

WEST PENN WIRE

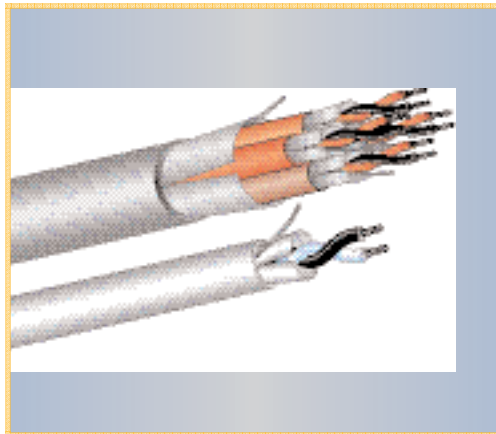
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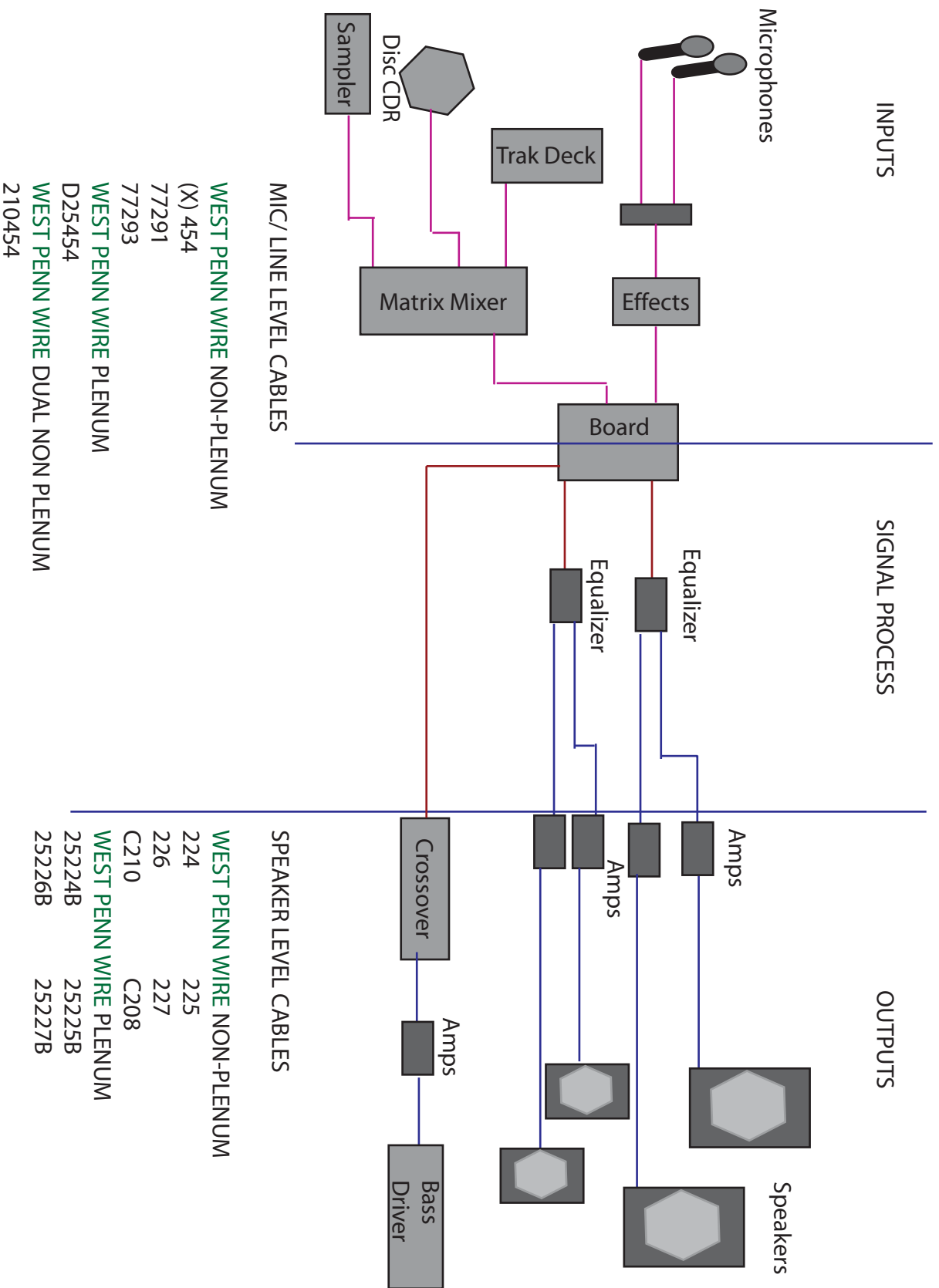
Audio Cables

Line Level

Speaker Level

Digital Level





ANALOG AUDIO CABLES:

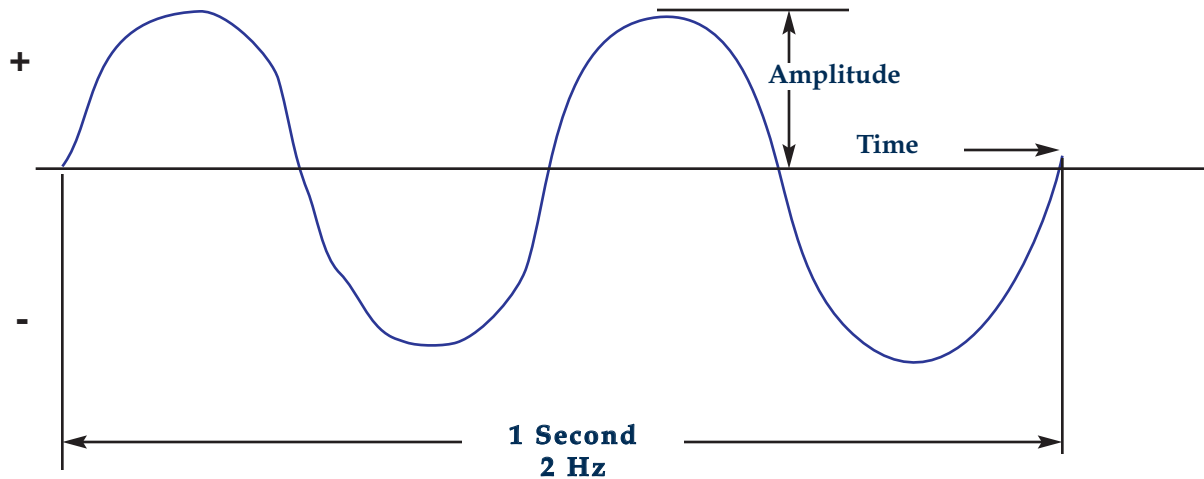
AUDIO RANGE 20Hz to 20 KHz.

20 Hz- Lowest Audible Frequency

440Hz- A on the piano (A_4)

4186Hz- Top key on a Piano (C_8)

20KHz- Highest Audible Frequency



Analog audio is a sin wave with an amplitude, time, and frequency.

Analog Audio Level Categories:

1. Microphone Level

a. Portable, b. Permanent

2. Line Level

a. Professional, b. Consumer

3. Speaker Level

a. High Impedance, b. Low Impedance

ANALOG AUDIO CABLES:

Decibel-1/10th of a Bel- Basic Unit of measure in Audio Signals

1dB is the smallest change detectable by the human ear.

-10dB change is subjectively about twice as loud or soft.

The Decibel is logarithmic because the human ear is logarithmic in response to sound.

A logarithm makes dealing with the audio range of numbers involved in amplifier power, sound levels and mic levels much easier to deal with.

Decibel in Audio Applications:

dB= $10 \log (P1/P2)$.- P- power

dBu-

Referenced to volts without regards to Impedance- u- unloaded (no devices attached)

0dBu is always .775Volts

dBm- is refers to a standard level of 1 milliwatt

dBV-

Voltage referenced to 1 Volt without regards to impedance.

dB SPL-

Measure acoustical sound pressure levels

65dB is typically two people talking in t conference room

110 dB- Rock Concert

140 dB- Threshold of physical pain

Signal Levels:

-60 dBu- Common lowest Microphone output

-50 dBu- Standard Microphone level

-10dBv- Line Level Standard Level (Consumer Hi/Fi) (.03162Vrms)

0 dBu- Standard professional Reference

+4dBu- Line Level Pro Analog Audio (1.228Vrms)

Microphone 50-60dB below line level. Having such a low signal level the signals are very weak. This makes those signals susceptible to interference.

Losses, noise and interference become more critical

Analog Audio Level Categories:

1. Microphone Level

a. Portable, b. Permanent

2. Line Level

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a. High Impedance, b. Low Impedance

Balanced vs. Unbalanced Signals:

Balanced audio circuits offer three connections points

- Conductor carrying the signal just as it originated (+)
- Conductor carrying the same signal with opposite polarity (-)
- Electrical Ground (Usually Shield)
- Connector (XLR, 1/4", 3.5mm)

AV Designers choice of Cable.

Unbalanced Audio Circuits

- Single Conductor to carry the signal
- Braid/Shield for Return Path
- Connector (RCA)

ANALOG AUDIO CABLES:

Microphone Level: Mic

-50 to -60dB signal level- Very weak signals.

The length of the average Mic run is very short, so electrical parameters are not an issue.

