Thermocouples

Mineral Insulated

Watlow's mineral insulated thermocouples are fast-responding, durable, and capable of handling high temperatures.

These thermocouples are manufactured with best-in-class XACTPAK®, Watlow's trademark for metal sheathed, mineral insulated (MI) thermocouple material. XACTPAK responds fast because the protective metal outer sheath allows the use of smaller diameter thermocouple conductors. The rock hard compacted MgO insulation further enhances the sensor's ability to "read" temperature by transferring heat quickly to the measuring junction.

The XACTPAK protecting sheath and compacted insulation outperforms bare wire thermocouples in most applications.

Performance Capabilities

- Easily handles temperatures up to 1200°C (2200°F)
- Meets or exceeds initial calibration tolerances per ASTM E 230

Features and Benefits

Special mineral insulation
- Protects thermocouple from moisture and thermal shock
- Permits operation in high temperature, high pressure environments

Diameters as small as 0.010 in. (0.25 mm)
- Ideal when physical space or extremely fast response are critical

Flexibility of the XACTPAK material
- Allows you to form and bend the thermocouple, without risk of cracking, to meet your design requirements

Outer sheath
- Protects the wires from oxidation and hostile environments

Wide range of sheath materials, diameters, and calibrations
- Meet specific requirements

In-house manufacturing of XACTPAK material
- Rigid quality control procedures
- Assures high standards are met
- Single source reliability

Custom capabilities
- Include options such as special lead lengths, lead wires and terminations

Applications

- Heat treating
- Furnaces/kilns
- Turbines
- Bearing temperature
- Power stations
- Steam generators
- Diesel engines
- Nuclear reactors
- Atomic research
- Jet engines and test cells
- Rocket engines
- Semiconductor manufacturing
- Refineries/oil processing
- Catalytic reformers
- Food processing

Mineral Insulated

Cut and Stripped Style AB

The main feature of Watlow's Style AB thermocouple is it allows you to terminate the thermocouple yourself. Style AB is simply a section of XACTPAK material, junctioned and stripped. It is the most basic of all the mineral insulated thermocouple styles.

Because it is constructed with XACTPAK mineral insulation, the thermocouple is protected from moisture, thermal shock, high temperatures and high pressure.

Performance Capabilities

- Maximum temperature depends on sheath material, calibration, and other variables

Features and Benefits

Cold end stripped and sealed with epoxy

- Inhibits moisture penetration

Dual element style

- Allows you to run two instruments off the same element, reducing your costs

Custom Ordering Information—Items in **Bolded Green Type** are preferred with shorter lead times.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	B		0		0									

3. Sheath O.D. (inch)

A = 0.010	**E = 0.063**	L = 0.375
B = 0.020	**G = 0.125**	M = 0.500
C = 0.032	**H = 0.188**	
D = 0.040	**J = 0.250**	

4. Enter "0"

5. Fittings, Weld Pads

If required, enter order code from pages 39-40. If none, enter **"0".**

6. Enter "0"

7. Sheath Material

A = 304 SS **Q = Alloy 600 (Type K)**

F = 316 SS

8-9. Sheath Length "L" (whole inches)

01 to 99

Lengths over 99 inches consult factory.

10. Sheath Length "L" (fractional inch)

0 = 0	4 = ½
1 = ⅛	5 = ⅝
2 = ¼	6 = ¾
3 = ⅜	7 = ⅞

11. Junction

	Grounded	Ungrounded	Exposed
Single	**G**	**U**	E
Dual	H	W (isolated)	D (isolated)

12. Calibration

	E	J	K	N	T
Standard limits	E	**J**	**K**	N	**T**
Special limits	2	3	4	—	8

13. Strip Length "S" (whole inches)

0, **1**, 2 and 3 - 1 inch maximum on 0.040 and smaller

14. Strip Length "S" (fractional inch)

0 = 0	4 = ½
1 = ⅛	5 = ⅝
2 = ¼	6 = ¾
3 = ⅜	7 = ⅞

15. Special Requirements

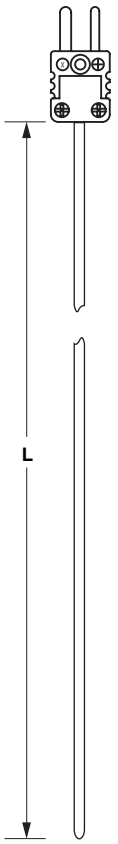
0 = None

X = Special requirements, consult factory

Thermocouples

Mineral Insulated

Mini Plug or Jack Termination
Style AC



Rapid Ship Sensors

Rapid Ship sensors come with mini male thermocouple connector directly attached to sheath, Type J or K, ungrounded junction, 0.063 or 0.125 inch sheath diameter and six or 12 inch sheath length.

