PHASE MASTER®

PHASE STABLE CABLE ASSEMBLIES

Are you a design or test engineer looking for cable assemblies that offer an unmatched combination of phase stability, low loss, and value?

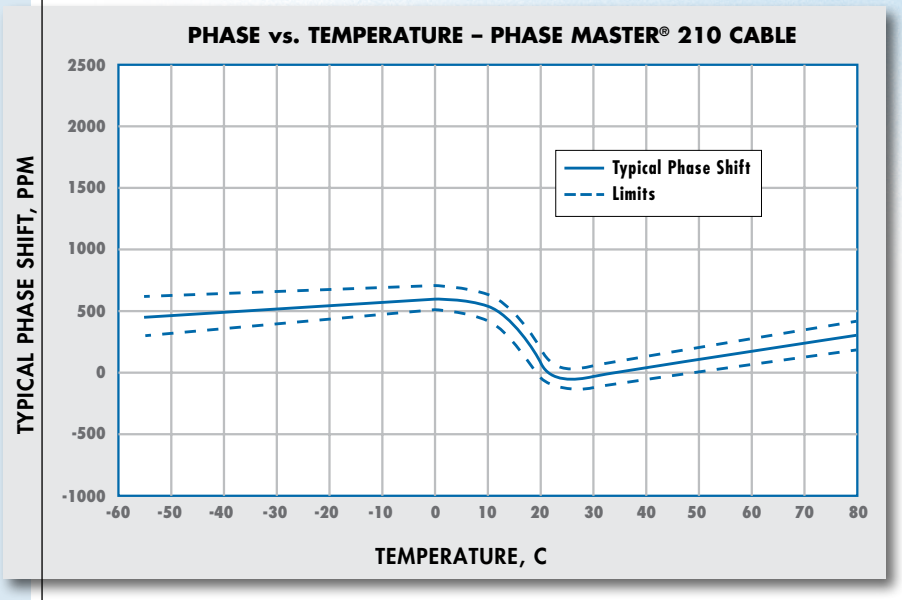
Then take a look at our **Phase Master®** cables.

Superior phase stability vs. temperature makes this cable the ideal choice for phase-sensitive applications—particularly those **with wide operating temperature ranges.**

Phase Master's enhanced phase stability—a result of a proprietary combination of high performance, tape wrapped PTFE dielectric and helically wrapped SPC shield—offers:

- Improved system performance
- Less frequent calibration
- More precise measurements

From environmental stress screening to electronically scanned radar systems, count on Phase Master® assemblies to provide **unparalleled value and performance**.



TELEDYNE
STORM MICROWAVE
Everywhereyoulook™

High value microwave and electronic interconnect solutions

www.teledynestorm.com

PHASE MASTER®

SPECIFICATIONS		PHASE MASTER® 096	110	160
Cable Designator		**66**	**65**	**64**
Diameter (in/mm)		0.096/2.44	0.110/2.79	0.160/4.06
Operating Frequency (Max, GHz)		50	50	40
Attenuation–Max @ 2 GHz (dB/ft)		0.303	0.253	0.150
Attenuation–Max @ 10 GHz (dB/ft)		0.694	0.581	0.347
Attenuation–Max @ 18 GHz (dB/ft)		0.944	0.794	0.474
Attenuation–Max @ 26.5 GHz (dB/ft)		1.160	0.978	0.585
Attenuation–Max @ 32 GHz (dB/ft)		1.283	1.083	0.648
Attenuation–Max @ 40 GHz (dB/ft)		1.447	1.224	0.732
Attenuation–Max @ 50 GHz (dB/ft)		1.634	1.384	–
Power Handling – Avg (watts @ 1 GHz)		178	262	527
Phase Stability vs. Temp – ppm (nom/tolerance)	–55°C	627/100	607/100	365/125
	+20°C	–4/100	–27/100	70/100
	+120°C	951/100	808/100	865/150
Phase Stability vs. Flexure† (@ 18 GHz, nom)		±6.5°	±4°	±3.5°
Shielding Effectiveness–Min‡ (dB @ 1 GHz)		> –95	> –95	> –90
Typical VSWR (2 straight connectors)		1.30 to 50 GHz	1.33 to 50 GHz	1.28 to 40 GHz
Min Bend Radius (in/mm)	Static	0.50/12.7	0.50/12.7	0.75/19.1
	Dynamic	1.00/25.4	1.00/25.4	1.5/38.2
Connector Retention to 18 GHz, pull (lbs/kg)		15/6.80	25/11.34	20/9.07
Velocity of Propagation (%)		81.0	81.0	87.0
Weight (grams/ft & /m)		4.83/15.85	6.77/22.21	12.12/39.76
Operating Temperature Range (°C)		–55 to +125 (FEP jacket) –55 to +100 (LSZH jacket)		

† ± 360 degree bends around a 20 x cable OD mandrel. ‡ Subject to connector choice.

