

**650T Series Transmitter
Model 652
Temperature transmitter
and sensor**

- **Totally flexible, easily specified**
 - meets your needs with a standard product

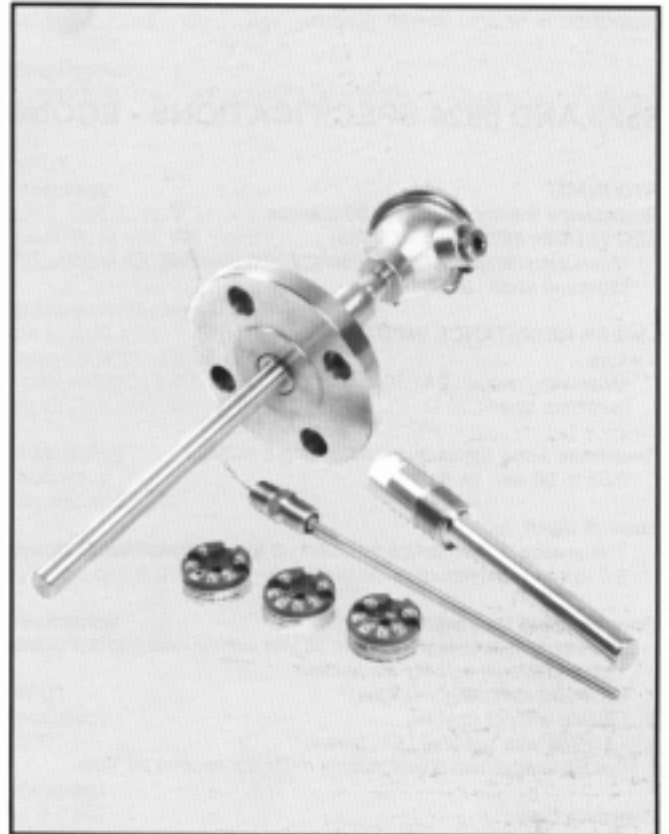
- **Choice of connection heads, styles and materials**
 - designed for flexibility

- **Fixed-range, economical, programmable, smart HART® transmitter options**
 - wide choice to suit the application

- **Standard and custom-designed thermowells**
 - screwed and flanged types as standard

- **Intrinsically safe version available**
 - may be used in hazardous environments

- **Programmable response time**
 - useful in conditions of temperature fluctuation



650T Series - flexibility by designs in a single range

Introduction

The 650T Series is a range of temperature transmitters, sensing elements (sensors), transmitters and assemblies suitable for a wide range of applications.

Elements – select RTD or thermocouple types J, E, K or T. Other element types may be supplied on request.

Transmitters – 2-wire devices operating from 7 to 35V d.c. supply and providing a 4 to 20mA output signal.

The low cost version is available operating over a selected RTD or resistance input. Growing to more power two comprehensive programmable types are available; one is smart HART® with capability for digital communications.

Programmable parameters include temperature range, response time and sensor failure.

Assemblies – several types of termination head are provided with construction ranging from ABS through cast aluminium alloy to stainless steel.

The thermowells are all manufactured from 316 stainless steel with process connection options of ANSI flanges or NPT fittings. A selection of extensions and unions are also available for high temperature use.

Individually manufactured designs for specific applications are also available on request.

6523 AND 6524 SPECIFICATIONS - ECONOMICAL TRANSMITTER

RTD INPUT

Resistance thermometer Pt100 3 wires
(IEC 751/DIN 43760; $\alpha = 0.00385$)

Measuring range : -200 to +850°C (-328 to +1562°F)
Minimum span : 25°C (45°F)

LINEAR RESISTANCE INPUT 3 wires

Measuring range : 0 to 10 kΩ
Minimum span : 30 Ω

Response Time selectable time constant (63%)
0.33 to 60 sec. as defined.

Loss of input

The analog signal can be selected up to a minimum value of 3.5 mA or a maximum value of 23 mA.