Calibration	Sheath Material	Sheath Diameter in.	(mm)	Sheath Length in. (mm) 6 (152)	12 (305)
J	316 SS	0.063	(1.6)	ACEF00F060UJ000	ACEF00F120UJ000
		0.125	(3.2)	ACGF00F060UJ000	ACGF00F120UJ000
K	Alloy 600	0.063	(1.6)	ACEF00Q060UK000	ACEF00Q120UK000
		0.125	(3.2)	ACGF00Q060UK000	ACGF00Q120UK000

Custom Ordering Information—Items in **Bolded Green Type** are preferred with shorter lead times.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	C				0							0	0	

3. Sheath O.D. (inch)

A = 0.010 D = 0.040
B = 0.020 **E = 0.063**
C = 0.032 **G = 0.125**

4. Connector Type

Miniature Plugs and Jacks 200°C (400°F)
(0.125 inch maximum O.D.)
F = Miniature plug
G = Miniature jack
H = Miniature plug with mating connector

5. Fittings, Weld Pads

If required, enter order code from pages 39-40.
If none, enter **"0"**.

6. Enter "0"

7. Sheath Material

A = 304 SS **Q = Alloy 600 (Type K)**
F = 316 SS
C = PFA coated over SS (available on G diameter)

8-9. Sheath Length "L" (whole inches)

04, 06, 12, 18, 24
Available lengths: 01 to 99, over 99 consult factory
Maximum length for PFA coating is 48 inches.

10. Sheath Length "L" (fractional inch)

0 = 0 2 = ¼ 4 = ½ 6 = ¾
1 = ⅛ 3 = ⅜ 5 = ⅝ 7= ⅞

11. Junction

	Grounded	Ungrounded	Exposed
Single	**G**	**U**	E

12. Calibration

	E	J	K	N	T
Standard limits	E	**J**	**K**	N	**T**
Special limits	2	3	4	—	8

13-14. Enter "00"

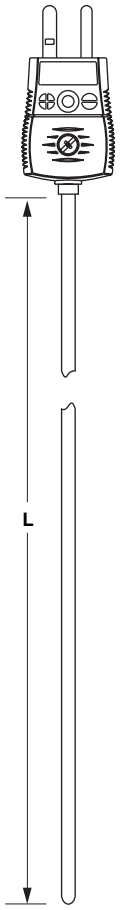
15. Special Requirements

0 = None
X = Special requirements, consult factory

Thermocouples

Mineral Insulated

Standard Plug or Jack Termination
Style AC



Rapid Ship Sensors

Rapid Ship sensors come with standard male thermocouple connector directly attached to sheath, Type J or K, ungrounded junction, 0.125, 0.188 or 0.250 inch diameter and six or 12 inch sheath length.

Calibration	Sheath Material	Sheath Diameter in.	(mm)	Sheath Length in. (mm) 6 (152)	12 (305)
J	316 SS	0.125	(3.2)	ACGA00F060UJ000	ACGA00F120UJ000
		0.188	(4.8)	ACHA00F060UJ000	ACHA00F120UJ000
		0.250	(6.4)	ACJA00F060UJ000	ACJA00F120UJ000
K	Alloy 600	0.125	(3.2)	ACGA00Q060UK000	ACGA00Q120UK000
		0.188	(4.8)	ACHA00Q060UK000	ACHA00Q120UK000
		0.250	(6.4)	ACJA00Q060UK000	ACJA00Q120UK000

Custom Ordering Information—Items in **Bolded Green Type** are preferred with shorter lead times.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	C				0							0	0	

3. Sheath O.D. (inch)
D = 0.040 **H = 0.188**
E = 0.063 **J = 0.250**
G = 0.125

4. Connector Type
Standard Plugs and Jacks 218°C (425°F)
A = Standard plug
B = Standard jack
C = Standard plug with mating connector