Specifications subject to change without notice.

PHASE MASTER® FEATURES & BENEFITS

FEATURES	ADVANTAGES	BENEFITS
~ *Low density, low loss ePTFE dielectric*	~ *Reduced cable loss*	~ *Meet challenging system gain or signal-to-noise requirements*
	~ *Increased thermal stability*	~ *Meet challenging system power or Mean Time Between Failures (MTBF) requirements*
~ *Helically wrapped SPC primary shield*	~ *Reduced cable loss*	~ *Meet challenging system gain or signal-to-noise requirements*
	~ *Reduced leakage*	~ *Improved system performance*
~ *Fully captivated connectors*	~ *Increased connector retention*	~ *Reduced chance of degradation after install or use*
~ *Combination hex/knurl coupling nuts*	~ *Easier to tighten, while still able to torque*	~ *Reduced fatigue, increased repeatability*
~ *Diameters of 0.096", 0.110", 0.160", 0.190", 0.210" and 0.300"*	~ *Sizes and frequencies to fit a wide range of applications*	~ *Enhanced design-in options*

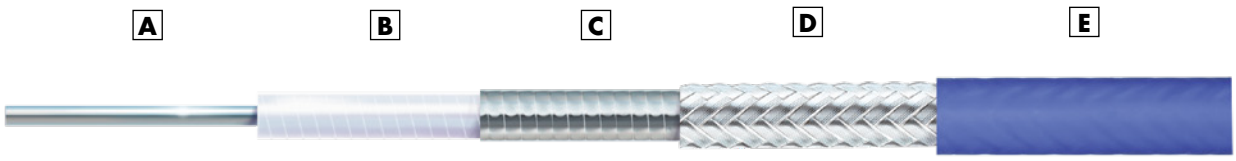
PHASE MASTER®

SPECIFICATIONS		PHASE MASTER® 190	210	300
Cable Designator		**63**	**62**	**61**
Diameter (in/mm)		0.190/4.83	0.210/5.33	0.300/7.62
Operating Frequency (Max, GHz)		32	26.5	18
Attenuation–Max @ 2 GHz (dB/ft)		0.121	0.099	0.067
Attenuation–Max @ 10 GHz (dB/ft)		0.282	0.232	0.159
Attenuation–Max @ 18 GHz (dB/ft)		0.388	0.320	0.221
Attenuation–Max @ 26.5 GHz (dB/ft)		0.481	0.396	–
Attenuation–Max @ 32 GHz (dB/ft)		0.535	–	–
Attenuation–Max @ 40 GHz (dB/ft)		–	–	–
Attenuation–Max @ 50 GHz (dB/ft)		–	–	–
Power Handling – Avg (watts @ 1 GHz)		759	878	1615
Phase Stability vs. Temp – ppm (nom/tolerance)	–55°C	445/150	285/125	415/150
	+20°C	35/100	75/125	70/100
	+120°C	800/125	730/125	945/100
Phase Stability vs. Flexure† (@ 18 GHz, nom)		±4°	±4.5°	±8°
Shielding Effectiveness–Min‡ (dB @ 1 GHz)		> –90	> –90	> –90
Typical VSWR (2 straight connectors)		1.25 to 32 GHz	1.22 to 26.5 GHz	1.22 to 18 GHz
Min Bend Radius (in/mm)	Static	0.95/24.1	1.0/25.4	1.5/38.1
	Dynamic	1.9/48.3	2.0/50.8	3.0/76.2
Connector Retention to 18 GHz, pull (lbs/kg)		40/18.14	50/22.68	75/34.02
Velocity of Propagation (%)		82.4	84.0	84.6
Weight (grams/ft & /m)		16.65/54.63	19.40/63.65	39.00/127.95
Operating Temperature Range (°C)		–55 to +125 (FEP jacket) –55 to +100 (LSZH jacket)		

† ± 360 degree bends around a 20 x cable OD mandrel. ‡ Subject to connector choice.

Specifications subject to change without notice.