Power supply (at transmitter terminals)

The transmitter operates on 8 to 35 Vdc with no load and is protected against reverse polarity connection.

Minimum operating voltages :

- 8 Vdc without options
- 10 Vdc with optional LCD meter

For Ex ia approval power supply must not exceed 28 Vdc.

Warm-up time

Operation within specification in less than 5 min.

Update time

135 ms approx.

Input impedance

10 MΩ

Output signal

Two-wire 4 to 20 mA dc., linear with ohms or linear with true temperature for RTD.

Max. offset (input)

50% of max. value

Temperature limits

Ambient

-40 and +85°C (-40 and +185°F)

Humidity

0 to 90% RH

PERFORMANCE SPECIFICATIONS

If not otherwise stated values as % should be considered percent of calibrated span.

COMMON CHARACTERISTICS

Linearity error

< 0.1%

Temperature coefficient

<± 0.01%/°C

Signal/noise ratio

min. 60 dB

Output meter indication accuracy

LCD : ± 0.1% of calibrated span ± 1 digit

Supply voltage

Within voltage/load specified limits the total effect is less than 0.005%/V.

Load

Within load/voltage specified limits the total effect is less than 0.01%/100Ω.

EMI/RFI

Meets EN50081 for emission and EN50082 for immunity when instrument is properly installed with or without output meter.

Vibration

IEC 68-2-6 Test FC

Lloyd's specification no. 1 : 4g/2-100 Hz

RTD INPUT

Basic accuracy

± 0.3°C

Sensor current

0.2 mA to 0.4 mA

Temperature coefficient

span <100°C : ± 0.01%/°C

Effect of sensor cable resistance (3-wire)

<0.002 Ω/Ω

Max. cable resistance per wire

10 Ω

LINEAR RESISTANCE INPUT

Sensor current

0.2 mA to 0.4 mA

Effect of sensor cable resistance (3-wire)

< 0.002 Ω/Ω

Max. cable resistance per wire

10 Ω

6525 AND 6526 SPECIFICATIONS - PROGRAMMABLE TRANSMITTER

THC INPUT

Thermocouple Type E (IEC 584-1)

Measuring range : -100 to + 1000°C (-148 to +1832°F)
Minimum span : 50°C (90°F)

Thermocouple Type J (IEC 584-1)

Measuring range : -100 to + 1200°C (-148 to +2192°F)
Minimum span : 50°C (90°F)

Thermocouple Type K (IEC 584-1)

Measuring range : -180 to + 1370°C (-292 to +2498°F)
Minimum span : 50°C (90°F)

Thermocouple Type T (IEC 584-1)

Measuring range : -200 to + 400°C (-328 to +752°F)
Minimum span : 50°C (90°F)

Resistance thermometer Pt100 2,3,4 wires (IEC 751/DIN 43760; $\alpha = 0.00385$)

Measuring range : -200 to + 850°C (-328 to +1562°F)
Minimum span : 25°C (45°F)

Refer to Company for other thermocouples and thermoresistances

Response Time selectable time constant (63%)

1 to 60 sec. as defined.

Loss of input

The analog signal can be programmed up to a minimum value of 3.5 mA or a maximum value of 23 mA.

Power supply (at transmitter terminals)

The transmitter operates on 7 to 35 Vdc with no load and is protected against reverse polarity connection.

Minimum operating voltages :

- 7 Vdc without options
- 9 Vdc with optional LCD meter

For Ex ia approval power supply must not exceed 28 Vdc.

Warm-up time

Operation within specification in less than 5 min.

Update time

0.5 sec. approx.

Isolation voltage

1500 Vac for 60 sec.

Output signal

Two-wire 4 to 20 mA dc., linear with ohms and mV or linear with true temperature for THC and RTD.

