



## Transmitters



## 150T Series

### RTD Input

#### Input Ranges

- 100 ohm Platinum (385/392) RTD (2, 3, or 4-wire connection)
- 10 ohm Copper RTD (2 or 3-wire)
- Differential RTD (two 100 ohm Pt-385/392 RTDs, 4-wire)

#### Output Range

4 to 20mA DC

#### Power requirement

12 to 50V DC, loop-powered

#### Approvals

CSA and FM

Intrinsically Safe

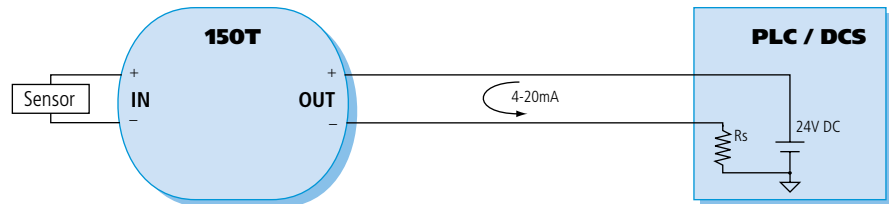
Class I; Division 1; Groups A, B, C, D

Hazardous Location

Class I; Division 2; Groups A, B, C, D

1500 Series

## 150T Loop-Powered Transmitter



### Description

These loop-powered transmitters convert low level sensor inputs to proportional process current output signals. The output and power share the same pair of wires.

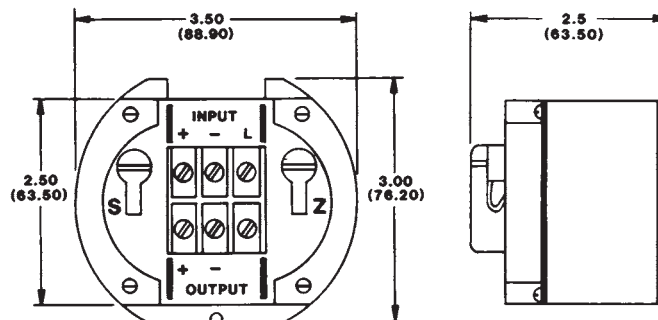
Units are not isolated. Input sensor must be isolated from ground if the output circuit is grounded.

These two-wire transmitters deliver outstanding performance and a broad range of flexibility for remote or control room mounting. They feature rugged construction and remain stable even in harsh industrial environments.

### Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of noise.
- Wide range zero and span adjustment enable precise calibration.
- RTD signal linearization improves accuracy and reduces drift.
- RTD break detection indicates open RTD failures with field-selectable upscale/downscale operation (downscale only for differential RTD input).
- RTD lead wire compensation eliminates the effect of the wire's resistance.

## 150T Dimensions



Dimensions are in inches (millimeters).



## Single RTD Input Models

The following specifications are for single RTD input models. Specifications for differential input models are listed on the next page.

### Performance

#### Reference Test Conditions

-RBP:

Input: 100 ohm, 3-wire Platinum, 0-100°C, (Alpha = 0.00385);

Output: 4-20mA into 500 ohm load;

-RBC:

Input: 10 ohm, 3-wire Copper (9.035 ohms at 0°C), 0 to 100°C;

Output: 4-20mA into 500 ohm load

Ambient temperature: 77°F (25°C)

Power supply: 24V DC supply.

### Input

#### Input range

-RBP: 100 ohm Platinum Resistance Temperature Sensor (RTD), 2, 3, or 4 wire connection. Standard calibration is based on the international R vs. T curve having an alpha of 0.00385 ohms/ohm/°C (Pt-385). Unit can also be calibrated for sensors having an alpha of 0.003925 ohms/ohm/°C (Pt-392). Excitation current is 1.0mA DC. The span and zero adjustment is a function of the RTD range code. Note: Linearization is maintained for any calibration within defined range.

-RBC: 10 ohm Copper Resistance Temperature Sensor (RTD), 2 or 3 wire connection. Standard calibration is based on a Copper RTD, 9.035 ohms at 0°C.

Maximum excitation is 2.0mA DC. The span and zero adjustment range is a function of the RTD range code. Note: Copper sensor is linear between -50°C and 150°C per manufacturers tables.

#### Linearization

The unit linearizes the RTD signal to provide an output signal that represents the percent of span value of the measured temperature.

#### RTD Break Detection

Standard units shipped with upscale detection; jumper J1 out. If unit is ordered with downscale detection, J1 will be installed.

