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.

5623 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 emmission 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/°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
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 (-192 to +2192°F)
Minimum span: 50°C (90°F)

Thermocouple Type K (IEC 584-1)
Measuring range: -180 to +1370°C (-328 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; α = 0.00385)
Measuring range: -200 to +850°C (-328 to +1562°F)
Minimum span: 5°C (9°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.

EMI/RFI
Meets EN50081 for emmission 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 : <± ±0.1%
- cold junction compensation (CJC) : <± ±1.0°C
- external CJC with Ni 100 or Pt 100 : T amb from -40°C to +135°C.

Temperature coefficient
- type E, J, K, L, N, T, U : <± ±0.5°C or ± 0.1%
- span <500°C : <± ±0.25°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

Thermowell
- 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.

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

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
S16 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 (T amb -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

Dimensions in mm (in.)

Adjustable union
(only for rigid mounting)

Extension

Union and Extension

Adjustable Union

General purpose

General purpose DIN

Corrosion resistant

Offshore

Dimensions in mm (in.)

Adjustable union
(only for rigid mounting)

Extension

Union and Extension
ORDERING INFORMATION

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

PRODUCT CODE

<table>
<thead>
<tr>
<th>abc</th>
<th>Base Model - 1st to 3rd characters</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temperature Transmitter</td>
<td>652</td>
</tr>
</tbody>
</table>

**d** TYPE OF DEVICE/OUTPUT SIGNAL - 4th character

<table>
<thead>
<tr>
<th></th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring element only</td>
<td>1</td>
</tr>
<tr>
<td>Programmable range transmitter - General Purpose non isolated</td>
<td>3</td>
</tr>
<tr>
<td>Programmable range transmitter - Intrinsic Safety non isolated</td>
<td>4</td>
</tr>
<tr>
<td>Programmable range transmitter - General Purpose isolated</td>
<td>5</td>
</tr>
<tr>
<td>Programmable range transmitter - Intrinsic Safety isolated</td>
<td>6</td>
</tr>
<tr>
<td>Smart transmitter with HART Protocol - General Purpose non isolated</td>
<td>7</td>
</tr>
<tr>
<td>Smart transmitter with HART Protocol - Intrinsic Safety non isolated</td>
<td>8</td>
</tr>
<tr>
<td>Custom electronics (refer to local sales Company)</td>
<td>9</td>
</tr>
</tbody>
</table>

**e** ELEMENT MOUNTING - 5th character

<table>
<thead>
<tr>
<th></th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring mounted</td>
<td>S</td>
</tr>
<tr>
<td>Pigged</td>
<td>S</td>
</tr>
<tr>
<td>None (transmitter electronics only, code 3 to 8 at position 'd')</td>
<td>0</td>
</tr>
</tbody>
</table>

**f** ELEMENT TYPE - 6th and 7th characters

<table>
<thead>
<tr>
<th>Element Type</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 wire RTD class A (not available with code 3 or 4 at position 'd')</td>
<td>2A</td>
</tr>
<tr>
<td>3 wire RTD class A</td>
<td>3A</td>
</tr>
<tr>
<td>4 wire RTD class A (not available with code 3 or 4 at position 'd')</td>
<td>4A</td>
</tr>
<tr>
<td>2 wire RTD class B (not available with code 3 or 4 at position 'd')</td>
<td>2B</td>
</tr>
<tr>
<td>3 wire RTD class B</td>
<td>3B</td>
</tr>
<tr>
<td>4 wire RTD class B (not available with code 3 or 4 at position 'd')</td>
<td>4B</td>
</tr>
<tr>
<td>Thermocouple type K (not available with code 3 or 4 at position 'd')</td>
<td>KS</td>
</tr>
<tr>
<td>Thermocouple type J (not available with code 3 or 4 at position 'd')</td>
<td>JS</td>
</tr>
<tr>
<td>Thermocouple type E (not available with code 3 or 4 at position 'd')</td>
<td>ES</td>
</tr>
<tr>
<td>Thermocouple type T (not available with code 3 or 4 at position 'd')</td>
<td>TS</td>
</tr>
<tr>
<td>Other (to be specified)</td>
<td>99</td>
</tr>
<tr>
<td>None (transmitter electronics only, code 3 to 8 at position 'd')</td>
<td>00</td>
</tr>
</tbody>
</table>
### HEAD TYPE / ELECTRICAL CONNECTIONS - 8th to 9th characters

