

Introduction



The Broadcasters' Choice

Perhaps there is no other industry which values reliability so highly because inferior broadcast performance has immediate, far-reaching and embarrassing results. Cable performance means assured product quality, absolute signal integrity and no system downtime. Did you watch television last night or listen to the radio this morning? Chances are the link were made with Belden cable – and with so much dedication to development and innovation, the link with Belden increases.

Belden products offer the highest performance in both critical field applications (where cable is dragged, crunched and trodden on) and permanent studio installations (where long runs are all important). Belden cables are an important link in network and cable broadcasts (e.g. BBC, CNN, NBC, NOB, ZDF), film studios (Lucas film) and corporate broadcasting (USA Today, Merrill Lynch).

Key Applications

- Television monitors
- LCD screens
- Microphones
- Lighting, DMX
- VGA on large screens
- Animation, editing
- Loudspeakers
- HD/SDI

Key Markets

- Broadcast TV and radio, music and entertainment industries
- OB vans
- Sports, entertainment stadiums/arenas, theatres, cinemas and hotels
- Airports, convention centers and other public facilities
- Race tracks and casinos
- Film studios
- Cruise ships

Key Products

Belden's commitment to product innovation and technical excellence in the broadcast industry has resulted in a range of reliable audio and video cabling products called Brilliance®. Known for sound and picture brilliance and improved signal integrity, Brilliance® embraces all Belden audio/video products.

The range includes:

- **Optical Fiber Cables:**
 - **HDTV Fiber/Copper Composite Cables**
Designed specifically for high-definition cameras, these composite cables can multiplex audio and video signals and power. The cables meet all the requirements of the SMPTE 311 standard developed by the Society of Motion Picture and Television Engineers (SMPTE). They are also compatible with industry standard SMPTE 304M connectors.
 - **Mobile Fiber Cables**
Broadcast truck owners and operators always appreciate the chance to reduce the size and/or weight of any component being carried. Lighter weight Belden mobile optical fiber cable with PUR jacket is extreme rugged and designed for despooling and respooling.

- **Flexible Microphone Cables**
Belden microphone cable is used for connecting low level microphones. Key properties of microphone (MIC) cables are ruggedness, flexibility, flex life and interference immunity. Low impedance MIC cables use balanced 2-, 3- or 4-conductor (quad) designs.
- **High-Conductivity Copper Cables**
All Belden microphone cables with bare copper conductors (except: BE46349) use only high-conductivity copper. The refining process, called Electrolytic Tough Pitch (ETP), produces a copper conductor that is 99.95% pure copper resulting in high-conductivity per ASTM B115. The high purity obtained from ETP copper results in microphone cables performance that is comparable to that of oxygen-free copper cables.
- **Plastic Cables**
These are recommended for lower capacitance, lower loss, greater ozone and oil resistance, lighter weight, smaller diameter.
- **Rubber (EPDM) Cables**
These are recommended for greater abrasion and impact resistance and extra limpness so the cable will lie flat on stage or on studio floors.
- **Four-Conductor Star Quad Cables**
Quad connection scheme: The two blue wires (or wires directly opposite one another) are connected together to form one conductor; similarly the two white wires (or remaining wires) are connected together to form the second conductor. Conductors joined in this manner reduce the chance of induced noise.
- **Line Level Analog Audio Cables:** Belden analog audio cables are used for connecting line level audio equipment, in either permanent or semi-permanent installations. They consist of one or two individually foil-shielded, twisted pairs. Once installed, they are not intended to be moved while in operation. For cables that are in motion during use, refer to the microphone and musical instrument cable section in this catalog.