Once the cable runs start exceeding a few hundred feet, the electrical parameters start becoming issues.

Mic Systems can be broken down into 2 Categories:

Portable Installations:

- Rugged
- Flexible
- High Flex Conductor
- Braid Shielding
- No UL Listing

Permanent Installations:

- UL Rating
- Flame / Smoke
- Flex Conductor
- Foil shield (Braid Shield - Optional)

Microphone level changes to line level as soon as possible- (+4dBu) or more.

You can run Mic cables a longer distance than a few hundred feet, there will be noise and interference that may show up, depending on the installation environment.

The construction of a mic cable becomes an issue when running longer distances. A low capacitance design is preferable for long distant Mic applications. Shielding becomes a factor.

Capacitance vs. Impedance:

-1dBm at 20KHz

Source (Z)	15pf/ft	20ft/ft	30pf/ft
50Ω	5406ft	4055ft	2703ft
150Ω	1873ft	1352ft	901ft
600Ω	451ft	338ft	225ft
1kΩ	271ft	203ft	135ft
10kΩ	27ft	20ft	14ft

Microphones generally have an impedance of 150Ω.

When Mic cable (signals) need to go longer distances, they are best suited to be placed in a conduit. By doing this, the ruggedness, and flexibility benefits, and cost are not utilized. Hence, go to a permanent high quality install cable, a good electrical characteristic line level audio, or digital audio design.



ANALOG AUDIO CABLES:

Line Level:

+4dBu- Professional a stronger signal than Microphone Level
-10dBv- Consumer

Line Level cables are physically the same as an permanent Mic cable and is distinguished by the fact that it carries balanced line level signals. Line level cables can carry the signals over 1000ft. Line Level signals have to be more robust than Mic cables, line level carries +/-2Volts with current measured in milliamps.

The cable Impedance (Z) is normally between 45-70Ω which closely matches the system Impedance which is close to 60Ω.

$$Z = \sqrt{L/C}$$

Good Quality Line Level Cable

Inductance (L)= .170uH/ft

Capacitance (C)= 35pf/ft* (67pf/ft)**

$$Z = \sqrt{170/67} = 50\Omega$$

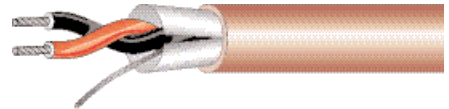
Line Level

There are two types of Line Level cables: Balanced and Unbalanced

Balanced vs. Unbalanced Signals:

Balanced audio circuits offer three connections points

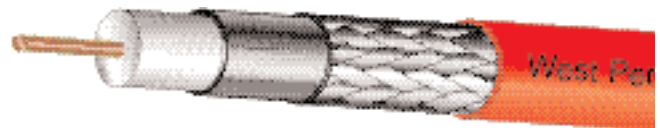
- Conductor carrying the signal just as it originated (+)
- Conductor carrying the same signal with opposite polarity (-)
- Electrical Ground (Usually Shield)
- Connector (XLR, 1/4", 3.5mm)



AV Designers choice of Cable.

Unbalanced Audio Circuits

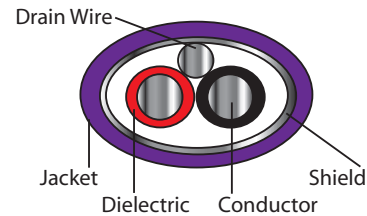
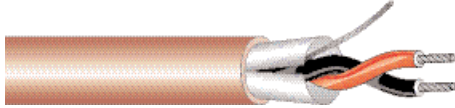
- Single Conductor to carry the signal
- Braid/Shield for Return Path
- Connector (RCA)



Because a line level cable carries less power than a speaker cable the cable is more susceptible to noise. A good line level audio cable contains a shield of some sort (foil, braid, foil/braid)- EMI noise emanates from florescent lighting, lighting dimmers, and electric motors. These EMI signals may penetrate into the line level audio and disrupt the audio signals.

ANALOG AUDIO CABLES:

Cable Design for Mic/Line Level Audio Cables:



Conductor:

Balanced Mic and Line Level Audio cables consist of stranded conductors- In a portable Mic application a high stranded conductor may be used.

22AWG - 7x30 - 7 Strands of 30AWG= 22AWG conductor

The conductor can be either bare copper or tinned copper. For most Mic and Line Level Applications, a tinned copper center conductor is used. The tinned conductor has been implied that it creates a better solder. This is a question for individual system installer. A tinned conductor will help in corrosion.

Insulation- Dielectric

The insulation is an important part of the construction of the Line Level Cables. A low loss insulation is used to create a flat frequency response, a lower capacitance, and a higher velocity of propagation.

For critical audio cables or audiophile applications, the capacitance between conductors of a cable may be a consideration. This is determined by the dielectric or insulation and the spacing between conductors.

In the highest quality audio circuits the dissipation factor (dielectric loss) of capacitors in the audio path is chosen to be as small as possible.

Dielectric Constant:

ratio of the electrical conductivity of a dielectric material to free space

Air- 1.05

Polypropylene(PP)- 2.20-2.30-

PP- Can cause some piezoelectric noise -due to the crystalline structure

Piezoelectric Noise- When moved or struck, the crystalline structure generates noise by itself.

Polyethylene (PE)- 2.30

Polyvinyl Chloride (PVC)- 3.40

Teflon- (FEP)- 2.10

See Frequency Response chart

Other Factors for the insulation:

<i>Plastic</i>	<i>Shrink Back</i>	<i>Solderability</i>
PP	Good	Very Good
PE	Poor	Good
PVC	Good	Good
Teflon	Excellent	Excellent

Low dielectric constant will provide better electrical characteristics to a cable. Capacitance would become lower and Velocity of propagation will increase.

Line Level Cables utilize a low dielectric polyolefin insulation.

ANALOG AUDIO CABLES:

Cable Design for Mic/Line Level Audio Cables:

Shield:

Shielding is also important to the construction of a line level audio cable. Shielding prevents unwanted noise to penetrate into the cable. Shielding also provides protection for any audio signals that try to leak out from the cable.

Portable Microphone cables- Because of the low signal levels, these cables are susceptible to noise.

Braid shields are excellent for low frequency noise shielding. (EMI interference)

Permanent Microphone and Line Level Audio Cables do not need the expensive braid, because the signal is stronger on line level, the interference protection of the braid is not needed.

Foil Shields are excellent for higher frequency noise shielding (RFI interference) and provide good shielding for EMI noise.

Jacket:

The jacket is dependent on the environment the cable is used:

- Portable Mic Cables: Rubberized, Flexible type Matte PVT- Usually not a UL Rating
- Permanent Mic/ Line Level Cables: Non-Plenum - PVT CM or CMR Rated
Plenum - Low Smoke PVT - CMP Rated

<i>Plastic</i>	<i>Flexibility</i>	<i>Electronic</i>	<i>Cost</i>
PP	Poor	Good	Avg.
PE	Poor	Excellent	Avg.
PVT	Very Good	Avg.	Low Avg.
Teflon	Bad	Excellent	Very High

Unbalanced Audio Cable Design:

75 ohm Coaxial Cable Design- See Digital Video Technical Bulletin.

Connector: RCA

ANALOG PRO-AUDIO LINE LEVEL CABLES

MINIATURE AUDIO CABLES	
(X)454	Miniature Audio Line Level Audio 1 pr. 22AWG Shielded 12 Colors
455	Miniature Audio Line Level Audio 1 pr. 22AWG Shielded Conformable Rack
25454	Miniature Audio Line Level Audio 1 pr. 22AWG Shielded Plenum
210454	Dual Miniature Audio Line Level Audio 2 pr. 22AWG Shielded
2452	Dual Miniature Audio Line Level Audio 2 pr. 22AWG Shielded
TWISTED PAIR SHIELDED NON PLENUM (BROADCAST QUALITY)	
77291	Miniature Audio Line Level Audio 1 pr. 22AWG Shielded
77292	Miniature Audio Line Level Audio 1 pr. 20AWG Shielded
77293	Miniature Audio Line Level Audio 1 pr. 18AWG Shielded
77294	Miniature Audio Line Level Audio 1 pr. 16AWG Shielded
77295	Miniature Audio Line Level Audio 1 pr. 14AWG Shielded
77296	Miniature Audio Line Level Audio 1 pr. 12AWG Shielded
TWISTED PAIR INDIVIDUALLY SHIELDED NON PLENUM	
77510	Miniature Audio Line Level Audio 2 pr. 22AWG Ind.Shielded
TWISTED PAIR SHIELDED PLENUM (BROADCAST QUALITY)	
D25291	Miniature Audio Line Level Audio 1 pr. 22AWG Shielded Plenum
D25292	Miniature Audio Line Level Audio 1 pr. 20AWG Shielded Plenum
D25293	Miniature Audio Line Level Audio 1 pr. 18AWG Shielded Plenum
D25294	Miniature Audio Line Level Audio 1 pr. 16AWG Shielded Plenum
ANALOG MULTIPLE PAIR- AUDIO SNAKE CABLE	
WP4546	6 Pair Analog Audio Snake Cables Non-Plenum
WP4548	8 Pair Analog Audio Snake Cables Non-Plenum
WP45412	12 Pair Analog Audio Snake Cables Non-Plenum
WP45416	16 Pair Analog Audio Snake Cables Non-Plenum

