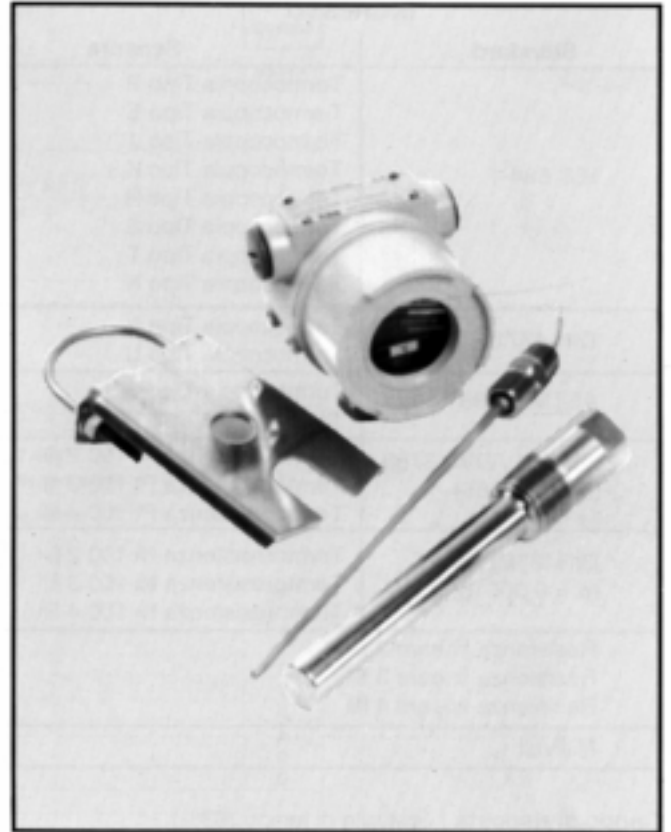


**Model 653S**  
**Electronic configurable**  
**temperature transmitter (HART®)**

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- **High flexibility and wide rangeability**
- **Single transmitter accepts RTD/THC/mV/ohm**
- **Differential measurement capability**
- **Galvanically isolated from sensor**
- **Primary element and calibration selectable**
- **User-selectable output drive under input failure conditions**
- **Complies with relevant IEC requirements for test procedure and environmental protection**
- **CENELEC Intrinsic Safety / Flameproof and Factory Mutual approvals**
- **Configurable to the actual application by standard PC**
- **Digital communications HART® 5**



***600T Series transmitter***  
***A complete family of process transmitters providing high performance in real operating conditions***

## FEATURES

Model 653S electronic transmitter is an extension of the Kent-Taylor 2-wire analog product line.

It is designed for factory setting, in order to meet the specific application requirement of measuring low level signals from thermocouples (THC), resistance thermometer (RTD), resistance (ohm) or e.m.f. (mV) sources.

Model 653S offers a standard communication capability using the proven HART® protocol. The instrument can be easily reconfigured for actual requirements by simple procedures through a standard PC equipped with a specific software available on request. (Part no. AN0239).

The temperature transmitter can be mounted directly on a thermowell and thermowell extension, or it can be mounted remotely on a pipestand.

The transmitter assures operational security by using non-volatile memory and also handling up/down scale procedure under sensor anomalies.

Compact, rugged, lightweight, easy to install and service, Kent-Taylor transmitters provide consistently reliable and stable performance under all types of process conditions, coupled with minimum maintenance requirements