<table>
<thead>
<tr>
<th>Material &amp; Form</th>
<th>Flange Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast Aluminium Alloy</td>
<td>CM 20 (see note)</td>
</tr>
<tr>
<td>Silver Painted, IP 68</td>
<td>Pg 16 (see note)</td>
</tr>
<tr>
<td>3/4” NPT (IP 65) (see note)</td>
<td>Pg 16 (see note)</td>
</tr>
<tr>
<td>Cast Aluminium, DIN Form B</td>
<td>CM 20 (see note)</td>
</tr>
<tr>
<td>Silver Painted, IP 65</td>
<td>Pg 16 (see note)</td>
</tr>
<tr>
<td>ABS, IP 67</td>
<td>CM 20 (see note)</td>
</tr>
<tr>
<td>Stainless Steel, IP67</td>
<td>CM 20 (see note)</td>
</tr>
</tbody>
</table>

Note: Not available with code 1 at position ‘d’

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

<table>
<thead>
<tr>
<th>Process connection type</th>
<th>Material &amp; Form</th>
<th>Flange Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (element or transmitter electronics only)</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>1/2” NPT - m</td>
<td>AISI 316 - Pipe</td>
<td>1</td>
</tr>
<tr>
<td>3/4” NPT - m</td>
<td>AISI 316 - Pipe</td>
<td>2</td>
</tr>
<tr>
<td>1” NPT - m</td>
<td>AISI 316 - Pipe</td>
<td>3</td>
</tr>
<tr>
<td>Flange 1/2” ANSI 150</td>
<td>AISI 316 - Pipe</td>
<td>5</td>
</tr>
<tr>
<td>Flange 1/2” ANSI 300</td>
<td>AISI 316 - Pipe</td>
<td>7</td>
</tr>
<tr>
<td>Special, to custom order</td>
<td>AISI 316</td>
<td>9</td>
</tr>
</tbody>
</table>

### EXTENSIONS AND UNIONS - 11th character

<table>
<thead>
<tr>
<th>Process connection type</th>
<th>Material &amp; Form</th>
<th>Flange Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (transmitter electronics only; code 3 to 8 at position ‘d’)</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Adjustable union (only available with code H at position 'e')</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>50 mm</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>75 mm</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>150 mm</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>250 mm</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>350 mm</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>Qty 2, 50 mm, ss. extension and 1/2” union (only available with code S at position &quot;e&quot;)</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Special, to custom order</td>
<td>-</td>
<td>9</td>
</tr>
</tbody>
</table>

### IMMERSION LENGTH "U" - 12th character

<table>
<thead>
<tr>
<th>Element only</th>
<th>Thermowell and element</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm</td>
<td>0000</td>
</tr>
<tr>
<td>150 mm</td>
<td>0100</td>
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<tr>
<td>200 mm</td>
<td>0150</td>
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<tr>
<td>250 mm</td>
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<tr>
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<td>0900</td>
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<tr>
<td>105 mm</td>
<td>100T</td>
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<tr>
<td>150 mm</td>
<td>105T</td>
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<tr>
<td>200 mm</td>
<td>200T</td>
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<td>250 mm</td>
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<tr>
<td>900 mm</td>
<td>900T</td>
</tr>
<tr>
<td>1000 mm</td>
<td>K00T</td>
</tr>
</tbody>
</table>

Note: (transmitter electronics only; code 3 to 8 at position "d")
ELECTRICAL CONNECTIONS

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

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

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