



**Measurement
Solutions LLC**

TEMPERATURE MEASUREMENT & CONTROL



SERVICES

- Sensor design and manufacturing
- Contract manufacturing
- N.I.S.T. calibration and repair
- Control systems design
- Consulting, validation and installation
- Gas combustion



LARGE INVENTORY

- Thermocouple, RTD and Thermistor Probes
- Wire, Connectors, Heads, Blocks, Panel Jacks
- Controllers, Indicators and Panel Meters
- Electric Heating Elements
- SCR and SSR



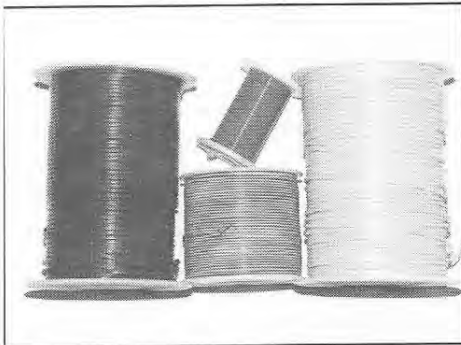
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Wire

THERMOCOUPLE GRADE VS. THERMOCOUPLE EXTENSION GRADE

Thermocouple wire should always be used to connect thermocouples to the control or readout instrumentation. The calibration of the wire must correlate with the calibration of the thermocouple. Extension grade thermocouple wire should not be used to manufacture thermocouples, but only to transmit the signal from thermocouple to instrumentation because it is not calibrated above 400°F and may not fall within ANSI standard limits of error at higher temperatures. Because of its slightly lower cost extension grade thermocouple wire is more economical to use especially for long runs. Typically, Therm-x stocks extension grade wire in PVC insulation (221°F max. temp.). Other insulations are available.

Thermocouple grade wire may be used either to connect the thermocouple to the instrumentation or in the manufacturing of thermocouples. Thermocouple grade wire is available in either standard or special limits of error. See the table on page 3 for tolerances. Thermocouple wire is manufactured under the strictest quality controls. All testing meets standard tolerances of ANSI MC96.1-1982.



SOLID CONDUCTORS VS. STRANDED CONDUCTORS

Thermocouple and extension grade wire are usually have solid conductors. When greater flexibility is required stranded conductors may be used. Typically the stranded construction consists of 7 strands of a smaller gauge wire twisted together to form the desired gauge size. Solid conductor wire is more economical to use where flexibility is not a great concern.

THERMOCOUPLE WIRE ORDERING INFO:

EXAMPLE:

P P S - K X - 20 S - SL

Insulation Type

GG - Glass Braid
HH - Hi Temp Glass Braid
KK - Kapton
PP - PVC Polyvinyl Chloride
PR - PVC Ripcord
XC - Nextel Braid

TF - FEP Teflon
TT - PFA Teflon
TW - Teflon Tape Wrap & Fused
PXFP - PVC Twisted / Shielded
FXFF - FEP Twisted / Shielded
TXFT - PFA Twisted / Shielded

Overbraid (optional - omit if not needed)

