<table>
<thead>
<tr>
<th>Products</th>
<th>Solutions</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Instrumentation Training</td>
<td>Temperature Measurement</td>
<td></td>
</tr>
</tbody>
</table>
Why Temperature Measurement?

- Temperature is the most important parameter in the process industry
  Temperature : Pressure = 7 : 1
  Temperature : Flow = 14 : 1
  Temperature : Level = 2.3 : 1
  Temperature : Conductivity = 20 : 1

- Temperature is a **safety** relevant parameter

- Temperature is a **quality** relevant parameter
Why would you buy a temperature sensor from E+H?

Life Cycle Management

Selection
Configuration
Buying
Procurement
Order tracking
Installation
Configuration
Commissioning
Operation
Condition monitoring
Spare part planning
Maintenance -Planned -Unplanned
Calibration
Documentation management
Replacing spare parts
Reorder
Engineering

Plant asset management (PAM)

W@M

Financial asset management

Human resource management

EAM

W@M - Life Cycle Management
Would you want this?

- Improve the installed base management (time and costs)
- Reduce internal workload and improve process quality
- Information availability 24/7
- Easy and fast access to information and document 24/7
Would you want this?

**Information traceability**

Logbook for traceability of calibration, repair and maintenance events

**Quality Control**

Analysis of critical measuring points and better spare part planning
This is what you get out from E+H devices

**End User (customer)**
- Standard operating procedures
- Internal certificates
- Pictures
- Memos
- any other device related documents

**3rd party service company (optional)**
- Service reports
- Calibration reports
- Repair reports
- etc

---

**W@M Portal**

- Serial number
- Order code
- Manuals
- Certificates
- Purchase info

**CER**
- Common Equipment Record
- Product status
- Spare Parts

**SAP Netweaver**

**Events:**
- Production info
- Calibration info

**INTERNET**

**over 15 Million S/N since 2000**

**3rd party service company (optional)**
- Service reports
- Calibration reports
- Repair reports
- etc

**End User (customer)**
- Standard operating procedures
- Internal certificates
- Pictures
- Memos
- any other device related documents

---

**SC= Sales/Service Centers**

**W@M - Life Cycle Management**
For Endress+Hauser instruments all documents are available automatically. Based on an instrument's serial number, even device-specific documents such as calibration certificates, material certificates, or service reports are accessible.

Files like operating instructions, technical spec sheets, SOPs, etc. can be attached to all assets.
The Logbook allows you to keep track of the device’s history. Here you find information about the production, shipment and service events performed by Endress+Hauser. But also your own service and calibration events are recorded here.
W@M - Life Cycle Management

**W@M: Installed Base Audit**

- Data is being presented in IBA report

- And data is made available in a W@M including 3rd party instruments.
Maintenance/Calibration Service

1. Creating service and calibration reports
2. Attaching documents to device in W@M
3. All data is available online
Introduction

Production Centers

Advanced Temperature Engineering.
Our Product Centers & Support Centers

- Germany: Nesselwang
- India: Aurangabad
- China: Suzhou
- USA: Greenwood
- Italy: Pessano
- South Africa: Benoni
- Singapore: Singapore
Core Competence SMD Assembling

In our 3 SMD-lines we convert 60 million assemblies for 640,000 printed circuit boards annually.
Core Competence Logistic

Kanban production:
Delivery performance >97%.
Order related production
2 to 4 working days.
Core Competence Welding

Special welding procedures like oxyacetylene, WIG, plasma, MIG and MAG welding. Certified welding experts and certified welding processes ensure constant quality.
Core Competence Insert Production

Automated production of temperature measuring inserts
- >100,000 pieces per year
- Constantly high quality
- Extremely vibration resistant devices
- 100% traceability and individual testing
Core Competence Thermowell Production

Thermowells and process connections for industrial thermometers, custom-made and with very short delivery time. We produce > 20,000 pieces/year.
Core Competence Test Center

Extensive measurement and test equipment are available for safeguarding the quality and continuous optimization of the thermometers, thermowells and transmitters.
Core Competence Test Center

<table>
<thead>
<tr>
<th>TEST TYPE</th>
<th>EQUIPMENT TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMI positive material identification</td>
<td>X-ray fluorescence type</td>
</tr>
<tr>
<td>Ferrite content analysis</td>
<td>Induction type (resolution 0.01%)</td>
</tr>
<tr>
<td>Helium leakage test</td>
<td>Mass spectrometry type</td>
</tr>
<tr>
<td>Endoscopic investigation</td>
<td>Optical fiber (minimum dia. 5mm)</td>
</tr>
<tr>
<td>X-Ray</td>
<td>3-D Inspection</td>
</tr>
</tbody>
</table>

Metallurgical and non-destructive material testing

Endress+Hauser
DKD/SIT accredited laboratories for temperature allow for the calibration of contact thermometers at highest accuracy: 0.002 K. Calibrations according to national standards and the international temperature scale ITS90.
Core Competence Engineered Solutions for Temperature

A team of experts develops and maintains customized solutions from the offer to the installation – worldwide.
Temperature Transmitters & Thermometers

Thermometers with Field Transmitters

Housings

RTD/TC Inserts

Thermowells

Head Transmitters
Temperature Transmitters & Thermometers - Industries

Universal | Oil & Gas | Energy | Petro-chemical

Temperature

Chemical | Food & Beverages | Pharmaceutical | Primaries

Endress+Hauser
Data Managers, Recorders, Data Loggers & Software
# Energy Managers & Components

<table>
<thead>
<tr>
<th>Application/Energy Managers</th>
<th>Energy Meters Batch Controllers</th>
<th>Barriers</th>
<th>Surge Arresters</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
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<tr>
<td>System Components</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image5.png" alt="Image" /></td>
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<tr>
<td>Universal Transmitters</td>
<td>Contactors</td>
<td>Displays</td>
<td>Power Supplies</td>
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<tr>
<td><img src="image6.png" alt="Image" /></td>
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<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
</tr>
</tbody>
</table>
Basic Principle

Temperature
Basic physics

- What are the 2 most popular principles to measure temperature?
  - Resistance Temperature Detector
  - Thermocouples

- Other types of temperature sensors used in industry:
  - Thermistor
  - Infrared
Basic physics - Resistance Temperature Detector (RTD)

- RTD – Resistance Temperature Detector

- A RTD changes its resistance value proportional to the temperature!