High Temperature Plugs and Jacks 540°C (1000°F)
(0.250 inch maximum O.D.)
L = High temperature plug
M = High temperature jack
N = High temperature plug with mating connector

5. Fittings, Weld Pads
If required, enter order code from pages 39-40.
If none, enter **"0".**

6. Enter "0"

7. Sheath Material
A = 304 SS **Q = Alloy 600 (Type K)**
F = 316 SS
C = PFA coated over SS (available on G, H, J diameters)

8-9. Sheath Length "L" (whole inches)
04, 06, 12, 18, 24
Available lengths: 01 to 99, over 99 consult factory
Maximum length for PFA coating is 48 inches.

10. Sheath Length "L" (fractional inch)
0 = 0 2 = ¼ 4 = ½ 6 = ¾
1 = ⅛ 3 = ⅜ 5 = ⅝ 7= ⅞

11. Junction

	Grounded	Ungrounded	Exposed
Single	**G**	**U**	E
Dual	H	W (isolated)	D (isolated)

12. Calibration

	E	J	K	N	T
Standard limits	E	**J**	**K**	N	**T**
Special limits	2	3	4	—	8

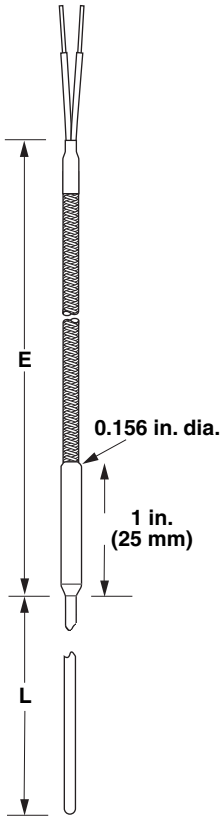
13-14. Enter "00"

15. Special Requirements
0 = None
X = Special requirements, consult factory

Thermocouples

Mineral Insulated

Miniature Transitions
Style AQ



Note: 149°C (300°F) potting standard.

Rapid Ship Sensors

Rapid Ship sensors come with three feet FEP insulated flexible extension, split lead termination, ungrounded junction. See page 166 to order additional connector hardware.

Calibration	Sheath Material	Sheath Diameter in.	(mm)	Sheath Length in. (mm) 3 (76)	6 (152)
J	316 SS	0.040	(1.0)	AQDC0TF030UJ030	AQDC0TF060UJ030
		0.063	(1.6)	AQEC0TF030UJ030	AQEC0TF060UJ030
K	Alloy 600	0.040	(1.0)	AQDC0TQ030UK030	AQDC0TQ060UK030
		0.063	(0.9)	AQEC0TQ030UK030	AQEC0TQ060UK030

Custom Ordering Information—Items in **Bolded Green Type** are preferred with shorter lead times.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	Q			0										

2. Style
Q = Miniature metal transition with 149°C (300°F) potting

3. Sheath O.D. (inch)
B = 0.020 **D = 0.040**
C = 0.032 **E = 0.063**

4. Lead Wire Construction

		Standard
Fiberglass	Solid	A
FEP	Solid	**C**

5. Enter "0"

6. Lead Wire Termination
A = Standard male plug
B = Standard female jack
C = Standard plug with mating connector
F = Miniature male plug
G = Miniature female jack
H = Miniature plug with mating connector
T = Standard, 1 ½ inch split leads
U = 1 ½ inch split leads with spade lugs

7. Sheath Material
A = 304 SS
F = 316 SS
Q = Alloy 600 (Type K)

8-9. Sheath Length "L" (whole inches)
03, 06, 12
Available lengths: 01 to 99, over 99 consult factory

10. Sheath Length "L" (fractional inch)
0 = 0 3 = ⅜ 6 = ¾
1 = ⅛ 4 = ½ 7= ⅞
2 = ¼ 5 = ⅝

11. Junction

	Grounded	Ungrounded
Single	**G**	**U**

12. Calibration

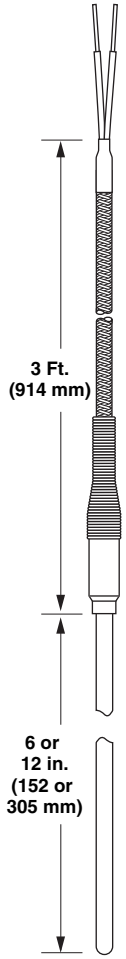
	J	K
Standard limits	**J**	**K**
Special limits	3	4