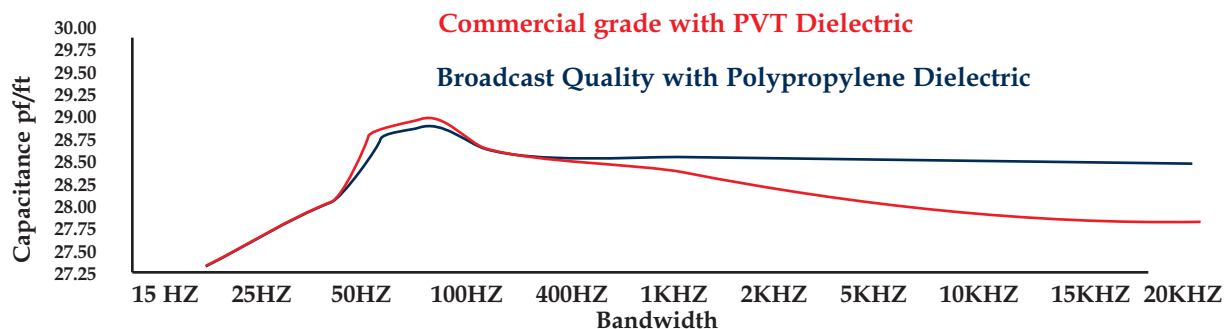
INSULATION COMPARISON OF ANALOG AUDIO CABLES

Catalog No.	Conductor Type	Insulation Type	Insulation Thickness	Nom. Capacitance pf/ft	Nom. Imp. Ω	Vel. of Prop.	Comments	Cable O.D.	Typical Application
291	Bare Copper	PVT	.010"	55pf/ft 99pf/ft**	45 Ω	48%	Non-Linear freq. response High Capacitance	.127"	Audio intercom, Stationary Mics, Commercial Grade
454	Tinned Copper	Poly-propylene	.008"	34pf/ft 67pf/ft**	55 Ω	65%	Low Capacitance Flat freq. response small size - Full AWG Drain	.135"	Audio intercom, Patchcables Broadcast Quality
77291	Tinned Copper	Poly-ethylene	.016"	24pf/ft 47pf/ft**	65 Ω	66%	Low Capacitance flat freq response	.175"	Pro-Audio Broadcast Quality

All cables listed are constructed with: 1 Pair 22 AWG Shielded construction. Capacitance of each cable is due to the type of insulation and the thickness of the insulation used on the primaries of the conductors.

454 - Benefits: Full AWG Drain Wire (22AWG), Bonded Foil to the Jacket for ease of stripping. 12 different Colored Jackets Available.

Frequency Response



Frequency response is one of the most fundamental indicators of a device's ability to faithfully record, reproduce, or transmit a complex signal.

Frequency response is a plot of the input signal to the output signal over a frequency band for the component or system.

Signal input is normally a flat frequency response, only the output is measured. Having a flat frequency response on the input and a flat frequency response over the medium will assure a measured flat frequency response at the output.

Professional Audio Cables



Description:

- ASTM Tinned Copper • Polyethylene or Polypropylene insulation
- Overall shield 100% coverage of aluminum polyester foil with drain wire • Twisted pair construction • Overall PVT jacket

Rating:

- NEC Type CM or CL2
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1685

Standard pool size 1000ft.

Applications:

Indoor for:

- Pro-Audio
- Sound Systems
- Sound and Audio
- Recording Studios
- Post-Production Facilities
- Line Level Audio- Best Design

Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shield & % Coverage Drain Wire	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
77291	1 Pair	22 AWG (7x30) 17 Ω/Mft	PE .016	Al. Foil 100% 22 Strd.	PVT .025	.175	CM	24pf/ft* 47pf/ft**	Gray
77292	1 Pair	20 AWG (7x28) 10.5 Ω/Mft	PE .016	Al. Foil 100% 20 Strd.	PVT .028	.204	CM	27pf/ft* 49pf/ft**	Gray
77293	1 Pair	18 AWG (16x30) 6.2 Ω/Mft	PE .018	100% Al. Foil 20 Strd.	PVT .028	.222	CM	24pf/ft* 44pf/ft**	Gray
77294	1 Pair	16 AWG (19x29) 4.2 Ω/Mft	PE .032	Al. Foil 100% 18 Strd.	PVT .032	.315	CL2	23pf/ft* 44pf/ft**	Gray
77295	1 Pair	14 AWG (19x27) 2.7 Ω/Mft	PE .032	Al. Foil 100% 16 Strd.	PVT .035	.355	CL2	24pf/ft* 47pf/ft**	Gray
77510†	2 Pair	22 AWG (7x30) 17 Ω/Mft	PP .008	Ind. Shielded Al. Foil 100% with 1 drain wire	PVT .020	.189	CM	35pf/ft* 62pf/ft**	Gray

Notes:

† - Employs individually shielded pairs with one drain wire common to all shields.

* Capacitance between conductors.

** Capacitance between one conductor and the other connected to the shield

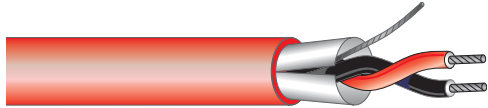
Special Notes:

- PE- Polyethylene
- PP- Polypropylene

Accessories: pages 137-138

Color Code		
Catalog No.	77291, 77292, 77293, 77294, 77295	77510
Primary Color Code	1. Black, 2. Clear	1. Black-Red, 2. White-Green
	JACKET: Gray	JACKET: Gray

Professional Audio Cables



Description:

- ASTM Tinned Copper • Polypropylene insulation
- Overall shield 100% coverage of aluminum polyester foil with drain wire • Twisted pair construction
- Overall PVT jacket

Rating:

- NEC Type CMR
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1685

Broadcast Audio

Miniature Audio / 22 Awg. Shielded

Applications:

Indoor for:

- Post-Production Facilities
- Recording Studios
- Sound and Audio
- Power-limited Control Circuits

Standard spool size 1000ft.

Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shield & % Coverage Drain Wire	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
(X)454	1 pair	22 AWG (7x30) 17 Ω/Mft	PP .008	Al. Foil 100% 22 Strd.	PVT .020	.135	CMR	34pf/ft* 67pf/ft**	See Color Code Chart
The Aluminum polyester shield is bonded to the jacket so both can be removed with automatic stripping equipment									

Color Code			
Pair No.	Jacket Color	Pair No.	Jacket Color
1	Brown	7	Violet
2	Red	8	Gray
3	Orange	9	White
4	Yellow	10	Black
5	Green	11	Tan
6	Blue	12	Pink

* Capacitance between conductors.

** Capacitance between one conductor and the other connected to the shield

Notes:

Replace (X) with number.

Example:

(2)454- Red Jacket

Broadcast Audio

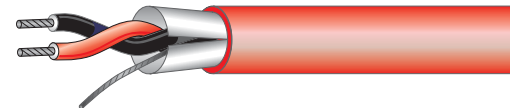
Miniature Audio / 22 Awg. Shielded Plenum

Rating:

- NEC Type CMP
- (UL) Listed
- Meets 300 Volt
- Flame Rating: NFPA-262 Smoke & Flame Test

Description:

- ASTM Tinned Copper • FEP Insulation • Overall shield 100% coverage of aluminum polyester foil with drain wire • Twisted Pair Construction • Overall Plenum Jacket



Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding & % Coverage Drain Wire	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
D25454 New	1 pair	22 AWG (7x30) 17 Ω/Mft	FEP .007	Al. Foil 100% 22 Strd.	Plenum .018	.130	CMP	35pf/ft* 67pf/ft**	See Color Code Chart
The Aluminum polyester shield is bonded to the jacket so both can be removed with automatic stripping equipment									

Special Notes:

- The drain wire on these products are on the inside of the foil shield
- Minimum order quantities may apply on select jacket colors.

Color Code	
D25454	1. Black, 2. Red
	JACKET: Black, Red, Gray, White

* Capacitance between conductors.

** Capacitance between one conductor and the other connected to the shield

Professional Audio Cables

Broadcast Audio Miniature Dual Audio / *Shielded*

Applications:

Indoor for:

- Post-Production Facilities
- Recording Studios
- Sound and Audio
- Power-limited Control Circuits
- Line Level Dual Line Applications

Description:

- ASTM Tinned Copper • Polypropylene insulation
- Each Pair shield 100% coverage of aluminum polyester foil with 22 AWG TC drain wire • Figure 8 ZIP CONSTRUCTION • Twisted pair construction
- Overall PVT jacket

Rating:

- NEC Type CMR
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1685

Standard spool size 1000ft.

Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shield & % Coverage	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
210454 New	2 pair	22 AWG (7x30) 17 Ω/Mft	PP .008	Each Pair Al. Foil 100% 22 Strd. drain	PVT .020	.135 x .280	CMR	34pf/ft* 67pf/ft**	Gray

Color Code	
210454	1. Black, Red
	2. Black, White
JACKET: Gray	

* Capacitance between conductors.