## FUNCTIONAL SPECIFICATIONS

| INPUT SOURCE                                 |                                       | MEASURING RANGE                       | MIN SPAN      |
|--|---------------------------------------|---------------------------------------|---------------|
| Standard                                     | Sensor                                |                                       |               |
| IEC 584-1                                    | Thermocouple Type B                   | + 400 to + 1820°C (+ 752 to + 3308°F) | 100°C (180°F) |
|  | Thermocouple Type E                   | - 100 to + 1000°C (- 148 to + 1832°F) | 50°C (90°F)   |
|  | Thermocouple Type J                   | - 100 to + 1200°C (- 148 to + 2192°F) | 50°C (90°F)   |
|  | Thermocouple Type K                   | - 180 to + 1370°C (- 292 to + 2498°F) | 50°C (90°F)   |
|  | Thermocouple Type R                   | - 50 to + 1760°C (- 58 to + 3200°F)   | 100°C (180°F) |
|  | Thermocouple Type S                   | - 50 to + 1760°C (- 58 to + 3200°F)   | 100°C (180°F) |
|  | Thermocouple Type T                   | - 200 to + 400°C (- 328 to + 752°F)   | 50°C (90°F)   |
|  | Thermocouple Type N                   | - 180 to + 1300°C (- 292 to + 2372°F) | 50°C (90°F)   |
| DIN 43710                                    | Thermocouple Type L                   | - 100 to + 900°C (- 148 to + 1652°F)  | 50°C (90°F)   |
|  | Thermocouple Type U                   | - 200 to + 600°C (- 328 to + 1112°F)  | 50°C (90°F)   |
| ASTM E 998                                   | Thermocouple Type W3                  | 0 to + 2300°C (+32 to + 4172°F)       | 100°C (180°F) |
|  | Thermocouple Type W5                  | 0 to + 2300°C (+32 to + 4172°F)       | 100°C (180°F) |
| IEC 751 / DIN43760<br>( $\alpha = 0.00385$ ) | Resistance thermometer Pt 100 2 wires | - 200 to + 850°C (- 328 to + 1562°F)  | 10°C (18°F)   |
|  | Resistance thermometer Pt 100 3 wires | - 200 to + 850°C (- 328 to + 1562°F)  | 10°C (18°F)   |
|  | Resistance thermometer Pt 100 4 wires | - 200 to + 850°C (- 328 to + 1562°F)  | 10°C (18°F)   |
| DIN43760<br>( $\alpha = 0.00618$ )           | Resistance thermometer Ni 100 2 wires | - 60 to + 250°C (-76 to + 482°F)      | 10°C (18°F)   |
|  | Resistance thermometer Ni 100 3 wires | - 60 to + 250°C (-76 to + 482°F)      | 10°C (18°F)   |
|  | Resistance thermometer Ni 100 4 wires | - 60 to + 250°C (-76 to + 482°F)      | 10°C (18°F)   |
| Linear resistance 2 wires                    |                                       | 0 to 7000 $\Omega$                    | 25 $\Omega$   |
| Linear resistance 3 wires                    |                                       | 0 to 7000 $\Omega$                    | 25 $\Omega$   |
| Linear resistance 4 wires                    |                                       | 0 to 7000 $\Omega$                    | 25 $\Omega$   |
| Voltage (millivolt)                          |                                       | -800 to +800 mV                       | 2.5 mV        |

**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.

### Optional output meter

LCD : 3 1/2 digit ( $\pm 1999$  counts) with 10 mm (3/8 in) high, 7-segment characters. Engineering unit labels are provided.

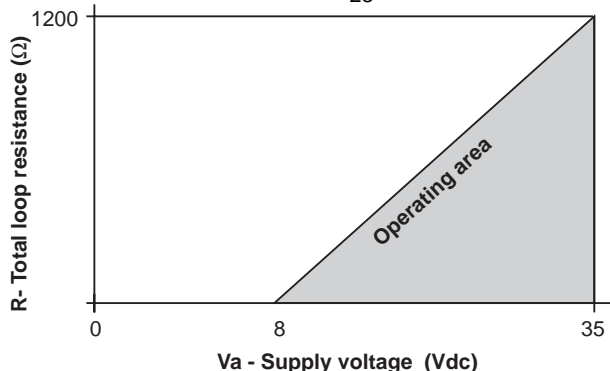
### Max. offset (input)

50% of maximum span value

### Load limitations

Total loop resistance including optional remote indicator line : see figure.

$$R(k\Omega) = \frac{\text{Supply voltage} - \text{min. operating voltage (Vdc)}}{23}$$



### Temperature limits

#### Ambient

-40 and +85°C (-40 and +185°F)  
with LCD meter : -20 and +80°C (-4 and +176°F)

#### Storage

-50 and +120°C (-58 and +248°F)  
with LCD meter : -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

#### 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/shock

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 : < ± 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 : T<sub>amb</sub> 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

## Configuration

Unless otherwise specified transmitters are supplied as follows :

### Standard configuration

- Sensor type (RTD): IEC 751 Pt 100 3-wire ( $\alpha = 0.00385$ )
- 4-20 mA values : 0-100°C
- Response time : 1 sec.
- Software Tag : Blank
- Output : Linear with temperature
- Broken sensor drive : Upscale

### Optional LCD meter : 0 to 100% linear

Customer may specify the above items at no charge.