13-14. Lead Wire Length "E" (whole feet)
03, 06
Available lengths: 01 to 30

15. Special Requirements
0 = None
M = 260°C (500°F) potting
X = Special requirements, consult factory

Mineral Insulated

Metal Transitions with Spring Strain Relief
Styles AF



Rapid Ship Sensors

Rapid Ship sensors come with three feet of stranded conductor FEP insulated flexible lead, split lead termination, ungrounded junction, 149°C (300°F) potting. See page 166 to order additional connector hardware.

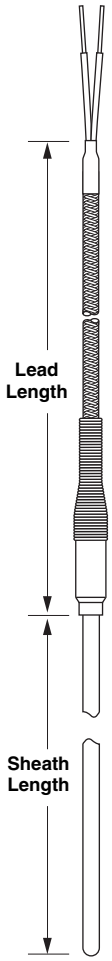
Calibration	Sheath Material	Sheath Diameter in.	(mm)	Sheath Length in. (mm) 6 (152)	12 (305)
J	316 SS	0.063	(1.6)	AFED0TF060UJ030	AFED0TF120UJ030
		0.125	(3.2)	AFGD0TF060UJ030	AFGD0TF120UJ030
		0.188	(4.8)	AFHD0TF060UJ030	AFHD0TF120UJ030
		0.250	(6.4)	AFJD0TF060UJ030	AFJD0TF120UJ030
K	Alloy 600	0.063	(1.6)	AFED0TQ060UK030	AFED0TQ120UK030
		0.125	(3.2)	AFGD0TQ060UK030	AFGD0TQ120UK030
		0.188	(4.8)	AFHD0TQ060UK030	AFHD0TQ120UK030
		0.250	(6.4)	AFJD0TQ060UK030	AFJD0TQ120UK030

See next page for custom ordering information.

Thermocouples

Mineral Insulated

Metal Transitions with Spring Strain Relief
Styles AF (Con't)



①Stranded lead wire available only for sheath O.D. 0.063 to 0.500 inch.

②1000°F potting not recommended with FEP insulated wire.

Note: 149°C (300°F) potting standard

Custom Ordering Information—Items in **Bolded Green Type** are preferred with shorter lead times.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**F**													

2. Style

F = Metal transition with strain relief and 149°C (300°F) potting

3. Sheath O.D. (inch)

A = 0.010 **E = 0.063**
B = 0.020 **G = 0.125**
C = 0.032 **H = 0.188**
D = 0.040 **J = 0.250**

4. Lead Wire Construction

		Standard	Overbraid	Flex Armor
Fiberglass	Solid	A	J	R
FEP	Solid	C	L	T
Fiberglass	Stranded①	**B**	**K**	S
FEP	Stranded①	**D**	M	U

5. Fittings, Weld Pads

If required, enter order code from pages 39-40.
If none, enter **"0"**.

6. Lead Wire Termination

A = Standard male plug
B = Standard female jack
C = Standard plug with mating connector
F = Miniature male plug
G = Miniature female jack
H = Miniature plug with mating connector
T = Standard, 1 ½ inch split leads
U = 1 ½ inch split leads with spade lugs
W = 1 ½ inch split leads with BX connector and spade lugs

7. Sheath Material

A = 304 SS **Q = Alloy 600 (Type K)**
F = 316 SS
C = PFA coated over SS (available on G, H and J diameter)

8-9. Sheath Length "L" (whole inches)

03, 06, 12, 18, 24
Available lengths: 01 to 99, over 99 consult factory
Maximum length for PFA coating is 48 inches.

