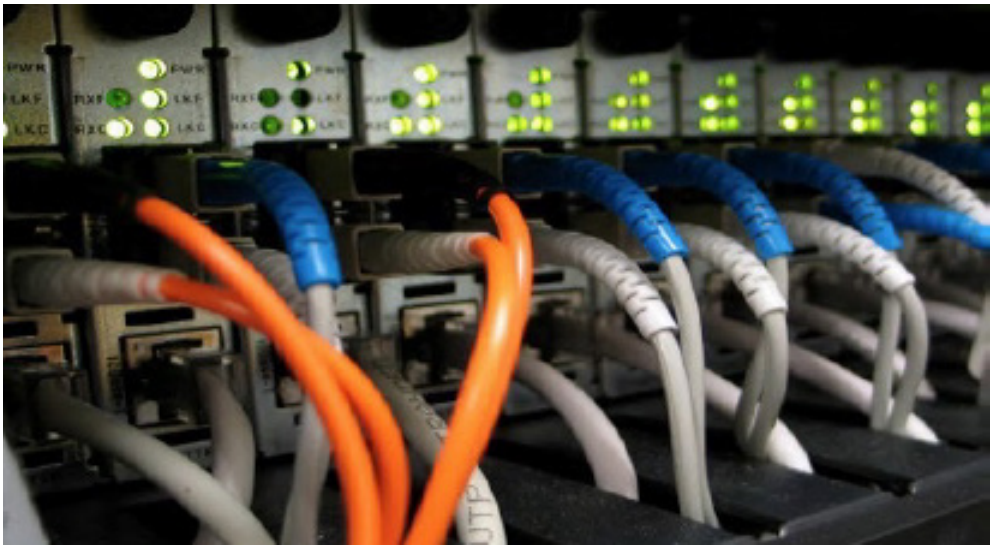
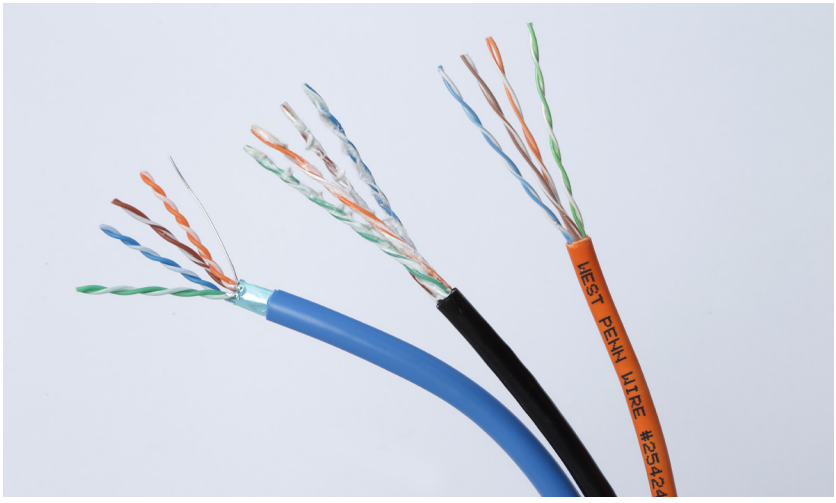
WEST PENN WIRE

PRODUCT GUIDE

Local Area Network (LAN) Networking Cabling & Accessories

Horizontal Cabling, Work Area and Telecom Room





STANDARDS

LAN Overview

INFORMATION CONTAINED IN THIS WEST PENN WIRE TECHNICAL BULLETIN HAS BEEN TAKEN FROM THE FOLLOWING STANDARDS AND MANUALS:

- TIA/EIA 568-B-1 - Commercial Building Telecommunications Standard: Part 1: General Requirements
- TIA/EIA 568-B-2 - Commercial Building Telecommunications Standard: Part 2 Balanced Twisted Pair Cabling Components
- TIA/EIA 568-B-2.1 - Commercial Building Telecommunications Standard: Part 2.1 Transmission Performance 4 pair 100 Ω Category 6 Cabling
- TIA/EIA 568-B-3 - Commercial Building Telecommunications Standard: Part 3 Optical Fiber Cabling Components
- TIA/EIA 568-B-3.1 - Commercial Building Telecommunications Standard: Part 3.1 50/125um Optical Fiber Specifications
- BICSI Design Reference Manual 5th Edition
- BICSI Telecommunication Cabling Installation Manual 3rd Edition
- Incorporation of the TSBs, Addenda, and Interim Standards from the TIA/EIA 568-A.
- The TIA/EIA 568-A Standard has been reorganized into three technical Standards.
- Category 5 is no longer recognized, and has been replaced by Category 5E and Category 6.
- Performance specifications are provided for Category 5E and Category 6.
- Performance specifications are provided for 50/125um Optical Fibers
- Small Form Factor (SFF) optical fiber connector designs are allowed in addition to the 568SC.
- The term 'Telecommunication closet' has been replaced with 'Telecommunications room'.
- The "permanent link" has replaced the "basic link" as the test configuration.