** Capacitance between one conductor and the other connected to the shield

Special Notes:

- The Aluminum polyester foil is bonded to the jacket- 210454 only
- 210454 Overall jacket is Gray with one channel imprinted for identification

Broadcast Audio Miniature Conformable Rack Cable / *Shielded*


Applications:

Indoor for:

- Line Level Audio Rack Cables

Rating:

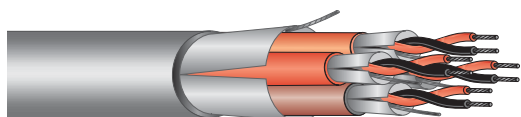
- NEC Type CM
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1685

Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness	Shield & % Coverage	Jacket Type & Thickness	Nom. O.D.	NEC Type	Nom. Capacitance	Jacket Color
 455 New	1 pair	Overcoat 22 AWG (7x30) 17 Ω/Mft	PP .008	Each Pair Al. Foil 100% 22 Strd. drain	PVT .020	.135 x .280	CMR	34pf/ft* 67pf/ft**	Black

Special Notes:

- Other Jacket Colors are available for manufacturing.
- Minimum order quantities may apply on select jacket colors

Professional Audio Snake Cables



Broadcast Audio Analog Multiple Pair/ Individually Shielded and Jacketed Pair

Description:

- ASTM Tinned Copper • Polypropylene insulation (Colors: Black,Red)
- Each Pair Individually Shielded with bonded aluminum polyester foil 100% coverage and 22 Strd. TC drain wire • Each Pair individually PVT jacketed
- Overall aluminum polyester foil with drain wire • Overall PVC jacket

Rating:

- NEC Type CM
- (UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1685

Applications:

Indoor for:

- Pro-Audio
- Sound Systems
- Sound and Audio
- Recording Studios
- Post-Production Facilities

Standard spool size 1000ft.

Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shield & % Coverage ‡	Jacket Type & Thickness Inches	Ind. Jkt. Nom. O.D. Inches	NEC Type	Nom. Capacitance	Overall Jacket Color
WP4546	6 Pair	22 AWG (7x30) 17 Ω/Mft	PP .008	Each Pair & Overall Al. Foil 100%	PVT .030	.475	CM	34pf/ft* 67pf/ft **	Gray
					Individual pair jacket Nom. O.D. - .135"				
WP4548	8 Pair	22 AWG (7x30) 17 Ω/Mft	PP .008	Each Pair & Overall Al. Foil 100%	PVT .030	.575	CM	34pf/ft* 67pf/ft **	Gray
					Individual pair jacket Nom. O.D. - .135"				
WP45412	12 Pair	22 AWG (7x30) 17 Ω/Mft	PP .008	Each Pair & Overall Al. Foil 100%	PVT .030	.675	CM	34pf/ft* 67pf/ft **	Gray
					Individual pair jacket Nom. O.D. - .135"				

* Capacitance between conductors.

** Capacitance between one conductor and the other connected to the shield

Special Notes:

- ‡ Individual pair drain wire size 22 AWG std. TC
- PP- Polypropylene

Individual Jacket Color Code See pg. 136

Professional Audio Accessories

Audio Connectors

Line Level Audio Connectors- Cable Mount

XLR Style Connectors

Catalog No.	Description
CN-NC3MXB	3 Position XLR Male Black-Gold Contact
CN-NC3MXBAG	3 Position XLR Male Black-Nickel Contact
CN-NC3MX	3 Position XLR Male Nickel-Nickel Contact
CN-NC3FXB	3 Position XLR Female Black-Gold Contact
CN-NC3FXBAG	3 Position XLR Female Black-Nickel Contact
CN-NC3FX	3 Position XLR Female Nickel-Nickel Contact
44-A3F	3 Position XLR Jack
44-A3M	3 Position XLR Plug



3.5mm Audio Connectors

Catalog No.	Description
19-1202	Stereo Mini Plug
CN-SM3.5F	3.5 Stereo Mini Jack
CN-NYS231B	3.5mm Mini Plug- Black/Nickel
CN-NYS231	3.5mm Mini Plug Nickel/Nickel
CN-MX35M	3.5mm Mini Plug- Terminal Block
19-1201	3.5 mm Mini Mono Plug

RCA Audio Connectors

Catalog No.	Description
19-1207	RCA Plug- Red
19-1268	RCA Plug- Black
CN-NYS373-xx	RCA Phono - xx-BK,BL,RD,YE,GN
25-7290	RCA RG59/U Male Plug

1/4" Audio Connectors

Catalog No.	Description
CN-NP3CBAG	1/4" Black-Silver Contact TRS
CN-NP3C	1/4" Silver- Silver Contact TRS
CN-NP2CBAG	1/4" Black-Silver Contact TS
CN-NP2C	1/4" Silver- Silver Contact TS
CN-NP3XB	Thin 1/4" Black-Gold Contact TRS
CN-NP3XBAG	Thin 1/4" Black-Silver Contact TRS
CN-NP3X	Thin 1/4" Silver- Silver Contact TRS
CN-NP2XB	Thin 1/4" Black-Gold Contact TS
CN-NP2XBAG	Thin 1/4" Black-Silver Contact TS
CN-NP2X	Thin 1/4" Silver- Silver Contact TS



Audio Stereo Mini Male to Male Cable Assemblies

CM Stereo Mini M to M 3.5mm	
Catalog No.	Description
CN-454SM-xx	Replace xx with: 15,25,50,75,100,150

ECONOMY Stereo Mini M to M 3.5mm	
Catalog No.	Description
CN-E3.5MM-xx	Replace xx with: 6, 12, 25

CMP RCA to RCA Phono	
Catalog No.	Description
CND25430RASxx	Replace xx with: 15,25,50,75,100,150

CMP Stereo Mini M to M	
Catalog No.	Description
CN-SMTSM-xx	Replace xx with: 15,25,50,75,100,150



ANALOG AUDIO CABLES:

Speaker (Loadspeaker) Levels:

Low Impedance System- 4Ω and 8Ω

High Impedance System- 70.7Volt

Low Impedance System: 4Ω and 8Ω

The cable is used to drive loadspeaker loads are normally between 2 and 32Ω, although most systems are 4 and 8Ω. If the concern is to deliver amplifier power to the loadspeaker, as the case for most commercial sound applications, the design procedure is straightforward, with cable resistance being the only concern. If the highest audio fidelity is needed, the cable construction will become an issue.

The Resistance of the cable is the most important electrical issue in loadspeaker installations. The effects of capacitance and inductance are negligible.

Low Impedance Systems output Impedance is low, the current must be high in order to get a given amount of power to the speaker. The lower the resistance of the cable, the more power gets to the speaker.

High Impedance- Distributed Loudspeaker System- Constant Voltage System:

Impedance of 4 and 8Ω are most common in amplifier outputs. Manufacturers of commercial amps might also supply an output transformer with a number of secondaries, one may be marked 8Ω and the other marked 70.7-Volts.

The impedance of a 70 Volt output transformer depends upon the wattage of the amp. A 25-watt, 70V amp has an output impedance of 196Ω.

Actual speakers are still 4 or 8Ω, however, so when the wire is connected to each speaker, there must first be a small transformer to reconvert from 70-volt to 4 or 8Ω. The quality of the transformer is an critical.

Distributed systems are used where quality is not the primary consideration, such as, public address, background music, or paging systems.

- High impedance loudspeaker distribution systems being higher voltage and lower current than low impedance (4/8Ω) loudspeaker systems have the following features:
 - higher operating voltage means less power is consumed by copper resistance
 - longer lines can be run before wire resistance becomes a concern
 - lower operating current means that thinner wire can be used

When installing large systems it is worthwhile to test the impedance of the loudspeaker lines prior to connection to the amplifier. Many possible errors in installation can be found this way.

The impedance expected on a 70.7-volt line is 5000 divided by the total watts. This should not exceed the rating of the amplifier drive line.

$$P=E^2/R$$

$$p= 70.7^2/ 20= 250W$$

Z- Impedance
I- Current

70.7V High Impedance System		
Power (W)	Z	I
1000	5	14.1
500	10	7.07
250	20	3.54
200	25	2.83
150	33.32	2.12
100	50	1.41
75	66.6	1.06
50	100	.71
25	200	.35
16	312.4	.23
10	499.9	.14
8	624.8	.11
5	999.7	.071
4	1.25K	.057

ANALOG AUDIO CABLES:

LoudSpeaker Cable Distances:

AWG	4Ω Speaker			8Ω Speaker			70V Speaker*		
	Power (%) /Loss(dB)								
	11% 0.5	21% 1	50% 3	11% 0.5	21% 1	50% 3	11% 0.5	21% 1	50% 3
8	180	370	1250	360	740	2495	9780	18000	61000
10	115	235	795	230	470	1585	5590	11495	38870
12	70	150	500	145	295	1000	3520	7245	24500
14	45	95	315	90	185	630	2220	4565	15430
16	30	60	195	55	115	395	1385	2855	9650
18	20	35	125	35	75	250	875	1795	6070
20	10	25	80	25	45	155	555	1140	3850
22	5	15	50	15	30	100	345	705	2390
24	5	10	30	10	20	60	220	450	1515

* 70 volt line drive systems, while considered a potential for Hi-Fi performance, follow same cable loss physics as the higher current (lower Impedance) system. For sake of this calculation, a 25 watt 70 volt system (196 ohm) was used.

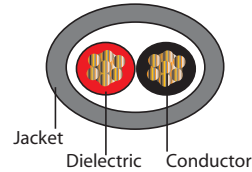
Damping Factor:

There is one other reason to use a larger gauge size when running speakers. This involves the transfer of power from the amplifier to the speaker. There is the damping factor specification- Speaker Impedance divided by the output impedance of the amplifier. A smaller gauge with a greater resistance add to the speaker impedance and affect the damping factor.