10. Sheath Length "L" (fractional inch)

0 = 0 1 = ⅛ 2 = ¼ 3 = ⅜ 4 = ½ 5 = ⅝ 6 = ¾ 7 = ⅞

11. Junction

	Grounded	Ungrounded	Exposed
Single	**G**	**U**	E
Dual	H	W (isolated)	D (isolated)

12. Calibration

	E	J	K	N	T
Standard limits	E	**J**	**K**	N	**T**
Special limits	2	3	4	—	8

13-14. Lead Wire Length "E" (whole feet)

03, 04, 06, 08, 10
Available lengths: 01 to 30, over 30 consult factory

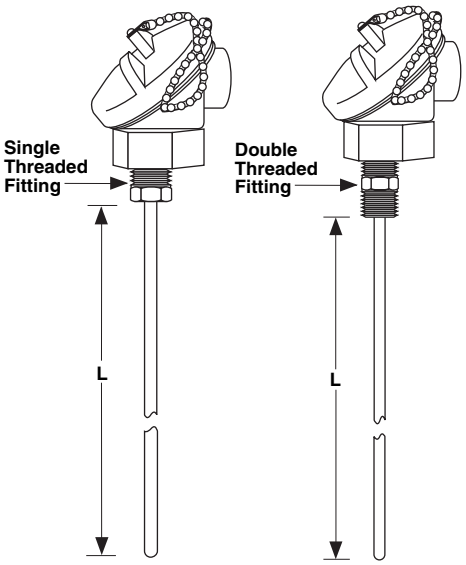
15. Special Requirements

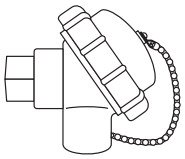
0 = None
H = High temperature 538°C (1000°F) potting
M = 260°C (500°F) potting
X = Special requirements, consult factory

Thermocouples

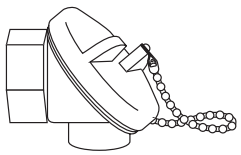
Mineral Insulated

Connection Head Style AR

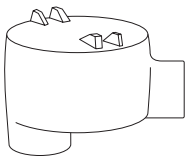




Type C (Polypropylene)



Type D (Small Cast Iron) or E (Small Aluminum)



Type H (Explosion Proof)

Rapid Ship Sensors

Rapid Ship sensors come double threaded ½ inch NPT mounting fitting, ungrounded junction, 0.250 inch sheath diameter and small aluminum (E) connection head.

Calibration	Sheath Material	Sheath Length in. (mm)		
		6 (152)	12 (305)	18 (457)
J	316 SS	ARJEF0F060UJ000	ARJEF0F120UJ000	ARJEF0F180UJ000
K	Alloy 600	ARJEF0Q060UK000	ARJEF0Q120UK000	ARJEF0Q180UK000

Custom Ordering Information—Items in **Bolded Green Type** are preferred with shorter lead times.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	R				0							0	0	

3. Sheath O.D. (inch)
E = 0.063 **J = 0.250**
G = 0.125 L = 0.375
H = 0.188 M = 0.500

4. Connection Head
C = Polypropylene
D = Small cast iron
E = Small aluminum
H = Explosion proof

5. Head Mounting Fittings
0 = Single threaded 303 SS
F = Double threaded 303 SS ½" NPT
*H = Spring loaded double threaded 316 SS ½" NPT

6. Enter "0"

7. Sheath Material
A = 304 SS
F = 316 SS
Q = Alloy 600 (Type K)

8-9. Sheath Length "L" (whole inches)
03, 06, 12, 18, 24
Available lengths: 01 to 99, over 99 consult factory

10. Sheath Length "L" (fractional inch)
0 = 0 2 = ¼ 4 = ½ 6 = ¾
1 = ⅛ 3 = ⅜ 5 = ⅝ 7= ⅞

11. Junction

	Grounded	Ungrounded	Exposed
Single	**G**	**U**	E
Dual	H	W (isolated)	D (isolated)

12. Calibration

	E	J	K	N	T
Standard limits	E	**J**	**K**	N	T
Special limits	2	3	4	—	8

13-14. Enter "00"

15. Special Requirements
0 = None
X = Special requirements, consult factory

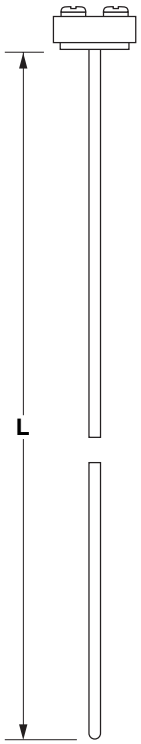
*0.250 inch diameter only.