PHASE MASTER® CABLE CONSTRUCTION



A Silver-plated copper center conductor

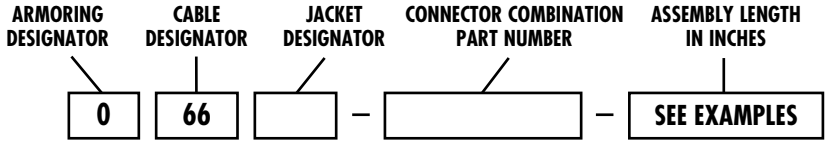
B Expanded PTFE dielectric

C Helically wrapped SPC flat wire shield

D Silver-plated copper braid

E Extruded blue FEP jacket standard; blue LSZH (low smoke zero halogen) jacket on request

PHASE MASTER® 096



Armoring Designator: 0 - Unarmored

Jacket Designator: Blank - Standard FEP **Z** - Low Smoke Zero Halogen (LSZH)

CONNECTOR COMBINATION PART NUMBERS*

		CONNECTOR OPERATING FREQUENCY				
		18 GHz	26.5 GHz	40 GHz		50 GHz
		SMA RAP	SMA SP	SMK (2.92 mm†) SP	SMK RAP	2.4 mm SP
18 GHz	SMA RAP	2121	0121	0521	2125	0621
26.5 GHz	SMA SP	0121	0101	0105	0125	0106
40 GHz	SMK (2.92 mm†) SP	0521	0105	0505	0525	0506
	SMK RAP	2125	0125	0525	2525	0625
50 GHz	2.4 mm SP	0621	0106	0506	0625	0606

** Other connector styles available; consult Storm*

† *IEEE Standard 287*

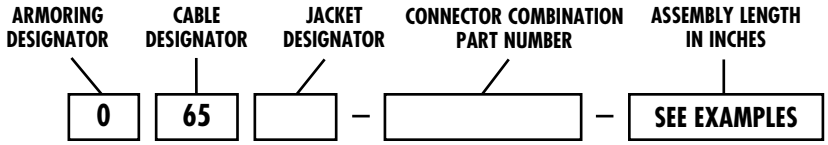
CONNECTOR CODES	
SP	Straight Plug
RAP	Right-Angle Plug

EXAMPLES:

066-0505-**048** = Unarmored Phase Master® 096 with standard FEP jacket, SMK (2.92 mm) SP to SMK (2.92 mm) SP (assembly operates to 40 GHz), **48 inches**

066**Z**-0101-**012** = Unarmored Phase Master® 096 with LSZH jacket, SMA SP to SMA SP (assembly operates to 26.5 GHz), **12 inches**

PHASE MASTER® 110



Armoring Designator: 0 - Unarmored

Jacket Designator: Blank - Standard FEP **Z** - Low Smoke Zero Halogen (LSZH)

CONNECTOR COMBINATION PART NUMBERS*

		CONNECTOR OPERATING FREQUENCY				
		18 GHz	26.5 GHz	40 GHz		50 GHz
		SMA RAP	SMA SP	SMK (2.92 mm†) SP	SMK RAP	2.4 mm SP
18 GHz	SMA RAP	2121	0121	0521	2125	0621
26.5 GHz	SMA SP	0121	0101	0105	0125	0106
40 GHz	SMK (2.92 mm†) SP	0521	0105	0505	0525	0506
	SMK RAP	2125	0125	0525	2525	0625
50 GHz	2.4 mm SP	0621	0106	0506	0625	0606

** Other connector styles available; consult Storm*

† *IEEE Standard 287*

CONNECTOR CODES	
SP	Straight Plug
RAP	Right-Angle Plug

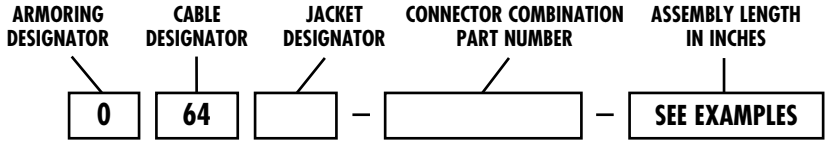
EXAMPLES:

065-0606-**180** = Unarmored Phase Master® 110 with standard FEP jacket, 2.4 mm SP to 2.4 mm SP (assembly operates to 50 GHz), **180 inches**

065**Z**-0525-**036** = Unarmored Phase Master® 110 with LSZH jacket, SMK (2.92 mm) SP to SMK RAP (assembly operates to 40 GHz), **36 inches**

