greater than 40 dB shall revert to the minimum requirement of 40 dB.				

Table 3 – ELTCTL Limits for Unshielded Twisted-Pair Cabling

Category	Frequency (MHz)	Minimum ELTCTL (dB)		
		E_1	E_2	E_3
5e and 6	$1 \leq f \leq 30$	30-20 log(f)	40-20 log(f)	50-20 log(f)
ELTCTL values greater than 40 dB shall revert to the minimum requirement of 40 dB.				

Fiber Optic

- Standard fiber optic cables
  – Optical fiber (glass) cabling shall meet the performance requirements of ANSI/TIA/EIA-568-C.3. Depending on the environmental conditions, additional enhancements or separation and isolation may be required.

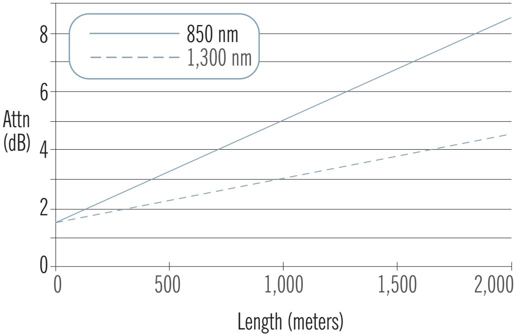


Figure 8 – Performance Requirements met by 62.5/125 µm or 50/125 µm Backbone Cabling Link Attenuation Based on Distance

- Multiuser telecommunications outlet assemblies (MUTOA)
  - Its use facilitates the termination of multiple horizontal cables in a common location within a manufacturing cell and allows cabling to remain intact when the cell is changed.
  - Cables from the MUTOA should be routed through device area pathways.
  - Automation island cabling should be protected from environmental conditions.

Figure 9 – MUTOA Assembly

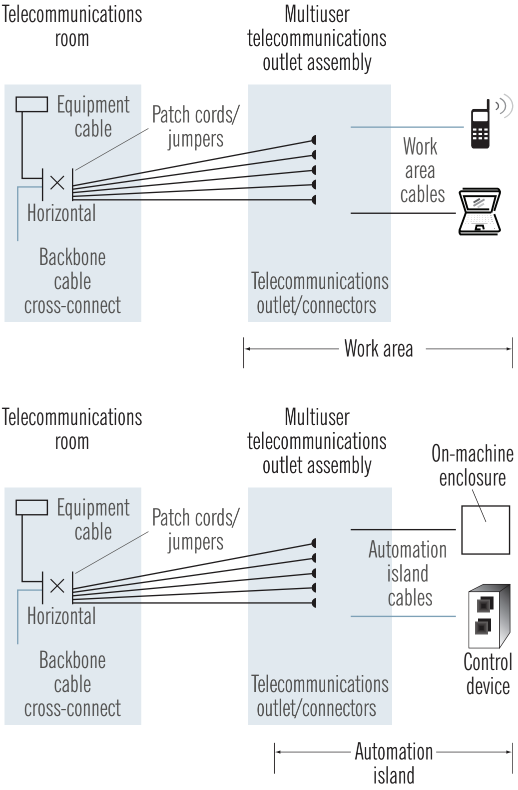


Figure 10 – MUTOA Use Diagram

Consolidation Point

- The interconnection point within the horizontal cabling must use ANSI/TIA/EIA-568-B.2- or -B.3-compliant connecting hardware in accordance with the requirements of Clause 6.2.2.
- It differs from a MUTOA as it requires an additional connection point.
- No more than a single consolidation point or transition point shall be used in the same horizontal run.
- Each cable extending to the work area from a consolidation point shall be terminated to a compliant TO, AO or MUTOA.