Metric sizes available for made-to-order units. Consult factory.

Thermocouples

Mineral Insulated

Wafer Head
Style AS



The Style AS thermocouple features a "wafer" head, which allows quick access to terminal screws for wiring. This thermocouple is an economical choice because the termination is attached directly to the XACTPAK sheath.

Performance Capabilities

Cold end termination temperature rating up to 540°C (1000°F).

Features

Termination directly to sheath

- Allows quick hookup and disassembly

Terminal head

- Available in a wide range of materials in both single and dual configurations

Custom Ordering Information—Items in **Bolded Green Type** are preferred with shorter lead times.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	**S**		**C**		**0**							**0**	**0**	

3. Sheath O.D. (inch)
G = 0.125 **J = 0.250**
H = 0.188

4. Cold End Termination
C = Ceramic 540°C (1000°F)
1 ⅛ inch diameter x ⅝ inch thick

5. Fittings, Weld Pads
If required, enter order code from pages 39-40. If none, enter **"0"**.

6. Enter "0"

7. Sheath Material
A = 304 SS F = 316 SS
Q = Alloy 600 (Type K)

8-9. Sheath Length "L" (whole inches)
04, 06, 12, 18, 24
Available lengths: 01 to 99, over 99 consult factory

10. Sheath Length "L" (fractional inch)
0 = 0 3 = ⅜ 6 = ¾
1 = ⅛ 4 = ½ 7= ⅞
2 = ¼ 5 = ⅝

11. Junction

	Grounded	Ungrounded	Exposed
Single	**G**	**U**	E
Dual	H	W (isolated)	D (isolated)

12. Calibration

	E	J	K	N	T
Standard limits	E	**J**	**K**	N	T
Special limits	2	3	4	—	8

13-14. Enter "00"

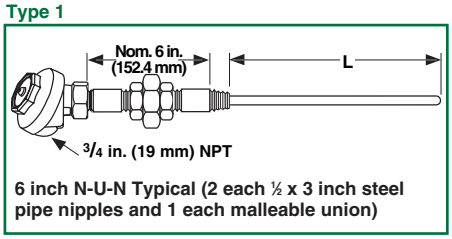
15. Special Requirements
0 = None
X = Special requirements, consult factory

Thermocouples

Mineral Insulated

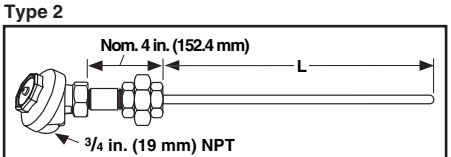
For Use With Thermowells Style AT

Type 1



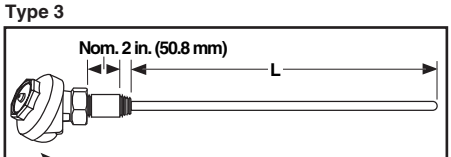
6 inch N-U-N Typical (2 each ½ x 3 inch steel pipe nipples and 1 each malleable union)

Type 2



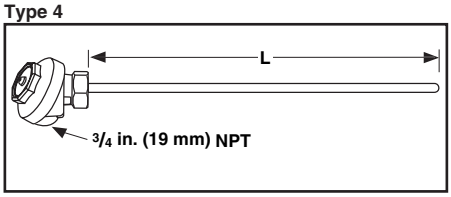
4 inch N-U typical (1 each ½ x 3 inch steel pipe nipple and 1 each malleable union)

Type 3



½ X 3 inch long steel pipe nipple typical

Type 4



Note: For a complete sensor, add thermowell part number to the 15-digit AT part number. For sheath length use "AR" (as required) and factory will determine correct length.
See thermowell section, pages 144 to 146.

See the hardware section, pages 156 to 157, for a complete description of Watlow connection heads.

Custom Ordering Information—Items in **Bolded Green Type** are preferred with shorter lead times.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	T	J			0							0		

3. Sheath O.D. (inch)
J = 0.250

4. Connection Head
C = Polypropylene (½ inch NPT thermocouple opening only)
D = Small cast iron
E = Small aluminum
H = Explosion proof (½ inch NPT and ¾ inch NPT thermocouple opening only)

5. Cold End Configuration
1 = Type 1, six inch nipple-union-nipple
2 = Type 2, four inch nipple-union
3 = Type 3, three inch nipple
4 = Type 4, no extensions
Note: Steel nipple and unions are standard.