Belden's analog audio cable range consists of several designs to handle a variety of audio applications. Belden part no. 8451 has a paper tape separator to facilitate easy long length jacket stripping. Part no. 9451 comes with a bonded Beldfoil® shield so that the shield and jacket strip simultaneously with automatic stripping equipment. A special matte PVC jacket material is used on part no. 1883A to make it a highly flexible construction. Double-pair cables are available in a round construction (part no. 8728).
- **Analog Multi-Pair Snake Cables:** Specially designed for the broadcast industry, Belden's full family of multi-pair audio "Snake" cables feature different options and constructions for virtually every application.
 - **Applications**
Snake cables are used to connect multiple audio channels in low-level (microphone) and high-level (line) configurations, such as console board equipment for recording studios, radio television stations, post-production facilities and sound system installations. With Belden's individually shielded and jacketed snakes, pairs can be split out of the overall jacket for any length and connected directly without the need for heat shrink tubing or costly and time-consuming preparation. 26 AWG and 24 AWG sizes are also ideal for punch down connector applications.
 - **Numbered and Color Coded**
Jacketed pairs are individually numbered and color coded (following the familiar resistor color code) for easy identification.

Belden's BE46313 Series; jacketed pairs are grey and individually numbered.

Introduction



- Mobile and Fixed Installations

Foil-shielded multicore cables are mainly used for permanent installations while Belden's braid shield constructions are recommended for mobile (semi-permanent) applications.

- French Braid® Shield

Belden's patented "French Braid" shield is a double spiral (double serve) bare copper shield with the two spirals tied together by one weave. This improves flex life over standard spiral shields, improves flexibility over conventional braid shields and lowers microphonic or triboelectric noise. The "French Braid" is easy to terminate since it is not fully woven. It also provides for lower DC loop resistance than the single spiral braid. The "French Braid" is featured in Belden's FlexSnake® Cables (1900 Series) and quad snake cables (7880 Series).

- Beldfoil® Shield

The foil shield of each pair is bonded to the jacket with the drain wire inside the foil. This makes the cable easier to strip. A standard stripping tool removes both the insulation and foil and greatly speeds up the installation time.

- **AES/EBU Digital Audio Cables:** The specification for digital audio was developed jointly by the Audio Engineering Society (AES) & European Broadcast Union (EBU). The key difference between twisted pair specifications for digital audio cable and standard analog audio cable is the impedance specification.

The detailed specifications of this standard are:

Sampling rate: from 32 KHz to 192 KHz

Bandwidth: from 4.096 MHz to 24.5 MHz

Impedance: 110 Ω ± 20%

Sampling Rate	Bandwidth
32 kHz	4.096 MHz
44.1 kHz	5.6448 MHz
48 kHz	6.144 MHz
96 kHz	12.228 MHz
192 kHz	24.576 MHz

AES/EBU, with its broad tolerance, allows cables with impedances from 88 Ohm to 132 Ohm to be used. Standard analog audio cable impedance is 45 Ohm to 70 Ohm. This amount of potential mismatch can result in signal reflections and jitter, causing bit errors at the receiver. For this reason, Belden recommends 100 to 120 Ohm shielded twisted pair cables.

How to Choose a AES/EBU Cable.

Single and Double Pairs

- **9180**
26 Gage (0.14 mm²/0.5 mm), Beldfoil®, Datalene®
- **1800B**
24 Gage (0.22 mm²/0.6 mm), Beldfoil®, Datalene®
- **1802B**
24 Gage (0.22 mm²/0.6 mm), Beldfoil®, Datalene®, Double-Pairs
- **1800F**
24 Gage (0.22 mm²/0.6 mm), FrenchBraid®, Datalene®, several colors
- **1696A**
22 Gage (0.34 mm²/0.8 mm), Beldfoil®/FrenchBraid®, Datalene®

Multi-Pair Snake Cables

- **7880A Series**
26 Gage (0.14 mm²/0.5 mm), Beldfoil®/Overall Beldfoil®, Datalene®, Color coded
- **BE46935 Series**
26 Gage (0.14 mm²/0.5 mm), Braid/Overall Braid, FRNC IEC 332-3C
- **BE46266 SlimSnake™**
26 Gage (0.14 mm²/0.5 mm), Braid/Overall Braid, Halogen-Free
- **1803F Series**
24 Gage (0.22 mm²/0.6 mm), Beldfoil®/Overall Beldfoil®, Datalene®, Color coded

