

# Coaxial cable

## Specifications

	Type C	Type SC	Type SS	Type SR
<b>Dimensions</b>				
Center conductor—AWG (diameter)	32 (0.2032 mm [0.008 in])	32 (0.2032 mm [0.008 in])	32 (0.2032 mm [0.008 in])	37 (0.1143 mm [0.004 in])
Dielectric/insulating material (diameter)	0.56 mm (0.022 in)	0.406 mm (0.016 in)	0.406 mm (0.016 in)	0.38 mm (0.015 in)
Shield (diameter)	0.025 mm (0.001 in) thickness	0.711 mm (0.028 in)	0.711 mm (0.028 in)	0.51 mm (0.02 in)
Drain wire (parallel to conductor)	32 AWG (0.203 mm [0.008 in])	NA	NA	NA
Jacket outer dimension	0.7874 mm × 1.016 mm (0.031 in × 0.039 in)	1.0 mm (0.04 in)	1.0 mm (0.04 in)	0.51 mm (0.02 in)
<b>Material</b>				
Center conductor	Silver-plated copper	Stranded copper <sup>1</sup>	304 stainless steel <sup>2</sup>	Carbon steel <sup>3</sup>
Dielectric/insulating material	Gore-Tex <sup>®</sup> expanded PTFE	Teflon <sup>®</sup> FEP	Teflon <sup>®</sup> FEP	Teflon <sup>®</sup> PTFE
Shield	Aluminized polyester <sup>4</sup>	Braided gold-plated copper <sup>5</sup>	304 braided stainless <sup>6</sup>	304 stainless steel <sup>7</sup>
Drain wire	Silver-plated copper	NA	NA	NA
Jacket material	FEP	Teflon <sup>®</sup> FEP	Teflon <sup>®</sup> FEP	NA
Jacket color	Blue	Gold	Gray	NA
<b>Electrical properties</b>				
Resistance Ω/m (Ω/ft)				
Center conductor at 293 K (20 °C)	0.541 (0.165)	0.282 (0.086)	23.62 (7.2)	4.30 (1.31)
Shield at 296 K (23 °C)	NA	0.085 (0.026)	3.61 (1.1)	8.63 (2.63)
Drain wire at 296 K (23 °C)	0.541 (0.165)	NA	NA	NA
Center conductor maximum DC voltage	150 V	600 V	600 V	700 V
Center conductor maximum DC current	150 mA	200 mA	200 mA	200 mA
Temperature range	10 mK to 400 K	<1 K to 400 K	10 mK to 473 K	10 mK to 400 K
Characteristic impedance	50 Ω (±5 Ω)	35 Ω at 10 MHz	40 Ω at 10 MHz	50 Ω (±2 Ω)
Nominal capacitance at 5 kHz	79 pF/m (24 pF/ft)	154.2 pF/m (47 pF/ft)	173.9 pF/m (53 pF/ft)	95.14 pF/m (29 pF/ft)

<sup>1</sup> 65 strands of 50 AWG

<sup>2</sup> 64 strands of 50 AWG 304 SS wire

<sup>3</sup> Silver-plated copper-clad carbon steel (0.103 mm outer diameter carbon steel covered by 0.0057 mm thick copper cladding covered by 0.001 mm thick silver plating)

<sup>4</sup> Aluminized polyester laminated tape, spirally applied at a 40–50% overlap, aluminum side in

<sup>5</sup> 12 × 3 matrix of 42 AWG wire

<sup>6</sup> 12 × 4 matrix of 44 AWG wire

<sup>7</sup> A seamless tubular metal jacket serves as the outer conductor/shield

# Coaxial cable

## Ultra miniature coaxial cable – Type C, SC, SS

- Very flexible
- Long flex life
- Available in three configurations:
  - C** – solid copper center conductor, drain wire, and aluminized/polyester shield
  - SC** – stranded copper conductors
  - SS** – stranded 304 stainless steel conductors

Ultra miniature coaxial cable is for use when a strong and flexible cable is needed. Type C and SC are recommended when low conductor resistance is a prime consideration. Type SC and type SS are mechanically the most flexible, due to their braided construction. Type SS is recommended for use when both shielding and low thermal losses are important.