BICSI

BICSI (bicsi.org) is a non-profit telecommunications association, founded in 1974 to serve and support telephone company building industry consultants responsible for the design and distribution of telecommunications wiring in commercial and multi-dwelling buildings.

Global Engineering Documents

To acquire telecommunication standards:

800.854.7179

www.global.ihs.com

Changes in TIA/EIA 568 Standards

TABLE OF CONTENTS

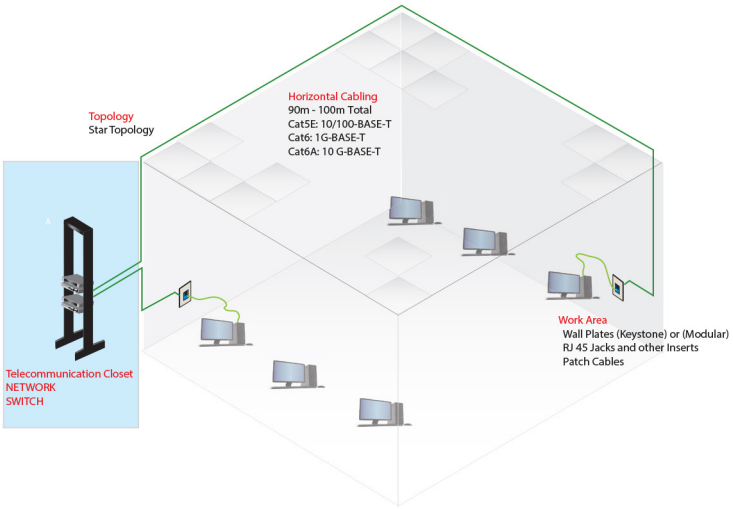
LAN

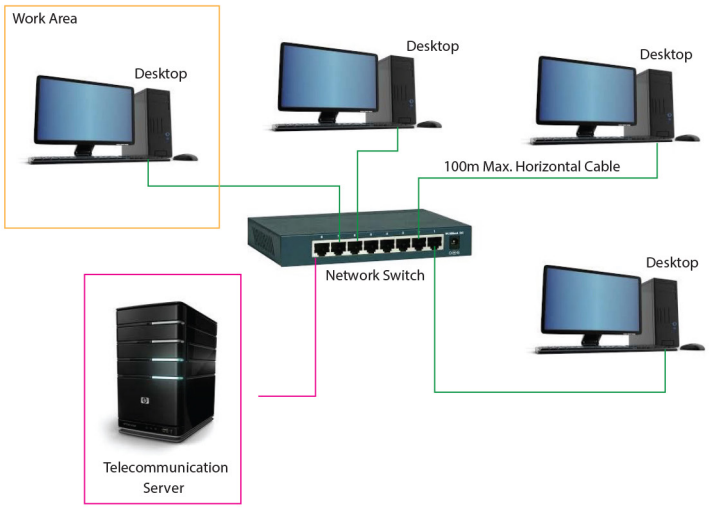
LAN Network Cabling

Local Area Networks (LANs) are used to interconnect two or more personal computers (PCs) and other network devices in a geographically limited area not exceeding a multibuilding campus

FUNDAMENTALS

In its basic form, a LAN is a group of PCs connected with cabling links to a centralized network access device (Hub or Switch). A special purpose PC (Server) is also connected to the same hub or switch and is used to coordinate network activities and store shared data.





Horizontal Cabling

Horizontal cabling is used to describe cabling that links network devices in user work areas (WAs) to network equipment located in the Telecommunications Room (TR). This cabling generally extends horizontally along floors, walls, and ceilings.

Distance: 90 m link - Link is the bulk cable run without assemblies or patch cables. 100 m channel- Channel is the entire run of cable including assemblies and patch cables.