Maximum Recommended Transmission Distance at Digital Audio Data Rates

Part No.	AWG	2 MHz		4 MHz		5 MHz		6 MHz		12 MHz		25 MHz	
		ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m
110 Ohm													
9180, 7880A Series	26	1197	365	948	289	869	265	813	248	633	193	472	144
1800F	24	1233	376	922	281	764	233	666	203	423	129	279	85
1800B, 1802B, 1803F Series	24	1538	469	1282	391	1178	359	1105	337	876	267	649	198
1696A	22	2148	655	1738	530	1666	508	1538	469	1250	381	1014	309
75 Ohm													
179DT	28.5	1492	455	1197	365	1148	350	1004	306	722	220	522	159
1855A	23	3519	1073	2427	740	2175	663	1991	607	1538	469	1112	339
1505F	22	5881	1793	3772	1150	3332	1016	2985	910	2040	622	1387	423
1505A	20	4864	1483	3477	1060	3175	968	2909	887	2221	677	1538	469
1694A	18	5881	1793	4182	1275	3703	1129	3408	1039	2499	762	2001	610

Much longer transmission distance is achievable but is contingent upon system component quality.

Introduction



• Speaker Cables

Speaker cables are used to connect receivers or power amplifiers to speakers and are also used for the internal wiring of the speakers themselves.

Because the impedance of the loudspeaker is quite low (typically 3 to 10 Ohm) much of the power conducted through the cable is carried in the current domain which is affected by conductor resistance. The resistance of the cable between the speaker and the amplifier turns some of the amplifier's power into heat and does not get to the speaker.

The feedback from the speaker is altered by the cable. This feedback is used by the amplifier to correct the speaker's non-linearity. This is measured as the 'damping' factor by amplifier designers and is called "Servoing" by the Hi-fi community.

In general, the higher the cable resistance, the lower the power level getting to the speaker. This results in "sloppier" speaker performance due to damping.

Ultimately, the system designer must decide how to compromise system performance against system cost. In general, one of the least expensive ways to squeeze increased and better performance out of the system hardware is to use larger speaker cables and cut your losses where they occur rather than try to "band-aid" the system later with equalization or more power.

The cable selection guide can aid in determining the proper gage selection depending on the speaker impedance, acceptable power loss and cable run length.

• Special Cables

Cables listed in this section are for special audio applications – unbalanced audio cables, DMX512 cable and CatSnake™.

- Unbalanced Audio Cables

Traditional unbalanced (coaxial) cables use two lines to transmit the audio signal – a hot line which carries the signal and an earth line. This is all that is required to transmit audio and is common in short cables (where noise is less of a problem).

- DMX512 Cables

The DMX512 standard describes a method of digital data transmission between controllers and controlled lighting equipment and accessories, including dimmers and related equipment. The cable has a nominal characteristic impedance of 100 to 120 Ohm and shielded twisted pairs approved by its manufacturer for EIA-422/EIA-485-A use at 250 Kbits/second and distances of 500 meters or more.

- CatSnake™

Belden now offers Brilliance CatSnake™. This is a mobile Category 5e cable which employs Belden's patented bonded-pair design, for use in high traffic areas in a broadcast studio or in any type of tactical field deployable digital audio/video installation.

- Video Triax Cables

Triaxial cables are used to interconnect video cameras to related equipment. They contain two isolated shields and a solid or stranded center conductor. Isolated shields allow the triax to provide multiple functions over one cable through multiplexing techniques.

Applications include: DC power to camera, intercom to operator, teleprompter feeds, monitoring feeds and even automatic or robotic functions.