Damping factor starts as a large number and drops as frequencies get higher. At higher frequencies the resistance of the speaker cable can add to the damping factor. This can also affect the slew rate, which is the ability of the amplifier to deliver very fast risetime (higher frequency) signals. Therefore, use bigger wire.

ANALOG AUDIO CABLES:

Cable Construction for Speaker Cables:



Conductor:

Speaker Level cables are driven by the conductivity or DCR of a conductor- A bare copper conductor is utilized.

Electro-tough-pitch (ETP) 99.95% Conductivity

Oxygen Free O² Free- 99.99% Conductivity

Over the last few years standard ETP copper processes has become much better. Process that get most of the oxygen out of standard ETP, making it almost as pure as Oxygen Free.

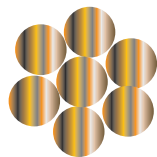
Testing Conductivity:

Our laboratory testing has determined that there is very little audible difference between Oxygen Free and ETP. There are still some audio engineers that say that there is a difference. The debate will continue.

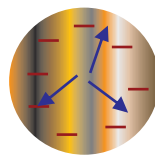
Skin Effect: At high frequencies the electrons become magnetized and shoot to the outside of the conductor.

Skin effect may not be an issue for audio frequencies. Audio frequencies are low frequencies, hence the entire bare copper conductor is used to pass the electrons. Even at the highest audio frequencies, some skin effect will occur.

Stranded vs. Solid- Speaker level cables are stranded conductors. The strands will help in the flexibility and audio conductivity.- (more surface area in a stranded conductor than a solid conductor of the same gauge size.



Stranded Conductor
7 strands



Skin Effect

Insulation- Dielectric

The insulation on a speaker level cable is not an important electrical part of the cable construction. The insulation is to provide dielectric strength between conductors. In a speaker level cable, the conductivity is important, but inductance is also important. The inductance can be determined by the conductor and also the insulation.

Because most electrical characteristics of a speaker level cables are not critical, the dielectric material is not critical. Most Speaker level cables utilize a PVT (Polyvinylchloride) insulation. PVT is an inexpensive material, with good flexibility, and good electronic performance.

Shield:

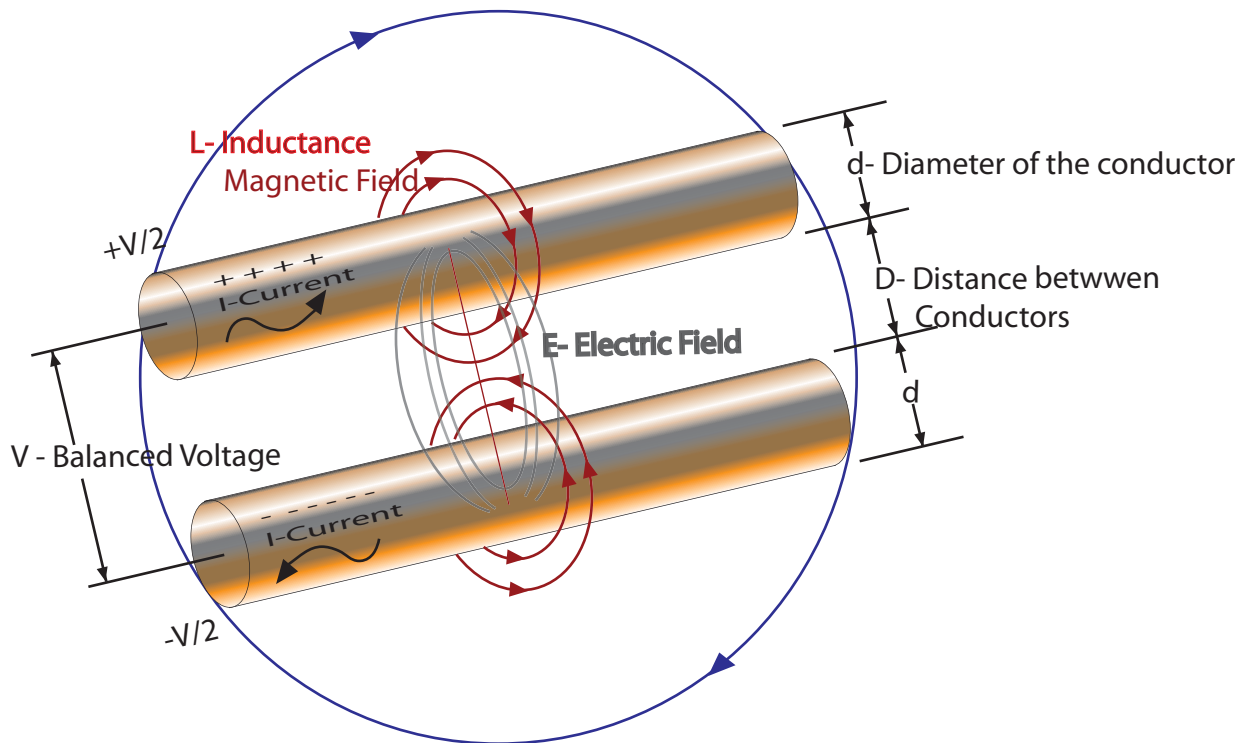
Shielding is not needed in most speaker level cable. Stronger signals

Jacket:

The jacket is dependent on the environment the cable is used:

- Portable Mic Cables: Rubberized, Flexible type Matte PVT- Usually not a UL Rating
- Permanent Mic/ Line Level Cables: Non-Plenum - PVT CM or CMR Rated
Plenum - Low Smoke PVT - CMP Rated

Electrical Characteristics - Conductors



Inductance is the electrical property of storing energy in the magnetic field that surrounds a wire. There must be electricity flowing to create this field. As soon as the electricity stops, the field will collapse, and energy will flow out of the wire. The inductance can change depending on the twisting of the conductor, and the amount and type of insulation. Inductance can be ignored in most audio signal applications

Speaker Cables

Communication & Control Cable Two Conductor / Unshielded



Description:

- ASTM Bare Copper • PVT insulation • Short overall twist lengths • Overall PVT jacket

Rating:

- NEC Type CMR or CL2R
- (UL)-C(UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1666

Applications:

Indoor for:

- Intercom Systems
- Security Systems
- Sound and Audio
- Background Music
- Power-limited Control Circuits

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
220	2	22 AWG Solid 17.5 Ω/Mft	PVT .008	None	PVT .017	.118	CMR	--	Gray
221	2	22 AWG (7x30) 17 Ω/Mft	PVT .007	None	PVT .017	.120	CMR	--	GY, WH
222	2	20 AWG (7x28) 10.5 Ω/Mft	PVT .008	None	PVT .017	.138	CMR	--	GY, WH
224	2	18 AWG (7x26) 6.2 Ω/Mft	PVT .008	None	PVT .017	.156	CMR	--	GY, BK, BN, WH
225	2	16 AWG (19x29) 4.2 Ω/Mft	PVT .008	None	PVT .017	.182	CMR	--	GY, BK, BN, WH
226	2	14 AWG (19x27) 2.7 Ω/Mft	PVT .010	None	PVT .017	.230	CL2R*	--	GY, BK, BN, WH
227	2	12 AWG (19x25) 1.7 Ω/Mft	PVT .010	None	PVT .017	.260	CL2R*	--	GY, BK

Special Notes:

- Selected Plenum Versions see pages 28
- Selected Indoor/Outdoor Aquaseal Water Resistant® Versions see Aquaseal Catalog Section pg.40
- Cables are packaged in our Advantage Box. Larger AWG sized cables may be on a reel.
- *- CL2R Meets 150V requirements for Low Voltage Circuits
- Speaker Connectors are listed on pg. 137
- Orange Rip Cord

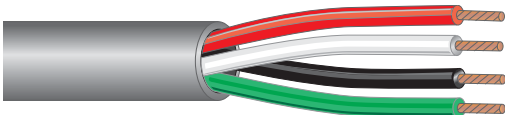
Color Code

Catalog Number	220, 221, 222, 224, 225	226, 227
Primary Color Code	1. Black, 2. Red	1. Black, 2. White
Jacket: GY-Gray, BK-Black, BN-Brown, WH-White		

800-245-4964 • www.westpenn-wpw.com

Speaker Cables

Communication & Control Cable Four Conductor / Unshielded



Description:

- ASTM Bare Copper • PVT insulation • Cabled construction • Overall PVT jacket

Rating:

- NEC Type CMR or CL2R
- (UL)-C(UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: UL1666

Applications:

Indoor for:

- Intercom Systems
- Security Systems
- Sound and Audio
- Background Music
- Power-limited Control Circuits

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
240	4	22 AWG Solid 17.5 Ω/Mft	PVT .008	None	PVT .017	.134	CMR	--	Gray
241	4	22 AWG (7x30) 17 Ω/Mft	PVT .007	None	PVT .017	.138	CMR	--	Gray, White
242	4	20 AWG (7x28) 10.5 Ω/Mft	PVT .008	None	PVT .017	.159	CMR	--	Gray
244	4	18 AWG (7x26) 6.2 Ω/Mft	PVT .008	None	PVT .017	.183	CMR	--	Gray
245	4	16 AWG (19x29) 4.2 Ω/Mft	PVT .009	None	PVT .017	.217	CMR	--	Gray
246	4	14 AWG (19x27) 2.7 Ω/Mft	PVT .010	None	PVT .017	.278	CL2R*	--	Gray
248	4	12 AWG (19x25) 1.7 Ω/Mft	PVT .010	None	PVT .017	.320	CL2R*	--	Gray