S - Stainless Steel
C - Copper Tinned
I - Inconel

Calibration

J, K, T, E, R, S, B

"X" designates extension grade wire, omit for thermocouple grade

Wire Gauge

"S" designates stranded wire, omit for solid wire

"SL" designates special limits of error, omit for standard limits

Wire

THERMOCOUPLE TOLERANCE AND SPECIFICATIONS

T/C Type	Single Color	ANSI Color Overall Extension	Coding Overall Thermocouple	Conductor Alloys	Temperature Range °F (°C) Thermocouple Grade Extension Grade	Tolerance (Standard) (Whichever is Greater)	Tolerance (Special) (Whichever is Greater)
E	Purple Red	Purple	Brown	EP/EN *Chromel/Constantan	-328 to 1652°F (-200 to 900°C) 32 to 392°F (0 to 200°C)	± 1.7°C or +/- 0.5%	± 1.0°C or +/- 0.4%
J	White Red	Black	Brown	JP/JN Iron/Constantan	32 to 1382°F (0 to 750°C) 32 to 392°F (0 to 200°C)	± 2.2°C or +/- 0.75%	± 1.1°C or +/- 0.4%
K	Yellow Red	Yellow	Brown	KP/KN *Chromel/Alumel	-328 to 2282°F (-200 to 1250°C) 32 to 392°F (0 to 200°C)	± 2.2°C or +/- 0.75%	± 1.1°C or +/- 0.4%
N	Orange Red	Orange	Brown	NP/NN *Nicrosil/Nisil	-450 to 2372°F (-270 to 1300°C) 32 to 392°F (0 to 200°C)	± 2.2°C or +/- 0.75% (2% below 0°C)	± 1.1°C or +/- 0.4%
T	Blue Red	Blue	Brown	TP/TN Copper/Constantan	-328 to 662°F (-200 to 350°C) -76 to 212°F (-60 to 100°C)	± 1.0°C or +/- 0.75% (1.5% below 0°C)	± 0.5°C or 0.4%
B	Grey Red	Grey	None	BP/BN Plt 30% Rhodium / Plt 6% Rhodium	32 to 3092°F (0 to 1700°C) 32 to 212°F (0 to 100°C)	± 3.7°C or +/- 0.5% over 800°C	Not Established
C	White Red	White Red Trace	None	CP/CN Tungsten 5% Rhenium Tungsten 26% Rhenium	32 to 4208°F (0 to 2320°C) 32 to 1600°F (0 to 870°C)	± 4.5°C (to 425°C) ± 1% (to 2320°C)	Not Established
R/S	Black Red	Green	None	RP/RN R = Plt / Plt 13% Rhodium S = Plt / Plt 10% Rhodium	32 to 2642°F (0 to 1450°C) 32 to 300°F (0 to 150°C)	± 1.5°C or ± 0.25%	± 0.6°C or ± 0.1%

Insulation Codes	Insulation Type		Temp. Range	
	Overall	Conductors	Continuous	Single
GG	Glass Braid	Glass Braid	900°F (482°C)	1000°F (538°C)
HH	High Temp Glass Braid	High Temp Glass Braid	1300°F (704°C)	1600°F (871°C)
KK	Kapton	Kapton	600°F (316°C)	800°F (427°C)
PP	Polyvinyl Chloride (PVC)	Polyvinyl Chloride (PVC)	221°F (105°C)	221°F (105°C)
PR	None	PVC Ripcord	221°F (105°C)	221°F (105°C)
PXFP	PVC	PVC Twisted, Shielded	221°F (105°C)	221°F (105°C)
TF	FEP Teflon	FEP Teflon	400°F (204°C)	500°F (260°C)
FXFF	FEP Teflon	FEP Twisted, Shielded	400°F (204°C)	500°F (260°C)
TT	PFA Teflon	PFA Teflon	500°F (260°C)	550°F (288°C)
TXFT	PFA Teflon	PFA Twisted, Shielded	500°F (260°C)	550°F (288°C)
TW	TFE Teflon (Wrap & Fuse)	TFE Teflon (Wrap & Fuse)	500°F (260°C)	600°F (316°C)
XC	Nextel Braid	Nextel Braid	2200°F (1204°C)	2600°F (1427°C)

ANSI Tolerances

Unless otherwise specified, all thermocouple wire and extension wire is supplied to meet Standard Tolerances of ANSI Circular MC96.1-1982. Special Tolerances are also available per ANSI MC96.1.

Conductor Wire Size B & S	Diameter (Inches)	Diameter (MM)
14	0.064	1.63
16	0.051	1.29
18	0.040	1.02
20	0.032	0.812
22	0.025	0.644
24	0.020	0.511
26	0.016	0.405
28	0.013	0.321
30	0.010	0.255
32	0.008	0.202
34	0.006	0.160
36	0.005	0.127