- A Pt100 is a “PTC” resistance with “Positive Temperature Coefficient”
Basic physics - Resistance Temperature Detector (RTD)

What does **Pt100** mean?
- “Pt” means “Platinum”
- “100” means “100 Ω” at “0°C”

What does **Pt50** mean?
- “50” means “50 Ω” at “0°C”
Basic physics - Resistance Temperature Detector (RTD)

Reference standard for RTD: EN 60751 Temperature / Resistance relationship 1°C = 0.385 Ohm

Copper or Nickel have restricted ranges because of non-linearities and wire oxidation problems in the case of Copper.
Basic physics – Thermocouple (TC)

\[ T_{\text{jct.}} \neq T_{\text{ref.}} \quad \rightarrow \quad \text{EMF} \quad \text{(Electromotive Force)} \]

Metal \( a \neq b \)

**SEEBACK EFFECT**
If the conductors' metal is not the same and if the two junctions are at different temperatures, between them a voltage is generated, and hence an electric current flows in the circuit.
Basic physics – Thermocouple (TC)

Uniform electrons distribution for a homogeneous temperature distribution in a conductor

Electron depletion at the hot end

Dissimilar electron concentration in the circuit consisting of two different conductors
Basic physics – Thermocouple (TC)

Reference standard: IEC 584
TC type K - Temperature / EMF relationship
Operation

Temperature
Filled product basket
Process Instrumentation Training

**Measurement range and segmentation**

The right portfolio for
- all industries
- all main process applications
- every budget

**Low duty**
- Low cost, standard applications and models

**Medium duty**
- Food & sanitary
- Light chemical
- Pipe thermowells (DIN std)
- Head transmitters
- Intrinsic safety

**Heavy duty**
- Oil & Gas, Energy
- Bar stock T-wells
- Field TMT HART
- Explosion proof

Endress+Hauser
**Wiring - Resistance Temperature Detector (RTD)**

Used where lead length is short. There is no compensation for resistance of lead wires.

Most common type of RTD assembly. Typically connected to standard bridge circuit, which allows lead wire resistance to be compensated.

Where higher accuracy is demanded. Lead wire resistance errors are eliminated in this configuration by measuring the voltage across the RTD element supplied with a constant current.

- **2 wire configuration**
- **3 wire configuration**
- **4 wire configuration**
Basic physics - Resistance Temperature Detector (RTD)
Reference resistance value of Pt100

**PT100 Resistance Table**

<table>
<thead>
<tr>
<th>°C</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-200.00</td>
<td>18.52</td>
<td>22.83</td>
<td>26.17</td>
<td>29.55</td>
<td>32.94</td>
<td>36.33</td>
<td>39.72</td>
<td>43.11</td>
<td>46.50</td>
<td>49.89</td>
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</tr>
<tr>
<td>-190.00</td>
<td>22.40</td>
<td>26.75</td>
<td>31.13</td>
<td>35.51</td>
<td>39.90</td>
<td>44.29</td>
<td>48.69</td>
<td>53.08</td>
<td>57.47</td>
<td>61.86</td>
<td>-190.00</td>
</tr>
<tr>
<td>-180.00</td>
<td>21.97</td>
<td>26.34</td>
<td>30.72</td>
<td>35.11</td>
<td>39.49</td>
<td>43.88</td>
<td>48.27</td>
<td>52.66</td>
<td>57.05</td>
<td>61.44</td>
<td>-180.00</td>
</tr>
<tr>
<td>-170.00</td>
<td>21.11</td>
<td>25.48</td>
<td>29.86</td>
<td>34.24</td>
<td>38.62</td>
<td>43.01</td>
<td>47.41</td>
<td>51.80</td>
<td>56.19</td>
<td>60.58</td>
<td>-170.00</td>
</tr>
<tr>
<td>-160.00</td>
<td>20.68</td>
<td>25.06</td>
<td>29.44</td>
<td>33.82</td>
<td>38.20</td>
<td>42.59</td>
<td>46.99</td>
<td>51.38</td>
<td>55.77</td>
<td>60.16</td>
<td>-160.00</td>
</tr>
<tr>
<td>-150.00</td>
<td>20.25</td>
<td>24.63</td>
<td>29.01</td>
<td>33.39</td>
<td>37.78</td>
<td>42.17</td>
<td>46.57</td>
<td>50.97</td>
<td>55.36</td>
<td>59.75</td>
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<td>39.49</td>
<td>38.62</td>
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<td>32.47</td>
<td>36.86</td>
<td>41.25</td>
<td>45.65</td>
<td>-80.00</td>
</tr>
</tbody>
</table>
Process Instrumentation Training

**Thermocouple (TC) – Extension/Compensation Cables**

Extension wires must be of the same alloy type as the TC

- Good precision
- Expensive for long distance

Compensation wires generate an EMF similar to TC (limited temp. range)

- Cheap for long distance
- Weak precision

Transmitter overheat

Good precision

Cheap
# Thermocouple (TC) – Extension/Compensation Cables

## International Insulation Colour Codes

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R, S, O</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Yellow Blue</td>
<td>Green Yellow</td>
<td>Yellow Blue</td>
<td>Red Yellow Blue</td>
<td>Yellow</td>
<td>Orange</td>
</tr>
<tr>
<td>Orange</td>
<td></td>
<td></td>
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<td><strong>N</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red White</td>
<td>Blue Yellow Blue</td>
<td>Blue Yellow Blue</td>
<td>Red White</td>
<td>Yellow Green</td>
<td>Green White</td>
</tr>
<tr>
<td><strong>K</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Yellow Blue</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Red Yellow Blue</td>
<td>Yellow Purple</td>
<td>Green Yellow White</td>
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<tr>
<td><strong>VX</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Yellow Blue</td>
<td>Blue Yellow Blue</td>
<td>Blue Yellow Blue</td>
<td>Red Yellow Blue</td>
<td>Yellow Purple</td>
<td>Green Yellow White</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Purple</td>
<td>Purple</td>
<td>Purple</td>
<td>Red Purple</td>
<td>Black</td>
<td>Purple</td>
</tr>
<tr>
<td><strong>J</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Yellow</td>
<td>Black</td>
<td>Black</td>
<td>Red Yellow</td>
<td>Yellow Blue</td>
<td>Black</td>
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<tr>
<td><strong>T</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Red Yellow</td>
<td>Brown</td>
<td>Blue</td>
<td>Red Yellow</td>
<td>Yellow Blue</td>
<td>Brown</td>
</tr>
</tbody>
</table>