Special Notes:

- Selected Plenum Versions see pages 30 & 31
- Selected Indoor/Outdoor Aquaseal Water Resistant® Versions see Aquaseal Section pg.40
- Cables are packaged in our Advantage Box. Larger AWG sized cables may be on a reel.
- *- CL2R Meets 150V requirements for Low Voltage Circuits.
- Orange Rip Cord

Color Code	
All Cables	1. Black, 2. Red, 3. White, 4. Green JACKET: Gray
241	1. Black, 2. Red, 3. White, 4. Green JACKET: Gray, White

800-245-4964 • www.westpenn-wpw.com

Plenum Speaker Cables

Plenum Communication & Control Cable Two Conductor / Unshielded Plenecon II ® Extra Flexible



Description:

- ASTM Bare Copper • Polymer alloy insulation • Short over-all twist lengths • Overall plenum PVT jacket

Rating:

- NEC Type CMP or CL2P
- (UL)-C(UL) Listed
- Meets 300V requirements as specified in the NEC
- Flame Rating: NFPA-262 Smoke & Flame Test

Applications:

Indoor within ducts, plenums and other spaces used for environmental air:

- Intercom Systems
- Security Systems
- Sound and Audio
- Background Music
- Power-limited Control Circuits

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
25221B	2	22 AWG (7x30) 17 Ω/Mft	Polymer alloy .007	None	Plenum PVT .015	.116	CMP	--	GY
25222B	2	20 AWG (7x28) 10.5 Ω/Mft	Polymer alloy .008	None	Plenum PVT .015	.134	CMP	--	GY
25224B	2	18 AWG (7x26) 6.2 Ω/Mft	Polymer alloy .008	None	Plenum PVT .015	.154	CMP	--	GY, BK, BN, OR, GN, WH, YE
25225B	2	16 AWG (19x29) 4.2 Ω/Mft	Polymer alloy .008	None	Plenum PVT .015	.176	CMP	--	GY, BK, GN
25226B	2	14 AWG (19x27) 2.7 Ω/Mft	Polymer alloy .010	None	Plenum PVT .015	.218	CL2P	--	GY, BK
25227B	2	12 AWG (19x25) 1.7 Ω/Mft	Polymer alloy .010	None	Plenum PVT .015	.256	CL2P	--	GY, BK

Special Notes:

- Plenum Installation Precautions see Technical Reference Section Page 196
- Cables are packaged in our Advantage Box.

Color Code	
All Cables	1. Black, 2. Red
	JACKET: GY-Gray, BK-Black, BN-Brown, WH-White, YE-Yellow, BL-Blue, GN-Green

Cluster Speaker Cables

Communication & Control Cable

Cluster Speaker Cable / Twisted Pair Unjacketed

Applications:

Indoor for:

- Cluster Speaker Cable
- Power-Limited Circuit Applications
- Sound and Audio
- Background Music

Description:

- ASTM Bare Copper • PVT Insulation with Nylon • Short overall twist Construction • Unjacketed

Rating:

- NEC Type CL2
- (UL) Listed
- Flame Rating: UL1685

Speaker Cable Accessories:
Pages 137-138

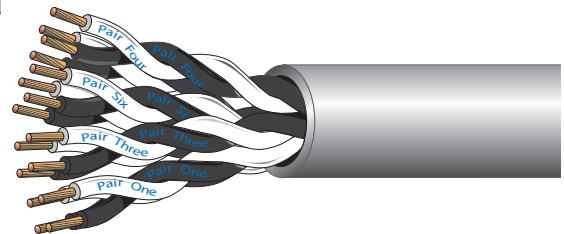
Standard spool size 1000ft.

Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
C205	1	16 AWG (19x29) 4.2 Ω/Mft	PVT .015 Nylon .005	None	None	.194	CL2	--	Unjacketed
C206	1	14 AWG (41x30) 2.7 Ω/Mft	PVT .015 Nylon .005	None	None	.222	CL2	--	Unjacketed
C207	1	12 AWG (65x30) 1.7 Ω/Mft	PVT .015 Nylon .005	None	None	.260	CL2	--	Unjacketed

Color Code	
All Cables	1. Black, 2. White
	JACKET: Unjacketed

Communication & Control Cable

High Paired Speaker Cable

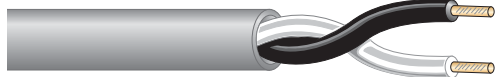


Standard spool size 500ft.

Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
NEW WP128P	8	12 AWG (19x25) 1.7 Ω/Mft	PVT .015"	None	PVT .050"	.825"	CL2R	--	Gray

Large gauge Speaker Cables

Communication & Control Cable Cluster Speaker Cable / Twisted Pair 8 and 10 AWG.



Description:

- ASTM Bare Copper • PVT insulation with Nylon • Twisted pair construction • Overall PVT Sunlight Resistant jacket

Rating:

- NEC Type TC
- (UL) Listed
- Meets 600 Volt - Class 1
- Approved for direct burial and outdoor use

Applications:

- Indoor/ Outdoor for:
- Sound and Audio

Standard spool size 1000ft.

Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
C210	1	10 AWG (65x28) 1.10 Ω/Mft	PVT .020 Nylon .005	None	.047	.357	Tray Cable TC	--	Gray
NEW C208	1	8 AWG (65x26) .70Ω/Mft	PVT .032 Nylon .006	None	.062	.498	Tray Cable TC	--	Gray

Speaker Cable Accessories:
Pages 137-138

Color Code

C210	1. Black, 2. White
C208	JACKET: Gray

Description:

- ASTM Bare Copper • (HA210), - Polyolefin, (25210)- Polymer Alloy • Twisted Pair Construction • Overall Jacket

Ratings:

- HA210 - NEC Type CL2
- 25210- NEC Type CL2P
- (UL) Listed

Applications:

- Indoor for:
- Sound and Audio
- Power-Limited Control Cable

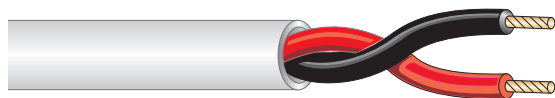
Standard spool size 1000ft.

Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
HA210	1	10 AWG (65x28) 1.10 Ω/Mft	.012	None	PVT .025	.275	CL2	--	Gray
25210	1	10 AWG (65x28) 1.10 Ω/Mft	.012	None	Plenum PVT .015	.275	CL2P	--	Ivory

Color Code

	1. Black, 2. White
Color Code	HA210 JACKET: Gray 25210 JACKET: Ivory

High Stranded Speaker



Description:

- ASTM Bare Copper • PVT insulation • Short overall twist lengths
- Overall PVT jacket
- HA208- utilizes Polyolefin insulation

Rating:

- NEC Type CL2
- (UL) Listed
- Flame Rating: UL1685



Home Speaker Cable

Two Conductor / Unshielded

Applications:

Indoor for:

- Home Entertainment
- Sound and Audio
- Background Music
- Power-limited Control Circuits

Standard spool size 1000ft.

Catalog No.	No. of Cond.	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
HA225	2	16 AWG (65x34) BC 4.02 Ω/Mft	PVT .015	None	PVT .025	.199	CM	--	White, Blue & Black
HA226	2	14 AWG (65x32) BC 2.58 Ω/Mft	PVT .015	None	PVT .025	.250	CL3	--	White, Black
HA227	2	12 AWG (65x30) BC 1.7 Ω/Mft	PVT .015	None	PVT .025	.280	CL3	--	White, Black
HA210	2	10 AWG (65x28) BC 1.1 Ω/Mft	PVT .012	None	PVT .020	.280	CL2	--	Gray

Color Code	
Catalog No.	HA225A, HA226A, HA227A, HA210
Primary Color Code	Black, Red

Speaker Level Audio Connectors

Banana and Binding Post Connectors	
Catalog No.	Description
19-1239	Banana Red
19-1240	Banana Black
CN-MDP8	Banana Plug (8 Awg.) Double
CN-BPX-24B	Binding Post with Red,Black



Speakon Cable Mt. Female SPX	
Catalog No.	Description
CN-NL4FX	4 Pole, SPX Gray
CN-NL4FX2	4 Pole, SPX Red
CN-NL4FX4	4 Pole, SPX Yellow
CN-NL4FX5	4 Pole, SPX Green
CN-NL4FX9	4 Pole, SPX White

Speakon Audio Adapter	
Catalog No.	Description
CN-NL4MMX	4 Pole Male to Male Adapter

Speakon Cable Mt. Female Standard	
Catalog No.	Description
CN-NL4FC	4 Pole, Standard

CN-NL4MMX

ANALOG AUDIO CABLES:

Signal separation and cable installation parameters:

Signal separation refers to providing physical distance among cables carrying various signal levels.

This protects weaker, low voltage, signals from noise and interference. Signal separation principles apply to cable routing and installation.