Max. offset (input)

50% of maximum span value

Temperature limits

Ambient

-40 and +85°C (-40 and +185°F)

Humidity

0 to 90% RH

PERFORMANCE SPECIFICATIONS

For data where two values are stated the greater one should be considered for the specific case. If not otherwise stated values as % should be considered percent of calibrated span.

COMMON CHARACTERISTICS

Linearity error

< 0.1%

Temperature coefficient

<± 0.01% / °C

Signal/noise ratio

min. 60 dB

Supply voltage

Within voltage/load specified limits the total effect is less than 0.005%/V.

Load

Within load/voltage specified limits the total effect is less than 0.01%/100Ω.

EMI/RFI

Meets EN50081 for emission and EN50082 for immunity when instrument is properly installed with or without output meter.

Vibration

IEC 68-2-6 Test FC

Lloyd's specification no. 1 : 4g / 2-100 Hz

Mounting Position

The transmitter may be mounted in any position with no effect on output signal.

THC INPUT

Basic accuracy

- type E, J, K, L, N, T, U : < ± 1.0°C
- type B, R, S, W3, W5 : <± 2°C
- cold junction compensation (CJC) : < ± 1.0°C

Temperature coefficient

- type E, J, K, L, N, T, U
 - span <500°C : ± 0.05°C/°C
 - span >500°C : ± 0.01%/°C
- type B, R, S, W3, W5 : 0.2°C/°C

VOLTAGE INPUT

Basic accuracy

± 0.01 mV or ± 0.1%

Temperature coefficient

± 1 μV / °C or ± 0.01% / °C

Input resistance

10 MΩ

RTD INPUT

Basic accuracy

± 0.2°C

Sensor current

nom. 0.2 mA

Temperature coefficient

- span <100°C : ± 0.01°C/°C
- span >100°C : ± 0.01%/°C

Effect of sensor cable resistance (3/4 wire)

<0.002 Ω/Ω

Max. cable resistance per wire

5 Ω

LINEAR RESISTANCE INPUT

Basic accuracy

± 0.1 Ω or ± 0.1%

Temperature coefficient

± 0.01 Ω / °C or ± 0.01% / °C

Sensor current

nom. 0.2 mA

Effect of sensor cable resistance (3/4 wire)

< 0.002 Ω/Ω

Max. cable resistance per wire

5 Ω

6527 AND 6528 SPECIFICATIONS - SMART HART® PROGRAMMABLE TRANSMITTER

THC INPUT

Thermocouple Type E (IEC 584-1)

Measuring range : -100 to + 1000°C (-148 to +1832°F)
Minimum span : 50°C (90°F)

Thermocouple Type J (IEC 584-1)

Measuring range : -100 to + 1200°C (-148 to +2192°F)
Minimum span : 50°C (90°F)

Thermocouple Type K (IEC 584-1)

Measuring range : -180 to + 1370°C (-292 to +2498°F)
Minimum span : 50°C (90°F)

Thermocouple Type T (IEC 584-1)

Measuring range : -200 to + 400°C (-328 to +752°F)
Minimum span : 50°C (90°F)

Resistance thermometer Pt100 2,3,4 wires (IEC 751/DIN 43760; $\alpha = 0.00385$)

Measuring range : -200 to + 850°C (-328 to +1562°F)
Minimum span : 10°C (18°F)

Refer to Company for other thermocouples and thermoresistances

Response Time selectable time constant (63%)

1 to 60 sec. as defined.

Loss of input

The analog signal can be programmed up to a minimum value of 3.5 mA or a maximum value of 23 mA.

Power supply (at transmitter terminals)

The transmitter operates on 8 to 35 Vdc with no load and is protected against reverse polarity connection.
Minimum operating voltages :

- 8 Vdc without options
- 10 Vdc with optional LCD meter

For Ex ia approval power supply must not exceed 28 Vdc.

Warm-up time

Operation within specification in less than 30 sec.

Update time

0.5 sec. approx.