For technical specifications on types SS, C, SC and SR, see page 147.

### Thermal conductivity of copper—units are W/(m·K)

	4 K	20 K	30 K	77 K	300 K
RRR <sup>8</sup> = 20	122	719	870	502	397
RRR = 100	460	2460	2070	533	407

<sup>8</sup> RRR = residual resistance ratio

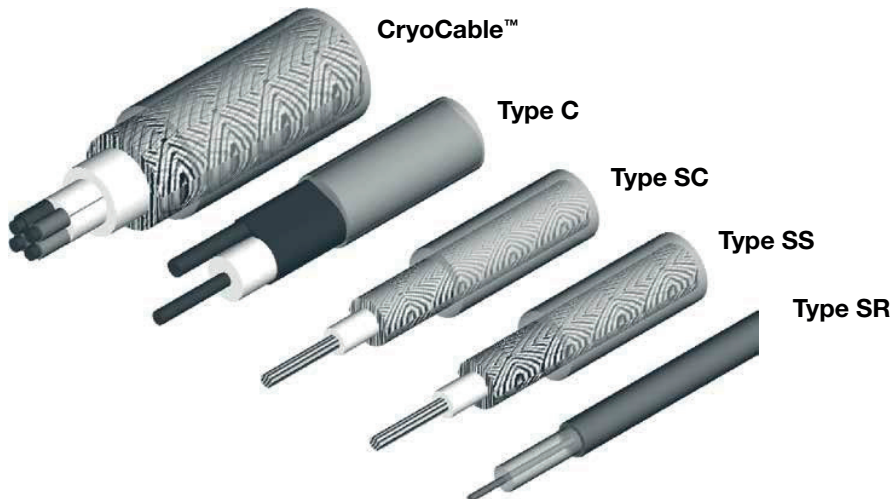
$$\frac{R_{273K}}{R_{4.2K}} = RRR$$

	Normal attenuation (dB/m)		
	C <sup>(1)</sup>	SC	SS
1 MHz	0.092	0.108	0.569
5 MHz	0.167	0.240	1.272
10 MHz	0.224	0.344	1.799
15 MHz	0.257	0.421	2.850
20 MHz	0.294	0.486	2.545
50 MHz	0.427	0.769	4.031
100 MHz	0.623	1.090	5.694
500 MHz	1.312	2.453	12.749
1 GHz	1.886	3.488	18.048
2 GHz	2.625	—	—
5 GHz	—	7.968	40.526

<sup>1</sup> Type C has a bandwidth to at least 3 GHz—above that, the aluminum/polyester becomes a less effective shield

## Ordering information

Part number	Description
CC-C-25	Solid copper, 7.6 m (25 ft)
CC-C-50	Solid copper, 15 m (50 ft)
CC-C-100	Solid copper, 30 m (100 ft)
CC-C-500	Solid copper, 152 m (500 ft)
CC-SC-25	Stranded copper, 7.6 m (25 ft)
CC-SC-50	Stranded copper, 15 m (50 ft)
CC-SC-100	Stranded copper, 30 m (100 ft)
CC-SC-500	Stranded copper, 152 m (500 ft)
CC-SS-25	Stranded stainless, 7.6 m (25 ft)
CC-SS-50	Stranded stainless, 15 m (50 ft)
CC-SS-100	Stranded stainless, 30 m (100 ft)
CC-SS-500	Stranded stainless, 152 m (500 ft)