Any or all the previous configurable parameters, including Lower range-value and Upper range-value can be easily changed using the K-HT hand-held communicator. The transmitter database is customized with specified code option and specific data.

The following data may be specified in addition to standard configuration parameters.

### Custom configuration (option)

- Descriptor : 16 alphanumeric characters
- Message : 32 alphanumeric characters
- Date : Day, month, year
- Response time: Seconds

### Custom configuration and trim to special sensor (option)

- As above
- Customer must specify the calibration schedule to which the transmitter is to be calibrated, in a Kent-Taylor specified format.

### Tagging

Transmitters will be tagged (wired-on) in accordance with specified customer requirements or left blank.

## PHYSICAL SPECIFICATIONS

### Materials

#### Housing and covers

Low copper aluminium alloy with baked epoxy finish;  
AISI 316 L ss

#### Covers O-ring

Buna N

#### Tagging

AISI 316 ss data plate attached to the electronics housing.

#### Mounting bracket (\*)

Zinc plated carbon steel with chrome passivation; AISI 316 L ss

### Optional extras

#### Output meter Plug-in rotatable type, LCD.

Standard LCD meter scale is 0 to 100% linear; special linear scale to specified range and engineering unit is available.

#### Supplemental customer tag

AISI 316 ss tag fastened to the transmitter with stainless steel wire for customer's tag data up to a maximum of 56 characters and spaces on two lines for tag number and tag name, and up to a maximum of 28 characters and spaces for calibration details.

### Configuration kit

Includes 3.5" configuration program disk, a RS232 interface unit, a cable set for transmitter and PC connection providing adaptor and the user manual (order as Part no. AN0239).

### Mounting bracket

For 60 mm. (2in) stand pipe or wall mounting.

## Environmental protection

### Wet and dust-laden atmospheres

The transmitter is dust and sand tight and protected against immersion effects as defined by IEC 529 (1989) to IP67.

Suitable for tropical climate operation as defined in DIN 40.040, application class GQC.

### Hazardous atmospheres

With or without output meter

INTRINSIC SAFETY

- CENELEC/DEMKO approval; certificate no. 97D.123302

EEx ia IIC T4 ( $T_{amb} -40$  to  $+85^{\circ}C$ )/T6 ( $T_{amb} -40$  to  $+60^{\circ}C$ )

FLAMEPROOF

- CENELEC/CESI Approval; certificate no. Ex-95.D.111

EEx d IIC T5 ( $T_{amb} -40$  to  $+85^{\circ}C$ )/T6 ( $T_{amb} -40$  to  $+70^{\circ}C$ )

FACTORY MUTUAL :

- Explosionproof: Class I, Div. 1, Groups B, C, D

- Dust ignitionproof : Class II, Div. 1, Groups E, F, G

- Suitable for : Class II, Div. 2, Groups F, G; Class III, Div. 1, 2

- Nonincendive: Class I, Div. 2, Groups A, B, C, D

- Intrinsically safe: Class I,II, III, Div. 1, Groups A, B, C, D, E, F, G

## Electrical connections

Two 1/2 NPT or M20 x 1.5 or PG 13.5 or 1/2 GK threaded conduit entries, direct on housing, both available for output/supply signal when the sensor is mounted remotely. Alternatively, one 1/2 NPT threaded entry for integrally mounted sensor and one 1/2 NPT or M20 x 1.5 or PG 13.5 or 1/2 GK threaded entry for output/supply signal, direct on housing.

### Terminal block

- two terminals for 4-20 mA output/supply signal wiring up to 2.5 mm<sup>2</sup> (14 AWG) and two jacks compatible with 3 mm dia miniature plugs.