6. Enter "0"

7. Sheath Material
A = 304 SS
F = 316 SS
Q = Alloy 600 (Type K)

8-9. Sheath Length "L" (whole inch)
Available lengths: 01 to 99, over 99 consult factory

10. Sheath Length "L" (fractional inch)
0 = Not required, complete assembly
1 = ⅛ 3 = ⅜ 5 = ⅝ 7 = ⅞
2 = ¼ 4 = ½ 6 = ¾

11. Junction

	Grounded	Ungrounded
Single	**G**	**U**
Dual, isolated	—	W

12. Calibration

	E	J	K	N	T
Standard limits	E	**J**	**K**	N	T
Special limits	2	3	4	—	8

13. Enter "0"

14. Spring-Loading
Y = Yes
N = No

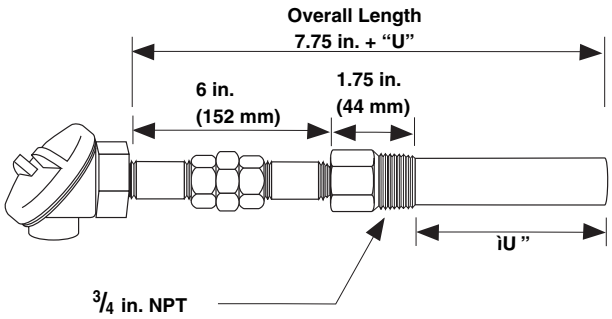
15. Special Requirements
0 = None
X = Special requirements, consult factory

Thermocouples

Mineral Insulated

Style AT With Thermowells

Straight Well

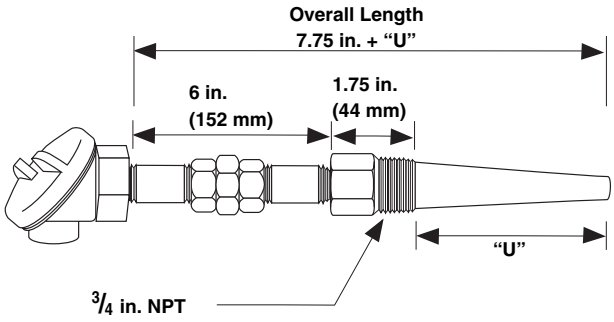


Rapid Ship Sensors

Rapid Ship sensors come with 316 SS straight well, nipple-union-nipple, 0.250 inch diameter spring loaded element, small aluminum connection head and ungrounded junction.

Calibration	"U" in.	"U" (mm)	Overall Length in.	Overall Length (mm)	Part Number
J	2.5	(64)	10.25	261	ATJE1SF024UJ0Y0
	4.5	(114)	12.25	312	ATJE1SF044UJ0Y0
	7.5	(191)	15.25	388	ATJE1SF074UJ0Y0
	10.5	(267)	18.25	465	ATJE1SF104UJ0Y0
K	2.5	(64)	10.25	261	ATJE1SF024UK0Y0
	4.5	(114)	12.25	312	ATJE1SF044UK0Y0
	7.5	(191)	15.25	388	ATJE1SF074UK0Y0
	10.5	(267)	18.25	465	ATJE1SF104UK0Y0

Tapered Well



Rapid Ship Sensors

Rapid Ship sensors come with 316 SS tapered well, nipple-union-nipple, 0.250 inch diameter spring loaded element, small aluminum connection head and ungrounded junction.

Calibration	"U" in.	"U" (mm)	Overall Length in.	Overall Length (mm)	Part Number
J	2.5	(64)	10.25	261	ATJE1TF024UJ0Y0
	4.5	(114)	12.25	312	ATJE1TF044UJ0Y0
	7.5	(191)	15.25	388	ATJE1TF074UJ0Y0
	10. 5	(267)	18.25	465	ATJE1TF104UJ0Y0
K	2.5	(64)	10.25	261	ATJE1TF024UK0Y0
	4.5	(114)	12.25	312	ATJE1TF044UK0Y0
	7.5	(191)	15.25	388	ATJE1TF074UK0Y0
	10.5	(267)	18.25	465	ATJE1TF104UK0Y0