---

**Endress+Hauser**
## Number of Conductors (TC) / Wires (RTD)

<table>
<thead>
<tr>
<th>Thermocouple Number of Conductors</th>
<th>RTD Number of wires</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single Pair</strong></td>
<td>2 Conductors</td>
</tr>
<tr>
<td><strong>Dual Pair</strong></td>
<td>4 Conductors</td>
</tr>
<tr>
<td><strong>Triple Pair</strong></td>
<td>6 Conductors</td>
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</table>

<table>
<thead>
<tr>
<th>Wiring System</th>
<th>Single</th>
<th>Double</th>
<th>Triple</th>
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<tr>
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<td><img src="image2.png" alt="Image" /></td>
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<tr>
<td>4</td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td>✗</td>
</tr>
</tbody>
</table>

Ø8mm sheath (standard thickness, 1.02mm)

Ø8mm sheath (special thickness, 1.9mm)

![Image](image7.png)

Sheath

Conductor / Wire

MgO Powder
Advantages, Features & Benefits

Temperature
Mineral Insulated Cable (MgO) type Sensors
– Basic Construction

**THERMOCOUPLE**

- Tip Closing By Welding
- Hot Junction By Welding
- MgO Powder For Insulation
- Thermocouple Wire
- Epoxy Seal

**RTD**

- RTD Sensor Bulb Welded to Ni Wire
- MgO Powder For Insulation
- Lead wire, Nickel
Temperature Sensor Assembly RTD – Inset

The inset:
- **protects** from shocks and humidity
- **allows** the insertion in the process insulation
- **prevents** short circuits

![Diagram of Temperature Sensor Assembly RTD – Inset]
RTD – PT100 Sensor Elements

- Ceramic wire wound
- Glass wire wound
- Thin film
- Platinum tape coiling
- Platinum thin film
- Spiral platinum wire in ceramic case
**RTD – PT100 Sensor Elements**

<table>
<thead>
<tr>
<th>Type</th>
<th>Ceramic</th>
<th>Glass</th>
<th>Thin film</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-200..600°C</td>
<td>-50..450°C</td>
<td>-50..400°C</td>
</tr>
</tbody>
</table>

*Endress+Hauser*

*Ci misuriamo sulla pratica*
Basic physics - Resistance Temperature Detector (RTD)

Tolerance Band

<table>
<thead>
<tr>
<th>Class</th>
<th>B</th>
<th>A</th>
<th>1/3B</th>
<th>1/10B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100</td>
<td>0.3 + 0.005*</td>
<td>0.15 + 0.002*</td>
<td>0.1 + 0.00167*</td>
<td>0.03 + 0.0007*</td>
</tr>
<tr>
<td></td>
<td>t</td>
<td>t</td>
<td>t</td>
<td>t</td>
</tr>
</tbody>
</table>

Accuracy (°C) vs. Temperature (°C)
Thermocouple (TC) – Junction Types

**Ungrounded (Insulated)**

**Grounded**

**Exposed**
Thermocouple (TC) – Temperature / EMF Relationships
Thermocouple (TC) – Application Temperature Range

Temperature Range Diagram:
- **DM**
- **Basic Cost per Mt.**
- **Temperature (°C)**
- **Thermocouple Types**

- Pt-30%Rh / Pt-6%Rh
- Pt-13%Rh / Pt
- Pt-10%Rh / Pt
- Ni-Cr / Ni-Al
- Ni-Cr / Cu-Ni
- Cu/Cu-Ni
- Fe / Cu-Ni

Endress+Hauser
Thermocouple (TC) – Useful Temperature Range

![Thermocouple Types and Temperature Range Graph](image)

- Pt-30%Rh/Pt-6%Rh
- Pt-13%Rh / Pt
- Pt-10%Rh / Pt
- Ni-Cr / Ni-Al
- Ni-Cr / Cu-Ni
- Cu/Cu-Ni
- Fe / Cu-Ni

**BASIC COST per Mt.**

**TEMPERATURE**

**USEFUL TEMPERATURE RANGE**

**THERMOCOUPLE TYPES**
### Combination of Thermocouple Wires

<table>
<thead>
<tr>
<th>Type</th>
<th>Old JIS Type</th>
<th>Positive (+) Leg</th>
<th>Negative (-) Leg</th>
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</thead>
<tbody>
<tr>
<td>B</td>
<td>70% Platinum * 30% Rhodium</td>
<td>94% Platinum * 6% Rhodium</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>87% Platinum * 13% Rhodium</td>
<td>100% Platinum</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>90% Platinum * 10% Rhodium</td>
<td>100% Platinum</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>CA</td>
<td>Chromel** (90%Ni * 10%Cr)</td>
<td>Alumel** (95%Ni * 2%Mn * 2%Al)</td>
</tr>
<tr>
<td>E</td>
<td>CRC</td>
<td>Chromel** (90%Ni * 10%Cr)</td>
<td>Constantan (55%Cu * 45%Ni)</td>
</tr>
<tr>
<td>J</td>
<td>IC</td>
<td>99.5% Iron</td>
<td>Constantan (55%Cu * 45%Ni)</td>
</tr>
<tr>
<td>T</td>
<td>CC</td>
<td>100% Copper</td>
<td>Constantan (55%Cu * 45%Ni)</td>
</tr>
<tr>
<td>N</td>
<td>Nicrosil (84%Ni * 14.2%Cr * 1.45%Si)</td>
<td>Nisil (95%Ni * 4.4%Si * 0.15%Mg)</td>
<td></td>
</tr>
</tbody>
</table>

** Note:**

** Chromel and Alumel are the registered trade marks by Hoskins Mfg., Co. USA.
Temperature Sensor Assembly

**Metallic Inset TC - RTD**

- Head / Housing
- Neck
- Thermowell
- Insert

Transmitter
- Housing

Thermowell
- Insert

Endress+Hauser
T-class example: TMR3x - compact and economic

Outstanding price/performance ratio

Material SST 316L, roughness Ra < 0,8um

With or without integrated transmitter
accuracy 0.1 K

Sensor Pt100/4-wire class A to EN 60751

Versions: Without thread or 1/2”G, 1/4” NPT, Clamp 1”, DIN11851, Varivent DN32, M/M)

Cost saving in stock keeping
PC programmable electronic
for Pt100 -50 to 200°C

Fast and precise setup by ReadWin2000
(M12 connector - no additional power supply)

Failure information to NAMUR NE 43
M-class example: TR4x - the hygienic line

Wide range of process connections
- Ingold, Varivent, SMS, ISO2852 clamp, Triclamp, Dairy DIN 11851/11864, ...