PHASE MASTER® ORDERING INFORMATION: Part Number Designation

PHASE MASTER® 160



Armoring Designator†: 0 - Unarmored **A** - Hard Armored (polyolefin jacket)
AN - Hard Armored (no polyolefin jacket)
† *Hard armoring with FFRA connectors is a custom part number; call Storm.*

Jacket Designator: Blank - Standard FEP **Z** - Low Smoke Zero Halogen (LSZH)

CONNECTOR COMBINATION PART NUMBERS*

CONNECTOR OPERATING FREQUENCY

	40 GHz			
	SMK (2.92 mm†) SP	SMK (2.92 mm†) FFRAP	2.4 mm SP	2.4 mm FFRAP
SMK (2.92 mm†) SP	0505	0555	0506	0556
SMK (2.92 mm†) FFRAP	0555	5555	0655	5556
2.4 mm SP	0506	0655	0606	0656
2.4 mm FFRAP	0556	5556	0656	5656

40 GHz

* *Other connector styles available; consult Storm*

† *IEEE Standard 287*

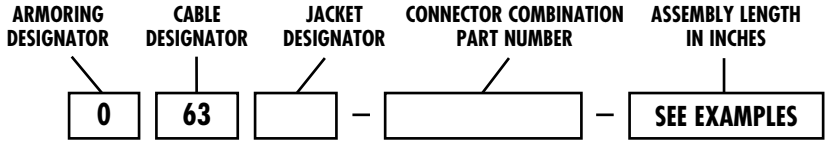
CONNECTOR CODES	
SP	Straight Plug
FFRAP	Factory Formed Right-Angle Plug

EXAMPLES:

064-0505-**048** = Unarmored Phase Master® 160 with standard FEP jacket, SMK (2.92 mm) SP to SMK (2.92 mm) SP (assembly operates to 40 GHz), **48 inches**

AN64**Z**-0606-**180** = Hard Armored (no polyolefin jacket) Phase Master® 160 with LSZH jacket, 2.4 mm SP to 2.4 mm SP (assembly operates to 40 GHz), **180 inches**

PHASE MASTER® 190



Armoring Designator†: 0 - Unarmored **A** - Hard Armored (polyolefin jacket)
AN - Hard Armored (no polyolefin jacket)
† *Hard armoring with FFRA connectors is a custom part number; call Storm.*

Jacket Designator: Blank - Standard FEP **Z** - Low Smoke Zero Halogen (LSZH)

CONNECTOR COMBINATION PART NUMBERS*

CONNECTOR OPERATING FREQUENCY

	32 GHz	
	2.92 mm SP	2.92 mm FFRAP
2.92 mm SP	0505	0555
2.92 mm FFRAP	0555	5555

32 GHz

* *Other connector styles available; consult Storm*

CONNECTOR CODES	
SP	Straight Plug
FFRAP	Factory Formed Right-Angle Plug

EXAMPLES:

063-5555-**048** = Unarmored Phase Master® 190 with standard FEP jacket, 2.92 mm FFRAP to 2.92 mm FFRAP (assembly operates to 32 GHz), **48 inches**

A63**Z**-0505-**180** = Hard Armored (polyolefin jacket) Phase Master® 190 with LSZH jacket, 2.92 mm SP to 2.92 mm SP (assembly operates to 32 GHz), **180 inches**

PHASE MASTER® ORDERING INFORMATION: Part Number Designation

PHASE MASTER® 210

ARMORING DESIGNATOR	CABLE DESIGNATOR	JACKET DESIGNATOR		CONNECTOR COMBINATION PART NUMBER		ASSEMBLY LENGTH IN INCHES
0	62		–		–	SEE EXAMPLES

Armoring Designator†: 0 - Unarmored **R** - Ruggedized (polyurethane jacket)
A - Hard Armored (polyolefin jacket) **AN** - Hard Armored (no polyolefin jacket)
† *Hard armoring with FFRA connectors is a custom part number; call Storm.*
Ruggedizing not available with FFRA connectors.