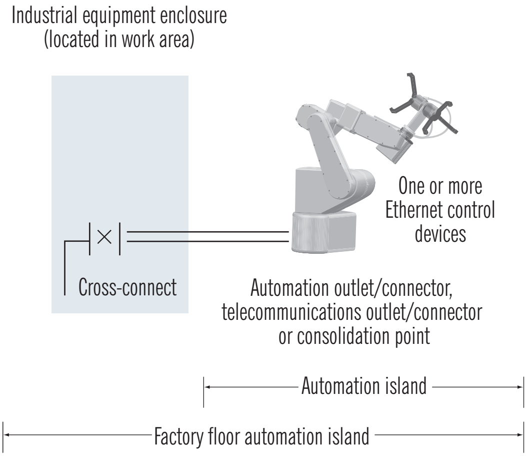


Figure 11 – Consolidation Point Diagram

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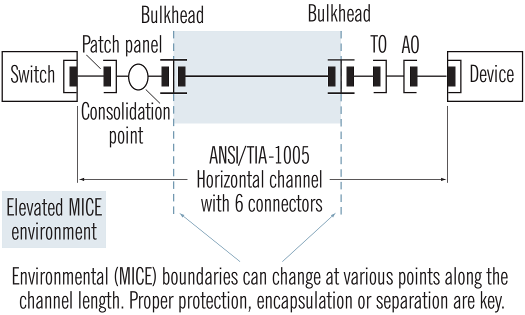
Normative

Annex A: Requirements for 2-Pair Cabling

- All unused conductors of a 4-pair cable shall be common-mode terminated.
- When connecting a complete 2-pair cabling system into equipment designed for 4-pair cabling (e.g., 100BASE-T), confirm that the correct pair assignment is used.
- Network switches designed for use with 2-pair cabling should not be connected with 4-pair cabling.
- If mixing 2-pair and 4-pair cabling systems, confirm that the resulting cabling channel meets the requirements of the application.



Legend:
TO = Telecommunications outlet
AO = Automation outlet

Figure 12 – Channel Containing 2-Pair Transition for Automation Outlet

Informative

Annex B: MICE Concepts as Described in ANSI/TIA/EIA-568-C.0

- There are three basic types of industrial areas:
  - – Factory floor (MICE 1 or 2)
  - – Work area (MICE 2 or 3)
  - – Automation island (MICE 3)
- The areas have mixed environments and are given classifications (subscripts 1, 2 and 3) based on the MICE limits assigned to that level of hazard.

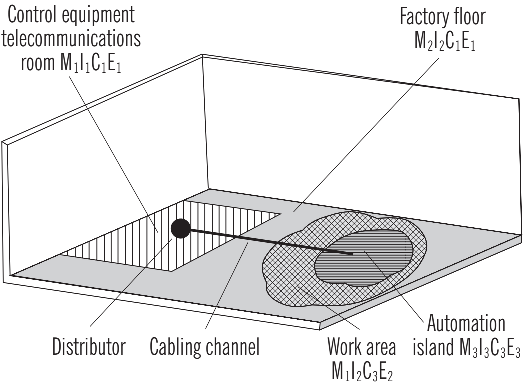


Figure 13 – Example of Enviromental Change Along Cable Channel

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MICE Definition and Tables

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

The MICE concept is based on the assumption that cabling, even under the worst conditions of an environmental class, is still protected and helps to create reliable network operations.

Figure 14 – MICE Definition

Table 4 – MICE Table for M_X and I_X

Mechanical	M_1	M_2	M_3
Shock/bump (see Note 1)			
Peak acceleration	40 ms $^{-2}$	100 ms $^{-2}$	250 ms $^{-2}$
Vibration			
Displacement amplitude (2-3 Hz)	1.5 mm	7.0 mm	15.0 mm
Acceleration amplitude (9-500 Hz)	5 ms $^{-2}$	20 ms $^{-2}$	50 ms $^{-2}$
Tensile force	See Note 2	See Note 2	See Note 2
Crush	45 N over 25 mm (linear) min.	1,100 N over 150 mm (linear) min.	2,200 N over 150 mm (linear) min.
Impact	1 J	10 J	30 J
Bending, flexing and torsion	See Note 2	See Note 2	See Note 2
Ingress	**I_1**	**I_2**	**I_3**
Particulate ingress (dia. max)	12.5 mm	50 mm	50 mm
Immersion	None	Intermittent liquid jet $<=$ 12.5 l/min $>=$ 6.3 mm jet $>$ 2.5 m distance	Intermittent liquid jet $<=$ 12.5 l/min $>=$ 6.3 mm jet $>$ 2.5 m distance and immersion ($<=$ 1 m for $<=$ 30 minutes)

Note 1: The repetitive nature of the shock experienced by the channel should be taken into account.

Note 2: This aspect of environmental classification is installation-specific and should be considered in association with the appropriate specification.