The O.D. describes size and distance – Triax 8 for short runs, Triax 11 for long runs and Triax 14 for very long runs.

Silver-plated copper: Typical triax cable construction in the industry is bare copper. Four of Belden's new triax cables use silver-plated copper for the inner conductor and the first shield. This construction provides exceptional electrical characteristics (attenuation and impedance stability) for excellent picture quality over extended transmission distances. These cables are also suitable for the latest digital camera triax applications.

- Standard Analog Video Cables

Belden standard video cables are typically used in non-critical video applications such as video equipment rack wiring, Closed Circuit TV (CCTV), Master Antenna TV (MATV) and color or monochrome video monitor hook-ups. Applications such as these do not require precision video coaxes which have extremely tight electrical tolerances.

Video coax cables have a characteristic impedance of 75 Ohm. This value was not chosen arbitrarily. Physics shows that optimum attenuation characteristics occur at 77 Ohm. Materials and design lead to the selection of 75 Ohm as the optimum compromise for low power applications. Standard video coaxes are available in both solid and stranded designs.

- Low Loss HDTV/SDI Digital Coax

HDTV/SDI video cables usually have solid center conductors and dual shields. The dielectrics can either be foamed or for better crush resistance have foamed HDPE insulation. Tighter impedance and attenuation tolerances, superior Return Loss (RL) specifications and improved shielding give precision video cables their no-compromise performance.

Cable Selection Guide

AWG	mm ²	4 Ω Speaker			8 Ω Speaker			70 V Speaker*		
		Power (%) / Loss dB/m								
		11% 0.5	21% 1.0	50% 3.0	11% 0.5	21% 1.0	50% 3.0	11% 0.5	21% 1.0	50% 3.0
11	4.00	53	116	438	109	232	871	2637	5675	21341
13	2.50	34	74	282	71	151	564	1711	3678	13834
14	2.10	27	59	226	56	120	451	1369	2942	11067
16	1.50	18	38	143	35	76	285	866	1860	6997
26	0.14	2	6	21	5	11	41	127	273	1027

The number of meter of cable you can run for a given loss and performance budget.

How to Use the Guide

Step One: Select the appropriate speaker impedance column.

Step Two: Select the appropriate power loss column deemed to be acceptable.

Step Three: Select the applicable wire gage size and follow the row over to the columns determined in steps one and two. The number listed is the maximum cable run length.

Example: The maximum run for 11 AWG in a 4 Ohm speaker system with 11% or 0.5 dB loss is 53 m.

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

Introduction



The Future is HDTV

The Society of Motion Picture and Television Engineers (SMPTE) has developed several standards for serial digital video transmissions (SDI) and a 540 Mb/s format is currently under development. There is also a European standards body known as the ITU (formerly CCIR) that has developed the composite video standard for Europe known as PAL/SECAM. The most common is the 270 Mb/s SDI (Serial Digital Interface). All of the specifications differ in bandwidth requirements and transmission technology, i.e. composite, component and digital:

Data Rate	Bandwidth	Standard	Description
143 Mb/s	71.5 MHz	SMPTE 259M	NTSC
177 Mb/s	88.5 MHz	ITU-R BT.601	PAL/SECAM
270 Mb/s	135.0 MHz	SMPTE 259M	Component Video 4:3
360 Mb/s	180.0 MHz	SMPTE 259M	Component 16:9
540 Mb/s	270.0 MHz	SMPTE 344M	Component Widescreen
1.5 Gb/s	750.0 MHz	SMPTE 292M	HDTV