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Wire

Thermocouple

Type J						
Insulation	Max. Temp.	Construction	AWG	Cond.	P/N	Price per/m
Ceramic	2200°F	Nextel cond. / Nextel overall	20	Solid	XC-J-20	\$1375.00
	2100°F	Nextel cond. / Nextel overall / Inconel overbraid		Solid	XCI-J-20	\$1800.00
Hi-Temp Glass	1300°F	HT fiberglass braid or wrap cond. / HT glass braid overall	20	Solid	HH-J-20	\$405.00
			24	Solid	HH-J-24	\$288.00
Glass w/SS overbraid	900°F	Glass braid or wrap cond. / Glass braid overall /SS overbraid	20	Solid	GGJ-J-20	\$640.00
				Stranded	GGJ-J-20S	\$740.00
Glass	900°F	Glass braid or wrap cond. / Glass braid overall	20	Solid	GG-J-20	\$395.00
				Stranded	GG-J-20S	\$495.00
			24	Solid	GG-J-24	\$314.00
				Stranded	GG-J-24S	\$325.00
			28	Solid	GG-J-28	\$256.00
			30	Solid	GG-J-30	\$239.00
TFE Tape	500°F	Fused TFE tape cond. / Fused TFE tape overall	20	Solid	TW-J-20	\$496.00
			24	Solid	TW-J-24	\$346.00
PFA Teflon	500°F	Extruded PFA teflon cond. / Extruded PFA teflon overall	20	Solid	TT-J-20	\$390.00
			24	Solid	TT-J-24	\$335.00
				Stranded	TT-J-24S	\$435.00
			30	Solid	TT-J-30	\$400.00
PFA Teflon w/SS overbraid	500°F	Extruded PFA teflon cond. / SS overbraid	20	Solid	TTS-J-20	\$850.00
FEP Teflon	400°F	Extruded FEP cond. / Extruded FEP overall	20	Solid	TF-J-20	\$375.00
Shielded FEP Teflon	400°F	Extruded FEP cond. / Twisted / Aluminized polyester tape shield & copper drainwire / Extruded FEP overall	20	Solid	FXFF-J-20	\$599.00
PVC	221°F	PVC conductors / PVC overall	14	Solid	PP-JX-14	\$555.00
			16	Solid	PP-JX-16	\$363.00
			20	Solid	PP-JX-20	\$182.00
				Stranded	PP-JX-20S	\$278.00
		PVC conductors / Ripcord construction	24	Solid	PR-J-24	\$144.00
Shielded PVC	221°F	PVC cond. / Twisted / Aluminized polyester shield w/drainwire / PVC overall	20	Solid	PXFP-JX-20	\$240.00
				Stranded	PXFP-JX-20S	\$337.00

Part numbers listed are typical stock. Prices are listed in 1000 foot spools. Smaller spools are available. Spools sizes less than 500 feet are subject to a \$5.00 spool charge. Therm-x stocks most thermocouple grade wire in specials limits of error. Non standard configurations are available and may be subject to a 2000 foot minimum.

Wire

Thermocouple

Type K

Insulation	Max. Temp.	Construction	AWG.	Cond.	P/N	Price per/m
Ceramic	2200°F	Nextel cond. / Nextel overall	20	Solid	XC-K-20	\$1425.00
	2100°F	Nextel cond. / Nextel overall / Inconel overbraid	20	Solid	XCI-K-20	\$1900.00
			24	Solid	XCI-K-24	\$1345.
Hi-Temp Glass	1300°F	HT fiberglass braid or wrap cond. / HT glass braid overall	20	Solid	HH-K-20	\$510.00
			24	Solid	HH-K-24	\$348.00
Glass	900°F	Glass braid or wrap cond. / Glass braid overall	20	Solid	GG-K-20	\$410.00
				Stranded	GG-K-20S	\$600.00
			24	Solid	GG-K-24	\$290.00
				Stranded	GG-K-24S	\$395.00
			28	Solid	GG-K-28	\$230.00
			30	Solid	GG-K-30	\$240.00
			36	Solid	GG-K-36	\$320.00
Glass w/SS overbraid	900°F	Glass braid or wrap cond. / Glass braid overall / SS overall	20	Stranded	GGs-K-20S	\$1025.00
			24	Solid	GGs-K-24	\$600.00
			24	Stranded	GGs-K-24S	\$740.00
TFE Tape	500°F	Fused TFE tape cond. / Fused TFE tape overall	20	Solid	TW-K-20	\$574.00
			24	Solid	TW-K-24	\$404.00
PFA Teflon	500°F	Extruded PFA teflon cond. / Extruded PFA teflon overall	20	Solid	TT-K-20	\$495.00
				Stranded	TT-K-20S	\$755.00
			24	Solid	TT-K-24	\$370.00
				Stranded	TT-K-24S	\$515.00
			30	Solid	TT-K-30	\$335.00
			36	Solid	TT-K-36	\$375.00
			40	Solid	TT-K-40	\$500.00
PFA Teflon w/SS overbraid	500°F	Extruded PFA teflon cond. / SS overbraid overall	20	Solid	TTS-K-20	\$775.00
FEP Teflon	400°F	Extruded FEP cond. / Extruded FEP overall	20	Solid	TF-K-20	\$490.00
			24	Stranded	TF-K-24S	\$534.00
Shielded FEP Teflon	400°F	Extruded FEP cond. / Twisted / Aluminized polyester tape shield & copper drainwire / Extruded FEP overall	20	Solid	FXFF-K-20	\$704.00
			24	Solid	FXFF-K-24	\$395.00
PVC	221°F	PVC conductors / Ripcord construction	24	Solid	PR-K-24	\$202.00
		PVC conductors / PVC overall	16	Solid	PP-KX-16	\$547.00
			20	Solid	PP-KX-20	\$281.00
				Stranded	PP-KX-20S	\$419.00
Shielded PVC	221°F	PVC cond. / Twisted / Aluminized polyester shield w/drainwire / PVC overall	20	Solid	PXFP-KX-20	\$340.00
Kapton	600°F	Kapton tape conductors / Kapton tape overall	20	Solid	KK-K-20	\$1055.00
				Stranded	KK-K-20S	\$1100.00
			24	Solid	KK-K-24	\$735.00