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Table 5 – MICE Table for C_X

Climatic and Chemicals	C_1	C_2	C_3
Ambient temperature	-10°C to 60°C	-25°C to 70°C	-40°C to 70°C
Rate of change of temperature	0.1°C per minute	1.0°C per minute	3.0°C per minute
Humidity	5% to 85% (non-condensing)	5% to 95% (condensing)	5% to 95% (condensing)
Solar radiation	700 Wm^{-2}	1,120 Wm^{-2}	1,120 Wm^{-2}
Liquid pollution contaminants	Concentration x 10^{-6}	Concentration x 10^{-6}	Concentration x 10^{-6}
Sodium chloride (salt/sea water)	0	<0.3	<0.3
Oil (dry-air concentration) (for oil types, see Note 2)	0	<0.005	<0.5
Sodium stearate (soap)	0	$>5 \times 10^{4}$ aqueous non-gelling	$>5 \times 10^{4}$ aqueous gelling
Detergent	None	ffs	ffs
Conductive materials in solution	None	Temporary	Present
Gaseous pollution contaminants	Mean/Peak (concentration x 10^{-6})	Mean/Peak (concentration x 10^{-6})	Mean/Peak (concentration x 10^{-6})

Note 2: This aspect of environmental classification is installation-specific and should be considered in association with the appropriate specification.

Table 6 – MICE Table for E_X

Electromagnetic	E_1	E_2	E_3
Electrostatic discharge – contact (0.667 μC)	4 kV	4 kV	4 kV
Electrostatic discharge – air (0.132 μC)	8 kV	8 kV	8 kV
Radiated RF – AM	3 V/m at 80–1,000 MHz 3 V/m at 1,400–2,000 MHz 1 V/m at 2,000–2,700 MHz	3 V/m at 80–1,000 MHz 3 V/m at 1,400–2,000 MHz 1 V/m at 2,000–2,700 MHz	10 V/m at 80–1,000 MHz 3 V/m at 1,400–2,000 MHz 1 V/m at 2,000–2,700 MHz
Conducted RF	3 V at 150 kHz–80 MHz	3 V at 150 kHz–80 MHz	10 V at 150 kHz–80 MHz
EFT/B	500 V	1,000 V	1,000 V
Surge (transient ground potential difference) – signal, line to earth	500 V	1,000 V	1,000 V
Magnetic field (50/60 Hz)	1 Am^{-1}	3 Am^{-1}	30 Am^{-1}
Magnetic field (60–20,000 Hz)	ffs	ffs	ffs

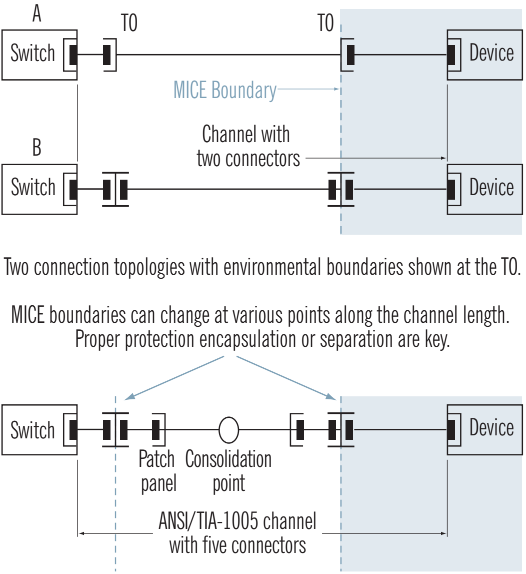
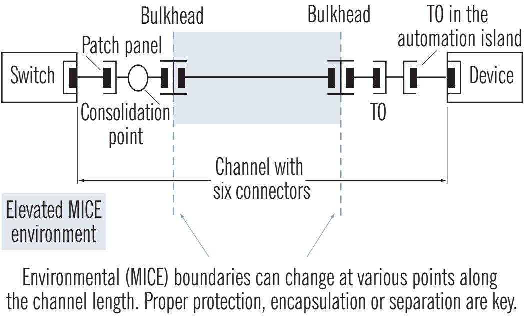


Figure 15 – Channel Makeup with Environmental Examples

Annex C: Guidance for Using More than Four Connectors in the Channel



Horizontal cable length with more than four connections in a channel.

Table 7 – Multiple Connection Performance Requirements

Desired Channel Category	Number of Connections	Minimum Connecting Hardware Return Loss (RL dB)	Minimum Connecting Hardware (NEXT 9dB)	Cable Category
Category 5e	5 or 6	26-20 log (f/100)	54-20 log (f/100)	5e
Category 6	5 or 6	30-20 log (f/100)	60-20 log (f/100)	6
Note: The elevated RL and NEXT performance levels shown may require the use of Augmented Category 6 connections as specified as ANSI/TIA/EIA-568-B.2-10.				