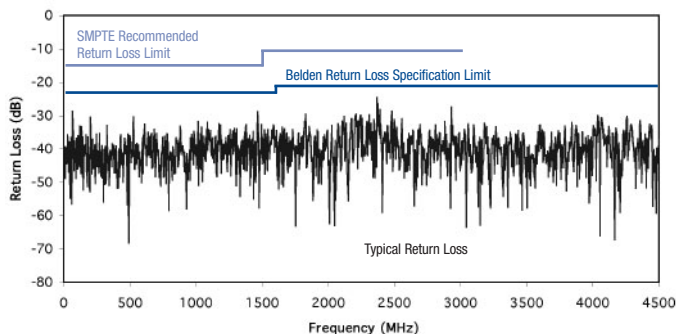
High Definition Television (HDTV) will require upgrades throughout the broadcasting industry, creating additional opportunities. International competitions such as the Olympic Games, Formula One, football and many other sporting events are very popular and demand the best broadcasting technology to guarantee viewer satisfaction.

Belden has a range of available coaxes that exceeds the SMPTE RL specification for HDTV distribution and provides maximum "RL headroom" to ensure that the user can achieve the SMPTE's requirement for signal distribution:

Specification RL Limit	RL	Frequency
SMPTE Recommendation	> 15 dB	5 - 1.5 GHz
Belden Guaranteed RL	> 23 dB	5 - 850 MHz
Belden Guaranteed RL	> 21 dB	850 MHz - 4.5 GHz

Using Belden coaxial cable will result in a minimum 6 dB of headroom to accommodate RL reduction created by connectors and patch-bays etc.

Below you will find the actual RL data of Belden 1505A. The cable is typically -30 dB:



Belden's extremely popular HDTV Brilliance® Broadcast video cables are now 4.5 GHz sweep tested! Prepared for 1080p formats, 1855, 1505A, 1694A and 7731A cables are sweep tested to 4.5 GHz. Belden has always tested every finished put-up to be certain of a top quality product. This is the only way in which damage introduced in finishing operations can be detected. This process sets Belden apart from competitors who only test in batches.

Introduction



Maximum Transmission Distance at Serial Digital Data Rates

Data Rate:	143 Mb/s		177 Mb/s		270 Mb/s		360 Mb/s		540 Mb/s		1.5 Gb/s		1.5 Gb/s		3.0 Gb/s		
Spec:	SMPTE 259M		ITU-R BT .601		SMPTE 259M		SMPTE 259M		SMPTE 344M		SMPTE 292M		Independent Test		SMPTE 424M		
Application:	Composite NTSC		Composite PAL		Composite Video		Component Widescreen		Component Widescreen		HDTV		HDTV		Prog. Scan HDTV		
Part No.	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	
179DT	500	152	450	137	380	116	340	104	280	85	110	34	132	40	+6	80	24
1855A	980	299	950	290	790	241	680	207	560	171	260	79	263	80	+1	150	46
1855ENH	-	-	-	-	-	-	-	-	-	-	-	-	328	100	-	-	-
1505A	1430	436	1360	415	1110	338	970	296	790	241	310	94	394	120	+26	220	67
1505F	1200	366	1071	327	857	261	732	223	588	179	225	69	328	100	+31	-	-
1694A	1880	573	1710	521	1,430	436	1240	378	1010	308	400	122	459	140	+18	270	82
7731A	2750	838	2480	756	2,040	622	1760	536	1430	436	550	168	656	200	+32	360	110

Crush Resistance

Manufacturers may provide very good cable and test data for their product in the laboratory or on the package spool. However, the rigors of installation can have a serious affect on the actual physical layer performance.

Any change in impedance at any point would cause a reflection. This reflection may have serious repercussions on the cable's performance.