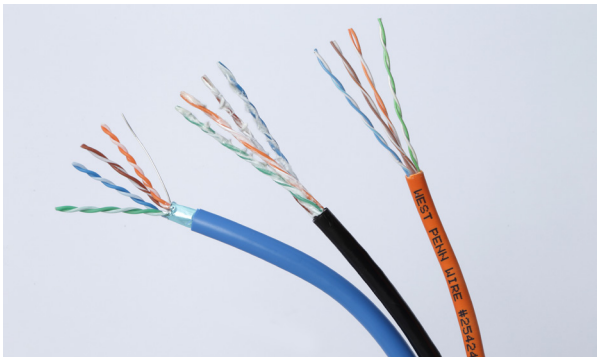
Topology: Star Configuration from Hub to Desktop

Cabling Media Types

4 Pair 100 Ω Impedance UTP (Unshielded Twisted-Pair) or F/UTP (Foil over UTP-Shielded).

Category 5e: TIA/EIA - 568.C.2

- 4 Pair 24 AWG
- Voice or Data - Data: 10/100 BASE-T Ethernet
- UTP or F/UTP Design

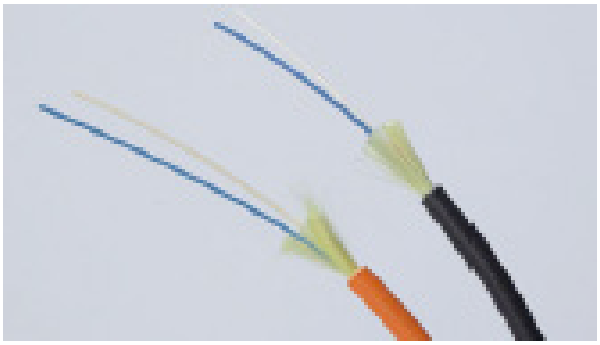


Category 6: TIA/EIA 568 C.2

- 4 Pair 24 or 23 AWG
- Data: 100/1000/10000-BASE-T Ethernet
- UTP or F/UTP Design

Category 6A: TIA/EIA 568 C.2

- Augmented Cat 6
- 4 Pair 23 AWG
- Data: 100/1000/10000 BASE-T Ethernet
- UTP or F/UTP Design



Category 7

- 4 Pair 23 or 22 AWG
- Data: 10G BASE-T Ethernet
- S/FTP Design- Shielded over Shielded Pair
- Optical Fiber OM1, OM2, OM3, OM4 Design
- OM1: 62.5/125 µm Fiber Shorter Runs
- OM2: 50/125 µm
- OM3: 50/125 µm Laser Optimized 10G Network
- OM4: 50/125 µm 40G Network

Cable

A Network Cable is designed specifically to carry a certain amount of digital data from one point to another with low loss, low cross talk and other electrical parameters.

One main design characteristic of all Network Cables is the Pair design. To keep crosstalk to a minimum, all four of the pairs of the Network Cables are twisted at different rates.

Category 5e:
- 24 AWG Solid Bare Coper
- 100 MHz Rated for 100 BASE-T Applications
- 4 Pairs twisted at different rates

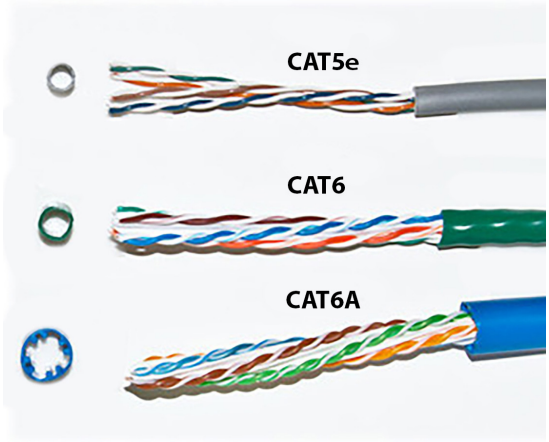
Category 6:
- 24 or 23 AWG Solid Bare Coper
- 250 MHz Rated for 1G BASE-T Applications
- 4 Pairs twisted at different rates
- Can support 10G up to 35 m (114 ft)

Category 6A:
- 23 AWG Solid Bare Coper
- 500 MHz Rated for 10G BASE-T Applications
- 4 Pairs twisted at different rates
- 10G Network up to 100 m (328 ft)