Isolation voltage (test/operation)

1500 Vac/50 Vac

Output signal

Two-wire 4 to 20 mA dc., linear with ohms and mV or linear with true temperature for THC and RTD.
Digital process variable superimposed on 4 to 20 mA signal. HART® digital communication.

Max. offset (input)

50% of maximum span value

Temperature limits

Ambient

-40 and +85°C (-40 and +185°F)

Humidity

0 to 90% RH

PERFORMANCE SPECIFICATIONS

For data where two values are stated the greater one should be considered for the specific case. If not otherwise stated values as % should be considered percent of calibrated span.

COMMON CHARACTERISTICS

Linearity error

< 0.1%

Temperature coefficient

<± 0.005% / °C

Signal/noise ratio

min. 60 dB

Supply voltage

Within voltage/load specified limits the total effect is less than 0.005% / V.

Load

Within load/voltage specified limits the total effect is less than 0.01% /100Ω.

EM/RFI

Meets EN50081 for emission and EN50082 for immunity when instrument is properly installed with or without output meter.

Vibration/shock

IEC 68-2-6 Test FC
Lloyd's specification no. 1 : 4g / 2-100 Hz

THC INPUT

Basic accuracy

- type E, J, K, L, N, T, U : < ± 0.5°C or ± 0.1%
- type B, R, S, W3, W5 : <± 1°C or ± 0.1%
- cold junction compensation (CJC) : < ± 1.0°C
- external CJC with Ni 100 or Pt 100 : Tamb from -40°C to +135°C.

Temperature coefficient

- type E, J, K, L, N, T, U
 - span <500°C : ± 0.025°C/°C
 - span >500°C : ± 0.005%/°C
- type B, R, S, W3, W5 : < 0.1°C/°C

VOLTAGE INPUT

Basic accuracy

± 0.01 mV or ± 0.1%

Temperature coefficient

± 0.5 μV / °C or ± 0.005% / °C

Input resistance

10 MΩ

RTD INPUT

Basic accuracy

Pt100/1000 : ± 0.1°C or ± 0.1%
Pt 50/200/500 : ± 0.2°C or ± 0.1%
Ni 100 : ± 0.2°C or ± 0.1%

Sensor current

nom. 0.2 mA

Temperature coefficient

Pt100/1000 : ± 0.005°C/°C or ±0.005% /°C
Pt 50/200/500 : ± 0.01°C/°C or ± 0.005% /°C
Ni 100 : ± 0.005°C / °C or ± 0.005% /°C

Effect of sensor cable resistance (3/4 wire)

<0.002 Ω/Ω

Max. cable resistance per wire

5 Ω

LINEAR RESISTANCE INPUT

Basic accuracy

± 0.1 Ω or ± 0.1%

Temperature coefficient

± 0.005 Ω / °C or ± 0.005% / °C

Sensor current

nom. 0.2 mA

Effect of sensor cable resistance (3/4 wire)

< 0.002 Ω/Ω

Max. cable resistance per wire

5 Ω

PHYSICAL SPECIFICATIONS

Measuring Elements

Mounting

Choice of spring-mounted (to ensure element tip contact) or rigid mounting

Construction

6mm OD stainless steel sheath

Thermoelements

Pt 100 resistance thermometers 2,3,4 wires Class A and B, to IEC 751 / DIN 43760, BS 1904
 Thermocouples type K,J,E,T to IEC 584, BS4937 Pt4, DIN 43710
 Special version thermocouples or resistance thermometers available upon request

Electrical Termination Heads

General purpose type

- Aluminium alloy head with silver acrylic paint finish
- Screw cap with retaining chain
- IP68
- Electrical entry: 1/2" NPT direct
CM 20, Pg 16, 3/4" NPT via adapter

Corrosion resistant type

- ABS head, colour black, with screw cap (max. temperature 70°C/158°F)
- IP67
- Electrical entry : 1/2" NPT direct; CM 20 via adapter