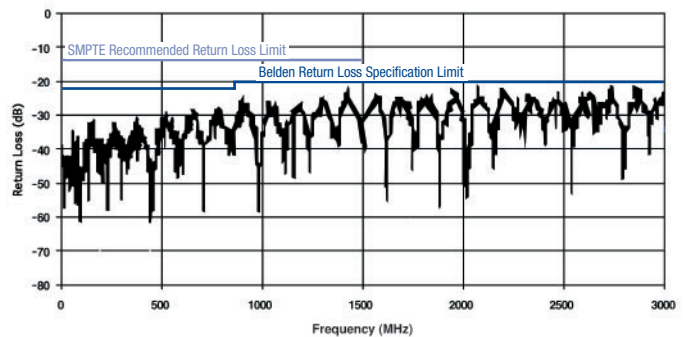
Belden products maintain superiority in crush resistance. Belden products use a gas-injected foam high-density polyethylene dielectric material in precision video cables in order to maintain:

- Better field ruggedness
- The ability to handle tighter bend radii
- More weight in cable trays
- Bending/flexing without pushing out the center pin and/or damaging attached equipment
- More rugged installation practices
- Plus various other environmental and installation benefits

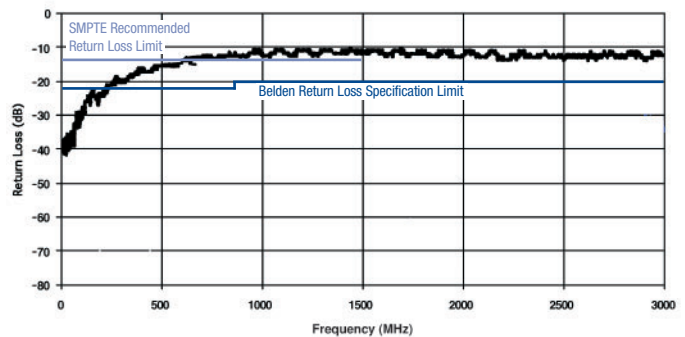
Return Loss (dB)

The tested cables were loaded with 50 N (50 Newton = 5 kilograms), according to EN50289-3-5.

75 Ohm Brilliance® precision video cable 1505A: RL 28 dB - 850 MHz, 22dB - 3 GHz



Manufacturer X: RL 12 dB - 850 MHz, 11 dB - 3 GHz



Introduction



Connector Cross

Belden	Type	ADC	Bomar	Damar + Hagen	Fischer	Lemo	Neutrik	Radiall	Telegärtner	Trompeter	Vitelec
179DT	0.3/1.4	BNC-31	-	-	-	-	NBTC75 BF14	-	-	-	-
152xA	0.3/1.42 RGB	-	-	on request	-	FGG.3B.244.CL.CD82	NBTC75 BF14	R142.004.000	J01002A0027	-D7	VB10-2036
12xxR	0.45/1.9 RGB	BNC-16	-	1-xxxx-2100	-	9.1.04	NBTC75 BNN5	-	9.1.04	105-2053-9	-
14xxB	0.5/2.3 RGB	BNC-13	-	1-3397-3602	-	-	NBTC75 BVV5	-	-	-D1	-
1865A	0.5/2.4	BNC-12	-	on request	-	FFSOA.250.NTAC40	NBTC75 BXX6	R142.078.161	J01002F1350	-D1	VB10-2063
1855A	0.6/2.6	BNC-13	SBC1855A	1-6097-2100	-	FFSOA.250.NTAC47	NBNC75 BDD6	R142.081.320	J01002A0030	-D1	-
1855ENH	0.6/2.8	BNC-26	-	1-4271-2100	-	FFSOA.250.NTAE63	NBNC75 BFG7	R142.082.027	J01002A0018	-D24	-
8241	0.6/3.7	BNC-2	-	1-1190-2100	-	on request	NBNC75 BLP7	R142.016.000	J01002A0003	-D3	-
1505A	0.8/3.7	BNC-1	SBC1505A	1-4253-2100	-	FFSOA.250.NTAE63	NBNC75 BLP9	R142.084.161	J01002A0031	-D2	-
8281	0.8/4.9	BNC-3	-	1-1194-2100	-	on request	NBNC75 BXY9	R142.090.161	J01002A0014	-D10	VB10-2026
1694A	1.0/4.6	BNC-8	SBC1694A	1-4482-2100	-	on request	NBNC75 BTU11	R142.086.161	J01002A0010	-D4	VB10-2024
1694F	1.0/5.7	BNC-8F-N	-	-	-	-	-	-	-	-	-
7731A	1.6/7.2	BNC-25	SBC7731A	1-5044-2100	-	FFA.4E.675.CTAC10	NBLC75 BVZ17	R142.186.000	J01002A1940	-D5	-
7783A	Triax 8	ProAx™	-	Serie47	1051 A004-5	FFA.4E.675.CTAC85	-	-	-	305-1365-1	-
1856A	Triax 9	ProAx™	-	Serie47	1051 A004-5	FFA.4E.675.CTAC95	-	-	-	305-0088-2	-
7784A	Triax 11	ProAx™	-	Serie47	1051 A004-5	FFA.4E.675.CTAC11	-	R142.017.000	-	305-1289-1	-
7785A	Triax 14	ProAx™	-	Serie47	1051 A004-4	on request	-	-	-	-	-