Grouping cables in a bundle should only be of one signal type:

- Microphone
- Line
- Control, data, and communication
- Loudspeaker
- AC
- DC
- Video
- RF

When pulling cable, different signal levels should be kept in separate conduits. In general:

- Signal cables should be routed in a completely alternate path from power cables.
- Metallic conduit should be used for signal cables.
- Microphone cables and speaker cables should not be placed in the same bundle or conduit.
- Audio cables should be separate from data cables to avoid spikes and data clicks in audio.
- If a control cable contains digital information, it must be kept separate from other signal cables.
- If there is only one conduit, high-level and microphone level signals should not be mixed.

Pull Tension:

22 Awg	7 lbs
20 Awg	12 lbs
18 Awg	19 lbs
16 Awg	30 lbs
14 Awg	48 lbs
12 Awg	77 lbs

Audio Cables Bend Radius: 7 to 10 times the cables O.D.

DIGITAL AUDIO CABLES:

Digital Audio is partly digital and partly audio. It is digital in that the analog signals are converted to digital data at one of a number of data rates. The analog audio rules do not apply to digital applications.

The cable must have specific electrical characteristics, such as impedance and capacitance. This is needed to transmit the digital (square wave data signals) effectively and efficiently.

The Audio Engineering Society (AES) along with the European Broadcast Union (EBU) has developed the AES/EBU digital audio standards. The development of this standard has led audio recording and reproduction in digitized signaling.

Digital is very stable and reliable. With digital signals being used it reduces equipment adjustments significantly. More and more audio tape recorders and studio equipment signals are being sent in digital form. The digitized form retains the quality of the original source. Degradation of signals are basically eliminated, noise effectiveness is greatly improved, and signal transparency is excellent.

The trend in broadcast and production technology is towards the use of digital systems. All aspects of recording, processing, and transmission take place in the digitized form. Using a digital system it becomes extremely important to select the proper cable. Without the proper cable, the system will not meet performance expectations.

DIGITAL AUDIO ADVANTAGES

- Improves audio tape recording
- Suitable for storage and computer-based production system
- Improves signal transparency
- Noise reduction
- Degradation of signals are eliminated

DIGITAL AUDIO STANDARDS

The specification for digital audio is developed by the AES/EBU. The two main electrical parameters in this specification pertaining to cable are:

- Data Rates- Depends on Sampling Rate
 - 3.072 Mbps is the normal standard
- Impedance- $110\Omega \pm 20\%$ ($88-132\Omega$)

Sampling Rates (kHz)	Bandwidth (Mbps)
32	4.096
38	4.864
44.1	5.645
48	6.144
96	12.228
192	24.576

Sampling rates

- 32kHz- Professional transmission (Voice recording, reportage)
- 38kHz- (Music, FM station quality)
- 44.1kHz- Consumer - (CD Sampling rate for music)
- 48kHz- Broadcast- Most commonly use- (Audio tracks on professional video machine)
- 96kHz- Top of the line professional machines
- 192kHz- Double quality of 96kHz

DIGITAL AUDIO CABLES:

Twisted Pair Cable Construction

Conductor:

- 22, 24 or 26 AWG
- Tinned Copper Conductors

Insulation:

- Low loss foam dielectric
 - Foam technique- blowing a percentage of air into the dielectric. This will decrease the dielectric constant and improve the dielectric constant. The technique to adding air to the dielectric is an important aspect of manufacturing processes.
 - Low loss foam dielectric will allow better electrical characteristics.

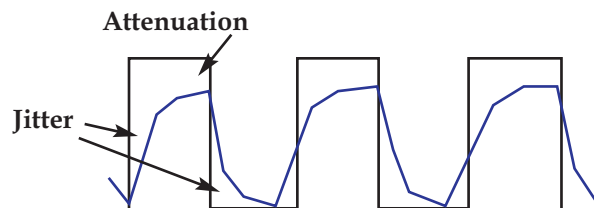
Digital signals are sequences of ones and zeros, looking like a square wave.



The original signal will shrink due to the pure resistance of the conductor (Attenuation).. Adding capacitance and impedance variations will cause the square waves to become rounded.

As the cable length increases, the square wave becomes less and less square. With impedance imperfections there will be some reflections in the signal back to the source. This is measured in VSWR or **voltage standing wave ratio**- related to SRL- **Structural Return Loss**..

Capacitance tends to make the edges of each square ragged. There will be timing errors also known as jitter in the signal. These variations will cause the receiving devices not to function



Shield:

Shielding is also important to the construction of a digital level audio cable. Shielding prevents unwanted noise to penetrate into the cable. Shielding also provides protection for any audio signals that try to leak out from the cable.

Jacket:

The jacket is dependent on the environment the cable is used:

- Permanent Digital Audio Cables: Non-Plenum - PVT CM or CMR Rated
Plenum - Low Smoke PVT - CMP Rated

Coaxial Cable Design: Unbalanced Design

See Digital Video Cable Design

Standards:

AES3-id- Professional version of digital audio
S/PDIF- Consumer version of digital audio- BNC Connectors
SDIF- Consumer- RCA Connectors - Short distance runs

DIGITAL AUDIO CABLES

DIGITAL AUDIO Attenuation

Cat. No.	2 MHz		4 MHz		5 MHz		6 MHz		12 MHz		25 MHz	
	db/100ft	db/100m	db/100ft	db/100m	db/100ft	db/100m	db/100ft	db/100m	db/100ft	db/100m	db/100ft	db/100m
DA Series	1.20	3.94	1.56	5.12	1.70	5.58	1.81	5.94	2.28	7.48	3.08	10.10
819 RG59/U	.41	1.35	.58	1.89	.63	2.07	.69	2.25	.90	3.32	1.30	4.27
6350 RG6/U	.16	.52	.48	1.57	.54	1.77	.59	1.93	.80	2.62	1.00	3.28

Maximum Recommended Transmission Distance at Digital Audio Rates (AES3-2003)

Cat. No.	2 MHz		4 MHz		5 MHz		6 MHz		12 MHz		25 MHz	
	Ft.	Meters	Ft.	Meters	Ft.	Meters	Ft.	Meters	Ft.	Meters	Ft.	Meters
DA Series	1538	469	1282	391	1176	359	1105	337	877	267	649	198
819 RG59/U AES+>	4866	1483	3487	1060	3175	968	2911	887	2222	677	1538	469
819 RG59/U AESid++	1946	593	1391	424	1270	387	1164	355	888	270	615	188
6350 RG6/U AES+>	5882	1793	4184	1275	3704	1129	3407	1039	2500	763	2000	610
6350 RG6/U AESid++	2353	717	1673	510	1482	452	1363	416	1000	305	800	244

* Longer transmission distances are achievable but are contingent upon system component quality of input/output voltages.

+ Transmission distance calculations assume minimum allowable output signal amplitude and minimum allowable input signal amplitude.

++ Per AES3id-2001- when using analog video distribution equipment to implement AES3id, maximum transmission distances are 40% of the AES3 values assuming a minimum allowable output signal amplitude of 1V and a minimum allowable input signal amplitude of 320mV.

> Implementation of AES3 with coaxial cable and 110-75Ω baluns can be achieved with transmission distances of 91% of the AES3 coaxial distances listed above.

Digital Audio Cables

Broadcast Audio AES/EBU Digital Audio Cable



Description:

- ASTM Tinned Copper • Low Loss Foam insulation • Individually shielded 100% coverage of aluminum polyester foil with 24 AWG Std.drain wire • DA2401 shield is bonded to the jacket for ease of stripping • Twisted pair construction • Overall jacket

Rating:

- NEC Type CM
- (UL) Listed
- Meets 300V requirements as specified in the NEC

Applications:

Indoor for:

- Pro-Audio
- Sound Systems
- Sound and Audio
- Recording Studios
- Post-Production Facilities

Standard spool size 1000ft.

Non-Plenum - Individually Shielded Pairs + PVT Jacket									
Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shield & % Coverage	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
DA2401	1 Pair	24 AWG (7x32) 26 Ω/Mft	Foam PE .020	Each Pair & Overall Al. Foil 100%	PVT .030	.182	CM	12.5pf/ft* 22.5pf/ft **	Gray
DA2402	2 Pair	24 AWG (7x32) 26 Ω/Mft	Foam PE .020	Each Pair & Overall Al. Foil 100%	PVT .030	.298	CM	12.5pf/ft* 22.5pf/ft **	Gray
DA2406	6 Pair	24 AWG (7x32) 26 Ω/Mft	Foam PE .020	Each Pair & Overall Al. Foil 100%	PVT .045	.439	CM	12.5pf/ft* 22.5pf/ft **	Gray

Special Notes:

- Orange rip cord included on cables with 2 or more pairs.
- DA2401- available in Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White, Black, Tan, Pink Jackets
- Minimum order quantities may apply on select jacket colors.
- PE- Polyethylene

Color Code			
Pair Colors			
Pair 1	Black/Red	Pair 4	Black/Blue
Pair 2	Black/White	Pair 5	Black/Yellow
Pair 3	Black/Green	Pair 6	Black/Brown
Jacket: Gray			

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Digital Audio Cables

Broadcast Audio

AES/ EBU Digital Audio Cable - Plenum

Description:

- ASTM Tinned Copper • Low Loss Foam insulation • Individually shielded 100% coverage of aluminum polyester foil with 24 AWG Std.drain wire • Twisted pair construction • Overall jacket

Rating:

- NEC Type CMP
- (UL) Listed
- Meets 300V requirements as specified in the NEC

Applications:

Indoor for:

- Pro-Audio
- Sound Systems
- Sound and Audio
- Recording Studios
- Post-Production Facilities

Plenum - Individually Shielded Pairs + Plenum PVDF Jacket									
Catalog No.	No. of Pairs	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shield & % Coverage	Jacket Type & Thickness Inches	Nom. O.D. Inches	NEC Type	Nom. Capacitance	Jacket Color
DA252401	1 Pair	24 AWG (7x32) 26 Ω/Mft	Foam FEP .020	Each Pair & Overall Al. Foil 100%	PVDF .010	.141	CMP	12.5pf/ft* 22.5pf/ft **	Gray
DA252402	2 Pair	24 AWG (7x32) 26 Ω/Mft	Foam FEP .020	Each Pair & Overall Al. Foil 100%	PVDF .010	.238	CMP	12.5pf/ft* 22.5pf/ft **	Gray
DA252406	6 Pair	24 AWG (7x32) 26 Ω/Mft	Foam FEP .020	Each Pair & Overall Al. Foil 100%	PVDF .010	.350	CMP	12.5pf/ft* 22.5pf/ft **	Gray

* Capacitance between conductors.