Note: Category 5e performance is a minimum requirement for 100 Mbps Ethernet to work correctly. In order to obtain this performance when more than four (4) connections are present in a channel, the use of Category 6 connectors and Category 6 cables will have to be used to effectively reach this performance level. In the case of a Category 6 channel requirement, the use of Category 6A connectors will be required.

Annex D: Extended Fiber Optic Channels

Tables 8 and 9 provide maximum channel and backbone lengths for applications not included in ANSI/TIA/EIA-568-B.1.

Table 8 – Supported Applications and Maximum Channel Lengths with All-Silica Multimode Optical

	λ nm	Core Diameter µm	OM1		
Network Application			CIL[1] dB	L[2] m	Class
ControlNET	1300	50	6.5	1,514	OF-500
	---	62.5	11.3	6,533	OF-2000

	λ nm	Core Diameter µm	OM2		
Network Application			CIL[3] dB	L[2] m	Class
ControlNET	1300	50	6.5	1,514	OF-500
	---	62.5	11.3	6,533	OF-2000

	λ nm	Core Diameter µm	OM3		
Network Application			CIL[1] dB	L[2] m	Class
ControlNET	1300	50	6.5	1,514	OF-500
	---	62.5	---	---	---

Notes:

1. CIL is the maximum channel insertion loss (or optical power budget, as applicable) as defined in the application standard.
2. L is the lower of either the maximum channel length specified in the application standard or a calculated length from the CIL with 1.5 dB allocated to connecting hardware.

Table 9 – Supported Applications and Maximum Channel Lengths with All-Silica Single-Mode Fibers

	λ nm	OS_1		
Network Application	---	CIL[1] dB	L[2] m	Class
ControlNET	λ1310	10.0	8,000	OF-5000

	λ nm	OS_2		
Network Application	---	CIL[1] dB	L[2] m	Class
ControlNET	λ1310	10.0	20,000	OF-10000

Notes:

1. CIL is the maximum channel insertion loss (or optical power budget, as applicable) as defined in the application standard.
2. L is the lower of either the maximum channel length specified in the application standard or a calculated length from the CIL with 2.0 dB allocated to connecting hardware.

ANSI/TIA-1005 Summary

By helping to enable the planning and installation of telecommunications cabling infrastructure within and between industrial buildings, the ANSI/TIA-1005 standard addresses the potential exposure to hostile environments in the industrial space. In addition to the special cabling system requirements for industrial operations, including 2-pair cabling systems, the standard provides definitions for areas in the industrial space including automation islands, outlets and cables. To achieve reliability and performance throughout the automation island, a Category 6 or better cabling is recommended. By defining the environmental concerns in concrete terms with the MICE tables as referenced in ANSI/TIA-568-C.0, the standard provides a clear view of the specifications and requirements needed to implement a cabling system to meet performance standards.

About Anixter

Anixter serves more than 100,000 customers across 52 countries every day with world-class inventory, technical expertise, global capabilities and Supply Chain Solutions. We stock more than 450,000 items in a global distribution network that encompasses more than $1 billion of inventory and 7 million square feet of distribution space. Anixter's expert systems engineers and specialists receive ongoing, extensive training about the latest products and technology. Our in-country sales specialists speak 30 different languages and are familiar with local markets, currencies, standards and customs.

Anixter's Value for Industrial Automation Applications

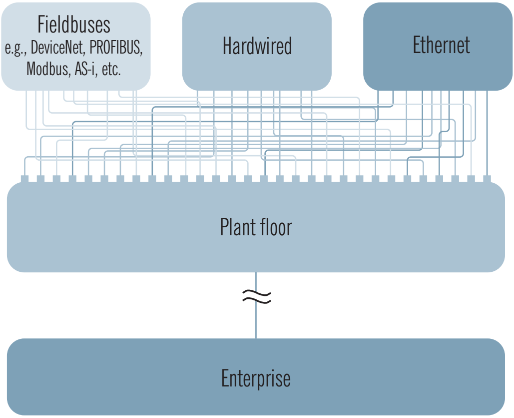
Anixter evaluates these networks to determine which products will improve each customer's unique manufacturing process. By thoroughly researching and evaluating the latest industrial networking solutions, our Infrastructure Solutions Lab augments our technical expertise and reinforces the value of implementing Industrial Ethernet.