ProAx™ is an ADC Krone trademark.

Multicore Cables

• Video Multicore Cables

Belden's video multicore cables (RGBs) are designed for high resolution VGA on large screens, HDTV, Hi-Res CAD, animation, editing and special effects.

RGB coaxial cables are used for sending Red, Green and Blue signals through separate coaxes in component video applications. This type of video transmission provides a sharper, clearer picture than the composite video format.

Bundled coaxial cables are available in 3-, 4- or 5-conductor versions and are color coded for easy identification. Cable selection depends on whether the component transmission is RGB (3 cdr.), RGB and Sync (4 cdr.) or RGB, Sync and Hold (5 cdr.).

All Belden RGB cables are pre-timed to less than 4.0 ns/m delay difference between each coax. This allows for cut-and-connect installation with no TDR or Vectorscope timing required.

• Banana Peel® - RGB Cable without a Jacket

Series 1281 is an enhanced version of traditional RGB cables and feature 25 AWG solid copper center conductors for lower attenuation and easier termination. Flexible PVC jackets and high frequency Beldfoil® foil shields are used in combination with Belden's unique interlocked serve copper shield for 100% coverage. The unique shielding design also prevents the shields from bunching up when flexed, yet the shield is easier to comb out than a full braid.

Banana Peel® hi-res composite video cables will decrease labor costs because the overall jacket has been eliminated. Without the overall jacket, a whole step in the termination process has been removed. In addition, the individual cable components are all instantly identifiable (the individual cables are color-coded and the print legends are immediately visible). Jacketed RGB cables are also notoriously difficult to strip for termination – Banana Peel® RGBs overcome this problem.

Exceptional Benefits:

- Labor saving
- Easy identification
- Smaller outer diameter than jacketed version
- More flexible than jacketed version

Availability

Most of our Brilliance® broadcast cables are available from stock. Many of these are available off the shelf from distributors. If you have a new or unusual application or you cannot find a Brilliance® broadcast cable in this catalog section that meets your technical requirements contact Technical Support at +31-77-3875-414 or techsupport.venlo@belden.com.

Corresponding Literature

Technical Bulletins

- TB-65: Digital studio guide
- TB E100: Video multicores
- TB E101: Belden exceeds the standards of HD
- TB E104: Flame retardant triax and coax

Product Bulletins

- NP151: Siamese cables (9451D)
- NP152: Star quad cables
- NP183: 1505F, flexible version of 1505A
- NP198: Mini High-Res RGBs (127XR)
- NP207: DigiTruck (179DT)
- NP217: Banana Peel® Mini-RGBs (Serie1281)
- NP228: CatSnake™ (1305A)
- NP233: 1694F, Flexible version of 1694A
- NP234: Banana Peel® designed SDI RGBs (1855S5/1505S5)
- NP108E: SlimSnake™ halogen-free AES/EBU multi-pair cable