Jacket Designator: Blank - Standard FEP **Z** - Low Smoke Zero Halogen (LSZH)

CONNECTOR COMBINATION PART NUMBERS*

		26.5 GHz		18 GHz							
		3.5 mm SP	3.5 mm FFRAP	SMA SP	SMA SP	SMA RAP	SMA FFRAP	TNC SP	TNC FFRAP	N SP	N FFRAP
26.5 GHz	3.5 mm SP	0404	0454	0441	0104	0421	0451	0204	0452	0304	0453
	3.5 mm FFRAP	0454	5454	4154	0154	2154	5154	0254	5254	0354	5354
	SMA SP	0441	4154	4141	0141	2141	4151	0241	4152	0341	4153
18 GHz	SMA SP	0104	0154	0141	0101	0121	0151	0102	0152	0103	0153
	SMA RAP	0421	2154	2141	0121	2121	2151	0221	2152	0321	2153
	SMA FFRAP	0451	5154	4151	0151	2151	5151	0251	5152	0351	5153
	TNC SP	0204	0254	0241	0102	0221	0251	0202	0252	0203	0253
	TNC FFRAP	0452	5254	4152	0152	2152	5152	0252	5252	0352	5253
	N SP	0304	0354	0341	0103	0321	0351	0203	0352	0303	0353
	N FFRAP	0453	5354	4153	0153	2153	5153	0253	5253	0353	5353

* *Other connector styles available; consult Storm*

CONNECTOR CODES	
SP	Straight Plug
RAP	Right-Angle Plug
FFRAP	Factory Formed Right-Angle Plug

EXAMPLES:

062-0404-**048** = Unarmored Phase Master® 210 with standard FEP jacket, 3.5 mm SP to 3.5 mm SP (assembly operates to 26.5 GHz), **48 inches**

R62**Z**-4141-**120** = Ruggedized Phase Master® 210 with LSZH jacket, SMA SP to SMA SP (assembly operates to 26.5 GHz), **120 inches**

PHASE MASTER® 300

ARMORING DESIGNATOR	CABLE DESIGNATOR	JACKET DESIGNATOR		CONNECTOR COMBINATION PART NUMBER		ASSEMBLY LENGTH IN INCHES
0	61		–		–	SEE EXAMPLES

Armoring Designator†: 0 - Unarmored **A** - Hard Armored (polyolefin jacket)
AN - Hard Armored (no polyolefin jacket)
† *Hard armoring with FFRA connectors is a custom part number; call Storm.*

Jacket Designator: Blank - Standard FEP **Z** - Low Smoke Zero Halogen (LSZH)

CONNECTOR COMBINATION PART NUMBERS*

		18 GHz					
		SMA SP	SMA FFRAP	TNC SP	TNC FFRAP	N SP	N FFRAP
18 GHz	SMA SP	0101	0151	0102	0152	0103	0153
	SMA FFRAP	0151	5151	0251	5152	0351	5153
	TNC SP	0102	0251	0202	0252	0203	0253
	TNC FFRAP	0152	5152	0252	5252	0352	5253
	N SP	0103	0351	0203	0352	0303	0353
	N FFRAP	0153	5153	0253	5253	0353	5353

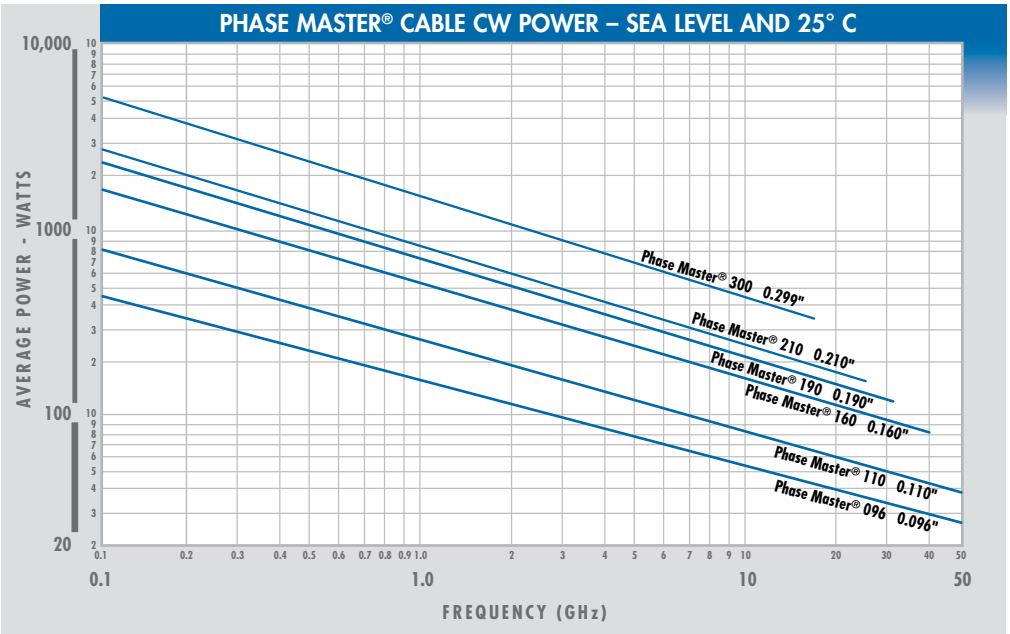
* *Other connector styles available; consult Storm*