Wire

Thermocouple

Type T						
Insulation	Max. Temp.	Construction	AWG	Cond.	P/N	Price per/m
Glass	900°F	Glass braid or wrap cond./ Glass braid overall	20	Solid	GG-T-20	\$295.00
				Stranded	GG-T-20S	\$385.00
			24	Solid	GG-T-24	\$240.00
				Stranded	GG-T-24S	\$380.00
			28	Solid	GG-T-28	\$220.00
PFA Teflon	500°F	Extruded PFA teflon cond. / Extruded PFA teflon overall	20	Solid	TT-T-20	\$380.00
				Stranded	TT-T-20S	\$495.00
			24	Solid	TT-T-24	\$335.00
				Stranded	TT-T-24S	\$365.00
			30	Solid	TT-T-30	\$390.00
PVC	221°F	PVC conductors / PVC overall	20	Solid	PP-TX-20	\$180.00
				Stranded	PP-TX-20S	\$239.00
		PVC conductors / Ripcord construction	24	Solid	PP-TX-24	\$240.00
				Stranded	PP-TX-24S	\$305.00
			24	Solid	PR-T-24	\$140.00
Shielded PVC	221°F	PVC cond. / Twisted / Aluminized polyester shield w/drainwire / PVC overall	16	Solid	PXFP-TX-16	\$431.00
			20	Solid	PXFP-TX-20	\$234.00

Type E						
Insulation	Max. Temp.	Construction	AWG.	Cond.	P/N	Price per/m
Glass	900°F	Glass braid or wrap cond. / Glass braid overall	20	Solid	GG-E-20	\$415.00
		Glass braid or wrap cond. / Glass braid overall / SS overbraid	20	Solid	GGs-E-20	\$695.00
		Glass braid or wrap cond. / Glass braid overall	24	Solid	GG-E-24	\$310.00
			30	Solid	GG-E-30	\$330.00
			36	Solid	GG-E-36	\$390.00
PFA Teflon	500°F	Extruded PFA teflon cond. / Extruded PFA teflon overall	20	Solid	TT-E-20	\$595.00
				Stranded	TT-E-20S	\$750.00
			24	Solid	TT-E-24	\$445.00
			30	Solid	TT-E-30	\$400.00
FEP Teflon	400°F	Extruded FEP cond. / Extruded FEP overall	20	Solid	TF-E-20	\$540.00
PVC	221°F	PVC conductors / PVC overall	20	Solid	PP-EX-20	\$276.00

Wire***Thermocouple***

T y p e B X						
Insulation	Max. Temp.	Construction	AWG.	Cond.	P/N	Price per/m
Glass	900°F	Glass braid or wrap cond. / Glass braid overall	20	Solid	GG-BX-20	\$390.00
Shielded FEP Teflon	400°F	Extruded FEP cond. / Twisted / Aluminized polyester tape shield & copper drainwire / Extruded FEP overall	20	Solid	FXFF-BX-20	\$615.00
Shielded PVC	221°F	PVC cond. / Twisted / Aluminized polyester shield w/drainwire / PVC overall	20	Solid	PXFP-BX-20	\$484.00
T y p e R X & S X						
Glass	900°F	Glass braid or wrap cond. / Glass braid overall	20	Solid	GG-SX-20	\$399.00
			24	Solid	GG-SX-24	\$390.00
PFA Teflon	500°F	Extruded PFA teflon cond. / Extruded PFA teflon overall	20	Solid	TT-SX-20	\$510.00
			24	Solid	TT-SX-24	\$480.00
PVC	221°F	PVC conductors / PVC overall	20	Solid	PP-SX-20	\$213.00
Shielded PVC	221°F	PVC cond. / Twisted / Aluminized polyester shield w/drainwire / PVC overall	20	Solid	PXFP-SX-20	\$272.00