Our READY!SM Deployment Services leverages this expertise with our extensive inventory, global distribution network and material management capabilities to quickly deploy solutions and so that products arrive in the right condition at the right time and place. Our suite of offerings, customizable packaging and delivery solutions minimize disruptions to the plant floor.

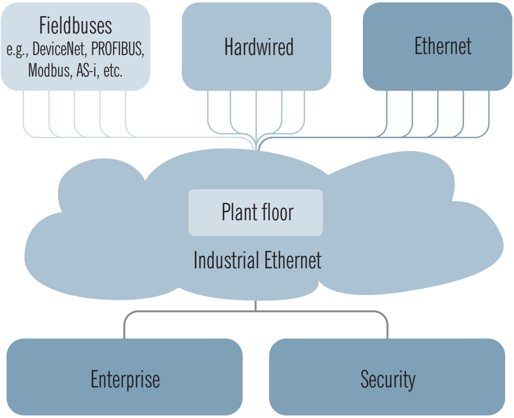
Business drivers influencing industrial automation decisions:

- Efficient installation and troubleshooting
- Faster and less costly plant upgrades, expansions and change-outs
- Access to real-time data to improve overall plant operations
- Remote troubleshooting and corrective action capabilities
- Reduced manufacturing personnel
- Total cost of ownership.

Improve Performance: The Migration to Industrial Ethernet



Today's plant has several systems communicating without a common backbone: controllers, robots and other intelligent devices. This makes sharing information within a plant environment difficult and cumbersome. With a common Ethernet network and backbone in place, sharing information becomes easier and more effective, in both efficiency and cost.



Anixter is the technical expert when it comes to traditional systems, next-generation Ethernet networks and the path in between. From traditional systems to fully automated solutions, Anixter has the breadth and depth of inventory to help migrate any Industrial Ethernet system for improved operations, plant-to-enterprise communications and security.

The Anixter Infrastructure Solutions Lab

Anixter's Infrastructure Solutions Lab℠ allows us to actively demonstrate the most practical technological solutions from best-in-class manufacturers in the areas 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 confirm that our customers are selecting the right products for their specific needs

We are continually testing products in our Lab to:

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

THE LAB
ANIXTER'S INFRASTRUCTURE SOLUTIONS LAB

Networking and security product testing at our 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) testing
- Application testing
- 10 Gigabit 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.

Anixter's 10 Gigabit Ethernet Cabling Testing

Anixter's Infrastructure Solutions Lab is the only UL Certified lab to conduct rigorous, independent third-party testing of the emerging 10 Gigabit cabling solutions. Anixter's 10 Gigabit cabling testing not only 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 draft spec). We confirm that the 10 Gigabit cabling solutions we sell meet the highest levels of performance and reliability for our customers, the Anixter Infrastructure Solutions Lab tests the toughest performance parameter—alien crosstalk—in a "worst-case" scenario. You can rest assured that the cabling solutions Anixter sells will provide the network performance you require.

Reference Documents

ANSI/TIA/EIA-568-B.1 (2001)
Commercial Building Telecommunications Cabling
Standard Part 1: General Requirements

ANSI/TIA/EIA-568-B.2 (2001)
Commercial Building Telecommunications Cabling
Standard Part 2: Balanced Twisted-Pair Cabling Components

ANSI/TIA/EIA-568-B.2-1 (2002)
Transmission Performance Specifications for 4-Pair 100Ω
Augmented Category 6 Cabling

ANSI/TIA/EIA-568-B.2-ad10 (2008)
Transmission Performance Specifications for 4-Pair 100Ω
Augmented Category 6 Cabling

ANSI/TIA/EIA-568-B.3 (2000)
Optical Fiber Cabling Components Standard

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

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

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

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

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

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

ANSI/TIA/EIA-758 (1999)

Customer-Owned Outside Plant Telecommunications Cabling Standard

ANSI/TIA/EIA-942 (2005)

Telecommunications Infrastructure Standard for Data Centers

ANSI/TIA-1005

Telecommunications Infratructure Standard for Industrial Premises

ISO/IEC 11801 (2002)

Generic Cabling for Customer Premises

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 802.3an (2006)

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

IEEE 802.5-1998 (1998)

Token Ring Access Method and Physical Layer Specifications (also known as ANSI/IEEE Std 802.5-1998)

*Canadian Standards Association equivalent document

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Obtaining Standards Documents

TIA/EIA documents may be purchased through Global Engineering Documents at 1.800.854.7179 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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