Flexible dimensioning and material finishing
- Neck length, immersion length or pipe diameter
- SS316L / 1.4435 with Ra <0.4 um (electropolished)

Different tip designs for fast response
- straight, reduced or tapered tip

Inset
- ATEX certification (1 GD)
- High accuracy: minimum Pt100 Class A acc. EN 60751
- Pt100 thin film: 3mm or 6mm
New Unique Insert – TS101

Specification:
- Diameter: Ø6 mm
- Sensor type: 1xPt100
- Model: Thin film (TF)
- Range: -50…500 °C
- Accuracy: class A, (450°C); class AA (250°C) acc. IEC60751
- Wiring: 4-wire
- Max. length: 970mm
- Vibration: 60g acc. IEC
- Response t90: 8s
## TS101 – Advantages in a glance

<table>
<thead>
<tr>
<th>Properties</th>
<th>Pros</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>High vibration resistance 60g acc. IEC60751 with parallel wide temperature range</td>
<td>No damaging of the sensor element in a wide temperature range</td>
<td>Safe and reliable measurement result</td>
</tr>
<tr>
<td>Fast response time $t_{90} = 8$ s</td>
<td>Fast reaction at temperature changes</td>
<td>High process stability</td>
</tr>
<tr>
<td>100% traceability due to automated production</td>
<td>Reproduceable product properties</td>
<td>Stable product quality</td>
</tr>
<tr>
<td>Several improvements at the terminal block</td>
<td>Fix mechanical and electrical connection</td>
<td>Reliable connections and improved measurement performance</td>
</tr>
</tbody>
</table>

Endress+Hauser 🏭
S-class example: TMT162x – rugged barstock thermowell

- Complete thermowell basket available as spare parts
- Wide range of steel grades available (e.g. Hastelloy, Duplex, Titanium, Tantalum, Zirconium,....)
- Stress calculation and individual thermowell design
Thermowell – Important differences
Bar stock Thermowells

- Weld in
- Threaded
- Flanged
Pipe Thermowells

- Flange with neck
- Threaded with neck
- Threaded without neck
- Thermowell with compression fitting
# Thermowell (Tubular / Pipe) - Tip Profile

<table>
<thead>
<tr>
<th>Form</th>
<th>Manufacturing</th>
<th>Inset replaceable</th>
<th>Pressure resistance</th>
<th>Insert length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapered</td>
<td>formed</td>
<td>yes</td>
<td>high</td>
<td>&gt; 65mm</td>
</tr>
<tr>
<td>Reduced</td>
<td>welded</td>
<td>yes</td>
<td>low</td>
<td>&gt; 30mm</td>
</tr>
</tbody>
</table>

- **Plug**
  - Straight
  - Tapered
  - Reduced
TC for high temperatures

Head Form A

Head Form B

Process connection

Gas tight coupling

Flange

In different ceramic materials
KER 610, KER 710,....
TC for high temperatures

Temperature measurement up to 1600°C

Heat resistant
Steel and ceramic

Gas tight coupling

Connection head Form A

Neck
Inner protection sheath
(Ceramic)
Isolation
(Ceramic)

Ceramic
Why use transmitters?

- Reduce wiring costs
- Eliminate plant noise (EMI)
- Increase accuracy
- Reduce control systems costs
- Allow sensor flexibility
- Avoid ground loops
- Make maintenance easier/Advanced diagnostics
Eliminates plant noise

Electromagnetic Interference (EMI) are present in almost all factories due to electrical and electronic systems (motors, power lines, radio....), as well as natural phenomena such as lightning occurring in the same area.

Their effects on extension wires are important and obviously affect the measured value.

All Endress+Hauser transmitters are electro magnetically compliant to IEC 61326-1 and NAMUR NE21. However EMI source can still affect the signal but within the nominal transmitter accuracy specification.
Good reasons for temperature electronics?

- **Safety**
  - Galvanic isolation in the transmitter prevents short cut loops and safes interface cards from over voltage
  - Compensation cables are much more sensible against mechanical stress or noise influence than 4-20mA copper cables
  - Control System suppliers are no temperature experts - development and diagnostics are not their focus
  - SIL2 can only be reached with temperature transmitters

- **Flexible programming**
  - offset, change of sensor, output simulation can be done local without touching the process control system
  - Additional displays, recorders or contactors can be added easily
Good reasons for temperature electronics?

- **Costs**
  - even in Ex-zones the transmitters are more cost effective
  - compensation cables are really expensive

- **Accuracy**
  - long sensor cables result in reduced accuracy
  - complete measurement point can be calibrated in a loop (transmitter and sensor together)
  - setup can be easily adjusted via software
Current temperature transmitter basket - overview

**iTEMP® Family**

### Fixed range
- TMT127
- TMT128
- TMT187
- TMT188
- TMT1x7
- TMT1x8

### PC-Programmable
- TMT111/121
- TMT112/122
- TMT142
- TMT162
- TMT181
- TMT182
- TMT180
- TMT182
- TMT183
- TMT84
- TMT85

### Multi-Input
- TMT22
- TMT82

**Ex**
- Non Ex
- Ex

**Communication Protocols**
- HART
- PROOF
- Foundation

**8-channel**
- TMT125
New Features iTEMP TMT82

Overview: iTEMP® TMT82 head transmitter

- 2 sensor inputs
- Support of all common sensor types
- High accuracy (0.1 K Pt100)
- HART6 protocol
- Advanced diagnostic functionality
- Optional with display (TID10)
- International Ex approvals
- Screw- or spring loaded terminals

New

- SIL acc. IEC61508 (SIL2, SW SIL3) (available Q2/12)
- Status/diagnostic messages – NE107
New temperature head transmitter platform

- Spring terminals or screw terminals
- Basis for new transmitter generation
- Optional display

Spring clip version
Spring terminal

Advantages:

- High reliability due to corrosion free and tight clamp-connection
- Reduced wiring time – Plug in of rigid and flexible wires with wire-end ferrules without any tools
- Easy releasing of the connection with a screw driver
Sensor backup: at breakdown of the sensor
- automatic switch to the residual sensor.
- alarm to control system via HART.
- function can be realized also with an insert 2xPt100.