- four terminals for input signal wiring up to 1.5 mm<sup>2</sup> (16 AWG)

### Grounding

Internal and external 6 mm<sup>2</sup> (10 AWG) ground termination points are provided

### Mass

1 kg approx (2 lbs) without sensor and options

### Packing

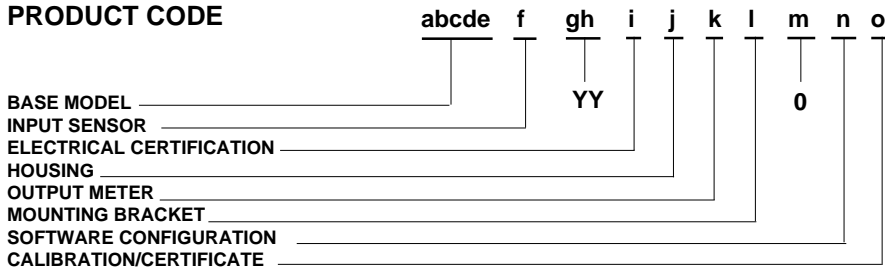
Expanded polythene box

(\*) U-bolt material : AISI 400 ss; screws material: high-strength alloy steel or AISI 316ss

# ORDERING INFORMATION

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

## PRODUCT CODE



|              |  |               |
|--------------|--|---------------|
| <b>abcde</b> | <b>BASE MODEL</b> - 1st to 5th characters    | <b>Codice</b> |
|              | Programmable Temperature Transmitter (HART®) | <b>653SY</b>  |

|          |   |          |
|----------|---|----------|
| <b>f</b> | <b>INPUT SENSOR</b> - 6th character                                     |          |
|          | Remote  | <b>1</b> |
|          | Integrally mounted (NOTE 1) (one 1/2" NPT CONNECTION ENTRY IS PROVIDED) | <b>5</b> |

NOTE 1 : quoted separately

|           |                        |           |
|-----------|------------------------|-----------|
| <b>gh</b> | 7th and 8th characters |           |
|           | Use code               | <b>YY</b> |

|          |   |          |
|----------|---|----------|
| <b>i</b> | <b>ELECTRICAL CERTIFICATION</b> - 9th character   |          |
|          | General Purpose   | <b>1</b> |
|          | Intrinsic Safety to CENELEC EN50014/20 DEMKO approval to EEx ia IIC T6/T4                   | <b>2</b> |
|          | Flameproof to CENELEC EN50014/18 CESI approval to EEx d IIC T6/T5 (NOTE 2)                  | <b>3</b> |
|          | Intrinsic Safety and Flameproof, as above, CESI approval (NOTE 2)                           | <b>U</b> |
|          | Factory Mutual (FM) (only available with Remote sensor and 1/2" NPT electrical connections) | <b>7</b> |

NOTE 2 : if integral sensor is required this must be supplied by ABB Kent-Taylor Lenno

**HOUSING** - 10th character

|          |                 |                               |          |
|----------|-----------------|-------------------------------|----------|
| <b>j</b> | <b>Material</b> | <b>Electrical connections</b> |          |
|          | Aluminium alloy | 1/2" NPT                      | <b>1</b> |
|          |                 | CM 20                         | <b>2</b> |
|          |                 | Pg 13.5                       | <b>3</b> |
|          | AISI 316 L ss   | 1/2" GK                       | <b>4</b> |
|          |                 | 1/2" NPT                      | <b>A</b> |
|          |                 | CM 20                         | <b>C</b> |
|          |                 | Pg 13.5                       | <b>D</b> |
|          |                 | 1/2" GK                       | <b>F</b> |

|          |  |          |
|----------|--|----------|
| <b>k</b> | <b>OUTPUT METER</b> - 11th character                           |          |
|          | None   | <b>1</b> |
|          | Digital LCD linear 0-100% user scalable                        | <b>3</b> |
|          | Digital LCD linear scale (specify range and engineering units) | <b>5</b> |