General Purpose DIN type

- Aluminium alloy head and pressed lid, silver acrylic paint finish
- Lid secured with plated screw
- IP65
- Electrical entry : 1/2" NPT direct; Pg 16 via adapter

Offshore type

- 316 stainless steel head with screw cap and retaining chain
- IP67
- Electrical entry : 1/2" NPT direct; Pg 16 via adapter

Thermowells

- 316 stainless steel fabricated thermowell.
 - Pocket material 12mm OD x 2mm-wall tube.
 - Instrument connection 1/2 in. NPT (or BSPP) female
 - Process connection
Threaded : 1/2", 3/4", 1" NPT male
Flanged : 1/2" ANSI 150 or 300 RF
- Custom-designed thermowells available on request.

Extensions and Unions

Adjustable Union

Stainless steel adjustable compression gland with 1/2 in. NPT (or BSPP) taper process connection (not to be used for pressure applications)

Extensions

316 stainless steel round extension nipples threaded 1/2 in. NPT (or BSPP) male at each end

Union and Extensions

316 stainless steel adjustable union and 2 off 316 stainless steel round extension nipples. All parts with 1/2 in NPT (or BSPP) threads.

Hazardous atmospheres

Intrinsic Safety

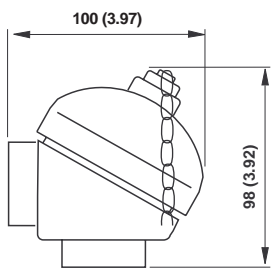
CENELEC DEMKO approval EEx ia IIC T4 (Tamb -40 to +85°C)/T6 (Tamb -40 to +60°C)

Terminals block

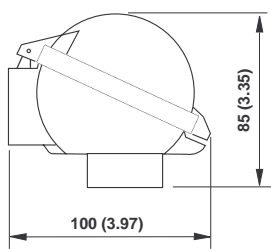
two terminals for 4-20 mA output signal and three or four terminals for input signal, wiring up to 1.5 mm² (16 AWG)

DIMENSIONS AND MOUNTING DETAILS (Not for construction unless certified)

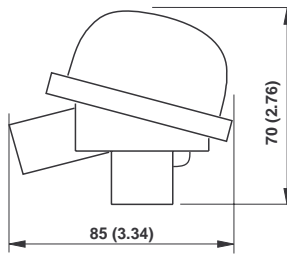
• Mounting heads



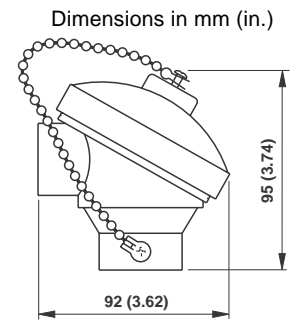
General purpose



General purpose DIN

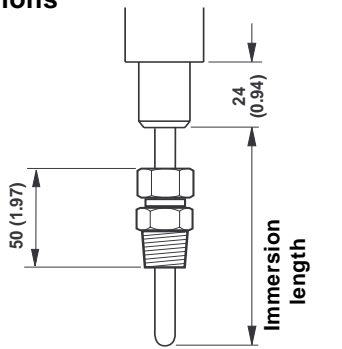


Corrosion resistant

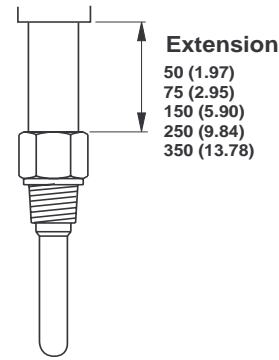


Offshore

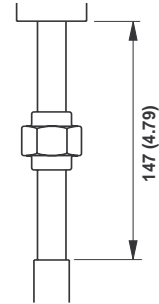
• Extensions



Adjustable union
(only for rigid mounting)