iTEMP® TMT8x:
- Switching to sensor 2
- Warning to the system
Another application example:
Temperature difference between sensor 1 and sensor 2 must not exceed 3°C otherwise a warning signal shall be output.
Application makes sense if 2 different sensor types are used!
Display module

- Display of the **measured value**
  - TAG – Information of the measuring point
  - Measured value and unit of each channel

- Display of an **error**
  - Inverse display of a specified error number and the error inducing channel
  - Alternating indication of the error number and the measured value
Food & Beverage – New hygienic thermometer

Key features & customer values:

- **One** global portfolio with international approvals
  - global availability of all versions for simple standardization and duplication of production processes of global customers

- Consistent product **segmentation**
  - fast and easy product selection

- Patented **Quick Connect Neck**
  - cost savings through simplified recalibration

- New inserts **TS101** with outstanding performance → see TS101 (following page)

- New hygienic heads **TA30R** (316L):
  - IP69K suitable for pressure washer
  - cost savings through simple and fast wiring
  - optional display TID10 for on-site process monitoring
Standardized Straight Multipoint
What are we talking about?

Several measuring points on different levels
Inside of a reactor or tank
Using only one process nozzle

Straight Multipoint Sensor TM911
Field of Applications

- High variety of applications in Oil & Gas and Petrochemical Plants such as:
  - Desulphurization reactors
  - Gas treatment
  - Fractionating columns
  - Hydro Cracking process
  - Storage tanks

- Typical process design conditions
  - Design pressure: \( \text{atm} < P_d < 250 \text{ bar} \)
  - Design temperature: \(-40 ^\circ \text{C} < T_d < 580 ^\circ \text{C}\)
  - Highly corrosive media
Oil & Gas – Straight Multipoint TM911

Key Features and Customer Value:

- Unmatched safety concept with 3 process barriers → safe operation also in fault condition
- Adherence to the pressure equipment directives (PED/CRN) and Ex-d certification of the whole device (ATEX, FM, CSA, IEC) → simplified plant certification
- Completely standardized product with consistent order structure and complete technical documentation → simple and easy product selection, configuration and ordering process – also for non-experts!
Temperature Engineering
Multi-point Temperature Sensor Measurement

Temperature Sensor Top Entry

Possible temperature measurement points

With Themowell System

Octopus and/or Radial Fixed System
Multi-point Temperature Sensor Measurement

Temperature Sensor Side Entry

With Themowell System

Possible temperature measurement points

Octopus and/or Radial Fixed Type System

Possible temperature measurement points

Guzman
Octoplus multipoint measurement

What is an Octop(l)us?
Desulphurization - Thermocouple Multi-point Sensor (15 points)

TEXACO UK
Pembrokeshire Refinery
ENGINEERED SOLUTIONS: MULTIPOINT – 3D MEASUREMENT DISTRIBUTION

Containment body of Octop(l)us system

Pressure vessel wall

Pressure vessel nozzle

Thermowells / Thermocouples

Top view of Octop(l)us systems

- Material of fixed internals: ISI 347, 321, 316L
- Corrosion allowance on each exposed surface:
ENGINEERED SOLUTIONS: MULTIPOINT – 3D MEASUREMENT DISTRIBUTION

Internal side of the vessel nozzle

Reactor wall
Basic Training Temperature

Desulphurization - Thermocouple Multi-point Sensor (13 points)
Desulphurization – Thermocouple Multi-point Sensor

Octopus System
Heater Tube Skin Thermocouples
E+H Solution - Hast ‘X’ Pad & Knife Edge Thermocouple

TSK100 technical characteristics

- Hole in heater wall
- Spring
- Cool air (air ‘intake’ due to low pressure in the heater)
- Closure disk (it’s pressed against heater wall by a light spring to avoid undesirable air infiltrations through the hole)

With this solution the thermocouple can follow the thermal expansion of the process pipe freely in all 3 directions and it’s completely free from mechanical stresses deriving from process pipe movements.

- Heater wall
- Protection tube (to shield thermocouple from direct heat)
- Air from outside ambient cools the thermocouple and sweeps it clean, thus preventing the deposition of damaging combustion products
- Skin thermocouple
- Thermocouple hot joint (knife edge)
- Thermal radiation
- Heater radiant section - low pressure -

- Process pipe
- Temperatures in different thermocouple points
Customer references - Italy


Nr. 56 skin points mod. TSK 100 ATEX certified for direct fired process heater (2 heaters CR-30 plant)

Technical data:
T = -20 ÷ +400 °C
Heating surface: pipe Ø 6” Sch 40
Material A335 – P5
Skin point material: Hastelloy X
Process heaters fuel: oil/gas
Agip Petroli Patent

Flames from burner
Applications

Temperature
Temperature Measurement in Food & Beverages

TM4xx – New modular hygienic thermometers for Food & Beverages and Life Sciences industry. Extensive variety ranging from basic thermometers to advanced technology thermometers – completely standardized.

iTHERM® QuickNeck – Neck with quick release for fast and easy recalibration.

iTHERM® QuickSens – Sensors with unmatched response times for high-precision measurements and accurate process control.
Temperature Measurement in Beverage Industry

Compact thermometer with short immersion length and fast response time in the Beverage industry

Field transmitter with dual Pt100 mounted in a “glove-box” in the Pharmaceutical industry
Temperature Measurement in Oil & Gas Industry

Temperature measurement via PROFIBUS® PA in the Chemical industry

Multipoint thermometer with safety chamber for the Oil & Gas industry
Tempereature Measurement in Chemical Plant

Head transmitters mounted on inserts for an application in an ethylene plant.