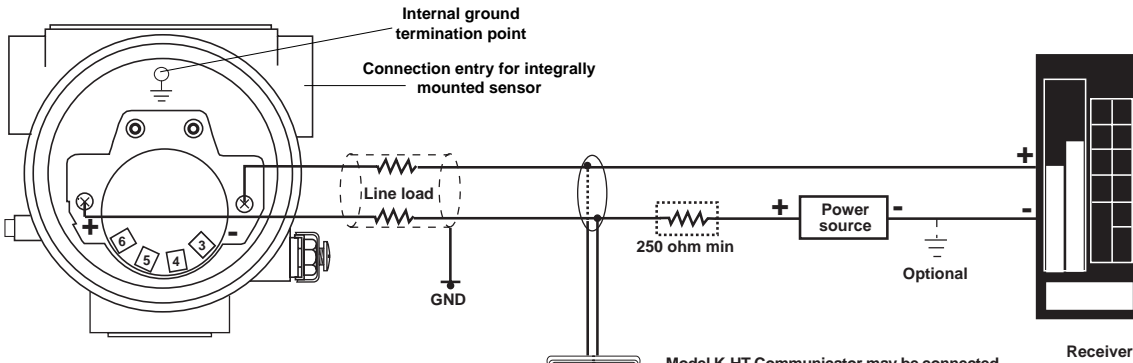
|          |  |          |
|----------|--|----------|
| <b>l</b> | <b>MOUNTING BRACKET</b> - 12th character |          |
|          | None                                     | <b>1</b> |
|          | Carbon steel                             | <b>2</b> |
|          | AISI 316 L ss                            | <b>3</b> |

|          |                |          |
|----------|----------------|----------|
| <b>m</b> | 13th character |          |
|          | Use code       | <b>0</b> |

|          |  |          |
|----------|--|----------|
| <b>n</b> | <b>SOFTWARE CONFIGURATION</b> - 14th character |          |
|          | Standard with temperature units deg. C         | <b>2</b> |
|          | Standard with temperature units deg. F         | <b>3</b> |
|          | Custom   | <b>4</b> |
|          | Custom with trim to special sensor             | <b>5</b> |

|          |   |          |
|----------|---|----------|
| <b>o</b> | <b>CALIBRATION CERTIFICATE</b> - 15th character             |          |
|          | Not required  | <b>1</b> |
|          | For the transmitter only                                    | <b>3</b> |
|          | For the transmitter and the integrally mounted input sensor | <b>4</b> |

## ELECTRICAL CONNECTIONS



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

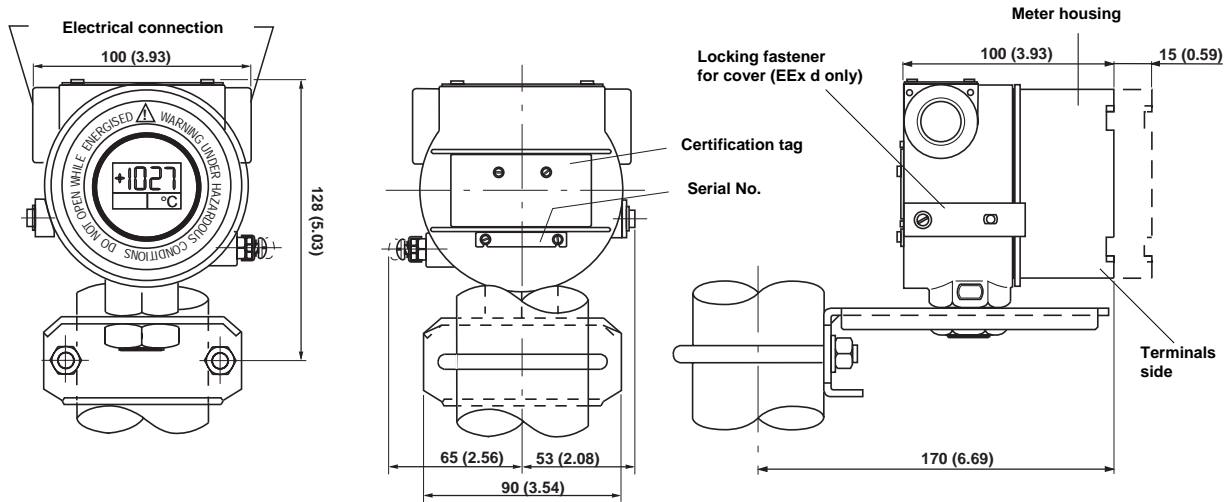


Model K-HT Communicator may be connected at any wiring termination point in the loop, providing the minimum resistance is 250 ohm. If this is less than 250 ohm, additional resistance should be added to allow communications.

**NOTES :**

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

## DIMENSIONS AND MOUNTING DETAILS (Not for construction unless certified)



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