** Capacitance between one conductor and the other connected to the shield

Electrical Characteristics
Nom. Vel of Propagation - 78%
Nom. Impedance Ω - 110Ω

Special Notes:

- Minimum order quantities may apply on select jacket colors.
- FEP- Teflon® Trademark of Dupont

Color Code			
Pair Colors			
Pair 1	Black/Red	Pair 4	Black/Blue
Pair 2	Black/White	Pair 5	Black/Yellow
Pair 3	Black/Green	Pair 6	Black/Brown
Jacket: Gray			

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Professional Video Cables



Applications:

- Digital Video-SDI
- AES3id & SPDIF Digital Audio
- CCTV
- CATV

Broadcast Video Cable Pro-Video/ Serial Digital SDI

Standard pool size 1000ft.

Catalog No.	NEC Type	Conductor Type & Nom. D.C.R	Insulation Type & Thickness Inches	Shielding & % Coverage	Jacket Type	Nom. O.D. Inches	Nom. Capacitance	Nom. VP	Nom. Imp. Ω	Jacket Color
HD825	CMR	25 AWG (Solid) BC 30Ω/M'	Gas Injected PE+ .085	Bifoil 100% Tinned Copper Braid 95%	PVT	.146	16.2 pf/ft	82%	75Ω	Black
					Connector Type	Connectors	Strip Tool	Crimp/Comp Tool		
					75Ω 3 Pc. Crimp BNC	CN-BM74-18	TL-KLEIN or TL-825	TL-105		
					75Ω Compression BNC	CN-BNCP-825	TL-CSST	TL-548G		
HD25825	CMP	25 AWG (Solid) BC 30Ω/M'	Foam FEP .078	Bifoil 100% Tinned Copper Braid 95%	Flex Plenum	.146	16.2 pf/ft	82%	75Ω	Black
					Connector Type	Connectors	Strip Tool	Crimp/Comp Tool		
					75Ω 3 Pc. Crimp BNC	CN-BM74-18	TL-KLEIN or TL-825	TL-105		
					75Ω Compression BNC	CN-BNCP-825	TL-CSST	TL-548G		
819	CMR	20 AWG (Solid) BC 10Ω/M'	Gas Injected PE+ .142	Bifoil 100% Tinned Copper Braid 95%	PVT	.232	16.2 pf/ft	82%	75Ω	BK,RD, GN, BL, YE, WH
					Connector Type	Connectors	Strip Tool	Crimp/Comp Tool		
					75Ω 3 Pc. BNC	CN-BM74-32	TL-7503	TL-104		
					75Ω Compression BNC	CN-CSBNC-59	TL-CSST	TL-SNSA		
25819	CMP	20 AWG (Solid) BC 10Ω/M'	Foam FEP .138	Bifoil 100% Tinned Copper Braid 95%	Flex Plenum	.207	16.2 pf/ft	84%	75Ω	Ivory
					Connector Type	Connectors	Strip Tool	Crimp/Comp Tool		
					75Ω 3 Pc. Crimp BNC	CN-BM74-32	TL-7503	TL-104		
					75Ω Compression BNC	CN-F559BNCPL4	TL-CSST	TL-SNSA		
6350	CMR	18 AWG (Solid) BC 6.4Ω/M'	Gas Injected PE+ .180	Bifoil 100% Tinned Copper Braid 95%	PVT	.275	16.2 pf/ft	82%	75Ω	BK,RD, GN, BL, YE, WH
					Connector Type	Connectors	Strip Tool	Crimp/Comp Tool		
					75Ω 3 Pc. Crimp BNC	CN-BM73-5	TL-7503	TL-107		
					75Ω Compression BNC	CN-CSBNC-6	TL-CSST	TL-SNSA		
256350	CMP	18 AWG (Solid) BC 6.4Ω/M'	Foam FEP .170	Bifoil 100% Tinned Copper Braid 95%	Flex Plenum	.236	16.2 pf/ft	84%	75Ω	Ivory
					Connector Type	Connectors	Strip Tool	Crimp/Comp Tool		
					75Ω 3 Pc. Crimp BNC	CN-BM73-4	TL-7503	TL-107		
					75Ω Compression BNC	CN-F56BNCPL2	TL-CSST	TL-SNSA		

SDI JACKET COLORS

Note: A minimum order quantity may apply on select jacket colors.

- Black • Red • Green • Blue • White • Yellow
- Other colors available upon request, minimum quantities may apply

Cross Reference

West Penn Wire	Description	Belden	Gepco	Liberty
(X)454	Miniature Audio Line Level Audio 1 pr. 22AWG Shielded 12 Colors	9451	61801EZ	22-1P-EZ
D25454	Miniature Audio Line Level Audio 1 pr. 22AWG Shielded Plenum	9451P	--	--
210454	Dual Miniature Audio Line Level Audio 2 pr. 22AWG Shielded	9451D	--	--
2452	Dual Miniature Audio Line Level Audio 2 pr. 22AWG Shielded	--	D61801EZGF	22-2PSIAM-EZ
77291	Miniature Audio Line Level Audio 1 pr. 22AWG Shielded	8761	--	--
77292	Miniature Audio Line Level Audio 1 pr. 20AWG Shielded	8762	61801	--
77293	Miniature Audio Line Level Audio 1 pr. 18AWG Shielded	8760	1800s	--
77294	Miniature Audio Line Level Audio 1 pr. 16AWG Shielded	8719	1600s	--
77295	Miniature Audio Line Level Audio 1 pr. 14AWG Shielded	8720	--	--
77296	Miniature Audio Line Level Audio 1 pr. 12AWG Shielded	8718	--	--
77510	Miniature Audio Line Level Audio 2 pr. 22AWG Ind.Shielded	--	--	--
D25291	Miniature Audio Line Level Audio 1 pr. 22AWG Shielded Plenum	87761	61801TK	--
D25292	Miniature Audio Line Level Audio 1 pr. 20AWG Shielded Plenum	--	--	--
D25293	Miniature Audio Line Level Audio 1 pr. 18AWG Shielded Plenum	87760	--	--
D25294	Miniature Audio Line Level Audio 1 pr. 16AWG Shielded Plenum	--	--	--
WP4546	6 Pair Analog Audio Snake Cables Non-Plenum	1816R	GA61806GFC	
WP4548	8 Pair Analog Audio Snake Cables Non-Plenum	1817R	GA61808GFC	22-8P SNAKE
WP45412	12 Pair Analog Audio Snake Cables Non-Plenum	1818R	GA618012GFC	22-12P SNAKE
WP45416	16 Pair Analog Audio Snake Cables Non-Plenum	1819R	GA618016GFC	22-16P SNAKE
WP45424	24 Pair Analog Audio Snake Cables Non-Plenum	1821R	--	--
WP45432	32 Pair Analog Audio Snake Cables Non-Plenum	1823R	GA618032GFC	22-32P SNAKE
DA2401	1 Pair 24 AWG Shielded Digital Audio Non-Plenum	1800B	5596EZ	24-1P DIG-SNAKE
DA2402	2 Pair 24 AWG Shielded Digital Audio Non-Plenum	9729	D5596EZ	24-2P DIG-SNAKE
DA2406	6 Pair 24 AWG Shielded Digital Audio Non-Plenum	1803F	559604GFC	--
DA2404S	4 Pair 24 AWG Shielded Digital Audio Non-Plenum	9731	--	24-4P DIG-SNAKE
DA2408S	8 Pair 24 AWG Shielded Digital Audio Non-Plenum	1805A	59608GFC	24-8P DIG-SNAKE
DA24012S	12 Pair 24 AWG Shielded Digital Audio Non-Plenum	1806A	559612GFC	24-12P DIG-SNAKE
DA252401	1 Pair 24 AWG Shielded Digital Audio Plenum	1801B	55961	24-1P P DIG-SNAKE
DA252402	2 Pair 24 AWG Shielded Digital Audio Plenum	89729	--	--
DA252406	6 Pair 24 AWG Shielded Digital Audio Plenum	89732	--	--

NOTE:

Information contained in the chart may change, or other Part numbers may apply. Call West Penn Wire Engineering Dept. to receive updated cable cross-references.