Category 7:
- 23 AWG Solid Bare Copper
- 650 MHz Rated for 10G BASE-T Application
- Digital Media Ultra 4K Applications
- 4 Pair twisted at different rates
- 10G Network up to 100 m (328 ft)

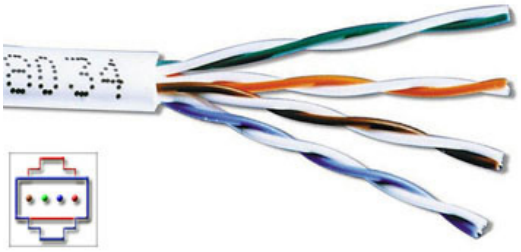
Cat 5e, 6 and 6A are offered in UTP (Unshielded Twisted-Pair) and STP (F/UTP) Shielded designs.

The shield's main purpose is to protect the internal signaling from outside electrical interference.



Shielded Twisted-Pair (STP)

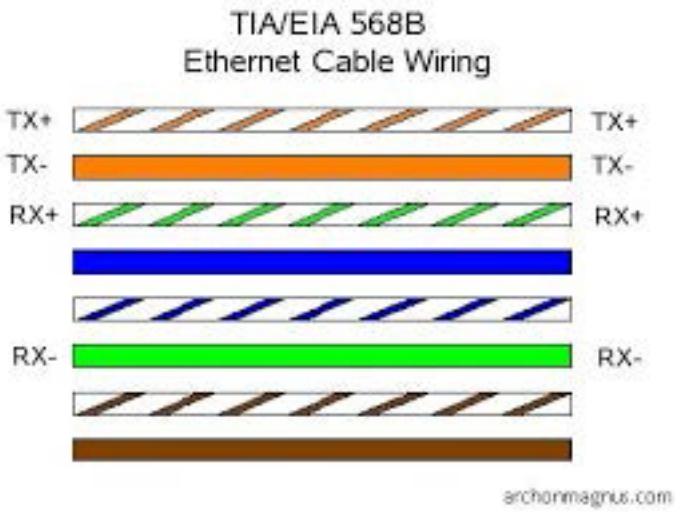
Unshielded Twisted-Pair (UTP)



Cable

Network Cable Color Code

1. White/Orange
2. Orange
3. White/Green
4. Blue
5. White/Blue
6. Green
7. White/Brown
8. Brown



Network Cable Installation

Pull Tension

Pull tension is applied to prevent conductors from being stretched during installation.

Category 5e: 25 lbf - (pounds of force)
Category 6: 25 lbf
Category 6A: 35 lbf

Cable Bend Radius

The bend radius of Network cable is a simple calculation. Take the OD of the cable and multiply it by 4.

Example

4245 Category 5e UTP CMR
.191 in x 4 = .76 in
Standard is called out to be 1 in

The "Don'ts" of Network Cable

- Do not bend the cable at more than a 90º angle
- Do not exceed the minimum bend radius at 4X the cable OD
- Do not forcibly tug the cable while pulling
- Do not tighten ties on cable bundles
- Do not run over or step on cables lying on the ground

Electrical Characteristics

Network cables are designed for digital data applications. To help ensure that cables can sufficiently handle data loads, there are numerous electrical performance criteria to consider during cable selection.

Characteristic Impedance

Impedance is an important electrical parameter in network cabling. Impedance is measured in Ohms (Ω). The impedance of a network cable is 100 Ω +/-5.

Capacitance

Capacitance is measured by pico farads per foot (pf/ft) or meter (pf/m). Capacitance of a network cable is nominally between 13 pf/ft and 16 pf/ft.

Attenuation

Attenuation is a loss of signal due to conductor size related dielectric materials and frequency. Attenuation is measured in decibles (dB) per foot or meter.

NEXT - Near-End CrossTalk

Near-end crosstalk (NEXT) is an error condition that can occur when connectors are attached to twisted-pair cabling. NEXT is usually caused by crossed or crushed wire pairs and is measured in decibels (dB).

PSNEXT - Power Sum NEXT

PSNEXT is a NEXT measurement which includes the sum of crosstalk contributions of all adjacent pairs. It is the algebraic sum of near-end crosstalk (NEXT) of three wire pairs as they affect the fourth pair in a four-pair cable.

FEXT - Far End CrossTalk

Interference between two pairs of a cable measured at the other end of the cable with respect to the interfering transmitter.