#### Lead Wire Compensation

-RBP: Zero shift is less than 0.01% per ohm of lead resistance, for up to 10 ohms per leg, with a total maximum shift of 0.1%.

-RBC: Zero shift is less than 0.05% per ohm of lead resistance, for up to 10 ohms per leg, with a total maximum shift of 0.5%.

### Output

#### Output Range

4-20mA DC output.

#### Output Limits (approximate)

3.8mA DC to 30mA DC

#### Output Ripple

Less than ±0.05% of maximum output span.

#### Current Drive Capability

$R_{LOAD} (max.) = (V_{SUPPLY} - 12V)/20mA$ .

At  $V_{SUPPLY} = 24V$ ,  $R_{LOAD} = 0$  to 600 ohms

#### Load Resistance Effect

+25nA, typical. Less than ±0.005% of output span for 100 ohm change.

#### Accuracy

Includes combined effects of transmitter repeatability, hysteresis, terminal point linearity and adjustment resolution. Does not include sensor error.

-RBP: ±0.1% of calibrated span or ±0.1°C whichever is greater for spans up to 720°F (400°C); ±0.25% of calibrated span for spans greater than 720°F (400°C).

-RBC: ±0.25% of calibrated span or ±0.25°C whichever is greater.

#### Response Time

For a step input the output reaches 98% of output span in 350ms, typical.

#### Bandwidth

-3dB at 3 Hz, typical

### Power

#### Power Supply

External loop power supply required, minimum 12V DC, maximum 50V DC. Unit has reverse polarity protection.

#### Power Supply Effect

DC Volts: ±0.001% of output span per volt DC.  
60/120 Hz ripple: ±0.01% of span per volt peak to peak of power supply ripple.

### Environmental

#### Ambient Temperature Range

-15 to 185°F (-25 to 85°C)

#### Ambient Temperature Effect (Combined effects of zero and span over temperature)

-RBP: Less than ±0.01% of output span per °F (±0.018% per °C) over ambient temperature range for reference test conditions.

-RBC: Less than ±0.025% of output span per °F (±0.045% per °C) over ambient temperature range for reference test conditions.

#### Isolation

No input circuit isolation, input sensor must be isolated from ground if the output circuit is grounded.

#### EMI Resistance

Less than ±0.25% of output span effect with switching solenoids or commutator motors.

#### Noise Rejection:

Common Mode: Not applicable; non-isolated.

Normal Mode: 26dB at 60 Hz, 100 ohm source; 20dB at 60 Hz, 10 ohm source.

#### RFI Resistance

Less than ±0.5% of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

#### Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

#### Approvals (CSA, FM)

Intrinsically Safe

Class I; Division 1; Groups A, B, C, D.

Hazardous Location

Class I; Division 2; Groups A, B, C, D.

### Physical

#### Case

Self-extinguishing polypropylene UL94 V-O, recognized by CSA, color blue.

#### Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

#### Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

#### Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

#### Mounting Position Effect

Position insensitive.

#### Shipping Weight

One (1) pound (0.45 kg.) packed.



## Differential RTD Input Models

The following specifications are for differential RTD input models. Specifications for single input models are listed on the previous page.

### Performance

#### Reference Test Conditions

Input: RTD Hot (RTD-1), maximum differential temperature span per range code, RTD Cold (RTD-2) 0°C, 2-wire Platinum Resistance Bulbs (Alpha = 0.00385), equal lead lengths;  
Output: 4 to 20 mA into 500 ohm load.  
Ambient temperature: 77°F (25°C)  
Power supply: 24V DC.

### Input

#### Input Ranges

Two RTDs; for best accuracy, use matched RTDs.  
-DRP: 100 ohm Platinum Resistance Temperature Sensor (RTD), 2, or 4 wire (Compensating Loop), standard calibration is based on the international R vs. T curve having an alpha of 0.00385 ohms/ohm/°C (Pt-385). Unit can also be calibrated for sensors having an alpha of 0.003925 ohms/ohm/°C (Pt-392). The span and zero adjustment is a function of the RTD range code.

#### Range Code

Differential Input Span, field adjustable. Cold sensor range -100 to 400°C. (-150 to 750°F).

- TRB: Span 10 to 25°C (20 to 50°F)
- TRA: Span 25 to 50°C (50 to 100°F)
- TR1: Span 50 to 100°C (100 to 200°F)
- TR2: Span 100 to 200°C (200 to 400°F)

NOTE: Zero adjustment: 0 to 50% of span, allows output to be set anywhere from 4 mA to 12 mA when RTD 1 equals RTD 2.