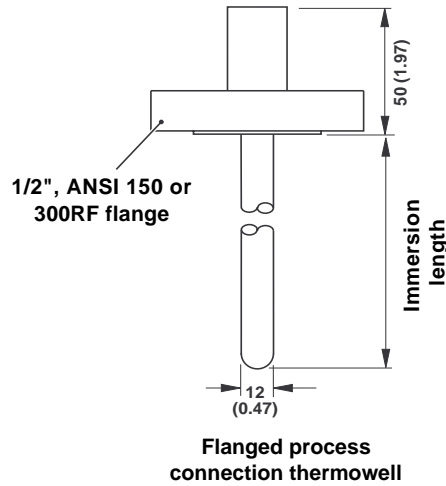
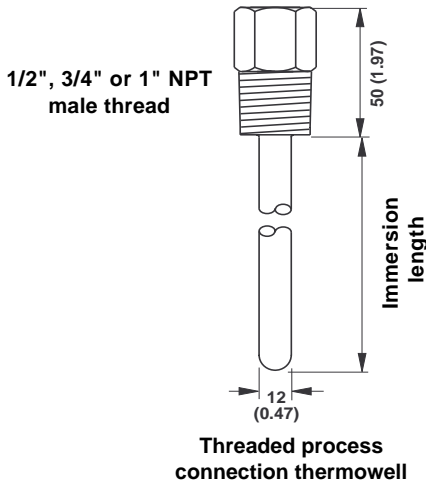
Extension



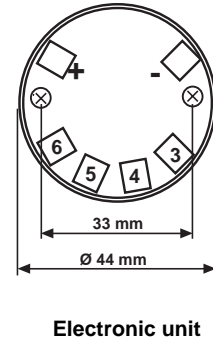
Union and Extension

Dimensions in mm (in.)

• Thermowells



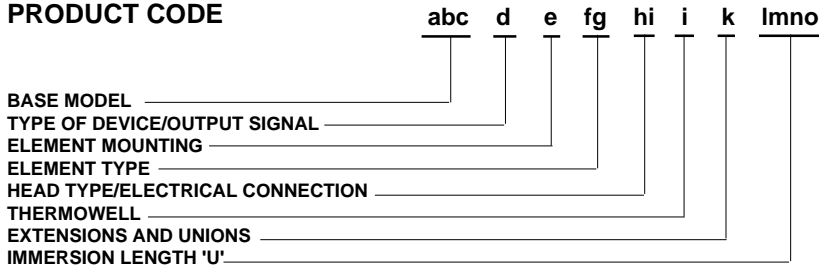
• Electronics



ORDERING INFORMATION

Select one character or set of characters from each category and specify complete catalog number.

PRODUCT CODE



abc	BASE MODEL - 1st to 3rd characters	Code
	Temperature Transmitter	652

d	TYPE OF DEVICE/OUTPUT SIGNAL - 4th character	
	Measuring element only	1
	Programmable range transmitter - General Purpose non isolated	3
	Programmable range transmitter - Intrinsic Safety non isolated	4
	Programmable range transmitter - General Purpose isolated	5
	Programmable range transmitter - Intrinsic Safety isolated	6
	Smart transmitter with HART Protocol - General Purpose isolated	7
	Smart transmitter with HART Protocol - Intrinsic Safety isolated	8
	Custom electronics (refer to local sales Company)	9

e	ELEMENT MOUNTING - 5th character	
	Spring mounted	S
	Rigid	R
	None (Transmitter electronics only, code 3 to 8 at position 'd')	0

fg	ELEMENT TYPE - 6th and 7th characters	
	2 wire RTD class A (not available with code 3 or 4 at position "d")	2A
	3 wire RTD class A	3A
	4 wire RTD class A (not available with code 3 or 4 at position "d")	4A
	2 wire RTD class B (not available with code 3 or 4 at position "d")	2B
	3 wire RTD class B	3B
	4 wire RTD class B (not available with code 3 or 4 at position "d")	4B
	Thermocouple type K (not available with code 3 or 4 at position "d")	KS
	Thermocouple type J (not available with code 3 or 4 at position "d")	JS
	Thermocouple type E (not available with code 3 or 4 at position "d")	ES
	Thermocouple type T (not available with code 3 or 4 at position "d")	TS
	Other (to be specified)	99
	None (transmitter electronics only; code 3 to 8 position "d")	00