ELFEXT- Equal Level Far End CrossTalk

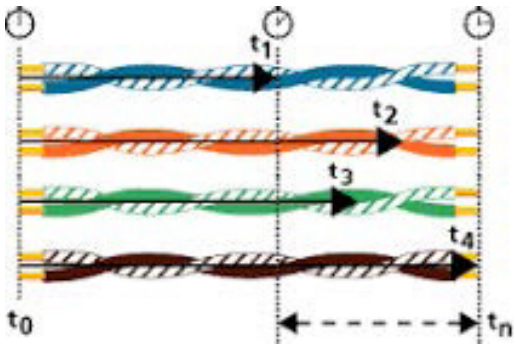
A FEXT measurement with attenuation compensation.

ACR Attenutaion to Crosstalk Ratio

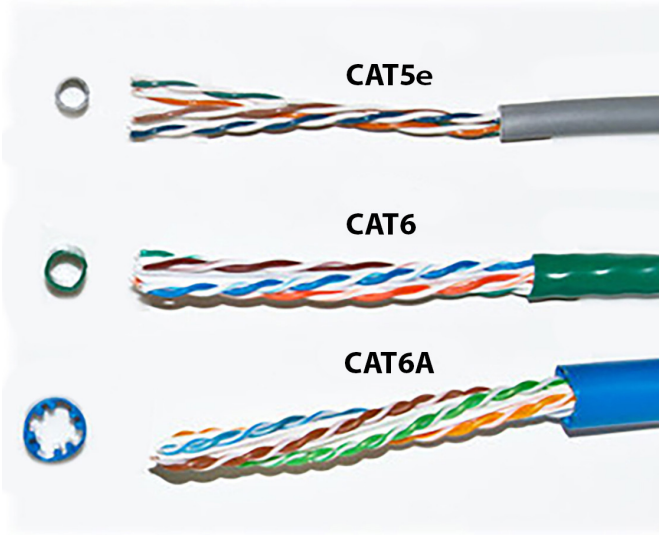
Attenuation-to-crosstalk ratio (ACR) is a parameter that is measured when testing a communication link, which represents the overall performance of the cable. ACR is a mathematical formula that calculates the ratio of attenuation to NEXT for each combination of cable pairs.

PS-ACR Power Sum Attenutaion to Crosstalk Ratio

Power Sum of the Attenutaion to Crosstalk ratio.