# Coaxial cable

## Semi-rigid coaxial cable—type SR

- Easily bent, coiled, stripped, machined, soldered, or connected without impairing performance
- Solid center conductor provides the optimum geometrical surface for transmission
- Low standing wave ratio (SWR) with a dielectric controlled to exacting tolerances
- Low thermal conductivity ( $\approx 0.4 \text{ W}/(\text{m}\cdot\text{K})$  at  $4.2 \text{ K}$ )<sup>9</sup>
- Matching minimizes reflective power loss
- Provides shielding isolation for virtually no extraneous signal pickup
- Tubular outer conductor offers minimum size and maximum conductor integrity; stainless steel jacket can be soldered directly to circuit boards
- 37 AWG, silver-plated copper-weld steel center conductor

<sup>9</sup> Thermal conductivity at low temperatures is dominated by the copper cladding around the center conductor

This cable transmits and receives high-speed, high-frequency microwave signals. Typically used for transmission lines in cryogenic-vacuum test systems.

### To remove the outer conductor:

1. Score jacket
2. Bend at score until shield kinks, fatigues, and breaks
3. Slide off outer conductor

Extreme caution must be used in this process to avoid damage to the cable

SR coaxial cable frequency response specifications		
	Insertion loss dB/m (dB/ft)	Power CW (20 °C, sea level, W)
0.5 GHz	4.43 (1.35)	7.6
1.0 GHz	6.27 (1.91)	5.3
5.0 GHz	14.09 (4.30)	2.4
10.0 GHz	20.01 (6.10)	1.7
20.0 GHz	28.45 (8.67)	1.2

## Ordering information

Part number	Description
CC-SR-10	Semi-rigid, 3 m (10 ft)

## CryoCable™—type CYRC

- **Robust:** the NbTi wire cores are strong and fatigue resistant, and the cable overbraid of 304 stainless steel adds significant strength and crush resistance
- **Low heat leak** due to all metal alloy and Teflon® construction
- **Solderable:** the CuNi wire surface is easy to solder with conventional rosin fluxes
- **Cryo-compatible:** all Teflon® (PFA) insulation is heat strippable for ease of preparation

A robust, 4-wire cable for use in cryogenic environments to room temperature is now available. The cable is designed around 32 AWG (203  $\mu\text{m}$ ) diameter superconductive wires consisting of a NbTi core (128  $\mu\text{m}$  diameter) and a Cu-10% Ni jacket.

**Minimum bend radius:** 15 mm (0.6 in)  
**Critical temperature:** 9.8 K  
**Critical field:** 10 T

The cable is constructed as follows:

1. 4 superconductive wires are overcoated with 75  $\mu\text{m}$  (0.003 in) thick Teflon® (PFA) of the following colors: white, yellow, green, and black.
2. 4 lengths of Teflon®-jacketed wire, one of each color, twisted together with a twist pitch of about 25 mm (1 in). Teflon® (PFA) is extruded over the 4 wires to a total diameter of about 1.2 mm (0.048 in).
3. Cable is overbraided with 304 stainless steel (5  $\times$  36 AWG). The overbraid is tight and presents complete visual coverage.
4. Teflon® (PFA) extruded over the entire cable for protection of the metal overbraid. The total finished cable is nearly round with a diameter of about  $2.4 \pm 0.2 \text{ mm}$  ( $0.094 \pm 0.008 \text{ in}$ ).

	Temperature (K)		
	295	77	4.2
Wire resistance — per wire ( $\Omega/\text{m}$ )	9.2	8.4	0 <sup>10</sup>
Overbraid resistance ( $\Omega/\text{m}$ )	0.90	0.64	0.62
Thermal conductivity — entire cable assembly ( $\Omega/\text{m}\cdot\text{K}$ )	7.6	2.8	0.17

<sup>10</sup> Superconducting

Field	Critical current (per wire)
3 T	35 A
5 T	25 A
7 T	15 A
9 T	6 A

## Ordering information

Part number	Description
CRYC-32-25	CryoCable™, 7.6 m (25 ft)
CRYC-32-50	CryoCable™, 15 m (50 ft)
CRYC-32-100	CryoCable™, 30 m (100 ft)