hi HEAD TYPE / ELECTRICAL CONNECTIONS - 8th to 9th characters

Cast Aluminium Alloy Silver Painted, IP 68	1/2" NPT (see note)	12
	CM 20 (see note)	13
	Pg 16 (see note)	14
	3/4" NPT (IP 65) (see note)	15
Cast Aluminium, DIN Form B Silver Painted, IP 65	1/2" NPT (see note)	22
	Pg 16 (see note)	24
ABS, IP 67	1/2" NPT (see note)	32
	CM 20 (see note)	33
Stainless Steel, IP67	1/2" NPT (see note)	52
	CM 20 (see note)	53
None (DIN Rail mounting of transmitter electronics only) (see note)		61
Special, to customer order (see note)		99
None (element or transmitter electronic only)		00

Note : Not available with code 1 at position 'd'

THERMOWELL (lagging extension = 50 mm) - 10th character

j Process connection type	Material & form	Flange material	
None (element or transmitter electronics only)	-	-	0
1/2" NPT - m	AISI 316 - Pipe	-	1
3/4" NPT - m	AISI 316 - Pipe	-	2
1" NPT - m	AISI 316 - Pipe	-	3
Flange 1/2" ANSI 150	AISI 316 - Pipe	AISI 316	S
Flange 1/2" ANSI 300	AISI 316 - Pipe	AISI 316	T
Special, to custom order			9

k EXTENSIONS AND UNIONS - 11th character

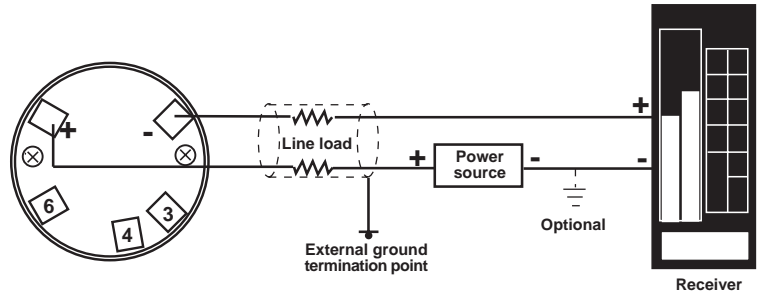
None (transmitter electronics only; code 3 to 8 at position "d")	0
Adjustable union (only available with code R at position "e")	1
50 mm	2
75 mm	3
150 mm	4
250 mm	5
350 mm	6
Qty 2,50 mm. ss. extension and 1/2" union (only available with code S at position "e")	7
Special, to custom order	9