#### Linearization

The unit linearizes the differential RTD signal to provide an output signal that represents the percent of span value of the measured differential temperature.

#### Lead Wire Compensation

- A. Two Wire RTDs: No lead compensation, equal lead lengths to both RTDs recommended.
- B. Four Wire RTD (compensating loop type): Zero shift less than 0.01% per ohm lead resistance each leg, per RTD sensor. Lead resistance, 10 ohms maximum per leg, with a total maximum shift of ±0.1%.

#### RTD Break Detection

- RTD-1: Inherent upscale break detection.
- RTD-2: Inherent downscale break detection.

### Output

Output  
4 to 20 mA DC output

#### Output Limits (approximate)

3.8 mA DC to 30 mA DC.

#### Output Ripple

Less than ±0.05% of maximum output span.

#### Current Drive Capability

$R_{LOAD} (max.) = (V_{SUPPLY} - 12V) / 20mA$   
At  $V_{SUPPLY} = 24V$ ,  $R_{LOAD} = 0$  to 600 ohms

#### Load Resistance Effect

Less than +0.005% of output span for 100 ohm change.

#### Accuracy

For a specific temperature span calibration and for measured temperatures above (-)100°C, see range codes below.

- TRB: = ±0.18°F (±0.10°C)
- TRA: = ±0.18°F (±0.10°C)
- TR1: = ±0.45°F (±0.25°C)
- TR2: = ±0.90°F (±0.50°C)

A. Accuracy includes combined effects of transmitter repeatability, hysteresis, terminal point linearity and adjustment resolution. Does not include sensor error.

B. Due to non-linearity of the RTD temperature vs resistance curve, a constant temperature span results in different resistance spans over the temp. range of the RTD. The unit should be calibrated in the area of interest.

#### Response Time

For a step input the output reaches 98% of output span in 350 ms, typical.

#### Bandwidth

-3 dB at 3 Hz, typical.

### Power

#### Power

External loop power supply required, minimum 12V DC, maximum 50V DC. Unit has reverse polarity protection.

#### Power Supply Effect

DC Volts: ±0.001% of output span per volt DC.  
60/120 Hz ripple: ±0.01% of span per volt peak to peak of power supply ripple.

### Environmental

#### Ambient Temperature Range

-15 to 185°F (-25 to 85°C).

#### Ambient Temperature Effect

Performance includes combined effect of zero and span over ambient temperature range and reference test conditions.

-TRB: Less than ±0.02% of output span per °F (±0.036%/°C).

-TRA, -TR1, -TR2: Less than ±0.01% of output span per °F (±0.018%/°C).

#### Isolation

No input circuit isolation, input sensor must be isolated from ground if the output circuit is grounded.

#### RFI Resistance

Less than ±0.5% of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

#### EMI Resistance

Less than ±0.25% of output span effect with switching solenoids or commutator motors.

#### Noise Rejection

Common Mode: Not applicable; non-isolated.  
Normal Mode: 26 dB at 60 Hz, 100 ohm source.

#### Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

#### Approvals (CSA, FM)

Intrinsically Safe  
Class I; Division 1; Groups A, B, C, D.

Hazardous Location

Class I; Division 2; Groups A, B, C, D.

### Physical

#### Case

Self-extinguishing polypropylene UL94 V-0, recognized by CSA, color blue.

#### Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

#### Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

#### Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

#### Mounting Position Effect

Position insensitive.

#### Shipping Weight

One (1) pound (0.45 kg.) packed.



## Ordering Information

### Transmitter Models

NOTE 1: To add factory calibration, append "-C" to end of model number. Specify ranges on order  
Ordering example: 150T-RBP-M15A-X-20-C.

NOTE 2: For agency approvals, add "CSA-" or "FM-" prefix to model number.  
Ordering example: FM-150T-RBP-M15A-X-20.

#### 150T-RBP-(code 1)-X-20

Transmitter, 100 ohm Pt RTD input,  
select range code from Chart #1 [replace '(code 1)' with desired range code number]

#### 150T-RBC-(code 1)-X-20

Transmitter, 10 ohm Cu RTD input,  
select range code from shaded region of Chart #1 [replace '(code 1)' with desired range code number]

#### 150T-DRP-(code 2)-X-20

Transmitter, Differential input, (two 100 ohm Pt RTDs)  
select range code from Chart #2 [replace '(code 2)' with desired range code number]

## Accessories

### Power supplies

See Power Supplies on page 213.