Robust thermometer with quick fastener neck for safety relevant applications.
RTD - Summary

- Definition RTD and PTC
- Power source required
- Ceramic Pt 100 (WW), -200°C...600°C
- Glass Pt 100, -50°C...450°C
- Thin film Pt 100 (TF), -50°C...400°C
- Accuracy class B, A, 1/3B, 1/5 DIN B, 1/10 DIN B
  Endress+Hauser Standard: Class A
- 2-, 3-, 4- wire configuration
- Endress+Hauser Standard: Pt100-Reverse (MgO- insulation)
**TC - Summary**

- EMF – no power supply required
- Junction types
- TC types:
  - T  -185.....300°C
  - J  +20.....700°C
  - E  0.....800°C
  - K  0...1100°C
  - N  0...1100°C
  - S  0...1550°C
  - R  0...1600°C
  - B  0...1600°C
- Class 1,2
- Compensation/Extension wires
Any Questions?
Product Selection
Standard E+H Temperature Products
## Typical Construction of a Thermometer

**Metric-Style**

<table>
<thead>
<tr>
<th>TERMINAL HEAD</th>
<th>US-Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>The terminal is fitted to the thermowell or the neck of the thermometer.</td>
<td></td>
</tr>
<tr>
<td>- Protection and installation for terminal block or transmitter</td>
<td></td>
</tr>
<tr>
<td>- Cable entry and wiring</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NECK / EXTENSION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The neck is the connection between terminal head and process connection / thermowell.</td>
<td>The neck is the connection between terminal head and process connection / thermowell.</td>
</tr>
<tr>
<td>- Protection of the head transmitter from over-heating</td>
<td>- Protection of the head transmitter from over-heating</td>
</tr>
<tr>
<td>- Guarantees access to the terminal head in the case of pipe insulation.</td>
<td>- Guarantees access to the terminal head in the case of pipe insulation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROCESS CONNECTION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The process connection is the connection between the process and the thermometer.</td>
<td>The process connection is the connection between the process and the thermometer.</td>
</tr>
<tr>
<td>- Threads</td>
<td>- Weld-in connections</td>
</tr>
<tr>
<td>- Flanges</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THERMOWELL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The thermowell is the process wetted component of the thermometer</td>
<td>The thermowell is the process wetted component of the thermometer</td>
</tr>
<tr>
<td>- Increases the life cycle of the measurement insert through protection against influence.</td>
<td>- Possible measurement insert exchange under process conditions.</td>
</tr>
</tbody>
</table>
# Quick Guidelines
## Process Connection

<table>
<thead>
<tr>
<th>PROCESS CONNECTION</th>
<th>SENSOR + THERMOWELL</th>
<th>THERMOWELL ONLY</th>
<th>SENSOR ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TUBE / PIPE</td>
<td>TUBE / PIPE</td>
<td>TUBE / PIPE</td>
</tr>
<tr>
<td>TST414</td>
<td>TR14</td>
<td>TA514</td>
<td>TTR31</td>
</tr>
<tr>
<td>TR10</td>
<td>TW10</td>
<td>TA555</td>
<td>TMT142R</td>
</tr>
<tr>
<td>TR11</td>
<td>TW11</td>
<td>TA556</td>
<td>TMT142R</td>
</tr>
<tr>
<td>TST90 (1 pair)</td>
<td>TW251</td>
<td>TA557</td>
<td>TMT142C</td>
</tr>
<tr>
<td>TST187 (Tube 9mm max.)</td>
<td>TST40H</td>
<td>TA560</td>
<td>TMT142C</td>
</tr>
<tr>
<td>TR61</td>
<td>TA540</td>
<td>TA562</td>
<td>TA62</td>
</tr>
<tr>
<td>TR63</td>
<td>TA541</td>
<td>TA565</td>
<td>TA65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TA566</td>
<td>TA88</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TR62</td>
<td>TST41H</td>
</tr>
</tbody>
</table>

**Diagram:**

- TST414: Connection for sensor and thermowell.
- TR14: Tube connection for sensor only.
- TA514: Type of connection for thermowell only, with single bore.
- TTR31: Connection for sensor only.
- TW10: Threaded connection for process connection.
- TA555: Type of connection for thermowell only, with double bore.
- TMT142R: Threaded connection for sensor only.
- TW11: Threaded connection for process connection.
- TA556: Type of connection for thermowell only, with single bore.
- TMT142C: Threaded connection for sensor only.
- TW251: Threaded connection for process connection.
- TA557: Type of connection for thermowell only, with double bore.
- TMT142C: Threaded connection for sensor only.
- TW25: Threaded connection for process connection.
- TA560: Type of connection for thermowell only, with single bore.
- TMT142C: Threaded connection for sensor only.
- TW40H: Threaded connection for process connection.
- TA562: Type of connection for thermowell only, with single bore.
- TA62: Type of connection for sensor only.
- TA565: Type of connection for thermowell only, with single bore.
- TA65: Type of connection for sensor only.
- TA566: Type of connection for thermowell only, with single bore.
- TA88: Type of connection for sensor only.
- TR62: Type of connection for sensor only.
- TST41H: Threaded connection for process connection.
# Quick Guidelines
## Process Connection

<table>
<thead>
<tr>
<th>FLANGED CONNECTION</th>
<th>SENSOR + THERMOVELL</th>
<th>THERMOVELL ONLY</th>
<th>SENSOR ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TUBE / PIPE</td>
<td>BAR-STACK</td>
<td>TUBE / PIPE</td>
</tr>
<tr>
<td>TRI2</td>
<td>TRI2</td>
<td>TRI3</td>
<td>TRI5</td>
</tr>
<tr>
<td>TC12</td>
<td>TC15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRI1</td>
<td>TRI4</td>
<td>TRI64</td>
<td>TA540</td>
</tr>
<tr>
<td>TC11</td>
<td>TC64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRI3</td>
<td>TRI5</td>
<td>TA555</td>
<td>TA554</td>
</tr>
<tr>
<td>TC13</td>
<td>TC65</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TA556</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TA557</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TA575</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TA576</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Quick Guidelines

Process Connection

<table>
<thead>
<tr>
<th>PROCESS CONNECTION</th>
<th>SENSOR + THERMO WELL</th>
<th>THERMO WELL ONLY</th>
<th>SENSOR ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUBE / PIPE</td>
<td>TR15, TC15</td>
<td>TW251</td>
<td>TW15</td>
</tr>
<tr>
<td>BAR-STOCK</td>
<td>TR47</td>
<td>TW47</td>
<td>TR48</td>
</tr>
<tr>
<td></td>
<td>TW571 (Weld-in Ø29 * 47mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TW571 (Weld-in Ø30 * 35mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TW571 (Weld-in Ø35 * 39mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TW571 (Weld-in Ø35 * 54mm)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Endress+Hauser
# Quick Guidelines

## Process Connection

<table>
<thead>
<tr>
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<th>SENSOR + THERMOWELL</th>
<th>THERMOWELL ONLY</th>
<th>SENSOR ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANITARY CONNECTION</td>
<td>TR45</td>
<td>TW45</td>
<td>TTR45</td>
</tr>
<tr>
<td></td>
<td>tube/pipe</td>
<td>tube/pipe</td>
<td>TR44</td>
</tr>
<tr>
<td></td>
<td>bar-stock</td>
<td>bar-stock</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
# Quick Guidelines
## Process Connection