Imno IMMERSION LENGTH "U" - 12th character

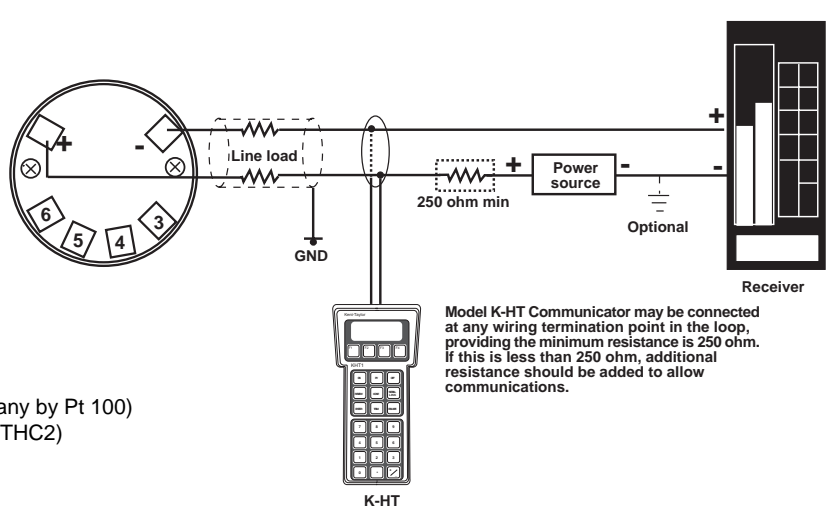
Element only	100 mm	0100
	150 mm	0150
	200 mm	0200
	250 mm	0250
	300 mm	0300
	350 mm	0350
	400 mm	0400
	450 mm	0450
	500 mm	0500
	550 mm	0550
	600 mm	0600
	650 mm	0650
	700 mm	0700
	750 mm	0750
	800 mm	0800
	Thermowell and element	850 mm
900 mm		0900
1000 mm		1000
100 mm		100T
150 mm		150T
200 mm		200T
250 mm		250T
300 mm		300T
350 mm		350T
400 mm		400T
450 mm		450T
500 mm		500T
550 mm		550T
600 mm		600T
650 mm		650T
700 mm		700T
750 mm	750T	
800 mm	800T	
850 mm	850T	
900 mm	900T	
1000 mm	K00T	
None (transmitter electronics only, code 3 to 8 at position "d")		0000

ELECTRICAL CONNECTIONS

INPUT TYPE	TERMINAL CONNECTION
Resistance thermometer and Linear resistance	Terminals 3 and 6 = inputs Terminal 4 = 3rd wire



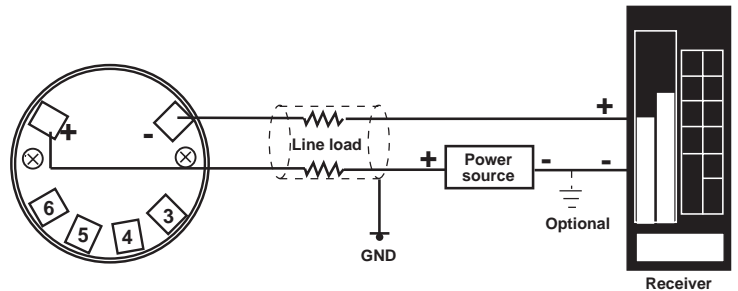
INPUT TYPE	TERMINAL CONNECTION
Thermocouple and voltage	Terminal 5 = positive Terminal 4 = negative
Resistance thermometer and Linear resistance	Terminals 3 and 6 = inputs Terminal 4 = 3rd wire (if any) Terminal 5 = 4th wire (if any)
Differential thermocouple	Terminal 6 = negative THC 1 and 2 Terminal 5 = positive THC 1 Terminal 4 = positive THC 2
Differential resistance thermometer	Terminals 5 and 6 = inputs RTD 1 Terminals 3 and 5 = inputs RTD 2



NOTES :

- Use terminals 3 and 6 for external CJC of thermocouple (if any by Pt 100)
- Differential measurement computes RTD1 - RTD2 (THC1 - THC2)

INPUT TYPE	TERMINAL CONNECTION
Thermocouple and voltage	Terminal 5 = positive Terminal 4 = negative
Resistance thermometer and Linear resistance	Terminal 3 and 6 = inputs Terminal 4 = 3rd wire (if any) Terminal 5 = 4th wire (if any)



NOTE: Use terminals 3 and 6 for external CJC of thermocouple (if any by Pt 100)



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ABB Automation Inc.
125 East County Line Road
Warminster, Pa.
18974-4995 USA
Tel. (215) 674-6693/6320/6777
Facsimile (215) 674-7184

The Company's policy is one of continuous product improvement and the right is reserved to modify the specifications contained herein without notice.