#### 150T-N4

NEMA 4 enclosure, water-tight.

#### 150T-N12

NEMA 12 enclosure, oil-tight.

#### 150T-XJSM-WM

#### 150T-XJSM-PM

Explosion-proof enclosure (-WM for wall-mount or -PM w/pipe-mount hardware).

#### 150T-SM-3.5

Mounting rail, 3.5" (holds one 150T) or 24" long.

#### 150T-MSM

Metal surface mounting bracket.

#### 150T-DRA

DIN rail adapter.

## Range Code Chart #1 (-RBP/RBC)

	0C (0F)	25C (45F)	50C (90F)	100C (180F)	200C (360F)	400C (720F)	800C (1440F)
		← SPAN ADJUST →			(Model Suffixes)		
-200C (-328F)		*M220	M201	M202	M204	M208	
-150C (-238F)		M15A	M151	M152	M154	M158	
-100C (-148F)		M10A	M101	M102	M104	M108	
-50C (-58F)		M05A	M051	M052	M054	M058	
0C (32F)		P00A	P001	P002	P004	P008	
+50C (+122F)		P05A	P051	P052	P054	P058	
+100C (+212F)		P10A	P101	P102	P104	P108	
+150C (+302F)		P15A	P151	P152	P154	P158	
+200C (+392F)		P20A	P201	P202	P204	P208	
+250C (+482F)		P25A	P251	P252	P254		
+300C (+572F)		P30A	P301	P302	P304		
+350C (+662F)		P35A	P351	P352	P354		
+400C (+752F)		P40A	P401	P402	P404		
+450C (+842F)		P45A	P451	P452			
+500C (+932F)		P50A	P501	P502			
+550C (+1022F)		P55A	P551				
+600C (+1112F)							

150T-RBC range codes are limited to shaded regions. All ranges above are supported on 150T-RBP models.

## RTD Range Code Chart #2 (-DRP)

Range code: Differential input span, field-adjustable.

Cold sensor range -150 to 750°F (-100 to 400°C)

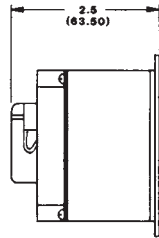
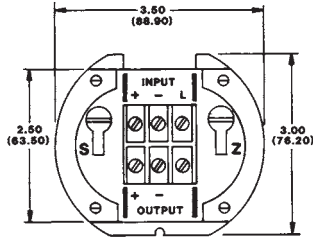
Code	Description
-TRB	Span: 20 to 50°F (10 to 25°C)
-TRA	Span: 50 to 100°F (25 to 50°C)
-TR1	Span: 100 to 200°F (50 to 100°C)
-TR2	Span: 200 to 400°F (100 to 200°C)

Zero adjustment: 0 to 50% of span, allows output to be set anywhere from 4mA to 12mA when RTD<sub>1</sub> = RTD<sub>2</sub>.

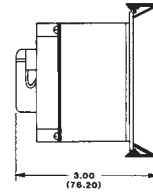
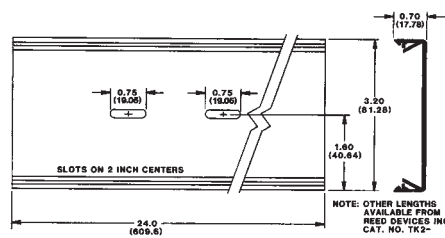


## 100T, 150T, 150I Dimensions

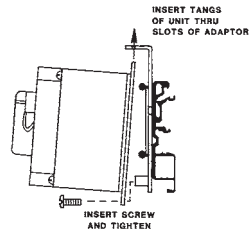
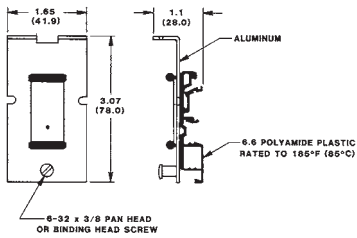
### 100T/150T/150I Housing



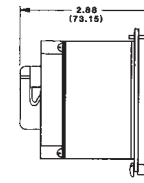
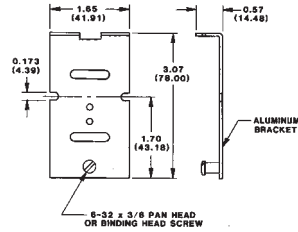
### 150T-SM-24 Mounting Rail



### 150T-DRA Adapter



### 150T-MSM Bracket



### 150T-N4, NEMA4 150T-N12, NEMA12