<table>
<thead>
<tr>
<th>Process Connection</th>
<th>Sensor + Thermowell</th>
<th>Thermowell Only</th>
<th>Sensor Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube / Pipe</td>
<td>Bar-Stock</td>
<td>Tube / Pipe</td>
<td>Bar-Stock</td>
</tr>
<tr>
<td>TR12 (1)</td>
<td>TW12 (6)</td>
<td>TST10 (1)</td>
<td>TST10 (1)</td>
</tr>
<tr>
<td>TC12 (1)</td>
<td></td>
<td>TST300 (1)</td>
<td>GPTC (1)</td>
</tr>
<tr>
<td>TR41 (1)</td>
<td>T6540 (1)</td>
<td>TST420 (1)</td>
<td>GPTL (1)</td>
</tr>
<tr>
<td>TR41 (1)</td>
<td></td>
<td>TST410 (1)</td>
<td></td>
</tr>
<tr>
<td>TAF11 (1)</td>
<td>T6541 (1)</td>
<td>TST414</td>
<td>TET10, TET200, TPR100, IPC100, TPR200, IPC200</td>
</tr>
<tr>
<td>TAF12S (1)</td>
<td></td>
<td>TST404 (wallmount)</td>
<td></td>
</tr>
<tr>
<td>TAF12T (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAF12B (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAF14 (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Images of sensor and thermowell configurations.*
Quick Guidelines
Sensor Extension / Neck

Neck (Metric style)

US style Neck

No Extension Neck
Quick Guidelines
Housing

Terminal heads

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TA30A</td>
<td>IP 66/67</td>
<td>TA20B</td>
<td>IP 65</td>
<td>TA30D</td>
<td>IP 66</td>
</tr>
<tr>
<td>(Form B Standard (also with display))</td>
<td></td>
<td>(Form BUK)</td>
<td></td>
<td>(Form BU2H)</td>
<td></td>
</tr>
<tr>
<td>(also with display)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(also with display)</td>
</tr>
<tr>
<td>TA20W</td>
<td>IP 66</td>
<td>TA30F</td>
<td>IP 66/67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Form BU5)</td>
<td></td>
<td>(also with display)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Terminal head with display, hinged cover and display window
# Quick Guidelines

## Transmitter

### iTEMP®, temperature transmitters

<table>
<thead>
<tr>
<th>Head and DIN rail transmitters</th>
<th>Field transmitters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td><strong>Model</strong></td>
</tr>
<tr>
<td>RoadWin 2000</td>
<td>TMT180</td>
</tr>
<tr>
<td>iTEMP ®</td>
<td></td>
</tr>
<tr>
<td>PCP</td>
<td></td>
</tr>
<tr>
<td>HART 4-20mA, 2-wire</td>
<td>TMT84</td>
</tr>
<tr>
<td>HART 4-20mA, 3-wire</td>
<td>TMT85</td>
</tr>
<tr>
<td>- communication protocol</td>
<td>TMT162</td>
</tr>
<tr>
<td>TMT125</td>
<td>TMT142</td>
</tr>
</tbody>
</table>

---

_Endress+Hauser_
System Components
Outlook – System Components

State of the art System Components - The “Solutions for the Loop”

<table>
<thead>
<tr>
<th></th>
<th>Field + Process</th>
<th>Panel + Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Isolation</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Indication</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Protection</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Limits + Alarms</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Recording + Batch</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Calculation</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
**Process Meters/Indicators: Portfolio**

<table>
<thead>
<tr>
<th>Category</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process meters with control unit</td>
<td>RIA45</td>
<td>RIA46</td>
<td></td>
</tr>
<tr>
<td>Loop powered indicators</td>
<td>RIA14</td>
<td>RIA16</td>
<td>RIA15</td>
</tr>
<tr>
<td>Process indicator with pump control</td>
<td></td>
<td></td>
<td>RIA452</td>
</tr>
<tr>
<td>Fieldbus indicators</td>
<td>RID14</td>
<td></td>
<td>RID16</td>
</tr>
</tbody>
</table>

Complete and state-of-the-art process meters and indicators portfolio with all kinds of housings and various communication protocols!
Loop Powered Indicator RIA15

- Loop powered indicator for hazardous areas

- LCD backlight can be activated
  -> excellent readability even in environments with poor lighting
  helps increased safety
NEW Feature HART® Communication

Key feature: Master functionality

- HART® is a protocol which works according to the master slave method. This means the communication activity comes from the master.
- In the HART® loop there can be two masters: A primary master and a secondary master.
- RIA15 can be set up as primary or secondary master (default is secondary master).
- The indicator can actively interrogate and display the process values of a HART® sensor.

The sensors/actuators can be directly addressed by RIA15, also inside a multi-drop network

- Cost saving for the customer since no other master is required
- RIA15 as a HART® master can evaluate the status byte of the sensor/actuator
NEW Feature HART® Communication

Key feature: Low voltage drop

- Also with HART® communication RIA15 is powered from the loop
- The voltage drop of RIA15 with HART® is still very low at ≤ 1.9 V

- No additional power supply is needed!
- More than one display can be integrated into one loop!
Loop Powered Indicator RIA15 HART®

Key features & added values:

- Increased process safety
  -> loop powered & low voltage drop means no additional power supply needed even in Ex applications with reduced voltage

- Cost saving for the customer since no other master is required
  -> RIA15 can be HART® master and actively inquire values from the measurement devices

- Time-saving with easy commissioning from the pushbuttons
**Smart Recorder - Ecograph T RSG35**

- Completely new enhanced webserver  
  -> easy visualization and parameterization

- Up to 12 input channels and 4 freely adjustable display groups  
  -> increased flexibility

- SD card for Ecograph T and Memograph M  
  -> same data storage media for both devices

- Four virtual math channels for universal calculation  
  -> increased application flexibility for the customer
## Overview: RSG30 vs. RSG35