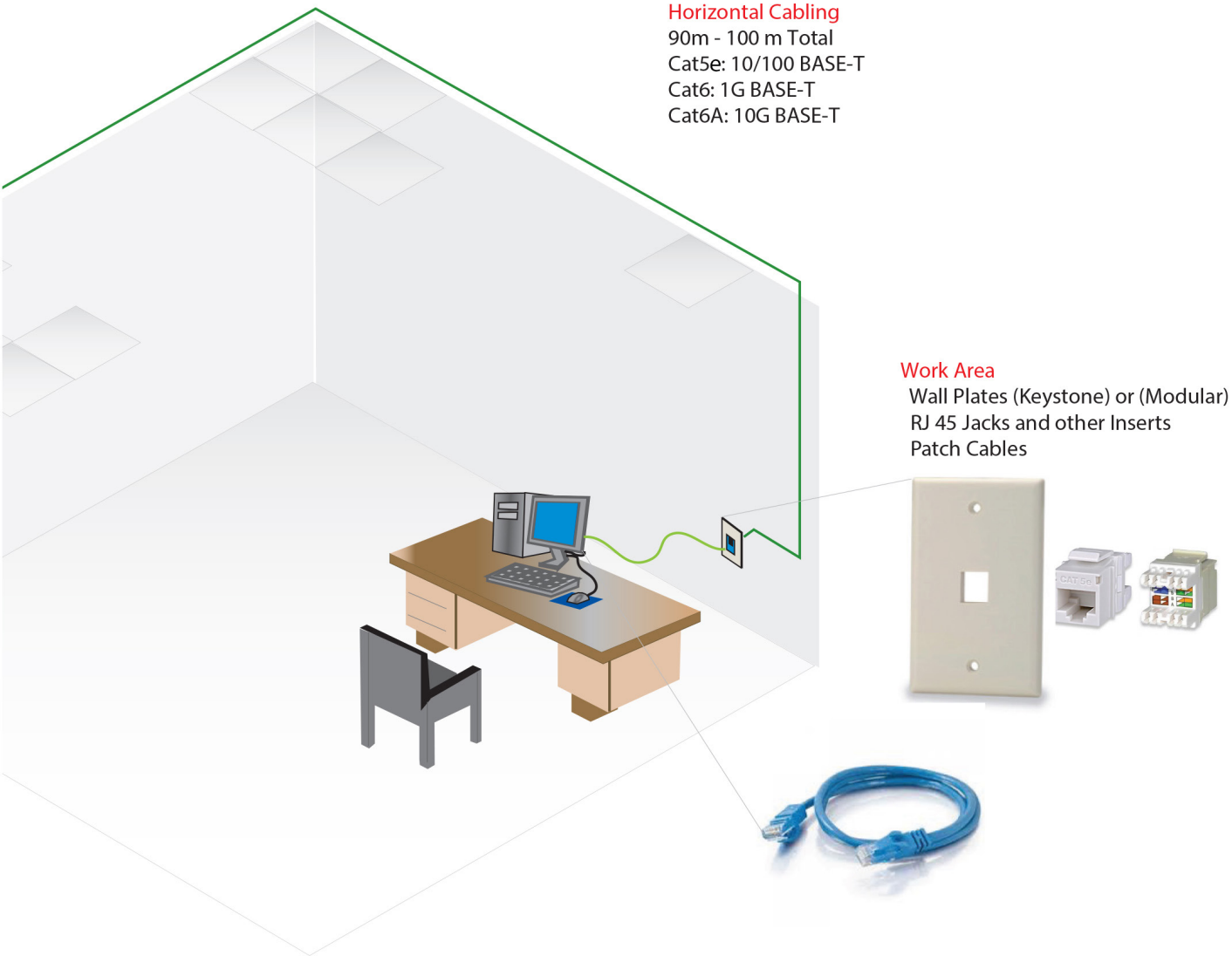
West Penn Wire Bulk Cables



Environment	Category 5e UTP	Category 5e F/UTP	Category 6 UTP	Category 6 F/UTP	Category 6A UTP	Category 6A F/UTP	Category 7 F/STP
Non Plenum	4245	4245F	4246	4236F	4346A	4246AF	–
Plenum	254245	254245F	254246	254236F	254346A	254246AF	254247F
Indoor/Outdoor	4245IO	–	4246IO	4246FIO	4246AFIO	–	–
Outside Plant	4245OSP	–	4246OSP	–	–	–	–
Armored	M57562	–	–	–	–	–	–

Work Area

The Work Area (WA) employs Wall Plates, Cable Assemblies, and Connectors. The Wall Plate contains inserts such as an RJ45 jack to connect horizontal cabling to IP devices through cable assemblies.



Keystone

The wall plates used are usually Keystone style. Decora® modular style wall plates can be used to transition from horizontal cabling to the work area.

Keystone Type	Keystone Style Plates-West Penn	Keystone Style Plates	Keystone Style Plates w/Label	Keystone Style Plates Stainless	Keystone Adapters
1G, 1 Port	SGKF-1	SKF-1	SKFL-1	SSKF-1	CMK-BA
1G, 2 Port	SGKF-2	SKF-2	SKFL-2	SSKF-2	CMK-BL
1G, 3 Port	SGKF-3	SKF-3	SKFL-3	SSKF-3	CMK-BNC75
1G, 4 Port	SGKF-4	SKF-4	SKFL-4	SSKF-4	CMK-F3
1G, 6 Port	–	SKF-6	SKFL-6	SSKF-6	CMK-HDMI
2G, 6 Port	–	DKF-6	DKFL-6	–	CMK-LC
2G, 8 Port	–	DKF-8	–	DSKF-8	CMK-PCTRS
2G, 12 Port	–	DKF-12	DKFL-12	DSKF-12	CMK-SC
–	–	–	–	–	CMK-USB

Decora® Type	Keystone Adapter Plates	1G Decora Style	2G Decora Style
1G, 1 Port	DA-1	SKFD-1	DKFD-2
1G, 2 Port	DA-2	–	–
1G, 3 Port	DA-3	–	–
1G, 4 Port	DA-4	–	–
1G, 6 Port	DA-6	–	–
2G, 6 Port	DKF-6	–	–
2G, 8 Port	DKF-8	–	–
2G, 12 Port	DKF-12	–	–