Bare Thermocouple

Price per 50' spool

Ga.	Dia.	Type J		Type K		Type T		Type E		Type N	
		Iron +	Constantan -	Chromel +	Alumel -	Copper +	Constantan -	Chromel +	Constantan -	Nicrosil +	Nisil -
20	0.032"	JP-032 \$16.00	JN-032 \$16.00	KP-032 \$16.00	KN-032 \$16.00	TP-032 \$16.00	TN-032 \$16.00	EP-032 \$16.00	EN-032 \$19.20	NP-032 \$19.20	NN-032 \$19.20
24	0.020"	JP-020 \$16.00	JN-020 \$16.00	KP-020 \$16.00	KN-020 \$16.00	TP-020 \$16.00	TN-020 \$16.00	EP-020 \$16.00	EN-020 \$19.20	NP-020 \$19.20	NN-020 \$19.20
26	0.015"	JP-015 \$10.00	JN-015 \$10.00	KP-015 \$10.00	KN-015 \$10.00	TP-015 \$10.00	TN-015 \$10.00	EP-015 \$10.00	EN-015 \$16.00	NP-015 \$16.00	NN-015 \$16.00
28	0.012"	JP-012 \$10.00	JN-012 \$10.00	KP-012 \$10.00	KN-012 \$10.00	TP-012 \$10.00	TN-012 \$10.00	EP-012 \$10.00	EN-012 \$12.00	NP-012 \$12.00	NN-012 \$12.00
30	0.010"	JP-010 \$10.00	JN-010 \$10.00	KP-010 \$10.00	KN-010 \$10.00	TP-010 \$10.00	TN-010 \$10.00	EP-010 \$10.00	EN-010 \$12.00	NP-010 \$12.00	NN-010 \$12.00

Wire

RTD, Heater Hook-Up Wire, Ring Terminals

Teflon Insulated Heater Hook-Up Wire

Type E 600 Volt Max. Temp. 500°F / 260°C

Part Number	Stranding	AWG.	Price per foot
P10TEFNKLE	37 x 26	10	1.60
P14TEFNKLE	19 x 27	14	1.00
P16TEFNKLE	19 x 29	16	.60

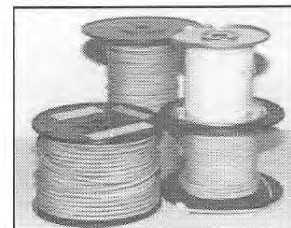
Description:

Stranded nickel coated copper conductor insulated with extruded teflon® jacket. Rated to 600 volts.

Color: Black

Applications:

Wiring of heater elements for applications up to 500°F.



Ultrahigh Temp. Heater Hook-Up Wire

Mica/Glass Insulated Max. Temp. 1000°F/538°C

Part Number	AWG.	O.D.	Max. Amps @ 80°C	Price per foot
P10MGTSNCC	10	.212"	100 amps	3.00
P12MGTSNCC	12	.161"	75 amps	1.66
P14MGTSNCC	14	.142"	55 amps	1.20
P16MGTSNCC	16	.127"	40 amps	.96
P20MGTSNCC	20	.104"	23 amps	.64

Description:

Stranded nickel coated copper conductor insulated with glass reinforced mica tapes. A fiberglass braid jacket is applied overall and treated with a high temperature saturant. Rated to 600 volts. Color: Natural

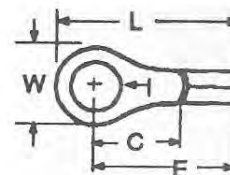
Applications:

Commercial and industrial ovens, commercial food service equipment, heat treating furnaces, kilns, heater elements and other applications to 1000°F.

Hi-Temp Ring Terminals

1200°F Uninsulated Nickel/Steel Construction

Wire AWG	Dimensions (inches)				Stud Size	Part Number	Price Each
	W	C	L	E			
22-18	.25	.22	.60	.47	6	RL6NI2218	.20
22-18	.33	.29	.70	.54	10	RL10NI2218	.20
16-14	.33	.29	.70	.54	10	RL10NI1614	.20
16-14	.56	.40	.93	.65	1/4"	RL14NI1614	.25
12-10	.38	.29	.73	.54	10	RL10NI1210	.35
12-10	.59	.44	.99	.69	1/4"	RL14NI1210	.35



RTD Hook-Up Wire

Part Number	No. of Conds.	AWG.	Insulation Type	Max. Temp.	Price per foot
EXTT3CU26S	3	26	Teflon over each cond. / Twisted / Teflon jacket overall	500°F	.65
EXTT4CU26S	4	26	Teflon over each cond. / Twisted / Teflon jacket overall	500°F	.70
TTC4CU26S	4	26	Teflon over each cond. / Twisted / Copper braid shield / Teflon jacket overall	500°F	1.30
RT3-24-8-705	3	24	Glass braid over each cond. / Twisted / Glass braid jacket overall	900°F	.434
RT4-24-8-705	4	24	Glass braid over each cond. / Twisted / Glass braid jacket overall	900°F	.571

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