# Introduction

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- 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 FleXnake® 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

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- **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

| | | 4 Ω Speaker | | | 8 Ω Speaker | | | 70 V Speaker* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Power (%)/Loss dB/m | | | | | | | | |
| AWG | mm² | 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

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### 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 |

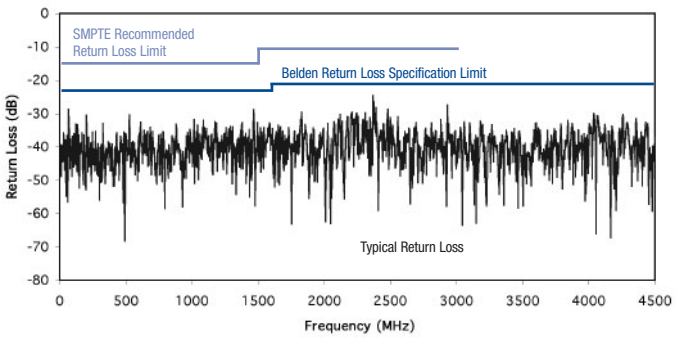
High Definition Television (HDTV) will require upgrades throughout the broadcasting industry, creating additional opportunities. International competitions such as the Olympic Games, Formula One, football and many other sporting events are very popular and demand the best broadcasting technology to guarantee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