MODULAR Type	Plates	Adapters	2-Port Adapters
1G Modular	SGF-06	–	–
2G Modular	SGF-12	–	–
BNC	–	SCM-1BNC	SCM-2BNC
"F" Type	–	SCM-1F	SCM-2F
LC	–	SCM-1LC	SCM-2LC
SC	–	–	SCM-2SC
CAT 5E	–	–	SCM245-C5E
CAT 6	–	–	SCM245-C6C
HDMI	–	SCM-1HDMI	SCM-2HDMI
USB	–	SCM-1USB	SCM-2USB
VGA	–	SCM-1VGATB	–

Connectors

RJ45 Jacks

Registered Jacks (RJ45) are data connectors with 8P8C. A variety of RJ-style connectors, such as RJ11/RJ12, can be uses in homes and offices for telecommunication voice, and networking and data applications.

The RJ45 Jacks can accommodate T568A or T568B Wiring

Back View of Keystone Jack

SX-KJMT-8600
4-Pair Termination Tool

RJ45 Jacks can be terminated by a single punch-down tool or a multi-termination tool, such as our KJMT-8600.

RJ45 Jack Style

Category 5e: UTP or Shielded
Categoy 6: UTP or Shielded
Category 6A: UTP or Shielded

UTP RJ45 Jacks are avialable in multiple colors: Black, Blue, Red, Yellow, Orange and Green.

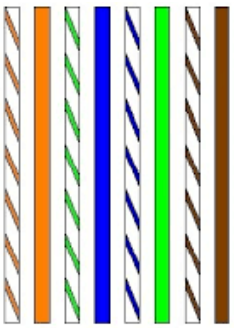
F/UTP RJ45 Jacks have to be shielded or metal.

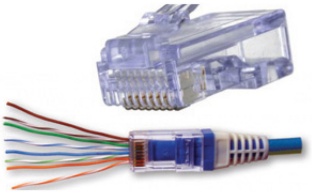
Type	Category 5e UTP	Category 5e F/ UTP	Category 6 UTP	Category 6 F/ UTP	Category 6A UTP	Category 6A F/ UTP
West Penn Brand	–	–	KJ456C-C6C-xx	–	–	–
MT Series	KJ458MT-C5E-xx	KJS458MT-C5E	KJ458MT-C6C-xx	KJS458MT-C6C	KJ458MT-C6AC-xx	KJS458MT-C6AC
Tool-Less	–	KJS458TL-C5E	–	KJS458TL-C6C	–	KJS458TL-C6AC
MT Tool	KJMT-8600	KJMT-8600	KJMT-8600	KJMT-8600	KJMT-8600	KJMT-8600
Pair Separation	TL-CATWIREST	TL-CATWIREST	TL-CATWIREST	TL-CATWIREST	TL-CATWIREST	TL-CATWIREST

Modular Plugs

Although modular plugs are not often used in the work area, there may be times when you need to install and terminate a modular plug.

Color code of T568B cables loaded into a modular plug.





Modular Plug Style

Category 5e: UTP or Shielded
Categoy 6: UTP or Shielded
Category 6A: UTP or Shielded

West Penn Wire offers EZ Modular Connectors and standard plugs for our Category 6 and 6A Shielded Cables, as well as Modular Kits (90170-BI).

Type	Category 5e UTP	Category 5e F/ UTP	Category 6 UTP	Category 6 F/ UTP	Category 6A UTP	Category 6A F/ UTP
EZ Plug	32-EZP	CN-EZP-STP	32-6EZP	–	–	–
Loading Bar	32-2198UL	–	32-6198UL	106190	106190	106090
Standard Plug	32-5998UL	32-2098UL	–	–	CN-CAPFMUL-S1	–
Kits	–	–	–	90170-BI	90170-BI	90170-BI
Crimp Tool	TL-EZRJ45PROCT	TL-EZRJ45PROCT	TL-EZRJ45PROCT	12515C	12515C for 106190	12515C
Strip Tool	TL-15015	TL-15015	TL-15015	15010C	15010C	15010C
Pair Separation	TL-CATWIREST	TL-CATWIREST	TL-CATWIREST	TL-CATWIREST	TL-CATWIREST	TL-CATWIREST
Boats	32-1900-xx	32-1900-xx	32-1900-xx	CN-B0051	CN-B0051	CN-B0051

Cable Assemblies Work Area

Cable Assemblies are needed at the Work Area location to allow signals to be guided from the wall plate (RJ45 Jack) to the computer or IP device.