CONNECTOR CODES	
SP	Straight Plug
FFRAP	Factory Formed Right-Angle Plug

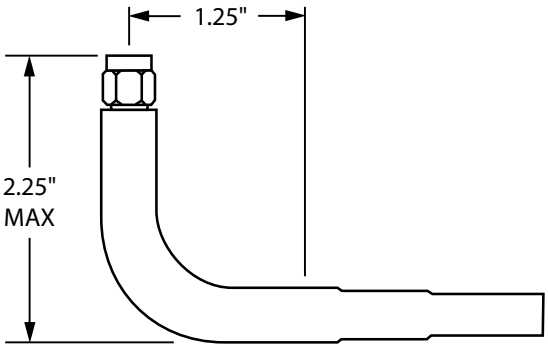
EXAMPLES:

061-0303-**036** = Unarmored Phase Master® 300 with standard FEP jacket, N SP to N SP (assembly operates to 18 GHz), **36 inches**

AN61**Z** -0101-**108** = Hard Armored (no polyolefin jacket) Phase Master® 300 with LSZH jacket, SMA SP to SMA SP (assembly operates to 18 GHz), **108 inches**



FACTORY FORMED RIGHT-ANGLE (FFRA) CONNECTORS



Designed using straight connectors and a shrink tubing–strain relief combination, FFRA connectors offer a moderate right-angle space advantage at a significant cost savings over traditional right-angle connectors.

FFRA connectors are available for all Phase Master® cable sizes. See the Connector tables for specific connectors available as FFRAs.

Note: The dimensions given here are for PM160 with an SMK connector. Larger cables will have proportionally larger dimensions. Contact Storm for specifics.

ARMORING & RUGGEDIZING OPTIONS

The Hard Armored option (with and without polyolefin jacket) is available only for Phase Master® 160, 190, 210, and 300 cables. And, when specifying FFRAP connectors, custom part numbering must be used. Call Storm for details.

The Ruggedized option (with polyurethane jacket) is available only for Phase Master® 210 cable, but not with FFRAP connectors.

HARD ARMORED – Polyolefin jacket

Armoring Designator: **A**

Designed for both inside and outside environments where flexibility and weight are not as critical, but where the application requires the ultimate in cut and crush resistance (500 lbs/in). The cable is covered with a stainless steel interlocked armor and a cross-linked polyolefin jacket.

Temperature: −54° C thru +125° C

Diameter: **Phase Master® 160 – 0.300"/7.62 mm**
Phase Master® 190 – 0.430"/10.92 mm
Phase Master® 210 – 0.430"/10.92 mm
Phase Master® 300 – 0.525"/13.34 mm

HARD ARMORED – No polyolefin jacket

Armoring Designator: **AN**

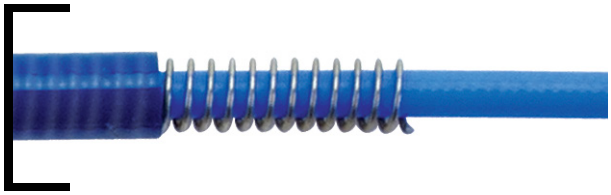
Designed for both inside and outside environments where flexibility and weight are not as critical, but where the application requires the ultimate in cut and crush resistance (500 lbs/in). The cable is covered with a stainless steel interlocked armor.

Temperature: −54° C thru +125° C

Diameter: **Phase Master® 160 – 0.265"/6.73 mm**
Phase Master® 190 – 0.395"/10.03 mm
Phase Master® 210 – 0.395"/10.03 mm
Phase Master® 300 – 0.475"/12.07 mm

RUGGEDIZED – Polyurethane jacket

Armoring Designator: **R**



For applications similar to the above, where weight, flexibility, and moderate compression resistance (300 lbs/in) are important, but where abrasion resistance is also critical. The cable is covered with a flexible wound helix of passivated stainless steel wire and an extruded polyurethane jacket.

Temperature: −54° C thru +100° C

Diameter: **Phase Master® 210 – 0.360"/9.14 mm**

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