<table>
<thead>
<tr>
<th>Feature</th>
<th>RSG30</th>
<th>RSG35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal analog inputs</td>
<td>3/6</td>
<td>4/8/12</td>
</tr>
<tr>
<td>Signal types</td>
<td>Current, voltage, RTD, TC</td>
<td>Current, voltage, RTD, TC, frequency, pulse</td>
</tr>
<tr>
<td>Digital inputs</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Alarm set points/relays</td>
<td>16/4</td>
<td>30/6</td>
</tr>
<tr>
<td>Signal analysis</td>
<td>Totalization (optional)</td>
<td>Totalization (standard)</td>
</tr>
<tr>
<td>Mathematics</td>
<td>5 math channels (optional) Every used math channel reduces the number of analog channels +, -, *, /, constants, average</td>
<td>4 math channels (optional) Virtual Formula editor for individual calculations</td>
</tr>
<tr>
<td>Communication protocols</td>
<td>-</td>
<td>Modbus RTU slave, Modbus TCP slave</td>
</tr>
<tr>
<td>Interfaces</td>
<td>USB, RS232/RS485 (standard) Ethernet (optional)</td>
<td>USB RS232/RS485 (optional) Ethernet (standard)</td>
</tr>
</tbody>
</table>
## Overview: RSG30 vs. RSG35

<table>
<thead>
<tr>
<th></th>
<th>RSG30</th>
<th>RSG35</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display</strong></td>
<td>4.7”, 320 x 240 pixel</td>
<td>5.7”, 640 x 480 pixel</td>
</tr>
<tr>
<td><strong>Display groups</strong></td>
<td>-</td>
<td>4 groups with up to 8 channels</td>
</tr>
<tr>
<td><strong>Size of internal memory</strong></td>
<td>2 MB</td>
<td>128 MB</td>
</tr>
<tr>
<td><strong>External storage medium</strong></td>
<td>CF card</td>
<td>SD card, USB stick</td>
</tr>
<tr>
<td><strong>Set-up</strong></td>
<td>On-site via keys</td>
<td>On-site via navigator</td>
</tr>
<tr>
<td></td>
<td>ReadWin® 2000</td>
<td>Integrated web server</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FieldCare</td>
</tr>
<tr>
<td><strong>E-mail</strong></td>
<td>-</td>
<td>Yes, in case of limit value infringements/alarms</td>
</tr>
<tr>
<td><strong>Readout</strong></td>
<td>ReadWin® 2000, Field Data Manager Software</td>
<td>Field Data Manager Software</td>
</tr>
<tr>
<td><strong>Front material</strong></td>
<td>Fiberglass reinforced plastic</td>
<td>Zinc diecast</td>
</tr>
<tr>
<td><strong>Protection class</strong></td>
<td>IP54 (front)</td>
<td>IP65 (front)</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>Various language packages</td>
<td>One firmware for all languages</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remote access on current and stored data via webserver</td>
</tr>
</tbody>
</table>
Features and Added Values

Flexible display possibilities
- Indicate curves, waterfall, bargraph or digital values dependent on the specific process and data
- Display of curves and waterfall in ranges gives an improved overview

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
<th>Added Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible display possibilities</td>
<td>Indication as required for the specific process</td>
<td>Quick process overview, Wide range of applications</td>
</tr>
</tbody>
</table>
Universal Data Manager RSG35

Web Server - Parameterisation

New web server – worldwide access

Integrated web server
- Timesaving set-up of the RSG35 via standard web browser
- Changes of the set-up are immediately transferred to the device
- Three password protected user levels with various user rights
**Universal Data Manager RSG35**

# Web Server – Instantaneous Values

**New web server – worldwide access**

**Integrated web server**
- Indication of instantaneous values of the RSG35 as digital values
- Indication of limit value infringements
- Easy device identification
- Information on the device status in the header

![Web Server Interface](image)

<table>
<thead>
<tr>
<th>Measured values</th>
<th>Menu</th>
<th>Instrument health status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instantaneous values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tank monitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pack check</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote control</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Device name: Ecograph T
- Device tag: Action Team 2013
- Status signal: OK

- Auto refresh: 5s
- Tank monitor: 24.06.2013 09:23:38
- Flow: 21.4 %
- Temp. in: 213.3 °C
- Flow in: 7.2 l/s
- Flow in (Σ): 34668.3
- Flow in (Σ2): 338.0
- Setup lock: unlock

*Endress+Hauser EH*
New web server – worldwide access

**Integrated web server**
- Remote access on and control of the device
- Display the current values and historical data as indicated on the device
## Web Server – Diagnostics Messages

### New web server – worldwide access

**Integrated web server**
- Indication on the health status of the Ecograph T RSG35 from all over the world!

<table>
<thead>
<tr>
<th>Measured values</th>
<th>Menu</th>
<th>Instrument health status</th>
</tr>
</thead>
<tbody>
<tr>
<td>F100</td>
<td>Temperature 1: Sensor-/Input error!</td>
<td></td>
</tr>
<tr>
<td>Maintenance required (M)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Out of specification (S)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Function check (C)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

![Device Image] Device name: Ecograph T
- Device tag: Unit 1
- Status signal: Failure (F)
Smart Scale Solution - Memograph M RSG40

- Process related graphic
- USB printer interface (PCL V5.0)
- USB keyboard
- Additional functionality
  - Telealarm
  - Energy package
  - Water/wastewater package
**Energy package**

Mass- and Energy calculation

- Water
- Steam
- Water / Glycol mixtures

- Calculation standards
  - Accurate Water- and steam calculations due to the usage of the IAPWS97 Standards (International Association for the Properties of Water and Steam Version 1997)
  - Water / Glycol applications according EN1434
Telealarm Package

- Monitoring of remote stations such as pumping stations, water treatment plants etc.
- Unmanned plants
- Plants with no connection to centralized systems
- Where regular visits to check remote sites made
- Monitoring critical parameters which require immediate action
- Inventory monitoring
Memograph M - Telealarm software package

**Telealarm – Modes**

- Automatic alarm in case of limit violations
  - via SMS
  - via email
- Receiving of instantaneous values on demand on a cell phone
- Remote control of relays
- Confirmation of incoming alarms
- Alarm forwarding (with 4 escalation levels)
Telealarm functions – retrieving values remotely

- Instantaneous values or counter values can be retrieved as a text message from Memograph M
  - Analog values
  - Digital values (counters)
  - Math channels
- Values from a single channel or a whole signal group can be retrieved
- Syntax:
  - GETA;8;1 or
  - GROUP4
Benefit of water / wastewater software option

- Monitoring of remote stations such as pump stations, water treatment plants, storm water tank overflow etc.
- Remote monitoring and remote control of waste water and water plants
- Increased security due to fast alarm forwarding via SMS/text message or email
Water/ Wastewater Package

- Storm water tank overflow monitoring
- Analogue channel peak and low value recording
- Quantity floating peak and low value recording
- Seepage water monitoring
- Tele alarm included
- Math included
- Alarm statistic