Network Assemblies are available for Category 5e, Category 6, and Category 6A.

For Network UTP Cables, assemblies are available in multiple colors: Black, Red, Yellow, Orange, Green, and Pink.

F/UTP Network Assemblies are available in a Gray Jacket, but other colors can be ordered.

Network Assemblies are available in a variety of lengths:
3, 5, 7, 10, 15, 20 and 25 ft.

West Penn Wire also offers long-length cable with pulling eye.

Cable Assemblies Telecommunication Closet (TC) & Equipment Room (ER)

Cable assemblies are needed in the TC or ER to guide signals from the patch panel (RJ45 Jack) to computers or network switching devices.

Type	Category 5e UTP	Category 5e F/UTP	Category 6 UTP	Category 6 F/UTP	Category 6A UTP	Category 6A F/UTP
West Penn Brand	–	–	C6-CA1-cc-xx	–	–	–
Component Level	C5EC-114cc-xxFB	C5ES-314GY-xxFB	C6C-114cc-xxFB	C6CS-314GY-xxFB	C6A-114cc-xxFB	C6AS-314cc-xxFB
Channel Level No Boots	C5E-121cc-xxFB	–	C6C-115cc-xxFB	–	–	–
Channel Level with Boots	C5E-114cc-xxFB	–	–	–	–	–

Category Cable Colors

Black (BK), Blue (BU), Green (GN), Gray (GY), Orange (OR), Red (RD), White (WH), Yellow (YE)

Category Cable Lengths

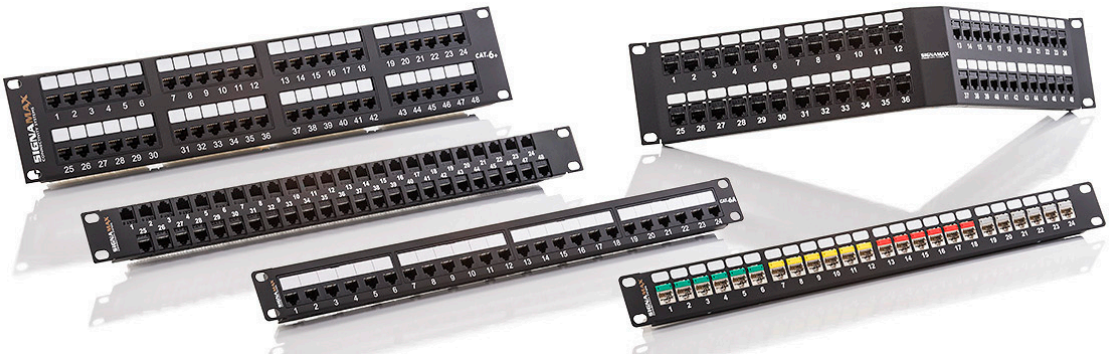
3, 5, 7, 10, 15, 20, 25 ft

Telcommunication Room (TR) / Equipment Room (ER) - TIA/EIA-569

In the TR and/or ER Networking, passive equipment is needed. These parts are typically a patching system. If a Category 6 System or a 1G Network is implemented, a passive network patch panel of the same or better quality is needed.

Patch Panel Style

Category 5e: UTP and Shielded
Category 6: UTP and Shielded
Category 6A: UTP and Shielded



Type	Category 5e UTP	Category 5e F/UTP	Category 6 UTP	Category 6 F/UTP	Category 6A UTP	Category 6A F/UTP
West Penn Branded	–	–	24PP-C6C-L 48PP-C6C-L	–	–	–
MD Series	12458MD-C5E 24458MD-C5E 48458MD-C5E	–	12458MD-C6C 24458MD-C6C 48458MD-C6C	–	24458MD-C6AC 48458MD-C6AC	–
MT	–	24458S-C5E 48458S-C5E	24458-C6C 48458-C6C	24458S-C6C 48458S-C6C	24458-C6A 48458-C6A	24458S-C6A 48458S-C6A
High Density	48458HD-C5E	–	48458HD-C6C	–	–	–
Angled	24458A-C5E 48458A-C5E	24458SA-C5E 48458SA-C5E	24458A-C6C 48458A-C6C	24458SA-C6C 48458SA-C6C	24458A-C6A 48458A-C6A	24458SA-C6A 48458SA-C6A

MD Series: 110 Connector Blocks
MT Series: Snap-in Keystone Jacks

800.245.4964

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